Multi-Objective River Corridor Plan for the Methow Basin

Okanogan County
Office of Planning and Development

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This plan was developed with the help of a Citizens' Advisory Group and a Technical Advisory Committee. While words cannot convey the value of their contributions, their generous gifts of time and talent are acknowledged herewith.

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EXECUTIVE SUMMARY

Flooding has not been frequent in the Methow valley. However, severe floods have occurred, and risks to people and property are increasing as the area's population grows. People are drawn to running water; river-front lots are popular throughout the valley. The Multi-Objective River Corridor Plan for the Methow Basin was written in response to concerns that arose as development rates within flood-prone areas increased. The purpose of this plan is to address flood hazard management in the context of other values that are important to the people who live here. Although flooding is the primary focus, the plan is a multi-objective one because other factors have been considered in making recommendations. Property rights issues played an important role in shaping the plan. Other local concerns include fish and wildlife habitat, the scenic quality of the valley, and public access to rivers. All of those factors helped make the plan what it is.

This executive summary gives an overview of the planning project and summarizes the plan's major issues and recommendations.

Developing the Plan

Public participation was crucial to development of this plan. County planning staff worked with a Citizens' Advisory Group, held public meetings, and conducted a river corridor survey to be sure the plan would reflect the interests of local citizens. Staff members also worked with a Technical Advisory Committee composed of representatives of interested agencies and tribes. County planners met with the committee as a whole throughout the plan development process. Individual members were also called on to answer questions or discuss issues related to their areas of expertise.

Planning Area Characteristics

The Methow Valley is an extremely scenic area with a strong sense of place derived from large-scale landscape features. The valley's *river corridors* unify the landscape, while the surrounding mountains and terraces define it. The Methow River is the basin's principal hydraulic feature. Its major tributaries include three rivers, the Twisp, the Chewuch (previously spelled Chewack), and Lost River, and six creeks, Gold, Libby, Beaver, Wolf, Goat, and Early Winters. There are numerous minor tributaries.

The Methow River extends approximately 80 miles from its headwaters in the Cascade Mountains to its confluence with the Columbia River at the City of Pateros and drains an area of just under 1,800 square miles. Bridges are an important part of the transportation system in the basin, with its narrow valley floor, meandering rivers, and many tributaries. Traditionally, those bridges have been vulnerable to flood damage. The valley's many bridge approaches and the proximity of the highway to the rivers in many places have resulted in considerable bank armoring to protect infrastructure, which in some places has affected river morphology and function.

The planning area comprises the entire river basin (Washington State Water Resource Inventory Area 48). Approximately 80 percent of the land in the basin is administered by the United States Forest Service (USFS) and is not subject to County policies and regulations. The

County chose to include the entire basin in the planning area because watershed processes are functions of topographic, not jurisdictional, boundaries. The authors address *cumulative effects* and the results of natural and human-induced processes throughout the basin by looking at it as an integral landscape unit.

Climate and topography

Climate and topography play critical roles in the Methow basin's flood regime. Peak streamflows tend to coincide with the middle elevation snowmelt, beginning in May or early June. Cool spring temperatures are likely to increase peak flows. Snow that has remained in the mountains throughout the early spring will melt and run off quickly if temperatures increase suddenly in late spring or early summer. Flooding becomes likely when large amounts of wet snow accumulate and runoff cannot percolate into the soil. (Snowmelt cannot soak into soil that has already been saturated [typically during a wet fall] or is still frozen.)

Biological resources

Most of the basin is forested, with coniferous species dominating. At higher elevations, forest cover gives way to alpine vegetation, bare rock, and glaciers. In low-elevation areas that do not support forest cover, land that is not cultivated or developed is dominated by shrub-*steppe* communities. Undisturbed *riparian areas* in the Methow Valley are heavily vegetated with deciduous trees and shrubs. Riparian vegetation is usually extremely diverse, providing habitat for a wide variety of species, especially migratory birds.

The Methow River basin supports many fish and wildlife species, including some that are rare, threatened, endangered, or of local concern. Mule deer are the basin's most visible animal residents; the Methow Valley is home to the largest migratory mule deer population in the state of Washington. Fish and wildlife resources add significantly to the quality of life and the economy of the area.

Land use

Most of the forested lands in the Methow River basin are managed by the U.S. Forest Service for multiple use. Historically, agriculture has been the principal use on private lands. In recent years, subdivision and recreational development have become lucrative, with a loss of open space resulting. A considerable amount of land has been subdivided since the opening of the North Cascades Highway in 1972. Many small lots have been created adjacent to or near rivers and creeks. Subdivision was concentrated in the upper part of the basin during the late 1970s and early 1980s. However, over the last ten years, growth in population and lots has tended to occur in the central and southern parts of the basin. When developed, most subdivided land is used for residences, either year-round or seasonal.

Recreation and tourism

The Methow River basin offers a wide range of opportunities for both active and passive recreation throughout the year, and tourism has become an important component of the area's

economy in recent years. Many visitors are attracted to the area by its natural beauty and scenic setting; others come to visit wilderness areas and use forest recreation facilities. Within the basin, skiing, snowshoeing, snowmobiling, dog-sledding, camping, hiking, driving for pleasure, fishing, hunting, horseback riding, river rafting, kayaking, canoeing, mountain climbing, rock climbing, backpacking, bicycle touring, and mountain biking are all popular activities.

Summary of problems and opportunities

The characteristics of the Methow River basin provide both problems and opportunities with regard to *river corridor* and flood hazard management. Rivers and their corridors are important economically—as a source of irrigation water, for the aesthetic qualities that draw tourists to the area, as a recreational resource—and so their management is critical to many local residents and landowners. The most important factor is the diversity of conditions found in various parts of the basin, which means that different approaches will be needed in different places.

Alluvial fans and erosive bluffs stand out as problems related to the geomorphology of the valley. Both are high-hazard areas not designated on flood maps. In addition, there are many bridges in the valley; they are vulnerable to damage or destruction during floods. The condition of the *riparian zone* is another area that warrants attention. The condition of the *river corridor* has a strong impact on flooding. Native vegetation has been disturbed in many places, affecting the river's ability to handle floods and also diminishing habitat quality.

One complicating factor, which creates both problems and opportunities, is Forest Service management. Because much of the basin is administered by the Forest Service and not subject to County jurisdiction, careful coordination will be necessary to ensure that local citizens' needs are met.

Finally, land use patterns present a variety of problems and opportunities. Much of the land adjacent to the Methow River, and some land along the lower reaches of the Twisp and Chewuch Rivers, is in private ownership. As land use in the valley shifts from agriculture to residential use, there are likely to be changes in management that will influence the *river corridor*. While the area's population is small, it is dispersed, which will tend to result in fragmentation of the landscape and especially of the riparian resources that help maintain channel function. Many residents have moved to the area since 1972, when the rivers last flooded, and so are not aware of hazards or of the conditions that promote flooding, such as removal of native vegetation and increases in impermeable surface area.

Flood Damage

The Methow River basin has experienced three noteworthy floods since European settlement—in 1894, 1948, and 1972. All of those floods occurred in late May or early June and were caused by unusually heavy spring runoff. Smaller floods have also occurred in the basin; the conditions that caused them have not been documented, but the timing suggests they were also the result of heavy spring runoff or above-average snow-pack with sustained high temperatures. Flood hazards may also be associated with ice jams, alluvial fans, and intense localized thunderstorms over small sub-basins.

Flooding impacts result primarily from two types of hazards created by floods: inundation and erosion. Inundation (floodwater and debris flowing through an area) usually occurs due to high flows, but can also be the result of an obstruction in the channel. Bank erosion can threaten areas that are not inundated by floods at all. Buildings on high banks, above flood levels, have been undermined by the Methow River's erosive flows. Flood control actions in the Methow River basin have been limited to bank protection for erosion control, construction of marginal levees, debris removal, and channel alteration. Rock *riprap* is common; 35 miles, or 22% of the Methow's banks, have been riprapped. Debris removal following the 1948 and 1972 floods had a major impact on aquatic habitat quality and stream *energetics*. Large amounts of debris were removed, eliminating structure that is essential for healthy aquatic ecosystems and reducing hydraulic resistance.

While *Floodplain Boundary* maps produced by the Federal Emergency Management Agency (FEMA) provide information about the likelihood of inundation, they do not address erosion hazards. Parts of the Methow Valley are particularly prone to erosion; protecting life and property in those areas will present special challenges. Other potential problems include structures within *floodplain* boundaries and infrastructure damage due to debris in the water. The County also needs to develop maintenance strategies for Corps-of-Engineers-approved dikes; no maintenance work has been done for at least ten years.

Existing Organizations and Programs

A number of government agencies, local entities, and private non-profit organizations are involved in *river corridor* management and related issues in the Methow River basin. The U.S. Army Corps of Engineers participates in flood control activities throughout the country. The Corps built levees, installed bank protection, and removed woody debris from rivers in the Methow basin following the floods of 1948 and 1972. The U. S. Fish and Wildlife Service administers various federal programs aimed at conserving fish and wildlife, including the Endangered Species Act as it applies to freshwater and terrestrial species. The United States Forest Service administers resource lands throughout the country. About 80% of the land in the Methow River basin is administered as wilderness or for multiple use under Forest Service jurisdiction. The United States Geological Survey (USGS) collects streamflow data at gaging stations throughout the country, in part for use in predicting the frequency and magnitude of floods and in designing structures such as roads, bridges and culverts. There are seven gaging stations in the Methow River basin. The National Marine Fisheries Service administers the Endangered Species Act as it applies to marine species, including *anadromous* fish such as salmon and steelhead. The National Weather Service uses data from USGS streamflow stations to forecast river stages and flow conditions on major rivers. The Natural Resource Conservation Service provides a variety of services to agriculturists, including working to control soil erosion and developing riparian grazing management strategies to minimize impacts of livestock use on rivers and *riparian zones*.

On the state level, the Department of Ecology's Floodplain Management Section provides technical assistance to communities on flood insurance and Floodplain management. The Department of Fish and Wildlife has an interest in the condition of the *river corridor* as it pertains to fish and wildlife habitat issues, and has undertaken a number of riparian restoration projects in the basin. On the local level, Okanogan County and the towns of Twisp and Winthrop are

responsible for planning and emergency management. The Colville Confederated Tribes and the Yakama Indian Nation have interests in the Methow basin. The Methow Valley Sport Trails Association, Methow Institute Foundation, and Methow Valley Land Trust are private organizations with roles related to *river corridor* management.

A number of existing regulatory, planning, and capital improvement programs are relevant to *river corridor* management in the Methow River basin. At the federal level, flood hazard management is addressed through the Unified National Program for Floodplain Management, the National Flood Insurance Program, and the Disaster Relief Acts. At the state level several acts compose the Washington State Floodplain Management Program. Floodplain construction is regulated locally by the Okanogan County Flood Damage Prevention Ordinance.

Federal programs that relate to rivers but have little direct bearing on this planning effort include Sections 401 and 404 of the Clean Water Act, the National Wild and Scenic Rivers Act, and the National Environmental Policy Act.

In Washington state, the Growth Management Act was enacted to manage growth by mandating adoption of local comprehensive land use plans and development regulations. In 1994, Okanogan County adopted Critical Areas Regulations, which affect development in critical areas as mandated under the Growth Management Act.

The State's Shoreline Management Act (SMA) was enacted in 1971 to manage appropriate uses of the shorelines of the state. Most activities in and on shorelines are subject to the SMA. Okanogan County issues permits for shoreline substantial development, shoreline conditional uses, or shoreline variances in accordance with its Shoreline Master Program and Department of Ecology guidelines.

The State Hydraulic Code, intended to protect fish resources, is implemented through a permit called the Hydraulic Project Approval (HPA), obtained from the State Department of Fish and Wildlife (DFW). Activities that require an HPA include streambank protection; construction of bridges, piers, and docks; channel change or realignment; log, log jam, or debris removal; and use of equipment for installation or maintenance of water diversions.

On the local level, Okanogan County's Comprehensive Plan was adopted in 1964 to provide a framework for the future orderly development of the County. A Parks and Recreation Element was adopted in 1993. Two addenda, the Methow Valley Plan and the Mazama Area Master Plan for Methow Valley Planning Area Subunit A, apply within the Methow Valley. The Methow Review District Recreation Plan was adopted in 1990 as an addendum to the Okanogan County Trails Plan. Development is regulated by the County's zoning code and subdivision ordinance and the Uniform Building Code.

Issues, Goals, and Policies

Early in the plan development process, County staff, Citizens' Advisory Group members, and Technical Advisory Committee members identified the issues involved in flood hazard and *river corridor* management in the Methow River basin. Choices about addressing those issues guided the development of the plan's recommendations. Flood-related **issues** can be grouped under five headings:

• Basin characteristics: issues arising as a result of the physical characteristics of the basin and, specifically, the rivers and their corridors. Those issues relate to dynamic river channels, erosion hazards, alluvial fans, flash flooding, and ice jams.
• Policy and management: issues arising from current policies and management approaches. Those issues relate to "up-and-out" building sites, riparian vegetation management, exemptions for single-family residences, and the relationship between management on National Forest lands and conditions in the river valleys.
• Flow regime: issues arising from alterations to the natural flow regime as a result of development. Those issues relate to channel constraint, upland management, and emergency actions.
• Hazards: issues related to hazardous conditions in the basin. Those issues relate to vulnerable structures and large woody debris.
• Awareness: issues related to awareness of flood hazards, both on the part of the general public and within agencies responsible for making decisions that pertain to flood conditions. Those issues relate to awareness of flood hazards and understanding of *cumulative effects*.

Other issues relate to economic development, water supply, property rights, health, recreational use of the *river corridor*, fish and wildlife habitat quality, aesthetics, and landscape character.

Based on the issues identified and the physical, social, and economic characteristics of the basin, four major **goals** for this plan were developed. Goals are the ends the plan is intended to serve; they form the framework on which the plan's recommendations were fashioned. The plan's goals are:

• Reduce flood-related hazards and damages;
• Sustain natural processes;
• Reduce the long-term costs of flood control and floodplain management;
• Maintain the character of the Methow Valley and the variety of uses supported by the *river corridor*.

The plan also includes a list of objectives derived from the goals. Objectives are more specific than goals. They provide direction in accomplishing the purposes laid out by the goals. In this multi-objective plan, most objectives will help meet more than one goal.

Policies have been based on the issues, goals, and objectives. Policies reflect the County's stance with regard to the plan's goals—they define the direction the County intends to go and can be used to guide decision making. They relate to reducing vulnerability, flood damage reduction, cooperative planning, implementation, and outreach.

Program Recommendations

The program recommendations address the current and potential problem areas and maintenance needs and the issues identified in the plan. Issues, problem areas, and needs are addressed in the context of the plan's goals and objectives and of the County's resources. The recommendations have been very carefully crafted to reflect the needs and desires of the community as they have been communicated both by the Citizens' Advisory Group and by the

Board of County Commissioners in their role as elected leaders. The recommendations are grouped into the following categories:

- Flood Warning and Emergency Response
- Development regulations
- Mapping
- Outreach programs
- Incentive Programs
- Property Protection
- Watershed Management Guidelines
- Structural Projects
- Debris Management
- Operations and Maintenance
- Recreation: Trails and River Access
- Methow River corridor northwest of Mazama Bridge
- Other issues

The Multi-Objective River Corridor Plan for the Methow Basin was designed to be put to use immediately to solve existing problems and prevent new ones. In developing recommendations, the emphasis was on effective measures that would be inexpensive to implement. Once the plan has been adopted, Okanogan County will be eligible to apply for funds to implement the plan's recommendations from the state's Flood Control Assistance Account Program. Implementation timing and responsibilities are outlined, and the plan includes a clause calling for periodic reviews of progress. Every effort has been made to ensure that this is not a plan that will gather dust, but one that will benefit the citizens of Okanogan County.

VISION STATEMENT

Okanogan County's Multi-Objective River Corridor Plan for the Methow Basin is intended to provide for the long-term health, safety, and welfare of Methow Valley residents and others with an interest in the valley's future by providing for a healthy, functional *river corridor* system, an intact cultural landscape, and a thriving economy.

The Plan calls for a safe environment for the people who live here, in which their investments are protected and dreams can be realized. It is also intended to bring to life a vision of a basin in which clean, clear water flows from healthy forests and rangeland to rivers that once again support viable runs of salmon and trout, where trees and plants line stable rivers and creeks, supporting an abundance of wildlife; and of *river corridors* open and uncluttered, so the Methow, the Chewuch, and the Twisp can continue to delight us with their beauty, to provide hunting grounds for eagles and swimming holes for children, to run unfettered from the Cascades to the Columbia.

Making the vision a reality will involve a range of activities, including:

- outreach programs, involving public education, involvement, and partnerships;
- a comprehensive flood hazard management system, including flood warning and emergency response programs, development regulations, mapping, incentive programs, and property protection techniques;
- structural projects and maintenance activities that support community goals.

This Vision Statement will guide the development of Goals and Objectives for the Valley's *river corridors*, the formulation of recommendations for meeting those goals and objectives, and the drafting of a plan to implement the recommendations.

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Note: This plan contains many technical terms, which are defined in the glossary near the end. Terms that are defined in the glossary are printed in *italics*. The word "floodplain" appears numerous times and is defined the first time it appears in each chapter.

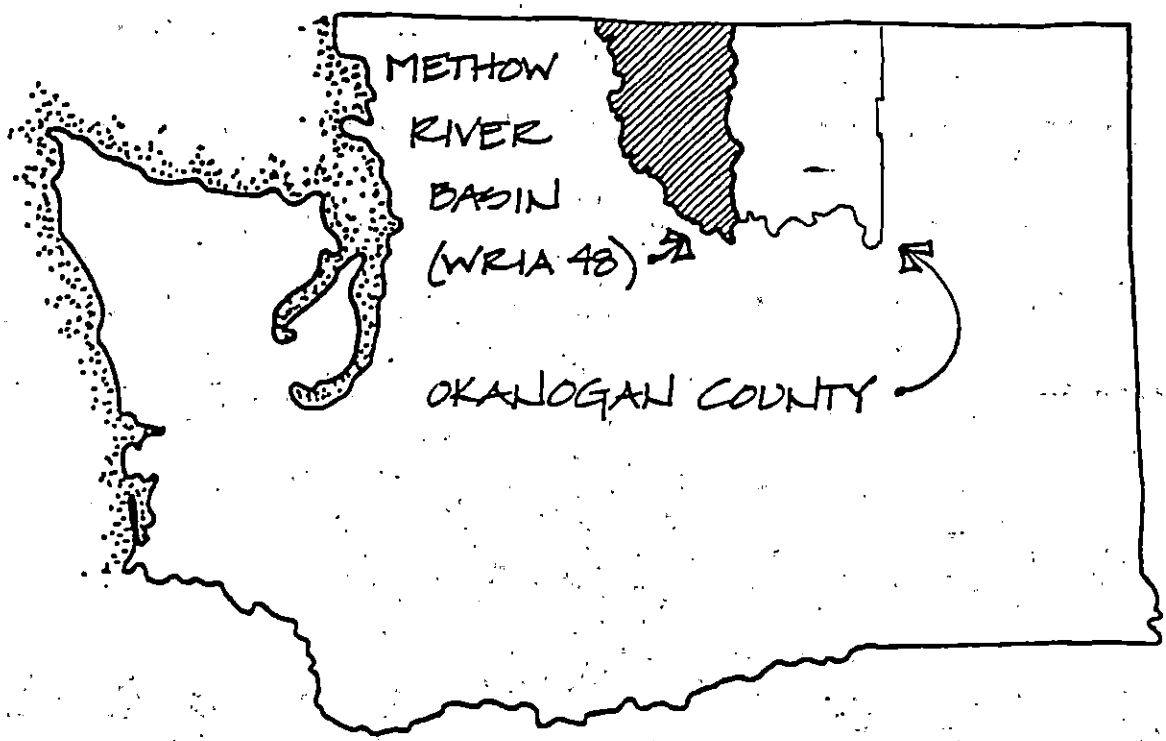
LIST OF FIGURES

CHAPTER I: INTRODUCTION

Sweeping from the crest of the Cascades to the Columbia River, the Methow River basin enfolds a mosaic of dramatic and beautiful natural systems that compose a landscape of stunning visual quality. Within that basin, the Methow Valley is a unique cultural landscape dominated by its rivers, and any plan addressing the future of those rivers and their *floodplains* must address the cultural as well as the physical dynamics of the place. The boundary of the basin, and its position within the state of Washington, are shown in Figure I.1.

Flood hazard planning for the Methow River basin is being incorporated in this Multi-Objective Management plan because of the importance of the river system to the Methow Valley. Rivers and their corridors play a variety of roles in the Valley; managing them solely for flood conveyance would be detrimental to many values that are important to the people who live, work, visit, and own property here. This plan attempts to address the river system as a whole, taking an integrated approach to balancing various roles to best meet the needs of all. It has been developed to reflect previously defined policies and goals and is based on input from local citizens as well as technical experts.

Figure I.1
Vicinity Map



A. Scope and Authority

This plan has been developed in accordance with State of Washington requirements, to address flood hazard management in the Methow River basin. It is also intended to function as a multi-objective corridor plan for the Methow, Twisp, and Chewuch River corridors, and, as such, addresses a broad range of issues related to human use of the floodplain. While the principal goal of the plan is to reduce the risks to human life, health and property associated with flooding, it also incorporates other goals that are important to stakeholders in the basin (see Chapter V, "Issues, Goals and Objectives, and Policies").

Washington State statutes use the terms "flood plain management" and "flood control management" to describe activities covered in this plan. This Multi-Objective River Corridor Plan meets the state's requirements for both "flood plain management", as defined in Chapter 86.16 RCW, and "comprehensive flood control management plans", as described in Chapter 86.26 RCW.

Chapter 86.12 of the Revised Code of Washington (RCW) authorizes the county legislative authority (in Okanogan County, the Board of County Commissioners) to adopt a comprehensive flood control management plan for any drainage basin located wholly or partially within that county, and requires that such plans include certain elements. This Multi-Objective River Corridor Plan was prepared by the Okanogan County Office of Planning and Development under that authority. It follows the general outline and approach developed by the Washington State Department of Ecology (DOE) for comprehensive flood hazard management plans and described in that agency's *Comprehensive Planning for Flood Hazard Management Guidebook* (Washington State Department of Ecology, 1991).

Development of this plan was sponsored by the Okanogan County Office of Planning and Development and has been funded in part by Grants No. G9400051 and G9600050 from the Washington State Department of Ecology under the Flood Control Assistance Account Program (FCAAP).

B. Background

How floodplains work

Floodplains are the areas that are inundated when rivers overflow their banks. They are part of a system that has evolved to accommodate changing water levels during the course of each year. In a natural landscape, floodplains temporarily store floodwaters during spring runoff, reducing flood levels and slowing the river's flow. Those functions of floodplains can be impaired when a river is isolated by *riprap*, diking, or a bulkhead; or when the floodplain's characteristics are changed by development or by removal of native vegetation. When a river is cut off from its *floodplain* and confined to a single channel, it flows more quickly. As its velocity increases, the water gains power and can erode its banks, scour its bed, and damage structures.

Floodplain characteristics also affect the river's behavior during floods. Native vegetation helps slow the water, allowing it to soak into the ground or move gradually back to the channel. Plant roots help control erosion by binding the soil. On the other hand, when vegetation is removed, water runs off more quickly, often taking valuable topsoil with it. Lawns and other

non-native plantings do a better job than paved surfaces or bare soil, but they are not as effective as natural riparian and *wetland* vegetation.

Floodplains provide a number of other benefits. They are important habitat areas, especially in arid places like the Methow Valley. *Wetlands* and *riparian areas*[1] support a great variety of plants. That diversity, and the availability of water, make floodplains attractive to many mammals, birds, amphibians, reptiles, and insects. Floodplains are also valuable recreational resources. Because they attract wildlife, they are appealing to hunters, birdwatchers, and photographers. Their aesthetic appeal makes them popular places to walk, hike, or simply enjoy being out of doors. The diversity of natural floodplains also makes them useful to scientists and educators—they are outdoor classrooms and laboratories from which all of us can learn.

In addition, floodplains help maintain water quality by filtering surface water runoff before it reaches the river. Natural floodplains help keep groundwater levels high, as well. More water soaks into the ground because plant roots and soil-dwelling animals (like earthworms and beetles) keep the soil porous, and because plant stems and litter slow runoff.

Historical background

Compared to many other watersheds in the state, the Methow River basin is in relatively good health. Flooding is infrequent, water quality is high, and there is little impermeable surface area. The most significant human-induced changes to the watershed have resulted from timber management and agricultural activities. However, residential development has increased in recent years, and some conflicts have arisen over the location of houses near the Methow River. One of those conflicts precipitated a re-mapping effort by FEMA and the preparation of this plan.

On August 20, 1991, the Board of County Commissioners declared a safety emergency and ended the issuance of building permits within the 100-year floodplain of the Methow River above the Mazama Bridge. On February 18, 1992, their resolution to that effect was extended until May 31, 1992. On June 1, 1992, the restriction on issuance of building permits was ended for the northern three miles of the study area, and extended through October 30, 1992 for the southern four miles. The *floodplain* in the area north of Weeman Bridge was then re-analyzed by FEMA, and three new map panels (panel numbers 450, 650, and 675) were issued in May, 1994.

Within the remapped area is a subdivision located at the confluence of the Methow and Lost Rivers, which has caused considerable concern. A number of platted lots are within the 100-year *floodplain*. Houses have been built on several of those lots. In addition, the channel in that location is subject to migration during flood events. The need to establish a consistent policy for all *floodplain* areas, and particularly those in the remapped area, coupled with the need to address the existing vulnerable structures and the possibility of serious damage in the event of channel changes, prompted the development of this plan.

Need for plan

This plan has been developed to provide for sound *floodplain* management in the Methow River basin. Engrossed Substitute Senate Bill 5411 (ESSB 5411), adopted in 1991 to coordinate flood hazard management activities state-wide, emphasizes the importance of comprehensive

[1] See section II.G for more information about riparian areas.

planning to effective flood-hazard management. The Department of Ecology's *Comprehensive planning for flood hazard management guidebook* (1991) notes "We are learning that flood plains are laden with complex planning issues ranging from biological resource protection, geohydrological engineering, land use development and aesthetics, [to] open space and recreation objectives. Therefore, it makes sense to address these issues comprehensively..." While flooding has not been frequent in the Methow Valley (three major floods in 102 years), and environmental conditions remain relatively good compared to those in many other parts of the state, the dangers posed by the basin's rivers remain a concern. As human use of flood-prone lands increases, and as more and more upland areas of the basin are developed or otherwise altered, the need to address flood hazards grows. By providing for comprehensive flood hazard management, this plan seeks to address those hazards in the context of the other issues and values associated with floodplains.

Comprehensive flood hazard management embraces a number of principles related to balancing the range of issues related to floodplains. Those principles include:

- Public involvement in reducing hazards and vulnerability
- Understanding rivers' natural hydrologic and geomorphic processes
- Focus on the cause of flood damage
- Consideration of the entire watershed
- Process-oriented examination of issues
- Pursuit of other social and resource protection goals
- Interagency and interdepartmental coordination
- Incorporation of comprehensive planning solutions

Those principles have been used to develop a plan designed to help protect lives, property, and a range of other resources central to the health of the Methow Valley and its rivers. In addition, a link has been provided between various existing regulations that affect development in and use of *river corridors* in Okanogan County, including the Flood Damage Prevention Ordinance (Ordinance 87-2), Critical Areas Regulations (Ordinance 94-2), Shoreline Management Master Program (Resolution _____), and Zoning Code (Okanogan County Code, Title 17). Those regulations and their relationships to flood hazards are discussed in Chapter IV.

The National Flood Insurance Program (NFIP) mandates that local communities regulate development through a permitting system using the mapped 100-year frequency floodplain designated by the Federal Emergency Management Agency (FEMA). In many cases those efforts are not adequate to prevent flood damage and do not assure good flood hazard management planning. State law encourages local entities to go beyond the minimum requirements of the NFIP and of Chapter 86.16 RCW by adopting Comprehensive Flood Hazard Management Plans. Chapter 86.12 RCW, as amended by ESSB 5411, includes a list of elements that must be part of a county's comprehensive flood hazard management plan; they are as follows:

- Designation of areas that are susceptible to periodic flooding;
- Establishment of a comprehensive scheme of flood control protection and improvements;
- Establishing land use regulations that preclude the location of structures, works, or improvements in critical portions of such areas subject to periodic flooding;
- Establishing restrictions on construction activities in areas subject to periodic floods;

• Establishing restrictions on land clearing activities and development practices that exacerbate flood problems by increasing the flow or accumulation of flood waters.

This plan has been written to fulfill those requirements, providing the foundation for future flood hazard management projects. In addition, it offers a set of recommendations intended to support the County's flood hazard management efforts in the context of previously established goals for the Methow basin.

Finally, Washington State communities with approved Comprehensive Flood Hazard Management Plans are eligible for Flood Control Assistance Account Program (FCAAP) funds, which can be used to implement the recommendations of this plan.

Description of FCAAP

The Flood Control Assistance Account Program (FCAAP) was established in 1984 under Chapter 86.26 RCW, "State Participation in Flood Control Maintenance." The program is administered by the Washington State Department of Ecology and provides matching grants to local entities for development of flood control management plans, feasibility studies for new flood control projects, flood control maintenance projects, and emergency flood control projects. The flood hazard management activities of a local jurisdiction must be approved by The Department of Ecology, in consultation with the Washington State Department of Fish and Wildlife (WDFW), in order for that jurisdiction to be eligible for FCAAP assistance. The state will only participate in flood control maintenance projects in areas for which flood control management plans have been or are being developed. To render a local jurisdiction eligible for grants for flood control maintenance, that jurisdiction's flood control management plan must:

- Determine the need for flood control work;
- Consider alternatives to instream flood control work;
- Identify and consider potential impacts of instream flood control work on the state's instream resources; and
- Identify the river's *meander belt* or *floodway*.

An optional element of this program provides for local governments to use the planning process to develop a *wetlands* management strategy.

Finally, local jurisdictions, to be eligible for funding under FCAAP, must participate in the National Flood Insurance Program (NFIP) and meet all of its requirements, and must restrict land use in the *meander belts* or *floodways* of rivers to flood-compatible uses.

C. Planning Process and Methodology

This plan was prepared by County staff in cooperation with a Technical Advisory Committee and a Citizens' Advisory Group. The process included review of existing plans; this plan incorporates goals and policies that have already been established by the people of the Methow Valley. This section describes the plan development process; the process is outlined in Figure I.2, on page 9.

Role of the Technical Advisory Committee

County staff worked with a Technical Advisory Committee (TAC) composed of representatives of interested agencies and tribes. In convening the TAC, staff members strove to include representatives of all interested parties and also to include individuals with a variety of backgrounds, so that the committee as a whole would offer a balanced perspective and be able to offer advice on a broad range of issues. TAC members advised County staff on issues important to their agencies and technical matters related to their areas of specialization. Staff members interviewed TAC members early in the process to determine their backgrounds and areas of expertise and the missions of their agencies. The interviews were helpful in focusing discussions and in eliciting information from individuals as the planning process progressed. The interview records are located in the project file. A list of TAC members and their agencies and mailing addresses is included as Appendix D.1.

Planning staff members met with the committee as a whole throughout the plan development process. Individual members were also called on to answer questions or discuss issues related to their areas of expertise.

Public participation process

The citizen involvement process included both workshops with the general public and meetings and correspondence with a Citizens' Advisory Group (CAG). Staff also conducted a mail questionnaire to gather information and solicit additional involvement, during the spring of 1995. In addition, local real estate agents were briefed on the process and invited to become involved, since the plan is expected to have an effect on land uses in and near the *floodplain*. Letters sent to real estate agents are in Appendix D.4.

Citizens' Advisory Group

The County's intention to form a Citizens' Advisory Group (CAG) was advertised in the *Methow Valley News* in November, 1994; during the same period the newspaper published a story about the project and the role the CAG would play. The eight people who responded include seven residents and one non-resident landowner, and represent a range of interests. (Four others joined later in the process.) As outlined in Figure I.2, staff met with the CAG to brief members on the project and discuss issues. Department of Ecology staff members also attended, and were able to give additional background on the Comprehensive Flood Hazard Management Plan development process and parameters. Following that meeting, CAG members were asked to comment by mail on various elements of the plan. The group also met several times in late 1995 and early 1996 to discuss ideas and address specific issues. Appendix D.2 includes a list of CAG members, copies of written comments, and summaries of comments received by telephone. See Appendix E.3 for copies of advertisements and newspaper stories that appeared during the development of this plan.

Public workshops

Two public workshops were scheduled as part of the process of developing this plan—one to gather information about past flooding and the other to solicit comments on the draft plan. At the Flood History Workshop, held in January, 1995, about two dozen members of the community shared their reminiscences about the floods of 1948 and 1972 (and relatives' stories of the 1894 flood) and discussed their views about flood control. A number of participants brought photographs; staff members made photocopies for use later in the planning process. The *Methow Valley News* published two follow-up stories, which played an important role in bringing the subject of flooding into the public eye.

At the second workshop, held in December, 1995, members of the public had a chance to review a draft of this plan and to see the preliminary results of the River Corridor Survey (discussed below) as well. At the same time, copies of the draft plan were placed in the public libraries in Pateros, Twisp, and Winthrop for review by interested parties.

River corridor survey

In April, 1995, a survey was sent to all landowners in those parts of the Methow River basin over which Okanogan County has jurisdiction. The survey was designed to determine how people use the *river corridors*, what uses they consider desirable, and how they believe flood hazards should be addressed. The survey was also an attempt to increase citizen involvement, since the Citizens' Advisory Group was so small. 4,858 questionnaires were mailed; 971 were returned for an overall response rate of 20%. The results are discussed briefly in Chapter V. Survey methodology and results are presented in greater detail in Appendix D.3.

Overview of technical planning process

The paragraphs that follow describe a linear process, which formed the basis for the technical planning process used to prepare this plan. The same process is represented graphically in Figure I.2, which also shows the roles of staff, the Technical Advisory Committee and the Citizens' Advisory Group. In fact the process was an iterative one, owing in part to the nature and scale of the project and in part to limitations on field work imposed by weather—especially the early snowfall in the fall of 1994.

Inventory

The process began with an inventory for the purpose of determining existing conditions and describing the basin. As discussed in Chapter II, County planners decided to take a watershed approach to account for the effects of activities in all parts of the basin on the rivers and their corridors. (Figure II.1 is a map of the watershed.) The initial inventory was thus based primarily on existing published information and intended to give a broad overview of conditions in the basin. Needs for additional inventory work have been identified in Chapter VI (Program Recommendations).

Analysis

As information about the basin was collected, it was analyzed in the context of the scope of work for the corridor planning project. Early in the process, available information was used to prepare an introduction to the basin for Technical Advisory Committee and Citizens' Advisory Group members, so they would understand principal features and processes that would guide decision making.

In addition, staff analyzed pertinent federal, state, local, and tribal regulations in the context of corridor plan development. The results of that analysis are discussed in Chapter IV.

Issue identification

Based on preliminary inventory and analysis results, Technical Advisory Committee and Citizens' Advisory Group members were asked to help staff members identify issues related to the *river corridor* and, specifically, to flooding and flood hazards; and also to identify specific problem and opportunity sites within the *river corridors*. Issues identified involved both conditions on the ground and the existing regulatory environment. Issues are summarized in Chapter V.

Development of a vision statement, and goals and objectives

Once issues had been identified, they were used, along with the results of previous studies of demographics and recreation preferences, to develop a Vision Statement and a list of goals and objectives for this plan. The Vision Statement follows the Executive Summary at the beginning of this plan. The goals and objectives are listed in Chapter V.

Plan development

Options for meeting the plan's goals and objectives in a way consistent with the Vision Statement were developed based on current flood hazard management models. Both Technical Advisory Committee and Citizens' Advisory Group members reviewed and commented on the options. Once the options had been reviewed, they were evaluated, and the most feasible ones used as the foundation for the program recommendations presented in Chapter VI. Again, both TAC and CAG members reviewed the plan; their comments have been incorporated in the final plan.

Figure I.2
Timetable for Development of the
Multi-Objective River Corridor Plan for the Methow Basin

Date	County	TAC	CAG/Public
October and November 1994	Inventory, data collection	State goals, needs, areas of expertise (10/31/94)	
December 1994	Develop introduction to basin	Review & analyze data; identify issues (12/12/94)	
January 1995	Set goals, objectives, develop vision by 1/13/95	Review/comment on vision statement (1/20/95)	Introductory CAG meeting (1/7/95) Flood history workshop (1/14/95)
February 1995			CAG: review/ comment on needs and issues summary, vision statement, and goals and objectives
March 1995	Develop options for reaching goals by 3/3/95	Review/comment on options (3/16/95)	
April 1995	Revised options to CAG for review Mail project update and survey to landowners		
May 1995			Landowners respond to survey CAG: review/ comment on options
June 1995	Tabulate survey responses		
July 1995	Develop first draft of plan		
August 1995		Discuss first draft of plan (8/1/95)	
September 1995	Revise draft and send to CAG members for review	Discuss survey results (9/14/95)	CAG: Discuss draft plan (9/30/95)
October 1995		Discuss citizens' comments, how they can best be incorporated (10/26/95)	

Date	County	TAC	CAG/Public
November 1995	Complete draft plan for public review and comment and deliver to libraries		CAG: meeting w/Lynda Hofmann, DFW and Will Keller, NRCS (11/11/95)
December 1995		Discuss option evaluation methods (12/12/95)	Open House (12/2/95)
January 1996		Discuss options, cost estimating, map development (1/16/96)	CAG: meet to discuss options for instream work (1/24/96)
February 1996			CAG: meeting w/Debbie Knaub, COE and Bob Clark, Okanogan County (2/28/96)
March 1996		Discuss program recommendations, mapping methods (3/12/96)	
April 1996	Begin revisions based on comments from TAC, CAG, and members of the general public		
August 1996	Develop final draft plan and send to TAC members for review		
September 1996	Develop final draft plan and send to CAG members for review Begin public education and awareness program	Meet to review final draft	
October 1996	Complete SEPA checklist/MDNS Complete revisions to revised flood damage prevention ordinance		CAG: meet to review final draft
November 1996	Submit plan and revised ordinance to Planning Commission for recommendations		
December 1996	Submit plan and revised ordinance to Board of County Commissioners for adoption	Meet to comment on Planning Commission recommendations	Participate in public hearing process

CHAPTER II: PLANNING AREA CHARACTERISTICS

A. Boundary

The Methow River extends approximately 80 miles from its headwaters in the Cascade Mountains to its confluence with the Columbia River at the City of Pateros and drains an area of just under 1,800 square miles. The study area comprises the entire river basin (Washington State Water Resource Inventory Area 48). Figure I.1 shows the watershed boundary and its location within the state of Washington. Figure II.1 shows the basin in greater detail.

Approximately 80 percent of the land in the basin is administered by the United States Forest Service (USFS) and is not subject to County policies and regulations. The County chose to include the entire basin in the study area because watershed processes are functions of topographic, not jurisdictional, boundaries. The authors address *cumulative effects* and the results of natural and human-induced processes throughout the basin by looking at it as an integral landscape unit.

B. Climate

Climate in eastern Washington is a function of both maritime and continental influences. The Methow River basin's location just east of the Cascade crest places it in the rainshadow, with hotter summers, colder winters, a shorter growing season, and less precipitation than areas of similar latitude west of the Cascades. To the east, the Rocky Mountains provide a buffer against continental air masses. In spite of that buffer, the Methow Valley is known for severe winters, with temperatures among the coldest in the state. Within the basin, topography and elevation strongly influence climate. Temperatures generally increase and precipitation rates generally decrease from north to south, and from high to low elevation.

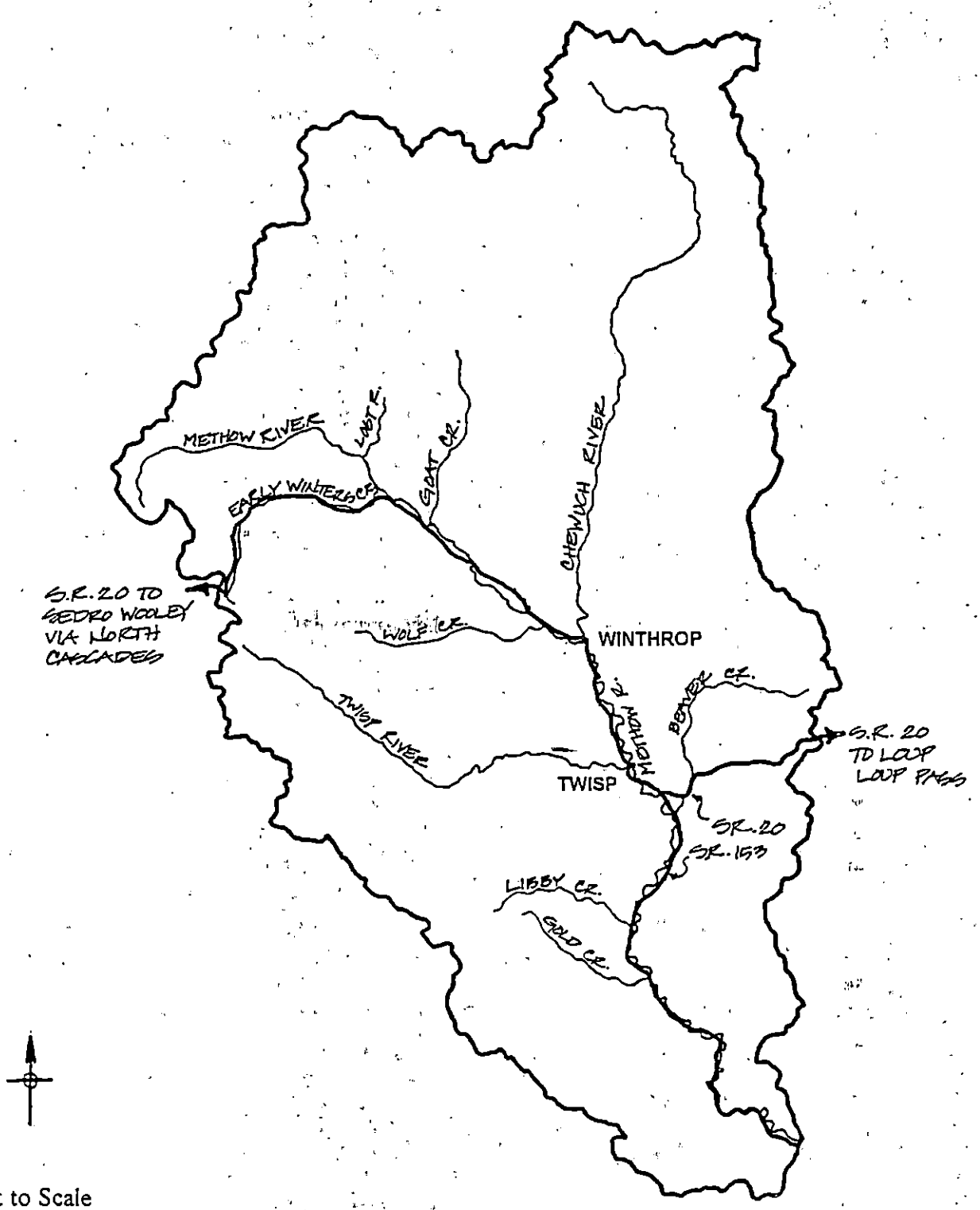
Temperatures

Because of the variation in elevation, temperatures vary widely in the basin. In the Methow Valley and at low elevations on the flanks of the Cascades, summers tend to be hot, with wide diurnal fluctuations, and winters mild to severe. At Mazama, for instance, monthly mean temperatures for the period 1970 to 1990 averaged 71° F in July and August; summer high daily temperatures range from 90° to 105° F. At the same location, monthly mean temperature for the period 1970 to 1990 was 9° F in January, with normal wintertime lows ranging down to -35° F.

Data are scarce for higher elevation areas; in general, those areas are characterized by cool summers and cold winters. For instance, in the Subalpine Fir forest zone, which extends from about 5,000 ft. to timberline, mean July temperatures in the range of 55° to 60° F can be expected.

Temperature affects snowmelt rates in the basin and plays a critical role in flooding. In years with warm spring temperatures, snowmelt will occur over a shorter period than in cooler

Figure II.1
Methow River Basin



Not to Scale

years. Cool spring temperatures are likely to increase peak flows. Snow that has remained in the mountains throughout the early spring will melt and run off quickly when temperatures increase in late spring or early summer. When large amounts of water run off at one time, high flows occur. Higher peak flows increase the possibility of flooding.

Precipitation regime

As is typical of areas in the lee of large coastal mountain ranges, the Methow basin is generally arid, with average annual precipitation estimated at 30 inches. Spatial distribution is extremely uneven, varying with elevation and distance from the Cascades. Rates range from 80 inches annually at the Cascade crest and 60 inches in adjacent upland areas to 22 inches at Mazama, 15 inches at Winthrop, and 10 inches at Pateros.

Precipitation rates vary from one sub-basin to another. Average annual precipitation over the Methow River drainage above Winthrop ranges from 15-80 inches; over the Chewack River drainage, from 15-35 inches; and over the Twisp River basin, from 15-80 inches. Disparities in precipitation rates from one sub-basin to another affect runoff rates and the character of the rivers in the various drainages, influencing flooding and land use potential.

Summers in the Methow basin tend to be dry; approximately two-thirds of the area's annual precipitation occurs between October and March, with most falling as snow. Summer rains tend to come in concert with thunderstorms; the rains are often brief and intense, and so may not infiltrate the soil. Localized thunderstorms over small sub-basins may cause flooding on the streams draining those basins. While the flood effect is generally dampened when flow from the tributary stream enters one of the basin's rivers, the sub-basin in which flooding occurs may be significantly affected.

In the winter, considerable snow often accumulates, especially at high elevations and in the upper valley (northwest of Winthrop). In the valley, snow season dates generally range from November through March, with considerable variation from one season to the next. Peak streamflows tend to coincide with the middle elevation snowmelt, beginning in May or early June. The basin's higher peaks may be snowbound all year.

Relationship of climate to flooding

Temperature and precipitation shape the flood regime in the Methow basin. The amount of snowfall and temporal distribution of snowmelt runoff are critical determinants. The majority of flooding in the Methow Valley follows winters in which large amounts of wet snow accumulate, and is associated with late spring rain-on-snow events during which runoff cannot percolate into the soil, either because the soil has been saturated (typically during a wet fall) or because it is still frozen. Flooding is most likely when a high-water-content snowpack remains late in the year due to cool spring temperatures, and a sudden warming trend is accompanied by precipitation.

Sources of information in this section are listed in the Bibliography, on page 363

C. Geology, Topography, Soils, and Mineral Resources

Geology

The Methow basin lies near the eastern edge of the North Cascade sub-continent, a granitic land mass that joined North America about 50 million years ago, bringing the old North Cascades volcanoes with it. The Methow Valley was formed when a block of that land mass, known as a graben, dropped relative to the adjacent areas. North of Twisp, the valley has filled with sedimentary rocks of uncertain origin. South of Twisp, igneous and metamorphic rocks cover the older rock of the North Cascade sub-continent. The shape of the valley reflects the origins of the rocks filling it. To the south, durable rocks confine the Methow River within a narrow gorge. The more easily eroded rocks farther north offer less resistance to erosion, allowing the valley to broaden. USGS bedrock geologists recently finished mapping the area north of Twisp; mapping of the area to the south is currently underway.

The Methow Valley has been shaped by glaciers. Alpine glaciation created the high mountain landscape of peaks and *cirques*. The Okanogan Lobe of the Cordilleran Ice Sheet moved down over the Okanogan County area and past the Columbia River into what is now Douglas County, covering all but the high mountain peaks. Those peaks retain the features formed by alpine glaciers. Glacial action scoured the walls of the valley formed by the Methow graben, creating a U-shaped trough that lies 1,000 to 2,500 ft. below the adjacent mountains. The retreating glaciers also deposited thick layers of *unconsolidated* sediments in the valley, resulting in the present-day landscape of rounded hills, outwash terraces, and moraines. As discussed below, the layers of *unconsolidated* material affect the way water moves in the basin. The depth of the deposits varies, ranging from tens of feet to over 1,000 feet.

Hydrogeology

Hydrogeology refers to the relationship between water and geologic conditions, both above and below the ground.

Running water has created alluvial fans at the mouths of many streams in the Methow Valley. McFarland, Gold, Wolf, Goat, and Early Winters Creeks and Lost River are among the larger streams that cross fans; many smaller tributaries have created fans as well. Alluvial fans are fan-shaped deposits of rock and soil which eroded from mountainsides and accumulated on the valley floors. The deposits are narrow and steep at the head of the valley, broadening as they spread out onto the valley floor. Alluvial fans tend to be especially prone to flooding because they are located at the mouths of steep canyons. Rain runs off of steep valley walls, gaining velocity and carrying large boulders and other debris. The *unconsolidated* sediments that compose the fans provide little resistance to the force of running water. Stream channels can move easily from one part of a fan to another. When the debris fills the runoff channels on the fan, flood waters spill out and cut new channels. The process is then repeated, resulting in shifting channels and combined erosion and flooding problems over a large area.

The subsurface geology of the upper Methow Valley has been thoroughly studied, but information about areas below Winthrop is extremely scarce. Indications are that there are substantial differences in conditions in different parts of the valley. Because the sediments that underlie the upper Methow Valley's soils are *unconsolidated*, they are very permeable. Water

percolates quickly from the surface to groundwater. Interaction between the aquifer and the river is high. Water levels in ponds and *wetlands* within a few hundred feet of the river change rapidly in response to changes in river stage, suggesting that rainfall also reaches the river quickly once it has soaked into the ground. Geophysical investigations suggest there is a dramatic change in depth of sediment deposits about two miles below the Weeman Bridge, with a bedrock barrier blocking the flow of water through the aquifer in that area. The result is an upwelling of water, creating *wetlands* and sustaining the flow of the river when upstream reaches are dry.

Topography

Topography within the basin is varied, ranging from mountainous alpine areas to relatively flat floodplains. The upper elevations are characterized by rugged mountains, several with elevations over 8,500 feet, separated by narrow U-shaped valleys. The Methow Valley is less than a mile wide in most places. Its floor is composed of irregular terraces (former floodplains), alluvial fans, and floodplain meadows. Valley floor elevations range from 2,600 to 780 feet above mean sea level. The valley is bounded by steep bedrock uplands that rise to elevations over 5,000 feet. Topography is considerably different below Wolf Creek than in the upper Methow Valley, reflecting the different geologic processes that shaped the land.

Soils

The soils of the Methow River basin have been mapped by the Soil Conservation Service (now known as the Natural Resource Conservation Service) and the Forest Service. The Washington State Department of Natural Resources has mapped soils in parts of the basin as well. The SCS's *Soil Survey of Okanogan County Area, Washington* was issued in 1980 and is based on field work completed in 1971. In general, coverage offered by the SCS maps is limited to areas outside the National Forest boundary. The Forest Service completed an Order IV Soil Resource Inventory (mapped at a scale of 1:63,000) for all of the Okanogan National Forest in the 1970s. An Order III Soil Resource Inventory (mapped at a scale of 1:24,000) was begun in 1990, with completion expected sometime in the 1990s. Some mapping has been done under WDNR's State Soils Mapping Program. Economic and Engineering Services, Inc., in developing Okanogan County's Geographic Information System for the Methow Valley, found that digital coverage of the Methow basin was minimal. Unless otherwise noted, the information below is derived from the SCS *Soil Survey*.

The alluvial and outwash materials underlying the soils of the Methow Valley provide for fast drainage. North of Carlton, most valley floor soils belong to the Owhi-Winthrop association of deep, well-drained to excessively drained soils. From Carlton south to Pateros, the valley floor is composed of soils of the Pogue-Cashmont-Cashmere association of deep, somewhat excessively drained and well-drained soils.

The SCS has defined four hydrologic groups, designated A-D, for classifying soils according to their drainage characteristics. Most soil types in the area covered by the soil survey for the Okanogan County area belong to group B, composed of soils with moderate infiltration rates. A few soil types belong to Group A, composed of soils with high infiltration rates. They occur only in the upper part of the Methow Valley, often in large areas near the river.

Steep, erosive soils along the river pose hazards in places. Steep bluffs are common adjacent to the Methow River south of Gold Creek. Many soils are composed of sands and sandy loams, which tend to be easily eroded. During past flood events, dramatic erosion of sandy bluffs has been common. Several buildings situated high above the river have been lost when flood waters undermined them.

The SCS rates soils in terms of suitability for a number of activities, including building site development. The alluvial fan soils in the Methow Valley, including Boesel, Colville, and Leavenworth units, are considered to have severe limitations for construction of dwellings and small commercial buildings owing to susceptibility to flooding. Boesel soils are found in large areas adjacent to the Methow River north of Winthrop. Colville and Leavenworth soils are less common. Many soils adjacent to the river are moderately to severely limited for paths, trails, and other recreational development. With the exception of a few extremely gravelly or stony units, most soils within the *river corridors* are suitable for a variety of agricultural uses, including orchards, grazing, and irrigated crops. The *Soil Survey of Okanogan County Area, Washington* provides additional information on soil suitability.

Mineral resources

Ore mining in the Methow basin began shortly after European settlement, and has since continued intermittently. The Alder, Red Shirt, and several smaller mines yielded gold, silver, copper, zinc and lead into the 1940s. Since the 1950s, mining interests in the Cascades and western Okanogan areas have focused on development of large-scale, low-grade deposits. Various proposals for development of a large open-pit mine north of Mazama were presented during the 1960s and 70s, stimulating sales of land—especially river-front lots—in the area and raising concerns about water use and effects on water quality. Mining has never been a major factor in the economy of the area, with total production from mines in the basin estimated at $1,100,000 as of 1976.

Sources of information in this section are listed in the Bibliography, on page 363

D. Hydrology and Fluvial Geomorphology

Understanding basin hydrology helps planners to estimate the likely frequency and magnitude of flooding and to locate sites where erosion may be a hazard. The hydrology of the basin is a function in large part of climate, topography and the region's geology and glacial history. The Methow River basin measures just under 1,800 square miles; its river system drains most of western Okanogan County. River basins in arid areas tend to have dominant contributions of discharge in headwaters and minimal downstream water sources; in eastern Washington and Oregon, elevations below 2,000 feet usually do not contribute significantly to streamflows. The Methow basin is no exception; mean annual runoff decreases from 60 inches at the Methow River headwaters to one inch near Pateros. Snowmelt is the main source of runoff in the basin. Bedrock and sediment deposition patterns influence the fate of runoff once it reaches the valley floor.

Hydrology

The Methow River is the basin's principal hydraulic feature. Its major tributaries include three rivers, the Twisp, the Chewuch (previously spelled Chewack), and Lost River, and six creeks, Gold, Libby, Beaver, Wolf, Goat, and Early Winters. There are numerous minor tributaries.

The Methow River rises in the northwestern part of the basin, and flows in a more-or-less southeasterly direction for more than 80 miles to its confluence with the Columbia River at Pateros. The mainstem is formed by the confluence of the West Fork Methow River and Robinson Creek. The drainage upstream from Winthrop is estimated at 500 square miles, and also includes Lost River, Early Winters Creek, Goat Creek, and Wolf Creek; together, they drain most of the northwestern part of the basin from the crest of the Cascade Range to Winthrop. Average runoff from the area is about 25 inches per year. Lost River, Early Winters Creek and the mainstem provide most of the inflow to the surface and groundwater systems above Weeman Bridge.

The Chewuch River drains about 525 square miles in the northeastern part of the basin, rising at an elevation of about 5,100 feet near the Canadian border and flowing southward for 36 miles before joining the Methow at the Town of Winthrop (approximate elevation: 1,740 feet). While the land area is approximately the same as that drained by the Methow River above Winthrop, the Chewuch discharges considerably less water (average annual runoff is about 10 inches) because its basin receives less precipitation, and less of it is at high altitude than the upper Methow basin. The *energetics* of the Chewuch are thus very different from those of the upper Methow.

The Twisp River's drainage area is about 250 square miles. Like the Methow, it originates near the crest of the Cascade Range. The Twisp flows southeast and east for about 27 miles, joining the Methow at the Town of Twisp. Annual precipitation over the Twisp River basin ranges from more than 80 inches along the crest of the Cascade Range to about 15 inches at Twisp.

Geomorphology

Geomorphology refers to the relationship between the shape and other physical characteristics of the river (its morphology) and the rocks and sediments of the valley in which it flows. The river creates its channel, which reflects the force of the flowing water and the material of which the bed and banks are made. Changes in watershed condition can affect the amount of runoff, the amount and size of sediment that enters the river, or both. Changes in runoff and sediment loading affect the river's behavior, including flood characteristics.

The Methow River's character changes in response to the valley's geology as it flows downstream. North of Winthrop, the river is braided, with interlaced channels and gravel bars within the active channel area. The river's movement in the valley is constrained in places by alluvial fans, notably at Early Winters and Wolf Creeks. Where it is not so constrained, the river channel may be as much as several hundred feet wide, influencing a significant portion of the valley floor. R. W. Beck and Associates reported in 1973 that the average slope of the river bed between Mazama and Winthrop was 23.4 ft./*river mile*. That figure may have changed as a result of *aggradation* (increase in streambed level due to deposition of sediments). The slope of the

river bed, or stream gradient, is important because it affects the river's velocity. As water moves faster, its power to move sediment and woody debris and to erode streambanks increases. Velocity increases with increased stream gradient—the river flows faster in the Mazama area than near Twisp, where the slope is not as steep. The river bed is composed of coarse material—cobbles and boulders—indicating the river moves with a great deal of force during flood periods.

Between Winthrop and Twisp the river is more confined; its channel occupies a smaller portion of the valley floor than in many reaches above Winthrop. The average slope of the bed in the reach drops to 17.0 ft./*river mile*. The river has less erosive power and carries finer sediment than in the upper reaches..

From Twisp at River Mile 39.40 south to River Mile 32.67, river bed and valley floor are composed of easily eroded alluvial sediments that allow the river to change course relatively easily. The river is somewhat braided and meanders within a broad area of alluvial deposits overgrown in places with riparian vegetation. A *meander belt* showing evidence of abandoned channels adjoins the active channel. From River Mile 32.67 to Carlton at River Mile 27.24, bedrock contains the river within a narrow canyon. Again, the average slope of the river bed drops in the reach, to 14.1 ft./*river mile*. As between Winthrop and Twisp, the decrease in gradient signals a reduced ability to move material within the channel. However, the banks in the Twisp-to-Carlton reach tend to be of fine, easily eroded sediments, so the river has the potential to do a great deal of damage when it floods and its force increases.

Below Carlton, the valley narrows and the river is confined to a channel eroded in bedrock. Sediment has been deposited immediately adjacent to the river in some places, forming discontinuous terraces.

Streamflow

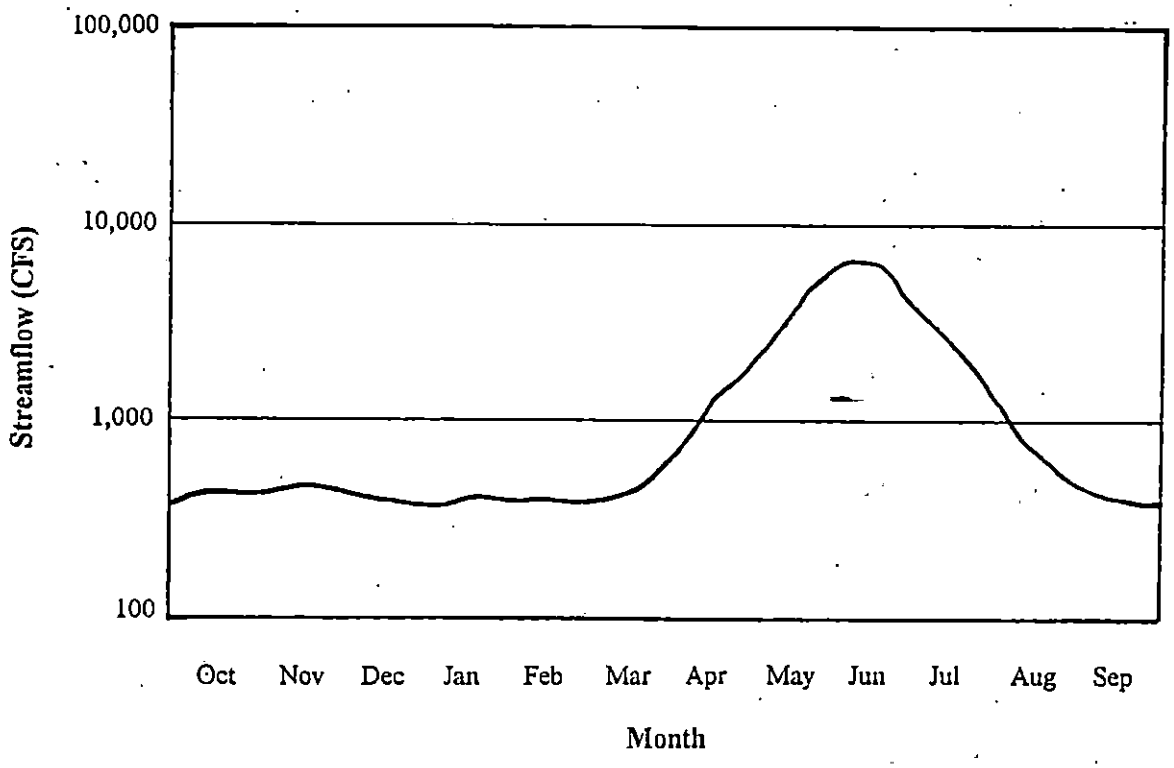
Precipitation is the source of virtually all fresh water in the basin; groundwater migration from outside the catchment is negligible. Two factors, runoff and hydraulic exchange, affect flow rates. Much precipitation remains as snowpack for several months after it falls, providing for high flows concentrated during the late spring melt-out. The bulk of the spring *freshet* comes from snowmelt, with concurrent rains contributing relatively little. Some 80% of the annual runoff occurs during the April-through-July high-flow period. Flow rates begin to increase in April, as temperatures increase and snow begins to melt at higher elevations. Rates peak in May and June, when 60% of the annual runoff occurs. The annual peak flow generally occurs in late May or early June (see Fig. II.2). Flows typically remain high during the month of July, diminish rapidly in August, and reach their annual low in September. The low flow season lasts through March, with rates increasing slightly in October in response to fall rains, dropping through the winter as more precipitation is tied up in snowpack, and reaching a winter low in February.

Exchanges between surface and groundwater are the second factor driving streamflow in the Methow River basin. Relationships between surface and groundwater are complex. Permeable glacial sediments form the principal Methow Valley aquifer, and are thought to provide for a high degree of hydraulic continuity between surface and groundwater in most parts of the basin. However, there has been little detailed study of conditions below Winthrop. In the upper valley, groundwater discharges into stream channels when the basin water table is higher than the stream level. Thus, during the high flow periods in spring and early summer, the river recharges the groundwater; during dry periods the river is fed by groundwater discharge. Recharge/

discharge characteristics vary spatially as well as over time. During low flow periods, much of the Methow's surface flow goes into the groundwater around the confluence with Lost River, then reappears between the Weeman and Winthrop bridges (River Mile 59.7 to 49.8). As mentioned in the section on hydrogeology above, stretches of the river below the Weeman bridge continue to flow even when the river drops to low flow. The hydrologic regime may influence flood levels. Gaging station records show that stage variations at the Mazama Bridge are greater and have much higher peak flows than at Weeman Bridge, approximately 5.7 miles downstream, probably because of movement of water from the stream to the aquifer at high flow in the reach above the Weeman Bridge.

Where surface and groundwater are in continuity, the condition of the *river corridor* will have a strong impact on groundwater resources as well as on flooding. Riparian vegetation both slows flows and helps water infiltrate to the zone from which it can recharge the aquifer. Similarly, changes in land use that affect groundwater quality and quantity and aquifer recharge potential will be reflected in the river.

Figure II.2
Peak Flow Diagram



Based on average of flows on the Methow River near Pateros, 1959-1992

Sources of information in this section are listed in the Bibliography, on page 363

E. Biological Resources

Vegetation

The natural vegetation of the Methow River basin varies in response to temperature, moisture availability, and soil characteristics. Most of the basin is forested, with coniferous species dominating. At higher elevations, forest cover gives way to alpine vegetation, bare rock, and glaciers. In low-elevation areas that do not support forest cover, land that is not cultivated or developed is dominated by shrub-*steppe* communities. The exact elevation at which the shift from one vegetation type to another occurs depends on latitude (how far north or south a given site is), aspect (what direction a site faces—and hence how much sun it gets), and other environmental factors. *Riparian areas* support plants adapted to wetter conditions. Native vegetation has been disturbed in many places. Much low-lying land has been converted to apple orchards and alfalfa fields. Throughout the basin, *steppe* lands have been used as cattle and sheep range and mid-elevation forests have been logged.

Undisturbed *riparian areas* in the Methow Valley have a more reliable source of water than is available in most parts of the basin, and are therefore heavily vegetated with deciduous trees (including quaking aspen, black cottonwood, alder, willow, maple, and hawthorn) and shrubs (including snowberry, rose, and red-osier dogwood), and support a wide variety of herbaceous species as well. Riparian vegetation is usually extremely diverse, providing habitat for a wide variety of species, especially migratory birds. The stems and roots of the dense natural vegetation are important in slowing flood flows, trapping sediment, and stabilizing streambanks. Such vegetation also helps to provide aquatic habitat. Where riparian vegetation has been removed, riparian and aquatic habitat quality and flood attenuation capacity of the *river corridor* are dramatically reduced, and water tables may drop as water moves more quickly through the area.

The *steppe* areas beyond the *riparian zone* support a variety of *plant communities* dominated by shrubs and large perennial grasses adapted to arid conditions. The composition of those communities varies with differences in precipitation, temperature, and soil type. Sagebrush, bluebunch wheatgrass, and Idaho fescue dominate in most parts of the valley. Moister sites support bitterbrush communities, while rabbitbrush is common on drier sites with sandy soils. Throughout the valley, but especially on the moister sites, communities include many perennial *forbs*, with balsamroot conspicuous among them.

In upland areas, *steppe* communities give way to coniferous forest, with groves of aspen and cottonwood continuing to occur in *riparian areas* and on poorly-drained soils. The level of low timberline is a function of precipitation rates and aspect as well as elevation. Forest and *steppe* communities tend to be strongly *interdigitated*, with trees growing at lower elevations on north-facing slopes and in areas of higher precipitation, and *steppe* vegetation extending higher on hotter, drier land. In addition, ponderosa pine distribution is strongly tied to soil moisture levels and hence to soil texture; the driest sites exhibit a mosaic of pine and *steppe* communities, so the boundary between forest and *steppe* may not be an abrupt one.

About 75% of the basin is forested with trees of commercial value. The basin's topography results in a variety of environmental conditions and hence of forest types. At the lowest forested elevations, moisture is the principal limiting factor. Ponderosa pine dominates at the forest/*steppe* ecotone, followed by Douglas-fir at somewhat higher elevations. At higher

elevations, moisture ceases to be severely limiting, and forest communities are dominated by subalpine fir and lodgepole pine. At the highest forested elevations, where temperature limits tree growth, forest composition shifts to communities dominated by whitebark pine and subalpine larch. Above high timberline, forest gives way to shrub and meadow communities, bare rock, and glaciated areas.

Native plant associations have been changed in many parts of the basin by agricultural and logging operations and residential development. In *riparian areas* where livestock graze the major shrubs and herbs, native understory tends to be replaced by exotic grasses. Livestock grazing and human land disturbance activities have resulted in a shift in many *plant communities'* composition from native to aggressive introduced species. Much of the floodplain has been converted to pastures, alfalfa fields, and orchards. In many places, riparian vegetation has been removed to allow cultivation or use of the area by livestock. Much of the forested land in the basin has been logged, leading to changes in vegetative cover and function. Specifically, runoff rates and sediment loading have been affected. The Okanogan National Forest established a policy of no old growth logging in 1989, providing for the preservation of important vegetation resources in the basin.

Fish and wildlife

The Methow River basin supports many fish and wildlife species, including some that are rare, threatened, endangered, or of local concern (discussed below). Fish and wildlife resources add significantly to the quality of life and the economy of the area. Among the most prominent are mule deer and various species of salmon and trout. In many cases, conversion of habitat areas to agricultural and residential use has restricted species range and distribution.

Aquatic biology

Fish

Methow basin watercourses support both *anadromous* and resident fish, including spring, summer, and fall chinook, sockeye salmon, rainbow/steelhead trout, cutthroat and brook trout, bull trout, whitefish, suckers, sculpins, squawfish, and dace. There is a sport fishery on the steelhead (returned *anadromous* rainbow trout). Coho salmon were extirpated in the early decades of this century when a dam at the mouth of the Methow River blocked migrants returning to the basin to spawn. Brook trout are non-native fish introduced to the basin early in the twentieth century. Brook trout are thought by some to hybridize and compete with bull trout. Species distribution naturally varies from headwaters to downstream reaches, depending on the habitat requirements of individual species.

Although Mullan (1992) has stated that "There is no evidence that historical abundance of salmon and steelhead in the...Methow [River] differed markedly from now", some stocks in the basin have been classified as depressed. A depressed stock is defined as a stock of fish whose population is substantially below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely. In the 1992 Salmon and Steelhead Stock Inventory (SASSI), spring chinook on the Methow, Twisp, Chewuch, and Lost Rivers; summer chinook on the Methow River; and summer steelhead on the

Methow River are all classified as depressed stocks (Caldwell and Catterson, 1992). Poor fish passage because of dams is a major factor in population declines, as are seasonal losses of water in tributaries (both natural and resulting from irrigation withdrawals) and *cumulative effects* of past and present land and water uses. *Stochastic* events such as droughts and floods also affect population levels.

Sometime between 1912 and 1915, a hydroelectric dam was built across the Methow River at Pateros. By the time it was removed in 1929, the basin's coho salmon run had been extirpated. Attempts to reestablish the run with stocks from the lower Columbia River tributaries have been unsuccessful. A new effort to reintroduce coho into the Methow River is currently underway. The program was initiated by the Yakama Indian Nation and started this year with the release of about 250,000 smolts. Supplementation of other *anadromous* fish species has been successful in developing viable hatchery runs with some natural (not spawned and reared in a hatchery) runs developed as well. Land use practices have caused some decline in habitat quality due to vegetation removal and sedimentation. Salmon and trout have fairly precise habitat requirements, and changes in watershed condition (whether natural or human-caused) may have a negative effect on survival rates and population density. In addition, Methow basin salmon stocks are subject to ocean fishing, which has an unknown impact on populations. Because stocks are depressed, no sport or tribal fishing for salmon is allowed in the Methow River. The only commercial fishery is a small tribal steelhead fishery.

In 1993, the U. S. Forest Service's Forest Ecosystem Management Assessment Team (FEMAT) determined that Methow basin spring chinook runs are at moderate risk of *extinction*, and that summer steelhead runs are at a moderate-to-high risk of extinction. Bull trout and westslope cutthroat trout are candidates for listing by the USFWS under the Endangered Species Act. The bull trout population was found to meet listing criteria in 1994, but has not been listed because of staff and budget limitations within the U.S. Fish and Wildlife Service. The U. S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) were recently petitioned to list the Methow River summer chinook under the Endangered Species Act; NMFS determined that the summer/fall chinook run in the Mid-Columbia river and tributaries were the same species and that those runs were healthy. The steelhead population could also meet listing criteria. On February 16, 1994, the secretary of Commerce received a petition requesting that steelhead populations in California, Oregon, Idaho and Washington be listed under the Endangered Species Act. On August 6, 1996, NMFS published a proposed rule in the Federal Register Notice that includes listing steelhead as endangered in the Columbia and tributaries upstream of the confluence with the Yakima River (including the Methow River and its tributaries). NMFS has a year from their publication date to determine if the steelhead will be listed. Land west of the Chewuch River has been identified by the federal government as key habitat for at-risk *anadromous* salmon and steelhead and bull trout. WDFW priority fish species include cutthroat trout, bull trout, and rainbow trout. Okanogan County's Critical Areas Ordinance lists *anadromous* and resident fish as Species of Local Concern (Level II species).

Hatchery supplementation programs have been used to boost fish populations in the basin since 1899; two hatcheries are currently in operation. In addition, the Wells Salmon and Steelhead Hatchery at Wells Dam on the Columbia River has raised summer steelhead for stocking into the Methow River since 1967. Summer chinook from Wells Hatchery were released into the Methow River in 1987. The Eastbank Hatchery, near Rocky Reach Dam, releases summer chinook from the Methow River acclimation pond.

The Winthrop National Fish Hatchery, operated by the USFWS, was built in 1940 and first released smolts soon after. The hatchery was inundated by the flood of 1948, allowing smolts to escape ahead of schedule. Spring and summer chinook, coho, and sockeye smolts were released through 1962. Salmon were not reared at the hatchery in the years 1963-1975. Since 1976, the hatchery has reared and released an average of one million spring chinook per year. From 1977 through 1979 and again in 1983 the hatchery also reared and released summer chinook. Currently, spring chinook and summer steelhead are being released; the Fish and Wildlife Service is not anticipating any future release of summer chinook.

The Methow Spring Chinook Hatchery, operated by the Washington State Department of Fish and Wildlife, was built in 1992 and first released smolts in 1994. The hatchery was built as mitigation for the loss of downstream migrant salmon not protected by the bypass system at Wells Dam. (Between one and two percent of the salmonids passing the project die while passing through the turbines.) It rears and releases spring chinook only.

As a supplement to hatchery programs, the Chelan and Douglas County Public Utility Districts agreed to build acclimation ponds in the basin, into which pre-smolts raised at Wells and Eastbank Hatcheries are released. The intent is that the juveniles migrating from the ponds will return to the river reaches on which the ponds are located to spawn, strengthening the natural runs on those reaches. Ponds are located on the Twisp and Chewuch Rivers, at the Methow Hatchery, and on the Methow River upstream of the town of Carlton. The Douglas County PUD built the Twisp, Chewuch, and Methow Hatchery acclimation ponds. The Twisp and Chewuch ponds were used to release spring chinook in 1994. Chelan County PUD constructed the Carlton acclimation pond as part of the Eastbank Hatchery program to compensate for the loss of downstream migrants at Rock Island Dam Summer chinook from Eastbank Hatchery were first released from that facility in 1991.

The potential effects of extensive hatchery supplementation on the genetic makeup of the Methow River basin salmon and steelhead runs are unknown. Studies have shown naturally-produced salmon and trout to be superior to hatchery-reared stock, raising concerns over the current trend toward reliance on supplementation.

Other aquatic species

Little is known about amphibian, mollusk, and aquatic *macroinvertebrate* populations in the Methow basin. According to the U.S. Fish and Wildlife Service (1995), several species that are candidates for listing under the Endangered Species Act may occur in the basin; they include the California floater, Cascades frog, Columbia pebblesnail, and Pacific lamprey. Spotted frog and tailed frog are candidate species known to occur in the basin.

Terrestrial wildlife

Federal and State agencies and Okanogan County have identified several wildlife species and habitat types that are of special importance in the basin (Figure II.3). The United States Fish and Wildlife Service designates species that are experiencing or have experienced declining populations, and are in danger of *extirpation* or *extinction*, as endangered or threatened. The Washington State Department of Fish and Wildlife designates Priority Habitats and Species, maps areas of critical importance to them, and develops management recommendations for them.

Priority habitats are those with unique or significant value to many species. Priority species are those that have been listed by the state as endangered, threatened, or sensitive, or are candidates for such listing; vulnerable species that are susceptible to significant population declines; and species of recreational importance.

Within the areas designated by the state as priority habitat or habitat for priority species, Okanogan County has identified certain lands as Fish and Wildlife Conservation Areas under the County Critical Areas Regulations (Growth Management Act regulations). The ordinance specifies development regulations for those areas based on a three-tiered habitat classification system. The Critical Areas Regulations and the habitat classification system are discussed in Chapter IV.

Figure II.3
Wildlife Species of Special Importance in the Methow River Basin

Species	Federal	State	Okanogan County		
			Level I	Level II	Level III
Bald eagle	Threatened	Threatened	x		
Western gray squirrel		Threatened	x		
Northern spotted owl	Threatened	Endangered	x		
Mountain goat		Recreational		x	
Mule deer		Recreational		x	x
Golden eagle		Candidate		x	
Harlequin duck	Candidate	Recreational		x	
Sharp-tailed grouse	Candidate	Candidate		x	
Western bluebird		Candidate		x	
White-tailed deer		Recreational			x
Chukar		Recreational			x
Habitat Type					
Cliffs		Priority area		x	
Shrub-steppe		Priority area		x	

In addition to the species listed in Figure II.3, grizzly bears, gray wolves, wolverines, and lynx, all of which are listed as sensitive, endangered, threatened, or candidate species by the federal and state governments, have been sighted in the basin. Six bats considered by the Forest Service and the State to be species of concern occur in the basin.

County-designated habitat for bald eagles, western gray squirrels, northern spotted owls, mule deer, golden eagles, harlequin ducks, and white-tailed deer lies wholly or partially within the *river corridor* as defined in this plan. The life cycles of bald eagles, mule deer, harlequin ducks, and white-tailed deer are closely tied to the river.

Bald eagle

Bald eagles winter in *river corridors* in the Methow Valley, concentrating in areas where food is abundant and disturbance is minimal. During the day, the birds use perches selected primarily on the basis of proximity to a food source. Perch trees tend to be the tallest available. Eagles conserve energy by roosting in sheltered places. The quality of riparian habitat affects the suitability of the *river corridor* as eagle habitat, in terms of both perch and roosting sites and prey availability. Bald eagles are sensitive to human activity; disturbances during nesting and wintering periods can weaken them by causing them to expend more energy. Human activities such as camping, fishing, boating, construction, and logging disturb bald eagles. In addition, the eagles are less likely to nest near houses. The *cumulative effects* of habitat changes also threaten eagle populations, by restricting their range.

Harlequin duck

Harlequin ducks breed in the Methow Valley. During the April-June nesting season, they require fast-flowing water, nearby loafing sites, dense shrub or timber/shrub mosaic vegetation on the banks, and an absence of human disturbance. Broods require adequate populations of *macroinvertebrates* (such as stone fly larvae) as food sources. Thus, the quality of riparian vegetation is critical to their success.

Mule deer

Mule deer are the basin's most visible animal residents. The Methow Valley is home to the largest migratory mule deer herd in the state of Washington. Increasing development in the valley has had a negative impact on the deer population; both habitat fragmentation and disturbance by human beings and dogs are threats. According to the Methow Valley Plan, an addendum to Okanogan County's 1964 Comprehensive Plan, loss of ranges on federal, state and private lands would result in the loss of 75 percent to 80 percent of the deer herd in the valley. The Washington Department of Wildlife's management recommendations state that, "Mule deer require juxtaposition of food, cover, and water...Areas without water available within 1.6 km (1 mi.) show decreased use." Methow Valley rivers and their corridors serve as sources of water, food, and cover for mule deer.

Migratory corridors, spring range areas, and fawning areas are also important to mule deer survival. Lands designated as Level II mule deer habitat by Okanogan County include migratory corridors, critical winter range areas, and spring range areas. Designated Level III habitat includes priority winter range areas and migration corridors. *River corridors* are a significant component of the designated migration corridors and spring range areas.

A publication titled *Living with Mule Deer in the Methow Valley* provides guidance for residents in maintaining a non-disruptive environment.

White-tailed deer

Like mule deer, white-tailed deer require food, water, and cover, appropriately juxtaposed. According to the Washington Department of Wildlife, "Closed canopies of mature forests along streams and at lower elevations are extremely important white-tail habitat." The

same authors note that "Riparian areas can be important as travel corridors but by themselves are usually not enough to ensure adequate" lanes for movement. Areas designated by Okanogan County as Level III habitat for white-tailed deer in the Methow Valley are primarily in or adjacent to *river corridors*.

Other wildlife

Wildlife populations in the basin have not been extensively inventoried, and no systematic program for conducting an inventory is in place. Inventory by WDFW is ongoing. Numerous species of birds, large and small mammals, reptiles, and amphibians are known to occur. The basin is home to black bear, coyote, cougar, beaver, snowshoe hare, bobcat, yellow-bellied marmot, raccoon, mountain cottontail, long-tailed weasel, marten, red fox, red squirrel, porcupine, blue grouse, golden eagle, various frogs, toads, snakes, and bats, and many other animal species.

The role of beaver is worth discussing since the animals have a profound effect on riparian and wetland structure. Beaver are found in many parts of the basin. Historically, they have played an important role in stream ecosystems. The vegetative cover and habitat characteristics of land inundated by water backed up behind beaver dams change dramatically. Beaver eat large amounts of vegetation, changing the structure of the ecosystem in areas they inhabit. Trees left standing will die if they cannot adapt to their new environment; they can provide habitat for a wide variety of species, both while they remain standing and after they have fallen. Abandoned dams eventually wash away, leaving areas of enriched soil to support a new generation of riparian vegetation.

Beaver activity can have both positive and negative impacts in the short term. Beaver ponds are productive and provide important habitat for fish. Beaver activity also raises the water table and creates *wetlands*. Dams help to slow flow during spring runoff and add visual variety to the landscape. They can also block upstream migration and raise stream temperatures. When a dam washes out, the silt that is flushed downstream may smother spawning beds. Land use is affected by beaver as well. Beaver dams often block culverts and irrigation ditches. In addition, their tree cutting activities can cause conflicts with landowners in *riparian areas*. A variety of methods has been developed to keep beaver from causing damage without relocating them.

Sources of information in this section are listed in the Bibliography, on page 364

F. Water Resources

The term "water resources" refers to the quality and quantity of water. Adequate supplies of good quality water are important for groundwater recharge, fish and wildlife habitat, recreation, irrigation, and domestic use. As is the case throughout the arid west, water resource issues have aroused considerable interest and conflict in the Methow Valley. Many studies have been undertaken as part of the process of reaching equitable solutions to problems relating to water quantity and quality. They are summarized in the "Annotations and Summaries of Library Contents" notebook and computer search system (developed as part of the Methow Valley Water Pilot Planning Project and currently housed in Okanogan County's Twisp Planning Office).

Both ground and surface water are relied upon for domestic and agricultural use. The *unconsolidated* sediments that underlie the valley floor are the basin's principal aquifer. That aquifer is considered to be in hydraulic continuity with surface water in the basin. While the Department of Ecology concluded twenty years ago that "Supplies of ground water will...be adequate for presently projected use...for many years to come", recent growth and issues surrounding instream uses have spurred concern over water supply. Agriculture is by far the largest water user in the valley, with domestic use a distant second. The effect of surface water diversions for agricultural irrigation on river flows, instream and riparian habitats, and *anadromous* fish populations is a major issue.

Several planning efforts have addressed water resources in the Methow River basin. A Methow Water Basin Plan was developed in the early 1970s to estimate water use, prioritize various uses, and set minimum instream flows. Minimum flow rates specify the amount of water that must be maintained in rivers and streams to protect fish and wildlife resources. Instream flow rates have remained a subject of great debate. The plan is based on the work of the Methow River Basin Steering Committee and questionnaires sent to valley residents. The *Methow Valley Plan*, adopted in 1976 as an addendum to the Okanogan County Comprehensive Plan, promulgates policies addressing water supply and water quality issues, including the need to protect existing water rights and the need to protect fisheries habitat by maintaining adequate stream flow.

More recently, both the Methow Valley Groundwater Advisory Committee (GWAC) and the Methow Valley Water Pilot Planning Project (Pilot Project) have developed plans addressing water resources in the basin. The GWAC grew out of concerns about the potential effects of an alpine ski resort proposed for development in the Sandy Butte/Early Winters Creek area. As development pressures increased, concern grew to include water supply issues. The Department of Ecology established a Ground Water Management Area in the Methow Valley to fund planning related to both water quality and supply. The GWAC was convened in 1989 to provide local input to the planning process, and submitted a draft of the Methow Valley Groundwater Management Plan to the Department of Ecology in September, 1993.

The Pilot Project stemmed from a state-wide regional planning effort. In 1988, water-resource conflicts prompted the state legislature to create the Joint Select Committee on Water Resource Policy (JSC) to recommend procedures for allocating water resources in the state. In 1990 the legislature adopted JSC-sponsored bills calling for cooperation between interest groups, local governments, tribes, and water users in regional water planning. Representatives of those entities met at Rosario, to discuss approaches, and again at Lake Chelan, where cooperative planning goals and a pilot planning process were codified in the Chelan Agreement. The Methow and Dungeness-Quilcene basins were selected as the initial pilot planning areas. The goal of the Methow Valley Water Pilot Planning Project was to create a water-resource management plan for the Methow River Basin, providing recommendations for resolving current and long-range (20 to 50 years) water use conflicts. The plan is intended to supersede the current Basin Plan. GWAC and Pilot Project representatives have been working to make the two plans consistent with each other, so that they provide a unified approach to water resources planning for the basin. The Department of Ecology is currently writing the rule that will be used to implement the new plan.

Agricultural irrigation has long been the basin's largest out-of-stream use. Both ground and surface water are used for irrigation. About five percent of irrigation water comes from groundwater; the rest comes from streams, and much of it is transported through the valley via a

network of unlined ditches. The amount of water diverted is not known for certain, but is estimated at 200-260 cfs (396-515 acre-feet/day) during the peak irrigation period (July and August). Irrigation depletes the Methow River's discharge by 28 to 79 percent annually, depending on season, reach, return flow rates, and the water levels in a given year. The valley's irrigation ditches have been found to be only 40-45% efficient—the majority of the water diverted seeps into the ground before reaching the lands it is meant to irrigate. The fate of that seepage is not known. Some of the water may reach groundwater and eventually recharge the rivers. Irrigation diversions are in place on the Methow, Chewuch and Twisp Rivers; and on Early Winters, Wolf, Eightmile, Little Bridge, Buttermilk, Eagle, Gold and Libby Creeks.

Surface water diversion has caused considerable concern because of its effect on instream flows and hence on habitat availability and on fish populations. For several reasons, the exact effect of diversions on instream flows is not known. A number of major diversions predate any flow measurements. Flow rates fluctuate naturally in response to climatic conditions; flows are naturally low in some reaches at certain times of year. Finally, the nature of the Methow Valley aquifer and the relationships between surface and groundwater complicate quantification of the effects of diversions. Whether as a result of irrigation diversions, groundwater withdrawals, natural causes, or, as is most likely, a combination of factors, flows are often critically low in some reaches; other reaches are completely dewatered during peak irrigation periods. Maintaining or improving instream flows by improving the efficiency of the irrigation water delivery system is a major focus of the Pilot Project's *Draft Methow Basin Plan*. Irrigation systems are in use during the late-May/early-June peak flow period; however, increases in instream flows as a result of ditch improvements are unlikely to affect flood flows as the amount of water diverted is small in comparison to the *zero-damage flow rate* (the highest discharge a stream can accommodate without causing any damage). However, flow increases may affect the *riparian zone*. Streamside vegetation is an important factor in flood attenuation; the effect of surface water diversions on that vegetation is not known.

Water is also diverted from Methow basin streams for fish hatchery and acclimation pond use; however, those uses are considered non-consumptive as the water is returned to the stream after use. While there is general agreement that instream flows in the basin are below optimum for *anadromous* fish, no one is certain what flow rates are needed to create healthy habitat and adequately support the basin's fish populations. Wissmar *et al.* conclude that further study of basin geomorphology and flow regimes will be required to establish realistic instream flow rates.

In addition to threats stemming from loss of habitat, fish are jeopardized by irrigation ditches because unscreened diversions allow them to become trapped in the ditches. Screening ditches, and improving existing screens that are in poor condition, are among the Pilot Project's recommendations.

Unlike water quantity, water quality has not been a major issue in the Methow basin. Water quality is generally high, with the Methow River rated Class A (Excellent) from its mouth to its confluence with the Chewuch River. The Chewuch and Twisp Rivers, and the Methow above Winthrop, are rated Class AA (Extraordinary). Water quality standards are set forth in WAC 173-201; a Class AA rating indicates waters markedly and uniformly exceeding the requirements for all or substantially all uses, while a Class A rating indicates water quality that meets or exceeds the requirements for all or substantially all uses. Temperatures on the Twisp River did exceed Department of Ecology standards when measured in 1989; Ecology is in the process of establishing a monitoring program to determine whether or not such exceedances are

natural in that area. The Town of Twisp regularly discharges treated waste water into the Methow River; the Town of Winthrop does so occasionally. Commercial and industrial uses have not had significant effects on water quality. To date, leakage from septic systems has not been a problem, but the valley's permeable soils create the potential for contamination. Logging, grazing, land clearing and road building throughout the basin have led to some increase in sediment loading and erosion rates; further study is needed to fully understand the impacts of those activities on water quality. Removal of riparian vegetation may have caused temperature increases in some river and creek reaches.

Sources of information in this section are listed in the Bibliography, on page 364

G. Wetlands and Riparian Zones

Wetlands and *riparian zones* are transitional areas between aquatic regions and the adjacent dry land. They typically share some characteristics of both aquatic and terrestrial ecosystems. Both *wetlands* and *riparian zones* are ecologically complex areas that perform a variety of functions, including water quality protection, flood storage and conveyance, bank stabilization, groundwater recharge, and streamflow maintenance. Because of their complexity and diversity, they are also important contributors to wildlife and fish habitat.

Little is known about the structure and function of wetland and riparian ecosystems in most parts of the basin. The condition and use of *wetlands* and *riparian areas* are important determinants of habitat and water quality. Removal of wetland and riparian vegetation, compaction of soils, and alteration of hydrology—as, for instance, when fill is added, a pasture drained, or a channel constrained by *riprap*—diminish the capacity of those natural systems. Major impacts on the frequency and severity of flooding can result from individually minor but collectively significant actions taking place over time. The effects of work in and near stream channels in the basin have not been quantified. In some of the basin's *wetlands* and *riparian zones*, function has been affected by land use and development activities. However, the Methow Valley's *wetlands* and *riparian areas* retain substantial capacity to reduce flooding and erosion.

Wetlands

Wetlands are areas in which the presence of water is the dominant factor influencing soil development and *plant communities*. Every wetland has at least one of the following attributes:

- the land supports, at least periodically, predominantly *hydrophytic* plants;
- the *substrate* is predominantly undrained hydric soils; or
- the *substrate* is non-soil (e.g., peat) and is saturated with water or covered by shallow water at some time during the growing season of a normal year.

Development in and adjacent to *wetlands* is regulated under the County's Critical Areas Regulations (Ordinance 94-2).

The only inventory of *wetlands* for the Methow basin was conducted in 1987 by the U.S. Fish and Wildlife Service as part of the National Wetland Inventory (NWI). The (NWI) used analysis of high altitude aerial photographs to map *wetlands*. Error is approximately 60%, due to

the methods used. Forested or seasonal wetlands were often missed. Conversely, the maps may incorrectly identify areas as wetland when they are not. There is no established system for tracking changes in wetland acreage or function in the Methow Valley.

Many Methow basin *wetlands* are associated with rivers and creeks, but wetlands may also be located in areas remote from flowing water. The diversity of the wetlands in this basin results in high function for fish and wildlife habitat. They provide resting, foraging, and nesting areas for most species of vertebrates for at least part of their life cycle. Factors that affect the value of a given wetland include hydrology, soils, climate, size, vegetation type, and position in the landscape.

Many *wetlands* in the basin are associated with floodplains; they have a particularly important function in flood attenuation. Floodplain wetlands influence water flow regimes by intercepting runoff and storing water, thereby changing sharp runoff peaks to slower discharges over longer periods of time. Peak flows cause most flood damage; *wetlands* are therefore very important in reducing flood hazard.

Groundwater recharge is an important function of *wetlands* associated with highly permeable soils. In parts of the Methow basin, soils are very permeable and there is a high degree of continuity between *wetlands* and groundwater. Wetlands remove organic and inorganic nutrients and toxic materials from water that flows across them. They can help to keep groundwater free of pollutants by purifying water before it reaches the aquifer. *Wetlands* where groundwater recharge takes place will be increasingly important in this role, and under greater pressure as the basin becomes more developed.

Wetlands are especially significant in arid areas such as the Methow Valley. Lush vegetation, particularly in wetlands associated with rivers and streams, contrasts dramatically with dry upland vegetation. Such areas are valuable to terrestrial species because of the presence of water, a mesic microclimate, and a diversity of plant species and structures.

Size affects both the habitat value and the water storage capacity of a wetland. The opportunities a wetland offers for wildlife vary depending on its size. Larger *wetlands* have long been considered most valuable, and for many species they are. Other species, however, thrive in smaller wetlands. Larger wetlands absorb more water than do smaller ones. The dominant vegetation type is another indicator of a wetland's value. Forested wetlands are very valuable because they support multi-layered, structurally diverse *plant communities* that offer habitat for a wide variety of species. In addition, they are extremely difficult to replace, since mature trees require so much time to become established. Scrub-shrub wetlands (those dominated by shrubs) are less complex and so somewhat less valuable.

The location of a wetland in a watershed affects its flood control value. *Wetlands* reduce flooding by storing water during periods of high runoff, then gradually releasing it during drier seasons. Wetlands in the middle of a watershed are most valuable—they have large tributary areas, and so can collect and store large amounts of water. Headwater wetlands are less valuable for flood attenuation. Since their tributary areas are small, they cannot collect enough water to diminish flooding downstream to any great extent. Wetlands in the lower part of a watershed also have minimal value in reducing flooding. If filled to capacity, they are most likely to flood the river without reducing flood peaks.

Large, complex *wetlands* with significant forested areas are found near the middle of the Methow, Twisp, and Chewuch watersheds, indicating that wetlands have substantial value in the basin. On the Methow River, wetlands are nearly continuous from above Lost River to the lower

end of the Heath Ranch, with large areas dominated by forest or shrubs. There are also large areas of mixed forested, scrub-shrub, and *emergent wetlands* adjacent to the Methow in the reach beginning at the Methow Valley State Airport (Intercity Airport) and ending near Alder Creek, several miles south of Twisp. On the Twisp River, there are substantial *wetlands*, mostly forested and scrub-shrub, above Little Bridge Creek, as well as a large forested wetland complex near the mouth of Poorman Creek. On the Chewuch, good-sized wetland complexes appear above both Eightmile and Boulder Creeks. In addition, large forested wetland areas are nearly continuous between Cub Creek and Lake Creek.

There will be more pressure on wetland systems as the level of development in the Methow Valley increases. Human beings, as well as wild animals, are attracted by the presence of water in a dry landscape. *Wetlands* requiring the highest level of protection are those most difficult to replace or restore (such as forested wetlands), those that are particularly valuable to endangered or threatened plant or animal species, and those that are rare within the region.

Riparian areas

Riparian ecosystems are those located adjacent to rivers and creeks, where there is enough water to support vegetation that would not grow farther from the water. They encompass the area beginning at the ordinary high water mark and extend to that portion of the terrestrial landscape that is influenced by, or that directly influences, the aquatic ecosystem. *Wetlands* and *riparian areas* are often located within floodplains.[2] Riparian areas are classified as Level II habitat in the Okanogan County Critical Areas Regulations. (See Figure II.3 for an explanation of the County's habitat classification system.) Riparian vegetation has been the subject of some study in the Chewuch watershed by the U. S. Forest Service, and adjacent to State Route 20 between Boesel Creek and Winthrop by the U. S. Department of Transportation. However, no full characterization of the basin's *riparian zones* and their functions and values has been developed.

Riparian areas include the entire floodplain and frequently coincide with *wetlands*. They are an important link between aquatic and upland systems. Although *riparian zones* occupy only a small area within the watershed (probably three to five percent), they are a significant factor in the success of most species. The Forest Service estimates that *riparian zones* are used by 340 of the 400 species known to occur on the Okanogan National Forest. They provide food, cover, movement corridors, and access to water for many terrestrial species. They are also vital habitat areas for amphibians and for neo-tropical migratory birds—both groups that are declining throughout North America. Riparian vegetation provides refugia for fish and thermal protection (shading) for streams. It serves as a source of dissolved nutrients, fine litter, and large woody debris—all vital components of instream habitat. Fish feed on the insects that live in riparian vegetation. In addition, riparian vegetation plays an important role in stabilizing stream banks and trapping sediments that would otherwise be washed into the water.

Sources of information in this section are listed in the Bibliography, on page 365

[2] Riparian areas adjacent to headwaters and tributary streams may not be within mapped *floodplain* areas, but they are likely to be subject to inundation during periods of high water.

H. Land Use

Land use has a significant effect on the basin's *river corridors*. Approximately 80% of the land in the basin is owned by the federal government and administered by the Forest Service. National Forest System lands are divided between the Pasayten Wilderness, the Lake Chelan-Sawtooth Wilderness, and the Okanogan National Forest. Most of the land within the wilderness areas is mountainous, with much over 5,000 feet in elevation. Portions of the headwaters of the Methow, Twisp, Chewuch, and Lost Rivers are inside the wilderness boundaries. The principal uses of wilderness lands are as wilderness ecosystem reserves and wildlife habitat; they are also used for non-motorized recreation and limited mining and grazing activities.

Okanogan National Forest lands range in elevation from below 1,500 to nearly 9,000 feet. Land cover varies from heavy forest to rangeland. The land is managed for multiple uses, including timber management, grazing, mining, wildlife habitat, and recreational use. Much of the National Forest System land within the basin is within the boundaries of the Northwest Forest Plan, and is subject to management guidelines specified in the FEMAT report. Some of that land is managed as *Late Successional Reserve* and *Riparian Reserve* areas. The remainder is classified as matrix; a variety of activities occur there. Because Forest lands drain into the part of the basin under County jurisdiction, management of those lands has a strong impact on the lower reaches of rivers and creeks.

The USDI Bureau of Land Management (BLM) manages approximately 1% of the land in the basin. Cover on BLM land is mostly mixed forest and grassland; land uses include commercial logging, grazing, mining, and recreation.

The State of Washington owns 5% of the land in the basin. A small amount is timber and grassland managed by the Department of Natural Resources (DNR) for timber harvest, wildlife habitat, recreation, and grazing. The remainder of the State land is managed by the Department of Fish and Wildlife (WDFW) for wildlife habitat, recreation, and grazing. Much of the WDFW land lies within the Methow Wildlife Area, which includes lower to middle elevation grasslands and timbered areas with peaks up to 6,000 feet in elevation. Also included are heavily-used river-front campgrounds. In 1991 WDFW purchased 300 acres of the Heath Ranch, on the Methow River northwest of Winthrop, for management as wildlife habitat.

The remaining 14% of land in the basin is privately owned. Most of that land is below 2,000 feet in elevation, on valley floors and adjacent benchlands. Sixty-four and a half miles of the lower Methow River, and several miles each of the Twisp and Chewuch Rivers, are in private ownership. Historically, agriculture has been the principal use on private lands. With the shift to a recreation-based economy in recent years, subdivision and recreational development have become lucrative, with a loss of farmland resulting. From Pateros to Carlton, most of the irrigated land is in fruit production. Between Carlton and Twisp, land use is half orchards and half field crops. Above Twisp, most of the irrigated lands are in alfalfa, with some grain. Some land is planted to dryland crops, as well. Until 1969, apples were grown throughout the Methow Valley. A severe freeze during the winter of 1968-69 killed most of the fruit trees north of Twisp, and most of the orchards have not been replanted.

A considerable amount of land has been subdivided since the opening of the North Cross State Highway (now known as the North Cascades Highway) in 1972. Many small lots have been created adjacent to or near rivers and creeks. Subdivision was concentrated in the upper part of the basin during the late 1970s and early 1980s. However, over the last ten years, growth in

population and lots has tended to occur in the central and southern parts of the basin. When developed, most subdivided land is used for residences, either year-round or vacation. The County's Office of Planning and Development is encouraging cluster development as a means of preserving open space and minimizing water use in the valley.

Sources of information in this section are listed in the Bibliography, on page 365

I. Population and Projected Growth

The Methow River basin supports a combined permanent and seasonal population of about 5,750. Most of the privately-owned lands in the Methow River basin are in unincorporated areas, and the bulk of the population is located in those areas as well. Incorporated towns are located at the confluences of the basin's rivers—Twisp at the confluence of the Methow and the Twisp, and Winthrop at the confluence of the Methow and the Chewuch. The basin is also home to several unincorporated communities—Methow, Carlton, Heckendorn (which abuts the Town of Winthrop to the south and is almost entirely residential), and Mazama. Zoning allows for higher densities, which typically spur growth, within towns and unincorporated communities. However, growth in the Methow Valley has tended to occur outside of towns and communities, in rural areas.

Towns: Twisp and Winthrop

Twisp is the largest town in the valley, with an economy largely based on agriculture. The town's early economy was based on mining and agriculture. By the 1970s, mining had been replaced by timber and tourism, with the Twisp Division of the Crown Zellerbach Lumber Company constituting the town's largest industry. The 1980s saw the closure of the town's mill; agriculture and tourism now form Twisp's economic base. The Town of Winthrop adopted a western theme in 1972 and has developed a tourism-based economy. Methow, Carlton and Mazama all have very small commercial areas catering to local residents and tourists.

Twisp has had planning for land use and facilities since early 1960 when its first comprehensive plan was adopted. An updated version was adopted in 1991. The Town Council adopted a Shoreline Master Program in 1990. The Town's Flood Damage Prevention Ordinance was adopted in 1988 and amended in 1989. Public facilities include a water system, sanitary sewer and treatment plant which was under construction in 1975. The town has a park at the confluence of the Methow and Twisp Rivers, and owns additional riverfront land in the same area. 1990 population was 876.

Winthrop is the northernmost incorporated town in the Methow Valley. The town originated with the establishment of the first store in the Methow Valley in 1891 and was platted and incorporated in 1924. It grew through 1940, with its fastest growth in the 1930s. The town population was relatively constant from 1940 through 1970. The estimated population in 1975 was 408. The population in 1990 was 322. The Town's Shoreline Master Program was adopted in 1990, and its Flood Damage Prevention Ordinance in 1988. Public facilities include a water system, sanitary sewer and lagoon-type sewage treatment facility. The Town of Winthrop also has a park near the Methow River, and owns adjacent undeveloped riverfront land. Plans are underway to build a nature trail in the undeveloped area.

As part of the Methow Valley Water Pilot Planning Project, the Local Government Caucus ordered a review and analysis of population and growth data for the basin. That report, prepared by Highlands Associates and completed in 1993, summarizes population projections made in a number of studies prepared over the last twenty years. The report includes 1990 population figures (drawn from census data) for each of seven river reaches in the Methow basin, as well as for the towns of Twisp and Winthrop. Also included are projections for the year 2010. Those statistics are summarized in the two tables below.

Figure II.4
1990 Year-Round Population

River reach (see Figure D:3:1)	Population
Lower Methow	1,473
Town of Twisp	876
Middle Methow	390
Town of Winthrop	322
Twisp River	731
Upper Methow	369
Chewuch River	293
Early Winters	25
Methow Headwaters	62
Total	4,541

Figure II.5
Projected Methow River Basin Population

1990		2010 (projected)	
Year-round: 4,541	Seasonal: 1,215	Year-round: 5,251-6,926	Seasonal: 3,239-4,486

Highlands and Associates also cite figures showing that population in the basin has grown steadily, with an increase from 2,629 in 1970 to 4,541 in 1990 (representing a growth rate of 73%). Since the last flood occurred in 1972, and the most recent episode of high water in 1983, those figures suggest many residents may be unaware of Methow Valley rivers' potential for flooding and the dangers inherent therein.

Sources of information in this section are listed in the Bibliography, on page 365

J. Transportation and Utility Systems

Transportation

The main thoroughfare through the Methow Valley is provided by State Routes 20 and 153. The opening of State Route (SR) 20 was a significant event as it reduced travel time to the valley from the Puget Sound area and helped spur the development of a recreation-based economy. There is no public transportation in the valley; travel is almost exclusively by car or truck.

State Route 153 runs north from Pateros and terminates about two miles south of Twisp. SR-20 enters the basin from the east via the Loup Loup pass, joins SR-153 at its terminus, and continues north and west out of the basin, crossing the Cascade Range and continuing via Whidbey Island to the Olympic Peninsula. See Figure II.1. The highway crosses deer migration corridors and river-access routes in several places; accidents are common, and many deer are killed each year.

Construction of SR-20 through the North Cascades began in 1964 and was completed in September, 1972. The new highway was originally known as the North Cross-State Highway and is now commonly referred to as the North Cascades Highway. It provides access to recreation areas in the Okanogan National Forest, Ross Lake National Recreation Area, Pasayten Wilderness Area, and North Cascades National Park. Routes 20 and 153 through the Methow valley were designated as part of Washington State's scenic and recreational highway system under the Scenic and Recreational Highway Act of 1967 (Chapter 47.39 RCW). They are also part of a designated scenic route called the Cascade Loop. Severe winter conditions force closure of the highway near Early Winters during the winter months.

Bridges are an important part of the transportation system in the basin, with its narrow valley floor, meandering rivers, and many tributaries. Traditionally, they have been vulnerable to flood damage. A bridge spanning the Chewuch at Winthrop, built in 1891, was destroyed during the flood of 1894. The 1948 flood damaged or destroyed all of the bridges on the Methow River, leaving residents of some parts of the valley stranded. Current Washington State Department of Transportation policy calls for bridges to be built with sufficient clearance to allow passage of debris during a 100-year flood, which should diminish hazards during high flow periods. Bridge locations, dates, and clearances are shown below.

The valley's many bridge approaches and the proximity of the highway to the rivers in many places have resulted in considerable bank armoring to protect infrastructure, which in some places has affected river morphology and function. Most dramatically, Highway 20 was constructed on a berm that blocked the historical floodplain for Early Winters Creek. In addition, constriction of the channel by bridge abutments can affect conditions both up- and downstream. Increases in water depth and velocity resulting from confinement of the channel increase the erosive power of the water and can lead to downstream damage. Constriction can also cause water to back up behind a bridge and spread into areas that would not otherwise be inundated.

Other roads in the valley are either part of the County-maintained system or are on Forest Service lands. The Forest Service road network is extensive and, in concert with timber management activities, has had a major impact on the Methow basin's river system. Roads have

Figure II.6
Methow River Bridges: Dates and Clearances

Bridge	River	River mile	Date	Clearance above 100-year flood
Carlton	Methow	27.2		7-8 ft.
Twisp①	Methow	39.4		8-9 ft.
Winthrop②	Methow	49.8		10 ft.
Weeman	Methow	59.7		
Mazama	Methow	65.4		4-5 ft.
Winthrop②	Chewuch			9 ft.
Chewuch	Chewuch			5 ft.
Twisp①	Twisp			

①WSDOT's current six-year plan calls for replacement of the bridges over the Twisp and Methow Rivers at Twisp.
②The 1977 *Flood Insurance Study* for the Town of Winthrop found that the two bridges in the town are free of obstructions and do not restrict flood flows to any great extent.

been built on Forest Service lands primarily for timber access. The existing road system has been developed over the last 60 years, with the bulk of construction taking place during the 1940s–1960s. In recent years, the Forest Service has begun to consider the impacts of road construction when deciding where to build, and to avoid building new roads when practical. Currently, roads are prohibited in wilderness and prohibited or very restricted in Riparian Reserve and Late Successional Reserve areas. Forest roads have been found to affect runoff and sediment production, with resulting changes in hillslope stability, water quality, riparian and instream habitat stability, water yield, and peak flows. Even with decreased road construction and restoration of some existing roads, those effects are likely to continue to have an impact on the basin's river system for some time to come.

There are no rail lines in the basin. There is no commercial navigation on the rivers; local outfitters do offer recreational and educational boat and raft trips. There are several runways and landing strips in the Methow basin, but no scheduled commercial flights to or from the area. The basin's terrain limits approach directions. The Methow Valley State Airport (intercity airport), located four miles southeast of Winthrop, is used as a smokejumper base during the summer fire season.

Utility systems

Sewer and water systems

Most parts of the Methow Valley are not served by sewer or water systems; water is supplied by springs and individual and community wells, and sewage treatment provided by on-

site septic tanks and drainfields. The exceptions are the Towns of Twisp and Winthrop, which have municipal water and sewage treatment systems, and lots in the Lost River Airport Tracts and Edelweiss developments, where the subdivisions' neighborhood associations operate community sewage treatment systems. The Twisp and Winthrop water systems supply about 40% of the water for domestic use in the basin, both using groundwater wells. Twisp treats sewage using an oxidation ditch system, discharging treated effluent to the Methow River. Winthrop uses a non-overflow lagoon system. Because of the permeable sediments underlying much of the Methow Valley, the use of on-site septic systems outside of the towns has raised concerns as the valley's population grows. Because permeable sediments allow water to move easily below the surface, there is potential for contamination of both ground and surface waters.

Electricity

There is no natural gas service in the Methow basin; electricity and wood are used for heating. Electrical service in and south of Twisp is provided by Okanogan County Public Utility District (PUD) #1, while Okanogan County Electric Cooperative #32 serves the basin north and east of Twisp, including the Beaver Creek and Chewuch River areas. Both are supplied with power by the Bonneville Power Association (BPA); PUD #1 also receives power from the Wells Hydroelectric Project.

There are no hydropower generation facilities in the basin. Hydropower facilities would require storage, and there are not enough suitable storage sites to make generation feasible. In addition, the Northwest Power Planning Council (NWPPC) has designated the Methow River basin as an area to be protected from future hydroelectric development as a means of preserving habitat for *anadromous* and resident fish and wildlife. If a generation facility were proposed in the basin, the NWPPC would argue against its licensing, and the facility would be unable to sell power to the BPA.

Sources of information in this section are listed in the Bibliography, on page 365

K. Scenic, Aesthetic, and Historical and Cultural Resources

The Methow Valley is an extremely scenic area with a strong sense of place derived from large-scale landscape features. The valley's *river corridors* unify the landscape, while the surrounding mountains and terraces define it. A high degree of visual variety enhances the valley's scenic quality. Rock outcrops, hills vegetated with mixtures of grass and trees, timbered slopes, and alpine crags provide a dramatic backdrop to the pastoral landscape that dominates much of the valley floor. As noted in Section II.J, the highways running through the valley are part of Washington State's system of Scenic and Recreational Highways, and compose one leg of the Cascade Loop scenic tourist route.

The basin supports a variety of cultural resources, representing Native American, settlement period, and agricultural themes. The Methow Indians used the area during the pre-settlement period; the oldest known sites in the valley were occupied 3,000 to 5,000 years ago. The basin is still important to local tribes, both in terms of historical and spiritual significance and as a source of natural products. Tribe members gather food and materials for ceremonial and

medicinal use in the area. The basin is also considered a significant fisheries resource, and impacts on water quality and quantity are of concern in the Native American community.

Many structures, artifacts, and other landscape features from the early settlement and mining periods remain. Some sites are still in use. A number of sites have been documented, and some interpreted for visitors. The condition of existing structures from the period varies. The "Old West" theme has been capitalized on in the Town of Winthrop, where the downtown commercial area was re-vamped in the 1970s to appeal to tourists. The most prominent cultural landscape feature of the Methow Valley is the network of irrigation ditches that serves farms and ranches throughout the area. The ditches date from as early as the 1890s; many are still in use. They represent a living legacy from both the settlement period and the succeeding years during which agriculture was one of the region's chief economic generators. They have also engendered considerable controversy in water-supply negotiations (see Section II.F).

Sources of information in this section are listed in the Bibliography, on page 366

L. Recreation and Tourism

The Methow River basin offers a wide range of opportunities for both active and passive recreation throughout the year, and tourism has become an important component of the area's economy in recent years. Many visitors are attracted to the area by its natural beauty and scenic setting; others come to visit wilderness areas and use forest recreation facilities.

The opening of the North Cascades Highway in 1972 improved the area's accessibility to visitors from the Puget Lowland and stimulated the development of a recreation-based economy. The highway allowed development of the Cascade Loop route, which brings tourists through the valley throughout the period when the highway is open (generally April-November). The Methow basin is located near the North Cascades National Park and Ross Lake National Recreation Area. Much of the basin is occupied by Forest Service lands suitable for recreational use, including portions of the Pasayten and Lake Chelan-Sawtooth Wildernesses. The Pacific Crest National Scenic Trail runs through the basin, and is accessible from the North Cascades Highway. All of those features, along with the North Cascades Range and the Methow Valley itself, draw visitors to the area.

Within the basin, camping, hiking, driving for pleasure, fishing, hunting, horseback riding, river rafting, kayaking, canoeing, mountain climbing, rock climbing, backpacking, bicycle touring, and mountain biking are all popular activities. Many visitors are attracted by the "Old West" theme adopted by the Town of Winthrop in 1972. Hunting and fishing draw enthusiasts in the spring and fall and are important economic generators during those seasons. Use of Forest Service areas and facilities is on the rise, with the Winthrop Ranger District reporting a steady increase in visits to the Pasayten Wilderness in recent years, and the Twisp District noting a "slight to moderate increase" in recreation use in the Twisp River watershed in the past decade. State Routes 20 and 153 have been designated as part of the statewide bicycle corridor master plan and are well used by cyclists. Most notable has been the increasing popularity of winter sports in the basin. Although the North Cascades Highway is closed in winter, increasing driving time from the western part of the state, substantial numbers of visitors come to the Methow Valley for snowmobiling, ice fishing, and cross-country skiing. Dog-sledding and heli-skiing are also popular.

The role of cross-country skiing in the Methow Valley deserves special mention. The basin is known as one of the world's top cross-country ski areas, in large part because of the extensive network of trails developed by the Methow Valley Sport Trails Association (MVSTA) in cooperation with public agencies, private landowners, and local businesses. MVSTA grooms just over 100 miles of trails, which traverse a varying terrain on National Forest, state, and private land. Parking and toilet facilities and a network of warming huts add to the popularity of the trail system, which draws 20,000 to 25,000 skiers per year. Cross-country skiing has become the valley's main winter economic generator, without having a major effect on the area's community structure and physical environment. In summer the trails are maintained for mountain biking. About 10,000 cyclists per year use the system, and their ranks are growing even faster than those of skiers. The Association is supported primarily by revenues from sales of trail passes.

MVSTA is currently working with Okanogan County and the non-profit Methow Institute Foundation to develop a valley floor trail that will link the existing network of MVSTA and Forest Service trails to each other and to the valley's communities, resorts, and small inns. The trail will also provide a connection to Arrowleaf, a planned destination resort scheduled for construction near Early Winters Creek beginning in 1997. Over the past twenty years, several groups have proposed to develop a downhill ski resort at the Arrowleaf site, with alpine runs located on adjacent Forest Services lands. The proposals engendered considerable controversy. They were eventually dropped in favor of a development that would provide recreational opportunities consistent with those that already exist, and would have less impact on local communities and the character of the valley.

The basin's *river corridors* have special importance. The Methow and Chewuch Rivers are listed on the Nationwide Inventory of Wild and Scenic Rivers, with the entire length of the rivers off the National Forest classified as Recreational[1]. The rivers and creeks are used recreationally throughout the year. Active uses such as rafting, kayaking, canoeing, tubing, swimming, and fishing are popular during the warm months. Hunters and skiers also use the *river corridors* in season. In addition, the rivers and adjacent lands provide opportunities for walking, bird watching, naturalizing, and contemplation. They are valued for their beauty and visual variety. On Forest Service lands, the most popular campsites tend to be those associated with water.

Access to the basin's rivers and creeks is limited in many parts of the basin. The *Methow River Basin River Access Study*, published in 1993, mapped points of access to the Methow, Twisp and Chewuch Rivers and found that although access points are fairly plentiful south of Winthrop, there is only one on the Methow River between Winthrop and the Forest boundary, and none on the Chewuch between town and the Forest boundary.[2] Although a 1976 survey found that most residents of the area were not in favor of increasing public access to rivers, surveys conducted during preparation of the Parks and Recreation Element of the County's Comprehensive Plan has shown that increasing river access is a high priority for local residents.

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[1] The Wild and Scenic Rivers Act establishes three classifications, Wild, Scenic, and Recreational. The Recreational classification is the least restrictive. It applies to those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

[2] As of 1995, the public has access to the Methow River north of Winthrop via the Big Valley Ranch, purchased by the Department of Fish and Wildlife in 1991. Department of Fish and Wildlife lands provide access to the Chewuch River.

The Department of Fish and Wildlife has recently established several public access sites for fishing.

Two existing documents address recreation potential in the Methow Valley. The *Comprehensive Recreation Plan for the Methow Review District of Okanogan County, Washington* was prepared in 1990 and adopted as an element of the Okanogan County Comprehensive Plan by the Board of County Commissioners in 1991. The plan discusses needs and opportunities for recreational facilities in the Methow Review District, which comprises that part of the Methow Valley north of Gold Creek (Figure IV.1). *Methow River Basin: River Access—Options and Opportunities*, prepared in 1993, examines sites being used for recreational access to rivers in the Methow Valley south of Mazama, and assesses the potential of each for future development.

Sources of information in this section are listed in the Bibliography, on page 366

M. Summary

The characteristics of the Methow River basin present both problems and opportunities with regard to *river corridor* and flood hazard management. Rivers and their corridors are important economically—as a source of irrigation water, for the aesthetic qualities that draw tourists to the area, as a recreational resource—and so their management is critical to many local residents and landowners. The most important factor is the diversity of conditions found in various parts of the basin, which means that different approaches will be needed in different places.

Alluvial fans and erosive bluffs stand out as problems related to the geomorphology of the valley. Both are high-hazard areas not designated on flood maps. In addition, there are many bridges in the valley; they are vulnerable to damage or destruction during floods. The condition of the *riparian zone* is another area that warrants attention. The condition of the *river corridor* has a strong impact on flooding. Native vegetation has been disturbed in many places, affecting the river's ability to handle floods and also diminishing habitat quality.

One complicating factor, which creates both problems and opportunities, is Forest Service management. Because much of the basin is administered by the Forest Service and not subject to County jurisdiction, careful coordination will be necessary to ensure that local citizens' needs are met. Management activities on the National Forest affect privately-owned reaches of the valley's rivers and creeks; forest roads affect runoff and sediment production. The problems inherent in those conditions are balanced to some extent by the recent institution of a system of *Riparian Reserves* on land within the boundaries of the Northwest Forest Plan, and by other programs intended to improve instream conditions.

Finally, land use patterns present a variety of problems and opportunities. Much of the land adjacent to the Methow River, and some land along the lower reaches of the Twisp and Chewuch Rivers, is in private ownership. As land use in the valley shifts from agriculture to residential use, there are likely to be changes in management that will influence the *river corridor*. While the area's population is small, it is dispersed, which will tend to result in fragmentation of the landscape and especially of the riparian resources that help maintain channel function. Many residents have moved to the area since 1972, when the rivers last flooded, and so are not aware of

hazards or of the conditions that promote flooding, such as removal of native vegetation and increases in impermeable surface area.

CHAPTER III: FLOOD DAMAGE HISTORY, FREQUENCY PATTERNS, AND PROJECTED PROBLEMS

A. Introduction

Flooding in the Methow River basin tends to occur in spring as a result of rain-on-snow events. The basin has experienced three noteworthy floods since European settlement—in 1894, 1948, and 1972. All of those floods occurred in late May or early June. Conditions in the basin prior to the floods included above-normal snowpack with high moisture content and near saturated or frozen soils; flooding resulted when a sudden and sustained increase in temperature was accompanied by warm rain. Smaller floods have also occurred in the basin; the conditions that caused them have not been documented, but the timing suggests they were also the result of heavy spring runoff or above-average snow-pack with sustained high temperatures. Such spring rain-on-snow events tend to be less destructive than the winter events seen west of the Cascade range and farther to the south. Flood hazards may also be associated with ice jams, alluvial fans, and flash flooding caused by intense localized thunderstorms over small sub-basins.

Flows in the Methow basin's rivers have been measured intermittently since early in the twentieth century. The locations and dates of operation of USGS gages in the basin are shown below.

Figure III.1
Methow River Basin Gaging Stations

Location	Years of Operation
Methow River near Mazama	1991-present
Andrews Creek near Mazama	1968-present
Chewuch River at Winthrop	1912-1913 (seasonal); 1991-present
Methow River at Winthrop	1912; 1971-1972; 1989-present
Twisp River near Twisp	1975-1979; 1989-present
Methow River at Twisp	1919-1962; 1991-present
Beaver Creek below South Fork	1960-1971 (?)
Methow River at Pateros	1903-1920
Methow River near Pateros	1959-present

The sporadic record has made it difficult to develop a complete record of past floods and to generate flood frequency curves. For instance, there was no gage at Pateros, where the Methow enters the Columbia, during the flood of 1948. Several gages now in place have been operating only since 1989 or 1991. As a more complete record is developed, it will be easier to record patterns and develop predictive models. Some estimates have been made, and are

discussed below. Most estimates are for the Methow River at Twisp, since that station has the longest record and is the only one at which the 1948 flood was measured.

On the Methow River at Twisp, *zero-damage discharge*—the flow rate at which no flood damage is expected—is estimated at approximately 17,000 cfs. A flood of that magnitude has a 20% chance of occurring in any given year, and so can be expected about one year in five, on average. (A flood of any magnitude can occur in any year, regardless of how long it has been since the last flood. For instance, two one-hundred-year floods can occur in two consecutive years.) Figure III.2 shows the peak flows that exceeded or are estimated to have exceeded that level since 1921. The three largest floods and those that illustrate special flood hazards are discussed in this chapter.

Figure III.2
Flood Peak Discharges
Methow River at Twisp

Estimated peak discharge (cfs)	Date of river crest
40,800	May 29, 1948
26,120	May 31, 1972
21,755	June 17, 1974
21,300	May 26, 1942
19,800	June 18, 1950
19,570	May 31, 1983
19,000	May 19, 1957
18,580	June 22, 1967
17,600	May 12, 1951
17,400	May 21, 1956
17,200	June 15, 1933

USGS analysis of the stream flow records for the same location indicates that the 100-year flood (the flood having a 1% chance of occurring in any given year) would have a discharge rate of 35,700 cfs. Beck and Associates estimate that a flood the size of the 1948 flood has a 0.5% chance of happening in any given year—that is, the 1948 flood would qualify as a 200-year event.

Several authors have studied flooding in the Methow River basin. In 1973, R. W. Beck & Associates prepared a floodplain information report on the Methow River, covering the reach between Twisp and Mazama, for the Department of Ecology. In 1974, Norman and Associates prepared a similar report for the Methow River between Carlton and Twisp. Both floodplain information reports were intended to guide planning by providing for preservation of adequate *floodway* channels and channel clearances. In 1975 the Soil Conservation Service (now known as the Natural Resource Conservation Service) prepared a flood hazard analysis for the Chewack River in the vicinity of the Town of Winthrop.

FEMA published a *Flood Insurance Study* for unincorporated Okanogan County in 1978. That study covered the parts of the Methow River basin under County jurisdiction. (I.e., lands outside the National Forest boundary, with the exception of the Towns of Twisp and Winthrop.

HUD wrote flood insurance studies for the two towns in 1977.) Subsequently, errors were identified in that study that called into doubt the accuracy of the information presented for the reach of the Methow River above the Mazama Bridge.

In 1990, Okanogan County officials requested that FEMA re-analyze flood levels between Mazama and the Lost River. The request was made in response to questions about the accuracy of the information published in 1978, coupled with a number of applications for permits to build houses in the *floodplain* above Mazama. In addition, there was concern that changes in conditions in the area could affect flood elevations. In 1992, a Limited Map Maintenance Program investigation was undertaken for the reach of the Methow River between the Mazama Bridge and its confluence with the Lost River. The hydraulic analysis performed in the course of that investigation was used by FEMA in revising the *Flood Insurance Study* for unincorporated Okanogan County. The revised version was issued by FEMA in May, 1994, along with revised versions of the Floodway maps and Flood Insurance Rate Maps for the study reach.

Types of flood-related hazards

Flooding impacts result primarily from two types of hazards created by floods: inundation and erosion. Inundation (floodwater and debris flowing through an area) usually occurs due to high flows, but can also be the result of an obstruction in the channel. Ice jams are one cause of channel obstruction in the Methow basin. Damage caused by inundation can be minor to severe, depending on the velocity and depth of flows, the quantity of logs and other debris they carry, and the amount and type of development in the floodwater's path.

Bank erosion can threaten areas that are not inundated by floods at all. Buildings on high banks, above flood levels, have been undermined by the Methow River's erosive flows (see Figure III.3). Damage due to bank erosion can also range from minor to severe, depending primarily on whether or not there is a structure on the property. The amount of erosion at a site depends on its location on the channel (e.g., outside or inside bend of a meander), flow velocities, the pattern of debris and sediment accumulation in the channel, and the erodibility of the bank.

Both inundation and erosion create hazardous conditions on alluvial fans. Flooding on alluvial fans causes greater damage than clear water flooding for several reasons:

- Floodwaters move at high velocities due to steep slopes and lack of vegetation. Velocities of 15 to 30 feet per second are common. At these velocities, water has tremendous erosive force and damage potential.

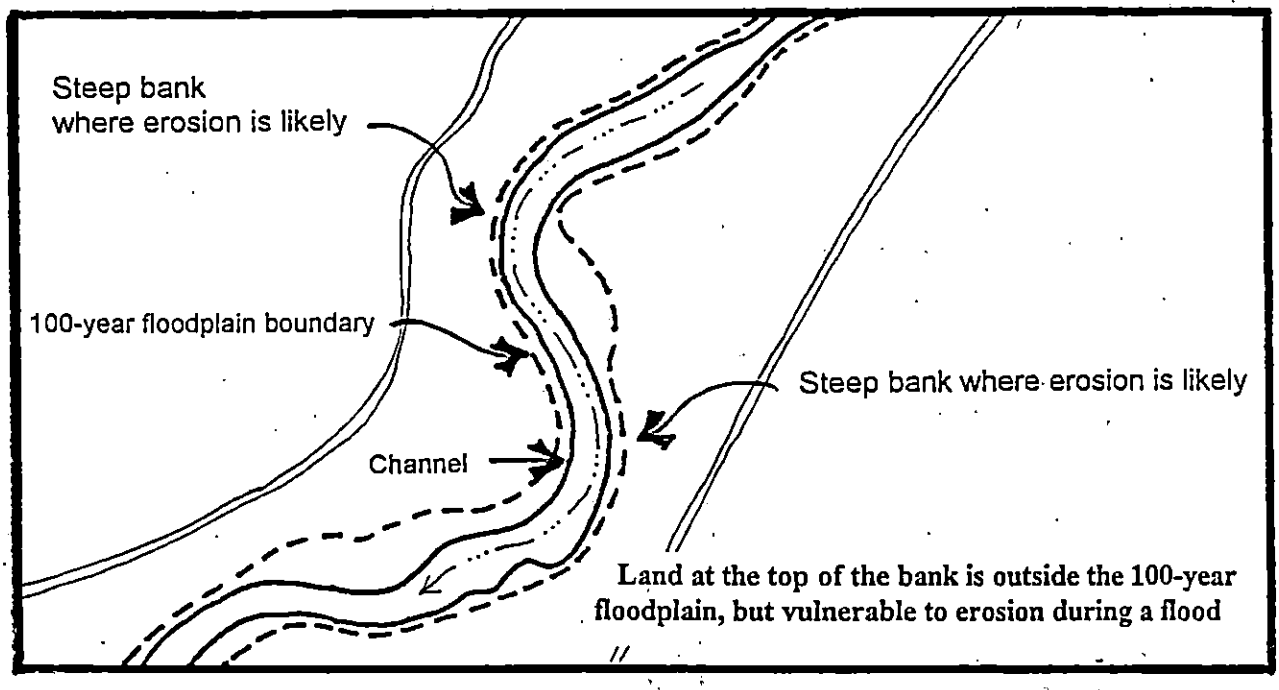
- Floodwaters contain large amounts of sediment and debris including boulders and trees.

- Floodwaters are not confined to a single channel. The channels meander, threatening development over a broad area.

Finally, flash floods resulting from thunderstorms over small tributary basins can result in both inundation and erosion. Okanogan County's Flood Damage Prevention Ordinance and Critical Areas Regulations do not address either development adjacent to erosion-prone banks or that on alluvial fans and tributaries that have not been mapped by FEMA. The Early Winters alluvial fan is the only one in the Methow basin that has been mapped. Throughout the country, alluvial fans

have often been mapped and regulated as shallow flooding areas requiring minimal flood protection. Such maps and regulations underestimate actual risk on fans because they are based on depth of flooding alone. They do not reflect potential damage due to high velocity, debris, erosion or the meandering channel.

Figure III.3
Bank Erosion Diagram



B. Record of Historic Flood Events

Major floods

1894

The Methow's first recorded flood occurred in 1894. It is the least well documented, but is considered to have been the largest of the three floods, with an estimated peak discharge on the Methow of 50,000 cfs at Twisp. While there were no gages operating in the basin at the time, the 1894 flood was measured on the Columbia River at The Dalles, Oregon, and is the largest recorded since gaging began there in the mid-nineteenth century. Assuming runoff from tributary basins to be proportionate to the whole, that gage record provides some evidence that the 1894 flood was also the greatest to strike the Methow basin since white settlement in the 1850s. Eyewitness accounts support that contention. The event followed both a year of heavy snowfall

and several cool summers in which snow did not melt completely, contributing to a heavy snowpack.

Development in the Methow basin was limited in 1894, with only two towns settled along the Methow River, Silver (about four miles south of the confluence of the Methow and Twisp Rivers) and Winthrop (at the confluence of the Methow and Chewuch Rivers). Silver was built on a bluff or high bank next to the river; the handful of buildings that composed the town was swept into the river on June 5 after several days of turbulent high water eroded the bank and undermined the structures. In addition, the bridge across the Chewuch River at Winthrop, built in 1891, was lost. While no estimate of the dollar value of losses from the flood is available, the cost was clearly high in social terms. Interestingly, losses in floodplain areas appear to have been minimal. Local citizens have commented that the pioneers knew better than to build in the bottomlands. The greatest property losses occurred where structures were built on an erosive bank—land not currently considered flood prone—and, in the case of the Winthrop bridge, where proximity to the river was unavoidable. The 1894 flood also claimed one life—the only flood-related loss of life in the Methow basin.

1948

More information is available about the 1948 flood. Above-normal precipitation between October 1947 and April 1948 produced snowpacks also above normal. Air temperatures during April and early May were below normal; as a result, melting of snow in the high mountains was delayed. Also, contrary to normal trends, the water content of snowpacks increased during April and early May. This was followed by sustained above-normal temperatures after May 16. In addition, during the period from May 1 through May 29, precipitation totals of 4.26 inches (3.30 inches above normal), and 4.93 inches (3.97 inches above normal) were recorded at Winthrop and Mazama, respectively. Thus, all the elements favoring a major flood occurred. A gage was installed on the Methow River at Twisp in 1919, and on May 29, 1948 it recorded a peak discharge of 40,800 cfs. R. W. Beck and Associates (1973) estimate the return interval of a flood of that magnitude at 200 years. (Others have estimated the return interval at 92 and 500 years. As discussed above, the lack of data makes estimating frequencies difficult.)

While smaller in magnitude than that of 1894, the 1948 flood caused the greatest loss of property, with a dollar value estimated at $2,250,000. The flood caused extensive damage to roads, bridges, houses and land, much of it the result of increased development in floodplains. Six highway bridges were destroyed or damaged, either because fill supporting the abutments eroded or as a result of pressure caused by debris accumulation. The valley highway was washed out, leaving residents isolated for eleven weeks. Two hundred acres of orchards were destroyed, and some 2,500 acres of floodplain inundated by the flood. Damage also occurred on the Okanogan National Forest, with two bridges and a section of road lost in the Chewuch drainage. Parts of the valley were without electricity and phone service for as long as three months.

1972

The flood of 1972 had a peak discharge of 26,120 cfs at Twisp, and caused damages in the valley estimated at $420,000. Damage to Forest Service roads was extensive. The flood was forceful enough to carry a 9 ft. x 11 ft. x 55 ft. culvert one and a half miles downstream from the

mouth of Twentymile Creek, twenty miles upstream from the confluence of the Methow and Chewuch Rivers. The flood also caused some bank erosion, which was followed by *riprapping* to protect at-risk property.

Other flooding

While high flows resulting from spring runoff are the principal cause of flooding in the Methow River basin, localized events sometimes occur over small basins during summer thunderstorms, and have caused flooding. Cow Creek, near Gold Creek in the lower Methow Valley, has flooded several times, doing some damage to Highway 20. Such areas have not been considered by FEMA in developing flood hazard maps.

In 1983, an ice jam on the Twisp River in the Town of Twisp caused localized flooding and threatened a mobile home park lying in the 500-year floodplain and protected by a dike. Heavy equipment and explosives were used to dislodge the ice jam, at considerable risk to those involved. Ice jams are special hazards not considered by FEMA in the development of flood hazard maps.

C. Prior Flood Control Investments and Actions

Flood control actions in the Methow River basin have been limited to bank protection for erosion control, construction of marginal levees, debris removal, and channel alteration. Rock *riprap* is common; 35 miles, or 22% of the Methow's banks, have been riprapped. "Junk revetments", often composed of car bodies, have been used to stabilize banks as well. The U.S. Army Corps of Engineers (Corps) projects described below are documented in a projects listing provided to Okanogan County by the Corps in 1994. The Corps also provided photocopies of aerial photographs with *River Miles* marked. The descriptions in the following paragraphs are tabulated in Figure III.4.

On the Methow River, several actions followed the 1948 flood. In 1948, the Corps "restored" 1,720 linear feet (l.f.) of bank and levee at the Winthrop Fish Hatchery, located on the *right bank* between River Mile 50.1 and River Mile 50.6. A 700 l.f. extension was added to the downstream end in 1951. In 1949 the Corps, sponsored by Okanogan County, installed *riprap* bank protection on the left bank between River Mile 39.4 and River Mile 39.7, to protect the Highway 20 Bridge at Twisp. (The bridge had washed out in 1948; it was replaced, raised and lengthened, in 1949-50. A temporary bridge served in the interim.) In 1951 the Corps, again sponsored by Okanogan County, installed armored levee protection for road and irrigation ditch on the right bank between River Mile 37.2 and River Mile 37.5. Also in 1951, the Corps installed armored bank and levee protection above and below the intake of the Foghorn Ditch, on the right bank between River Mile 51.6 and River Mile 51.8.

The Corps also completed several actions on the Methow River during the 1970s, both before and after the flood of June, 1972. In May of 1972, the right bank was protected with 500 l.f. of riprap at River Mile 29.5 and the left bank with a total of 150 l.f. of riprap at River Mile 43.9 (four miles upstream of Twisp). Both actions were completed as part of Operation Foresight, and probably had some effect on the flooding that occurred the following month. In 1974, the Corps installed bank protection on both banks of the Methow at River Mile 9.2, to protect bridge abutments; installed 210 l.f. of riprap on the right bank at River Mile 33.8 (six miles

downstream of Twisp); riprapped 700 l.f. of the left bank between River Mile 47.9 and River Mile 48.1 (1.25 miles downstream of Winthrop) for irrigation ditch protection; and riprapped 375 l.f. of the left bank at River Mile 60.5 (0.7 miles upstream of the Weeman Bridge).

On the Twisp River, the Corps constructed an armored levee 665 ft. long at the Twisp City Park (right bank, River Mile 0.2) in 1949. In 1974, the Corps restored 100 l.f. of levee on the left bank of the Twisp at River Mile 0.5. The Flood Insurance Rate Map for the Town of Twisp shows a levee located on the left bank of the Twisp River at approximately River Mile 1. A dike on the opposite bank protects the Horseshoe trailer park. Beck and Associates (1973) mention a "rock and gravel fill dike approximately one-fourth mile long located two miles above Twisp which directs the river into its present channel." When the dike was built, and by whom, is not known. FEMA (1994) notes that levees in the County "are usually built by local individuals or towns....most levees will fail at the 100-year flood or higher." One example is the dike on the Methow River near its confluence with Lost River, discussed later in this chapter. According to HUD (1977b), the levees that parallel the Twisp River in the Town of Twisp "will not be overtopped by the 100-year flood."

While previous actions have been successful in controlling erosion and maintaining the conveyance capacity of the river channel, they have also had deleterious effects. The Methow Valley Water Pilot Planning Project participants concluded that "Channelization with riprap in the upper Methow Valley has confined the river limiting the extent of riparian communities." Channelization also affects channel dynamics and morphology, changing the way water moves and sediment is transported. Water tends to have greater erosive power in and downstream from channelized reaches.

Figure III.4
Prior Flood Control Actions

Action	Date	River and Bank*	Location
Bank and levee restoration	1948	Methow, right bank	RM 50.1-50.6
Addition to above	1951	Methow, right bank	
Riprap installed	1949	Methow, left bank	RM 39.4-39.7
Armored levee	1949	Twisp, right bank	RM 0.2
Armored levee protection	1951	Methow, right bank	RM 37.2-37.5
Armored bank and levee protection	1951	Methow, right bank	RM 51.6-51.8
Riprap	1972	Methow, right bank	RM 29.5
Riprap	1972	Methow, left bank	RM 43.9
Bank protection	1974	Methow, both banks	RM 9.2
Riprap	1974	Methow, right bank	RM 33.8
Riprap	1974	Methow, left bank	RM 47.9-48.1
Riprap	1974	Methow, left bank	RM 60.5
Levee restoration	1974	Twisp, left bank	RM 0.5

*See "Right bank" in Glossary for explanation of right and left banks

Debris removal following the 1948 and 1972 floods had a major impact on aquatic habitat quality and stream *energetics*. Large amounts of debris were removed, eliminating structure that is essential for healthy aquatic ecosystems and reducing hydraulic resistance. In 1961, the Okanogan National Forest received funds to correct flood damage from the 1948 flood; debris and logjams were removed and channels "rehabilitated." Channel clearing on Forest lands also followed the 1972 flood. The Twisp Watershed Analysis notes that large woody debris complexes below War Creek are less than 50% of the Forest Plan Standard and Guidelines. Similar conditions may prevail in other parts of the basin.

D. List of Current and Potential Problem Areas

Current problem area

Methow River corridor northwest of Weeman Bridge

Flood hazard management will be particularly challenging in the Methow River corridor above Weeman Bridge, the area for which FEMA produced new Flood Hazard Boundary maps in 1994. (See Figure III.5. Flood mapping in the Methow basin is discussed near the beginning of this chapter.) The low-lying portion of the Lost River Airport Tracts Second Addition is especially vulnerable, although hazards stemming from erosion and high velocity flows extend throughout the reach. The Lost River subdivision is located adjacent to and northeast of the Methow River, extending approximately from River Mile 72 to River Mile 73. It is near the confluence of the Methow and Lost Rivers, in an area traversed by overflow channels. Eighty-four lots lie within the boundary of the 100-year floodplain as shown on those maps. There are ten houses (plus one house currently under construction) and five trailers with covers, decks, or other permanent structures associated with them within the floodplain. The current assessed value of the structures is $441,400.00. Value at build-out could be expected to run to several million dollars. In addition, some lots are served by a community sewer system, so sewer lines extend into the floodplain.

Since 1979, the Okanogan County Zoning Code has not permitted construction of new structures for human habitation (e.g., houses) in areas inundated by the 100-year flood; however, construction is permitted on existing lots within the *floodplain boundary* if a proponent can show that the building site is above the *base flood elevation* ("up-and-out"). Many such sites exist at Lost River. (Subdivision in the Conservancy Shoreline Environment is no longer allowed, under the County's Shoreline Management Program. The Lost River Airport Tracts Second Addition was approved prior to adoption of the SMP.) In addition, certain lots in the subdivision have been pre-approved for construction on the grounds that sewer connections have been provided to those lots, indicating investment for the purpose of constructing a structure. (See Figure III.6.) Houses built prior to 1979 may be located in areas inundated by the 100-year flood, as may houses built under the 1979 Zoning Code amendments but prior to the 1994 re-mapping of the floodplain. Some may also be located in the regulatory *floodway*. Field checking, and perhaps a survey, will be required to determine the exact locations of structures relative to the floodplain and *floodway* boundaries.

Figure III.5
Methow River Corridor Above Weeman Bridge

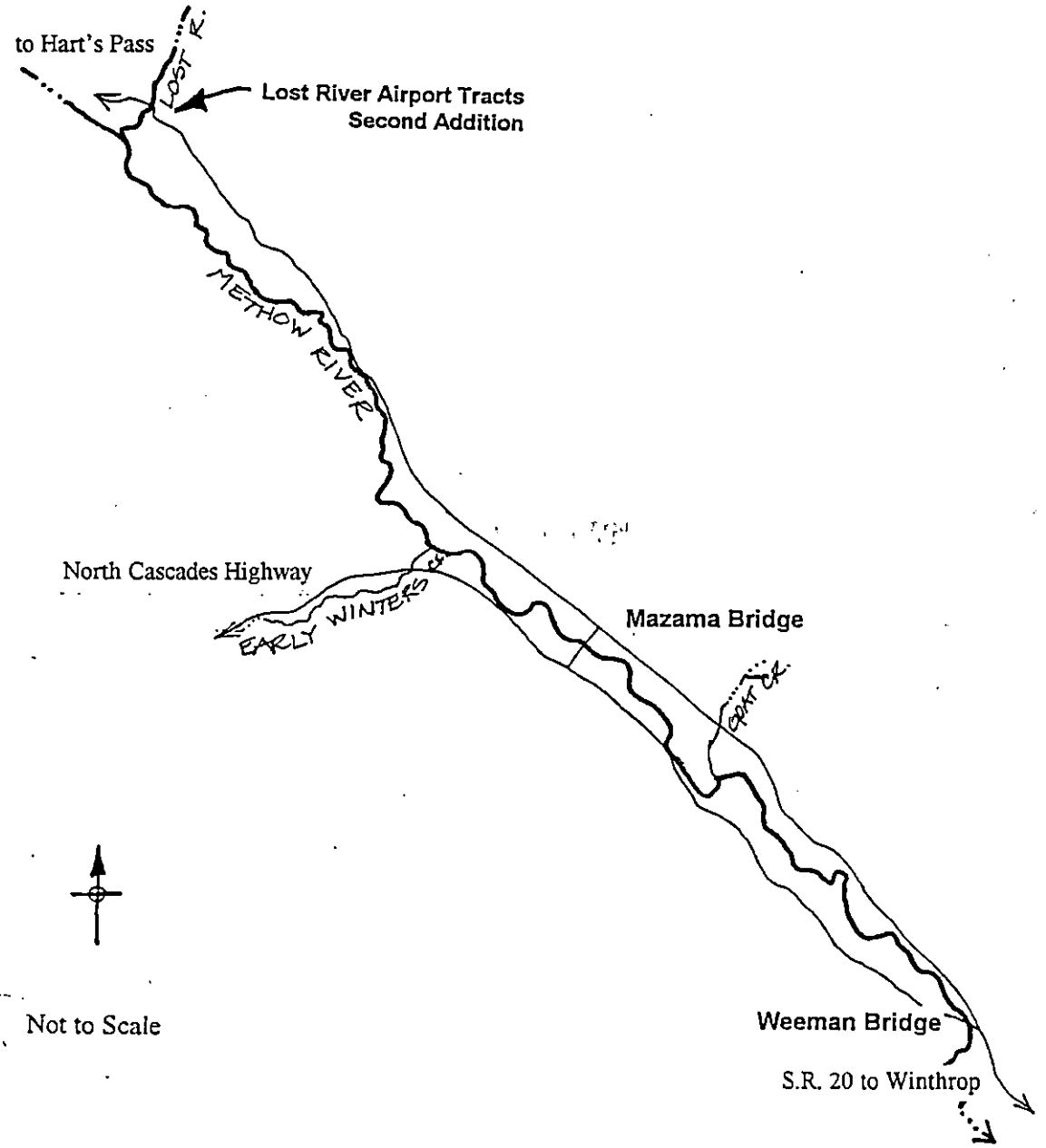
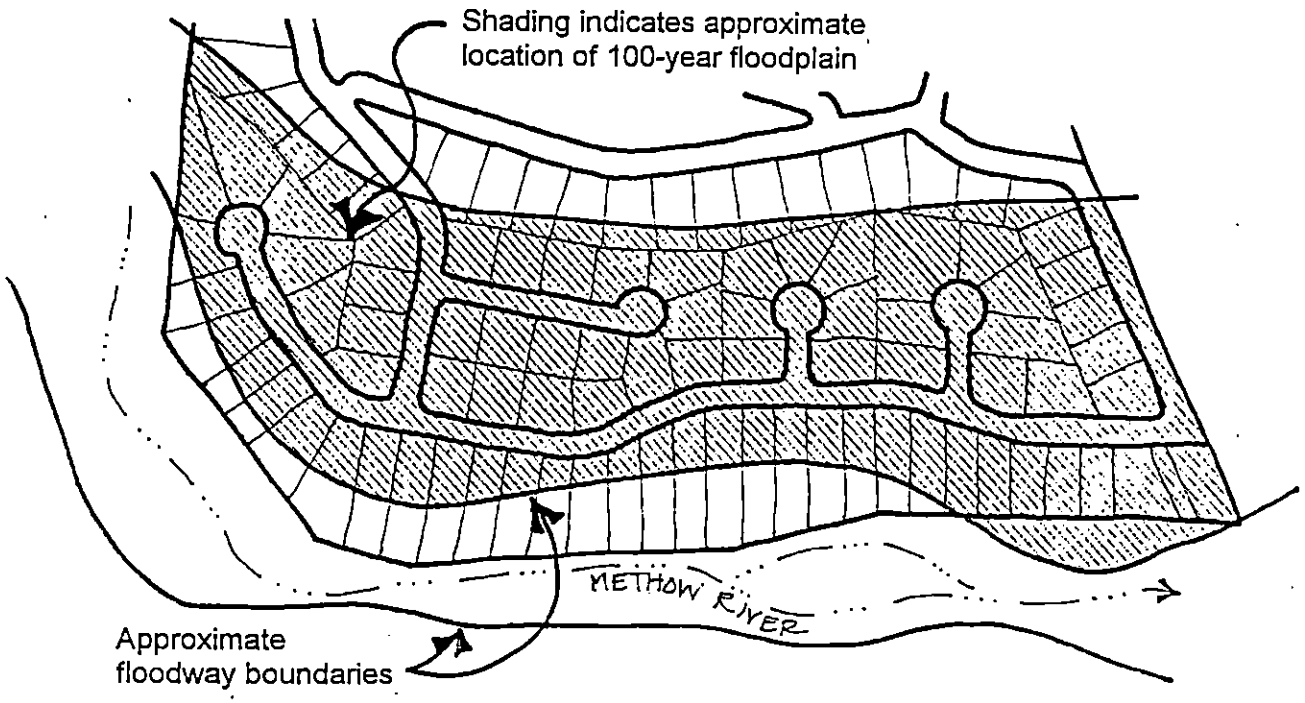


Figure III.6
Lost River Airport Tracts Second Addition
Floodplain Lots

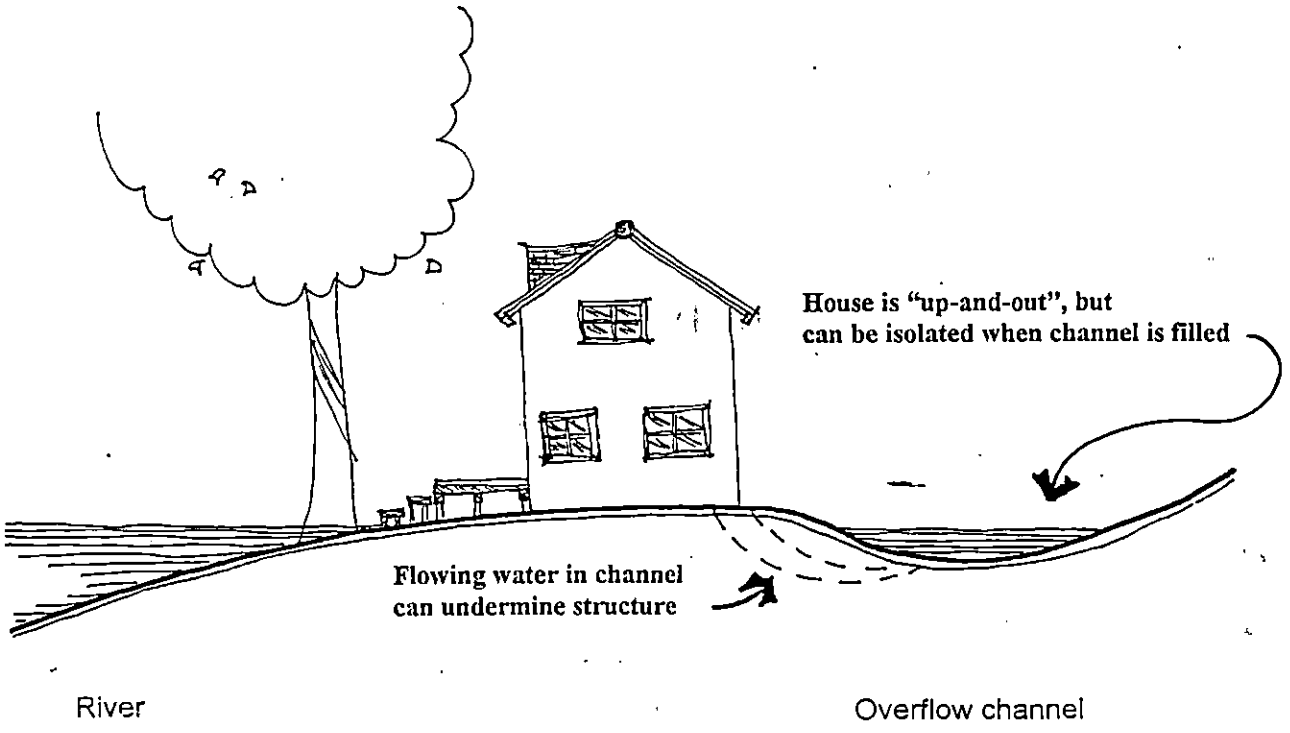


According to Northwest Hydraulic Consultants, the authors of the Limited Map Maintenance Study produced in conjunction with FEMA's 1994 re-mapping, sub-channels within the *floodplain boundary* in the area above Weeman Bridge would experience substantial flow rates during a 100-year event, with depths as great as 8 or 10 feet, widths exceeding 100 feet, and velocities in the range from 6 to 8 feet per second. (It is generally considered dangerous for people to be in any area in which the product of water depth and velocity is greater than 10. Even very shallow water [less than 2 feet deep] would be unsafe with velocities as great as 6 to 8 feet per second. Similarly, even slow moving water would be dangerous if depths as great as those predicted were encountered. The combination of depth and velocity could be deadly.) NHC's report also states that there is significant risk that the river could relocate into areas now outside the *floodway*. Relocation of the river's main channel could damage structures located within the *floodplain boundary*, especially if sediments are significantly re-worked and new channels formed. Northwest Hydraulic Consultants' report states that any development, even that permitted on sites above the 100-year flood level, could be suddenly and unpredictably isolated by the formation of a major channel between the development and Lost River Road, and subject to inundation and erosion (See Figure III.7). The hazard posed by channel change is significant. The methodology prescribed by FEMA for flood hazard analysis and mapping assumes that existing conditions will not change; it does not account for the risk of erosion. Channel change

and-out" of the 100-year floodplain could be within areas that would be inundated by the 100-year flood if flooding patterns change as a result of erosion.

Because houses that are above the base flood elevation ("up-and-out") are not subject to the insurance requirements of those in the floodplain, there is a danger that many of the vulnerable structures may not be covered by flood insurance. In addition, many of the structures in the area are vacation houses and so are ineligible for federal disaster assistance. Thus, flooding could result in substantial losses to residents of the area. Water and sewer lines are at risk as well as structures, with the added danger that damage to sewer lines could result in release of untreated waste directly to the river. There is some question as to whether people buying land in the area are being adequately informed regarding the limitations to construction on their lots.

Figure III.7
Isolation and Erosion Hazard Diagram



In several places, dikes or berms have been built to protect riverfront property in the Lost River Airport Tracts Second Addition. The existence of those structures illustrates vividly the relationship between the subdivision and the river. All were constructed from *unconsolidated* materials and are unlikely to withstand a major flood; indeed, high water in 1983 damaged several sections of bank protection dike. Northwest Hydraulic Consultants have expressed the opinion

that existing berms along the river bank and road embankments across bypass channels would be ineffective in preventing a major shift in main-channel location during a severe flood event.

The most problematic of the structures is an illegally constructed dike built partially on Forest Service land. The dike was built in 1983, a year in which water reached unusually high levels throughout the valley. No permits were applied for or granted for its construction, and it was not engineered. Construction took place in mid-May; high water on May 31 flooded portions of the Lost River Airport Tracts and washed out the upstream end of the new dike. Any maintenance of the dike is fraught with dilemmas relating to ownership and responsibility, as well as to habitat impacts. The Lost River Airport Tracts Homeowners' Association has looked into the possibility of having the dike re-built or replaced with one that would withstand a flood of known return interval (e.g., 25 years). However, financial constraints, restrictions relating to site constraints and environmental concerns, and the problem of trespass on Forest Service land make it unlikely that any action will be taken by the Homeowners' Association.

The topography and hydrology of the area surrounding the Lost River development render structural changes (to the existing dike or otherwise) impractical. The site is located near a persistent pool that makes an important contribution to habitat. Modifications could not be undertaken without severe impacts to hydrology and habitat. Structural solutions are also problematic because they change the dynamics of the river channel, with potential effects on downstream land and structures. Where the river is constrained by dikes and berms, it moves more quickly and hence has greater erosive power. Artificial constraints also can change flow patterns, so that the river's erosive power is directed differently than in the past. Again, such changes may have deleterious effects on property downstream of the site. Any action on National Forest land would have to be negotiated with the Forest Service.

The situation described above has contributed to a three faceted problem in the reach above Weeman Bridge. The facets are as follows:

- Existing vulnerable houses—A number of houses that pre-date the current Zoning Code and Flood Hazard boundary maps are currently at risk. In addition, houses that are "up-and-out" of the mapped floodplain may be at risk due to the dynamism of the river environment in the area.

- Undeveloped lots—There are lots where construction permits may be issued in the future, and where houses would be at risk if built. Lots that have been pre-approved for construction because sewer connections are in place are a special consideration within the category.

- Risks to land and structures downstream due to actions at Lost River—There are risks to property farther down river from alterations in the floodplain at the Lost River site.

Different approaches may be required to effectively address the various facets of the problem. Common factors contribute to the first two. The mapping methodology prescribed by FEMA unfortunately does not recognize erosion hazards. However, physical conditions at the site make erosion hazards a very real concern; coupled with the fact that construction is permitted on "up-and-out" building sites, they create a situation in which it is possible to build in areas that may prove very unsafe.

The Technical Advisory Committee discussed the situation at Lost River at length, since it is the most severe problem in the basin, and developed several specific objectives for the site intended to move toward achievement of the goals of this plan and limit the County's liability. The objectives have been incorporated in the basin-wide goals and objectives stated in Chapter V. They are as follows:

- Reduce risk to life and property
- Not increase hazard potential
- Protect channel function and dynamics
- Protect the public interest in healthy river function—including fish and wildlife, water quality, aesthetics, recreation, and life/health/safety considerations

Potential problems

Houses in floodplains

In addition to houses in the Lost River area, there are probably other structures for human habitation within the 100-year floodplain. Locations of such structures have not been mapped, so it is not currently possible to determine how much property is involved. FEMA has estimated that in Washington state, flood insurance is carried on roughly 14 percent of houses in floodplains. No data is available on the number of flood insurance policies in effect in the Methow Valley. However, as of November, 1995, there were roughly 100 policies in effect in unincorporated Okanogan County—and so an estimated 715 houses in floodplains, based on FEMA's data. Once mapping has been done, planning can proceed based on a cost:benefit analysis of each case.

"Up-and-out" houses

Currently, construction of structures for human habitation within the *floodplain boundary* is allowed in the Methow Review District if those structures are located above the level of the 100-year flood. Such "up-and-out" building sites are often in areas of *unconsolidated* sediments subject to reworking in case of flood, and houses built on them may be vulnerable to damage. As is the case with houses in floodplains, the locations of such structures have not been mapped.

As discussed in the description of conditions at Lost River, channel change and erosion are likely to result in changes in *floodway* and floodplain location, as well as redistributing sediments and possibly undermining structures.

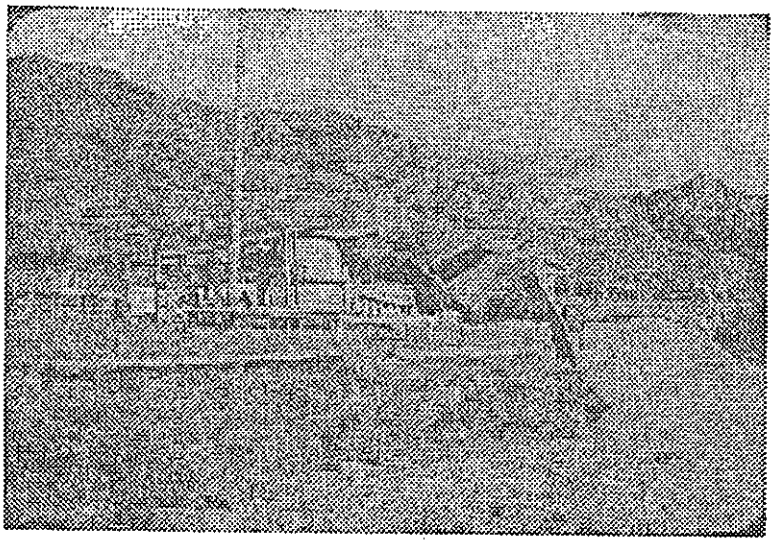
Erosion hazard areas

As discussed elsewhere in this chapter, both stream banks subject to undercutting and land within a stream's *meander belt* present erosion hazards not identified on FEMA's maps. Houses and property can be threatened by bank erosion and channel migration, particularly in reaches where the river is most dynamic and in areas where banks are composed of easily erodible soils. In the 1894 and 1948 floods, houses and other structures washed into the Methow River. Houses continue to be built on land that is subject to destruction during flooding. Since such sites are

often outside the regulatory floodplain, and so are not mapped and zoned as high hazard areas, many people are unaware of the potential danger to their lives and property.

When land is destroyed by erosion, the damage is irreversible. The only way to protect houses built in vulnerable sites is to stabilize the stream banks or relocate the structures. Both measures are extremely expensive. In addition, streambank stabilization can disrupt habitat function and channel dynamics.

Figure III.8
Intercity airport building destroyed when floodwaters eroded the river bank in 1948



Alluvial fans

As discussed above and in Section II.C, alluvial fans are much more hazardous than shallow flooding areas or normal riverine floodplains due to the combined erosion and flooding problem. High flow velocities and debris in the water present special hazards. There are several major fans in the basin. The Wolf Creek alluvial fan, in particular, is developing quickly. The privately owned land on the Early Winters alluvial fan is scheduled for development over the next 20-25 years as part of the Arrowleaf Planned Development Resort proposed by the R. D. Merrill Company. Plans call for subdivision of land on the fan into residential lots. Flood hazards on a portion of the site are mitigated by the presence of Highway 20, built on a berm across the alluvial fan. The berm acts as a dike, preventing most flows from reaching the north side of the highway. However, the vulnerability of the area to flooding has not been analyzed. Development is also occurring on the Lost River alluvial fan.

The Early Winters alluvial fan is within the area re-mapped by FEMA during the Limited Map Maintenance Study the agency sponsored in 1992. The revised *Flood Insurance Study* that resulted, published in 1994, states that "Because of the alluvial cone at the Early Winters Creek area, standard backwater computations did not apply. Once the channel capacity of Early Winters Creek is exceeded, shallow overland flow will occur with no definable path." The study goes on to note that overbank areas outside the Forest boundary were designated as a shallow overflow flooding zone. The implication, that risk in

those areas is low, is false; furthermore, areas subject to flooding in case of lateral migration or overland flow are not shown as hazard areas at all. Early in 1995, Northwest Hydraulic Consultants drafted a flood study for the Early Winters Creek area. That study recommends further analysis prior to development on the alluvial fan.

Flash flooding

Flash flooding encompasses a broad range of flood problems on alluvial fans, in narrow and steep valleys, and upon release of ice jam flooding. During a flash flood, water not only rises rapidly but moves at high velocity and contains large amounts of debris. It can tear out trees, undermine buildings, bridges and roads, and scour out new channels. Flash floods rank as the first cause of weather-related deaths in the United States. Steeply sloping valleys in mountainous areas are the most common setting.

The intensity and duration of rainfall and the steepness of watershed and stream gradients are the key factors in flash flooding. Other factors include the amount of watershed vegetation and natural or artificial flood storage areas, and the configuration of the streambed and floodplain. In general, the more intense the rainfall, the greater the probability of flash flooding, and the longer it rains in a given area, the greater the probability of flooding. Stationary or slow moving thunderstorms produce the most serious flash floods because of their intensity and duration. A series of fast moving storms over a short time can also produce huge volumes of runoff.

Flash floods cause greater damage than ordinary riverine floods because of the suddenness of flooding (which may prevent evacuation), the velocity of the water, and the debris load. In addition, one, two or more flood crests may occur during a flash flood when a series of fast-moving storms occurs. Sudden destruction of structures and washout of access routes may result in loss of life. Deaths are common when motorists underestimate the depth and velocity of flood waters and attempt to cross swollen stream. Several years ago a car was swept from the highway during a flash flood on Cow Creek, between Carlton and Methow.

There are no floodplain maps for the small tributaries in the Methow Valley that are at greatest risk for flash flooding. Furthermore, many small changes in a stream's watershed—not just the floodplain—can drastically increase flash flooding. Such changes may include building construction, vegetation clearing, grazing, or logging. Currently, there are no maps reflecting those watershed changes and so no way to estimate the damage potential.

Ice jam flooding

An ice jam is an accumulation of floating ice fragments that causes bridging or damming of a river. The flooding caused by ice jams is similar to flash flooding. The formation of a jam results in a rapid rise of water at the point of the jam and upstream. Failure of the jam results in sudden flooding downstream. Washington is one of several states particularly prone to such flooding.

The formation of an ice cover on a river or stream depends upon such factors as flow velocity, turbulence, surface disturbances (wind) and temperature. Successive days of below zero temperature are often required to form an ice cover on a rapidly flowing stream.

Knowing how ice jams form is the key to knowing when and where to expect them. Ice jam formation depends on both the weather and the physical conditions in the river channel. Flooding due to ice jams or other ice conditions can occur at different times and in different ways:

• Ice can cause flooding during fall freeze-up due to the formation of frazil ice. Frazil ice forms when temperatures drop but a swift current prevents the formation of an ice cover. Frazil forms in the stream, floats downstream until it reaches an area that is slower moving and frozen over, then attaches itself to the underside of the ice cover. It may accumulate to the point of forming a hanging dam. Frazil can also attach itself to the stream bed, forming anchor ice.

• Ice can cause flooding during mid-winter periods of very low temperature when the stream channel freezes completely solid. Additional water coming down the stream freezes on top of the solid ice until the channel is blocked and the stream flows overland, flooding and freezing on adjacent lands. Solid ice formed in this way can block culverts.

• Ice can cause flooding at spring breakup due to a combination of ice conditions creating the classic ice jam. Most often, rising water levels in the river or stream from snowmelt and rainfall break the existing ice cover into large chunks. These floating ice masses lodge at bridges or other constrictions, creating dams. Rapid flooding may occur, first upstream, then downstream, as the mass of ice and water finally breaks free. Huge ice masses moving downstream can shear off trees and destroy buildings above the level of the flood waters.

Damage from ice jam flooding usually exceeds that of clear water flooding because of higher than predicted flood elevations, rapid increase in water levels upstream and downstream, and physical damage caused by ice chunks.

Potential infrastructure losses due to woody debris in the water

Woody debris jams can increase the impact of flowing water on land or infrastructure, especially when the water is high. Logs have caused damage in the past, and their presence in streams is a very sensitive issue. Some of the basin's older bridges may not have sufficient capacity to accommodate woody debris jams or live trees in the water during flood events. Although debris loading is not likely to approach natural levels for some time, it remains a concern, especially in the towns. Debris hazards have not been assessed. One potential problem has been on the Methow River. High water in 1983 eroded a large section of bank near Gate Creek (northwest of Mazama). Many trees were swept into the river and remain lodged in the channel. They may have the potential to cause damage to the Mazama Bridge during a flood. The debris pile is located in a very complex area and makes a significant contribution to habitat. Currently, it is stable.

E. Maintenance Needs

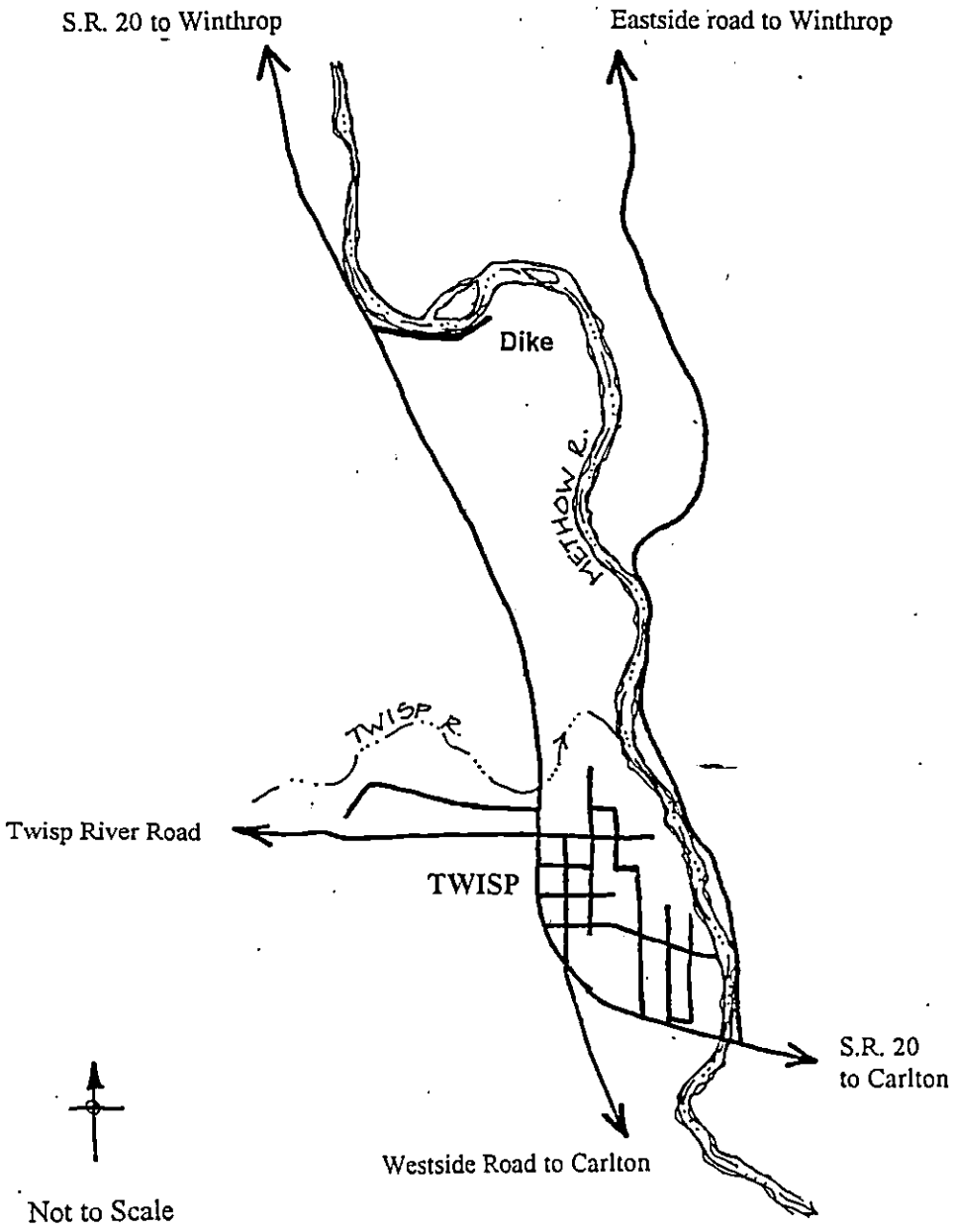
There are a number of dikes in the Methow River basin. There is no inventory, and the exact locations and condition are not known. It is not clear who is responsible for maintaining the various structures. The County has done no dike maintenance work in at least ten years. The

County's Public Works Department is currently working to determine the County's maintenance responsibilities. Dikes constructed by the U. S. Army Corps of Engineers must be maintained to standards established by the Corps. There may be conflicts between those standards and state regulations relating to preservation of fish and wildlife habitat. The Public Works Department is currently working with both the Corps of Engineers and the Department of Fish and Wildlife to establish standards that meet the needs of both agencies. Federal disaster funding is not available for repair of dikes that have not been maintained to Corps standards.

There is one dike in the Methow Valley that is known to be the County's responsibility. It is located north of Twisp, near Highway 20 (see Figure III.9). It protects a low-lying area northwest of the confluence of the Methow and Twisp Rivers. There are several houses and trailers and a church located behind the dike. Much of the land is undeveloped. The southeast end of the dike has begun to erode, and the face of the dike supports trees too large to meet the Corps of Engineers' standards.

Sources of information in this Chapter are listed in the Bibliography on p.

Figure III.9
Army Corps of Engineers dike north of Twisp



CHAPTER IV: EXISTING ORGANIZATIONS AND PROGRAMS

A. Existing Organizations

A number of government agencies, local entities, and private non-profit organizations are involved in *river corridor* management and related issues in the Methow River basin. Their roles relative to the work embodied in this plan are discussed below.

Federal

Army Corps of Engineers

The U.S. Army Corps of Engineers participates in flood control activities throughout the country. The Corps built dikes, installed bank protection, and removed woody debris from rivers in the Methow basin following the floods of 1948 and 1972.

Fish and Wildlife Service

The U. S. Fish and Wildlife Service (Service) operates the Winthrop National Fish Hatchery. The Service provides technical and cost share assistance on non-federal lands to restore *wetlands*, *riparian areas* and stream habitat, and is currently participating in a number of restoration projects within the Methow basin. The Service also assists the U. S. Forest Service in the implementation of the Northwest Forest Plan and administers programs such as Jobs in the Woods and the Endangered Species Act. In addition, the Service conducts aquatic and terrestrial surveys and uses the data to develop management plans that aid in the conservation of fish and wildlife.

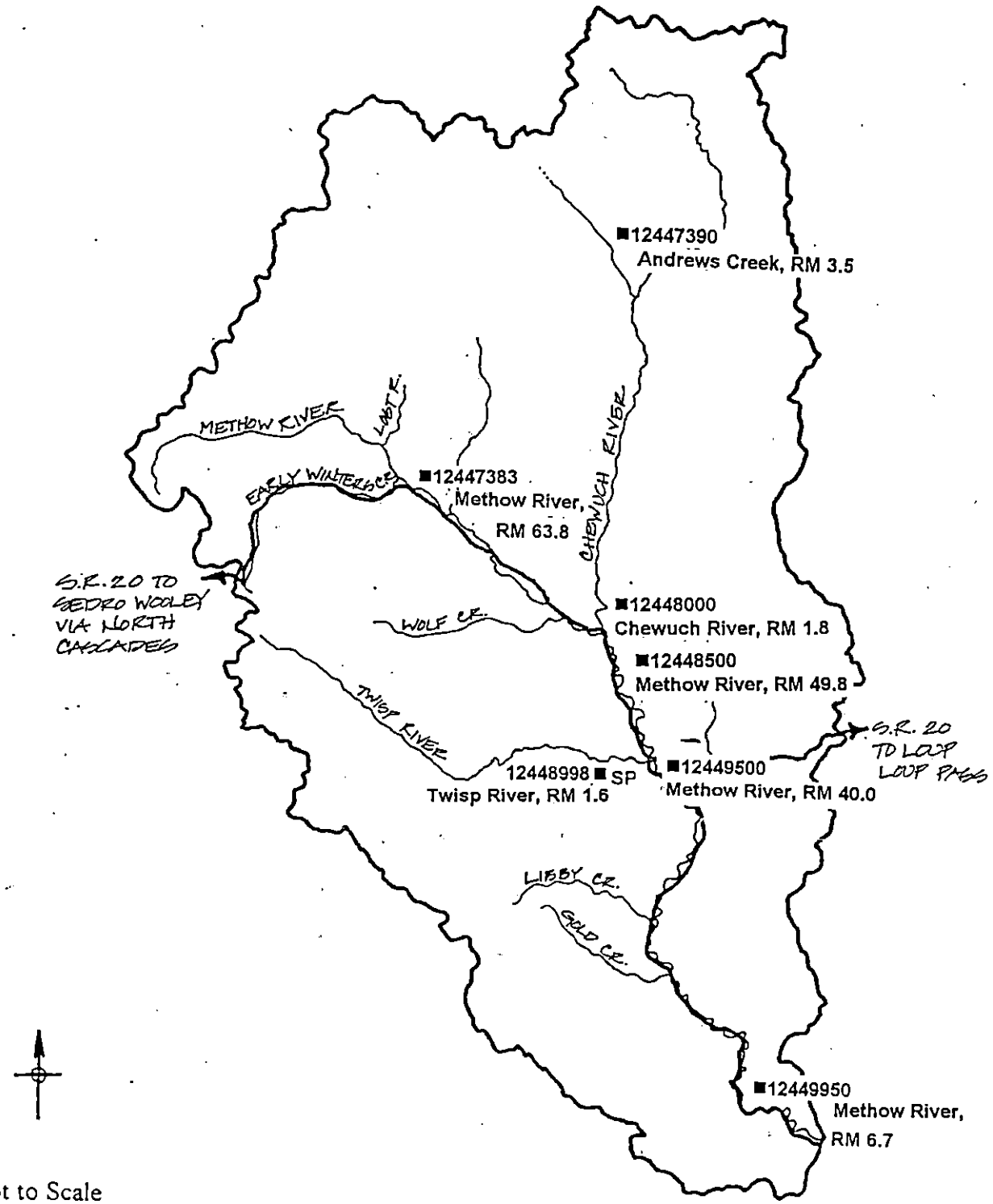
Forest Service

The United States Forest Service administers resource lands throughout the country. About 80% of the land in the Methow River basin is administered as wilderness or for multiple use under Forest Service jurisdiction. Forest Service management activities affect many aspects of watershed structure and function, including runoff rates, which can influence the frequency and severity of flooding.

Geological Survey

The United States Geological Survey (USGS) collects streamflow data at gaging stations throughout the country, in part for use in predicting the frequency and magnitude of floods and in designing structures such as roads, bridges and culverts. There are seven gaging stations in the Methow River basin (see map, Figure IV.1). Much of the hydrologic data collected by the USGS

Figure IV.1
USGS Gaging Stations



Not to Scale

is available, via satellite, as it is collected, and so can be especially useful during emergencies. In 1975, the USGS completed an analysis of flood frequencies in Washington; that analysis is currently being revised to reflect new data.

The USGS also produces topographic and geologic maps. Topographic maps show elevations throughtout the basin; the contour interval is 40 feet. Geologic mapping has just been completed for the Robinson Mountain area in the northern part of the basin, and is underway for the Twisp area.

National Marine Fisheries Service

Under the Endangered Species Act, the National Marine Fisheries Service (NMFS) is responsible for listing marine species, including *anadromous* fish such as salmon and steelhead. That responsibility includes determining what habitat is critical for the maintenance and recovery of *endangered species*. The NMFS also is responsible for determining if an activity in or near a river is harmful to a listed species and what mitigation may be required to allow the activity to continue after listing.

National Weather Service

The National Weather Service uses data from USGS streamflow stations to forecast river stages and flow conditions on major rivers.

Natural Resource Conservation Service (formerly the Soil Conservation Service)

The Natural Resource Conservation Service provides a variety of services to agriculturists, including working to control soil erosion and developing riparian grazing management strategies to minimize impacts of livestock use on rivers and *riparian zones*.

State

Washington State Department of Ecology

The Department of Ecology's Floodplain Management Section provides technical assistance to communities on flood insurance and *floodplain* management. It is FEMA's National Flood Insurance Program arm at the state level for community assistance. It also provides funds for flood control maintenance work and development of comprehensive flood control management plans. Staff participate in pre- and post-disaster mitigation.

The Department of Ecology also provides technical assistance to local jurisdictions in reviewing Shoreline Substantial Development Permit applications and makes the final review of the applications.

Washington State Department of Fish and Wildlife

The Department of Fish and Wildlife owns land in the basin both for fish and wildlife habitat conservation and for recreational use. The Department is interested in the condition of the

river corridor as it pertains to fish and wildlife habitat issues, and has undertaken a number of riparian and fisheries restoration projects in the basin.

Local

Okanogan County Office of Planning and Development

The Office of Planning and Development administers the County's Flood Damage Prevention Ordinance (Ordinance 87-2), Zoning Code (Okanogan County Code, Title 17), Subdivision Ordinance (Okanogan County Code, Title 16), Shoreline Management Master Program (Resolution _____), and Critical Areas Regulations (Ordinance 94-2). The Planning Office is also responsible for long-range planning, including development of comprehensive plans.

Okanogan County Sheriff's Department

The County's Director of Emergency Management is housed in the Sheriff's Department and is responsible for developing and updating the County's Emergency Management Operations Plan and for organization, administration, and operation of the County emergency organization under the direct authority of the County Commissioners. The Sheriff's Department takes the lead in many flood response and recovery operations. In case of flood or other emergency, direction and control of emergency management activities will be under authority of the County Commissioners; the Emergency Management Director will coordinate operations.

Okanogan Conservation District

The Okanogan Conservation District is part of a state-wide network of conservation districts that administer programs aimed at protecting natural resources. Districts throughout the state promulgate conservation Best Management Practices (BMPs) through public outreach efforts and demonstration projects. In concert with the NRCS, the Okanogan Conservation District offers technical assistance and information about good stewardship at no cost to interested land owners. The District can help coordinate cost sharing, as well.

Pateros

The Town of Pateros, located near the mouth of the Methow River, is partially within the Methow basin, but most of its land area lies within the Okanogan River basin or drains directly into the Columbia River. Most flooding problems in Pateros are alluvial-fan related. They will be addressed in the Multi-Objective River Corridor Plan for the Okanogan Basin, scheduled for completion by June, 1999. Town officials did not choose to participate in the development of this plan.

Twisp

The Town of Twisp, located at the confluence of the Methow and Twisp Rivers, is entirely within the Methow basin. The Town has a Flood Damage Prevention ordinance,

Shoreline Master Program, and Comprehensive Plan in place. The Town is within the area addressed by this plan; however, town officials did not participate in development of the plan.

Winthrop

The Town of Winthrop, located at the confluence of the Methow and Chewuch Rivers, is entirely within the Methow basin. The Town has a Flood Damage Prevention ordinance(Ordinance 352), Shoreline Master Program, and comprehensive plan in place. Bill Morgan, Town Public Works Director, served as a member of the Technical Advisory Committee during development of this plan. Don Johnson, Mayor, and Terry Cooper, Planning Commission member, both served as members of the Citizens' Advisory Group.

Tribal

Although there is no Indian Reservation in the basin, two tribal governments have treaty rights in the Methow River basin. Both have strong interests in salmon populations and so in the use and condition of the river and adjacent habitat resources.

Colville Confederated Tribes

The Methow Tribe is one of the Confederated Tribes of the Colville Reservation. The Reservation is located outside the basin, but the Tribes have been guaranteed rights to customary uses in the Methow Valley. The Colville Confederated Tribes did not choose to participate in the development of this plan.

Yakama Indian Nation

Members of the Yakama Indian Nation are guaranteed fishing rights on the Columbia River; because the Methow River is a tributary of the Columbia, all activities in the basin that affect fish habitat must comply with treaty provisions. The Yakama Nation maintains an active presence in the Methow Valley. Joel Hubble, a tribal biologist, served as a member of the Technical Advisory Committee during development of this plan.

Douglas County PUD

The Douglas County Public Utility District (PUD) owns most of the Wells Reservoir shoreline, including the lower two miles of the Methow River. The District requires a permit for the private or commercial use of lands within the Wells Hydroelectric Project Boundary. The Federal Energy Regulatory Commission (FERC) must authorize any commercial use of those lands. All lands within the Project boundary are open for public recreation.

Private

Methow Valley Sport Trails Association

The Methow Valley Sport Trails Association (MVSTA) maintains a network of trails on public and private land in the basin for skiing and mountain biking. The association is participating in development of a valley floor trail, parts of which are within the *river corridor*, as mentioned in Section II.M.

The Methow Institute Foundation

The Methow Institute Foundation was founded in 1989 to preserve open space, provide for public trails and park lands, protect sensitive natural features, and provide opportunities for education of the public in the principles of conservation and preservation. The Foundation has been involved with MVSTA in the development of the valley floor trail mentioned above.

The Methow Valley Land Trust

The Methow Valley Land Trust is a nonprofit organization founded to protect land for natural, recreational, scenic, agricultural, historical, cultural, educational and scenic purposes. The Land Trust acquires land, conservation easements, and development rights through voluntary, private action; participating landowners are eligible for various tax reduction benefits. (Conservation easements and the role of the Land Trust are discussed in greater detail in Chapter VI.)

B. Existing Programs

A number of existing regulatory, planning, and capital improvement programs are relevant to *river corridor* management in the Methow River basin. Those pertaining specifically to flood hazard management are discussed first, followed by other federal, state, and local programs.

Flood hazard management

The Unified National Program for Floodplain Management

The Water Resources Planning Act of 1965 (P.L. 89-90) created the U.S. Water Resources Council, an independent executive agency that encourages the conservation, development, and use of water and related land resources on a comprehensive and coordinated basis. The chief tool in carrying out that mission is the Unified National Program for Floodplain Management. First issued in 1976, and revised and reissued in 1979, the Program analyzes the basic principles of flooding and relates floodplains to the natural and social systems of which they are a part. Based on that analysis, it outlines a series of management strategies, implementation techniques, and recommendations for an effective response to floods. Those guidelines can be applied by all levels of government and the private sector, nationwide.

The National Flood Insurance Program

The National Flood Insurance Program (NFIP) was established with the passage of the National Flood Insurance Act (P.L. 90-448, Title 13) in 1968 to enable property owners to buy insurance against flood losses. However, to be eligible for insurance, an individual must live in a community with an approved floodplain ordinance in conjunction with a floodplain management program. Thus, part of the responsibility for flood damage reduction is shifted to local governments, and they are given an incentive for floodplain regulation. The program is administered by the Federal Insurance Administration of the Federal Emergency Management Agency (FEMA). Like most communities that include flood-prone areas, Okanogan County participates in the NFIP; residents of the County are eligible to purchase flood insurance.

The Federal Disaster Protection Act of 1973 (P.L. 93-234) effectively changed the NFIP from a voluntary to a mandatory program by requiring purchase of flood insurance for any federal project and, more significantly, any project in a flood-prone area that relies on federal mortgage guarantees. Flood insurance was thus tied to any building that was financed with assistance of Federal Housing Administration and Veterans Housing Administration loans, or for which a loan was guaranteed by the Federal Deposit Insurance Corporation or the Federal Savings and Loan Insurance Corporation.

Participating communities must adopt and enforce certain minimum floodplain management standards, including requiring permits for all development within the 100-year floodplain, requiring that construction materials and methods used in the 100-year floodplain will minimize future flood damage, and maintaining construction documentation for buildings in the 100-year floodplain. Okanogan County's building codes and floodplain ordinance were designed to help the county meet the minimum standards of the NFIP.

Disaster Relief Acts

The 1970 Disaster Relief Act (P.L. 91-606) set up a disaster relief program to assist areas that have suffered major damage during a natural disaster. The program is managed by the Disaster Response and Recovery Office, a part of the Federal Emergency Management Agency (FEMA). The 1974 Disaster Relief Act (P.L. 93-228) supplemented the 1970 act by requiring hazard mitigation actions, either before or after a disaster, as a condition for receipt of disaster relief funds.

The Washington State Floodplain Management Program

Washington State's floodplain management program seeks to integrate local, state, and federal regulatory programs in a comprehensive effort to reduce flood damages and protect human health and safety. The chief requirement of the state's regulatory program is that local flood-prone jurisdictions adopt a flood damage prevention ordinance based upon federal standards contained in the NFIP. Property owners in flood-prone jurisdictions with such an ordinance are eligible to buy federal flood insurance.

Chapter 86.16 RCW[1], "Flood Plain Management", forms the core of the state's regulatory program. In it, the State of Washington assumes regulatory control over the waters of the state, and the Department of Ecology is designated as the agency responsible for coordinating floodplain management regulation aspects of the National Flood Insurance Program (NFIP). The State requires counties to adopt floodplain management ordinances that comply with the minimum standards of the NFIP and with additional requirements developed by the Department of Ecology.

The rules developed by the Department of Ecology to administer the provisions of Chapter 86.16 RCW are contained in Chapter 173-158 WAC[2]. They include the additional state standards for floodplain management, which are primarily aimed at protecting health and safety. Chief among them is a prohibition against new or substantially improved residential development in any designated *floodway*.

Chapter 173-158 WAC also includes an advisory standard pertaining to *wetlands* management. The standard points out the beneficial role wetlands play in alleviating flood damage. The advisory suggests a program by which local governments, with technical assistance from the Department of Ecology, can identify and map critical wetland areas located within base floodplains.

The following regulations complete the State's floodplain management program:

- Chapter 86.12 RCW, "Flood Control by Counties", authorizes county governments to adopt Comprehensive Flood Control Management Plans for any drainage basin that is located wholly or partially within the county.

- Chapter 86.26 RCW, "State Participation in Flood Control Maintenance", establishes the Flood Control Assistance Account Program, under which local governments receive funding to prepare Comprehensive Flood Control Management Plans and undertake flood control maintenance projects. As required in that Chapter, this plan identifies the need for flood control work in the Methow River basin, discusses alternatives to instream flood control work, assesses the potential impacts of instream flood control work, and identifies *river corridor* areas. Chapter 86.26 RCW also designates the Department of Ecology (DOE) as the agency in charge of administration and enforcement of all laws relating to flood control in the State of Washington.

In addition, several provisions of Chapter 36.32 RCW pertain to floodplain management. In that chapter, counties are authorized to regulate and control the flow of navigable and non-navigable waters for the purpose of preventing floods (36.32.280). County Commissioners are authorized to remove material from the beds, channels, and banks of watercourses for flood prevention purposes (36.32.290), and to have trees that are in danger of falling into a watercourse removed (36.32.300).

DOE's *Comprehensive planning for flood hazard management guidebook* offers a discussion of Washington State statutes governing comprehensive flood hazard management activities.

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[1] RCW stands for the Revised Code of Washington

[2] WAC stands for the Washington Administrative Code

The Okanogan County Flood Damage Prevention Ordinance

Okanogan County's first Flood Damage Prevention Ordinance was adopted in 1979. The current ordinance (Ordinance 87-2) was adopted in 1987 to minimize losses due to flooding. It includes provisions for:

- Restricting or prohibiting uses that are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion, flood heights or velocities.

- Requiring that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction.

- Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters.

- Controlling filling, grading, dredging, and other development that may increase flood damage. Removal of riparian vegetation is considered development, and a permit is required whether or not construction takes place in conjunction with the clearing.

- Preventing or regulating the construction of flood barriers that will unnaturally divert flood waters or may increase flood hazards in other areas.

The ordinance also addresses repairs to structures damaged by flooding. With some exceptions, repairs to a structure within a designated *floodway* may not exceed fifty percent of the market value of that structure before the damage took place.

The Flood Damage Prevention Ordinance is being revised in conjunction with development of this plan; the revised version will satisfy FEMA's requirements for participation in the NFIP as well as establishing specific regulations for development in floodplain areas. All new construction must adhere to the County's current Flood Damage Prevention Ordinance.

Federal

Section 404—Clean Water Act

The primary goal of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 404 is specifically directed toward regulating discharge of dredged or fill material into waters of the United States. "Waters of the United States" include navigable waters and other waters the degradation of which could affect interstate or foreign commerce, tributaries to those waters, and adjacent *wetlands*.

Section 404 provides for government and public review and comment on projects that alter or destroy waters of the United States by filling (including any soil movement) or disposal of dredge spoil. Exempted activities include normal existing farming, forestry, and ranching activities. Fill quantities of less than ten cubic yards are exempt as well. Section 404 is implemented by the United States Army Corps of Engineers (COE), which issues or denies

permits. Permit approval must comply with guidelines developed by the Environmental Protection Agency (EPA). Included in EPA's 404 guidelines are provisions against permitting disposal of dredged or fill materials that will "jeopardize federally listed endangered or threatened species" or "significantly reduce recreational, aesthetic and economic values." In some cases, an EIS may be required prior to permit issuance.

Section 401—Clean Water Act

The purpose of Section 401 provisions is to ensure that federally permitted activities comply with the federal Clean Water Act, state water quality laws, and any other appropriate state laws. Section 401 requirements pertain to any activity that requires a federal permit and that may result in a discharge to state water. The person or agency proposing the activity is required to obtain a certification from the Department of Ecology that the activity will comply with water quality standards and discharge limitations for waters of the state.

Structural flood control measures such as stream bank protection and instream gravel removal have the potential to create temporary instream turbidity in excess of state water quality standards during construction. Such projects will require a Temporary Modification of Water Quality Criteria from the Department of Ecology. For stream bank protection and gravel removal projects, a Modification will be required before the Department of Ecology can issue a water quality certification.

The National Wild and Scenic Rivers Act

The National Wild and Scenic Rivers Act was passed in 1968. The intent of the Act is to protect selected free-flowing rivers with unique natural, cultural and recreational features for the benefit and enjoyment of present and future generations. Rivers or segments of rivers can be designated as Wild, Scenic, or Recreational. Designation affords protection for a river's corridor as well, although the Act limits the size of the protected corridor to an area averaging 320 acres per *river mile*[3]. The Act's primary strength is its ability to protect outstanding recreational and scenic segments and corridors on federal lands. Guidelines to prevent any uses or development proposals that might affect a river's values are established for not only federal agencies, but state and local governments as well. The Act prohibits federal licensing, assistance, or construction of any water project that would alter a protected river's flowing condition or diminish its outstanding values.

To date, three rivers in the State of Washington, none of them in the Methow basin, have been designated under the Wild and Scenic Rivers Act. Any future designation would prevent dam construction on the designated river segment and impose an obligation on federal agencies managing affected lands to protect water quantity and water quality. The role of the County in managing any designated lands within County jurisdiction is less clear.

[3] An area of 320 acres distributed about a 1 mile long river reach would measure 1/4 mile wide on each side of the river.

The National Environmental Policy Act

Federal concern for natural floodplain values developed incrementally from a series of essentially single-purpose public laws into a broad national policy objective of environmental quality set forth in the National Environmental Policy Act of 1969 (NEPA). In enacting NEPA, the Congress formalized recognition of the fact that the values of environmental resources are dependent upon the function of complex natural systems. Application of the process mandated by NEPA has prompted efforts to restore and preserve natural floodplain values, while protecting life and property.

NEPA declared environmental quality to be a national goal and established a process requiring federal agencies to consider the environmental impacts of agency-sponsored development projects and of privately-sponsored projects that require agency permits and approvals. The Act requires that an environmental impact statement (EIS) be prepared for any major federal action that would have significant adverse environmental impacts. The proponent of a privately sponsored project may also be required to perform an EIS if any federal moneys are a part of the project or if the permitting federal agency receives a recommendation that an EIS be prepared.

An EIS must thoroughly evaluate any adverse environmental impacts of the proposed action and its alternatives. The NEPA process emphasizes public involvement, the full disclosure of environmental impacts, and the consideration of those impacts, along with technical and economic considerations, prior to an agency decision.

Since work in the *river corridor* has the potential to affect the environment, NEPA review will be required for any work with federal funding. Structural and bioengineered flood hazard management projects generally receive federal funding and so must comply with NEPA requirements. NEPA will also be invoked if funds allocated under the Intermodal Surface Transportation Efficiency Act (ISTEA), or other DOT funds, are used. In addition, NEPA provides an avenue for protection of *river corridor* values on federal lands in the basin.

The Endangered Species Act of 1973

The Endangered Species Act (ESA) was intended to protect *endangered* and *threatened species* by preventing both the taking of individuals and the destruction of critical habitat. The U.S. Fish and Wildlife Service has jurisdiction over terrestrial and native freshwater species and the National Marine Fisheries Service is responsible for listings of marine species, including *anadromous* fish, such as salmon and steelhead. Currently, NMFS is in the process of determining whether steelhead will be listed as an *endangered species* under the act. If steelhead are listed, many activities in the *river corridor* may need ESA Section 10 permits for non-federal action that may have an impact on steelhead.

State

The Washington State Growth Management Act

The Growth Management Act (GMA) was enacted in two phases—GMA I in 1990, and

GMA II in 1991—to manage growth by mandating adoption of local comprehensive land use plans and development regulations. While only the state's fastest-growing counties were required to adopt comprehensive plans under GMA, all counties were directed to classify and designate natural resource lands and to classify, designate, and regulate critical areas. Critical areas include *wetlands*, critical aquifer recharge areas, fish and wildlife habitat, frequently flooded areas, and geologically hazardous areas. The inclusion of hazards reflects their effects on communities and on land use as a whole. Communities are identifying areas that flood repetitively and geologically hazardous areas, and beginning to plan for and create balance between these land uses and population needs, environmentally sensitive areas, infrastructure needs, and so on. The entire growth management effort provides information and additional opportunity for communities to reduce flood effects and vulnerability. Okanogan County's critical areas regulations are intended to accommodate development while being sensitive to critical areas.

The Washington State Shoreline Management Act

The State's Shoreline Management Act (SMA) was enacted in 1971 to manage appropriate uses of the shorelines of the state. In its action, the Legislature stated that shoreline areas are among the most valuable and fragile natural resources and established a state policy to provide management by planning for and fostering all reasonable and appropriate uses. Under the SMA, development of the State's shorelines is intended to proceed in a manner that promotes and enhances the public interest, and that protects against adverse effects to the public health, the land and its vegetation and wildlife, and the waters of the state and their aquatic life. The SMA provides for local regulation with oversight by the Department of Ecology, mandating the development of a Shoreline Master Program (SMP) by each local government in the state.

The shorelines of lakes greater than 20 acres or streams with mean annual flow greater than 20 cfs, and their associated *wetlands*, fall under the jurisdiction of the SMA. The SMA also designates shorelines of state-wide significance and establishes policies pertaining to those shorelines. Where shorelines of state-wide significance are concerned, it is the intent of the SMA to "recognize and protect the state-wide interest over local interest" and to "preserve the natural character of the shoreline." East of the Cascade range, shorelines ~~of~~ state-wide significance include rivers or segments thereof with a mean annual flow of 200 cfs or more, or the portions of rivers downstream from the first 300 square miles of drainage area, whichever is longer. The Chewuch and Twisp Rivers below the Okanogan National Forest boundary, and the Methow River below its confluence with Lost River, have been designated shorelines of state-wide significance.

Most activities in and on shorelines are subject to the SMA; some are exempted. Major exemptions include:

- developments having a fair market value less than $2,500
- maintenance and repair of existing structures
- construction of protective bulkheads on property occupied by single family residences
- emergency construction to protect property from damage by the elements
- construction and practices necessary for farming, agricultural, and ranching activities
- construction of certain single family residences

Local governments have the option of adding regulations reflecting their own goals and values to the mandates of the SMA via their Shoreline Management Programs.

The Open Space Taxation Act

The Open Space Taxation Act was enacted in 1970 to provide an incentive for protection of environmentally sensitive areas. Under the act, private land classified as open space is assessed at a reduced rate, with the percentage reduction based on the type and amount of public access (encouraged, but not required) and the type and amount of resource found on the parcel. Credit for resource restoration is available as well. Additional information is provided under the heading "Incentive programs" in Chapter VI.

The Washington State Environmental Policy Act

The State Environmental Policy Act (SEPA) parallels the requirements of NEPA. SEPA was passed by the Legislature to provide a process for analyzing the environmental impacts of development. Information provided during the SEPA process helps agency decision-makers and the general public understand how a proposed project would affect the environment. It is intended to help decision-makers at all levels of government in the state make better environmental decisions.

SEPA requires a full disclosure of the probable significant adverse environmental impacts of a project and the identification of ways to mitigate or reduce the impacts of a project. Impacts to the natural and built environment are considered. For proposals with probable significant adverse impact on the environment, an environmental impact statement (EIS) must be prepared. State and local agencies may deny permits or other approvals under SEPA if a proposal would be likely to result in significant adverse environmental impacts and if mitigative measures would be insufficient to mitigate the identified impact.

SEPA provides for a variety of proposed actions that are categorically exempt from the SEPA process, including construction of most single-family houses. In addition, minor new construction in five categories[4] is exempt. "Flexible thresholds" allow cities and counties to set their own size criteria within a specific range for each of those five categories of exemptions.

Like NEPA, SEPA has provided for examination of the full range of *river corridor* values that may be affected by a proposed development, unless the development is exempt. Non-exempt development that threatens those values can be controlled by imposition of conditions or denial of permits.

The Washington State Wild and Scenic Rivers Act

The Washington State Wild and Scenic Rivers Act was enacted in 1977. To date, two rivers have been designated under the law. Eighteen other rivers have been proposed as candidates, but have not been designated. The Methow River (including Lost River) is on the candidate list. Like the WSRA, the Act protects designated rivers from construction of dams and impoundments and provides guidance for management of public lands. The Act gives the state no

[4] The five categories are: residential dwelling units; agricultural structures; office, school, commercial, recreational, service, or storage buildings; parking lots; landfills and excavations.

authority over privately-owned land. Until recently, the Washington State Parks Department provided staff support for the state wild and scenic rivers program. That support ended in 1995; designation of the Methow River would require that the community develop support and prepare management and stewardship plans for public lands along the river. Any protection of private lands would result from voluntary action by landowners.

The Washington State Hydraulic Code

Passed into law in 1949, the State Hydraulic Code is intended to protect fish life from damage by construction and other activities in all waters of the state. In enacting the Code, the Legislature recognized that virtually any construction within the high water areas of state waters has the potential to cause damage to fish life and its supporting habitat.

The Hydraulic Code is implemented through a permit called the Hydraulic Project Approval (HPA), obtained from the State Department of Fish and Wildlife (DFW). Activities that require an HPA include streambank protection; construction of bridges, piers, and docks; channel change or realignment; log, log jam, or debris removal; installation or maintenance with equipment of water diversions; and any other activity that could affect fisheries resources or fish habitat. Among other things, the Hydraulic Code provides that bank protection shall be confined to damaged banks; water course encroachment shall be held to a minimum; and bank protection material shall not appreciably reduce normal water course capacity or configuration. An HPA may be denied when, in the judgment of DFW personnel, the project is directly or indirectly harmful to fish life and adequate mitigation cannot be assured by conditioning the approval or modifying the proposal. The Code states that protection of fish life shall be the only ground upon which an application may be denied or conditioned.

Bald Eagle Protection Rules

The purpose of the State's Bald Eagle Protection Rules is to protect bald eagle habitat and so increase and maintain the eagle population, with the goal of seeing the species removed from the state special species list. The Rules provide for development of a site management plan for bald eagle habitat protection when land-use activity is proposed on land containing or adjacent to an eagle nest or communal roost. Site management plans are intended to provide for habitat protection through a process that is sensitive to the landowner's goals, and may include the use of incentives or acquisition of high priority habitat land.

Local

The Comprehensive Plan for Okanogan County

Okanogan County's Comprehensive Plan was adopted in 1964 to provide a framework for the future orderly development of the County. The Plan was developed locally to help government serve the needs of the people of Okanogan County. It is non-regulatory, meaning it lacks any enforcement mechanism; it was intended to serve as a general guide for growth and land use for a term of about twenty years. The Comprehensive Plan establishes goals and policies meant to be met by various land use ordinances. Several policies relate to *river corridor* planning;

they involve maintaining low densities in waterfront areas to prevent pollution, conserving natural resources for the betterment of the County's economy, encouraging recreational development, and assuring public access to the waterfront. Two addenda, discussed below, apply within the Methow Valley.

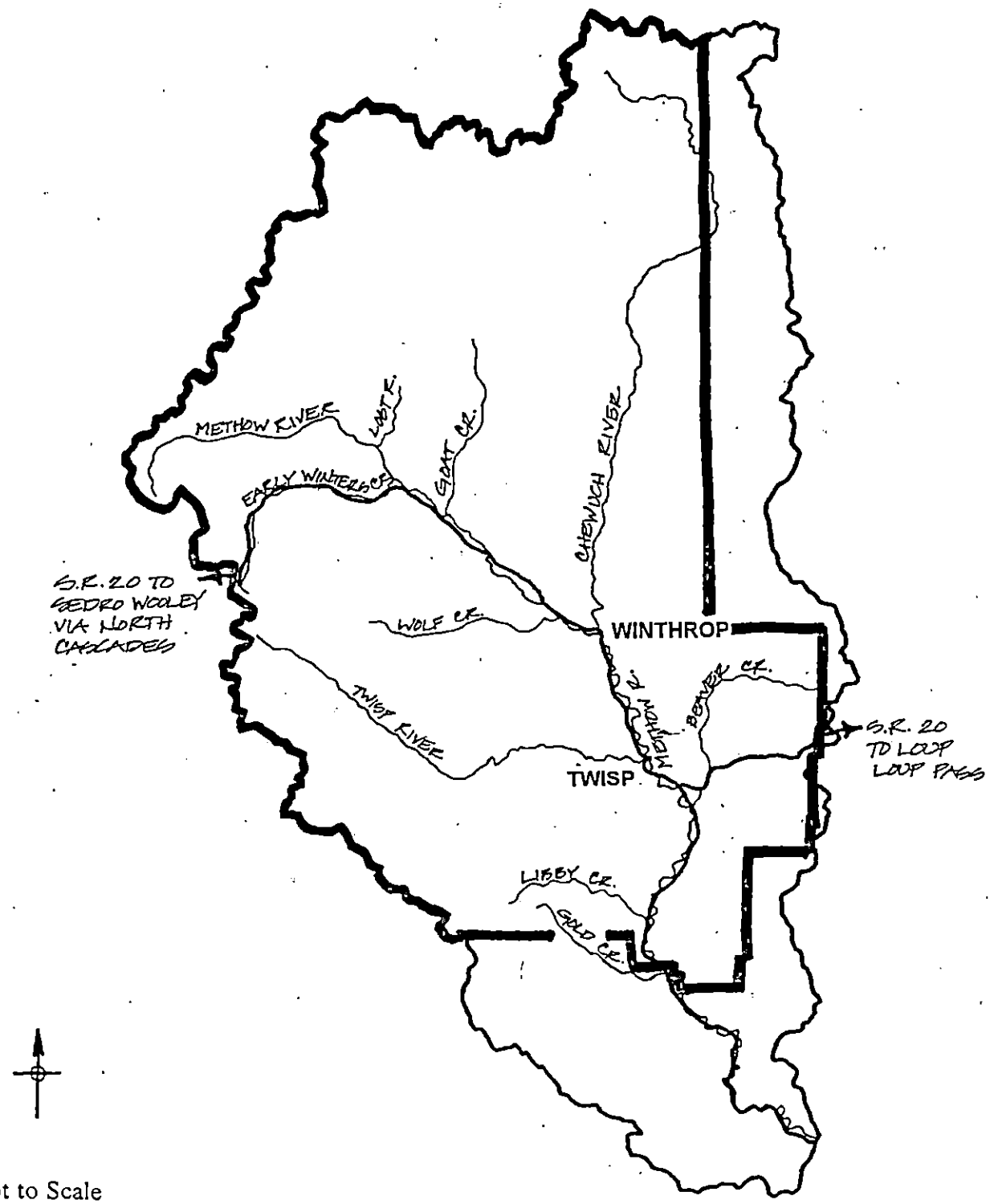
The Methow Valley Plan

The Methow Valley Plan was adopted as an addendum to the County's Comprehensive Plan in 1976. The Plan covers School District No. 350, and was undertaken in response to concern over potential changes resulting from the opening of the North Cascades Highway, a development proposal by the Aspen Skiing Corporation, and possible open-pit mining. It was developed with the help of a citizens' group, the Methow Valley Land Use Advisory Committee. The Plan establishes four planning sub-units (A-D) within School District No. 350 (see Figure IV.2) and presents policies relating to Land Use, Community Facilities, and Sensitive Areas, along with a discussion of methods for implementing those policies. Land Use policies related to *river corridor* planning include coordinating forest practices to minimize impacts on critical wildlife and fisheries habitat and prohibiting development designed for human habitation in the 100-year floodplain. Sensitive Areas policies include protecting the natural character of the shoreline; discouraging development adversely affecting critical and key wildlife areas; and protecting valley fisheries habitat by maintaining adequate stream flow, subject to existing water rights.

The Mazama Area Master Plan for Methow Valley Planning Area Subunit A

The Mazama Area Master Plan was adopted in 1989 as an amendment to the Okanogan County Comprehensive Plan and the Methow Valley Plan for the purpose of guiding development within Subunit A by addressing planning issues in greater depth than had the earlier plans. Subunit A was identified as the "most environmentally fragile" of the four sub-units identified in the Methow Valley Plan. Like the Methow Valley Plan, the Mazama Area Master Plan was considered necessary in part because of the anticipated development of a destination ski resort near Early Winters Creek. The plan presents goals, policies, and implementation strategies intended to provide for an attractive and livable community. Specific to *river corridor* planning, the plan calls for a river-front greenbelt in the Mazama community area.

Figure IV.2
Methow Review District



Not to Scale

The Comprehensive Parks and Recreation Element

The Parks and Recreation Element of the Comprehensive Plan was adopted in 1993 to develop a comprehensive approach to recreation planning, to meet the population's needs for park and recreation programs and facilities, to establish priorities for program development, land acquisition/disposal, and capital improvements, and to ensure conformance with federal and state funding requirements.

Plan recommendations are based in part on the results of surveys and public meetings. Survey results showed that lakes and rivers are among the most popular recreation facilities in the county, used by 24% of respondents. The two most popular activities are water-dependent ones, fishing and swimming. Seven percent of respondents indicated a desire for more lake and river developments, including swimming areas, boat launches, and boat ramps; 10% requested better access to rivers and lakes; and 12% expressed a preference for an increase in trails for walking and biking. "Outdoor trails system and facilities" tops the list of needs for the Methow Valley, which is based on survey results from the area and local public meetings. The plan calls for a feasibility study for lake and river facilities, and for identification of specific trail projects. It also recommends "continued cooperation on developing trails in the Methow Valley" and "cooperative park planning relations" with other agencies.

The Comprehensive Recreation Plan for the Methow Review District

The Methow Review District Recreation Plan was adopted in 1990 as an addendum to the Okanogan County Trails Plan. Public meetings and a survey were used to assess public opinion and guide development of the Plan. The recreational facilities rated most important were trails—for walking, skiing, mountain biking, bicycling, and horseback riding. The Plan's objectives include providing trail facilities for year-round recreation, encouraging non-vehicular travel by providing trail alignments that enable pedestrian, bicycle, and equestrian movement between populated areas, and seeking innovative ways to fund trail projects. The Plan identifies valley floor trails and trails connecting towns (especially Winthrop and Twisp) as desirable.

The Okanogan County Critical Areas Regulations

In 1994, Okanogan County adopted Critical Areas Regulations to comply with the mandates of the Washington State Growth Management Act of 1990. Compliance with the regulations is a condition of development approvals that are permitted through the County Office of Planning and Development. Most pertinent to this plan are the provisions for development in frequently flooded areas, defined in the Regulations as lands subject to a one percent (1%) or greater chance of flooding in any given year, as designated by the Federal Insurance Administration of the National Flood Insurance Program. Those lands are shown on Flood Insurance Rate Maps issued by the Federal Insurance Administration. The regulations state that "Any use or development shall maintain the pre-development movement (volume and velocity) of surface water and prevent or minimize the unnatural diversion of flood water to otherwise flood-free areas which could necessitate expensive and environmentally disruptive flood control methods."

The section of the Regulations on Fish and Wildlife Habitat Conservation Areas addresses development in areas that support important species or provide unique or significant habitat to many wildlife species. Many of those areas are wholly or partially within riparian corridors. The Regulations establish a three-tiered classification system based largely on habitat areas designated by the Washington State Department of Fish and Wildlife (WDFW). Level I habitat is that of threatened or *endangered species* as identified by federal or state government. Level II habitat is that **essential** to populations of fish and wildlife of local concern. Level III habitat is that which is **important** to fish and wildlife species of local concern. Species and habitat types currently included are discussed in section II.E. Habitat areas are indicated on non-regulatory maps; the areas may change depending on species distribution. The regulations establish requirements relating to native revegetation, riparian vegetation protection, fencing, and access for all development in Level I and Level II habitat areas.

Most relevant to this plan are the requirements for riparian vegetation protection. The Critical Areas Regulations note that riparian vegetation plays a role in preventing erosion and slowing flood waters, and in storage and release of water. As defined by the regulations, the *riparian zone* varies in width; it may extend a maximum of 200 ft. from the Ordinary High Water Mark (OHWM) on each side of a given water body or wetland. Within that zone, it is the intent of the regulations that riparian vegetation be maintained as riparian habitat. Some clearing is allowed to provide view and access corridors. Riparian setbacks are established as follows:

Water Type	Setback
1 and 2	200 ft.
3	150 ft.
4	50 ft.
5	not regulated

When the placement of a structure does not remove riparian vegetation, County Shoreline Management Program setbacks apply. (The Shoreline Management Program is discussed on page 79.)

Additional requirements apply to development in Level I habitat areas. Bald Eagle habitat, which is found exclusively in riparian corridors, is classified as Level I habitat. Development proposals that are likely to have a direct impact on the habitat of the Bald Eagle are required to follow the state's Bald Eagle Protection Rules, discussed on page 73.

Development in landslide hazard areas is regulated under the Critical Areas Regulations. Landslide hazard areas include areas that are potentially unstable as a result of rapid stream incision or stream bank erosion, and are relevant to this plan because there are areas of unstable banks adjacent to the Methow River. Such areas are not to be developed unless it is demonstrated that the project is structurally safe from the potential hazard and that development will not increase the hazard risk. Setbacks are to be established on a case-by-case basis.

Finally, the *wetlands* section of the regulations contains provisions that are pertinent to this plan since wetlands are often found in association with *riparian areas* in the Methow River

basin. That section establishes a four-category rating system for *wetlands* in Okanogan County[5], regulates various activities in wetlands, and establishes wetland *buffer zone* widths[6] based on wetland category and use intensity, as follows:

Wetland Category and Use Intensity	Buffer Width
Category I	
High intensity	300 ft.
Low intensity	200 ft.
Category II	
High intensity	200 ft.
Low intensity	75 ft.
Category III	
High intensity	75 ft.
Low intensity	50 ft.
Category IV	50 ft.

Buffer zones are to be maintained in their natural condition, with some alteration allowed following review. Mitigation is required in case of alteration. The goal of buffer requirements is to provide for no net loss of *functions and values* of regulated *wetlands*.

The Okanogan County Zoning Code

The current Okanogan County Zoning Code (Okanogan County Code, Title 17) was adopted in 1992 as a tool for implementing the County's Comprehensive Plan. The Zoning Code establishes a number of districts within the County, and designates allowable uses, residential densities, and standards of development within each district.

With the exception of certain areas near towns and unincorporated communities, School District #350 in the Methow Valley has been designated the Methow Review District (MRD). See Figure IV.2, p. 75. The MRD was established "to protect the sensitive environmental, aesthetic and economic qualities of the Methow Valley through review and the imposition of more stringent development and subdivision standards." Lands within the MRD are designated as either Uplands or Valley floor. In areas classified as Uplands, the minimum lot size is 20 acres. In Valley Floor areas, the minimum lot size varies from 5 acres to 12,500 square feet, depending on zoning classification. In addition, the Code states that within the MRD, "No structures for human habitation or any sewage disposal facilities shall be constructed or placed in areas inundated by the 100-year flood." While that provision prevents houses from being built on land below the *Base flood elevation*, it does not on its face restrict construction within the *floodplain boundary*. The code is interpreted to allow elevated areas within the flood hazard boundary to be built upon.

[5] Okanogan County's wetlands rating system is based on the Washington State Wetlands Rating System for Eastern Washington, developed by the Department of Ecology.

[6] Wetland *buffer zones* are areas that surround and protect a wetland from adverse impacts to its functions and values. Wider buffers offer greater protection.

The Okanogan County SEPA Ordinance

The Okanogan County SEPA Ordinance (Ordinance 95-5) contains the County's SEPA procedures and policies, including flexible thresholds for categorical exemptions. Different exempt levels are established for lands within and outside of School District No. 350 (the Methow Review District). The exempt levels within School District No. 350 are lower (that is, smaller projects will require a SEPA process), in acknowledgment of the area's environmental sensitivity. SEPA review is required for non-exempt work in the *river corridor*.

The Uniform Building Code

Building codes are meant to regulate the safety and quality of structures by establishing minimum standards of safe design and construction. In 1975, Okanogan County adopted the Uniform Building Code (UBC) as the source of those standards. (The UBC is updated periodically. Local government agencies in Washington State are currently using the 1994 version.) When used in concert with flood hazard management planning, the building code ensures proper flood proofing of new construction and reconstruction in flood hazard areas.

The Okanogan County Subdivision Ordinance

Subdivision ordinances prescribe procedures and conditions for dividing land into smaller parcels. Okanogan County's Subdivision Ordinance (Okanogan County Code, Title 16) was adopted in 1992. With some exceptions, divisions of land into five or more parcels are considered subdivisions, and so regulated by the Ordinance. The Ordinance specifies that subdivisions shall conform to zoning and other regulations in effect at the time the application for the proposed subdivision is made. Subdivisions by nature influence flood hazard management planning in that they allow for increased density.

The Master Program for Okanogan County Shoreline Management

Okanogan County's Shoreline Management Program (SMP) was adopted in 1987 in accordance with the state Shoreline Management Act. The County issues permits for shoreline substantial development, shoreline conditional uses, or shoreline variances in accordance with the SMP and Department of Ecology guidelines. Review of each development proposal is required prior to permitting, so that shoreline development can be balanced with habitat protection and other shoreline interests, such as public access.

Okanogan County's shoreline jurisdiction includes the 100-year floodplain *or* the area 200 feet landward, on a horizontal plane, from the ordinary high water mark, whichever is greater. Using the entire floodplain to define the shoreline jurisdiction has the advantage of placing shoreline management protection on lands surrounding *wetlands* in the floodplain without requiring extensive inventory of riverine wetlands, since such wetlands occur within the floodplain. It also allows for shoreline management planning that addresses the floodplain as a functional landform.

The SMP establishes five shoreline designations: Natural, Conservancy, Rural, Suburban, and Urban. The following three apply to shorelines in the Methow basin.

- Conservancy Environment: An area containing a resource capable of sustained yield. Forest products, hunting, fishing, agriculture, and many types of recreation are examples of uses compatible with this environment. The intent of this environment is to maintain the existing character of the shoreline.

- Rural Environment: An area where there exists land capable of supporting cultivated and irrigated agriculture with associated activities. It is also an area where recreational activities can take place that do not conflict with agriculture.

- Suburban Environment: An area where there are few biophysical limitations to development. These are areas planned for expansion of nearby residential developments. These areas are not desirable locations for commercial or industrial development.

The shoreline jurisdiction applies to Patterson, Pearrygin, Moccasin, Davis, and Alta Lakes; the Twin Lakes; portions of the Methow, Chewuch, and Twisp Rivers; and portions of Early Winters, Wolf, Beaver, and Gold Creeks. The shoreline designation for each area within the shoreline jurisdiction is shown on the Official Map of Shorelines for Okanogan County. Most shorelines in the basin are designated Rural, with some reaches in the Conservancy environment, and a very small area in the Suburban environment near the Town of Winthrop.

The SMP has a great deal of potential to affect the quality of the *river corridor*. Its general regulations include three provisions with important ramifications for shoreline condition:

- Any development or use activity within the shoreline areas is to be consistent with the intent of the Act and with current zoning and building codes, the subdivision regulations, and the floodplain ordinance.

- Shorelines are to be restored upon completion of construction, installation, or maintenance projects.

- Agricultural land requiring cultivation is to have a *buffer* strip of native vegetation at least 20 feet wide established and maintained along shorelines.

In addition, the SMP contains prohibitions against subdivision in the Natural, Conservancy, and Rural environments, and establishes minimum lot sizes for residential development in all shoreline environments.

The Shoreline Master Programs for the Towns of Twisp and Winthrop

The towns of Twisp and Winthrop both adopted Shoreline Master Programs in 1990. Each establishes four shoreline designations: Urban, Suburban, Rural and Conservancy Shoreline Environments. Each environment designation is delineated on maps, and regulations are promulgated for activities and development within each area. Like the County, the towns issue

permits for shoreline substantial development, shoreline conditional uses, or shoreline variances in accordance with the SMP and Department of Ecology guidelines.

The Methow Basin Level B Study of the Water and Related Land Resources

The Level B study was prepared in 1977 by the Pacific Northwest River Basin Commission's Washington State Study Team. "Level B" studies were prepared with the idea that they would be used to create a comprehensive plan for the Pacific Northwest. The Methow basin study was designed to be consistent with the National Environmental Policy Act (NEPA) and the Washington State Environmental Policy Act (SEPA). It provided an assessment of problems to be addressed within a 15-to-25 year time frame based on the Methow Valley Plan (discussed on page 74) and other available reports. Potential problems and issues in agriculture, domestic, municipal and industrial water supply, recreation, flood damage reduction, water quality, fish and wildlife, and electric power are discussed. Among other priorities, the study recommended adoption of a water resources management program.

The Water Resources Management Program for the Methow River Basin

The Water Resources Management Program for the Methow River Basin, also known as the Methow Basin Plan, was prepared by the Department of Ecology in 1976. In formulating the Plan, the Department of Ecology utilized policies developed by the Methow River Basin Steering Committee, composed of local citizens, and the results of a questionnaire concerning water allocation and future planning that was sent to all mailing addresses in the basin. The Plan establishes base stream flows for the Methow, Twisp, and Chewuch Rivers and for Early Winters Creek. It also establishes priorities of beneficial use, allocates waters to each use, and identifies the constraints on allocation of groundwater in continuity with surface water. Priorities are as follows:

Priority I	Existing rights
Priority II	Single domestic and stock use
Priority III	Base flows
Priority IV	Public water supply, irrigation, and other uses

The Plan establishes maximum surface water available for future allocation from each of three critical surface water reaches: the upper Methow River above Winthrop to Little Boulder Creek; the Methow Headwaters, above the confluence with Little Boulder Creek; and Early Winters Creek. Two cubic feet per second from each reach is allocated for single domestic and stock use. A specific amount is reserved in each case for base flow; the remainder is available for public water supply, irrigation and other uses up to the appropriation limit set forth in the Plan. A 1991 revision provides for the emergency closure of a number of smaller sub-basins in the middle and lower Methow drainage to all withdrawals of surface waters and groundwaters that are in continuity. When the Methow Valley Water Pilot Planning Project's plan is adopted, it will supersede the Methow Basin Plan.

downstream, and physical damage caused by ice chunks. No analysis has been done to locate areas at greatest risk from ice jam-related flooding.

How should Okanogan County reduce and prevent flood hazards associated with ice jams?

Policy and management

"Up-and-out" building sites

As the Flood Damage Prevention ordinance is currently being interpreted, new structures for human habitation are allowed within the flood hazard boundary in the Methow Review District, as long as they are built on land higher than the *base flood elevation* ("up-and-out"). In many parts of the valley, geology and the morphology of the *river corridor* render those sites hazardous since the sediments on which the structures are built are subject to erosion during flood events.

Should Okanogan County continue to grant development permits for "up-and-out" sites, regardless of hazard?

Riparian vegetation management

Riparian vegetation, which plays an important role in flood attenuation and is a major component of riparian habitat, has been removed or altered in many places. Shoreline vegetation is often removed in violation of County ordinances intended to protect the *riparian zone*. The County lacks staff to adequately monitor the provisions of regulations designed to protect riparian vegetation. Prior to a project proponent's application for a permit, the County has no mechanism for enforcing its regulations or alerting landowners regarding those regulations. In addition, vegetation is often cleared from sites used for camping or other recreational use. Since no development permit is sought, County staff often are not aware of a landowner's intentions in advance. In other cases, vegetation has been removed in conjunction with agricultural use.

How can Okanogan County act to protect riparian vegetation and preserve the values associated with it?

Exemptions for single family residences

Single-family residences are exempt from many provisions intended to maintain the integrity of the shoreline environment. Residential development is increasingly common along the Methow Valley's rivers. The *cumulative effects* represent a threat to the functional characteristics of the *river corridors.*

How can Okanogan County prevent or mitigate the cumulative effects associated with single-family residential development?

Erosion hazards

In several places, erosive banks subject to undercutting during floods line the basin's rivers. Erosion of bluffs along the Methow River between the present Towns of Carlton and Twisp destroyed the Town of Silver during the flood of 1894. A number of structures located on high banks were lost during the 1948 flood when the banks collapsed. High bank sites are well out of the floodplain, but structures built on top of them are vulnerable due to erosion.

What approach should Okanogan County take to identifying areas where erosion presents a special hazard and granting development permits in those areas?

Alluvial fans

Alluvial fans are subject to special flood hazards. Alluvial fan floods are less predictable, and their boundaries less well-defined, than most riverine floods. Hazards that may be encountered on fans include high-velocity flow, serious erosion and scour, deposition of sediment, debris flows, mudflows, and flash flooding, as well as inundation. Flood maps for alluvial fan areas designating them as shallow flooding areas incorrectly imply low risk. Usually the risks there are quite serious due to high velocities, debris and erosion. In addition, alluvial fan flows are subject to lateral migration and sudden relocation during the course of a flood. Fans occur at several locations in the basin, notably at Early Winters Creek.

How should Okanogan County reduce and prevent flood hazards associated with alluvial fans?

Flash flooding

The combination of steep tributary streams and occasional intense storms creates the potential for flash flooding in the Methow Valley. Flash floods cause greater damage than ordinary riverine floods because of the suddenness of flooding (which may prevent evacuation), the velocity of the water, and the large amounts of debris in the water. There are no floodplain maps for the small tributaries in the Methow Valley that are at greatest risk for flash flooding. Furthermore, many small changes in a stream's watershed—not just the floodplain—can drastically increase flash flooding.

How should Okanogan County reduce and prevent flood hazards associated with flash flooding?

Ice jams

Ice jams have the potential to cause flooding on Methow Valley rivers. The flooding caused by ice jams is similar to flash flooding. The formation of a jam results in a rapid rise of water at the point of the jam and upstream. Failure of the jam results in sudden flooding downstream. Damage from ice jam flooding usually exceeds that of clear water flooding because of higher than predicted flood elevations, rapid increase in water levels upstream and

CHAPTER IV: ISSUES, GOALS AND OBJECTIVES, AND POLICIES

Based on existing conditions (discussed in Chapter II), flood history (discussed in Chapter III), current plans and regulations (discussed in Chapter IV), and the results of the River Corridor Survey, County staff worked with Technical Advisory Committee and Citizens' Advisory Group members to identify issues to be addressed in the development of this plan. Those issues are summarized below. Analysis of the issues led to development of goals and objectives for the *river corridor* that this plan is intended to meet. Policies were derived from the goals and objectives.

A. Issues

Flood-related issues

Flood-related issues can be grouped under five headings:

- Basin characteristics: issues arising as a result of the physical characteristics of the basin and, specifically, the rivers and their corridors.

- Policy and management: issues arising from current policies and management approaches.

- Flow regime: issues arising from alterations to the natural flow regime as a result of development.

- Hazards: issues related to hazardous conditions in the basin.

- Awareness: issues related to awareness of flood hazards, both on the part of the general public and within agencies responsible for making decisions that pertain to flood conditions.

-Basin characteristics

Dynamic channels

The Methow, Twisp, and Chewuch Rivers are very dynamic in places. Channel locations change frequently, changing elevations within the *floodplain*. Flood heights at a given location may change in response. Flood elevations established by FEMA may no longer be accurate by the time a development proposal is submitted for permitting. Erosion also presents a hazard in such areas, as sediments are subject to reworking during floods.

What approach should Okanogan County take to granting development permits in dynamic channel reaches?

C. Analysis

• The County's land-use management tools do not treat the Methow River basin as a unit. Regulations vary within and outside the Methow Review District, making management of the *river corridor* as a system difficult.

• Certain activities with the potential to affect flood flows and *river corridor* condition are exempt under the County's Shoreline Management Program. Bulkheads (allowed for single-family residences in all shoreline environments, and for permitted structures within the Rural shoreline environment) and direct access by livestock to the stream are particularly detrimental to shoreline condition. Landfills and mining and dredging operations are other permitted uses that may affect flood flows.

• Outside of the Methow Review District, new structures for human habitation are allowed in the floodplain if they are above *base flood elevation* or use flood-proof foundation construction, as long as they are in compliance with all pertinent provisions of applicable regulations.

• Throughout Okanogan County, new structures not intended for human habitation are allowed in the 100-year floodplain (subject to provisions of all applicable regulations); they can contribute to increased flood flows and present hazards in case of flooding.

• Single-family residences are exempt from a number of regulations; those exemptions have the potential to contribute to the degradation of conditions in the *river corridor*, and to increase flood hazards.

• Taken together, provisions of the Shoreline Management Plan (discussed on page 79) and the Critical Areas Regulations limitations on vegetation clearing in *riparian areas* (discussed on page 77) serve to preserve shoreline vegetation. Since one of the functions of riparian vegetation is floodwater retention, the SMP can be used as a tool for maintaining the capacity of the floodplain to absorb and slow water that might otherwise cause flooding. In addition, the prohibition against shoreline protection in the Conservancy zone offers some measure of protection for habitat values.

Sources of information in this Chapter are listed in the Bibliography, on page __

Management of Forest Service lands

Much of the land in the basin is managed by the Forest Service for multiple use. Effects of grazing and timber management activities on *river corridors* in areas under County jurisdiction may not be taken into account in developing plans for Forest lands.

How can Okanogan County best protect lands under its jurisdiction from the effects of management activities on Forest Service lands?

Flow regime

Channel constraint

The natural relationship between the Methow basin's rivers and their floodplains has been compromised in a number of places. *Riprap*, dikes, and bulkheads used to control flooding and erosion have constrained the channel, resulting in localized increases in water velocity and erosive power and in destruction of habitat values. While the impact of each encroachment is usually small, the *cumulative effects* are significant.

What should be Okanogan County's policy with regard to existing and proposed channel constraints?

Upland management

Much of the basin's upland area is managed for multiple uses, including timber harvest and grazing. Both uses can dramatically affect runoff rates, influencing the frequency and severity of flooding and changing in-channel and near-channel conditions that affect riparian vegetation, fish, and other wildlife.

How can Okanogan County best protect its river corridors from the effects of management activities in upland areas?

Emergency actions

County and state regulations allow landowners to protect their property from imminent flood damage without going through the usual permitting process. Bank protection measures taken during emergencies may have long-term effects on channel dynamics and habitat quality.

How can Okanogan County work with landowners to ensure the protection of their property during emergencies without compromising river corridor values and County policies intended to protect those values?

Hazards

Vulnerable structures

Although new structures for human habitation may not be built within the 100-year floodplain in the Methow Review District, vulnerable structures do currently exist. Some may have been built before adoption of the 1979 zoning ordinance, which disallowed structures for human habitation in areas inundated by the 100-year flood. In addition, FEMA issued new flood hazard boundary maps for the area above Weeman Bridge in 1994. Some structures built outside the floodplain prior to 1994 may now be within the flood hazard boundary. Non-residential structures, and structures outside the Methow Review District, may also be at risk.

Where structures exist in the floodplain, how should the County protect the health, safety, and welfare of the owners and occupants? In each case, is it practical to reduce the vulnerability of the structure? What about the downstream risks posed by the structure?

Large woody debris

Organic debris entrained by high water can pose a risk to bridges and road embankments. During the 1948 flood, woody debris caused substantial damage to bridges in the Methow Valley. Woody debris is also an important structural component of the river and *riparian zone*. Its presence is essential to the survival and recovery of native fish stocks. The removal of wood from the rivers following past floods has had a dramatic effect on habitat quality, and contributed to the decline of fisheries in the basin.

What should be the County's policy with regard to woody debris in the river corridor?

Awareness

Level of awareness of flood hazards

Rivers in the Methow River basin flood infrequently. Population in the area has grown rapidly since the last flood; many residents are unaware of the rivers' destructive potential. Newcomers often have little sense of the dangers of locating in flood-prone areas. Even people who have witnessed flooding in the Methow Valley are often unprepared, or unaware of the risks inherent in their own situations. In 1974, the Department of Housing and Urban Development's Federal Insurance Administration prepared a Congressional report on flood hazards in the United States. A major conclusion of the report was that many people in high flood risk areas are seriously uninformed about the risk of flooding to which they are exposed; or that they are grossly overoptimistic about the chances that their property will not be flooded; or else that they expect public help to bail them out when the inevitable flood disaster strikes.

How can the County increase the level of awareness of flood hazards?

Lack of understanding of cumulative effects

Few people understand the effects of their actions on the structure and function of the river system. While the impact of individual actions may be slight, the *cumulative effects* of development and use throughout the *river corridor* have had and are continuing to have a deleterious impact on the river's ability to handle flooding, as well as on habitat values and aesthetic characteristics.

How can the County improve understanding (on the part of the general public and staff) of the Methow basin's rivers as components of a system?

Other issues associated with the river corridor and its use

- The future of existing platted lots in the floodplain: where undeveloped lots in the floodplain are unbuildable under current regulations, the County must ensure that the owners are not being denied reasonable use of their land.
- Economic development: both the condition of the *river corridor* and restrictions on development in the floodplain affect economic development in the Methow Valley.
- Water supply: the condition of the *river corridor* affects groundwater levels, and so may also affect water supply. Groundwater is a source of water for domestic use, stock watering, and irrigation. Irrigation water is diverted from the basin's rivers and creeks, as well.
- Property rights: landowners are increasingly concerned with the effect of land-use regulations on their ability to use and develop their land.
- Landscape character: *river corridors* within the Methow basin are vital components of the landscape, and make a large contribution to people's sense of place.
- Recreational uses in the *river corridor*: the natural character of the river corridor makes it attractive for recreationists. Public access to the river is becoming an issue as more and more land is developed.
- Degradation of fish habitat: confinement of river channels, riparian vegetation removal, and removal of woody debris from the *river corridor* all have negative effects on fish habitat.
- Obstructions to fish passage: when water levels are lowered, either because the water table drops as a result of vegetation clearing, or because of diversions for irrigation, some stream reaches are dewatered, and may present barriers to fish movement. In addition, diversion structures can obstruct passage or allow fish to become stranded in irrigation ditches.
- Fragmentation and loss of *river corridor* values: the river corridor has value to wildlife as a linear feature that allows them to move from one area to another while staying within reach of water and using riparian vegetation for food and cover. Land development has broken the corridor up in many places, restricting animal movement and reducing the habitat value of the corridor.
- Aesthetics: the beauty of the Methow Valley has drawn many people to the area, both as residents and as visitors. The quality of the *river corridors* contributes to the aesthetics of the place.
- Health: permeable sediments and reliance in most places on septic systems combine to make ground and surface water contamination an issue in the Methow River basin.

Concerns related to issues

- Impact on people's lives of this plan
- Social costs associated with the existing situation
- Local values

B. Survey Results

The results of the river corridor survey are summarized in Appendix D.3. (A copy of the survey is included, and the survey methodology described, as well.) Those results helped guide the development of goals, objectives, and policies, as well as the evaluation of options and the development of the program recommendations (Chapter VI). Some of the most significant findings are discussed in this section. In most cases, there was significant variation in responses between river reaches, suggesting that planning should address the differing needs of people in various parts of the basin.

Current use of river corridors

The most commonly reported uses of the *river corridor* are for aesthetic appreciation (66% of those responding), wildlife observation (57%), and fishing (56%). Other popular uses are camping (43%) and boating (38%). Agricultural uses were less commonly reported, but are important to the overall economy of the Methow Valley.

Desirable uses of river corridors

A substantial majority of respondents favor natural/wildlife areas (73%) or trails (71%) in the river corridor. Passive recreation (58%), viewpoints (55%), single-family residences (53%), and parks/active recreation (46%) also received substantial support. Condominiums, multiple-family residences, mining, and commercial and industrial uses all rated very low, with 12% or fewer of respondents considering them appropriate.

The Methow River as a scenic resource

Seventy-nine percent of respondents agreed with the statement "The Methow River is a scenic resource and should be preserved in a natural state for future generations to enjoy." Sixteen percent disagreed and five percent registered no opinion. Several people commented that the question was too broadly worded.

Structures in the floodplain

Seventy-four percent of respondents believe existing structures in the floodplain should be allowed to remain, but only 25 percent favor allowing new structures to be built in flood-prone areas.

C. Goals of This Plan

Goals are broad statements of direction. Four river-corridor management goals have been developed for the Methow River basin.

Reduce flood-related hazards and damages

Provide a basin-wide strategy for flood hazard reduction that balances engineering, economic, environmental and social factors in recommending options for reducing flood damage in the Methow Valley.

Sustain natural processes

Minimize the environmental impacts of flood hazard management. Maintain and improve the health of the Methow, Chewuch and Twisp River corridors to support their natural functions, including flood attenuation, water quality protection, aquifer recharge, and fisheries and wildlife habitat support (including *endangered species* protection). To the extent practical, maintain or restore the full range of hydrologic characteristics of the natural watershed.

Reduce the long-term costs of flood control and floodplain management

Provide for cost:benefit analysis of flood-hazard reduction options, including analysis of the full range of social costs (including financial and psychological costs and costs in lost values) associated with all alternatives. Minimize economic impacts (including maintenance costs) to the extent consistent with a balanced approach to flood hazard management.

Maintain the character of the Methow Valley and the variety of uses supported by the river corridor

Minimize the social impacts of flood hazard management; support appropriate use of the floodplain. Maintain the scenic quality of the Methow Valley by maintaining the valley's *river corridors* as amenities, preserving the aesthetic qualities of the river and tributary corridors, and providing for preservation of open space. Maintain existing recreational uses of the *river corridors*, and provide for improvement of recreational opportunities where consistent with flood hazard reduction and natural resource preservation goals. Maintain water supply and provide for appropriate stormwater management.

D. Objectives

Objectives are more specific than goals. They provide direction in accomplishing the purposes laid out by the goals. The objectives listed below state how the four goals above will be met. In this multi-objective plan, most objectives will help meet more than one goal.

- Identify and address factors that increase the destructive force of flood waters.

• Identify a corridor with the capacity to convey the 100-year flood while supporting a variety of objectives on those reaches of the Methow, Chewuch, and Twisp Rivers, and Early Winters Creek, outside the National Forest.

• Find and fill gaps in Okanogan County regulatory structure to improve consistency in floodplain management activities and support the goals and objectives of this plan.

• Coordinate floodplain management activities with the activities of other entities.

• Prevent new development in hazardous areas or ensure that it is built in such a way that on-site and downstream risk is minimized *and* that the builder is aware of and accountable for effects.

• Protect or alter existing development in hazardous areas to make it less susceptible to damage.

• Address the needs of landowners with unbuildable or at-risk parcels/lots.

• Protect infrastructure, using means that support environmental and recreational values within the *river corridor*.

• To the extent practical, eliminate the need for emergency measures by employing a combination of planning and structural and non-structural flood hazard reduction measures.

• Improve awareness of flood hazards, and of the relationship between the state of the *river corridor* and flooding.

• Take advantage of flood-control benefits of natural stream systems.

• Retain the dynamism of the watershed as a system—allow flexibility for vegetation and wildlife communities as well as morphology.

• Identify ecologically critical and sensitive areas within the *river corridor*, and provide for their protection, restoration, or enhancement where practical.

• Stabilize soil and stream banks; reduce erosion and sedimentation throughout the basin to the extent practical.

• Preserve and protect riparian vegetation and wildlife habitat.

• Retrofit existing projects and/or change maintenance practices to protect or enhance riparian habitat.

• Where the benefits of maintaining existing flood control improvements do not outweigh their costs, retrofit projects to make them less susceptible to damage or implement some other type of solution at the site.

• Provide for analysis of all proposals in terms of effects on people's lives as well as in purely financial terms.

• Provide for analysis of all proposals in terms of effects on the entire range of *river corridor functions and values.*

• Plan for public participation in ongoing *river corridor* management.

• Plan for implementation of plan recommendations; develop means to fund needed solutions.

E. Policies

General

• Flood hazard management should be undertaken in the context of the various legally existing uses in the basin, including agriculture, residential and commercial development, habitat, water supply, open space, recreational use, and timber and range management.

• Okanogan County should support the goals and objectives of the Washington State Flood Damage Reduction Plan (see Appendix E.4).

• The County should encourage establishment and maintenance of greenways in river and creek corridors as a means of reducing flood-related hazards and sustaining natural processes.

• Flood control activities should be consistent with the intent of the Growth Management Critical Areas Regulations and any other goals related to use or management of environmentally sensitive areas that are adopted by the County.

• Land use and related regulations and zoning should recognize the natural dynamics associated with the Methow basin's floodplains, *meander belts*, alluvial fans, and riparian habitat zones.

◦ *River corridor* planning should account for the long-term costs and benefits of any proposed action, regulation, or policy.

• Landowners should be accountable for the effects (including *cumulative effects*) of their actions in *river corridors*—including effects on public resources and on other people's property.

Reducing vulnerability

• New structures for human habitation should not be allowed within the *floodplain boundary* (as mapped by FEMA) in the Methow River basin.

• The County should plan for *amelioration* of risk to residents of flood-prone areas. Means other than protection of existing structures on existing sites should be considered (e.g., relocation; acquisition and demolition).

• *Critical facilities* should be located outside the limits of the mapped 100-year floodplain. Existing critical facilities should have top priority for relocation or risk management activities.

Flood damage reduction

• New development in river and creek corridors should utilize design, construction, and maintenance techniques that ensure the development will not diminish *corridor functions and values*. Analysis should consider upstream and downstream impacts, long-term effectiveness, and cumulative maintenance costs.

• Landscape changes that have the potential to increase flood severity and frequency should be avoided. Such changes include, but are not limited to, those that result in significant changes in sediment delivery, snowmelt, or runoff rates. Where avoidance is not possible, the County should encourage the use of appropriate measures to prevent increased flood hazards.

• Mitigation should be required for impacts to river and creek corridor resources. *Cumulative effects* should be evaluated in assessing the impact of any proposed change in corridors.

• Any new development within the mapped 100-year floodplain should cause no increase in *Base flood elevation* of the Methow River or its tributaries.

• Okanogan County should encourage solutions that limit vulnerability to flood hazards through better land use, construction standards, and other non-structural measures. Where structural solutions are warranted, the County should encourage designs that support *corridor functions and values*.

• Requirements for upland development should minimize changes in runoff patterns that increase potential for flood damage.

Cooperative planning

• Flood hazard management should be undertaken in the context of an ongoing, systematic, and comprehensive approach to basin management.

• Okanogan County should work cooperatively with community groups, citizens, and other agencies in the Methow River basin to plan on a watershed basis, and should encourage other agencies to support the policies of this plan.

• Flood hazard management planning and implementation should be coordinated among County departments, as well as with community groups, individuals, and other local, state, federal and tribal agencies with jurisdiction in the basin.

Implementation

• The County should be prepared for flood-related disaster. Disaster mitigation preparedness should include project planning and assessment sufficient to allow timely application for disaster-related funding.

• Planning should be the basis for community action and investment.

• Okanogan County should identify funding sources and seek funds to pay for implementation of the elements of this plan.

• Any damage to existing flood control facilities should be assessed relative to the goals and objectives of this plan, and repair/maintenance planned accordingly.

• This Multi-Objective River Corridor Plan for the Methow Basin should be reviewed and updated as necessary to reflect current conditions in the basin and results of research, inventory, and monitoring; and to maintain consistency with applicable laws, regulations, and programs.

• Okanogan County should support *adaptive management* in the *river corridors* of the Methow basin. Adaptive management involves assessing and responding to change in the environment.

Outreach

• Outreach should be a major component of the County's *river corridor* management efforts in the Methow basin. The County should develop a diversified education and involvement program designed to support the goals of this plan.

• Outreach should focus on helping people learn to make good decisions, not tell them how to think.

• Education efforts should be targeted, so resources are used efficiently.

• The Office of Planning and Development should develop partnerships for the purpose of planning for the future of the basin in the context of all users' goals and objectives.

CHAPTER VI: PROGRAM RECOMMENDATIONS

This chapter presents program recommendations for *river corridor* management in the Methow basin. The recommendations address the current and potential problem areas and maintenance needs identified in Chapter III and the issues identified in Chapter V. Issues, problem areas, and needs are addressed in the context of this plan's goals and objectives and of the County's resources. A phasing plan and list of responsible agencies and funding sources have been included in this chapter, which is intended to provide a holistic management program for the Methow basin's *river corridors*. Once this plan has been adopted, Okanogan County will be eligible to apply for funds to implement the plan's recommendations from the state's Flood Control Assistance Account Program. Applications for the biennium beginning in June, 1997 will be due early in 1997.

A. Program Recommendations

Flood warning and emergency response

Discussion

A flood warning and emergency response system can reduce deaths, injuries, and property damage by giving *floodplain* residents time to evacuate and, where practical, to protect their possessions when flooding is imminent; and by ensuring that emergency service personnel are on hand where and when needed. A well-designed system can provide for notification of people at greatest risk and make them aware of evacuation routes and safety measures in advance.

Okanogan County's emergency management program is housed in the Sheriff's Office. Emergency plans and operational procedures are addressed in the County's Emergency Management Operations Plan. The plan is reviewed annually during the month of February. It provides guidance for coping with natural, technological, and war-caused disasters, but does not contain specific flood warning or evacuation plans.

The local Emergency Broadcast Station is KOMW, broadcasting from Omak. Reception is good south of Twisp, but poor to non-existent in the upper part of the Methow Valley and in the Twisp and Chewuch river valleys. The Sheriff's Office relies on deputies to relay information in areas beyond the station's range. KOMW is in the process of installing a translator, which may improve reception in some areas.

Emergency management personnel monitor river levels during the period when flooding is most likely each year, receiving gage readings daily from the National Weather Service, making occasional visual checks of river level, and following up on citizen reports of flooding or high water.

Emergency management staff have not yet developed emergency preparedness materials and programs for distribution to the public. They do have some information on post-flood clean up, including a list of local contractors qualified to perform the necessary work.

Recommendations

• Amend the Emergency Management Operations Plan to make it clear that KOMW's range is limited, and clarify the responsibilities of Sheriff's deputies for informing those members of the public who are out of range of the station. Using the County's GIS (in conjunction with local knowledge and ground truthing), develop and maintain call lists or an automatic dialing system to ensure that all citizens whose lives or property may be at risk are informed in case of an emergency.

• During periods when flooding is likely, use the local media (Methow Valley News and radio station KVLR) to let people know that KOMW is the official emergency station, and how they will be contacted if they live out of range. Radio station KOZI (Chelan) can also be received in the Methow Valley, and may provide another means of disseminating information.

• At Lost River Airport Tracts, present flood awareness information to landowners to give them an opportunity to prepare for flooding and inform them about emergency plans. The Homeowners' Association holds general membership meetings twice a year, which would provide a good forum for reaching landowners and answering their questions.

• Make contact with people in other high risk areas to be sure they are informed and know what to do in case of a flood.

• Emergency work (including recovery work) is to be consistent with the goals of this plan. Develop emergency guidelines to direct the Washington State Department of Transportation, the County Public Works Department, and contractors in the performance of urgent repairs. Hold a workshop to promulgate the guidelines. Brief staff and contractors in years when flooding is likely.

• Planning and Emergency Management staff will meet (and conduct site visits together) to incorporate the goals and policies of this plan in emergency operations. Meetings should ensure that Emergency Management staff members know Planning's concerns and have the opportunity to incorporate them in future planning. Planning and Development staff should be invited to attend the annual meetings at which the Emergency Management Operations Plan is revised, and Planning should ensure that Emergency Management personnel have a list of *critical facilities* as they are defined in the County's Flood Damage Prevention Ordinance. If necessary, coordination meetings should be held with staff from other agencies involved in flood emergency preparedness to ensure understanding of responsibilities and roles.

• Develop and institute a community-wide disaster awareness program, designed to reach all sectors of the population.

• Ensure that any recovery information that is disseminated is consistent with the goals and policies of this plan.

• Develop a manual on Emergency Flood Response and Reconstruction/Restoration Activities Within the Shoreline Environment. Topics to be addressed should include, but are not limited to, roads and bridges; debris removal; erosion control; bank stabilization; and demolition, repair, and reconstruction of structures. When complete, the manual should be incorporated in or appended to this plan.

Development regulations

Discussion

Development regulations are a standard tool for guiding land use, both within and outside *river corridors.* Special regulations often apply to river corridor lands because of the hazards and resources associated with them. (See Chapter IV for a discussion of pertinent regulations.) Regulation has become unpopular with the general public. A number of new regulations have been enacted in recent years, and the large number of requirements and permitting agencies has created confusion and a measure of dissatisfaction with the permitting process. The Citizens' Advisory Group is opposed to new regulations, and none are recommended here. This section does call for three amendments to the Okanogan County Flood Damage Prevention Ordinance. It also recommends as options several other regulatory changes.

Recommendations

• Amend the Flood Damage Prevention Ordinance to allow no more than a 50% cumulative increase in building footprint size[11] when existing structures in areas of special flood hazards are *substantially improved.* One function of floodplains is to provide space in which water can spread out when rivers overflow their banks. When structures are built in floodplains, the space available for water is reduced, and flood levels may rise downstream to compensate for the loss. Limiting the footprints of buildings in the floodplain is a way of keeping the floodplain available to floodwaters.

• Amend the Flood Damage Prevention Ordinance to require that, in all areas of special flood hazards, new construction and *substantial improvement* of any residential structure shall have the lowest floor, including basement, elevated one foot or more above *base flood elevation.*

• Amend the Flood Damage Prevention Ordinance to require that, in all areas of special flood hazards, new construction and *substantial improvement* of any commercial, industrial, or other nonresidential structure shall either have the lowest floor elevated one foot or more above the level of the *base flood elevation* or shall be floodproofed so that below one foot above the *base flood* level the structure is watertight. Currently, the Flood Damage Prevention Ordinance requires both residential and non-residential structures to be constructed at or above *base flood elevation.* Elevating structures to one foot above base flood elevation (BFE) provides a higher level of protection than does the current practice for two reasons. First, BFEs are mathematical predictions.. They are inherently imprecise, and are only intended to be accurate within six

[11] Percentage increase in size to be based on the size of the building footprint when the amended ordinance goes into effect.

inches—that is, *base flood elevation* may actually be six inches higher or six inches lower than indicated in the *Flood Insurance Study*. Second, elevation above the base flood elevation provides a margin of safety against floods greater than the 100-year event, such as those that occurred in many parts of eastern Washington this year. In addition, insurance rates are lower for residential structures elevated to one foot above *base flood elevation* than for structures at BFE.

• Adopt one or more of the five options listed below for further limiting development in the floodplain. There has been a great deal of discussion about whether to further limit floodplain development. Limiting development in the floodplain is generally seen as supporting a range of goals and values, including protection of life and property, flood attenuation, soil conservation, and habitat, aesthetic, and recreation values. Although development regulations curtail individual freedom and property rights, they are also a means for preventing individuals from creating hazards to others and costs to the public at large. A number of citizens have commented that they are not in favor of continued taxpayer support for individuals who make poor choices. As discussed in Chapter III, floodplain development has created problems and risks. The options listed seek to balance the positive and negative aspects of regulation in addressing those problems and risks. Although some members of the Citizens' Advisory Group expressed reluctance to impose more stringent regulations than those that already apply, the existing and potential risks and hazards suggest that adopting one or more of the following options would be advisable.

¤ Amend the Zoning Code and/or the Flood Damage Prevention Ordinance to prohibit structures for human habitation in areas inundated by the 100-year flood throughout the Methow basin.

¤ Amend the Zoning Code and/or the Flood Damage Prevention Ordinance to prohibit structures for human habitation in high hazard portions of areas inundated by the 100-year flood throughout the Methow basin.

¤ Amend the Zoning Code and/or the Flood Damage Prevention Ordinance to prohibit structures for human habitation in high hazard portions of mapped floodplains throughout the Methow basin.

¤ Amend the Zoning Code and/or the Flood Damage Prevention Ordinance to prohibit structures for human habitation in mapped floodplains throughout the Methow basin.

¤ Amend the Zoning Code and/or the Flood Damage Prevention Ordinance to prohibit *all* structures in mapped floodplains throughout the Methow basin.

In deciding which option or options to adopt, the questions to be addressed include:

• Should construction of non-residential structures, as well as structures for human habitation, be limited? Limiting construction of structures for human habitation is a safety measure, designed to reduce risks to life and health. In addition, since most new development in the Methow valley is residential, it effectively limits the amount of floodplain construction. Limiting construction of non-residential structures as well as those for human habitation will

further protect floodplain functions and values, but will not affect human safety to the same extent.

• Should development within high hazard areas be limited? FEMA's mapping methodology does not account for flood hazards related to erosion, high velocity, or debris in the water. In the Methow valley, there are areas at risk from those factors both within and outside the floodplain (see Chapter III). Current regulations do not include measures to increase protection of life or property in such high hazard areas.

• Should "up-and-out" development be prohibited? In the Methow Review District, construction of structures for human habitation is allowed on high spots within areas of special flood hazard. Such "up-and-out" development is vulnerable both to isolation (if the surrounding floodplain is inundated) and to inundation (if flood levels higher than the predicted *base flood elevation* occur). In high hazard areas, "up-and-out" structures may also be at risk due to erosion, high velocity flows, and debris in the water.

• Should (current and future) limitations on development that apply to the Methow Review District be extended throughout the Methow River basin? Current regulations rely on an arbitrary jurisdictional boundary (the Methow Review District boundary, which coincides with the boundary of School District 350). Watershed functions do not respect that boundary; making regulations consistent throughout the basin will make it easier to manage the watershed as a unit.

Mapping

Discussion

Accurate floodplain maps are important tools, both for floodplain planning and for disaster response and recovery. The Flood Damage Prevention Ordinance is Okanogan County's primary tool for regulating development in floodplains. The ordinance applies to all areas of special flood hazard identified in FEMA's current *Flood Insurance Study* for unincorporated Okanogan County. Thus, the Flood Insurance Rate Maps and Flood Hazard Boundary Maps published as part of the *Flood Insurance Study* form the basis for decisions about construction in the floodplain. Where the floodplain has not been mapped by FEMA, the County has no authority to regulate development based on flood hazards, even though the danger may be as great as that in mapped areas. There are unmapped floodplains adjacent to the Twisp and Chewuch Rivers and Gold Creek, and vulnerable structures with the potential to affect other properties and the system at large continue to be built.

FEMA's floodplain maps identify only those areas subject to inundation, not alluvial fans, flash flood areas, other land where flood-related erosion is likely, or areas prone to ice jams. Erosion has caused substantial damage during past floods, with many structures lost when the land on which they stood was undermined. The only loss of life due to flooding in the Methow basin occurred when a river bank collapsed south of Twisp. While the County's Critical Areas Regulations make some provision for regulation of construction in stream erosion areas, many hazard areas are unregulated. Okanogan County has no maps that identify hazard areas other than the 100-year floodplains identified by FEMA.

Recommendations

• Develop *river corridor* maps.

• Have flood boundary maps developed for reaches of the Twisp and Chewuch Rivers in which no floodplain mapping has been done and for Gold Creek. Once the maps have been prepared, they should be adopted by FEMA and the County. Currently, the top priority is development of a flood boundary map for private land on the Chewuch River, because of the high rate of development in that area.

• Have *detailed studies* done of areas where flood elevations are not available. Currently, the top priorities are: 1) Twisp River; 2) lower Methow River, because of the high rates of development in those areas.

• Develop maps of houses and other structures in the floodplain (including "up-and-out" structures) for use during rescue and disaster recovery operations. Enter the data in the County's Geographic Information System and update periodically.

• Map all areas in the Methow basin that are potentially unstable as a result of rapid stream incision or stream bank erosion. Use those maps in determining Geologically Hazardous areas (Landslide Hazard areas) per the Critical Areas Regulations (GMA).

• Map streams and alluvial fans with potential for rapid inundation, high velocity flows, or debris flows. Explore options for reducing hazards associated with alluvial fans, erosion-hazard areas, and flash flood areas. Mapping guidelines and a discussion of options are included in Appendix G.

• Map potential ice jam areas, and explore options for reducing hazards related to ice-jam flooding. See Appendix G for a discussion of options.

• Enter hazard data in the County's Geographic Information System and have them available for planners' use in advising the public.

• Develop a *cumulative effects* model and a land change map that can be used to track cumulative effects of development and land alterations in floodplain areas and analyze the impacts of proposed development. Use the map and model to assess potential floodplain encroachments, per Okanogan County's Flood Damage Prevention Ordinance. Enter the data in the County's Geographic Information System and update periodically.

• Adopt any revised flood studies when they are published.

• When *base flood elevation* data for an area are not available from FEMA (that is, a *detailed study* has not been done), Okanogan County may use data from other sources to administer the

County's Flood Damage Prevention Ordinance. Have such *base flood elevation* data adopted by FEMA.

Outreach programs

Discussion

One point that has become very clear during the process of developing this plan is that there is a strong need to increase public awareness with regard to *river corridors* in the Methow Valley. Both Citizens' Advisory Group and Technical Advisory Committee members believe that education must be a component of the County's efforts to manage its *river corridors*. Outreach programs include a variety of education, public involvement, and partnership development activities. A well-thought-out and carefully targeted program of public involvement and education can be an effective and relatively inexpensive way to increase public awareness of flood hazards and *river corridor* functions, and involve valley residents in the process of planning for the future of their river resources. In addition, education and involvement can prevent resource damage that would be difficult and expensive to mitigate. Both public involvement and development of partnerships build good relationships that can help reduce conflict. By taking a pro-active stance, the County can ensure that the needs of a variety of users are considered in the planning process *and* meet the goals of this plan more efficiently.

Education programs are intended to disseminate information that will help people make choices about ways of addressing hazards and resources. By increasing awareness, education gives people an opportunity to learn what they need to know to make good decisions—what factors are involved and how to analyze the issues and decide what is right for them. Education will serve both to increase public health, safety, and welfare and to generate support for policies intended to maintain and improve corridor conditions. In response to a question in our *river corridor* survey about what should be done to protect against flood damage, one respondent wrote "Land owners know the risk..." In fact, many residents may be unaware of Methow Valley rivers' potential for flooding and the dangers inherent therein. The County can reduce government involvement and costs by ensuring that land owners *do* know the risks inherent in their actions. Public education helps to promote awareness of the hazards and values associated with river and creek corridors in the Methow River basin. In many cases, education will be the only way to prevent violations of County codes resulting from ignorance, as when riparian vegetation clearing precedes any permit application. In addition, an informed public will be better prepared to respond to emergencies, and act in a manner that benefits rather than harms the river and its basin. Brochures, newspaper articles, and seminars are examples of efforts that can enhance citizens' understanding of the forces at work in the basin's *river corridors* and provide the basis for land use and flood preparedness choices.

Public involvement activities are designed to open communications with citizens and involve them in making decisions about *river corridor* issues. Public involvement increases the likelihood that the County's plans will reflect the needs of all who have interests in the basin and helps to build understanding between people with different objectives. Public meetings, workshops, task forces, and advisory groups are examples of vehicles for public involvement.

Finally, partnership development involves working cooperatively with other agencies and citizen groups. Partnerships offer both tangible benefits and ones that are less easily assessed.

Working cooperatively with other agencies and with citizen groups can enable the County to use its resources more efficiently and to realize the goals of this plan in ways that might not otherwise be possible. Because *river corridors* are affected by whatever happens within the watershed, planning across agency lines will be more effective than working within jurisdictional boundaries. In addition, partnerships offer an opportunity to simplify planning and permitting processes—a need expressed by both Citizens' Advisory Group and Technical Advisory Committee. Sharing information and communicating about needs, issues, and goals are ways of working in partnership with others.

Recommendations

Outreach was a recurring topic of discussion at Citizens' Advisory Group and Technical Advisory Committee meetings. Both groups talked about a number of ideas. The Technical Advisory Committee, in particular, emphasized using a broad range of programs to reach as many people as possible. Many of the recommendations below are based on ideas raised by the two advisory groups. Availability of staff and funds will play a strong role in determining which recommendations will be implemented, and in setting the timetable for implementation.

Education

Each educational program must be carefully targeted to reach people who will be influenced by it. Members of the general public are currently inundated with information; effort should not be wasted in adding to the overload, but spent wisely. Citizens' Advisory Group members, while agreeing on the importance of education, also questioned the level of responsibility the County should take in making people aware of hazards and limitations associated with their land. They did not favor making a large investment in informing all citizens. Among the groups to be targeted are people who now live in the floodplain, new buyers of floodplain land, owners and new buyers of *river corridor* land, permit applicants, real estate agents, lenders, builders and developers, surveyors, and students. Programs aimed at the general public can be appropriate as well.

One specific recommendation of the Citizens' Advisory Group was that educational materials avoid jargon and use simple language that can be understood by all. The educational materials and programs that result from adoption of this plan should be carefully designed to make it easy for members of the public to understand what is being said. Asking CAG members to participate in developing or reviewing materials to ensure they are easily understood is an option that should be explored.

Members of the Citizens' Advisory Group also asked that the Office of Planning and Development ensure that its staff understand the various permitting processes and timetables and be able to answer questions and explain the permitting process. Specific recommendations and comments were as follows: have someone available to answer questions; have someone locals can talk with with whom they have rapport; cooperative attitude on part of agency people is important; flexibility is important—have staff able to use judgment/work as problem solvers. Group members noted that it is difficult to work effectively with staff members who have not been on the job long—high turnover rates impede the flow of communication between County staff and the public. The education program should include guidance for County staff in educating those with whom they come in contact.

The recommendations in this section are listed in approximate order of priority. The phasing plan should be seen as flexible; if opportunities arise to implement lower-priority recommendations, they should be considered. In addition, County staff may find other opportunities for educating citizens about flood hazards and *river corridor* values and involving them in decisions about corridor management. Such opportunities should be explored to the extent that resources permit. Any program adopted should be consistent with the Outreach Policies stated in Chapter V.

• Develop a fact sheet on "Working Near Water" for distribution to people interested in doing work in the *river corridor*. The fact sheet can be used as a cover sheet for JARPA applications and distributed alone to people not applying for permits. The sheet should provide information on timing, regulations, and the permitting process, and may include a flow chart and/or checklist.

• Develop a booklet on flood hazards and preparedness for distribution to people who now live in the floodplain, new buyers of floodplain land, and floodplain permit applicants. The publication might be produced in cooperation with other interested agencies and groups and/or as part of the Methow Institute Foundation's ongoing "Good Neighbors" series.

• Advertise in *Methow Valley Building and Construction*, the *Methow Valley News*'s annual builders' guide. A one-eighth page ad can alert people planning to buy land near a river or creek to find out whether the land is in the floodplain, and advise those planning to build in the *river corridor* to look at the "Working Near Water" fact sheet for a rundown on permit requirements.

• Add comments referencing available informational materials to site analyses prepared for parcels in the *river corridor*. On request, the Office of Planning and Development will prepare a site analysis for any parcel of land in the County. The site analyses tell real estate agents and prospective land buyers whether the parcel in question is in the floodplain. A comment line on any site analysis for land in the floodplain can direct people to the "Working near Water" fact sheet, flood hazard and preparedness booklet, and other educational materials for more information.

• Distribute brochures on flood-prone property to lenders, real estate agents, builders, and developers. The Tennessee Valley Authority has developed guides for lenders, for real estate professionals, and for builders and developers. The brochures are intended for use throughout the country, and are available free of charge from the TVA. Samples are included in this plan as

Appendix E.6. The Office of Planning and Development should distribute them in the Methow Valley, and retain a supply for distribution.

• Make brochures on working near water and on flood-prone property available to members of the general public. Examples include: "So you want to work near the water", Washington Departments of Fish and Wildlife; "Flood hazards: Be aware; be prepared" (publication no.91-BR21); and "Permit handbook: Commonly required environmental permits for Washington state" (publication no. 90-29) both, Department of Ecology. Samples, publication numbers, and ordering information are included in Appendix E.6.

• Develop a booklet designed to increase awareness of stream and riparian function and stewardship for *river corridor* land owners and prospective land owners. The booklet should address ways in which landowners can enhance function and explain activities that are harmful to the system.

• Develop a brochure for landowners on preserving property by using bioengineering to prevent streambank erosion. The Illinois State Water Survey has developed a brochure for DuPage County, Illinois that can serve as a model. A copy is included in Appendix E.

• Develop a summary of available brochures that will guide people in selecting the ones most pertinent to their situations. The summary should indicate the depth as well as the range of material covered in each item—i.e., indicate whether the material is simple or more complex.

• Use the Office of Planning and Development's Home Page to educate citizens about *river corridors* and flood hazard management. Include items that explain permitting processes, development criteria, the Open Space Taxation Act, and so on.

• Assist in distribution of information about the Stewardship Incentive Program (SIP), a cost-sharing program that can help landowners cover the cost of planting in *riparian zones*, streambank stabilization, planting wetland plants, and planting *buffer zones* around *wetlands*.

• Work with the Okanogan Conservation District to make people aware of opportunities for working with the District, and to develop and distribute materials on *riparian zone* stewardship and restoration.

• Mail information on floodplain status with tax bills.

• Use newspaper articles and radio coverage to improve awareness of the *river corridors* and their functions. For instance, articles in the *Methow Valley News* could raise awareness of flood hazards and associated issues and be a cost-effective means of disseminating information to a large number of people. Radio coverage during the spring runoff period could be used to raise awareness of flood potential.

• Develop a speakers' bureau. Seek opportunities to address local groups (e.g., Kiwanis) and provide speakers; enlist "old-timers" and others with special knowledge to speak to classes and community groups about their experiences with the river (including flooding).

• Develop and make available to landowners a brochure on special considerations for building on alluvial fans and in other areas subject to erosion, debris flows, and flash floods.

• Develop school programs and/or curricula that will educate children about floods and other aspects of *river corridor* function. Several environmental education programs make available materials that could be used or adapted for use to educate school children about floodplain issues. (Children will help educate the adults with whom they live, as well as learning themselves.)

• Develop reach-specific fact sheets that will help landowners understand the unique qualities of each river reach, and any limiting factors that will help guide design and stewardship on land adjacent to the reach in question.

• Develop a fact sheet on various stewardship opportunities, incentive programs, and funding possibilities.

• Develop a display for public places.

• Develop a video for presentation to students and community groups and at public meetings. Consider using footage from, e.g., the 1995 Leavenworth area floods. The Leavenworth floods happened in our region, at an unusual time of year, and are a good example of both unexpected flooding and the destructive power of floodwaters.

• If the County or the Office of Planning and Development starts a newsletter, place items relating to flood hazard and *river corridor* management in the Methow basin in that newsletter.

• Work with the Washington State Department of Transportation on road signs showing levels of past flooding, which are an effective way of reminding drivers of the danger of flooding.

Involvement

Many of the preliminary remarks on education apply to involvement as well. Programs must be carefully targeted, although the general public should have ample opportunities to participate as well. Programs should be carefully designed to clarify issues and invite real involvement. As with education, the recommendations are listed in approximate order of priority and should be seen as a starting point—they are meant to guide future work, not limit opportunities. In addition to the recommendations below, involvement is recommended as part of several other components of this plan, such as reach-scale planning.

• Establish a River Corridor Management Forum composed of informed residents (and perhaps non-resident landowners) to oversee implementation of this plan, coordinate with other planning and implementation efforts (e.g., Basin Plan implementation; Habitat Conservation Plan

development), and participate in reach-scale planning and education. Members of the Citizens' Advisory Group who are willing to do so may form the core of the Forum.

• Establish a Reach Watch program, through which residents volunteer to help their neighbors plan and implement projects. The program should establish a framework, but allow citizens to organize themselves.

• Sponsor a biannual workshop on flood hazards, *river corridor* values, and relevant regulations for real estate agents, lenders, and appraisers. Encourage disclosure of floodplain status.

• Participate in the public involvement component of the Chewuch Restoration Project currently underway.

• Sponsor a workshop on flood hazards, *river corridor* values, and relevant regulations for builders, developers, and surveyors.

• Involve local young people in implementation of this plan when appropriate. For instance, teenagers may be able to help with inventory and monitoring; having children develop disaster preparedness kits (with the help of local volunteers) could be part of the program. Outreach should extend both to schools and to extracurricular fora such as scouts, Campfire, and local nature camps.

• Sponsor field trips (e.g., to existing riparian restoration sites; to natural areas where *river corridor functions and values* can be illustrated).

• Involve citizens in mitigation planning for County and State public works projects in the *river corridor* (e.g., bridges, revetments).

• Where project proponents are willing, involve local volunteers in implementation of *river corridor* restoration projects. Possibilities include involving citizens in the restoration work being through the Jobs for the Environment program or in bioengineering projects done on private land.

• Sponsor or participate in community events such as Methow Valley as a Classroom (contact Sandy Moody at 996-9205), National Fishing Day (contact Jenny Molesworth at 996-4026), or Art in the Park (contact Laura Fine-Morrison at 997-4004). Publicize the events as a part of Washington WaterWeeks (contact Washington WaterWeeks at (360) 786-1002).

• Develop an oral history project to record old-timers' flood memories; use the results in education and involvement programs. Videotaped interviews with "old timers" might be used, along with historic photographs of the *river corridor* and local flood events, to make a video for use as part of local education programs and displays.

Partnerships

The need to streamline government processes became very clear while this plan was being developed. Partnerships provide one way of doing that—when agencies and other groups collaborate, they are less likely to duplicate efforts or work at cross purposes. Some specific partnership needs have become clear during the development of this plan, and are spelled out in the recommendations below. Other possibilities will emerge over time, and should be considered as they arise.

• Establish an ongoing Technical Advisory Committee to address *river corridor* issues and coordinate cross-jurisdictional responsibilities. The Committee should meet semi-annually, in early spring and after the field season.

• Work with other permitting agencies (e.g., Department of Ecology, Department of Fish and Wildlife, U.S. Army Corps of Engineers) to streamline permitting processes.

• Work with the Okanogan Conservation District to develop and promote riparian grazing management strategies conducive to *river corridor* health—perhaps in conjunction with an incentive program.

• Work with the Forest Service on watershed analyses, and on *river corridor* issues that concern both agencies.

• Continue to work with the Yakama Indian Nation, the U.S. Fish and Wildlife Service, the Department of Fish and Wildlife, and the Public Utility Districts to address fisheries resource issues in the basin.

• Work with the Methow Valley Land Trust and other similar groups on implementation of the education recommendations in this section.

• Work with local citizens to plan projects that will support the intent of this plan. For instance, Citizens' Advisory Group members have proposed both tree-planting and disaster-preparedness programs. County staff should work to further feasible proposals and ensure they are consistent with the goals and objectives of this plan.

• Work with interested groups to plan *river corridor* projects consistent with the intent of this plan. The Pacific Watershed Institute is currently working on restoration projects in the Chewuch drainage; is beginning work in the Twisp drainage; and may in future undertake projects in other parts of the watershed. Jeanette Smith is the contact person for those projects; her telephone numbers are 996-3452 (local) and (206) 328-8814 (Seattle). Bob Bugert, at (509) 663-8121, is working for the Mid-Columbia PUDs on a Habitat Conservation Plan for four eastern Washington watersheds, including the Methow. In all cases, projects undertaken in the Methow basin should be consistent with the goals and objectives of this plan, including participation by local citizens. This plan, supported by staff involvement, should serve as guidance for other *river corridor* projects as well.

• Work with other agencies (e.g., Department of Transportation, Department of Fish and Wildlife) to develop interpretive facilities.

• Work with the Department of Fish and Wildlife to enhance fishing access sites and campgrounds so that those facilities better meet the goals of this plan.

• Work with the State Department of Parks and Recreation to encourage development of river recreation access sites that meet the goals of this plan, the Comprehensive Recreation Plan for the Methow Valley, and the Recreation Element of the County's Comprehensive Plan.

Incentive programs

Discussion

Incentive programs are non-regulatory approaches to protecting *river corridor functions and values*. Unlike development regulations, they are voluntary. Options include a variety of tax and stewardship incentives. Disincentives, such as assessment for emergency assistance costs related to location in a flood-prone area, are another way of encouraging landowners to take responsibility for their decisions and the impacts of those decisions on others.

Incentive programs have the benefit of offering greater participation and decision making on the part of property owners than do development regulations. However, the incentives offered must be sufficient to alter private land-use decisions if the programs are to be effective. There may be a cost to local government in lost revenues when lands are enrolled in the current use taxation program, although it could be offset in the long run if land preservation enhances the Methow Valley's recreation-and-tourism-based economy. As an example, in King County, the loss in tax revenues from participation in the Open Space program has been small enough to be offset by an increase in the levy rate amounting to $1.21 annually for a $150,000 house.

Methods

Cost-sharing programs

Cost-sharing programs offer various kinds of assistance to landowners who practice good stewardship. Assistance may be technical or financial, or may involve donations of labor or materials.

Land donation

Landowners who make donations may be eligible for income and estate tax relief. The extent of benefits depends on the kind of donation, the donor's financial situation, and prevailing federal tax law at the time the donation is made.

Donations of land can take several forms, including outright donation; bargain sale, in which the land is conveyed at a price below fair market; donation with a reserved life estate, which allows the landowner to continue to live on the land throughout the course of his or her life; and bequest.

Conservation easements

A conservation easement is a legal agreement between a land owner and a qualified organization (typically a non-profit organization, such as a land trust, or a government agency) to restrict the type and amount of development that can take place on the property. Granting a conservation easement is a voluntary way for a landowner to preserve land with significant environmental or historic preservation values. The land remains in private ownership; unless a specific grant of public access is included in the easement, the public has no more right to trespass on land covered by an easement than on any other private property. Each easement is tailored to meet the needs of the landowner and preserve the values of the piece of land in question. The easement runs with the land, providing legal protection in perpetuity. In actuality, easements can be lost over time if the terms are not enforced.

For many landowners, the principal incentive for conservation easements is the federal tax benefits that may be available. Others may be attracted by the opportunity to preserve places they see as special for future generations. In the federal tax code, conservation easements are considered charitable donations, subject to certain requirements. The landowner receives a tax credit for giving up certain rights of ownership. Estate taxes may be reduced as well.

Tax incentive programs

The property tax system tends to encourage the conversion of agricultural and open space lands to more developed uses. Most states assess real estate for property taxation on the basis of "highest and best" use. As development pressures increase, higher assessments increase rural landowners' property taxes. Land development can adversely affect not only natural resources and the associated values and amenities, but also an area's economic base. Tax incentive programs recognize the value society places on undeveloped land, whether it is farmland or natural open space, and offer tax relief to landowners who allow that value to be retained. Most states offer such programs, under which eligible lands are taxed on their current-use value rather than market value. The programs can be divided into four categories: preferential assessment programs, deferred taxation programs, voluntary restrictive agreement programs, and mandatory zoning and planning programs. Washington state uses a deferred taxation program, the Current Use Taxation Program, discussed under the heading "Existing incentive programs" below.

Existing incentive programs

Washington State Stewardship Incentive Program

The Stewardship Incentive Program (SIP) is a cost-sharing program that reimburses landowners for part of the cost of implementing resource protection and improvement practices. SIP is intended to provide financial incentives to non-industrial private landowners to manage their properties using an integrated, multi-resource approach. SIP is a federally-funded program, administered in Washington by the Department of Natural Resources. While the program is intended primarily to support work on forested lands, riparian and other wetland areas capable of supporting trees may be eligible as well. SIP 6, the program for riparian and wetland area protection and enhancement, cost shares planting of *riparian zones*, streambank stabilization, planting wetland plants, and planting *buffer zones* around *wetlands*. Programs for soil and water protection, fisheries habitat enhancement, wildlife habitat enhancement, and forest recreation enhancement are open only to owners of forest or closely associated lands. An Approved Forest Stewardship Plan is required before a landowner can receive SIP funds; cost sharing is available

for plan development. Landowners are reimbursed at predetermined flat rates for each practice (e.g., site preparation; trees and planting) implemented. Further information is available from the DNR Forest Landowner Assistance Coordinator in Colville, telephone (509) 684-7474.

Washington State Ecosystems Conservation Program

The Washington State Ecosystems Conservation Program is a partnership between the U.S. Fish and Wildlife Service and the Washington State Department of Fish and Wildlife that provides funding or other assistance, on a cost-sharing basis, for protection, restoration, enhancement, or creation of fish and wildlife habitat by private landowners. *Wetlands* and *riparian zone* projects are administered by the Fish and Wildlife Service. (The Department of Fish and Wildlife administers the upland habitat program.) One of the goals of the program is to develop partnerships between landowners, the Fish and Wildlife Service, and other agencies and groups (such as conservation organizations). Cooperators other than the Fish and Wildlife Service may provide additional funds, materials, or labor. Further information is available from the Service's Moses Lake office, telephone (509) 765-6125.

Methow Valley Land Trust

The Methow Valley Land Trust is a non-profit organization developed to accept donations of land and conservation easements, legally hold those assets, and maintain and monitor them. *Wetlands* and other lands that offer substantial wildlife benefits are among those of special interest to the local land trust.

The Current Use Taxation Program

Washington state law provides an incentive for protection of environmentally sensitive areas. In 1970 the legislature enacted the Open Space Taxation Act (RCW 84.34), which allows property owners to reduce property taxes for private land classified as open space. Eligibility is based on historical use. Lands that are classified as open space under the statute are assessed under their current use rather than their "highest and best" use for purposes of property taxes. The program is considered a deferred taxation program because if land is withdrawn from classification, or if the use of the property changes, the owner must pay the additional taxes for the period of time his or her property was designated as open space.

To obtain a current use classification of open space, a property owner must apply to the County's Office of Planning and Development. The current use assessed value will depend on the type and amount of public access (encouraged, but not required) and the type and amount of resource found on the parcel. Credit for resource restoration is available as well. The County's Public Benefit Rating System is used to determine the current use assessed value. The system establishes priority resources and a ranking system for evaluating properties. The list of priority resources includes shoreline areas designated in the County's Shoreline Management Master Program. It also includes fee recreation areas, such as those in the Methow Valley trail system, some of which are within the *river corridor*.

Recommendations

- Amend the Open Space Tax Program/PBRS to provide incentives for owners of flood-prone properties to participate.

• Encourage *river corridor* landowners to participate in the revised Open Space Tax Program. The Open Space Tax Program offers landowners incentives for choosing not to use land because of identified hazards or values. Participating in the program offers a reduction in assessed value to ensure that property owners receive just compensation for the property value they lose in making a contribution that benefits the community.

• Encourage landowners to participate in cost-sharing programs for stewardship, enhancement, restoration, and management that are offered by other agencies.

• Explore the possibility of developing a special assessment district that would assess floodplain landowners for emergency services related to their use of the floodplain.

Property protection

Discussion

There are a number of ways in which landowners can protect houses from flood hazards. They include relocation, purchase and demolition, elevation, floodproofing, and insurance. Relocation—moving a structure to higher ground—is the surest and safest way to protect it from flooding. It can be expensive (in the range of $25,000-$50,000 per house), but is worth considering in high hazard areas where the only safe approach is to move buildings out of harm's way. Some government funding is available. Relocation also creates open space within the *meander belt*, improving flood storage and conveyance and giving the river room to function naturally without threatening property. An alternative is purchase and demolition of floodplain structures by a government agency. Purchase and demolition is most appropriate for buildings that are too expensive to move or that are not worth the expense of moving. Like relocation, purchase and demolition converts problem areas to assets by creating open space. Relocation and purchase and demolition projects are desirable options for high hazard areas; they should be seriously considered for sites above the Weeman Bridge and any other very hazardous areas. However, cost is a major drawback, as is the requirement for increased government involvement.

Elevation is a suitable property protection method where the flood hazard is limited to shallow flooding with low water velocities. Raising a house above the flood level is the best on-site property protection method for existing structures in areas not subject to extreme hazards. Water flows under the building, causing little or no damage to the structure or its contents. Elevating a building is less expensive than moving it, with costs averaging $15,000 to $25,000, and is less disruptive for the owners. During a flood, an elevated building may be isolated and without utility service, and therefore unusable. Elevation to a safe level may not be feasible in areas such as the Lost River Airport Tracts where very dangerous conditions may occur and sediments are subject to substantial movement during floods. Floodproofing can be used to protect buildings that cannot be elevated or moved. When a building is floodproofed, all areas below the flood protection level are sealed against floodwaters *or* the building is constructed so that floodwaters can flow through any enclosed areas below the *Base flood elevation*. Walls are coated with waterproofing compounds or plastic sheeting, and openings are closed, either with removable shields or with sandbags. Either elevation or floodproofing can be used to protect new, as well as existing, structures. New residential structures are currently required to have the

lowest floor elevated to or above *base flood elevation.* (In the Methow Review District, zoning prohibits construction of new dwellings in areas below the *Base flood elevation.*) New non-residential structures must be elevated or floodproofed.

Insurance provides protection against financial loss in case of flood damage. Under the National Flood Insurance Program (NFIP), flood insurance is available to landowners in communities that comply with minimum standards for floodplain management; Okanogan County and the Towns of Twisp and Winthrop all participate. Community participation allows any local insurance agent to sell flood insurance policies under rules and rates set by the Federal Emergency Management Agency. Under the NFIP's Community Rating System, discounted rates are offered in communities that undertake activities beyond the minimum standards. Discounts range from 5% to 45% depending on the community's efforts. Community officials must apply to the NFIP to get credit for their efforts and qualify citizens for rate discounts.

Recommendations

• Apply to the NFIP to receive credit under the Community Rating System for floodplain management activities. Local landowners' flood insurance premiums will be reduced if Okanogan County and the Towns of Twisp and Winthrop receive credit for floodplain management activities in which they already participate. Many of the recommendations in this plan will, when implemented, qualify the communities for additional credit and corresponding rate reductions.

• Educate landowners about flood hazards and the availability of flood insurance. Without flood insurance, landowners will have to bear at least some of the cost of flood damage themselves. Federal disaster relief funds will provide some help to people whose primary residences are damaged, but will not cover all costs associated with flood damage. Vacation houses and rental properties are not eligible for federal disaster relief; only if the owners carry flood insurance will they be protected.

• Encourage elevation and floodproofing of existing floodplain structures and publicize funding sources. Elevation and floodproofing are more likely to be undertaken if landowners know where to go for financial assistance.

• Encourage relocation of existing floodplain structures.

Watershed management guidelines

Discussion

How land is managed within the Methow River watershed affects both habitat quality and flood characteristics. Many areas in the Methow river system are functioning well; maintaining properly functioning condition will help further the goals of this plan. Riparian grazing management, stormwater management, and clearing and grading practices are three components of land management that play roles in determining how the Methow, Twisp, and Chewuch Rivers and their tributaries function. Riparian grazing management is a tool for ranchers that helps --- protect and restore *riparian areas* while allowing continued use by livestock. Careful

management reduces the degradation of riparian resources and increase in runoff rates that can accompany grazing. The Natural Resource Conservation Service works with ranchers at no charge to plan management strategies. Funding for implementation of those strategies may be available from a variety of sources. Stormwater management refers to practices intended to prevent new development from increasing runoff rates. Typically, land development reduces infiltration of rain and snowmelt. The increased runoff can increase flood volumes. Groundwater levels and habitat quality are also affected as more water runs off rather than being held in the basin. Finally, clearing and grading activities associated with property development may cause erosion and siltation, increase runoff and flood volumes, reduce flood storage capacity, and damage habitat. Managing clearing and grading activities can minimize impacts.

The importance of each of the three components in the overall health of the system will change as land uses change. For instance, grazing on the valley floor is on the wane, and will probably become a less prominent factor over the next few decades. Development is increasing, which will increase the impacts of stormwater management and clearing and grading practices.

Recommendations

• Develop and distribute stormwater management, clearing and grading, and riparian management guidelines for landowners—perhaps in partnership with the Okanogan Conservation District. The guidelines should help landowners and developers make land use decisions that minimize adverse impacts on river and stream corridors.

• Modify the County's Public Benefit Rating System to provide additional incentives for effective riparian grazing management.

• Work with other interested agencies to support the raising and keeping of livestock in the basin in a manner that minimizes the adverse impacts of livestock on river and stream corridors. Partners might include the Natural Resource Conservation Service, providing expertise; the Washington State Department of Fish and Wildlife, providing stewardship incentives, and the U.S. Fish and Wildlife Service, providing implementation funding.

Structural projects

Discussion

Structural techniques are those that involve modification of conditions on the ground. In the past, structural modifications have been invasive and emphasized control of natural systems. Over the past 30 years, more cost-effective techniques have been developed. They are intended to work with natural systems to support habitat and aesthetic as well as flood hazard management objectives. Decisions about what technique or techniques to use at a given site should be based on context analysis, extending at least through the adjacent *riparian zone*. The degree to which projects are able to replicate natural conditions will depend in part on existing and proposed land use in the vicinity of the proposed structural modification; for instance, where a road or bridge is to be protected, instream work may be proposed to deflect flows. In such cases, the structure should be located and designed to support instream and riparian functions and values. In all

cases, careful analysis and design are essential to ensure that the structural modification is suited to the site.

The recommendations in this section are intended to provide guidance for developing and evaluating proposals so that structural projects undertaken in the Methow basin will be consistent with the goals of this plan. They address three types of projects: those in which the County is involved, those proposed by other agencies, and those proposed by private parties, including landowners and nonprofit organizations.

Structural modifications include dikes and a variety of stabilization and restoration techniques. Each approach is described briefly below. Specific techniques are discussed in Appendix F, which also contains a project assessment system for use in assessing the impacts of structural proposals.

Stabilization projects

Stabilizing streambanks is one way to protect land and structures in problem areas. Stabilization projects may also involve instream modifications, especially where infrastructure is at risk. As with all structural approaches, a thorough understanding of the site and the forces operating there is a vital prerequisite to any action on the ground.

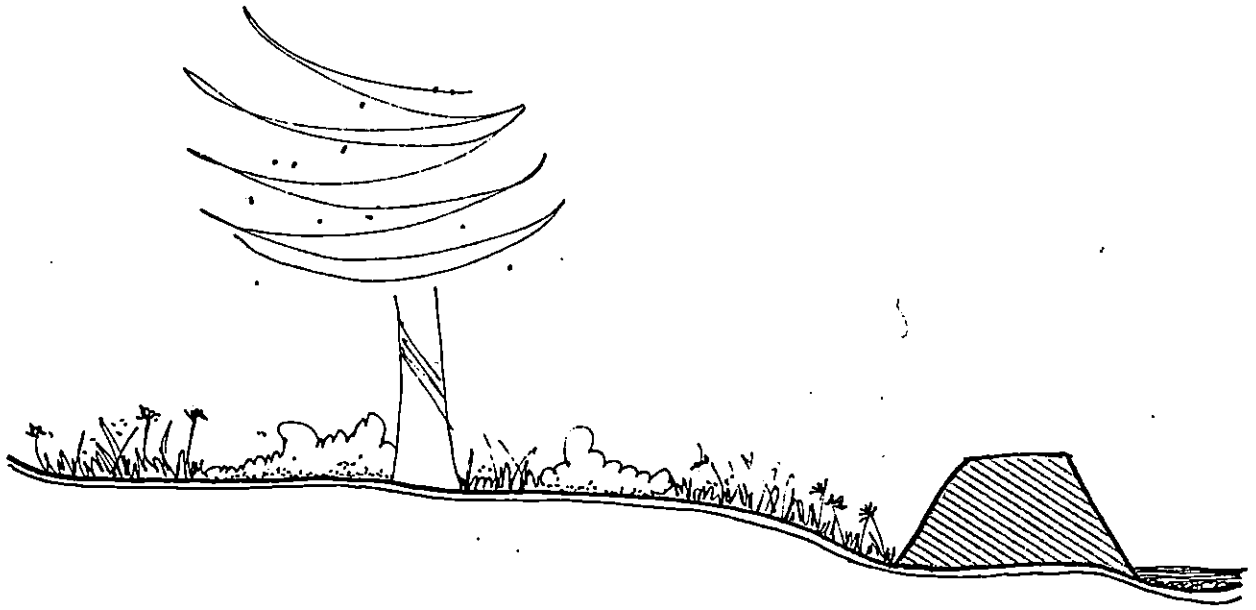
Traditionally, stabilization techniques have tended to degrade habitat and aesthetic values, reduce flood storage capacity, and increase flow velocities downstream. However, carefully designed stabilization projects using newer techniques can help protect land and infrastructure while stabilizing a stream and improving its function relative to a range of values. Such projects are less expensive to install and maintain than old-fashioned methods such as *riprapping*. Careful design and cost:benefit analysis should be a part of stabilization project planning. Design costs associated with complicated stabilization projects may be higher than those for bank armoring; other projects will not require a great deal of design work.

Dikes

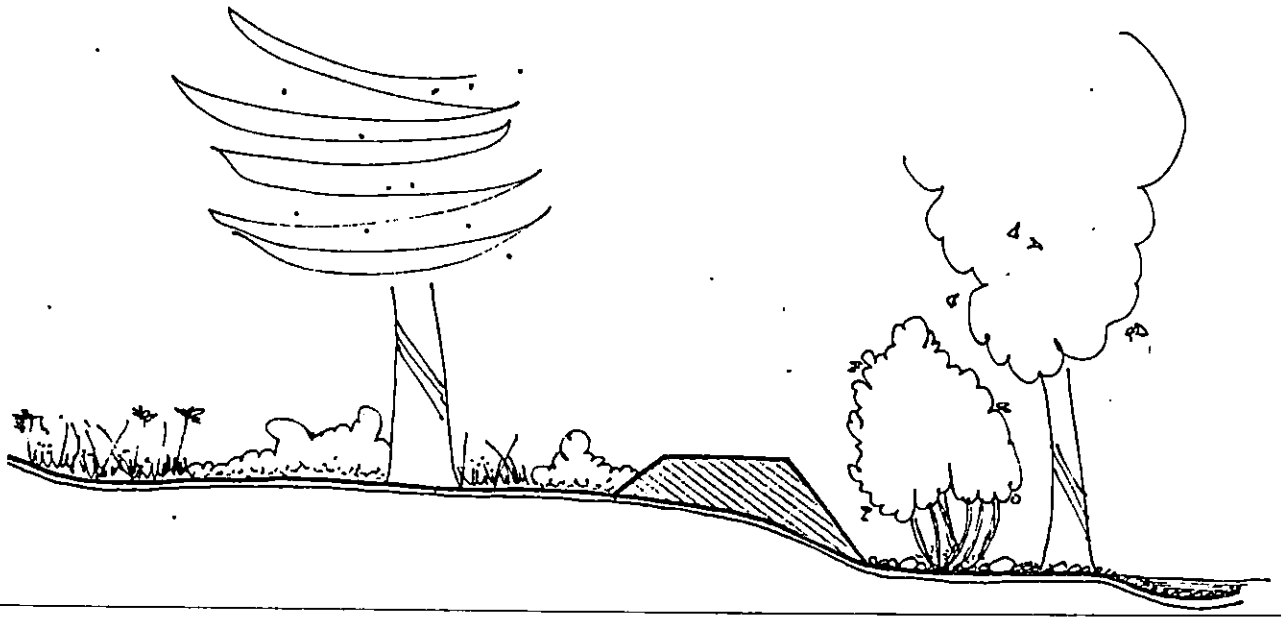
Dikes protect low-lying areas from inundation by flood waters by constraining the channel. Typically, they have been built at channel's edge. However, streamside dikes result in loss of instream and riparian values, and change channel *energetics*. By constraining the river, they reduce flood storage and conveyance and diminish other values in the *river corridor*. They can cause backwater flooding upstream and increase flow velocities downstream. Habitat is destroyed as a result of vegetation removal and changes in sedimentation patterns. Thus, although a dike may protect certain properties, risk to other properties can be increased. Dikes that are set back so that at least part of the floodplain retains its connection to the river can reduce the impact of diking. (See Figure VI.1.)

In addition to their effects on physical and biological systems, dikes can create a false sense of security if landowners do not know what level of flood they have been designed to protect against, and expect more security than a particular structure can offer. Dikes are expensive to build and maintain. Initial construction costs are very high, and the structures, once installed, require recurrent maintenance. Dikes may be cost effective where many high-value structures are protected, or where they provide another benefit (as when trails are built on dikes to improve public access to shorelines). They may also be useful where bridges or essential roads

Figure VI.1
Traditional and Set-Back Dikes



TRADITIONAL DIKE



DIKE SET BACK FROM EDGE OF CHANNEL

are at risk. Costs are likely to be too high to justify them solely for protection of existing floodplain residences.

Restoration projects

Restoration projects provide a means for improving the functional quality of a degraded or disturbed stream system. Where a channel has been constrained or cleared, or the integrity of the *riparian zone* compromised, restoration techniques can be used to improve the river's capacity to handle flood flows, stabilize groundwater levels, prevent erosion and scouring, and support fish and wildlife. In any situation in which restoration is proposed, the project must be designed to suit the specific conditions at the site. It is never appropriate to select a technique without thoroughly analyzing the problem site in context. Techniques may be combined or modified. In many cases restoration projects offer outstanding benefits. Restoration offers a range of benefits consistent with the goals of this plan.

Recommendations

• On public and private projects, encourage use of bioengineering techniques, rather than *riprapping* and other single-objective bank stabilization techniques. Bioengineering techniques are more effective and less expensive than *riprap*, and support a wider range of corridor values. Where bank stabilization is indicated, solutions that support riparian and instream values and do not contribute to accelerated flows downstream should be encouraged.

• On public and private projects, discourage the use of dikes and levees. Develop guidelines that encourage project proponents to assess the impacts of diking, including impacts on downstream properties. Guidelines should encourage use of setback structures (as shown in Figure VI.1), and mitigation to protect downstream landowners' property rights, *if* dikes or levees must be built.

• The Office of Planning and Development will develop a formal process to assist the Public Works Department in coordinating planning of any work within stream corridors, starting early in the design process.

Cooperative efforts will result in transportation projects that support both the goals of this plan and those of the County's Transportation element. One goal of the Transportation element is to "Establish an efficient, safe and environmentally sensitive road system that supports desired development patterns." Policies associated with that goal include "Avoid, to the degree possible, locating roads in sensitive areas to minimize environmental disruption and construction costs" and "Design roads to minimize impacts on hydrologic systems, including surface and groundwater." Coordinated planning will support the Public Works Department in adhering to those policies.

In addition, inter-departmental cooperation will enhance funding possibilities by developing projects that meet multiple objectives. Coordination early in the design process will enable creative approaches that will expand options for funding.

• Use the project assessment system (see Appendix F) to assess projects in which the County participates, including Public Works, Engineering, and Roads projects and projects proposed under the Habitat Conservation Planning/Watershed Planning process.

• Encourage the Department of Transportation and other agencies to use the guidelines presented in this plan, and to work with the County's Office of Planning and Development, to develop projects that will improve river and riparian function and will not contribute to problems in the *river corridor*.

• Encourage project proponents to consult with the County prior to applying for permits. Analyze proposals using the project assessment system in Appendix F and offer an "FYI" evaluation that can be used, on a voluntary basis, to modify proposals so that environmental disruption is minimized.

Woody debris management

Discussion

Woody debris management is a sensitive subject because large woody debris plays an extremely important role in the river environment, but also has the potential to damage land and infrastructure. In the past, the U.S. Army Corps of Engineers has responded to flooding by removing debris, simplifying stream channels in hopes of increasing conveyance capacity. Large quantities of wood were removed from the Methow, Twisp, and Chewuch Rivers following the floods in 1948 and 1972. The physical and biological impacts have been dramatic.

Wood removal changes channel dynamics in ways that can increase damage. In addition, woody debris forms the basis of the aquatic food chain. It is also an important structural component of habitat—branches and logs create pools and hiding places that fish use during various parts of their life cycles. In terms of habitat values and natural channel dynamics, it would be preferable to allow woody debris to accumulate in the channel and *riparian areas*. Indeed, some biologists have proposed adding wood to the system to replace that removed during years of timber harvest and during flood clean-up.

Leaving debris in streams would be consistent with regulations intended to provide for protection of natural resources. However, in some places, that might put infrastructure (e.g., roads and bridges) at risk. Woody debris often floats downstream during high flow periods. It can accumulate at bridges, where mats of wood collect against piers. (See Figure VI.2.) Such debris accumulations can deflect water toward adjacent piers or toward an embankment, or can intensify the effect of the current on pier foundation soils, causing scour. Logs have caused damage to bridges in the past. The risk of damage has been reduced in recent years by policies providing for armoring of embankments and design of bridges to accommodate entrained debris. Currently, Town of Winthrop, Okanogan County Public Works and Washington State Department of Transportation employees monitor such debris accumulations during high water periods and floods. Town and County personnel remove debris that threatens local infrastructure. DOT employees usually dislodge material that may pose problems, although the Department has a permit to remove logs when necessary.

Most debris piles are not hazardous; few will move from year to year. Removal of debris piles from rivers would not be acceptable because of the effects on habitat biology, channel dynamics, and river character. However, in order to avoid adverse impacts to infrastructure, it will be advisable for County officials to work with responsible agencies and County departments

to plan for management of debris so that accumulations of large wood that develop upstream of vulnerable sites do not become threats during flood events. A thoughtful and sensitive approach to debris management will be required to achieve a safe and acceptable balance.

Figure VI.2
Woody Debris Mats above the Carlton Bridge

Recommendations

• In cooperation with other interested agencies (e.g., the Department of Fish and Wildlife, the Department of Ecology, the Department of Transportation, and the Corps of Engineers) develop a risk-assessment process whereby a team will regularly evaluate debris that has the potential to threaten land or infrastructure (roads, bridges, etc.) and recommend action where necessary.

Team members should represent a range of disciplines—for example, a hydraulic engineer, a geologist, and a biologist—and be qualified to assess the impact of their proposals on the stream and riparian environment. If the Natural Resources Conservation Service develops a local Stream Team, that group may be able to serve. Team members should work with maintenance personnel during flood events to make decisions when structures are threatened.

If large woody debris must be moved, it should either be dislodged so it can continue down through the system, or removed and put back into the system at the next available downstream location. If it is not practical or reasonable to return the materials to the channel, they should be incorporated into the adjacent riparian corridor, if possible. When woody debris is replaced in the river channel or corridor, its placement should not create new direct or imminent threats to property or infrastructure. Large woody debris pieces should be left intact.

In conjunction with the risk assessment process:

¤ Develop guidelines for management of debris being carried by the river, including that which may pile up against bridge piers or otherwise threaten infrastructure.

¤ To ensure the expertise and concerns of all parties are considered, involve maintenance personnel in the decision-making process when debris management activity is indicated.

¤ Provide training and guidance for personnel involved in debris management so they understand the impacts of their work on the river and land.

• When woody debris is to be removed from private land, work with landowners to ensure their rights are respected and their concerns addressed to the extent possible.

• Maintenance personnel should have adequate guidance and leadership to take action during emergencies when fast action is needed. Develop emergency debris management guidelines and, if possible, involve the risk assessment team in emergency debris management decisions.

Operations and maintenance

Discussion

River corridor operations in Okanogan County have been focused on maintaining roads and bridges. The County has done no work on dikes since sometime in the 1980s. Road and bridge repairs are done as needed during and after emergencies. *Riprapping* has been the accepted method of protecting structures, but can have deleterious effects on flooding, habitat quality, and aesthetic and recreational values. The County's Public Works Department has expressed concern about the effects of maintenance and repair activities elsewhere in the system, but lacks the technical expertise to assess the impacts of the work.

Bridges are inspected annually for erosion and scour damage. The County's Public Works Department is currently conducting an in-depth scour survey that will continue for several years. The intention is to monitor changes in conditions and use the data to apply for funding to make necessary repairs. In addition, the Department is making plans to assess the intrusion of fill associated with County facilities on floodplains.

It is unclear exactly what dikes the County is responsible for maintaining; Public Works personnel are currently working to determine what maintenance and access agreements are in place. The dikes in question in the Methow Valley are located on the *right bank* of the Methow River north of Twisp, and on the right bank of the Methow River between Mazama and the Weeman Bridge. Work on dikes was suspended 10-15 years ago because of apparent discrepancies between the U.S. Army Corps of Engineers' standards for dike maintenance and the Department of Fish and Wildlife's habitat preservation requirements. The Corps requires that all trees larger than 4 inches in diameter be removed from dikes it has certified; the DFW favors retaining riparian vegetation that provides habitat benefits. FEMA will not provide disaster relief funds for repair of dikes not maintained to Corps standards and certified by the Corps. Public Works personnel are working to clarify requirements so that maintenance work can be

undertaken. The County has a very limited amount of money available for dike maintenance (currently estimated at $11,000-$12,000). County crews and equipment could be used for dike maintenance only if the Road Fund is reimbursed. The Public Works Department is looking into possibilities for using displaced workers, inmates, or youth crews to provide low-cost labor for dike maintenance.

Recommendations

• Inventory County facilities (dikes, bridges, and armored embankments) in the *river corridors* and determine the County's role in maintaining them. Where necessary, update or enter into maintenance agreements. Ensure that legal access is available. Maintain accurate, up-to-date records and make conditions of maintenance and access agreements available to County personnel responsible for maintaining facilities so that they are aware of their responsibilities.

• Assess the dike north of Twisp and develop a plan for short-term and long-term maintenance. The planning process should address a range of alternatives including relocating (reconfiguring or setting back) the dike, removing the dike, and using instream structures in designing a solution. Public access and recreational use of adjacent land (some of which is owned by the Town of Twisp) should also be considered. The dike and adjacent areas have been used for ski trails in the past. If necessary, a long-term plan for acquisition of land or easements should be developed and funding sought.

• In cooperation with U.S. Army Corps of Engineers and Washington State Department of Fish and Wildlife representatives, assess the current condition of any other dikes in the basin and develop a maintenance plan.

• Regularly assess the condition of County dikes and armored embankments. Facilities should be inspected annually and following any flood events that may have caused damage. A standard reporting form (including written and photographic documentation) should be used to establish records for use in applying for disaster relief and maintenance funding.

• Seek funding for maintenance of County flood control facilities, including design of appropriate alternatives to current configurations where warranted. Where feasible, seek funding to convert *riprap* to structural treatments that will have less impact on *river corridor* function. (See p. 113 and 288 for discussions of structural treatments.)

• Develop an Operations and Maintenance Manual for Activities Within the Shoreline Environment. Topics to be addressed should include, but are not limited to, permit requirements; assessment of off-site impacts; roads and bridges; debris removal; erosion control; dike maintenance; bank stabilization; and demolition, repair, and reconstruction of structures. Guidance in complying with the relevant provisions of the Shoreline Management Program, Critical Areas Regulations, and Flood Damage Prevention Ordinance should be included. When complete, the manual should be incorporated in or appended to this plan.

to do the work under its cost-share program. If that is not feasible, the County should seek alternative funding. The USGS cost-share program is described in Appendix E.5.

• Stop issuing building permits for structures for human habitation in areas that are shown to be hazardous, using the map of potentially unstable areas to determine which sites are not safe for residences. The landslide hazards section of the County's Critical Areas Regulations states that areas identified as Landslide Hazard Areas, including all areas that are potentially unstable as a result of rapid stream incision or stream bank erosion, shall not be developed.

• Sponsor acquisition of undeveloped floodplain land (or easements) when the following conditions can be met: the acquisition will result in no change in County tax revenues (that is, funds must be available to make payments in lieu of taxes); no cash will be required from the County (any match required must come from other sources); there will be no maintenance responsibilities on the part of the County.

• Develop a flood warning and evacuation system for the area.

• As part of the Public Education and Involvement component of this plan, work to inform *meander belt* residents. Topics should include hazards associated with the area; the warning and evacuation system and how residents can prepare to evacuate; and river-corridor regulations, such as those pertaining to diking within the shoreline zone. Work with the Lost River Airport Tracts Homeowners' Association (which holds general membership meetings twice a year) to address problems specific to that development. Make special efforts to contact individuals living in the highest-risk areas.

• In cooperation with the Forest Service and the Lost River Airport Tracts Homeowners' Association, have the dike down-river from the confluence of the Methow and Lost Rivers assessed and develop a strategy for addressing the problems associated with it. The USGS may be able to do the assessment work under its cost-share program, with the County's share of the cost coming from already-appropriated FCAAP funds. If that is not feasible, the County should seek alternative funding. The USGS cost-share program is described in Appendix E.5. A trained negotiator should be involved in strategy development, and the County should participate in seeking funding to implement the strategy agreed upon by all parties. Resident and non-resident landowners who are likely to be affected should be invited to participate in the acquisition planning process.

• Develop guidelines for assessment of any diking proposal.

• Use legal counsel to assess the County's present liability. Take actions necessary to minimize that liability.

Other issues

Discussion

Watershed processes are complex; an understanding of the entire basin may be needed to develop solutions to many of the existing and potential problems in the Methow River basin. Much of the work required to gain such an understanding is beyond the scope of the current planning effort. A systematic program of study designed to assess conditions, find problems, and identify critical resources in the Methow River basin and in river and creek corridor areas will be required to develop long-term, balanced solutions.

Recommendations

• Develop a program to inventory resources and conditions and monitor change. Specifically:

¤ Chronicle past activities to help establish linkages between those activities and *river corridor* condition.

¤ Monitor activities in the upper basin (as they have the potential to affect channel form and processes downstream).

¤ Inventory resources in the *river corridor*, including river and stream classification, vegetative cover indexing, riparian vegetation condition analysis, *wetlands* assessment. River and stream classification should be based on assessment of channel morphology, including measurements of width, depth, sinuosity, velocity, discharge, channel slope, channel roughness, and sediment loading. The hydrogeology of the middle and lower Methow River should be studied as well.

¤ Inventory corridor condition/trouble spots.

¤ Establish reference reaches.

¤ Monitor structural improvement projects as installed. Monitor non-structural improvement projects as they are implemented.

¤ Monitor trouble spots where no action is taken.

¤ Assess and monitor the flood-damage potential of the river (i.e., calculations should not continue to be based on numbers derived when conditions in the basin were different than they are now).

• Based on the results of inventory and monitoring, have floodplains re-studied and new FEMA maps prepared when changes in the basin suggest the existing maps are no longer accurate.

• Assess the impact of human use and naturally-occurring upper-watershed disturbances (e.g., fire) on ecosystem structure and function and, specifically, on the capacity of the river and its floodplain to accommodate flooding.

• Determine what changes must take place throughout the watershed to improve function to the level necessary to support the goals and objectives of this plan. For example, if *aggradation* (increase in streambed level due to deposition of sediments) is a problem, will sediment trapping and removal solve it, or must revision of the road network take place? If lack of riparian

vegetation is a problem, will vegetation restoration solve it, or must upper basin hydrology be restored to create conditions favorable to improved bank conditions? Basic research may be required to determine limiting factors—e.g., for fish survival.

• With landowners, work to develop systems of public access and restoration and stabilization plans compatible with the results of the studies discussed above. Plans for each reach should specifically address existing and potential problems in that reach, and should be responsive to the results of the River Corridor Survey from the reach.

B. Phasing Plan

The Multi-Objective River Corridor Plan for the Methow Basin will be implemented in phases, proposed in the table below. Recommendations in the table correspond with those in the preceding section. In some cases recommendations have been abbreviated; page numbers in parentheses following each item show where the complete descriptions can be found. No dates are shown for the future phases (II-IV); implementation will depend on availability of funding. The Phasing Plan is intended to reflect current priorities. Those priorities should be considered flexible, and tasks undertaken when it is logical to do so—for instance, if funding becomes available for a particular project. Work on tasks in Phase I is expected to begin in the current biennium. Some tasks may extend through more than one phase. Only the phase in which the task is to be started is marked.

Figure VI.3
Multi-Objective River Corridor Plan for the Methow Basin
Phasing Plan

Recommendations	Phases			
	1996-1997	Future phases		
		II	III	IV
Flood warning and emergency response				
Amend the Emergency Management Operations Plan to address flood warnings for people out of range of KOMW. (see p. 96)	X			
Use the local media to inform people of flood danger. (see p. 96)	In case of flooding			
At Lost River Airport Tracts, present flood awareness information. (see p. 96)	X			
Make contact with people in other high risk areas. (see p. 96)	X			
Ensure that emergency work is consistent with the goals of this plan. (see p. 96)		X		
Incorporate the goals and policies of this plan in emergency operations. (see p. 96)		X		
Develop and institute a community-wide disaster awareness program. (see p. 96)		X		
Ensure that recovery information is consistent with the goals and policies of this plan. (see p. 96)		X		
Develop a manual on Emergency Flood Response and Reconstruction/Restoration Activities Within the Shoreline Environment. (see p. 97)		X		

Development regulations				
Amend the Flood Damage Prevention Ordinance to allow no more than a 50% increase in building footprint size when existing structures in areas of special flood hazards are *substantially improved.* (see p. 97)	X			
Amend the Flood Damage Prevention Ordinance to require that, in all areas of special flood hazards, new construction and *substantial improvement* of any residential structure shall have the lowest floor, including basement, elevated one foot or more above *base flood elevation.* (see p. 97)	X			
Amend the Flood Damage Prevention Ordinance to require that, in all areas of special flood hazards, new construction and *substantial improvement* of any commercial, industrial, or other nonresidential structure shall either have the lowest floor elevated one foot or more above the level of the *base flood elevation* or shall be floodproofed so that below one foot above the *base flood* level the structure is watertight. (see p. 97)	X			
Amend the Zoning Code and/or the Flood Damage Prevention Ordinance to further limit floodplain development. (see p. 98)			X	
Mapping				
Develop *river corridor* maps. (see p. 100)	X			
Have flood boundary maps developed for unmapped reaches of the Twisp and Chewuch Rivers and for Gold Creek. (see p. 100)	X			
Have detailed studies done of areas where flood elevations are not available. (see p. 100)	X			
Develop maps of houses and other structures in the floodplain (including "up-and-out" structures) for use during rescue and disaster recovery operations. (see p. 100)		X		
Map all areas in the Methow basin that are potentially unstable as a result of rapid stream incision or stream bank erosion. (see p. 100)	X			
Map streams and alluvial fans with potential for rapid inundation, high velocity flows, or debris flows. Explore options for reducing hazards associated with alluvial fans, erosion-hazard areas, and flash flood areas. (see p. 100)		X		
Map potential ice jam areas, and explore options for reducing hazards related to ice-jam flooding. (see p. 100)		X		

Mapping (*continued*)				
Enter hazard data in the County's Geographic Information System and have them available for planners' use in advising the public. (see p. 100)		X		
Develop a *cumulative effects* model and a land change map that can be used to track cumulative effects of development and land alterations in floodplain areas and analyze the impacts of proposed development. (see p. 100)		X		
Adopt any revised flood studies when they are published. (see p. 100)	As needed			
Have elevation surveys adopted by FEMA. (see p. 100)			X	
Outreach programs				
Education				
Develop a fact sheet on "Working Near Water" for distribution to people interested in doing work in the *river corridor*. (see p. 103)	X			
Develop and distribute a booklet on flood hazards and preparedness for people who now live in the floodplain, new buyers of floodplain land, and floodplain permit applicants. (see p. 103)	X			
Advertise in *Methow Valley Building and Construction*. (see p. 103)	X			
Add comments referencing available informational materials to site analyses prepared for parcels in the *river corridor*. (see p. 103)	X			
Distribute brochures on flood-prone property to building and real estate professionals. (see p. 104)	X			
Make brochures on working near water and on flood-prone property available to members of the general public. (see p. 104)	X			
Develop a booklet designed to increase awareness of stream and riparian function and stewardship. (see p. 104)	X			
Develop a brochure for landowners on preserving property by using bioengineering to prevent streambank erosion. (see p. 104)	X			
Develop a summary of available brochures that will guide people in selecting the ones most pertinent to their situations. (see p. 104)	X			
Use the Office of Planning and Development's Home Page to educate citizens about *river corridors* and flood hazard management. (see p. 104)		X		
Assist in distribution of information about the Stewardship Incentive Program. (see p. 104)	X			

Outreach programs				
Education (continued)				
Work with Okanogan County Conservation District to make people aware of opportunities for working with the District, and to develop and distribute materials on *riparian zone* stewardship. (see p. 104)		X		
Mail information on floodplain status with tax bills. (see p. 104)		X		
Use newspaper articles and radio coverage to improve awareness. (see p. 104)		X		
Develop a speakers' bureau. (see p. 105)		X		
Develop and make available to landowners a brochure on special considerations for building on alluvial fans and in other areas subject to erosion, debris flows, and flash floods. (see p. 105)			X	
Develop school programs and/or curricula that will educate children about floods and other aspects of *river corridor* function. (see p. 105)			X	
Develop reach-specific fact sheets that will help landowners understand the unique qualities of each river reach. (see p. 105)			X	
Develop a fact sheet on various stewardship opportunities, incentive programs, and funding possibilities. (see p. 105)			X	
Develop a display for public places. (see p. 105)				X
Develop a video for presentation to students and community groups and at public meetings. (see p. 105)				X
Place items relating to flood hazards and *river corridor* management in a County newsletter. (see p. 105)				X
Work with the state Departments of Transportation and Ecology on road signs showing levels of past flooding. (see p. 105)				X
Involvement				
Establish a River Corridor Management Forum. (see p. 105)	X			
Establish a Reach Watch program. (see p. 105)	X			
Sponsor a biannual workshop on flood hazards, *river corridor* values, and relevant regulations for real estate agents, lenders, and appraisers. (see p. 105)	X			
Participate in the public involvement component of the Chewuch Restoration Project currently underway. (see p. 106)	X			
Sponsor a workshop on flood hazards, *river corridor* values, and relevant regulations for builders, developers, and surveyors. (see p. 106)		X		

Outreach programs				
Involvement (continued)				
Involve local young people in implementation of this plan when appropriate. (see p. 106)		X		
Sponsor field trips. (see p. 106)		X		
Involve citizens in mitigation planning for public works projects in the *river corridor*. (see p. 106)		X		
Where project proponents are willing, involve local volunteers in implementation of *river corridor* restoration projects. (see p. 106)		X		
Sponsor or participate in community events. (see p. 106)			X	
Develop an oral history project to record old-timers' flood memories; use the results in education and involvement programs. (see p. 106)			X	
Partnerships				
Establish an ongoing Technical Advisory Committee. (see p. 107)	X			
Work with other permitting agencies (e.g., Department of Ecology, Department of Fish and Wildlife, U.S. Army Corps of Engineers) to streamline permitting processes. (see p. 107)		X		
Work with the Okanogan Conservation District to develop and promote riparian grazing management strategies conducive to *river corridor* health. (see p. 107)		X		
Work with the Forest Service on watershed analyses, and on *river corridor* issues that concern both agencies. (see p. 107)	X			
Continue to work with the Yakama Indian Nation, the U.S. Fish and Wildlife Service, the Department of Fish and Wildlife, and the Public Utility Districts. (see p. 107)	X			
Work with the Methow Valley Land Trust and other similar groups on implementation of the education recommendations in this section. (see p. 107)		X		
Work with local citizens to plan projects that will support the intent of this plan. (see p. 107)			X	
Work with interested groups to plan *river corridor* projects consistent with the intent of this plan. (see p. 107)	As projects arise			
Work with other agencies to develop interpretive facilities. (see p. 108)			X	
Work with the Department of Fish and Wildlife to enhance fishing access sites and campgrounds so that those facilities better meet the goals of this plan. (see p. 108)			X	
Work with the State Department of Parks and Recreation to encourage development of river recreation access sites that meet the goals of this plan, the Comprehensive Recreation Plan for the Methow Valley, and the Recreation Element of the County's Comprehensive Plan. (see p. 108)				X

Incentive programs				
Amend the Open Space Tax Program/PBRS. (see p. 110)			X	
Encourage *river corridor* landowners to participate in the revised Open Space Tax Program. (see p. 111)				X
Encourage landowners to participate in cost-sharing programs. (see p. 111)			X	
Explore the possibility of developing a special assessment district. (see p. 111)				X
Property protection				
Apply to the NFIP to receive credit under the Community Rating System for floodplain management activities. (see p. 112)			X	
Educate landowners about flood hazards and the availability of flood insurance. (see p. 112)	X			
Encourage elevation and floodproofing of existing floodplain structures and publicize funding sources. (see p. 112)			X	
Encourage relocation of existing floodplain structures. (see p. 112)				X
Watershed management guidelines				
Develop and distribute stormwater management, clearing and grading, and riparian management guidelines for landowners. (see p. 113)			X	
Modify the County's Public Benefit Rating System to provide additional incentives for effective riparian grazing management. (see p. 113)			X	
Work with other interested agencies to support the raising and keeping of livestock in the basin in a manner that minimizes the adverse impacts of livestock on river and stream corridors. (see p. 113)				X
Structural projects				
On public and private projects, encourage use of bioengineering techniques, rather than *riprapping* and other single-objective bank stabilization techniques. (see p. 116)			X	
On public and private projects, discourage the use of dikes and levees. (see p. 116)	X			
The Office of Planning and Development will develop a formal process to assist the Public Works Department in coordinating planning of any work within stream corridors, starting early in the design process. (see p. 116)			X	
Use the assessment system in Appendix F to assess projects in which the County participates. (see p. 116)			X	

Recreation: trails and river access				
Conduct a lake and river facilities feasibility study, as discussed in the Parks and Recreation Element of the County's Comprehensive Plan. (see p. 122)				X
Continue to work in partnership with the Methow Valley Sport Trails Association, the Methow Institute Foundation, and the U.S. Forest Service on trail projects. (see p. 122)	As projects arise			
Develop cooperative planning relationships with other agencies and among County departments to improve river access and foster development of trails and other *river corridor* facilities. (see p. 122)			X	
Encourage use of *river corridor* trails for transportation as well as recreation through development of trails that link populated areas without compromising riparian resources. (see p. 123)				X
Educate recreational users of the Methow Valley's *river corridors* in safe use that does not damage natural resources. (see p. 123)			X	
Methow River corridor northwest of Mazama				
Map all areas that are potentially unstable as a result of rapid stream incision or stream bank erosion throughout the *river corridor* north of the Mazama Bridge. (see p. 123)	X			
Stop issuing building permits for structures for human habitation in areas that are shown to be hazardous. (see p. 124)		X		
Sponsor acquisition of undeveloped floodplain land (or easements) when the following conditions can be met: the acquisition will result in no change in County tax revenues (that is, funds must be available to make payments in lieu of taxes); no cash will be required from the County (any match required must come from other sources); there will be no maintenance responsibilities on the part of the County. (see p. 124)	When conditions can be met			
Develop a flood warning and evacuation system for the area. (see p. 124)	X			
As part of the Public Education and Involvement component of this plan, work to inform *meander belt* residents. (see p. 124)	X			
In cooperation with the Forest Service and the Lost River Airport Tracts Homeowners' Association, have the dike down river from the confluence of the Methow and Lost Rivers assessed. (see p. 124)			X	
Develop guidelines for assessment of any diking proposal. (see p. 124)		X		
Use legal counsel to assess the County's present liability. Take actions necessary to minimize that liability. (see p. 124)		X		

Other issues				
Develop a program to inventory resources and conditions and monitor change. (see p. 125)			X	
Based on the results of inventory and monitoring, have floodplains re-studied and new FEMA maps prepared when changes in the basin suggest the existing maps are no longer accurate. (see p. 125)	As needed			
Assess the impact of human use and naturally-occurring upper-watershed disturbances (e.g., fire) on ecosystem structure and function and, specifically, on the capacity of the river and its floodplain to accommodate flooding. (see p. 125)			X	
Determine what changes must take place throughout the watershed to improve function to the level necessary to support the goals and objectives of this plan. (see p. 125)				X
With landowners, work to develop systems of public access compatible with the results of the studies discussed above. (see p. 126)				X

C. Implementation Plan

The following table states the County department responsible for implementing each of the Phase I recommendations. The anticipated source of funds is noted for projects that will require outside funding. Implementation of future phases (II-IV) will be scheduled as funding becomes available. The funding manual (Appendix E.5) catalogues potential funding sources. Once this plan has been adopted, Okanogan County will be eligible to apply for funds to implement the plan's recommendations from the state's Flood Control Assistance Account Program. Applications for the biennium beginning in June, 1997 will be due early in 1997.

Figure VI.4
Multi-Objective River corridor Plan for the Methow Basin
Implementation Plan

Recommendation	Responsible Agencies and Funding Sources
Flood warning and emergency response	
Amend the Emergency Management Operations Plan to address flood warnings for people out of range of KOMW. (see p. 96)	Sheriff's Department
At Lost River Airport Tracts, present flood awareness information. (see p. 96)	Sheriff's Department, Office of Planning and Development
Make contact with people in other high risk areas. (see p. 96)	Sheriff's Department
Development regulations	
Amend the Flood Damage Prevention Ordinance to allow no more than a 50% increase in building footprint size when existing structures in areas of special flood hazards are *substantially improved*. (see p. 97)	Office of Planning and Development
Amend the Flood Damage Prevention Ordinance to require that, in all areas of special flood hazards, new construction and *substantial improvement* of any residential structure shall have the lowest floor, including basement, elevated one foot or more above *base flood elevation*. (see p. 97)	Office of Planning and Development

Recommendation	Responsible Agencies and Funding Sources
Development regulations (*continued*)	
Amend the Flood Damage Prevention Ordinance to require that, in all areas of special flood hazards, new construction and *substantial improvement* of any commercial, industrial, or other nonresidential structure shall either have the lowest floor elevated one foot or more above the level of the *base flood elevation* or shall be floodproofed so that below one foot above the *base flood* level the structure is watertight. (see p. 97)	Office of Planning and Development
Mapping	
Develop *river corridor* maps. (see p. 100)	Office of Planning and Development
Have flood boundary maps developed for unmapped reaches of the Twisp and Chewuch Rivers and for Gold Creek. (see p. 100)	Office of Planning and Development. FEMA has allocated some funds for use during Federal Fiscal Year 1997. FCAAP funds may be available to supplement the money from FEMA.
Have detailed studies done of areas where flood elevations are not available. (see p. 100)	Office of Planning and Development. Studies during Phase I will be done by the U.S. Army Corps of Engineers at no cost to the County. FEMA has allocated funds for additional mapping during Federal Fiscal Year 1997. FCAAP funds may be available to supplement the money from FEMA.
Map all areas in the Methow basin that are potentially unstable as a result of rapid stream incision or stream bank erosion. Use those maps in determining Geologically Hazardous areas (Landslide Hazard areas) per the Critical Areas Regulations (GMA). (see p. 100)	Office of Planning and Development. The USGS can do the work under its cost-share program, with a 50% match required from the County. FCAAP funds may be available to pay the County's share of the cost.

Recommendation	Responsible Agencies and Funding Sources
Outreach programs	
Education	
Develop a fact sheet on "Working Near Water" for distribution to people interested in doing work in the *river corridor*. (see p. 103)	Office of Planning and Development; work will be done under the current FCAAP grant
Develop and distribute a booklet on flood hazards and preparedness for people who now live in the floodplain, new buyers of floodplain land, and floodplain permit applicants. (see p. 103)	Office of Planning and Development
Advertise in *Methow Valley Building and Construction*. (see p. 103)	Office of Planning and Development
Add comments referencing available informational materials to site analyses prepared for parcels in the floodplain. (see p. 103)	Office of Planning and Development
Distribute brochures on flood-prone property to building and real estate professionals. (see p. 104)	Office of Planning and Development
Make brochures on working near water and on flood-prone property available to members of the general public. (see p. 104)	Office of Planning and Development
Develop a booklet designed to increase awareness of stream and riparian function and stewardship. (see p. 104)	Office of Planning and Development; work will be done under the current FCAAP grant
Develop a brochure for landowners on preserving property by using bioengineering to prevent streambank erosion. (see p. 104)	Office of Planning and Development
Develop a summary of available brochures that will guide people in selecting the ones most pertinent to their situations. (see p. 104)	Office of Planning and Development
Assist in distribution of information about the Stewardship Incentive Program. (see p. 104)	Office of Planning and Development

Recommendation	Responsible Agencies and Funding Sources
Outreach programs	
Involvement	
Establish a River Corridor Management Forum. (see p. 105)	Office of Planning and Development. Funding may be available from the Public Power Council.
Establish a Reach Watch program. (see p. 105)	Office of Planning and Development
Sponsor a biannual workshop on flood hazards, *river corridor* values, and relevant regulations for real estate agents, lenders, and appraisers. (see p. 105)	Office of Planning and Development. Supplemental funding may be available from the Department of Ecology.
Participate in the public involvement component of the Chewuch Restoration Project currently underway. (see p. 106)	Office of Planning and Development
Partnerships	
Establish an ongoing Technical Advisory Committee. (see p. 107)	Office of Planning and Development
Work with the Forest Service on watershed analyses, and on *river corridor* issues that concern both agencies. (see p. 107)	Office of Planning and Development
Continue to work with the Yakama Indian Nation, the U.S. Fish and Wildlife Service, the Department of Fish and Wildlife, and the Public Utility Districts. (see p. 107)	Office of Planning and Development
Property protection	
Educate landowners about flood hazards and the availability of flood insurance. (see p. 112)	Office of Planning and Development
Structural projects	
On public and private projects, discourage the use of dikes and levees. (see p. 116)	Office of Planning and Development
Encourage project proponents to consult with the County prior to applying for permits. (see p. 117)	Office of Planning and Development

Recommendation	Responsible Agencies and Funding Sources
Operations and maintenance	
Inventory County facilities (dikes, bridges, and armored embankments) in the *river corridors* and determine the County's role in maintaining them. (see p. 121)	Public Works Department
Assess and plan for maintenance of the dike north of Twisp. (see p. 121)	Public Works Department
Regularly assess the condition of County dikes and armored embankments. (see p. 121)	Public Works Department
Seek funding for maintenance of County flood control facilities. (see p. 121)	Public Works Department
Develop an Operations and Maintenance Manual for Activities Within the Shoreline Environment. (see p. 121)	Office of Planning and Development
Methow River corridor northwest of Mazama	
Map all areas that are potentially unstable as a result of rapid stream incision or stream bank erosion throughout the *river corridor* north of the Mazama Bridge. (see p. 123)	Office of Planning and Development. The USGS can do the work under its cost-share program, with a 50% match required from the County. FCAAP funds may be available to pay the County's share of the cost.
Develop a flood warning and evacuation system for the area. (see p. 124)	Sheriff's Department and Office of Planning and Development. May be funded in part by the Corps of Engineers' Planning Assistance to States program.
As part of the Public Education and Involvement component of this plan, work to inform *meander belt* residents. (see p. 124)	Office of Planning and Development

D. Plan Review

The Methow River basin is a dynamic system; conditions will change over time. Needs will also change, as a result of changes in the system, changes brought about by implementation of this plan, and changes in the needs and goals of the people who live here. This plan is intended to be a working document, updated periodically to reflect changes in needs and in our knowledge of how rivers work. The Office of Planning and Development should monitor implementation of the plan and submit a progress report to the Board of County Commissioners each year. The report should include, at a minimum, the following:

- A review of the original plan.
- A review of any floods that occurred during the previous calendar year.
- A review of action items in the original plan, including how much was accomplished during the previous year.
- A discussion of why any action items were not completed or why implementation is behind schedule.
- Recommendations for new projects or revised action items.
- Recommendations for scheduling of new and revised items and items in the original plan.

CHAPTER VII: APPENDICES

A. DCD Certification

A letter stating that Okanogan County has an emergency management plan that meets the States' requirements follows.

(insert DCD certification when received)

B. SEPA Documentation

The completed SEPA Environmental Checklist and Determination of Non-Significance for the Multi-Objective River Corridor Plan for the Methow Basin follow.

SEPA ENVIRONMENTAL CHECKLIST
WAC 197-11-960

Purpose of Checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impact from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answ these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:

Multi-Objective River Corridor Plan for the Methow Basin

2. Name of applicant:

Okanogan County Office of Planning and Development

3. Address and phone number of applicant and contact person:

P. O. Box 1009
Okanogan, WA 98040

(509) 422-7160

Contact: Robert I. Clark, Planning Division Supervisor

4. Date checklist prepared:

October 9, 1996

5. Agency requesting checklist:

Washington State Department of Ecology

6. Proposed timing or schedule (including phasing, if applicable):

Plan is scheduled for review by the Okanogan County Planning Commission on November 25, 1996. Implementation will begin as soon as the plan is adopted by the Board of County Commissioners.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

The plan will be reviewed annually, and may be amended to reflect changes in conditions.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

River corridor maps; Flood Insurance Studies for Okanogan County and the Towns of Twisp and Winthrop

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

Does not apply

10. List any government approvals or permits that will be needed for your proposal, if known.

Adoption by Okanogan County Board of County Commissioners; letter from Washington State Military Department regarding compliance with Emergency Operations Plan requirements; Washington State Department of Ecology approval

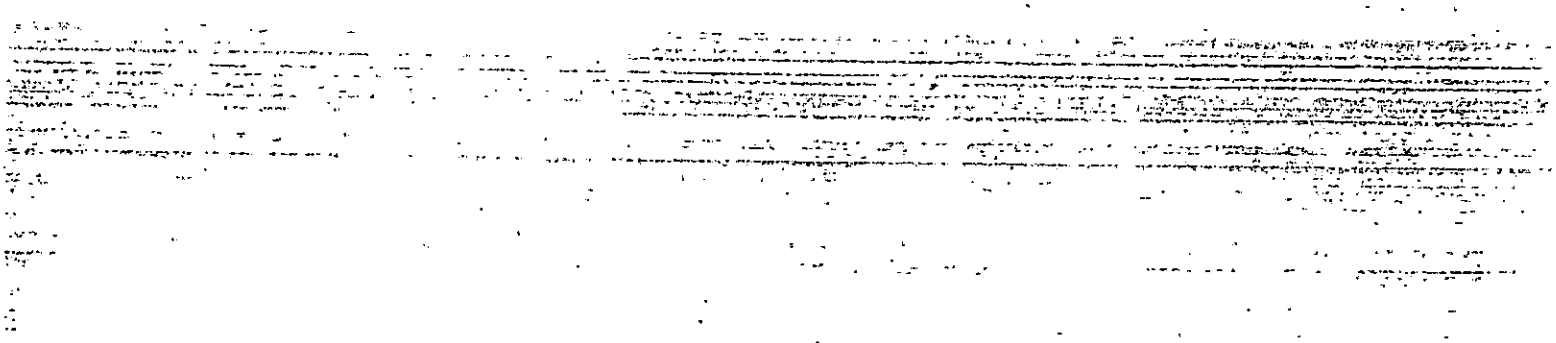
11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page.

The Multi-Objective River Corridor Plan for the Methow Basin addresses land use and shoreline condition in the parts of the basin's stream corridors that are under Okanogan County's jurisdiction. It will serve as Okanogan

County's Comprehensive Flood Hazard Management Plan for the Methow, Chewuch, and Twisp Rivers and Early Winters Creek.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

Methow River basin (WRIA 48), Okanogan County



B. ENVIRONMENTAL ELEMENTS:

1. Earth

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other: Topography in the basin ranges from steep mountains to relatively flat terraces and floodplains. River corridor areas vary from broad valley bottoms to narrow incised channels and include streamside cliffs and bluffs.

b. What is the steepest slope on the site (approximate percent slope)?

Slope of some bluffs and cliffs exceeds 50%

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

The alluvial and outwash materials underlying the soils of the Methow Valley provide for fast drainage. North of Carlton, most valley floor soils belong to the Owhi-Winthrop association of deep, well-drained to excessively drained soils. From Carlton south to Pateros, the valley floor is composed of soils of the Pogue-Cashmont-Cashmere association of deep, somewhat excessively drained and well-drained soils. Many areas are riverwash.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Soils adjacent to the river channel are highly erosive in some places, and there have been slides and episodes of undercutting associated with flooding in the past.

e. Describe the purpose, type and approximate quantities of any filling or grading proposed. Indicate source of fill.

Does not apply

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Does not apply

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Does not apply

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Implementation of the plan is not expected to produce erosion or other impacts to the earth. The plan encourages riparian vegetation preservation and restoration and recommends development of guidance for instream and riparian work. Both measures can be expected to reduce erosion.

2. Air

a. What type of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

Does not apply

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

Does not apply

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Does not apply

3. Water

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

The project area is drained by the Methow River, which flows into the Columbia River at Pateros. Its major tributaries include the Twisp, Chewuch, and Lost Rivers and Gold, Libby, Beaver, Wolf, and Early Winters Creeks. There are numerous smaller tributaries, some of them intermittent, as well

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Does not apply. The plan recommends development of guidelines for work in shoreline areas. The intent of the guidelines would be to reduce impacts to river corridor resources.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Does not apply

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

Does not apply.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Mapped and unmapped floodplains adjacent to the Methow, Twisp, and Chewuch Rivers are within the affected geographic area.

6) Does the proposal involve any discharges of waste materials to surface waters? If so describe the type of waste and anticipated volume of discharge.

No

b. Ground:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

No

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: domestic sewage; industrial, containing the following chemicals...; agricultural: etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Does not apply

c. Water runoff (including storm water)

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Does not apply

2) Could waste materials enter ground or surface waters? If so, generally describe.

Does not apply

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

Does not apply

4. Plants

a. Check or circle types of vegetation found on the site:

__X__ deciduous tree: Aspen, black cottonwood, and rocky mountain maple predominate
__X__ evergreen tree: Ponderosa pine predominates at lower elevations, grading into Douglas-fir at moderate, and subalpine fir at higher elevations.
__X__ shrubs: Sage, bitterbrush, and rabbitbrush predominate on dry sites; rose, snowberry, hawthorn, and dogwood are common in riparian areas
__X__ grass: Native grassland communities are dominated by bluebunch wheatgrass.
__X__ pasture
__X__ crop or grain (Alfalfa, orchard crops)
__X__ wet soil plants: cattail, buttercup, bulrush, skunk cabbage,
other: All of the above, along with various other rushes and sedges.
__X__ water plants:
__X__ other types of vegetation: Exotic grasses, forbs, and annual plants have become established in many parts of the basin.

b. What kind and amount of vegetation will be removed or altered?

Does not apply

c. List threatened or endangered species known to be on or near the site.

None known

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Does not apply

5. Animals

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: hawk, heron, eagle, songbirds, other: All of the above; bald eagle, northern spotted owl, golden eagle, harlequin duck; various neo-tropical migrants, others too numerous to list

mammals: deer, bear, beaver, other: All of the above; mule deer, white-tailed deer, western gray squirrel, various bats considered species of concern; others too numerous to list

fish: bass, salmon, trout, herring, shellfish, other: Methow basin watercourses support both anadromous and resident fish, including spring, summer, and fall chinook, sockeye salmon, summer steelhead, rainbow, cutthroat, and brook trout, bull trout (commonly known as Dolly Varden), whitefish, suckers, sculpins, squawfish, and dace.

b. List any threatened or endangered species known to be on or near the site.

Bald eagle, northern spotted owl, western gray squirrel

c. Is the site part of a migration route? If so, explain.

The affected geographic area is home to Washington State's largest migratory mule deer herd. Riparian areas are components of deer migration corridors.

d. Proposed measures to preserve or enhance wildlife, if any:

The plan will encourage preservation and restoration of riparian habitat. The plan also encourages use of bank stabilization techniques that preserve or enhance habitat quality.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Does not apply

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

Does not apply

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Does not apply

7. Environmental Health

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

Does not apply

1) Describe special emergency services that might be required.

2) Proposed measures to reduce or control environmental health hazards, if any:

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Does not apply

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Does not apply

3) Proposed measure to reduce or control noise impacts, if any:

Does not apply

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties?

Current use varies and includes agricultural, residential, commercial, and recreational use, grazing, commercial forestry, and natural areas.

b. Has the site been used for agriculture? If so, describe.

Much of the lower-elevation land in the affected geographic area has been used for agriculture (grazing, alfalfa and grain production, orchards, some truck crops). Some agricultural lands have been converted to residential use; other remain in production or have been abandoned.

c. Describe any structures on the site.

Both residential and non-residential structures exist in the project area

d. Will any structures be demolished? If so, what?

Does not apply

e. What is the current zoning classification of the site?

Does not apply

f. What is the current comprehensive plan designation of the site?

Does not apply

g. If applicable, what is the current shoreline master program designation of the site?

Most of the shorelines in the affected geographic area are classified as rural shoreline environment. Small areas are classified as conservancy or suburban.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

No

i. Approximately how many people would reside or work in the completed project?

Does not apply

j. Approximately how many people would the completed project displace?

Does not apply

k. Proposed measures to avoid or reduce displacement impacts, if any:

Does not apply

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The plan was written to be compatible with the County's Comprehensive Plan and its addenda, the Methow Valley Plan and the Mazama Area Master Plan.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Does not apply

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Does not apply

c. Proposed measures to reduce or control housing impacts, if any:

Does not apply

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Does not apply

b. What views in the immediate vicinity would be altered or obstructed?

Does not apply

c. Proposed measures to reduce or control aesthetic impacts, if any:

Does not apply

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Does not apply

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Does not apply

c. What existing off-site sources of light or glare may affect your proposal?

Does not apply

d. Proposed measures to reduce or control light and glare impacts, if any:

Does not apply

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

Rafting , canoeing, kayaking, swimming, and fishing are popular on the Methow, Chewuch, and Twisp Rivers. A network of sport trails is maintained for skiing and cycling in the Methow Valley; some of those trails are in the river corridor. The river corridor is also used for hunting, camping, wildlife observation, walking, and aesthetic appreciation.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Does not apply

13. Historic and Cultural Preservation

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

A prehistoric campsite located on the first and second river terraces near the mouth of Wolf Creek was discovered during preparation of an EIS for improvements to SR 20 in 1985. The site was determined eligible for inclusion in the National Register of Historic Places.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

See above. In addition, there are pictograph sites at various locations in the basin.

c. Proposed measures to reduce or control impacts, if any:

Does not apply

14. Transportation

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The Methow Valley is served by State Routes 20 and 153. The route through the valley has been designated as part of Washington State's scenic and recreational highway system. County roads serving the area include the Gold Creek Loop Road, the Twisp-Carlton Road (Westside Road), Stokes Road, the Twisp River Road, Poorman Creek Road, Buttermilk Creek Road, the Twisp-Winthrop Road (Eastside Road), the East and West Side Chewuch River Roads, Wolf Creek Road, Goat Creek Road, and Lost River Road.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

There is no public transit in the affected geographic area.

c. How many parking spaces would the completed project have? How many would the project eliminate?

Does not apply

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

Does not apply

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Does not apply

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

Does not apply

g. Proposed measures to reduce or control transportation impacts, if any:

Does not apply

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

Does not apply

b. Proposed measures to reduce or control direct impacts on public services, if any.

Does not apply

16. Utilities

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

Does not apply

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

Does not apply

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Robert D. Clark Date Submitted: October 9, 1996

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS
(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent of the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water: emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

The proposal is not likely to affect emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise. Implementation of the plan's recommendations is likely to decrease runoff to surface water and increase infiltration to groundwater.

Proposed measures to avoid or reduce such increases are:

Does not apply

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

Implementation of the proposal is likely to result in improved habitat conditions in the affected river corridor areas.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

Environmental education; encouragement of riparian vegetation preservation and restoration; development of guidance for instream and riparian work.

3. How would the proposal be likely to deplete energy or natural resources?

Does not apply

Proposed measures to protect or conserve energy and natural resources are:

Does not apply

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

Implementation of the plan is likely to improve the condition of threatened species habitat, wetlands, and floodplains. The other resources listed are not likely to be affected.

Proposed measures to protect such resources or to avoid or reduce impacts are:

Environmental education; encouragement of riparian vegetation preservation and restoration; floodplain awareness program

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

The proposal will discourage uses incompatible with existing plans. Implementation of the plan is likely to result in an improvement of riparian vegetation quality and a reduction in the rate of development in the floodplain. Wetlands preservation and enhancement and removal of structures currently in the floodplain may result.

Proposed measures to avoid or reduce shoreline and land use impacts are:

Education and improvement of awareness; incentives; development of guidance for government employees working in shoreline areas.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

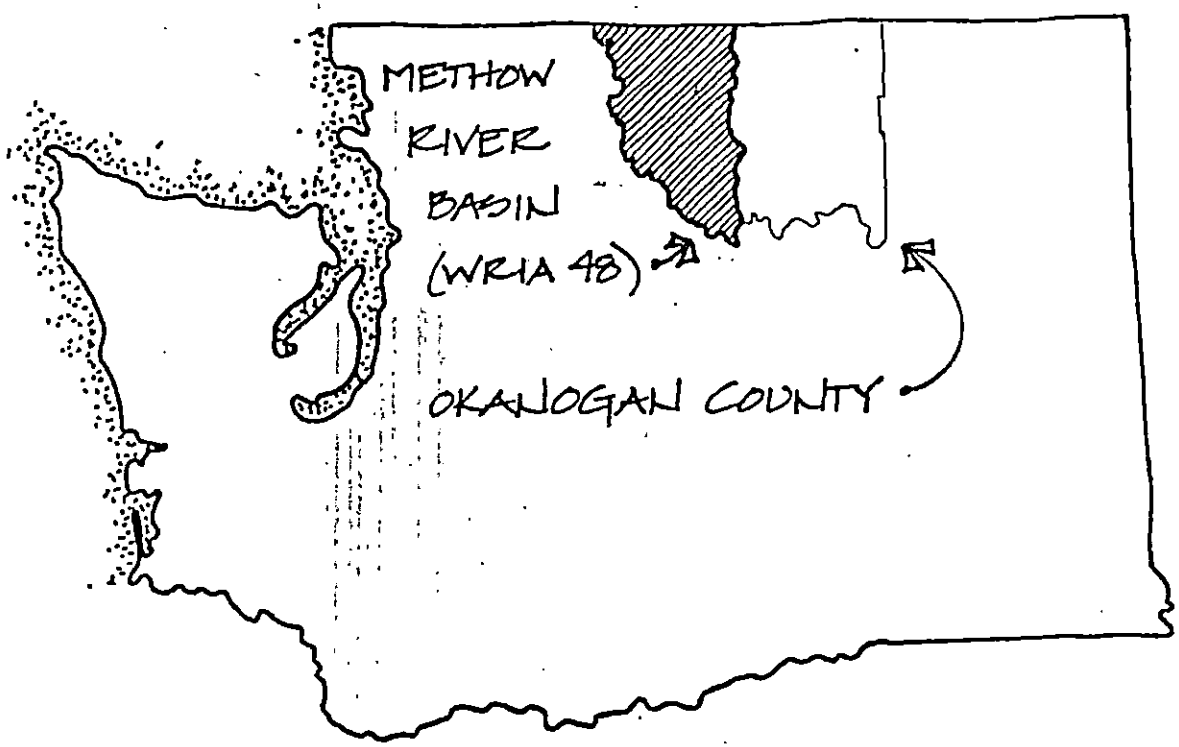
Does not apply

Proposed measures to reduce or respond to such demand(s) are:

Does not apply

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

The proposal is not expected to conflict with any laws or requirements for the protection of the environment.


METHOW
RIVER
BASIN
(WRIA 48)
OKANOGAN COUNTY

WAC 197-11-970 Determination of nonsignificance (DNS)

DETERMINATION OF NONSIGNIFICANCE

Description of proposal: Multi-Objective River Corridor Plan for the Methow Basin addressing land use and shoreline condition in the parts of the basin's stream corridors that are under Okanogan County jurisdiction. The plan will serve as Okanogan County's Comprehensive Flood Hazard Management Plan for the Methow, Chewuch, and Twisp Rivers and Early Winters Creek.

Proponent:
OKANOGAN COUNTY OFFICE OF PLANNING AND DEVELOPMENT
P.O. BOX 1009
OKANOGAN, WA 98840

Location of Proposal, including street address, if any: Methow River basin (WRIA 48), Okanogan County, Washington.

Lead Agency: Okanogan County Office of Planning & Development
P.O. Box 1009
Okanogan, WA 98840

The lead agency for this proposal has determined that the proposal does **not** have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is **not** required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ There is no comment period for this DNS.

☒ This DNS is issued under 197-11-350; the lead agency will not act on this proposal for 15 days from the Date below. Comments must be received by **5:00 p.m., November 7, 1996.**

Responsible Official: Robert I. Clark

Position/Title: Interim Director, Office of Planning and Development ***Phone:*** (509) 422-7160

Address: P.O. Box 1009, Okanogan, Washington 98840

Date: October 23, 1996 ***Signature:*** Robert I. Clark

You may appeal this determination to the Okanogan County Commissioners at P.O. Box 791, Okanogan, WA 98840 no later than **5:00 p.m., November 22, 1996, in writing.** Failure to comment on this notice of intent by the comment due date noted above shall be determined to deny a party standing to appeal the final determination.

You should be prepared to make specific factual objections.
Contact the Office of Planning & Development to read or ask about the procedures for SEPA appeals.

C. Technical Hydrologic Data and Analysis

No new technical data were generated during the development of the Multi-Objective River Corridor Plan for the Methow Basin. The hydrologic data in this appendix come from the following sources:

Caldwell, Brad and Dave Catterson. 1992. *Methow River basin: Fish habitat analysis using the instream flow incremental methodology.* Olympia, WA: Washington State Department of Ecology, Water Resources Program.

Northwest Hydraulic Consultants. 1992. *Final report of the limited map maintenance study of areas of unincorporated Okanogan County, Washington.* Prepared for FEMA Region X and Okanogan County Office of Planning and Development.

Floodway data, maps of flood plain limits, flood profiles and historical information on floods can be found in the following publications:

Beck, R. W. and Associates. 1973. *Flood plain information, Methow River: Mazama to Twisp, Okanogan County, Washington.* Prepared for the Washington State Department of Ecology.

Federal Emergency Management Agency. 1994. *Flood insurance study: Okanogan County, Washington, unincorporated areas.*

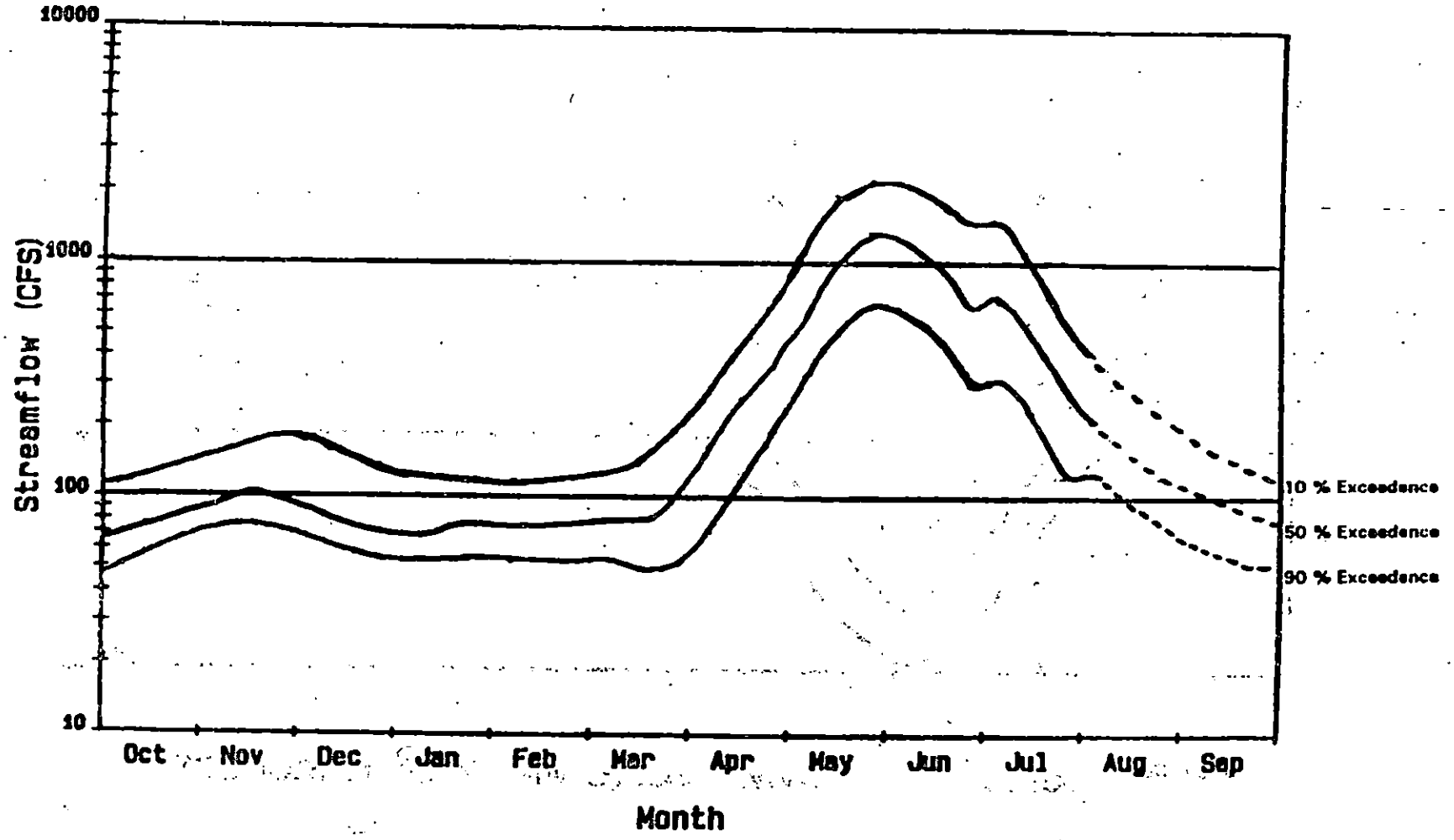
Norman Associates. 1974. *Flood plain information: Methow River, Twisp to Carlton, Okanogan County, Washington.* Prepared for Okanogan County.

United States. Department of Agriculture. Soil Conservation Service. 1975. *Flood hazard analyses: Chewack River in the vicinity of the Town of Winthrop, Okanogan County, Washington.* Spokane, WA.

United States. Department of Housing and Urban Development and Federal Insurance Administration. 1977a. *Flood insurance study: Town of Winthrop, Washington, Okanogan County.*

United States. Department of Housing and Urban Development and Federal Insurance Administration. 1977b. *Flood insurance study: Town of Twisp, Washington, Okanogan County.*

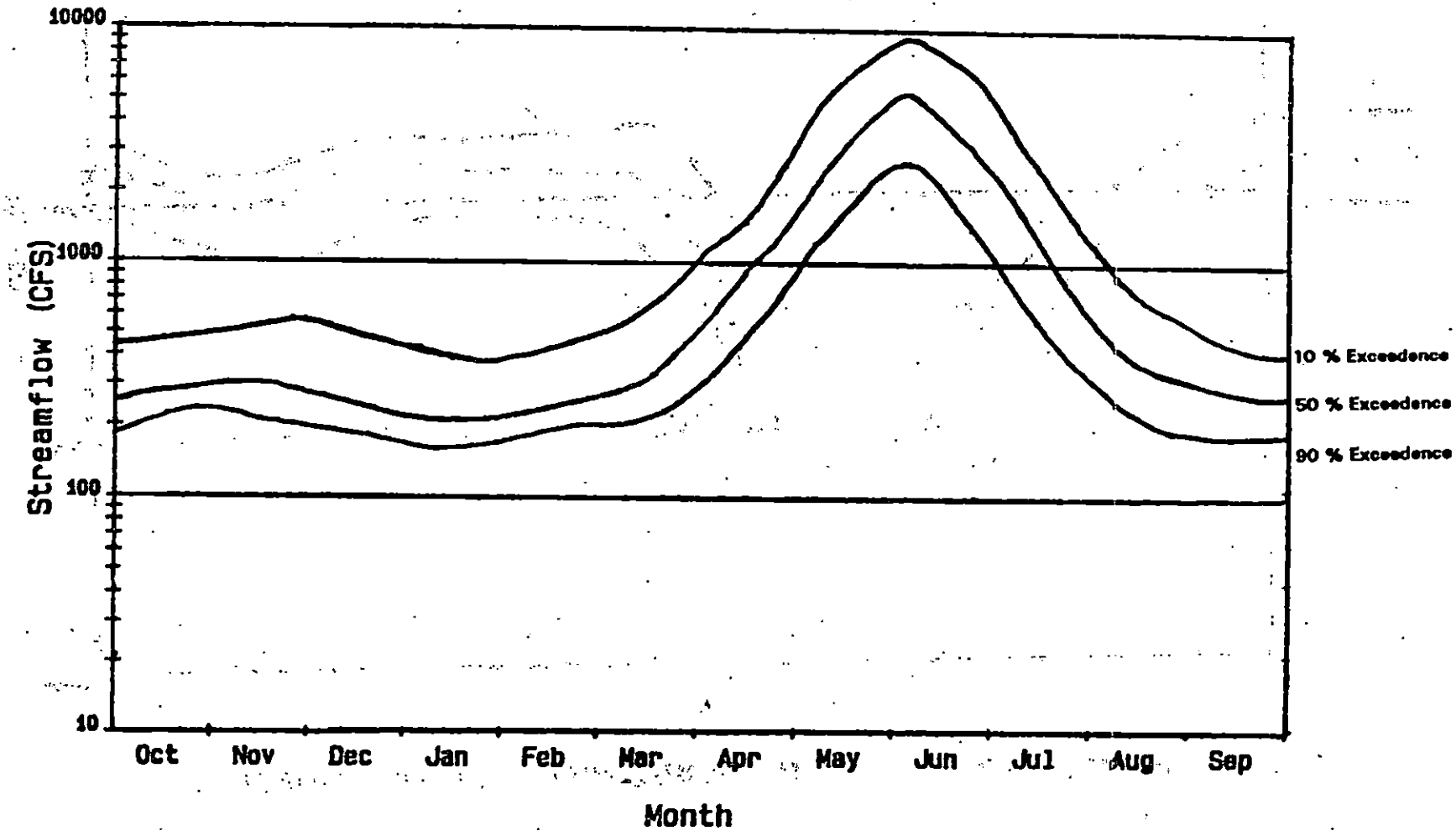
CHEWUCH RIVER AT WINTHROP, WA GAGE 12448000



PERIOD OF RECORD = Synthesized from 33 years at Pateros gage with Chewuch gage flows from 1991 and 1992.

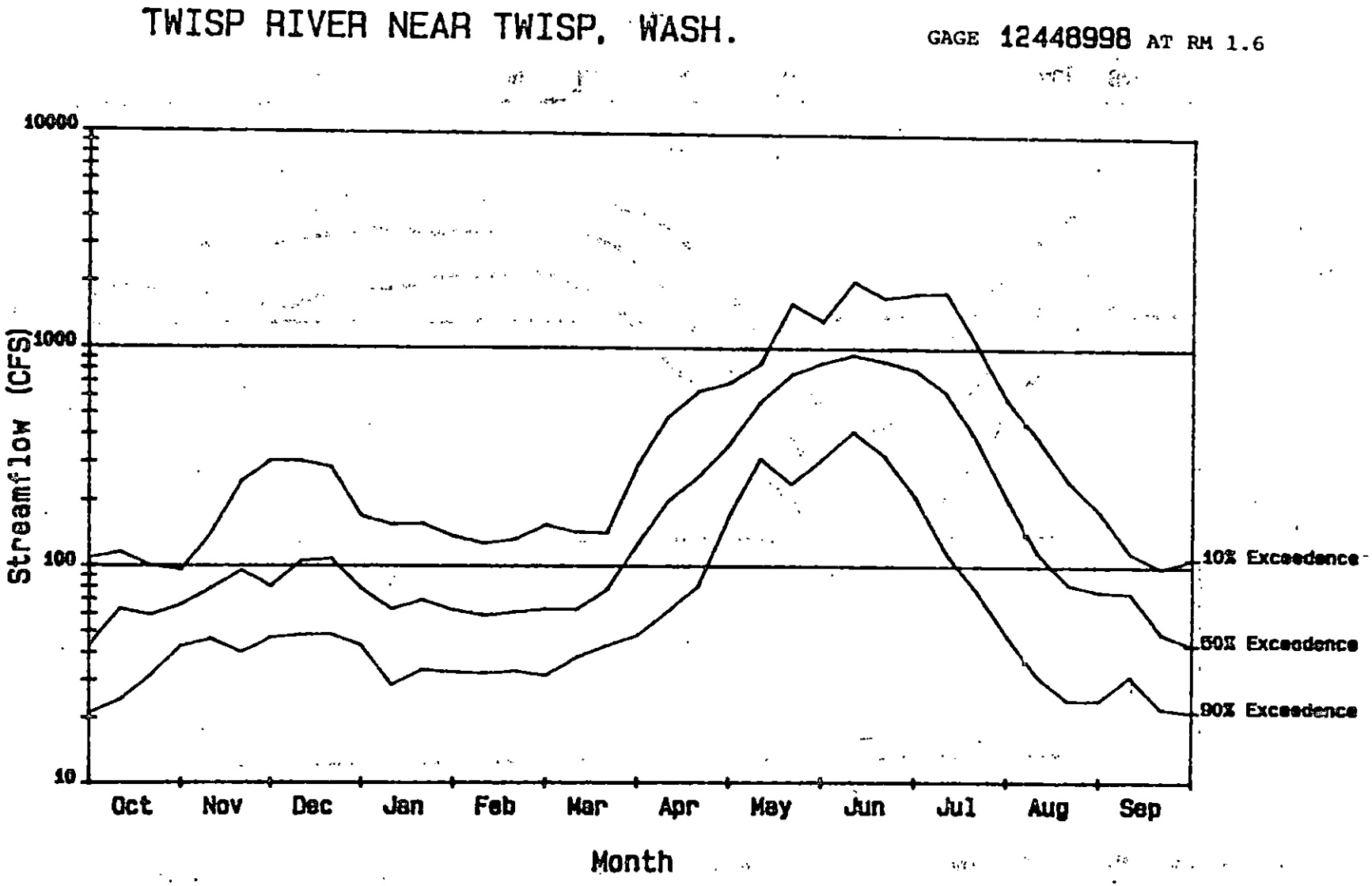
Source: Caldwell and Catterson, 1992

METHOW RIVER AT WINTHROP, WASH. GAGE 12448500 AT RM 49.8



PERIOD OF RECORD = Synthesized from 33years of Pateros gage with Winthrop gage flows from 1991.

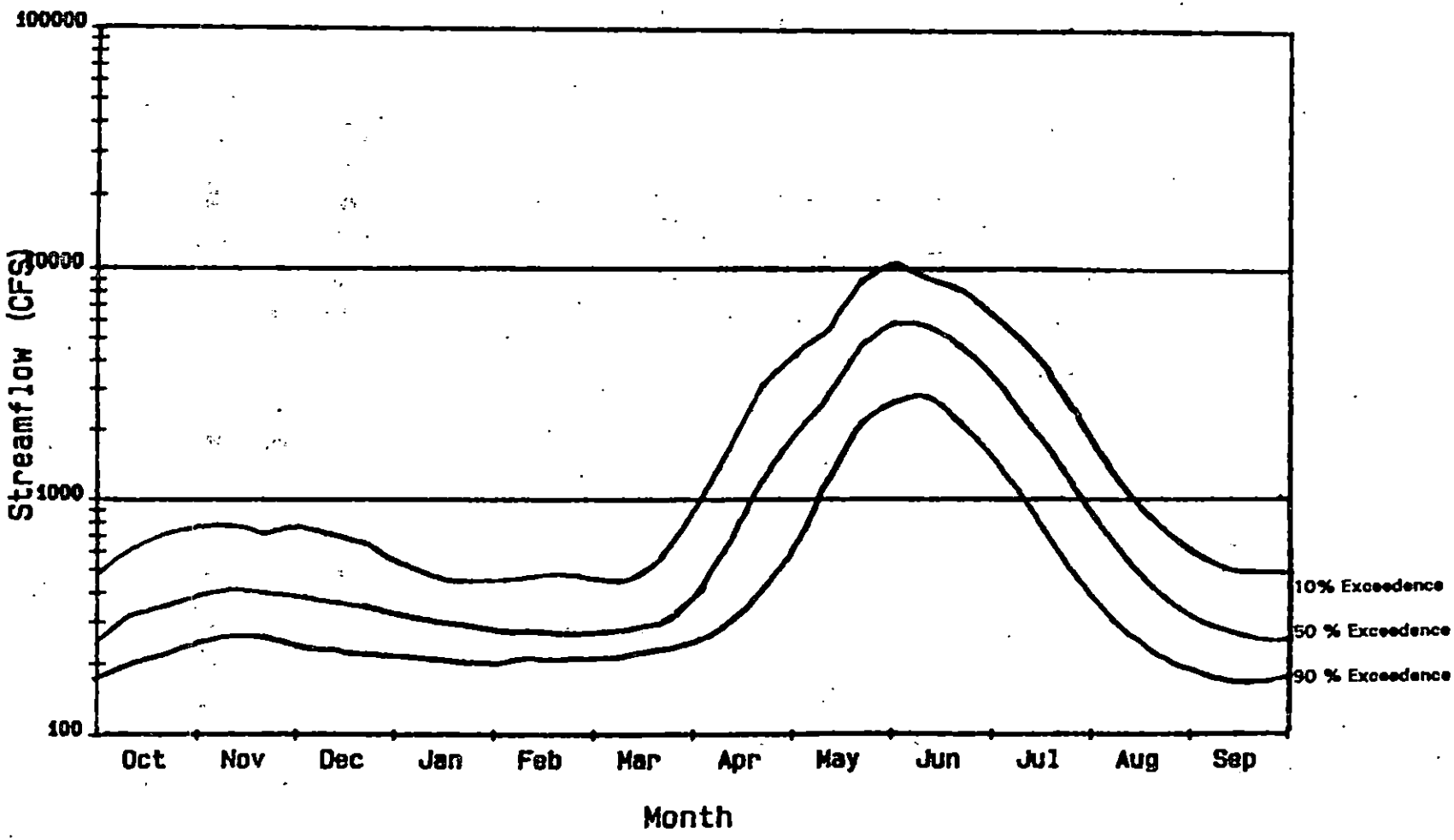
Source: Caldwell and Catterson, 1992



Source: Caldwell and Catterson, 1992

METHOW RIVER AT TWISP, WA

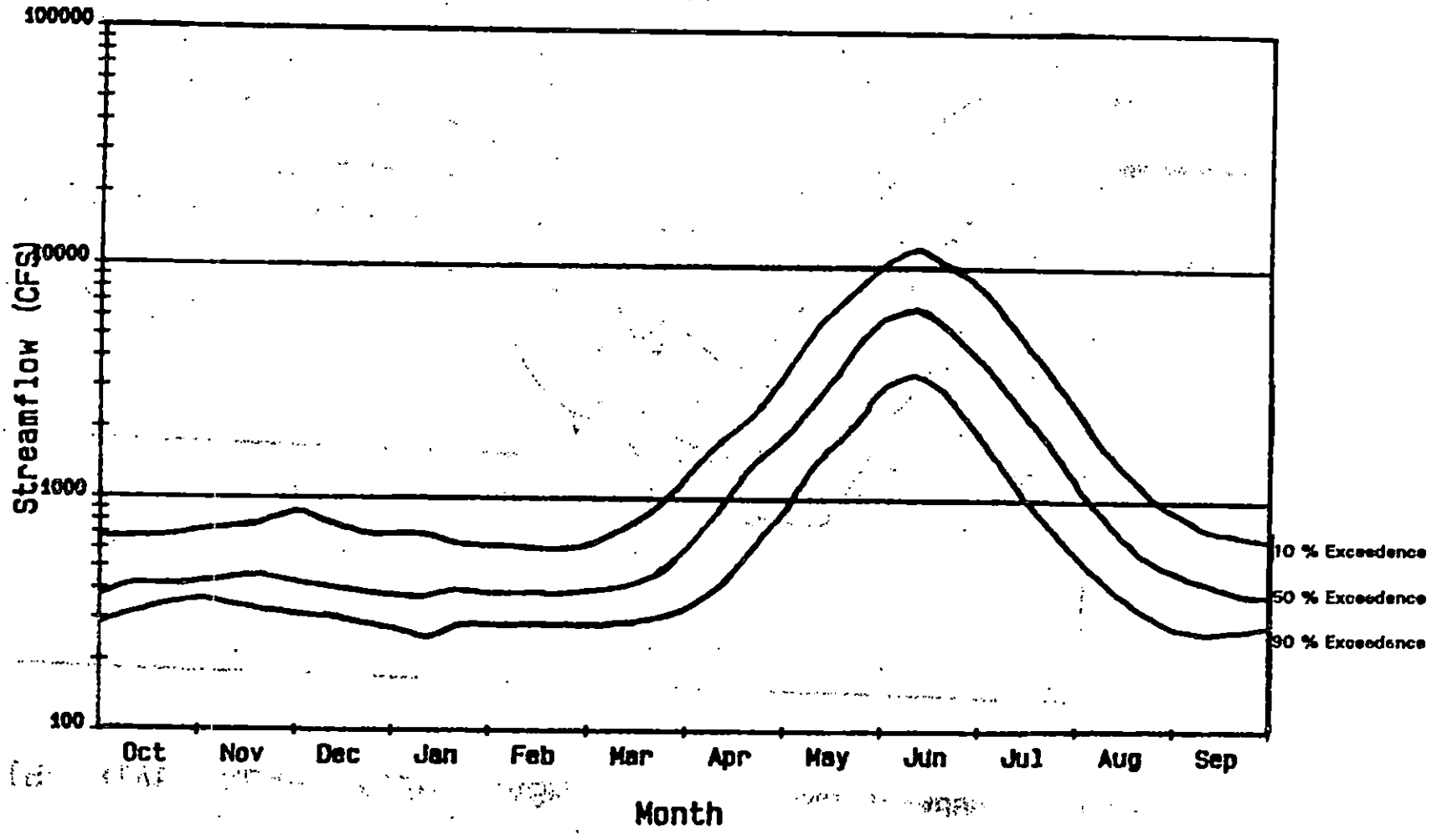
GAGE 12449500 AT RM 40



PERIOD OF RECORD = 1919 to 1962 and 1991 to 1992

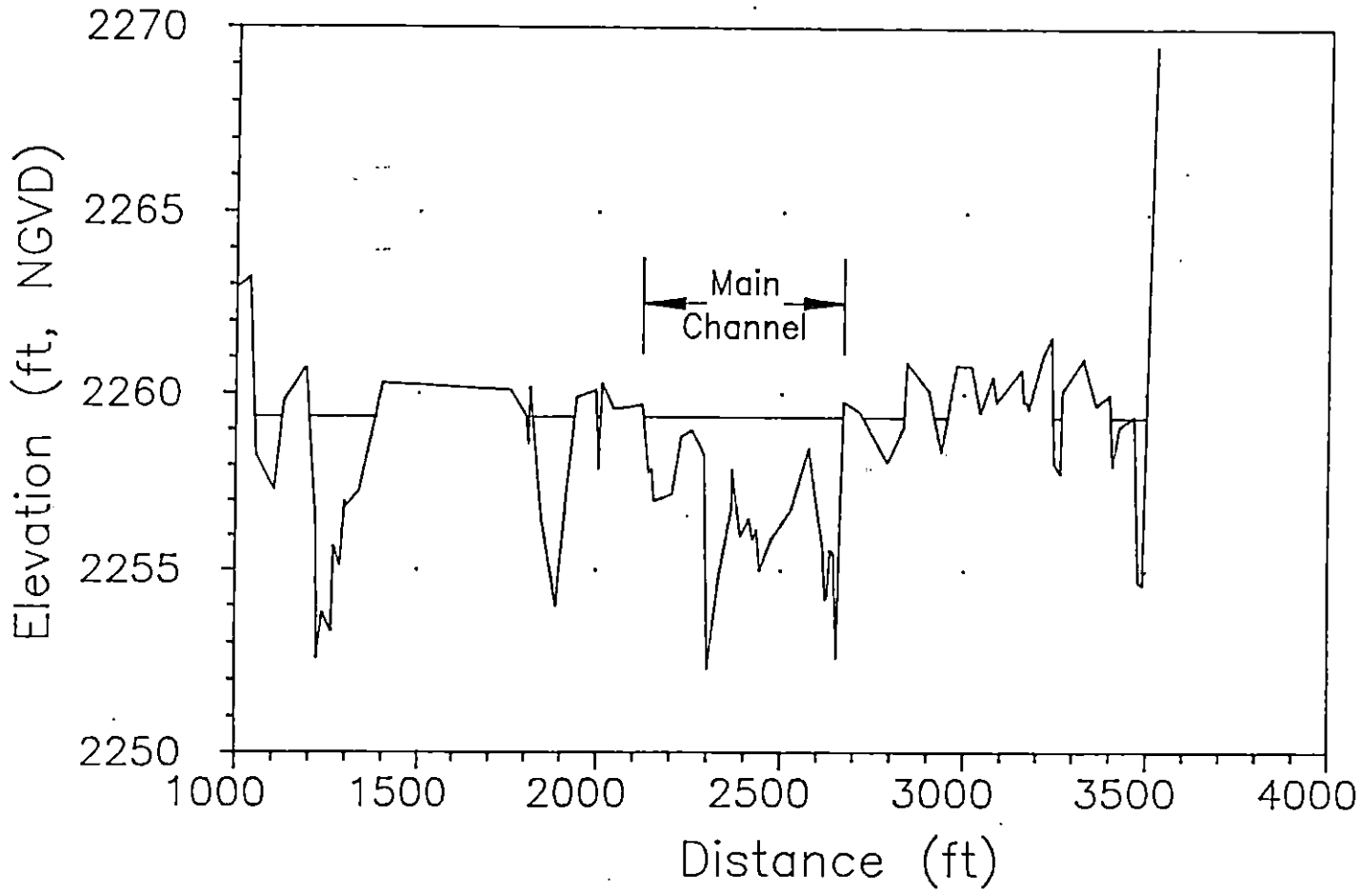
Source: Caldwell and Catterson, 1992

METHOW RIVER NR PATEROS, WASH. GAGE 12449950 AT RM 6.7



Period of record = 1959 to 1992

Source: Caldwell and Catterson, 1992



Source (Sections 2-6): Northwest Hydraulic Consultants, 1992.

Notes:

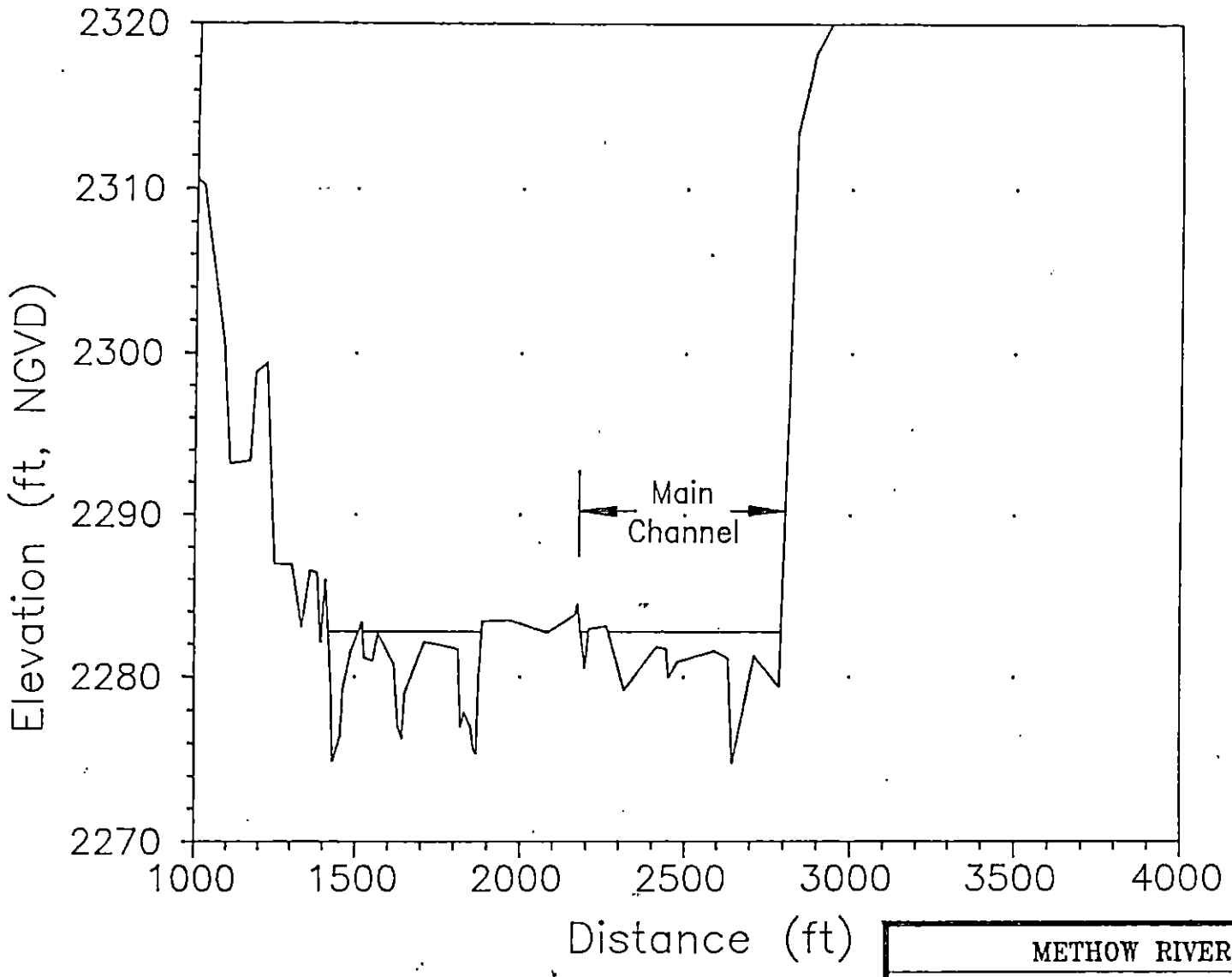
1. 100-yr water surface shown
2. Cross-section viewing downstream

20628.2.18.2

METHOW RIVER LMMP

CROSS-SECTION BC

northwest hydraulic consultants inc. | 2



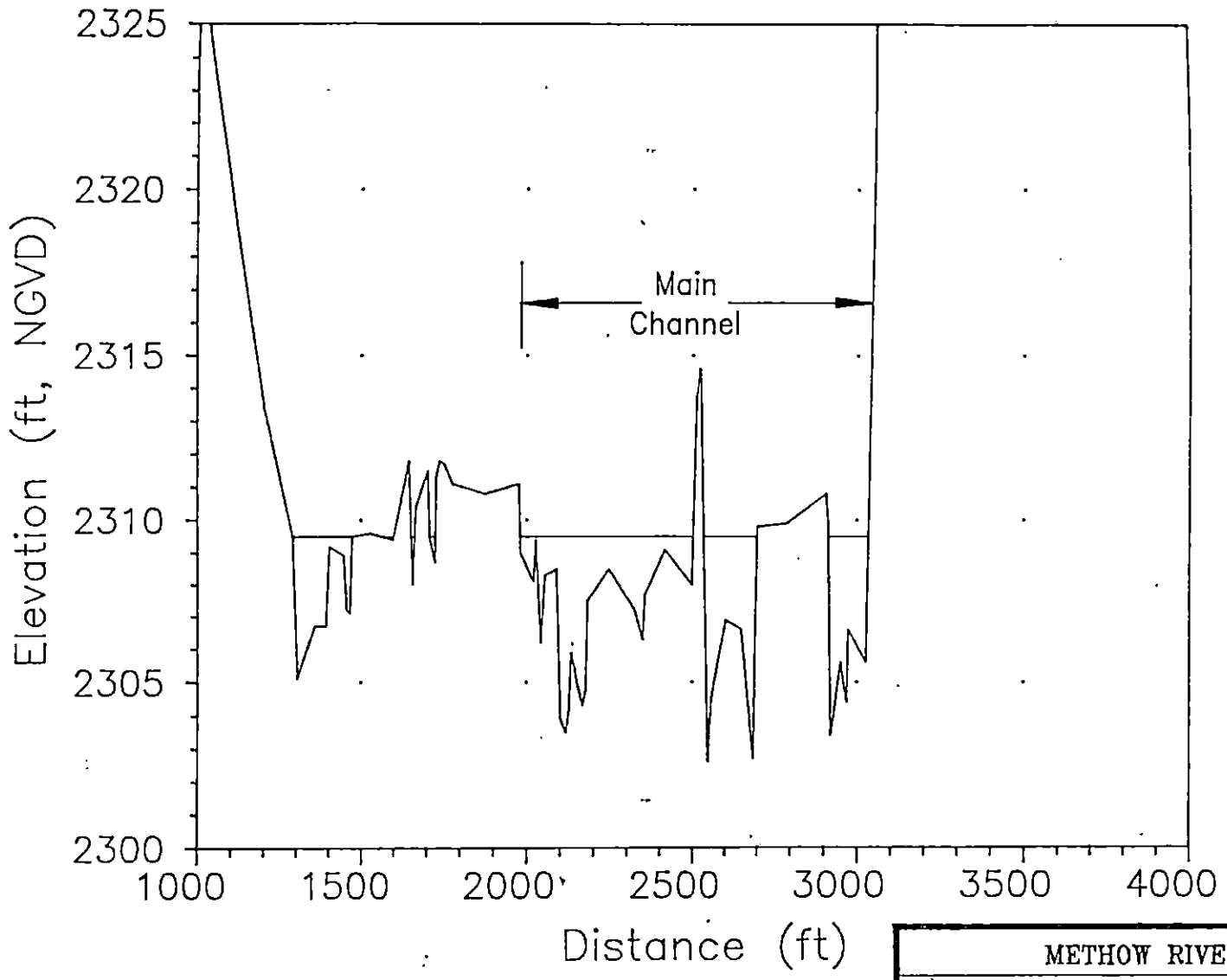
Notes:

1. 100–yr water surface shown
2. Cross–section viewing downstream

20628.3.18.2

METHOW RIVER LMMP

CROSS–SECTION BF



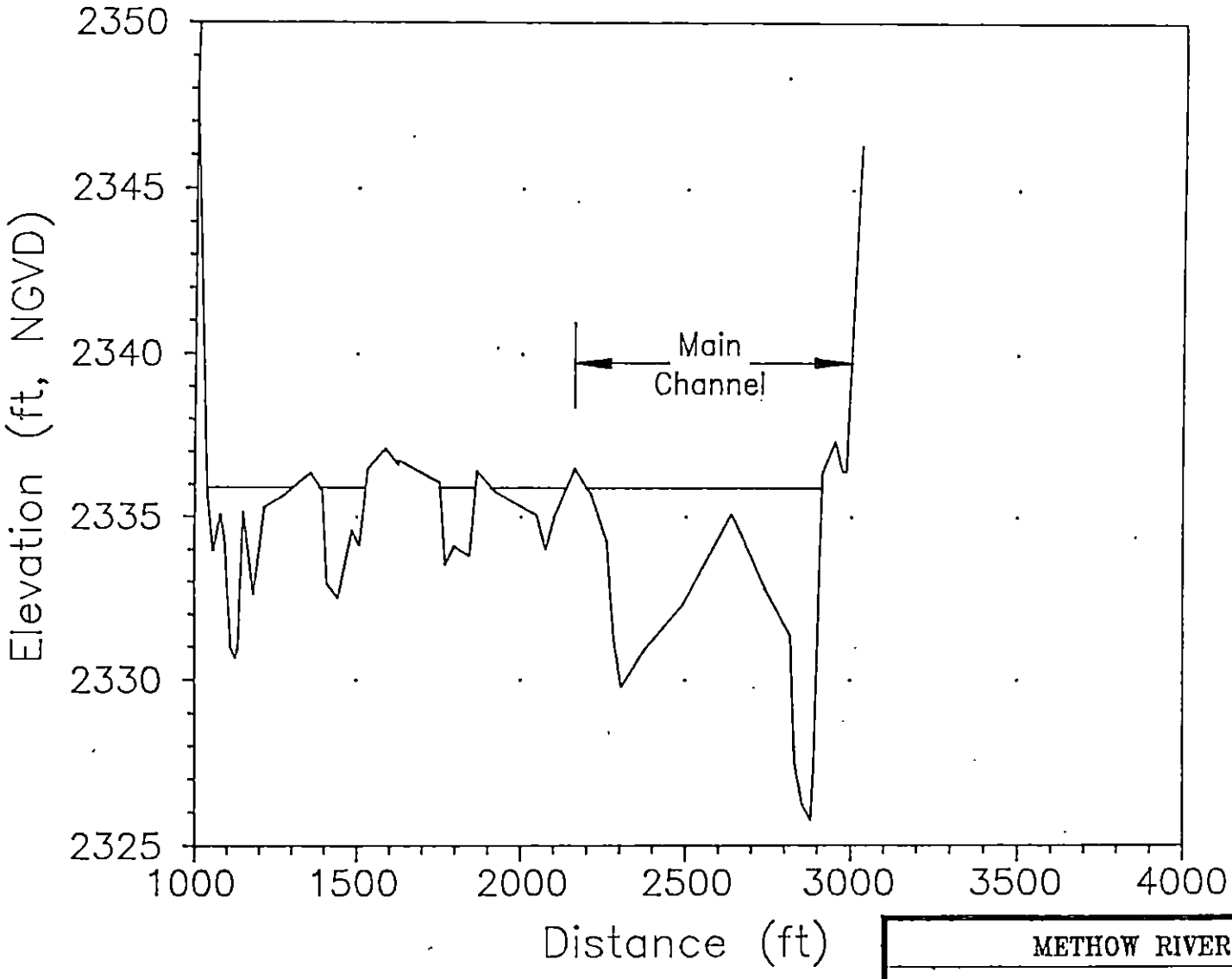
Notes:

1. 100–yr water surface shown
2. Cross–section viewing downstream

20628.4.18.2

METHOW RIVER LMMP

CROSS–SECTION BJ



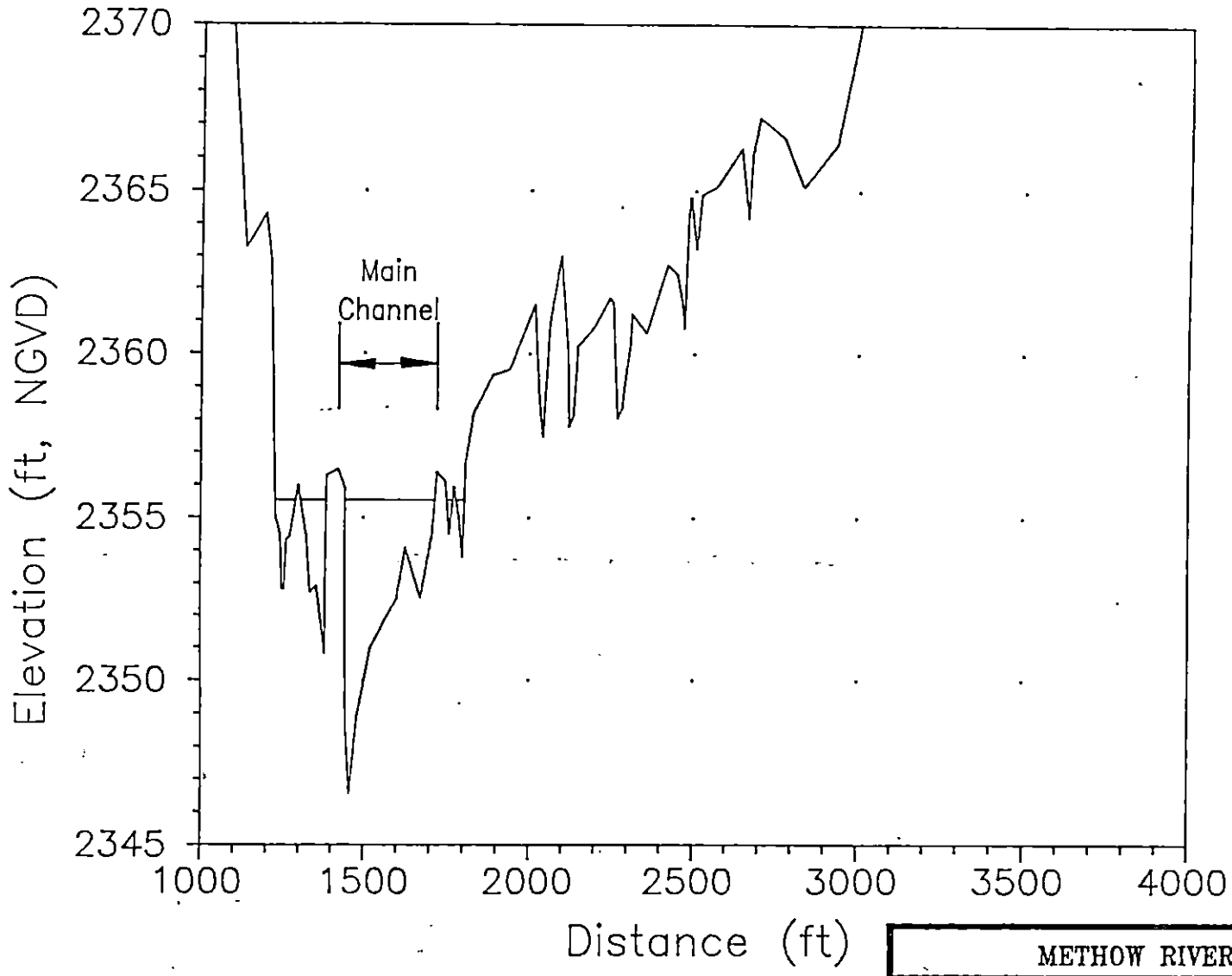
Notes:

1. 100-yr water surface shown
2. Cross-section viewing downstream

20628.5.18.2

METHOW RIVER LMMP

CROSS-SECTION BN



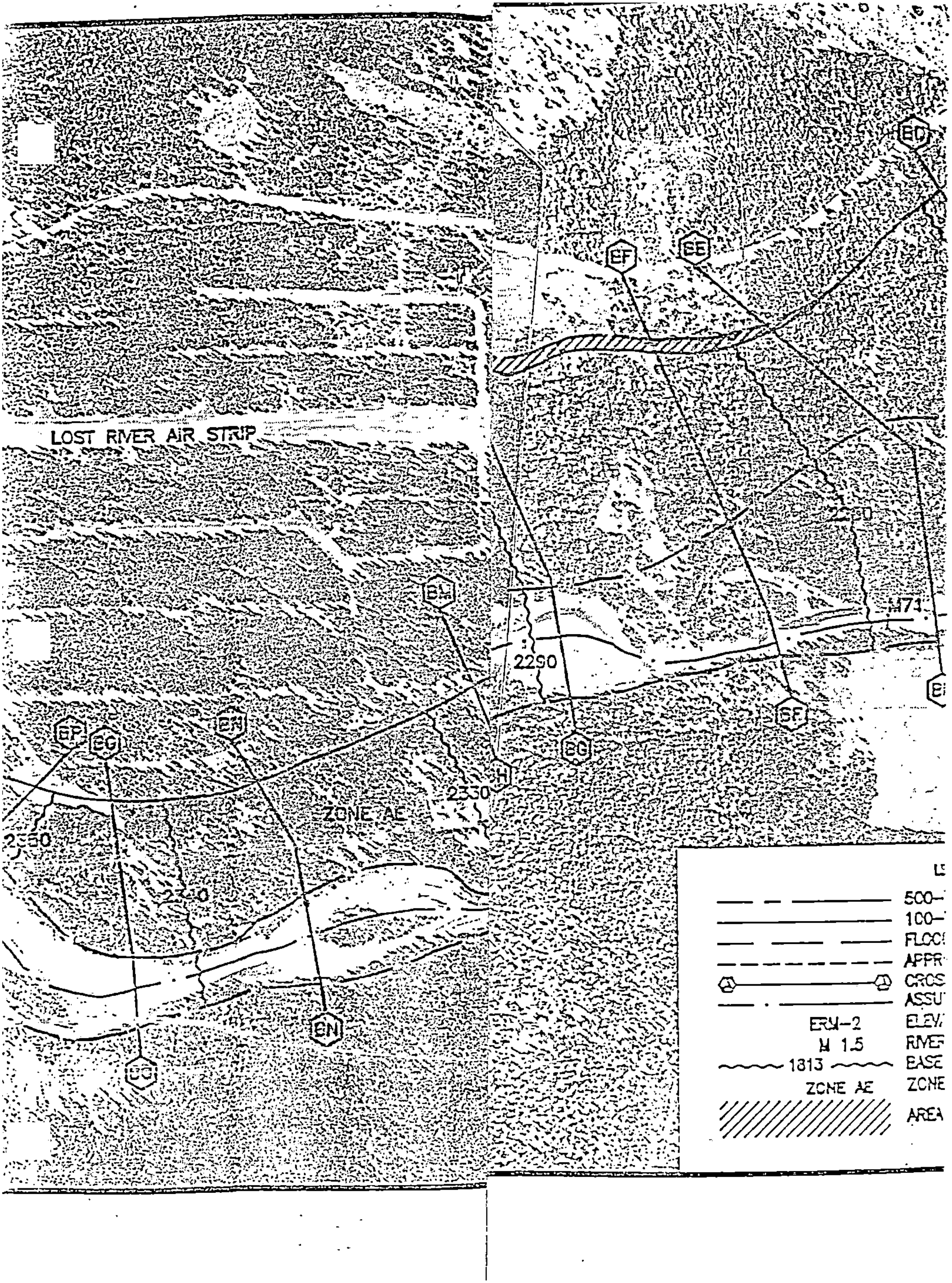
Notes:

1. 100-yr water surface shown
2. Cross-section viewing downstream

20628.6.18.2

METHOW RIVER LMMP

CROSS-SECTION BQ



LOST RIVER AIR STRIP
ZONE AE
2290
2330
2330
2340
2290
BD
EE
EF
EG
EH
EM
EN
EP
BG
SF
L
500-
100-
FLOO
APPR
CROS
ASSU
ERM-2
ELEV
M 1.5
RIVER
1813
BASE
ZONE AE
ZONE
AREA


LOST RIVER ROAD
ERM-4
BI
BJ
BK
BL
BM
2300
2310
2320
2330
METHOW RIVER
M72

D. Planning Process: Supplemental Information

1. Technical Advisory Committee

A list of Technical Advisory Committee members follows. The following agencies were invited to send representatives to the Committee but did not participate: Colville Confederated Tribes, Department of Natural Resources, Town of Pateros, Town of Twisp.

Mr. Mel Bennett, Okanogan National Forest Supervisor's Office, 1240 South 2nd Avenue, Okanogan, WA 98840
Mr. Dave Burdick, Northwest Regional Office, Dept. of Ecology, Mail Stop NB-81, 3190 160th Ave. SE, Bellevue, WA 98008-5452
Mr. Dave Carie, U. S. Fish & Wildlife Service, 12790 Fish Hatchery Rd., Leavenworth, WA 98826
Mr. Jim Gregg, Methow Valley Ranger District, P.O. Box 579, Winthrop, WA 98862
Ms Lynda Hofmann, Washington State Department of Fish and Wildlife, P. O. Box 1118, Twisp, WA 98856
Mr. Joel Hubble, Yakama Indian Nation, P. O. Box 151, Toppenish, WA 98948
Mr. Randy Kelley, NRCS, 1251 Second Avenue South, Okanogan, WA 98840
Ms Debbie Knaub, U.S. Army Corps of Engineers, P. O. Box 549, Manson, WA 98031
Ms Katherine March, Washington State Department of Fish and Wildlife, 1550 Alder St. NW, Ephrata, WA 98823-9651*
Mr. Terry Mattson, Dept. of Transportation, Box 98, Wenatchee, WA 98807-0098
Mr. Jim Martin, Commissioner, P.U.D. #1 of Okanogan County, P.O. Box 1234, Okanogan, WA 98840
Mr. Jim McGee, Douglas County P.U.D., 1151 Valley Mall Parkway, East Wenatchee, WA 98802-4497
Ms Jennifer Molesworth, Methow Valley Ranger District, P.O. Box 579, Winthrop, WA 98862
Mr. Bill Morgan, Town of Winthrop, P. O. Box 459, Winthrop, WA 98862
Mr. Kim Sherwood
Ms Sandra Strieby, Okanogan County Office of Planning and Development, P. O. Box 931, Twisp, WA 98856
Ms Kate Terrell, U. S. Fish and Wildlife Service, P. O. Box 1157, Moses Lake, WA 98837

* Ms March joined the Department of Fish and Wildlife in September, 1996. Prior to that, she participated as an employee of the Department of Ecology.

° Mr. Sherwood joined the TAC as an employee of the BLM. He continued to comment on the document after leaving the agency in 1995.

2. Citizens' Advisory Group

A. List of Citizens' Advisory Group members

Craig Boesel, Winthrop
Grace Cisneros, Mazama
Terry Cooper, Winthrop
Dewane Crevelling, Methow
Patrick Fitzgerald, Twisp
Kathleen Hirschstein, Carlton
Bill Imes, Winthrop
Don Johnson, Winthrop
Frank O. Johnson, Winthrop
Connie Murry, Snohomish
Terry O'Reilly, Winthrop
Ben Rust, Winthrop
John Sunderland, Mazama

B. Citizens' Advisory Group comments

Oral comments are summarized here; copies of written comments follow.

Comments on Vision Statement and goals and objectives of the Multi-Objective River Corridor Plan for the Methow Basin. The vision statement and lists of goals and objectives were mailed in January, 1995.

- Terry O'Reilly:
  Would like to see consolidation of regulatory requirements as part of vision statement.
  Regarding corridor identification (objectives): maybe focus harder on risk areas. Want to avoid battle over property rights. Concentrate on how to do what you want rather than stop people from doing anything.
  Regarding objective of preventing vulnerable new development: Ensure objective is consistent with existing regulations. Get back to incentives/education/hazard mitigation.

Comments on policies and options for river corridor management. Proposed policies and options were mailed in April, 1995.

- Grace Cisneros:
  Concerned about activities in tributary shoreline areas—e.g., vegetation clearing, waste disposal—that are important to function of the overall system but are not regulated under the Shoreline Management Program.
  Problem regarding riparian vegetation/shoreline regulations: Agriculture is excluded from shoreline regulations. Often vegetation has been removed for agriculture; no rehabilitation takes place when the use changes. Structures are then allowed closer to the shoreline as there's no riparian vegetation.

Regulations only apply once a building permit's been acquired (there is a problem with people clearing vegetation, etc., prior to any involvement by the County).
Can't increase County taxes; suggest creating junior taxing districts to fund management activities.
Suggest an extension of the trail system or a greenbelt down valley. Would increase land values.

- Terry Cooper:
  In agricultural/rural areas: cattle should be kept out of the river; illegal camps should be closed; walking trails should be considered.
  In urban areas: assess uses, develop appropriate strategies.
  Each use must be careful not to add to burden, pollution.
  If structures are built in floodplain, make owners and insurers aware.
  Permit non-residential structures in floodplains; ensure owners understand potential risk. Insurers should know as well.
  Don't try to over-regulate. Give people a way to do what they want that's fair to all.
  Need to look at problem log jams—de-fuse them.
  Call on people at highest risk with information. Ask them to sign statements that they have been informed.

- Terry O'Reilly:
  Regarding "Reducing vulnerability": "No more structures" is a problem. Wouldn't have a problem with incentives.
  Critical facilities inventory needs to be done.
  A flood disaster education program should be developed on a community-wide basis.

Comments on draft plan, mailed in September, 1995.

- Grace Cisneros:
  Key is single-family residences (they enjoy many exemptions, are having a substantial impact).

- Terry O'Reilly:
  Education—re. condition of rivers, life/safety considerations—is hugely important.
  Nothing else to comment on.

- John Sunderland:
  Broad outlines seem good.
  Looks like most important issues are included—how strongly stated is a question.
  As a builder, would advise elevating or moving floodplain residences.
  At Lost River, will get wiped out. Water comes from below.

Rcd. 2.3.95

Grace Cisneros
P.O. Box 754
Winthrop, Washington

February 2, 1995

Dear Ms. Striebv and Mr. Bettman.

I submit the following comments on the draft Multi-Objective River Corridor Plan for the Methow Basin.

1. — Other issues associated with the river corridor and its use include:

I would suggest you remove Affordable Housing. Affordable Housing will not be built along the river. The abilitv to purchase propertv and/or housing along the river is not an affordable propositon for most individuals living on Methow wages.

This winter a four acre piece of property between Carlton and Twisp with about 500 feet of high bank river front sold for $ 104,000.00.

Or maybe you could define affordable housing for me.

2. —The term social cost is used throughout the plan. How is the term social cost defined?

3. — Reduce the long-term costs of flood control and floodplain management.

Make sure costs and benefits to taxpayers are presented in a tangible manner.

SC

from Terry Cooper

Multi-Objective River Corridor Plan for the Methow Basin

DRAFT VISION STATEMENT

Okanogan County's Multi-Objective River Corridor Plan for the Methow Basin is intended to provide for the long-term health, safety, and welfare of Methow Valley residents and other stakeholders by preserving a healthy, functional river corridor system, an intact cultural landscape, and a thriving economy.

Activities designed to guide the management of the corridor's resources will include:

- a comprehensive, consistent regulatory structure addressing the use of the floodplain, including guidance for uniform enforcement of ordinances and regulations;

- physical planning, including master planning, development of restoration and use guidelines, and site specific design;

- improvement projects, such as riparian restoration, obstruction clearance, bioengineering, and bank stabilization; and

- public education/involvement necessary to support community goals.

This Vision Statement will guide the development of Goals and Objectives for the Valley's river corridors, the formulation of alternatives for meeting those goals and objectives, and the drafting of a plan to implement the selected options.

1. hand delivered 2.3.95

916·2650

from Frank O. Johnson

FLOOD REDUCTION MANAGEMENT

First try to make it simple

Profit time wise by studing the scessful experienced of other liken basins

Start at the scourde of water retention of flow which is mostly from public lands of higher elevations --the forestry.

Most damage at the lower levations are the result of other factors caught up in and by this flow--errosion of first sand thence to larger material for more progressely larger rock--boulders picking up debris, trees, and structures

DESTRUCTIVE FORCE REDUCTION

Curtain clear cutting

curtailent of clear burning practices of vegitation of full growth stands as well as timber thrash burns.

Rdduce over grazing on all public land --- this is an abusive practice that is not recognized,--sort of an out of sight out of mind.

Identify and curtail all practices in the flood plain that enhances fast run off and pollutionn then discourage such practices.

Identify the geological natural and man made contributionsing factors that con tribute to possible propertys of increasing the flood distrutive forces.

Nearly all of the above may have short term negative effect on the economy localy but will return and greatly enhance it for the long haul in many way as heen happening else where in othere basins such as--the White mountain in the north east; the Adarondacks on the east coast; and here in the west the best example is the Missuora river basin and the upper smaller contributing one which more nearly match ours.

But keep in mind there is no quick fix more ever any full control as is demonstrated in the Hi-tech nation of Netherlands who has been trying to for 12 centuries and is today evacuating one quater million to safety.

Methow Valley is of high glacierl residual material effect, leaving much alluvial deposits in the lower lands, from the mountains that were wiped clean down to shear bed rock.

The resulting alluvial debris left in the valley floor or flood plain has been a play thing for the water forces that have meandered to criss cross ALL the flood plain through out the ions leavein vertiully no area that could be consid ered safe for any type of development over the long haul--perhaps,perhaps for the short ter n yes, butit must be remembered there is vertually no foundation that can be developed economically indestructable on the floor plain area, thus we must consider and make aware to protect to the better of our ability practices for the quality of life of man, animal and fisheries, economically to direct to meet this so called progress.

To do this may disrupt some peoples dreams of better life, others of dreams of of great profits at expense of future enviormental and quality of the valley. and still others having the dream of the Golden years to depart from this world with out the disruptive influnces of the metropolitian they have fled from. In the planning of flood control all this must be recognized to include proposed practices to minimumize adverse effect to all their dreams.

Perhaps to devise a system of renumerations of some form seperating the property owners with their home residents here unlike the one or two week annual residents or the absentee property owner who is here for the big kill of profit at the expense of to heck with every thing esle less just slam it together however and run to H_ll with any thing we dont live here anyhow.

DESTRUCTIVE FORCE REDUCTION

In the beginning it has been recognized here and in other basins that it is the combinations of natural forces together produce the maximum of destruction.

Our beginning force of greater destruction is in this Valley start up in the mountains on the 80 per cent of public lands of forestry, with delayed melt of the snow pack caused by warm weather with rains followed by sudden clearing of the clouds exposing a hot sun.

Reduced clear cutting would reduce the harmful effect of this two or more fold by providing protedtive cover of vegetation and leaf dropping in the fall to reduce ground frost allowing penetration of the first moisture in the spring instead of running off, as well as having tree shadow reducing the hot spring sun and also slowing the warm breeze that come up.as the slope heats up to creat an upward draft from the valley floorwhich is warmer. thus helping in all ways to reduce the fast run off enhancing more moisture to further store moisture at this locatiin to propetuate greater plant growth to help the cycle self perpetuate. All of which slows the run off errosion with root growth and stablizing the soil from start downward to snowball effect of loosing larger and larger material up to large boulder to eventually enter the main flow on the flood plain where it loosens the alluvial material.

Clear burning is one of the most destructive wasteful , polluting forces senselessly produced by so call educated govermental agencies as is further recognised and demnostrated by the Yellowstone fire not stopped by man. This practice as all the foregoing adversities of clear cutting plus destroying habitat and wild life with out desgression brutually it must be stopped for air pollution as well as run off pollution killing stream fish.

Over grazing also effects run off as well and must be address for attention perhaps monitoring more and rotating annually or longer rest regenerative eriods.

Practices in the flood plain of development in the flood plain should be curtailed such as indiscrimatingly well meant development protection if done at all should be done by permit only as it could possibly cause greater destruction by misapplication on unstable alluvial foundation underbeding ; footing soil which could misdirect the flow to a more damaging diredtion.

Harvesting or cutting of timber in the flood plains of any type old growth, or new cornifer or dicedious curtailed for the sake of flood reduction.

Development of any kind that would produce effects of faster run off such as roads, streets, and parking area, housing roofing, should be made aware of and mimimuized.

Development of ponding should be discourage due to the unstable alluvial glaeral deposits, especially in the upper reaches of the valley.

High density housing with street or road ways with accompaning sewerage disposal systems, septic tank or collective should be carefully evaluative for the potential of adverse down stream effect that could be far reaching to public and habitat practical impossible to reverse.

Gelogical factor of the most sunificant for uncontrolable destruction; would be the under lying alluvial deposits that have been displaced and moved depoisted hog pog in the valley flood plain over the ions as the forces of high water can with ease under mine or get behind the best of economically engineer planned deversion of dikes such as we have now; or misdirect the flow from the area protected to the opposite side such as the major dike now hopefully protedting the fish hatchery.

It is fruitless to try to protect our future habitat and property with the atitude of do something even if it is wrong if from political or finacial pressure rather then from the grass roots.

Floyd E. Kilcup

rcd. 2.3.95

January 31, 1995

Ms. Sandra Strieby
Flood Program Planner
Okanogan County
Twisp Office
Post Office Box 931
Twisp, Washington 98856

Dear Ms. Strieby:

Following are the thoughts arrived at after the CAG meeting held in Twisp on January 7, 1995, concerning the **MULTI-OBJECTIVE RIVER CORRIDOR PLAN PROJECT** for the Methow Valley.

This meeting seemed to have two separate factions involved. The first being the Okanogan County Planning and Development department and the second a hydrologist representing the flood control department in Olympia, Washington. The later provided excellent information on flood control and the awesome results of flooding however, he appeared focused only on the prevention/results of flooding. To us there is a larger scope to view, that of businesses, residences, farms, and townships that are already established in the Methow Valley that cannot be displaced without tremendous effort, expense, and anger.

The Methow Valley extends from Mazama right down to the entrance of the Columbia River - not an exceedingly long distance. The Valley, whose floor is narrow, is inhabited the entire distance; although sparsely in some areas. It appears, for the most part, that the existing population and growth of the area has remained the same for some time. It also appears that the Valley has two different groups within it - one group who desires no growth and the second who wants to see managed growth. For survival of the Methow Valley the latter, in our opinion, must win (if, indeed, there are to be winners and losers) however, no one wants to see the growth pattern of areas like Marysville, Woodinville, and Monroe - all located just on the western edge of the Cascades - happen in the Methow Valley. These towns experienced too great a growth at too fast a pace. They were once lazy little towns and have now become too crowded with no planning direction as far as housing, streets ingress and egress, schools, parks, etc. All of this must be considered when putting together a plan that deals with people, their property, and their towns.

Again, growth is a necessity for survival but in a well designed direction. The river corridor is prime land to build on, beautiful with its flowing water and rising hillsides. It is also one of the heaviest taxed areas. It seems inconsistent to want to limit building, as was the suggestion of the Olympia representative, on the river corridor and yet tax it so highly. Taxing it at a higher rate implies it is prime land to build on and, therefore, desirable to own.

Those living or owning property on the Methow, Chewuch, and Twisp rivers must be made to realize what a privilege it is to own property on them. They also must be made accountable for the conditions of the land that they live on since, directly or indirectly, their decisions could ultimately result in the rivers degradation. In our opinion, river landowners - and those landowners close to the rivers edge - must:

1. Maintain riparian vegetation along the river's edge.

   The Olympia representative gave an excellent description and slides on how soil is held back with minimal work and expense by simply planting fast growing, far reaching rooted plants on the river's bank. The information could be circulated in the yearly tax statements with just a one page explanation of materials required, the right type of plants to use, and a sketch of how it is done. Very simple and inexpensive yet the rewards could be tremendous.

2. Cut dead or dying trees close to the rivers edge to prevent those trees from falling in the river to cause log jams during high water.

   Again, this work would be done by the landowner and at his expense. We feel that perhaps this would help minimize the log jams that the Winthrop Mayor is so concerned about. However, we also believe that healthy trees should be left alone as they also help hold back ground erosion which, besides what has already been mentioned, would also help maintain healthy water conditions for fish habitat.

3. Maintain minimal clutter/debris within a certain distance of the river's edge to prevent possible damage during high water.

   This statement is self-explanatory. During high water or flooding, any "junk" will be picked up and moved down river leaving unsightly debris in its path. And, of course, the possibility of it gathering momentum and damaging vegetation, bridges, and other structures is high.

4. Maintain rip rap along the river's edge.

   This has proven to be effective. The design and the need for rip rap would be handled by the Corps of Civil Engineers and at the expense of whatever government body "bag of goodies" it would come from. The need for this can be seen in the Pateros, Carlton area where banks without vegetation is sloughing off into the river. There seems to be no evident reason for this happening, no people close by, just mother nature causing the possible danger.

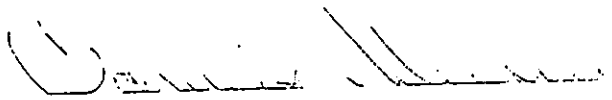
Other suggestions would be the short plat process and to limit parcels outside city limits to no less than 5 acre parcels and could, in areas where vegetation is really limited, be no less than 10 acres. Vegetation, we know, helps control water flow and erosion of land in general. The more people - the more land use - the greater chance of overused soil. This idea, though, would undoubtedly not be favorable to those landowners wishing to short plat to smaller parcels thereby receiving more return on their investment.

Also, anyone owning land on the river must be cognizant of flooding possibilities. A possible proposal to building in dangerous areas where flooding would definitely occur would be to charge homeowners the cost of rescue efforts if they did not evacuate when the need arose. By doing this, the taxpayers would not have to foot the expense and the homeowners would be held responsible for their own actions.

The Winthrop area is definitely one of the most beautiful areas in Washington. It has a national reputation for cross-country skiing conditions, a delightful area to shop in Winthrop, great inns and resorts to stay in, good restaurants, and rivers throughout the Valley to enjoy. But this is all seasonal employment which means that if the Methow Valley doesn't want to see growth, then maintaining what they do have must be upper most in their minds.

And if growth is to occur, then it must have far-sighted individuals to be watch dogs over it. Individuals that would allow growth with new housing and businesses but with a plan in mind - not just there's an acre of cheap land, let's put a gas station on it. The local, county, and state government agencies must take their directions from the people who live in the area - not arbitrarily make rules that are ridiculous and expensive to follow. To get the people involved seems to be the plan of the Okanogan County Planning and Development department which is the first step in the right direction.

Sincerely,



Connie, Mike, and Matthew Murry
Post Office Box 575
Snohomish, Washington 98291

rcd. 2.8.95

Memo

Feb 6, 1995

To: Sandra Strieby
Chris Bettman
From: John Sunderland
re: River Corridor Plan

Sandra and Chris:

Please excuse the fact that my comments are a few days overdue; I've been busy and haven't had time to get to them.

My comments are of a general nature — in the manner more of guiding principles. They are as follows:

(1) As I said at our meeting, our definition of the Methow River Corridor must be reasonable and defensible. In this regard I believe we should focus on the 100 year flood plain, with the primary goal of keeping any additional structures from being built there. I believe this is a prudent choice for these reasons:

(1) The prohibition of building dwelling units in the flood plain in the Methow Review District is of long standing. Addressing the "future of existing platted lots in the floodplain" is really not an issue in the MRD; if owners have not proven by requisite survey that they are "up and out" and vested their rights by filing an application for a building permit, they have no compliant

no prohibition currently exists below Carlton, development pressures there are not such that a great deal of resistance should be expected to bringing the rules there in line with the upriver regulations.

(2) The mapping of the "River Corridor", if defined as the 100 year floodplain, has already been done by FEMA. This both

(1) Saves costs of mapping and
(2) provides scientifically based boundaries.

The lone problem with this approach is, that despite the "scientific" nature of the flood plain studies, they are fairly obviously wrong in a number of places. How to rectify this problem I'm not exactly sure.

(2) It should be made abundantly clear in the Vision Statement and any statement of goals and objectives that one of the primary purposes of a River Corridor Plan is to preserve and protect riparian vegetation and wildlife habitat. The tendency of some is to think simply in terms of infrastructure protection at the expense of other values.

(3) The plan should not be unduly limited by the [illegible]

long term perspective should be adopted.

④ A brief editorial comment – I think your ~~statement~~ of goals and objectives represents a good start, but the vision ~~statement~~ needs a lot more development. A vision ~~statement~~ is just that – a ~~vision~~ of trees, plants, birds and fish – of clean, clear, drinkable water – of open space uncluttered by human construction – of safe and flood protected infrastructure – of erosion-free river banks – of restored riparian habitat – of model planning and regulation envied by other localities. Give a little life to the vision –

Anyway, thank you for the opportunity to comment. Please contact me if you have any questions.

Sincerely,

John Sundelson

3. Survey methodology and responses

This section describes the process used in developing and conducting the River Corridor survey, and summarizes survey results. The survey was recommended by the Technical Advisory Committee as a way of increasing citizen participation. A copy of the survey appears at the end of the section.

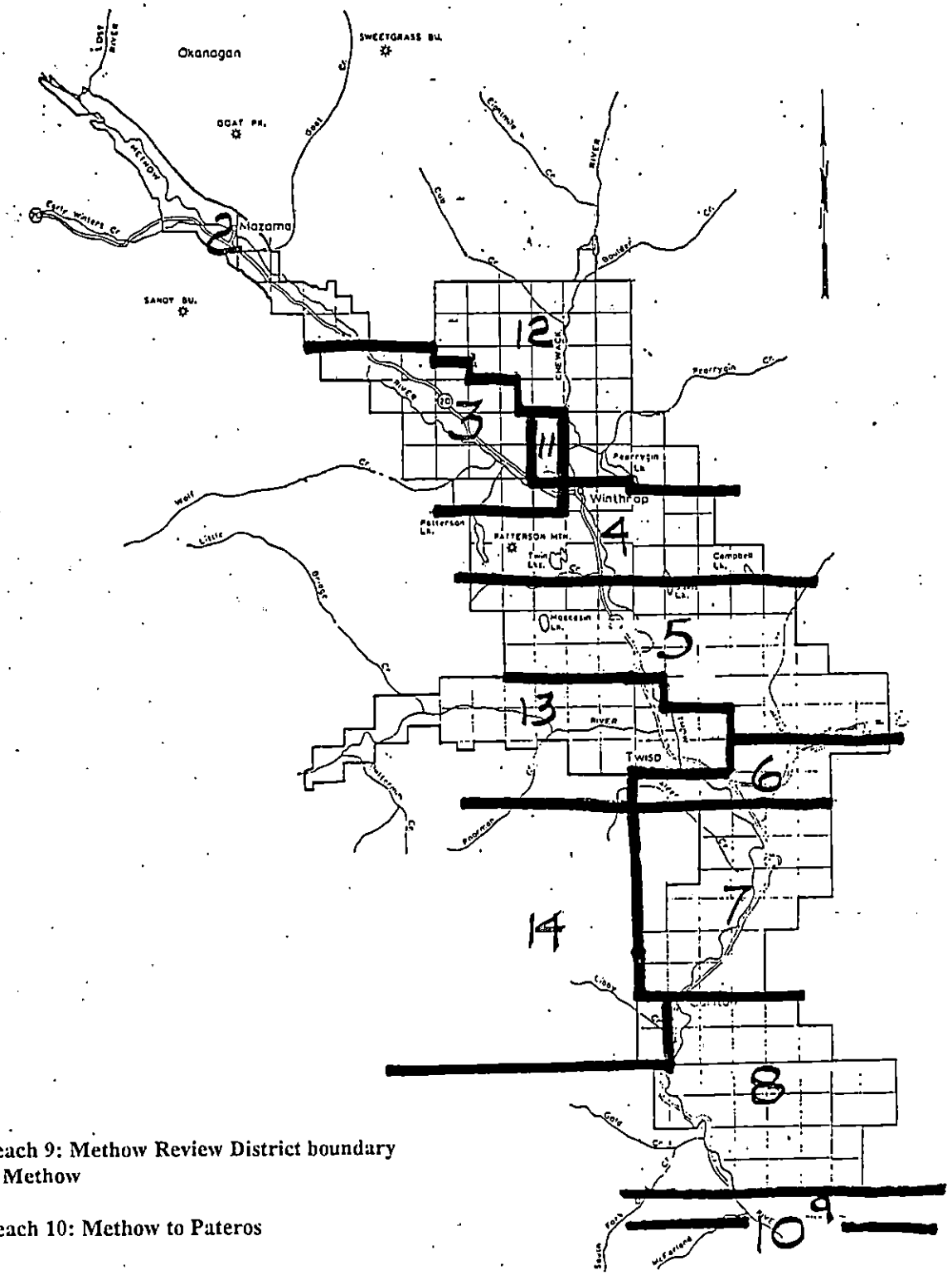
Survey methodology

Surveys were sent to all private (non-agency) owners of land in the Methow River basin. Because physical conditions, land use, and the needs and goals of landowners vary from one part of the basin to another, surveys were color coded so that responses could be sorted by river reach. Thirteen river reaches were delineated, nine within the Methow Review District and four in the Minimum Requirement District (see Figure D.3.1). The reaches within the Methow Review District were delineated in part based on the planning sub-unit boundaries established in the Methow Valley Plan. The thirteen reaches are as follows:

1. North of the Weeman Bridge (sub-unit A)
2. Between the Weeman Bridge and Winthrop (sub-unit A)
3. Between Winthrop and Twisp, in sub-unit B
4. Between Winthrop and Twisp, in sub-unit C
5. Between Twisp and Carlton, in sub-unit C
6. Between Twisp and Carlton, in sub-unit D
7. Between Carlton and Methow, in sub-unit D
8. Between Carlton and Methow, in the minimum requirement district
9. From Methow to Pateros
10. The portion of the Chewuch River drainage in sub-unit A
11. The portion of the Chewuch River drainage in sub-unit B
12. The Twisp River drainage (sub-unit C)
13. The Libby Creek drainage(sub-unit D)

The initial list of landowners was compiled using the Okanogan County Office of Planning and Development's geographic information system; it included approximately 5,571 names. After sorting for errors and duplications, a final list of 4,858 property owners was compiled. The following table shows the number of surveys sent and the number of responses received from each river reach. The survey was drafted by County staff and included a brief overview of the corridor planning project.

Figure D.3.1
Survey Reaches



Reach 9: Methow Review District boundary to Methow

Reach 10: Methow to Pateros

Survey Statistics

Area	Owners	Responses	River Reach	Sub-unit	Color
1	878	187	Weeman Bridge north	Sub-unit A	Cream
2	245	79	Weeman Bridge to Winthrop	Sub-unit A	Ivory
3	838	182	Winthrop to Twisp	Sub-unit B	Peach
4	396	77	Winthrop to Twisp	Sub-unit C	Tan
5	400	51	Twisp to Carlton	Sub-unit C	Orchid
6	333	50	Twisp to Carlton	Sub-unit D	Aqua
7	179	27	Carlton to Methow	Sub-unit D	Pink
8	139	26	Carlton to Methow	(Min. Rqt. Dist.)	Red
9	387	47	Methow to Pateros	(Min. Rqt. Dist.)	Blue
10	58	21	Chewuch	Sub-unit A	Yellow
11	396	90	Chewuch	Sub-unit B	Green
12	556	108	Twisp River	Sub-unit C	Gold
13	53	14	Libby Creek	Sub-unit D	White
Not specified		12			
Total	4858	971			

Summary of survey results

Question 1: Is your property located in the valley or up on the slopes?

Area	Owners	Responses	Valley	Slopes
1	878	187	121	62
2	245	79	57	20
3	838	182	94	80
4	396	77	34	40
5	400	51	41	9
6	333	50	30	17
7	179	27	16	4
8	139	26	16	9
9	387	47	30	13
10	58	21	66	39
11	396	90	48	39
12	556	108	11	9
13	53	14	2	11
Total	4858	959	566	352

Question 2: Is your property within 200 feet of any creek or river?

Area	Owners	Responses	Within 200 ft.
1	878	187	83
2	245	79	38
3	838	182	57
4	396	77	24
5	400	51	24
6	333	50	29
7	179	27	18
8	139	26	16
9	387	47	27
10	58	108	60
11	396	90	50
12	556	21	11
13	53	14	8
Total	4858	959	445

Question 3: Are you a year-round resident of the Methow Valley?

Area	Owners	Responses	Year-round
1	878	187	42
2	245	79	38
3	838	182	69
4	396	77	12
5	400	51	15
6	333	50	29
7	179	27	28
8	139	26	24
9	387	47	28
10	58	108	48
11	396	90	22
12	556	21	24
13	53	14	7
Total	4858	959	386

Question 7: Please indicate how you use the river corridor. Check all that apply.

Area	Responses	A	B	C	D	E	F	G	H	I	J	K	L	M
1	187	71	100	83	92	22	24	114	6	9	4	5	19	28
2	79	40	50	35	43	7	8	60	2	18	11	0	7	4
3	182	69	98	76	101	42	27	123	10	48	4	3	17	14
4	77	35	55	36	45	17	16	58	2	18	6	2	2	6
5	51	19	28	27	36	23	9	30	3	16	7	0	1	5
6	50	20	26	18	27	12	6	32	0	14	2	0	3	4
7	27	13	17	13	18	10	5	18	3	13	4	0	1	2
8	26	4	10	3	13	5	1	12	0	9	5	0	4	3
9	47	15	20	13	28	22	5	31	2	22	7	2	1	7
10	108	33	68	59	70	44	16	75	2	32	13	1	4	9
11	90	28	54	39	51	19	13	61	2	12	3	1	6	9
12	21	9	16	12	13	8	3	16	0	3	1	0	0	1
13	14	9	7	7	10	3	1	9	1	5	1	0	0	3
Total	959	365	549	421	547	234	134	639	33	219	68	14	65	95

Legend

Letter	Activity	Letter	Activity
A	Rafting, boating, kayaking	H	Water skiing
B	Bird-watching, wildlife observation	I	Irrigation
C	Camping	J	Stock watering
D	Fishing	K	Water-related business
E	Hunting	L	No use of river corridor
F	Educational uses	M	Other uses
G	Aesthetic appreciation		

Question 8: What uses do you think belong on or near the rivers and creeks in the Methow basin? Check all that apply.

Area	Responses	A	B	C	D	E	F	G	H
1	187	155	135	93	137	59	112	49	76
2	79	60	60	46	58	24	55	15	30
3	182	131	117	97	138	53	109	40	55
4	77	59	52	34	65	24	43	19	26
5	51	36	27	24	38	15	34	10	13
6	50	28	19	16	34	6	18	8	12
7	27	12	8	5	14	3	8	4	8
8	26	16	9	8	18	5	14	1	7
9	47	21	14	12	19	7	13	10	13
10	108	78	53	51	84	28	56	22	27
11	90	66	59	39	72	19	49	16	25
12	21	18	9	12	19	10	16	2	6
13	14	9	5	7	11	2	7	3	3
	959	689	567	444	707	255	534	199	301

Area	Responses	I	J	K	L	M	N	O	Q
1	187	100	37	28	27	2	1	5	5
2	79	41	13	12	6	3	3	5	10
3	182	88	18	20	15	2	4	10	15
4	77	36	12	10	10	1	2	2	2
5	51	21	5	9	4	0	4	2	4
6	50	26	4	4	4	1	3	6	1
7	27	18	0	1	4	0	1	4	1
8	26	19	0	1	4	1	1	0	2
9	47	29	6	4	7	0	1	7	4
10	108	66	8	11	6	1	6	3	1
11	90	55	11	13	9	2	4	3	5
12	21	11	0	0	0	0	0	0	0
13	14	6	1	1	2	1	2	2	0
	959	516	115	114	98	14	32	49	50

Legend (question 8)

Letter	Activity	Letter	Activity
A	Trails	I	Single-family residences
B	Passive recreation	J	Condominiums
C	Parks, active recreation	K	Multi-family residences
D	Natural/wildlife areas	L	Commercial uses
E	Interpretive centers	M	Industrial uses
F	Viewpoints	N	Mining
G	Hotels, motels	O	All uses
H	Inns and bed-&-breakfasts	Q	Other uses

Question 9: Do you agree with the statement "The Methow River is a scenic resource and should be preserved in a natural state for future generations to enjoy"?

Area	Owners	Responses	Agree	Disagree	No opinion
1	878	187	142	25	7
2	245	79	61	10	5
3	838	182	130	23	7
4	396	77	61	9	1
5	400	51	34	10	3
6	333	50	32	9	3
7	179	27	18	7	1
8	139	26	13	8	4
9	387	47	25	15	3
10	58	108	87	12	3
11	396	90	70	11	2
12	556	21	18	1	0
13	53	14	12	1	0
Total	4858	959	703	141	39

Question 10: Should those structures currently in flood-prone areas be allowed to remain?

All respondents

Area	Responses	Yes	No	No opinion
1	187	127	21	28
2	79	58	9	6
3	182	129	26	18
4	77	52	10	12
5	51	35	8	82
6	50	31	11	6
7	27	24	1	0
8	26	17	2	6
9	47	36	7	1
10	108	79	15	10
11	90	69	9	8
12	21	13	5	1
13	14	9	1	2
Total	959	679	125	180

Respondents within 200 feet

Area	Yes	No	No opinion
1	65	2	10
2	30	2	3
3	44	7	3
4	18	3	3
5	19	2	3
6	22	5	2
7	15	1	0
8	10	1	5
9	20	6	0
10	45	7	6
11	43	2	5
12	8	2	0
13	6	0	2
Total	345	40	42

If you answered "Yes", what kinds of structures do you think should be allowed to remain?

All respondents

Area	Responses	Residences	Non-residential structures	Both
1	187	14	9	97
2	79	3	4	49
3	182	11	9	106
4	77	1	4	45
5	51	3	1	29
6	50	2	1	27
7	27	1	0	23
8	26	1	0	16
9	47	0	3	32
10	108	6	4	66
11	90	9	5	53
12	21	1	1	9
13	14	1	1	7
Total	959	53	42	559

Respondents within 200 feet

Area	Residences	Non-residential structures	Both
1	8	5	50
2	2	1	27
3	2	4	36
4	0	0	12
5	2	1	14
6	2	1	19
7	0	0	15
8	1	0	9
9	0	1	18
10	3	1	40
11	4	3	34
12	0	0	7
13	1	0	5
Total	25	17	286

Question 11: Should building of new structures be allowed in flood-prone areas?

All respondents

Area	Responses	Yes	No	No opinion
1	187	43	108	24
2	79	20	47	4
3	182	37	125	8
4	77	17	49	6
5	51	13	35	3
6	50	9	30	6
7	27	10	11	1
8	26	6	14	4
9	47	16	21	8
10	108	29	62	10
11	90	22	58	6
12	21	1	16	0
13	14	1	10	2
Total	959	224	586	82

Respondents within 200 feet

Area	Yes	No	No opinion
1	27	42	9
2	10	22	2
3	19	32	1
4	8	13	2
5	5	17	2
6	7	15	4
7	8	7	0
8	3	11	1
9	8	13	5
10	20	28	8
11	17	28	3
12	1	8	0
13	1	7	0
Total	134	243	37

If you answered "Yes", what kinds of structures do you think should be allowed?

All respondents

Area	Responses	Residences	Non-residential structures	Both
1	187	10	1	21
2	79	0	2	15
3	182	3	6	28
4	77	0	2	15
5	51	2	2	9
6	50	2	0	7
7	27	0	0	8
8	26	1	2	3
9	47	0	1	13
10	108	1	2	25
11	90	3	2	16
12	21	1	0	0
13	14	0	0	1
Total	959	23	20	161

Respondents within 200 feet

Area	Residences	Non-residential structures	Both
1	0	4	14
2	0	0	9
3	5	1	13
4	1	0	7
5	2	1	2
6	0	2	5
7	0	0	6
8	2	0	1
9	0	0	7
10	0	1	18
11	2	1	13
12	0	1	0
13	0	0	1
Total	12	11	96

Question 12: Please tell us what you think: How would you like to see the land along rivers and creeks in the Methow basin used? What should be done to protect land, people, and structures in the basin from flood damage?

Responses include the following:

- 1) Quality development should be allowed; 2) Industrial development near rivers shouldn't be allowed; 3) Clean and safe commercial development should be allowed.
- 20 year floods-dikes; 50 year flood-nothing; 100 year floods - nothing.
- 200 ft. back from centerline of waterway it should be left natural.
- 5 acres or more only, no smaller lots; should set back from river at least 100-200 feet.
- A 100 year floodplain should be established and no building allowed in this area, those who are presently in the floodplain should be required to carry flood insurance.
- A balance of economic and aesthetic uses.
- A mixture of residential structures and access with natural park areas.
- A planned multi-use scenario is feasible. Growth cannot be controlled in a democratic society, it can be properly managed.
- A River Walk through Winthrop.
- Access consistent with the development of the recreation/tourism economy in the valley, enhancement of the trail system.
- Access in a non-intrusive manner. Hiking, painting, gentle.
- Accessible to everyone.
- Agricultural use if stock are kept out of stream.
- All flood-prone areas should be left natural and undisturbed except for trails. Existing zoning regulations should be strictly enforced if not added to, to insure a minimum density along the river corridor.
- Allow access to it all by all.
- Allow all taxpayers to determine the use of their private property. Read the 5th amendment of the Constitution of America.
- Allow anyone to waive damages from floods and accept the risk of flooding. There is lots of floodplain in the Methow which would discourage building.
- Allow homeowners to reinforce banks and weak spots along the banks and have the forest service remove log jams in the river beds to enable easier flow. The Planning Commission needs to work with individuals better.
- Allow no construction within 1000" of river.
- Allow no more agriculture next to water due to pollution runoff from chemicals, fertilizers and animal waste.
- Allow present structures to remain. Change zoning laws to allow no homes in the floodplain only barns and out buildings. No industrial buildings, no bailouts for flood damage.
- Allow sensitive/legal development outside of flood plains. Maintain viable tax base. Provide appropriate sites for public access. Close public access where damaging to water quality. Stock/maintain fishery in Chewuch.
- Any private use that does not interfere with rights.
- Any use compatible with the river's natural functions and movement is fine. Structures close to rivers do nothing but cost us all money for flood control, subsidized flood insurance, etc.

• Any use that does not lower the water quality. A pulp mill should be allowed if the water quality can be maintained, Development is not bad if environmental concerns are mitigated in the process.
• Any way as long as it is kept clean.
• Anyone who builds in flood-prone areas must accept the consequences if it floods. No new building should add to the flood potential. Disturbed land must be replanted.
• As a natural landscape.
• As is, new building should be built on pilings or raised mounds.
• As is, no Government Control, Planning Commission restrictions only.
• As Natural as possible.
• As now. With re: to flood-prone areas—I don't want the taxpayers to foot any of the owner's bills for insurance or disasters as they should be responsible for any damage caused to others by their choice.
• As passively as possible.
• As recreational lands(e.g., parks, trails, boat launches for river rafting, interpretive centers).
• As the owners see fit to use the land with a minimum of government regulation, also have Indian Tribes manage their own lands & not ours.
• As they are now. Stay out! Keep the Okanogan County Planning Department out of the area. Quit trying to take away our property rights for the benefit of the 206 Envirofreaks.
• At time building permit asked for, County should make it clear that building in flood prone areas is at your own risk. There is no government or county liability.
• Awareness. Advice to flood land owners/inhabitants not to build in it.
• Balance between environment and economic advances and job opportunities for people living year round in area. Common sense. Polarized positions as little as possible.
• Balance of uses.
• Be reasonable in requirements and keep from spending federal money.
• Beauty and recreation, residential houses.
• Best economic use without damage to river and shoreline
• Biological Reserves.
• Buffer Zones, runoff at a minimum.
• Build a huge dam at the upper end of the valley to control waters and provide boating.
• Build above the 100 year flood level—flood proofing measures applied (Flow through foundation, etc.). Reasonable setbacks from creeks/rivers.
• Build on high Ground.
• Build on only flood safe areas where river erosion will not danger houses.
• Build parks in flood prone areas, floodwalls for protection.
• Build reservoirs and dams to control the runoff.
• Build structures on stilts or piles.
• Building anti-erosion measures/plant form or other. People who want to build in flood areas should accept full responsibility for their property and hold everyone else harmless.
• Building codes should prevent anyone from building anything within the floodplain and eliminate the up and out loophole.
• Building in floodplain should be stopped and area kept in a natural state as much as possible.
• Building restrictions.

• Buildings in the flood plain should be only allowed at the owner's risk. No government subsidized insurance!
• Buildings raised to above the 100 year floodplain.
• Built wisely for natural conditions.
• Buy Flood Insurance. Not the County's problem.
• Buy flood rights, do nothing in the way of diking/dredging, gravel removal or above waterline in summer. New structures in floodplain only if flood proofed and built above the 100 year floodplain elevation. You will need good flood maps.
• By channeling water through aquifers and culverts, possibly new ponds/small lakes & potholes.
• By the people that live and own it.
• Can't stop all growth, can carefully monitor and control.
• Care and maintenance of the river banks.
• Careful development constraints with recreation and preservation of the "Wild Character" of the Methow Valley.
• Carefully for one, I think it is increasingly important to maintain the purity and integrity of the river. I think any further development along the river should be carefully thought out.
• Case by case basis and limited development in floodplain or prone areas. Does not make sense to build in areas that are subject to flooding.
• Cattle and horses should not be allowed to use the rivers as a barnyard.
• Caveat Emptor! No further restrictions on the rights of land owners. I am willing to assume the risk of property damage in the event of a 100 year flood. Quit trying to protect me.
• Clean and natural picnic areas, no business.
• Clean, established setbacks, clean the river banks up.
• Clear the riverways and debris whenever possible, no further construction along river way.
• Clearly the Methow's future is in recreation. Preservation of the rivers and creeks combined with public and private recreation is important. I do not think we should remove existing structures or stop people from single family cabins/homes development, but at their own risk. People that build in floodplains are responsible for their own errors and the County should not protect them by "controlling" the rivers so that their structures are safe. I would prefer the land along rivers be available for fishing and camping, but again education is needed so that the land is not "overused." No cattle.
• Common sense development not interfering with the natural beauty of the river but do not stagnate the economy by stopping all development on the river basin.
• Common sense in building. Realtors liable for selling floodplain as prime building sites.
• Common sense planning for the long term.
• Common sense planning is all you need.
• Common Sense, do not lock up public access to river.
• Common sense, water quality should be protected in the river.
• Control development along sensitive areas, no clear cutting or environmental degradation to increase flood damage. Keep people and structures out of harm's way.
• County should purchase this land first before controlling it.
• Current management gives broad usage, no further restrictions.
• Curtail logging along creeks, streams and rivers.
• Design flood relief drainage to meadows.
• Design the house like Noah's Ark on a higher foundation so water doesn't hit the 1st floor.

• Enough use now. Protect what is still fairly natural. Keep land parcels to 10+ acres close to water.
• Environmental training center.
• Erosion control.
• Existing building should be allowed, but no enlarging or replacement.
• Existing non-flood-prone sites should be open for recreational and residential development.
• Existing structures are at risk. The river nor the vegetation should be modified to protect the few structures. Floods will occur in time. The best protection is for those who currently reside within the flood zone to relocate.
• Existing structures subject to flooding are the problem of the owner—there should be no public liability.
• Existing uses allowed to remain. Trails on voluntary easement. Not within 100 feet of current open space large parcels.
• Existing uses should be allowed to continue—new uses relative to river flooding problems and flood plains subject to permits by planning and building department.
• Farming/Wildlife first/recreation.
• Farms built this country. Leave them be.
• Feed deer, birds, eagles other wildlife, reserves.
• Five acre lot size with allowance for a second guest house, not 10 acre minimum. Allow for public access, tradeoff for density in PUD.
• Five acres or more required for any single family residences.
• Flood is nature's way—make no changes.
• Flooding is a natural phenomena. People/structures located in flood prone areas are there at their own risk. Dollars spent on flood control should be directed at land erosion only.
• Floodplain building standards and restrictions should be enforced. Shoreline building restrictions should be enforced. Simplified version of regulations clarifying regulations to Realtors and building contractors.
• Floodplain property should be used for recreation, not permanent dwellings. Only homes that have been there for lots of years should be allowed to remain.
• Floodplain standards and restrictions should be enforced. Simplified version of regulations.
• Floodplain/river channel areas are to be kept natural/undeveloped. Maintain existing building setbacks from floodplain. Develop a mall system and public right of ways in flood plain areas.
• Floods happen.
• For recreation only.
• For the benefit of all residents.
• For the enjoyment of all, now and forever.
• For the enjoyment of all. Hold down the commercialism.
• For trails and scenic enjoyment. Access should be allowed.
• For whatever the landowner wants.
• From existing natural flooding...nothing. From future building...proper drainage. Planning is easy and does not have to be expensive.
• Full potential of commercial use only.
• Get livestock out of river.
• Get out of the way! I love a good flood! Good for local economy later to rebuild.
• Getting enough use now.

• Give them the facts—don't issue building permits in critical areas—then let owners and insurers make their own decision.
• Grandfather existing structures—no more.
• Grazing, orchards at present density—no more
• Greater setbacks on housing, do not allow platting of flood prone areas, do not dike or otherwise subsidize housing built where floods will remove them.
• Greenbelt available to public with little or no buildup (e.g., interpretive center, trails, etc.) scattered all over but maybe just a few designated areas.
• Greenstrip/side creeks additional setbacks.
• Guess we do not know enough about the issue. Seems like if people want to build on their land they should be allowed to. If the rivers flood and take away the structure, it is the owner's loss.
• Have the owner insure their own property—no Federal or State funds.
• How about some BASIC education for those who do not believe in the power and destruction of nature.
• Human access should be secondary to natural flora and fauna.
• I agree that the Methow is a scenic river but only to the point that it does not conflict with my right to build.
• I believe if you own land and pay taxes on it you should be able to manage it and do whatever you want as long as it doesn't affect your neighbor!
• I believe that there must be some regulations about development. I also am afraid of the government making so many regulations that it infringes on my rights as a landowner.
• I didn't think the Methow flooded.
• I don't know.
• I feel that we should protect and use these lands with respect and preserve one of the prettiest places in the state.
• I find no fault with the present use patterns.
• I have lived on lakes and streams most all my life and in every case seen the natural beauty, the wild life, and the quality of life give way to oversaturation...But steps can be taken as areas develop to retain as much as possible the scenic beauty & wildlife of the valley. Plant trees, keep natural vegetation for buffer zones...work with owners, they pay taxes and have rights too, and maybe we can keep what we have in this valley for as long as possible.
• I have no information on this problem.
• I oppose new laws that affect private property rights, unless they compensate private property owners for new laws.
• I support the Winthrop "River Walk" project.
• I think a solid comprehensive plan would be a good start.
• I think low floodplain areas are perfect natural areas for wildlife & not for human habitation. High bank is O.K. Current regulations on 1 foot up from flood is buildable is ridiculous. I have seen whole new channels cut through the forest in Mazama.
• I think that is adequately taken care of with our present building and zoning codes!
• I think the basin areas should be preserved as open lands. Coming from an area where open lands have been destroyed I feel it should be our #1 goal.
• I think the land along the rivers and creeks should be impacted as little as possible. No buildings, septic tanks, drainfields allowed within the floodplain, natural riverbanks, keep cattle fenced away.

• I think the Methow River can be preserved as a scenic resource yet allowing some development along its shore.
• I think this questionnaire is vague. A map outlining areas of concern or at least a definition or setback should be included. Are we talking above 200' from river, 200 yds?
• I was there in 1948, I do not think there is any danger.
• I would like to see all measures taken to re-establish the salmon runs of old.
• I would like to see bike trail access and fishing trail access. All river front should be open to public. Domestic animals (cattle, etc.) should not be allowed w/in one or two hundred feet of the waterfront; same goes for logging of trees close to creeks or rivers.
• I would like to see it "used" as habitat and for prevention of soil erosion. There might be the occasional campground (small) as at Falls Creek or an observation platform/bridge. To control floods and preserve water quality, farming and grazing shouldn't be allowed on the flood plain.
• I would like to see it be allowed to be used without continued restriction by governing bodies who think they know what's good for me. I want governing bodies stopped from forcing me to pay for things like the water quality program which was forced upon us by officials without consent from us. My property is on Lost River, if I want to remodel or expand I want to be able to do so. A person works all their life to someday be able to afford to do things then someone is always telling them they can't or restricting them. I have heard that some owners can't utilize their lots up there now because they can no longer get septic permits, that's wrong and ridiculous.
• I would like to see it preserved in as natural state as possible.
• I would like to see the land left as natural as possible.
• I would like to see the Merrill project encouraged to move along as well as John Hayes' plans to develop trails and planned projects to develop the valley in a thoughtful manner.
• I would like to see the valley used as a multi-use area. There seems to be enough area to allow for recreational development and protection. Development and preservation can co-exist with compromises on both sides.
• I would like to see the waterways remain as natural as possible.
• I would prohibit significant structures (barns, homes) in flood plain. Areas must be identified—homes, etc., already in the flood plain should be advised of their risk.
• I'd consult with a trained environmental expert.
• I'm not sure what the options are.
• If a person wants to build in floodplain then that is their personal risk.
• If people choose to have structures in a floodplain it is their own fault if damaged by flooding.
• If people own the property and want to live along the river they should be able to do so.
• If people want to build in an area, that they own, in a flood area, so be it. When they are flooded, I would not expect any financial help other than clean up.
• If the river is protected from abuse...the people will be safe from the river!
• If there is a problem the public should mitigate existing conditions and new development shall mitigate those impacts either on site or off site in the same basin.
• If you build in the floodplain, you should be responsible for the consequences.
• Ignore any resource council input/wise use input, these people are evil and violent.
• In a manner that promotes a healthy environment for plants, wildlife and people. A strong environmental ethic should guide all decisions regarding river corridors.
• In all capacities as noted above, which is possible.

• In my local area the problem as I see it is visible from State Highway 20. In certain areas, the river banks need to be raised to protect the land, people and structures.
• In the Mazama area the local taxpayer should have control of how the land is used.
• In Winthrop, a trail boardwalk along the river.
• Increase minimum acreage to preserve rural setting. Do not allow PUD.
• Increase Riparian Zones.
• Insist that all owners buy Flood Insurance.
• Intensive land use and development within riparian corridors should be prohibited, passive recreation and non vehicular access should be encouraged and required.
• It's unlikely it will flood.
• It is their problem, disallow future building in floodplain areas.
• It should be used as the property owner wishes, as long as they do not pollute the river.
• It would be nice to have a few more public access points for float boats and canoes and kayaks.
• Just the same as they are today. Make no changes.
• Just the way it is now.
• Keep Army Engineers out.
• Keep as is, no permanent structures in floodplain.
• Keep as much as possible debris from building up.
• Keep as natural as possible.
• Keep cows away from shoreline, maintain water allocation for in stream flow uses.
• Keep government out of private property.
• Keep homes out of the floodplain. Restore upland tributary ecology. Restore the river course—remove riprap, put back woody debris; restore forests so they retain water; take out erosion points; get stock out of the creeks. Remove some roads and replant vegetation.
• Keep in natural state.
• Keep natural, zoned against large scale development. Thanks!
• Keep out structures.
• Keep people and structures away from the rivers/creeks. Have one area every 10 to 15 miles for developing a place for people to use or enjoy.
• Keep structures out of flood prone areas.
• Keep the channel clear of debris.
• Keeping people and structures out of harm's way is the best insurance.
• Kept as close as natural as possible to provide good habitat.
• Kept as natural as possible.
• Kept in a natural state except for flood control, creeks improved for fish.
• Kept in its natural state and as much as possible no large developments that would have an impact on the quality of rivers and creeks.
• Kept in its natural state. No trails or commercial development.
• Kept in natural state.
• Large buffer zones, low density strict enforcement of pollution and dumping laws.
• Laws need to state land use decisions.
• Leave a wide (500') riparian corridor on either side of the stream as natural as possible, thus increasing water quality and controlling water quantity and providing wildlife protection.
• Leave as is, wild and beautiful.
• Leave as is.

- Leave it as is, it's been that way for ever.
- Leave it in its natural state.
- Leave it natural except for trails.
- Leave it open for all people to use.
- Leave natural.
- Leave some as natural areas, develop some for commercial and residential use.
- Leave the river natural, you live or build on the river you take your chances, just as those who build in the forest face fire danger.
- Leave wetlands alone, do not fill in.
- Left alone as they are. Keep government out of private land use.
- Left alone for the wildlife.
- Left in a natural state.
- Left natural as possible. Not exploited for financial gain.. The land is to be respected.
- Left natural to provide wildlife corridor, preserving riparian vegetation and maintaining ecological balance.
- Left to the people who already live on them.
- Let others join in the joy of living near the river also.
- Let people build, but only at their own risk.
- Let private owners protect their respective property.
- Let the people make their own decisions if they wish to build where they will get flooded!
- Let the people that own it protect it.
- Let the property owner decide.
- Let the river run as naturally as possible.
- Limit development along the river as much as possible.
- Limit development near the floodplain.
- Limit development only to preserve water quality and current Environment.
- Limit development.
- Limited and regulated development by private sector: 1) motels, hotels and resorts; 2) private single family (with acreage minimum).
- Limited commercial use/Accessible to all.
- Limited development for human usage, maintain and or create developed wildlife areas.
- Limited development in floodplain.
- Limited residential/large % left for public use.
- Line the banks in flood areas with quarry rock to prevent wash outs.
- Listen to the people in the Methow basin and do what is good for them as well as the County.
- Livestock and commercial access restricted/development allowed if compliance with land use plan is carefully followed.
- Livestock out of river, no surface diversions for irrigation.
- Low impact use, no stock watering, no farm runoff, no motorized boats.
- Low profile residential, lots of public access—no pollution of any type.
- Mainly for natural habitat & activities that would not jeopardize animals and plants.
- Maintain a high scenic fishing priority. Upper Methow is truly pristine. Protect this with very strict limit to development. Cluster development in towns, not spread out. Large parcel residential zoning and strict limits to commercial development.
- Maintain a natural environment.

• Maintain the scenic resource, everyone gets value from it.
• Maintain the value of flora and fauna.
• Maintain vegetation and soils for water re-charge areas.
• Maintained as naturally as possible to maintain fish and wildlife.
• Maintenance of sustainability or no diversity.
• Manage as riparian reserves. Get tough on building in the floodplain, require on site inspections in this area. Do not rely on FEMA Mapping in this area.
• Maybe rock banks 10-12 feet high in flood plain areas.
• Minimum amount, no more than done now.
• Mixed use, agricultural, residential, resorts, minimum 100' setback.
• Mixed use—recreational/residential as long as ecology is maintained with safeguards.
• Mixture of residential and recreational uses.
• Moratorium on further building in the floodplain areas. Should not penalize people who have already built.
• More stringent rules regarding future construction.
• Mostly for recreation or dwellings if they are not in the flood plain.
• Move everything back from flood danger.
• Much as in the past.
• Much as they are now except: 1) keep cattle out of the river; 2) close all "unofficial" camp sites; 3) shape up Forest Service logging contracts to truly protect streams.
• Multi-purpose, leave some areas pristine.
• Natural Area, building should be severely limited in river corridor, also the watering of animals (cattle) in river corridor.
• Natural cycles should not be altered, i.e. no drainage, dikes, dams. Let the owners assume the risks. The corridor is special and unique and rare. Let commerce build on support of these values.
• Natural scenic recreation; wildlife habitat; "public" accessible areas to enjoy.
• Natural state for future enjoyment.
• Natural state.
• Natural use for all not just the rich ones.
• Natural wildlife area, hunting, fishing, camping.
• Natural wildlife, passive recreation.
• Nature will do what she wants to. Humans have only so much control. This Earth was meant to be used with common sense.
• New development should be constructed to have a low impact upon the valley with respect to the river. People should have flood insurance.
• No building in flood prone areas.
• No building in floodplain.
• No building in the floodplain areas.
• No building in the floodplain.
• No building in the floodplain. Good place for trails
• No building.
• No clear cutting of trees—if construction is necessary then limited trees should be cut to preserve as much natural appearance as possible.
• No clear-cut of forests; no building in flood plains.

• No commercial building, low density residential only off the floodplain, natural and agricultural interspersed on floodplain.
• No construction in floodplain areas.
• No cutting of trees within 100' of either side of stream to protect water quality and prevent, slow erosion. We strongly oppose golf courses near streams. Streams are very important to wildlife habitat. Only trails should be near them.
• No development in flood prone areas, no alteration in the natural flow of the river.
• No development in flood-prone areas.
• No development of permanent structures in flood prone areas will protect people and structures/the land is shaped by seasonal flooding, do not interfere with the natural order.
• No dikes or man made channels please. Prevent or severely limit new construction in flood prone areas. Those that have already built in flood zones deserve no special protection.
• No further activity of building.
• No further building in flood-prone areas.
• No further building.
• No further construction in floodplain.
• No government involvement
• No heavy industrial use.
• No intrusive pathways.
• No levees, dikes or rechanneling. Prohibit any building except fencing in flood plains. If current building is destroyed by flood, prohibit rebuilding in that area.
• No new building in the floodplain.
• No new structures in floodplain.
• No new structures, those that were built should have been built according to flood codes and be prepared for the river to reclaim its rightful place.
• No River Walk—pollution, trash and the sites will be used as party sites for the local kids.
• Non-intrusive recreation—little or no removal of natural vegetation within the 100-year floodplain. No roads. Limited livestock use. It is a beautiful river and one of the few remaining like it in the country.
• None or very little in critical places only.
• None, let nature take its course.
• Not allow new structures.
• Not qualified to answer.
• Not to build on them.
• Nothing—and no tax-paid compensation for the fools who build there.
• Nothing—build rock banks.
• Nothing—their risk—let nature alone!
• Nothing—they chose to build and live in flood area.
• Nothing—we should discontinue granting permits to build in flood areas, and people already there should take responsibility for damage.
• Nothing at government expense, people should insure themselves and be responsible for their own property.
• Nothing except a good helicopter service for evacuation services. Flooding is an assumed risk, restrictions are not needed.

• Nothing should be done, at least in our area, leave it as is. If restrictions are to be placed they should be applied to new or future owners. Existing property owners should be allowed to utilize their property through grandfathered rights.
• Nothing whatsoever—if a man wants to be a damned fool and build a house in a floodplain, what business is it of yours?
• Nothing! Just leave the river alone!
• Nothing! Preventing floods is like preventing sunrise. It's like building in tornado alley or on the San Andreas fault. Land owners know the risk and there should be *no* government bail-out.
• Nothing! We could not get any help for our property and have donated plenty so far!
• Nothing, assure that adequate sewer systems are used and will not be affected by high water.
• Nothing, but let's ask this—How much flood damage to private individuals' property has been assessed against Okanogan County in the past 20 years? I would venture to guess 0.00.
• Nothing, except provide information about the risk and enforce current building setbacks. Eliminate public subsidized flood insurance, let property owners bear the risks of imprudent development.
• Nothing, except to not allow building in floodplain. Every so often mother nature reminds us where we can build and where we can't.
• Nothing, except to not allow residences on floodplain and no recompense for any other losses to floods.
• Nothing, floods are part of the natural processes. Do not protect people from themselves, they chose to live in the flood plain.
• Nothing, I do not mind utilization of the floodplain, but let them do it at their own risk, no government help on guarantees.
• Nothing, if structures are damaged they should not be re-built, require that septic systems be safe from high water.
• Nothing, it is a natural event to flood occasionally. People have to understand natural events such as flooding.
• Nothing, people know the dangers of building or living next to a river that has a history of flooding. That is the chance they take. Let them buy insurance.
• Nothing, protection for the bridges and potential river route changes only.
• Nothing, they settled there, they take their chances.
• Nothing.
• Nothing. Building in the floodplain is a risk and responsibility of the owner.
• Nothing. Do not allow any more structures. Maybe grazing or pastures.
• Nothing. If they build there it's their problem. When was the last time the river flooded? What was the damage? Is this a big deal?
• Nothing. Let the river be as nature controls it.
• Nothing. People accept these risks when building. Government should not invest $ here except to inhibit new structures going into floodplain.
• Nothing. Quite a bit of work was done after 1948 flood. Allow only if critical and then use riprap (large rocks).
• Nothing. Why do you feel you have to protect us? If one wants to take the risk they should be allowed to build on their property.
• On a sensible case by case basis.

• Once again, if someone does something stupid—they alone should live with the results, I despise the welfare state—No bailouts.
• Ongoing inspection and maintenance of existing dikes and new dikes where needed. (Corps of Eng.)
• Only things that can be flooded occasionally or easily moved without being damaged should be permitted.
• Open as much as possible so all can enjoy.
• Open public space for recreation.
• Owner occupied not rentals on the property. No commercial, minimum 5 acre lots.
• Pass zoning laws to protect the use of those areas.
• People need to understand we all need to give a little to gain a lot when it comes to the beauty of the Methow Valley. It's our greatest resource.
• People should be able to build on their land as long as the water quality of creeks and rivers is protected, by not allowing septic systems too close to rivers and creeks.
• People should be able to use their own land. Public lands should allow access.
• People should be informed and then held responsible for their own decisions.
• People who own property on the rivers should be able to build if so desired. The County should begin to acquire property for public access.
• Present public access should be maintained. Private citizens should be allowed to use their property as they choose with all necessary restrictions to protect the quality of the streams.
• Preservation of existing natural areas.
• Preservation of the Methow river in as pristine a condition as possible should be the utmost concern—clean, clear with adequate flow for fisheries.
• Preserved and protected
• Preserved and protected for the enjoyment of wildlife and natural beauty.
• Preserved as a greenbelt refuge area for birds, access for the public
• Preserved as much as possible in its natural state. New structures should be limited to SFD.
• Preserved as natural as possible.
• Preserved as open lands.
• Preserved for natural beauty, limited residential use, limited recreational use.
• Preserved for SFD, farming, recreation.
• Preserved for wildlife and passive recreation.
• Preserved in a natural state.
• Preserved in its most natural state. No more commercial or tourism buildings permitted.
• Preserved through the use of selective logging and industry.
• Preserving something such as riverfront land areas is taking uses from property owners for the good of everyone. Proper Planning/mixed uses are important, but people should be compensated for takings.
• Prevent clear cutting, over-grazing of land, too many roads.
• Prevent people from building in the floodplain.
• Prevent people from building/living/developing in the floodplain.
• Primary rural and pastoral, with recreational access, agricultural uses should be encouraged.
• Pristine and natural-SFD structures on 5 acres or more.
• Private buy out, commercial, throw them out.
• Private land/private development, public land leave natural.

• Prohibit building on 200' floodplain.
• Prohibit buildings of any kind in the 100-year floodplain—change law so state owns rivers—allowing various uses but get land off the tax/real estate rolls.
• Proper management.
• Property owners' rights should be upheld.
• Property owners should finance their flood protection. Tax moneys are for the protection of the general population.
• Protect land by establishing appropriate setbacks where existing vegetation cannot be cleared and graded. • Increase acreage needed to build homes, require Planned Developments to have waste water treatment systems.
• Protect private property and preserve original platting and permits attached to property at time of original purchase.
• Protected and enhanced.
• Protected and preserved in its natural state.
• Protected with limited access. Public money used to purchase land/ covenants used to prohibit development.
• Protective Roadways along river corridor.
• Public access in certain areas should be allowed.
• Public education of hazard.
• Public property should be multiple use.
• Public, low impact use. Protection of natural areas and wildlife habitat should get highest consideration.
• Question 9 is misleading. All residents of the Methow believe the river should be preserved but this should not be interpreted to mean the river should not also be developed.
• Raise the home, do away the barns and so for no business building at all, keep the rivers clean.
• Raised foundations, some park areas, 5 to 10 acre residential development in certain areas, RV parks.
• Ranching Activities 40 % of Shoreline use, Fly Fishing Mecca Goal for valley.
• Reasonable building regulations, i.e.: stream protection and structures. Proper engineering can address all these issues.
• Recreation—no large developments.
• Recreation and growth should be controlled but not at the expense of Landowners' rights.
• Recreation and natural scenic resource with areas set aside for local people.
• Recreation some residential, more campgrounds.
• Recreational open to all.
• Recreational use from now on.
• Reduce areas of impermeable surfaces and require all new development to deal with their stormwater.
• Regularly organized rituals with singing and offerings to propitiate the storm gods.
• Reinforce banks.
• Remain as is with no business or commercial allowed.
• Remain as natural as possible with trails and access points.
• Remove people and structures.
• Require flood insurance, so that we the public do not have to pay for their destroyed homes, via FEMA, built in a stupid place to build. Do not control the rivers w/dams or bulkheads. They can

sign a consent form whereby the County is not responsible for their building in a dumb location, and that they were warned that it was not a suitable place to build.
• Require structures to withstand flooding or accept responsibility for loss. Not to be able to drain dangerous chemicals into the soil.
• Reserve as much riparian habitat as possible, but all property owners to use their land for residences and farming & allow development along rivers in urban areas—Twisp, Winthrop, Mazama.
• Residential/cluster development. Nature Trails/Easements X-Country Skiing.
• Resorts for all outdoor activity including skiing.
• Resorts, Hotel, Motels, Bed and Breakfast, etc.
• Restrict building in the floodplain.
• Restrict further building in floodplains.
• Restrict up-slope paving. Run off is an issue.
• Retain natural high aesthetic state. This is a strong scenic tourist area. Very little development of roads/parking/paving that yields runoff. The Methow has the cleanest water in the state. Keep it that way.
• Retain pristine nature, no dumping of any kind, camping allowed in designated areas having access for fishing.
• Retain the current uses that are an asset to the area. In the towns, improve the public access and use.
• Rip-Rap and Dikes.
• Rip-rapping in spring.
• Rip/Rap along erosion areas and diking if necessary.
• Rip/rap river to contain banks. Qualified study of water availability and sewer control.
• Rip/Rap river to protect present lands from flooding, recreation, vacationing rafting, fishing.
• Rip/Rap.
• Riparian zones should be left intact.
• Risks should be borne primarily by those who choose to take them.
• River shoring and Rip/Rapping.
• River walks in towns, limited trails and access outside. Generally I like the way it is now.
• Riverfront property should be condemned for the public good.
• Scenic uses—no major business. Recreational—left in natural state as much as possible—preserved for future generations.
• Scenic uses, tubing, picnics, fishing.
• Scenic wildlife reserves, school field trips and education. Photo areas for tourists.
• Sensibly developed with periodic open spaces purchased for parks.
• Several small portage areas-parks.
• Should be left in as pristine state as possible.
• Should be left to nature.
• Should be more public access. Too many "No trespass" signs even for fishing. Public is to be blamed, though, for their "no care" attitude.
• Should be preserved in a natural state as it is now.
• Simple, don't allow human habitation of flood prone areas. Structural controls such as rock rip-rapping etc. should be allowed to minimize erosion to agricultural, forested areas already occupied by homes.

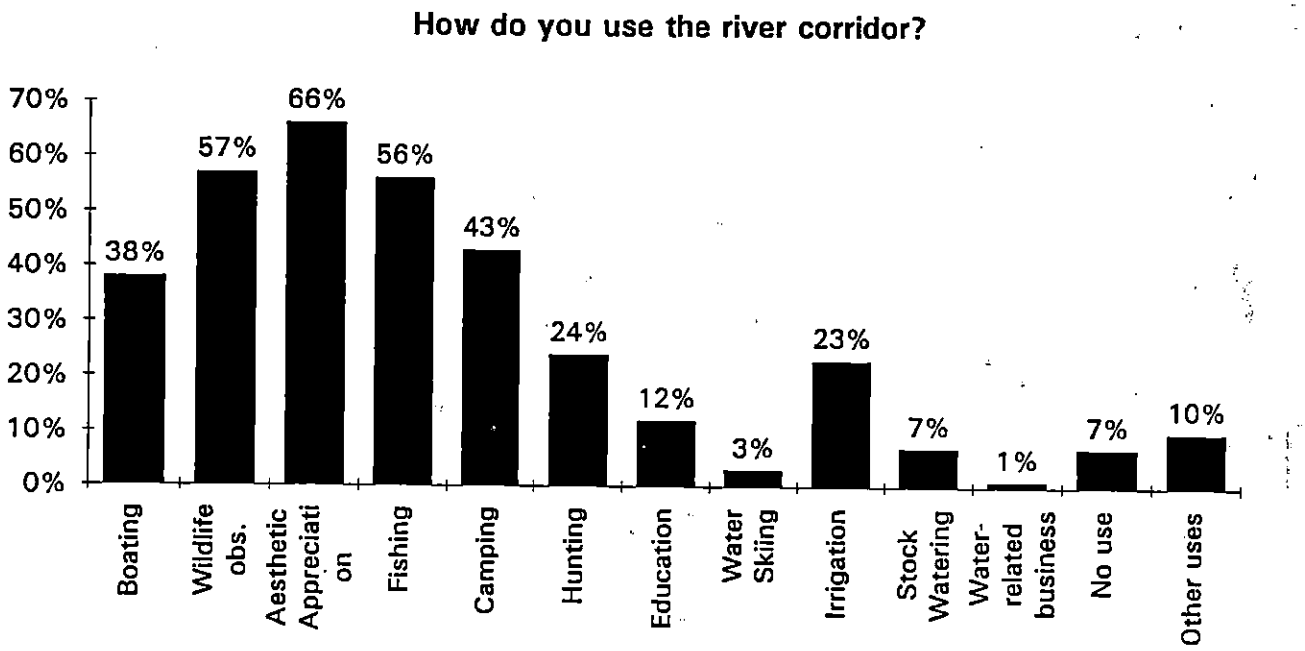
• Single-family development only, get cattle out of the river.
• Some areas retained for public access. Trails wherever possible for passive recreation. Fencing to keep livestock out of the river and away from banks, except for occasional crossing in transportation. Floodplain building standards and restrictions should be enforced. Shoreline building restrictions should be enforced. Simplified version of regulations clarifying regulations to Realtors and building contractors.
• Some bridges(Mazama, Lost River) restrict flow and could be lengthened to widen the channel.
• Some dams to hold and release to cut flood damage of flood crest.
• Some dikes after '48 flood were ill-advised and will cause problems in future floods.
• Some farming, ranching & recreational.
• Some type of flood damage control i.e.: dam
• State and Federal fish habitat.
• Stay off the floodplain with capital investment—did not the Mississippi teach us anything?
• Stay out of historic flood areas and leave the valley alone.
• Stick to floodway restrictions! The recent built or permitted structures I am familiar with between Mazama and Lost River were allowed due to County naïveté or capitulation to bullying, legal threats, etc.
• Stop all construction in floodplain.
• Stop building in the Floodplain.
• Stop clear cutting in the drainage, stop any building or altering of the river course inclusive of bank retention.
• Stop development on Floodplains.
• Strong Growth management regulations, no future residential or business development.
• Structures should not be permitted in flood-prone areas.
• Study situation.
• Swimming Hole might be a good idea.
• Take a look at what the beaver are doing, a lot of flood damage is caused by beaver downed trees.
• Taken care of with our present building and zoning codes!
• The areas along the rivers and creeks should be protected as much as possible. Low impact activities such as hiking, biking and skiing should be promoted.
• The basin should not be altered for flood control of any sort. Flooding is a natural occurrence and should be allowed to flood and ebb at will. Structures should not be accommodated in flood planning.
• The County does not seem to pay attention to its own rules having permitted several new homes right in the floodplain in the upper valley (Mazama).
• The farms are a very important part of our society.
• The land does not need "protection" from flooding. It shifts sometimes but overall it is enriched by flooding. People who build structures on the flood plain should have enough common sense to know that that is a risk. If they don't want that risk then they should build elsewhere.
• The land doesn't belong to the public, the water does. The land owners should be able to use their land as long as the river is not affected.
• The Methow River is such a beautiful resource that every effort should be made to preserve it.
• The only way I see to protect from flooding is to build proper systems of dikes such as were built after the 1948 flood.

• The owner should be allowed to develop their land consistent with fair zoning laws. If the public wants to restrict property rights then it should.
• The owner should have the right to use it as they see fit. Keep government out of the decisions.
• The property owners should be able to use their property like anybody else. Any attempt to preserve should be done at the expense of those preserving and not the unfortunate owner.
• The river should be appreciated but don't restrict all property close to it. When County or any government agency gets involved with regulations—property owner loses.
• The rivers should be enjoyed by all. Limited construction should be allowed. No commercial building, recreational use only.
• The same uses they have traditionally. I see this as an attempt by those who already have "theirs" to try to prevent others from enjoying the same uses they enjoy.
• There has to be well thought out regulations.
• There is little that can be done, unless it is to design runoff areas to carry water away during flood season. Surely no damming should be allowed.
• There is no need to spend public money other than try to prevent flood damage & if it ain't broke don't fix it!
• There needs to be more public access spots.
• They need to build above FEMA floodplain elevations.
• Think the land along the rivers and creeks should be impacted as little as possible. No buildings, septic tanks, drainfields allowed within the floodplain, natural riverbanks, keep cattle fenced away.
• This is a fragile area that must be protected, no permanent structures in the floodplain.
• This is a touchy subject.
• This should not be a government issue. Government sponsored flood insurance should not be available.
• This to me is a property rights owner's issue—if it is not yours—butt out, despite government's current infatuation of butting in, I suggest you don't.
• Those that have structures—build at your own risk.
• Tighten controlled logging.
• Trails, access to river, wildlife.
• Trails, Ski, Biking, Rafting-limit # of groups if it becomes too excessive.
• Trails; natural wildlife areas; scenic vistas/viewpoints.
• Try to buy the land and structures so they can be moved back away from flood areas.
• Undeveloped. Too many people ruin the river banks. If there is a flood the tax payer ends up helping if someone floods.
• Unless you own it, it's none of [your] business as long as there's no pollution!
• Use in a way that is consistent with land use planning goals. Timber harvest O.K.
• Used car lots, factory outlets, malls, fast food, strip malls, condos.
• Used to their full potential. The last thing we need is a wild and scenic situation.
• Uses and access consistent with the development of the recreation/tourism economy in the valley, enhancement of the trail system. Zoning safeguards to protect the aesthetics and quality of the valley. Strict signage restrictions, no more trailer parks.
• Uses only if out of 100 year floodplain.
• Uses that are as low impact as possible. I am opposed to developments and commercial and industrial near the river. I also worry about the amount of spraying—herbicide, etc. that eventually seeps into the river.

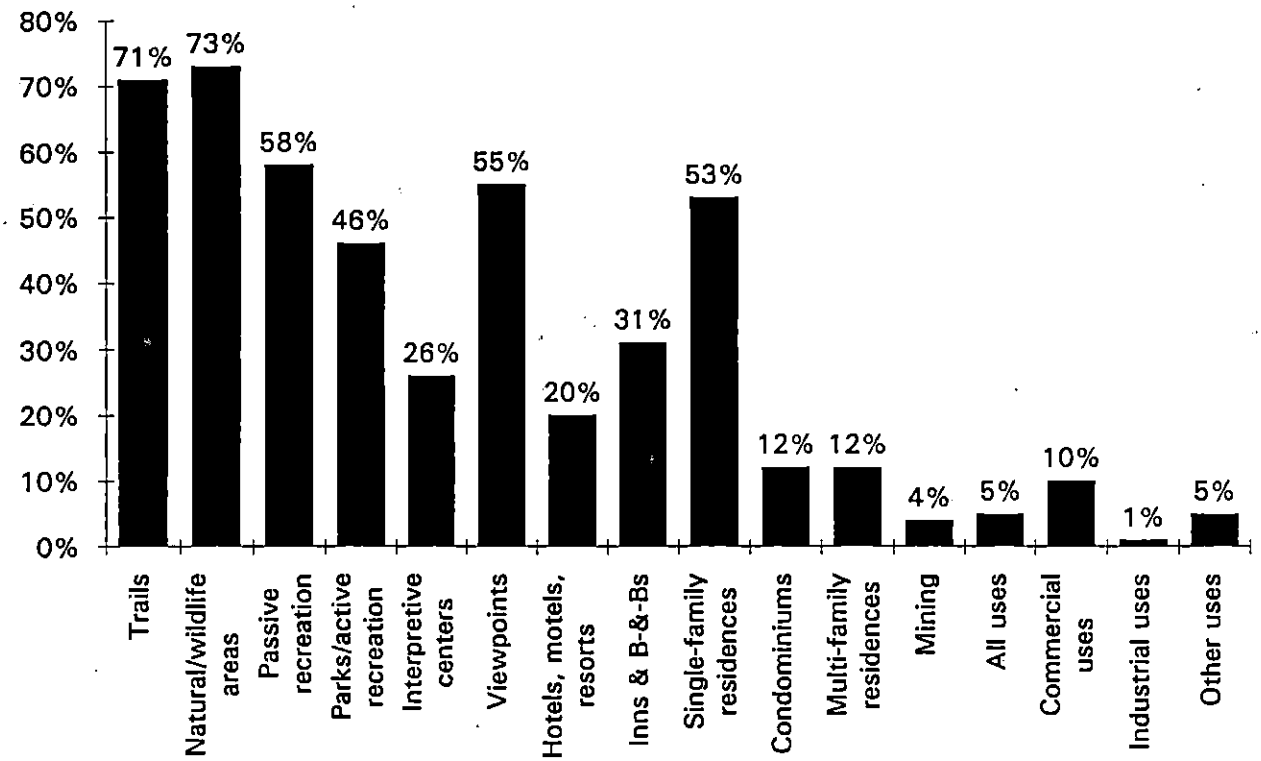
• Valley should not be limited to certain people.
• Vegetation for bank protection and wildlife.
• Very little.
• Very low impact, carefully limited rafting and kayaking, limited fishing.
• Walk, riding and skiing trails, setbacks and structures for owners, not industrial sites.
• Walking fishing access preferably, I hate to see construction near the river. I also think property owners should not expect the County (or taxpayers) to rip/rap or otherwise protect their investment.
• Waterfront property should be held collectively for the people.
• We don't use any because we are not sure where public access is.
• Well, I was here in 1948 and saw that flood, and I can tell you, in many instances, not much!!...sudden warmth...brought the rain and snowmelt down in one great swoosh!! Trees came downstream upright, logs created temporary dams and diverted the flood into new channels. Houses were swept away. Bridges washed down. The river went pretty much where it wanted to since the valley floor was inundated. Good farmland was isolated and washed away or covered with sand and gravel.
• What applies now seems reasonable.
• What can be done? Those people who choose to settle there are taking the risk—and that is their choice.
• Whatever it takes.
• Whatever needs to be done. Safety.
• Why don't you send a map out w/this survey of the flood damage basin if there really is one if you want informed answers?
• Why is this an issue?
• Why protect people who are stupid enough to build on a flood plain?!?
• Wildlife buffer, fishing, minimal recreational access.
• Wildlife habitat, open space, agricultural, logging outside of shorelines designated areas only, other flood compatible uses.
• Wildlife sanctuary. Allow no grazing of cows, sheep, etc. along stream or river banks.
• Wildlife, natural state, no trails, limited access.
• Wise use planning methods.
• Wise Use. Protect the rivers for my children's future and all children who will inherit what we leave them.
• With as few rules and regulations by government agencies as possible.
• With great care.
• With great respect to the river.
• With re: to flood prone areas—I don't want the taxpayers to foot any of the owner's bills for insurance or disasters as they should be responsible for any damage caused to others by their choice. WE the people (The Government at whatever level) should offer nothing more than counsel and advice. We're talking here about private property; if public property obviously the situation changes, we take whatever action(or inaction) necessary.
• With the thought in mind of what the valley will look like in 100 years. It will grow.
• Without abuse to the owner and the land.
• Work out a plan of reasonableness.

• Would like to see more development and would like to see more people allowed to utilize their property without further government interference.
• You can't stop Mother Nature.
• Zoned to allow responsible/appropriate development. i.e.: nice resorts (Not cheapo bed and Breakfast/motel). Not do it yourself hobbit houses.
• Zoning flood prone areas, require developers to disclose flood-prone areas.

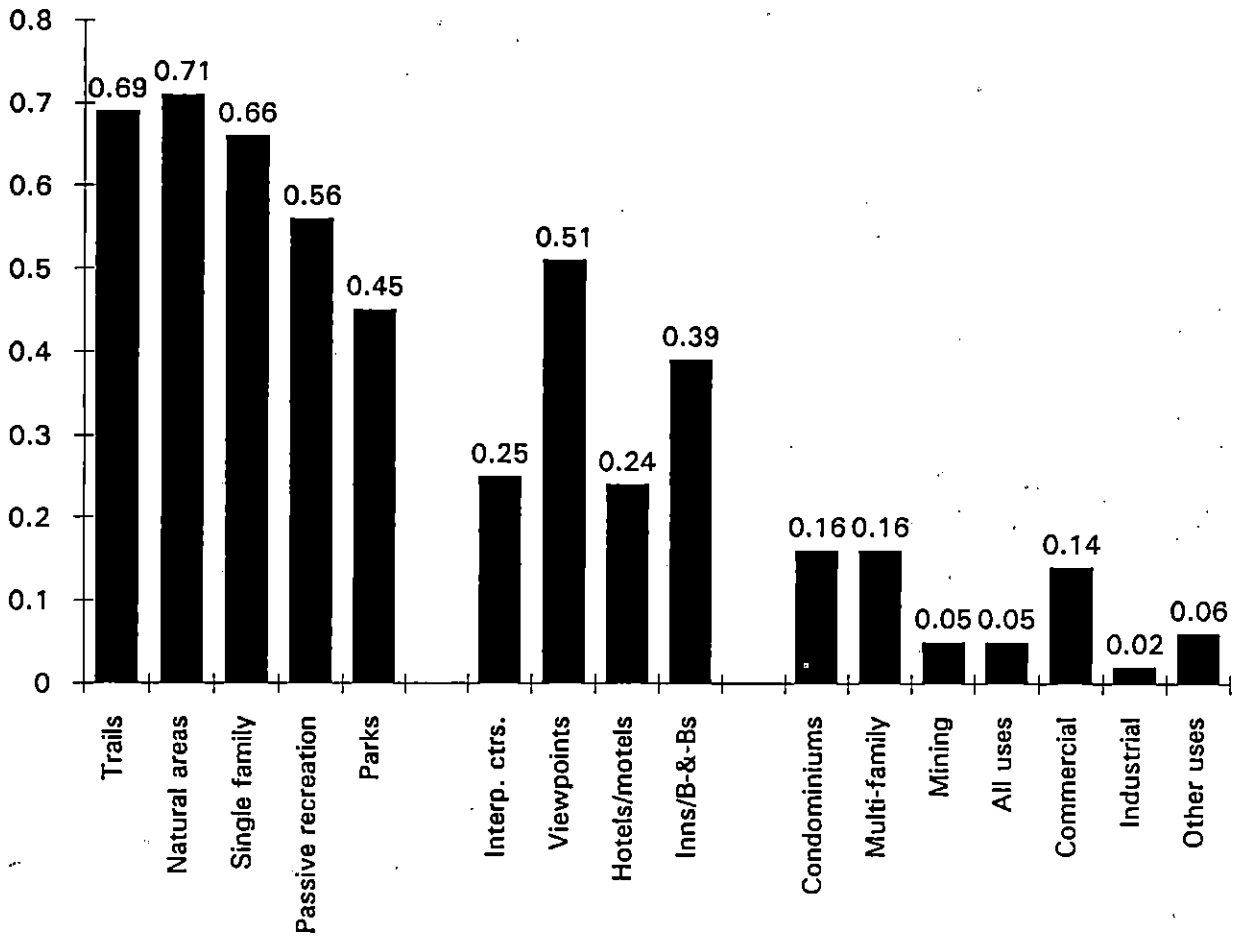
Responses to Questions 4-6 have not been analyzed.

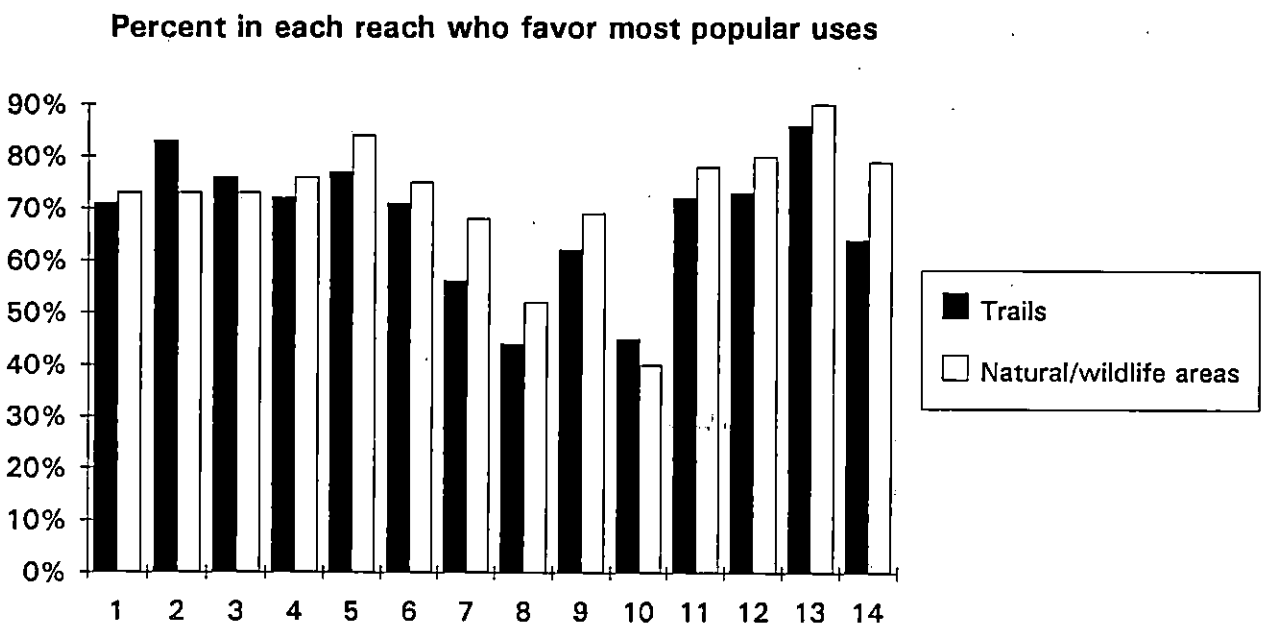

How do you use the river corridor?
70%
60%
50%
40%
30%
20%
10%
0%
38%
57%
66%
56%
43%
24%
12%
3%
23%
7%
1%
7%
10%
Boating
Wildlife obs.
Aesthetic Appreciation
Fishing
Camping
Hunting
Education
Water Skiing
Irrigation
Stock Watering
Water-related business
No use
Other uses

How do you think the river corridor should be used?

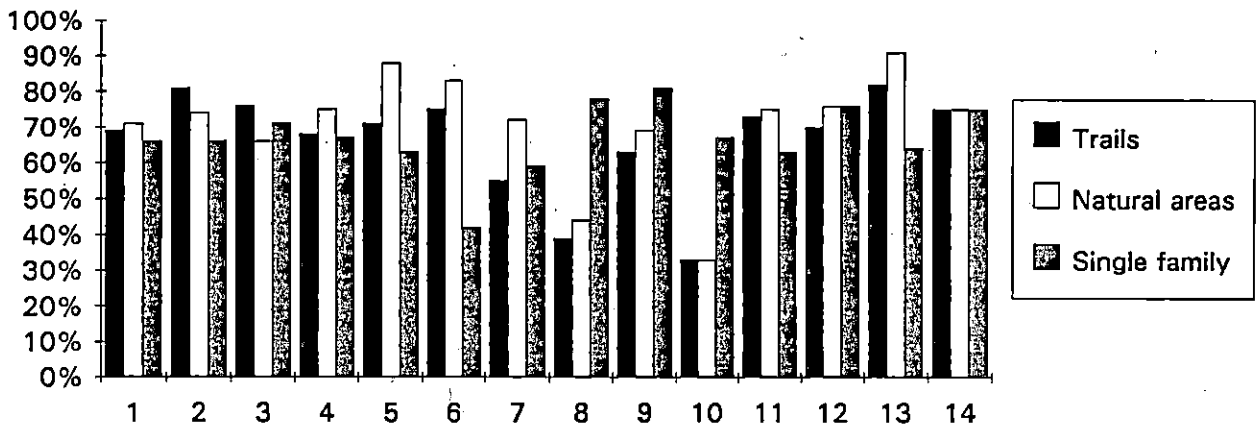


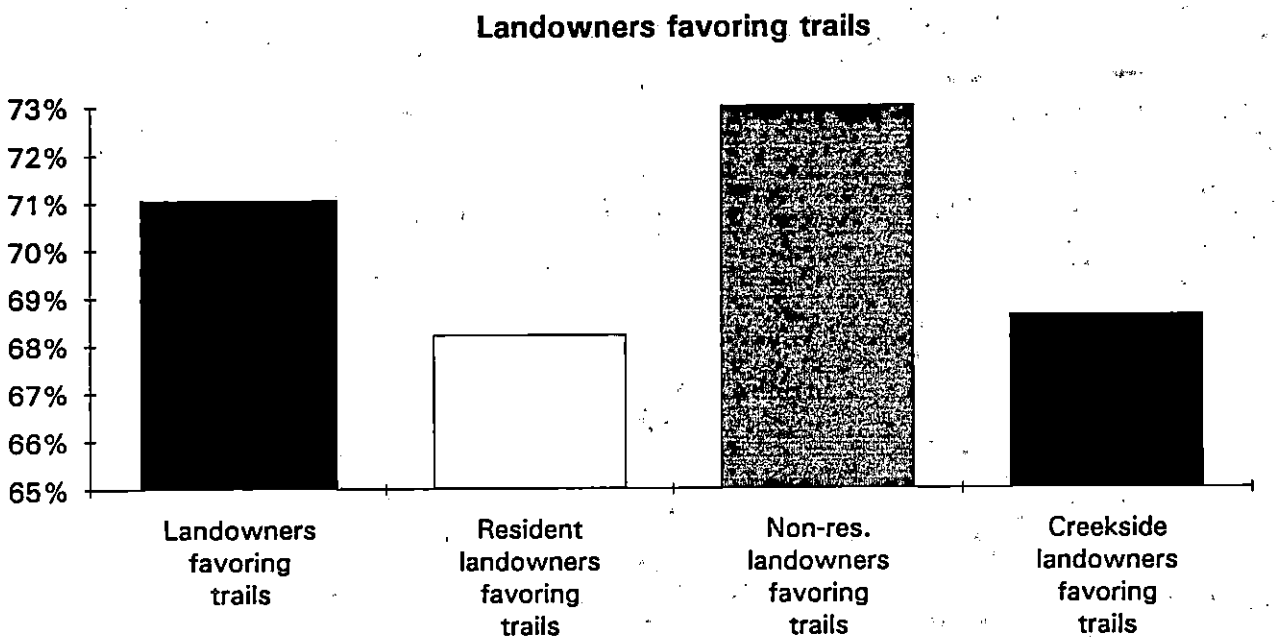
Percent of those within 200 ft. favoring each use



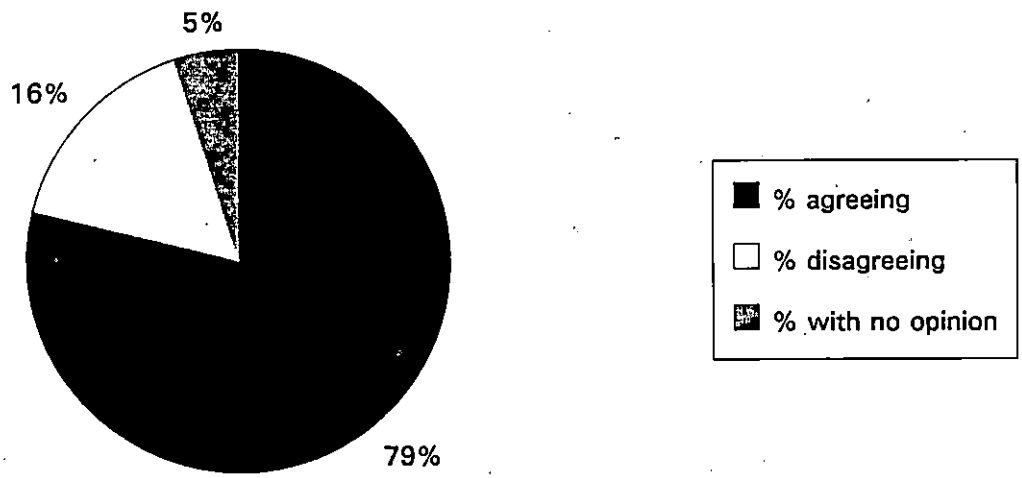

Percent in each reach who favor most popular uses
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Trails
Natural/wildlife areas

Within 200', percent in each reach favoring most popular uses

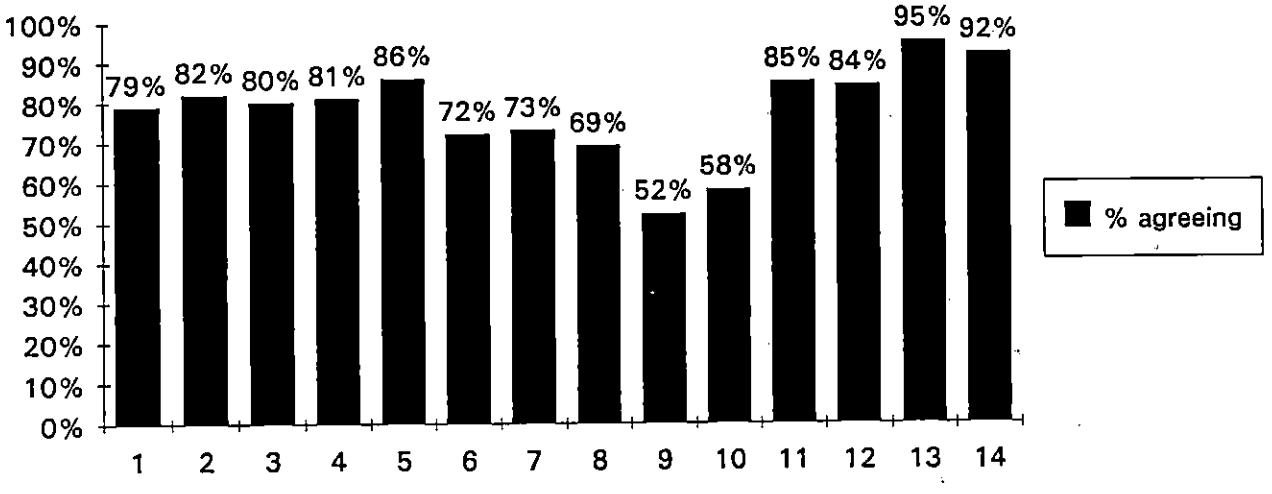



Landowners favoring trails
73%
72%
71%
70%
69%
68%
67%
66%
65%
Landowners favoring trails
Resident landowners favoring trails
Non-res. landowners favoring trails
Creekside landowners favoring trails

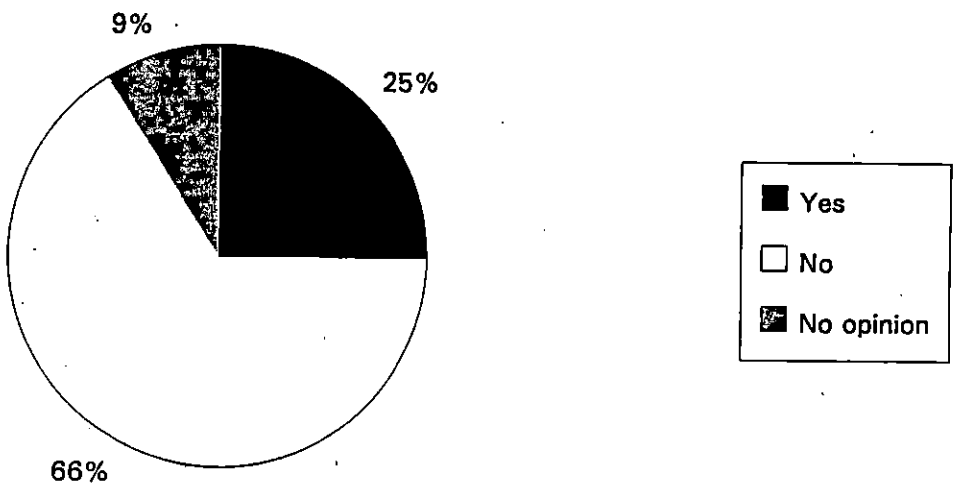
The Methow River as a scenic resource



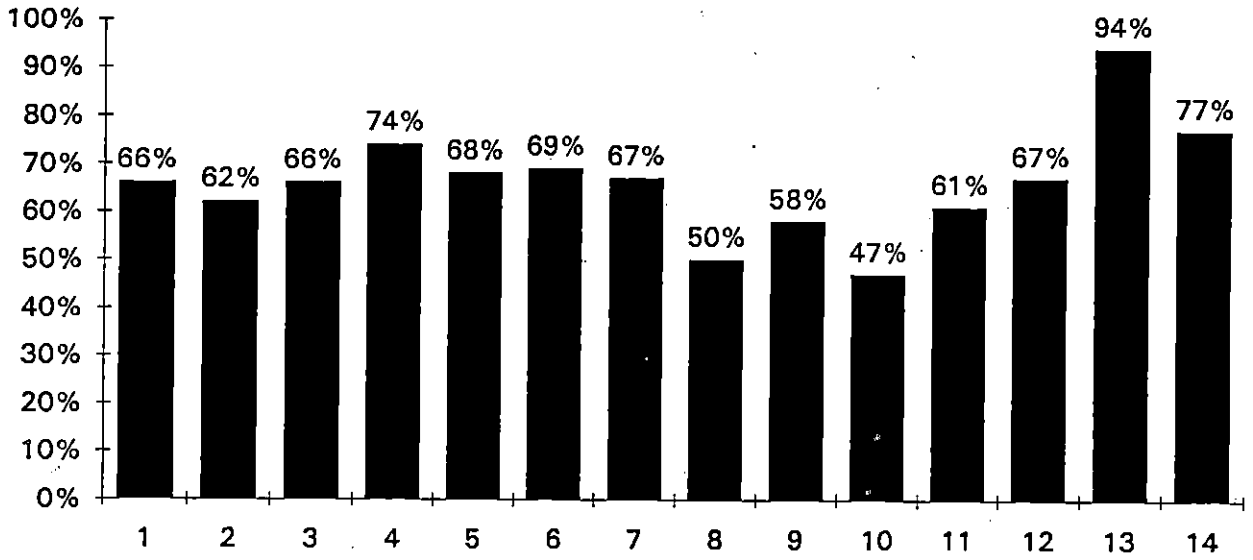
Percent in each reach who agree the Methow River is a scenic resource and should be preserved



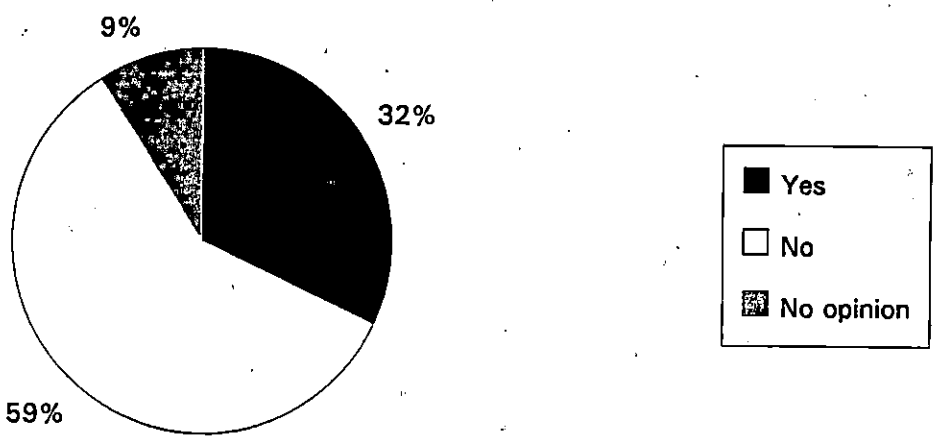
Should new structures be allowed in the floodplain?



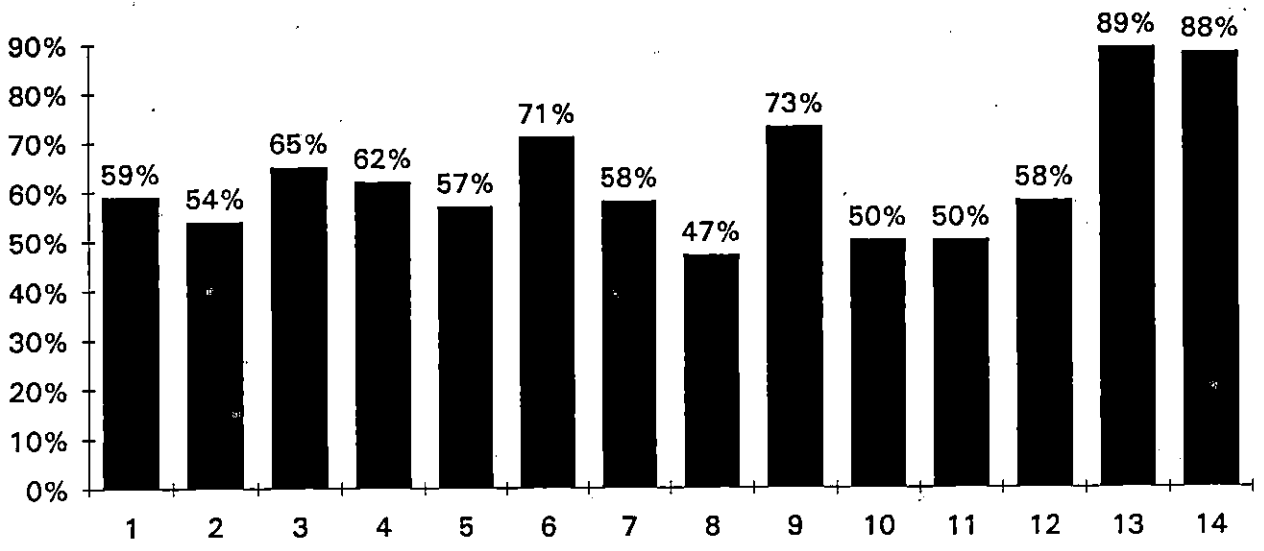
Percent in each reach opposing new structures in the floodplain



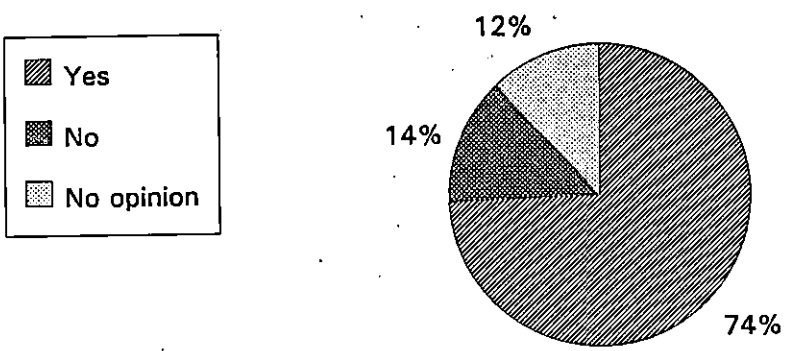
Among shoreline-zone residents: Should new structures be allowed in the floodplain?



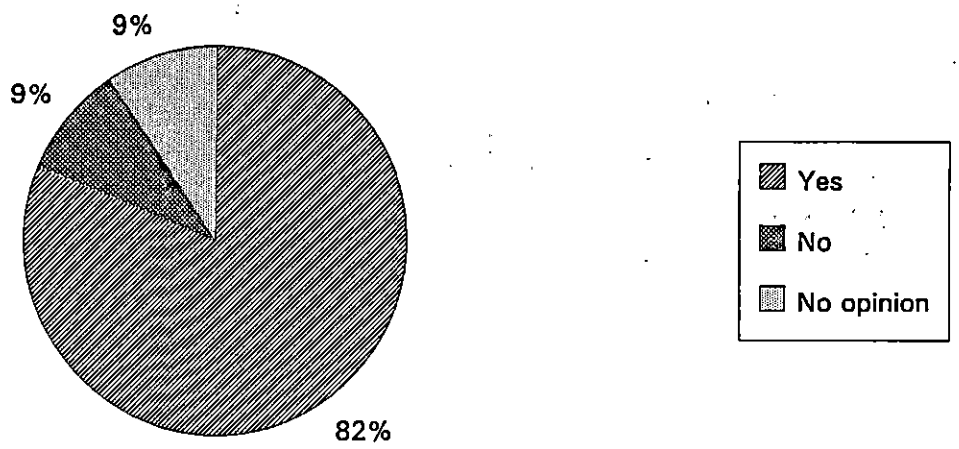
In shoreline zone, % in each reach opposing new structures in the floodplain



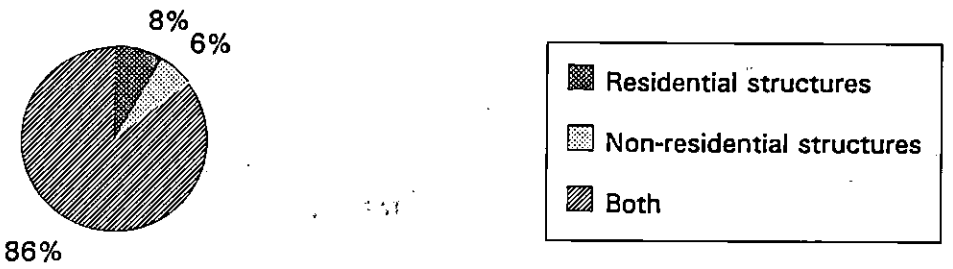
Should existing structures in the floodplain be allowed to remain?



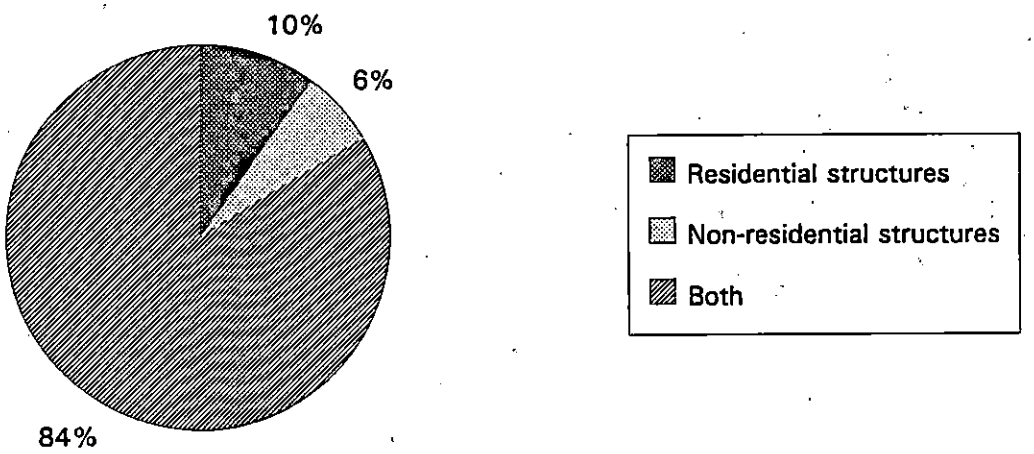
Within shoreline zone: should existing structures remain?



What type of structures should be allowed to remain?



Shoreline zone residents: what types of structures should remain in floodplain?



A copy of the survey, reduced to fit the format of this plan, follows.

River Corridor Plan Underway

River corridors are sensitive areas. When they are altered, the change affects not only the land on which it takes place, but lands up and down stream as well. Flood effects can be dramatically altered by development. Proper floodplain management can protect landowners and natural resources from activities on properties located upstream.

In September, Okanogan County's Office of Planning and Development began work on a Multi-Objective River Corridor Plan for the Methow Basin. The plan's primary objective is to reduce flood hazards; it is also intended to help maintain other qualities of the Methow, Chewuch, and Twisp Rivers that are valuable to residents of the valley. As part of our study, we are asking you and other local landowners for your opinions, and for information about how you use the river.

We would like to know what you think! Please complete the attached survey and return it to us by May 15. You may call us at 997-2143 if you would like to discuss the plan and its effects or work with us to make it work for you.

RIVER CORRIDOR SURVEY

CIRCLE ONE

1. *Is your property in the valley or up on the slopes?* — *Valley* *Slopes*
2. *Is your property within 200 feet of any creek or river?* — *Yes* *No*
3. *Are you a year-round resident of the Methow Valley?* — *Yes* *No*

If not, do you:

- *live here during part of the year? How long (number of months per year)?* _____
- *vacation here? How often (number of days or weekends per year)?* _____
  At what time of year? _____

4. *How many acres of land in the Methow basin do you own?* _____ *acres*
5. *How long have you owned your property in the Methow basin?* _____
6. *Is there a residential structure on your property?* *Yes* *No*
7. *Please indicate how you use the river corridor. Check all that apply.*

☐ A. Rafting/Boating/Kayaking ☐ F. Education/Field Trips ☐ B. Wildlife Observation/Bird Watching

☐ D. Fishing ☐ E. Hunting ☐ C. Camping ☐ H. Water-skiing ☐ G. Aesthetic Appreciation

☐ I. Irrigation ☐ J. Stock Watering ☐ K. Water-related business (e.g., river guide, river-front hotel)

☐ L. No Use ☐ M. Other _____

8. *What uses do you think belong on or near the rivers and creeks in the Methow basin? Check all that apply.*

☐ A. Trails ☐ B. Passive recreation (walking, bird-watching) ☐ C. Parks/Active recreation

☐ D. Natural/Wildlife Areas ☐ E. Interpretive Centers ☐ F. Scenic vistas/viewpoints

☐ G. Hotels, motels, and resorts ☐ H. Inns and bed-&-breakfasts

☐ I. Single-family residences ☐ J. Condominium ☐ K. Multiple-family residences

☐ L. Commercial uses (please specify) _____

☐ M. Industrial uses (please specify) _____

☐ N. Mining/sand & gravel extraction ☐ O. All uses ☐ Q. Other _____

Turn over to continue

Okanogan County
Office of Planning and Development
P. O. Box 931
Twisp, WA 98856

RIVER CORRIDOR SURVEY—continued

9. *The Methow River is a scenic resource and should be preserved in a natural state for future generations to enjoy.*	*Agree*	*Disagree*	*No opinion*
10. *Should those structures currently in flood-prone areas be allowed to remain?*	*Yes*	*No*	*No opinion*
If you answered "Yes", what kinds of structures do you think should be allowed to remain?	*Residential (houses, motels)*	*Non-residential (barns, garages)*	*Both*
11. *Should building of new structures be allowed in flood-prone areas?*	*Yes*	*No*	*No opinion*
If you answered "Yes", what kinds of structures do you think should be allowed?	*Residential (houses, motels)*	*Non-residential (barns, garages)*	*Both*

12. *Please tell us what you think....*

- *How would you like to see the land along rivers and creeks in the Methow basin used?*

_____

_____

_____

- *What should be done to protect land, people, and structures in the basin from flood damage?*

_____

_____

_____

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. Twisp, WA 98856

POSTAGE WILL BE PAID BY ADDRESSEE

Okanogan County
Office of Planning and Development
P. O. Box 931
Twisp, WA 98856

4. Letters to real estate agents

Following are the materials used to solicit participation by local real estate agents in the plan development process.

Okanogan County
Office of Planning and Development
Twisp Office
P.O. Box 931
Twisp, WA 98856

December 30, 1994

«firm»
«address»
«town»

As you may know, the Okanogan County Office of Planning and Development is in the process of developing a Multi-Objective River Corridor Plan for the Methow Basin, which will address issues affecting flooding hazards, flood-related erosion, natural resource use and protection, and community development.

The project's goal is to develop a plan for land use and flood control that

- complies with state standards
- protects citizens from the loss of life and property
- identifies alternative approaches for floodplain development, incorporating recreational uses and other values that meet previously-defined community development goals
- improves the level of awareness of flood hazards in the community.

A Technical Advisory Committee, composed of representatives of local agencies and towns who manage lands along the river corridor, is assisting in plan development by providing oversight on technical issues including historical trends, existing conditions and forecasts. In addition, a Citizens' Advisory Group will review the proposed plan at several stages in its development.

Because our plan will have long-term land use implications, we would like to involve interested members of the Real Estate community in the planning process. I am writing to invite your firm to send a representative to the next meeting of our Technical Advisory Committee, scheduled for Friday, January 20, 1995, at 10am, to learn more about the project and share your concerns and ideas. If you would like to participate, please let me know the name of your firm's representative. I will be mailing meeting agendas about a week before the meeting date. Please feel free to call me at 997-2144 if you have any questions.

Sincerely,

Sandra Strieby
Flood Program Planner

salutation	firm	name	address	town
	Alpine View Realty		P. O. Box 1088	Twisp, WA 98856
Mr. Arkell	Arkell Agency	Mr. Cliff Arkell	P. O. Box 1035	Twisp, WA 98856
Mr. Christen	Christen & Associates Realty, Inc.	Mr. Paul Christen	P. O. Box 727	Winthrop, WA 98862
Mr. Orme	Methow Land Company	Mr. Earl Orme	P. O. Box 548	Winthrop, WA 98862
	Methow Valley Realty, Inc.		Box 27	Winthrop, WA 98862
Mr. Miller	Miller and Associates	Mr. Lee Miller	P. O. Box 819	Winthrop, WA 98862
	North Cascade Realty, Inc.		Box 10	Winthrop, WA 98862
Mr. Campbell	North Cross State Realty, Inc.	Mr. Ray Campbell	P. O. Box 148	Winthrop, WA 98862
	Okanogan-Methow Realty, Inc.		Box 306	Winthrop, WA 98862
	Ray Walsh Real Estate		P. O. Box 728	Twisp, WA 98856
	Winthrop Realty, Inc.		P. O. Box 100	Winthrop, WA 98862

Okanogan County
Office of Planning and Development
Twisp Office
P.O. Box 931
Twisp, WA 98856

December 29, 1994

Mr. Ray Campbell
North Cross State Realty, Inc.
P. O. Box 148
Winthrop, WA 98862

Dear Mr. Campbell,

As we discussed yesterday, I am sending to you a copy of the Washington Administrative Code (WAC) chapter that specifies the State's floodplain management requirements. I hope this will answer your questions about the standards with which the County is working to comply.

I will be sending you a letter about our planning process next week, but wanted to get this in the mail right away.

Sincerely,

Sandra Strieby
Flood Program Planner

enc.

Okanogan County
Office of Planning and Development
Twisp Office
P.O. Box 931
Twisp, WA 98856

February 10, 1995

«firm»
«address»
«town»

In December, I wrote to tell you about the Multi-Objective River Corridor Plan for the Methow Basin being prepared by Okanogan County's Office of Planning and Development, and invite your office to send a representative to our Technical Advisory Committee meeting on January 20. At that meeting, we discussed some issues of interest to real estate agents, and the committee agreed that it is important for us to keep you informed about our planning process. The following summary highlights some points we covered that may be of important to you.

A draft Vision Statement was distributed at the meeting and formed the basis for most of the day's work, precipitating questions regarding the scope of the TAC's work and of the plan being developed, and discussion of the broad areas to be covered by the plan and the information needed to address them.

The TAC discussed current regulations and their limitations. Gaps in those regulations that need to be addressed were identified, as follows:

- Unmapped tributaries and reaches
- "Up-and-out" approach, which allows building on knolls and islands within mapped floodplain areas
- Known hazard areas not mapped
- Tie between riparian vegetation management and building permit—currently, vegetation removal is not regulated until a building permit is applied for
- Variance provisions—do they allow override of "no build in floodplain" provisions? (Consistent language between flood and zoning [Methow Review District] ordinances. Does the more stringent regulation apply?)
- Status of undeveloped land owned prior to adoption of zoning ordinance
- Inconsistencies between ordinances
- Inconsistencies between MRD and rest of County
- Subdivisions under PDR
- Single Family Residences exempt under SMMP

TAC members requested more information on current regulations, as well as information on conforming and non-conforming lots, built on and not built on, in order that the impact of build out may be determined.

There was some discussion of the need for further education to enable people to protect themselves to the greatest extent possible. Ideas for increasing awareness included:

- Increase awareness of natural rivers/get out information on riparian vegetation and stabilization
- Address effect of changes in population on system (incl. cumulative impacts), why things are an issue now that weren't 20 years ago
- Improve disclosure laws, so land purchasers are aware of potential hazards
- Place photo displays in restaurants (and other places non-residents may visit while shopping for land)
- Speak on flooding as part of the local lecture series
- Mail information with tax bills
- Get the message out that we are at a good point to make a difference in the Methow

The group discussed possible alternatives for defining the river corridor, and some areas that should be addressed, including alluvial fans, tributaries, tributary junctions, islands in FIRM zones, associated areas (e.g., wetlands), flood-prone areas, land that has flooded/may flood again, mapped areas known to be incorrect.

TAC members also talked about the need for economic analyses—for instance, of the costs of restoration versus preservation of an intact system; of the costs of emergency services and related support associated with building in flood plains.

Finally, changes were proposed to the opening paragraph of the draft Vision Statement to make it more realistic. The following opening paragraph has been proposed: "Okanogan County's Multi-Objective River Corridor Plan for the Methow Basin is intended to support the long-term health, safety, and welfare of Methow Valley residents and other stakeholders by providing for a healthy, functional river corridor system, an intact cultural landscape, and a thriving economy."

The next TAC meeting was set for March 16, 1995, from 10am until 2pm, with brown-bag lunch at noon. The meeting will focus on analysis of alternative approaches to managing corridors in the Methow River basin. Please let me know if you are interested in attending!

Sincerely,

Sandra Strieby
Flood Program Planner

Okanogan County
Office of Planning and Development
Twisp Office
P.O. Box 931
Twisp, WA 98856

March 23, 1995

«firm»
«address»
«town»

In December, I wrote to tell you about the Multi-Objective River Corridor Plan for the Methow Basin being prepared by Okanogan County's Office of Planning and Development, and invite your office to send a representative to our Technical Advisory Committee (TAC) meeting on January 20. At that meeting, we discussed some issues of interest to real estate agents, and the committee agreed that it is important for us to keep you informed about our planning process. The plan we are developing will affect the way people are able to use land in the Methow Valley's river corridors; we want to be sure you are informed about, and have a chance to contribute to, the changes we will be proposing. The following summary highlights some points we covered that may be important to you.

The TAC discussed current regulations and their limitations. We would like to ensure that land development is undertaken with adequate consideration for hazards and values associated with the river corridor.

We also discussed the need for further education to enable people to protect themselves to the greatest extent possible. One item TAC members thought was important to work on was improvement of disclosure laws, so land purchasers are aware of potential hazards. In addition, we hope to increase people's awareness of the functions of natural river systems, which we think will make it easier to preserve the character of the Methow Valley, and so its appeal as a place to live in and visit.

The group discussed possible alternatives for defining the river corridor, and some areas that should be addressed, including alluvial fans, tributaries, tributary junctions, islands in FIRM zones, associated areas (e.g., wetlands), flood-prone areas, land that has flooded and/or may flood again, and mapped flood hazard areas known to be incorrect. Further study of those areas is likely to result in changes in land use regulations to protect life and property in hazardous places.

TAC members also talked about the need for economic analyses—for instance, of the costs of restoration versus preservation of an intact system; of the costs of emergency services and related support associated with building in flood plains.

At our last meeting, we discussed options for action to diminish flood hazards and prevent inappropriate development in the river corridor. We will be drafting the Corridor Plan over the course of the next few months, and are interested in hearing from you if you have concerns or if there are issues you believe should be addressed.

Sincerely,

Sandra Strieby
Flood Program Planner

E. Other Exhibits as Applicable

1. Flood damage prevention ordinance

Date	Area covered	Source	Location	Comments
1974	Methow River, Carlton to Twisp	*Flood Plain Information*, prepared by Norman Associates	Okanogan County Office of Planning and Development and Twisp Planning Office	Prints of black-and-white aerials marked with floodplain and river miles
1980	Methow Valley	USFS	Methow Valley Ranger District	1:24,000. Black-and-white orthophotos. (Barry George)
1982		USFS	Methow Valley Ranger District	Color obliques. (Barry George)
1983	Non-Forest lands in the Methow Valley	Okanogan County	Assessor's Office	1"=400'. Non-rectified color aerial photos with parcel lines drawn on. Accurate to ± 300 feet.
1983		SCS	NRCS, Okanogan	1:24,000
1991		SCS	NRCS, Okanogan	1:24,000. Poor contrast
1991	Entire basin	DNR	Methow Valley Ranger District	Orthophotos (Mark Fonn)
1992	State Highways in the Methow Valley	Washington State DOT	Prints in Twisp Planning Office	1"=400'. Orthophotos. River shows along much of highway.
1992	Methow River, Mazama Bridge to Lost River	Limited Map Maintenance Study report, prepared by NHC	Copy in Twisp Planning Office	Black-and-white aerials showing floodplain and floodway
1994	Okanogan County	Okanogan County	Assessor's Office	True color. 1"=2,000'
1994	Methow Valley river corridors	Okanogan County	Twisp Planning Office	1"=2,000'±. Mosaic on five boards. From 1994 true color aerials.
1995	Okanogan County	DNR		1 inch=1 mile±. Township centered. Black-and-white. Project NE-H-95

Date	Area covered	Source	Location	Comments
1977	Methow Basin (WRIA 48)	Ecology, Kauffman and Bucknell	Copy in project file	Shows townships, latitude and longitude, drainage network
1977	Town of Twisp	FEMA	Copies in Twisp Planning Office	Flood Boundary and Flood Hazard Rate Maps
1977	Town of Winthrop	FEMA	Copies in Twisp Planning Office	Flood Boundary and Flood Hazard Rate Maps
1978	Okanogan County	SCS	Copy in project file	Important agricultural lands. 1:300,000
1979	Okanogan County	SCS	Copy in project file	Generalized land use. 1:300,000
1980	Okanogan County	Okanogan Cons. District	Copy in project file	1:577,000. Shows rivers and principal tributaries.
1981	Methow Valley Special Flood Hazard Areas	FEMA	Copies in Twisp Planning Office	Flood Insurance Rate Maps, panels 850, 875, 1050, 1200, 1325
1981	Methow Valley Special Flood Hazard Areas	FEMA	Copies in Twisp Planning Office	Flood Hazard Boundary Maps, panels 850, 875, and 1050
1987	Okanogan National Forest	U.S. Forest Service	Methow Valley Ranger District, Okanogan National Forest Supervisor's Office. Copy in project file.	½"=1 mile. Forest Visitor map. Shows public land ownership, drainage network, townships, road network.
1987	Methow basin river corridors*	U.S. Fish and Wildlife Service	Copies in Twisp Planning Office	National Wetlands Inventory maps
1987, 1988	Methow basin rivers	Caldwell and Catterson	Methow basin IFIM. Copies in project file.	Salmon redd locations from 1987 and 1988 surveys
1990	Methow River basin (WRIA 48)	Ecology?	Twisp Planning Office	Approx. 3'x5' laminated print. Shows drainage network, well locations
1990	Methow Valley	Washington State Department of Wildlife	Twisp Planning Office	Methow Valley deer map—Okanogan National Forest map with deer migration corridors and deer winter range drawn on by hand.

Date	Area covered	Source	Location	Comments
1991	Okanogan County shorelines	Okanogan County	Electronic data in Office of Planning and Development. Copy in Twisp Planning Office	Shows shoreline designations
1992	Methow Review District	Okanogan County	Electronic data in Office of Planning and Development. Copy in Twisp Planning Office	Zoning map; shows upland/valley floor boundary
1993	Methow River basin	Okanogan County	Electronic data in Office of Planning and Development and Twisp Planning Office	Geographic Information System developed under the auspices of the Methow Valley Pilot Planning Project
1993, 1994	Okanogan County	Okanogan County	Electronic data in Office of Planning and Development. Copy in Twisp Planning Office	Priority Habitat and Species maps
1994	Upper Methow Valley	FEMA	Copies in Twisp Planning Office	Flood Insurance Rate Maps, panels 450, 650, and 675
1994	Upper Methow Valley	FEMA	Copies in Twisp Planning Office	Flood Hazard Boundary Maps, panels 450, 650, and 675
1995	Methow basin salmon spawning areas	DFW (Bob Steele)	Copies in Twisp Planning Office	Show redd locations based on 1991-95 spawning surveys

Date	Area covered	Source	Location	Comments
1995	Methow basin non-Forest lands	Okanogan County	Paper maps in Twisp Planning Office. Electronic data in Okanogan County Office of Planning and Development	1:63,360. Existing land-use maps developed for River Corridor planning process, based on 1993 assessor's data
1995	Methow Valley Special Flood Hazard Areas	Okanogan County	Hard copies in Twisp Planning Office. Electronic data in Okanogan County Office of Planning and Development	Show parcel lines and FEMA floodplains
1995	Upper Methow	Okanogan County	Twisp Planning Office	USGS quads with floodplain drawn on from 1973 USFS infrared photos
Dates vary	Methow basin river corridors*	USGS	Copies in Twisp Planning Office	7.5' quads
no date	Carlton to Twisp	FEMA	Archived in Alexandria, VA.• Copies in Twisp Planning Office.	Work maps for FIRMs and FHBMs. Prepared by CH2M Hill.

* The following quads: Blue Buck Mountain, Brewster, Cooper Mountain, Doe Mountain, Hoodoo Peak, Hungry Mountain, Lewis Butte, Mazama, McLeod Mountain, Methow, Oval Peak, Pateros, Rendezvous Mountain, Robinson Mountain, Thompson Ridge, Twisp East, Twisp West, Winthrop

• Archived maps can be requested from FEMA Region X.

Other Resources

Item	Date	Location	Comments
Slides	1948-51	Methow Valley Ranger District	Slides of flooding and flood damage at various Methow Valley locations. Most from 1948. Greg Knott knows about the collection
Okanogan County Soil Survey		Available from NRCS	Contains soil maps based on aerial photos. Copy in Twisp Planning Office

LEGEND

ASCS	USDA Agricultural Stabilization and Conservation Service (now FHS)
COE	U.S. Army Corps of Engineers
DNR	Washington State Department of Natural Resources
Ecology	Washington State Department of Ecology
FEMA	Federal Emergency Management Agency
NHC	Northwest Hydraulic Consultants
NRCS	USDA Natural Resource Conservation Service
NWI	National Wetlands Inventory
PHS	Priority Habitat and Species
PUD	Okanogan County Public Utility District
SCS	USDA Soil Conservation Service (now NRCS)
USFS	United States Forest Service
USGS	United States Geological Survey
WRIA	Water Resource Inventory Area

3. Ads and newspaper articles

Following are copies of press releases, advertisements, and newspaper articles related to the planning process. The initial press release was sent to the *Omak-Okanogan County Chronicle*, the *Wenatchee World*, and the *Quad City Herald* as well as the *Methow Valley News*.

Okanogan County
Office of Planning & Development
P.O. Box 931, Twisp, WA 98856
509/997-2143

TO: Methow Valley News
FROM: Hilary Lyman, Flood Program Planner
RE: Press Release
DATE: September 15, 1994

Press Release

Flood Management Study Undertaken

The Okanogan County Office of Planning & Development has received a grant from the Department of Ecology to develop a coordinated long-term management approach to issues affecting flooding hazards, flood-related erosion, natural resource use and protection, and community development in the Methow River Basin. This project will last through June of 1995.

The project's goals are to develop a management plan for land use and flood control policy that

- are more compatible with state standards
- protect citizens from the loss of life and property
- identify alternative approaches for floodplain development, incorporating recreational uses and other values that meet previously-defined community development goals.

A public involvement process is key to the development of this plan. There will be several public meetings designed to inform residents about the plan's objectives, obtain input on critical areas of concern, and seek guidance as the plan is developed over the next nine months. All meetings will be open to the public and announced in the newspaper.

This plan will be developed through a multi-agency, interdisciplinary approach. A technical advisory committee, made up of local agencies and towns who manage lands along the river corridor, will assist in plan development by providing oversight on technical issues including historical trends, existing conditions and forecasts.

Hilary Lyman and Sandra Strieby have been hired through the grant to develop this plan. Hilary managed and coordinated the M.V. Water Planning Pilot Project. Sandra recently moved to the Methow Valley and has a Master's Degree in Landscape Architecture. They will both be available in the Twisp office at 301 Glover Streeet. Call 997-2143 for more information.

Methow River floodplain up next for study

by Mary Rea

"We all know the Methow River is going to flood," said Hilary Lyman. "Our goal is develop a plan that will minimize the impacts of future floods on people, resources and habitats."

How best to manage the floodplain of the Methow River is the subject of a $125,000 grant recently awarded to the county planning department. Funding for the study came the state Department of Ecology and will last through June of 1995.

Hilary Lyman and Sandra Strieby have been hired through

Continued on page 3

Floodplain

Continued from page 1

the grant to develop a flood management plan. Lyman coordinated the Methow Valley Water Planning Pilot Project. Strieby recently moved to the Methow Valley and holds a Master' degree in landscape architecture. Both will work out of the county planning office branch in Twisp.

"The state has revised its guidelines for flood management," Lyman said. "The county flood ordinance was created in 1987 and needs to be revised to make it compatible with current state and federal standards.

"We also want to create a multi-objective river corridor plan which protects citizens from the loss of life and property, and identifies alternative approaches for floodplain development." Ninety-nine percent of the time the river is not in flood stage, Lyman went on. The grant will allow the county to develop a long-term management approach of the Methow River floodplain that includes natural resource protection and community development, she noted.

Lyman described the study as "multi-agency and interdisciplinary" and said it involves pubic participation. "There will be several public meetings designed to inform residents about the plan's objectives, obtain input on critical areas of concern, and to seek guidance as the plan is developed over the next nine months," she said.

Grant funding only covers developing a floodplain plan, Lyman noted. Funding for implementation will have to come from a future grant.

...an sid... ...n 85 percent of the... ...ed, Nethercutt had 29 pe... ...plastic Book ... ...drilled from 8 a.m. to 3 ... ...l also be open this Saturday and ... ...ed in the book fair were carefully selected by committee of editors and educators and there will be hundreds of titles from over 70 publishers. Included are how-to books, biographies, classics and a variety of the newest titles in children's literature.

Book fair proceeds will benefit the middle school, and adults may enter a drawing to win one of the four $10 gift certificates that can be used toward the purchase of books. Winners will be notified on Sept. 29. For further information call Maryanne Cramer, Omak Middle School 826-2320 ext. 653.

Planning Department to do flood study

OKANOGAN — The Okanogan County Office of Planning and Development is undertaking a study of long-term management of flood hazards, flood-related erosion, natural resource use and protection and community development in the Methow River Basin.

The study, being paid for through a state Department of Ecology grant, aims to develop a flood-control policy that is more compatible with state standards and other things.

The planning office intends to sponsor public meetings to gather comments and answer questions about the study.

For more information, contact Hilary Lyman, flood program planner at 997-2143.

Clothes for Kids drive under way

WENATCHEE — Clothing for babies and young children, baby food and money are now being collected as part of the nationwide Clothes for Kids campaign.

Donations are being accepted at Key Bank branches and area food banks.

FE

Info needed about past floods

Where were you when the bridges washed out?

Do you remember being stranded when the Methow River rose? Do you have pictures of high water inundating what's normally dry ground?

If you weathered one or both of the Valley's big floods, or any of the smaller ones, you're invited to share your memories and photos on Saturday, Jan. 14 at the community center in Twisp. The Okanogan County Office of Planning and Development will host a Flood History Workshop in the gym from 1-4 p.m. Planners will be on hand to record stories and duplicate photographs. The information gathered will be used in the preparation of a plan to address flood hazards in the Methow.

First-hand knowledge of what happened during previous floods is an important key to understanding what may happen in the future.

All members of the community are welcome to attend and learn more about the Valley's flood history. Enjoy a cup of coffee with your neighbors and listen to the "old timers" reminisce!

Methow River Corridor group seeks advisory members

What do 1894, 1948 and 1972 have in common? They were all years in which heavy snows contributed to severe flooding in the Methow Valley. If snow continues to accumulate as it has been doing, 1995 may bring spring floods also.

The Okanogan County Office of Planning and Development is developing a multi-objective plan for the Methow Valley's floodplain. The plan is intended to minimize flood hazards while meeting the community's other goals.

A citizens' advisory group is forming to involve valley residents in the planning process. Residents who are interested in the future of the Methow, Twisp, and Chewuch Rivers and adjacent lands are encouraged to join. Economic development, habitat values, and water-oriented recreation are among the issues related to the floodplain to be addressed by the plan.

The committee will meet just once, on Jan. 7. Members will then be asked to comment in writing on elements of the plan in late January, March and May.

For more information, call the county planning office in Twisp, 997-2143, before Dec. 14.

Future flood control will strike a balance

by Sandra Strieby
County flood program planner

"Anybody that lives in the Methow Valley and makes their living on the land keeps an eye on the river," commented Dewane Creveling at Okanogan County's recent flood history workshop. Few would argue about the river's power in times of high water. Less certain is what the human response to that power ought to be.

The Methow Valley's rivers are one of its great treasures. They provide water for irrigation, a place to fish and swim, and refreshing scenery. They also have the potential to threaten roads and bridges, to sweep houses downstream, and to take lives. The question of how to reduce the danger posed by the rivers provided a variety of responses from residents gathered at the workshop.

Frank Johnson noted that management activities high in the watershed affect the river's behavior in the valley bottom. Removing vegetation at high altitudes influences the amount of snow that accumulates and the rate at which it melts and enters streams and rivers. Analyzing the effects of those changes, and developing management practices in response, may be one way to modulate the effects of flooding on the valley floor.

Most discussion focused on what could be done closer to home in the river corridor itself. Several people expressed concerns about the damage that can be done by trees growing close to the river. When their root systems are undercut, trees may fall into the water, taking soil with them and leaving a bare spot to erode. Once in the river, accumulations of fallen trees can change the direction in which water flows, causing the river to erode a bank or even change its course.

Howard Weller brought up the idea of clearing the river banks of trees, while Dewane Creveling suggested removing logs from the river, to prevent such problems. Ron Cramer and Rick Renn noted that river bank vegetation slows flood flows and protects banks from erosion, while wood in the stream provides habitat for fish. They argued in favor of restoring the river in hopes of winning back the fishing holes of their youth.

Riprap - large rocks used to armor river banks against erosion - was seen as an answer by some. Mr. Creveling noted that riprap installed following the 1972 flood has effectively stabilized a bank on his land, and that over the years it has developed a mantle of vegetation and so is aesthetically pleasing as well.

The key issue for all those attending seemed to be finding some balance between the need to protect human lives and property and the desire to preserve the characteristics of the river that add so much to the quality of life in the Methow Valley. The days of aggressively manipulating the river are past; the task that remains is finding creative ways to meet the needs of those who live and work on its banks.

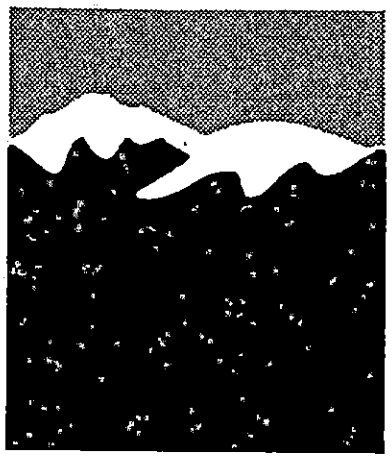
Winter '95

Let's Not Forget the Towns

Although Okanogan County policies will have the greatest overall impact on the future of the valley, it will be town practices which could produce the most visible changes, especially when seen from the perspective of State Route 20.

Under current county policy, commercial development is generally restricted to the towns, Exceptions to this are made for inns & lodges, campgrounds, guest ranches, RV Parks, and Planned Destination Resorts. Though concern exists that some commercial activities that should be restricted to the towns could masquerade as one of the above uses, in reality most will be within town boundaries.

Though the Growth Management Act addressed the scenario of runaway annexations by requiring Urban Growth Boundaries, our towns are not presently required to designate them. Without enlightened planning, strip development could be intensified along SR 20 both north and south of Winthrop and Twisp. Town codes will be the determining factor.



River Corridor Planning Begins

A project to develop a coordinated long-term management approach to address flood hazards, flood related erosion, natural resource use and protection, and community development in the Methow River Basin has been started by the county Office of Planning and Development.

The "Multi-Objective River Corridor Plan" is funded by a Department of Ecology grant. A technical advisory group and a Citizens' Advisory Group will assist with the plans development. The plan is scheduled to be submitted to the County Commissioners by the end of June 1995.

For More information contact Sandra Strieby, Flood Program Planner, at 997-2143.

The Valley Voice

Methow Valley Citizens Council
P.O. Box 774
Twisp, WA 98856

Bulk Rate
U.S. Postage
PAID
Twisp, WA
Permit No. 13

Inside This Issue:
Wise Use/Catron County
"Property Rights" Update
Mazama Community Action

Next General Meeting: March 07, 7pm at the Twisp Community Center. Potluck at 6

Survey will be used to guide river plans

Okanogan County's Office of Planning and Development will mail a survey to all Methow Valley landowners during the second week in May in conjunction with the county's on-going river corridor and flood hazard management planning project.

The survey is intended to determine how valley landowners use river and creek corridors and what uses they think are desirable in those areas.

County staff will use the responses to guide development of the Multi-Objective River Corridor Plan for the Methow Basin. Survey recipients are encouraged to call Christopher Bettman or Sandra Strieby at 997-2143 if they have questions or comments or would like to know more about the plan development process.

M.V. News 5.10.95

Get shoreline permits, even during flood

by Sandra Strieby, County Flood Program Planner

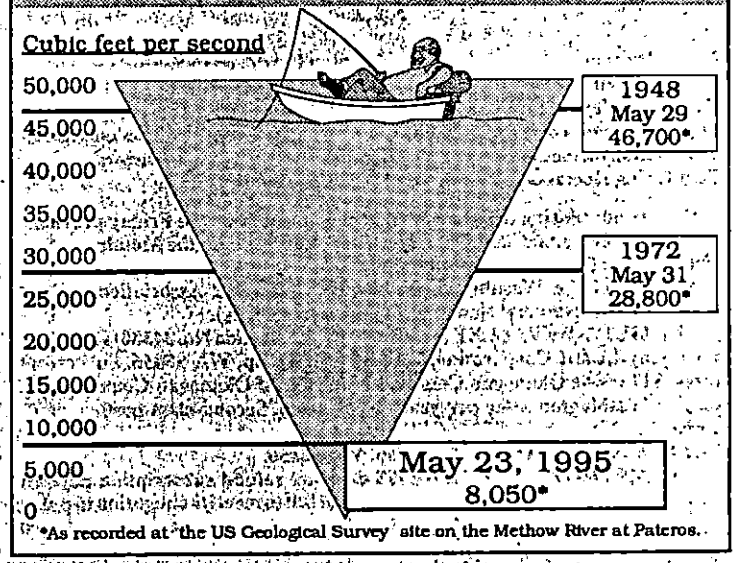
Last winter's heavy snowfall has led to high water levels in the Methow Valley's creeks and rivers - in some cases higher than have been seen in several years. With a substantial amount of snow remaining in the mountains, those water levels may rise especially if temperatures warm up quickly. What does that mean if you find your property threatened by high water?

Okanogan County's Shoreline Management Master Program states that "Emergency construction designed for shoreline protection is permitted when life and/or property is in danger." You may take measures necessary to stop excessive erosion or keep rising waters from damaging structures, but you must first request a permit for emergency shoreline action from the county's office of planning and development.

To apply for an emergency permit, submit a request stating the location at which construction is required, the intended action, and the reason emergency action is required. Your letter should also state that you are requesting an exemption from the substantial development permit process under Section 9.03 of the County Shoreline Management Master Program. Requests may be made by telephone or fax, and followed with a written request. County planning staff will respond to requests for emergency permits as quickly as possible.

See *PERMITS* page 3

UPDATE: HIGH WATER



*As recorded at the US Geological Survey site on the Methow River at Patcros.

PERMITS

Continued from Page One

The permitting requirements discussed above have been developed to protect the productivity of the lands and waters of Okanogan County. By taking proper action, even in case of an emergency, you can protect your investment from high water without threatening property that belongs to your neighbors downstream.

Addresses and telephone numbers: Okanogan County Office of Planning and Development, P.O. Box 1009, Okanogan, WA 98840. Phone: 422-7110, FAX: 422-7106.

Washington State Department of Fish and Wildlife, P.O. Box 1118, Twisp, WA 98856. Phone: 997-9428.

MVN 5.25.95

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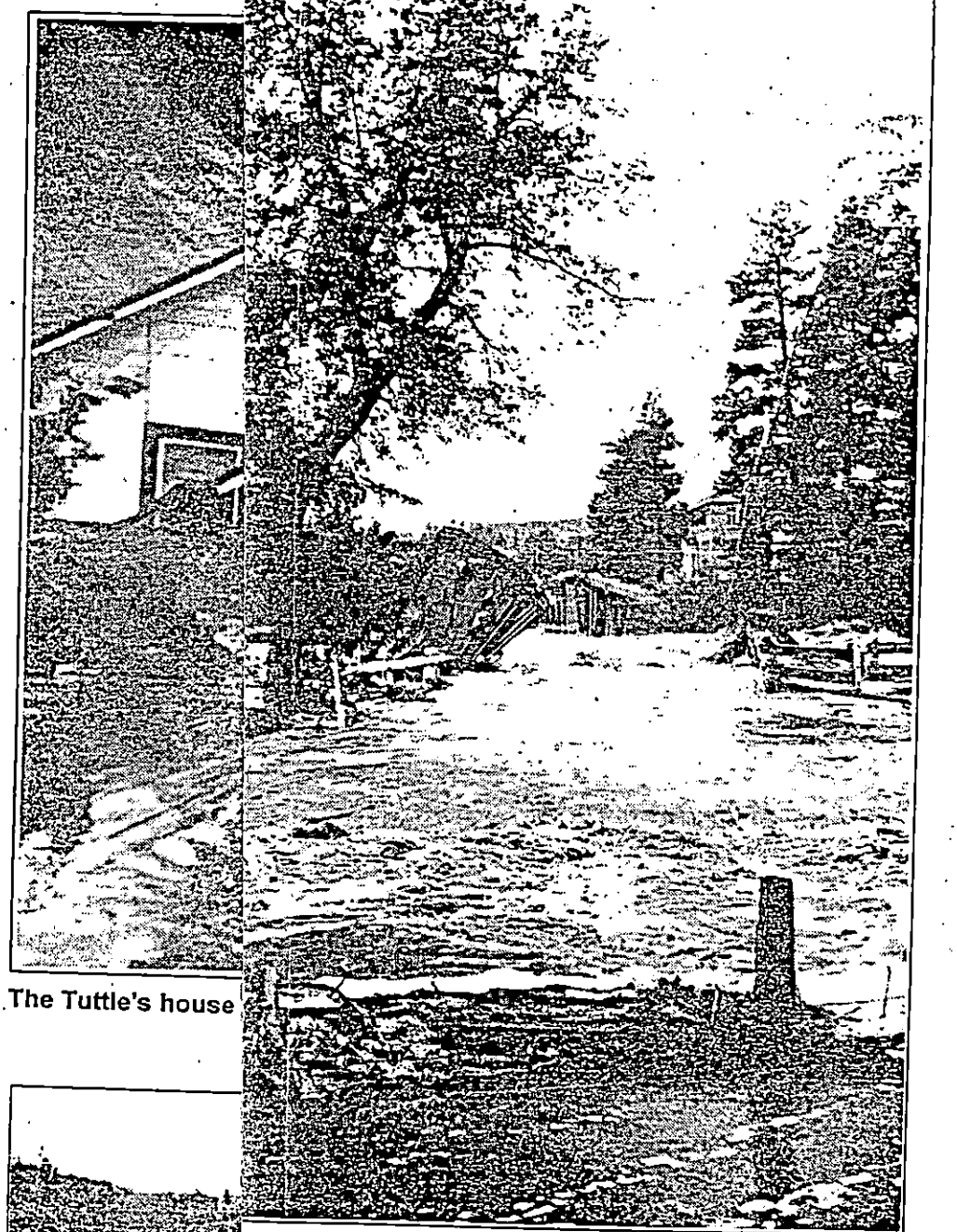
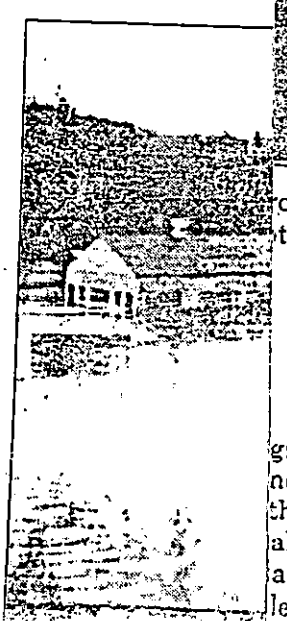


The Tuttle's house



op Bridge goes down.Note old Winthrop High School in
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noted that when they hit
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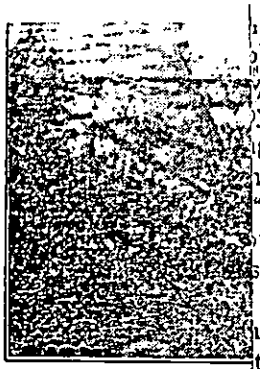
that the loss of power was not as much of a problem as it would be today, since people relied less on appliances than we do now. Bread and milk were flown into the valley, with airplanes landing on the high



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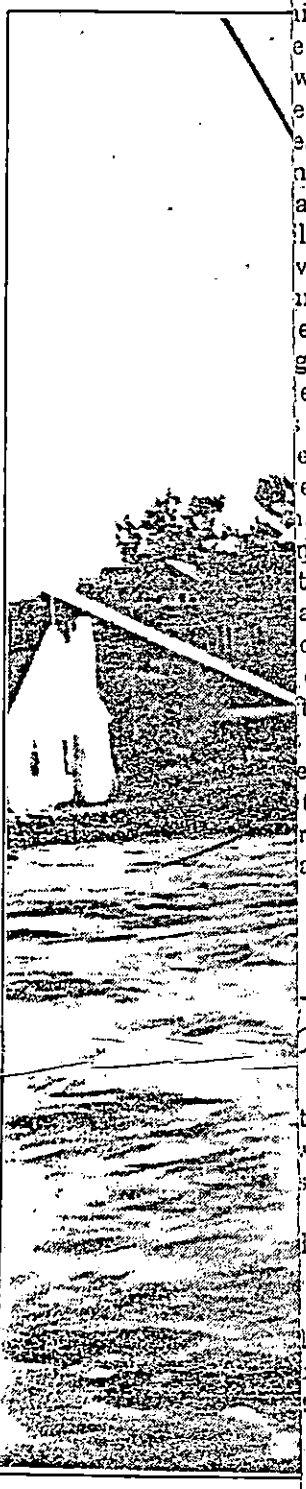

After the flood of 1948, r

...hand near Pateros, they ...le ends of houses with ...s intact" buried in silt ...y the floodwaters. ...gs were lost to erosion as ...ndation. Howard Brewer ..."this valley's got a lot of ...t of people who thought ...safe - it just washed out

...l lost its church and com- ...ter to undercutting - just ...h of Silver lost its store in ...ne Luft recalled that ...he outer banks of bends ...r were subject to under- ...hile those on the inner ...ined safe. He noted that ...e that water got to Black ...was really going. Every- ...e outside loop went out." ...es many feet above the ...not safe when the banks ...ay beneath them.

...l of the bridges over the ...ver washed out or dam- ...mmer of 1948 was filled ...eniences. Little help was ...g from the government; ...ents remember helping ... and their neighbors. ...e from the river, it was ...ettle to remove silt, then ...ake it fit for drinking. ...nurses set up a medical ...ton to give typhoid shots. ...and phone service were ...ong as three months in ... of the valley.

...ter the flood, the Twisp ... up a temporary system ...e town; it was eventually ...th a generator that pro- ...r from 6 a.m. until 10:30 ...al in attendance noted with airplanes landing on the high school football field. Cables were strung across the river at Winthrop and Twisp, and those who had to cross the river did so in metal cages dangling above the water.

By the time of the next major flood on the Methow River, in the summer of 1972, the valley's communities had grown. Although flood flows were not as great, more houses were in harm's way. In some instances, areas that had stayed dry in 1948 were flooded due to river channel changes. One resident recalled that in 1972 "everybody was helping everybody. The Army Corps of Engineers came in; a lot of people helped fill sand bags, working 16 to 18 hours shifts." In spite of the efforts, water flooded basements and living rooms; one farmer lost 100 chickens when a dike protecting his property broke.

Residents disagreed as to what course should be taken to prevent flood damage in the future. Some argued that trees take portions of the bank with them when they are undercut and fall into the river, instigating erosion; others noted that vegetated banks are essential to the ecology of the river. Most agreed that the river cannot be completely controlled; rather, it is something with which we must learn to live as harmoniously as possible.

As life-long resident Ron Cramer said, "Every inch of this valley floor has at one time been river bottom ... that's why we have fertile valley floor ... that's the way nature creates fertile land ... it's a natural process."

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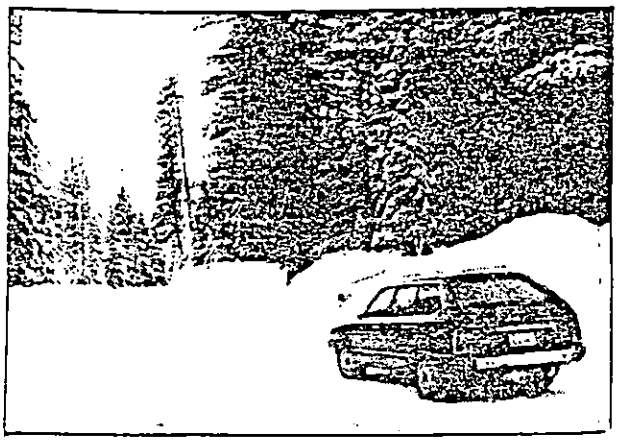

Snow is building along the Hart's Pass Road

MVN 11.30.95

Open House
Meeting on the Multi-Objective River Corridor Plan for the Methow Basin. Methow Valley Community Center. Everyone invited. Come and share your ideas. 10 a.m. - 1 p.m.

The Okanogan County Office of Planning and Development
will hold an
OPEN HOUSE
on Saturday, December 2, 1995
from 10:00am until 1:00pm
at the Methow Valley Community Center
to present the draft
Multi-Objective River Corridor Plan for the Methow Basin
and discuss options for inclusion in the Plan

The draft plan will be on file at local public libraries beginning the week of November 28

Please come and share your ideas! Call 997-2144 for more info.

MVN 11.30.95

Time to buy flood insurance

MVN 11.30.95

Flood insurance has always been a good idea, and now it is a necessity if you want federal help repairing damage after a flood disaster.

Washington residents who own property in a flood-prone area must be covered by the National Flood Insurance Program (NFIP) in order to be eligible for federal disaster loans to repair flood damage. It takes 30 days after purchase for the coverage to take effect. Formerly the waiting period was only five days.

For more information about flood preparedness and insurance needs, property owners can call their local insurance agent or Eric Paige at 360-923-4581, or Tim D'Acci at the state department of ecology 360-407-6796, or George Currin of the Federal Emergency Management Agency at 206-487-4679.

4. Goals and objectives of the Washington State Flood Damage Reduction Plan

The goals and objectives stated in the Washington State Flood Damage Reduction Plan are as follows:

State Flood Damage Reduction Goals

- Save lives and reduce public exposure to risk
- Reduce or prevent damage to public and private property
- Reduce adverse environmental or natural resource impacts
- Reduce the financial impact on public agencies and society

Objectives

To achieve the above goals, the state has identified four primary objectives.

1. Enhance coordination of agencies and consistency of policies
2. Increase knowledge regarding flood hazards and the impacts of land uses and resource management practices on flood plains
3. Reduce vulnerability to flood damage through comprehensive planning, improved design and construction standards, and programs that address current at-risk development
4. Strengthen flood preparedness, response, and education

ınding manual

This funding manual lists potential sources of funding for implementation of the Multi-Objective River Corridor Plan for the Methow Basin. It can be used by both County departments and private organizations to find money for river corridor projects. It includes a matrix, which gives an overview of the various funding sources; and a list of sources, which offers more detailed information about each of the items listed in the matrix. Funding for disaster response and recovery is available from other sources—lists of current sources are included in the project file. The manual has been made as thorough and up-to-date as possible. Funding sources change—some of the sources listed may no longer be available; others may have become available. One guide that may list additional possibilities is *Funding Sources for Community and Economic Development*, published by Oryx. Assistance may also be available from the Local Government Finance Clearinghouse, (360) 586-0488. The clearinghouse maintains a central store of information on funding alternatives and provides local governments access to information on financial resources available to them. "A funding dilemma: The Fish and Wildlife Conservation Act" (copy in project file) discusses funding mechanisms.

• Agency or Foundation ° Program	Purpose	Who is eligible?	Match percentage	Type of assistance	Contact	Deadlines
Federal						
• Army Corps of Engineers ° Basinwide Restoration New Starts General Investigation	Restoration, in areas auth. by Congress		Reconn. and feas.: 50%; imp.: 25%		Lester Soule, (206) 764-3699 or Noel Gilbrough, 764-3652	
• Army Corps of Engineers ° Erosion of Shore and Streambank	Prevention of damage to public facilities from erosion	Gov'ts	No match required	Technical assistance	Lester Soule, (206) 764-3699	
• Army Corps of Engineers ° Flood Control Studies	Feas. studies for des. and const. of flood dam. prevention measures	Gov'ts	None for recon.; 50% for feas. studies over $40K		Steven Foster, (206) 764-3600	
• Army Corps of Engineers ° Flood Plain Management Services (FPMS)		Gov'ts	No match required	Technical assistance	Joe Weber, (206) 764-3661	

• Agency or Foundation ° Program	Purpose	Who is eligible?	Match percentage	Type of assistance	Contact	Deadlines
• National Fish and Wildlife Foundation ° Wildlife and Habitat			50% minimum, cash only ¤	Grants	Katie Frohardt, (202) 857-0166	April 15, Aug. 15, Dec. 15*
• National Park Service ° Rivers, Trails and Conservation Assistance Program	Community-based conservation action			Technical assistance	Sally Sheridan, (206) 220-4122	
• Natural Resource Conservation Service ° Wetland Reserve Program	Conversion of ag., range, or forest land back to wetlands			Planning, implementation funding, incentives	Greg Fisher, (360) 753-8070	App. per. is May 30-June 30
• Recreational Fisheries Initiative	On-the-ground fish habitat and fish stock restoration	Gov'ts	50% ¤	Grants	Lou Jurs (509) 536-1200	September
• Washington Conservation Corps	Enhancement of environmental and youth resources	Gov'ts	In-kind logistical plus equipment support	Technical assistance	Linda Bradford, (360) 459-6131	Apply at any time
Regional						
• BPA	To help designated watersheds meet BPA's protection and mitigation obligations	Gov'ts			John Marsh (360) 222-5161 Kasi Beale, (503) 230-5885	
State						
• Dep't.of Natural Resources ° Aquatic Lands Enhancement Account (ALEA)	Aquatic resource access, awareness, improvement•	Gov'ts			Lisa Randlette (360) 902-1085; Jim Sweeney, 902-1090.	Process begins in fall*
• Department of Ecology ° Centennial Clean Water Fund	Water pollution control/point- or non-point wq improvement	Gov'ts	25%		Steve Carley, (360) 407-6572 or Brian Howard	App. per. 1.2-2.29.96*

• Agency or Foundation ° Program	Purpose	Who is eligible?	Match percentage	Type of assistance	Contact	Deadlines
• Department of Ecology ° Flood Control Assistance Account Program (FCAAP)	Development and implementation of comp. flood hazard management plans	Gov'ts	25% for planning; 50% for implementation	Grant	Tim d'Acci, (360) 407-6796; George Kaminsky, (360) 407-6797	February of odd-numbered years
◦ Department of Ecology ° Nonpoint Water Pollution Program	NPS reduction	Gov'ts		Technical	Dick Wallace, 438-7070	
• Dep't. of Fish and Wildlife ° Cooperative Fish and Wildlife Program	Salmon habitat rest., enhancement research, or education	Gov'ts, others			Dave Gadwa, (360) 902-2806	
• Dep't. of Fish and Wildlife ° Jobs in the Woods		Gov'ts			Maria Hug, (360) 902-2433	Varies*
• Dep't. of Fish and Wildlife ° Regional Fisheries Enhancement Program	Salmon habitat enhancement. Volunteer contribution is desirable.	Gov'ts, others		Grant	Connie Iten, (509) 754-4624; Rich Kolb, (360) 902-2260	*
• Dep't. of Fish and Wildlife ° Volunteer Fisheries Program	Fisheries education, habitat, or production			Grants, technical assistance	Rich Kolb, (360) 902-2260	
• Dep't. of Fish and Wildlife (with Natural Resources) ° Watershed Restoration and Grants Program	Watershed rest. and cons. in priority watersheds				Leni Oman, (360) 902-2592 or Bob Brandow, 902-1039	
• Dep't.of Natural Resources	Stewardship Incentive Program				Steve Gibbs, (360) 902-1706	
• Dep't of Natural Resources (with DFW) ° Watershed Restoration and Grants Program	see listing under Fish and Wildlife					
• Dep't.of Natural Resources ° Watershed Restoration Jobs Grant	Funding for watershed restoration w/rqt. to target disloc. nat. res. workers			Grants	Daryl Johnston, (360) 902-1114	Varies

• Agency or Foundation ° Program	Purpose	Who is eligible?	Match percentage	Type of assistance	Contact	Deadlines
• Dep't. of Transportation ° ISTEA enhancement project funding	Enhance nat. and cultural resources, improve bicycle and ped. access, preserve abandoned railway corridors	Gov'ts	13.5% in 1996	Grants	Greg Selstead, (509) 663-9631	March 29 in 1996
• Interagency Committee for Outdoor Rec. ° Boating Facilities Program	Purchase of boating-related lands and dev. of boating-related facilities	Gov'ts	50%	Grants	(360) 902-3000	May*
• Interagency Committee for Outdoor Rec. ° Land and Water Conservation Fund	Encrges. new & expanded outdoor rec. areas and facil.	Gov'ts	50%	Tech. and financial assistance	Eric Johnson, (306) 902-3015	May*
• Interagency Committee for Outdoor Rec. ° Washington Wildlife and Recreation Program	Acquis., dev., and renovation of parks, urban wildlife habitat, open space, trails; and water access facilities	Gov'ts	50%	Grants	(360) 902-3000	May*
• Natural Resource Conservation Commission	Habitat restoration, jobs for displaced fishers	Gov'ts			Diane Harvester (360) 407-6214	May
• Parks and Recreation Commission ° Winter Recreation Program	Non-snowmobile winter rec. facil.	Gov'ts		Financial	James Horan, 586-1253	
• State Conservation Commission ° Non-point Water Quality Grants Program	On-the-ground water quality improvement	Cons. districts only		Financial and technical	Carroll Boone, 459-6141	
• Washington Conservation Corps	Enhancement of environmental and youth resources	Gov'ts	In-kind logistical plus equipment support	Technical assistance	Linda Bradford, (360) 459-6131	Apply at any time

• Agency or Foundation ° Program	Purpose	Who is eligible?	Match percentage	Type of assistance	Contact	Deadlines
Private						
• American Conservation Association, Inc.	Pub. understanding of cons. issues, citizen partic.				George R. Lamb, (212) 649-5669	
• Bullitt Foundation	Environmental projects			Grants	Emory Bundy, (206) 343-0822	April 1, August 1, and Dec. 1*
• Coors ° Pure Water 2000	Water quality improvement	Nonprofits		Small grants	Dave Taylor, (800) 642-6116	
• Finlandia Clean Water Fund	Preserve, protect, and enhance rec. waterways	Nonprofits		Grants	David Jenkins, (703) 451-0141	August 15
• FishAmerica Foundation	Enhance fish populations				(703) 548-6338	One year in advance of need
• Give to the Earth Foundation	Small environmental projects			Grants	Ellen Liberatori, (800) 933-9628	
• Harder Foundation	Habitat protection			Grants	Del Langbauer, (206) 593-2121 (**check area code**)	
• Laird, Norton Foundation	Projects related to forestry			Grants	Marie B. Mentor, (206) 464-5292	August 31, Dec. 31
• M. J. Murdock Charitable Trust	Env. ed., research, health			Grants	Ford A. Anderson III, (206) 694-8415	
• Norcross Wildlife Foundation, Inc.	Nat. res. cons., env. ed.				Richard S. Reagan, (212) 362-4831	
• North American Wildlife Foundation, Inc.	Soil and water cons., wetland pres., pesticide research				Charles S. Potter, Jr., (708) 940-7776	
• Northwest Area Foundation	Sustainable dev., incl. ecosys. pres.				Terry T. Saario, (612) 224-9635	
• Patagonia, Inc.	Habitat and wild river pres., env. ed.			Grants, clothing donations	Paul Tebbel, (805) 643-8616	

• Agency or Foundation ° Program	Purpose	Who is eligible?	Match percentage	Type of assistance	Contact	Deadlines
• Pequod Fund	Pacific Northwest community-based progs. and orgs.				Alan Rabinowitz, (415) 771-4308	
• Phillips Petroleum ° Environmental Partnership Awards	Community environmental projects	Nonprofits	Match required	Grants	Patricia Marshall, (918) 661-5139	
• REI ° Great Outdoors Grants	Identifying and working to protect specific places for outdoor rec.	Nonprofits		Grants	Grants Administrator, (206) 396-3780	Ongoing*
• REI ° Special Projects Grants	Greenways, Mediation, General activism	Nonprofits		Grants	Grants Administrator, (206) 396-3780	Ongoing*
• Strong Foundation for Environmental Values	Habitat protection	Nonprofits		Grants	Ann Bade, (415) 882-7982	Jan. 15, May 15, Sept. 15
• Washington Foundation for the Environment	Local env. projects, env. ed.	Nonprofits		Grants	P.O. Box 2123, Seattle, WA 98111	*
• Wilburforce Foundation	Wildlife and habitat protection, env. ed.	Nonprofits			Timothy Greyhavens, (206) 286-4554	

* Application and/or other materials in project file

• ALEA funds for small projects may also be available from the Department of Fish and Wildlife; call Connie Iten, (509) 754-4624.

¤ Non-federal match only

Funding Sources

This roster gives more complete information about the funding sources listed in the Funding Matrix.

Federal

Army Corps of Engineers

• Basinwide Restoration New Starts General Investigation: Funding is provided for restoration through a 75:25 cost share program. Projects must be in areas that Congress has authorized. Non-Corps sponsors are required. Prior to project implementation, a reconnaissance process and feasibility study are required and cost must be matched at 50:50. Contact: Lester Soule, (206) 764-3699 or Noel Gilbrough, (206) 764-3652.

• Erosion of Shore and Streambank: Technical assistance to cities, counties, tribes, and special districts. The program provides technical and engineering assistance to non-federal public interest in developing structural and non-structural methods to prevent damages from shore and streambank erosion. Assistance may consist of discussion of erosion problems, advice on alternative solutions to the problem, and construction permit requirements. Included is review of plans and specifications prepared by non-federal interests. Not included are costs of surveys, foundation investigations, design plans, nor any cost of supervision and construction. No local contribution required for technical assistance. Contact: Lester Soule, (206) 764-3699.

• Flood Control Studies: Feasibility studies which may lead to the design and construction of flood damage prevention measures. Counties, cities, districts, and tribes are eligible. Project must be cost-shared with a local sponsor. 100% federal for reconnaissance studies, 50% federal for feasibility studies exceeding $40,000. Available funding varies. Letter requesting study begins the application process. Contact: Steven Foster, (206) 764-3600.

• Flood Plain Management Services (FPMS): Provides floodplain and non-structural damage reduction information, technical assistance, and engineering analysis to aid land use decisions where flood damage potential exists. Available to individuals, communities, cities, counties, states, and other federal agencies. Contact: Joe Weber, (206) 764-3661.

• Planning Assistance to States (PAS): Grant and technical assistance to cities, counties, tribes, and special districts. The Corps can assist in preparing comprehensive plans for development, utilization, and conservation of water related resources. Technical assistance available includes engineering analysis, one-on-one information, and planning guidance. 50% cost sharing with a maximum of $600,000 per study. The funding period is on-going beginning in September until funds are allocated. Application period is continuous. Contact: Paul Cooke, (206) 764-3600.

• Section 1135 Program: Funding is provided through the Continuing Authorities Program for on-the-ground restoration connected with Corps projects. Requires a 25% non-federal match. If the match is provided in land, it must be adjacent to the Corps project. Funds are provided to federal agencies, state and tribal governments, and private entities. The Corps provides 100% of project design. Contact: Lester Soule, (206) 764-3699 or Noel Gilbrough, (206) 764-3652.

• Small Flood Control Studies: Grant and technical assistance to cities, counties, tribes, and special districts. Feasibility studies that may lead to the design and construction of flood damage prevention measures. Technical assistance available is engineering analysis, community coordination, one-on-one information, planning guidance, and site evaluation. Contact: Frank Urabeck, (206) 764-3708.

• Streambank and Shoreline Protection Grants: Grant and technical assistance to cities, counties, tribes, and special districts. The Corps will develop and construct emerging streambank and shoreline protection projects to protect endangered highways, highway bridge approaches, public works facilities such as water and sewer lines, public and private non-profit schools and hospitals, and other non-profit public facilities. The amount of funding available varies from year to year. A local match of 25% is required and moneys can be used for construction projects only. There is a Federal total contribution limit of $500,000 per project. Contact: Lester Soule, (206) 764-3699.

Bureau of Land Management and Forest Service

• Challenge Cost Share Program: Projects on at least some federal land for fish and wildlife or recreation projects. Grants are awarded on a competitive basis. An anticipated $70,000 will be available for FFY 96. Submit grant proposals in September 1995 for FFY 96. Contact Lou Jurs at (509) 536-1200.

Bureau of Reclamation

• Small Reclamation Projects Act: Grants and loans to cities, counties, tribes, and special districts. Program provides loans for the development or rehabilitation of small reclamation projects. A small reclamation project must include irrigation as a purpose but may take any of several forms. It may be a complete single-purpose irrigation or irrigation drainage project, or a multi-purpose water resource project. Partial grants for flood control, fish and wildlife enhancement, and recreation enhancement are awarded. Funds are limited to 2/3 of the maximum total project cost. Loan periods are for 40 years, no more. Call Robert Hamilton, (208) 334-1369, for application information.

EPA

• Section 319 Clean Water Act: Congress enacted the Clean Water Act in 1987, enacting a national program to implement local programs that control and/or prevent nonpoint pollution sources of water pollution. Funding is provided by the EPA to states, which

administer a grant program for public entities. The Department of Ecology administers the program in Washington State. Projects that have been funded in the past include: restoration of watersheds, streambanks, wetlands, or riparian corridors, stormwater runoff reduction, and various other means of reducing nonpoint pollution. Another innovative type of project that is being considered for eligibility is land acquisition as a means of protecting stream corridors and wetlands. All entities except private may sponsor the project. Proposed work must have a water quality benefit; activities focus on water quality but attempt to improve the health of the ecosystem. There is a requirement of 25 percent match or in-kind services. Funded on calendar year basis, with $1.7M allocated for FFY 96. Application deadline varies. Contact: Max Lynden, (509) 454-7207; Terry Fisher, (360) 407-6406.

• Environmental Education Grants Program: Support for projects that design, demonstrate, or disseminate environmental education practices,.methods, or techniques. Contact: Sally Hanft, (206) 553-1207 or (800) 424-4EPA.

• Wetlands Program: Funding is provided to state, tribal, and local entities to protect and restore wetlands. Projects must provide a direct link to increase the state's ability to protect wetland resources. Competitive nationwide with grants ranging from $16,000 to $316,000. There are $15M available for 95. Contact: Gary Voerman, (206) 553-8513.

FEMA

• Flood Mitigation Assistance Program: One of the primary provisions of this act is a mitigation grant program to support planning, technical assistance, and mitigation activities for flood damage reduction. As a condition for receiving grant funds to perform mitigation activities, a local or state government must prepare a mitigation plan which is also eligible for grant funds. Types of mitigation activities which relate to multi-objective management of river corridors include demolition or relocation of structures to non-hazard areas; acquisition of property; and erosion control measures. The match requirement for the program is 75% federal and 25% state or local match. Contact: Carl Cook, (206) 487-4687; Martin Best, (360) 923-4585.

Fish and Wildlife Service

• Challenge Cost Share Program: Grants may be sponsored by the USFWS or other nonfederal entities. Projects may be on federal or nonfederal lands with 50:50 non-federal match. Funding may be used for education, restoration, enhancement, and natural resource related activities. Program funds vary. Contact any USFWS facility for information.

• Washington State Ecosystems Conservation Program: provides funding or other assistance, on a cost-sharing basis, for protection, restoration, enhancement, or creation of fish and wildlife habitat by private landowners. *Wetlands* and *riparian zone* projects are administered by the Fish and Wildlife Service. One of the goals of the program is to

develop partnerships between landowners, the Fish and Wildlife Service, and other agencies and groups (such as conservation organizations). Cooperators other than the Fish and Wildlife Service may provide additional funds, materials, or labor. Contact Alisa Ralph in western Washington, (360) 412-5414, or Kate Terrell in eastern Washington, (509) 765-6125.

• Jobs in the Woods: Funding is provided for habitat restoration projects that employ workers from timber-dependent communities. Projects must demonstrate local partnerships. $1.25+M were available for FFY 95. Contact Alisa Ralph, (360) 412-5414.

• North American Wetland Conservation Grants: Grants provided for restoration, enhancement, and acquisition of wetlands. The program requires a 50:50 non-federal match. Anyone can apply. Approximately $8 million available for FFY 95. Contact: Carey Smith, (503) 231-6164.

• Section 6 Pre-listing Recovery Monies: State agencies may apply for grants to target species or habitat, but must contribute to the recovery of Federal Candidate Species for listing under the Endangered Species Act. Funding varies by project. Contact Jim Michaels in western Washington, (412) 5448, or Dave Kaumheimer in eastern Washington, (509) 765-6125.

• Spotted Owl Recovery Program: Depending on funding, money and/or technical assistance may be available for work within the territory of the Northern Spotted Owl. Contact Tim McCracken, (509) 548-6016.

• Upland Wildlife Restoration: Funding by the Department of Interior through USFWS regional office in Portland, and administered by Washington Department of Fish and Wildlife. Applicants may include private and non-federal landowners. Projects are for upland areas and must provide access to public user groups for hunting by written, verbal, or "feel-free-to-hunt" permission from landowners. Access may also by for camera/viewing only; no shooting. Approximately $700,000 available annually. Apply year-round. Contact: Dan Blatt at (360) 902-2594.

National Environmental Education and Training Foundation

The Foundation awards one-year challenge grants for environmental education and training projects. 50% non-federal cash match required. (202) 628-8200.

National Fish and Wildlife Foundation

Grants are provided for fish and wildlife related projects in habitat/species restoration and conservation, education, research, and policy development. A 50:50 non-federal match is required. Pre-proposal deadlines are April 15, August 15, and December 15. Programs in Conservation Education, Fisheries Conservation and Management, Wetlands and Private Lands, Wildlife and Habitat. Contact program managers at (202) 875-0166.

National Park Service

• Rivers, Trails, and Conservation Assistance Program: The mission of the RTCA Program is to advocate and assist community-based conservation action. The program is committed to improving public awareness about comprehensive watershed planning and helping to identify options for resource conservation and improvement. RTCA acts as a catalyst for organizing and facilitating local restoration initiatives. RTCA offers staff time to provide technical assistance for river, trail, and greenway planning to national and local cooperators. RTCA can help to organize and facilitate community meetings; assist in developing public involvement strategies; help to develop promotional materials; assist in developing a restoration plan; detail an action plan with community involvement; and identify potential funding options. Contact: Michael Linde, (206) 220-4122.

Natural Resource Conservation Service

• Wetland Reserve Program: Competitive; funds projects that convert private agriculture, range, or forest lands back to wetlands. Landowners apply to convert property and receive up to $2,500 per acre converted. A local planning team develops detailed plans to implement conversion. The NRCS also pays up to 75% of the implementation costs per specifications. Contact Greg Fisher, (360) 753-8070.

Recreational Fisheries Initiative

• Grants are provided for on-the-ground fish habitat and fish stock restoration activities. Eighty percent of projects are to target federal lands. Projects must be completed within one year. Cost share of 50:50 non-federal match with no more than 20% of cost share as in-kind services. Preference to those collaborating with BLM, BuRec, and USFS. Deadline for grant proposals is September 1995 for FFY 96. Available funding depends on costs of identified projects. Contact Joe Kelly in Western Washington at (360) 665-2118 or Lou Jurs in Eastern Washington at (509) 536-1200.

Regional

BPA

• Funding is available for designated model watersheds in the Columbia River Basin through the BPA and NWPPC. Projects must help meet BPA's protection and mitigation responsibilities under Public Law 95601. Funds are dispersed through contracts with fish and wildlife agencies and Tribal governments. Contact John Marsh, BPA Fish and Wildlife Division at (503) 222-5161.

State

Department of Ecology

• Centennial Clean Water Fund: Promotes water pollution control. Sponsors can be local governments, tribes, and special districts. Grant projects must have a 25 percent local match and must be implemented on public lands. Projects include facilities, groundwater protection, nonpoint, fresh water, and educational programs. Provides technical and financial assistance to cities, counties, tribes, special districts, and service agencies. Funding for implementation of projects identified and prioritized in a management plan. Work Okanogan County can't afford to complete under FCAAP grants could be eligible, as could fine-scale planning efforts for re-vegetation/enhancement of an area identified in the Multi-Objective River Corridor Plan for the Methow Basin. Application period is early in the year (January, February; exact dates vary.) Contact Steve Carley, (360) 407-6572, or Brian Howard, (360) 407-6000.

• Flood Control Assistance Account Program: FCAAP provides funds to local governments to develop comprehensive plans for flood damage reduction. The comprehensive plans developed with the assistance of this program can be innovative in nature depending on the needs of the local officials and any unique features within the particular river basin. A multi-objective management plan is what is intended through this program, since in addition to the primary goal of flood damage reduction, plans must also address fish and wildlife resources, scenic and aesthetic resources, water quality, and recreation. State funds are available for up to 75% of the total eligible cost of the plan with a 25 % local match requirement. State funds are also available to implement plan recommendations, and also can be used for multi-objective management activities. State funds are available for up to 50% of the total eligible project cost with a 50% local match requirement. Contact: Tim d'Acci, (360) 407-6796; George Kaminsky, (360) 407-6797.

• Nonpoint Water Pollution Program: Develops policies and guidance to reduce pollution from diffuse sources that flow into waters. Provides technical assistance to cities, counties, and special districts. Contact Dick Wallace, 438-7070.

Department of Fish and Wildlife

• Regional Enhancement Groups: Competitive grant program with funding coming from annual salmon license sales. Projects must be salmon habitat restoration, enhancement, or research. Anyone may apply year-round. Partnerships and cost sharing are encouraged. Apply to one of 12 regions. Funding varies based on license sales. Contact: Rich Kolb, (360) 902-2260.

• Cooperative Fish and Wildlife Program: Funding through Washington Department of Wildlife for salmon, marine fish, or shellfish habitat restoration, enhancement, research, or education. Funding available annually is approximately $300,000 for new projects. Anyone may apply year-round. Contact Dave Gadwa, (360) 902-2806.

• Volunteer Fisheries Program: Provides grants, technical assistance for fisheries education, habitat, or production projects. Contact Rich Kolb, (360) 902-2260.

• Watershed Restoration Jobs Grant Program: see listing under DNR

Department of Natural Resources

• Aquatic Lands Enhancement Account (ALEA): The Washington State Department of Natural Resources (DNR) administers the ALEA Account which is funded from leases of aquatic lands, which are state-owned. The DNR reinvests ALEA funds to support protection and enhancement of the aquatic resource, providing funding to state and local agencies. Funds projects that expand the public access to state-owned aquatic lands and increase public awareness and knowledge of the state's aquatic resources. Also funds projects that improve fisheries and wildlife habitat. Has provided funds for public access capital development and planning. Projects funded involve shoreline access development, but have included interpretive projects and wetland acquisition. Competitive grant process for 1998-99 biennium starts in Fall, 1995. Sponsors can be local or tribal governments. Primary contact: Lisa Randlette, DNR, (360) 902-1085.

• Stewardship Incentive Program: Funding is provided for forest stewardship activities on private lands of less than 1,000 acres through DNR. Up to $10,000 is provided per project. The program requires cost sharing by the landowner. Eligible activities include: wetland, riparian, instream fish enhancement, and upland wildlife projects. There are $350,000 for FY 95. Applications should be submitted to USDA Consolidated Farm Service Agency, county offices. Contact: Steve Gibbs, (360) 902-1706.

• Watershed Restoration Jobs Grant Program: Jobs for the Environment and Watershed Restoration programs have been combined in this iteration. Provides funding for watershed restoration with a requirement to target dislocated natural resource workers or fishers. Available for bank stabilization, watershed restoration. Not for planning—want to see work on the ground. Funds were awarded this summer; expect another round of funding in the spring—funding depends on legislature. Contact Daryl Johnston, (360) 902-1114.

Department of Transportation

• ISTEA enhancement project funding: Provides funds to local jurisdictions for enhancement projects—those designed to enhance natural and cultural resources, improve bicycle and pedestrian access, and preserve abandoned railway corridors. All projects must relate to transportation and must be capital improvements. The program categorizes enhancement projects into the following ten categories: provision of facilities for bicycles; provision of facilities for pedestrians; acquisition of scenic easements and scenic or historic sites; scenic or historic highway programs; landscaping and other scenic beautification; historic preservation; rehabilitation and operation of historic transportation buildings,

structures, or facilities; preservation of abandoned railway corridors; control and removal of outdoor advertising; archaeological planning and research; mitigation of water pollution due to highway runoff. Contact Greg Selstead, (509) 663-9631.

Interagency Committee on Outdoor Recreation

• Boating Facilities Program: Provides funding for boating-related lands and facilities. Both shoreline and upland acquisition or development projects along fresh or saltwater are eligible, including launch ramps, transient moorage, and support facilities. Contact: (360) 902-3000.

• Land and Water Conservation Fund: Encourages new and expanded public outdoor recreation areas and facilities. Includes development, renovation, and land acquisition. Provides both technical and financial assistance. Eligible clients include cities, counties, tribes, special districts. Must have a comprehensive plan, inventory, and capital improvement program. Contact: (360) 902-3000.

• Washington Wildlife and Recreation Program: Land acquisition program for recreational or habitat related activities. There are seven funding categories—four recreational, and three habitat. The recreational categories may be sponsored by tribes or local governments with a 50:50 match. Funding varies by category and can be sponsored as follows: Critical areas, state agencies; natural areas, state agencies; urban wildlife habitat, tribes and local governments. A $65M appropriation was made for 93-95. Applications due May 1, 1996 for the 97-99 biennium. Contact Eric Johnson at (360) 902-3015.

Natural Resource Conservation Commission

• Funding is provided to employ displaced fishers in habitat restoration through the salmon disaster initiative. Implementation will be carried out through the Washington Conservation Commission. There are $1.4 M provided to Washington Conservation Districts. Application deadline is May 12, 1995. Contact Diane Harvester at (360) 407-6214.

Parks and Recreation Commission

• Winter Recreation Program: Provides funding for non-snowmobile winter recreation facilities. Includes acquisition of land, planning, development, operation, and maintenance. Financial assistance, to cities, counties, tribes, and special districts. Contact: James Horan, 586-1253.

State Conservation Commission

• Non-Point Water Quality Grants Program: The primary purpose of water quality grants is to get practices for water quality improvement on the ground. Eligible water quality projects/activities may include data collection, demonstration projects, implementation of

best management practices, info/education, monitoring, planning, and technical assistance. Provides technical and financial assistance to Conservation districts. Contact: Carroll Boone, 459-6141. Source: Growth Management Directory.

Washington Conservation Corps

• The WCC is a state-funded program designed to enhance Washington's environmental and youth resources. WCC employs young adults in a variety of public works projects. Projects which qualify for the WCC program are: projects that conserve, rehabilitate, or enhance the state's natural, historic, environmental, and recreational resources, such as stream rehabilitation, irrigation district assistance, and erosion control; projects that make outdoor and historic resources of the state available for public enjoyment, such as trail construction and maintenance, or the restoration of historic and recreational properties; projects that assist agencies with limited funding to carry out their statutory assignments, such as lab assistance, land clearing, or fencing around waterways; and projects that provide needed public services in both urban and rural settings. A local match is required through in-kind logistical plus equipment support. A project request can be filled out and submitted at any time; a response is usually made within one month. The project can be initiated one month after approval. Contact: Linda Bradford, (360) 459-6131. The Departments of Fish and Wildlife, Agriculture, and Natural Resources and the Parks and Recreation Commission also have WCC programs.

Private

American Conservation Association, Inc.

Funds activities directed toward information and action programs that increase public understanding of conservation issues and citizen participation in their resolution. Send a short letter and proposal. Contact: George R. Lamb, Executive Vice President, (212) 649-5669. 30 Rockefeller Plaza, Rm. 5402, New York, NY 10112.

Bullitt Foundation

• Gives grants to a variety of environmental projects in the Pacific Northwest. The Foundation has identified the following priority issues: Puget Sound and the strait of Georgia drainage basins; the Columbia River basin; open space; Northwest forests; energy and transportation; environmental justice. Proposals that do not fall within those fields will be considered. Most interested in projects that address important issues in imaginative ways, and use the Foundation's support as leverage to obtain greater resources elsewhere. Call or write for application materials. Deadlines are April 1, August 1, and December 1. Contact: Emory Bundy, (206) 343-0822. 1212 Minor Ave., Seattle, WA 98101.

Coors

• Pure Water 2000: Provides nonprofit groups nationwide with small grants for water quality improvement projects such as river cleanups, restoration projects and educational programs. To apply contact your local Coors distributor or send a short proposal to Coors Pure Water 2000, NH 320, 311 Tenth St., Golden, CO 80401. Contact: Dave Taylor, (800) 642-6116.

Finlandia Clean Water Fund

In conjunction with the American Canoe Association, this group provides grants under $5,000 to grassroots groups working to preserve, protect and enhance the nation's recreational waterways. This includes projects such as water quality monitoring, education and streamside restoration. If interested, write for an application. The deadline is August 15. Contact: David Jenkins, (703) 451-0141. 7432 Alban Station Blvd., Suite B-226, Springfield, VA 22150-2311.

FishAmerica Foundation

This organization supports small projects designed to enhance fish populations, such as habitat enhancement and water quality improvement projects. Write for materials if interested. Applications should be made approximately one year in advance of anticipated need for funding. 1033 North Fairfax St., Suite 200, Alexandria, VA 22314. (703) 548-6338 or fax, (703) 519-1872.

Give to the Earth Foundation

This foundation funds a variety of small environmental projects. Applicants' organizations must have minimal administrative overhead and results must be tangible. Typical grant size is $2,500. Call to obtain guidelines, which can be mailed or sent electronically. Contact: Ellen Liberatori, (800) 933-9628. 4000 Pheasant Ridge Dr., Minneapolis, MN 55449.

Harder Foundation

This is a small foundation. It funds environmental action projects in support of habitat protection, especially prime habitat areas facing immediate threats on public lands. It also funds river protection work. Some of the Harder Foundation's grants involve acquisition of natural areas, especially when they are of biological significance regionally. 40% of grants are made in aggregate to grantees in the states of Washington and Oregon. Write for Guidelines for Grant Proposals. Proposals must be received by August 15. Contact: Del Langbauer, President, (206) 593-2121. 401 Broadway, Tacoma, WA 98402.

Laird, Norton Foundation

Gives grants for projects related to forestry, including habitat protection and environmental protection. If interested, send a letter describing the project, budget and amount requested. If they are interested, an application will be sent. Deadlines are August 31 and December 31. Contact: Marie B. Mentor, President, (206) 454-5292. Norton Building, Floor 15, 802 Second Ave., Seattle, WA 98104-1564.

M. J. Murdock Charitable Trust

The Trust makes environmental grants to Pacific Northwest nonprofit organizations for projects in the categories of education, scientific research, and health. Send a letter of inquiry summarizing the main elements of your proposal. Contact: Ford A. Anderson II, Executive Director, (360) 694-8415. P.O. Box 1618, Vancouver, WA 98668.

Norcross Wildlife Foundation, Inc.

Supports nonprofit organizations doing projects that preserve, conserve, and protect the environment—especially natural resource conservation and environmental education. Prefers specific projects with completion dates and one-year projects (?). Write for guidelines. Richard S. Reagan, President. P.O. Box 0414 Planetarium Station, New York, NY 10024-0414. (212) 362-4831.

North American Wildlife Foundation, Inc.

Funds nonprofit groups doing conservation, demonstration projects, and education in the areas of soil and water conservation, wetlands preservation, and pesticide research. Send letter of inquiry. Charles S. Potter, Jr., Vice President. 102 Willmot Rd., Suite 410, Deerfield, IL 60015. (708) 940-7776.

Northwest Area Foundation

Funds projects promoting sustainable development, including preserving ecosystems. Send a letter of inquiry. Contact: Terry T. Saario, President, (612) 224-9635. East 1201 First National Bank Building, 332 Minnesota St., St. Paul, MN 55101-1373.

Patagonia, Inc.

Makes grants and donates clothing to grassroots and activist organizations working to support environmental issues, especially habitat and wild river preservation and environmental education. Send letter requesting guidelines. Paul Tebbel, Environmental Program Director. P.O. Box 150, Ventura, CA 93002. (805) 643-8616.

Pequod Fund

Supports community-based programs and organizations in the Pacific Northwest. Send a letter of inquiry no longer than two pages. Contact: Alan Rabinowitz, Advisor, (415) 771-4308. c/o the Tide Foundation, 1388 Sutter St., 10th floor, San Francisco, CA 94109.

Phillips Petroleum

• Environmental Partnership Awards: This program gives grants of $500-$5,000 to community organizations doing environmental projects like stream restoration projects. Grants tend to be given to educational projects with schools or groups working with schools. Matching funds are required. Contact: Patricia Marshall, (918) 661-5139. 16 D1 Phillips Building, Bartlesville, OK 74004.

REI

• Great Outdoors Grants: This new initiative seeks to identify specific places for climbing, camping/hiking, bicycling, and cross-country skiing, connected regionally to REI's store locations. REI's focus is on supporting advocacy-oriented, grass-roots citizen participation in outdoor protection at local, state, and national levels. REI is particularly interested in recreation and conservation grants that connect to climbing, camping/hiking, bicycling, paddling and skiing opportunities. Contact: Grants Administrator, (206) 395-3780.

• Special Projects Grants: Grants in three areas. Greenways: urban trail resource encouragement. Mediation: to address user conflicts in the muscle-powered recreation arena, with particular interest in mediation on mountain bike/hiker issues and snow boarding/downhill skiing issues. General grants: assisting conservation and outdoor user groups with membership drives, constituency building, lobbying Congress and grants for activist travel to DC, improving communication technology for grassroots organizing purposes, and other organization strengthening projects. REI's focus is on supporting advocacy-oriented, grass-roots citizen participation in outdoor protection at local, state, and national levels. REI is particularly interested in recreation and conservation grants that connect to climbing, camping/hiking, bicycling, paddling and skiing opportunities. Contact: Grants Administrator, (206) 395-3780.

Strong Foundation for Environmental Values

Gives small grants (~$2,000) to conservation organizations working on habitat protection issues including watershed and river protection. Write for application materials; deadlines are January 15, May 15, and September 15. Contact: Ann Bade, Executive Secretary, (415) 882-7982. 116 Montgomery St., Suite 532, San Francisco, CA 94105.

Washington Foundation for the Environment

Supports groups and individuals working on the cutting edge of environmental concerns in Washington. Provides grants for small but well-focused local environmental projects; sponsors environmental education (students and general public) and organizes conferences on crucial environmental issues. Send a letter of inquiry to P.O. Box 2123, Seattle, WA 98111.

Wilburforce Foundation

Funds wildlife and habitat protection and environmental education projects. Call for application materials. Contact: Timothy Greyhavens, (206) 286-4554. 1200 Westlake Ave. N., Suite 414, Seattle, WA 98109-3528.

6. Sample brochures

Following are samples of brochures that may be used to implement some of the outreach recommendations of this plan.

F. Structural Techniques

Techniques

The discussion of techniques in this section is intended to give the reader a sense of the range of possibilities. The list is not exhaustive. New techniques are continually being developed. Many projects use a combination of techniques; in other cases, techniques are modified to meet the demands of the project. Not all of the techniques discussed are recommended; some are inherently better suited to meet the goals of this plan than others.

Structural projects require careful analysis, on a case-by-case basis, both to ensure that the benefits outweigh the costs and to ensure that the approach used will solve the problem without causing further harm. The techniques listed have been grouped into two broad categories. In general, channel control techniques are used where a stream threatens structures, while restoration techniques are used to improve the function of degraded systems.

Channel control techniques

Channel control projects usually involve stabilizing banks to protect land and structures in problem areas. They may also involve instream modifications, especially where infrastructure is at risk. As with all structural approaches, a thorough understanding of the site and the forces operating there is a vital prerequisite to any action on the ground. One factor common to all such projects is that they tend to restrict movement of the channel. While that is desirable in places where a large investment (such as a bridge) is to be protected, it has undesirable effects as well, and those should be taken into account when designing a project.

Bank stabilization

Many stabilization techniques tend to degrade habitat and aesthetic values, reduce flood storage capacity, and increase flow velocities downstream. However, carefully designed stabilization projects can help protect land and infrastructure while stabilizing a stream and improving its function relative to a range of values. While the cost of installation may be high, maintenance of a well-designed project is likely to be minimal. Careful design and cost:benefit analysis will be required if stabilization projects are recommended.

Riprap

Traditionally, levees and river banks have been protected from scour by *riprap*—armor composed of large pieces of broken rock. Riprapped embankments successfully control erosion, but they create problems as well. The bare rock faces offer less resistance to flow than does native vegetation, so stream velocities may be accelerated, which can cause scouring and erosion downstream. In addition, riprapped banks offer little habitat support—the large debris and litter inputs, shading, and structural complexity associated with natural stream banks are absent. Riprap also constrains the channel, preventing it from moving. When the channel cannot move, it is unable to dissipate energy in response to changing conditions, causing instability in the system. Riprapping is not recommended.

Riprap rehabilitation

Vegetating riprapped banks can restore some of the river's functional capacity. Again, a number of techniques have been used successfully and are suitable as models. Some involve planting hardwood cuttings (e.g., willow stakes) between the rocks composing the riprap; with others, the riprap is covered with soil, the soil stabilized with a geotextile layer, and plants placed on that surface. In addition, placing large rocks or root wads at the toe of the slope may enhance instream habitat quality. Riprapped reaches may also be rehabilitated using any of the riparian restoration techniques discussed below.

Bioengineering

Bioengineering involves the use of geotextiles (fabrics designed for use in soil stabilization projects) and/or engineered plantings. Engineered planting are plantings in which plant materials are used structurally. For instance, in the technique known as live cribbing, dormant hardwood cuttings of *riparian zone* trees are used to construct crib walls. Because of the way they are placed, the stakes help prevent erosion even before they take root. Many techniques are in use, and new ones are being developed as the art of bioengineering evolves. Bio-engineering typically performs better and costs less than riprap in property protection, while providing much greater habitat, hydraulic, and aesthetic benefits.

Biotechnical bank stabilization

Biotechnical projects involve technical stabilization, such as a rock key at the toe of a slope, used in conjunction with bioengineering or other planting techniques.

Dikes

Dikes protect low-lying areas from inundation by flood waters by constraining the channel. Dikes are expensive to build and maintain. Initial construction costs are very high, and the structures, once installed, require recurrent maintenance. While dikes may be cost effective where high-value structures (such as bridges or essential roads) are protected, costs are likely to be too high to justify them solely for protection of floodplain residences. In addition, dikes can create a false sense of security if landowners do not know what level of flood they have been designed to protect against, and expect more security than a particular structure can offer.

Typically, dikes have been built at channel's edge, where they constrain the river, reducing flood storage and conveyance and diminishing habitat and aesthetic values. They can cause backwater flooding upstream and increase flow velocities downstream. Thus, although a dike may protect a given site, damage can be increased elsewhere in the system. Typically, dikes have been built at channel's edge. However, streamside dikes result in loss of instream and riparian values, and change channel *energetics*, increasing the possibility of damage downstream during periods of high water. More recently developed is the idea of setting dikes back so that at least part of the floodplain retains its connection to the river. (See Figure VI.1.)

Instream modifications

Instream modifications may be appropriate where infrastructure needs protection, or where environmental changes have destabilized the system, changing channel *energetics* to the

extent that some modification of flow is required. Various techniques may be used to realign flow or disperse erosive energy. Possibilities include:

- Spur dikes or bank barbs (short dikes extending into the stream) to direct water away from the bank and minimize erosion.

- Low dikes designed to protect vulnerable sites from flooding. Dikes should be short and used to protect a given site, not to allow development within an area. Where possible, they should be located outside the floodway. If necessary (e.g., to protect a bridge approach), they may be located within the floodway.

- Boulders placed in the low-flow channel to disperse flow, create habitat, and disperse bedload.

- Logs anchored in stream to redirect flow or reduce flow velocity.

- Approach dikes to align flow upstream of bridges.

- Channel re-alignment to a more naturally-occurring stream type.

- Diversion modification to reduce erosion and/or improve habitat characteristics at irrigation diversion sites.

- Vortex rock weirs.

Techniques for restoring function

Floodplain modifications

Floodplain modifications are techniques for restoring the connection between rivers and their floodplains where the channel has been constrained by dikes, levees, or roads. Several options are possible, depending on the situation; they include:

- Raise key roads above the maximum flood level to prevent overtopping and keep them in service during floods. Drainage should be provided under the road prism to allow more of the floodplain to be used by floodwaters.

- Rebuild bridges to reduce their constriction of flood flows and to improve conditions relative to other values—e.g., riparian habitat, pedestrian/bicycle use.

- Remove dikes to restore some areas of the floodplain that previously served to store or convey floodwaters.

- Lower non-critical roadways to allow floodwaters to flow more freely.

Stream and riparian restoration

Restoration projects provide a means for improving the functional quality of a degraded stream system. Restoring stream and riparian structure and function can slow flood waters, provide storage capacity, and improve groundwater recharge. Where a channel has been constrained or cleared, or the integrity of the *riparian zone* compromised, restoration techniques can be used to improve the river's capacity to handle flood flows, stabilize groundwater levels, prevent erosion and scouring, and support fish and wildlife. Many restoration techniques have been developed and can be used as models. Riparian restoration usually involves revegetation or enhancement of existing vegetation, although in some cases native vegetation will regenerate naturally. Recontouring may be used to restore artificially steepened banks. Where the streambank is not stable or where much bare soil is exposed, structural measures and instream modifications may be required (see bioengineering, above).

Restoration offers a range of benefits consistent with the goals of this plan. In any situation in which restoration is proposed, the project must be designed to suit the specific conditions at the site. It is never appropriate to select a technique without thoroughly analyzing the problem site in context. Techniques may be combined or modified; riparian restoration may be used in conjunction with floodplain modifications to develop a functional floodplain.

Project Assessment System

The questions below are intended to be used to assess projects in which the County participates, including Public Works, Engineering, and Roads projects and projects proposed under the Habitat Conservation Planning/Watershed Planning process.

Safety

- To what degree does the proposal protect lives and reduce public risk?
- To what degree does the proposal reduce the level of flood damage vulnerability in existing structures and developed property?
- Does the proposal address a serious hazard to life or property?

Imminence

- Does the problem addressed present an immediate acute danger to life, property, or habitat? An existing chronic degradation? A projected acute danger?

Land use compatibility

- To what degree does the proposal meet the intent of land use plans and regulations?
- What will be the effect of the project on future development in areas vulnerable to flooding?

Environmental compatibility

- To what degree does the proposal restore or protect natural resources, recreational areas, open space, or other environmental values?
- To what degree will the proposal enhance existing elements of the river corridor and its associated habitats or restore degraded elements?
- Are flood waters accommodated through protection or restoration of wetlands and floodplains?

Costs/funding

- What is the cost of the project, including construction, engineering, land acquisition, operations and maintenance, and legal fees?
- What funding is available?
- Will the project provide a long-term solution by addressing the cause of a problem?
- What is the cost: benefit ratio, taking into account the full range of tangible and intangible factors?
- Will the project reduce County liability?

Public participation or acceptance

- Has the public been involved in addressing the problem?
- Does the proposal provide for present and ongoing public education?
- What is the degree of public acceptance for the proposal?

G. Alluvial Fan Flooding, Flash Floods, and Ice Jams

The following material on alluvial fan flooding, flash flooding, and ice jams has been copied from *Reducing Losses in High Risk Hazard Areas: A Guidebook for Local Officials*, prepared for FEMA by the association of State Floodplain Managers. It includes options for community action, guidelines and examples of ordinances adopted by other communities, and lists of references.

OPTIONS FOR COMMUNITY ACTION

Policy and Program Elements

A community with alluvial fan flooding should adopt a policy and program which contains the following elements:

1. A statement that alluvial fans are much more hazardous than shallow flooding areas or normal riverine floodplains due to the combined erosion and flooding problem;
2. A mapping program, perhaps as an overlay system for existing land use base maps;
3. Special standards for siting and constructing on fan areas to address velocity, debris and erosion;
4. A master drainage and development plan for the fan as a whole, including careful design and siting of roads, drainageways and other public works on the fan;
5. Construction of debris basins or other engineering measures for the fan, particularly where existing development is at risk.

Mapping

At a minimum, alluvial fan areas should be identified on flood maps as high risk areas. Some alluvial fans have already been identified on flood insurance study maps as "shallow flooding" areas. Fans so designated should either be remapped or an overlay map should be prepared to indicate areas where water velocities, debris, erosion and channel migration are potential problems.

It may be possible to identify alluvial fan areas at modest cost using existing air photos, soils maps and topographic data. Alluvial fans are often highly visible in arid and semi-arid areas due to their distinctive shape and the presence of boulder trains. In

forested areas, fans may be more difficult to map. Topographic and soils maps may be used to identify areas with steep slopes and alluvium.

An outline of alluvial fan areas can, even without more detailed identification of risk zones within the fans, be an important "red flag" for land use decisions. Once outlined, fans can be zoned as high risk areas. Developers can be required to conduct detailed studies of the flood risk and design accordingly.

Engineering methods, although quite expensive, are available for mapping fans in more detail and determining the relative risks within the fans. With these maps, zoning regulation can be quite specific. However, site-specific studies and master planning will still be needed as new development is proposed.

Regulations

Regulations for alluvial systems should have two principal goals: to prevent acceleration or diversion of runoff and increased erosion, and to insure that individual structures and infrastructures are adequately protected from high velocity flows, debris and erosion.

If the fan is undeveloped, future flood damages can be avoided by prohibiting development. Development should only be permitted if a master plan has been prepared. An alluvial fan master plan should show the drainage system, roads, grading and filling needed for drainageways, debris walls and other flood protective measures, such as bank stabilization, erosion control measures and floodways to be maintained as open space. Where the fan is in multiple ownership, the community should prepare the master plan. Developers can be required to implement their portion as a condition of plat approval or building permits. Las Vegas takes this approach. Where the fan is in single ownership, regulations may require the developer to prepare a master plan for the fan as a whole. Zoning, subdivision controls or grading codes can be adopted to limit development densities, impervious surfaces and modifications to natural topography.

To help protect individual structures, include the following provisions in your building codes, zoning regulations, grading codes and subdivision regulations:

1. Prohibit building in areas where velocities exceed a selected threshold level (e.g., 7 feet per second).
2. Require that structures in other areas be elevated on stabilized fill or reinforced pilings to a height above the 100-year flood elevation, taking into account debris as well as water elevations.

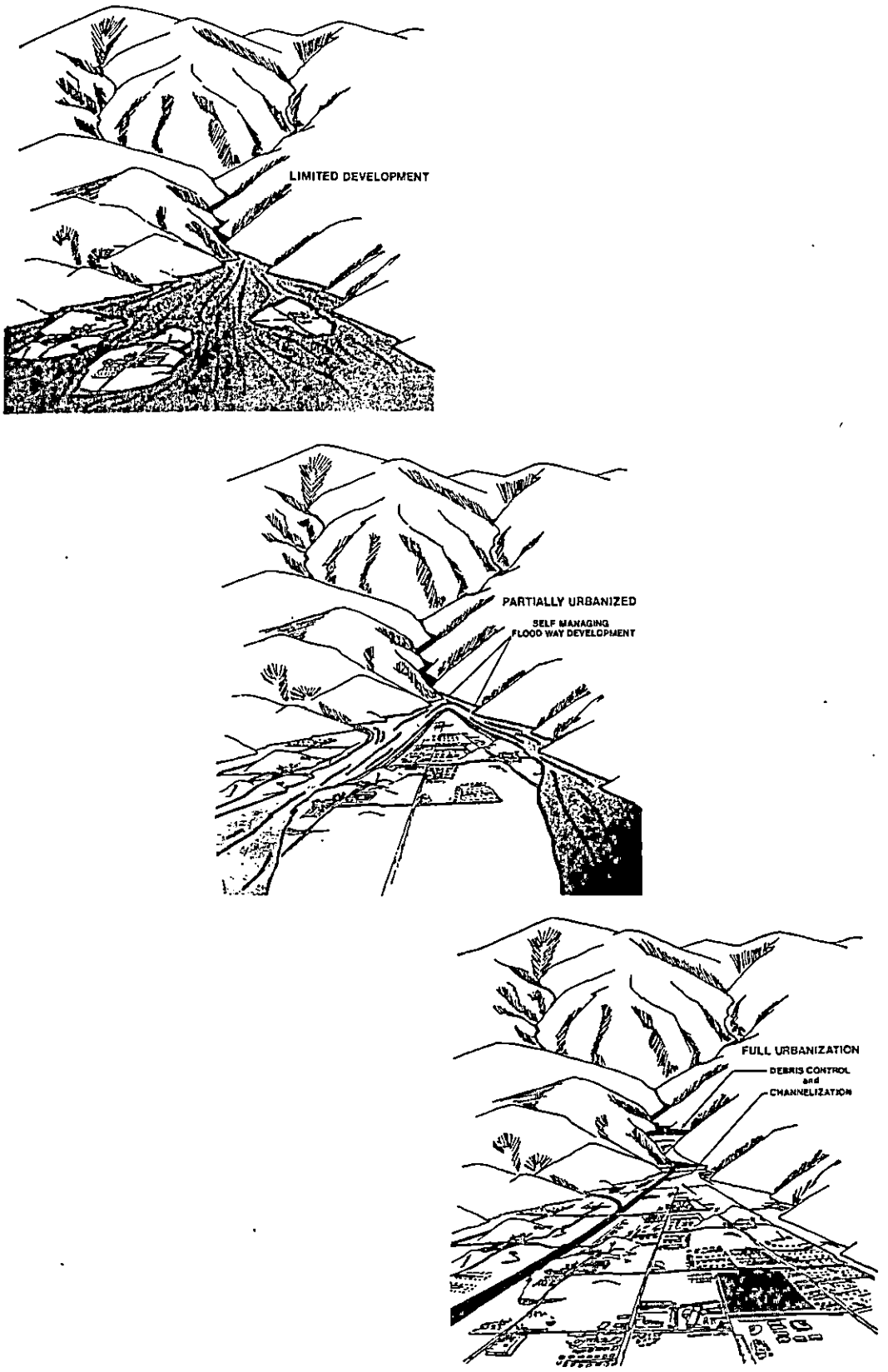

Figure 3-6: Regulations should be combined with nonregulatory options depending upon the levels of existing development.

Appendix 3-A: Suggested Development Guidelines for Various Hydraulic Zones on the Fan.

The following applications of management tools were recommended by *Floodplain Management Tools for Alluvial Fans*, a report prepared for the Federal Emergency Management Agency (1981). The recommendations apply to each hydraulic zone on the fan and for the placement of single structures:

Channelized Zone

Development prohibited unless whole-fan measures are implemented.

Braided Zone

Basements and mobile homes prohibited.

Streets aligned and designed to convey entire flood flow.

Use of local dikes to direct flows into streets.

Use of drop structures between homes built on high slopes to prevent excessive erosion.

All management tools must be coordinated with tools in existing developments.

Whole-fan management tools can be used instead of the above provisions.

Shallow Flooding Zone

Elevation of structures on piles or armored fill.

Street orientation to maximize flood conveyance.

If up-fan subdivisions use depressed streets or channels to convey floods, these tools must be continued down to the fan toe.

Use of drop structures between homes built on high slopes.

Whole-fan management tools can be used instead of the above provisions.

Placement of Single Structures

In undeveloped areas, place structures on armored fill or use local dikes provided that no added flood damage to other structures results.

In developed areas, local dikes, channels and armored fill must tie in with existing flood control tools.

Elevation on piles should be used if above criteria cannot be met.

No single placement should be allowed in the channelized zone.

Appendix 3-B: FEMA's Guidelines for Study Contractors: Alluvial Fan Studies

From *Guidelines and Specifications for Contractors*, September 1982, FEMA - 37/July 83 printing, Federal Emergency Management Agency, Washington, D.C.

1. INTRODUCTION

The methodology outlined in this Appendix is based on procedures developed by Dawdy (Reference 1) and later modified (Reference 2) to account for split flow conditions generally found in the lower reaches of active alluvial fans. It is recommended that the Study Contractor review these publications for a complete discussion of the theory, rationale and assumptions used to develop this methodology. In portions of alluvial fans in which natural alluvial fan processes may not occur, such as in areas of entrenched channels, areas protected by flood control works, and heavily developed areas, the Study Contractor should exercise good engineering judgment in determining the most appropriate methodology or combinations of methodologies.

When it is determined that an area in a community is subject to alluvial fan flooding, a thorough reconnaissance of the alluvial fan should be made in order to determine the source of flooding, the apex of the fan, the boundaries the fan, the areas of coalescence of contiguous fans, the limits of entrenched channels, single and multiple channel regions where evident, and the areas of active alluvial fan processes. The reconnaissance should make use of available topographic, geologic, and soil maps; aerial photographs; historic records; and site inspection.

Prior to undertaking any computations, the Study Contractor should obtain approval from the PO for the use of the methodology outlined in this Appendix.

2. ASSUMPTIONS AND OBSERVATIONS

The approach outlined in this Appendix makes use of statistical analyses that relate the probability of given discharges at the apex of a fan to the probability of certain depths and velocity of flow occurring at any point on the fan below the apex. The methodology presented in this Appendix is based on assumptions and observations regarding floodflows on active alluvial fans outlined in the following sections.

a. Channel Pattern and Location

At the time of maximum flow during a major flood event on an active fan, flow does not spread evenly over the fan but is confined to only a portion of the fan surface that carries the water from the apex to the toe of the fan. In upper region of the fan, flood flows are confined to a single channel which is formed by the flow itself through erosion of the loose material that makes up the fan. Because of the relatively steep slopes in the upper region, flood flows are at critical depth and critical velocity. Below the apex of fan (or the zone of entrenchment in the case of mature fans), the channel will occur at random locations at any place on the fan surface; under natural conditions, it is no more likely to follow a pre-existing flowpath than it is to follow a new flowpath. This channel has an approximately rectangular cross section for which depth, width, and velocity of flow can be expressed as functions of discharge at the apex of the fan.

In the lower region of the fan, flood flows split and form multiple channels. For purposes of this procedure, the concept of a single eguivalent channel is used to compute flood depths and velocities. Normal flow conditions are considered to exist in the multiple channel region due to the relatively flatter slopes.

The probability of a point being flooded in a given flood event decreases from the apex to the toe of the fan because the downslope widening of the fan surface provides a greater area over which a channel of given width may occur.

b. Depth of Flooding

For flood mapping purposes, the depth of flooding computed on alluvial fans is the depth of flow (depth of channel) in the channel that carries a given discharge to the toe of the fan surface.

c. Velocity of Flooding

For alluvial fan flood mapping, the velocity of flooding computed for alluvial fan flood mapping is the velocity of flow in the channel that carries the given discharge to the toe of the fan surface.

d. Avulsions

During major floods on active alluvial fans, peak flows may abruptly abandon one channel that had been formed during the flood, and form a new channel This phenomenon, termed an avulsion, can cause a significant increase in the probability of flooding at a given point on a fan because of the increased channel widths that may cross a given contour during a given flood event. The treatment of avulsions is an important factor in the application of the methodology presented in this Appendix.

3. FLOOD HAZARD ZONES

Special flood Hazard Areas on alluvial fans are identified as Zone AO with the following definition:

*Zone AO: Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

** Exception to the 3-foot depth limit for zone AO is permitted for alluvial fans when approved by the PO.*

The Special Flood Hazard Area on each alluvial fan is subdivided into separate AO zones with similar depths and velocities. Zones are delineated that have depths or velocities differing by an average of 1.0 foot in depth or 1.0 foot per second (fps) in velocity.

In areas of coalescent alluvial fans, separate depth-frequency relationships should be developed for each source of flooding and combined based on the probability of the union of independent events.

4. COMPUTATIONAL INSTRUCTIONS

Step-by-step instructions are provided below for computing the boundaries of flood hazard zones on alluvial fans using log-Pearson Type III analyses in accordance with Bulletin No. 17B (Reference 3).

a. Determine Flood Discharge-Frequency Distribution

For the source of flooding at the apex of each alluvial fan, a complete flood discharge-frequency distribution should be determined using log-Pearson Type III analyses in accordance with Bulletin No. 17B. The determination of flood discharges in arid regions, where alluvial fans are most frequently found, should be closely coordinated with the PO to ensure agreement on methodology.

The skew coefficient, standard deviation, and mean of logarithms of discharges must be determined for the flooding source at the apex of the fan. When an analysis according to Bulletin No. 17B is done, these statistics are known. For most alluvial fans, however, these statistics will not be available. Therefore, flows of various recurrence intervals should be computed from appropiate regional methods, and the synthetic log-Pearson Type III parameters should be derived.

Derivation of Skew Coefficient. Derive the skew coefficient using the ollowing equations:

$$G = -2.50 + 3.12 \text{ Log } [(Q_{.01}/_{.10})/(Q_{.10}/_{.50})] \quad (1)$$

Using the skew coefficient computed above and the K values for the skew as shown in Bulletin No. 17B, the standard deviation should be derived according to the following equations:

$$S = [\text{Log}(Q_{.01}/_{.50})/(K_{.01} - K_{.50})] \quad (2)$$

(2) Derivation of Mean of Logarithms. Using the values determined in Equations 1 and 2, the mean of logarithms should be derived according to the following equation:

$$X = \log (Q_{.50}) - K_{.50}(S) \quad (3)$$

where S and X are the standard deviation and mean respectively; $Q_{.01}$, $Q_{.10}$, and $Q_{.50}$ are discharges with 0.01, 0.10 and 0.50 exceedance probabilities; and $K_{.01}$ and $K_{.50}$ are Pearson Type III deviates for respective exceedance probabilities of 0.01 and 0.50 and skew coefficient G. Equation (1) above is an approximation appropriate for use between skew values of +2.5 and -2.0.

b. Compute Transformation Variables

To permit solutions by use of log-Pearson Type III analysis and Bulletin No. 17B, the log-Pearson Type III parameters must be transformed.

Variables for transforming these parameters should be computed as follows:

$m = \overline{X} - 2S/G$

$alpha = 2/GS$

$lambda = 4/G^2$

and

$a = alpha - 0.92$

If the skew coefficient is zero (log normal distribution), the transformation variables should not be computed.

c. Transform log-Pearson Type III Parameters

Where skew coefficients are not zero, the log-Pearson Type III parameters should be transformed using the variables above according to the following equations:

$\overline{Z} = m + lambda/a$

$S_Z^2 = 2/lambda^{1/2}$

Where the skew coefficient is zero (log normal distribution), compute the parameters as follows:

$\overline{Z} = \overline{X} + 0.92S^2$

$S_Z = S$

$G_Z = G$

d. Compute Transformation Constant

$C = (alpha/a)lambda\ e^{0.92m}$

Where the skew coefficient is zero (log normal distribution), the transformation constant should be computed as follows:

$C = e^{0.92X+0.42S*S}$

e. Determine Discharges for Depth and Velocity Zones

The alluvial fan flooding can be determined by a combination of two methods. They are based on a single channel region and a multiple channel region in the analyses. The single channel region is defined by the length of the single channel measured from the mouth of the canyon to the point where the flood channel splits. If there is no clear indication as to the length of the single channel from data collected during the reconnaisance phase, the length of the single channel can be determined using Figure B-1. Below

the single channel region of the fan is the multiple channel region. The fan width along the boundary between the single channel and multiple channel regions can be measured from the topographic map, once the length of the single channel is known.

I. Single Channel Region

Within this region, discharges, Q (in cubic feet per second), that correspond to the various depth zone boundaries should be selected using the table below. This table was derived from the relationship:

$$Q = 280\ D^{2.5}$$

where D is the total depth in feet due to pressure head and velocity head.

Q	49.5	772	2770	6420	12000
D	0.5	1.5	2.5	3.5	4.5

Depth zones are designated from zone boundaries as follows:

Depth of Zone	Depth of Lower Boundary	Depth of Upper Boundary
1	0.5	1.5
2	1.5	2.5
3	2.5	3.5
4	3.5	4.5

Discharges, Q (in cubic feet per second), that correspond to the various velocity zone boundaries should be selected using the table below. This table was derived from the relationship:

$$Q = 0.13\ V^{5}$$

where V is velocity in feet per second.

Q	68	240	654	1510	3080	5770
V	3.5	4.5	5.5	6.5	7.5	8.5

Velocity zones are designated from zone boundaries as follows:

Zone Velocity	Velocity of Lower Boundary	Velocity of Upper Boundary
4.0	3.5	4.5
5.0	4.5	5.5
6.0	5.5	6.5
7.0	6.5	7.5
8.0	7.5	8.5

II. Multiple Channel Region

Within the multiple channel region, discharges, Q (in cubic feet per second), that correspond to the various depth zone boudaries may be calculated by iteratively solving the following equation:

$$D = 0.0917\, n^{.6} S^{-.3} Q^{.36} + 0.001426\, n^{1.2} S^{.6} Q^{.48}$$

where D is the total depth in feet due to pressure head and velocity head, S is the fan slope, and n is Manning's roughness coefficient for the alluvial fan flood channel.

Discharges, Q (in cubic feet per second), that correspon to the various velocity zone boundaries should be calculated using the equation:

$$Q = 99314\, n^{4.17} S^{-1.25} V^{4.17}$$

where V is velocity in feet per second and S is the fan slope.

Depth zones and velocity are designated from zone boundaries in the same manner as shown in the analysis for the single channel region.

f. Compute Fan Widths for Zone Boundaries

The fan widths (i.e., arc lengths from one lateral limit of the fan to the other taken parallel to contours) that correspond to each upper and lower zone boundary depth and velocity listed in Section 4e should be computed both for the single channel region and the multiple channel region. The following formulas should be used:

I. Single Channel Region

Fan Width = 950ACP

II. Multiple Channel Region

Fan Width = 3610ACP

In the above two formulas, A is the avulsion coefficient, C is the transformation constant, and P is the probability of the discharge that corresponds to each given depth and velocity.

An avulsion coefficient (factor) greater than 1 should be selected by the Study Contractor in consultation with the PO. A factor of 1.5 is recommended in the absence of other data.

In summary, the steps for the determination of the flood velocity and depth boundaries are listed as follows:

1. Compute all flood depth and velocity zone boundaries by the standard single channel method.

2. Determine point of bifurcation into multiple channel region through use of Figure B-1 and the calculation of near fanhead canyon slope to fan slope ratio.

3. If the point of bifurcation is downfan from the lower boundary of the one-foot depth zone as computed by the standard single channel method, the standard single channel method will be used for the determination of all flood boundaries on the fan.

4. If the point of bifurcation is upfan from the upper boundary of the one-foot depth zone as computed by the standard single channel method, the one-foot depth zone boundaries will be changed to that computed for the multiple channel method. Substitute those boundaries for the boundaries computed by the standard single channel method.

5. If the point of bifurcation is upfan from the one-foot depth zone boundaries as computed by the standard single channel method, compute the depth and velocity at the point of bifurcation by the standard single channel method. Compute the velocity and depth boundaries for velocities and depth less than those determined for the point of bifurcation by use of the multiple channel method. Substitute those boundaries for the boundaries computed by the standard single channel method.

5. FIRM

When the fan arc widths that form flood hazard zone boundaries have been computed, these distances should be scaled onto topographic base maps, taking care to make the boundaries parallel to contours.

The sketch map shown in Figure B-1 depicts the typical distribution of flood insurance rate zones on an active alluvial fan, as determined by the methodology outlined in this Appendix.

6. REFERENCES

1. David R. Dawdy, Flood Frequency Estimates on Alluvial Fans, *Journal of the Hydraulics Division, ASCE, Proceedings,* Vol. 105, No. HYII, pp.1407-1413, 1979.

2. DMA Consulting Engineers for FEMA, *Alluvial Fan Flooding Methodology - An Analysis,* August 1985.

3. U.S. Department of the Interior, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No 17B, *Guidelines for Determining Flood Flow Frequency,* September 1981, revised March 1982.

Appendix 3-C: Excerpts from Sample Flood Damage Prevention Ordinance, Prepared by FEMA, Region X, Bothell, Washington.

5.2 STANDARDS FOR ALLUVIAL FANS

Areas subject to alluvial fan flooding have irregular flow paths that result in erosion of existing channels and the undermining of fill material. Those areas are identified on the Flood Insurance Rate Map as AO Zones with velocities.

1. All structures must be securely anchored to minimize the impact of the flood and sediment damage.

2. All new construction and substantial improvements must be elevated on pilings, columns, or armoured fill so that the bottom lowest floor beam is elevated at or above the depth number.

3. Use of all fill materials must be armoured to protect the material from the velocity of the flood flow.

4. All proposals for subdivision development must provide a mitigation plan that identifies the engineering methods used to:

   a. Protect structures from erosion and scour caused by the velocity of the flood flow.

   b. Capture or transport flood and sediment flow through the subdivision to a safe point of deposition.

5. All mobile homes shall be prohibited within the identified hazard area except within existing mobile home parks or subdivisions.

Appendix 3-D: Excerpts from Colorado's Model Geologic Hazard Area Control Regulations.

The following model regulations for identification, designation, and control of land use in areas of geologic hazard were prepared by the Colorado Geological Survey in accordance with statutory charges contained in Colorado HB-1041. Whereas, at least to our knowledge, comparable laws or regulations dealing with geologic hazard areas have never been written, this has been a pioneer effort. However, since laws, regulations, and administrative procedures for floodplain hazard areas have been developed and tested during the past, they have drawn heavily upon the language of tested floodplain regulations in drafting these model regulations.

WHEREAS, authority for the governing body of a municipality or a county to adopt, amend, repeal, enforce and otherwise administer under the police power reasonable Geologic Hazard Area Land Use Control Regulations and orders pertaining to land use within the areas of its jurisdiction..., and

WHEREAS, the uncontrolled use of land within geologic hazard areas...adversely affects the public health, safety and welfare of the citizens..., and

WHEREAS, the governing body...is empowered...to designate and administer areas of state interest in a manner that will minimize significant hazards to public health and safety or to property due to a geologic hazard, and

WHEREAS, geologic hazards are declared to be matters of state interest and are defined...to include but not be limited to avalanches, landslides, rockfalls, mud flows, unstable or potentially unstable slopes, seismic effects, radioactivity and ground subsidence;

...NOW, THEREFORE, the Board of County Commissioners (City Council) does enact the following Geologic Hazard Area Control Regulation:

SECTION 1.0 PURPOSES

To promote the public health, safety and general welfare, to minimize the effect of significant hazards to public health and safety or to property due to a geologic hazard by the proper administration of all land use changes within such geologic hazard areas, and to promote wise use of geologic hazard areas. This Geologic Area Control Regulation has been established with the following purposes intended:

1.1 To reduce the impact of geologic hazards to life and property by:

1.11 Prohibiting certain land uses...

1.12 Restricting the uses which would be hazardous...

1.13 Restricting the uses which are particularly vulnerable to geologic hazards so as to alleviate hardship and reduce the demands for public expenditures for relief and protection.

1.14 Restricting permitted land uses in geologic hazard areas, including public facilities...to be protected...by providing for geologic hazard investigation and avoidance or mitigation or hazard impacts at the time of construction.

1.15 Adopting Chapter 70 of the Uniform Building Code...for the regulation of excavation and grading of lands...

1.2 To protect geologic hazard area occupants or users from the impacts of geologic hazards which may be caused by their own, or other, land use and which is or may be undertaken without full realization of the danger by:

1.21 Regulating the area in which, or the manner in which, structures designed for human occupancy may be constructed...

1.22 Designating, delineating and describing areas that could be adversely affected by geologic hazards so as to protect individuals from purchasing or improperly utilizing lands for purposes which are not suited.

1.3 To protect the public from the burden of excessive financial expenditures from the impacts of geologic hazard and relief by:

1.31 Regulating land uses within geologic hazard areas so as to produce a pattern of development or a soundly engineered manner of construction which will minimize the intensity and/or probability of damage to property and loss of life...

1.32 Regulating the cutting, filling, or drainage changes...which could initiate or intensify adverse conditions within geologic hazard areas.

SECTION 2.0 GENERAL PROVISIONS

2.1 Jurisdiction: This regulation is applicable to all lands within Designated Geologic Hazard Areas...

2.2 Boundaries: The boundaries of the Designated Geologic Hazard Areas shall be as they appear on the official recorded Designated Geologic Hazard Area Maps as adopted... and kept on file...

2.3 Interpretation: In their interpretation and application, the provision ... shall be held to be minimum requirements and shall be liberally construed in favor of the governing body... Interpretations... shall be consistent with GUIDELINES AND CRITERIA FOR GEOLOGIC HAZARD AREAS prepared by the Colorado Geological Survey...

2.4 Warning and Disclaimer of Liability: The degree of protection from geologic hazards intended to be provided by this Regulation is considered reasonable for regulatory purposes, and is based on accepted geologic and scientific methods of study...unforeseen or unknown geologic conditions or natural or man-made changes in conditions such as climate, ground water, drainage, or structural strengths of the rocks and other geologic materials may contribute to future damages to structures and land uses even though properly permitted...

2.5 Adoption of Official Maps: The location and boundaries of the Designated Geologic Hazard Areas established by this Regulation are shown upon the official Des-

ignated Geologic Hazard Area Maps...which are hereby incorporated into this Regulation...

SECTION 3.0 NONCONFORMING USES.

SECTION 4.0 DESIGNATED GEOLOGIC HAZARD AREAS.

4.1 Application

4.2 Description of Designated Geologic Hazard Areas

4.3 Description of Permitted Uses: The following open uses shall be permitted within Designated Geologic Hazard Areas...

4.31 Agricultural uses such as general farming, grazing, truck farming, forestry, sod farming and wild crop harvesting;

4.32 Industrial-commercial uses such as loading areas, parking areas...and storage yards for equipment...easily moved or not subject to geologic hazard damage.

4.33 Public and private recreational uses not requiring permanent structures designed for human habitation...if such uses do not cause concentrations of people in areas during periods of high hazard probability.

SECTION 5.0 ADMINISTRATION

5.1 Designated Geologic Hazard Area Administrator...

5.2 Application for Development Permit...

5.3 Permit Review...

5.4 Permit Approval or Denial...

5.5 Mapping Disputes...

SECTION 6.0 ENFORCEMENT AND PENALTIES

SECTION 7.0 AMENDMENTS

SECTION 8.0 SEVERABILITY

SECTION 9.0 DEFINITIONS

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OPTIONS FOR ACTION

FLASH FLOOD WATCH

there may be flooding;
stay alert;
watch for thunderstorms;
keep an eye on rivers and streams;
be ready to take necessary actions if a FLASH FLOOD WARNING is issued
or if flooding is observed.

FLASH FLOOD WARNING

there is flooding;
act at once;
move out;
go to a safe area on high ground.

Policy and Program Elements

A community with a flash flood problem should adopt a policy and program with the following elements:

1. A resolution or ordinance stating that certain flood areas are subject to special risks to life and property due to rapidly rising water and in some instances, high velocity, erosion and debris.
2. The mapping or designation of streams or drainageways with potential for rapid inundation, high velocities and erosion or debris potential.
3. Regulations for new development in flash flood areas to either prohibit such development or require that it be designed and located to withstand flash flooding and so that rapid evacuation is possible. Warning systems and evacuation plans should be required for hotels and other establishments open to the public. Where

flooding will be worsened by development in the watershed, zoning and subdivision regulations should adopt a zero excess discharge goal for stormwater runoff.

4. Implementation of flood warning systems and evacuation plans for areas with existing development. (See Appendix 7-A for an inventory of organizations to be involved.)

5. Marking of flash flood areas with "climb to safety" or other indicators of risk.

6. Implementation of flood control measures (where appropriate) including construction of levees, dikes, reservoirs.

7. Relocation of structures from truly high risk areas.

Mapping

A community should prepare maps for areas subject to flash flooding. If areas are already mapped by the NFIP, the preparation of new overlay maps may be advisable. NFIP maps indicate floodway and flood fringe boundaries but do not indicate areas with rapidly rising water, high velocity (except in floodways), debris or erosion potential. New maps may also be needed for smaller streams and drainageways which typically have not been mapped by the NFIP. In mapping flash flood areas, an inventory should also be made of specific sites where threats to private and public safety may occur in the event of a flash flood such as low road crossing at hotels, motels, houses or other structures threatened by the flood waters and having inadequate access.

A community effort to identify areas with flash flood potential can begin with the collection of historical flood data. Local residents and newspaper accounts often indicate streams or reaches of streams subject to flash flooding. Historical data can be supplemented with preliminary watershed surveys based upon topographic maps, soils maps, and air photos. High gradient streams in areas of steep topography with limited vegetation or natural detention areas are often potential flash flood areas.

If sufficient funds are available, more detailed engineering studies can be used to identify streams and reaches of streams with flash flood potential, areas along these streams subject to potential debris and erosion problems or areas where threats to public or private safety may occur.

Stormwater runoff models are available to identify flash flood areas in urban settings. See the selected reference for a description of some models. In general, these models require slope, soil and land use information. Regional streamflow and precipitation as well as other data can often be obtained from published sources.

Regulation

New floodplain regulations should be adopted for existing community floodplain regulations upgraded for flash flood areas. After a flood disaster, moratoria on rebuilding can be adopted to permit mapping, planning, relocation and other mitigation. Such moratoria were adopted by both Rapid City after the 1972 flood and Larimer County after the 1976 flood in Big Thompson Canyon. Other options in both pre- and post-flood contexts include:

1. *Zoning* can be used to broaden floodways to include areas where the rapid rise of water may threaten life, areas subject to high velocity flows (if such areas are not already included) and areas subject to severe erosion. Alternatively, additional building setbacks or open space zoning can be applied to such high risk areas.
2. *Building codes and zoning* can require that buildings be designed to withstand anticipated velocities, erosion and debris. Storage of vehicles, mobile homes and other materials on the floodplain should also be regulated to insure adequate time is available for their removal in the event of a flash flood.
3. *Housing codes* can be used to require that owners of existing multi-family structures in high risk areas install warning systems and prepare evacuation plans.
4. *Drainage and subdivision regulations* can be used to require installation of drainage systems in subdivisions. They can also be used to reduce increases in runoff due to urbanization by limiting development densities and percentages of impermeable surfaces and by requiring onsite detention and flood storage areas.
5. *Land and water conservation regulations* can be adopted in rural areas to guide management of farming and forestry practices which may increase runoff.

For both urban and rural areas performance standards should be adopted for:

-- Vegetation changes or removal. On steep slopes vegetation should not be disturbed; elsewhere vegetation may be removed if revegetation is completed within a specific period of time after construction.
-- Slope changes. Any change that shortens runoff path should be carefully evaluated for impact on flooding.
-- Impervious surfaces. Impervious surfaces in high risk watersheds should be kept to a minimum. Regulations should allow conversion of only a small percentage of each total site.

-- Wetlands and other natural flood detention areas. Filling of natural detention areas should be prohibited. Creation of new detention areas should be required as a condition of plat approval or of a building permit.

Stormwater management models can be used to determine critical slopes and acceptable vegetation coverage and impervious surface. Dallas, TX has conducted detailed studies and mapping to develop such performance standards.

Nonregulatory Options

Principal nonregulatory options for flash flood areas include flood warning systems, evacuation plans and marking of hazard areas. Other options include relocation and engineering works such as dams, dikes and levees.

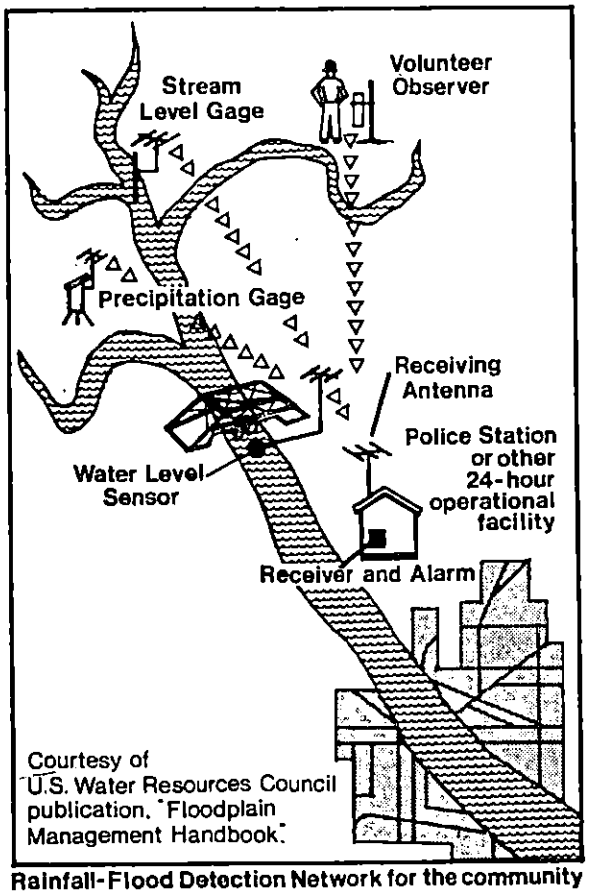
Flood Warning Systems

Flood warning systems can achieve a wide range of benefits outlined in tables Such systems may take several forms:

1. **Self-help** warning system. In populated watersheds, volunteers can monitor rainfall and stream levels during periods of intense rainfall. The inset describes how the self-help flash flood warning system works for communities in the Susquehanna River Basin of Pennsylvania. Many communities have adopted self-help systems with substantial reduction in flood losses in some instances. The National Weather Service provides technical assistance and training for communities establishing self-help flash flood forecasting and warning systems.

How a Self-Help Flash Flood Warning System Works.

The self-help flood warning system is activated by weather forecasts indicating the potential for heavy rain, by locally observed heavy rains, overland runoff or rising streams or by specific information from the National Weather Service. The initial alert starts a pre-planned system of observation and reporting. Volunteer rain and stream gage observers telephone a watershed coordinator who assembles their reports and calls the county or city flash flood coordinator. Using the rainfall and stream reports plus formulas, charts and graphs from the National Weather Service, the flash flood coordinator makes a flood forecast. A forecast can be made in 15 to 30 minutes after the reports are received. Observers report new rainfall and stream data every 30 to 60 minutes; flood forecasts are updated as needed. In addition to the rain and stream gage observers, stream patrols provide on-the-spot reports of conditions such as ice or debris jams and performance of dams, levees and floodfighting efforts. The flood forecasts are used to activate evacuation plans.



Rainfall-Flood Detection Network for the community

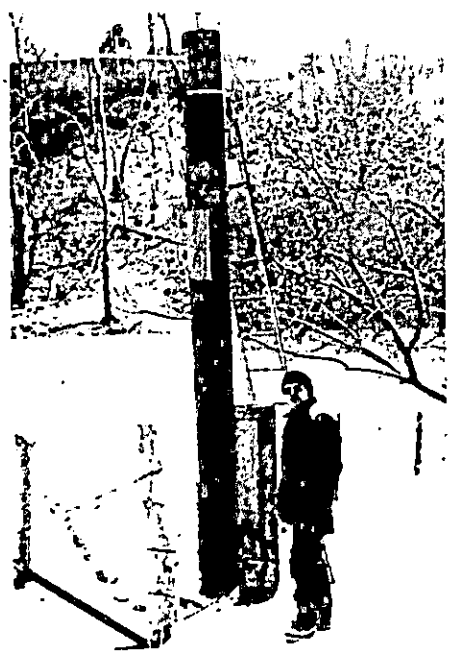


Figure 7-3. Elements of Automated Flash Flood Warning System.

2. **Automated flash flood warning systems.** Often, flash floods are caused by storms in remote areas -- where volunteers are not available and hired observers would be prohibitively expensive. Progress has been made in designing fully automated flash flood warning systems although few are totally operational. (See, for example, discussion of Whitewater State Park Warning System in Appendix 7-B.) Many systems use a combination of data gathered by manual and automated gaging systems. Electronic gages monitoring rainfall and stream levels feed directly into a computer programmed for flood forecasting. Many private firms now design and install automated flash flood warning systems. The National Weather Service has published specifications for communities to use when retaining a contractor to design their flood warning system.

Whether a self-help or automated system is used, flood warning and preparedness involves four major elements:

-- a flood recognition system

-- a flood warning arrangement

-- a preparedness plan and

-- maintenance arrangements.

A careful definition and coordination of roles for public service and safety organizations and the private sector are essential to the operation of each of the elements. Appendix 7-C discusses the benefits of flood warning in the 1985 flood at Ft. Wayne, IN and also shows the need for a wide variety of groups to be involved.

Emergency Response and Evacuation Plans

Warnings can be automated; emergency response and evacuation plans cannot. A flash flood warning system is of little value without a sound emergency response and evacuation plan. Residents and visitors alike must be educated as to the correct response to a flood warning. This may include the closing of flood doors and sewer backup valves, elevation of motors and other electrical equipment, removal of rugs and personal belongings and evacuation. The map of flash flood prone areas should be prominently posted in public places. Information about the flash flood danger and about the warning systems should be discussed in the town, city, county, annual meeting. Other approaches for dissemination include local radio and television stations and brochures made available to residents and visitors.

Marking of Areas

Various types of marking may be applied to flash flood areas. After one flood, Crookston, MN posted markers on telephone poles and other public works indicating flood heights. Although this was not a flash flood, a similar approach could provide invaluable information for flash flood areas. After the Big Thompson Canyon disaster in 1976, the Colorado Department of Transportation posted "climb to safety" signs along roads in canyons along the Front Range.

Acquisition and Relocation

For areas of very high flash risk or in the aftermath of a disaster, acquisition and relocation of structures can provide a permanent solution to flash flood dangers. Relocation may be easier to promote in the aftermath of a flash flood disaster since structures are often severely damaged. Rapid City spent $45 million and purchased the entire floodplain of Rapid Creek for open space use after the disaster in 1972.

Engineering Works

Flash floods dangers may be reduced by constructing dams and levees, floodwalls and other engineering works. However,such works may not be effective for small watersheds with buildings at risk at many sites along the streams and drainageways.

x [illegible] Whitewater State Park -- Case Example, exepts from Minnesota Flood Pain m[illegible] Newsletter, Vol. 1, No. 2, 1983.

Whitewater State Park is a well established regional recreational area in southeast-nesota. In addition to the scenic bluffs, the park is a popular location for camp-ing, fishing, swimming and cross-country skiing. Unfortunately, many of the parks s are located in the floodplain of the Whitewater River.

he Whitewater River has flooded on numerous occasions. Poor soil conservation s during the late 1800's and early 1900's contributed to major flooding during the nd 1940's. By the end of 1978, after four significant floods in five years, the De-t of Natural Resources began to make changes in the use of floodplains in the l explore methods of reducing the threat of floods to existing facilities.

he lack of access to the Group Camp and portions of other campgrounds was a t problem surfacing after each flood event in the 1970's. Unfortunately, federal relief monies made available following floods in 1974 and 1975 could only be restore facilities to their pre-flood conditions. The need to relocate certain park s was recognized and incorporated into the Management Plan for Whitewater State

he July, 1978 flood was the most damaging of all; federal disaster assistance ex-87,000. A portion of the federal relief funds was used to convert one campground -use-only picnic area. State funds were later used to expand camping facilities f the floodplain.

h[illegible] oup Camp, nestled in the narrowing valley of the Middle Fork of the te[illegible]ver, consists of seven cabins accommodating a total of 132 persons. The only ess to the site is over a bridge which has washed out on several occasions. The 1974, 1975 and 1978 did little structural damage to these buildings. However, had to evacuate the area by climbing the adjacent bluffs on one occassion and pped in the dining hall on another occasion. Following the 1978 flood, the was made to close the Group Camp during the peak summer thunderstorm months sures could be implemented to reduce the risk to human lives.

ne alternative evaluated was relocating the Group Camp buildings to a site above level. This alternative would have required campers to [safely] remain at the site mes of periodic flooding because the access road to the proposed site would still n inundated by flood water. Estimates for the cost of the project approached

hancing the ability to predict flood occurrences was also evaluated and ulti-iosen as the preferred alternative for two primary reasons: 1) full utilization of p Camp could be maintained while minimizing the threat to human safety, and 2) native could be implemented at a fraction of the cost of relocating the structures.

e National Weather Service (NWS) has determined that it takes anywhere from ve hours from the *beginning* of heavy rainfall to the flooding of the access road oup Camp. Past experience indicates it can take up to 20 minutes to evacuate the mp. To insure to the greatest extent possible that prior warning of potential

flooding is available, a three-tier approach to flood warning is now utilized in the Whitewater River valley.

First, the NWS will continue to provide advance warning of approaching storms. The NWS will issue severe weather watches and warnings directly to the park headquarters, using radio communications if necessary.

Second, an automated flood warning system was installed in the Middle Fork Whitewater River watershed. This system consists of three precipitation gages and two river level sensing gages which utilize radio telemetry to send instantaneous, "real-time" data to the park office. A microcomputer in the park office is used to receive, display and store the rainfall and river level data.

Finally, volunteers in the Whitewater River basin provide backup rainfall data in the event of hardware failure in the automated system.

Flood advisory tables, developed by the NWS, provide a means to predict whether flooding is imminent, based on antecedent soul moisture conditions and rainfall amounts. Once a decision is made that flooding is likely, a written response plan is set into action. This "Flash Flood Emergency Preparedness Plan" details actions to be taken for various anticipated levels of flooding.

While the primary beneficiary of this flood warning system is Whitewater State Park and the public it serves, much of southeastern Minnesota also benefits from this system. The NWS will have direct access to the data from this system to be used to correlate actual rainfall intensities with radar images. More accurate and timely flash flood watches and warnings should result.

Appendix 7-C: February 1985 Fort Wayne Flood Summary, excerpts from a paper by C[illegible], T.R. and R.D. Marshall, 1985.

NWS Airborne Snow Survey

January, 1985 was the fifth snowiest January on record in the Fort Wayne area. From February 10 to 14, 1985, snowfall contributed to a total accumulation of 2.5 to 3.5 inches of snow water equivalent over large portions of Indiana, Michigan, and Ohio. It is interesting to note that a total snow water equivalent accumulation of 3 inches at Fort Wayne during the March 1 to 15 period has a reoccurrence interval of approximately 3300 years (U.S.DOC/WB, 1964). Soil moisture near the surface over the region was at (or above) field holding capacity. On February 15, 16, and 17 (Friday, Saturday, and Sunday), the National Weather Service made airborne snow water equivalent measurements over 92 flight lines covering 20,000 square miles in northern Indiana, southern Michigan, and northwestern Ohio.

The airborne data were sent digitally to the office in Minneapolis, checked for accuracy, entered into SHEF format, and sent over AFOS approximately one hour after the aircraft landed each noon and evening during the three day survey. In this way, the appropriate NWS offices had access to the airborne data within one hour after the aircraft landed from each survey mission.

NWS WSFO and WSO Warnings and Statements

Monday, February 18, was a government holiday. Based on the airborne data collected on February 15-17, on February 18 WSO Fort Wayne notified Allen, Adams, and DeKalb County government units that snowmelt flooding was possible for the region. On T[illegible]ay, February 19, the Indianapolis WSFO issued a severe flood potential statement fo[illegible]orthern Indiana. Additionally, the Indiana Governor and various state agencies were warned of the threat of severe snowmelt flooding for the northern portion of the state during the coming weekend. Weather forecasts for Thursday, February 21, called for above freezing temperatures and precipitation. WSO Fort Wayne called a meeting on February 21 with the Red Cross, Civil Defense, Lutheran Social Services, Salvation Army, Church of the Brethern and the city of Fort Wayne to warn of the flooding threat over the coming weekend. On February 25 at 1:15 PM, the Weather Service issued a crest forecast of 9.50 feet above flood stage for the Maumee River at Anthony Boulevard in Fort Wayne. Thirty-four hours and forty-eight minutes later on February 27 at 12:03 AM, the Maumee River at Anthony Boulevard in Fort Wayne crested at 9.55 feet above flood stage.

Flood Summary for 1978, 1982 and 1985

Fort Wayne has experienced substantial snowmelt flooding during the century. Major floods occurred in 1913, 1943, 1950, 1959, 1978, 1982 and 1985. The Table below summarizes the four greatest floods on the Maumee River at Anthony Boulevard in Fort Wayne where flood stage is 15 feet. It is interesting to note that although the 1978 flood crested 0.7 feet below the 1985 flood crest, the damage caused by the 1978 flood was over $50 million greater that the damage estimated for the 1985 flood by Fort Wayne officials.

FOUR GREATEST FORT WAYNE FLOODS

Year	Stage (feet)	Event (years)	Actual Damage (Feb. 1985 $)
1913	26.1	110	?
1978	23.8	25	$56.8 million
1982	25.9	77	$56.1 million
1985	24.5	50	$ 4.0 million

1982 Flood Costs

Both the U.S. Army Corps of Engineers (Detroit District) and Fort Wayne officials have estimated the 1982 flood damage cost at approximately $57 million (in February 1985 dollars). The Corps has summarized the total 1982 flood costs for each of nine major categories given in the Table below.

ACTUAL 1982 FLOOD COSTS

(Estimated by the U.S. Army Corps of Engineers, Reconnaissance Report - June 1984)
(in February 1985 dollars)

FLOOD COSTS (Feb. 1985 $)	1982 Actual
Structure and Contents Damage	$11,138,000
Public (city and county) Costs	10,079,000
Agency Costs	2,332,000
Evacuation-Residential	1,964,000
Evacuation-Commercial	2,910,000
Lost Wages	6,370,000
Lost Business Revenue	19,943,000
Vehicle Operational Costs	743,000
Opportunity Costs for Vehicle Occupants	611,000

In response to the 1982 flood, the City of Fort Wayne produced a "Fort Wayne - Allen County Flood Protection Plan: April 1982" which outlines an 18 Month Work Program designed to minimize the impact of future flooding. The $11 million dollar program describes measures to:

1. Install river gages, prepare emergency action plans, implement an early warning system (ALERT) in cooperation with the National Weather Service, and develop a flood proofing program,

2. Build new dikes and repair and increase the height of old dikes,

3. Install backwater gates to prevent floodwater backup through the city water and sewage system,

4. Improve existing channels,

5. Acquire floodplain property,

6. Install emergency pumping stations, and

7. Prepare damage survey reports.

In addition, the National Weather Service expanded the Airborne Snow Survey Program operational flight line network to cover much of the area in Indiana, Michigan, and Ohio which experienced significant snowmelt flooding in 1982.

1985 Flood Costs

The U.S. Army Corps of Engineers Reconnaissance Report (1984) provides a procedure to estimate flood costs based on flood stage both with and without the implementation of the Fort Wayne 18 Month Work Program. Consequently, it is possible to take the 1985 flood stage and estimate what the flood damage would gave been without the implementation of the Work Program, the flood ALERT system, or the Airborne Snow Survey Program. The Table below summarizes the estimate of the 1985 flood costs without the previously mentioned improvements.

ESTIMATED 1985 FLOOD COSTS WITHOUT IMPLEMENTATION OF THE FORT WAYNE 18 MONTH WORK PROGRAM, THE FLOOD ALERT SYSTEM, FOR THE AIRBORNE GAMMA RADIATION SNOW SURVEY PROGRAM

FLOOD COSTS (Feb. 1985 $)	1985 ESTIMATE
Structure and Content Damage	$8,954,000
Public (city and county) Costs	7,239,000
Agency Costs	1,681,000
Evacuation-Residential	903,000
Evacuation-Commercial	1,064,000
Lost Wages	,739,000
Lost Business Revenue	5,445,000
Vehicle Operational Costs	541,000
Opportunity Costs for Vehicle Occupants	$433,000
Total	$27,999,000

DISCUSSION AND SUMMARY

Most of the recommendations suggested in the 18 Month Work Plan were implemented before the 1985 flood. The flood ALERT system was installed and the operational airborne flight line network was established in the region before the 1985 flood. These three major improvements limited actual damage in the 1985 Fort Wayne flood to $4 million. Consequently, it is reasonable to suggest that the improvements prevented approximately $24 million in 1985 flood damage.

The Work Plan improvements which were implemented were, no doubt, responsible for preventing a major portion of the $24 million damage which would have likely occurred without the three improvements. Additionally, the flood ALERT system contributed to damage prevention by providing essential hydrometrological data required for accurate and timely flood forecasts. The airborne snow survey conducted one day after a major regional snow storm and ten days before the flood crest provided information necessary to issue an early severe flood warning for the region. The early warning facilitated timely flood fight planning and consequently contributed to the prevention of subsequent flood damage.

It is, of course, impossible to accurately partition the relative merits of each of the three major improvements implemented before the 1985 flood. It is possible, however, to arbitrarily assign various relative importances to each of the three major improvements to estimate, in a crude fashion, the contribution each improvement made to the total savings of $24 million in damage prevention. The table below gives three arbitrary estimates of the percent of the total $24 million savings associated with each of the three major improvements. In the first case, if the Work Plan contributed 80 percent to the total flood damage prevention, then the savings directly attributable to the Work Plan improvement would be approximately $19 million. In a similar fashion, the flood damage prevented as a direct result of the early warnings and river forecasts facilitated by the airborne snow survey data can be variously estimated from $700,00 to $2,400,000 depending on the relative importance placed on the airborne data.

FLOOD DAMAGE SAVINGS BASED ON IMPROVEMENT TYPE

Improvement type	Case 1		Case 2		Case 3	
18 Month Work Plan	80%	$19.2	85%	$20.4	90%	$21.6
Flood ALERT system	10%	$2.4	10%	$2.4	7%	$1.7
Airborne Snow Survey	10%	$2.4	5%	$1.2	3%	$0.7

Note: $ in millions

The $7,700 cost of the February 1985 Fort Wayne airborne snow survey was substantially less than the projected flood damage prevented as a result of the early warnings and flood forecasts based on the airborne snow water equivalent data.

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Ice jams

EXISTING MITIGATION EFFORTS

Ice jam flooding has not been extensively addressed in flood hazard planning, regulations or management at any level of government. Until recently NFIP flood maps and those prepared by other agencies and states rarely reflected the potential for ice jams. In 1982, the NFIP adopted guidelines for identifying and mapping potential ice jam flooding areas as part of flood insurance studies (see Appendix 10-A). While predicting exactly when and where ice jams will occur is difficult, likely locations can be identified using such an approach.

Research on ice jam flooding has been carried out by the Cold Regions Research Lab of the U.S. Army Corps of Engineers in Dartmouth, New Hampshire. The Corps has also experimented with "ice booms," mechanical removal of ice, and other techniques to reduce ice jam problems.

OPTIONS FOR ACTION

Policy and Program Elements

A community policy and program for ice-related flooding should include the following elements:

1. Adoption of a resolution or policy statement that ice can cause flooding more frequently and at higher levels than the predicted 100-year flood;
2. Mapping of potential ice jam areas such as bridges, natural constrictions in the valley wall as well as potential upstream and downstream inundation areas;
3. Adoption of supplementary regulations including additional setbacks or broadened floodway designations for high velocity flood areas and strengthened performance standards for pilings or floodproofing in flood fringe areas subject to ice-related damages;
4. Installation of warning systems and evacuation plans for areas where serious ice-jam flooding may occur;
5. An analysis of whether remedial engineering measures such as enlargement of culverts or bridge crossings are effective and whether such actions will make ice jam problems greater in other parts of the river;
6. Preparation for short-term remedial actions to clear ice when a jam occurs;
7. Coordination of the activities of floodplain management, transportation and navigation officials.

Mapping

Several options are available to a community in mapping ice jam areas:

1. Map locations potentially susceptible to ice jam flooding and the boundaries of inundation areas using historical evidence of ice jam flooding. Such evidence may include air photos taken during or immediately after the flood while fragments of ice are still present, high water marks, scars on trees, and other physical damage caused by ice. Historic evidence can also be gathered from newspaper archives and interviews with long-term residents. Existing flood maps, topographic maps, air photos, soil maps or other maps may be used as base maps.
2. In the absence of or to supplement historical evidence, carry out engineering studies to identify locations and boundaries of areas subject to inundation. Include subzones within these areas subject to high velocity flows. Federal or state flood-mapping contractors can conduct engineering studies. Potential ice jam and ice damage areas can be identified based upon depth of flow, river profile, valley cross-sections and other factors discussed below.

Modifications to flood maps or the preparation of new maps to reflect ice jam flooding may involve several options:

1. The floodway should be broadened to encompass areas needed to convey flood flows during the jam and adjacent areas threatened by with floating ice.
2. The flood fringe boundaries should be broadened both upstream and downstream of anticipated jam areas to reflect higher flood elevations.

In the last decade technical standards for identifying ice jam inundation areas have improved substantially. Although there are uncertainties in predicting exactly when and where an ice jam will occur, the nature and extent of a possible ice jam at a given location can be anticipated with fair accuracy based on:

1. The anticipated ice thickness;
2. The strength of the ice (estimated by measuring the number of "degree days");
3. The difference between water level just after the formation of a stable ice cover and the water level expected in spring thaw.

The other factor controlling ice jam formation is river morphology (see Figure 11-1). Ice jams typically form:

1. Wherever river slope decreases due either to natural or human causes such as the headwaters of a reservoir.
2. Any constriction in the channel, such as a bend or bridge abutments.
3. Shallow reaches where the ice can freeze to the bottom.

In mapping ice jams as part of broader floodplain mapping efforts designed to identify the 100-year floodplain, the major difficulty is the development of frequency relationships. FEMA's guidelines (Appendix 10-A) describe three possible approaches.

Regulation

Several options are available for strengthening a community's regulations to reduce ice jam damage:

1. Amend floodway maps, as described above, to extend floodway restrictions to the high risk area.
2. As an alternative to a broadened floodway, the high risk areas can be separately zoned as open space through setbacks or open space zoning. Such

LIKELY ICE JAM AREAS

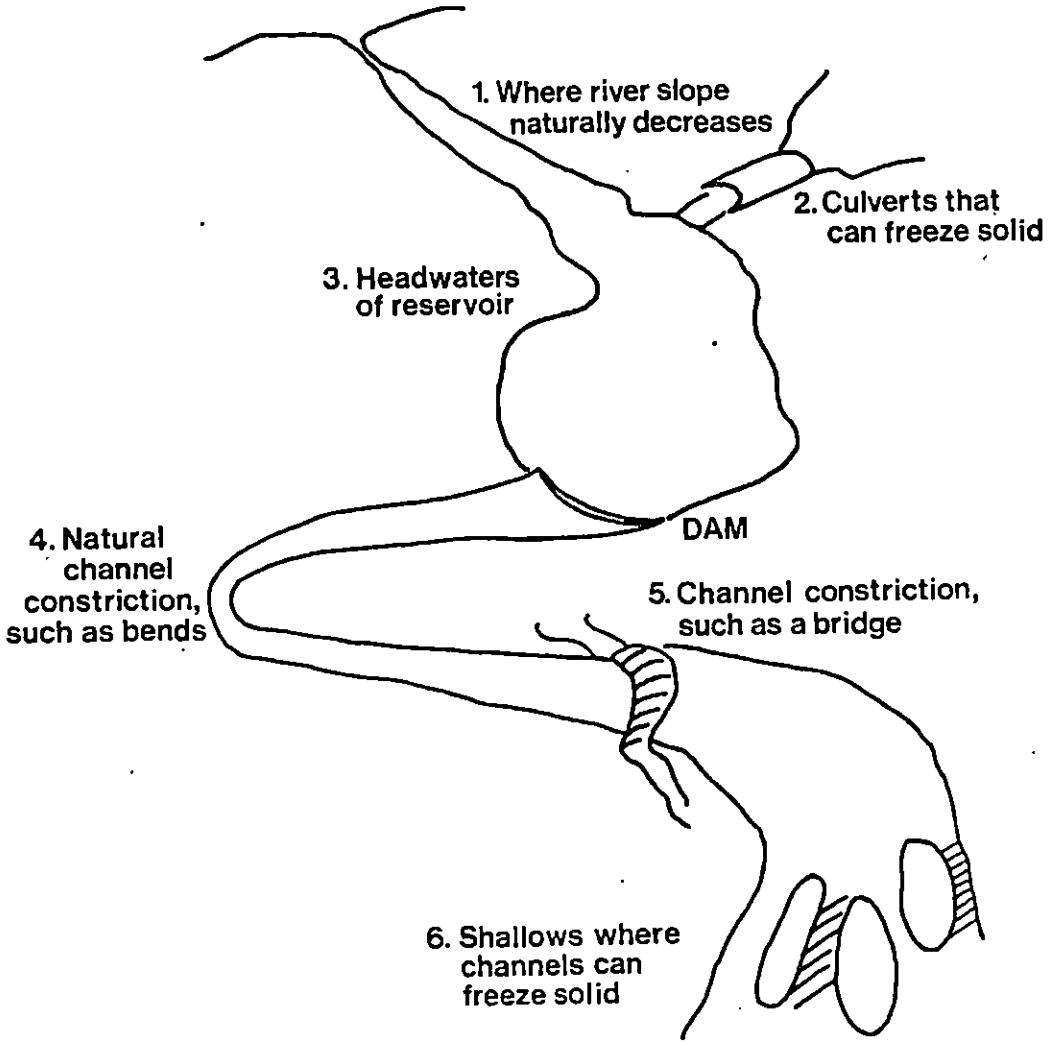

Figure 10-1. Likely ice jam areas.

restrictions can be applied to high velocity flow areas only or to the entire area subject to ice damage.

3. Add freeboard to protection elevations for structures in flood fringe areas to reflect added heights when jams occur or to protect against damage from floating ice. The amount of freeboard can be based on historic evidence of ice jam inundation or ice damage. For example, a federal hazard mitigation team suggested an added two feet of freeboard in flood fringe areas in response to severe ice jam flooding in Monroe, Michigan.

4. Amend building codes to include strengthened performance specifications for structures elevated on pilings in high velocity flow or ice damage areas. Alternatively, prohibit pilings altogether in ice jam inundation areas; allow only elevation on fill.

Nonregulatory Options

Principal nonregulatory options include relocation, removal or modification of obstruction, channel modification, ice retention and diversion structures and warning systems. Several case studies are discussed in Appendix 10-B.

Relocation

For areas subject to frequent and severe ice jam flooding and ice damage, acquisition and relocation of structures may be the only permanent way to reduce damages.

Public purchase of land and buildings and relocation of residents are particularly appropriate after an ice jam disaster because ice often totally destroys structures. Relocation is expensive and requires careful planning to be successful. Residents must be involved in the planning as early as possible.

A short-term moratorium on rebuilding after a disaster can facilitate relocation.

Warning Systems and Evacuation Plans

Because of the suddenness of ice jam flooding and the high velocity, ice-laden flows when a jam breaks, a warning system and an evacuation plan similar to those for unsafe dams, levees or other flash flood areas are appropriate.

Removal or Modification of Obstructions

Bridges, culverts, low head dams - even brush and debris in the channel - can cause ice jam flooding. Removing brush and debris and old or obsolete structures may be cost-effective. Rebuilding structures to increase channel capacity and decrease resistance to water and ice flow is another option. For example, replacing a single bridge reduced flood damages by about 80% for two similar flood events in Adams County, North Dakota.

Channel Modifications

Deepening a channel or straightening a stream can help reduce ice jam problems. The U.S. Army Corps of Engineers is currently studying channel modification as a technique for reducing damage. However this approach is expensive, and dredging is often needed to maintain the new channel configuration. Dredging may even worsen ice jamming downstream because deepened areas allow increased formation of frazil ice in the flowing water which attaches to the bottom of the ice cover downstream.

Ice Retention and Diversion Structures

Diversion channels can divert floodwaters away from the site of jams. The U.S. Army Corps of Engineers Cold Regions Research Laboratory has constructed a physical model for a high level diversion channel.

Piers which retard ice movement or break up ice are a second possibility. The Corps of Engineers has completed this type of project on the Narraguagus River in Cherryfield, Maine.

A third option is an ice retention dam. The Corps has also tried this at the Cherryfield site.

An ice boom is a fourth possibility. An ice boom on the Allegheny River in Oil City, PA controls ice at freeze-up so that ice jamming is minimized at break-up. The boom is submerged at high flows. This approach was used to help protect the Allegheny's wild and scenic river character.

Other Preventative or Remedial Actions

When ice-jamming is likely to occur or has already occurred, several other types of remedial actions are possible to reduce flooding and ice damage. These include dusting, mechanical removal, blasting, controlling the flow of water by surging, and the use of ice breaking ships. See insert.

Dusting

Dusting is the spreading of dark, environmentally safe substances on the ice surface. The dark material absorbs and retains the sun's heat and speeds melting of the ice. Dusting materials must be dry and uniformly sorted. Application is usually from the air which is not always easy on narrow or sinuous rivers. The weather can seriously limit the success of this approach since cloudy skies greatly slow melting and even a slight covering with snow will almost entirely negate the dusting. Despite the difficulties, dusting has been used quite successfully. It was, in fact, the recommended solution for probable ice jam formation in 1984 on the main stem of the Upper Mississippi River.

Mechanical Removal

Construction equipment may be used to mechanically remove jammed ice. If the jam has formed at a bridge, a dragline or backhoe may be used to physically remove blocks of ice from the river. Mechanical removal, while relatively safe, is slow and expensive and only suitable where access is available.

Blasting.

Blasting to break the ice jam can be effective as an emergency technique, but it is also dangerous and can result in downstream flooding. Blasting begins at the head of the jam, where holes are bored through the ice and charges, usually a mixture of ammonium nitrate fertilizer and fuel oil (ANFO), are placed beneath the ice and detonated.

Surging

"Surging" is accomplished by opening and closing the gates of a dam to abruptly change the discharge of the river. The sudden increase in flow velocity and stage may break up a jam. However, if the increased flow is not successful in dislodging the jam, flooding problems can worsen. This method can only be used where control structures exist.

Ice Breaking.

Ships have been used to break up sheet ice. This is a slow, expensive process and most inland rivers are not suited for ice breakers.

Ice Storage.

On smaller streams, it may be possible to use the natural floodplain to "store" ice and prevent jams. Land areas on the outside of bends would be mechanically graded to facilitate the movement of ice onto them during the breakup. Hardwood, Vermont is taking advantage of shallow floodplain areas to store ice to prevent downstream jams. Ice is being held in place by tires tied together by steel cable. The tires and cable are removed during the summer.

Appendix 10-A: Analysis of Ice Jam Flooding excerpts from FEMA's Guidelines and Specifications for Flood Insurance Study Contractors, 1985.

1. INTRODUCTION

An ice jam may be defined as an accumulation of ice in a stream which reduces the cross-sectional area available to carry the flow and increases the watersurface elevation. The accumulation of ice is usually initiated at a natural or manmade obstruction or a relatively sudden change in channel slope, alignment, or cross-section shape or depth. In northern regions of the United States, where rivers can develop relatively thick ice covers during the winter, ice jamming can contribute significantly to flood hazards. When historical records are examined, ice jams are typically found to occur in the same locations. This is because the necessary conditions for genesis of an adequate ice supply and obstruction of its downstream transport determine the specific areas where ice jams will occur. In areas likely to be selected for a detailed FIS, historical documentation is usually available that will indicate if ice jam caused- flooding is a significant factor warranting consideration in the study. In cold regions of the country where ice jams are typical, the Study Contractor should investigate historical floods for evidence of ice jam contribution as part of the study reconnaissance effort. Where ice jams historically contributed to flooding in a community, they should be evaluated using the procedures described in this Appendix (when appropriate).

2. TYPES OF ICE JAMS

Ice jams have been classified in numerous ways by various investigators. Calkins (Reference 1) has classified ice jams as freezeup- or breakup-types, moving or stationary types, and floating or grounded types. Freezeup-type jams are associated with the formation and accumulation of frazil ice, which eventually forms a continuous ice cover. Freezeup-type jams usually do not need to be addressed in a FIS because they are not associated with large discharge events, which are necessary to cause flooding problems. However, the Study Contractor should be aware of possible exceptions. Breakup-type jams are frequently associated with rapid rises in river stage, resulting from rainfall and/or snowmelt, and usually occur in the late winter or early spring. Because of the large volumes of ice that may be involved and the greater discharges associated with them, breakup-type jams are predominant in ice jam-caused flooding and are typically the type requiring investigation in a FIS.

Moving ice does increase water levels; however, these effects are minor compared to those of stationary jams and usually do not need to be considered in a FIS. Floating-type ice jams are considered to be those where the ice is not grounded to the channel bottom and significant flow takes place beneath the ice cover. Grounded-type jams are characterized by an ice cover that is partially grounded to the bed of the channel, with most of the flow being diverted into the overbank and floodplain areas. Grounded-type jams are typical of shallow, confined stream sections, while floating-type jams are typical of deeper rivers. Both of these stationary-type ice jams can cause significant effects and should be addressed in a FIS.

3. RECONNAISSANCE

While conducting the reconnaissance effort for a FIS, the Study Contractor shall detemine whether ice jamming has historically resulted in flooding within the community

under study. Where such flooding has occurred, the reconnaissance effort should be intensified to acquire as much data as possible concerning ice jam events in the community, on the streams being studied, and in the region. Such data should include, but not be limited to: locations of ice jams, dimensions, ice volumes, causes, associated river stages discharges, frequency of occurrence, lateral and upstream extent of flooding, season of occurrence, and other contributing or correlative factors. The nature of ice jamming common to the site should also be investigated (i.e.,whether freezeup- or breakup-type jams are typical and whether grounded- or floating-type jams are typical). Because very little documented data are usually available, all possible sources of information must be investigated, including photographs, local residents, newspapers, community officials, State agencies, and Federal agencies.

During the field reconnaissance, the Study Contractor should investigate Physical evidence of ice jams, such as high-water marks, damage to structures or scars on trees, which may provide useful data for the analysis or support for the study results.

4. ANALYSES

Different methods may be used for establishing flood elevations in areas subject to ice jam flooding, depending on the availability of data and the nature of the ice jamming phenomena that occur at the site of interest. The methods outlined herein are applicable primarily to stationary-type (floating or grounded) ice jams that occur during periods of ice breakup. These types of jams have historically resulted in major flooding in certain regions of the United States. The Study Contractor should be aware of conditions that may warrant alternate analytical methods, and should seek approval of alternate methods from the PO before proceeding.

The approaches below are based on the development of stage-frequency relationships for two different populations (ice jam flood stages and free flow flood stages), which are then combined into a single composite curve for flood stages at a site under study. Depending on the availability of ice jam stage information, ice-jam stage-frequency relationships may be determined directly or indirectly as discussed below. The direct method is preferred where applicable.

Direct Approach

If sufficient data exist at the site of interest, an ice-jam stage-frequency distribution can be established directly by fitting a frequency curve to historical ice stage data. This approach is recommended where ice jam stages are available for more than two significant events (i.e., overbank flooding) that span more than a 25-year period of record and where hydraulic conditions have not changed appreciably since those events. Historical stages will permit the computation of plotting positions and fitting a frequency curve on probability paper. Weibull plotting positions are recommended for this purpose.

This approach is preferred over the indirect approaches discussed in the following sections of this Appendix because the joint probabilities of various hydrologic and hydraulic factors, such as discharges, ice volumes, and ice thickness, are inherently included in the frequency analysis.

To apply the direct approach, certain steps should be taken. First, a discharge-frequency curve should be established, using annual peak flows or a suitable regional method, under procedures as required by these Guidelines.

Second, standard hydraulic techniques should be used to establish corresponding free-flow stage-frequency curves for each of the cross sections in the reach where ice jams are to be considered. Usually, the analyses of standard return intervals used in a FIS (i.e., 10-, 50-, 100-, and 500-years) will be sufficient to establish the free-flow stage-frequency curve on normal probability paper.

Third, an ice-jam stage-frequency curve should be established by assigning Weibull plotting positions to historical ice jam stages and fitting a curve to these points on normal probability paper. Fourth, where ice-jam stage-frequency information must be developed for reaches upstream or downstream of the location where a direct analysis can be made, the hydraulic techniques discussed in the following sections on indirect approaches should be used and calibrated to match the ice-jam stage-frequency curve developed for the site with available data. The calibration for floating-type jams would be accomplished by assuming equilibrium ice thickness (as discussed in Section 4b(1)) at the location where the ice-jam stage-frequency curve was developed and by establishing a combination of discharge, equilibrium ice thickness and roughness that would correspond to that stage. The calibration for grounded-type jams would be accomplished by assuming complete blockage of the main channel at the point of obstruction, with equilibrium ice thickness upstream, and then establishing the combination of discharge, equilibrium ice thickness, and roughness that would correspond to that stage. This will permit the HEC-2 ice cover option to be used for estimating corresponding ice jam stages upstream or downstream of the point where historical data are available.

Finally, for each cross section subject to ice jam flooding, the free flow stage-frequency curve, established as described above, must be combined with the ice-jam stage-frequency curve established as described above, assuming the events are independent. Thus,

$$P(s) = P(si) + P(sq) - P(si) \times P(sq)$$

where P(s) = probability of a given stage being equaled or exceeded from either an ice jam event or a free flow event,

P(si) = probability of that stage being equaled or exceeded from an ice jam event,

P(sq) = probability of that stage being equaled or exceeded from a free flow event.

This provides the composite stage-frequency curves at each cross section, which are used to develop flood profiles and maps for the FIS.

Indirect Approaches

(1) Assumptions. The indirect approach to ice-jam stage-frequency analysis may be used where available data are insufficient to establish a stage-frequency distribution directly. This approach makes use of several assumptions:

1. Ice-jam stage frequency is a function of ice jam season discharge frequency.

2. Ice jams are of the breakup type.

3. Ice jams are of the stationary type.

4. For all jams, the ice thickness will be given by the equilibrium relationship developed by Pariset et al. (Reference 2) and the stage-discharge relationship will be determined by adjusting the standard step-backwater technique for flow under an ice cover of equilibrium thickness.

5. For grounded-type jams, the stage-discharge relationship at the point of ice jam formation will be that resulting from complete or nearly complete blockage of the normal channel, with flow being carried in the overbank floodplain areas.

(2) General Procedures. To apply the indirect approach, certain procedures are used. First, a free-flow stage-frequency distribution is established for each cross section by using standard backwater modeling to establish stage-discharge relationships. Usually, the four standard discharges (10-, 50-, 100-, and 500-year return intervals) will provide sufficient points to establish the stage-frequency curve for each cross section on normal probability paper.

The water year is then separated into an "ice jam season" and a "free flow season" based on the historical occurrence of ice jams in the region and, in particular, in the stream under study. The season should encompass the period when breakup-type ice jams normally occur and will likely vary with the latitude and elevation of the stream being studied.

Ice jams tend to be associated with one of the seasonal peak flows because ice jams typically form during rises in river stage that break up the ice sheet. All ice jam season annual peak flows should be fitted to a frequency curve. Weibull plotting positions are recommended for this purpose. For ungaged streams, ice jam season discharge-frequency relationships must be established by regional analysis of seasonal flows for gaged streams. Usually, the establishment of regional ice jam season discharge-drainage area curves will be sufficient for this purpose.

The ice jam season discharge-frequency curve is then converted to a conditional (given that an ice jam occurs) stage-frequency curve. This is done at each cross section subject to ice jam flooding using the HEC-2 program, with the ice cover option. This option takes into account the hydraulic aspects of flow under ice, such as a reduction in flow area, increased wetted perimeter, and ice roughness. Inputs required to utilize this option include the normal HEC-2 input, the thickness of ice in the channel and overbank, Manning's "n" value for the underside of the ice cover, and the specific gravity of the ice. The Study Contractor is referred to documentaion prepared by the U.S. Army Corps of Engineers; Hydrologic Engineering Center (Reference 3) on the use of this option. The recommended ranges for "n" values are from 0.015 to 0.045 for unbroken ice and from 0.0[illegible] to 0.07 for ice jams. The specific gravity of normal ice is approximately 0.92, which is the recommended value for this analysis. Where major floods are caused by ice jams, the assumption of equilibrium ice thickness is probably reasonable because sufficient upstream conditions exist to generate the ice volumes needed. Unless there is strong evidence to the contrary, the ice thickness used in the analysis should be the approximate equilibrium

thickness as defined by Pariset et al. (Reference 2). Where equilibrium ice thickness is not appropriate, the Study Contractor should justify the thickness used in the analysis.

The composite stage-frequency curve for establishing the elevations of the various return interval floods at each cross section is then obtained by combining the free-flow stage-frequency distribution and the ice-jam stage-frequency distribution as follows:

$$P(s) = (P(s)|S=F) \times P(S=F) + (P(s)|S=J) \times P(S=J) - ((P(s)|S=F) \times P(S=F)) \times ((P(s)|S=J) \times P(S=J))$$

The probability (P(s)|S=F) is the conditional probability that a given stage(s) is equaled or exceeded given that an annual maximum stage is a free flow event. This conditional probability is the stage-frequency curve for free flow events as derived above. The probability (S=F) is simply the fraction of all annual maximum stages that are free flow events. Likewise, the probability (P(s)|S=J) is the conditional probability that a given stage(s) is equaled or exceeded given that the annual maximum stage is an ice jam event. This conditional probability is obtained as described above. The probability (S=J) is simply the fraction of all annual maximum stages that are ice jam events.

The fraction of annual maximum stages that is attributable to ice jams should then be established through an analysis of historical data at the site, other sites on the same stream and other sites in the region. An analysis of peak stages at gaged sites is often useful for this purpose because peak stages affected by ice are usually documented. Note that, in this indirect procedure, only the relative frequencies of maximum annual stages from ice jam and non-ice jam events need to be estimated. The actual ice jam flood elevation, which is often more difficult to ascertain, is not needed.

The above analysis provides the composite stage-frequency curves for establishing the elevations of the various return interval floods at each cross section. These are then used to establish the flood profiles and floodplain delineations for the FIS.

Grounded Jams

The Study Contractor should document that grounded-type ice jams have occurred historically before grounded-type jam behavior is assumed. The procedures for establishing stage-frequency relationships for stream sections subject to grounded-type ice jamming are identical to those cited earlier except for the hydraulic analysis. Grounded-type jams may occur at confined sections, such as bridges, and at shallow sections. The hydraulic analysis assumes that a high percentage of the normal flow area of the channel (or bridge) is obstructed and that most of the flow is in the overbank areas.

Hydraulic effects at the point of obstruction and upstream should be modeled using step-backwater methods modified for ice cover. The U.S. Army Corps of Engineers' HEC-2 program, with the ice cover option, is recommended for this purpose (Reference 3). At the point of obstruction, the use of an actual or hypothetical bridge section will permit the special bridge routine to be used to facilitate the analysis. The low chord of the bridge (HEC-2 variable ELLC) and the net flow area (HEC-2 variable BAREA) may then be adjusted to achieve different degrees of blockage of the main channel. The Study Contractor should normally assume between 95 and 100 percent blockage of the channel unless sufficient evidence exists to support another assumption. In that case, the alternative should be documented and justified. Upstream from the site of grounding, equilibrium ice

thickness, as computed according to the Pariset formulation (Reference 2), should be assumed unless alternate thicknesses can be justified.

5. PRESENTATION OF RESULTS

FIS Report

A discussion of historic ice jam flooding should appear in Section 2.3 (Principal Flood Problems) of the FIS report.

Section 3.1 (Hydrologic Analyses) of the report should include a discussion of any discharge-frequency analysis for the ice jam season, if used. Similarly, the statistical treatment of stage-frequency analyses for ice jam and non-ice jam events should be discussed. The historical data used in the analyses should be referenced in the discussion along with its source and how it was used. The Summary of Discharges Table should be based on analysis of the full year and footnoted to that effect.

Section 3.2 (Hydraulic Analyses) of the FIS report should include a discussion of how free flow and ice jam stages were computed, whether stages were computed directly from stage-frequency analyses or indirectly analyzed. The approximate channel blockage and ice thickness assumed should be discussed, if used. The relationship of the computed ice jam stages to historic floods should be discussed. An example of stage-frequency curves for combined floods should be provided for the point of obstruction, or a representative cross section within the community should be provided if the former is outside the corporate limits. The discussion should also indicate that floodways were computed only for free flow conditions.

The "Regulatory" column of the Floodway Data Table should be prepared using the 100-year flood elevations established from the composite ice-jam and free-flow season stage-frequency curves and footnoted to that effect. All other columns in the Floodway Data Table shall be based on the 100-year free flow conditions.

Profiles

The flood profiles shown in the FIS shall be based on the elevations established from the composite ice-jam and free-flow stage-frequency analysis.

Maps

FIRM shall be developed based on the elevations established from the composite ice-jam and free-flow stage-frequency analyses performed at each cross section. Floodways shall be established and plotted based on the 100-year flood discharges and hydraulics assuming free flow conditions. The lateral extent of a major historic ice jam may be indicated on the work map if it is well documented, does not hamper interpretation, and is appropriately annotated as such.

6. REFERENCES

1. U.S. Army Cold Regions Research and Engineering Laboratory, Technical Note, *Methodology for Ice Jam Analysis*, D. J. Calkins, October 1980.

2. E. Pariset, R. Hausser, and A. Gagnon, *Formation of Ice Covers and Ice Jams in Rivers.* Journal of the Hydraulics Division, ASC,. November 1966.

3. U.S. Army Corps of Engineers. Hydrologic Engineering Center, *Analysis of Flow in Ice Covered Streams Using Computer Program HEC-2*, February 1979.

Appendix 10-B: Cold Facts of Ice Jams: Case Studies of Mitigation Methods

Extracted from a paper by Darryl J. Calkins, Research Hydraulic Engineer at USACRREL, presented at the 8th Annual Conference of the Association of State Floodplain Managers, 1984.

CASE STUDIES

The following case studies represent several types of ice-related flood problems. In some cases solutions were recommended and implemented, while others are still in the evaluation or design phase.

1. Allegheny River

Report: Ice Jam Problems at Oil City, PA, by Deck and Gooch, USACRREL Special Report 81-9.

Location: Oil City, PA

Problems: Ice jam flooding at the confluence of Oil Creek and the Allegheny River.

Cause: A river dredging project on the Allegheny created a deep, long pool just downstream of the confluence with Oil Creek, which caused a large ice accumulation to occur. The ice run from the smaller tributary could not penetrate the Allegheny River ice cover. The ice jam would remain in the tributary channel and the floodplain (Oil City Business district) would handle the flow.

Solution: Winter field investigations revealed an excessive ice build-up - 15 feet at the confluence during freeze-up. A relatively inexpensive ice boom just upstream of the confluence was designed to start the freeze-up ice cover at that location and minimize the ice volume at the confluence area.

Implemented: 1982

Performance: Ice volumes have been dramatically reduced. Although conditions have been favorable for ice jam formation, no ice jam flooding has occurred, as the tributary ice run can now move into the main river.

2. Salmon River

Reports: a) Special Flood Hazard Information - Salmon River Ice Jams, February 1984, USACE - Walla Walla District.

b) Salmon River Ice Jams, 1984, by Cunningham and Calkins, ASCE Hydraulics Division Specialty Conference, Coeur d'Alene, ID.

Location: Salmon, ID

Problem: Ice jam flooding at freeze-up and break-up on both the mainstem river and a tributary.

Background: The river is designated as wild and scenic. Hydraulic mining activities created the problem in late 1800's by altering the natural channel characteristics of the Salmon River 26 miles downstream of Salmon, Idaho. Winter river observations will be expanded to analyze the environmental impact and to assess performance of the possible alternatives with respect to the ice regime.

Causes: a) Thick ice cover formation results in stage increases of 8 - 12 ft; low temperatures must occur in the basin.

b) Floodplain encroachment.

c) Break-up ice conditions occur with a higher flow discharge, which creates even higher stages; mild weather must occur to create high flows.

Solutions: Alternatives are being evaluated under the 205 program.

3. Israel River

Reports: a) Israel River Ice Jam, by Frankenstein and Assur, 1972 IAHR Symposium on Ice, Leningrad, pp. 153-157.

b) Detailed Project Report - Israel River, NED-COE, Waltham, MA.

Location: Lancaster, NH.

Problem: Break-up ice jam flooding in the business district and some residential areas.

Causes: a) Removal of two old mill dams upstream of the flooding area.

b) The flooding area is located at the transition from steep to mild slope.

c) A thick accumulation of ice develops in the mild slope reach during freeze-up, reducing break-up ice storage.

Solution: Install submarine net 1 mile above the flooded area where the river changed slope and floodplain relief for water and ice was available.

Implemented: 1974.

Performance: The structure has held back ice each year, primarily because floodplain relief for the water is available. This was a good solution for holding back ice at this location. However, the 1 mile of ice between the net and the town was still sufficient to cause ice jams in the flooded area.

Solution: Construct a low head weir 0.5 mile upstream of the flooding area near the site of the first old mill dam to serve as a replacement.

Implemented: 1982.

Performance: The structure does not hold back ice, as the pool length is too short. Ice jam flooding still exists. Additional modifications may be necessary.

4. Delaware River

Reports: a) General Investigation Report in preparation, Sept. 84, Philadelphia District, COE.

b) Preliminary Ice Jam Study - Delaware River, by Calkins, Report submitted to Philadelphia District, June 1984.

Location: Port Jervis, NY - Matamorous, PA.

Problem: Break-up ice jam flooding in above communities.

Causes: Not fully understood yet; only three major events have occurred in the last 110 years, with the jam of record occurring in 1981, which caused $18 million in damage. A midwinter jam at Port Jervis followed by the spring break-up appear to be causes of this flood.

Solution: Several alternatives are being considered.

a) Permanent hydraulic structure.

b) Flow control, freeze-up and break-up.

c) Ice control at freeze-up with ice booms.

d) High-level diversion channels.

e) Levee protection.

5. Peace River

Report: a)Freeze-up flood stages associated with fluctuating reservoir releases, by O'Neill and Adres, 3rd Specialty Conference on Cold Regions Engineering, April 4-6, 1984, Edmonton, Alberta.

b) Several other references cited in the above paper for same site.

Location: Peace River, Alberta, Canada

Problem: Freeze-up ice cover flooding.

Causes: a) Construction of hydropower dam 100 miles upstream.

b) Release schedule of flow (surges).

c) Increased winter flows versus the natural condition (factor of 2-3).

Solution: Modify release schedule during freeze-up.

Implemented: Some modification of the releases.

Performance: Insufficient data have been collected.

6. Chaudiere River

Report: a) Projects to alleviate ice jams on the Chaudiere River, by Deslauriers, Proceedings of Eastern Snow Conference 1965, pp. 115-127.

b) Ice control structures for river break-up, by Michel, Proceedings, 11th Congress of IAHR 1965, Vol. 5, pp. 37-48.

Location: Quebec.

Problem: Ice jam flooding at break-up.

Causes: a) Thick ice accumulations at freeze-up.

b) No river channel storage at break-up for the ice due to freeze-up of thick ice.

Solution: Construct a 60-ft-high dam upstream of the flooded area.

Implemented: 1967.

Performance: Ice jam flooding occurs now in the pool behind the structure and not in the community. It is considered very successful.

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H. Glossary

Adaptive management: a technique for managing a dynamic system (like a river corridor, where conditions change with time) by observing changes in that system and adapting, or modifying, management practices in response to those changes.

Aggradation: The geologic process by which stream beds and floodplains are raised in elevation by the deposition of material eroded and transported from other areas.

Ameliorate: to improve; to make better or more tolerable.

Anadromous fish: Salmon and trout that are hatched and reared in freshwater streams, migrate to saltwater as juveniles, and return to fresh water as adults to spawn.

Base flood: the flood having a one percent chance of being equaled or exceeded in any given year. Also referred to as the "100-year flood."

Base flood elevation: the elevation of the base (100-year) flood at a given site.

Buffer zones: areas adjacent to wetlands and streams that protect them from adverse impacts to functions and values. Wider buffer zones offer greater protection.

Cirque: steep hollow at the upper ends of a mountain valley.

Corridor functions and values: benficial roles served by the river corridor and the systems of which it is a part. The term *function* refers to the work done by a natural system, including flood reduction, water supply, groundwater recharge, and shoreline stabilization. The term *values* refers to benefits to human beings. Many functions also have value to individuals and society.

Critical facilities: facilities for which even a slight chance of flooding might be too great. Critical facilities include, but are not limited to, schools, nursing homes, prisons, hospitals, police, fire, and emergency response installations, and installations that produce, use or store hazardous materials or hazardous waste.

Cumulative effects: The impact on the environment that results from incremental impact of actions when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

Detailed study areas: Floodplain areas that have been studied by detailed methods. Detailed study entails the use of hydrologic and hydraulic study methods to determine flood hazard data.

Endangered species: any species which is in danger of extinction throughout all or a significant protion of its range.

Energetics: a measure of the way the energy of moving water is used. A change in energetics can affect erosion, debris distribution, and flood potential.

Emergent: dominated by herbaceous species, such as sedges and cattails.

Extinction: complete elimination of a species throughout the world.

Extirpation: elimination of a species from an area (such as the Methow River basin).

Flood Insurance Study: an official report provided by the Federal Insurance Administration, which includes flood profiles and the water surface elevation of the base flood.

Floodplain boundary: The landward limit of the 100-year floodplain as delineated by FEMA.

Floodplains: areas that are inundated when rivers overflow their banks.

Floodway: the channel of a river and that portion of the adjacent floodplain that must be reserved in an unobstructed condition in order to discharge the base flood without increasing flood levels by more than one foot. FEMA requires communities to designate a floodway to avoid the possibility of significantly increasing upstream flood elevations.

Forbs: herbaceous plants other than grass, such as wildflowers and rushes.

Freshet: a rapid temporary rise in stream discharge and level caused by heavy rains or rapid melting of snow and ice.

Hydrophytic: growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Interdigitation: where "fingers" of forest (on cooler or wetter slopes) reach into areas of steppe vegetation, the two communities are said to be interdigitated.

Late Successional Reserve: Late Successional Reserve areas were designated under the Northwest Forest Plan to maintain mature and old growth forests.

Macroinvertebrates: invertebrate animals (animals without backbones, such as insects and spiders) large enough to be seen with the naked eye.

Meander belt: the area within which a stream channel can be expected to move in the present climate.

Non-detailed study areas: floodplain areas that have been studied by approximate methods. Study by approximate methods entails extrapolation of data computed for detailed study areas.

Plant community: a group of plants that grow together.

Right bank: the bank of a river or creek that is on a person's right-hand side as he or she faces downstream. The opposite bank is called the left bank.

River corridor: a river and the land that is directly influenced by it, including the floodplain, bank system, *meander belt*, and associated uplands. River corridors vary in width depending on the terrain through which they pass and the features associated with the river at any given point.

Riparian area: see *Riparian zone*

Riparian Reserve: Riparian Reserve areas were designated under the Northwest Forest Plan to provide protection for riparian areas.

Riparian zone: The area between a stream and the adjacent upland identified by soil characteristics and distinctive vegetation. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation (moisture-loving plants). The ecology of riparian zones is strongly influenced by the presence of water nearby. NOTE: the riparian zone regulated by Okanogan County's Critical Areas Regulations extends "a maximum of 200 feet, measured on the slope of the land, from the ordinary high water mark on each side of the perennial streams, rivers, lakes, ponds, marches, wetlands, Type 1-5 waters, etc."

Riprap: large pieces of angular rock used to armor river banks and levees.

River mile: one mile measured along the course of a river. Rivers are measured from their mouths toward their headwaters. River mile 0.00 on the Methow River is at Pateros. On the Twisp, measurement starts at Twisp; on the Chewuch, it starts at Winthrop.

Steppe: land on which grasses or grass-shrub communities compose the native vegetation.

Stochastic: randomly occurring. For instance, we can predict that there will be a flood of a certain magnitude once in 100 years on average, but we cannot know in what year it will occur. Thus the 100-year flood is a stochastic event.

Substantial improvement: any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure, either 1) before the improvement or repair is started or 2) if the structure has been damaged and is being restored, before the damage occurred.

Substrate: the base or substance on which an attached species is growing. A substrate may be soil or a non-soil substance such as peat.

Threatened species: any species which is likely to become an endangered species within the foreseeable future through all or a significant portion of its range.

Unconsolidated: not compacted; loose. Water can move easily through unconsolidated material. When sediments have been compacted, water flows through them less readily.

Wetlands: areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. **Note**: the term "wetlands" is used in the original (1971) Shoreline Management Act to refer to the 200-foot area landward of shorelines that falls under SMA jurisdiction. In this plan, the term "wetlands" refers to biological wetlands, as defined above.

Zero-damage flow rate: the highest discharge a stream channel can accommodate without causing any damage.

I. Abbreviations

BPA	Bonneville Power Administration
cfs	Cubic feet per second
CFHMP	Comprehensive Flood Hazard Management Plan
COE	United States Army Corps of Engineers
DCD	Washington State Department of Community Development
DOE	Washington State Department of Ecology
FCAAP	Flood Control Assistance Account Program
FEMA	Federal Emergency Management Agency
l.f.	Linear feet
MRD	Methow Review District
MVWPPP	Methow Valley Water Pilot Planning Project
NFIP	National Flood Insurance Program
NRCS	USDA Natural Resource Conservation Service (formerly SCS)
NWPPC	Northwest Power Planning Council
OHWM	Ordinary High Water Mark
PUD	Public Utility District
RCW	Revised Code of Washington
RM	River Mile
SCS	USDA Soil Conservation Service (now NRCS)
SMP	Shoreline Management Program
USFWS	United State Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WDW	Washington State Department of Wildlife. The state Departments of Fish and Wildlife merged in 1994, becoming WDFW (see)

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