# Appendix B
## IMPACT ANALYSIS METHODS

The National Environmental Policy Act requires Federal agencies to consider the impacts of their proposed actions, and reasonable alternatives to their proposal, on the human environment. Agencies must document that consideration before proceeding with an action. This appendix describes the methods used to evaluate the impacts of the EWP Program alternatives.

## B.1 ANALYSIS OF WATERSHED ECOSYSTEM IMPACTS

The NRCS interdisciplinary team analyzed the environmental consequences of the EWP alternatives using a stepwise process to ensure that all relevant impacts were considered in their appropriate contexts. The details of the methodology are presented in Appendix B.

The steps in the process to address impacts on watershed ecosystems were:
1) Specify EWP practices, typical techniques, and practice components
2) Determine contexts for evaluation of direct and indirect impacts
3) Develop flow diagrams linking practice components with ecosystem components
4) Review the scientific literature for impacts studies of effects of disasters and effects of EWP practices or similar practices and construction projects
5) Adapt an ecosystem condition classification as the basis for evaluating disaster and EWP project impacts
6) Analyze impacts generically using scientific studies and using field data on recent typical techniques at example EWP sites
7) Compile impacts of EWP work in example watersheds to address cumulative impacts
8) Document analysis details in Appendices
9) Document principal findings in Chapter 5 covering practices, easements, and Alternatives
10) Compare impacts of the alternatives in Chapter 3.

The steps were similar for addressing impacts to human communities, except the analysis did not focus on specific practices but rather on how EWP work, which could be comprised of different practices to deal with the aftermath of a disaster, would affect various aspects of community life. A range of affected community types was represented by example communities that had recent EWP restoration work.

### *B.1.1 EWP Program Characteristics Affecting the Impacts Evaluation*

Several aspects of the EWP program were considered in determining the most appropriate method for evaluating the program's impacts.

**B.1.1.1 Uncertainty in EWP Project Timing and Location**

An important distinction between EWP Program practices and other agencies' projects is the great degree of uncertainty in the location and timing of EWP projects. This uncertainty is because they are undertaken in response to unpredictable natural disasters. A predictive model fits well where the location and nature of an action can be clearly defined, e.g. construction of a dam or road or harvest of a stand of timber. The EWP Program does not conform well to this model because the location and characteristics of any individual EWP project are subject to the unpredictability of natural disasters. In general, EWP practices are most likely to be required in or adjacent to stream or river channels and their floodplains. Those are the locations where watershed impairments most often occur. The particular channels or floodplains that will be impaired next month, next year, or within the next ten years, depends on global, regional climatic, and local weather factors. Certain states and regions can anticipate certain types of natural disasters occurring on a fairly recurrent basis, e.g. ice storms in the Northeast, tornadoes in the southern Plains, fires in southern California. They can focus their pre-disaster planning on those disaster types, however, the specific location, severity, and geographic extent of the natural disasters and the impairments they cause are not predictable. Thus, the evaluation of Program impacts was structured to show a range of potential effects without making specific assumptions about the location, frequency, and severity of disasters and resulting impairments in any given watershed.

**B.1.1.2 EWP Program Coverage**

Another important distinction is that the Program encompasses virtually the entirety of the United States. EWP projects may be funded in any watershed anywhere in the U.S. except for coastal areas and Federal lands other than National Forests. However, projects tend to be undertaken with greater frequency in smaller, rural watersheds. This argues against any attempt to predict the potential range of impacts of every EWP project likely to be carried out within a given time horizon under the EWP Program alternatives. The input data would be too voluminous and difficult to obtain in a timely manner, the analysis too laborious, the results and conclusions too voluminous and difficult to easily present or describe to the reader. Therefore, it was considered appropriate for the purposes of programmatic decisionmaking to employ a more constrained approach that used a minimum reasonable amount of data encompassing the range of impacts likely to occur in watersheds under the various program alternatives. This representative approach was considered sufficient to inform the decisionmaker and the public about the environmental impacts of the Program alternatives, as well as provide an adequate basis for a clear comparison of these alternatives.

**B.1.1.3 EWP Program: Projects and Practices**

Two groups of alternatives are evaluated in the PEIS. The *program alternatives* represent different ways of administering the EWP Program from the national, state, and local perspective. The *practice alternatives* address the choices made among the available EWP practicess about what is actually done in the field to mitigate an emergency situation where a watershed impairment poses an immediate threat to life or property.

To adequately characterize the environmental impacts of the program alternatives, the impacts of EWP practices were evaluated. These project alternatives comprise the NRCS EWP "toolbox" of practice standards. The decision criteria for selecting one practice over another is part of the experience and skill set of the local NRCS staff member dealing with the emergency at hand. The PEIS will be useful in providing further impetus for establishing a more formalized structure, a national database, clarifying the decision criteria applied to the practices, and identifying the best practices suited to particular conditions. All practices included in either the current or proposed program need to be evaluated and discussed in terms of their environmental impacts in this chapter. The impacts identified in those discussions provides the basic information for characterizing the range of impacts of the Program alternatives at the watershed, state, and national Program levels.

### *B.1.2 EWP Practices and Practice Components*

Specification of the practices, typical techniques and practice components of current practices is documented in Chapter 2. Components of proposed practices are described in Chapter 3 under the description of the elements of the Proposed Action. And listed in Table B.1-1. A flow chart illustrating the connections from disaster events, to watershed impairments and EWP practices is presented in Fig. B.1-1.

*Table B.1-1 Work Elements of EWP Practices used in Impacts Analysis*

| | Bank Armoring | Bank Revegetation | Modify In-stream Flow | Modify In-stream Capacity | Diversions | Sediment/ Debris Basins | Slope Stabilization | Critical Area Planting | Dam/Dike Repair/ Installation | Obstruction Removal |
|---|---|---|---|---|---|---|---|---|---|---|
| Create Access | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Clearing | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Dewater | ✔ | | ✔ | ✔ | ✔ | | | | ✔ | ✔ |
| Work From Bank | ✔ | | ✔ | ✔ | ✔ | | | | ✔ | ✔ |
| Work In Stream | ✔ | | ✔ | ✔ | ✔ | | | | ✔ | ✔ |
| Earth Moving | | | ✔ | ✔ | ✔ | ✔ | ✔ | | ✔ | |
| Repair Spillways | | | | | | | | | ✔ | |
| Install Drains/Conveyance | | | | | | | ✔ | | | |
| Construct/Install Outlet | | | | | ✔ | ✔ | | | | |
| Build/Install Diversions | | | | | ✔ | | | | | |
| Install Armor | ✔ | | | | | | | | ✔ | |
| Build/Install Retaining Structures | | | | | | | ✔ | | | |
| Remove Debris | | | ✔ | ✔ | | ✔ | | | | ✔ |
| Grade/Shape | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | |
| Fill | | ✔ | | | ✔ | | | | | |
| Revegetate | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Apply Fertilizer/Additives | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Material Disposal | | | ✔ | ✔ | | ✔ | | | ✔ | ✔ |
| Borrow | ✔ | | | | | ✔ | | | ✔ | |
| Harvest Plant Materials | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| Stabilize Borrow Areas | ✔ | | | | | ✔ | | | ✔ | |
| Compact Soils | | | | | ✔ | ✔ | | | | |

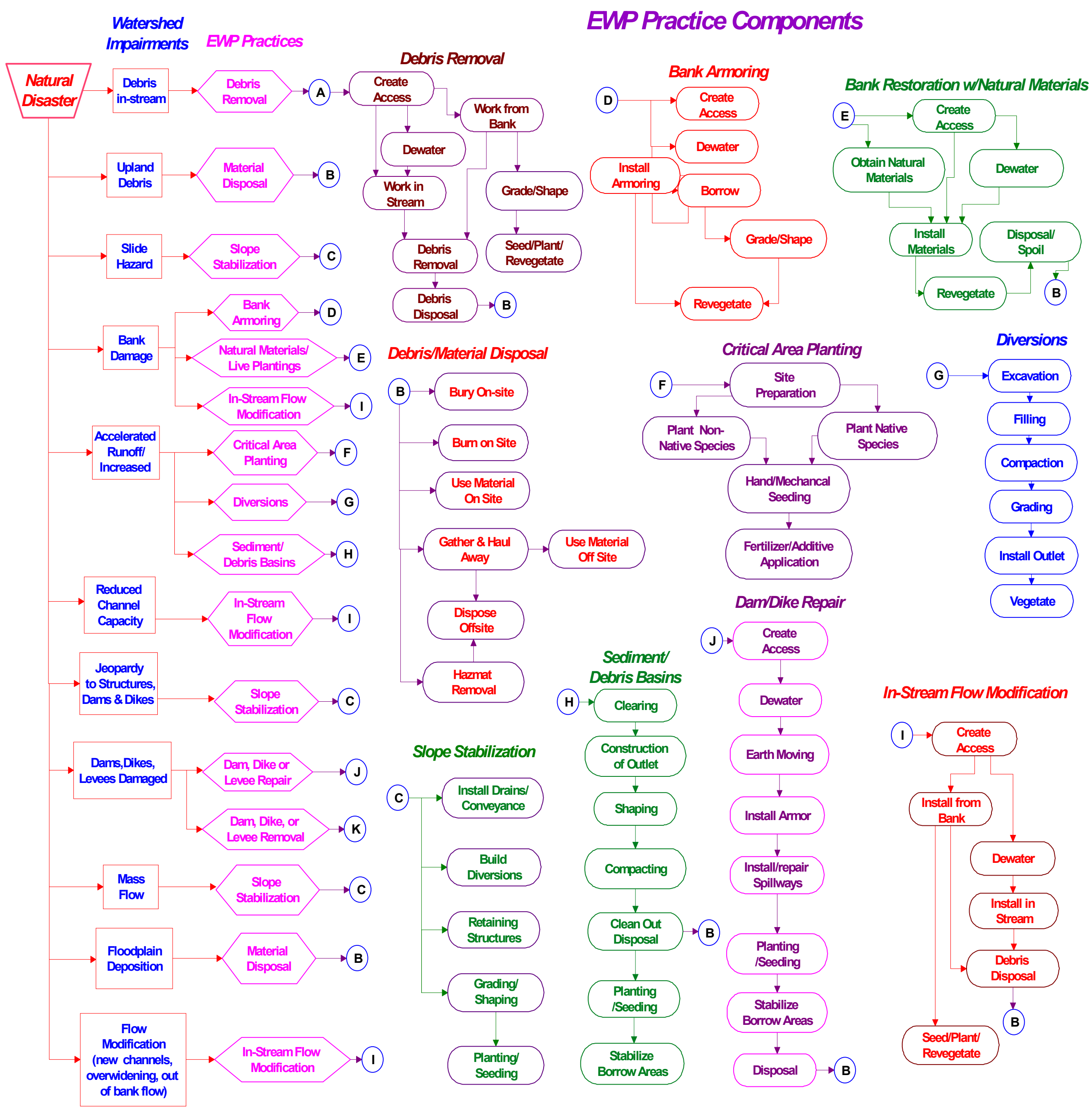


*Fig B.1-1 EWP Project Flow Chart of Watershed Impairments, Practices and Practice Components.*

### *B.1.3 Contexts for Impacts Analysis*

The NRCS interdisciplinary team evaluated the impacts of the EWP current and proposed practices and the EWP Program alternatives in three applicable contexts:

- Individual practices were evaluated at the location of, and immediately adjacent to and downstream of, a series of typical EWP projects
- Multiple EWP projects were evaluated in a set of typical rural communities
- Multiple EWP projects and other NRCS, Federal, State, and local actions were evaluated in three typical rural watersheds.

The significance of an impact is to be determined by its context and intensity (Fig. B.1-2). Referring to figure B.1-2 the larger the area represented, the more likely that EWP benefits and impacts would diminish in importance. Local, regional, and national contexts are all relevant to the EWP PEIS analysis. The EWP Program elements that cause environmental impacts are the individual EWP construction and easement projects. Thus, they are the basic unit actions of the EIS impacts analysis. The local context would include the particular location of the project being proposed to deal with each watershed impairment, and the impaired watershed itself, particularly downstream from the impairment. A larger context would include all the EWP projects undertaken on the watershed in response to a disaster event. A still larger context would include the major watershed that the impaired watershed is a part. Major river basins would provide the broadest geographic context for evaluation of impacts. At this level, the impacts of any single EWP project, even a large one, would have diminished to the point that they would be undetectable.

**Contexts for Environmental Impacts of EWP Practices**

In the first context, the focus of analysis was to evaluate the impacts of an EWP practice on the aquatic, wetland, floodplain, riparian, and upland biotic communities and on human activities directly relating to those resources.

**Context for Socioeconomic Impacts of EWP Program**

In the second context, the focus broadened to address how groups of different EWP practices employed to repair watershed impairments would affect the rural communities struck by the disaster event.

**Context for Cumulative Impacts of EWP Program**

The third broader context considered that individual EWP projects, and groups of projects responding to a disaster event, occurred while other actions of NRCS and other agencies, organizations, and individuals were also affecting the locality and larger watershed in question.

In each context, the team first defined the baseline of impacts as one that had been just recently affected by a disaster. Thus, the ID team recognized that the sites, rural communities, and greater watershed contexts were not ecological and human systems simply undergoing minor day-to-day adjustments to environmental inputs, but rather were substantially stressed and altered systems responding to major environmental disturbances.

The relationships between context, intensity, and significance of EWP Program-induced impacts are outlined below in Table B.1-2.

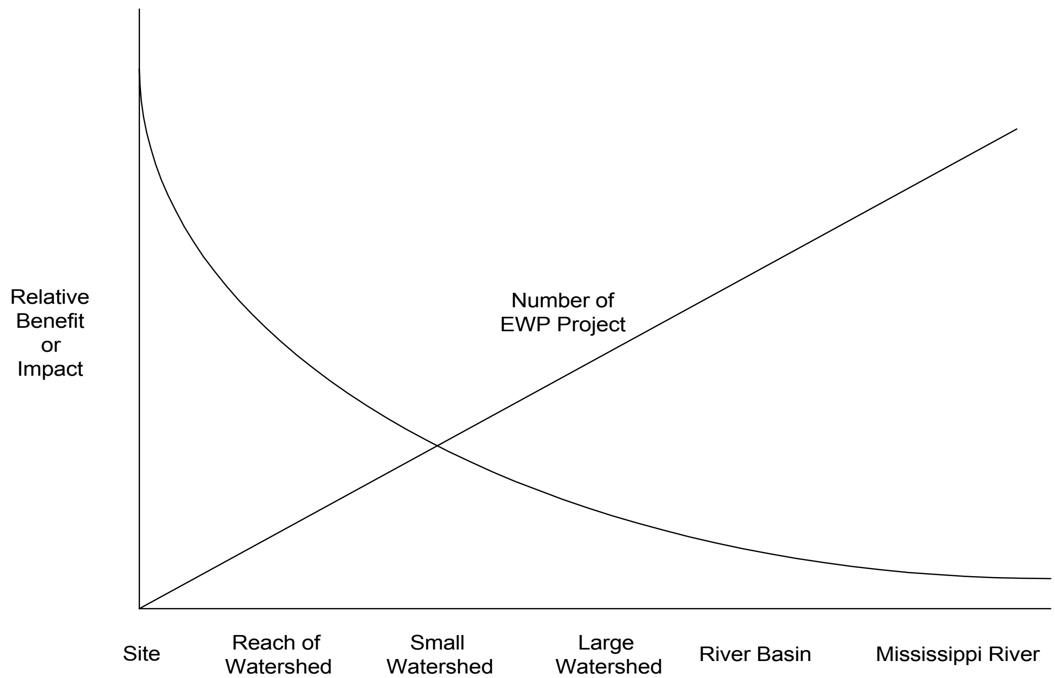


***Fig B.1-2 Relationship between EWP Projects and Geographic Context where their benefits and impacts would occur.***

*Table B.1-2 EWP Practice Context-Impact Relationships*

| Analytical Context | Direct Impacts (impacts caused by EWP activities that occur when and where the EWP practice is installed; short-term or long term) | Indirect Impacts (impacts caused by EWP activities that occur some distance away from or at some time after the EWP practice is installed; short-term or long-term) | Cumulative Impacts (combined impacts from all sources including EWP activities; both direct and indirect effects; short- and long-term; same and different locations) |
|---|---|---|---|
| **EWP Installed Practice Site Vicinity and Immediately Downstream** | Likely a significant contributor | May be a significant contributor | May be significant contributor |
| **Sub-watershed/Reach** | May be significant contributor | May be significant contributor | May be significant contributor |
| **Watershed** | Unlikely to be significant contributor | Unlikely to be significant contributor | May be significant contributor |
| **Basin-Wide** | Unlikely to be significant contributor | Unlikely to be significant contributor | Unlikely to be significant contributor |
| **Regional/State** | Unlikely to be significant contributor | Unlikely to be significant contributor | Unlikely to be significant contributor |
| **National** | Unlikely to be significant contributor | Unlikely to be significant contributor | Unlikely to be significant contributor |

EWP experience shows that sudden impairments are clustered along certain reaches or in particular sub-watersheds of larger watersheds. This is due to the locally intense nature of the disaster event that causes the impairments and the susceptibility of specific watershed locations to being impaired. The direct impacts of a single EWP project to deal with a single impairment could be locally significant, and it may or may not be significant at the reach or sub-watershed level. The direct impacts of the several individual EWP projects employed to restore all of the impairments could be significant at the sub-watershed/reach level. Only in wide-scale emergency events would the direct effects likely extend to the whole watershed context

Indirect impacts are usually even more localized because they tend to be attenuated by both time and distance. Therefore, indirect effects also are likely to be confined to the same sub-watershed/ reach context as the direct impacts to which they are related.

Cumulative impacts do not tend to "scale up" beyond the watershed context as the "incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions," is considered in both space and time. This is because waterborne sediment and pollutants remain within watershed boundaries until they discharge to the downstream watershed. Affected species, such as fish, do not generally cross the watershed boundaries. Therefore, resource agencies have begun to organize their planning and goals on a watershed basis. Only in the most widespread natural events (*e.g.*, the Mississippi River floods of the 1990s), or in highly stressed regions (*e.g.*, urbanized watersheds, such as the lower Delaware and Hudson rivers), are the impacts likely to be significant at a larger scale.

As a result, the ID team concluded that any attempt to perform comprehensive cumulative impact analysis directly at the national and state level contexts would not likely yield meaningful results. Therefore, the most productive contexts in which to analyze cumulative impacts were assumed to be the watershed and sub-watershed/reach level contexts.

EWP practices carried out in three example watersheds – the Buena Vista-Maury in Virginia, the Eighth Street Burn Area-Lower Boise in Idaho, and the East Nishnabotna in Iowa – were chosen for cumulative impact analysis. These three EWP projects were the best examples of the range of possible EWP practice situations in an acceptable range of terrain and ecological community contexts. Buena Vista and Boise represent the use of EWP practices in areas of potentially high interaction with a variety of other land uses because of their near-urban settings, steep-slope environments, and respective high-rainfall and low-rainfall climates. East Nishnabotna represented an almost totally agricultural land use context in the Great Plains ecoregion. At the same time, the watershed also provided the opportunity to compare agricultural land use impacts with land use impacts from a group of different sized human communities along the river. Taken as a whole, these three watersheds were considered to present the best set of contexts for cumulative impact analysis because these representative interactions were present. However, the watersheds were not considered to be representative from a standpoint of any overall cumulative impact intensity. Therefore, no attempt was considered to scale the cumulative impacts up to a basin-wide, regional, or national context.

## *B.1.4 Practice Component Linkages to Ecosystem Components*

Determining what types of environmental impacts the EWP practice components are likely to have, what environmental resources might be affected, was accomplished by developing network diagrams depicting the basic components and causal connections of affected watershed freshwater aquatic, riverine wetland, floodplain, riparian, and upland ecosystems. All major ecosystem components and their linkages were defined. Similar impact flow diagrams were created for the elements of human communities likely to be affected by EWP projects. The network diagrams were then used to develop comprehensive lists of questions that needed to be answered to evaluate the likelihood of occurrence, frequency, and magnitude of the impacts. Flow diagrams and question sets are presented in Appendix B. The method is comprehensive in identifying the range of impacts likely to occur in a situation, so that all are demonstrably considered. The method then focuses on the more important impacts as required under NEPA.

### B.1.4.1 Range of Impacts Evaluated

NEPA requires agencies to employ an Interdisciplinary Team approach to accomplish a thorough, comprehensive evaluation of impacts on all aspects of the human environment. NEPA requires an evaluation of both adverse and beneficial impacts even if the agency believes that the impacts would be beneficial.

Three types of impacts are required to be assessed:
- *Direct impacts* that would occur at the location of the action at the time the action is taken
- *Indirect impacts* that would occur at some distance removed or at some later time
- *Cumulative impacts* that would occur when the incremental effects of the action are added to the impacts of all other actions—past, present, and reasonably foreseeable future actions—regardless of what agency or other entity is acting

***Specific Impact Categories Evaluated for Direct, Indirect, and Cumulative Effects***

The PEIS evaluated all relevant impacts including impacts to:
- Soils
- Water Quality and Resources, including watershed functions and values, floodplains, wetlands, and riparian areas, permitting and regulatory oversight
- Air Quality
- Biota—including aquatic and terrestrial plants and animals, particularly sensitive and Federal T&E species, fish and wildlife habitat, and other natural areas
- Recreation
- Cultural Resources
- Socioeconomics—including effects on the local economy and social resources
- Environmental Justice—including effects on minorities and low-income populations
- Infrastructure
- Aesthetics
- Land Use, Land Valuation, Prime & Unique Farmland, & Zoning Conflicts
- Petroleum-based Organic Liquids (POLs), hazardous materials, and solid wastes
- Public Health & Safety

### B.1.4.2 Impacts Flow Diagrams

The method that the Interdisciplinary (ID) Team used to evaluate the environmental impacts of the EWP practices and program alternatives is a focused, deliberative approach. It identified, and diagrammatically depicted with detailed flow charts, the elements of the agency's actions and of the environment that would be affected by the actions. The ID team then posed sets of questions to determine whether an impact would likely occur and how important it would be if it did.

EWP project impacts flow diagrams were designed to illustrate the interconnections between work components of EWP practices and their potential effects on aquatic communities, wetlands and floodplains, terrestrial communities, and the socioeconomic and related elements of human communities. EWP project work elements and the EWP practices that employ them are listed in

Table B.1-1. The flow charts include all work components of all practices; the user needs to identify which components are employed on any particular project in question. The affected environmental resources identified in the chart series were developed from the SWAPA+H (soil, water, air, plants, animals plus humans) resources of NRCS and expanded to provide some additional detail.

The method is comprehensive in identifying all of the types of impacts likely to occur in a situation, so that all are demonstrably considered. The method then focuses on the more important impacts as is required by NEPA. For the EWP program, four major aspects of the human environment were used to organize the analysis effort: 1) aquatic communities, 2) wetlands and floodplains, 3) terrestrial communities, and 4) socioeconomic and other human resources. Impacts flowcharts that schematically depict the relationship between components of the EWP practices and adverse impacts or beneficial effects to specific resource elements within each of the major resource areas are presented here. Question sheets that catalog the questions that were to be answered to characterize the impacts follow each flow-diagram.

***Design of Impacts Flow Diagrams***

The basic flow-chart elements are illustrated in Figure B.1-3. Work elements are identified in wide, rounded boxes. Resource categories are labeled in plain boxes at the top of each resource set and are color-coded. Specific affected elements are identified in a resource column. Direct effects are indicated by arrows originating at work elements and flowing to the beneficial effects (green side) or detrimental effects (red side) of a specific resource element. Color-coded arrows originating at resource elements identify indirect effects. Solid line flows indicate the effect is detrimental; broken line flows show beneficial effects. The flow-diagrams consist of an upper-half, which identifies environmental resources likely to be affected in the short-term and a lower-half which identifies long-term impacts on resources.

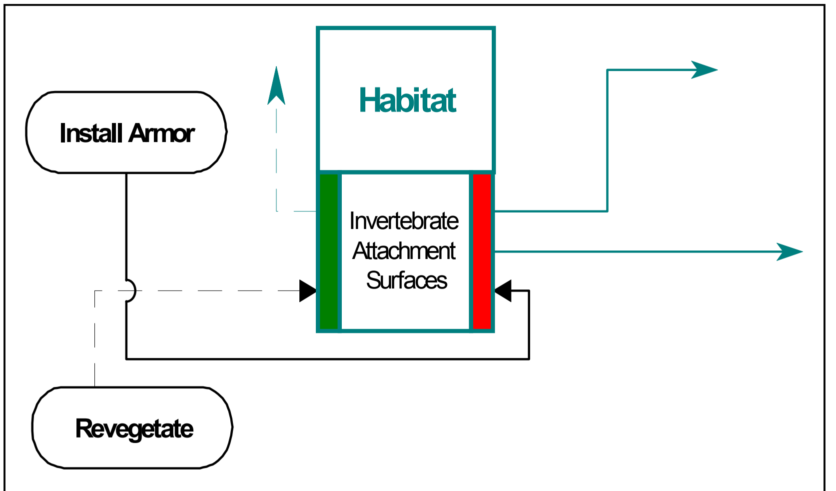

*Fig. B.1-3 EWP Impacts Flow-Chart Elements*

### *Project Question Sheets*

The EWP project impacts question sheets have been designed to correspond with each resource element of the impacts flow charts. The questions are listed in box table format (Figure B.1-4) color-coded to correspond with the flow charts. Where appropriate, the question sheets identify relevant regulatory requirements in coded form. The codes correspond with the laws and regulations described in the regulatory environment section of Appendix A of this report. For the aquatic, wetlands and floodplains, and terrestrial charts, the first (upper) sheet covers short-term effects, that second (lower) the longer term impacts. For the socioeconomic effects flow-diagrams and question sheets, no clear distinction is drawn between short and long term effects.

| | |
|---|---|
| Stream Bottom Substrate& Structure | What types of substrate are present at, or near the construction site? Are these substrates adequate for spawning? Will the anticipated increases in sedimentation significantly decrease the amount of spawning habitat? [FWCA] |
| Are the substrates in the impairment area suitable for macroinvertebrate attachment? Would the potential increase in erosion and sedimentation fill the areas used for cover and attachment by invertebrates? [FWCA] | |
| Are there existing pools in the impairment region? Would the sedimentation significantly fill in existing pool areas, thus decreasing habitat types? [FWCA] | |

*Fig. B.1-4 EWP Impacts Questions Sheet Format*

### *Aquatic Community Effects Charts*

The charts that follow address potential EWP-practice work element effects on aquatic communities. The first chart identifies potential direct and indirect short-term and long-term impacts. The second chart formats corresponding questions that need to be addressed to evaluate the short-term and long term impacts.

Aquatic Impacts Flow Chart

Aquatic Impacts Question Sheet

***Riparian, Floodplains, and Wetlands Effects Charts***

The charts that follow address potential EWP-practice work element effects on riparian, floodplain, and wetland communities. The first chart identifies potential direct and indirect short-term and long-term impacts. The second chart formats corresponding questions that need to be addressed to evaluate the short-term and long term impacts.

Wetlands, Floodplains, Riparian Flow Chart

Wetlands, Floodplains, Riparian Impacts Question Sheet

### B.1.4.3 Watershed Upland Effects Charts

The charts that follow address potential EWP-practice work element effects on watershed upland communities. The first chart identifies potential direct and indirect short-term and long-term impacts. The second chart formats corresponding questions that need to be addressed to evaluate the short-term and long term impacts.

Watershed Uplands Impacts Flow Chart

Watershed Uplands Impacts Question Sheet

### B.1.4.4 Socioeconomic and Related Human Effects Charts

The charts that follow address potential EWP-practice work element effects on human communities; including socioeconomics, cultural resources, environmental justice, public health, land use, and related resources. The first chart identifies potential direct and indirect short-term and long-term effects. The second chart formats corresponding questions that need to be addressed to evaluate the short-term and long-term effects.

**Socioeconomic and Related Human Resources Impacts Flow Chart**

**Socioeconomic and Related Human Resources Impacts Question Sheet**

## *B.1.5 Review of Relevant Scientific Studies*

The ID Team reviewed relevant scientific literature to determine the characteristics and intensity of the potential impacts identified in the questions and to determine which impacts were potentially significant and should be the focus of the analysis. The relevant findings of the literature review are presented in Appendix E.

## *B.1.6 Use of Ecosystem Condition Classifications and Example Sites*

The basis for addressing ecosystem impacts generically on a programmatic level was facilitated by use of condition classifications of aquatic, wetland, riparian, floodplain, and upland watershed ecosystems. The classifications are described in Chapter 4.

Example sites were used to support the generic analysis of impacts of the EWP practices and easements on watershed ecosystems, to evaluate EWP project impacts on human communities, and to address EWP Program cumulative impacts. Table B.1-3 lists the numbers of sites, communities, and watersheds used in the analysis. Chapter 4 describes the affected environment at the 23 sites in 14 watersheds used in the PEIS. Detailed descriptions of their affected environment are presented in Appendix D.

***Table B.1-3 EWP Program Components and Impacts***

| **EWP Program Component** | **Aquatic Riparian Floodplain, Wetland, Impacts** | | **Terrestrial Impacts** | | **Socioeconomic & Other Human Impacts** | |
|---|---|---|---|---|---|---|
| | Direct and Indirect Impacts | Cumulative Impacts | Direct and Indirect Impacts | Cumulative Impacts | Direct and Indirect Impacts | Cumulative Impacts |
| **Individual Installed EWP Practice** | 20 Example Sites | | 20 Example Sites | | 20 Sites Cultural Resources, Visual, Recreation | |
| **Suites of EWP Practices at an Impairment Site** | 14 Example Sites | | 14 Example Sites | | 14 Sites Cultural Resources, Visual, Recreation | |
| **Floodplain Easement at an Impairment Site** | 6 Example Sites | | 6 Example Sites | | 6 Sites Cultural Resources, Visual, Recreation | |
| **Multiple Easements along an Impaired River Reach** | 3 Example Sites | | 3 Example Sites | | 3 Sites Cultural Resources, Visual, Recreation | |
| **EWP Project(s) in a rural community** | | | | | All Effects 6 Rural Communities | |
| **EWP Project(s) in a Small Watershed** | 2 Example Watersheds | 2 Example Watersheds | 2 Example Watersheds | 2 Example Watersheds | 2 Example Watersheds | 2 Example Watersheds |
| **Groups of EWP Projects in a Large Watershed** | 3 Example 8-digit Watersheds | 3 Example 8-digit Watersheds | 3 Example 8-digit Watersheds | 3 Example 8-digit Watersheds | 3 Example 8-digit Watersheds | 3 Example 8-digit Watersheds |

### *B.1.7 Documentation of Impacts*

The literature review findings and condition classes were then used to evaluate and document the impacts of current and proposed EWP practices and floodplain easements and, based on those findings, to evaluate the impacts of the alternatives in this chapter. Example sites were used as "case studies" to supplement the broader impacts discussion by addressing the effects of typical applications of EWP practices and easements in recent disaster situations. Summarization of analysis of the impacts of the Alternatives is presented in comparative form in Chapter 3. As part of the analysis of Program alternatives, the team evaluated what would likely have occurred under the proposed action and other alternatives in the same circumstances at the example sites.

No attempt was made to analyze the impacts to specific Federally-protected T&E species or cultural resources or to specific wetlands because these resources are site specific in nature and a specific analysis at this programmatic level would be neither feasible, considering the massive data and analytical requirements, nor credible. These resources are addressed in terms of the "case study" analyses of the example sites, which bring into focus what has been done at these particular sites to assess the presence and evaluate the need to protect T&E species, cultural resources, and wetlands. Wetland resources are addressed generically in terms of likely effects of practices and easements on their general condition where they may be present. Wetlands, T&E species, and cultural resources are key resources that are highlighted in the DSR evaluation of defensibility of proposed EWP work and in agency coordination and they would continue to be so regardless of which alternative is selected.

The cumulative impacts analysis focused on three example watersheds – the Buena Vista-Maury in Virginia, the Eighth Street Burn Area-Lower Boise in Idaho, and the East Nishnabotna in Iowa. These were the best examples of the range of possible EWP practice situations in an acceptable range of terrain, ecological, and human community contexts. Buena Vista, VA and Boise Hills represented the use of EWP practices in areas of potentially high interaction with a variety of other land uses because of their fringe-urban settings, steep-slope environments, and respective high-rainfall and low-rainfall climates. East Nishnabotna represented an almost totally agricultural land use context. At the same time, the watershed also provided the opportunity to compare agricultural land use impacts with land use impacts from a group of different sized human communities along the river. Taken as a whole, these three watersheds were considered to present the best set of contexts for cumulative impact analysis because these representative interactions were present.

## B.2 EVALUATING THE SOCIOECONOMIC IMPACTS OF EWP PROGRAMS

The socioeconomic impacts of EWP Program practices on a community are measured by comparing eight categories of socioeconomic conditions in example communities before a disaster to the condition immediately following the disaster, and then to the condition following the installation of EWP Program practices. Finally, potential effects of the EWP Program alternatives are compared. This comparison forms the conclusion of the socioeconomic impact assessment.

A natural disaster places some level of stress on the economic, social, and physical infrastructure of a community. Actual damage to or destruction of a resource, or the threat to life and property can inflict this stress. The level of stress can grow beyond the capability of institutional structures, social services, and support networks to cope with it or to adapt to meet future contingencies.

The specific consequences associated with a natural disaster, as well as the prevailing conditions of the individual communities affected, are unique to each event. As a result, no uniform or codifiable set of socioeconomic effects exists for natural disasters (Vogel, 1999). However, some general areas of impact can be defined. These effects are the primary result of the determination of a potential threat to human life or the potential, actual loss, damage, or destruction of property that are the consequence of a natural disaster. They include the potential for change in the local or regional economic structure or damage or destruction of infrastructure, housing, or other community resources.

The economic and social effects of the EWP Program result from a complex interrelationship between a project and the social conditions of the community. A community's response to the changes that would result from implementing a proposed alternative will be unique, based on its economic conditions, social history, population characteristics, social organization, and the culture and character of the community.

An impact is defined as a quantitative or qualitative change in some aspect of the environment. A change is evaluated in terms of its potential to harm or benefit a community. The magnitude and extent of the change is a function of the intensity and duration of the Program activity and the social condition of the community.

Three levels of analysis have been defined:

- Immediate Neighborhood
  - Identify culturally significant structures and properties
  - Direct effects of the project
  - Direct effect of the project's completed construction

- Community
  - Quantitative assessment, with some qualitative evaluation of land uses and community plan

- Indirect effects of project on community
- Provide statistical basis for determination of other local effects (e.g. age and value of housing, or commercial and agricultural land in non-residential areas)
- Determined on the basis of Census block (and any incorporated areas where relevant)

➢ Watershed
- Basis of cumulative impact assessment
- Qualitative assessment (quantitative capture of total dollars spent on all EWP projects related to specific threat condition)
- Region defined on the basis of political boundaries within the geographic boundaries of the Watershed community
- Regional political boundary may differ slightly from the geographic boundary of the watershed
- County level data used as a basis for general setting, block-level data defines the region itself

Specific socioeconomic factors that may be important (Burdge 1995, ICGP 1994, Leistritz, 1998) include:

➢ The demographic characteristics of the local community, including population size, and composition as well as any socioeconomically sensitive population clusters
➢ The structure of the local economy, including employment levels, the dominant economic activity of the area, and the value of potentially affected property
➢ Community resources, including patterns of natural resource and land use, the availability of housing and other land for production or investment purposes, and future community development plans
➢ Community/institutional arrangements, including provision of necessary services, organization of local government, and linkages to external systems.
➢ Individual and neighborhood characteristics such as residential stability, age of the built environment, residential networks, level of identification with the community, and the presence of significant cultural or religious institutions

## *B.2.1 Components or Characteristics of the Affected Communities*

In recent years, rural communities have undergone what is frequently characterized as an economic restructuring (Reeder, 1990). Maintaining the residential and employment bases and attracting new residents or business investment to the community have become increasingly difficult. Rural communities have also lost per capita income over the past two decades. As Leistritz (1994) notes, this significant loss of purchasing power through out-migration and a general decline in employment opportunity resulting from productivity increases in agriculture and manufacturing, have made it hard for communities to address critical problems.

Rural communities also tend to social and lifestyle patterns that are distinct from their metropolitan counterparts. The predominately rural character of the communities under study indicates that in addition to population, employment, and economic factors, community history and social characteristics may also be important to identify potential impacts. The social environment of rural communities includes important emphasis on a sense of place and community. Residents of rural communities tend to have deep attachments to their communities and to individual places within them that have a special meaning.

A rural community is defined by population size and density, regional geography, and community social patterns. The spatial location of population, physical structures and natural landforms, patterns of land use, and the organization of economic, cultural and social activity, all contribute to the definition of the rural character of an area (McClelland et al. 1995). Rural communities can thus be distinguished from urban or metropolitan communities on a continuum of more to less rural.

The 1990 U.S. Census classified 2,288 counties as rural. Although the United States has become increasingly urbanized, rural communities continue to be important. In 1990, they included 83 percent of the nation's land area, 21 percent of its population, 18 percent of its employment and contributed to 14 percent of the national income (Cromartie and Swanson, 1996).

In contrast to metropolitan communities, rural areas tend to be characterized by comparatively few people living in an area, with limited access to large cities or, in some cases, smaller towns, and considerable travel distance to centers of employment or market activity (Hewitt, 1989). Correspondingly, rural government structures are generally smaller than their urban counterparts, and have smaller financial resources (per capita) to address local problems (Reeder, 1990). The institutional and administrative structures of rural communities are therefore more susceptible to changes or alterations in local conditions.

Rural communities tend to share certain characteristic structures, social patterns and cultural practices, but there is a degree of diversity within the rural community as well. Where agriculture was once the dominant defining rural characteristic, contemporary rural communities, while still strongly influenced by agriculture, display socioeconomic patterns that are no longer dominated by a single industrial mode, residential configuration, or lifestyle. Manufacturing and service industries are now a more important part of the rural economy, and rural communities have become more popular as tourist and recreational centers and as residential areas for retirees and families (Cromartie and Swanson, 1996).

Although generally rural, the communities affected by the EWP Program display a diversity of economic activity, land use patterns, social structures and administrative organization. Regional differences are one important distinguishing factor. Among the factors that may be associated with specific regions are income level and the presence of persistent poverty, size, population density and structure, proximity to urban centers and the level of economic and social integration with them (Hewitt 1989, Cromartie and Swanson 1996). As a result, the susceptibility of a community to the effects of a natural disaster and the importance of EWP Program activity to the continued maintenance and future development of the community will be unique.

Natural land forms, relationships between physical components of the land, the political, technological, economic, and social history of a region, the availability of resources and needed services, and the racial, ethnic and cultural composition of the population contribute to the diversity among rural areas (McLelland et al. 1995). Classifying of counties by type provides a convenient mechanism to group them according to important economic or social traits. A county is normally the smallest unit of analysis for which consistent information on a wide variety of economic, demographic, and other social characteristics is available.

The Economic Research Service of the USDA has classified non-metropolitan counties according to their primary economic activity and certain social characteristics (Cook and Mizer, 1989). The USDA classifies 2,259 nonmetropolitan counties into six economic activity categories:

- Farming – located in more remote areas, predominately rural, and sparsely populated
- Mining – frequently located near natural resource sites, generally more remote, and containing larger population bases
- Manufacturing – more densely populated, urban, and usually adjacent to metropolitan areas
- Government - may contain larger cities (20,000 or more), sometimes adjacent to larger metropolitan areas;
- Services-based – tend to have at least some urban population
- Nonspecialized – two types; a strong economy associated with diversification or the service sector, and a weak economy associated with a shift away from a previously specialized economy, a small economic base, or high concentrations of poverty.

In addition to these six categories, counties can be classified further according to certain social characteristics. The ERS categorizes 1,197 of the 2,259 nonmetropolitan counties into five subcategories, including:

- Retirement-destination – Reflecting the movement of retirees into rural and small town environments, the 190 counties in this category are primarily in the South and West, particularly in the traditional retirement areas of the country. These counties tend to be more rural in character, with over half containing cities with populations from 2,500 to 20,000, and may also serve as recreation and resort areas for younger populations.
- Federal lands counties – Including 270 counties in which at least 30 percent of the land is owned by the Federal government. The counties in this category are primarily in the West, with small concentrations in the national forests of the Appalachians, the Ozarks, and in the north central states. These counties tend to have a lower population density and a larger than average land area.
- Commuting counties – More than 40% of the workforce of these 381 counties commutes to employment outside the county. Concentrated in the South and the Midwest, they tend to be smaller in area and adjoin a metropolitan area to which they are also linked economically and socially. These counties substantial urban population and they are more likely to contain higher percentages of disadvantaged populations.
- Persistent poverty counties – These counties have 20 percent or more of the population below the poverty level for the previous four years. The 525 counties in this group tend to be smaller and have a less urban population. Also characteristic is a disproportionately high percentage of economically at-risk populations, including minorities, female heads of households, high-school dropouts, and disabled persons. Incomes are generally lower and employment rates generally higher than in other nonmetropolitan counties.

- Transfer-dependent counties –381 counties that depend heavily on unearned income from government transfer payments such as social security, unemployment insurance, welfare and retirement medical payments, and government pensions, these counties tend to be concentrated in the South and Midwest. They overlap with persistent-poverty counties and tend not to adjoin metropolitan counties and more than half are completely rural in character.

To assess the socioeconomic condition of a community, predominant economic organization in which a community is located must be defined. The county-level typologies provide a mechanism by which to categorize economic, demographic and social conditions. Along with state level information, county-level data also provide a basis against which a community's condition can be compared.

Rural communities affected by EWP Program projects are generally of four types:
- Individual farms or multiple farms in a lightly populated agricultural area;
- Housing clusters in areas defined by the Census Bureau (1994) as rural unincorporated with populations under 500.
- Villages and small communities in Census Bureau defined non-farm areas with populations of less than 2500.
- Incorporated towns and cities with populations of 2,500 to 10,000 in nonmetropolitan counties.

The socioeconomic setting of a community is characterized by:
- Population size
- Population density (percent rural)
- Minority composition
- Poverty level
- Per capita income
- Total employment (age 16 and over)
- Major industrial sectors
- Principal agricultural products
- Number of farms
- Age of housing stock
- Tenure of owner-occupied housing
- Value of owner-occupied housing

Data sources include:

- U.S. Bureau of the Census, Census of Population and Housing 1990 STF1a and STF 3a
- U.S. Bureau of the Census, 1996 Population Estimates
- U.S. Bureau of the Census, 1992 Economic Census
- U.S. Bureau of the Census, 1992 Census of Agriculture
- U.S. Bureau of the Census, 1992 Census of Retail Trade
- Secondary data sources provided by local government

### *B.2.2 Impact Indicators*

Social communities are generally complex and dynamic. Thus, potential direct and indirect impacts of EWP Program practices are multiple and diverse. It was necessary to define social variables or indicators, that, when changed by a Program practice, would change other aspects of the social structure. From these indicators, other impacts can be inferred.

Eight indicators have been identified. These indicators are grouped into three primary categories:

- Effects on Business and the Local Economy;
  - Potential effect on employment and income in the community
  - Changes in the value and quantity of land and natural resources available to the community that may serve as a source of investment or raw material input to production
- Effects on Infrastructure and Community Resources; and
  - Elements of the built environment
  - Community infrastructure (utilities, energy, waste treatment, transportation, etc.)
  - Services (police, fire, hospitals, social assistance)
  - Resources (cultural, educational, recreational, aesthetic
- Effects on Community Structure and Social Patterns.
  - Demographic composition of the community
  - Existing land uses in the adjacent and surrounding community

These variables reflect the elements of the social environment that might be sensitive to impact both from the experience of a natural disaster event and subsequently by the implementation of a proposed EWP practice.

### *B.2.3 Example Community "Case Studies"*

Six communities were chosen to illustrate the potential socioeconomic effects of the EWP Program at the community level. (Table B.2-1) They were selected to reflect certain important characteristics associated with each community type, and also represented a varied sampling of EWP Program practices, (e.g. streambank stabilization, debris removal, revegetation, levee repair, etc.).

Each community has suffered a natural disaster associated with a regional watershed. Although short-term impacts are normally the greatest concern for local residents and business entities, these impacts may also have long-term consequences where repair and restoration is not accomplished. Because the affected areas are primarily rural, impacts to agricultural areas of the watershed region are especially important. However, in several cases, the effects of watershed disasters also extend to large population centers in nearby urban and metropolitan communities.

*Table B.2-1 EWP Communities Analyzed*

| State | County | Community | Community Type | Practice |
|---|---|---|---|---|
| **Virginia** | Rockbridge | Buena Vista City | Independent city in predominately rural region | Sediment and cobble, Debris removal |
| | Rockingham | Rocky Run | Residential Cluster | Riprap and gabion |
| | Madison | Rose River | Independent | Debris removal |
| **Georgia** | Hall | Bethel Road | Independent | Woody, Debris removal |
| **Iowa** | Fremont and Montgomery | Shenandoah | Incorporated rural community | Levee repair |
| **Idaho** | Ada | 8th Street, Burn-Boise | Rural area located in a metropolitan county. | Critical area treatment |

The DSR provides the best available data on the properties of the immediate community. Census Bureau statistics on population and demographics, employment, income, and property value are also used.

## B.3 EVALUATING THE CUMULATIVE IMPACTS OF THE EWP PROGRAM

This Discussion outlines the research in the regulatory requirements for considering cumulative impacts, a review of past Federal agency efforts to include such analysis in NEPA documents, and outlines the steps NRCS completed to develop the cumulative impacts methodology used in this PEIS.

### *B.3.1 Introduction*

The CEQ EIS Regulations, 40 CFR 1500-1508, require that an EIS consider three types of *effects* (or *impacts* — the terms are synonymous in NEPA terminology): *direct effects*, *indirect effects*, and *cumulative effects*. Direct and indirect effects methodologies have been discussed earlier. Cumulative effects or impacts are defined by 40 CFR 1508.7 as:

***"The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."***

The regulations point out that cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

From the standpoint of the PEIS, the consideration of cumulative impacts poses both important and difficult policy and technical issues. On the one hand, the early-stage analysis that occurs in a PEIS presents the best opportunity to eliminate or minimize the environmental impacts of a program. On the other hand, analysis at the programmatic level is by necessity less detailed, and it is widely agreed that detailed information is needed for adequate cumulative impact analysis. From the outset, consideration of cumulative impacts at the programmatic level requires compromises in the scope and detail of analysis.

### *B.3.2 Review of Cumulative Impacts Analysis in Past EISs*

The NRCS Interdisciplinary Team began developing the cumulative impacts assessment methodology by reviewing the literature on considering cumulative impacts in NEPA analysis. The team concluded that adequate consideration of cumulative impacts had been most effective in individual project-type EISs rather than in programmatic EISs. For example, a recent review of 33 selected EISs found that, particularly since 1990, agencies such as the U.S. Forest Service (USFS) and the U.S. Army Corps of Engineers (USACE) had improved their consideration of cumulative impacts in their project-specific EISs (Cooper and Canter, 1997). The recent Council on Environmental Quality (CEQ) publication, *Considering Cumulative Effects Under the National Environmental Policy Act*, also served as an important source for the development of this methodology.

Considering cumulative impacts first involves defining geographic (spatial) and time (temporal) boundaries for the purposes of the analysis. If the boundaries are defined too broadly, the analysis becomes unwieldy. Conversely, if boundaries are defined to narrowly, significant issues may be missed, and decisionmakers will be incompletely informed about the consequences of their actions. Methodologies for analyzing cumulative impacts generally mirror the traditional components of a NEPA environmental impact assessment: (1) scoping; (2) describing the affected environment; and (3) determining the relevant environmental consequences (CEQ, 1997).

Typically, the ideal way of addressing these three components is to apply them sequentially. Due to the compressed time frame of the EWP Program PEIS, however, scoping and data-gathering for this project were contemporaneous. Informal and formal lines of communication were developed between the NRCS headquarters and state technical representatives. A state technical representatives task force was established to select example watersheds, gather watershed information, and perform peer review for the PEIS project.

EWP Program sudden impairments occur in particular watersheds because of spatial distribution of the natural events (e.g., flood, hurricane, tornado, or forest fire) that cause the sudden impairments. The direct impacts of these sudden impairments can be extensive in the short-term because of the high-energy nature of the emergency-causing natural event. Direct short-term impacts therefore may be significant on the immediate stream reach, and possibly to the watershed level. Only in the largest emergency events however do the direct effects tend to extend to the basin-wide context. Long-term direct impacts tend to be minimal because the EWP Program practices are restorative, designed to eliminate the short-term effects of the sudden impairment, and the initial site work to correct it.

Indirect impacts usually are even more localized (i.e., attenuated by both time and distance) because of the localized, one-time occurrence of typical natural emergencies. Indirect impacts therefore also are likely to be confined to the immediate stream reach. Even more than the direct impacts to which they are related, indirect impacts are less likely to extend to the watershed.

Cumulative impacts can scale up as other related past, present, and reasonably foreseeable future Governmental and non-Governmental actions are considered. As a general rule, however, this scale-up is limited because water pollutants tend to remain within watershed boundaries and affected migratory fish generally do not cross-watershed boundaries (CEQ, 1997). Moreover, only in the most massive natural events (e.g., the Mississippi River floods of 1997) or in very highly stressed watersheds (*e.g.*, very urbanized watersheds such as the lower Delaware and Hudson rivers, or in watersheds with extremely high agricultural runoff, such as the San Joaquin and Imperial valleys in California), are cumulative impacts likely to be significant on a basin-wide scale.

This is not to say that the level of EWP Program practice cumulative impacts on a specific reach in any particular watershed will be insignificant. Whether this is the case will most likely be a function of the overall stress of actions similar to EWP actions in the watershed. This identification and overall summing of the actual effects of all activities related to the proposed action is the heart of the cumulative impact analysis.

With these concepts in mind, the team conducted a literature search for the appropriate cumulative impact analysis approaches on which to model the cumulative impact methodology and found several useful examples. Details of the review are presented in Appendix E. In particular, the U.S. Fish and Wildlife Service (USFWS) and the USFS made significant attempts to include cumulative impact analyses in their NEPA documents and other technical environmental studies. The Interagency Stream Team organized by the USFS recommended the following approach in a June 1998 study (McCammon, 1998).

- *Hydrologic condition analysis results in an understanding of the interrelationships among meteorological, surface- and ground-water, and physical and biological factors that influence the flow, quality, and/or timing of water. The magnitude, direction, and rate of change are the expression of hydrologic condition. The determination of hydrologic condition should, therefore, focus on the analysis of the factors that most directly influence changes in the specific watershed of interest. Watershed characteristics that are not subject to change by management activities (e.g., geology, landform, precipitation) are fundamental in defining physical limits within which management actions can be expected to influence water flow, quality, or timing. Analysis and documentation of these characteristics are needed to support interpretations of hydrologic condition and to defining the limits of management influence over the physical system.*

- *Because watersheds vary tremendously across the country, analysts need the flexibility to select the watershed characteristics that are most relevant for the watershed they are considering. The analysis procedure outlined in this document is intended to provide the needed flexibility. The focus is on a process of analysis rather than on a prescribed or fixed set of factors that drive the analysis. This approach allows analysts to use existing tools (e.g., regional curves, nomographs) and to adapt the process based on available information (local watershed case files) and local or regional conditions and -needs. It is expected that standard procedures will* *be used to analyze factors indicative of hydrologic condition (e.g., Techniques of Water Resources Investigations of the United States Geological Survey and An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources [A Procedural Handbook – USDA]. Use of existing information brings with it a wide range of reliability and confidence in the values. It is very important for analysts to document the level of confidence and the reliability of their estimates and conclusions. It is important to document data voids that have decreased the reliability of conclusions.*

- *The analysis steps follow a logical sequence that will provide the basis for supporting professional estimates and judgments resulting in credible conclusions. The products of one step provide information for subsequent steps. The following steps presume that some preliminary work has been accomplished, including delineating the watershed and assembling pertinent data:*

  *Step 1. Characterize the watershed*
  *Step 2. Rate factors*
  *Step 3. Identify important factors*
  *Step 4. Establish current levels*
  *Step 5. Establish reference levels*
  *Step 6. Identify changes and interpret results*

The cumulative impact analysis methodology adopted for the EWP PEIS generally follows these procedures. Where our process varies, it is designed to take into account the fact that the EWP PEIS is a national program, whereas the processes used by USFWS and USFS are designed to evaluate watershed-level and regional-level cumulative impacts. However, there is not as much difference in the scope of analysis in the EWP PEIS as the above statement might indicate. Although the EWP Program is nationwide in scope, the environmental effects of the individual projects that comprise the overall action have more limited spatial and temporal contexts. The major difference is that the evaluation of Program impacts is by necessity more qualitative than project-specific evaluations because of the less specific nature of programmatic objectives compared to project objectives.

## *B.3.3 Procedures Used in Conducting the EWP Cumulative Impacts Analysis*

As noted above, methodologies for analyzing cumulative impacts generally mirror the traditional components of a NEPA environmental impact assessment: (1) scoping; (2) describing the affected environment; and (3) determining the relevant environmental consequences (CEQ, 1997). This organization for the cumulative impacts analysis fits well with the methodology adopted for the analysis of direct and indirect impacts, discussed in Section B.5.1 above, we therefore chose to organize the cumulative impact analysis similarly.

### B.3.3.1 Cumulative Impact Scoping

Natural disasters that cause sudden impairments can occur in any watershed. Cumulative impact analysis, however, cannot be performed for watersheds in which EWP Program activities have not occurred. The number of potential watershed that could be chosen for analysis is very large in relation to the total number of EWP Programs activities implemented since the 1975 PEIS, therefore, a random sampling of those watersheds would be unlikely to select a watershed in which EWP Program activities have been pursued.

The NRCS Interdisciplinary Team selected seven states in which it believed that a representative group of EWP Project activities had taken place. NRCS technical representatives chosen from those states selected 14 example watersheds within those states for the initial PEIS evaluation of direct, indirect, and cumulative effects

The scoping process for cumulative impacts complimented the overall PEIS scoping process. First, the task group chose the natural events and sudden impairments for analysis. The respective NRCS state technical representatives were supplied information on potentially useful and informative EISs in their states that might augment the relatively modest amount of environmental data available in the individual EWP Program files. The task group then gathered relevant general information on the nature of the events and the impairments to be analyzed (i.e., floods, tornadoes, wildfires, etc.).

The task group met subsequently to choose example watersheds and refine the general scope of the natural impairment analysis. Once the entire group of example watersheds was chosen for the overall impact analysis process, the additional steps in the cumulative impact analysis scoping process involved: (1) choosing which watersheds were the most appropriate for cumulative impact analysis; (2) setting appropriate geographical boundaries for cumulative impact analysis; (3) identifying the potentially relevant cumulative impact-inducing actions; (4) identifying the appropriate time frame for each action; and (5) identifying the appropriate time frames for the cumulative impact analysis action. Each of these activities is discussed briefly below.

***Choosing the Specific Example Watersheds for Cumulative Impact Analysis***. A number of the example watersheds chosen for direct and indirect impact analysis either had relatively isolated EWP practices or they were carried out in a context that minimized the opportunity for interaction with other actions. These watersheds were not the most appropriate candidates for cumulative impact analysis. Those chosen—the Buena Vista-Maury in Virginia, the Eighth Street Burn Area-Lower Boise in Idaho, and the East Nishnabotna in Iowa—were the best examples of the range of possible EWP Program practice situations in an acceptable range of terrain and ecological community.

***Setting Appropriate Geographical Boundaries for a Cumulative Impact Analysis of Each Resource.*** This process began as soon as each natural event and its sudden impairment and relevant example watershed was selected. First, the area affected by the sudden impairment (i.e., the disaster impact zone) was determined from the relevant NRCS Damage Survey Reports (DSRs). Such impacts usually were limited to the immediate reach of the stream on which the sudden impairment had occurred. Next, a list of resources within the area that could be affected by the sudden impairment was prepared. Then, the geographic areas occupied by those resources *outside* the project impact zone were determined. The largest of these areas was designated the appropriate area for the cumulative impact analysis.

In some instances, the most immediate watersheds (i.e., 12-digit HUCs) boundaries were the appropriate contexts for this analysis because the relevant water pollutants tended to remain within watershed boundaries and the sensitive biological indicators, such as migratory fish, also did not cross the watershed boundaries (CEQ, 1997). In several instances, however, it was appropriate to examine the larger (8-digit HUC) watersheds in which the 12-digit watersheds were nested to see if cumulative interactions could be identified and to ensure that the analysis process was properly bounded. Socioeconomic, historical, and cultural resources generally do not follow watershed boundaries strictly; therefore, these resources were analyzed separately to determine appropriate geographical boundaries.

***Identifying Potentially Relevant Cumulative Impact-Inducing Actions.*** This process also started as soon as each natural event and sudden impairment and relevant example watershed was selected. The NRCS state representatives identified cumulative actions by reviewing geographically-appropriate lists from nearly 1,500 EISs in the Northwestern University Transportation Library (NWU, 1999). Despite the large number of potential actions described by the EISs in the list, however, most other relevant Federal actions were identified through consultation with the NRCS state technical representatives, review of Federal agency home pages and web sites and reports, and contacts with other Governmental and non-Governmental sources. Relevant state actions were determined in a similar manner.

The previously mentioned sources of information were used as a starting point for determining the relevant private actions for analysis. In addition, local zoning ordinances and their permits, water use plans, economic development plans, and other-land-use oriented materials were consulted. The task group also consulted local governments and various watershed stakeholders.

***Identifying the Appropriate Time Frames for the Cumulative Impact Analysis Actions.*** CEQ recommends setting the time frame for future cumulative impacts in the same period frame as project-specific analyses (CEQ, 1997). The potentially longer time frames of programmatic actions make following this advice problematic. The varying lengths of time impacts are likely from EWP Program practices also alter the appropriate time frames for analysis. The following ground rules were applied to determine the appropriate time period for each cumulative impact analysis:

- Except to the extent that the factors described in 2 and 3 below were relevant, the time frame for the cumulative impact analysis was the period from the November 1975 publication of the PEIS to the present;
- Where EWP Program activities had not been performed before November 1975, the cumulative impact analysis time frame began with the date that the first performance of an EWP activity was performed in a particular watershed;
- The time frame for a reasonably foreseeable future action was set to coincide with the time frame of the EWP Program practice and included all actions currently identified as planned during that period in appropriate documentation.

Examining the plans of the proponent agency and other agencies was useful. The mention of an action in a formal Governmental plan was deemed enough of an indication of reasonable foresight for its inclusion in the cumulative impact analysis. The time frame for private actions was estimated by examining local and regional economic planning studies and data. The team paid careful attention to the likelihood of the addition of such growth-inducing activities as roads, road interchanges, utilities (sewage treatment plants and water supply systems), regional facilities (such as major manufacturing plants and shopping centers), and large residential development projects. The availability of data often determined how far in the past and future it was reasonable to analyze potential cumulative actions.

Further step in the scooping process involved determining which other actions should be included in cumulative impact analysis. Best professional judgment was applied in determining which actions to include. Relevant major Federal actions significantly affecting the human environment were identified from the EISs listed in Table A.2-1. Next, other relevant federal actions (i.e., NRCS, other USDA agencies, and other Federal agencies—see listings and descriptions in Tables 2.3-1 through 2.3-3 in Chapter 2 and Tables E.2-1 through E.2-3 in Appendix E) were identified through a process of intra- and inter-agency scoping and information gathering.

Relevant state and local actions were identified through an information-gathering process that enlisted appropriate state and local governmental personnel and reviewed relevant state and local information sources (e.g., state agency websites, planning documents, local government land use and public facility plans, local government land use ordinances), followed by verification telephone calls.

Finally, relevant private actions were identified through steps 2 and 3 above and through contacts with local development agencies (industrial development commissions, chambers of commerce, newspaper business editors). Watershed land use maps and data were used for estimating the small actions too numerous to identify individually, but which still have impacts similar to EWP Program activities (e.g., acres of: cropland, highly erodible soils, impervious surfaces, lost riparian habitat, filled wetlands, etc.).

To the maximum extent possible, the activities were presented in appropriate tables for peer review (see Tables 4.5-1, 4.5-3, and 4.5-5). The tables were reviewed by the NRCS state technical advisors and appropriate changes and additions were made.

**B.3.3.2 Describing the Cumulative Impacts-Affected Environment**

Describing the affected environment for cumulative impacts did not differ greatly from describing the affected environments for direct and indirect impact analysis. This process involved identifying relevant ecological stress indicators and socioeconomic variables, and defining an overall baseline condition for the watersheds. Each of these activities is discussed briefly below.

***Identifying Relevant Ecological Stress Indicators and Socioeconomic Variables.*** Biological communities act as integrators of multiple stresses over time, therefore, indicators of biological sensitivity are useful tools for evaluating cumulative impacts. Biological-sensitive indicators were drawn from EPA watershed evaluations (EPA, 1999d). Socioeconomic variables include changes in employment through the addition or removal of jobs and how minority and low-income communities may be disproportionately affected. Governmental laws and regulations at the Federal, state, and local levels also comprise an important part of the affected environment because they provide a window on how far ecological stress and community disruption may be allowed to progress without being deemed significant.

***Defining an Overall Baseline Condition for the Watersheds.*** This activity represents a summation and integration of the processes described above, and one description should suffice for direct, indirect, and cumulative effects, except to the extent that a geographic boundary for a cumulative impact analysis is expanded, as discussed in Scoping, B.5.3.1.

#### B.3.3.3 Determining the Relevant Environmental Consequences of Cumulative Impact

To an even greater extent than scoping and describing the affected environment procedures, this phase of the analysis was formalized through comparative tables. The process identified the important cause-effect relationships that focus on cumulative effect pathways; incorporated the past, present, and reasonably foreseeable future actions and determining the magnitude and significance of cumulative impacts; and explicitly addressed the uncertainties that result from incomplete or unavailable information or data gaps. Each of these activities is discussed briefly below.

***Identifying the Important Cause-Effect Relationships that Focus on Cumulative Effect Pathways.*** This was a complimentary process to that which identified the cause-effect relationships for the analysis of direct and indirect effects. Therefore, direct and indirect biological sensitive indicators were used. The major difference involved socioeconomic, historic, cultural, and recreational resources, which were analyzed separately.

***Incorporating the Past, Present, and Reasonably Foreseeable Future Actions and Determining the Magnitude and Significance of Cumulative Impacts.*** This culminating procedure combined efforts that has gone before—scoping, describing, and preparing—to determine the true significance of cumulative impacts. For comparison and evaluation, this procedure used table containing the time frames, geographic relationships, and intensity of effects of all of the actions (see Tables 5.2-2, 5.2-4, and 5.2-6).

***Explicitly Addressing the Uncertainties that Result from any Incomplete or Unavailable Information or Data Gaps.*** When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency must always make clear that such information is lacking. The following procedure, set forth 40 CFR 1502.22, was employed:

- Incomplete information concerning to reasonably foreseeable significant adverse impacts that is essential to a reasoned choice among alternatives, must be included in the EIS if the overall costs of obtaining the information are not exorbitant. No such information was identified in this analysis.

- Information relevant to reasonably foreseeable significant adverse impacts that cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, is identified by one of the following:

- A statement that such information is incomplete or unavailable
- A statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment
- A summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment,
- The agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. Reasonably foreseeable includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

This information is contained in the subsections entitled “Areas of Uncertainty that Affect the Cumulative Impacts Analysis” in Chapter 5, Sections 5.4.2.1, 5.4.2.2, and 5.4.2.3.

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