Chapter 5
ENVIRONMENTAL CONSEQUENCES

Environmental Consequences—This section forms the scientific and analytic basis for the comparisons under 1502.14 (Comparison of Alternatives). (40CFR1502.16).

This chapter describes the direct, indirect, and cumulative environmental impacts of the EWP Program alternatives. The chapter analyzes the impacts of current and proposed EWP restoration practices and floodplain easements—and the EWP Program alternatives in which they would be employed—on watershed aquatic, wetland, riparian, floodplain, and upland ecosystems. It analyzes EWP Program alternative effects on human communities and the cumulative impacts of the EWP Program on the natural and human aspects of watersheds.

5.1 ANALYSIS METHODS & CHAPTER ORGANIZATION

This section describes how the analysis of EWP Program impacts was conducted and how this environmental impacts chapter is organized.

5.1.1 Impacts Analysis Methods

The NRCS interdisciplinary (ID) 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.

5.1.1.1 Stepwise Analytical Process

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, floodplain 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.

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 Preferred Alternative.

5.1.1.2 Contexts for Environmental, Socioeconomic, and Cumulative Effects

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.

In the first context, the focus of analysis was to evaluate the impacts of EWP restoration practices and floodplain easements on aquatic, wetland, riparian, floodplain, and upland ecosystems, and human activities (such as sport fishing) that rely on those resources. 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 a disaster event. The third even broader context took into account the fact that individual EWP projects, and groups of projects responding to a disaster event, would be undertaken while other NRCS actions and other agencies, organizations, and individuals also act in and affect 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 disaster-struck. The Team recognized that the sites, rural communities, and greater watershed contexts, were not ecological or human systems simply undergoing minor day-to-day adjustments to environmental inputs. Rather, they were disrupted systems responding to major environmental disturbances.

5.1.1.3 Determining the Impacts of EWP Recovery Practices and Floodplain Easements

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.

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.

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.

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 floodplain 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.

5.1.1.4 Addressing Potential Impacts to Federally Protected Resources

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 floodplain 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.

5.1.1.5 Analyzing Cumulative Impacts

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.

With this comprehensive approach, the PEIS should fulfill its purpose as the Program overview analysis, with any additional NEPA analysis to be done as appropriate and tiered to the PEIS.

5.1.2 Organization of this Environmental Consequences Chapter

This chapter has three major analytical sections. The first section describes the impacts of the individual EWP practices on the biotic environment, the second the socioeconomic and related human resources impacts of multiple EWP projects responding to natural disasters in rural communities, and the third, the cumulative impacts of EWP projects and other actions in whole watersheds.

The next section (5.2) describes the effects of the EWP practices dealing with debris removal, streambank protection, dam, dike, and levee repair, protection of floodplain structures, critical area treatment, and floodplain easements. Each subsection briefly describes the general impacts of the practices on aquatic communities, floodplain, wetland, and riparian communities, and upland biotic communities. These discussions are based on a review of the most recent scientific studies of watershed restoration methods and construction activities in floodplain environments. A more detailed review of these studies is presented in Appendix E. Because impacts on cultural resources are site-specific, they are discussed in this section as well. Then two sets of tables are given: the first lists the effects on the biotic communities of the natural disasters that cause the watershed impairments at issue; the second, the environmental impacts of the EWP practices that are employed to deal with the impairments.

Because socioeconomic effects are based on one or more EWP projects that combine a number of different practices, Section 5.3 describes overall EWP project impacts on rural communities.

Section 5.4 addresses the cumulative impact of EWP projects when considered with other NRCS actions, actions of other agencies, and other government entities and private entities and citizens. Section 5.5 describes the unavoidable impacts of the Preferred Alternative, Section 5.6 effects on productivity, resources, and energy.

5.2 IMPACTS OF EWP PRACTICES & FLOODPLAIN EASEMENTS ON WATERSHED ECOSYSTEMS

This section addresses the adverse and beneficial effects of the EWP practices and floodplain easements on aquatic, floodplain, riparian, wetland, and watershed upland environments.

5.2.1 Section Organization and Assumptions

For the practices that apply to impaired watercourses directly, such as debris removal, streambank protection, and dam, dike, and levee repair, the impacts on upland watershed communities are expected to be absent or negligible. Creating access to the impairment site might affect some minor acreage of uplands, but only in the case of T&E species or cultural resources is there reason for concern about upland impacts in these cases. Because EWP project teams would coordinate on these sensitive resources with the USFWS, and SHPO, and/or THPO as a matter of course in conducting their projects, they would still be considered. Thus, upland impacts are not evaluated for those practices here. Upland community impacts are evaluated for the practices that are employed in impaired upland situations, critical area treatment, upland debris removal, and reconstruction of enduring conservation practices.

The current EWP watershed restoration practices evaluated in this section include practices that:

- Restore stream channel capacity
- Stabilize and protect streambanks
- Repair or remove damaged dams, dikes, and levees
- Protect structures located in floodplains
- Protect damaged critical upland areas of watersheds

Effects of floodplain easements under the current Program are assessed.

EWP practices proposed under the Preferred Alternative include:

- Restoration of floodplain deposition sites
- Removal of disaster debris from watershed uplands
- Repair of damaged structural/enduring/long-life conservation practices

Effects of the changes in floodplain easements under the Preferred Alternative and purchase of floodplain easements on improved lands are also assessed.

5.2.2 Impacts of Current EWP Watershed Restoration Practices

This section evaluates the effects of disasters on stream, floodplain and associated environments, and uplands in the context of the watershed impairment situations in which EWP is involved. It evaluates the impacts on these ecosystems of current EWP practices that address debris impairments, streambank damage, dam, dike, and levee damage, threats to structures in the floodplain, and damage to critical upland areas.

5.2.2.1 Practices that Restore Channel Capacity (Debris Removal)

This section evaluates the effects on aquatic, floodplain, wetland, and riparian ecosystems of disaster-caused debris impairments and the impacts of current EWP practice of removal and disposal of debris.

5.2.2.1.1 Effects of Disaster Debris on Stream and Related Ecosystems

Accumulation of large amounts of debris is a common result of natural disasters. Debris jams of downed trees and branches, channels clogged with sand, gravel, or cobble, and widespread floodplain deposits are typical in the aftermath of major flood events. Tornados leave widely dispersed household debris and downed trees. Debris remaining in these situations can have a wide range of effects, from blocking stream channels and altering stream flows, drastically altering stream substrate and structure, burying cropland in a thick layer of sediment, or creating public health and environmental hazards in watershed uplands. Hazardous materials may also be encountered and would be handled and removed in accordance with all applicable State and local regulations.

Effects of Disaster Debris on Aquatic Ecosystems

During flood flows, debris can cause heavy damage to in-stream and riparian areas, including scouring the streambed of benthic habitat, structurally weakening streambanks, and damaging riparian and aquatic vegetation. Debris jams can cause the water to pond behind the newly created dam, leading to saturation and destabilization of streambanks, accelerated erosion, and secondary flooding along the banks. When floodwaters recede, debris left in-stream may cause sedimentation and smothering of bottom habitat by slowing water velocities and may redirect flow to more erodable areas forming new channels and abandoning old ones (see Cooper, 1997; Darnell, 1976).

Stream systems are naturally dynamic systems forming and reforming channels with scour and fill areas, riffles and pools, and rapids and backwaters, in response to the erosive force of stream flow and the resistance of bottom substrate and debris. These dynamics vary depending largely upon a stream's gradient and flow volume and the geology of the bedrock material.

Stream habitats can benefit or be damaged by debris; both may occur simultaneously. This section focuses on the adverse and beneficial ecological effects of in-stream debris and EWP practices to remove debris. Floodplain deposition removal and watershed upland debris removal are addressed in the proposed practices sections later in this chapter.

The benefits of debris deposition include creation of new habitat for fish and wildlife with the introduction of submerged woody cover, release of nutrients from woody and other biodegradable debris, and sediment deposition along sandbars, spits and streambanks. Gravel deposits may provide spawning habitat for anadromous salmonids, as well as provide stream channel stability (Kondolf and Swanson, 1992).

Rocky debris tends to scour the substrate, fill pools, and alter stream morphology by collecting in the stream channel. Finer debris materials may be smoother than gravel habitats. The impacts of debris on the aquatic community depend on the characteristics of the debris involved; whether woody debris, finer sediments, sand, gravel, cobble or some combination.

The impact of disaster debris on aquatic communities is evaluated here in terms of the parameters outlined in Chapter 4. *Sedimentation and turbidity* may be affected positively or negatively. Debris may be positioned such that previous areas of high turbidity are now sheltered or sediment is trapped along streambanks. Conversely, debris may be located such that sediment is trapped and covers benthic habitat or fills pools. *Temperature and dissolved oxygen* may benefit if debris creates an in-stream structure that provides shade or creates turbulence. However, debris may damage riparian and aquatic vegetation or block turbulence-causing structures that previously provided environmental benefits. When flooding due to debris jams inundates agricultural or other improved lands that contain fertilizers and other compounds, it may increase the occurrence or concentrations of *pollutants, nutrients and other chemicals*. Effects on *habitat structure* can vary greatly with the positioning of debris; some debris may improve existing cover or introduce habitat elements that were not there prior to the disaster. However, aquatic habitat may also be covered, damaged, or destroyed by the influx of debris. *Channel structure* may similarly be improved or damaged, depending on debris-induced changes in the course of the stream or in the substrate. Either situation could negatively affect biotic resources in the stream by altering stream-flow or position or changing the available habitat. Benefits might include the creation of new channels or expansion of previously minor habitats, which may increase some aquatic species populations (see Cooper, 1997; Darnell, 1976).

Effects of Disaster Debris on Riparian, Floodplains and Wetland Ecosystems

Nearby riparian areas, floodplains, and wetlands may be affected by debris in the current flood situation or by subsequent flooding resulting from debris jams, by channel course alterations and sediment deposition. Flooding from debris jams may affect habitat, vegetation, and hydrologic function in some wetlands and floodplains communities, depending on flood frequency and duration (see Keller and Swanson, 1979; Marzolf, 1978; and Cooper, 1997). Flooding can be of benefit to wetlands and aquatic ecosystems, even though it may change species composition or hydrologic function. Although debris deposition modifies topography so that some wetlands are negatively affected, new wetlands and riparian zones can develop. Additional or sustained flooding may change species composition or hydrologic function, as scouring of a riparian area may remove decadent woody vegetation, providing a substrate for seed deposition and germination. Channel course alteration could have substantial effects on streamside communities, as the former floodplain may become drier if the stream moves further away from its previous course. Wetlands and riparian zones that depend on continual or periodic exposure to streamflow will be negatively affected. Lastly, sediment deposition due to in-stream debris may improve habitat conditions, as streambank rebuilding may provide new habitat for riparian vegetation. Deposition of coarse debris in previously fine grain sediment areas can increase structural diversity of the ecosystem and increase biological diversity.

Variability of Debris Impacts across Watersheds

The specific characteristics of debris impairments will also vary regionally. Different watersheds will exhibit different levels and types of debris based on the type and amount of material present in the watershed and the type and destructive capacity of the disaster event. For example, a mountainous, forested watershed would have an ample cover of trees and a rocky substrate. Disaster debris in such a watershed would be predominantly woody, with an additional component of cobble, gravel or other rocky materials. The high gradients and fast moving waters of mountain streams create conditions for intense erosive force and rapid, long-distance movement of relatively massive pieces of debris. In contrast, low-gradient agricultural watersheds are affected by large amounts of finer grain sediments, with a substantial component of suspended sediments and a relatively smaller contribution of woody debris. Low-gradient rivers are slower flowing and unable to move rocky debris long distances. However, their high volumes of floodwater can severely damage levees and streambanks, eventually overwhelming streamside environments. Debris in these rivers is often floating woody debris from uprooted riparian vegetation, material from damaged levees, and material from man-made structures in the floodplain.

The creation of debris is also highly dependent on the type of disaster. Floods are the most typical example of a disaster where debris impairments are prominent. Floodwaters carry rocky and woody debris, as described above. Tornados usually leave a narrow swath of damage with multiple types of debris, because they are not generally confined to prescribed paths analogous to floodplains. Damage occurs in any type of environment, from wooded areas to urban centers.

Debris Damage at Example EWP Sites

The general discussion of impacts is supported with specific recent examples of EWP debris removal projects. In-stream debris example sites are located in Rockingham County, VA, Hall County, GA, and Montgomery County, IA. Each site is briefly described below, including an assessment of the pre-disaster and post-disaster natural conditions. More detail on the impacts of the disaster and of EWP practices at these sites is presented in Appendix D.

The Buena Vista EWP site in Rockingham County, VA, comprises four streams that originate in a high gradient National Forest area above the city, flow through the city, and empty into the Maury River. The streams are intermittent or perennial and support a variety of fish species including dace, chub and suckers. Two are cold-water streams with self-sustaining populations of brook trout in the upper reaches. No T&E species are known to occur in the area (Mohn, 1999). The nearest wetland is approximately 800 feet downstream and is classified as PFO1A, a forested wetland (NWI, 1999). The Buena Vista, VA site experienced heavy rain in 1995, leading to severe floods in these high gradient streams. Cobble, and to a lesser extent woody debris, were carried in large volumes, blocking the streams' channels and causing secondary flooding of the city.

The Bethel Road site, in Hall County, GA, is a heavily wooded site with a section of the West Fork of the Little River composed primarily of riffle and pool habitat, with invertebrates and some common fish species. Woody debris in-stream serves at least a minor role in the ecosystem, providing habitat, nutrients and slowing water velocities. No game fish populations, such as trout or other salmonids, are known to be present. No T&E species are known to occur onsite, although the red cockaded woodpecker and the bald eagle are found elsewhere in Hall County. No wetlands are onsite; the nearest downstream wetland would be in the headwaters of Lake Sidney Lanier, approximately five miles downstream (Cooper, 1999). When the site was struck by the tornado, a large numbers of trees were uprooted along the West Fork of the Little River. Large woody debris predominated the site, damaging streambanks and clogging the channel.

The Montgomery County, IA, site is located in a predominantly agricultural watershed. Riparian and aquatic vegetation and habitat in the area are generally poor, as agricultural use and previous flooding has degraded these resources over time. Fish populations are typical of fair to degraded streams, comprised of hardy fish such as catfish, carp and some bass (Priebe, 1999). No salmonids or T&E species are known to be present onsite or in the near vicinity. The federally endangered Indiana bat is listed in Montgomery County but would not normally reside in this area. A mapped riparian area (classified as R2USA) and a forested wetland (PFO1A) are located immediately downstream (NWI, 1999). The EWP project site is located on a tributary of the East Nishnabotna River, where heavy rain transported a large volume of woody debris, blocking a culvert and creating secondary flooding.

5.2.2.1.2 Effects of Current Practices to Restore Hydraulic Capacity (Debris Removal)

This section describes the environmental impacts of the current EWP practice of debris removal. Chapter 2 describes the practice of debris removal, and the specific activities involved in removal, such as access creation. As with all EWP projects, the primary goal of debris removal is to reduce or eliminate threats to life and property. Threat reduction may require removing blockages in streamflow to restore the stream's hydraulic capacity and removing debris that could pose a threat to downstream areas in future disaster events.

<u>Impacts of Debris Removal Project Activities</u>

As described in Chapter 2, debris removal may involve a number of related activities: access creation, dewatering, heavy equipment use, establishing a low flow channel, grading and shaping, revegetation, and debris disposal. Site conditions determine which of the activities are required to execute a specific project.

To reach the stream and debris, vegetation may be removed to *create access* for equipment and workers. This may be as simple as removing a small amount of vegetation along well-established roads, or may be as complex as clearing a new road. For example, at the Bethel Road site, the project location was not easily accessible, necessitating the creation of a road, substantial removal of large woody vegetation along the streambank, and creation of an in-stream crossing point for machinery to reach the opposite bank and complete the work. Access creation can have several adverse effects, including soil compaction and decreased infiltration, increasing the potential for soil erosion, decreased streambank stability through vegetation removal, and direct impacts such as increased turbidity, particularly in cases where machinery operates in-stream (USACE, undated).

Dewatering, the process of rerouting streamflow away from the project site so that the debris can be cleared, may be used if a debris jam impounds water behind it, including a large volume of sediment, which may need to be removed. Removal of the debris dam without dewatering could release a plug of sediment that would be detrimental to downstream resources, so this is avoided if possible. Dewatering allows for a more controlled removal of the debris jam and sediment. Diverting water can have substantial effects on aquatic life residing at the dewatered site, which depend on continual flow, such as increased mortality in salmonid embryos (Becker et al., 1983). There may also be an increase in turbidity when the streamflow is returned to its original channel. (Dewatering is discussed further in the section on streambank protection practices, which require a relatively dry work area to ensure proper installation and stability.)

In-stream work may cause a number of other effects. Operation of *heavy equipment* in-stream or along the bank can disturb bottom sediments and increase turbidity, leak pollutants in the form of petroleum, oil and lubricants (POLs) or other substances, alter channel morphology by compaction from the weight of the vehicle, and directly harm aquatic biota such as vegetation, and immotile or slow moving species (USACE undated). Working in-stream is often the most expeditious way to remove debris, but tends to have greater direct aquatic impacts. Of the effects listed above, all would come into play. Working from the streambank, on the other hand, reduces the level of impact but could increase the duration of impacts, as the work generally takes longer. See the summary of impacts to aquatic ecosystems below for more details on biotic impacts.

It is worth noting that the more important debris removal efforts, in terms of fully restoring hydraulic capacity and stream morphology, occur in-stream. This serves to magnify the importance of those removal efforts. In-stream debris may be the most urgent to remove a threat, yet it may also poses the greatest environmental risks.

Following debris removal, *grading and shaping* may be necessary to restore more natural streambank conditions, repair any damage done during the EWP work, and help reestablish riparian vegetation (see Beeson and Doyle, 1995; Karr, 1977; Sweeney, 1993; FISWRG, 1998). This work is generally done with heavy equipment and would produce similar impacts to debris removal efforts conducted from the streambank as discussed above.

Revegetation is normally accomplished through seeding, but may occasionally involve tree plantings. Restoring the riparian vegetation that was damaged or removed during the process of debris removal will reduce erosion, improve turbidity levels, and reduce temperatures in the stream. NRCS is recognized as a leader in plant materials technology and maintains a wide array of plant species that would be suitable for rapid re-establishment of bank vegetation and stability. NRCS will make every attempt to use native plants in revegetation, but introduced (i.e., non-native) species may be used as the site conditions warrant. Invasive or weedy species will be avoided in accordance with Executive Order 13112.

Once the debris is removed it must be disposed. *Disposal* methods vary regionally and within individual watersheds. Woody debris may be hauled away to landfills or incinerators, burned onsite, chipped and left onsite, or used in EWP practices such as rootwads or tree revetments. Some landowners may wish to keep some debris as firewood or chipped as mulch. It has been suggested to use cobble and other rocky debris to create low berms to alleviate future flood effects or for streambank stabilization practices, but these uses conflict with natural flood regimes and create an onsite supply of cobble for future disasters (Darnell, 1976). Gravel removal, if excessive, may lead to downstream streambank damage as sediment is deposited to fill the voids left by removal, thus creating flows with a greater erosive potential (Kondolf and Swanson, 1992).

Disposal by burning, whether onsite or at a central location, contributes to air pollution and can create problems for sensitive areas downwind, such as homes or airports. Local burning ordinances may prohibit burning or restrict the amount and timing of burning allowed. Leaving debris onsite allows for slow release of important nutrients into the local ecosystem but can pose problems in future disaster events, as this material would again be available for transport downstream. Use in other EWP projects is an environmentally sound method, as it generates relatively little environmental impact and restores many natural functions to the stream. The volume and type of debris would determine its appropriateness for such use at the site or a nearby site. Berm creation may have both positive and negative impacts, as these structures may protect the floodplain and adjacent areas during smaller floods. However, they may also provide additional debris for larger floods, as well as altering the natural flood cycle, which may adversely affect wetlands and other flood sensitive areas. The use of cobble in streambank protection practices is virtually identical to loose rock riprap and other practices, which are discussed in greater detail later in this chapter.

Summary of Impacts on Aquatic Ecosystem Parameters

Sedimentation and turbidity: Short-term increases in sedimentation and turbidity may result from operation of equipment in or near the stream. Removal of debris may remove structures that reduce flow velocities and increase sedimentation. Removal of vegetation may increase runoff and erosion, introducing additional sediment to the stream.

Temperature and dissolved oxygen: Areas that were previously shaded or covered by debris may experience increases in temperature. Riparian vegetation removed or damaged in creating access or in completing the debris removal, may reduce vegetative cover and increase temperature. The removal of debris may alter or eliminate in-stream structures that create turbulence and/or direct flows that increase oxygen content.

Pollutants: Heavy equipment use in and around the stream may result in leaks of POLs and other mechanical fluids into the stream. Changes to the streambank structure, such as creating gullies, steep slopes, or denuded slopes, may decrease infiltration capabilities for rainfall and encourage runoff and erosion of fertilizers, pesticides, urban runoff or other chemicals found on the lands nearby.

Habitat structure: Debris removal can remove or alter habitat structure, adversely affecting aquatic organisms. Sedimentation caused during removal can fill or bury benthic habitats and organisms. Woody debris can comprise a substantial portion of invertebrate biomass, secondary production, and prey species for fish (Benke et al., 1985).

Channel structure: Removal of woody debris can either increase or decrease the potential for bank erosion, depending on how the debris was arranged and pre- and post-removal flows are directed (either towards the bank or the stream center, see Keller and Swanson, 1979). Removal of debris can increase flow velocities, increasing bed erosion. Removal efforts may change the location of the low flow channel and have significant impacts on plant and animal communities.

Biota: Increased sedimentation and turbidity can result in decreased spawning success, gill abrasions, migration barriers, lower dissolved oxygen, and the filling of downstream riffle areas (see Berkman and Rabini, 1987; Koonce and Teraguchi, 1980; McCabe and O'Brien, 1993). Removal of woody debris may decrease available habitat.

Debris Removal at Example EWP Sites

The Buena Vista, VA debris removal efforts primarily involved cobble removal in three of the four streams. *Sedimentation and turbidity* may have been problematic, as equipment was used in-stream and from the streambank. However, the brook trout populations reside well up-gradient from these particular sections of the streams as they enter the city, so the debris removal would not affect their habitat. *Temperature and dissolved oxygen* was likely only minimally affected. Riparian vegetation is in moderate to poor condition, as urban land uses are prevalent and most work was done without creating access by removing streamside vegetation. *Pollutants* may have been introduced with equipment operation at these stream stretches, which might add to what is already affected from similar urban runoff sources. Effects to *habitat structure* would have been both positive and negative, as cobble was removed to reopen habitat for fish but may have removed some of the original rocky substrate with resident benthic species. *Channel structure* was improved with the creation of low flow channels and removal of flow impediments. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

At the Bethel Road site, large volumes of woody debris were removed from the stream, chipped and left on-site. *Sedimentation* increased in the short-term, as equipment use occurred in-stream, vegetation was removed to create access to the site, and soil was compacted. *Temperature* may have increased with the removal of vegetation and increase in turbidity. *Pollutants* may have been introduced during in-stream work. *Habitat structure* may have been affected positively or negatively, as debris removal would reopen aquatic habitat, but some debris present in the stream before the disaster was likely removed as well. Future rainfall events may have washed chipped material into the stream, possibly burying benthic habitat or possibly providing organic material input for organisms. *Channel structure* could been positively or negatively affected, as storm debris may have been blocking flow channels or may have been directing flow away from streambanks. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

At the Montgomery County site, pooling of water behind the debris jam led to secondary flooding. Increased *sedimentation* may have occurred during removal and the sudden release of the sediment trapped behind the debris jam may have filled benthic habitats downstream. Turbidity is an existing problem in this watershed, to which debris removal would have contributed to a negligible to minor increase. *Temperature* increase also would have been negligible, as riparian vegetation is sparse and turbidity was already high. *Pollutants* may have been introduced by equipment and deposition or erosion of adjacent agricultural lands, or during the burning of the debris. *Habitat structure* and *channel structure* would not have been affected, as the existing stream channel has marginal habitat and tends to be wide and flat, with a silty bottom. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

Effects on Floodplain, Wetland, and Riparian Community Parameters

Bank stability and erosion: Removal of vegetation to create access to site may increase runoff and erosion. Removal of debris that is protecting a bank from direct exposure to flow will likely increase streambank erosion. Debris jams that divert flows into wetlands may adversely or beneficially affect the wetland hydrology.

Vegetative cover and habitat: Removing vegetation to create site access will decrease cover and may reduce habitat quality. Equipment use from the bank may damage riparian vegetation through leaks, soil compaction or direct damage from equipment operation (Darnell, 1976).

Hydrology and water quality: Removal of debris may decrease pooling and subsequent flooding caused by debris jams, which may adversely affect floodplain and wetland ecosystems. Removal of vegetation may increase erosion from floodplain areas, increasing turbidity and input of nutrients from agricultural or other lands.

Biota: Destabilization of streambank may adversely affect riparian vegetation. Effects to wetland hydrology may decrease wetland function, adversely affecting plant and animal life.

Wetlands: Changes in hydrology, bank stability or biota may adversely affect any wetlands on-site or downstream.

Debris Removal at Example EWP Sites

At the Buena Vista, VA, site, some riparian vegetation may have been removed while creating access, reducing *bank stability*. *Vegetative cover and habitat* may have been adversely affected, as riparian shade, cover and source material for carbon and other nutrients may have been removed. *Hydrology and water quality* may have been slightly affected, as equipment use and access creation may have increased erosion near the site. *Biota* may experience some negative effects due to the removal of riparian vegetation. The Maury River channel does have some riparian and *wetland* vegetation, according to NWI maps of the area, but adverse effects were likely minimal, as the effects to hydrology and vegetation were localized.

The Bethel Road debris removal efforts required a more substantial amount of heavy equipment use and access creation. *Riparian vegetation* may have been removed and equipment use along the bank may have reduced bank stability. Similarly, *vegetative cover* was likely reduced in both quality and quality. *Hydrology* may have been slightly impacted, as equipment use along the bank may have increased soils compaction, overland runoff, and erosion. *Biota* may have experienced some adverse effects from the removal of vegetation. There are no *wetlands* near the site, removing any possible impacts to wetland ecosystems.

The Montgomery County site is located in an area of highly erodable loess soils, which are highly susceptible to increases in *erosion* and *turbidity*. The area also has very little riparian *vegetation*, reducing the impacts from equipment use and removing the need for creating access. There are *wetlands* along the East Nishnabotna, however, that may have experienced a decline in water quality or an alteration in hydrology.

5.2.2.1.3 Comparison of the Impacts of Debris Disposal Practices

Table 5.2-1 summarizes the impacts of the various methods used to dispose of disaster debris. On-site methods may have adverse effects to the local ecosystem, over either the short or long-term. Off-site methods benefit the ecosystem at the site by transferring adverse effects to the new disposal site, which may or may not be more sensitive to these effects.

Table 5.2-1 Impacts Comparison of Debris Disposal Techniques

Use On-Site	Haul Off-Site	Burn On-Site	Burn Off-Site	Bury On-site	Bury Off-Site
Water Quality[1]					
Onsite use could allow material to re-enter the stream.	Hauling offsite could increase site disturbance by heavy equipment, increasing compaction and erosion. Removes debris from future threats to the site.	Burning onsite could cause short-term increases in pH and stream temperature. Runoff from ashes could increase turbidity.	Burning offsite could increase site disturbance by heavy equipment during removal.	Burying onsite would cause short-term site disturbance.	Burying offsite could increase site disturbance during removal by heavy equipment.
Habitat and Channel Structure					
Using the material onsite could cause runoff, which could cover or create habitat.	Hauling offsite would decrease the potential for debris to re-enter the stream and affect habitat.	Burning onsite could increase pH and temperature, decreasing habitat quality.	Burning offsite should decrease the risk of onsite chemical and biological effects.	Burying onsite would cause short-term increases in erosion.	Burying the material offsite would decrease effects on benthic habitat.
Biota					
Using the material onsite could cause the debris to reenter the stream and cover organisms or habitat.	Hauling the debris offsite should decrease the potential for debris to re-enter the stream and affect habitat.	Burning the material onsite could affect pH and temperature regimes, adversely affecting fish and invertebrates.	Burning the material offsite should decrease onsite chemical and biological effects.	Burying the material onsite could cause short-term increases in erosion, which may affect habitat.	Burying the material offsite should decrease onsite impacts to habitat.
Riparian, Floodplain and Wetland Ecosystems					
Onsite use could cause wetland filling during future disaster events or other damages from remaining debris.	Onsite use could cause wetland filling during future disaster events or other damages from remaining debris.	Onsite use could cause wetland filling during future disaster events or other damages from remaining debris.	Onsite use could cause wetland filling during future disaster events or other damages from remaining debris.	Onsite use could cause wetland filling during future disaster events or other damages from remaining debris.	Onsite use could cause wetland filling during future disaster events or other damages from remaining debris.

[1] Includes turbidity, temperature, dissolved oxygen, and pollutants

5.2.2.2 Practices that Protect Streambanks

A common result of disasters is the destabilization of streambanks through flood damage, vegetation removal, and changes in streamflow or channel location.

5.2.2.2.1 Effects of Streambank Protection on Stream and Related Ecosystems

General Discussion

Damaged streambanks are a common result of natural disasters. Excessive erosion, scour and gullying, damage from debris, uprooted riparian vegetation, and floodwaters that overtop banks and create new channels, are typical impairments to streambanks. The effects include damage to aquatic and riparian habitat and wildlife, weakening of streambank stability, and endangerment of structures or lands in the floodplain and nearby areas.

Impairments caused by streambank damage affect both in-stream and adjacent communities. Of primary concern are structures and property along the bank, which may be threatened by streambank failure, erosion, or possible changes in stream course. In the aquatic environment, damaged banks may lead to increased erosion from gullying or loss of riparian vegetation, increased sedimentation and turbidity as excess sediment is deposited in-stream, and increased stream temperatures, as vegetative cover is reduced. Stream channels may change course as flows overtop their banks. Floodplains and wetlands may also be affected by the encroaching erosion, streambank failure, or by course alterations that may drastically affect the hydrologic regimes of those communities.

Damaged streambanks may also benefit the local environment. The creation of new stream channels may create new wetlands or floodplain areas, benefiting species of those communities. The recently abandoned stream channel may also receive enough flow or have sufficient standing water to maintain a backwater supporting a wetland environment. A new stream channel may also support improved aquatic and riparian habitat due to a better substrate or improved hydrology.

Sedimentation and turbidity will increase, as vegetation may have been removed, increasing bank erosion. Increased sediment loads may fill benthic habitat and pools. Alterations in the direction of flow may route the channel into more highly erodable bed materials. *Temperature and dissolved oxygen* will increase with the removal of riparian vegetation, as well as increased turbidity. Short-term increases in temperature may be experienced if flows overtop the streambank and exhibit sheet flow before carving a new channel. Dissolved oxygen may increase or decrease, depending on the post-disaster arrangement of in-stream or streambank structures that cause turbulence. The risk of introduction of *pollutants, nutrients and other chemicals* will increase as the removal of riparian vegetation and increased floodplain erosion from floodwaters overtopping the streambanks, especially if the adjacent areas are agricultural or receive urban runoff, occurs. *Habitat structure* will be adversely affected with the removal of vegetation and increase in sedimentation. Redirected channel flows may be routed through improved habitat. *Channel structure* may be negatively affected, as flows erode damaged streambanks and sedimentation fills pools and low flow channels. Damage may also redirect flows into the streambank, further altering the future structure.

Effects on Other Communities

Effects to adjacent communities will be similar to those experienced with debris removal (Section 5.2.2.1.1). Riparian areas, wetlands and floodplains may see increased erosion, vegetation removal, increased sedimentation, and possible changes in community type if there are directional alterations in the streamflow.

Variability of Impacts between Watersheds

Similar to the practice of debris removal, streambank impairments are largely dependent on the characteristics of the watershed. High gradient streams have faster moving waters and are less likely to meander around obstructions or bends in the stream channel. Instead, these streams may overtop the streambank, create new channels, cause heavy erosion or otherwise damage the bank structure. Flat waterbodies will be more likely to meander. However, larger rivers can accumulate flood stage waters and may overflow the streambank, destroy vegetation, or carry debris that can damage the streambank. Another possibility lies with streams that are channeled, either by natural topography or structures such as levees. These streamflows are restricted to the channel and unable to overtop the banks. They often dissipate the energy associated with flooding through increased bank erosion, the undercutting or progressive weakening of the streambank through saturation of the soil.

The type of disaster will also affect the damage to streambanks. Floods are the most common cause, as floodwaters erode or overtop banks and remove vegetation. Tornados damage vegetation by uprooting larger woody species, causing drastic changes in the streambank stability. Fires or extended drought will likely remove vegetation from the streambank and adjacent areas, increasing the potential for erosion along the banks.

Streambank Damage Situations at Example EWP Sites

Streambank repair example sites are located in Rocky Run, VA, Montgomery County, IA, Rose River VA and Santa Cruz, CA. Each site is briefly described below, including an assessment of the pre-disaster and post-disaster natural conditions. A more detailed analysis of impacts of the disaster and of EWP practices at these sites is discussed in Appendix D.

The Rocky Run EWP site is located at the outflow of Rocky Run, a high gradient stream originating in forested, rocky area. The housing community is situated where Rocky Run empties into the Dry River. The stream is intermittent, drying in summer, but still maintains wild populations of brook trout in the pools that remain during dry periods. The riparian areas along Rocky Run are heavily wooded, with substantial herbaceous cover as well, implying a significant contribution of woody debris and organic material. There are no known T&E species in the area (Mohn, 1999) and the nearest wetland is approximately one mile downstream, classified by NWI as R4SBA, a riparian area (NWI, 1999). Heavy rainfall led to flood conditions, with cobble and woody debris deposition. Significant streambank damage occurred, as the stream overflowed its banks and created a new channel through the housing community. Riprap and gabion walls were installed to repair the streambank, direct flows around the community, and prevent future erosion and damage.

In 1998, Montgomery County, Iowa was the site of streambank damage from flooding in the East Nishnabotna River. The local environment was described in Section 5.2.2.1 under the practice of debris removal, and can be briefly described as heavily farmed with little riparian vegetation and poor aquatic habitat (Priebe, 1999). A large volume of riprap was used to restore a streambank and protect a bridge and homes downstream. As noted previously, there are no known T&E species onsite or nearby. The nearest wetlands are immediately downstream and are classified as R2USA and PFO1A, a riparian area and a forested non-tidal wetland, respectively (NWI, 1999). These wetland and riparian areas likely are the wetted areas located between the levees (Miller, 1999).

The Rose River site in Virginia is located on cattle grazing land and a moderately well-formed riparian vegetation zone composed mostly of grasses. The stream originates in a high gradient forested area several miles upstream and supports brook trout populations both upstream and downstream of the project area, and presumably in the project area itself. There are no known T&E species in the area (Mohn, 1999) and there are wetlands located onsite and are classified as R3USA and PEM1A, a riparian area and an emergent wetland (NWI, 1999). Rock weirs and rootwads were installed to protect the streambanks and to prevent sedimentation and filling of the wetlands.

The Santa Cruz bioengineering site is located in a residential area at the foot of a mountainous State park. Riparian vegetation is somewhat limited due to the development but does contain some woody species. Two Federal T&E species are known to inhabit the area: the red-legged frog and the steelhead (a salmonid fish). No wetlands are known to exist nearby (Davis, 1999). Restoration work entailed the use of riprap, geotextile fabric, and the planting of willow trees along the bank.

5.2.2.2.2 Effects of Current EWP Practices to Repair Streambanks

This section describes environmental impacts of the current EWP practice of streambank restoration. Chapter 2 describes in more detail streambank impairments, the practice of streambank restoration, and the specific activities involved. As is the case with all EWP projects, the primary goal of the repairs is to reduce or eliminate threats to life and property. Threat reduction may require stabilizing streambanks, halting erosional losses, and installing structural practices to prevent future erosion.

Impacts of Streambank Restoration Project Activities

The practice of streambank restoration is closely related to debris removal and often involves similar activities. Access creation, dewatering, heavy equipment use, and grading and shaping are employed in essentially the same activities described under the practice of debris removal. Activities unique to streambank restoration would include: borrowing of materials, installation of structural practices, and revegetation.

Borrow of materials refers to the use of natural materials either onsite or from other locations in restoring the streambank. For example, rootwads are normally constructed using downed trees from the particular project site, whereas the rock used as riprap often comes from local quarries or other suppliers. The location where materials are acquired can have both positive and negative aspects. Using debris that already exists at a site is a very efficient, natural method of site restoration, as the streambank can be restored and debris disposal is no longer an issue. However, there is a slight risk that onsite borrowing may remove important structures from other areas of the site and lead to future problems such as weakened streambanks from excavation or removed vegetation or reduced effectiveness of floodplains.

Installation of structural practices is a general description of the process of constructing streambank and in-stream structures that reduce streambank erosion and protect banks from severe erosion. These structures include streambank armoring methods such as riprap, gabions, rootwads, and stream barbs, as well as in-stream methods such as rock weirs. The installation of these practices often involves heavy equipment and substantial preparation of the exact location of the practice. For example, installing riprap normally involves heavy equipment working in-stream or from the bank, to grade, excavate, or otherwise shape a site for the placement of the rock. The impacts from these activities are similar to those from equipment operation during debris removal, including short-term increases in turbidity and impacts to riparian and aquatic vegetation.

Revegetation is the final stage of streambank restoration. Once the structural work has been completed, it is possible that the equipment operation, in combination with the disaster impacts, has left the riparian vegetation in poor condition. To increase the effectiveness of the newly installed practices, grasses and woody species can be planted to reduce erosion, stabilize streambanks, and provide cover and temperature regulation (see Sweeney, 1993; Beeson and Doyle, 1995). NRCS is recognized as a leader in plant materials technology and maintains a wide array of plant species that would be suitable for rapid re-establishment of bank vegetation and stability. NRCS will make every attempt to use native plants in revegetation, but introduced (i.e., non-native) species may be used as the site conditions warrant. Invasive or weedy species will be avoided in compliance with Executive Order 13112.

Summary of Impacts on Aquatic Community Parameters

Sedimentation and turbidity: Short-term increases in sedimentation and turbidity will be seen with equipment operation and access creation. Excavation and installation of the practices will have similar short-term effects. Long-term effects will be beneficial, especially in sites using rootwads and rock weirs, as these structures reduce water velocity and improve turbidity levels.

Temperature and dissolved oxygen: Short-term increases in temperature and decreases in dissolved oxygen will result from equipment use and excavation. Long-term benefits will be realized as riparian vegetation is reestablished and installed structures may create turbulence. Rock weirs increase turbulence, raising dissolved oxygen levels.

Pollutants: Equipment operation introduces risks of leaks. Access creation may remove riparian vegetation and promote erosion and runoff. Reestablishment of riparian vegetation will reduce erosion and runoff of agricultural or urban lands.

Habitat structure: Sedimentation may fill benthic habitat. Access creation may remove riparian and aquatic vegetation. Some practices, such as riprap and gabions, may decrease riparian and aquatic habitat for some species and limit access to the water for terrestrial species. Some invertebrate species may find additional habitat in these structures (Bradt and Wieland, 1978). Other practices, such as rootwads and rock weirs, may increase habitat, as pools and covered areas develop (Rosgen, 1996). All practices will stabilize streambanks and provide substrates for vegetative growth.

Channel structure: Riprap and gabions may redirect energy towards other areas, increasing erosion in other parts of the channel and altering the natural meandering of the stream (USACE, 1981; Gore et al., 1995; and Stern and Stern, 1980). Gabion mattresses and other stream bottom structures may have significant effects on the location or existence of low flow channels, which may not form until sedimentation fills the pore spaces in the rock substrate and forms naturally in the stream bottom. Rock weirs and rootwads create pool areas and alter flow velocities. Rock weirs may be constructed to direct flows away from streambanks and reduce bank erosion.

Biota: Increased sedimentation and turbidity can result in decreased spawning success, gill abrasions, migration barriers, lower dissolved oxygen, and the filling of downstream riffle areas (see Berkman and Rabini, 1987; Koonce and Teraguchi, 1980; McCabe and O'Brien, 1993).

<u>Streambank Restoration Effects on Aquatic Ecosystems at Example EWP Sites</u>

To better illustrate the impacts of streambank restoration, each example site can be examined in terms of the above parameters. A more detailed analysis of the site-specific impacts can be found in Appendix D.

EWP activity at Rocky Run involved the installation of riprap and gabions to strengthen streambanks along part of the stream. *Sedimentation and turbidity* may have increased with equipment operation, excavation, and impacts to riparian vegetation. However, the brook trout populations lie above these reaches, removing any effects of debris removal to their habitat. *Temperature and dissolved oxygen* may have declined as riparian vegetation was removed and turbidity increased. Dissolved oxygen may increase with the addition of structures that create turbulence. *Pollutants* may have been introduced as well, with equipment operation, vegetation removal, and the proximity of urban runoff sources. Effects to *habitat structure* could have been positive and negative, as riprap and gabions do not provide habitat preferred by fish and other species, but may benefit invertebrates. Terrestrial species will face restricted access to the stream but may gain habitat in the re-vegetated areas. *Channel structure* became poorer, as the riprap and gabions serve to force flows through turns in the channel and do not allow for natural flow regimes or floodplain development. The gabion mattress may also eliminate the low flow channel for some time until sediment fills the spaces and a new low flow channel can form naturally. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

Montgomery County was the site of an extensive installation of riprap along the East Nishnabotna River. *Sedimentation and turbidity* may have increased with equipment operation and excavation, causing impacts to riparian vegetation. However, these impacts might be regarded as minimal, since turbidity was an existing problem in this river. *Temperature* may have increased as turbidity increased. *Pollutants* may have been introduced as well, with equipment operation and the proximity of agricultural runoff sources. Effects to *habitat structure* could have been positive and negative, as riprap may create additional habitat for invertebrates. Fish species in this river tend to be bottom dwellers and would likely be unaffected. Terrestrial species will face restricted access to the stream but may gain habitat in the revegetated areas. *Channel structure* remained neutrally affected, as the riprap protects the site but directs energy further downstream and natural meandering is removed. The frequent use of levees in this area mimics the installation and function of riprap. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

At the Rose River site, riprap, rootwads, and rock weirs were installed. Increased *sedimentation* may have occurred during construction and excavation. The rootwads and rock weirs will act to minimize long-term turbidity impacts or even improve conditions. *Temperature* increased in the short-term as turbidity increased. The establishment of riparian vegetation, cover through rootwads, and the pooling created with rock weirs, will benefit temperatures in the long-term. *Pollutants* may have been introduced by equipment and erosion of adjacent agricultural lands. *Habitat structure* saw both positive and negative impacts, as riprap offers mixed habitat benefits and some cover and pools were created. C*hannel structure* was improved with pools and cover creation. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

The Santa Cruz site employed riprap, geotextile fabric and willow tree planting to stabilize the streambank. Short-term increases in *sedimentation* were seen but long-term effects will be positive, as the geotextile and vegetation will enhance erosion resistance. *Temperature* was increased in the short-term with increased turbidity, but will benefit from vegetation establishment over the long-term. *Pollutants* may have been introduced by equipment but vegetation and bank stability may decrease future erosion and runoff potential. *Habitat structure* exhibited positive and negative effects, as riprap yields mixed benefits to habitat and riparian vegetation will benefit both aquatic and terrestrial species. *Channel structure* was neutral, as this section lies in a residential area and must remain on its present course. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

Effects on Floodplain, Wetland, and Riparian Community Parameters

Bank stability and erosion: Removal of vegetation to create access to site may increase runoff and erosion. Removal of debris that is protecting bank from direct exposure to flow will likely increase streambank erosion. Soil compaction from equipment operation may decrease infiltration of soils, increasing runoff. Armoring may redirect flows to unprotected banks and lead to increased erosion of the bank at that location. Rock weirs will likely reduce erosion, as flows are directed towards the center of the stream channel.

Vegetative cover and habitat: Removal of vegetation to create access to site will decrease cover and may reduce habitat quality. Root wads may encourage riparian vegetation.

Hydrology and water quality: Removal of vegetation may increase erosion from floodplain areas, increasing turbidity and input of nutrients from agricultural or other lands. Channelization of stream may remove natural flood regime and adversely affect the formation of wetlands (Possardt and Dodge, 1978).

Biota: Destabilization of streambank may adversely affect riparian vegetation. Alteration in wetland or floodplain function may result in adverse effects to resident biota (see Darnell, 1976; Gore et al., 1995; Brode and Bury, 1984).

Wetlands: Changes in hydrology, bank stability or biota may adversely affect any wetlands on-site or downstream.

Effects on Floodplain, Wetland, and Riparian Ecosystems at Example EWP Sites

At the Rocky Run site, some vegetation may have been removed to create access to the location for gabion installation. *Bank stability*, *vegetative cover* and *biota* may have been adversely affected. The *hydrology* at Rocky Run is substantially different from natural stream conditions, as the stream takes several engineered turns, possibly affecting riparian and floodplain ecosystems. There are no wetland on-site or nearby that may have been adversely affected, as the effects are localized.

The Montgomery County site would have involved some heavy equipment usage, possibly impacting *bank stability and water quality*. There is very little riparian *vegetative cover* to have any substantial impacts upon. There are *wetlands* along the East Nishnabotna that may have experienced a decline in water quality or an alteration in hydrology.

The Rose River site had been degraded by prior flooding and landowner attempts to modify the stream channel. Possible impacts to *bank stability* and *hydrology* may have occurred. The work was completed in a dry channel, so *biota* would have been minimally affected. No access was created, minimizing impacts to *vegetation*, and *wetlands* just downstream actually benefited from the work, as future sedimentation would likely have filled them.

The Santa Cruz site would have shown similar effects to the Montgomery County site in terms of effects on *bank stability* and *water quality*. However, the Santa Cruz site has a substantial amount of *riparian vegetation* that may have been removed of affected in implementing streambank restoration practices. Consequently, *biota* may have been adversely affected. There are no *wetlands* on-site or nearby (Davis, 1999).

5.2.2.2.3 Comparison of the Impacts of Streambank Restoration Practices

Table 5.2-2 illustrates the impacts of the various methods used in restoring streambanks. Each practice serves the purpose of reducing erosion and protecting streambanks, but some may be more 'green' than others. Armoring is generally less functional for aquatic and vegetative species, whereas practices that employ natural materials often provide additional benefits.

5.2.2.3 Dam, Dike, and Levee Repair

The primary functions of water control structures include flood control, infrastructure protection, and land development. Dam, dike, and levee repair or removal is an EWP practice that is applied to either NRCS assisted structures, or for dams, dikes, or levees located along streams with a drainage of less than 400 square miles.

5.2.2.3.1 Impacts of Disaster-damaged Dams, Dikes, and Levees on the Environment

Dams, dikes, and levees are constructed for the purposes of impounding or re-routing stream flows. The installation of a dam is directly in the path of the stream and generally results in the formation of a reservoir. This may provide for municipal drinking water supply, recreation or simply flood protection for structures in the historical floodplain below. Dikes and levees, on the other hand, are built alongside a stream and are intended to mitigate the effects of high water levels, potentially preventing flooding in the protected areas behind.

Impacts to Aquatic and Related Ecosystems

Damages to these structures can have serious short-term impacts. The breach of a dam could lead to the release of the entire impounded volume of water into the floodplain below. The volume of water released could actually be greater than any possible flood, depending on the size of the reservoir. The downstream effects of flooding would be amplified, as water scours stream channels, streambanks are damaged, and debris torrents are propelled into the floodplain. Impacts to ecological communities could also be amplified above 'normal' flood damage.

Table 5.2-2 Impacts Comparison of Streambank Protection Techniques

Armoring	Natural Materials			In-stream flow modifications
	Dead Woody Structures	Soil Bio-engineering	Vegetative Planting and Seeding	
Sedimentation and Turbidity				
Armoring would stabilize eroded streambanks within the impaired reach, reducing erosion. Flows could be re-directed into downstream banks and increase erosion, sedimentation and turbidity. Spawning and riffle habitat could be affected.	Structures would increase bank stability and reduce erosion.	Soil bioengineering would stabilize eroded streambanks within the impaired reach and decrease sedimentation and turbidity.	Vegetation stabilization would reduce sedimentation and turbidity by filtering overland flow and decreasing erosion within the impaired reach. Bank failure during high velocity flows could occur and cause increased erosion and sedimentation.	Decreases in bank erosion would result and therefore decrease sedimentation and turbidity levels. Increased flow velocities should aid in the transport of sediments.
Temperature and Dissolved Oxygen				
Near-shore habitat could be reduced and cause reductions in cover and food sources for larger biota.	Structures would provide quality substrate for vegetation, providing cover, shade, and detrital inputs.	Soil bioengineering would provide substrate for vegetation, providing cover, shade, and detrital inputs.	Vegetation stabilization would improve habitat and eventually provide shade and cover resulting in a cool, well-fed stream system.	In-stream flow modifications would decrease erosion and increase dissolved oxygen and habitat diversity.
Pollutants				
Heavy equipment use increases risk of POL spills/leaks. Decreases in streambank vegetation would decrease the filtration of overland runoff.	Heavy equipment use increases risk of POL spills/ leaks.	Heavy equipment use increases risk of POL spills/leaks. Mixed practices would increase habitat diversity since both vegetation and hard structures are used, and should reduce runoff-based nutrient flows to stream.	Heavy equipment use increases risk of POL spills/leaks. Vegetation would filter overland flow and reduce sediment and nutrient loads.	Heavy equipment use increases risk of POL spills/leaks.
Habitat Structure				
Armoring could decrease bank vegetation and potentially inhibit future vegetation colonization. Armoring may increase attachment surfaces for invertebrates and increase food supplies within the system. Armoring likely will not provide substantial riparian habitat.	Structures would provide additional habitat for aquatic species and provide substrate for riparian vegetation, improving cover instream.	Improved riparian vegetation would provide additional cover for aquatic species and provide nutrient inputs.	Improved riparian vegetation would provide additional cover for aquatic species and provide nutrient inputs. Improved riparian vegetation would provide additional riparian habitat for amphibians, reptiles, birds, and mammals.	Flow modifications would direct flows away from banks, preventing the under-cutting of bank vegetation and would create some pools instream, providing habitat areas for aquatic species.

Table 5.2-2 (continued) Impacts Comparison of Streambank Protection Techniques

Armoring	Natural Materials: Dead Woody Structures	Natural Materials: Soil Bio-engineering	Natural Materials: Vegetative Planting and Seeding	In-stream flow modifications
Channel Structure				
Armoring banks would decrease bank erosion within the impaired reach and reduce sedimentation to downstream reaches.	Structures would reduce erosion and sedimentation, preventing the degradation of downstream reaches.	The combination of vegetation and hard structures should decrease downstream sedimentation from both overland flow and bank erosion.	Vegetation would decrease downstream sedimentation from both overland flow and bank erosion. Erosion could reoccur during high flows and fill downstream riffles and pools.	In-stream structures would improve sediment transport and protect streambanks from instream erosion.
Biota				
A reduction in near-bank habitat could cause a reduction in spawning and rearing success in fish species, food sources, and overhead cover. Invertebrates may benefit from additional habitat in armoring structures.	Additional instream habitat and vegetative cover would benefit both fish and invertebrate species.	Fish would benefit since shade, cover, and in-stream habitat would be improved over impaired conditions. Vegetation establishment would increase food sources for invertebrate populations, provide habitat and cover for fish and improve water quality.	Shade, cover, and in-stream habitat would be improved over impaired conditions. Vegetation establishment would increase food sources for invertebrate populations, provide habitat and cover for fish and improve water quality.	In-stream structures would increase dissolved oxygen rates, pool structures and water quality, benefiting fish and invertebrates.
Riparian, Floodplain, and Wetland Ecosystems				
Armoring maintains the current channel, reducing localized flooding and channel meanders, possibly adversely affecting floodplain and wetlands.	Structures may improve riparian habitat with vegetation and instream cover. Structures may encourage meanders, possibly benefiting floodplains and wetlands.	Would improve riparian habitat with vegetation and instream cover.	Would improve riparian habitat with vegetation and instream cover.	Would improve riparian areas by reducing bank erosion.

In addition to the debris torrents and streambank damage, turbidity levels would be very high, vegetation may be stripped away and many biotic organisms would be destroyed or carried away. The torrent might seriously damage or bury sensitive ecosystems downgradient, such as wetlands.

Levee breaches may have similarly harmful results. Raised floodwaters may breach the levee, carrying large volumes of water and sediment load into the flat lands behind, damaging agricultural lands. The damage is often not localized to the breach, as floodwaters may spread both upstream and downstream, creating widespread damages. Similar effects to dam breaches may be seen, as vegetation is uprooted and erosional forces are high.

Long-term impacts of dam, dike, and levee breaches are less serious, however, as these breaches would closely approximate natural floodplain functions. In cases where repairs are not made, the site acts as a floodplain easement, the benefits of which are discussed in the next section. If a dam or levee is removed, as opposed to repaired, full floodplain functions could be restored. Alternately, some positive impacts may be realized with levee repairs, such as improved retention of chemicals in the protected farmlands behind the levee and the accompanying lack of pollutant inputs.

To summarize, the parameters introduced in Chapter 4 can be discussed. *Sedimentation and turbidity* would increase greatly, as the earthen dam or levee would be a source of sediment and the force of the floodwaters would cause heavy erosion**.** However, once flows begin to slow, areas of slack water would begin to see increases in *temperature* and decreasing *dissolved oxygen*. *Pollutants* would likely have a minimal impact in dam breaches, as the volume of water would dilute the pollutant. In the case of levee breaches, though, agricultural chemicals from the lands behind the levees may be added to the water column and decrease water quality. *Habitat structure* would see negative effects, as the breaches and subsequent large flow volumes will likely cause substantive damages to the stream channel and riparian areas. *Channel structure* would also see impairments, as the floodwaters would erode streambanks, scour channels, and lead to the formation of new stream channels.

Over the long-term, these effects would be mitigated, as structures such as dams and levees would not be replaced and natural floodplain function would return (see The Cosumnes River Project, undated). These effects are further discussed in the section on floodplain easements.

Effects of Disaster-damaged Dams, Dikes, and Levees on Riparian, Floodplain and Wetland Ecosystems

Dams, dikes, and levees normally work to restrict natural floodplain dynamics and provide for other uses of the land. Breaches in these structures would have both positive and negative effects on riparian, floodplain and wetland communities, as a more natural flow regime would be returned but often in a large, unmanageable volume. Riparian and floodplain vegetation and wetlands might benefit from the more natural hydrology, as flooding in these communities is common. However, the volume of water impounded and the force of water accompanying these breaches would likely be very damaging to any community. Scour, excessive erosion, and uprooting of vegetation would be likely impacts. Sedimentation may fill wetlands, reducing their functionality or possibly destroying them.

Damage to Dams and Levees at Example EWP Sites

Repairs to a levee were made in Fremont County, Iowa along the East Nishnabotna River. The levee damage threatened several hundred acres of farmland and several residences. As noted before, the East Nishnabotna has poor water quality, little riparian vegetation, and some hardy fish species present. Also noted was the continuum of wetlands and riparian areas along the river channel, often located in the area between the levees (NWI, 1999; Miller, 1999).

The Switzer Dam is located along the Dry River near the Virginia-West Virginia border and is part of the Maury River watershed. The spillway of this earthen dam was damaged by the rains accompanying Hurricane Fran, as overflow waters passed through the spillway, causing severe erosion, gullying, and uprooted numerous trees, leading to debris blockages downstream. A second spillway on a second dam along an unnamed tributary of the Dry River was also damaged. There is no continuous flow through the spillway, so there is no aquatic community to speak of. The outflow of the dam does eventually reestablish the Dry River, which supports trout and other aquatic, wetland, floodplain and riparian ecosystems, as described in the Rocky Run discussion. Rocky Run is located approximately seven miles downstream.

5.2.2.3.2 Impacts of EWP Dam, Dike, and Levee Repair or Removal

EWP dam, dike, and levee repair or removal does not apply to structures maintained or owned by other Federal agencies. Dam, dike, or levee removal practices are used in a situation when the threat of failure is high and repair is either not economically or socially defensible or not technologically feasible. Dam, dike, and levee removal may occur in combination with floodplain easement purchasing to help restore hydrological functions and protect life and property.

<u>Dam, Dike, and Levee Repair Practice Components</u>

Dam, dike, and levee repair (including dam spillway repair) may consist of the following practice components:

- Creating access when needed to move heavy equipment to the site;
- Dewatering to allow operation to proceed under “dry” conditions;
- Installing armor to protect either the dam, dike, or levee, or downstream structures;
- Repairing spillways; and
- Grading, shaping, and re-vegetating affected areas by seeding or planting:
    - Fill – may cause increased runoff and affect aquatic habitat and biota. Sediment may fill in riffle habitats, turbidity may inhibit migration patterns of salmonids, turbid conditions may irritate gill structures (See Section 5.2.2)
    - Excavation – Same impacts as above
    - Compaction – See Section 5.2.2.4
    - Revegetation – See Section 5.2.2.1 (grading, shaping, and revegetating).

The impacts of creating access, dewatering, grading, shaping, and re-vegetating have previously been discussed in Section 5.2.2.1. The impacts of installing armor have been discussed in Section 5.2.2.2, actions that protect streambanks.

<u>Summary of Impacts on Aquatic Community Parameters</u>

Impacts would have been similar to those seen in association with other practices, such as short-term increases in *sedimentation and turbidity*, *temperature and dissolved oxygen*, and a possible risk of *pollutants*. *Habitat structure* and *channel structure* may also be affected by sedimentation and other construction impacts. *Biota* may also be adversely affected, as previously discussed.

The impacts of dam, dike, and levee removal are discussed under floodplain easements, as the natural flow regime would be returned. Long-term impacts of dam removal would likely benefit aquatic communities, as natural stream conditions are restored. Downstream human and biotic communities would also benefit from dam removal, as the threat of dam failure would be removed.

<u>Dam and Levee Repair at Example EWP Sites</u>

As previously stated, the East Nishnabotna watershed is located in Southwestern Iowa and is comprised of mostly agricultural land. The natural environment, at the time of the disaster, was typical of an agricultural setting. Little or no riparian vegetation existed due to severe erosion from floodwaters. Short-term impacts to water quality occurred from heavy equipment traffic, which included an increase in *sedimentation and turbidity*. Some effects to *temperature and dissolved oxygen* may have also occurred. The risk of *pollutants* was present, and *habitat structure* and *channel structure* may have been adversely affected as previously discussed under construction impacts. *Biota* may have been adversely affected by the increased turbidity or reductions in habitat quality.

The Switzer Dam site would have experienced minimal impacts to the aquatic community due to the lack of freely flowing water. Slight impacts to *sedimentation, temperature, pollutants, and habitat* and *channel structure* may have occurred. Soil compaction and vegetation removal may have occurred. There is no aquatic *biota*.

<u>Effects on Riparian, Floodplain and Wetland Communities</u>

Bank stability and erosion are improved, as the previous bank condition is returned. V*egetative cover* will be restored in some cases, such as the grasses that cover levees. *Hydrology, biota* and *wetlands* will return to conditions under the altered flow regime.

The impacts of dam, dike, and levee removal approximate the conditions of floodplain easements and further discussion may be found in that section. In some cases, the natural communities are impaired by the implementation of the dam or levee itself and would benefit most by their removal.

5.2.2.4 Practices that Protect Structures in Floodplains

Floodplain diversions and sediment/debris basins are constructed to protect important public infrastructure, such as water and wastewater treatment plants, as well as other property located in floodplains.

5.2.2.4.1 Floodplain Diversions

Disaster Effects of Damaged Floodplain Diversions and Sediment/Debris Basins

Floodplain diversions are constructed and used when excessive runoff, or debris flow, is threatening to damage water or wastewater treatment or similar facilities. Sediment and debris basins cause stormwaters or floodwaters to pool, allowing for some settling of sediment and debris, reducing the downstream damages. When breached, the overland flow of water may lead to severe erosion, which can damage the municipal or other structures, fill aquatic habitat, uproot vegetation, and increase turbidity in streams. These effects to aquatic, riparian, wetland, and floodplain ecosystems are similar to those resulting from damaged dams or levees, and a more detailed discussion of these effects can be found under dam, dike and levee repair.

Damage at Example EWP Site: Floodplain Diversion Site – Clarendon, Texas

The City of Clarendon, Texas utilizes a six-lagoon system to treat its wastewater, eventually emptying the treated water into Lake Clarendon. The lagoons are protected by a system of levees which guard against inundation from Lake Clarendon, which is a playa lake. The lake may contain a small population of catfish and carp, each of which are very tolerant of fluctuations in turbidity, nutrient and dissolved oxygen levels. Lake Clarendon and its surrounding environment is a wetland (Sears, 1999). Heavy rainfall caused the lake, which is normally 40 acres, to expand to 360 acres. This caused several of the first levees to fail, and allowed untreated sewage to be expelled into Lake Clarendon.

5.2.2.4.1 Sediment/Debris Basins

Sediment and debris basins temporarily detain a portion of stormwater runoff for a specified length of time, releasing the stormwater slowly to reduce flooding and remove a limited amount of pollutants. Pollutants are removed by allowing particulates and solids to settle out of the water. The primary focus of detention basins is to reduce peak stormwater discharges, control floods, and prevent downstream flooding (NCSU, 1999). Sediment or debris detention basins also prevent down-gradient debris torrents from destroying infrastructure. Water and sediment control basins are effective for preventing downslope gully erosion, trapping sediment, and reducing peak flows downstream. The basin traps sediment and the nutrients attached to it. Infiltration through the bottom of the basin provides for groundwater recharge.

5.2.2.4.3 Effects of Current EWP Practices to Protect Structures in Floodplains

Components of Diversion Installation

The following EWP practice components are involved in installing a diversion:

- Creating access when needed to move heavy equipment to site;
- Excavating soil;
- Compacting soils for stability;

- Constructing outlets for the release of stormwater; and
- Grading, shaping, and revegetating affected areas by seeding or planting.

Components of Sediment and Debris Basin Installation

EWP practice components involved in sediment and debris basin installation include the following:

- Creating access when needed to move heavy equipment to site for short-term construction and for long-term maintenance;
- Excavating soil and shaping the basin;
- Compacting soils for basin stability and retention capabilities;
- Constructing outlets for the release of stormwater; and
- Grading, shaping, and revegetating affected areas by seeding or planting.

Impacts of Practice Components

The above practice components can lead to impacts to aquatic, riparian, wetland, and floodplain ecosystems due to the compaction of soils, creating access, clearing land, increased runoff, and sedimentation. A complete description of these practice components can be found under the practices of debris removal or streambank restoration.

5.2.2.5 Practices that Restore Watershed Uplands (Critical Area Treatment)

Watersheds are often impaired and lives and property threatened by damage done in upland areas that leaves large areas depleted of protective vegetation and susceptible to severe erosion, debris flows, and mud slides when heavy rain events next occur.

5.2.2.5.1 Impacts of Disasters that Create Critical Upland Areas

Natural disasters such as droughts, fires, or floods have the potential to denude large areas of vegetation growth. Vegetation plays a vital role in controlling wind and water erosion, groundwater infiltration, and soil productivity. Without vegetation, soils become susceptible to increased erosion, decreased infiltration, decreased soil productivity, and mass-flow events. These events can lead to decreases in wildlife habitat, water quality, and increases in threats to life and property. Areas that have been voided of vegetation often become a priority concern for entire communities or residents living adjacent to the impaired area. Unprotected soil particles carried by high winds can reduce visibility and irritate eyes and respiratory systems. Heavy rains can lead to debris torrents, which can deposit sediment, woody debris, and other materials in floodplains.

Damage at Example EWP Sites

Critical Area Planting Site – Boise 8th Street Burn

On August 26, 1996, the Boise Front experienced a devastating fire that burned nearly 15,300 acres. A principal concern of the Boise Front Watershed was the susceptibility of the area to catastrophic erosion. The combination of steep slopes and highly erodable granite soils make the area extremely sensitive to changes in the vegetative community. Ninety percent of the soils within the burned area were classified as highly erosive and the burn left no standing vegetation on approximately 95 percent of the lands within the fire boundary (BLM, 1996). There are no wetlands onsite and the downstream areas are also unlikely to have wetlands (Fink, 1999). There are no T&E species present or nearby that would have been affected. The burn area has minimal aquatic, riparian, floodplain, and wetland habitat, as streams are intermittent. However, subsequent rainfall and the ensuing erosion and debris torrents would affect both human and natural communities downstream, where the burned area gives way to the city of Boise and the Boise River.

Critical Area Planting Site - Antelope Valley Drought, CA

Due to an extended drought in California, soil was being rapidly eroded from a 7,700-acre parcel of land that had previously been farmed. Federal air quality standards were not being met in surrounding areas during high wind events, as visibility was reduced and deposition of sand was threatening roads. The site is within the historic range of the federally listed desert tortoise (*Gopherus agassizi*) and the kit fox (*Vulpes macrotis*), but as indicated by the USFWS, it is unlikely that the tortoise or fox would inhabit abandoned cropland. Therefore no impacts to T&E species should have occurred. There are no perennial streams on-site, but deposition of sediments may have affected downstream channels or riparian areas.

Upland Diversions Example Site – Boise 8th Street Burn

Upland diversions were used to divert surface flows away from areas prone to extreme erosion. The diversions utilized in the 8th Street Burn rehabilitation included contour felling and contour trenching. Site preparation activities included cutting down burned trees, excavating, filling, grading, and compacting soils. No additional roads were constructed for the creation of upland diversions, all equipment was either air-lifted by helicopter, or transported by hand to the site.

Check Dam Example Site – Boise 8th Street Burn - Hulls Gulch and Crane Creek Drainage

Numerous gravel bag and straw bale check dam sites were established in the Hull's Gulch and Crane Creek drainages in 1997 to help control soil loss in impaired areas while ground cover was being re-established.

Road Protection (BAER) Site – Boise – 8th Street Burn

Three projects areas were selected for the installation of drains and conveyances to protect roads from surface water flow and debris torrents. The three areas included a roadway in Stewart Gulch, in the Cottonwood Creek drainage, and in Upper Hulls Gulch. The structure installed in Stewart Gulch consisted of a conveyance structure that was placed under the roadway, below a detention basin. The structure installed in the Cottonwood Creek drainage included placing two major culverts under the realigned road up-slope of a flood channel. The structure installed in Upper Hulls Gulch included installing a rock armored flood diversion channel, which protects the road from wash out. Each of the structures is intended to convey water from the overflow of the detention basin under the road to protect it from washing out.

5.2.2.5.2 Impacts of EWP Practices to Restore Critical Areas

Critical area treatment involves the use of one or more practices to stabilize these priority areas of a watershed that pose a high threat to life or property. These practices tend to increase the vegetative cover, bind and retain soils, help maintain infiltration, reduce surface runoff by slowing water velocity through structures on side slopes, and improve drainage conditions to protect property (SCS, 1992). Treatments that are used to stabilize critical areas include critical area planting, installing diversions, installing grade stabilization structures, installing contour trenches, and protecting roads. All practices within critical area treatment, depending on the location of the project, may have similar short-term and long-term actions including creating access and grading, shaping, and revegetating affected areas by seeding or planting. The environmental consequences of these actions have previously been discussed in general in Section 5.2.2, and will be discussed only briefly here.

Components of Critical Area Treament Practices

Critical area planting utilizes permanent grasses and legumes to stabilize soil and reduce damage from sediment and runoff to downstream areas. It is also used to control wind erosion from exposed topsoil. Critical area planting may require creating access and preparing sites for planting, seeding with native, or non-native stock, planting native, or non-native plants, and applying fertilizers and other additives that aid in plant growth.

Preparing sites for planting may involve tilling, ripping and raking, which turn soil over to make it more conducive to vegetation growth. This is used especially in areas where soils have become hydrophobic and do not allow seeds to penetrate the surface layer.

Seeding, or planting with native, or non-native stock can be accomplished a number of ways including aerial seeding, drilling, and hand seeding. Aerial seeding involves the deposition of seeds from a plane or helicopter. Drilling involves the use of a tractor pulled drill, such as the rangeland drill, which furrows a trench and plants the seed stocks. Many times, chains are dragged behind the drill to cover the trenches, which prevents the loss of seed. As previously stated, drilling is often conducted horizontally on side slopes, which helps create terraces that slow runoff and aid in the infiltration of surface water (Vetten, 1999). Hand planting is also an option that can be utilized to stabilize impaired areas in settings, which are not conducive to mechanical planting, or seeding. NRCS is recognized as a leader in plant materials technology and maintains a wide array of plant species that would be suitable for rapid re-establishment of bank vegetation and stability. NRCS will make every attempt to use native plants in revegetation, but introduced (i.e., non-native) species may be used as the site conditions warrant. Invasive or weedy species will be avoided in accordance with Executive Order 13112.

Applying fertilizers, additives, or ground cover such as lime and mulch, aid in the re-establishment of newly planted vegetation may impact certain compartments of the environment. During rain events, runoff containing fertilizer and additives may enter the aquatic environment and affect both the water chemistry and the biology of the system.

Grade stabilization structures are employed to reduce the effects of unchecked runoff on unprotected slopes while they are revegetating. *Check dams* are small dams constructed in drainageways, across slopes, or at the toe of slopes, to reduce downslope erosion by restricting flow velocity. Check dams are utilized in areas that have intermittent flows where it would be impractical to line an area with non-erodable materials. Check dams are usually constructed of riprap, straw bales, logs, or sandbags (Smoot and Smith, undated).

The critical area treatment process may also include the *protection of roads* from severe floodwaters, which can cause erosion and instability. EWP practice components that are involved in road protection may include access creation, installing drains and conveyance, armoring, and grading, shaping, and revegetating.

Installing drains and conveyances involve heavy construction activities, including the removal of ground cover, and excavation.

Upland diversions, including contour felling and contour trenching, are constructed and used to protect critical areas that lack vegetative cover from excessive runoff, and protect downslope communities, or structures from debris laden subsurface water flow. Contour felling involves placing cut trees in rows horizontally on side slopes to divert water. Contour trenching involves a similar practice, except that logs are replaced by excavated trenches, which are constructed on slopes of between 35 and 60 percent with moderate to deep rills. Their main purpose is to store or divert runoff thus reducing soil erosion and overland flow.

Outlet structures are utilized to conduct storm water away from developed lots, buildings, housing developments, or critically damaged areas and usually discharge into the nearest stream channel. Outlet structures are usually lined with clean stones to reduce the velocity of water exiting the structure.

Soil compaction may be required to aid in diversion stability and effectiveness. Compaction of soils decreases infiltration rates, increases in runoff, ponding of water, and decreased soil productivity.

Summary of Impacts of Critical Area Treatment Practices to Aquatic Ecosystems

Critical area treatment is more frequently used in upland areas where streams tend to be intermittent and the primary concern to aquatic systems is not construction-related, but related to storm events, where sudden erosion and vegetation uprooting may harm downstream, perennial aquatic systems.

Sedimentation and turbidity: Short-term increases in sedimentation and turbidity may be seen with equipment operation and access creation. Excavation, soil compaction, and installation of the practices may have similar short-term effects. Long-term effects may be beneficial, as revegetation stabilizes streambanks and reduces overland erosion.

Temperature and dissolved oxygen: Short-term increases in temperature and decreases in dissolved oxygen will result from equipment use, removal of vegetation, and excavation. Long-term benefits will be realized as riparian vegetation is reestablished.

Pollutants: Equipment operation introduces risks of leaks. Access creation may remove riparian vegetation and promote erosion and runoff. Reestablishment of riparian vegetation will reduce erosion and runoff of agricultural or urban lands. Use of fertilizers and other chemicals may adversely affect water quality if not absorbed before next rainfall event.

Habitat structure: Sedimentation may fill benthic habitat. Access creation may remove riparian and aquatic vegetation. Some practices, such as riprap and gabions, may decrease riparian and aquatic habitat for some species and limit access to the water for terrestrial species.

Channel structure: Sedimentation may alter channel structure. Drains or other structures may alter course or profile of stream channels.

Biota: Increased sedimentation and turbidity can result in decreased spawning success, gill abrasions, migration barriers, lower dissolved oxygen, and the filling of downstream riffle areas (see Berkman and Rabini, 1987; Koonce and Teraguchi, 1980; and McCabe and O'Brien, 1993).

Critical Area Treatment Impacts at Example EWP Sites

The 8th Street Burn restoration involved critical area planting, the installation of upland diversions, the installation of check dams, and the protection of roads. The area of the burn typically has only a few perennial streams but a larger number of intermittent channels, minimizing direct aquatic impacts. *Sedimentation and turbidity* may have increased during construction, as heavy equipment was used for some of the work and the vegetation on-site would have been removed or damaged in the burn. T*emperature, habitat structure, channel structure, and biota* would have experienced minor effects during construction, but long-term effects would be positive, as erosion would be decreased substantially by vegetation establishment. Impacts from *pollutants* were restricted to POLs from equipment, as no fertilizers or other chemicals were used.

The Antelope Valley site required tilling of the sandy soils and seeding of native grasses to establish vegetative cover. In some places, snow fences were erected to impede further erosional losses. Much like the 8th Street burn site, there is no aquatic environment on-site but concerns for downwind aquatic systems, as well as impacts to humans, prompted restoration action. *Sedimentation and turbidity* may have increased during construction, as heavy equipment was used to till the soils, possibly creating more wind-borne sand particles that may have impacted downwind streams. T*emperature, habitat structure, channel structure, and biota* would have experienced minor effects during construction, but long-term effects would be positive, as erosion would be decreased greatly by vegetation establishment. Adverse effects from *pollutants* may have resulted from equipment use and fertilizers.

<u>Effects on Riparian, Floodplain and Wetland Ecosystems</u>

Bank stability and erosion: Short-term effects may have included increased soil compaction from equipment use and minor vegetation removal or damage. Long-term effects are highly beneficial, as revegetation stabilizes soils in the upland and streamside areas, reducing erosion (see Karr, 1977). Aerial or hand seeding and planting may reduce short-term impacts.

Vegetative cover and habitat: Short-term adverse effects to vegetation may have occurred if vegetation were damaged or removed. Erosion and sedimentation during construction could have affected downstream vegetation. Long-term effects are likely to be highly beneficial, as revegetation returns natural grasses or woody vegetation, providing habitat and cover.

Hydrology and water quality: In the long-term, hydrology would be improved, as vegetation and structural measures would improve water flows and prevent erosion and sedimentation.

Biota: Revegetation would have restored habitat and forage for local biota. Use of native species would have promoted local diversity and discourage exotic species.

Wetlands: Reducing the overland erosion and debris flows would have reduced sedimentation and filling of wetlands downslope.

<u>Effects on Upland Ecosystems</u>

Erosion: Short-term adverse impacts to soil stability may have occurred from equipment usage and other construction work may have compacted soils or created ruts. Revegetation and structural practices would reduce long-term erosion substantially.

Vegetative cover and habitat: Some adverse effects may have occurred as construction of the conservation measures took place, but revegetation likely would substantially improve vegetative cover in damaged areas. Depending on the type of vegetation used, various types of habitat would be promoted.

Biota: Revegetation would have restored habitat and forage for terrestrial biota. Use of native species would promote local diversity and discourage exotic species.

5.2.2.5.3 Comparison of the Impacts of Critical Area Treatment Techniques

Table 5.2-3 below illustrates the impacts of the various methods used in treating critical areas. Natural vegetation has minimal impacts but generally takes more time than other practices, increasing the risks of further damage from new rainfall events or disasters.

Table 5.2-3 Impacts Comparison of Critical Area Treatment Techniques

Natural Revegetation	Conventional Seeding	Critical Area Planting	Structural Measures
Water Quality[1]			
Natural regeneration would help reduce peak flows once established. Vegetation could take longer to establish. Natural regeneration would not involve the use of fertilizers that may enter the stream and lower water quality.	Seeding an area should reduce peak flows once established. Seeding should have minimal site disturbance impacts. Conventional seeding could cause fertilizers and chemicals to enter waterways and affect algae and plant populations.	Critical area planting should reduce peak flows once established. Site disturbance could cause increased sedimentation in the short-term. Critical area planting could cause fertilizers to enter waterways and affect algae and plant populations.	The construction of structural measures could increase sedimentation in the short-term. Erosion and sedimentation should decrease in the long-term. Structural measures will likely reduce erosion more quickly than with vegetation establishment.
Habitat and Channel Structure			
Natural regeneration could allow sedimentation and runoff in the short-term.	Habitat should be improved over the long-term due to decreases in erosion and sedimentation.	Habitat should be improved over the long-term due to decreases in erosion and sedimentation.	Increased turbidity could occur during the construction of structural measures.
Biota			
Natural regeneration could allow sedimentation and runoff in the short-term.	Conventional seeding methods that use fertilizers could affect stream biota in the short-term. Improved habitat would benefit biotic species.	Critical area planting methods that use fertilizers could affect stream biota in the short-term. Improved habitat would benefit biotic species.	Increased turbidity could occur during the construction of structural measures.
Riparian, Floodplain and Wetland Ecosystems			
Natural regeneration would not control sedimentation until vegetation becomes established. Sites should have improved habitat once revegetation occurs.	Conventional seeding practices that utilize fertilizers could affect wetlands. Sedimentation and filling could occur until vegetation becomes established.	Conventional seeding practices that utilize fertilizers could affect wetlands. Sedimentation and filling could occur until vegetation becomes established. Critical area planting could disrupt wildlife and vegetation. Sites should have improved habitat once plantings become established.	The construction of structural measures would cause high levels of site disturbance. Immediate sediment control would occur. Structural practices would cause high initial site disturbances and could decrease wildlife habitat.
Upland Ecosystems			
Natural regeneration would not control sedimentation until vegetation becomes established. Sites should have improved habitat once revegetation occurs.	Conventional seeding practices that utilize fertilizers could affect wetlands. Sedimentation and filling could occur until vegetation becomes established.	Conventional seeding practices that utilize fertilizers could affect wetlands. Sedimentation and filling could occur until vegetation becomes established. Critical area planting could disrupt wildlife and vegetation. Sites should have improved habitat once plantings become established.	The construction of structural measures would cause high levels of site disturbance. Immediate sediment control would occur. Structural practices would cause high initial site disturbances and could decrease wildlife habitat.

[1] Includes turbidity, temperature, dissolved oxygen, and pollutants

5.2.3 Impacts of Proposed EWP Watershed Restoration Practices

This section describes the impacts of the new practices that would be implemented under the alternatives to the No Action—use of natural stream dynamics principles in streambank restoration projects, floodplain deposition site restoration, upland debris removal, repair of damaged structural/enduring/long-life conservation practices, and restoration using improved alternative treatment practices.

5.2.3.1 Restoration Using Natural Stream Dynamics Principles

The practice of streambank restoration has been analyzed in detail earlier in the Chapter. Traditionally, EWP has used armoring methods to repair damages, such as riprap or gabions. While effective for protecting the structural integrity of the streambank and property along the stream, these practices offer little to the biotic components of aquatic and riparian communities. The Preferred Alternative would promote using the principles of natural stream dynamics and the use of minimally intrusive solutions to restore self-sustaining stream corridor functions.

5.2.3.1.1 Effects of Streambank Protection on Stream and Related Ecosystems

The impacts of streambank restoration have been discussed in Section 5.2.2.2. Streambank damage and subsequent impacts at sites where the Rosgen method of classifying streams and restoring natural stream dynamics would be applied would be very similar to the impacts and sites presented in that section.

Impacts on Riparian, Floodplain, and Wetland Ecosystem Parameters

Bank stability and erosion: Removal of vegetation to create access to a site may increase runoff and erosion. Removal of debris that is protecting a bank from direct exposure to flow will likely increase streambank erosion. Soil compaction from equipment operation may decrease infiltration of soils, increasing runoff. Natural streamflows would create a meandering stream channel, decreasing flow velocity and reducing erosion.

Vegetative cover and habitat: Removal of vegetation to create access to a site will decrease cover and may reduce habitat quality. Natural stream dynamics may promote establishment of riparian, floodplain or wetland vegetation, depending on the hydrologic regime in the reach. Increased cover and vegetation may induce improvements in biotic species present.

Hydrology and water quality: Removal of vegetation may increase erosion from floodplain areas, increasing turbidity and input of nutrients from agricultural or other lands. Channelization of stream may remove natural flood regime and adversely affect the formation of wetlands. Slower stream velocities may reduce turbidity.

Biota: Improved habitat and hydrology may improve biotic resources such as wetland vegetation. Riparian vegetation will likely improve, as riparian areas would see reduced erosion and increased bank stability.

Wetlands: Returning a more natural stream flow with meanders will likely promote wetland restoration or improvement. Using the principles of natural stream dynamics may increase the prevalence of slack waters and reduces flow velocity, promoting wetland functions.

Variability of Impacts between Watersheds

The variability of impacts across different types of watershed would be similar to the analysis in Section 5.2.2.2.

Streambank Damage Situations at Example EWP Sites

The Plumtree site is located along the North Toe River in the mountains of western North Carolina, just north of the town of Plumtree. The reach has a well-developed, woody riparian area and supports a very active recreational fishery, including brook, brown and rainbow trout, as well as smallmouth bass, chubs and dace. There are no T&E species onsite or in the general vicinity. No wetlands are onsite or in the immediate downstream area (Brown, 1999), although the North Toe does show several areas classified as riparian zones (NWI, 1999). A stretch of the river approximately nine miles long was damaged by heavy rainfall, leaving woody and rocky debris and damaging streambanks. The Rosgen method of classifying streams was used to design the stream restoration, which included stabilization techniques such as rootwads, rock vanes, log sills, point bars and streambank revegetation.

5.2.3.1.2 Effects of Proposed EWP Practices to Repair Streambanks

This section describes environmental impacts of using the Rosgen method of stream restoration. Chapter 2 describes in more detail streambank impairments, the practice of streambank restoration, and the specific activities involved. As with all EWP projects, the primary goal of the repairs is to reduce or eliminate threats to life and property. Threat reduction may require stabilizing streambanks, halting erosion losses, and installing structural practices to prevent future erosion.

Impacts of Natural Stream Dynamics Project Activities

Many of the activities involved with using the Rosgen method are essentially the same as those described under streambank restoration. The primary differences are found in the *borrow of materials* and the *installation of structural practices*.

Borrow of materials, under the Rosgen method, is somewhat different than traditional EWP practices. Use of natural materials from the disaster site or areas close by are emphasized. The type of materials acquired are generally very different as well, since natural stream dynamics methods call for a greater use of rootwads, tree revetments, rock vanes and other natural uses of woody and rocky material. Often, these materials are available onsite, either as existing borrow materials or as storm debris.

The *installation of structural practices* differs from prior EWP sites. Equipment use is encouraged to be in-stream in cases where the work can be completed relatively quickly and the effects of equipment use can be temporally restricted to a short period of more intense disturbance, rather than an extended period of moderate disturbance. Installation by hand is also common at sites using the Rosgen method.

Summary of Impacts on Aquatic Community Parameters

As mentioned previously, the impacts of using the principles of natural stream dynamics in designing restoration practices are similar to impacts observed with other streambank restoration sites. Refer to Section 5.2.2.2 for details, as this section will simply address any changes in those discussions.

Sedimentation and turbidity: Sedimentation will be greatly reduced, as extensive revegetation, engineered meanders, flow control structures, and natural bank protection practices such as rootwads will improve flow conditions and decrease turbidity. The short-term increases from in-stream equipment use may be restricted to a limited time period, minimizing the temporal disturbance to aquatic species.

Temperature and dissolved oxygen: The methods used will increase dissolved oxygen and reduce temperatures by providing pool areas, as well as multiple structures that will increase turbulence.

Pollutants: Reduced time of equipment operation in-stream may reduce the risk of spills. Structural methods will decrease erosion and encourage meandering streams, reducing the inflow of runoff and pollutants.

Habitat structure: Habitat will be greatly improved, as natural materials will create cover and pool habitats. Improved water quality from more natural and more effective practices will improve habitat quality.

Channel structure: With the creation of meanders, natural flow is restored, improving the sedimentation and erosion cycle in-stream. Flow control structures can reduce bank erosion while still maintaining natural flow regimes.

Effects on Floodplain, Wetland, and Riparian Community Parameters

The following effects are similar to those experienced under streambank restoration in Section 5.2.2.2. Only the changes to the effects listed there are discussed further here.

Bank stability and erosion: There is an increased focus on leaving some debris in-stream. This will reduce the chances that a critical piece of debris that may be protecting a streambank from direct flows will be removed. Rootwads, rock weirs, and other methods increase bank stability by not only protecting the streambank, but also introducing meanders, directional controls, and pooling to slow the flow velocity and reduce erosion.

Vegetative cover and habitat: These methods leave the streambank in a more natural state, allowing for quicker re-establishment of riparian vegetation. Rootwads may also provide some limited riparian habitat for small mammals or birds.

Hydrology and water quality: The introduction of meanders and reduction of flow velocity will improve hydrology by creating some areas of slack water and promoting riparian and wetland vegetation. Water quality will likely improve, as turbidity and runoff will likely be decreased.

Biota: Riparian vegetation is likely to re-establish more quickly, favoring terrestrial biota. Access to the stream is improved, as meanders may create sandbars and other streamside habitats.

Wetlands: Improvements in hydrology and water quality, along with improved vegetation should promote wetland formation or restoration.

Impacts of Design Based on Natural Stream Dynamics at Example EWP Sites

At the Plumtree site, NRCS used a combination of rootwads, revetments, and weirs to implement the principles of natural stream dynamics. *Bank stability and erosion* were improved, as rootwads and weirs protected banks from flows. Most of the heavy equipment use was completed in-stream, reducing the impacts to riparian soils and vegetation. *Vegetative cover* was disturbed as little as possible, and the natural streambanks will likely promote rapid re-establishment. Some planting and seeding was also completed to augment natural revegetation. *Hydrology* was improved by the introduction of meanders and slack water areas, and water quality improved with the reductions in runoff and decreased turbidity. *Biota* will likely see positive effects, as riparian areas are left in a natural state, sand bars are created and vegetation will re-establish quickly. *Wetlands* are not found on-site, but the natural stream function may lead to the creation or restoration of wetland communities.

5.2.3.2 Restoration of Agricultural Uses in Floodplains (Floodplain Deposition Removal)

Larger rivers frequently carry a heavy sediment load, especially during floods. The high erosion potential of the flood and the increased velocity creates an environment for increased amounts of suspended sediment. When these floodwaters reach an area of slower velocities, this sediment can be rapidly deposited. A common example is seen during the breach of a levee, when floodwaters reach the flat land behind and deposit the suspended sediment, burying crops or structures in thick layers of silt and sand.

5.2.3.2.1 Effects of Floodplain Deposition on Stream and Related Ecosystems

Floodplain deposition generally involves the deposition of large volumes of sediments and other debris on agricultural land in floodplains. Such materials are usually coarse and infertile, and frequently destroy or smother plants and impair normal agricultural use. This is a normal occurrence in the dynamics of floodplain systems, but can jeopardize the productivity of agricultural lands. Impacts to aquatic communities are similar to the effects under other flood events, whereas floodplains see substantially different effects.

Effects of Floodplain Deposition on Aquatic Ecosystems

The impacts of floodplain deposition would be similar to those described under dam, dike, and levee repair, most specifically under the impacts of levee breaches. *Sedimentation* increases, as floodwaters slow and begin to settle. *Temperature* increases and *dissolved oxygen* decreases over time. *Pollutants and nutrients* are very likely to increase, since most floodplain deposition sites involve active cropland. *Habitat structure* would see negative effects, as sedimentation would fill benthic habitat and vegetation may be destroyed. *Channel structure* would likely also be adversely affected, as sedimentation could partially fill the channel.

Effects of Floodplain Deposition on Riparian, Floodplains, and Wetland Ecosystems

Riparian, floodplain, and wetland communities can be devastated by floodplain sediment deposition, as the volumes of sediment involved can be incredibly large. Layers of sand and silt can reach several feet thick, burying crops and other vegetation, as well as filling wetlands. *Bank stability* is generally poor due to the levee breach or other event, but is not directly related to the deposition. *Erosion*, however, may have adverse effects, as there is an ample supply of highly erodable material in the floodplain with very little vegetation to reduce erosional flows. *Vegetative cover and habitat* are generally buried in layers of sediment, greatly reducing the quality. *Water quality* may see some negative impacts, as turbidity levels may increase with the introduction of this source of sediment. *Biota* will experience negative impacts, as habitat is degraded or destroyed and wetlands are damaged. *Wetlands* may be filled by sediment, effectively destroying them.

Floodplain Deposition at Example EWP Site

The Missouri River site is located along the Missouri River in St. Charles County, Missouri. The property lies behind levees on the northern bank of the river and is primarily used for agriculture, in a corn-soybean rotation. Historically, flooding has been frequent and severe, as the site is subjected to floodwaters from the Missouri as well as backwater from the Mississippi River. A layer of sand up to one-foot thick covered cropland, rendering it useless to further cropping (Cook, 1999). The wetlands found near the river were likely filled with sand and their function greatly reduced.

5.2.3.2.2 Effects of EWP Practices to Restore Agricultural Use to Floodplains

There are two principle methods to deal with floodplain sediment in order to restore agricultural uses: incorporating the sediment into the underlying soil by deep tilling and removing the sediment. Deep tilling involves using heavy equipment to level the sediment to an even thickness, followed by tilling the soils to mix the sediment with the topsoil buried below and restore agricultural function. Sediment removal would involve scraping the land and loading the sediment for shipping and disposal off-site. The most effective method used depends upon many factors, including size of the deposited particles, depth of material deposited, lateral extent of the deposit, land use, and the soil type of the underlying material. In addition, floodplain easements can be offered to provide disaster relief where there is too much debris to incorporate or haul off-site or otherwise dispose of.

Impacts of Floodplain Sediment Removal Project Activities

Deep tilling, as described above, uses heavy equipment to level and mix the soils. These activities would occur after floodwaters had retreated and the floodplain was again dry. This would tend to minimize impacts to ecological communities, as no water flows, riparian areas or wetlands would be affected, and floodplain vegetation is mostly in the form of crops. The primary concern to ecological communities would be prevention of erosion, as the supply of *sediment* and *pollutants and nutrients* is high. Other functions would essentially be unaffected by the restoration efforts, as the work is intended to restore agricultural function to previously farmed land.

Sediment removal involves many of the same principles as deep tilling. Virtually no impacts would be felt in the ecological communities. Disposal of the sediment, however, may pose some problems. Many levees are constructed with sediment dredged from river channels, and floodplain sediment would be a likely source of levee materials. This may introduce erodible materials back into the floodplain, increasing *turbidity* and contributing to *sedimentation* and the degradation of *habitat and channel structure*.

Floodplain Sediment Removal at Example EWP Sites

The Missouri River site was flooded in 1993 by a breached levee and immense volumes of sand and debris were deposited in the cropland. The levees themselves are composed of sand dredged from the river, providing further material for deposition. In order to restore agricultural utility to the lands, two phases of heavy equipment operation were used. First, a scraper was used to flatten and level the sand deposits to an even layer of approximately 18 inches. Then, a deep plow was used to till the soil and mix the sand with the buried topsoil and recreate usable fields. The levees were repaired (Tummons, 1995).

Summary of Impacts on Aquatic Ecosystem Parameters

Minor effects to *sedimentation and erosion*, *pollutants,* and *habitat* and *channel structure* as described above. The scraping and deep tilling at the Missouri River site had very minimal effects on natural communities, as it mostly worked towards restoring prior cropland.

Effects on Floodplain, Wetland, and Riparian Community Parameters

There would be minor effects to *vegetation* as described above.

5.2.3.3 Restoration of Watershed Uplands (Tornado Debris Removal)

5.2.3.3.1 Effects of Upland Disasters on Watershed Ecosystems

Tornadoes and hurricanes can deposit large amounts of debris on upland areas. Such debris may cover portions of several watersheds and normally consists of downed trees, utility poles, and fence posts; livestock and poultry carcasses; or building materials, such as insulation, shingles, metal roofing, metal siding, and similar non-biodegradable materials. Ice storms may also result in debris deposition. The removal of debris will typically be associated with upland areas where the buildup of debris in a waterway will cause flooding of homes or other structures.

Disaster Impacts on Aquatic Ecosystems

The impacts of storm debris in uplands are similar to the impacts seen in critically damaged areas such as the 8th Street burn. Often, there is no aquatic environment nearby, as streams are intermittent or are located well away from the disaster site. The impacts may be felt in aquatic systems downslope of the site, as subsequent rainfall events may wash sediment or pollutants into those systems. These impacts, whether local or further away, would be similar to the impacts discussed under debris removal and critical area treatment, with one notable addition to *pollutants*, as household debris may contain paint, asbestos, insulation and other household chemicals. Hazardous materials would be handled and removed in accordance with all applicable State and local regulations. Woody debris would only be removed if it posed a threat and may be left in place, providing habitat for terrestrial species.

Upland Tornado Damage at Example EWP Sites

Upland Debris Removal Site – Bauxite National Areas, Arkansas

In 1997 a category F4 tornado devastated 500 acres of sensitive glade and woodland forest in the Blue Branch Watershed in Arkansas. Thousands of piles of blown-down trees cluttered the forest floor suppressing rare species and creating a fire hazard (TNC, 1998). Two species of aggressive, non-native plants also existed at the site further threatening the stressed communities. These species, the kudzu vine (*Pueraria lobata*) and the Japanese honeysuckle (*Lonicera japonica*) readily colonize bare soil and out-compete native vegetation, threatening a State listed threatened plant. The restoration efforts included debris removal by hand, followed by a series of prescribed burns.

Upland Debris Removal Site – Saline County, Arkansas

The tornadoes of March 1, 1997 also devastated private property. The Griffin property was an upland debris removal site on five acres of privately owned land. The project involved the cleanup and removal of 4 acres of damaged timber and 150 cubic yards of household debris, which had been scattered over the property. Debris removal involved the use of heavy equipment, and its subsequent delivery to a county landfill for burning or burial (Reitzke, 1999).

5.2.3.3.2 Impacts of Upland Debris Removal

Upland debris removal uses similar methods as debris removal in stream channels, but would likely have far less aquatic impacts. Heavy equipment and machinery is used when needed to create access to a site and gather and process the debris, creating possible impacts from erosion and soil compaction on downslope stream systems. Special technical assistance and personnel may be required to handle any hazardous materials. Debris removal may alter the overland flow of rain and runoff, possibly affecting erosion along the slope and sedimentation instream.

<u>Upland Debris Removal at Example Sites</u>

As mentioned above, impacts to aquatic communities would have been minimal. At both sites, streams are at least a half-mile away, minimizing any overland aquatic impacts. For a more detailed discussion of some of these possible impacts, see the impacts section of critical area treatment.

<u>Effects on Riparian, Floodplain, and Wetland Ecosystems</u>

Impacts to these communities would also be similar to the impacts under critical area treatment. Any portion of the area affected by the debris removal operation should be graded, reshaped, and revegetated by seeding or planting, as needed.

<u>Effects on Upland Ecosystems</u>

As with riparian, floodplain, and wetland ecosystems, upland ecosystems would experience similar impacts to those seen under critical area treatment. Similar exceptions to these impacts would also be experienced, as noted above.

5.2.3.4 Restoration of Damaged Structural/Enduring/Long-life Conservation Practices

Structural/enduring/long-life conservation practices eligible for repair include grassed waterways, terraces, embankment ponds, diversions, and water conservation systems. These structures are generally upland structures designed to operate on a single farm, most often for soil conservation.

5.2.3.4.1 Effects of Damaged Conservation Practices on Stream and Related Ecosystems

Practices such as diversions, ponds, and waterways are common structures on farms used to prevent soil erosion, contain wastes and runoff, and to provide a supply of water for irrigation or animal consumption. Diversions and grassed waterways are often used together and serve to redirect overland runoff and intermittent streams around valuable cropland and into existing stream channels. Animal waste storage ponds collect waste for long-term storage, and it is generally emptied periodically for application to the croplands. Embankment ponds collect rainfall and runoff for protection against erosion, animal drinking water, and for human recreational use.

Effects of Damaged Enduring Conservation Practices on Aquatic Ecosystems

These four practices are typically placed in upland areas, away from stream channels, and should have minimal effects on aquatic communities, even when damaged. A failure in a diversion or waterway would likely result in increased erosion to croplands, as the runoff would no longer be diverted away. These effects may be localized to the damaged structure, as the volumes of water contained or diverted are rather small and may not be sufficient to reach existing waterways. The content of the runoff would be composed of water and sediment, with some contribution from pollutants and chemicals. A failed animal waste storage pond would prove highly problematic, however, as the highly concentrated waste can be devastating on aquatic communities, causing sizeable fish kills and degrading water quality. The failure of an embankment pond could also be more troublesome, depending on the volume of water impounded. The effects could be minimal and localized, or they may more closely resemble the effects seen under dam and dike repairs.

To summarize, *turbidity* may be locally increased during failures, with the possibility of larger effects during greatly elevated flows. *Temperature and dissolved oxygen* are unlikely to see substantial effects. *Pollutants* may become suspended in the runoff, degrading water quality. *Habitat structure* may be adversely affected if erosion or poor water quality negatively impacts aquatic vegetation and habitat. *Channel structure* may be negatively impacted by increased erosion and sedimentation.

Effects of Damaged Enduring Conservation Practices on Riparian, Floodplains and Wetland Ecosystems

The general effects on riparian, floodplain, and wetland ecosystems would be similar to those seen in aquatic systems. Normally, enduring conservation practices are located outside of historic floodplains and stream channels, minimizing interactions with those environments. *Bank stability and erosion* may be negatively affected if flow volumes are large, as the riparian vegetation may be damaged. *Vegetative cover and habitat* may be similarly affected. *Water quality* may experience some decreases, especially in cases where animal waste or agricultural chemicals are introduced to the stream channel. *Biota* may be adversely affected by increased erosion or reduced water quality. *Wetlands* may see some change in water flows, in water quality, or may experience some negative effects from sedimentation.

Damaged Enduring Conservation Practices at Example EWP Site

There are four enduring conservation practice sites located in the Maury River watershed, all upstream of the City of Buena Vista and on private farms. The four practices represented are: a diversion, a waste storage pond, an embankment pond, and a grassed waterway. Each of these sites is fully functional and has not failed during their lifespan, even in the heavy rains that caused the severe flooding in Buena Vista, VA. Therefore, hypothetical failures have been analyzed with available information about the sites and the possible environmental effects. On each site, there are no wetlands present (except for one wetland upstream of the diversion site {NWI, 1999}), no T&E species are known to exist, nor are any cultural resources present.

5.2.3.4.2 Effects of EWP Practices to Repair Enduring Conservation Practices

Generally, repair of each of these conservation practices would involve the use of heavy equipment for a short time and require some grading and shaping. Much like floodplain sediment removal, the work is normally completed with very little impact to aquatic, riparian, floodplain, and wetland ecosystems.

Impacts of Repair of Enduring Conservation Practices Project Activities

The primary concern to ecological communities would be prevention of erosion, as the supply of *sediment* and *pollutants and nutrients* would likely be high. Other functions would essentially be unaffected by the restoration efforts, as the work is principally conducted in upland areas.

Repair of Enduring Conservation Practices at Example EWP Sites

Each of the four sites located within the Maury River watershed exhibit somewhat similar biotic characteristics. The terrestrial environment is generally agriculture and tends to be constructed outside of normal stream channels. Intermittent streams may be nearby and runoff channels may exist, but the aquatic environment is virtually non-existent on-site. However, each of the sites do eventually empty into stream channels and a typical stream in this area is a stable stream with a fairly high gradient. Many of the streams in the area are intermittent, but some do maintain populations of smallmouth bass and perch in the permanent reaches. Generally, there is a well-developed riparian zone and agriculture near the streambeds tends to be more haying or pasture, reducing the amount of fertilizers and other chemical inputs to the streams (Nye, 1999). There are no wetlands at these sites, except for some small wetlands near the grassed waterway site (Flint, 1999).

The diversion is found on the Goodbar farm just to the south of the town of Denmark. The area is moderately steep, as it is part of the downward slope from Big House Mountain to Kerr's Creek below. The diversion is located away from existing stream channels and protects the downslope croplands from overland flow of rainfall and subsequent erosion. The water is channeled into a waterway and routed around the croplands.

A likely scenario for the failure of the diversion would involve heavy rainfall and a breach in the diversion, allowing runoff to erode the croplands. Depending on the volume of rainfall, the erosion could damage crops and flood the field below. These effects would probably be localized to the farm, but there are also two homes nearby that might be affected by erosion and runoff flows. Possible effects would include sediment deposition and threats to structures.

The waste storage pond is found on the Martin farm, to the north of the town of Fairfield. The waste from the dairy on-site is collected and dried within the pond before eventually being applied to agricultural fields. There is no outflow from the pond and no stream channels are located nearby, although intermittent portions of Marlbrook Creek are a quarter of a mile away.

If the waste storage pond were to receive heavy rainfall, it could overtop is walls and possibly lead to a breach in the wall of the pond. The waste would flow into and probably damage a pasture and pose a threat to water quality, as the creek may receive some of the animal waste runoff. The impacts would include increased turbidity and threats to aquatic life due to torrents of nutrients and sediment into the stream. Human health would be a primary concern, as drinking water wells may be threatened and fish may not be fit for human consumption.

An embankment pond is located on the Hickman farm, east of Horseshoe Bend in the Maury River. It is in an upslope area that drains into an unnamed intermittent stream and eventually into the Maury River approximately two miles below. It was built where two hills converge and serves to collect the runoff from each, preventing excessive runoff in the pasture and residences below.

If the embankment pond were to fail, the erosion would damage the downslope pasturelands, yards and homes. The pond is fairly small, so effects would be localized to very near the site and any additional damage would be constrained by an old railroad grade located further downslope. As the stream is intermittent, there would be no fish or wildlife effects, but vegetation may be removed by the small scale flooding.

The grassed waterway site is found on the Moore farm to the southwest of the town of Raphine. The waterway routes runoff waters around agricultural land to prevent erosion. The grassy vegetation, a tall fescue, is used to slow flow velocities and prevent erosion of the waterway. The site drains into an unnamed tributary and eventually into Moore's Creek approximately a half mile downstream.

If the waterway were to fail, damage would likely occur to the pastureland in the form of gullies and erosion. The effects would probably be local but there are several roads and houses located approximately a half mile away.

Summary of Impacts on Aquatic Ecosystem Parameters

Minor effects to *sedimentation and erosion*, *pollutants*, and *habitat* and *channel structure* would occur as described above.

Effects on Floodplain, Wetland, and Riparian Community Parameters

Minor effects to *vegetation* would occur as described above.

Effects on Upland Ecosystems

Minor effects to *erosion* and *vegetation* would occur as described above.

5.2.3.5 Restoration Using Improved Alternative Solutions

The implementation of improved alternative solutions would involve one of the practices introduced. A typical site where this practice may be used would be a streambank restoration site. In some cases, NRCS may find that a given amount of protection is sufficient for removing the threat of damages, yet the sponsor may wish to expand the size of the restoration. NRCS would review the plan for environmental and social defensibility, as well as technical merit, and give its approval if warranted. The positive and negative impacts of both the original alternative and the "improved alternative" will be site-specific and those impacts will have been addressed in the section of this document that discusses the impacts associated with that practice.

5.2.4 Impacts of Current EWP Floodplain Easements

Floodplain easements offer a long-term, economically, and environmentally sensible solution for floodplain management. A surprising number of EWP sites are frequently damaged, requiring repeated restoration efforts by NRCS. Recurring levee repair, streambank restoration, and debris removal work is common at these sites.

5.2.4.1 Impacts of Floodplain Easements

Floodplain easements will provide both landowners and NRCS a desirable alternative that will reduce threats to the public, protect property, reduce public expenditures, retard soil losses and erosion, allow for natural floodplain function, promote riparian and buffer areas, improve wildlife and fish habitat, and still provide for agricultural use of the floodplain lands.

5.2.4.1.1 Impacts of Floodplain Easements on Floodplain Health and Functionality

The impacts of floodplain easements can be captured in an analysis of the floodplain parameters. Six parameters have been identified for characterizing the health and functionality of a floodplain (see The Cosumnes River Project, undated). Floodplain easements will change *land development and use* to a less developed state, with more natural vegetation and minimal agricultural use. These changes will greatly improve the filtration, water storage, wildlife and fish habitat, and energy dissipation capabilities of the floodplain. *Hydrology* will be improved, as infiltration rates will increase, velocities will be reduced, filtration capacity will increase, and natural flood regimes will be returned. *Vegetation* in the floodplain will benefit greatly from floodplain easements, as the land uses will revert to more natural functions, promoting grasses, woody vegetation, and possibly wetland vegetation. This will improve habitat, slow water velocity, and improve infiltration rates. *Habitat*, as discussed, will improve markedly, as terrestrial areas will be revegetated with herbaceous and woody vegetation. Aquatic communities will also benefit, as the floodplain easements will improve water quality through better runoff filtration, reduced erosion, and floodwater retention. Floodplain easements may create additional habitat for aquatic species such as herpetiles or may open new fish spawning habitat. *Wildlife* will see similar benefits, due to the habitat improvements and the removal of development. *T&E species* will benefit, as floodplains will return to more natural conditions and be more capable of supporting those species.

5.2.4.1.2 Impacts of Floodplain Easements on Riparian, Floodplain, and Wetland Ecosystems

Floodplain easements will have impacts on related ecosystems. Aquatic communities will benefit from the improved water quality, reduced floodplain and in-stream erosion, slower flow velocities, and improved flood storage. Riparian communities will see similar benefits, as streambank erosion will be reduced, revegetation will be encouraged, and habitat will be improved. Wetland communities will also be positively affected by improved hydrology, improved water retention, reduced erosion, and revegetation. Upland communities will see some benefits as well, as habitat will be improved, erosion reduced, and vegetation will improve.

5.2.4.1.3 Effects of the Different Floodplain Easement Categories

The current EWP floodplain easement Program is characterized by having three categories of eligible lands. All sites are agricultural land, but each category has different requirements for the subsequent use of the lands. These categories provide a gradation from more natural floodplain easements (Category 1) to fully functioning agricultural land (Category 3). All floodplain easements are perpetual in duration. A floodplain easement may be comprised of acreage from one or more categories as outlined below.

Category 1 Floodplain Easements

Category 1 floodplain easements are considered to be the most natural of the three categories. These floodplain easements are for use on lands where vegetative buffer areas are to be restored or where a State or Federal T&E species may benefit from restored habitat. Once established, no grazing, cropping or timber harvest is allowed. Floodplain function and habitat for fish and wildlife is to be optimized in these floodplain easements.

To the extent possible, these floodplain easements essentially return the natural floodplains to the land. All compatible uses are excluded from these properties, removing any agriculture or development. Vegetation will return and floodplain hydrology will begin to exhibit natural functions. This category of floodplain easement will return the land to a fully functional natural floodplain more quickly than other floodplain easement categories.

Category 2 Floodplain Easements

Category 2 floodplain easements are moderately natural areas and tend to be the more commonly purchased floodplain easements. They are characterized as lands that are, or historically have been, at high risk for frequent flood damages. These lands may also benefit wildlife species designated as species of Federal concern, such as anadromous fish or migratory birds. Land use on the floodplain easement will be limited to compatible uses such as managed timber harvest, haying or grazing. Cropping will not be permitted, and haying and grazing may not be authorized if the floodplain easement restoration plan calls for reestablishment of woody vegetation.

Floodplain easements created under Category 2 exhibit similar characteristics of those under Category 1. Land use is more flexible, allowing some compatible uses, but eliminates intensive agriculture. This will improve water quality in the aquatic community, floodplain habitat, and hydrology. Natural vegetation will return and wildlife will realize benefits from the improved floodplain community. The critical difference with Category 2 floodplain easements is the time required to return to more natural floodplain functions. The inclusion of compatible uses will inhibit some natural processes, the most prominent of which is revegetation of woody species and grasses. The slower recovery period will lead to smaller improvements in infiltration, sedimentation, and habitat establishment.

Category 3 Floodplain Easements

Category 3 floodplain easements are the most agricultural in nature and include only good quality farmlands that are subject to periodic flooding. These areas may remain in cropping, timber, grazing and haying.

These types of floodplain easements offer the least benefits to restoring floodplain function. By continuing with intensive cropping, natural vegetation is not restored, erosion continues at a similar rate, and no additional habitat is created. A benefit of Category 3 floodplain easements is that the capacity for floodwater retention is increased, as these lands are open to flooding, which will reduce flow velocity and improve flood storage.

[Note: Since 2001, as a result of a USDA Office of Inspector General (OIG) investigation, NRCS has operated the floodplain easement portion of the EWP Program by purchasing a single type of floodplain easement, restoration with compatible uses, which is category 2 under the previous categorization. Therefore, categories 1 and 3 are no longer part of the current EWP program and would not be part of implementing the No Action alternative.]

5.2.4.2 Impacts at Floodplain Easement Example Sites

Floodplain easement example sites are located at Medicine Creek, Missouri, Platte River, Missouri, and East Nishnabotna, Iowa. Rose River has also been included as a hypothetical example of a floodplain easement outside of the Mississippi/Missouri River corridor and provides an example of a very different waterbody. Each site is briefly described below, including an assessment of the pre-disaster and post-disaster natural conditions.

5.2.4.2.1 Medicine Creek Site

The Medicine Creek site is a frequently flooded tract located in northern Missouri. The property is located between Medicine Creek and Muddy Creek, two heavily modified streams with levees directly adjacent to the streambank for much of the stream length. Subsequently, there is virtually no floodplain remaining in these sub-basins. Riparian areas are narrow and of poor quality. Water quality is also poor, as turbidity and agricultural runoff are common problems in this region. Aquatic habitat is of low quality, as reflected by the fisheries present: channel catfish and sunfish. Two State listed T&E species are in the area, the American bittern and the northern harrier, two migratory birds. No wetlands are on-site but NWI maps (1999) list some wetlands nearby as part of the continuum of riparian and wetland habitat along Medicine Creek. In 1993 and 1995, the levees protecting the site were breached during flooding and repairs were made. The site is now targeted for floodplain easement purchase, complete with the installation of a setback levee to reopen floodplain area and create managed wetlands (Young, 1999).

5.2.4.2.2 Platte River Site

The Platte River floodplain easement site is located in western Missouri at the confluence of the Platte River and the Little Platte River. Flooding is very frequent in this area, with 3 to 4 short duration floods per year in the spring (Berka, 1999). Traditionally, maintaining this levee has taken a great deal of effort (Howard, 1999). The Platte is a typical prairie river, being flat, wide and having muddy waters. Riparian and aquatic habitat is poor, as extensive levees and agriculture have degraded these communities. Fish populations near the site include hardy fish such as catfish and carp. There are no T&E species in the area, but some migratory waterfowl and a significant population of game mammals and game birds are in the area. There is an emergent wetland on the southeast corner of the property that has open exchange with the waterbodies. There are also several wetlands listed nearby and downstream in the Platte River corridor (NWI, 1999). During the rains leading to the 1995 flooding, a breach formed along the Platte River portion of the privately constructed levee, damaging crops. The restoration plan for this floodplain easement features wetland creation and enhancement (Berka, 1999).

5.2.4.2.3 East Nishnabotna Site

Along the East Nishnabotna, the Riverton floodplain easement site is located downriver from the other sites described under debris removal, streambank repair, and levee repair. Expectedly, flooding is frequent and levees predominate the riparian area. The river is typical of rivers in the area, with slow moving, muddy water. As with the Missouri floodplain easement sites, the aquatic and riparian habitats are poor and support very little diversity of vegetation or wildlife. No T&E species are onsite or in the area. There are wetlands onsite, along the northern portion of the property as well as across the river in the Riverton management area. The East Nishnabotna River corridor also shows several wetlands and riparian areas (NWI, 1999) both upstream and downstream of the site. The constant threat of flooding persuaded the landowner to enter the property into the floodplain easement Program, where it will be restored with managed wetlands and turned over to the Iowa Department of Natural Resources for inclusion in the Riverton State Game Management Area on the opposite bank.

5.2.4.2.4 Rose River Site

Purchasing a floodplain easement at the Rose River site would have both beneficial and adverse impacts. As previously discussed, Rose River is a high gradient stream that has naturally reproducing brook trout in its upper reaches. The floodplain easement would allow floodwaters to overtop channel banks and increase stormwater detention times in floodplain areas. This would reduce downstream storm surges. Both aquatic and riparian biota would benefit from the establishment of a floodplain easement and vegetation establishment. Vegetation would provide food, cover, and detrital material for both the terrestrial and aquatic systems, as well as filter overland flow.

5.2.5 Impacts of Proposed Changes in Floodplain Easements

5.2.5.1 Floodplain Easement Changes Proposed under the Alternatives

Under the three alternatives to No Action, two proposed changes would affect the operation of the EWP Floodplain easement Program, a change in the types of floodplain easements eligible for purchase and a change in the lands eligible for purchase.

5.2.5.1.1 Changes in Floodplain Easement Types

Under the three action alternatives, the classification system for eligible land and floodplain easement type (Category 1 to 3) will be revised to include only Category 2 floodplain easements. Under this floodplain easement type, NRCS may, to the extent practicable, actively restore the natural features and characteristics of the floodplain through re-creating the topographic diversity, increasing the duration of inundation and saturation, and providing for the reestablishment of native vegetation. Funding for hydrology restoration and enhancement action may include removal of levees, filling of ditches, or impoundment of water for flood storage or to restore or establish floodplain features. Landowners retain several rights to the property, including the right of quiet enjoyment, the right to control public access, and the right to undeveloped recreational use such as hunting and fishing. At any time, a landowner may obtain authorization from NRCS to engage in other activities determined to be compatible with the protection and enhancement of the floodplain easement's floodplain functions and values. These compatible uses may include managed timber harvest, periodic haying, or grazing. Cropping would not be authorized as a compatible use, and haying or grazing would not be authorized as a compatible use on lands that are being returned to woody vegetation.

[Note: Since 2001, as a result of a USDA Office of Inspector General (OIG) investigation, NRCS has operated the floodplain easement portion of the EWP Program by purchasing a single type of floodplain easement, restoration with compatible uses, which is category 2 under the previous categorization. Therefore, this proposed change has already been implemented.]

5.2.5.1.2 Changes in Eligible Lands

The second major change in the floodplain easement program is that the eligible lands guidelines will be expanded to include improved lands in order to maximize floodplain function. Under the Draft PEIS Proposed Action and Alternative 3, the availability of the floodplain easements would be expanded to non-agricultural lands with a low population density, and used to relocate families and businesses that are under constant threat of flooding damage.

Under Alternative 4, the Preferred Alternative, NRCS would purchase floodplain easements on improved lands where the improvements are affecting attainment of full floodplain function of a floodplain easement; for the sole purpose of creating a manageable floodplain easement area. Under the Preferred Alternative, NRCS would not purchase floodplain easements on lands with multiple property owners and residences for the sole purpose of relocating small flood-prone rural communities. Structures within any floodplain easement may be demolished or relocated outside the 100-year floodplain.

5.2.5.2 Impacts of Changes in Agricultural Floodplain Easements

5.2.5.2.1 Elimination of Categories 1 and 3

The elimination of Categories 1 and 3 from the current floodplain easement Program will have both positive and negative impacts. Elimination of Category 1 would likely have adverse environmental effects, as the potential benefits to the biotic and hydrologic functions of the floodplain easement will be reduced. However, the restoration/management plan will require a buffer strip along the water course and can prohibit any compatible use if a “hands off” state is desired. Category 2 floodplain easements, by allowing compatible uses, will not be as effective in reducing erosion, promoting revegetation, improving flood storage, and will also take longer to reach a restored state.

Conversely, the removal of Category 3 floodplain easements from the Program will have positive effects of the biotic and hydrologic function. By not allowing continued intensive cropping in the floodplain easement area, agricultural runoff will be reduced, habitat will improve, erosion losses will be reduced and floodwater retention will increase.

These effects may tend to be somewhat offsetting, as the most restrictive and least restrictive floodplain easement categories are eliminated. However, the benefits of eliminating cropping on floodplain easements and simplifying the floodplain easement procurement process would likely more than compensate for the lack of the most restrictive category, particularly if such restrictions can be applied, if warranted, on a Category 2 floodplain easement.

5.2.5.2.2 Impacts of Non-agricultural Floodplain Easements under Alternatives 2 and 3

To date, floodplain easements under EWP have addressed principally agricultural lands and the elimination of future expenditures for flood repairs. With the addition of improved lands floodplain easement purchases, inhabited areas that are subject to frequent flooding may be purchased and returned to natural floodplains, removing imminent threats to life and still satisfying the desire to reduce government expenditures for disaster relief. The EWP recovery practice of structure removal will have similar environmental effects as the non-agricultural floodplain easement program.

To illustrate a floodplain easement purchase, the community of Rocky Run, VA can be used as a hypothetical non-agricultural floodplain easement site. Purchasing a floodplain easement would allow the channel to return to its natural route and alleviate much of the erosion that occurs around the sharp bends. Gabion and riprap structures would no longer be needed, and the riparian vegetation would be allowed to re-establish itself. The re-establishment of the riparian vegetation would benefit the biota of the local riparian and aquatic communities by creating more habitat for biota, and providing shade and detrital material for the aquatic system. The established vegetation would also filter overland runoff, which would help reduce nutrient and sediment loads within the aquatic system. Sediment and cobble would continue to be deposited in the lower gradient regions of the stream system. This is a natural process that occurs in high gradient systems. The channel may become braided, or change course depending on the amount and location of debris deposition.

5.2.5.2.3 Impacts of Non-agricultural Floodplain easements under Alternative 4

Under Alternative 4, the addition of improved lands floodplain easement purchases would be limited to floodplain easements on non-agricultural lands where the land is adjacent to agricultural floodplain easement land, for the purposes of creating a larger sized floodplain easement area. Floodplain easements would not be purchased on lands with multiple property owners and residences for the sole purpose of relocating small flood-prone rural communities. However, the EWP recovery practice of structure removal would have similar environmental effects as the non-agricultural floodplain easement program under Alternatives 2 and 3. Under the proposed recovery practice of structure removal in floodplains, NRCS would partner with a third-party sponsor, such as a town or county, to buy-out structures on land. The third-party sponsor would be responsible for acquiring the property and taking title to the land.

Non-agricultural floodplain easement purchases under the Preferred Alternative would not be an option for the community of Rocky Run, VA, as the project would involve the relocation of multiple property owners. However, NRCS could partner with a state or local agency acting as the project sponsor and provide a cost-share for the buy-out of structures on the land. The land would then be bought by the community project sponsor and used for a stream floodplain. In this case, the effects on the watershed would be analogous to the effect of the non-agricultural floodplain easement purchase program proposed in Alternatives 2 and 3 and described in Section 5.2.5.2.2

Effects on Floodplain, Wetland, and Riparian Community Parameters

Bank stability and erosion: Bank stability is no longer of great concern, as stream channel would be allowed to meander and flood stage waters would be common. Sedimentation and erosion are normal processes in floodplains and would be allowed to proceed naturally.

Vegetative cover and habitat: Floodplain easements will improve hydrologic conditions for establishing wetland vegetation, as well as encourage other riparian and floodplain vegetation. Habitat will likely become more diverse and foster a wider variety of species.

Hydrology and water quality: Natural streamflow returns full floodplain function. Wetland establishment or enhancement will improve water filtration capabilities and improve water quality. Restriction of land uses will reduce the input of chemicals and other pollutants into the waterbody.

Biota: Improved habitat and hydrology will likely lead to improved conditions for plant and animal species. Widespread improvements to all types of biota, as natural conditions return.

Wetlands: Restoration of natural flooding regime and hydrology promotes wetland formation and enhancement.

5.2.6 Watershed Ecosystem Impacts under the EWP Alternatives

The changes to the Program described in Chapter 2 will have significant impacts in how future EWP projects are selected, prioritized, and implemented. Subsequently, the impacts to the natural environment will also vary across the alternatives. Below is an analysis of the changes to the Program and the impacts to the biotic communities within watersheds.

5.2.6.1 Alternative 1 (No Action Alternative)

The No Action Alternative would not involve any changes in the current Program. The impacts to the environment would be essentially the impacts described under each practice, in Sections 5.2.2, 5.2.3, and 5.2.4. Refer to these sections for the detailed discussions on environmental impacts of the current Program.

5.2.6.2 Alternative 2 (Draft PEIS Proposed Action)

The 15 changes proposed under the Draft PEIS Proposed Action are organized here in three general categories: Execution of EWP Recovery Practices, Floodplain Easements, and Environmental Review. *Execution of Practices* refers to changes made in the way an existing practice is planned or conducted, or the addition of a new practice. *Floodplain Easement* changes are those that involve floodplain easement purchases of all types and changes to floodplain easement management. *Environmental Review* refers to activities that help to characterize a particular site or the process of evaluating a given site.

5.2.6.2.1 Effects of Alternative 2 Changes on Implementation of EWP Practices

Eliminating the use of 'exigency' (Element #1) would likely have environmental benefits, as only extremely critical situations would be considered under the "urgent and compelling" designation. Previously, many sites were listed as "exigent" in order to take advantage of a more favorable cost-share ratio. This may have resulted in restoration work being completed hastily and without full coordination with other agencies, possibly resulting in less than optimal consideration of environmental resources. Allowing more extensive planning and coordination would likely result in greater environmental benefits.

The *"urgent and compelling" designation* would be added to stress critical repair work (Element #2). This could certainly affect the implementation of debris removal, streambank restoration, or any other practice that centers on structural repairs. This change would increase the emergency response nature of EWP and help to protect life and property. This quick response may have undesirable environmental impacts, as there may not be sufficient time for coordination with other agencies and environmental resources may be damaged. However, in combination with the changes described under *improving disaster readiness* (Element #6), the risk of these types of damages would be reduced, as training would help NRCS staff to recognize potential problems with T&E, cultural resources, and other resources of interest. The planning and coordination conducted would establish a protocol for ensuring that environmental resources are not overly affected, while not hampering the urgency of the repairs.

Establishing cost share rates (Element #4) would likely have positive environmental impacts, as EWP can complete work for sponsors that may not have been able to afford their portion under the previous cost-share arrangement. Depending on site-specific information and the type of practices used, benefits may be generated by the restoration beyond simply restoring flows and protecting streambanks. Reducing the general Federal cost-share from 80 to 75 percent likely would not have much effect in terms of reducing numbers of sites restored because the funding level has been the level applied in practice for the past ten years.

Improving disaster readiness (Element #6) should reduce adverse environmental impacts. Training would increase staff awareness to problem areas with the implementation of the various practices. Pre-disaster planning and coordination would prepare staff for what impacts to expect and allow for proactive solutions to situations that are likely to be encountered. Disaster response protocols can be established to prepare for the possible interactions with T&E species or cultural resources, and plans can be made to preserve those resources while still responding to the urgent need for repairs. NRCS staff also could be made aware of areas where these resources are known to exist or how to recognize new occurrences, and rapid response consultations with outside agencies could be facilitated. Pre-disaster planning and training would also inform staff about disaster effects that may be considered beneficial, such as certain amounts of woody debris in-stream or periodic small floods in wetland areas.

Repairs to agricultural lands (Element #7) may yield environmental benefits, as these repairs would employ streambank restoration practices described in Section 5.2.2.2, which carry some benefits and some consequences, depending on site-specific characteristics and the type of practice implemented. By repairing or restoring previously untreated land, stream degradation due to disaster impairments would decrease. Also, under the new Program, more environmentally beneficial methods would be available for implementation, which increases the likelihood of positive impacts from this restoration work. However, if repairs are made, the land would likely continue in agricultural use and may contribute to poor water quality and habitat. If repairs were not made to the site, erosion would increase, resulting in increased sedimentation.

Limiting repairs to twice per 10-year period (Element #8) would likely have mixed environmental effects. In the short term, it is likely that more structurally flow-resistant armoring designs for individual projects (e.g. longer stretches of riprap or using gabions instead of riprap) would be used to ensure that repeated damages are avoided if possible. The solution would still meet the environmental defensibility criterion, but this element may not lead to a short-term increase in greener solutions. However, at repeatedly damaged sites, floodplain easements would become the only available option regardless of previous restoration history. Therefore, this element may provide some long-term environmental benefits, unless landowners choose not to sell an easement and perform the repairs on their own. Over both the short and longer term, however, landowner repairs may have negative effects, as there may not be equal consideration of environmental, social, and cultural values, as provided by the EWP process.

Enabling single beneficiaries (Element #9) to be eligible for EWP work may generate positive environmental impacts, as previously un-restored sites may now be eligible for repairs. Depending on the site-specific details and restoration, benefits may be realized, especially if more natural restoration practices are used. Additionally, current policy may encourage single beneficiary site owners to attempt the restoration work on their own or through private contractors. These privately funded repairs would be made without interagency review or consultation, possibly resulting in greater environmental degradation over both the short and long-term, as these groups may not have the training necessary to properly address environmental considerations.

Use of *natural stream dynamics* (Element #10) may produce locally significant environmental benefits, as a closer approximation to natural stream function would be returned. Other benefits such as improved habitat and reduced erosion would also be realized. These are detailed in Section 5.2.3.1.

Repair of enduring conservation practices (Element #12) would likely offer positive environmental benefits, as discussed in Section 5.2.3.4. Repairing damaged or undersized conservation structures would minimize further environmental degradation of downstream habitat. These practices are installed for the purposes of environmental protection, such as the containment of agricultural runoff, erosion control, or animal waste management. Additionally, by requiring that these practices meet current NRCS standards, older or undersized practices would be replaced with more effective ones.

Partially funding expanded or improved alternative solutions (Element #13) may yield positive environmental effects, as discussed in Section 5.2.3.5. Supplemental work completed on EWP projects could yield improved water quality or habitat and would be subject to the normal environmental review process under EWP. The substitution of one practice for another could also give rise to significant benefits, especially in cases where the sponsor wishes to employ more natural restoration methods. Where local entities wish to install more expansive or different measures, NRCS funding and technical oversight would ensure the environmental and social defensibility of the measure.

Disaster recovery work away from streams (Element #14) can lead to environmental benefits. By restoring floodplain deposition and upland areas, the areas below (floodplains, wetlands, riparian zones and aquatic communities) can realize benefits in water quality and habitat, as seen in Sections 5.2.3.2 and 5.2.3.3. Conversely, repairing these sites may discourage floodplain easements or other more natural land uses since a landowner can continue to farm the restored land.

5.2.6.2.2 Effects of Alternative 2 Changes in Floodplain Easements

Improved disaster readiness (Element #6), as described above under *Execution of Practices*, may provide additional environmental benefits. In addition to the positive impacts listed, disaster-readiness training, coordination, and planning may encourage further identification of problem areas within the watershed and subsequent floodplain easement purchases. This change would offer broader solutions and provide for better coordination of easement purchases.

Limiting repairs to twice per decade (Element #8), as presented above, would likely encourage floodplain easement purchase of repeatedly damaged sites.

Simplification of agricultural floodplain easement purchase (Element #11) would provide some benefits and some detrimental effects, as discussed in Section 5.2.5.1. The elimination of Category 1 removes the most natural floodplain easement, as acceptable uses of the land would maximize floodplain function and natural restoration. By eliminating Category 3, the least desirable floodplain easement from an environmental standpoint, the consequences of continued cropping on floodplain easement lands are removed. The remaining Category 2 easements provide positive environmental impacts but not to the degree of the former Category 1 (by allowing compatible uses), requiring longer timescales for floodplain restoration. Simplifying agricultural floodplain easement purchase would also tend to foster reduced production of agricultural crops in the floodplain. In sum, there is no net gain or net loss of environmental benefits.

Non-agricultural floodplain easements (Element #15), as analyzed in Section 5.2.3.2, may provide significant environmental benefits. By removing developed land uses, the floodplain easement tract would be returned to a far more natural state and improved floodplain function.

5.2.6.2.3 Effects of Proposed Changes on Environmental Review

Prioritization of funding (Element #3) would likely yield some environmental benefits, as potential sites would be evaluated for unique environmental characteristics. Sites with sensitive environmental resources would be restored first, reducing the length of time in a damaged condition. This would likely benefit the environmental resource, as the source of impairment would be removed more quickly and the length of the disturbance minimized.

Defensibility review (Element #5) would ensure that social requirements are also met in determining site eligibility. Additional projects may become eligible for restoration due to some socially compelling reason. Based on previous conclusions that restoration may yield environmental benefits, these socially compelling projects are also likely to have accompanying environmental benefits. Additionally, social values may influence the environmental outcome, as a community may request more environmentally beneficial restoration practices or may be unsure of such practices and request armored structures. The former would likely result in environmental benefits, and the latter would likely result in smaller benefits than those that would have been realized by installing the practices originally proposed by EWP.

5.2.6.3 Alternative 3 (Prioritized Watershed Planning and Management)

Alternative 3 would include all of the proposed changes described in Alternative 2, while also including *disaster-readiness and mitigation*, *prioritization of watersheds*, and *coordination of disaster planning with other stakeholders*. These three additional elements are linked to one another through a watershed-level management plan, and they can therefore be discussed jointly.

The total watershed management process of prioritization and disaster planning would yield significant environmental benefits. Using a locally led process, stakeholders would increase acceptance of environmental factors such as water quality and wildlife habitat, as well as ensure that unique environmental values in a particular watershed are considered. By ranking watersheds and focusing disaster planning in high priority areas, the cumulative impacts of the disaster/repair cycle that historically have typified these areas would begin to diminish, as short-term solutions are set aside in favor of longer term ones. Easement purchases and other longer term approaches would produce substantial environmental benefits, by changing land uses to restore natural floodplain functions, reducing the amount of recurring restoration work, and introducing management strategies that are more proactive in dealing with natural disasters instead of simply responding to them. The planning process would address much larger spatial and temporal scales for disaster impact prevention/mitigation and recovery, accounting for natural variability and processes. Although still secondary to the overall goal of protecting life and property, the process would include environmental considerations as important items, promoting improved watershed health in each of the ecosystem types. Cooperation with other programs would also serve to improve watershed health, as actions by the various stakeholders and agencies would be conducted to avoid overlapping or conflicting efforts, and with multiple goals in mind.

5.2.6.4 Alternative 4 (Preferred Alternative)

NRCS' Preferred Alternative includes many of the proposed changes and would cause environmental impacts similar to those described for Alternative 2, with some important exceptions. The impacts of the Preferred Alternative are described here in three general categories in parallel with the previous discussion of impacts of the Draft PEIS Proposed Action: Execution of EWP Recovery Practices, Easements, and Environmental Review.

5.2.6.4.1 Effects of Preferred Alternative Changes on Execution of EWP Recovery Practices

Retaining use of the term 'exigency' but eliminating the term "non-exigency" under Preferred Alternative Element #1 would result in environmental benefits similar to the impacts discussed for the Draft PEIS Proposed Action. Rather than changing EWP terminology to help prioritize and focus funding on situations requiring immediate attention, NRCS would instead reinforce the originally intended meaning of the term exigency through oversight at NHQ. Rather than creating State-level pre-disaster funding to be used "on the spot" as proposed under Draft PEIS Proposed Action Element 2, NRCS NHQ would continue to oversee DSR review and funding of exigencies to ensure that only fully documented critical situations are funded under the "exigency" designation. Emphasis on this oversight requirement would be extremely important because *exigencies would be the first priority for funding* under Preferred Alternative Element 3.

Another Preferred Alternative change would also help ameliorate the problem of too many projects being identified as exigencies. Because the newly proposed *cost-share rates would be the same for exigencies and other emergencies* under Preferred Alternative Element 4, there would not be a cost-share advantage in listing a site as an exigency.

Extending the time to make repairs of exigencies from 5 days to 10 days under Preferred Alternative Element 2 will help ensure NRCS and sponsors have sufficient time for environmental review, permitting, and securing the sponsor's cost share. In contrast with the "on the spot" response time of the Draft PEIS Proposed Action, this 10-day period would reduce the chances that environmental resources might be damaged. In combination with the changes described under *improving disaster readiness* (Preferred Alternative Element #6), the risk of such damages would be further reduced, as training would help NRCS staff to recognize potential problems with T&E species, cultural resources, and other resources of interest. The planning and coordination conducted would establish a protocol for ensuring that environmental resources are not overly affected, while not hampering the urgency of the repairs.

Revising the cost share rates (Preferred Alternative Element #4) would likely have positive environmental impacts, as EWP can complete work for sponsors that may not have been able to afford their share under the previous cost-share arrangement. Reducing the general Federal cost-share from 80 to 75 percent likely would not have much effect in terms of reducing numbers of sites restored because the funding level has been the level applied in practice for the past ten years.

Improving disaster readiness (Preferred Alternative Element #6) should reduce adverse environmental impacts. Training would increase staff awareness to problem areas with the implementation of the various practices. Pre-disaster planning and coordination would prepare staff for what impacts to expect and allow for proactive solutions to situations that are likely to be encountered. Disaster response protocols can be established to prepare for the possible interactions with T&E species or cultural resources, and plans can be made to preserve those resources while still responding to the urgent need for repairs. NRCS staff also could be made aware of areas where these resources are known to exist or how to recognize new occurrences, and rapid response consultations with outside agencies could be facilitated. Pre-disaster planning and training would also inform staff about disaster effects that may be considered beneficial, such as certain amounts of woody debris in-stream or periodic small floods in wetland areas.

As was the case for the Draft PEIS Proposed Action, *making repairs to agricultural lands eligible under EWP* (Preferred Alternative Element #7) may yield environmental benefits, as these repairs would employ streambank restoration practices described in Section 5.2.2.2, which carry some benefits and some adverse consequences, depending on site-specific characteristics and the type of practice implemented. By repairing or restoring previously untreated land, stream degradation due to disaster impairments would decrease. Also, under the new Program, more environmentally beneficial methods would be available for implementation, which increases the likelihood of positive impacts from this restoration work. However, if repairs are made, the land would likely continue in agricultural use and may contribute to poor water quality and habitat. If repairs were not made to the site, erosion would increase resulting in increased sedimentation.

Limiting repairs to twice per 10-year period (Preferred Alternative Element #8) would likely have mixed environmental effects as was discussed under the Draft PEIS Proposed Action. Hard armoring may tend to be the solution chosen for first or second repairs in cases where NRCS technical staff believe a location is disaster-prone and wish to avoid a near-term requirement for a third repair. Greener solutions might be reserved for those locations that are not considered likely to be repeatedly damaged. The solution would still meet the environmental defensibility criterion, but this element might tend to weigh against any near-term increase in use of greener solutions which is one of the major program improvement goals. Offsetting this potential short-term trend would be the fact that at repeatedly damaged sites, floodplain easements or recovery funded buyouts would become the only available options regardless of previous restoration history. Therefore, this element would likely provide some longer-term environmental benefits, unless landowners choose not to sell an easement or take a buyout and perform the repairs on their own.

Enabling single beneficiaries (Element #9) to be eligible for EWP work may result in positive environmental impacts, as previously un-restored sites may now be eligible for repairs. Depending on the site-specific details and restoration, benefits may be realized, especially if more natural restoration practices are used. As was discussed for the Proposed Action, not requiring documentation of multiple beneficiaries for emergency repairs would tend to limit the number of privately-funded repairs made without interagency review or consultation, thus reducing the potential for environmental degradation over the short and long-term.

Use of *natural stream dynamics* (Element #10) may produce locally significant environmental benefits, as a closer approximation to natural stream function would be returned. Other benefits such as improved habitat and reduced erosion would also be realized. These are detailed in Section 5.2.3.1.

Allowing repair of enduring conservation practices (Preferred Alternative Element #12) would lead to environmental benefits because repairing damaged or undersized conservation structures would minimize further environmental degradation of downstream habitat and, by requiring these practices meet current NRCS standards, older or undersized practices would be replaced with more effective ones.

Partially funding expanded or improved alternative solutions (Preferred Alternative Element #13) would yield environmental benefits in terms of improved water quality and aquatic habitat where the improved projects are intended to provide such benefits and because NRCS would oversee the work and would ensure adequate environmental review as well. The substitution of one practice for another could also give rise to significant environmental benefits in cases where the sponsor wishes to employ more natural restoration methods. Where local entities wish to install more expansive or different measures to address community social values, NRCS funding and technical oversight would ensure the environmental defensibility of the measure.

Funding disaster recovery work away from streams and critical upland areas (Preferred Alternative Element #14) would also lead to environmental benefits although these would be limited by the fact that EWP would not fund projects that are eligible under ECP. By restoring floodplain deposition and upland debris areas, affected floodplains, wetlands, riparian zones and aquatic communities can realize benefits in water quality and habitat. Conversely, restoring these sites may discourage the landowner from selling a floodplain easement or putting the land to other more natural uses since they can continue to farm the restored land.

5.2.6.4.2 Effects of Preferred Alternative Changes on Easements

Improved disaster readiness (Preferred Alternative Element #6), as described above under *Execution of Practices*, may provide environmental benefits in addition to the positive impacts listed. Disaster-readiness training, coordination, and planning would also encourage further identification of problem areas within the watershed and subsequent floodplain easement purchases. This change would offer broader solutions and provide for better coordination of easement purchases. *Limiting repairs to twice in 10-years* (Preferred Alternative Element #8) would likely encourage floodplain easement purchase of repeatedly damaged sites.

Simplification of agricultural floodplain easement purchase (Element #11) provides benefits but has some limitations. Elimination of Category 1 easements has removed the most natural floodplain easement, as acceptable uses of the land would maximize floodplain function and natural restoration. By eliminating Category 3, the least desirable floodplain easement from an environmental standpoint, the consequences of continued cropping on floodplain easement lands are removed. The remaining Category 2 easements provide positive environmental impacts but not to the degree of the former Category 1 (by allowing compatible uses), requiring longer timescales for floodplain restoration. Simplifying agricultural floodplain easement purchase would also tend to foster reduced production of agricultural crops in the floodplain. In sum, there is no net gain or net loss of environmental benefits.

Non-agricultural floodplain easements (Preferred Alternative Element #15), as analyzed in Section 5.2.3.2, would provide significant environmental benefits in instances where those lands are purchased to restore full floodplain function to a larger easement area. By removing improvements, the floodplain easement tract would be returned to a far more natural state and improved floodplain function.

5.2.6.4.3 Effects of Preferred Alternative Changes on Environmental Review

Prioritization of funding (Element #3) would likely yield some environmental benefits, as potential sites would be evaluated for unique environmental characteristics. Sites with sensitive environmental resources would be restored first, reducing the length of time in a damaged condition. This would likely benefit the environmental resource, as the source of impairment would be removed more quickly and the length of the disturbance minimized.

Defensibility review (Element #5) would ensure that social requirements are also met in determining site eligibility. Additional projects may become eligible for restoration due to some socially compelling reason. Based on previous conclusions that restoration may yield environmental benefits, these socially compelling projects are also likely to have accompanying environmental benefits. Additionally, social values may influence the environmental outcome, as a community may request more environmentally beneficial restoration practices or may be unsure of such practices and request armored structures. The former would likely result in environmental benefits, and the latter would likely result in smaller benefits than those that would have been realized by installing the practices originally proposed by EWP.

5.2.6.5 Differences in Actions at Example Sites under the Alternatives

A number of the sites discussed in this document may have been repaired differently had the differing elements of the current program alternatives been available. These are discussed in detail below. Some sites involve practices that are not affected by any changes to the current program and would not have been executed any differently.

Rose River, Virginia. It should be noted that the EWP floodplain easements were not part of the Program in 1996 when EWP repairs were being made following Hurricane Fran. Therefore, the current Program alternatives as they are now could not have included agricultural floodplain easements for the Rose River site. However, the area of the site along the highway that was rip-rapped would not have changed. Protection of the streambank along that section of the highway would still have been provided.

Given that the floodplain easements would now be available under the all the alternatives to the No Action (current program), one alternative for this site could have been the following:

- Purchasing a floodplain easement for the majority of the site; about 100 acres.
- Stabilizing just the 300 feet of streambank with riprap where it was encroaching on the highway.

Several new and innovative practices that were not routinely used on other EWP sites throughout the State were employed at this site. An example is the use of vortex rock-weirs to provide grade control in the stream channel and create riffle-pool structure in the stream to provide diverse aquatic habitat. Class-3 riprap was also used to reinforce the rootwad revetments and ensure their effectiveness and long-term stability. Because this site was approximately 1 mile long and the stream structure had been totally destroyed by a flood event, it required some special considerations. Design of this site was carried out in cooperation with the Virginia Department of Game and Inland Fisheries and the Virginia Department of Forestry to ensure that issues regarding aquatic and riparian habitat were properly addressed and principles of natural stream dynamics were properly employed in the restoration design. Using the defensibility criteria being proposed, the use of the innovative practices installed could be justified under any of the alternatives to No Action.

Long-term stabilization was accomplished using USDA Conservation Reserve Program funds and U.S. Army Corps of Engineers mitigation funds to purchase trees, and personnel from Trout Unlimited to plant a riparian forest buffer from which livestock were excluded. This combination of programs and practices addressed all aspects of long-term stream health for this model restoration site where both in-stream and bank stabilization practices were incorporated for a comprehensive restoration project.

Buena Vista, Virginia. It is unclear which additional practices would be needed as part of the alternatives. Floodplain easements are not an option within this urban setting because of the large number of houses and limited benefits of such an option. However, there are approximately 10 to 15 structures located in the frequently damaged areas that could be moved out of the floodplain. Under Alternatives 2 and 3 this could be accomplished by purchasing non-agricultural floodplain easements and restoring the floodplain. Under the Preferred Alternative, it could be accomplished by a cost-share to buy-out the frequently damaged structures and a local project sponsor to purchase the land for floodplain restoration. The City has applied to FEMA for assistance in relocating or elevating approximately 44 structures within the floodplain. This proposal is still viable but has not been implemented at this time.

The longer-term solution which has been selected by the city for this watershed is to construct channel improvements and sediment basins in specific areas throughout the City. NRCS has helped the community develop a flood control watershed plan under the authority of Public Law 83-566 for the community that describes the proposed practices that could be implemented. This plan is currently in the review and approval process for OMB and Congress. This plan is an example of what would be proposed under Alternative 3.

It should be noted that this watershed received EWP assistance three times from 1992-1996 because of flooding which severely damaged the entire community. The proposed limitation of 2 repairs within a 10-year period could affect the EWP Program in this community in instances where the same practice, for example the gabions installed for stream stabilization, is repeatedly damaged. Since purchase of EWP floodplain easements does not appear to be a viable option, this community would suffer with the proposed limitation if that were their only recourse. They have chosen to permanently remedy the situation through participation in the PL 83-566 program. However, there is limited funding under PL 83-566 program and it may take some time to obtain the needed funds. If Alternative 3 were an option for the local sponsors and they can secure additional funding from other sources, they may elect to construct the needed practices using EWP funds.

Rocky Run, Virginia. This site is located in a rural setting with a small 15-unit subdivision where 8-10 houses get flooded frequently. In the past, the Rocky Run was diverted and re-channeled to allow for the construction of the homes. This stream has jumped the banks several times in the last 10 years as it attempts to return to its original channel. EWP assistance has been provided to restore the channel to its pre-flood re-channeled location. This site is an ideal situation for either the use of improved land floodplain easements under Alternatives 2 and 3, or the buy-out recovery measure that would be available under the Preferred Alternative. Any of these program options would assist the residents to relocate their homes out of the floodplain and allow the stream and floodplain to be restored to a more unrestricted flow regime.

Dry River Dam, Virginia. This PL 83-566 dam was repaired using the Chief's exception to the current Codified EWP Rule. If NRCS were to repair this structure under any of the proposed alternatives, it would be done the same way. The only other choice would be to breach it in order to prevent a dam failure with potentially catastrophic results. This would negate all the benefits it was originally built to provide. No additional practices would be needed in the upstream watershed since it is forested and flows from the George Washington and Jefferson National Forests.

East Nishnabotna River, Iowa. Policies under the alternatives to the current Program would have had little effect on the execution of the East Nishnabotna restoration work. Soils in this area are highly susceptible to erosion and the channels are constricted by levees. Therefore, the work completed under the current program would remain necessary to remove the threats to the properties. Using the principles of natural stream dynamics may not be effective, as the crops generally are planted directly to the edge of the bank and a meandering stream may destroy substantial amounts of cropland. Floodplain easements, on the other hand, might have been a useful tool in mitigating the damages.

5.3 EWP PROGRAM IMPACTS ON HUMAN COMMUNITIES

An assessment of the EWP Program effects identified and evaluated the social, economic, and other "human-based" resource elements of the environment (that is, the social environment). The process included developing a meaningful description of the social setting in which the proposed alternatives are implemented, isolating those components that may be affected, and describing the magnitude and extent of anticipated effects.

The potential socioeconomic effects of EWP Program practices in the affected communities are derived by comparing the prevailing social conditions in selected example communities before the disaster (pre-disaster) with those immediately following the event (post-disaster), as well as those following the installation of EWP Program practices (post-EWP). The prevailing social conditions before the disaster are presented by the description of the Affected Environment in Chapter 4 and further detailed in Appendix D for the communities selected as example demonstration sites for EWP Program practices. The potential effects of a natural disaster on the affected communities are addressed here as part of the impact assessment, along with a general review of the potential effects of the EWP Program and a summary description of Program effects at the selected example communities. The comparison of the effects of the EWP Program alternatives is based on a generalization of the effect of the Program alternatives on individual communities and forms the conclusion of this assessment.

5.3.1 Assessment of Human Community Effects

The economic and social effects of the EWP Program are the result of a complex interrelationship between the project activity and the existing social conditions of the affected communities. Each community's response to the changes resulting from the implementation of a particular alternative will be unique. This unique response arises from individual variations among communities in terms of their economic conditions; previous social history, population characteristics, social organization, and the prevailing culture and character.

5.3.1.1 Elements of Human Communities Assessed (Jobs, Income, Services, and Resources)

Social communities are complex and dynamic. The range of potential direct and indirect effects associated with EWP Program practices is diverse. To characterize these impacts in the context of the communities affected, it was necessary to define certain key elements, or social variables. These indicators are logically connected to actions that are a part of the EWP Program alternatives and represent direct and indirect effects of the proposed practices on the social structure and patterns of the affected communities. Changes in these variables as the result of an EWP action would reflect important changes in other aspects of the social structure as well.

Eight specific variables serve as indicators of potential effects on the socioeconomic environment from the EWP Program. The eight are grouped into three categories:

- Effects on business and the local economy;
- Effects on infrastructure, public health and safety, and community resources; and
- Effects on community, structure and social patterns.

Business and the local economy includes the potential effect on employment and income in the community as well as changes in the value and quantity of natural resources (land) available to the community that may serve as a source of investment or raw material input to production. Effects on the *infrastructure, public health and safety, and community resources* relate to elements of the community infrastructure (utilities, energy, waste treatment, transportation, etc.), services (police, fire, hospitals, social assistance), physical property (houses, commercial and industrial buildings, other structures), and resources (cultural, educational, recreational, aesthetic). *Community structure and social patterns* are a function of the demographic composition of the community, existing land uses in the adjacent and surrounding community, and the characteristic patterns of interaction and attachment to the community that may exist among residents.

An impact, or effect, is defined as either a quantitative or qualitative change in some aspect or characteristic of the environment. This change is evaluated in terms of its potential (on balance) to result in an adverse or beneficial effect on the human social community. The magnitude and extent of the potential effect is a function of the intensity and duration of an associated activity, and the extent of the total land area or size of the community segment affected by the action.

5.3.1.2 Assessing the Effects of EWP Program Projects Nationally Using Typical Rural Communities

For the programmatic assessment of the proposed alternatives, the socioeconomic environment is defined as a generalization of the social characteristics of the communities addressed by the EWP Program. These characteristics are selected on the basis of their relevance to the assessment and comparison of the proposed Program alternatives. They reflect the anticipated effect of the Program in addressing the specific threat to life and property associated with a natural disaster.

Implementation of the selected EWP Program practice itself, however, will have additional consequences for the local community. These effects reflect necessary activities associated with the implementation of the proposed practice in the local community. Examples of these activities include those associated with Program expenditures, changes in land use or function, or the acquisition of a floodplain easement. Therefore, the potential effects of the EWP Program include both the outcome of the Program activity as it relates to the alleviation of a potential threat and those associated with the implementation of the proposed practice itself. These effects are demonstrated by the examination of specific EWP Program project impacts in selected example communities.

The assessment of the socioeconomic effects of the EWP Program practices focused on six communities selected as examples of each of the five rural community types identified in Chapter 4 (Section 4.1.3). Three of these communities also were the subject of the cumulative effects assessment described in Section 5.4. As described in Chapter 4, effects are found in both rural and metropolitan areas. One of the communities selected for this assessment, the Boise Hills community, was selected because it also demonstrates potential downstream beneficial effects in a major metropolitan area, in this case the city of Boise.

Floodplain easements represent a categorically distinct option that would not be appropriate to all settings; therefore, a separate analysis was conducted for the socioeconomic impact of floodplain easements. A sixth community, considered a plausible candidate for the potential use of the floodplain easement option, was included in the assessment along with the original five communities. Table 5.3-1 summarizes the impact assessments that were conducted for each of the six sites described in the affected environment section of Chapter 4 and in Appendix D

Table 5.3-1 Socioeconomic Assessments Conducted for Selected Sites

Community	Bethel Road, GA	Buena Vista, VA	Boise Hills, ID	Shenandoah, IA	Rocky Run, VA	Rose River, VA
Community Type	Multiple farms	Independent city in rural area	Rural portion of metro county	Incorporated rural community	Residenti al cluster	Multiple farms
EWP Practices	Debris removal	Debris/ cobble removal	Critical area treatment	Levee repair	Gabions and riprap	Debris removal
Socioeconomic Impacts Practices	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic Impacts, (Hypothetical) Floodplain easements	No	No	No	Yes	Yes	Yes
Cumulative Impacts, Watershed	No	Yes	Yes	Yes	No	No

5.3.2 Effects of Natural Disasters on Human Communities

The general social effects of a natural disaster (and also the primary criteria for defining a natural event as a disaster) are that some level of stress is placed on the economic, social, or physical infrastructure of a given community. This stress results through the direct damage or destruction of a given resource or through the creation of a continuing threat to life and property. The level of stress in these situations normally grows beyond the capability of existing institutional structures, social services, and support networks to cope, to absorb the change, 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. 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, or 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 the damage, as well as the destruction of infrastructure, housing, or other community resources. Additionally, natural disasters have the potential to be traumatic experiences for local residents, possibly leading to psychological impacts.

5.3.2.1 General Discussion

In addition to the direct physical effects of a natural disaster, the patterns and structures of social life within the community may be altered. Dislocated businesses or services may disrupt neighborhoods and communities. Local sources of employment and income may be temporarily or permanently lost. Disasters also can affect the appearance, quantity, or value of land available to the community as a source of current and future investment or as the source of productive resources. Where public revenue is required for disaster response and recovery, other socially beneficial or valued programs (such as education or recreation) may be denied funding because the money has been spent on disaster recovery (Myers, 1997). Other effects may include the temporary or permanent disruption of services to the community or the destruction of important cultural or social resources.

For individuals within the community, increased levels of tension, anxiety, and interpersonal conflict are evident (Morris-Oswald, 1997). The immediate or long-term evacuation of residents during reconstruction may require the inconvenience of living in temporary housing, sometimes far removed from the permanent place of residence. An additional source of strain for both business and residential property owners results from the time (normally uncompensated) required to clean up and repair damage or from the long-term effects of damage that is not repaired (Cushing, 1999).

The major sources of effects on individuals and communities resulting from a natural disaster can be grouped into the impact categories noted above. Table 5.3-2 presents a summary overview of the consequences of a natural disaster for the human social community.

5.3.2.2 Summary of Disaster Impacts in Six Example Communities

Each community represented to demonstrate the socioeconomic impacts of EWP Program practices in Section 5.3.2.2 has been affected by natural disasters associated with the regional watershed. Although short-term impacts normally are the greatest concern for local residents and business entities, these impacts also may have long-term consequences if repair and restoration are not accomplished. The affected areas are primarily rural in character, therefore, impacts on agricultural areas of the watershed region are especially important. In several cases however, the effects of watershed disasters also extend to large population centers in nearby urban and metropolitan communities. Table 5.3-3 presents a summary of the post-disaster impact of the natural disasters occurring in each community selected to demonstrate socioeconomic impacts.

Table 5.3-2 Summary of Socioeconomic Effects of Natural Disasters

Community Aspect	Potential Effect
Economic Structure	
Employment and Income	Loss caused by threat or damage to or destruction of individual firms, agricultural production, recreational, or other economically productive resources. May also be indirectly affected by changes in the cycle of business activity, alterations in supply demand relationships, or a change in the relationship with external firms or market sectors.
Value and Quantity of Natural Resources	Change in quantity and condition of the land and associated resources caused by loss or damage may affect both current economic value (represented as a capital loss to its owner) or its desirability as a source of future investment (especially by outside entities), potentially threatening community viability and future growth.
Infrastructure and Resources	
Infrastructure	Damage to the essential elements of community infrastructure (i.e., water supply, waste treatment, transportation, or power systems) may have both short-term consequences for the conduct of social life and long-term implications for public revenue expenditure for restoration.
Property	Loss of residential housing and other important economic or culturally significant buildings may affect the immediate quality of life in the community or in the long-term, may represent an irreplaceable loss.
Public Health and Safety and other Community Resources	Indirect effects on the community include increased demand on public revenue and other resources to assist in post-disaster recovery. Other consequences may include loss or impairment of emergency services, increased risk to public health, social assistance and basic services. Aesthetic, recreation, and other resources also may be affected.
Social Pattern and Structure	
Demographic Composition	Change in the size and composition of the local population may result from the loss of housing resources and out-migration in response to a perceived continuing threat or to the negative perception of long-range desirability of the community.
Land Use	Potential threat or actual loss may alter existing or planned uses of certain properties essential to community life or economic production. Alteration of physical appearance may diminish the value of adjacent or neighboring properties.
Community and Neighborhood Social Patterns	Loss or damage to property may result in the disruption of residential networks important to the social life of the community. Loss may also include culturally important facilities such as churches, schools, and community centers, as well as commercial and retail outlets for basic services.

Table 5.3-3 Summary of Post-Disaster Socioeconomic Effects on Rural Communities

Bethel Road, GA	Buena Vista, VA	Boise, ID	Rocky Run, VA	Rose River, VA	Shenandoah, IA
Employment and Income					
Agricultural production from two private farms lost	Potential loss of retail and manufacturing employment	Income from recreational and agriculture uses; threat to central city	Affected areas contain no economically productive facilities	Loss of production from two private farms and pasture	Potential loss of retail and commercial income
Natural Resources					
Diminished land value due to physical and visual damage	Decreased attraction for industrial and residential development	Diminished value of adjacent areas; potential threat to planned development	Value of residential properties diminished	Diminished land value due to physical and visual damage	Value of land area for development and other uses diminished
Infrastructure					
Two public roads and storm drainage structures	No disruption of services; some effect on roadway and other facilities	No significant disruption; potential threat to water quality, public roads, storm drainage	No significant disruption, some potential threat to local transportation	State Road protected with riprap at lower end	Local airport, public highway; impaired wells contaminated or collapsed
Property					
Two private dwellings and associated farm outbuildings	Residential areas and two manufacturing facilities are threatened	Limited damage from fire; flood significant threat majority of community	Fifteen residences damaged or threatened	Two residences, state road, farm buildings, and other structures	Residential areas, retail, and commercial structures affected
Public Health and Safety, and other Community Resources					
No major impact, some loss of visual quality	Visual quality of the affected area compromised	Loss of major recreational area; viewshed destroyed	No major impact to resources	No significant resources; visual quality compromised	Major effect on recreational and other significant areas
Demographic Composition					
No major change to current configuration	Slight decline in population; potential for new growth threatened	No major effect from fire; flood threat affects older neighbor-hoods, suburban areas	Potential dislocation of approximately 42 individuals	No major change to current configuration	Local residents displaced or threatened by flood damage
Land Uses					
Existing land uses threatened	Potential threat to future planned uses in the urbanized areas	Recreational uses of burned area lost; threat impedes regional plan	Threatens residential use of land in the immediate area	Existing land uses threatened	Potential threat to current uses and future development plans
Social Patterns					
No major change to current configuration	Potential disruption of neighborhood; viability of community threatened	Indirect effect from threat to neighborhood posed by subsequent flooding	Disruption of neighborhood; potential threat to viability of residential community	No major change to current configuration	Potential for disruption of residential networks and neighborhood patterns

5.3.3 Impacts of EWP Program Projects on Human Communities

The rural quality of the communities potentially affected by EWP Program activity introduces certain special characteristics unique to the rural environment. Affected communities generally are small, with populations of less than 10,000. In many cases, they consist of unincorporated villages, hamlets, and housing clusters that may lack a distinct economic base. In some cases, these communities may be integrated economically with nearby metropolitan centers or with the regional economy, while others may be self-sufficient and isolated. In general, characteristic patterns of community life, the presence of shared values and information, and a sense of community identification define each of these communities in a uniquely rural context.

The resources, institutional structures, and service delivery mechanisms of these small communities are often smaller-scale, more informal in structure, and more diversified in function. Correspondingly, local resources in the form of land, employment opportunities, natural qualities, cultural features, and the quality of social life may be more important, more highly valued, and correspondingly more difficult to replace if lost or damaged, either by a natural event, or in the process of eliminating the threat to life and property that may result from a future disaster event. In many cases, there may not be an identifiable community center where public activity (commercial, administrative, and recreational) is carried out, or specific boundaries that define the parameters of the community.

5.3.3.1 General Discussion

The socioeconomic impact assessment addresses the relationship of each impact element to the EWP Program from two perspectives. The first is the effect of the Program as it relates to the elimination of the direct or potential effects of a natural disaster by reducing the potential risk to some socially important or valued aspect of community life (such as human health, or the protection of homes, businesses, or some other important social facilities within the community).

The second is related to the requirements of the proposed EWP Program practice itself, including construction activity or physical structures required for the immediate protection of property, or the purchase of floodplain easements or title to land as a means of eliminating the object of the threat instead of the threat itself. Capital expenditures, additional employment, additional land and facilities associated with construction, physical alteration of the environment, or fiscal and administrative requirements to be met by sponsors, property owners, public entities or other elements of the community, may be considered. The EWP Program requires that the effect of the proposed action must be acceptable to the individual property holder and the community as a whole (NRCS, 1999).

5.3.3.1.1 EWP Program Impacts on Business and Local Economy

The extent of potential effects of the EWP Program is related to the potential for the reduction of risk to human health and property or protection of the value and utility of existing land, structures, or other facilities. Also related is the value of economic contribution or loss (e.g. additional employment or income) that may result from EWP Program activity in the local community. It is reasonable to assume that the proposed Program alternatives will have the potential to affect the local economic climate of participating communities by influencing the type of practice implemented and the manner of its implementation.

The purpose of assessing potential economic effects is to estimate changes in employment, income, and levels of business activity that may result from EWP Program activities (Leistritz, 1994). Direct effects are those immediately attributable to the disaster itself, such as loss of life, injury, capital losses, crop damage, damage to public and residential structures. Indirect consequences, which follow from those immediate impacts, include such changes as interruption or alteration of business activity, changes in employment caused by a loss of capital, or changes in regional supply relationships. Two primary circuits of capital are important, one involving the circulation of capital into and out of the production/consumption cycle, and the second involving capital investment in land and infrastructure (Gottdiener, 1994).

Employment and Income

Local industry, and therefore, employment or income, may be affected by EWP Program projects thorough the expenditure of project funds, hiring of local residents for proposed work, or by noise, visual, or other impacts that interrupt business activity. To the extent that money is spent in the local community in support of the proposed action, the local trade and service sector of the economy can be expected to experience some direct and indirect increase in employment, as well as additional income from sales of products and services. This cycle of spending is the basis of an economy's multiplier effect and is predicated on the assumption that an increase in external activity (i.e., sales outside the community, in this case, in the form of contract services) will create a corresponding and amplified economic effect within the community.

The magnitude of the change is dependent on what proportion of the Federal share of EWP Program funding is actually spent locally with each new round of expenditure and what proportion is lost in the form of taxes, savings, or the purchase of products and services that are not available within the local community. Community resources flow very quickly from communities where there are limited institutions and resources to meet the requirements of local residents (LaMore, 1995). Indirect effects may include the creation or expansion of local businesses or the creation of secondary or indirect employment as a function of direct expenditure and employment. In contrast, monies or services-in-kind offered as the community share of the project may offset the local gain in the economy from Federal funds.

Because of the competitive nature of contracting operations for the EWP Program projects, and the limited resources available in most of the target communities, much of the work associated with an EWP Program project will likely be contracted to firms outside the community. As a result, much of the dollar value of a project will be lost to the community. It is reasonable to assume, however, that some increased revenue will be available to the local community in the form of money spent by temporary workers, through employment of available local workers, or by contracting portions of projects to local firms that may have the necessary resources to perform certain parts of an EWP Program project.

Changes in local employment and income also may be a result of restoring impaired facilities and resources. Smaller rural communities tend to be net exporters of labor, either to the surrounding regional area, or by commuting to nearby metropolitan centers of employment. Indigenous employment in sectors such manufacturing, agriculture, services, or construction also is important to the local economy. To the extent that EWP Program practices restore the economic productivity of land and associated facilities that might otherwise be destroyed or abandoned as a result of a natural disaster, a beneficial impact to the local economy is realized.

Value and Quantity of Natural Resources

Natural resources, defined economically, refer to the stock of environmentally provided assets (land, soil, forests, minerals, water, fauna, wetland areas, etc.) that represent the useful materials that are the raw input or consumable products of human production. The quantity and condition of natural resources are both important. In addition to their utility value, these assets also represent a source of investment income to the current owner and a source of future investment in the community by outside sources. Natural resource assets may be damaged either by the disaster or by implementation of the proposed EWP Program practice.

Protecting property such as land for investment becomes an important beneficial impact of the Program, while potential loss of productive agricultural, commercial or residential property, or diminishment of its attractiveness, may represent a serious negative impact, even though the overall benefit of the project is positive. A change in the quantity or condition of land may decrease agricultural production and will affect the local economy. For many communities, potential income from recreation and tourism, and additional income realized from a growing base of retiree in-migration may be an important contribution to the local economy.

The value and quantity of natural resources may change with the restoration or improved condition of land, the damage or destruction of land during construction, the removal of threat to a designated property, or the removal of existing productive (or residential) land from the economic base through the exercise of a floodplain easement on the property. A floodplain easement will permanently remove land from production or investment, thereby diminishing the available capital stock of land as part of the economic base of the community.

Removing a potential threat to the land or property may increase its value, or at minimum, restore it to its original value before the disaster. With residential property, Fridgen and Shultz (1999) found that flood risk was a significant factor in the valuation of residential property. Several studies have found that floodplain property values are lower than those land values outside the floodplain (e.g., Damianos and Shabman, 1976; Donnelly, 1989), while others found no variation in value. Two studies concluded that residential land values within floodplains were nearly 12 percent lower than land outside the area (Holway and Burby, 1993). Similar results were found for vacant lands.

Correspondingly, the property itself and any adjacent properties may be subject to increased value and subsequent development pressure should the immediate threat of a natural disaster be removed. Early studies of flood control programs indicated that, “for every six dollars in potential flood damage savings, at least five dollars was lost through increased floodplain occupancy” (Moore and

Moore, 1989). Much of the early justification for funds was due to eventual habitation of these areas. However, studies conducted on the values of land protected by such programs and practices as the EWP Program implements have varied results.

5.3.3.1.2 EWP Program Impacts on Infrastructure, Public Health, and Community Resources

Although economic factors are a primary aspect of the decision to implement one or another of the Program alternatives, certain social and community factors also become important. The characteristics of the proposed project may have the potential to impair or disrupt the local community through changes in the associated property, infrastructure, public health and safety, or other resources important to the local community. These changes, either beneficial or adverse, can substantially alter residents' perception of the quality of life in the community or threaten the continued viability of the community itself.

Property

Changes may result from the removal or perpetuation of a threat to specific properties, the restoration of damaged or unusable properties to productive use, or the exercise of a right of way or floodplain easement for the construction of a practice. Using a floodplain easement as a mechanism to restore watershed areas to a much better natural condition is another area of potential influence. Removing a threat contributes to the protection of valued structures and community settings, thereby enhancing the character and desirability of the community.

The potential loss of a structure due to a floodplain easement or failure to restore has the potential to disrupt local social life and may have an adverse impact on important cultural events. Apart from direct project-related actions, the effect of a change is also influenced by the character of the community setting, the presence of informal support systems and mechanisms, the current value and age of the structure, and considerations of existing vacancy rates.

Infrastructure

EWP Program project activities have the potential to increase or decrease the requirements for basic infrastructure services within the community. Elements of the local infrastructure can be jeopardized by the existing watershed impairment, if not removed. Likewise, the requirements of the project (water, land, transportation, and temporary workers) may place additional stresses on existing infrastructure resources or, as in the case of local transportation, block or obscure essential services. Infrastructure impacts on the cost and quality of public services has an influence on residents' sense of well being and satisfaction with the community (Burdge, 1995).

The existing and future water supply, municipal waste treatment and discharge, sewer lines, power lines and substations, natural gas pipelines, or transportation facilities are of concern both for the comparison of EWP Program alternatives and for the impact of specific projects on participating communities. Potential demands that are increased beyond existing capacity or service that is impeded will have an adverse impact. Conversely, where project actions restore or protect infrastructure resources, a beneficial impact may be offsetting.

Community Resources

The availability of social services such as those related to public health and safety, emergency response, social assistance, and other basic services are especially important to the maintenance of the social life of rural communities. However, they may be either temporarily or permanently affected by the implementation of EWP Program practices. Similarly, community resources, cultural, educational, civic, or recreational and aesthetic opportunities may be lost or impaired. Both the existing watershed impairment and the project efforts to restore the watershed and reduce the existing threat to life and property may result in a change.

The most important effect of a natural disaster is to increase the level of risk to the life and health of the residents of the affected community. EWP program measures have the potential to reduce the potential level of risk both directly through the repair and restoration of damaged land, and the corresponding removal of threat to life and property, and indirectly by restoring the operation of local public health and emergency response services. In addition to the direct threat to residents or users of affected properties, natural disasters may cause impairment to the normal operation of public health and safety systems. EWP practices that protect vital infrastructure, or transportation routes, hospitals and other medical facilities have the additional benefit of contributing to the general health and welfare to the community at large.

Apart from direct impacts on the land and physical structures, project-related employment may affect local demand for basic services such as shopping, food, and entertainment, as well as for necessary social services, public assistance entities, and educational or social support services. Other concerns may exist for potential changes in local government services or anticipated increases in local tax rates to provide needed temporary service or the sponsor's share of proposed projects. The ability to provide these services affects the availability of public capital for investment in social development. Sensitive local buildings and structures such as museums, churches, cemeteries, theaters, or nursing homes, public housing, or retirement facilities also may be affected.

One of the key components of quality of life for many people is the availability of open space, parks, and recreational facilities (Hollis et al., 1999). The level and reliability of service, as well as the level of satisfaction of local residents may be directly affected. Either the beneficial removal of an existing threat or the requirement to alter the quality or appearance of a viewscape or other facilities such as trails, parks, or natural recreation features such as rivers or lakes, may have an impact. For many communities, these resources represent a source of economic income from tourism as well as a recreational resource for local residents.

Where community facilities are protected or the previous use of a damaged facility is restored, a beneficial effect of the program can be anticipated. The potential for a negative impact also exists as a result of the potential increased demand on or impairment of these resources that may be related both to the manner of the project execution or to project activity in the form of the proposed practice at a specific site. Questions related to who bears responsibility for the cost of maintenance or repair, and to the source and availability of additional resources necessary to restore damaged services or to create additional service capability, become important.

5.3.3.1.3 EWP Program Impacts on Community Structure and Social Patterns

Determining the potential effect of the program on the character and social structure of the local community depends on consideration of potential changes in a number of social characteristics. For some projects, construction-related activity, the protection of land through installation of protective mechanisms, or the exercise of floodplain easements have the potential of affecting the demographic composition of the local community. Also important is the potential to disrupt historic or established neighborhoods within the community, unique residential networks, or communities (Cantor, 1993).

Demographic Composition

Population-related consequences of the project on the local community may include changes in the size, age, racial and ethnic composition, poverty and income levels, or residence patterns of the community. Effects may be short-term in the case of temporary workers present in the community during the construction phase of the project, or the temporary displacement of local residents. Long-term effects may result from permanent in-migration or out-migration in response to project-related activity. These changes may indirectly influence other aspects of social life, including the community setting and character, the size and structure of local government services, the availability of housing and community services, and alterations in the patterns of natural resource use. Of particular interest for the implementation of EWP Program practices is the presence of sensitive populations in the immediate area of the project.

Land Use

Changes in land uses resulting from EWP Program implementation are possible where potential threats are eliminated, previous land uses are restored, or alternative development options change the attractiveness of existing land. The magnitude of any effect will be influenced by certain community factors such as the general character of the community setting and the importance of the previous land use (recreational, income producing, residential, open space, etc.) to the social life of the community or the maintenance of the watershed.

At the site level, the physical alteration of the environment may affect visual appearance or other characteristics, altering the suitability of the land for certain uses. Alterations to the land used as a staging area or to provide access to the project during construction or for subsequent maintenance requirements, must be considered in addition to any new changes to land uses. Exercise of a floodplain easement affects the land's potential use irrespective of any other physical change.

On a large scale, the EWP Program may affect several pieces of land use regulation: local zoning, comprehensive planning, farmland preservation, and the control of urban development. Each element can be addressed on the local level through land use planning mechanisms already in place. While Alternatives 1,2, and 4, discussed in Sections 5.3.5.1, 5.3.5.2, and 5.3.5.4, respectively, address more localized land use decisions such as zoning ordinances and comprehensive planning, Alternative 3 encompasses land use decisions and planning tools on a larger scale. See Section 5.3.5.3 for a discussion of those decisions.

Local land use decisions that are applicable to EWP Program components differ, encompassing legislative, administrative, and quasi-judicial ones. Administrative decisions require objective standards for decision-making and can be made by a planning officer of the jurisdiction. A legislative body, such as a County Council, has the final power to make policy and zoning decisions. Their decisions are subjective and can be influenced by politics. Quasi-judicial bodies such as a board of adjustment will hear facts about a case, often an appeal of a zoning decision, and make a judgment. The type of land use decision will dictate the amount and type of evidence and information needed to make local decisions (Callies et al., 1994).

The EWP Program practices would be closely related to current zoning within the affected community. One commonly occurring example is that of a floodplain ordinance regulating development within a designated area. This ordinance could be part of the local zoning code or may exist as a separate regulation. Floodplain ordinances are often based on FEMA-delineated floodplains and floodways. The ordinances usually prohibit all development in the area, or they impose building elevation requirements for structures. EWP Program components should be checked against existing regulations to identify potential conflicts.

Land use and comprehensive plans also are important considerations for EWP Program coordination. The practices should be compatible with the long-term vision of the community's spatial structure. The standing comprehensive plans could influence EWP Program decisions regarding particular practices in designated areas. The need to demonstrate how a development application follows the intent of the comprehensive plan is required in many legislative and quasi-judicial decisions.

The legality of floodplain ordinances has been challenged in takings claims. Regulatory takings are those where a land use regulation is so restrictive that it constitutes a taking of private property. This can sometimes be a concern with floodplain easements as well as any land use regulation. The following case is an example of a land use regulation challenged on its 'over-regulation'.

In *Responsible Citizens v. City of Asheville*, the validity of the floodplain ordinance was upheld. The court used two tests for determining if a taking had occurred through the enactment of this floodplain ordinance. The first test was whether the end goal of the floodplain ordinance was within the police power granted to the local government; the second, whether the means by which this goal was obtained were reasonable. The court found that protecting the public safety is a permissible objective, and preventing floodway obstructions and requiring flood-proofing of structures is a reasonable means of achieving this (Owens, 1999).

Community Structure and Social Patterns

Project-related effects might result in the breakup or isolation of specific neighborhoods, affecting the sense of community and disrupting important networks that support local residents. Disruption may result from the maintenance of important social networks and from necessary economic functions (such as the barter exchange of construction or mechanical skills among neighbors, or the exchange of services like transportation or child-care). Also potentially affected may be significant cultural and social institutions such as churches, social centers, public buildings, or unique structures that have special meaning to local residents even though they are not specifically eligible for consideration as historic or cultural resources. Consequently changes in the patterns of interaction of local residents can occur (Gramling and Freudenburg, 1992).

The potential for relocation or temporary dislocation of significant segments of the population, either because of land requirements for new construction or floodplain easement purchase, also represents a significant potential for disruption to local community life. It may also threaten the continuing viability of the community, especially in smaller rural areas. Land acquisition may disrupt social networks, both for families that may be relocated and for those that remain in the affected area. Burdge (1987) found that the resiliency of large family-based communities was lost when the families that comprised the community lost land or were forced to relocate.

A high level of social cohesiveness often characterizes rural communities. Cohesion in this sense refers to the forces or attractions that hold members of a community together and is based on the quality of social life within the community. Anything that may decrease the desirability of the community itself, or the desirability of associating with or identifying with the community, may have a detrimental effect on the level of cohesion and the corresponding sense of community (Finsterbusch, 1980). Local change, the loss of stability, or a sense of traditional identity can significantly affect this level of cohesion, especially in small, traditional, rural communities. Correspondingly, the protection of these elements may be considered a uniquely beneficial impact, depending on the specific characteristics of the individual community.

5.3.3.1.4 EWP Program Impacts on Environmental Justice

Executive Order 12898 (1994), "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," requires that Federal agencies consider as a part of their action any disproportionately high and adverse impacts on minority or low-income populations. This consideration has three components: 1) a demographic assessment to identify minority and low-income communities that may be present in the affected area; 2) an integrated assessment of disproportionately high and adverse impacts on these communities; and 3) the increased involvement of the affected public in decision making and potential mitigation strategies (Wilkinson, 1998).

A primary objective of the EWP Program is its equitable administration: the accessibility of information about the EWP Program components, the availability of project assistance to individuals and local communities, and the consequences of project implementation. Of essential concern is the identification of those who benefit and those who are disadvantaged by the implementation of one or another of the proposed alternatives and whether the individuals or populations involved are representative of either a recognized minority or socioeconomically disadvantaged (poverty) status. Also of concern is the presence or absence of small, local businesses and small farm operators, especially minority contractors who may be present and who could perform required EWP Program construction work.

The potential effect of the proposed alternatives on limited-resource farmers, ranchers, and communities is another area of concern. Limited resource farmers and ranchers are defined as those having a distinct disadvantage in obtaining USDA program assistance (NRCS, 1998). Limited-resource communities are defined as those where average housing value is less than 75 percent of the State housing value average, where the average per capita income is 75 percent or less than the national per capita income and where current unemployment is at least twice the national average over the past 3 years based on annual unemployment figures (USDA, 1988). The capability of the community as a whole to provide local sponsorship and to absorb the costs associated with sponsorship is also important considerations in determining local effects.

5.3.3.2 Impacts in Typical Affected Communities

To demonstrate the potential socioeconomic effects of the EWP Program at the community or site level, an assessment was made of the potential impact of the installed practices on six example communities. These communities were selected to reflect the more important characteristics associated with each community type and represented a varied sampling of EWP Program installed practices, (e.g., streambank stabilization, debris removal, revegetation, levee repair).

For purposes of the demonstration assessment, the result of the No Action alternative (Alternative 1) is described for each community to serve as a basis of comparison with the other alternatives. The results of the analysis from each of five communities, while not strictly a representative sampling, can be generalized to other communities of the same type. Under similar conditions, the anticipated effects of EWP Program actions would be similar to those identified here for the six communities.

In general, the primary effect of EWP Program practices in the watershed communities selected for this assessment is evident in the beneficial aspect of repairing and restoring the affected area to its pre-disaster condition and use. Protected land areas are regained by the community as part of the economic base or as residential, investment, or natural use areas. From a programmatic perspective, the primary consequence of EWP Program action is to mitigate the effects of natural disasters in the subject communities. This mitigation often results in a potential for increased human habitation and higher levels of social and economic dependence on these disaster-prone areas of the watershed region. An adverse effect on the associated watersheds can be anticipated where increased development results in an increase in urban or agricultural runoff.

5.3.3.2.1 Effects on Business and the Local Economy

For each of the six sites included in the assessment, direct effects on the local economy resulting from potential employment or project expenditures in the local community are minimal. With the exception of the Boise Foothills project, the scope of the EWP Program practices in the other five communities was relatively small and the time required for the construction phase of the project relatively short. The smaller community size also limited the institutional and commercial entities that might be present to supply goods and services to the projects, thereby limiting the communities' ability to absorb project expenditures. This is especially true for the Rocky Run community, which is entirely residential and for the smaller, single, or multiple-property projects such as Rose River, VA, or Bethel, GA. However, some demonstrable income may have been created in the larger community settings such as Buena Vista, VA, and in the Shenandoah, IA, projects. The larger effort in the Boise Foothills project, in conjunction with the increased economic capacity of the larger community, enhances the ability of the community to capture additional income and employment from the project.

The primary benefit to each community examined is related to the effect of the installed practices in restoring or protecting the existing value and utility of natural resources, in this case the quantity and appearance of land and other resources in the community. In the case of the smaller projects, this benefit is confined to one or two agricultural properties, whereas the effect on communities such as Buena Vista, VA and Shenandoah is experienced more as a benefit to the entire community. This is especially true in the case of the Boise Foothills where the outcome of the project provided a significant benefit in restoring the value of the mostly residential and commercial land adjacent to the burn area. The project also provided additional protection to the central business district of Boise. In all cases, the land disturbed or permanently withdrawn from the community base was minimal compared to the total land area available. Most of the disruption to land was temporary.

For the communities affected, minority or socioeconomically disadvantaged residents do not represent a substantial portion of the affected populations. However, because of local concern for the physical appearance and land requirements associated with the Boise Foothills project, some concern may exist. In some cases, the visual appearance and character of more remote, rural areas may have been compromised to provide increased protection and remove the potential threat to residential and commercial neighborhoods in the close-in suburbs and downtown core. A potential for a disproportionate effect on minority and small landholders in the Eighth Street Fire community is therefore a consideration. The presence of minority populations in the area is not high and examples of a disproportionate impact are not evident. The project also was preceded by a number of public meetings to address local residents' concerns.

5.3.3.2.2 Effects on Infrastructure, Public Health and Community Resources

With the exception of the Rocky Run, VA and Rose River, VA communities, all remaining communities included in the assessment experienced some benefit from the protection or restoration of infrastructure services. Benefits included restoration of stormwater drainage and improved flood control, water quality improvements, and restoration of secondary roads. In the East Nishnabotna, IA watershed, where EWP Program activity is complemented by other flood-control and disaster-recovery efforts, the protection of wells and sewers represents a major contribution of the Program. EWP Program activity in each of the six sites was not significant in impairing or disrupting existing infrastructure elements.

In all cases studied, some benefit from EWP Program activity extended to elements of property. At three of the sites, Rose River, VA, Shenandoah, IA, and Bethel Road, GA, the primary protection was extended to one or two residences in low-density rural/agricultural settings. In the case of Rocky Run, VA and Buena Vista, VA, however, multiple residential properties and some commercial residences were protected. As a result of the program, the overall risk to the health and safety of the residential population was significantly reduced. In Rocky Run, VA the overall viability of a small and isolated community was enhanced by project activity. For the Boise project, the EWP Program action protected as many as 4,500 residences and 760 commercial and business establishments in suburban and downtown areas downstream from the site of EWP Program activity. For all six sites, the execution of the EWP Program installed practices represented no significant effect on any existing elements of property.

EWP Program activity at the six sites did not substantially affect social services or other basic services to local residents. In the Boise Foothills, ID project, a substantial benefit was realized from the increased protection of public buildings and commercial establishments in the central core of the city. The EWP Program effect on local resources is somewhat more defined. In Boise, ID and Shenandoah, IA the areas affected represent substantial resources for recreation or educational uses. In the Rose River, VA and Rocky Run, VA communities, there was some improvement in the visual quality of the area. The overall effect of the EWP Program was not substantial, although some visual impairment might be associated with installed practices in the Rocky Run, VA and Boise Foothills, ID projects.

5.3.3.2.3 Effects on Community Structure and Social Patterns

The relatively small size and the short duration of most of the EWP Program projects under consideration had no effect on the demographic composition of the community associated with increased employment or other project-related activity. In Rocky Run, VA and Buena Vista, VA the project was significant in protecting a residential community and thereby maintaining the existing residential character of the area. In all cases, one indirect effect of EWP practices in protecting the affected area was to increase the possibility that additional development in the floodplain may be encouraged. Floodplain easements could be utilized to keep these “open tracts” from being developed. Particularly in the areas around Boise, ID and Shenandoah, IA, where additional development is planned, this may have the effect of increasing the extent of the cost and potential damage associated with a subsequent natural disaster.

EWP Program practices within the highlighted communities have different effects on an area's land use, depending on the type of practice used. The practices differ in the amount of change they create. For example, the use of riprap and gabions are practices primarily within a stream and its bed. Debris removal is also concentrated in a more localized area. On the other end of the spectrum, floodplain easements and levees require larger tracts of land and have broader-reaching impacts.

Using floodplain easements and setback levees as EWP Program practices often have a larger impact on land use decisions than practices focused on smaller areas. In the East Nishnabotna, IA, watershed, the use of floodplain easements and setback levees are decisions affecting the land use of areas throughout the watershed, as well as near the town of Shenandoah, IA. The purchase of floodplain easements throughout the watershed affect not only the inundation of agricultural land zoned for that purpose, but downstream properties that may wish to maintain the integrity of current land use. Placing a floodplain easement on one parcel without acquiring the rights on adjacent properties would affect the neighboring landowners. In addition, the development plans of a city such as Shenandoah may be affected by the purchase of a floodplain easement and subsequent inundation. Levees would have an impact on the development plans of an urban area in a similar manner, protecting some land upstream, and having negative effects on downstream uses.

Critical area treatment uses a combination of armoring practices on a larger scale. Practices such as vegetation planting and grade stabilization structures can produce impacts on a large scale. However, the land use impacts are not as significant as the biotic or landscape ones. Preventing erosion on susceptible slopes such as in the Boise Foothills project protects residential and recreational land uses. The revegetation alone would not cause large disruptions in existing land uses. As in Boise, the revegetation and erosion prevention practices protected existing land uses.

On a smaller scale, practices such as riprap and gabions in streambeds and on streambanks affect a small area of adjacent land uses. Use of these armoring practices in communities such as Buena Vista, VA protects the developed areas within the city, allowing adherence to a master plan. Immediate flooding of susceptible land also is prevented by these structures. Without practices regulating the streamflow and integrity of the bank, land uses within the immediate area would be threatened.

Lastly, removing post-disaster debris within waterways is a practice influencing the uses of adjacent land as well as further into the community. The amount of flooding is largely dependent on the amount of stream blockage. The flooding of land, by water prohibited from flowing in its course, can affect lands on various scales. As in Hall County, GA and Rose River, VA, adjacent farmland was threatened; however, no immediate threat to any surrounding communities or developed area existed. In Buena Vista, VA, however, developed areas were threatened by imminent flooding. The extent of the EWP Program practice will largely depend on the location of debris blockage and its proximity to developed land rather than open space or farmland.

Preserving the existing community structure and social patterns of the affected communities is an important beneficial effect of the EWP Program. Particularly in the case of the three projects, Bethel, Rose River, and Shenandoah, where the affected area was primarily agricultural, EWP Program activity protects existing farm operations. In the more residential areas, especially Buena Vista, VA and Rocky Run, the continuing viability of the local community or neighborhood depends on the ability to control the effects of flooding. For the Boise Foothills project, EWP Program practices reduce the effect of the original disaster and facilitate the continued development of the community. Although each project required minimal disruption of the local environment during project construction, only the Boise project resulted in a substantial temporary loss of access to neighborhood parks or other recreational locations. No permanent disruption of community was experienced. In all cases, the overall effect of the project was essentially beneficial in protecting or restoring the previously existing community structure and patterns of interaction.

5.3.3.2.4 Environmental Justice Effects

The communities studied do not have substantial minority populations; therefore, environmental justice effects related to these populations are minimal. In the cases presented no communities or neighborhoods were identified that were predominately minority in character. Several of the states involved have existing programs to encourage minority and small and disadvantaged businesses to participate in contracting opportunities. Minority contractor participation was identified in at least one of the projects, Rose River, VA. Minority participation in the other projects could not be determined from the information provided for this assessment. In the case of the Boise project, a substantial participation of the local community was evident in facilitating acceptance of the proposed practices by local residents.

5.3.3.2.5 Summary of Socioeconomic Effects of the EWP Program at Six Selected Example Communities

Table 5.3-4 presents a summary of impacts on the communities selected for this analysis. A summary description for each site follows the table.

Table 5.3-4 Summary of Post-EWP Program Socioeconomic Effects on Rural Communities

Bethel Road, GA	Buena Vista, VA	Boise Hills, ID	Rocky Run, VA	Rose River, VA	Shenandoah, IA
Employment and Income					
Small potential for increased income	Some benefit from project expenditure, significant benefit from protection of businesses	Substantial income from project-related expenditure; benefit from the removal of threat to commercial and retail areas	No commercial or business entities present in the community	Restoration of income potential from affected properties; small business benefits from project expenditure	Income from agricultural production; indirect benefit to retail and commercial areas

Table 5.3-4 (continued) Summary of Post-EWP Program Socioeconomic Effects on Rural Communities

Natural Resources					
Utility and value of affected land area restored	Repair and removal of threat enhances value as investment	Restoration and improved value of affected areas	Property value maintained by threat removal	Utility and value of affected land area restored	Agricultural value of land affected; some increased development potential
Infrastructure					
Restoration of drainage culverts in the affected environment	Some benefit derived from threat removal	Flood control benefits to agricultural areas; water quality improvement	No significant infrastructure features affected	No significant infrastructure features affected	Repair reduces threat to local wells and sewage system
Property					
Two residential properties protected from immediate threat	Protection of residential properties and business areas; some benefit to important structures	Reduction of threat to 4,500 residences and 760 commercial properties; major impact from protecting important structures	15 residential properties protected by installation of flood-control structures	Two single-family dwellings and state road protected; several buildings nearby indirectly benefited	Residential dwelling and a number of buildings significant to the community social life protected
Public Health and Safety, and other Community Resources					
No expected effect	Provision of sponsor's share represents noticeable expense for small community	Restoration of recreational and other watershed uses; some visual impairment from engineered structures	Some visual impairment associated with riprap and gabion structures, but improved over post-disaster condition	Some improved visual quality over post-disaster appearance, no other resources significantly affected	Adjacent areas are important for recreation uses and provision of basic services
Demographic Composition					
No change in the local community	No change; restoration may increase growth potential	Restoration increases potential growth of new communities in suburban areas	Maintains population that may otherwise be displaced by flood	No change in the local community	Maintains population that may otherwise be displaced by flood
Land Uses					
No anticipated change in land uses	No change in anticipated land uses	Restoration of pre-disaster uses in burned area; some change may result from potential new development	Some loss of land for new structures; otherwise no change in existing uses	No change in anticipated land uses	Protects existing land uses; some development potential from reduction of potential threat
Social Patterns					
Minimal disruption during construction; threat removal benefits local church	Significant benefit to maintenance of continuing viability and attractiveness of community	Enhanced viability of new development; established neighborhoods protected	Continuing viability of community depends on control of periodic flooding	Immediate area is sparsely populated; some potential for disruption during construction	Benefit to the maintenance of community activities; nearby residential neighborhood protected

Bethel Road Neighborhood – Hall County, GA

The requirement for debris removal and stream bank stabilization in the Bethel Road area of Hall County is the result of flood damage in the West Fork Little River Watershed. The area affected is a less-densely populated rural portion of Hall County. The potential for a significant impact on the local economy is small. Immediate effects on the local community would be expected to be beneficial, but not major. Only two private properties are affected and the result of the action in of restoring land and protecting of structures is generally beneficial. The project is in a rural land use zone, considered in the county's comprehensive plan as accommodating slow residential growth without the provision of water and sewer. The project site is within about 700 feet of existing structures. In the absence of the EWP Program installed practice, the roadway and adjacent rural lands would be threatened with inundation. Residences within the immediate vicinity would not be directly threatened. The impacts of the Program practices are primarily beneficial to undeveloped lands.

Apart from access roads to the two properties affected, construction-related disturbances are essentially temporary. Impact on the local community from noise or other construction-related activity is minimal. Any adverse visual impact associated with the newly installed structures is offset by the improved appearance of the restored area. The sparsely populated area surrounding the site would be expected to minimize any local impacts on community life or social structure.

Buena Vista, VA

In general, any potentially adverse effects of EWP Program project activity on the socioeconomic conditions of the Buena Vista, VA community are balanced against potential benefits. EWP Program practices in the area respond to flood damage that potentially threatens residential and commercial areas of the city. The community's continuing viability and its attractiveness to current and potential new residents and investors depends to a great extent on its ability to control flooding or protect local property from the effects of the flood plain. Although the project contributes additional EWP Program support money to the local economy, provision of the local sponsor's share represents a noticeable expenditure for a smaller community of an independent city such as Buena Vista, VA.

The developed areas near the EWP Program sites are primarily residential. These are the areas most affected by the direct impact of stream blockage. Commercial uses and industrial areas are indirectly affected. The comprehensive plan acknowledges the conservation of naturally sensitive areas as important, specifically targeting development within the floodplains, on steep slopes, and in areas with drainage problems (Buena Vista Comprehensive Plan, 1995). Potential impact on the immediate local neighborhood from project-related construction includes some physical disruption, as well as increased noise levels. A benefit to the immediate community is an improved visual aspect as well as increased protection of local residents in the event of another flood. The affected properties also are restored to their previous value. No substantial alteration of the pre-existing social community or demographic characteristics would be expected from a project of this level and this short duration.

Boise Foothills, ID

Although the area immediately affected by the Eighth Street Burn is primarily agricultural and open space with few residential and commercial areas, it lies adjacent to a major suburban expansion of the City of Boise. The affected area is also the watershed for the greater Boise area. The potential of flood and flood runoff to affect these adjacent suburban communities and the older residential and commercial areas of the central portion of Boise represents a major adverse impact on the maintenance of the quality of life that may be associated with any subsequent natural disasters. EWP Program practices were directed primarily at decreasing the threat of massive slides and erosion from burned hillsides. Although the EWP Program project resulted in no net increase in the total acreage available for human uses beyond that which existed before the fire, the installed practices removed the immediate potential hazard associated with flooding and restored the utility and visual qualities associated with the original condition of the land before the event. In addition to a number of important public buildings and other structures of cultural importance, the protected area also includes approximately 4,500 residences and 760 commercial buildings. Although no significant loss of residential or commercial property occurred as a result of the fire, the burn area extended into residential areas north of the city and produced a significant visual impact (NRCS, 1996). The rural quality of the watershed also provides access to recreational facilities for a substantial portion of the area populations.

Some potential for temporary disruption (noise, other physical disturbance, and some loss of access to recreational areas) from project-related construction activity was likely during the two-year duration of the project. The project was preceded by a number of public meetings to address local resident concerns. Despite initial concerns, the overall evaluation of the completed project by local residents is generally favorable. Although some permanent impairment of the land resulted from these practices, the impact on adjacent property holders has been minimized and no disproportionate impact on minority, socioeconomically disadvantaged, or sensitive populations is evident. The EWP Program practices installed to mitigate the effects of the Eighth Street Burn allow Boise to continue development within the city. Without these mitigative practices, both the urbanized areas and foothills would be threatened for future development.

Rocky Run, VA

Flooding of the Rocky Run area has resulted in substantial damage to a residential community, affecting 15 single-family dwellings and associated service buildings. No other significant structures (e.g., churches, schools, public buildings,) were affected. The effect of the EWP Program project is generally beneficial in terms of an improved visual aspect (compared to the unrestored condition), but permanently alters the visual qualities of the stream. Some temporary disruption of the surrounding area may have occurred during the construction phase of the project. The community at the Rocky Run site is not large enough to benefit economically from the EWP Program project expenditures, apart from the protection of property that may result from the action.

The project site in Rocky Run lies within the planning jurisdiction of the county and is currently zoned as general agricultural with single-family residences permitted. The comprehensive plan for the County envisions that current land uses will continue in the project area. The County also has a floodplain ordinance, restricting new development within the floodplain and floodway. Currently, the residential subdivision protected by the EWP Program project improvements is a nonconforming use under the zoning ordinance.

The conditions of the Rocky Run site are conducive to consideration of an improved land floodplain easement option. Removal of the existing residential community and returning the stream to its original condition would eliminate the requirement to maintain and continually repair the existing structures that are required to reroute the stream around the 15-house cluster that represents the community. Apart from economic costs, however, the potential for significant disruption of the current community and the near improbability of being able to reconstruct the community and its social relationships at some other site are serious considerations.

Rose River, VA

The area immediately affected by EWP Program project actions is primarily rural in character. The flood-related threat to the area is centered on two farm properties and includes two single-family dwellings, farm buildings, associated structures, a state road, and pastureland. Since the site had already been damaged by floodwaters and heavy equipment use by the landowner before the EWP Program action, any potentially adverse visual impact associated with the newly installed structures is offset by the improved appearance of the restored area. The sparsely populated area surrounding the site would be expected to minimize any local impacts on community life or social structure. The potential for a significant impact to the local economy is small. There are several important structures, including three churches, a school and two cemeteries, near the restored area. Although not directly threatened, these facilities benefit from the improved setting.

The site lies within various zones defined by the county zoning ordinance, including agricultural use, single-family homes, and other miscellaneous uses such as a greenhouse or airport with special use permits. The comprehensive plan for the County envisions the same long-term uses within this area (Grayson, 1999). The practices installed in Rose River allow these existing land uses to remain intact. Since the Rose River project restores a naturally functioning floodplain, the alternative use of an agricultural floodplain easement might also be considered. The purchase of a floodplain easement would have the beneficial effect of removing the requirement to continue to provide and maintain protective measures and would reduce the potential demand on the local sponsor, especially if the Federal role is reduced. Use of a floodplain easement however, would require the removal of agricultural land from crop production and could involve one or two immediately adjacent dwellings.

Shenandoah, IA

Since 1993, three major floods have had a significant effect on the community surrounding the EWP Program sites at Shenandoah and in the East Nishnabotna Watershed. In addition to the destruction of cropland and damage to physical structures, wells in several areas have been contaminated, affecting sources of water for local residents. For the affected sites, the unrepaired condition of the levee represents a potential loss of cropland and a significant negative impact on the local community. The scope of the EWP Program actions was relatively small and did not involve either a substantial capital expenditure in the region or a major change in land area and uses. The principal benefit to the local community is associated with the restoration and protection of potentially productive cropland and the restoration of the value of existing buildings and other structures that would result from removal of the potential threat. Short-term, construction related effects would be expected to be minimal and confined to the areas immediately surrounding the sites. Long-term effects of the levee repair do not significantly alter the appearance of the local area, compared to its condition before the flood.

Various EWP Program projects installed within the East Nishnabotna Watershed could have beneficial effects on the land use decisions of the City of Shenandoah. While the practices occur at many points upstream of the City, their effects will noticeably permit certain land use and development decisions. Levee repairs upstream from Shenandoah, as well as the levees nearest to the city limits, allow agricultural land to remain. In the absence of the levee, agricultural land to the northwest of the city would be flooded, possibly jeopardizing current pockets of development. The revised county comprehensive plan anticipates zoning changes to allow commercial industry in this area (Marker, 6/15/99). Without the protective levee, changes such as those proposed would not likely occur. The continuing potential for flood-related damage to this area would, however, indicate that floodplain easements might be considered as one of the EWP Program options. Other flood response programs (FEMA, USACE) in the community include consideration of the removal of individual residences, farm structures, and other facilities from the most seriously affected areas of the floodplain. Purchase of floodplain easements on agricultural land, as the EWP Program considered for the Shenandoah sites, would support or complement the actions of other programs in the area.

5.3.4 Impacts of Floodplain Easements on Human Communities

The most important characteristic of a floodplain easement is that it gives the private landowner and the public an alternative to using public funds to restore disaster-prone property to pre-disaster condition and function. In addition to reducing risks to lives and property, the purchase of a floodplain easement eliminates the need for future disaster payments.

The floodplain easement, a perpetual legal interest in a property, restricts the owner's use of the land as a mechanism to reduce flood damage claims and protect wildlife habitat or floodplain hydrology. In contrast to expensive, and sometimes temporary, conservation practices, the impacts of a floodplain easement and reconstruction of a floodplain may benefit an area both ecologically and socioeconomically. Similar to the floodplain easement, the setback levee adds the element of protection of neighboring property.

Incorporated as part of all four EWP Program alternatives, the exercise of floodplain easements is structured differently according to the alternative, the requirements of project, and the type of land involved. Where floodplain easements replace other recovery practices on non-improved land, local sponsorship would be possible, but not required since the USDA would hold the floodplain easement. This option would be voluntary on the part of the landowner and would require minimal local revenue contribution. USDA would fund the establishment of the floodplain easement and any environmental measures required. Floodplain easements on agricultural land differ categorically from those on other unimproved or improved floodplain easements. Depending on the application, restrictions may allow the use of natural vegetation only or compatible uses by the landowner (e.g., haying, grazing, and timbering).

Exercise of a floodplain easement on both agricultural and improved lands is possible under Alternative 2 and Alternative 4, the Preferred Alternative, and would be expanded to include multiple floodplain easements in priority watersheds under Alternative 3. Floodplain easements may include developed and commercial property in which residential relocation may be necessary. Where improved land floodplain easements are exercised, the participation of a local sponsor, specifically a government entity or administrative district with authority to hold property, is required. Local sponsorship increases obligations on a local government, as well as the potential for community disruption caused by relocating the current tenant of the property.

5.3.4.1 Current Agricultural Floodplain Easements

Repeated cycles of damage and repair to agricultural land as a result of periodic flooding adversely affect rural communities located in flood-prone areas. Protective practices and engineered substitutes for the normal functioning of the watershed cost not only the local community, but also larger public entities (State and Federal agencies) that provide resources and funding for disaster assistance. Constructing protective practices includes a social cost in terms of the alteration of the environment and setting of the community.

The use of a floodplain easement offers a cost-effective alternative to more traditional flood control approaches. Traditional approaches usually involve a tradeoff between flood control and damage reduction, and the continued health of ecological resources (Williams, 1996). These approaches reduce the threat of flooding but do not eliminate it. Flood control practices may also compromise the character and aesthetic quality of a setting. However, the exercise of a floodplain easement on flood-prone properties also is a trade-off between the economic and social value of the land in its current use and the beneficial effect of restoring the land to its natural condition and minimizing future costs of natural disasters and flooding.

The purchase of floodplain easements through the EWP Program in a location such as the East Nishnabotna, IA watershed would benefit the landowner and community alike. The purchase of floodplain easements in land designated as open space would allow land uses to remain unchanged. If land were designated agricultural, their uses could potentially be minimally impacted. In Iowa, the proposed floodplain easements are in areas designated for agriculture. Using the floodplain easement for constructed open space improvements could, however, have some impact. The improvements would then be susceptible to recurring floods. If floodplain easements were purchased in developed areas, however, impacts would be different.

The socioeconomic effect of the exercise of floodplain easements is a combination of beneficial and adverse changes that affect the critical aspects of the social community. Table 5.3-5 summarizes these potential effects on the socioeconomic indicators identified in this section.

Table 5.3-5 Summary of Socioeconomic Effects of Floodplain Easement Acquisition

Community Aspect	Impact Area	Potential Effect
Economic Structure	Employment and Income	• Purchase price of floodplain easement represents income to the landowner; • Marginally productive land becomes a one-time asset to owner; • Income generated from recreational and other permitted uses of the protected property; • Benefit associated with restoration of watershed condition: loss of economic or agricultural production-associated employment; • Future cost of damage recovery and flood protection minimized, but also income lost to community from periodic disaster payments.
	Value and Quantity of Natural Resources	• Loss of value of affected lands for investment or as part of the economic base; • Value and development potential of adjacent land may be improved; • Enhancement of ecological value.
Infrastructure and Resources	Infrastructure	• Improved function minimizes cost of associated flood protection strategies; • Potential for improved water quality, especially in areas serviced by wells.
	Property	• Where floodplain easement is purchased on improved land, associated residential or commercial structures are demolished or removed; • Value and use of adjacent structures improved.
	Public Health & Safety and other Community Resources	• Change in value of floodplain easement property represents a small tax advantage to owner, but reduces the revenue base to local government; • Improved recreational and other uses of the land.
Social Pattern and Structure	Demographic Composition	• Relocation of residents may change demographic distribution of certain social characteristics in the population.
	Land Use	• Tradeoff between value of existing uses to social community and benefit of reducing continuing need to respond to flood conditions; • Some potential for conflict with existing community land use plans.
	Community and Neighborhood Social Patterns	• Permanent disruption of neighborhood or community networks; • Potential threat to ongoing viability; • Floodplain easement on agricultural land may enhance community desirability.

Effects on the Local Economy

Employment and Income. Apart from the benefit of reducing the continuing cost of flood control and damage recovery, the community experiences a number of additional beneficial economic effects. The purchase price of the floodplain easement supplies income to the landowner and by extension to the community, as the income is re-spent within the community. By volunteering land for floodplain easement, a landowner, especially in agricultural areas, may realize income from land that otherwise would be costly to maintain and that may not have furnished regular income from production (NRCS, 1999).

Purchasing floodplain easements on agricultural land could provide local farmers with some tax breaks; however, they would not be an economic windfall. Every state except Michigan has deferred assessment programs for agricultural lands (AFT-Deferred, 1998). A deferred assessment program, also referred to as use-value, taxes land at its agricultural value instead of its market value. The use-value of agricultural land is often a small percentage of the full market value. In Orange County, North Carolina, for example, farmers pay taxes equaling an average of 6 percent of market value on land enrolled in the program (Belk, 1999). Thus, direct tax savings of a floodplain easement to the average farmer are not substantial due to the small amount already paid. Only the benefits gained through reducing the estate tax burden by selling a floodplain easement would be substantial to most farmers.

While an individual farmer might not realize great economic benefits, the community would. Through the purchase of floodplain easements to preserve open space or flood-prone areas, the community would maintain a solid tax base. When land is developed, police, fire, schools, water, sewer and after services must be provided. The cost of these services burdens a tax base. Communities with primarily residential development often incur heavy debt, destroying credible bond credit ratings.

Open space is an affordable use of land from the perspective of providing community services. Studies on the costs of community services have been conducted around the country. The median costs (per tax dollar of revenue raised) of providing services for commercial/industrial use is $0.28, for farm/forest use is $0.37, and for residential use is $1.15 (AFT-COCS, 1999). Floodplain easements purchased under the EWP Program could contribute to a sound economic strategy for a community; protecting flood-prone areas from development will prevent economic losses while strengthening the local tax base.

Floodplain easements may be the best use of land within a watershed from social, ecological, and economic standpoints. Although losing the previously productive land may carry adverse effects, the community could benefit from changes in income and employment associated with increased recreational and other permitted uses of the land. An associated benefit is derived from the improved condition of the watershed itself.

Exercise of a floodplain easement on the land does reduce income to the community that was previously derived from disaster payments. These payments often represent a boon to the property owner and by extension to the local community in the form of compensation for damaged crops or structures (Philippi, 1995) and resources to construct and maintain flood control devices.

Value and Quantity of Natural Resources. Any loss of productive agricultural, commercial, or residential property represents a potentially significant impact to a community. The exercise of floodplain easements removes the land from the economic base of the community and potentially

decreases its value. Schueler (1999) cites several studies indicating that the value of wetland and floodplain areas lying within a protected region in which development is restricted may be 10 to 36 percent of the original.
However, the return of watershed land to its natural function contributes significant economic benefit such as increased seasonal water availability for agricultural, municipal, and industrial uses, reduced downstream sedimentation and pollution, increased biodiversity, and improved habitat for fisheries, plant life, and animals (Williams, 1996). Additionally, economic benefit also accrues to the local community because of an increase in the attractiveness of properties adjacent to protected floodplains as potential development areas (EPA, 1995). Thus, although some land is lost to the local economic base, remaining adjacent property may increase in value and desirability.

Effects on Infrastructure, Public Health and Community Resources

Infrastructure. By imposing use restrictions on an affected property, a floodplain easement reduces both the requirement for and associated cost of implementing extensive flood-control practices. Restoring the natural function of the watershed may also improve water quality as well as reduce runoff and the associated costs for treatment that would otherwise be borne by local government. An improvement in water quality is often associated with improved property values particularly in areas served by wells (Schueler, 1999).

Property. A floodplain easement on improved property results in the loss of the value and use of any structures, except where they can be relocated outside the floodplain. Assistance to the local community from State and Federal sources may afford some compensation, but the loss of these structures is usually irreversible. Less important to a floodplain easement on agricultural land, the loss of residential, commercial, or other structures significant to the social life of a community may be an important impediment to exercising a floodplain easement. This is especially true where the cost greatly exceeds the cost of maintaining flood control structures, or where the structures involved are culturally or socially important to the life of the community and are not easily replaceable.

Public Health and Safety and other Community Resources. The exercise of a floodplain easement, especially on non-agricultural or improved land has the effect of removing the potential risk to the health and safety of resident or other user populations. By relocating human activity away from flood prone areas, the floodplain easement removes the object of any potential harm from natural disasters and thereby eliminates any subsequent risk. In addition to removing the direct threat to immediately affected populations, floodplain easements also benefit the community as a whole. Elimination of the population at risk contributes to the overall effectiveness of disaster emergency services by reducing the number of sites that must be addressed in the event of a future disaster and allowing a more efficient use of disaster resources.

A change in the value and use of the land designated as part of a floodplain easement will give a tax advantage to the landowner, but also causes loss of revenue to the local government. Floodplain easement areas are typically assessed at a much lower value than other property. Removing too much land from the local tax base could undermine the revenue source for other important local governmental services. However, this effect is at least partially offset by the improved value of neighboring parcels and the reduced cost of providing infrastructure services to the local community that may result from restoring the natural function of the watershed. The potential for use of the restricted land for parks or other recreational uses represents a corresponding benefit.

Social Pattern and Structure

Demographic Composition. Demographic changes are not an important consideration for the use of a floodplain easement on agricultural land. However, one exception is the potential for a floodplain easement to reduce the total amount of agricultural land available to the community. Such a reduction changes land availability and price, which may restrict the establishment of new farms or make the operation of existing farms more difficult. Depending on the scale of the floodplain easement Program, this may have a tendency to reduce the demographic diversity of agricultural communities as fewer owners control a greater portion of the remaining land.

Land Use. Exercising a floodplain easement is a meaningful tradeoff between the social value of the current use of the land and reducing potential flood-related damage and any associated impediment to the full utility of the affected land. The condition and use of the land before a disaster and the effect of the disasters on the continued use of the land must be considered. In many cases, the desirability of a “naturalized” landscape may increase the value of the land over current uses such as agriculture, particularly when the current value is offset by the cost of maintaining the land or repairing flood damage. The community benefits when the exercise of a floodplain easement is part of an overall land use plan that includes watershed management to ensure environmental and flood protection and where land uses on adjacent parcels are compatible with the proposed floodplain easement restrictions.

Community and Neighborhood Social Patterns. Purchasing floodplain easements has the potential to disrupt important social patterns and neighborhood networks. In agricultural areas, the acquisition of a farm property may affect the individual farm family, and in the case of marginal farms, the economic and cultural diversity of the community by concentrating the remaining farmland in the hands of fewer owners. Burdge (1998) notes that the process of creating a single-family farm business often requires the participation of multiple other families and the intergenerational transfer of property among interconnected families. To determine the full impact of a floodplain easement purchase, therefore, the full range of impacts resulting from the intergenerational effect and the immediate relocation of the tenant must be taken into consideration. Changes in land availability and price in the immediate area may increase the floodplain easement owner’s difficulty in acquiring land to compensate for the lost acreage or in establishing a new farm.

5.3.4.2 Proposed Non-agricultural Floodplain Easements

The purchase of a floodplain easement on improved land, or the outright purchase of title to the land, expands the potential range of impacts associated with Alternatives 2 and 3. Although not a significant issue on agricultural land, exercise of a floodplain easement in residential areas or on improved lands can change the size and composition of the local population. Under Alternatives 2 and 3, non-agricultural floodplain easements could be applied for the purposes of relocating small, flood-prone communities. As residents move and relocate, the characteristics of neighborhoods may change. Especially important is any permanent differential change affecting minority or low-income households. Similar impacts can result from the EWP recovery practice of structure removal proposed under Alternative 4, the Preferred Alternative, where NRCS would coordinate with a third-party project sponsor who would then purchase the land. Under the Preferred Alternative, however, only improved lands in rural areas adjacent to agricultural lands would be considered for direct floodplain easement purchase by the NRCS. Multiple residency areas would not be purchased or demolished, and small communities would not be relocated, minimizing the impacts to a community.

In residential areas or on improved lands, removing or relocating a population under Alternatives 2 and 3 may significantly alter the local environment. Where a sufficient number of residents are involved and the community is sufficiently small, the disruption could be significant and could threaten the viability of the community itself. Also important is the availability of suitable residences nearby for persons displaced by floodplain easement purchase. Where land values in the displaced neighborhood are substantially lower than in the immediately surrounding areas (particularly with respect to low-income neighborhoods), residents may have to move to distant locations, thus permanently disrupting social networks.

If a floodplain easement were to result in the loss of an important structure or place within a community such as a park, monument, or gathering place for residents, the potential effect may be disruptive, at least temporarily. However, in order for a restoration measure, including floodplain easements, to be eligible for program funding the measure has to be socially defensible which means that the measure cannot cause unmitigated or disproportionate harm to a valued social resource. This would minimize the disruption that a non-agricultural floodplain easement would have on a community resource.

The floodplain easements proposed under the EWP Program alternatives preserve a community's environmental and economic resources. Through the use of floodplain easements, open space is preserved, the tax burden of providing community services is reduced, and flood-prone lands are restored to their natural state as floodplains.

Structural flood-control projects often create a false sense of security in the community. They increase the potential for development of flood-prone areas if land use zoning is not properly implemented. Rather than reducing the threat of damage from catastrophic flooding, structural practices may actually increase the risk of damage and loss by increasing the population density and the number of structures in the floodplain areas that could be affected if the protective practices fail. If not coordinated with local planning ordinances to prohibit development, residents could move back into the protected area. Development also increases the stress on the watershed itself. Despite protection efforts flood losses cost $4 billion annually (Faber, 1997). The use of an improved land floodplain easement would eliminate increased development and reduce the need to return and continue to make repairs after disaster.

Floodwaters often cause losses in the short-term, but landowners receive disaster assistance from Government agencies and insurance policies. This disaster assistance can exceed profits from the use of the land. The purchase of floodplain easements on these lands will reduce repair expenditures and disaster funding.

Although landowners participate voluntarily in the purchase of improved-land floodplain easements some participation of the local government is required as sponsor and holder of the land title. For some communities, this represents an administrative burden that may not be supportable without additional resources. This is especially true when tax revenue is lost because the property is withdrawn from the tax base.

Because the use of floodplain easements is a relatively new Program practice, the number of actual sites to demonstrate potential impacts is limited. Two sites, Rose River and East Nishnabotna, were therefore selected for hypothetical consideration under the current Program, Alternative 1, and one, Rocky Run, was considered under alternatives to the current Program (Alternatives 2, 3, and 4). All are summarized in Table 5.3-6. The improved-land floodplain easement option would have impact on land uses often residential in nature, returning the land to its natural use as a floodplain. The floodplain easement purchase could conflict with the long-term development visions of a community and require analysis on a case-by-case basis. However, community impacts are not anticipated to occur on a large scale under any of the Program alternatives, as it is the intention of the alternatives to minimize negative social impacts. In communities such as Rocky Run, VA, the purchase of floodplain easements would require the relocation of residences in the floodplain. These residences lie within an area zoned as general agriculture, but permitting single-family residences (Grayson, 1999). Thus, the official land use category would not change while actual use would change from residential to open space.

Table 5.3-6 Summary of Effect of Floodplain Easement Option on Three Example Communities

Impact Area	Rocky Run, VA	Rose River, VA	Shenandoah, IA
Employment and Income	Community is residential and employment and income is from outside sources. Therefore, no effect.	Depending on restrictions, floodplain easement could result in the loss of value of agricultural production.	Income from agricultural land lost. Some commercial areas may be affected.
Natural Resources	Loss of the value of 15 properties currently used for residential dwelling. *(Note: This scenario would be highly unlikely to occur under the Preferred Alternative).*	Agriculture value of land jeopardized by repeated flooding and repair attempt. Acreage loss may be compensated by increased value of adjoining land.	Loss of land area may be compensated by enhanced value of adjacent land for additional development by the community.
Infrastructure	Improved drainage to the remaining community, some improvement in water quality anticipated.	No major disruption. Some improvement expected from enhanced watershed function.	Improved water quality in an area serviced by wells. Transportation facilities located nearby may be affected.
Property	Loss of 15 single-family dwellings; no other significant structures. *(Note: This scenario would be highly unlikely to occur under the Preferred Alternative).*	Two single-family residences may lie in the designated floodplain easement area. Minimal effect to other farm buildings and structures.	Potential loss of residential units and service structures in the area.

Table 5.3-6 (continued) Summary of Effect of Floodplain Easement Option on Three Example Communities

Impact Area	Rocky Run, VA	Rose River, VA	Shenandoah, IA
Public Health & Safety and other Community Resources	Potential use of affected area as park or other recreational area.	No real effect on community resources. Some improvement to the overall visual quality of the land anticipated.	Removal of major responsibility for the maintenance and repair of levee. Floodplain easement area is a potential recreational resource.
Demographic Composition	Relocation of approximately 42 residents could substantially change composition of community. *(Note: This scenario would be highly unlikely to occur under the Preferred Alternative).*	No significant change to community composition. Only two households directly affected.	Some relocation of residents, but substantial change in population size and composition.
Land Uses	Change in current use from residential to nonresidential would not impact surrounding land uses. Restores a naturally functioning floodplain.	Change in current use is compatible with surrounding uses and enhances open space quality of the setting.	Change in current land uses may enhance development plan for other areas. Repeat flooding inhibits many uses of floodplain easement area.
Social Patterns	Relocation would have a significant effect and could threaten future viability. Housing values lower than surrounding area could require relocation. *(Note: This scenario would be highly unlikely to occur under the Preferred Alternative).*	No change in community social patterns anticipated.	Affected area is primarily nonresidential. Some potential for effect on current residents.

5.3.5 Human Community Impacts under the EWP Alternatives

5.3.5.1 No Action-Continue Current EWP Program (Alternative 1)

In general, the effect to the human social community of continuing the current Program would be similar to that described for the six example sites in Section 5.3.3.2. In addition to the reduction of any potential risk to public health and safety that may result from repair of the affected site, EWP program measures have the beneficial effect of protecting the use and social value of any associated property. Thus, the beneficial effects of program implementation would extend to owners, residents, or other users of the recovery site and the area protected and, indirectly, to the local community as whole. On a programmatic basis, the primary beneficial effect can be represented as the aggregate reduction of risk to human health and safety and protection of the value of threatened property in all of the communities nationwide that are potentially affected by damage from natural disasters.

Continuing the current Program would create no change in the technical and financial assistance provided to local communities or to the administrative approach to the Program. Program-related impacts to local economies would be minimal. Most proposed projects are relatively small in scope and, despite the smaller rural characteristics of most of the communities involved, the total dollar expenditures would not contribute substantially to the local economy.

Under the current EWP Program, land use decisions are affected largely by the type and timeliness of post-disaster repair. The practices used by the EWP Program are often structural, intended to restore pre-disaster land use. However, current uses should correspond with the local long-term land use plan. Although the land use plan is not a legally binding document, it is important to ensure that current EWP Program practices correspond with the intent of local land use plans to avoid possible policy conflicts with local jurisdiction. Without coordination with local planning and development ordinances, pre-disaster land use cannot be guaranteed. In the absence of these regulations, post-disaster land uses may fluctuate.

The effects of the practices under this alternative would, however, benefit the community by restoring or protecting economically productive or residential properties. Program practices may repair and protect land, thereby restoring the value of its use to the local community. Although program practices provide a substantial benefit to the local community in the short-term, this does not necessarily eliminate the need for additional repairs over the longer term.

In some cases, the effect of EWP Program practices may be to create a false sense of security and may actually encourage development in flood-prone areas. This has the effect of providing an immediate benefit to the health and safety of affected populations and the protection of the affected property. But, in the longer term, the frequency and cost associated with another natural disaster may be increased. The immediate risk is reduced, but the future risk remains as long as human uses of flood-prone land continue unchanged. Purchase of floodplain easements on agricultural land minimizes this effect, but since no similar option for improved land floodplain easement exists, the potential for perpetuating cycles of damage and repair on residential, industrial, and commercial areas remains high.

Floodplain easements allowed under the current Program do not always protect high-value agricultural land. Thus, depending on the type of agricultural land affected by the disaster, the land may or may not return to its former use. For example, a high-value vineyard may be destroyed by a disaster, and financial hardship could cause the owner to sell his land. None of the project sites had high-value crops, so an example of a landowner selling due to financial difficulties is not available. However, the diversity of crops throughout the country allows such a situation to occur.

With respect to infrastructure and social resources and services, the Program's effects are generally beneficial. The immediate threat to the safety and health of residents and users is reduced, and in many cases, the longer term risk to the property itself may be reduced as a result of EWP practices. Installed practices restore the previously existing condition and provide a measure of protection for important structures and resources. In some cases, installed practices may diminish the aesthetic quality or recreational experience associated with some properties, but in general, the Program does not appear to have a major adverse effect. The primary direct effect is beneficial by providing for the recovery of previously existing levels of service. Exercise of an agricultural floodplain easement in some cases may provide the additional benefit of protecting open space and improving the aesthetic or recreational quality of an area.

The sponsor's share of project costs may present obstacles to some smaller, independent communities that do not have support from county or State jurisdictions. The economic strain placed on local resources may cause other important social efforts within the community to be underfunded.

The immediate effect of the EWP Program is to provide for the restoration and protection of communities through either the installation of armored structures or the exercise of floodplain easements on agricultural lands. Both of these approaches support the existing community structure. In smaller communities, such as the Buena Vista, VA and Rocky Run examples, EWP Program assistance may be critical to continuing viability of the community. Exercising the floodplain easement option on unimproved agricultural lands does not have a serious impact on the community, but may result indirectly in a long-term change if land becomes less available and the viability of smaller farms is compromised.

Because project defensibility under the No Action alternative is based primarily on environmental and economic justification, environmental justice may not always be served by Program projects. In socioeconomically disadvantaged areas, some property owners may be denied assistance because the cost of protecting the property is greater than the value of the property. However, the same project at the same cost may be justifiable in another area because property values are higher. This leads to a potential for disproportionate access to benefits from the Program and may be especially important in socioeconomically distressed areas.

5.3.5.2 Draft PEIS Proposed Action (Alternative 2)

Under Alternative 2, direct effects to the local economy, infrastructure, community resources, and social patterns of affected communities would remain substantially unchanged from those identified for the No Action Alternative. However, several changes proposed under this alternative would influence the overall impact of the EWP Program on the human social environment and may alter the solutions proposed or the manner of participation for the affected communities.

Under this alternative, the beneficial effect of reducing the risk to human health and safety evident under the current program would be further enhanced by the addition of an immediate response mechanism for "urgent and compelling" situations. These situations often represent a high risk to human life or substantial damage to property that require a more immediate response. By providing a spending allocation of up to $25,000 based on local authorization for these "urgent and compelling" conditions, Alternative 2 substantially increases the ability of the Program to respond more quickly and directly in circumstances where an immediate threat to life and property is apparent. As a result, the overall benefit of risk reduction associated with the program would be significantly enhanced.

Changes to the cost-share rate from 80 to 75 percent Federal would minimally increase the cost burden for some communities. However, the 90-percent Federal cost share proposed for areas designated as "limited resource" would encourage EWP Program participation by communities that might not otherwise be able to afford to participate in the Program. This provision would help address environmental justice concerns, by improving access to Program benefits for socioeconomically disadvantaged communities

Program modifications in funding, priorities, and floodplain easement regulations could potentially affect post-disaster land uses. Additionally, this alternative allows for greater opportunities for cooperation with local land use plans. Floodplain easement purchases could be integrated into an area's comprehensive plan for growth and provide functional open space for a community.

A landowner's ability to restore the land to pre-disaster uses depends largely on the elements of the proposed Program changes and the economic incentives available to him. The elimination of the exigency designation and a new priority ranking system are expected to influence this ability. The priority ranking system could delay or deny protection to properties that would have been protected under the old system. The proposed Program changes under Alternative 2 also include a change in the cost-share ratio for reconstruction activities. Although changing the cost share ratio would reduce the maximum funding available to sponsors, the potential effect of the change is minimal because the higher rate has fallen into disuse already under the current Program.

Adding social defensibility criteria to the ecological and environmental defensibility criteria used in the current Program in reviewing EWP recovery measures also addresses environmental justice issues. By establishing a social rationale based on the utility of the property to the landowner, Alternative 2 includes participants who might have been left out of the current Program. This is especially true when the economic value of a property may be low or difficult to calculate, but the importance of the property to the landowner as a place of residence or business, or to the community as a vital part of its social or cultural life, is recognized. Criteria for social defensibility provide another perspective on the justification to carry out a project with the result that additional segments of the population (especially minority or low-income) have access to Program benefits.

Alternative 2 would also allow for the buyout (under a floodplain easement) of residential or improved lands. This would convert previously residential, commercial, or industrial land to open land. Converting developed land to open space would reduce the need to provide public services, relieving the burden on the tax base associated with providing these relatively expensive services. The reversion of land to its "natural use" after two repairs in ten years also would encourage the conversion of developed land to open space. The end result would be increased open space in the community, a lower tax burden, and improved natural capabilities to fight disasters.

By expanding floodplain easements to include non-agricultural or improved land, Alternative 2 addresses an important long-term effect associated with the current program. Relocation of people and structures away from flood-prone areas eliminates any potential future risk and has the beneficial aspect of reducing the cost of future disaster recovery. The short-term impacts and cost of exercising floodplain easements on improved land may be greater than those associated with the immediate repair of land and protection of existing property under the Current Program. However, a longer term benefit from eliminating the potential for future risk to people and property and a subsequent reduction in the cost and resource commitment necessary for future disaster recovery can be anticipated to offset the higher short-term cost of the program under this alternative.

Participation in the floodplain easement purchase program under the Draft PEIS Proposed Action would be voluntary; however, the proposed limitation of two repairs in ten years encourages property owners to consider the floodplain easement option. The floodplain easement may appear to be the only solution, and therefore, a somewhat less-than-voluntary alternative. Although this provision may have an adverse impact if a property owner opposes the floodplain easement option, (because of financial considerations or a particular attachment to the property), it does have beneficial consequences for the community at large. By encouraging floodplain easements, this provision reduces the potential for continuing cycles of damage and recovery and tends to discourage additional development in frequently flooded areas. The overall effect of this provision would not be substantial because frequent damage to the same site is relatively uncommon.

The exercise of a floodplain easement option on a property withdraws the property from the revenue base of the community and eliminates a source of capital investment. In the case of agricultural floodplain easements, this may not have a substantial impact unless the total floodplain easement area is a substantial portion of the total agricultural land in the community. Although not likely when only a few properties are involved, a shortage of agricultural land may drive up the price of remaining land. Community structures may also change if marginal farms are unable to compete and are forced to sell out.

In the case of improved-land floodplain easements, both the land and its associated structures may be lost to the community. Floodplain easements alter the character of community by breaking up social networks. Where only a few properties are involved, the loss of investment value is not likely to be great; however, floodplain easements may be too costly in terms of property values and the costs of relocating the residential, structural or social function associated with the property.

On balance, Alternative 2 would have a generally beneficial impact. The potential impact of the installation of EWP recovery measures would not differ substantially from that of the No-Action Alternative. The expansion of the floodplain easement option to include non-agricultural and improved land increases the potential to disrupt communities or neighborhoods by displacing residents, but it also offers an opportunity for the community to reduce the impact of natural disasters and the associated recovery cost, especially on improved properties. Expanding the defensibility criteria would substantially increase access to potentially beneficial effects of the Program for economically disadvantaged or minority persons who may have been previously excluded. Similarly, the provision for funding up to 90 percent of the cost of EWP Program projects in limited-resource communities also decreases the potential burden on these communities and increases potential access to Program benefits.

5.3.5.3 Prioritized Watershed Planning and Management (Alternative 3)

The watershed planning and management approach proposed under this alternative allows watershed planning on a macro scale while providing the project funding and technical assistance outlined in the proposed action. This alternative includes pre-disaster planning and watershed management to help form a long-term vision of a community's land use priorities. The pro-active approach under this alternative could be expected to further enhance the benefit of reducing the risk to human health and property presented under Alternative 2 and included as part of the Preferred Alternative, Alternative 4.

This long-term vision would be achieved through a comprehensive planning process, integrating watershed management with land use planning. The process addresses environmental concerns as part of a community's long-term growth strategies. Coordinating floodplain/open space protection and comprehensive long-term growth plans will formulate better land use policies. Proactive approaches to land use and comprehensive planning, such as suggested by Berke (1998) are essential to prevent further disaster-induced loss. Tools such as floodplain easements and development regulating ordinances would help ensure that losses are minimized by preventing development on these lands.

Determining a taking, whether regulatory in nature or not, is a difficult task. The coordination of EWP Program components with land use regulation must be well managed. To avoid possible takings violations, the specific floodplain ordinances and floodplain easement purchases within the Program area should be carefully crafted. Takings claims must be reviewed case-by-case and definitive rules for judgment on them are lacking. Most closely resembling a standardized rule is the need to prove a "rational nexus" between public purpose and benefits received. Without proof of this connection, takings claims will be less defensible by the defendant (Owens, 1999).

Allowing farmers to continue using land with floodplain easements for haying is a form of farmland preservation. Permitting haying and/or other agriculture on lands with floodplain easements allows farmers to continue reaping some benefit from their land, aiding their operations fiscally. Typically using Purchase of Development Rights (PDR) programs, farmers with land in disaster-susceptible areas may find new options in the EWP Program. Without relying on the selection process of many local governments and nonprofits that administer many PDR programs, farmers may be able to sell floodplain easements under the EWP Program.

Potential conflicts with the EWP Program may arise with the use of PDRs in floodplain areas. Farmers may sell agricultural easements to preserve the right to farm, thus prohibiting the return of the floodplain to its natural state. Farmers who are repeatedly flooded out may seek any type of easement offered to them. The floodplain easements could be from the EWP Program or through a traditional PDR program. Neither program will provide assistance in the case of future disasters. Depending on the valuation method used by the EWP Program, offers for the floodplain easements from competing bidders could be very similar or substantially different. An entity bidding for the floodplain easement under a traditional PDR program will usually use the difference between the market value and agricultural value to determine the asking price.

Every floodplain easement negotiated under PDR programs is unique, and the restrictions vary depending upon the entity holding the floodplain easement.

If the entity purchasing the floodplain easement is a non-profit whose goal is farmland preservation, the floodplain easement will most likely allow continued farming and cropping. Thus, the farmer could continue to reap financial benefit from the crops while tempting fate for the next disaster to strike. If the non-profit or government entity has a different motive for protection, e.g., wetland protection or open space, the terms of the floodplain easement will vary and potentially have greater restrictions.

If a farmer chooses to purchase floodplain easements through a PDR program instead of EWP, it is likely that the land could continue to be cropped. Many agricultural floodplain easements allow the continued farming of land as the main premise behind farmland preservation efforts. This cropping could occur in an area where EWP is attempting to return the floodplain to its natural state. Thus, EWP might view the agricultural floodplain easements allowing cropping as incompatible. Also inherent in farmland preservation efforts is the desire to use agricultural floodplain easements to curb development and urban growth. While cropping is not a natural state, it is more compatible with EWP goals than a developed floodplain.

The overall urban development of an area can be affected by the EWP Program practices. Most relevant to Alternative 3, this planning, coordinated with local comprehensive plans as outlined above, would help reduce future risk to the community. Targeting a community's urban development to a location outside the floodplain, in coordination with regulations encouraging compact growth, would reduce overall risk from natural flooding hazards.

Using floodplain easements and a comprehensive watershed planning approach enables a community to maintain open space while managing urban growth. Open space advocates use the purchase of floodplain easements, through the PDRs or Transfer of Development Rights (TDRs), to limit the developable area within a community (Daniels and Bowers, 1997). These tools, coupled with regulations governing the type of development by area, help an urban area contain growth while protecting the natural areas needed to support the human population. The provision of adequate community services, including a clean water supply, results from watershed planning that incorporates a natural floodplain, wetlands, and habitat.

A planned approach to exercising floodplain easements minimizes problems associated with a project-by-project approach, such as when neighboring or adjoining properties are volunteered for the Program at different times under differing circumstances. Instead, with this alternative open spaces can be planned as integral elements of the area landscape.

Purchase of floodplain easements under this alternative may alter the composition or structure of a community by displacing residents. Floodplain easements could also alter land uses or break up residential networks. These potentially adverse effects may be offset, however, by the more effective use of floodplain easement purchases as a part of a longer-term flood management and watershed planning approach.

An integrated approach to Program management allows for more efficient use of capital resources and the economic potential of the watershed, while minimizing adverse environmental effects. Existing community resources may be lost, but these losses are offset by increased recreational and educational use of the watershed. An important beneficial effect of this alternative is that it involves multiple Federal programs, local and State agencies, and stakeholders early in the planning process, increasing the potential for acceptance of a watershed management plan. This is especially important where multiple floodplain easements may be required as part of the proposed solution.

5.3.5.4 Preferred Alternative (Alternative 4)

The impacts of the Preferred Alternative on the local economy, infrastructure, community resources, and social patterns of affected communities would be similar to the impacts of the Draft PEIS Proposed Action. Several changes proposed under the Preferred Alternative would potentially affect what restoration solutions are proposed at a site or the manner of participation for the affected communities. Under the Preferred Alternative, the option to participate in the EWP program would be emphasized to relevant low-income or minority populations that may not be aware of the program, as an aspect of the expanded role of environmental justice.

Changes to the cost-share rate from 80 to 75 percent Federal would minimally increase the cost burden for some communities. However, the 90-percent Federal cost share proposed for areas designated as “limited resource” would encourage EWP Program participation by communities that might not otherwise be able to afford to participate in the Program. This provision would help address environmental justice concerns, by improving access to Program benefits for socioeconomically disadvantaged communities.

Program modifications in funding, priorities, and floodplain easement regulations could potentially affect post-disaster land uses. Additionally, this alternative allows for greater opportunities for cooperation with local land use plans. Floodplain easement purchases could be integrated into an area’s comprehensive plan for growth and provide functional open space for a community.

Applying cost-share rates to sites irrespective of their priority designation is anticipated to assist areas more efficiently where threats to life or property are the most imminent, while extending the response time to address an exigency from 5 to 10 days would allow for more planning and community coordination.

Similar to Alternative 2, under the Preferred Alternative social defensibility criteria would be added to the current Program environmental and economic defensibility requirements. If a proposed EWP practice or some aspect of an EWP project could potentially seriously harm an important social element of a community, mitigation to reduce any adverse affects or redesign of the project would be required. If neither mitigation nor redesign would be adequate to offset such adverse effects, the project would not be considered socially defensible and would not be allocated project funding. Additionally, a project not considered economically defensible could still be eligible for EWP funding if there is a compelling social or environmental justification for the work. By establishing a social rationale meant to address the value of a community property, or based on the utility of a property to the landowner, the proposed action includes participants who might have been left out of the EWP Program in the past. This is especially the case when the economic value of a property may be low or difficult to calculate but the importance of the property to the community as a vital part of its social or cultural life, or to the landowner as a place of residence or business, is recognized.

The Preferred Alternative expands the current EWP program to a limited extent to provide assistance for the removal of sediment and debris, including windblown debris, from agricultural land (croplands, orchards, vineyards, and pastures), particularly in areas considered environmentally sensitive. This would contribute to the restoration of a community's productive agricultural land and be a source of capital investment following a natural disaster. However, debris removal, and the provision of repairing structural/enduring/long-life conservation practices, would be limited to sites not eligible for assistance under the Emergency Conservation Program (ECP) administered by the Farm Service Agency. This would limit the number of instances where these provisions would be used, especially on agricultural lands cultivating commodity crops under the jurisdiction of the ECP. Thus, the potential benefits realized from these program measures could be significantly reduced when compared to such benefits accruing under Alternatives 2 or 3.

Although it would not allow Federal purchase of floodplain easements in small rural communities, the Preferred Alternative would allow for the restoration of flood-prone rural areas through buyout of residential or improved lands, either directly through a floodplain easement or indirectly through funding of structure removal where a project sponsor, such as a town or county, assumes the floodplain easement. Converting such developed land to restored floodplain uses would reduce the need to provide public services, relieving the burden on the tax base associated with providing any relatively expensive services that might have been associated with developed uses, such as water, sewer, solid waste disposal, and fire response. Incorporating a limit of two repairs in ten years to EWP structures damaged from the same type of natural disaster and repaired with EWP assistance will encourage the purchase of floodplain easements and the conversion of developed land to open space. The end result will be increased open space in the community, a lower tax burden, and improved natural capabilities to fight disasters.

The effects of agricultural floodplain easements are the same in all of the current Program alternatives, and are detailed in Section 5.3.5.1. The Preferred Alternative expands the purchase of floodplain easements to include non-agricultural or improved lands, but only where such land is in a rural, agricultural setting and multiple residences are not relocated solely for the purpose of flood avoidance. The structure buy-out practice proposed under the Preferred Alternative, however, could have similar effects on a community as the non-agricultural floodplain easement program proposed under Alternative 2, and detailed in Section 5.3.5.1. Relocation of people and structures away from flood-prone areas eliminates potential future risk and has the beneficial aspect of reducing the cost of future disaster recovery. The short-term impacts and cost of exercising floodplain easements on improved land may be greater than those associated with the immediate repair of land and protection of existing property under the Current Program. However, a longer term benefit from eliminating the potential for future risk to people and property and a subsequent reduction in the cost and resource commitment necessary for future disaster recovery would be expected to offset any higher short-term cost of the program under this alternative.

Participation in the floodplain easement purchase program would remain completely voluntary under the Preferred Alternative. Although this provision would directly affect property owners who sell easements, it does have indirect consequences for the community at large. By encouraging floodplain easements, this provision reduces the potential for continuing cycles of damage and recovery and tends to discourage additional development in frequently flooded areas. Adverse effects of floodplain easements on a community may include a decrease in the community's capital investment source because of loss of productive agricultural land, or, a change in the community's social networks from the loss of an important social property.

Overall, the Preferred Alternative would have several beneficial impacts on the human community. These beneficial impacts are anticipated to offset any adverse effects associated with the potential increase of community disruption and/or resident displacement from structure buy-out practices or the expansion of the floodplain easement option. Expanding the defensibility criteria to include social defensibility, and including provisions for limited-resource communities, would substantially increase access to potentially beneficial effects of the Program for economically disadvantaged or minority persons who may have been previously excluded.

5.4 CUMULATIVE IMPACTS OF THE EWP PROGRAM

In addition to considering direct and indirect effects, the CEQ NEPA regulations require that an EIS consider "cumulative impacts." Cumulative impacts are the combined impacts on the environment from the incremental effects 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 C-E-Q method used to evaluate cumulative impacts of the EWP Program alternatives is the same methodology that was used to analyze direct and indirect effects. The methodology used to determine which potential actions were included and how their incremental and cumulative effects were determined is discussed in detail in Appendix B.

NRCS determined that it was not feasible to evaluate Program impacts in every watershed in the United States where EWP practices might be employed. Consequently, EWP practices carried out as a result of sudden impairments in three example watersheds–the Buena Vista-Maury in Virginia, the 8th Street Burn Area-Lower Boise in Idaho, and the East Nishnabotna in Iowa–were chosen for cumulative impacts analysis. The rationale for their selection (explained more fully in Appendix B) was that these three EWP sites were examples of the range of possible EWP practice situations. Buena Vista, VA and Boise represented the use of EWP practices in areas of potentially high interaction with a variety of land uses because of their interface between undeveloped, Federal, and State agency-managed land and urban settings and their steep-slope environments. East Nishnabotna represented an almost totally agricultural land use context.

The analysis below begins by describing what "other" types of actions were considered. Then, cumulative impacts are considered for each of the alternatives. For each alternative, that analysis begins by considering the cumulative impacts in each example watershed. Finally, the Program-wide implications of the watershed-specific analysis are discussed. The cumulative impacts of the alternatives are compared in Chapter 3.

5.4.1 Description of Other Actions

Choosing and evaluating the other Federal and non-Federal actions to be considered in the cumulative impacts analysis first involved defining spatial and temporal boundaries for the actions to be considered in the analysis. After this "scoping" process, the affected environment for cumulative impacts was described. The cumulative environmental consequences were determined for the appropriate spatially-and-time-bounded actions in the same way the direct and indirect effects were analyzed.

Most EWP practices are stream or floodplain-specific. Therefore, many of the "other" governmental actions that interact with them are also stream or floodplain-specific. Because of the regulated nature of floodplains and watercourses, many of these actions are associated with the actions of NRCS and other Federal agencies, and with State or local government actions. The major exceptions are private actions that increase runoff or modify the hydraulic regime in the same watershed as the EWP activities. Typically, these are upland land-disturbing activities associated with agriculture and commercial and residential activities. Each of these types of other actions is described briefly below.

Other NRCS Actions. Other NRCS actions include past EWP activities in the same watershed as a current EWP action, particularly those on the same reach as the current EWP activity. Also included are past, present, or planned actions of other NRCS programs in the same watershed as the current EWP action, particularly those on the same reach as the current EWP practice.

Other USDA Actions. Other USDA actions include past, present, or planned actions of other USDA agency programs *(i.e.,* not including NRCS programs) in the same watershed as the current EWP action, particularly those on the same reach as the current EWP practice.

Other Federal Agency Actions. Other Federal agency actions include past, present, and planned actions of other Federal agency programs (i.e., not including USDA programs) in the same watershed as the current EWP action, particularly those on the same reach as the current EWP practice. Chapter 2 and Appendix E contain information on these Federal programs.

State and Local Government Actions. State government actions often result from State delegation of some or all aspects of the Federal programs discussed above. However, many other State actions, and most local government actions, are smaller and even more site-specific than the Federal governmental program actions discussed above. Again, the actions considered are those occurring in the same watershed as the EWP action, particularly those on the same reach as the current EWP practice.

Private Actions. Private actions can include all nongovernmental actions that increase runoff or modify the hydraulic regime in the same watershed as the EWP activities. Such private actions are the most site-specific of all actions considered in the cumulative impact analysis. However, because they are ubiquitous, all such actions in a watershed tend to interact and to be reflected in the overall characterization of the watershed's water quality. Therefore, all such actions are considered in the cumulative impact analysis.

5.4.2 Cumulative Impacts under the Current Program (Alternative 1)

Cumulative impacts for the three example watersheds under the Current Program are analyzed on a watershed by watershed basis in 5.4.3.1. Program-wide implications are discussed in 5.4.3.2

5.4.2.1 Cumulative Impacts in the Example Watersheds

Cumulative impact analysis in each example watershed starts with describing the relevant impacts for the EWP practice or practices and determining the relevant watershed ecosystem components for biological resources in the watershed. The analysis then determines what other actions should be considered. Determining the cumulative impacts is accomplished through analyzing the spatial and temporal interaction between the impacts of these actions. Finally, areas of uncertainty that may affect the analysis are discussed.

5.4.2.1.1 Buena Vista and Maury River Watersheds, Virginia

The affected environment information for the Buena Vista-Maury River watersheds is presented in Chapter 4, Section 4.2. Additional, detailed environmental information about the watershed is found in Section D.3.2 of Appendix D.

Relationship between Cumulative Impacts in the Buena Vista Watershed and the Maury River Watershed

As noted in Chapter 4, the two watersheds differ significantly in that the Buena Vista watershed is primarily urban and recreational or part of the George Washington and Jefferson National Forests, while the Maury River watershed is primarily agricultural. EPA has characterized the Maury River watershed as having "less serious water quality problems" and "low vulnerability to stressors" (EPA, 1999a). In the absence of any demonstrated impairment of the Maury River watershed downstream of the four streams that constitute the Buena Vista watershed, there do not appear to be any significant cumulative environmental impacts from the actions in the Buena Vista watershed downstream in the Maury River watershed. Similarly, there do not appear to be sufficiently intense agricultural impacts upstream from the reach of the Maury River that flows through Buena Vista, VA, and constitutes the receiving stream for the four streams that comprise the Buena Vista watershed, to cause any significant cumulative biotic impacts in the Maury River.

Cumulative Biological Impacts

The relevant EWP impacts for beginning this analysis are those associated with cobble and tree-slide debris removal. These impacts can be divided into two categories: (1) impacts associated with site preparation and (2) impacts associated with sediment and cobble or tree-slide removal and disposal. Impacts associated with site preparation include the removal of vegetation and topsoil, which may increase stream temperature, decreased habitat, increased turbidity and sedimentation, increased pollution from heavy equipment, and modification of water chemistry through the addition of sediment, nutrients, and other pollutants. Impacts associated with debris removal include the direct effects of the removal of bottom materials, such as disturbance of habitat and nesting, turbidity and sedimentation impacts, migration blockage, and physical and chemical water quality reduction (see Darnell, 1976). These impacts are described more fully in Section 5.2.2.

Biological Watershed Ecosystem Components

Based on the types of impacts described above, the following biologic watershed ecosystem components were identified at the locations indicated within the watershed and downstream: (1) warm-water fisheries in the extreme lower reaches of the four tributary streams and in the Maury River; and (2) sedimentation and turbidity in the four streams and into the Maury River and, possibly, downstream. No wetlands or T&E species were found in the relevant portions of these watersheds.

Analysis of Cumulative Biological Environmental Consequences

The governmental and nongovernmental actions that have the potential to interact cumulatively with the EWP practices performed in the Buena Vista watershed are outlined in *Table 5.4-1 -- Cumulative Actions–Buena Vista Watershed*. Cumulative biological environmental consequences of the proposed activities and the related actions are summarized below in *Table 5.4-2 -- Summary of Cumulative Impacts for the Buena Vista Watershed*, found at the end of Section 5.6. The overall cumulative biological significance of all of the actions analyzed is discussed in the paragraph entitled *Summary of Biological Cumulative Environmental Consequences* following Table 5.4-1.

Table 5.4-1 -- Cumulative Actions – Buena Vista Watershed

Federal Actions	State Actions	Local Actions	Private Actions
Other EWP Practices (Bank Armoring and Debris Removal) Elsewhere in Watershed NRCS Buena Vista Public Law 566 Project (flood control) USFS George Washington National Forest Mgmt. Plan Corps of Engineers Flood Wall Project (incl. Flood protection of City STP) FEMA Disaster Assistance Program	Virginia Dept. of Emergency Services Flood Mitigation Activities Virginia Dept. of Transportation post-flooding road and infrastructure repair and construction	City post-flooding CDBG block grant for drainage repair City post-flooding riprapping City post-flooding street and utility repair City school construction project ; borrow area for floodwall project	Flood repair Riparian area construction and modification Upland construction and ground disturbing activity Commercial, industrial, agricultural, forestry, recreational, and residential land use activities

Summary of Cumulative Biological Environmental Consequences

As Table 5.4-2 at the end of this section indicates, because of either time frame separation or spatial separation within the watershed, under the No Action Alternative (the Current Program*)* cumulative environmental consequences of the EWP practices are modest. No indication has been found of any cumulative interaction that would adversely affect any of the fisheries or watershed ecosystem components identified in either watershed. No wetlands or T&E species were found in the project area, or are thought to be adversely affected. Very little interaction was found for the turbidity and sedimentation watershed ecosystem components, and that interaction was found to be only short-term in nature. The overall contribution of the EWP practices to water quality and habitat degradation in the watershed was small and far less influential cumulatively than the other actions, particularly the private actions, which were too numerous to evaluate individually. Overall, the contribution of all actions to water quality and habitat degradation in the watershed were modest. This is consistent with the EPA watershed characterization summarized in *Table 4.5-2* in Chapter 4, which indicates that the Buena Vista and Maury River watersheds exhibit "low vulnerability to stressors" (EPA, 1999a).

Therefore, from a biological standpoint, neither watershed would appear to be highly enough stressed environmentally to demand extensive coordination of future EWP practices with other potentially interactive actions. Nor does it appear that it is necessary to favor less environmentally impacting practices, such as floodplain easements or critical area treatment, over the more traditional structural EWP practices used in 1995 in either watershed in order to maintain cumulative biological impacts at an acceptable level in either watershed.

For example, because of the highly urban nature of floodplain usage in the Buena Vista watershed, it is less likely that floodplain easements will play as important role there than they potentially may play in the more rural Maury River watershed. On the other hand, the possibilities of Program coordination presented by the interaction of the various activities would appear to offer mutual Program benefits and savings that should not be discounted in either watershed (see also the discussion of socioeconomic impacts that follows). See Table 5.4-2 for a summary of cumulative impacts in Buena Vista, VA.

Socioeconomic and Other Human Resource Cumulative Impacts

Socioeconomic and other human resources are analyzed separately from biological impacts because their interactions are not limited to the watersheds in which they occur.

Socioeconomic Impacts in the City of Buena Vista, VA

In general, any potentially adverse effects of EWP project activity on the socioeconomic conditions of the Buena Vista, VA community are balanced against potential benefits. Some potential for disruption of the local neighborhoods surrounding specific project sites is possible. However, the primary effect of these actions is the general benefit of protecting the residential and commercial properties immediately surrounding the project sites, restoration of damaged land areas, and the improved appearance of the surrounding area following restoration and repair activity.

The cumulative effect of EWP activity on the socioeconomically defined region corresponding to natural boundaries of the Maury Watershed is influenced by a number of factors. These include the economic value of the watershed as a source of production (agriculture and industry), tourism and other recreational uses, and residential use of the land. The direct economic contribution of construction related expenditures associated with EWP activity in the Buena Vista, VA community is not expected to have a noticeable effect when arrayed against the regional economy of the watershed area. Similarly, any direct physical effect would not be expected to extend beyond the immediate community. In its current configuration, the project does not change or alter the physical condition of the site beyond what existed prior to the flood event. As a result, the project represents no net loss or acquisition of economically productive land, or land that may be converted to desired social uses.

However, the overall effect of the project is to reduce the potential threat to existing property posed by the potential for additional flooding in the future and to improve the general appearance and utility of available land. The potential for increased development in the Buena Vista, VA area and by extension, other areas of the watershed region does follow from the effect of EWP activity. The direct benefit of the project is the enhancement of the desirability of the region as a place to live and invest for local residents. At the same time, the project contributes, along with other locally based programs, to the attractiveness of the area for new residents and investors, thus increasing development pressures on the watershed.

Table 5.4-2 -- Summary of Cumulative Impacts of the Buena Vista Watershed

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
EWP Practice on Chalk Mine Run, Pedlar Gap Run, and Lowry Run	1995	Not applicable	Minor short-term increases in turbidity and sedimentation confined to lower reach of Chalk Mine Run; long-term impacts to environment should be positive as a result of reestablishing the flow regime and reducing the impacts of flooding	Minor short-term increases in turbidity and sedimentation; long-term reduction in nonpoint source runoff
Other EWP Practices in Watershed (bank armoring on Pedlar Gap Run and Debris removal on Pedlar Run and Indian Gap Run)	1996	On same and nearby streams in Buena Vista watershed	Minor short-term increases in turbidity and sedimentation confined to lower reaches of streams; long-term impacts to environment should be positive as a result of reestablishing the flow regime and reducing the impacts of flooding	Unlikely – actions not sufficiently time-linked
Buena Vista Watershed Public Law 566 Project	Near Future	On same streams in Buena Vista watershed	Potential short-term adverse impacts to fisheries during construction; long-term impacts should be positive as a result of the reduction of nonpoint source runoff into the watershed	Unlikely – actions not sufficiently time-linked

Table 5.4-2 (continued) -- Summary of Cumulative Impacts of the Buena Vista Watershed

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
George Washington and Jefferson National Forests Management Plan	Ongoing	Upstream of all EWP practices in Buena Vista watershed	Maximization of natural vegetation on the high relief topography, this management should minimize runoff from the headwaters and reduce the likelihood of interactive impacts on the lower reaches of the streams	Unlikely – minimal nonpoint source runoff; no interaction with trout fishery sensitive indicator because of spatial separation
U.S. Army Corps of Engineers Floodwall Project	1992-1997	Immediately downstream from EWP practice on lower Chalk Mine Run and approximately 1 mile downstream from other EWP practices	Loss of 0.6 acres of subaqueous bottom and associated benthos; modification of 25 acres of terrestrial habitat, including the removal of some riparian vegetation, which was subsequently revegetated for wildlife and aesthetic benefits; widening and improvement of riparian habitat at Glen Maury Park across the Maury River; temporary water quality deterioration during the construction of the floodwall (but improvement of water quality in the long-term through addition of pools and riffles for fishery enhancement and terrestrial vegetation for wildlife values)	Minimal – actions time-linked but short-term increases in turbidity are minor and siltation spatially separated except on Lower Chalk Mine Run; long-term reduction in nonpoint source runoff
FEMA Disaster Assistance for Hurricane Fran Flood	1996	In same areas of the Buena Vista watershed as the EWP practices	Short-term increases in turbidity and sedimentation during the repair and construction phases of these activities; long-term impacts should be positive as a result of the overall long-term reduction of nonpoint source runoff into the watershed	Unlikely – actions not sufficiently time-linked
Virginia Department of Emergency Assistance Hurricane Fran Flood Assistance	1996	Same as above	Same as above	Unlikely – actions not sufficiently time-linked
Virginia Department of Transportation Post-Flooding Road and Infrastructure Repair	1996	Same as above	Same as above	Unlikely – actions not sufficiently time-linked
City of Buena Vista CDBG Block Grant for Neighborhood Flood Repair	1996	Same as above	Same as above	Unlikely – actions not sufficiently time-linked
City of Buena Vista Post-Flood Riprapping	1996	Same as above	Same as above	Unlikely – actions not sufficiently time-linked
City of Buena Vista Post-Flood Street and Utility Repair	1996	Same as above	Same as above	Unlikely – actions not sufficiently time-linked
City of Buena Vista School Construction at Floodwall Borrow Pit Area	Near Future	Upslope from EWP practices on Pedlar Gap Run	Same as above	Unlikely – actions not sufficiently time-linked
Flood Protection for City Sewage Treatment Plant	1992-1997	Downstream on Maury River from EWP practices	Same as above	Minor short-term increases in turbidity and sedimentation; long-term reduction in point and nonpoint source runoff

Table 5.4-2 (continued) -- Summary of Cumulative Impacts of the Buena Vista Watershed

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
Flood Repair Activities	Ongoing	In same areas of the Buena Vista watershed as the EWP practices	Short-term increases in turbidity and sedimentation during the repair and construction phases of these activities; long-term impacts should be positive as a result of the overall long-term reduction of nonpoint source runoff into the watershed	Minor short-term and long-term increases in turbidity and sedimentation
Riparian Area Construction and Modification	Ongoing	Same as above	Same as above	Minor short-term and long-term increases in turbidity and sedimentation
Upland Construction and Ground Disturbing Activity	Ongoing	Same as above	Same as above	Minor short-term and long-term increases in turbidity and sedimentation
Commercial, Industrial, and Residential Land Use Activities	Ongoing	Same as above	Same as above	Minor short-term and long-term increases in turbidity and sedimentation
Flood Related Business Closures	Ongoing	Downstream in the Buena Vista watershed from the EWP practices	Significant reduction in manufacturing out put and employment in Buena Vista community	Unlikely – EWP practices have very minor employment input into Buena Vista economy
Railroad Bridge Modifications to Remove Flow Restrictions	Near Future	Downstream on same reaches as EWP practices	Same as above	Unlikely – actions not sufficiently time-linked

Total watershed management utilizing a non-engineered approach, such as that proposed under Alternative 3, would have the potential to significantly affect both the patterns of land use in the local community and the social and economic structure of the community, as well. Essentially, the cumulative social effect becomes a value-based trade off between maintaining the status quo of the local community through short-term, engineered solutions and potentially altering the natural characteristics of the watershed; or restoring the natural qualities of the watershed and potentially altering land uses and social practices in the watershed community.

Land Use Impacts

The effects of the EWP practices within Buena Vista will be more significant on a localized level. However, the combination of the floodwall and increased flow from unimpeded streams within the city may result in greater flooding downstream in the watershed. The land outside of Buena Vista, in Rockbridge County, is primarily rural agricultural (Rockbridge County Comprehensive Plan, 1996). Any downstream effects of flooding in the City will cause damage to agricultural and rural residential areas rather than major population centers. The closest population center to Buena Vista is the town of Glasgow, situated approximately 11 miles downstream. In that location, both industrial and residential uses are near the Maury River.

However, it is unlikely that any major land use decisions in that community will be altered due to the diversion of waters from Buena Vista.

Upstream from Buena Vista lie primarily agricultural and forested lands. The portion of Rockingham County within the greater watershed is very low density. Its agricultural land is zoned at approximately 1 dwelling unit (DU)/75 acres, encompassing a large amount of the area within the study watershed. In addition to the agriculture, much of the land is national forest and has prohibitions on development. Approximately 20 percent of the land in the study area is rural residential, with the densities averaging 1 DU/acre. Development within the area is prohibited within 500 feet of the 100-year floodplain, resulting in a relatively unencumbered riverbank. According to the County, activity in that area is relatively nonexistent, thus presenting little threat to Buena Vista downstream (Crowder, 1999).

The portion of Augusta County within the watershed is also comprised of primarily agricultural land and national forest. Only a small pocket of relatively concentrated development within the watershed exists, centered on Criglersville. However, nearly all the development is residential in nature, with a small amount of commercial also present. The area is zoned for agricultural uses with minimum lot sizes of one acre. Some of the area is also designated as agricultural conservation. No formal regulations are part of this designation; it merely demonstrates the intent of maintaining the agricultural nature of the land. The development potential of the lands within the watershed is primarily limited by the provision of water and sewer. Currently, the utilities are at their maximum capacity, so future development is not likely. The comprehensive plan does not include any changes to the area; the current level of development is expected to remain the same (Earhart, 1999).

Augusta County also has a floodplain overlay district article governing development and activity within this area. Due to its location upstream from the EWP sites in Buena Vista, any activities regarding damming or relocation of watercourses could be detrimental. However, the article prohibits any such action within the floodplain, flood fringe, or floodway. (Augusta County Floodplain Article, Undated) Thus, any downstream effects on Buena Vista in this portion of Augusta County shall be nearly non-existent.

Impacts to Historic, Cultural and Recreational Resources

The EWP DSRs did not note any historic properties located in the project areas. However, this does not mean that historic resources were not present, since several historic sites have been identified on Indian Gap Run and Chalk Mine Run (NRCS DSRs, 1995a). Also, as noted in Chapter 4, significant historic and cultural resources are found in the City of Buena Vista, and abound in Rockbridge County (Rockbridge County, 1996). Nevertheless, given the lack of any specific impacts to historic and cultural resources identified in carrying out the EWP practices, and the relatively modest impacts to these resources from the other actions identified for cumulative impact analysis, it does not appear that any significant interaction between the actions resulted in any significant cumulative impacts to historic and cultural resources. Further, it does not appear that any recreational resources were adversely affected by the cumulative affects of the actions analyzed.

Areas of Uncertainty that Affect the Cumulative Impacts Analysis

At least some areas of uncertainty were identified regarding most of the actions considered in the cumulative impact analysis. Most importantly, the environmental analysis performed on the EWP practice under review (NRCS DSRs, 1995a) was very rudimentary, consisting essentially of only an economic justification of the practice. In addition, EWP practices that were carried out in 1992 could not be analyzed because the records of those projects are no longer available (Biddix, 1999).

Environmental baseline information required for the analysis initially was drawn from the EPA evaluation of the Maury River watershed, of which the Buena Vista watershed is a subwatershed (EPA, 1999a). This information is more general in nature than would be ideal. Fortunately, much of the more specific information needed was available from the NRCS Buena Vista Watershed Final Plan-Environmental Impact Statement (NRCS, 1999b), the U.S. Army Corps of Engineers Environmental Assessment and Supplemental Environmental Assessment (USACE, 1990 and 1992), and the County of Rockbridge Comprehensive Plan (Rockbridge County, 1996).

The major problem in the Buena Vista watershed was in the area of private land use actions, where more specific information would be useful. In addition, a comparable level of comprehensiveness of information was not as available for the Maury River Watershed as for the Buena Vista watershed. Thus, the relationship of impacts in the Buena Vista watershed to impacts in the Maury River watershed is less well documented than would be ideal.

5.4.2.1.2 Eighth Street Burn Area-Lower Boise River Watersheds, Idaho

The affected environment information for the 8th Street Burn Area-Lower Boise River watershed is presented in Subsection 4.5.2. Additional, detailed environmental information about the watershed is found in Section D.3.3 of Appendix D.

Relationship of Cumulative Impacts in the Burn Area Watershed and the Lower Boise River Watershed

As noted in Chapter 4, the two watersheds differ significantly in that the Eighth Street Burn Area watershed was used primarily for grazing and recreation prior to the fire (with some mining, forestry, and residences in the area), while land use in the adjacent portion of the Lower Boise River watershed is primarily a commercial and residential urban area. However, even before the fire, and increasingly since, the private property portions of the area are under significant development pressures. As noted, EPA has characterized the Lower Boise River watershed as having “more serious water quality problems, but with “low vulnerability to stressors” (EPA, 1999b). Thus, in the absence of any demonstrated impairment of the Lower Boise River watershed downstream of Boise, there do not appear to be significant cumulative environmental impacts from the actions in the Boise watershed further downstream than perhaps in the immediate portion of the Lower Boise River watershed in the city itself.

Cumulative Biological Impacts

The relevant EWP impacts for beginning the analysis are those associated with "critical area treatment" practices (upland diversion, grade stabilization structures, critical area seeding, and the construction of debris basins). These practices have short-term and long-term impacts similar to those of debris removal, including creating access and grading, shaping, and re-vegetating affected areas by seeding or planting. The environmental consequences of all of these actions have been discussed in Sections 5.2.2, 5.2.3, 5.2.4, and 5.2.5.

Biological Watershed Ecosystem Components

Based on the types of impacts described above, the following biologic watershed ecosystem components were identified at the locations indicated within the watershed and downstream: (1) warm water fisheries in the Lower Boise River; and (2) sedimentation and turbidity in the subwatershed streams, the Lower Boise River and, possibly, downstream.

Analysis of Cumulative Biological Environmental Consequences

The actions that have the potential to interact cumulatively with the EWP practices performed in the Boise watershed are outlined in Table 5.4.3. Cumulative biological environmental consequences of the proposed activities and related actions are summarized in Table 5.4-4. The overall cumulative biological significance of all of the actions analyzed is discussed in the paragraph following Table 5.4.3.

Table 5.4-3 -- Cumulative Actions – Boise Watershed

Federal Actions	State Actions	Local Actions	Private Actions
Boise National Forest post-fire salvage timber sale Boise National Forest Management Plan BLM Boise Front ACC Plan Boise National Forest BAER Plan BLM Emergency Fire Rehabilitation Plan NPS Emergency Fire Rehabilitation Plan BIA Emergency Fire Rehabilitation Plan	Department of Disaster Services fire rehabilitation activities Department of Water Resources fire rehabilitation activities Department of Fish and Game fire rehabilitation activities Department of Lands fire rehabilitation activities Department of Agriculture fire rehabilitation activities Department of Transportation fire rehabilitation activities Department of Parks and Recreation fire rehabilitation activities Department of Veterans Affairs fire rehabilitation activities	Boise City Foothills Policy Plan Repair and reconstruction of Eighth Street road Other road and utility construction and repair projects	Grandfathered subdivisions in and adjacent to Burn Area Private fire repair activities Other upland construction and ground disturbing activity Commercial, industrial, mining, grazing, forestry, off-road vehicle recreational, and existing residential land use activities

Summary of Cumulative Biological Environmental Consequences

As Table 5.4-4 indicates, because of time frame linking and spatial proximity within the subwatersheds and in the reach of the Lower Boise River immediately downstream of the subwatersheds, cumulative impacts are potentially significant in both watersheds under the No Action alternative (the current Program). However, because of "low vulnerability to stressors" characterization in the EPA watershed characterization summarized in Table 4.5-4 in Chapter 4, there is no indication that such cumulative interaction would adversely affect any of the fisheries watershed ecosystem components identified in either watershed (EPA, 1999b). No wetlands were found in the project area, or are thought to be adversely affected. Where sensitive or T&E species were found in the project area, mitigative measures were taken to ensure that no adverse impacts occurred (BLM et al., 1996). Very little interaction was found for the turbidity and sedimentation watershed ecosystem components and that interaction was found to be only short-term in nature. The overall contribution of the EWP practices to water quality and habitat degradation in the watershed was small and far less influential cumulatively than the other actions, particularly the private actions, which were too numerous to evaluate individually. Overall, the contribution of all actions to water quality and habitat degradation in the watershed were modest. This is consistent with the "low vulnerability to stressors" characterization in the EPA watershed characterization.

Table 5.4-4 -- Summary of Cumulative Impacts for the 8th Street Burn Area and Lower Boise River Watersheds

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
EWP Practices on Cottonwood, Crane, Curlew, and Dry Creeks and Freestone and Hulls Gulches	1996-97	Not applicable	Minor short-term increases in turbidity at and downstream of all practices; long-term impacts to environment should be positive as a result of reestablishing the vegetation and reducing the impacts of runoff	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff
Bureau of Land Management (BLM) Salvage Timber Sale	1997	BLM Burn Area lands (in Burn Area watershed)	Minor short-term increases in turbidity; long-term impacts to environment should be positive as a result of reestablishing the vegetation and reducing the impacts of runoff	Same as above
BLM Boise Front Areas of Critical Environmental Concern (ACEC) Plan	Ongoing	BLM Boise Front lands (including part of Burn Area watershed)	Short- and long-term impacts should be positive as a result of more natural management resulting in the reduction of nonpoint source runoff into the watershed	Short- and long-term reduction in nonpoint source runoff should result in long-term positive interaction
Boise National Forest Management Plan	Ongoing (current plan adopted in 1990)	Boise National Forest (including part of Burn Area watershed)	Minor short-term increases in turbidity from runoff associated with limited grazing, hardrock mining, timber harvest, and off-road vehicle use; long-term impacts to environment should be positive as a result of increased efforts to combat the effects of these uses resulting in reestablishing vegetation and reducing the impacts of runoff	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff (livestock grazing removes flammable materials and reduces fire hazards)

Table 5.4-4 (continued) Summary of Cumulative Impacts for the 8th Street Burn Area and Lower Boise River Watersheds

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
Boise National Forest Burned Area Environmental Rehabilitation (BAER) Plan	1996-97	In National Forest portion of Burn Area watershed	Short-term increases in turbidity during the repair and construction phases of these activities; long-term impacts to environment should be positive as a result of the overall long-term reduction of nonpoint source runoff into the watershed	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff
BLM Emergency Fire Rehabilitation Plan	1996-97	In Burn Area watershed	Short-term increases in turbidity during the repair and construction phases of these activities; long-term impacts should be positive as a result of the overall long-term reduction of nonpoint source runoff into the watershed	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff
NPS Emergency Fire Rehabilitation Plan	1996-97	Same as above	Same as above	Same as above
BIA Emergency Fire Rehabilitation Plan	1996-97	Same as above	Same as above	Same as above
Idaho Department of Disaster Services fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Water Resources fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Fish and Game fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Water Resources fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Fish and Game fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Lands fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Agriculture fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Transportation fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above

Table 5.4-4 (continued) Summary of Cumulative Impacts for the 8th Street Burn Area and Lower Boise River Watersheds

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
Idaho Department of Parks and Recreation fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Idaho Department of Veterans Affairs fire rehabilitation activities	1996-97	Same as above	Same as above	Same as above
Boise City Foothills Policy Plan	Ongoing	Non-Federal Boise Front Foothills lands (including part of Burn Area watershed)	Short- and long-term impacts depend on level of buildout in Foothills area; should be slightly negative to mildly positive depending on success of attempts to encourage more natural management, which could result in the reduction of nonpoint source runoff into the watershed	Short- and long-term increase or reduction in nonpoint source runoff depending on success of Plan; could result in either long-term positive or negative interaction
Repair and reconstruction of Eighth Street Road	1996-97		Short-term increases in turbidity during the repair and construction phases of these activities; long-term impacts should be positive as a result of the overall long-term reduction of nonpoint source runoff into the watershed	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff
Other road and utility construction and repair projects	Ongoing	Developed and developing portion of Burn Area and areas downslope	Same as above	Minor short- and long-term increases in turbidity
Private fire repair activities	1996-97	Developed portion of Burn Area	Short-term increases in turbidity during the repair and construction phases of these activities; long-term impacts should be positive as a result of the overall long-term reduction of nonpoint source runoff into the watershed	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff
Private upland construction, ground disturbing activity, and commercial, mining, grazing, forestry, recreational, and residential land use activities	Ongoing	Developed and developing portion of Burn Area and areas downslope	Short- and long-term impacts depend on level of buildout in Foothills area (particularly the buildout in two large grandfathered subdivisions); could be negative to mildly positive depending on success of attempts to encourage more natural management, which could result in the reduction of nonpoint source runoff into the watershed	Short- and long-term increase or reduction in nonpoint source runoff depending on success of Plan; could result in either long-term positive or negative interaction

Because both watersheds are relatively highly stressed environmentally, the extensive coordination of past (and hopefully future) EWP practices with other potentially interactive actions appears well warranted, in order to reduce the likelihood of significant cumulative impacts. Less environmentally impacting practices, such as the critical area treatments employed, appear to have been the appropriate choice over more traditional structural EWP practices in order to maintain cumulative biological impacts at an acceptable level in either watershed. Floodplain, or perhaps more properly "floodway" floodplain easements, or other similar land use controls, may also be useful practices in this context, particularly in the rapidly developing areas where "grandfathered" subdivisions occur. See Table 5.4-4 at the end of Section 5.6 for a summary of the cumulative impacts in the Boise Foothills area.

Socioeconomic and Other Human Resource Cumulative Impacts

Socioeconomic and other human resources are analyzed separately from biological impacts because their interactions are not limited to the watersheds in which they occur.

Socioeconomic Impacts in the City of Boise

The communities that lie within the Lower Boise Watershed represent a mix of urban and non-urban residential patterns identified with the City of Boise, its suburban expansion, and the more rural qualities of the upper drainage area of the watershed. In addition to the economic value of agricultural products, the watershed represents a significant economic and social influence on the surrounding communities in the form of recreation and tourism income that is supported by a number of parks, trails, and educational facilities located within the watershed. Especially sensitive, though more indirectly affected, the continuing viability of the city's northern suburbs and downtown core is dependent on the management and control of potential flooding.

The primary economic benefit associated with the watershed lies in the value of the private and public uses that have been made of the watershed region for the benefit of the local community. The installed EWP practices require some permanent commitment of land to flood control requirements and do not recover any additional land beyond what had existed prior to the 1996 fire. However, the improved visual quality of the affected area in conjunction with the increased value of the existing restored natural acreage and protected urban residential and commercial areas represents a significant beneficial contribution to the continuing viability of the watershed communities. Installed EWP practices contribute to existing plans for local development by restoring and protecting the residential communities north of the city in the Boise Foothills region. An increased potential for urban runoff may be associated with this expansion.

The Upper Boise Watershed region is representative of a situation in which the installed EWP practices are implemented in the more rural areas of otherwise metropolitan counties. The need to intervene in these rural and natural areas of the watershed in order to protect and enhance the value of urban property downstream is comparable to the situation found in the Antelope Valley of California. Here, another relatively rural area, located within the metropolitan county of Los Angeles, is also the subject of EWP activity. In both cases, the need to alter the natural contours of the watershed region in order to protect land and the existing property of major urban centers is a consideration. Also of importance is the potential for a differential impact on small rural landholders in order to assure the social investment in higher valued residential, commercial and industrial properties in the developed urban core.

Restoration of the land through revegetation, along with the elimination of potential threat through flood control practices, increases the desirability of the land for expanded urban development and subsequently the expanded growth of the city of Boise into the more natural areas of the watershed.

Land Use Impacts

Land development patterns in Boise are typical of many cities, sprawling into open space areas surrounding the urban core. Both residential and commercial development are encroaching on the naturally sensitive areas of the Boise watershed. The foothills surrounding the city, as well as the floodplain bisecting the urban core, both warrant protection from further development and degradation. Land use decisions in the watershed rest on policy to protect and strengthen the natural reserves. The EWP practices in place affect the types of development throughout the watershed. Without these practices, coupled with policy plans of local governments, the expansion of Boise would be threatened. The EWP practices positively impact the overall land use of the area, allowing residential and commercial areas of Boise to be protected from further disaster.

Boise has taken several steps to protect the natural areas, thus safeguarding the future of the urbanized uses. Through its comprehensive plan, Boise has identified the protection of the floodplains and foothills as primary environmental concerns. Several methods, such as floodplain conservation floodplain easements, are proposed as potential policy action points for conserving these resources. In addition to these policies, the EWP practices aid in the protection of the resources from an engineering perspective. Projects are aimed at engineering solutions to reduce erosion and runoff.

Boise has adopted a Foothills Policy Plan in order to control the amount of development in the foothills areas surrounding the city, thus preventing further degradation of the natural vegetative cover. The Plan was initiated and developed by the City of Boise in the early 1990s. The primary impetus for the policy plan was the massive burn in the 1950s that consequently resulted in mass wasting and flooding of the City. At the time of the Eighth Street Burn, the Foothills Policy Plan was not formally adopted, yet it was nearly complete (Eggleston, 6/15/99). It is a formal amendment to the comprehensive plan, and it is the primary guiding force for development within the area to the east/northeast of the city (Foothills Plan, 1997).

The Plan establishes policies to control the amount and location of development within the Foothills area. Keeping development out of environmentally sensitive areas such as steep sloped hillsides, floodplains, and animal habitat is a primary goal aimed at preventing future degradation of the area. In protecting the entire watershed through stricter development controls, the likelihood of future fire-induced disasters is less likely. These controls will limit the development options for some land uses, while others will be encouraged. The limiting of employment, office, and commercial centers within the foothills area will hopefully result in a higher concentration of the uses in the established urban core of Boise. According to Ada

County, Boise is attempting to prevent further sprawl into the foothills and concentrate growth in the developed areas of the city (Nilsson, 6/25/99).

A majority of the land addressed under the plan lies outside of the City of Boise. Yet neighboring jurisdictions such as Ada County have also adopted the Plan until separate plans addressing individualized development circumstances can be developed. Ada County wants to discourage growth in the foothills, and supports the city's strategies for focused growth. Ada County is currently near the adoption process of its own policy plan. The plan would limit the size of developments, prohibiting large planned developments within their jurisdiction (Nilsson, 6/25/99). The County will withhold the provision of urban services to areas within the Foothills in order to discourage development.

Cumulatively, the EWP practices aid in the protection of the foothills ecosystem and the City of Boise. The impacts on areas adjacent to the foothills may inconvenience adjacent residential areas for the short-term; however, the long-term result of a vegetated watershed outweighs any negatives incurred through the clean-up process after the disaster event. The long-term effect of the EWP practices in the Boise watershed is best reflected in the different policy plans developed by different jurisdictions throughout the region. The plans envision the protection and return of natural vegetation to the foothills in order to protect all of the Boise area. These plans were developed through inter-jurisdictional efforts in many cases, and reflect similar goals. While Boise's Foothills Policy Plan does not provide for complete protection of the foothills area, it balances the needs of a growing city with increased natural disaster planning.

<u>Areas of Uncertainty That Affect the Cumulative Impacts Analysis</u>

At least some areas of uncertainty were identified regarding most of the actions considered in the cumulative impact analysis. However, the environmental analysis performed on the EWP practices under review (NRCS DSRs, 1995b) in the Interagency Fire Rehabilitation Report (BLM et al., 1996) was carried out in a NEPA format and therefore was relatively thorough. Several environmental groups raised questions about the adequacy of NEPA consideration of the fire and fire rehabilitation impacts, particularly the visual and recreational impacts of proposed sediment detention dams, and threatened NEPA litigation (Eastman, 1997; Feldman, 1997; Lucas, 1996). NRCS correspondence with the individuals and groups involved, and the lack of ensuing litigation, indicates that those concerns were largely eliminated (Kiger, 1997a; 1997b).

In addition, the major source of information on affected environment of in-stream water quality, from the EPA watershed analysis (EPA, 1999c), is also relatively general in nature. As a result, the environmental baseline information required for the analysis, while generally sufficient for the qualitative level of analysis performed here, ideally would have been more detailed. This is particularly the case in the lower Eighth Street Burn Area above the Lower Boise River, where more specific information on the private land-use actions would be beneficial. In this regard, the most useful information on private actions came from discussions of land use issues with the City Planning Department (Eggleston, 1999).

5.4.2.1.3 East Nishnabotna River Watershed, Iowa

The affected environment information for the East Nishnabotna River watershed is presented in Subsection 4.5.3. Additional, detailed environmental information about the watershed is found in Section D.3.4 of Appendix D.

Cumulative Biological Impacts

The relevant cumulative impacts for analysis are those associated with levee repair and woody debris removal. These impacts can be divided into two categories: (1) impacts associated with site preparation and (2) impacts associated with construction and dredging (soil disturbance, debris removal, and disposal). These impacts are described in Sections 5.2.2, 5.2.3, and 5.2.5 above.

Biological Watershed Ecosystem Components

Based on the types of impacts described above, the following biologic watershed ecosystem components were identified at the locations indicated within the watershed and downstream: (1) warm water fisheries in the East Nishnabotna River; (2) wetlands in the East Nishnabotna River; and (3) sedimentation and turbidity in the East Nishnabotna River (and possibly downstream after its confluence with the West Nishnabotna River). The location of these watershed ecosystem components and their areas of influence within the watershed are shown on *Figure 5.4-3 -- Map of the East Nishnabotna River Watershed*.

Analysis of Cumulative Biological Environmental Consequences

The connected, similar, and cumulative governmental and nongovernmental actions that have the potential to interact cumulatively with the EWP practices performed in the East Nishnabotna watershed are outlined in *Table 5.4-5 -- Cumulative Actions – East Nishnabotna River Watershed*. Cumulative biological environmental consequences of the proposed activities and the related actions are summarized at the end of Section 5.6 in *Table 5.4-6 -- Summary of Cumulative Impacts for the East Nishnabotna River Watershed.* The overall cumulative biological significance of all of the actions identified is discussed in the paragraph entitled *Summary of Cumulative Biological Environmental Consequences* following Table 5.4-5.

Table 5.4-5 -- Cumulative Actions – East Nishnabotna River Watershed

Federal Actions	State Actions	Local Actions	Private Actions
Public Law 566 projects in Fremont County (flood control) FEMA levee repair and floodplain structure removal and relocation NRCS Floodplain easements	Emergency Management Agency levee repair, floodplain structure removal and relocation activities Department of Transportation bridge, culvert, highway, and road replacement, construction, and repair	City and Drainage District levee repair, floodplain structure removal, and drainage modification activities	Development in Fremont County in vicinity of levee repair EWP Private flood repair Riparian area construction and modification Upland construction, ground disturbing activity, and commercial, industrial, agricultural, forestry, recreational, and residential land use activities

Summary of Cumulative Biological Environmental Consequences

As Table 5.4-6 indicates, because of either same or similar time frames or spatial positioning within the watershed, under the No Action Alternative, cumulative environmental contributions of the EWP practices themselves are not significant. Moreover, their interaction with other actions in the watershed have not caused significant measurable overall watershed environmental deterioration at the present time (EPA, 1999c). No indication has been found of any cumulative interaction that would adversely affect any of the fisheries watershed ecosystem components identified. No T&E species were found in the project area so none would have been adversely affected. While debris was burned on site, there is no indication of any significant air pollution condition to have resulted in any cumulative effect. In addition, the EPA watershed characterization summarized in Table 4.5-5 in Chapter 4 indicates that the East Nishnabotna River watershed exhibits "low vulnerability to stressors" (EPA, 1999c).

Table 5.4-6 -- Summary of Cumulative Impacts in the East Nishnabotna River Watershed

Actions for Cumulative Impact Analysis	Action Time Frames	Geographic Relationships to EWP Practices	Summary of Individual Action Environmental Impacts	Cumulative Impact Contribution of Individual Action
EWP Practices on East Nishnabotna River	1998	Not applicable	Minor short-term increases in turbidity at and downstream of all practices; long-term impacts to environment should be positive as a result of reestablishing the vegetation and reducing the impacts of runoff	Minor short-term increases in turbidity; long-term reduction in nonpoint source runoff
NRCS Floodplain easements	Ongoing	In same watershed, adjacent to and downstream from Riverton State Game Mgmt Area	Short-term and long-term reductions to turbidity and sedimentation as a result of reestablishing the vegetation and reducing the impacts of runoff	Modest but significant improvement in wetlands and riparian habitat; enlargement and improvement to wildlife habitat in Riverton State Game Management Area
FEMA, State, and local government efforts to remove structures from floodplain	Ongoing	Upslope from the EWP practices, both upstream and downstream	Positive short-term and long-term impacts resulting from more natural vegetation and less land disturbing activity in floodplain	Modest but significant improvement in aquatic, wetlands, and riparian habitat if activities continue
Agricultural land uses	Ongoing	Upslope from the EWP practices, both upstream and downstream	Predominant agricultural use of watershed (approximately 90% of land area) results in short- and long-term soil runoff that contributes to turbidity and sedimentation upstream and downstream of all practices, as well as wetland and riparian vegetation losses; many activities have significantly modified hydrologic regime of stream	Significant short- and long-term increases in turbidity and sedimentation, loss of aquatic habitat and wetlands through hydrologic modification of river and tributary streams
Commercial and residential land uses	Ongoing	Upslope from the EWP practices, both upstream and downstream	Very minor land use in watershed (less than 1% of land area, but concentrated in floodplain area) results in short- and long-term contribution to turbidity and sedimentation upstream and downstream of all practices (one potential development in and near floodplain is in close proximity to levee repair project near city of Shenandoah)	Modest but potentially significant short- and long-term increases in turbidity and sedimentation
Public Law 566 Projects	Ongoing	At various locations in the East Nishnabotna River Watershed	Minor short-term increases in turbidity and sedimentation at and downstream of all practices; long-term impacts to environment should be positive as a result of reducing the impacts of runoff	Minor short-term increases in turbidity and sedimentation; long-term reduction in nonpoint source runoff

Thus, the cumulative impacts of the EWP levee repair practices and the debris removal do not appear significant at the watershed level. The overall contribution of the EWP practices to water quality and habitat degradation in the watershed was small in and of itself and far less influential cumulatively than the other actions, particularly the private actions, which were too numerous to evaluate individually. Overall, the contribution of all actions to water quality and habitat degradation in the watershed were modest. This is consistent with the EPA characterization that the watershed exhibits "low vulnerability to stressors."

However, wetlands losses from both intentional and unintentional actions of numerous individual farmers in the watershed appear to be a serious concern. These impacts result from drainage system modification and wetlands filling and draining, and from agricultural runoff as well. These impacts appear to be cumulative both in the short-term and long-term.

Therefore, from a biological standpoint, the watershed would appear to be highly enough stressed environmentally to recommend extensive coordination of future EWP practices with other potentially interactive actions. In addition, it appears that less environmentally impacting practices, such as floodplain easements or critical area treatment, are preferable to the more traditional structural EWP practices used in 1998 in order to maintain cumulative biological impacts at an acceptable level in either watershed.

The possibilities of Program coordination presented would appear to offer a high degree of mutual Program benefits and savings that should not be discounted. In particular, the combined efforts of FEMA, its Iowa emergency management organization, and the local drainage districts to purchase land in the floodplain for the removal of structures and the reestablishment of normal floodplain hydrology and riparian vegetation would appear to be well suited for augmentation by a floodplain easement purchase program similar to the pilot project carried out by NRCS in Jasper County, IA.

However, while these actions should be beneficial to the watershed, it is not possible to predict from the information available at this time whether these improvements in the EWP Program in combination with other Federal, State, and local programs would reduce the wetlands losses below the level of significance. Therefore, implementation of this alternative should include sufficient monitoring of the environmental resources that are significantly affected at present to determine how well they recover as the current stresses are reduced. See Table 5.4-6 at the end of Section 5.6 for a summary of the cumulative impacts in the East Nishnabotna watershed.

<u>Socioeconomic and Other Human Resource Cumulative Impacts</u>

Socioeconomic and other human resources are analyzed separately from biological impacts because their interactions are not limited to the watersheds in which they occur.

Socioeconomic Impacts in the East Nishnabotna Watershed Communities

In the present decade, flooding and flood related damage has had a significant impact on the economic and social life of the community defined by the East Nishnabotna Watershed. The individual cities and residential settlements in this predominately rural area are generally smaller and have fewer resources available to address emergency related conditions. Although older and more stable in terms of growth and residence patterns, the continuing viability of these communities, as well as their attractiveness as a place to live and invest, is potentially threatened by the impact of repeated flooding.

The cumulative impact of the EWP practices within the watershed region, considered as a whole, does not represent a major change to the social environment. Including debris removal efforts in Montgomery County, bank erosion practices in Page County, and levee repair in Fremont County, EWP actions were primarily directed toward restoration of the affected communities to pre-flood conditions and contributed to the recovery of economically productive, agricultural acreage that is important to the local economy. The direct benefit of the project is to remove the potential threat to the areas affected. EWP installed practices contribute, along with other regional efforts, to the continuing viability of the local community.

In addition to EWP practices within the watershed, efforts are being made to remove and relocate the most severely damaged residential and other properties. These efforts have the potential to significantly affect social conditions in the local communities by removing residents, or altering the structure or patterns of everyday life. By contrast, EWP practices are less intrusive in the social life of the community, but do require a long-term commitment of resources to maintenance. In addition, while the immediate threat is removed, a potential does exist for future damage to residential, agricultural, or other economically productive land that may result if these structures should fail in the future. Because communities in this region are more established and have deep historical roots, short-term, less intrusive practices may be especially attractive. However, in coordination with other agencies active in flood control efforts in the East Nishnabotna region, EWP floodplain easement practices also represent a viable alternative.

Land Use Impacts

The EWP practices in the E. Nishnabotna watershed have several different effects on land use decisions of various jurisdictions. Levee repair and debris removal within the watershed are both aimed at creating natural, unimpeded flow of the E. Nishnabotna. Different development decisions by the various counties and cities along the river will largely depend upon the integrity of the EWP practices. The level of land use planning varies between the jurisdictions, some having more progressive policies towards environmental area protection.

The central portion of the watershed encompasses three different counties and several small rural communities. The majority of the communities' economies rely on agriculture, situated on or near the river and its floodplain (Page County Comp Plan, 1996). This close proximity to the river causes the effects of the EWP practices to play a major role in the stability of the land uses within the communities. While much of the land near the floodplain is primarily agricultural, other uses also appear in various locations throughout the watershed. Industrial, commercial, and residential uses are all within close proximity to the potentially affected areas. If EWP practices were not in effect, these areas could flood more easily, causing adverse impacts to life and property.

Montgomery County is one jurisdiction lacking any development regulations regarding floodplains. Recognizing this deficiency, the County states that development in these hazardous areas is at one's own risk (Montgomery County Comp Plan, 1996). Without intact levees and unimpeded river flow, this flooding would increase, further endangering the community within the area. Despite lacking these regulations, the County does not appear to be considering major changes in its land use policy. Some land in and around the floodplain is currently zoned for industrial development, permitting various uses. The comprehensive plan does not address any intended changes to protect the lands near the river; thus, EWP practices will continue to expand.

Neighboring Page County's land use policies address building within the floodplain and its immediate area. While most land near the floodplain is zoned agricultural, industrial and residential uses also exist (Page County Zoning Map, 1997). The County's comprehensive plan addresses the need to keep inappropriate development out of the floodplains, while also promoting the preservation of prime agricultural soils for agricultural use. Most areas along the E. Nishnabotna in the county are used as agriculture, yet some locations between the cities of Shenandoah and Essex are zoned industrial. The plan envisions reverting some of the lands zoned as industrial back to agricultural. However, some industrial uses will remain in this corridor (Page Comp Plan, 1996). Due to the presence of these industrial locations, the integrity of the EWP practices is necessary for protection during natural events. Without the nearby EWP practices, industrial lands could be inundated during a flood, resulting in a loss of property.

The protection of lands near Shenandoah in Fremont County also largely depends upon the adjacent EWP practices. As previously mentioned, lands intended for industrial development may possibly expand when the comprehensive plan update is complete. The rezoning of agricultural land to industrial uses would result in possible detrimental effects to new development occurring near the river. Thus, the EWP levee repair would be necessary to protect any possible losses of developed property.

Areas of Uncertainty That Affect Cumulative Impacts Analysis

Some areas of uncertainty were identified with respect to most of the actions considered in the cumulative impact analysis. Most importantly, the environmental analysis performed on the EWP practice under review (NRCS DSRs, 1998) was very rudimentary, consisting essentially of only an economic justification of the practice. The most useful information on private actions came from discussion of land use issues with the regional planning agency (Hall, 1999). Unfortunately, at this time no specific information has not been gathered on the Public Law 83-566 projects carried out by NRCS in the watershed. Thus, the cumulative relationship of impacts in the entirety of the East Nishnabotna watershed is more problematic than would be desirable.

5.4.2.2 General Implications of Cumulative Impacts (Alternative 1) Program-Wide

Under the No Action Alternative (Current Program), cumulative environmental contributions of the EWP practices themselves in the three example watersheds typically were not significant because of the absence of either same or similar time frames and/or spatial positioning within the watershed relative to the occurrence of the other actions. Moreover, the interaction of EWP practices with other actions in their respective watersheds typically was found to have not resulted in significant measurable overall watershed environmental deterioration. This is consistent with the respective EPA watershed characterizations (EPA, 1999c).

The overall contribution of the EWP practices to water quality and habitat degradation in all three watersheds was found to be small in and of itself and far less influential cumulatively than the other actions. This was particularly the case with regard to the many small private actions that were found to be far too numerous to evaluate individually but relatively important cumulatively.

However, where a watershed is significantly stressed from other sources, the contribution of EWP practices, though small, could contribute to significant negative cumulative impacts. The wetlands losses from both intentional and unintentional actions of numerous individual farmers in the East Nishnabotna watershed are instructive with regard to this potential. In the East Nishnabotna watershed, drainage system modification, wetlands filling and draining, and agricultural runoff have led to significant wetlands losses that appear to be cumulative both in the short-term and long-term. The sediment and turbidity contributions of EWP practices, while not significant themselves, were found likely to have interacted with the other actions to contribute to the wetlands losses.

Therefore, from a biological standpoint, where a watershed appears to be highly enough stressed environmentally to be found "vulnerable" by EPA, coordination of future EWP practices with other potentially interactive actions would appear highly advantageous. In addition, it appears that less environmentally impacting practices, such as floodplain easements or critical area treatment, would be preferable in these situations to the more traditional structural EWP practices that have been used in the past, in order to maintain cumulative biological impacts at acceptable levels.

5.4.3 Cumulative Impacts under the Draft PEIS Proposed Action (Alternative 2)

Alternative 2 contains 15 elements designed to improve the EWP Program and incorporate new restoration practices. These elements would be expected to influence cumulative impacts as follows:

Eliminating the terms "exigency" and "non-exigency" would be intended to speed up the overall EWP process while allowing more time for the DSR team to evaluate EWP site. This could result in a reduction of the short-term negative EWP contribution to cumulative impacts.

However, this change would work in combination with the next requirement, which might tend to limit its application.

Stipulating that "urgent" and "compelling" situations be addressed immediately upon discovery would allow immediate action when life- or property-threatening situations occur. This might result in a slightly greater short-term negative EWP contribution to cumulative biological impacts from the immediacy of applying the EWP practice selected and a slightly larger positive EWP contribution to socioeconomic impacts from the perspective of reduced losses and increased contribution of funds to the local economy. Long-term impacts would likely remain the same.

Setting priorities for funding of EWP practices would place some additional emphasis on T&E species and cultural resources, thus tending to lessen the short-term negative EWP cumulative impact contribution to cumulative biological impacts. However, since NRCS would still follow FEMA and State emergency agency direction, these potential lessened impacts might not materialize. Long-term impacts would likely remain the same.

Establishing a cost-share of up to 75 percent for all EWP projects (up to 90 percent for projects in limited resource areas) would make the Program more readily available in lower income communities. This could result in higher short-term positive EWP cumulative socioeconomic benefits to communities, particularly low-income communities. Long-term benefits could be positive as well.

Stipulating that practices be economically, environmentally, and socially defensible (with criteria for meeting these requirements) would tend to lengthen the process over that of the Current Program, which is less extensive in this respect. While conforming with these requirements should result in more environmentally beneficial decisions, the decisions might take more time. Thus, short-term impacts of the EWP practices might be increased and the long-term impacts decreased by this requirement.

Improving disaster-recovery readiness through training, interagency coordination, and planning would likely result in decreased short-term and long-term effects through improving the response capabilities of NRCS and other personnel charged with implementing EWP practices.

Allowing repair of impairments to agricultural lands using sound conservation alternatives would likely result in a short-term increase in runoff-related impacts and a long-term decrease in such impacts. However, the emphasis on structural solutions might result in slight decreases in downstream wildlife habitat values.

Limiting repair of sites to twice in a ten-year period would likely result in diminished damage if the landowner chooses to sell a floodplain easement. However, damages may increase if landowners opt to repair disaster sites with their own funds, as environmental, social, and cultural considerations may not receive equal consideration in restoration designs.

Eliminating the requirement of multiple beneficiaries would likely result in quicker and more efficient use of available resources and allow those resources to be more environmentally protective than at present. This could reduce both short-term and long-term impacts from EWP practices.

Applying natural stream dynamics and bioengineering to EWP practice design would likely have much more positive effects on reducing short-term erosion impacts. Long-term impacts should be slightly less as a result of more environmentally sensitive conservation practice implementation.

Simplifying purchase of agricultural floodplain easements should result in greater usage of such floodplain easements. The more natural uses encouraged by these floodplain easements should result in reduced short-term and long-term water quality impacts and improved habitat.

Repairing enduring conservation practices would be likely to result in reduced short-term and long-term erosion but, as a result of likely associated bank-hardening, aquatic, wetland, and floodplain habitat values might be somewhat reduced.

Cooperatively funding parts of projects would likely result in greater cooperation between the various agencies involved. This could result in more efficient use of available resources and allow those resources to be more environmentally protective than at present. This could reduce both short-term and long-term impacts from EWP practices.

Allowing certain EWP practices to be performed away from streams and in uplands would be limited to allowing the removal of floodplain deposition on cropland and tornado debris from uplands. Therefore, this change would not be likely to result in more natural uses of the floodplain and more emphasis overall on repairing upland flood damage. However, this change could be beneficial both to upland and floodplain habitat protection and upgrade in the limited circumstances where it applies.

Purchasing floodplain easements on non-agricultural lands would tend to place more protection in those areas. This could have positive impacts on protecting such areas. However, this might result in more intensive use of the associated agricultural lands, which could increase both short-term and long-term runoff impacts from those lands.

While some of the elements would continue to favor structural, engineering methods and rapid response to sudden impairments, the net thrust of the Program improvements would favor the evolution of a more nonstructural, environmental approach. A substantial majority of the components would appear to directly favor the latter approach. Thus, the thrust of the EWP Program would continue to evolve in this direction.

5.4.3.1 Cumulative Impacts of Alternative 2 in the Example Watersheds

Applying the Program changes proposed in Alternative 2 to the example watersheds, the likely changes in context and intensity of impact can be estimated qualitatively.

5.4.3.1.1 Buena Vista-Maury River Watersheds, Virginia

The lack of time-linking of the identified actions in the Buena Vista watershed makes it unlikely that measurable decreases in cumulative impacts would be able to be found for those actions. Moreover, the disproportionate impacts of the other actions in the watershed in relation to the impacts of EWP practices makes it difficult to reduce cumulative impacts in the watershed through the EWP changes included in Alternative 2 alone.

However, there may be measurable decreases in cumulative interaction with the ongoing construction and ground disturbing activity and commercial, industrial, and residential land use activity in the riparian and upland areas of the Buena Vista watershed. These decreases could result from better DSR evaluation of the need for bank armoring that might result in the establishment of stream buffers in floodplain easement areas as EWP funds become available for non-agricultural lands.

There also might be a slight reduction in the short-term impacts of debris removal through the employment of less intrusive techniques of natural stream dynamics and bioengineering approaches to these practices. More cooperation between the various agencies involved in flood restoration could result in floodplain critical areas determinations and removal of structures and reestablishment of natural vegetation in key areas, which could reduce the cumulative contribution of future EWP practices. Such approaches might lead to greater socioeconomic short-term impacts as a result of increased resettlement. However, the long-term socioeconomic impacts could be more positive as a result of increased property values on property that becomes less flood-prone.

5.4.3.1.2 Eighth Street Burn Area-Lower Boise Watersheds, Idaho

The potentially cumulative actions were considerably more time-linked in the 8th Street Burn Area watershed than in the Buena Vista watershed discussed above. Again, the disproportionate impacts of the other actions in the watershed in relation to the impacts of EWP practices makes it difficult to reduce cumulative impacts in the watershed through the EWP changes included in Alternative 2 alone.

However, despite the greater potential for interaction of impacts in this watershed, there would be a high likelihood of measurable decreases in cumulative interaction with the other Federal agency actions (BLM, NFS, NPS, BIA) and State actions (Department of Disaster Services, Department of Water Resources, Department of Fish and Game, Department of Lands, Department of Agriculture, Department of Transportation, Department of Parks and Recreation). Moreover, this decrease could occur despite the higher than normal coordination that developed between the Federal and State agencies in this instance as a result of local public pressure and congressional interest in the effects of the fire.

In particular, there might be a significant reduction in the short-term impacts of special area treatment through the employment of less intrusive fluvial geomorphological and bioengineering approaches to these practices. However, given the extensive development pressure in this watershed, it might be very difficult to apply these less environmentally intrusive EWP approaches, despite the efforts of the Boise Foothills Policy Plan. The development of the two large, grandfathered subdivisions could establish precedent that would be difficult to overcome through local government land use control. More successful growth-slowing efforts in the watershed would result in a different development scenario, which might have extensive cumulative socioeconomic implications. However, it is unlikely that these changed growth patterns would adversely affect the overall growth prospect, and if the Foothills Policy Plan resulted in a perception of better quality of life in the community and enhanced recreation potential, economic growth might be spurred.

Thus, despite these potential difficulties outlined above, the incremental Program changes should reduce long-term cumulative impacts in all but the most severe natural disasters. However, activities that are not included in Alternative 2, such as limiting of uses that may result in man-induced fires in this area and instituting more effective natural range fire reduction strategies, might be required to reduce the threat of catastrophic fires to the point where long-term cumulative impacts would be measurably more unlikely.

5.4.3.1.3 East Nishnabotna Watershed, Iowa

All of the other actions identified in the East Nishnabotna watershed were time-linked and the potential for significant cumulative detrimental impacts to wetlands were identified under the No Action Alternative. The incremental Program changes proposed for Alternative 2 could help reduce the EWP practice contributions to cumulative impacts in the watershed. The most beneficial aspect of the Alternative 2 changes to the EWP Program would likely result from potentially greater usage of floodplain easements in the watershed. In particular, simplifying floodplain easement purchase requirements and purchasing floodplain easements on both agricultural and non-agricultural land, in conjunction with local government efforts to move structures out of the floodplain could substantially improve the buffering of upslope sediment loss that is having a significant effect in producing wetlands loss in the main stream and tributaries.

Allowing repair of impairments to agricultural lands using sound engineering alternatives could be used in this watershed in a similar manner to a floodplain easement taken in Missouri, where a setback levee was used to create wetlands while at the same time protecting adjacent agricultural lands. This type of combination of protecting natural and agricultural land uses may be necessary in intensely agricultural watersheds like the East Nishnabotna.

Other elements of Alternative 2, such as setting more conservation-oriented priorities for EWP practices, requiring environmental defensibility, improving disaster-recovery readiness, and limiting repair of sites to twice in a ten-year period would likely result in reducing the use of structural practices even more and thereby reduce the short-term impacts of implementing structural practices.

However, the sheer magnitude of the differential between EWP practice impacts in the watershed and the impacts of the other practices, particularly the nearly ubiquitous agricultural practices, would make it impossible for the reduction of the EWP practice impacts to have a substantial impact on reducing cumulative impacts, even with the modest coordination of the EWP Program with other emergency and watershed-related that would occur in this Alternative.

5.4.3.2 General Implications of Alternative 2 Cumulative Impacts Program-Wide

It does not appear that the Program changes that would be incorporated in Alternative 2, which would be incremental rather than programmatic, would either enlarge or reduce the context in which cumulative impacts would be experienced. Thus, cumulative impacts of the EWP practices would, as under the Current Program, still occur in the 8-digit HUC Buena Vista and Eighth Street Burn Area watersheds and the 12-digit HUC East Nishnabotna watershed. As a result of the Program elements that would be incorporated in Alternative 2, the reduced cumulative inputs from the EWP practices would produce smaller impacts in the example watersheds, particularly at the 8-digit HUC levels, as discussed in the three example watershed analyses above.

Those lessened impacts would have a higher likelihood of being measurably positive in ecologically stressed watersheds, such as the East Nishnabotna watershed. However, it is important to stress that the disproportionate impacts of the other actions in the watershed in relation to the impacts of EWP practices would make it impossible to reduce cumulative impacts in the watershed through the EWP changes included in Alternative 2 alone.

The results of the analyses of the three example watersheds cannot be scaled up to a National analysis. However, the results of the analysis in the three example watersheds lead to several implications for the overall EWP Program. First, the Alternative 2 Program elements would result in overall improvement in the environmental performance of EWP practices themselves. Second, the additional coordination between NRCS and other Federal, State, and local agencies under this alternative would result in more efficient use of both NRCS resources and the resources of the other agencies where detrimental impacts to watersheds are concerned. Third, NRCS might find it advantageous to take the differences that the three example watersheds exhibit into account in formulating its plans. This is implicit in the Alternative 2 Program elements, which deal with a larger mix of agricultural and non-agricultural uses than has the traditional EWP Program.

5.4.4 Cumulative Impacts under Prioritized Watershed Planning and Management (Alternative 3)

Alternative 3 contains 5 elements designed to integrate the EWP Program into the broader NRCS mission and mandate of watershed management. These elements would be expected to influence cumulative impacts as follows:

- *Continuing to deliver EWP project funding and technical assistance to address immediate threats to life and property* would continue to allow immediate action when life- or property-threatening situations occur. This might result in a slightly greater short-term negative EWP contribution to cumulative biological impacts from the immediacy of applying the EWP practice selected and a slightly larger positive EWP contribution to socioeconomic impacts from the perspective of reduced losses and increased contribution of funds to the local economy. Long-term impacts would likely remain the same.

- *Instituting the 15 improvements and expansion of Alternative 2 noted above* would have the effects on cumulative impacts discussed in Section 5.4.3.

- *Facilitating locally led pre-disaster planning efforts* would address recurrent EWP practices in watersheds with a history of frequent disasters by categorizing such watersheds as high in a high-medium-low hierarchy of all of a State's watersheds. This should result in a preplanning effort that would reduce the short- and long-term impacts of the EWP practices in those high risk, high impact watersheds. To the extent that Alternative 2 level disaster-recovery planning in medium- and low-priority was not adversely affected, the effects should be positive in those watersheds as well.

- *Funding priority watersheds in each state for pre-disaster planning and management* would coordinate EWP preparation and implementation better in these priority watersheds, which should substantially reduce the short- and long-term impacts from future natural disasters if the preventive measures of the following element were successfully implemented.

- *Coordinating pre-disaster planning and management efforts with Federal, State, and local agencies and interested stakeholders* would implement preventive and restorative practices that take watershed functions and values into account and integrate NRCS programs with the overall EWP Program goals. This effort would involve purchasing floodplain easements on a stepwise, proactive, risk-reducing basis as an integrated part of overall watershed management, combining the EWP Program with other programs that enhance watershed values. Those watershed values would include fish and wildlife habitat improvements.

This alternative is a comprehensive approach that would fully address cumulative impacts in a NEPA-based analysis approach. Unlike the incremental approach found in Alternative 2 and 4, Alternative 3 would approach watershed environmental impacts programmatically and cumulatively. This approach should result in substantial reductions, not only of EWP contributions to cumulative watershed impacts, but of potentially all of the other actions as well, depending on how well local government and private stakeholders are involved.

5.4.4.1 Cumulative Impacts in the Example Watersheds

Applying the Program changes proposed in Alternative 3 to the example watersheds, the likely changes in context and intensity of impact can be estimated qualitatively.

5.4.4.1.1 Buena Vista-Maury River Watersheds, Virginia

Under Alternative 3, minimum short-term turbidity impacts would occur to aquatic and wetlands and floodplains resources. This would result from improvements to both impairment minimization and restoration practices as NRCS improvements in expanded EWP practices and the P.L. 566 Project made increased use of techniques to create and maintain more natural conditions in these areas. If other Federal and State agency programs (e.g., USFS, USACE, FEMA, Virginia Discharge Elimination System (VDES), Virginia Department of Transportation, and City of Buena Vista) were implemented in a more coordinated manner, these impacts should be reduced even more. This emphasis on planning should improve terrestrial habitat on a larger scale. Thus, areas outside of the floodplain and stream corridors might be converted into natural areas. This could enhance overall property values in the City (particularly those properties adjacent to these improved environmental amenities) to a greater extent than under the other alternatives. Where impacts to socioeconomic and other human resources are concerned, as discussed in more detail above, shifts in Program emphasis might result in a markedly different mix between agriculture and other uses in the larger Maury River watershed, as more extensive use might be made of conservation practices in both flood-prone and non-flood-prone areas. Thus, under this alternative, more extensive areas outside of the floodplain and stream corridors might be converted into natural areas. This, in turn, combined with watershed prioritization, could lead to lessened damages to watersheds from sudden impairments in future natural disasters. The Buena Vista watershed would clearly be high priority watershed in this hierarchy.

5.4.4.1.2 Eighth Street Burn Area-Lower Boise Watersheds, Idaho

Under Alternative 3, minimum short-term sedimentation and turbidity impacts would occur to aquatic and wetlands and floodplains resources. This would result from improvements to both impairment minimization and restoration practices as NRCS improvements in expanded EWP practices made increased use of techniques to create and maintain more natural conditions in these areas. If other Federal and State agency programs (e.g., USFS, BLM, FEMA, NPS, Bureau of Indian Affairs, and City of Boise) were implemented in a more coordinated manner, these impacts should be reduced even more. This emphasis on planning should improve terrestrial habitat on a larger scale. Thus, areas outside of the floodplain and stream corridors might be converted into natural areas. This could enhance overall property values in the City (particularly those properties adjacent to these improved environmental amenities) to a greater extent than under the other two alternatives. Where impacts to socioeconomic and other human resources are concerned, as discussed in more detail below, these shifts in Program emphasis might result in even more development pressure on the watershed, as discussed below. Thus, under this alternative more extensive areas outside of the floodplain and stream corridors might be converted into natural areas. This, in turn, combined with watershed prioritization, could lead to lessened damages to watersheds from sudden impairments in future natural disasters. However, under this alternative, implementation of viable development management plans, such as the Boise Foothills Policy Plan, would be vital to help control induced growth. The Eighth Street Burn Area watershed would clearly be high priority watershed in this hierarchy.

5.4.4.1.3 East Nishnabotna Watershed, Iowa

Under Alternative 3, minimum short-term sedimentation and turbidity impacts would occur to aquatic and wetlands and floodplains resources. This alternative would be the most likely to reduce or eliminate the significant wetlands loss currently being experienced in the watershed. This would result from improvements to both impairment minimization and restoration practices as NRCS improvements in expanded EWP practices (particularly a greatly expanded use of conservation floodplain easements throughout the watershed) and Public Law 566 projects made increased use of techniques to create and maintain more natural conditions in these areas. If other Federal and State agency programs (e.g., Corps of Engineers, FEMA, Iowa Department of Transportation, and local governments) were implemented in a more coordinated manner, these impacts should be reduced even more. This emphasis on planning should improve terrestrial habitat on a larger scale. Thus, areas outside of the floodplain and stream corridors might be converted into natural areas. This could enhance overall property values in the small communities (particularly those properties adjacent to these improved environmental amenities) to a greater extent than under the other alternatives. Under this alternative, more extensive areas outside of the floodplain and stream corridors might be converted into natural areas. This, in turn, combined with watershed prioritization, could lead to lessened damages to watersheds from sudden impairments in future natural disasters. Improvements in existing land use planning are vital, and would be more likely to occur under this alternative. The East Nishnabotna watershed would probably be a high priority watershed in this hierarchy; given the stressed nature of the watershed, indicated by the wetlands losses it continues to experience, it should be afforded high priority under proactive Alternative 3 whether or not it has a history of past EWP or not simply for its cumulative impacts situation.

5.4.4.2 General Implications of Alternative 3 Cumulative Impacts Program-Wide

As with the incremental changes involved in Alternative 2, it does not appear that the programmatic changes that would be involved in Alternative 3 would either enlarge or reduce the context in which cumulative impacts would be experienced. There also was no indication in any of the example watersheds that the changes in intensity that the Alternative 3 Program improvements would institute would result in impacts being experienced outside of the example watersheds. However, there is a possibility that the direct and indirect impacts of the improved EWP practices would be reduced enough not to interact with other actions even inside the 8-digit HUC watersheds.

Those reduced impacts would have a still higher likelihood of being measurably positive in ecologically stressed watersheds, such as the East Nishnabotna watershed. However, it is still important here to note that the disproportionate impacts of the other actions in the watershed, in contrast to the impacts of EWP practices, would make it difficult to reduce cumulative impacts in the watershed, even if direct and indirect EWP impacts would be reduced under Alternative 3 coordination efforts.

The results of the analyses of the three example watersheds cannot be scaled up to a national analysis. However, the results of the analysis in the three example watersheds lead to several implications for the overall EWP Program. First, the proposed Program elements would result in the best overall improvement in the environmental performance of EWP practices themselves. Second, the additional coordination between NRCS and other Federal, State, and local agencies under this alternative would result in the most efficient use of NRCS resources and the resources of the other agencies where detrimental impacts to watershed are concerned. Third, NRCS should reap benefits by taking the differences that the three example watersheds exhibit into account in formulating its plans in Alternative 3 to prioritize watersheds not only according to their disaster risks, but also to factor in the extent to which the watershed already exhibits stress from other actions, as the East Nishnabotna watershed demonstrates.

5.4.5 Cumulative Impacts under the Preferred Alternative (Alternative 4)

The Preferred Alternative is expected to have similar effects on cumulative impacts as described in Section 5.4.3 under each of the elements of Alternative 2, with the following exceptions:

Retaining the term exigency would have the same effects that the use of “urgent and compelling” would have under Alternative 2. Emergencies requiring immediate action would be considered exigencies and given a higher funding priority in the EWP Program. The time to respond to exigencies will be lengthened from 5 days to 10 days to allow additional time for sponsors to secure their cost-share amount and to conduct appropriate procurement procedures. The additional 5 days should provide a sufficient amount of time for sponsors to secure any necessary emergency permits and for the NRCS to ensure compliance with any and all applicable laws and regulations. This is anticipated to result in both a short term and long term positive EWP contribution to both socioeconomic and environmental cumulative impacts.

All non-exigencies will be referred to as emergencies. A cost-share rate of up to 75 percent would be applied to all emergencies, whether they are exigencies or not. Applying cost-share rates to sites irrespective of their priority designation is anticipated to assist areas more efficiently, where threats to life or property are the most imminent. Changes to the cost-share rate would increase the cost burden for some communities. However, the provisions to provide additional financial support to limited resource areas, or to *provide a waiver with up to 100 percent cost-share* for limited resource areas, situations involving environmental justice, or for projects protecting a community’s social values, encourages EWP Program participation by communities that might not otherwise be able to afford to participate in the Program. This provision coupled with increased Program awareness would improve access to Program benefits for socioeconomically disadvantaged communities, and result in positive long-term EWP contribution to cumulative socioeconomic impacts.

Improving disaster-recovery readiness through training, interagency coordination, and planning would not involve the implementation of the DART teams included in Alternative 2, though technical advisory assistance would be made available from the national office if requested. This change is not anticipated to alter the overall impact of this program provision, however, which would likely continue to result in decreased short-term and long-term negative cumulative effects through improving the response capabilities of NRCS and other personnel charged with implementing EWP practices.

Limiting repair of sites to twice in a ten-year period would be restricted to sites that are eligible for the purchase of a floodplain easement, and would not include repeated debris removal from the same location. For those sites where repeated damage occurs and the landowner does not want a floodplain easement, any continued and unrepaired damage would likely contribute minimally to negative cumulative impacts.

Allowing certain EWP practices to be performed away from streams and in uplands would include the removal of sediment and debris, including windblown debris, from agricultural lands and uplands. As in Alternative 2, this change would not likely result in more natural uses of the floodplain. However, in addition to both upland and floodplain habitat and cultural resources protection, this change could be beneficial to a community's economic resources if fertile agricultural land is restored. Under Alternative 4, only sites not eligible for assistance under the Farm Service Agency's Emergency Conservation Program (ECP) would be eligible for these practices. This change in eligibility requirements from Alternative 2 is anticipated to impact the reach of this provision, and as a result limit the potential positive effects of the provision, especially on agricultural lands cultivating commodity crops under the jurisdiction of ECP.

The Preferred Alternative further would emphasize, as introduced in Alternative 2, the increased use of environmental bioengineering techniques as a favored watershed impairment restoration practice, where such techniques are technically sound and sufficient. Additionally, floodplain easements are a strongly encouraged restoration option when possible. Both of these restoration methods promote the increase of natural floodplain area and riparian habitat as not only a favored watershed impairment solution but also a preventive method to minimize future area impairments. This approach will result in long-term positive EWP program contributions to cumulative impacts on the environment.

5.4.5.1 Cumulative Impacts of Alternative 4 in the Example Watersheds

Applying the Program changes proposed in Alternative 4 to the example watersheds, the likely changes in context and intensity of impact can be estimated qualitatively.

5.4.5.1.1 Buena Vista-Maury River Watersheds, Virginia

The cumulative impacts of the Preferred Alternative in the Buena Vista-Maury River Watersheds are the same as those described under Alternative 2, in Section 5.4.3.1.1. Again, as non-agricultural lands become eligible for floodplain easement or structure buy-out practices, and more natural techniques of stream restoration and bioengineering restoration practices are promoted, reductions in the effects that EWP program implementation have on cumulative impacts are anticipated. However, the disproportionate impacts of the other actions in the watershed in relation to the impacts of EWP practices makes it difficult to reduce cumulative impacts in the watershed through the EWP changes included in the Preferred Alternative alone.

5.4.5.1.2 Eighth Street Burn Area-Lower Boise Watersheds, Idaho

The cumulative impacts of the Preferred Alternative in the Eighth Street Burn Area-Lower Boise Watersheds are the same as those described under Alternative 2, in Section 5.4.3.1.2. In particular, the promoted use of less intrusive fluvial geomorphological and bioengineering practices under the Preferred Alternaitve might result in a significant reduction in the short-term impacts of special area treatment. Again, however, the disproportionate impacts of the other actions in the watershed in relation to the impacts of EWP practices makes it difficult to reduce cumulative impacts in the watershed through the EWP changes included in this alternative alone.

5.4.5.1.3 East Nishnabotna Watershed, Iowa

The cumulative impacts of the Preferred Alternative in the East Nishnabotna Watershed are the same as those described under Alternative 2, in Section 5.4.3.1.3. The program changes proposed under the Preferred Alternative could reduce the EWP practice contributions to cumulative impacts in the watershed. Again, the most beneficial aspect of the proposed changes to the EWP Program would likely result from potentially greater usage of floodplain easements in the watershed. Simplifying floodplain easement purchase requirements, purchasing floodplain easements on both agricultural and non-agricultural land, and adding the structure buy-out practice could substantially improve the buffering of upslope sediment loss that is having a significant effect in producing wetlands loss in the main stream and tributaries.

5.4.5.2 General Implications of Alternative 4 Cumulative Impacts Program-Wide

As in all of the current Program alternatives, the changes proposed under the Preferred Alternative do not appear to have a significant effect on the cumulative impacts experienced in the example watersheds. It does not appear that the proposed Program changes would either enlarge or reduce the context in which cumulative impacts would be experienced. Cumulative impacts of the EWP practices would continue to occur in the 8-digit HUC Buena Vista and Eighth Street Burn Area watersheds and the 12-digit HUC East Nishnabotna watershed. As a result of the proposed Program elements, the reduced cumulative inputs from the EWP practices would produce smaller impacts in the example watersheds, particularly at the 8-digit HUC levels, as previously discussed.

The reduced impacts would continue to have a higher likelihood of being measurably positive in ecologically stressed watersheds, such as the East Nishnabotna watershed. Again, however, the disproportionate impacts of the other actions in the watershed in relation to the impacts of EWP practices would make it impossible to reduce cumulative impacts in the watershed through the proposed EWP Program changes.

As with the other three alternatives, the results of the analyses of the three example watersheds cannot be scaled up to a national analysis. However, the results of the analysis in the three example watersheds lead to several implications for the overall EWP Program. First, the program elements of this alternative would result in overall improvement in the environmental performance of EWP practices themselves. Second, the additional coordination between NRCS and other federal, state, and local agencies under this alternative would result in more efficient use of both NRCS resources and the resources of the other agencies where detrimental impacts to watersheds are concerned. Third, NRCS can take advantage of the differences that the three example watersheds exhibit into account in formulating its plans. This is implicit in the elements proposed under the Preferred Alternative, which deal with a larger mix of agricultural and non-agricultural uses than has the current EWP Program.

5.4.6 Summary of the Cumulative Impacts of the Alternatives

Table 5.4-7 summarizes the cumulative impacts of the EWP alternatives. The contribution of the effects of EWP practices to cumulative impacts on watershed ecosystems, based on the analysis of the example watersheds, were minimal under all four EWP Program alternatives. However, in the East Nishnabotna River watershed, where wetlands are already highly stressed according to EPA, the overall cumulative impacts were found likely to be significant. Therefore, EWP environmental evaluations should pay particular attention to watershed health indicators in order to limit potential cumulative impacts to acceptable levels.

Because the requirements for protection of Federally-protected resources in watersheds are for the most part site specific, EWP restoration work may be one of the best ways to protect those resources that would otherwise be threatened. This is particularly true of cultural resources, where EWP work might not only remove threats to the property directly but also protect the environmental setting where the property is located. In the case of T&E species as well, EWP work may be a necessary part of habitat maintenance as a species recovers, although in the long-term, not desirable as a necessity to survival. In some instances, floodplain easements might provide a better solution for ensuring habitats are available that are conducive to a species recovery.

Alternative 1 (No Action Alternative) would not change cumulative impacts from their present levels. For aquatic resources, there would continue to be minor turbidity, sedimentation, and flow altering effects from restoration practices. These effects would add in the long-term to the slow decline of watershed health in some watersheds and to more rapid decline in others. For wetlands, riparian areas, and floodplains, minor effects from restoration practices would continue to occur and would add to the habitat loss and loss of natural floodplain functioning that are a contributing part of general watershed decline.

Human communities like the City of Buena Vista would continue to benefit from protection of their homes and businesses and would continue to derive income from performing EWP restoration practices although minor community disruptions may occur. Major floodwork by the USACE and NRCS at Buena Vista have combined to help sustain the viability of the community in the face of repeated recent flood damage, a community that has seen a marked industry decline because of the floods and other factors. The viability of agricultural communities such as that along the East Nishnabotna and of rural fringe communities such as Boise Hills, depend in large measure on damage restoration and preventative measures. In the long-term, however, the cumulative drain on local, State, and Federal resources to maintain any such communities that are repeatedly threatened may lead to sufficient impetus to seek longer-term solutions. Agricultural floodplain easements that are part of the current program are likely to be major parts of this solution.

Alternative 2 (the Draft PEIS Proposed Action) would emphasize more environmentally sensitive implementation of EWP practices and would expand the types of watershed impairments to activities away from streams, upland debris sites, enduring conservation practices, and others. Fifteen specific program changes would improve the EWP program and incorporate new restoration practices. For aquatic resources, there would be a reduction in minor turbidity, sedimentation, and flow altering effects from restoration practices. This would diminish the degree to which any of these adverse effects would add in the long-term to decline of watershed health. In some watersheds these improved practices may even slow or reverse some of the decline. For wetlands, riparian areas, and floodplains, there would be some reduction in minor effects from restoration practices, which would reduce the rate of habitat loss and loss of natural floodplain functioning. In some portions of watersheds the EWP work may reverse such a trend. Better coordination with other Federal, State, and local agencies and additional projects approved should result in less overall habitat destruction.

Human communities would continue to be protected in the short-term but a greater emphasis on agricultural floodplain easements and introduction of improved lands floodplain easements should provide better long-term solutions than repetitive repair work where repeated damages occur. Shifts in program emphasis may result in slightly different mix between agriculture and other uses as floodplain easement lands increase.

Alternative 3 (Prioritized Watershed Planning and Management) would tend to minimize EWP program impacts because it would be the most proactive and integrative EWP approach to disaster recovery and damage avoidance. It would allow maximized use of more environmentally beneficial EWP practices by focusing the resources of NRCS and other entities in disaster-prone watersheds. Here, restoration design based on the principles of natural stream dynamics and bioengineering would likely cause the most marked reductions in degradation of stream hydrology and habitat. When used in conjunction with purchase of floodplain easements in these more highly stressed watersheds, some substantive abatement or reversal of watershed degradation is possible. In less seriously stressed watersheds, use of these practices and floodplain easements would help maintain watershed integrity. NRCS and other technically cognizant agencies would need to take adequate steps during the locally-led conduct of the watershed plan to ensure all decisions are well-informed decisions, made with the best available scientific information and soundest technical advice to help avoid decisions made simply because they appear on first inspection to be heading in the right direction.

The Preferred Alternative (Alternative 4) involves many of the EWP program improvement and expansion elements discussed under the Draft PEIS Proposed Action and would share the majority of its cumulative impacts. Under the Preferred Alternative, NRCS would again emphasize implementation of EWP practices such as bioengineering, streambank protection with natural materials, and stream restoration using the principles of natural stream dynamics, all of which would reduce the potential for adverse environmental effects. NRCS also would expand the types of watershed impairments the program would address to include floodplain sediment deposition, upland debris sites, and enduring conservation practices where these impairments are not eligible for restoration under other Federal programs such as ECP. There would be a minor reduction in the immediate increase of turbidity, sedimentation, and flow-altering effects associated with the implementation of restoration practices. In some watersheds, the improved practices proposed may even slow or reverse some of the decline of long-term watershed health. For wetlands, riparian areas, and floodplains, there would be a minor reduction in restoration practice effects, which would reduce the rate of habitat loss and loss of natural floodplain functioning. In some portions of watersheds, the EWP work may even reverse such a trend. Purchase of floodplain easements would also reverse this trend. Improved agency coordination should decrease the effects on protected resources affected by restoration practices. Human communities would continue to be protected in the short term but a greater emphasis on agricultural floodplain easements and introduction of improved lands floodplain easements and buyouts of rural residents as a recovery measure should provide better long-term solutions than repetitive repair work where repeated damages occur. Shifts in program emphasis may result in slightly different mix between agriculture and other uses as floodplain easement lands increase.

Table 5.4-7 Summary of Cumulative Impacts of the EWP Alternatives

Environmental Resource	Alternative 1 –No Action Alternative – Continue the Current Program	Alternative 2 – Draft PEIS Proposed Action – EWP Program Improvement and Expansion	Alternative 4 – Preferred Alternative	Alternative 3 – Prioritized Watershed Planning and Management
Impacts to Aquatic Resources	Minor effects from restoration practices would continue to add to long-term declines in quality of aquatic habitat. These effects may be important in watersheds stressed by other factors such as development. Floodplain easements should help slow declines in some cases.	Upgrade in restoration practices would diminish any adverse effects and may slow long-term declines in quality of aquatic habitat. Expanded floodplain easement program would also help slow or reverse this situation in some watersheds.	Upgrade in restoration practices would diminish any adverse effects and may slow long-term declines in quality of aquatic habitat. Expanded floodplain easement program would also help slow or reverse this situation in some watersheds.	Upgrade in restoration practices and focused locally-led watershed management would be best way to slow long-term declines in quality of aquatic habitat. Expanded floodplain easement program could be used as an integrated part of watershed restoration program.
Impacts to Wetlands and Floodplains Resources	Minor effects from restoration practices would continue to occur and would add to habitat loss and loss of natural floodplain functioning that are a contributing part of general watershed decline. Agricultural floodplain easements may mitigate these effects in some watersheds.	Some reduction in minor effects from restoration practices, which would reduce the rate of habitat loss and loss of natural floodplain functioning. In some portions of watersheds the better designed EWP work may reverse such a trend. Expanded floodplain easement program would help slow or reverse this situation in some watersheds.	Upgrade in restoration practices would reduce the rate of habitat loss, and loss of natural floodplain functioning and value. In some portions of watersheds EWP work may reverse such a trend. Expanded floodplain easement program would help slow or reverse wetland and floodplain size and function declines in some watersheds.	Upgrade in restoration practices and focused locally-led watershed management would be best way to slow long-term declines in quality and acreage of wetland, riparian, and floodplain habitat. Expanded floodplain easement program could be used as an integrated part of watershed restoration program.

Table 5.4-7 (continued) Summary of Cumulative Impacts of the EWP Alternatives

Impacts to Watershed Uplands	Watershed impairments would continue to threaten life and property, except in cases where special authorization is given to repair the damage.	Adverse effects of impairments would be reduced, as upland debris would be removed. Floodplains, wetlands, riparian areas, and aquatic communities would likely benefit from the reduction in impacts.	Adverse effects of impairments would be reduced, as upland debris would be removed. Floodplains, wetlands, riparian areas, and aquatic communities would likely benefit from the reduction in impacts.	Adverse effects of impairments would be reduced, as upland debris would be removed. Floodplains, wetlands, riparian areas, and aquatic communities would likely benefit from the reduction in impacts.
Impacts to Socioeconomic and Other Human Resources	Life and property would continue to be protected but longer term solutions to repeated damage would not be a major consideration. Minor income would be derived from performing restoration practices, but resources may be inefficiently used.	Life and property would continue to be protected but longer term solutions to repeated damage would begin to be a major consideration, especially with use of improved lands floodplain easements. Minor income would be derived from performing restoration practices. Shifts in program emphasis may result in slightly different mix between agriculture and other uses.	Life and property would continue to be protected but longer term solutions to repeated damage would begin to be a major consideration, especially with use of improved lands floodplain easements. Minor income would be derived from performing restoration practices. Shifts in program emphasis may result in slightly different mix between agriculture and other uses. Social resource protection would be emphasized.	Life and property would continue to be protected but better organized and funded longer term solutions to repeated damage would be the major consideration. Minor income would be derived from performing restoration practices. Shifts in program emphasis may result in slightly different mix between agriculture and other uses.

5.5 UNAVOIDABLE IMPACTS OF THE PREFERRED ALTERNATIVE

Certain effects cannot be avoided if the Preferred Alternative is implemented. Affected streams, floodplains, and certain watershed upland areas will be altered by EWP restoration practices. In certain instances, to remove threats to life and property, some adverse environmental and/or social consequences may result. Any substantial adverse impacts would be limited to the immediate site and nearby environments and limited to the short-term. Procedures to ensure the economical, environmental, and social defensibility of EWP practice designs should minimize the likelihood of these effects occurring.

Certain structural practices, including armoring and woody structures, would be used for bank restoration where the circumstances warrant their use. These sites may remain as undesirable visual elements of the outdoor environment for a short period until the sites again support vegetation. Some of the hard-engineered structures may not re-vegetate. The shift in emphasis under the Preferred Alternative to employment of bioengineering practices and the incorporation of vegetative components to structures should minimize the number of instances where this is a long-term effect.

Impacts of purchasing floodplain easements on agricultural lands and on improved lands should be beneficial, restoring portions of floodplain environments to their natural functions. These purchases may disrupt the socioeconomic situation of some rural communities in the short-term and may introduce minor changes in the longer-term. However, in broader economic terms, this shift should tend to diminish demands on the Federal and State governments, and local communities to pay for flood fighting and to repair or compensate for disaster damage.

5.6 EFFECTS ON PRODUCTIVITY, RESOURCES, AND ENERGY

5.6.1. Short-Term Use versus Long-Term Productivity of the Environment

EWP restoration practices are employed to protect life and property, and as such, incorporate designs that attempt to restore a locality to pre-disaster conditions and forestall the erosive forces of the natural environment. They are employed to maintain land and improvements that are of value to human communities, that otherwise would be altered by natural forces. The natural environmental productivity of these protected locations is not achieved so long as their use is continued for human endeavors. The floodplain easement portion of the EWP Program is an attempt to mitigate that use to restore the long-term productivity of floodplain and related environments.

5.6.2 Irreversible or Irretrievable Commitments of Resources

Money and staff-hours used to implement the EWP Program are an irretrievable commitment of Federal resources regardless of which alternative is selected. However, decisions on the commitment of these resources are made on a case-by-case basis, with the option available in every case to not commit the resources.

5.6.3 Energy Requirements and Conservation Potential of Various Alternatives & Mitigation Practices

Fossil fuels are used to power the trucks and heavy equipment used to clear debris and install EWP restoration practices. Because the level of required disaster response is unpredictable from year to year, it is not possible to predict what the energy requirements would be. To the extent that floodplain easements are purchased that eliminate repetitive repair requirements at sites, the overall energy demands of the EWP Program would diminish.

5.6.4 Natural or Depletable Resource Requirements & Conservation Potential of Various Alternatives & Mitigation Practices

The natural or depletable resource requirements of the EWP Program, other than the fossil fuel requirements, include rock for riprap and gabions, trees for rootwads and log revetments, and live trees and shrubs for plantings. These are obtained as available from local sources, and if necessary, from more distant suppliers. The supply of these materials far outweighs the demands that are likely to occur.