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## Section 4.0 - Alternatives and Preferred Plan

This section of the Master Plan presents the transition from evaluating projects on an individual basis to combining projects into groups referred to as alternatives. This section also discusses the expected environmental consequences of implementing each of the alternatives.

### 4.1 Development of Watershed Restoration Alternatives

The following three approaches were used to develop watershed restoration alternatives:

- Project rank alternative
- Watershed objectives alternative
- Trustee priorities

The approach for formulating each alternative, or comprehensive package of projects, and the individual projects that best fit the approach are described below.

#### 4.1.1 Project Rank Alternative

The first alternative was assembled based on the project ranking established in **Section 3.15**. Project ranking was determined by ordering projects according to their total project score from highest to lowest. The highest ranked projects are shown in **Figure 4-1** along with the overall project scores. Project numbers are also included to assist with correlation to project descriptions in **Section 3**. Some projects were included out of rank order because they are either prerequisites for other highly ranked projects (shown in purple) or because they are logical combinations with other highly ranked alternatives (shown in green).

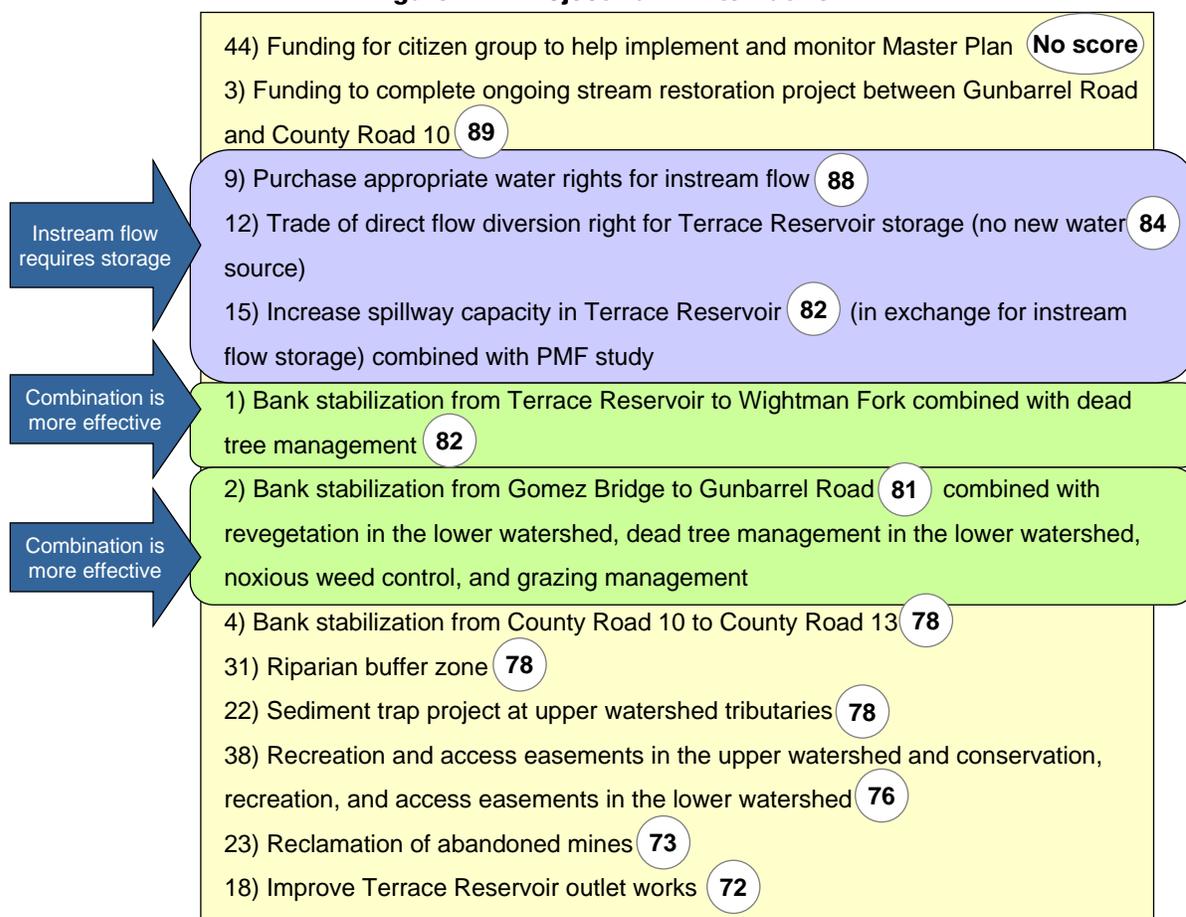
Funding for a citizen group to help implement and monitor the Master Plan, Project 44, was included in all three alternatives. Funding the Alamosa River Foundation will facilitate implementation of the preferred alternative. This project does not have a score because studies and administrative activities were not ranked on the same scale as physical projects.

Purchase instream flow water rights, Project 9, was the second highest ranked project with a total score of 88. The instream flow water rights project requires a storage project. Project 12, trade of direct flow diversion right for storage in Terrace Reservoir, was the highest ranked storage project and is included as a prerequisite. In most years, Project 12 is not expected to provide enough storage for the entire instream flow water right. Therefore, the second highest ranked storage project, increase spillway capacity, Project 15, is also included.

The stream restoration projects are combined with related projects such as revegetation, dead tree management, weed management, and grazing management. The combination of projects will improve the performance of stream restoration and will reduce the total project cost compared to implementation of each project independently.

This alternative includes the reclamation of abandoned mines, Project 23, at a funding level that would facilitate water quality treatment at both the Pass–Me–By and Miser Mines as well as provide funds for some other cleanup activities.

**Figure 4-1. Project Rank Alternative**



#### 4.1.2 Watershed Objectives Alternative

The Watershed Objectives Alternative was assembled by the consultant team (see **Figure 4-2**). This alternative is focused on the technical ability of projects to meet watershed objectives and the vision statements discussed in **Section 3.1.1**. At least one project was included to address each of the watershed problem categories identified at the outset of the restoration planning effort. In this alternative, additional projects are combined with the underlying base projects, either as prerequisites or as beneficial combinations to improve project effectiveness.

The Watershed Objectives Alternative includes more water quality projects than the Project Rank Alternative because improving water quality is necessary to meet many of the restoration objectives. Improved water quality will benefit riparian and aquatic habitat. The water quality projects include a small lake on the Alamosa River mainstem near Wightman Fork, a sediment trap project on Alum Creek, and reclamation of the Pass–Me–By mine.

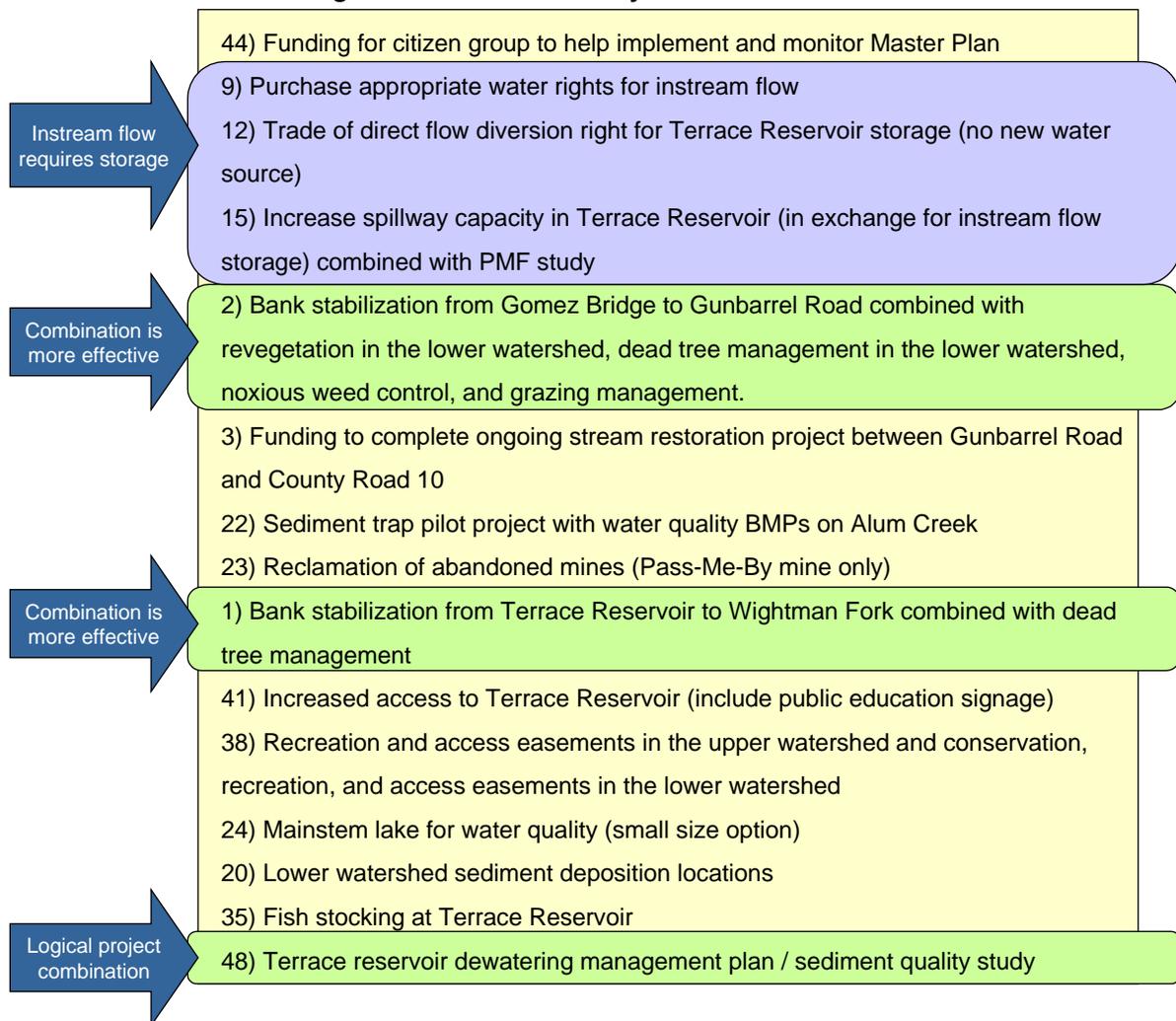
Treatment of Alum Creek is included because it is the tributary that contributes the highest load of iron and aluminum to the Alamosa River and significant amounts of sediments and low pH. Improving the water quality from this tributary may help offset the potential injury caused by hazardous substance release from the Summitville Mine. The project is proposed as a pilot because there are many challenges associated with capturing the sediment and treating the water quality in the small space available. It may be necessary to try more than one design to find the best approach.

Abandoned mines contribute to water quality problems, but to a much smaller degree than Wightman Fork and other altered tributaries. The abandoned mines contribute less than 5 percent of the watershed load for each metal of concern (as discussed in Section 2.4.9). Therefore, only the largest mine, the Pass–Me–By mine, is proposed for inclusion in this alternative. The Pass–Me–By Mine has the lowest pH and contributes the highest loads of copper, iron, and aluminum of any of the mining sites.

The instream flow project is included to restore some of the natural river function downstream of Terrace Reservoir.

Finally, the Terrace Reservoir dewatering management plan was proposed in combination with a sediment quality study. The sediment quality study will provide more information on how to best manage sediments if it is necessary to drain the reservoir.

**Figure 4–2. Watershed Objectives Alternative**



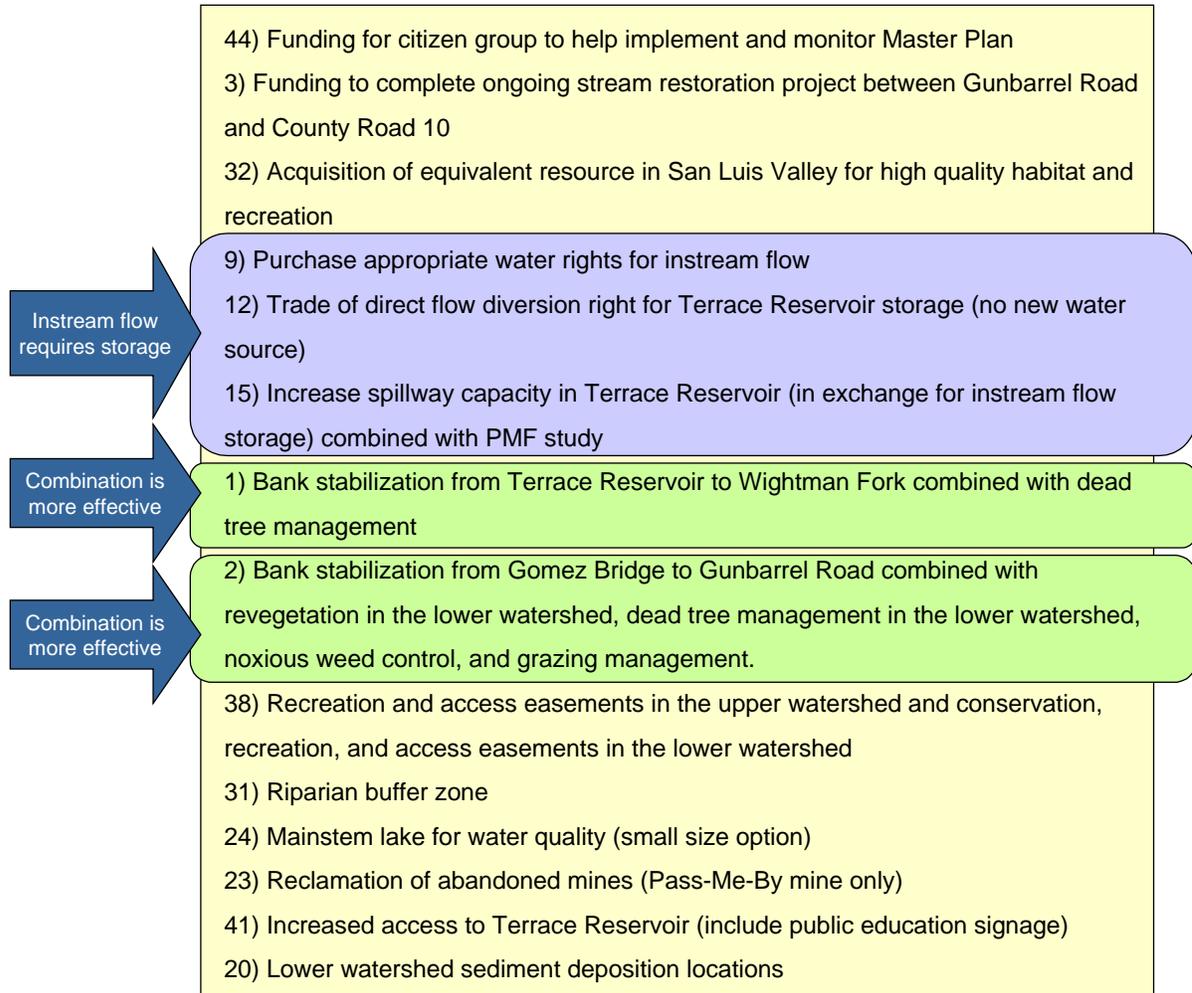
### 4.1.3 No Action Alternative

The No Action Alternative is mute because the consent decree requires the Trustees to take action and use the NRD funds for watershed restoration activities.

#### 4.1.4 Trustee Preferences Alternative

The Trustee Preferences Alternative was developed by the Trustees based on their natural resource restoration goals for the Alamosa River watershed. Their alternative is similar to the other two alternatives (see **Figure 4-3**). The Trustees included Project 32, acquisition of equivalent resource in the San Luis Valley for high quality habitat and recreation. This project would involve the acquisition of equivalent resources in the neighboring Conejos River watershed for high quality habitat and recreation. This project was important to the federal Trustees as it would provide immediate restoration, by the protection from residential development, of wildlife and recreation resources deemed important to the state and federal Trustees.

**Figure 4-3. Trustee Preferences Alternative**



## 4.2 Evaluation of Impacts of Watershed Alternatives

This section compares the prioritization of projects between the three alternatives and discusses the benefits and uncertainties of the projects.

### 4.2.1 Project Priority Comparison

The three watershed alternatives were each organized into three alternative funding levels, \$5, \$10, and \$15 million. The first funding level is what is already available through the Summitville settlement. The other two funding levels are discussed because the Foundation and Trustees plan to seek additional

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funding sources to leverage the funds that are already available. The different funding levels required that projects be prioritized and evenly divided into parts as needed to fit into three tiers. Prioritized alternatives are shown in **Table 4-1**. Projects that are the same amongst the alternatives are shown in the same color. The table shows that the alternatives are almost the same in terms of content. The major difference is the order that projects are listed.

#### **4.2.2 Project Benefits and Uncertainties**

At this stage of the restoration planning process, the draft Master Plan describes project concepts and general plans with cost estimates, but not specific, detailed project proposals with itemized implementation costs. Submission of such detailed plans will be the next step toward the ultimate implementation of selected restoration actions. Thus, it is not possible to do a quantitative benefit/cost analysis at this preliminary stage of project development.

The benefits and uncertainties of the different projects included in the three alternatives can be discussed qualitatively. The benefits of all of the projects are discussed in Section 3. The projects with the most uncertainty are discussed here to reiterate the significant obstacles that may exist for implementing these projects. The projects with the most uncertainty are instream flow, the sediment trap, the mainstem lake, and reclamation of abandoned mines. The uncertainty in each of these projects is discussed below. Despite the significant uncertainty, these projects are included in restoration alternatives because the stakeholders feel that their benefits are important and that they may be possible to implement.

##### ***9) Purchase Appropriate Water Rights for Instream Flow***

This project will help meet many of the Master Plan objectives and will lead to benefits in many resource categories. However, there is considerable uncertainty in its implementation as discussed below:

- The project requires a willing seller of an appropriate water right at a reasonable price. Only the most senior water rights are able to provide a reliable flow. There may not be a willing seller in the near future.
- The project will require a change of water right, which must be approved in water court. By law, a change in water right cannot negatively impact other water users, particularly downstream users who have historically relied upon agricultural return flows. The instream flow water right may not be able to claim the entire historical diversion right. Under the worst case scenario, only the historical consumptive use could be transferred. The exact ruling of a water court case cannot yet be predicted.
- Storage must be obtained to hold the water from the time it is in priority in spring and summer, to when it is beneficial in the stream, fall, winter, and early spring.
- CWCB is the only entity in Colorado legally entitled to hold instream flow water rights and must agree to accept the water right.
- The water right seller does not have to sell the land associated with the water right. However, if land is included as part of the sale, a new owner for the land will have to be determined. The subsequent disposition of that land in a non-irrigated status could also pose management issues.
- The final plan for storage and delivery of an instream flow should be based on the most economically efficient methodology. Therefore, although a framework has been suggested, the most economical methodology to achieve an instream flow is uncertain until negotiations are entered into for storage and delivery options.

**Table 4-1. Three Preliminary Watershed Alternatives**

By Highest Project Score	\$M	Watershed Objectives	\$M	Trustee Preferences	\$M
44. Funding for citizen group	0.3	44. Funding for citizen group	0.3	44. Funding for citizen group	0.3
3. Funding to complete project between Gunbarrel Road and County Road 10	0.12	9. Purchase appropriate water rights for instream flow	3.3	3. Funding to complete project between Gunbarrel Road and County Road 10	0.12
9. Purchase appropriate water rights for instream flow	4.0	12. Trade of direct flow diversion right for reservoir storage (no new water source)	0.1	32. Acquisition of equivalent resource in San Luis Valley for high quality habitat and recreation	0.8
12. Trade of direct flow diversion right for reservoir storage (no new water source)	0.1	2. Bank Stab Gomez to Gunbarrel / Revegetation in lower watershed / dead tree management / noxious weed control / grazing management	1.2	9. Purchase appropriate water rights for instream flow	2.5
1. Most important Stream restoration from Terrace to Wightman Fork	0.5	3. Funding to complete restoration project from Gunbarrel to County Road 10	0.12	12. Trade of direct flow diversion right for reservoir storage (no new water source)	0.4
				1. Bank Stab Terrace to Wightman Fork / dead tree management upper watershed	1.2
<b>Subtotal</b>	<b>5.02</b>	<b>Subtotal</b>	<b>5.02</b>	<b>Subtotal</b>	<b>5.02</b>
1. Complete Stream restoration Terrace to Wightman Fork / dead tree management upper watershed	0.7	9. Finish purchasing water rights	0.7	9. Finish purchasing water rights	1.5
15. Increase spillway capacity (in return for instream flow storage) / PMF Study	1.52	22. Sediment trap pilot project with water quality on Alum Creek	1.0	2. Bank Stab Gomez to Gunbarrel / Revegetation in lower watershed / dead tree management / noxious weed control / grazing management	1.2
2. Bank Stab Gomez to Gunbarrel / Revegetation in lower watershed / dead tree management / noxious weed control / grazing management	1.2	23. Reclamation of abandoned mines (Pass–Me–By mine only)	0.35	15. Increase spillway capacity (in return for instream flow storage) / PMF Study	1.52
4. Stream restoration County Road 10 to County Road 13	0.4	1. Bank Stab Terrace to Wightman Fork / dead tree management upper watershed	1.2	38. Conservation / recreation / access easements in lower watershed (500 acres)	0.5
31. Riparian Buffer Zone	0.2	15. Increase spillway capacity (in return for instream flow storage) / PMF Study	1.52	31. Riparian Buffer Zone	0.2
22. Sediment trap project Phase 1 (suggest Alum Creek)	1.0	41. Increased access to Terrace Reservoir (include parking lot, public education, trail)	0.2		
		38. Recreation / access easements in upper watershed (2 locations, 100 acres total)	0.1		
<b>Subtotal</b>	<b>10.04</b>	<b>Subtotal</b>	<b>10.09</b>	<b>Subtotal</b>	<b>9.94</b>
22. Complete sediment trap project	1.0	38. Conservation / recreation / access easements in lower watershed (500 acres)	0.5	24. Mainstem for water quality (small)	4.0
38. Recreation / access easements in upper watershed (2 locations, 100 acres total)	0.1	24. Mainstem for water quality (small)	4.0	23. Reclamation of abandoned mines (Pass–Me–By mine only)	0.35
38. Conservation / recreation / access easements in lower watershed (500 acres)	0.5	20. Lower watershed sediment deposition locations	0.2	41. Increased access to Terrace Reservoir (include parking lot, public education, trail)	0.2
23. Reclamation of abandoned mines (miser, Pass–Me–By major projects, small projects at other sites)	1.5	35. Fish stocking at Terrace Reservoir	0.05	20. Lower watershed sediment deposition locations	0.2
18. Improve Terrace Reservoir outlet works (tower)	3.0	48. Terrace dewatering management plan / sediment quality study	0.1		
<b>Total</b>	<b>16.14</b>	<b>Total</b>	<b>14.9</b>	<b>Total</b>	<b>14.7</b>

Note: Projects that were split between funding levels are indicated by an arrow. Only projects that can be completed in increments were split. The cost of combined projects, such as stream restoration and revegetation was estimated as 80 percent of their combined total due to economy of scale for doing them at the same time.

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The uncertainties listed above are significant. However, the project benefits are important enough to the stakeholders and Trustees such that further research into the project and the availability of a willing seller is at least warranted. If after some period of time, such as 5 years, there is no willing seller, the Trustees and stakeholders can decide to reallocate funds reserved for the instream flow project to other restoration projects.

#### ***22) Sediment Traps at Upper Tributary Confluences***

There were few water quality projects expected to have significant benefits with reasonable cost. The sediment trap at upper tributary confluences project could improve the water quality of the Alamosa River. Tributaries such as Alum Creek contain a very high load of sediment contaminated with metals. However, there is uncertainty over how effective a sediment trap project would be because there is little space at the tributary confluences to construct a project. The water quality impacts of the project are expected to be positive, but it is possible that removing easily settled metals such as aluminum and iron could actually increase the downstream concentration of other metals such as copper and zinc. Results of the pilot study will determine the overall impact of the project on water quality.

In addition, the project will need permission from the USDA Forest Service to construct in the National Forest.

#### ***24) Mainstem Lake***

The mainstem lake could remove the majority of suspended sediments and particulate iron, copper, and aluminum from the Alamosa River. It has the potential to make the most significant water quality improvement of any restoration project. However, there is substantial uncertainty in the implementation of the project. There are considerable permitting obstacles to creating a lake on the mainstem of a river due to environmental impacts, and these obstacles may even be sufficient to preclude the project. Permission would be needed for construction on National Forest lands. In addition, a water court action will be needed to initially fill the lake and account for additional evaporation from the reservoir surface.

#### ***23) Reclamation of Abandoned Mines***

The reclamation of abandoned mines project will have limited water quality benefits. The major uncertainty in this project is obtaining permission to do water quality activities on private lands. Work on abandoned mines would require permission from landowners who may not be interested in water quality projects.

### **4.3 Preparation of Preferred Alternative**

This section provides background information on the cost estimates for the projects and their major cost items that are common to the three alternatives in preparation for assembling a preferred alternative.

#### ***44) Funding for a Citizen Group to Help Implement and Monitor the Master Plan***

The Alamosa River Foundation would assist the Trustee Council in locally overseeing and monitoring restoration. The total cost of this project, \$300,000 was based on \$30,000 for 10 years to fund a part-time worker.

The Trustees will have the flexibility to provide more than \$30,000 per year for the first three to five years if they determine it would be beneficial. Additional funds could allow the Foundation to hire a more qualified person with engineering and grant writing experience, or they could hire someone for more than half time. Much of the Foundation's work can be done or planned for during the first five

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years of Master Plan implementation and then the funds could taper off. The Foundation could also apply for funds from different sources to help cover the cost of their work.

### ***9) Purchase Appropriate Water Rights for Instream Flow***

This project is estimated to cost between \$1 and \$4 million. The large cost range is due to the lack of basis for the cost of such a project within the watershed. The cost estimate is based on the cost of irrigated land within the Alamosa River watershed, which could range from \$500 to \$2,000 an acre. It is assumed that approximately 2,000 acres of irrigated land would be needed to obtain enough consumptive use water to meet the flow goal in the Alamosa River. The project will also incur significant legal costs for the transfer of use to instream flow. It is assumed that the \$4 million estimate is conservative enough to cover all legal costs.

### ***12) Trade of Direct Flow Diversion Right for Terrace Reservoir Storage***

The cost of this project, estimated at \$100,000 is based purely on legal costs to establish an agreement between Terrace Irrigation Company and the holder of the instream water right for storage and release of instream flow waters. There is no physical construction included in this project.

### ***1 to 4) Stream Restoration Projects***

Cost estimates for each stream restoration project were developed using the same method. The costs were based on a unit cost of \$100,000 per mile with a 20 percent contingency added for design, planning, and permitting costs. For the stream restoration projects between Terrace Reservoir and Wightman Fork, where only isolated banks would need attention, only half the length of the reach was used to calculate the project cost.

### ***23) Reclamation of Abandoned Mines***

Cost estimates for reclaiming abandoned mines to improve water quality were based on \$325,000 each for building typical structures such as limestone trenches and wetlands for the Pass–Me–By and Miser mines. These two mines have the largest flow and estimated metals load on an annual basis. It was estimated that for an additional \$50,000, improvement could be made at some of the other mines that are smaller and would require less extensive engineering and construction. It was estimated that the entire project would cost \$750,000 total. The cost estimates are based on the consultant team's experience with private mine reclamation companies in southwest Colorado.

The entire mine reclamation project was included in the Highest Project Score alternative. In the other two alternatives, only treatment of the Pass–Me–By Mine was included, for a total cost of \$325,000.

### ***15) Increase Terrace Reservoir Spillway Capacity***

A study should be conducted to determine the most cost-effective method of increasing the Terrace Reservoir spillway capacity in order to increase the water storage capacity of the reservoir. There are numerous options, as discussed in **Section 3**. It is likely that either a concrete labyrinth or roller compacted concrete spillway will be the most efficient. However, because each spillway is unique, there are no rules of thumb that can be applied to estimate the cost of a spillway. A total cost of \$1.5 million for studies, engineering and design is the best conceptual estimate.

### ***38) Conservation/Recreation/Access Easements***

The cost of this project was assumed to be \$1,000 per acre for an estimated 500 acres of lands along the Alamosa River, approximately half the estimated cost of property with river access.

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## ***22) Sediment Trap Pilot Project***

The cost to implement the sediment trap pilot project could vary based on the extent to which pilot water quality improvement options are explored and the degree to which future maintenance is funded. Installation of the containment berm, redirection of Alum Creek, and removal of downstream sediments would probably cost on the order of \$500,000. However, funds will have to be reserved for future removal of sediments from the sediment detention area, as well as for future lime addition if that option proves favorable. A number of different water quality improvement processes could also be explored at the site. Therefore, a total cost of \$1 million was estimated. The scope and funding of research projects could potentially rely on groups such as the U.S. E.P.A., the National Science Foundation, or universities, possibly reducing the NRD share of the cost.

## ***24) Small Mainstem Lake for Water Quality***

It is likely that a roller compacted concrete dam with an integrated spillway may be the most cost effective design for a small mainstem lake. However, the cost and most appropriate design for the dam is uncertain until geotechnical investigations can be conducted at the suggested dam location and at other potential locations. There is also uncertainty in the efforts that would be needed for studies and environmental permitting. The current best estimate for engineering and construction of a small dam at the suggested location is \$4 million as long as permitting obstacles are not insurmountable.

## **4.4 Preferred Restoration Alternative**

The preferred alternative was determined in a stakeholder meeting held in La Jara on December 13, 2004. Stakeholders were presented with the three alternatives shown in **Table 4-1**. The three alternatives include many of the same projects. The benefits and constraints of some of the projects were discussed and the preferred projects were added to the preferred alternative with the consensus of the group.

Project 32, Acquisition of equivalent resources outside of the watershed, was strongly supported by the stakeholders and Trustees as a project with important benefits that should be implemented. However, the stakeholders were opposed to using Natural Resource Damage funds to purchase land outside of the watershed. Furthermore, the Trustees' agreed that although the project was a high priority, it did not meet the intent of the consent decree.

The preferred alternative is listed in **Table 4-2** for funding levels of \$5, \$10, and \$15 million. Some of the projects described individually in **Section 3** have been combined into one logical combination. For instance, the stream restoration projects are combined with revegetation and noxious weed control.

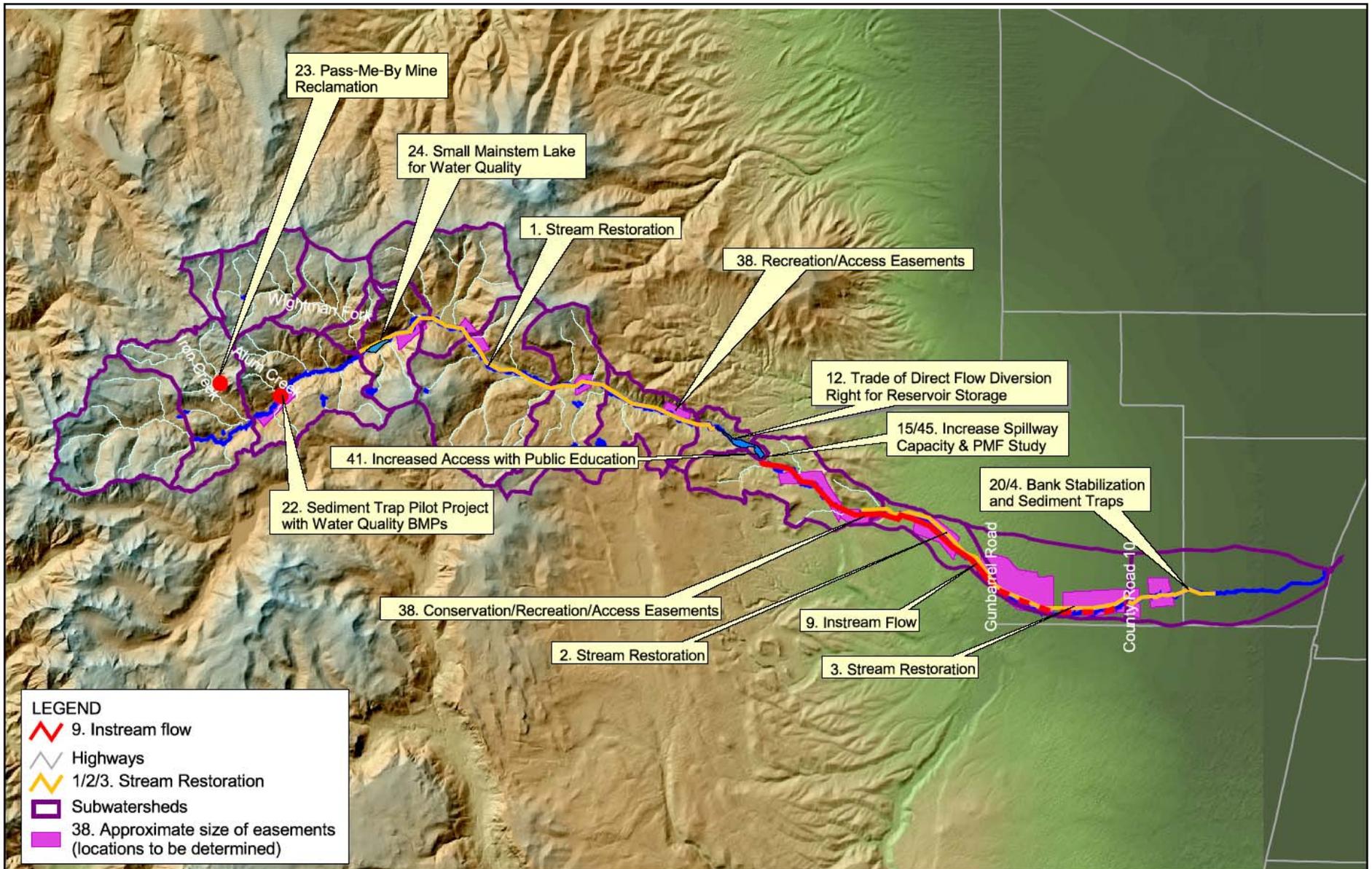
**Table 4-2** depicts the location of the proposed projects in the watershed. The location of easements is shown only to represent the suggested sizes of easement, not their physical location. Easements can only be implemented with the consent of the landowner.

**Table 4-2. List of Projects in the Preferred Alternative**

Project	Cost
44. Funding for a citizen group to help implement and monitor Master Plan	\$300,000
3. Funding to complete ongoing streambank project between Gunbarrel Road and County Road 10	\$120,000
2. Stream restoration from Gomez Bridge to Gunbarrel Road; Revegetation, dead tree management, noxious weed management, and grazing management in lower watershed	\$1,200,000
9. Purchase appropriate water rights for instream flow downstream of Terrace Reservoir	\$3,300,000
12. Trade of direct flow diversion right for storage of instream flow water rights in Terrace Reservoir (no new water source)	\$100,000
<b>Subtotal</b>	<b>\$5,000,000</b>
9. Finish purchasing water rights	\$700,000
1. Stream restoration from Wightman Fork to Terrace Reservoir; dead tree management in upper watershed	\$1,200,000
15. Increase Terrace Reservoir spillway capacity to remove storage restriction (in return for instream flow storage); PMF Study	\$1,520,000
31. Riparian buffer zone	\$200,000
22. Sediment trap pilot project with water quality best management practices on Alum Creek	\$1,000,000
23. Reclamation of abandoned mines (Pass–Me–By mine only)	\$325,000
<b>Subtotal</b>	<b>\$10,000,000</b>
38. Recreation or access easements in upper watershed (2 locations, approximately 100 acres total)	\$100,000
38. Conservation / recreation / access easements in lower watershed (approximately 500 acres total)	\$500,000
20/4. Lower watershed sediment deposition locations combined with stream restoration from County Road 10 to County Road 13	\$300,000
24. Mainstem lake for water quality (small size option)	\$4,000,000
41. Increased access to Terrace Reservoir (include parking lot, public education, trail)	\$100,000
<b>Total</b>	<b>\$15,000,000</b>

Note: Arrow indicates that Project 9 is split into two phases. The cost of combined projects, such as stream restoration and revegetation was estimated as 80 percent of their combined total due to economy of scale for doing them at the same time.

**Figure 4–4** depicts the location of the proposed projects in the watershed. The location of easements is shown only to represent the suggested sizes of easement, not their physical location. Easements can only be implemented with the consent of the landowner.



**Figure 4-4. Preferred Alternative Project Locations**

Note: Projects without a location, such as funding for the citizen group, are not shown. Riparian buffer zone would cover the entire riparian corridor of the Alamosa River.

2 0 2 4 Miles



**Alamosa River Watershed  
Restoration Master Plan**

MWH in association with Agro Engineering,  
Lidstone and Associates, and SWCA

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#### **4.4.1 Funding for Alamosa River Foundation to Help Implement and Monitor the Master Plan**

Several citizens groups have formed to promote the health of the watershed and represent the interests of its residents. However, these groups are volunteer organizations. The Alamosa River Foundation was involved in the development of the Master Plan from its inception. The Alamosa River Foundation could be provided with funding for a part-time staff person or persons to assist the Trustee Council by performing the following tasks:

- Act as watershed coordinator to facilitate community meetings.
- Assist in restoration project monitoring activities. Coordinate professionals and volunteers for restoration project monitoring as described in **Section 5.5**.
- Act as a restoration project sponsor/manager to submit proposals to Trustee Council for NRD funding.
- Assist in the implementation of restoration projects listed in the Master Plan but not receiving NRD funding.
- Seek additional funding from other sources for restoration projects to increase the funding available for watershed efforts well beyond the NRD funding.
- Seek additional funds for operating the citizen group to increase the scope and scale of activities they are able to perform.
- Work with the Colorado Tourism Office and other agencies and non-profit groups to promote tourism and recreation in the Alamosa River watershed.
- Conduct a public relations campaign to publicize watershed improvement projects, increased recreational opportunities in the watershed, and success stories.
- Communicate potential work opportunities to local businesses by publicizing RFPs, contracting, and project management opportunities. Using local project managers and contractors may help maximize cost savings and increase local ownership of the watershed restoration effort.
- Strive to manage and complete projects in the most cost-effective way in order to maximize the goals that can be achieved with available funding.

#### **4.4.2 Instream Flow Projects**

The instream flow project requires four projects discussed independently in **Section 3**:

- Purchase appropriate water rights for instream flow.
- Trade of direct flow diversion right for Terrace Reservoir storage.
- Increase Terrace Reservoir spillway capacity in return for instream flow storage.
- Probable maximum flood study.

##### ***Instream Flow Water Rights***

This project would acquire water rights to maintain streamflow during periods when the river is dry under existing conditions. The minimum release from Terrace Reservoir needed to significantly improve water quantity conditions below Terrace Reservoir is not known for certain. It has been assumed that reasonable targets are a 10 cfs flow from Terrace Reservoir to Gunbarrel Road and a 5 cfs flow from Gunbarrel Road to County Road 10. A senior priority water right would be purchased from one or more willing sellers to provide prolonged instream flows in virtually every year. A senior right could be combined with other lower priority rights until the target flow is established.

If willing water right sellers are identified, there are still several challenges to implementing this project including:

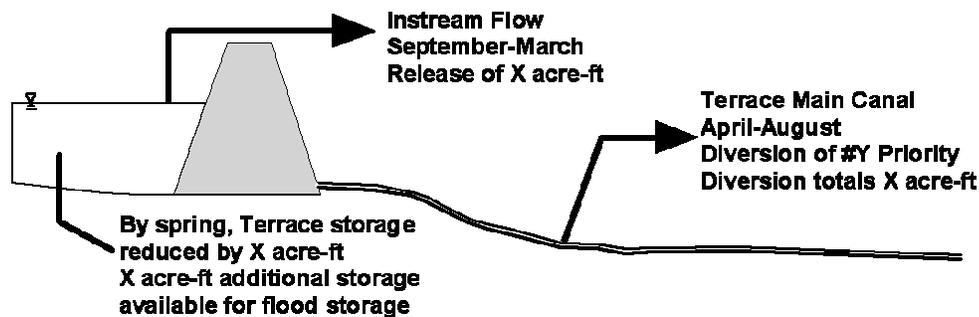
- Acquiring a water right to establish a more sustainable instream flow lasting longer than the current flow management will only be successful if storage is available for that flow.
- Negotiations with the CWCB will be required to create an instream flow donation or lease agreement.
- Applications to change the water right to instream flow uses must be formulated by an attorney and filed with the water court.
- The water right may be obtained with or without the associated land. If land is acquired as part of the transfer, a plan for long term management of the property will have to be developed.

### ***Trade of Direct Flow Diversion Right for Reservoir Storage***

Storage of the acquired water rights would be needed to capture spring and summer runoff for release throughout fall and winter. Assuming storage could fill over 6 months and release over 6 months, about 3,600 acre–feet of storage would be needed.

This project is an option for storing acquired water rights in Terrace Reservoir without construction of new storage facilities. Potentially, Terrace Irrigation Company could use the acquired water right as it is available in the spring and summer for irrigation purposes. The amount diverted would vary based on the water year. Then, an equal amount could be released from Terrace Reservoir during late fall, early spring, and perhaps winter months as a trade. **Figure 4–5** shows a simple schematic of a potential trade of use.

**Figure 4–5. Schematic of Trade of Direct Flow Right for Storage for Instream Flow**



By spring, the release out of Terrace Reservoir would reduce the volume of stored water in Terrace Reservoir by the total amount diverted the previous season through the Terrace Main Canal. This additional space could then be used to capture high spring flows. Therefore, the storage available for Terrace Irrigation Company to capture high flows would not be reduced. However, the Terrace Irrigation Company would probably be forced to divert more water early in the irrigation season while the acquired water right was in priority and reduce stored water that would be available late in the irrigation season.

This project would require Terrace Irrigation Company to agree to the trade, and reservoir improvements may be needed as an exchange for the trade. It would also require approval from the Division Engineer and potentially a water right change.

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### ***Increase Spillway Capacity in Return for Instream Flow Storage***

Increasing the Terrace Reservoir spillway capacity, thus allowing for the removal of the State Engineer–imposed filling restriction is the most economical way to increase the physical storage capacity available in Terrace Reservoir. Removing the filling restriction would recover about 2,200 acre–feet of storage capacity. This project could potentially be done in place of or in addition to Project 12, Trade of Direct Flow Diversion Right for Reservoir Storage. There are many options for increasing the spillway capacity that should be investigated through a feasibility study prior to design and construction. **Section 3.7.1** describes several spillway improvement options.

### ***Probable Maximum Flood (PMF) Study***

Conducting a site–specific PMF study for the basin could potentially reduce the cost of increasing the spillway capacity. Site–specific PMF studies are frequently successful in reducing the anticipated amount of flow that structures are required to pass. A more specifically calculated anticipated flood event could reduce the cost required to improve the spillway and remove part or all of the State Engineer’s restriction on the reservoir. This project would be done in conjunction with Project 15, Increase Terrace Reservoir Spillway Capacity.

### **4.4.3 Stream Restoration and Vegetation Projects**

The stream restoration projects will stabilize the channel and banks, thereby decreasing the amount of sediment entering the river, promoting native streambank vegetation, and enhancing fish and migratory bird habitat. The main focus of the proposed stabilization and restoration projects is to limit the amount of sediment entering the river due to stream bank erosion caused by human impacts. Mitigating sediment supply will improve channel stability at irrigation diversions and bridges, and will help maintain channel capacity. All stream restoration projects will require detailed designs that are location–specific and account for natural processes and appropriate stream type.

The four channel stabilization projects included in the preferred alternative are:

- Terrace Reservoir to Wightman Fork
- Gunbarrel Road to Gomez Bridge
- County Road 10 to Gunbarrel Road
- County Road 13 to County Road 10

In addition to these four restoration projects, three vegetation projects are included:

- Dead tree management
- Revegetation
- Noxious weed management

### ***Stream Restoration Terrace Reservoir to Wightman Fork***

Bank stabilization efforts in this reach should focus on small areas of the river channel impacted by human influences or with high rates of erosion. It will also repair areas where the river is encroaching on the access road. Fish habitat enhancement features could be incorporated into the design to provide areas for fish if the water quality improves.

### ***Stream Restoration Gunbarrel Road to Gomez Bridge***

In the reach from Gunbarrel Road to Gomez Bridge there are steep eroded banks with the potential to introduce significant sediment load to the channel. During periods of high flow, this sediment is transported downstream of Gunbarrel Road where the sediment drops out and clogs the channel. Stream restoration to protect these banks would improve habitat in the downstream area most benefited by the instream flow project.

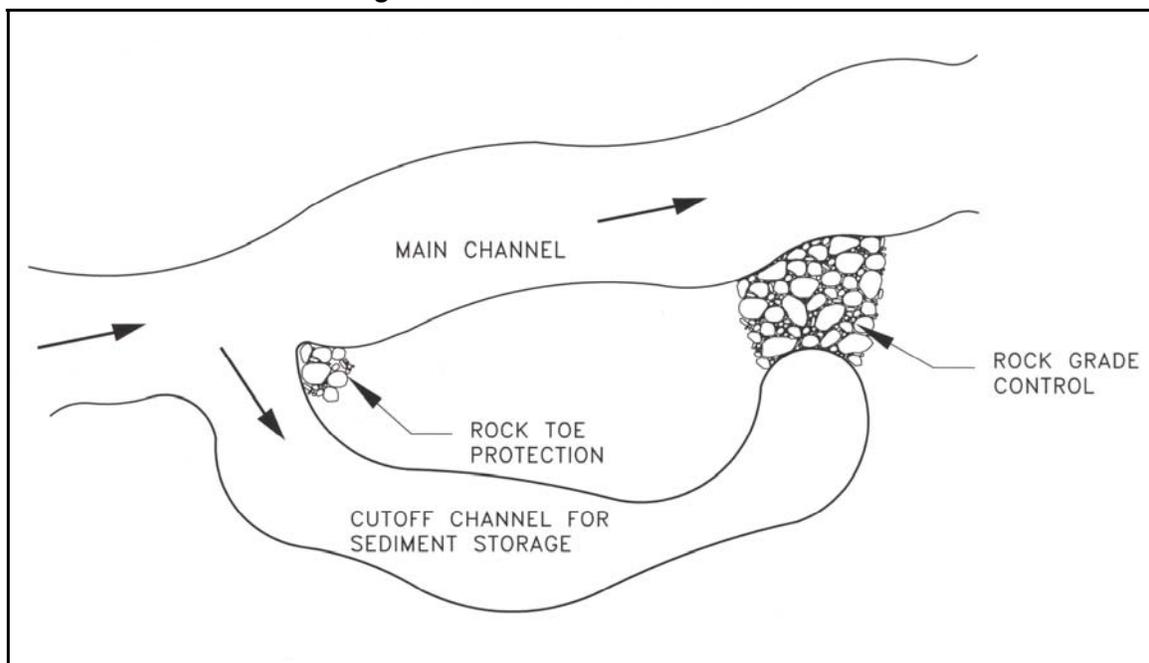
### ***County Road 10 to Gunbarrel Road***

There is currently a channel stabilization project underway between County Road 10 and Gunbarrel Road. Although construction started on the project in 2004, there are not enough funds available to complete the implementation. Completion of this restoration project will minimize the amount of sediment transported to downstream reaches and improve the efficiency of diversion structures.

### ***County Road 10 to County Road 13 – Combined with Sediment Deposition***

The main focus in this reach will be to stabilize the few isolated, eroded banks and manage sediments that tend to accumulate in the channel. Creation of sediment storage and deposition sites is recommended to manage existing and anticipated sediment load. **Figure 4-6** shows an artificial cutoff channel. This feature creates a location off of the main channel for excess sediment to drop out, thus promoting channel stability. The artificial channel is created by excavating material parallel to the main river channel and connecting the upstream end of the cutoff channel to the river.

**Figure 4-6. Artificial Cutoff Channel**



### ***Dead Tree Management***

There are areas near Jasper where trees have fallen in the river causing water to backup, potentially causing flooding. The trees should be removed from the river.

Downstream of Capulin, there is a stretch of cottonwood trees that are dead and will eventually fall into the river. These trees should be selectively removed if they are in danger of falling into the river or damaging river structures. Trees not in danger of falling should be left for wildlife habitat. Larger areas

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of dead trees could be removed when combined with revegetation efforts. The removed trees could be used as material for stream restoration and aquatic habitat projects.

### ***Revegetation***

After instream flow and any recontouring projects are completed, portions of the lower watershed should be revegetated with native plants. Riparian revegetation should be concentrated on the river from County Road 10 upstream to Terrace Reservoir. The dead cottonwood trees, combined with a lack of understory shrubs and saplings, results in a virtual lack of riparian corridor. Revegetation should focus on creating multistory layers of cottonwoods and willows. Cottonwood trees require overbank flooding and shallow groundwater levels to flourish. Although revegetation has been shown to be possible without instream flow, revegetation efforts must consider the amount of water available so that projects have a high likelihood of success.

### ***Noxious Weed Management***

The primary focus envisioned for this effort is to control noxious weeds in riparian areas that are restored or protected by stream restoration, revegetation, and riparian buffer projects. The aim of stream restoration is to eventually restore a vegetative cover that will stabilize banks and provide habitat. Noxious weed management will be a component of restoring healthy native vegetation to stream banks and riparian areas.

Currently, there are existing groups attempting to control weeds in the lower watershed primarily in agricultural areas. The existing weed management control district could be funded to control weeds in the riparian area of the Alamosa River or in the specific project areas.

#### **4.4.4 Riparian Buffer Zone**

A riparian buffer is an area adjacent to a water body that has been set aside for conservation and maintenance to protect stream and riparian habitat quality. Activities such as farming and development are limited in the buffer zone. The typical width of a buffer zone is 100 feet on either side of the channel with additional space in wetland areas or areas with significant streambank erosion. Buffers can be created through a combination of ordinances and easements, or can be implemented on a voluntary basis. In the Alamosa River where development pressure is minimal, a voluntary stream buffer implemented through education and easements may be the preferred option. A number of financial incentives for agricultural landowners to establish riparian buffers exist from government and private sector programs such as the Conservation Reserve Program.

#### **4.4.5 Sediment Trap Pilot Project with Water Quality BMPs on Alum Creek**

During high flows, Alum Creek carries a tremendous bedload of sediments derived from hydrothermally altered rocks to the Alamosa River. These rocks typically contain sulfide-rich accessory minerals, which when oxidized contribute metal loading as well as low pH runoff and acidic conditions in the Alamosa River. Following spring runoff, a large fan of materials is deposited at the terminus of the creek, and these sediments are then progressively eroded and carried downstream by the Alamosa River. **Figure 4-7** shows a photo of the sediment fan looking upstream as it was being eroded during summer of 2004.

**Figure 4-7. Photo of Alum Creek Sediment Fan Being Eroded by Alamosa River**



A sediment trap and water quality project would consist of regrading the fan area, stabilizing the adjacent river bank with limestone rock, constructing limestone rock check dams within the Alum Creek channel to trap a portion of the annual bedload, and directing the lower portion of Alum Creek to a flow-through pond. There are several options for water quality improvements that could be tested on Alum Creek as pilot projects and potentially implemented if successful and if funds are available. However, any sediment trap and water quality project would require significant, regular maintenance.

#### **4.4.6 Reclamation of Pass–Me–By Mine**

Contaminant loads from smaller historical mining sites are less significant on a watershed scale than loads from the Summitville site and loads from natural sources. These smaller mine sites represent less than one percent of the watershed contaminant load for copper, zinc, and magnesium, and less than 3 percent of the contaminant load for iron and aluminum. However, as point sources the mines are more readily treatable than non–point sources. The Pass–Me–By Mine produces the highest contaminant loads of all of the smaller sites and is the only abandoned mine included in the Preferred Alternative. The project could include a combination of an anoxic limestone drain at the collapsed mine portal followed by a sulfate reducing wetland or settling basin as well as capping and diversion of drainage around the mine tailings dump. The Pass–Me–By Mine is located on private property and an agreement would be needed from the landowner to implement the project.

#### **4.4.7 Easements**

Easements may be negotiated with willing landowners along the Alamosa River for various purposes such as conservation, recreation and access to the Alamosa River. Conservation easements are a tool to protect and enhance existing quality habitat and areas that can be improved through restoration projects such as those in the riparian corridor. Conservation easements are legal agreements between a landowner and a public agency or conservation group, in which the parties agree to protect certain natural resource values of the land or provide access to the public. Due to the extensive private

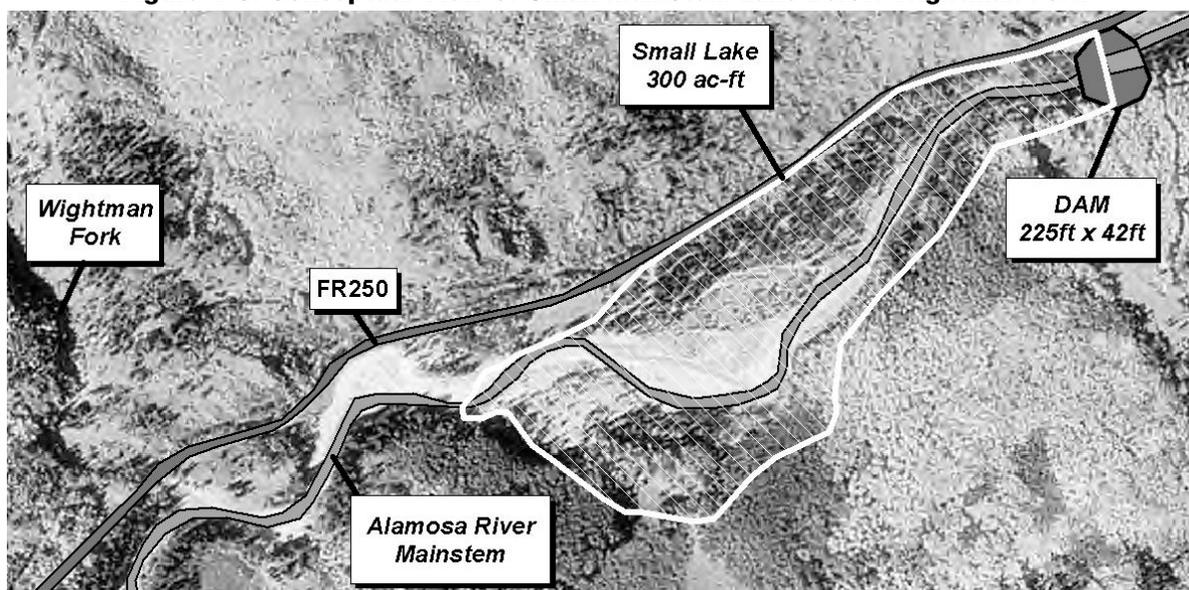
ownership along the river, access and recreation easements are proposed to allow the public to benefit from the restoration projects.

#### 4.4.8 Mainstem Lake for Water Quality

A lake constructed on the mainstem of the Alamosa River below Wightman Fork could significantly improve water quality conditions downstream in the watershed. The primary water quality improvement mechanism of a lake is the capture of sediments. Suspended sediments and metals in particulate form would be removed from the Alamosa River by such a lake. Lime addition or injection within the lake is an additional active process that could potentially reduce all water quality contamination and help meet water quality standards. In order to maintain the lake's capacity, sediments would periodically need to be removed.

**Figure 4-8** shows the potential location for a small, 300 acre-feet, lake on Forest Service land just below Wightman Fork. The size of the lake was estimated so that the current Forest Service road would not be inundated.

**Figure 4-8. Conceptual View of Small Mainstem Lake Below Wightman Fork**



#### 4.4.9 Increased Access to Terrace Reservoir

Improving public access to Terrace Reservoir should increase recreational utilization of the reservoir area. Improvements can include increased parking on FR 250, the establishment of a maintained trail from the parking area to the reservoir shore, fishing access, small boat and picnicking facilities, and lavatories. Educational signage could be included to teach visitors about water quality, mining impacts, and the Master Plan.

### 4.5 Environmental Consequences

The environmental consequences of the three preliminary alternatives, the Preferred Alternative, and the No Action Alternative are discussed below. The alternatives are referred to as alternatives 1 through 5:

- Alternative 1 – No Action
- Alternative 2 – Project Rank Preliminary Alternative
- Alternative 3 – Watershed Objectives Preliminary Alternative

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- Alternative 4 – Trustee Preferences Preliminary Alternative
  - Alternative 5 – Preferred Alternative / Proposed Action

This section is based on the assumption that all actions identified under each alternative would be implemented successfully.

The environmental consequences of Alternative 1, the No Action Alternative, are what would happen if none of the Master Plan projects were implemented. Consideration of this alternative is a requirement of the National Environmental Policy Act (NEPA). These consequences are discussed in **Section 4.5.1**. Alternatives 2 through 5 are considered the action alternatives. Most of the projects included in the action alternatives are the same for all alternatives. Therefore, the similar environmental consequences of the action alternatives are discussed together in **Section 4.5.2**. Then, in **Sections 4.5.3** through **4.5.6**, each action alternative is discussed independently to cover the different environmental consequences that would occur as a result of the varying projects implemented in each alternative. **Section 4.5.7** summarizes the environmental consequences of all of the alternatives.

#### **4.5.1 Alternative 1 – No Action**

NEPA requires that a No Action Alternative be considered. The No Action Alternative consists of the expected conditions under current programs pursued outside the NRDAR process. These current programs include management of the Rio Grande National Forest, efforts of the Alamosa River Foundation, and CDPHE's cleanup programs at Summitville, all at current funding levels. It is assumed that the stream restoration project currently in progress between Gunbarrel Road and County Road 10 would be completed and that the Summitville Treatment Plant and other water quality mitigation measures would continue to operate at their current capacity. The No Action Alternative is the baseline against which the other actions are compared. If this alternative were implemented, the Trustees would not initiate specific actions to restore natural resources potentially injured by Summitville releases to the environment.

The No Action alternative is moot in that restoration is a court ordered action required by the settlement described in Section 1.3. The No Action Alternative is described here as a basis of comparison for the other alternatives.

##### ***Surface Water Impacts***

The lower Alamosa River would continue to be dry between late fall and early spring. Water quality between Wightman Fork and Terrace Reservoir would continue to be degraded from high metals load, high sediment transport, and low pH.

##### ***Groundwater Impacts***

Regional groundwater levels will continue to decline.

##### ***Habitat Impacts***

The riparian habitat and aquatic habitat of the lower Alamosa River would continue to degrade due to lack of sustained flow. Poor water quality would continue to impact the aquatic and riparian habitat in the watershed due to high metals loading and low pH.

##### ***Biological Impacts***

The degrading riparian habitat would lead to fewer riparian dependent species in the watershed. There would be no sustainable fish populations in water quality impacted reaches upstream of Terrace Reservoir and the flow impacted reaches downstream of Terrace Reservoir.

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### ***Listed, Proposed and Candidate Species***

The southwestern willow flycatcher, bald eagle, and Canada lynx are endangered species with potential to inhabit the Alamosa River watershed. In the current condition of degraded wildlife habitat along the Alamosa River, there have been no documented occurrences of these species in the watershed (as discussed in **Section 2.9**). Therefore, no change to listed, proposed, or candidate threatened or endangered species or their critical habitats are expected.

### ***Cultural Resources***

There would be no change in cultural resources.

### ***Environmental Justice Issues***

Under the No Action Alternative, recreational opportunities would not be improved and environmental quality would not be enhanced. Commonly available recreation such as fishing, hiking, hunting and other activities would continue to be largely unavailable along the Alamosa River.

### ***Socioeconomic Issues***

Under the No Action Alternative, the image of the watershed as a “dead watershed” would continue and visitors would be discouraged from visiting and enjoying the natural resources. The Master Plan would not be implemented and would not provide opportunities for jobs in the watershed.

### ***Land Use Issues***

There would be no change to the current land use and traffic patterns. Channel instability would continue to pose problems for irrigators.

### ***Cumulative Impacts***

If the No Action Alternative were chosen, riparian and aquatic habitat would continue to be in a degraded condition due to natural and human-induced factors. Species dependent on riparian and aquatic habitat may also be further harmed due to continued degradation of existing habitat. The image of the watershed would still be of damaged natural resources and poor water quality. Channel instability would continue to pose problems for irrigators and no additional jobs would come to the watershed for restoration projects.

## **4.5.2 Environmental Consequences Common to Alternatives 2 through 5 (Action Alternatives)**

The following projects are common to each of the action alternatives:

- Funding for the Alamosa River Foundation to help implement and monitor the Master Plan
- Funding to complete ongoing streambank project between Gunbarrel Road and County Road 10
- Stream restoration from Gomez Bridge to Gunbarrel Road
- Stream restoration from Wightman Fork to Terrace Reservoir
- Purchase appropriate water rights for instream flow downstream of Terrace Reservoir
- Trade of direct flow diversion right for storage of instream flow water rights in Terrace Reservoir
- Increase Terrace Reservoir spillway capacity and complete probable maximum flood study
- Reclamation of Pass–Me–By Mine

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- Conservation / recreation / access easements in the lower watershed (approximately 500 acres)
  - Revegetation
  - Dead tree management
  - Noxious weed management
  - Grazing management

The common environmental consequences of these projects are discussed below.

### ***Groundwater Impacts***

Local groundwater levels would increase, or decline at a slower rate, due to infiltration of surface water into the groundwater in the channel downstream of Terrace Reservoir.

### ***Surface Water Impacts***

Surface water quantity downstream of Terrace Reservoir would be improved due to longer sustained flows. Water quality would be slightly improved due to abandoned mine reclamation and reductions in sediment loading from mine banks and other sources.

### ***Habitat Impacts***

Generally, upland conifer forests, which are the dominant habitats in the upper watershed, appear to be in good condition and would not be impacted by the action alternatives.

Available habitat in the riparian corridor was impacted by placer mining and excessive sedimentation. Abandoned mine reclamation and stream restoration in the action alternatives would reduce these impacts. In-stream aquatic habitat and riparian habitat would be improved by the action alternatives through improved water quality and a more sustained flow in the river downstream of Terrace Reservoir. Improved surface water conditions would lead to enhanced riparian vegetation conditions.

There would be short-term impacts to habitat due to needed earth moving for stream restoration. However, these projects would eventually improve the habitat quality due to the associated revegetation and channel stabilization.

### ***Biological Impacts***

The action alternatives would benefit many different species of fish and wildlife found in the Alamosa River watershed. Preservation and improvement of riparian areas, stream restoration, and instream flow would benefit waterfowl, sparrows, warblers, raptors, beaver and other species known to inhabit these habitats. Water quality improvements and establishment of an instream flow would benefit fish directly and would improve riparian habitat quality and those species dependent upon the riparian zone. Stream restoration projects would create localized scour pools, provide instream cover, and encourage development of small gravel bars for fish habitat. Revegetation would provide additional locations for forage and cover for riparian dependent species. The riparian buffer zone and grazing management would reduce disturbance of the riparian zone.

There would be minimal negative impacts to biological resources from human disturbance caused by increased public access to the river and riparian areas. Public use projects would also protect and potentially minimize human disturbance to fish and wildlife by minimizing human impacts on those resources.

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### ***Cultural Resources***

Cultural resources were not investigated in the Master Plan. However, the four action alternatives would either avoid or mitigate any archeological and historic resources or resources that have appreciable cultural value to the Indian tribes of the area. The projects in the action alternatives involving construction would be conducted in a manner complying with the following regulations:

- The National Historic Preservation Act of 1966 (P.L. 89–665 as amended).
- Native American Grave Protection and Repatriation Act (NAGPRA), (P.L. 101–601)
- Archeological Resources Protection Act of 1979 (P.L. 96–95)

### ***Environmental Justice***

Land, easement, and water right purchases would involve transactions with willing landowners paid fair market value. No minority or low-income populations would be displaced or negatively affected in any way. Some of the implemented projects would provide access to low income watershed residents for hiking, fishing, and wildlife viewing.

### ***Socioeconomic Impacts***

Habitat improvements, access, and recreation easements would provide more opportunities for public use and enjoyment of natural resources. Improving natural resource recreation facilities would increase the number of visitors to the Alamosa River watershed, bringing increased business to surrounding communities. Local businesses are likely to be awarded business through the competitive bidding process that would be used to implement the action alternatives. Farmers using irrigation water from the Alamosa River are likely to benefit from improved water quality and channel stability.

### ***Land Use Impacts***

There would be a decrease in the area of agricultural land irrigated by Alamosa River water due to the transfer of water rights to instream flow. This land may or may not be in the natural watershed due to irrigation diversions that currently transport water outside of the watershed. If the land is sold in conjunction with a water right transfer, a management plan for the land would be implemented.

Conservation, recreation, or access easements would be obtained for approximately 500 acres in the lower watershed. This would provide more recreational opportunities for watershed residents and visitors in the lower watershed. The added recreational and access opportunities may lead to more traffic on State Highway 15 and other routes providing access to the river downstream of Terrace Reservoir.

### **4.5.3 Alternative 2 – Project Rank Alternative**

The projects that are in the Project Rank Alternative but not all of the action alternatives are:

- Stream restoration County Road 10 to County Road 13
- Riparian buffer zone
- Sediment trap pilot project on Alum Creek
- Recreation / access easements in upper watershed
- Improve Terrace Reservoir outlet works
- Reclamation of abandoned mines including Miser Mine and other smaller projects (in addition to Pass–Me–By Mine)

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### ***Surface Water Impacts***

Surface water quality in the Alamosa River mainstem downstream of Alum Creek would be improved due to removal of suspended sediment and associated pollutants. Surface water quality will be slightly improved due to reclamation of additional abandoned mines.

Improvements to the Terrace Reservoir outlet works would allow operators to release water of higher quality to downstream uses. Improved outlet works would have less chance of releasing large sediment loads downstream.

### ***Listed, Proposed and Candidate Species***

The southwestern willow flycatcher, bald eagle, and Canada lynx are endangered species with potential to inhabit the Alamosa River watershed. Riparian habitat enhancements would eventually promote use by these species. Current programs to establish target populations of southwestern willow flycatcher would be supported through these actions.

### ***Land Use Impacts***

New recreation and access easements in the upper watershed would provide recreational opportunities to watershed residents and visitors. This may cause additional traffic on Forest Road 250.

### ***Cumulative Impacts***

The instream flow and stream restoration projects would improve riparian and aquatic habitat and increase populations of dependent species. Water quality associated with suspended pollutants would be somewhat improved due the sediment trap on Alum Creek and mine reclamation.

There would be an increase in recreational opportunities in the watershed. Visitors to the watershed and job opportunities for implementing the Master Plan would improve the local economy. Improved channel stability and control over water released from Terrace Reservoir would benefit irrigators. There would be a decrease in the amount of irrigated land due to a transfer of water rights to instream flow. There could be an increase in traffic on roads providing access to the river.

## **4.5.4 Alternative 3 – Watershed Objectives Alternative**

The projects that are in the watershed objectives alternative but not all of the action alternatives are:

- Sediment trap pilot project with water quality on Alum Creek
- Increased access to Terrace Reservoir
- Recreation / access easements in upper watershed
- Mainstem lake for water quality
- Lower watershed sediment deposition locations
- Fish stocking at Terrace Reservoir
- Terrace Reservoir dewatering management plan / sediment quality study

### ***Surface Water Impacts***

Surface water quality in the Alamosa River mainstem downstream of Alum Creek would be improved due to removal of suspended sediment and associated pollutants. Water quality downstream of Wightman Fork would be greatly improved due to the mainstem lake. Suspended sediments and particulate metals would be reduced and low pH winter flows and untreated releases from the Summitville site would potentially be buffered.

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### ***Habitat Impacts***

Additional aquatic habitat would be created by the mainstem lake. Some areas of riparian habitat would be displaced to construct and fill the mainstem lake. Aquatic habitat downstream of mainstem lake would be improved due to improved water quality.

### ***Biological Impacts***

Water quality improvements due to the mainstem lake and the sediment trap on Alum Creek may be significant enough that fish populations could be sustained between Wightman Fork and Terrace Reservoir. Fish stocked in Terrace Reservoir would increase the number of fish in the vicinity of the Reservoir.

### ***Listed, Proposed and Candidate Species***

The southwestern willow flycatcher, bald eagle, and Canada lynx are endangered species with potential to inhabit the Alamosa River watershed. Riparian habitat enhancements would eventually promote use by these species. Current programs to establish target populations of southwestern willow flycatcher would be supported through these actions.

### ***Land Use Impacts***

New recreation and access easements in the upper watershed and new facilities and fish stocking at Terrace Reservoir would provide recreational opportunities and environmental education to watershed residents and visitors. This may cause additional traffic on Forest Road 250.

### ***Cumulative Impacts***

The instream flow and stream restoration projects would improve riparian and aquatic habitat and increase populations of dependent species. Water quality associated with suspended pollutants would be greatly improved due the sediment trap on Alum Creek and the mainstem lake. Riparian habitat would be displaced in the footprint of the mainstem lake, but could be replaced at the upstream margins of the lake.

There would be an increase in recreational opportunities in the watershed. Visitors to the watershed and job opportunities for implementing the Master Plan would improve the local economy. Improved channel stability and water quality would benefit irrigators. There would be a decrease in the amount of irrigated land due to a transfer of water rights to instream flow. There could be an increase in traffic on roads providing access to the river.

## **4.5.5 Alternative 4 – Trustee Preferences Alternative**

The projects that are in the trustee preferences alternative but not all of the action alternatives are:

- Acquisition of equivalent resource in San Luis Valley for high quality habitat and recreation
- Riparian buffer zone
- Mainstem lake for water quality
- Increased access to Terrace Reservoir
- Lower watershed sediment deposition locations

### ***Surface Water Impacts***

Water quality downstream of Wightman Fork would be greatly improved due to the mainstem lake. Suspended sediments and particulate metals would be reduced and low pH winter flows and untreated releases from the Summitville site would potentially be buffered.

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### ***Habitat Impacts***

Additional aquatic habitat would be created by the mainstem lake. Some areas of riparian habitat would be displaced to construct and fill the mainstem lake. Aquatic habitat downstream of mainstem lake would be improved due to improved water quality. Acquisition of the Crowther property would immediately preserve a large area of high quality riparian and endangered species habitat in the Conejos River watershed.

### ***Biological Impacts***

Water quality improvements due to the mainstem lake may be significant enough that fish populations could be sustained between Wightman Fork and Terrace Reservoir. Acquisition of the Crowther property would immediately benefit fish, birds, and wildlife through the preservation of 420 acres of high quality habitat.

### ***Listed, Proposed and Candidate Species***

No negative impacts to listed, proposed, or candidate threatened or endangered species or their critical habitats are expected in the Alamosa River watershed. The acquisition of the Crowther property would preserve 60 acres of endangered southwest willow flycatcher habitat in the Conejos River watershed.

### ***Land Use Impacts***

New facilities at Terrace Reservoir would provide recreational opportunities and environmental education to watershed residents and visitors. Purchasing the Crowther property would preserve fishing areas and increase access on 1½ miles (both sides) of the Conejos River, adjacent to the Alamosa River watershed.

### ***Cumulative Impacts***

The instream flow and stream restoration projects would improve riparian and aquatic habitat and increase populations of dependent species. Water quality associated with suspended pollutants would be somewhat improved due the sediment trap on Alum Creek and mine reclamation. A large area of high quality habitat in the neighboring Conejos River watershed, including habitat for the endangered southwest willow flycatcher, would be preserved. Riparian habitat would be displaced in the footprint of the mainstem lake, but could be replaced at the upstream margins of the lake.

There would be an increase in recreational opportunities in the watershed and in the Conejos River watershed. Visitors to the watershed and job opportunities for implementing the Master Plan would improve the local economy. Improved channel stability and water quality would benefit irrigators. There would be a decrease in the amount of irrigated land due to a transfer of water rights to instream flow. There could be an increase in traffic on roads providing access to the river.

## **4.5.6 Alternative 5 – Preferred Alternative / Proposed Action**

The projects that are in the preferred alternative but not all of the action alternatives are:

- Riparian buffer zone
- Sediment trap pilot project with water quality best management practices on Alum Creek
- Recreation or access easements in upper watershed
- Lower watershed sediment deposition locations combined with stream restoration from County Road 10 to County Road 13.
- Mainstem lake for water quality
- Increased access to Terrace Reservoir

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### ***Surface Water Impacts***

Surface water quality in the Alamosa River mainstem downstream of Alum Creek would be improved due to removal of suspended sediment and associated pollutants. Water quality downstream of Wightman Fork would be greatly improved due to the mainstem lake. Suspended sediments and particulate metals would be reduced and low pH winter flows and untreated releases from the Summitville site would potentially be buffered.

### ***Habitat Impacts***

Additional aquatic habitat would be created by the mainstem lake. Some areas of riparian habitat would be displaced to construct and fill the mainstem lake. Aquatic habitat downstream of mainstem lake would be improved due to improved water quality.

### ***Biological Impacts***

Water quality improvements due to the mainstem lake and the sediment trap on Alum Creek may be significant enough that fish populations could be sustained between Wightman Fork and Terrace Reservoir.

### ***Listed, Proposed and Candidate Species***

The southwestern willow flycatcher, bald eagle, and Canada lynx are endangered species with potential to inhabit the Alamosa River watershed. Riparian habitat enhancements would eventually promote use by these species. Current programs to establish target populations of southwestern willow flycatcher would be supported through these actions.

### ***Land Use Impacts***

New recreation and access easements in the upper watershed and new facilities at Terrace Reservoir would provide recreational opportunities and environmental education to watershed residents and visitors. This may cause additional traffic on Forest Road 250.

### ***Cumulative Impacts***

The instream flow and stream restoration projects would improve riparian and aquatic habitat and increase populations of dependent species. Water quality associated with suspended pollutants would be greatly improved due the sediment trap on Alum Creek and the mainstem lake. Riparian habitat would be displaced in the footprint of the mainstem lake, but could be replaced at the upstream margins of the lake.

There would be an increase in recreational opportunities in the watershed. Visitors to the watershed and job opportunities for implementing the Master Plan would improve the local economy. Improved channel stability and water quality would benefit irrigators. There would be a decrease in the amount of irrigated land due to a transfer of water rights to instream flow. There could be an increase in traffic on roads providing access to the river.

## 4.5.7 Summary of Environmental Consequences

Table 4-3 summarizes the environmental consequences of each alternative.

**Table 4-3. Summary of Environmental Consequences by Alternative**

Attributes	Alternative 1 (No Action)	Alternative 2 (Project Rank)	Alternative 3 (Watershed Objectives)	Alternative 4 (Trustee Preferences)	Alternative 5 (Preferred Alternative / Proposed Action)
Surface water quantity	Continued lack of flow in lower watershed from late fall to early spring.	Longer period of sustained flow in lower watershed.	Longer period of sustained flow in lower watershed.	Longer period of sustained flow in lower watershed.	Longer period of sustained flow in lower watershed.
Surface water quality	Remain degraded due to high sediment and metal load.	Improved water quality associated with mine reclamation and sediment trap on Alum Creek. Additional control of water quality downstream of Terrace Reservoir due to improved outlet works.	Significantly improved water quality associated with mine reclamation, sediment trap on Alum Creek and mainstem lake.	Significantly improved water quality associated with mine reclamation, and mainstem lake.	Significantly improved water quality associated with mine reclamation, sediment trap on Alum Creek and mainstem lake.
Groundwater	Groundwater levels continue to decline.	Groundwater levels rise or decline at a slower rate.	Groundwater levels rise or decline at a slower rate.	Groundwater levels rise or decline at a slower rate.	Groundwater levels rise or decline at a slower rate.
Aquatic habitat	No change	Improved habitat downstream of Terrace Reservoir due to instream flow.	Improved habitat in and downstream of mainstem lake. Improved habitat downstream of Terrace Reservoir due to instream flow.	Improved habitat in and downstream of mainstem lake. Improved habitat downstream of Terrace Reservoir due to instream flow.	Improved habitat in and downstream of mainstem lake. Improved habitat downstream of Terrace Reservoir due to instream flow.
Riparian habitat	Continued loss of habitat due to lack of surface and groundwater and water quality.	Increase of habitat quantity and quality in Alamosa River watershed. Temporary impacts during construction in stream channels.	Increase of habitat quantity and quality in Alamosa River watershed. Displacement of riparian habitat in mainstem lake footprint. Temporary impacts during construction in stream channels.	Increase of habitat quantity and quality in Alamosa River watershed. Preservation of high quality habitat in neighboring Conejos watershed. Displacement of riparian habitat in mainstem lake footprint. Temporary impacts during construction in stream channels.	Increase of habitat quantity and quality in Alamosa River watershed. Displacement of riparian habitat in mainstem lake footprint. Temporary impacts during construction in stream channels.
Biological impacts	Continued harm and decrease in numbers of riparian dependent wildlife. No sustainable fish populations in water quality impacted reaches and water quantity impacted reaches.	Fish populations in Terrace Reservoir have potential to migrate downstream of Terrace Reservoir. Increased populations of riparian dependent wildlife.	Improved habitat downstream of mainstem lake due to improved water quality and downstream of Terrace Reservoir due to instream flow. Increased populations of riparian dependent wildlife. Additional fish in vicinity of Terrace Reservoir due to fish stocking.	Improved habitat downstream of mainstem lake due to improved water quality and downstream of Terrace Reservoir due to instream flow. Increased populations of riparian dependent wildlife. Protection of known southwest willow flycatcher and yellow-billed cuckoo habitat in Conejos River watershed.	May have sustainable fish populations downstream of mainstem lake and potential for fish downstream of Terrace Reservoir. Increased populations of riparian dependent wildlife.

**Table 4-3. Summary of Environmental Consequences by Alternative**

<b>Attributes</b>	<b>Alternative 1 (No Action)</b>	<b>Alternative 2 (Project Rank)</b>	<b>Alternative 3 (Watershed Objectives)</b>	<b>Alternative 4 (Trustee Preferences)</b>	<b>Alternative 5 (Preferred Alternative / Proposed Action)</b>
Cultural resources	No change	Potential impacts to sites and resources will be avoided or mitigated during construction.	Potential impacts to sites and resources will be avoided or mitigated during construction.	Potential impacts to sites and resources will be avoided or mitigated during construction.	Potential impacts to sites and resources will be avoided or mitigated during construction.
Environmental justice issues	No change	Increase in recreational opportunities.	Increase in recreational opportunities.	Increase in recreational opportunities.	Increase in recreational opportunities.
Socio-economic issues	Image of watershed as “dead watershed” continues. No change in recreational or job opportunities.	Increase in local economy due to improved public image of watershed, recreational opportunities, and additional jobs for Master Plan implementation.	Increase in local economy due to improved public image of watershed, recreational opportunities, and additional jobs for Master Plan implementation.	Increase in local economy due to improved public image of watershed, recreational opportunities, and additional jobs for Master Plan implementation.	Increase in local economy due to improved public image of watershed, recreational opportunities, and additional jobs for Master Plan implementation.
Land use impacts	Water quality and channel instability would continue to degrade the productivity of agricultural areas.	Additional recreation and access in the watershed. Channel stability would benefit irrigators. Decreased land area in production due to transferred water right. Increased reliability and functionality of Terrace outlet works improves water quality.	Additional recreation and access in the watershed and at Terrace Reservoir. Improved water quality and channel stability would benefit irrigators. Decreased land area in production due to transferred water right.	Additional recreation and access in the lower watershed, at Terrace Reservoir, and Crowther property. Improved water quality and channel stability would benefit irrigators. Decreased land area in production due to transferred water right.	Additional recreation and access in the watershed and at Terrace Reservoir. Improved water quality and channel stability would benefit irrigators. Decreased land area in production due to transferred water right.
Traffic impacts	No change	Increased traffic on roads providing access to the river.	Increased traffic on roads providing access to the river.	Increased traffic on roads providing access to the river and Crowther property.	Increased traffic on roads providing access to the river.

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## **Section 5.0 - Implementation of Preferred Alternative**

### **5.1 Implementation of Actions Under the Preferred Alternative**

The idea of opportunistic implementation will be important to making the most of the Master Plan. Opportunistic implementation means that projects should be implemented according to the following conditions:

- As the specific project proposals are submitted and approved by the Trustee Council and Alamosa River Foundation,
- As outside project proponents or “passionate advocates” are identified,
- As the appropriate mix of sufficient funding becomes available to complete the project, and
- As a specific project’s implementation is required by or coincides with another related project that is being implemented.

It may mean that projects are implemented out of their proposed order. The Trustee Council and Foundation will receive specific project proposals in accordance with the projects described in the finally approved Master Plan preferred alternative, and will approve acceptable proposals and allocate whatever funds are available and appropriate for their implementation.

Master Plan implementation will be managed partially by the state and federal Trustee Council, particularly to oversee the expenditure of the NRD settlement funds. However, the Foundation should provide essential local management of Master Plan implementation. The efforts of the Foundation may be spearheaded by the proposed paid watershed coordinator / project manager. The Foundation could take the lead role in coordinating work on multiple projects. The Foundation will also head up many of the funding tasks, and will be in charge of writing grant applications. The state and federal Trustee Council, the Foundation, and stakeholders will meet regularly to coordinate implementation and share knowledge.

Each project should be coordinated by a project manager. The project manager could be either the watershed coordinator, or another party such as a knowledgeable advocate for the project, a federal or state trustee, a non–paid foundation member, or a consultant. For many projects, there is an obvious choice for project manager, an individual or group with a majority stake in the project or direct experience with the type of project. For instance, completion of the project between County Road 10 and Gunbarrel Road would most logically be conducted by Alamosa River Foundation, Black Creek Hydrology, and CWCB, the groups currently undertaking the project.

### **5.2 Possible Implementation Schedule**

Certain projects should be implemented only after the implementation of others has begun. The following projects are best implemented after other projects:

- The trade of direct flow diversion right for reservoir storage and increase spillway capacity projects should not be initiated until there is a willing water right seller. Once there is a seller, these projects should all be coordinated together because the water

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rights change case will involve changes to the use, place of diversion, and transfer from direct use to storage.

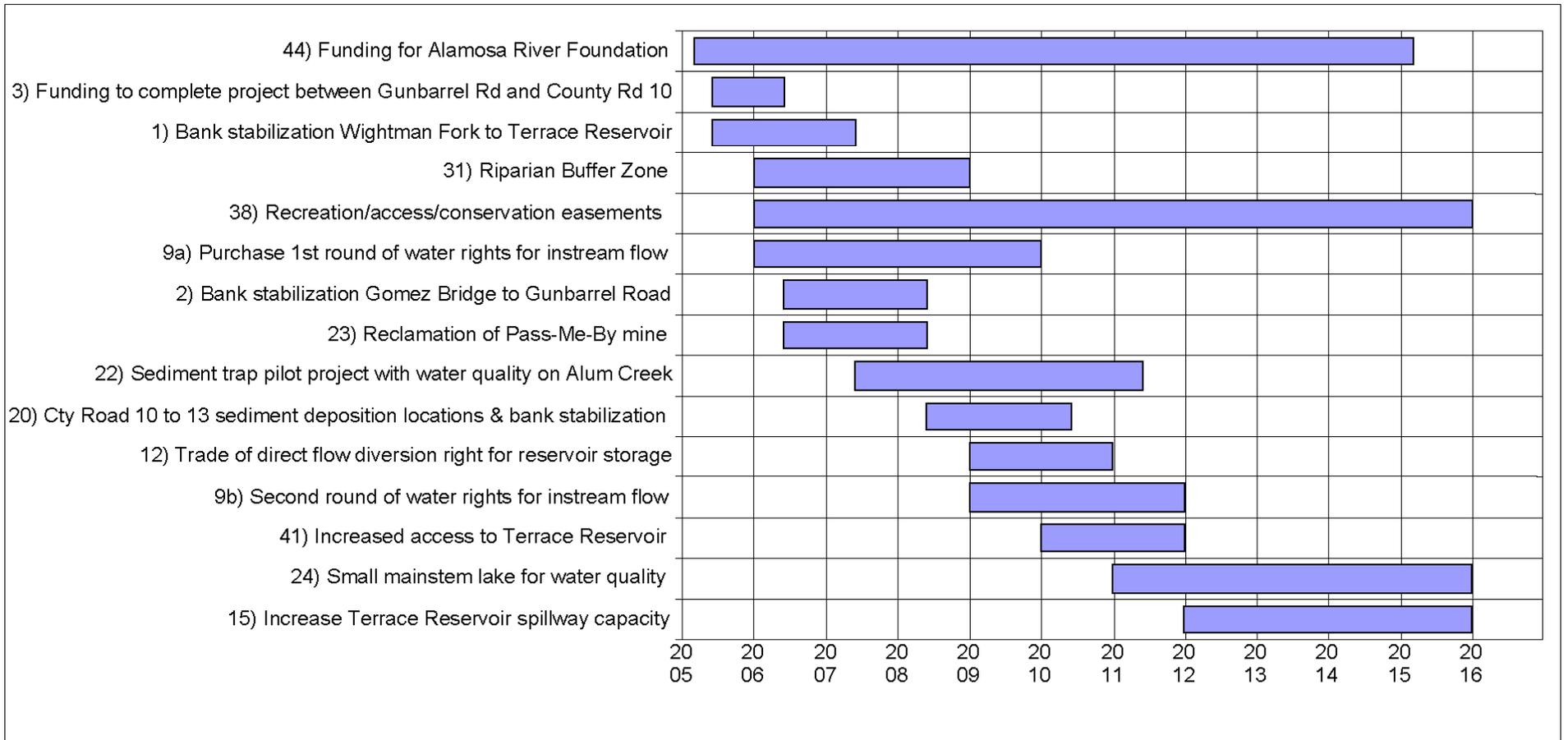
- If more than one water right is transferred, it is recommended that the second transfer does not occur until the first transfer is completed. With the number of uncertainties regarding the transfers, it would be beneficial to have the experience of the first transfer prior to the second. However, because water rights must be obtained when they become available, purchasing must be done when the opportunity presents itself.
- If after some period of time, such as 5 years, there is no willing water rights seller, the Trustees and Foundation can decide to reallocate those funds to implement another project.
- Bank work between County Road 10 and County Road 13 should not begin until after the upstream stream restoration projects. The upstream projects are likely to change the sediment balance in the river and could change the design necessary for the downstream reaches.

Stream restoration work between Gunbarrel Road and County Road 10 should be completed as soon as possible. Completing the stream restoration upstream of Gunbarrel Road should occur soon after. Stabilizing banks upstream of Gunbarrel Road will be important to maintain the benefits of the project between Gunbarrel Road and County Road 10.

Some of the restoration projects will occur on an ongoing basis. This includes the work of the Foundation and obtaining easements. The Foundation should be funded immediately to begin work on implementing the Master Plan. Easements can be obtained only when a willing landowner comes forward and can be established at any time if funds are available to complete the transaction.

**Table 5-1** summarizes one logical option for project sequencing and duration for the preferred alternative. The duration of design and implementation is listed in the table. Project phasing allows for more even distribution of cash flow. **Figure 5-1** shows one possible implementation schedule. As noted above, many factors will influence the actual order that projects are implemented. The Trustees and Foundation will chose to implement projects in an order that is appropriate for available funding and other factors. The actual order may be different from that shown below.

**Figure 5-1. Possible Implementation Sequence of Preferred Alternative**



Note: this chart represents one possible sequence of projects. Actual project sequencing may be different

**Table 5-1. Possible Project Sequencing and Duration of Preferred Alternative**

Project Number	Project	Predecessor Projects	Start Date	Approximate Duration (Years)
44	Funding for Alamosa River Foundation to help implement and monitor the master plan	–	Mar 2005	10
3	Funding to complete ongoing streambank project between Gunbarrel Road and County Road 10	–	Jun 2005	1
1	Stream restoration from Wightman Fork to Terrace Reservoir; dead tree management in upper watershed	–	Jun 2005	2
31	Riparian Buffer Zone	–	Jan 2006	3
38	Recreation/access/conservation easements	–	Jan 2006	10
9a	Purchase 1st round of water rights for instream flow	–	Jan 2006	4
2	Stream restoration from Gomez Bridge to Gunbarrel Road; Revegetation, dead tree management, noxious weed management, and grazing management in lower watershed	–	Jun 2006	2
23	Reclamation of abandoned mines (Pass–Me–By mine only)	–	Jun 2006	2
22	Sediment trap pilot project with water quality best management practices on Alum Creek	–	Jun 2007	4
20	Lower watershed sediment deposition locations combined with stream restoration from County Road 10 to County Road 13	2, 3	Jun 2008	2
12	Trade of direct flow diversion right for storage of instream flow water rights in Terrace Reservoir (no new water source)	9a	Jan 2009	2
9b	Second round of water rights for instream flow	9a	Jan 2009	3
41	Increased access to Terrace Reservoir		Jan 2010	2
24	Small mainstem lake for water quality	–	Jan 2011	5
15	Increase Terrace Reservoir spillway capacity to remove storage restriction (in return for instream flow storage); PMF Study	9a & 9b	Jan 2012	4

### 5.2.1 Options for Variation

There are several options for variation in the project implementation schedule. Also, it is important to keep in mind that projects should be attempted on an opportunistic basis. Projects that are particularly flexible are those without predecessors listed in **Table 5-1**. Projects that are independent of other projects and can be implemented at any time are:

- Small mainstem lake for water quality
- Reclamation of Pass–Me–By mine
- Sediment trap pilot project with water quality on Alum Creek
- Easements
- Riparian buffer zone

It is conceivable that one or more of the suggested restoration projects will not be feasible to implement. If this occurs, the Master Plan should be implemented without the project. However, all projects dependent on the missing project must also be neglected, unless a replacement project is found. Two such scenarios are discussed below:

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### ***Trade of Direct Flow Diversion Right for Reservoir Storage Infeasible Scenario***

If water rights are acquired but the trade of direct flow for reservoir storage project is not possible, other storage options can be pursued. Buying storage in Terrace Reservoir and changing the flow right to a storage right is a more conventional approach that may move through water court more easily. Another option would be to further investigate aquifer storage of the water right using an augmentation plan (as discussed in Section 3). A groundwater augmentation plan may allow the entire historical water right, not just the consumptive use, to be recharged to the groundwater and then a portion of that water could be pumped out for instream use.

### ***Instream Flow Project Infeasible Scenario***

If a water right cannot be acquired, the following projects will need to be removed from the implementation schedule, or modified:

- Instream flow storage projects including increase capacity of Terrace Reservoir Spillway
- Easements in the lower watershed
- Revegetation downstream of Terrace Reservoir may have to be scaled back based on less water in the stream and potentially decreased groundwater levels. The design of revegetation projects must consider the amount of water available.

There is no substitute project to provide the benefits of instream flow in the lower watershed if this project is not implemented.

### ***Mainstem Lake Infeasible Scenario***

If the mainstem lake project is infeasible, there are not any projects that need to be removed from the Master Plan. If this project is not constructed but funding is available, other proposed water quality projects could be implemented or expanded. Funds could be used to do additional sediment trap projects at tributary confluences, passive lime addition, or reclaim additional abandoned mines.

## **5.3 Funding Opportunities**

Natural Resource Damage (NRD) funds and other sources of funding are discussed below.

### **5.3.1 NRD Funding**

The NRD funds are a major source of funding for those projects that fit the NRD requirements. The NRD funds from the Summitville settlement total \$5 million, but can only be used for projects meeting the NRD criteria. As stated in Section 1, NRD-funded projects are intended to restore, rehabilitate, replace, or acquire the equivalent of natural resources that have been injured or lost as a result of releases of hazardous substances at the Summitville site. The Trustees reviewed the proposed projects and determined which projects would be eligible for NRD funds. Several of the projects qualify for NRD funding by addressing indirect impacts of releases from Summitville. An example of this type of project is a revegetation project that restores riparian vegetation damaged by poor water quality. Those determinations are summarized in **Table 5-2**.

**Table 5-2. Project Potential for NRD Funding**

#	Project Description	Potential for NRD Funding	Potential for Other Funding
1	Stream restoration Terrace Reservoir to Wightman Fork	x	x
2	Stream restoration Gomez Bridge to Gunbarrel Road	x	x
3	Funding to complete project between Gunbarrel Rd and County Rd 10	x	x
4	Stream restoration County Rd 10 to County Rd 13	x	?
5	Dead Tree Management Upstream of Terrace Reservoir	?	
6	Dead Tree Management Downstream of Terrace Reservoir	?	x
7	Modify Land Use Regulations for Flood Control		x
8	Setback Levees at Capulin for Flood Control		x
9	Purchase appropriate water rights for instream flow	x	x
10	Controlled Releases from Terrace Reservoir with Supplemental Water Source	x	x
11	Aquifer storage for instream flow	x	x
12	Trade of direct flow diversion right for reservoir storage (no new source)	x	x
13	New reservoir to store instream flow	x	x
14	New reservoir to store existing agriculture water rights		?
15	Increase spillway capacity	?	x
16	Raise crest of dam	?	x
17	Sediment removal to increase capacity	?	x
18	Improve outlet works (tower)	x	x
19	Power generation at Terrace Reservoir		x
20	Lower watershed sediment deposition locations		?
21	Road management in upper watershed	x	x
22	Sediment traps at tributary confluences	x	?
23	Reclamation of abandoned mines	x	x
24	Mainstem lake or reservoir below Wightman Fork	x	x
25	Sulfate reducing wetland on Wightman Fork or other tributaries	x	x
26	Active water quality improvement on tributaries upstream of Wightman Fork	x	x
27	Noxious weed management in the upper watershed	?	x
28	Noxious weed management in the lower watershed	?	x
29	Revegetation in the lower watershed	x	x
30	Grazing management	x	x
31	Riparian Buffer Zone	x	x
32	Acquisition of equivalent resource in San Luis Valley for high quality habitat and recreation	x	x
33	Purchase land DS of Wightman Fork for recreation and habitat	x	x
34	Fish-stocking above Terrace	x	x
35	Fish-stocking at Terrace	x	x
36	Fish-stocking below Terrace	x	x
37	Construction of fish barriers	x	x
38	Establishing conservation easements	x	x
39	Ditch headgate consolidation		x
40	Replace headgates with corrosion resistant materials		?
41	Improve public access to Terrace Reservoir	x	x
42	Improved access to main stem of the river above Terrace	x	
43	Improved access to main stem of the river below Terrace	x	x

**Table 5-2. Project Potential for NRD Funding**

#	Project Description	Potential for NRD Funding	Potential for Other Funding
44	Funding for citizen group to help implement and monitor the Master Plan	x	x
45	Site specific PMF study	?	x
46	Ice Jam Flooding Study	x	?
47	Capulin Flood Hazard Mitigation Plan		x
48	Dewatering Management Plan		x
49	Terrace Reservoir sediment quality study	?	x
50	Ground water monitoring		x

x = yes, ? = maybe, blank = no

Most of the projects included in the preferred alternative have potential for NRD funding. The preferred alternative projects for which eligibility for NRD funding is questionable are:

- Dead tree management, Projects 5 and 6
- Increase Terrace Reservoir spillway capacity, 15
- Site-specific probable maximum flood study, Project 45
- Noxious weed management, Projects 27 and 28

The only project from the preferred alternative that clearly does not have potential for NRD funding is lower watershed sediment deposition locations, Project 20. However, in the preferred alternative, this project is combined with Project 4, stream restoration between County Road 10 and County Road 13, which does qualify for NRD funds. The combined project may qualify for partial NRD funding.

Each of the questionable or no-potential projects is included in the preferred alternative to complement a project that does have potential for NRD funding. For instance, dead tree management and noxious weed management are combined with stream restoration projects to improve the effectiveness of each of the projects. Increasing the spillway capacity and doing the site-specific probable maximum flood study are only included to provide storage for the instream flow water rights. Because the questionable projects are included as a benefit to projects with NRD funding potential, a case could be made for each of them to meet the requirements of NRD funding. However, with the available NRD funds being only 1/3 of the total estimated costs of the preferred projects, the use of the NRD funds will be focused on those projects most in keeping with the NRD restoration goals identified at the beginning of this section.

### 5.3.2 Other Sources of Funding

Other sources of funding are available for watershed restoration projects that do not necessarily qualify for NRD funding. Potential national funding sources are summarized in **Table 5-3** and potential state and local funding sources are summarized in **Table 5-4**. It is critical to leverage the NRD funding with matching funds such as those described below in order to maximize benefits to the Alamosa River watershed.

**Table 5-3. Summary of Potential National Funding Sources**

Source	Fund/Program Name	Monetary Range	Requirements
US Army Corps of Engineers	N/A	N/A	Flood control and environmental restoration projects that meet certain benefit/cost and national economic development criteria.
US Army Corps of Engineers	Restoration of Abandoned Mine Sites (RAMS)	N/A	Restoration of abandoned non-coal mines.
American Sportfishing Association	FishAmerica Foundation	\$5,000 – \$50,000	Citizen-driven riparian habitat restoration projects for habitat important to anadromous fish species
USDA and Natural Resources Conservation Service (NRCS)	Integrated Research, Education, and Extension Competitive Grants	N/A	Projects that evaluate the effectiveness of conservation practices for achieving locally defined water quality goals
USDA and NRCS	Farm and Ranch Land Protection Program	N/A	Matching funds to help purchase development rights to keep productive farm and rangeland in agricultural uses
USDA and NRCS	Conservation Reserve Program	About \$30 per acre annually	10–15 year contracts for land owners and operators to convert highly erodible and other environmentally sensitive cropland to vegetative cover such as introduced and native grasses, wildlife habitat and food plot plantings, trees, filter strips, or riparian buffers.
USDA and NRCS	Environmental Quality Incentives Program	\$10,000 per year and \$50,000 over contract life	Technical, financial, and educational assistance to farms and ranchers to address significant natural resource concerns. Conservation practices includes grassed waterways, filter strips, manure management facilities, and protecting wildlife habitat.
USDA and NRCS	Resource Conservation and Development (RC&D)	N/A	RC&D areas promote conservation development and use of natural resources, improve the general level of economic activities, and enhance the environment and standard of living in communities. The San Luis Valley RC&D formed the San Luis Valley Environmental Conservation Education Council to provide environmental conservation education to youth.
USDA and NRCS	Small Watershed Program	N/A	Projects include watershed protection, flood prevention, erosion and sediment control, water supply, water quality, fish and wildlife habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres. Both technical and financial assistance are available.
USDA and NRCS	Wetlands Reserve Program, Wildlife Habitat Incentive Program, Grassland Reserve Program	N/A	Programs aimed at restoring and protecting wetlands, grasslands, and habitat.
USFWS	Partners for Fish and Wildlife	N/A	Funding and technical assistance for habitat improvement projects to private landowners.
Patagonia	Environmental Grants	\$3,000 – \$8,000	Priorities are biodiversity, forests, media/publications, resource extraction, social activism, sustainable agriculture, and water/marine protection.
USEPA	Regional Geographic Initiative Program	N/A	Funds for unique, geographically-based projects that fill critical gaps in the Agency’s ability to protect human health and the environment. Funds are available through EPA regional offices.
USEPA	Assessment and Watershed Protection Program Grants	N/A	Supporting a watershed approach to better address water quality problems
Department of Homeland Security	N/A	N/A	Reservoir Improvements
National Research Initiative	Enhancing the Prosperity of Small Farms and Rural Agricultural Communities Competitive Grants	Up to \$500,000	Projects that develop and test hypotheses to improve understanding of economic, social, biological, and environmental components important to small farms and rural economic development.

**Table 5-3. Summary of Potential National Funding Sources**

Source	Fund/Program Name	Monetary Range	Requirements
National Fish and Wildlife Foundation	Pulling Together Initiative Grant Program	N/A	Modest grants to support the creation of cooperative Weed Management Area partnerships.
National Geographic Society	Conservation Trust Grants	Roughly \$15,000 to \$20,000	Projects that contribute significantly to the preservation and sustainable use of biological, cultural, and historical resources, especially cutting edge programs that may be overlooked by other funding sources.
River Network	Watershed Assistance Grants	\$1,500 to \$30,000	Seed money to initiate grass-roots watershed protection groups. Projects have included development of GIS databases, funding for meetings/conferences, hire coordinators, and conduct studies. Grants cannot be used for on-the-ground restoration projects.
BLM / USFS	N/A	N/A	Funds to remediate abandoned mines on federal lands.
The Nature Conservancy	N/A	N/A	The Nature Conservancy is involved in private lands conservation through various programs and may fund other conservation measures.

**Table 5-4. Summary of Potential State and Local Funding Sources**

Source	Fund/Program Name	Monetary Range	Requirements
CWCB / Dept. of Natural Resources	N/A	N/A	Flood hazard mitigation plans, floodplain mapping projects, restoration projects, erosion control projects
CWCB	Construction Loan Program	N/A	Low interest loans for water resources projects
CDOW	Cooperative Habitat Improvement Program	N/A	Cost-sharing program for landowners interested in improving or developing wildlife habitat.
CDOW	Habitat Partnership Program	N/A	Improve habitat for big game animals and alleviate rangeland forage and fence conflicts with big game animals
CDOW	Colorado Waterfowl Stamp Program	N/A	Matching funds to private landowners interested in developing projects that provide benefits to waterfowl and wetlands habitat
CDOW	Colorado Wetland Initiative Legacy Project	N/A	Conserves biologically significant wetlands in Colorado
CDOW	Colorado State Trust Lands	N/A	Money for habitat management projects on private properties with high wildlife recreational uses such as hunting. Projects may include creation of small impoundments, fencing riparian corridors, and vegetative habitat plantings.
CDPHE	Clean Water Act Section 319 Non-point Source Grants	\$2 million total for 2005	Funds from EPA to reduce non-point source pollution for activities such as groundwater protection and abandoned mine cleanup. Funds can also be used to monitor 303(d) listed waters. Must have watershed-based plan for funding construction projects.
Colorado State Lottery	Great Outdoors Colorado Trust Fund	\$10,000 to \$2,000,000	Grants for recreation, wildlife and open space. Grants are typically awarded to Colorado State Parks, Division of Wildlife, Local Governments, and non-profit land conservation organizations.
Colorado Water Trust	N/A	N/A	Private, non-profit conservation organization, which acquires, or assists others in acquiring, water rights or interests in water rights, using voluntary approaches from willing owners, for conservation benefits
San Luis Valley Wetland Focus Area Committee	N/A	N/A	Local link to national funding organizations interested in supporting wetland preservation and enhancement projects.
Rio Grande Headwaters Land Trust	N/A	N/A	Provides financial incentives to establish conservation easements and preserve lands for agricultural use in the Rio Grande basin.

## 5.4 Implementation Steps

The Trustees will periodically announce a request for proposals (RFP) for restoration projects that qualify for NRD funds. Proposals will be considered from the general public, governmental agencies, members of the General Assembly, community groups, and private entities. The Trustees' project selection criteria are similar to the project evaluation criteria discussed in Section 4.3. The Trustees' screening and ranking criteria for awarding NRD funding are summarized in **Table 5-5**.

**Table 5-5. Trustees' Selection Criteria for Potential NRD-funded Projects**

Screening Criteria	Ranking Criteria
Compliance with laws	Public acceptance
Public health and safety	Likelihood of adverse impacts
Relationship to injured natural resources and services (includes surface water, groundwater, geologic resources, and biological resources)	Likelihood of success
Technical feasibility	Multiple natural resource benefits
Cost effectiveness (compared to other activities with similar benefits)	Time to provide benefits
Consistency with the Trustee's restoration goals	Duration of benefits
Opportunities for collaboration	Importance of NRDA funding to success of the project
	Protection of implemented project (such as easement or land acquisition)
	Project cost
	Project consistency with regional planning
	Public access and benefit

For projects that do not qualify for NRD funding, a proposal (e.g., grant application) would still be needed for other funding sources. A project sponsor may incur substantial cost in order to prepare a proposal due to the background work necessary to complete an adequate proposal. Many of the projects will require additional research and field work.

**Table 5-6** lists some of the steps that will be required for each project to be selected for funding and to complete the project.

**Table 5-6. Implementation Steps for Each Project in Preferred Alternative**

Project	Implementation Steps
44) Funding for citizen group to help implement and monitor the Master Plan	<ul style="list-style-type: none"> <li>• Develop a budget</li> <li>• Foundation submits proposal for funding</li> <li>• Hire a director</li> <li>• Establish policies and procedures</li> </ul>
3) Funding to complete ongoing stream restoration project between Gunbarrel Road and County Road 10	<ul style="list-style-type: none"> <li>• Identify needed changes to original design</li> <li>• Develop budget and schedule for remaining work</li> <li>• Project sponsor submits proposal to complete project between County Road 10 and Gunbarrel Road.</li> <li>• Complete construction</li> </ul>
1) Stream restoration from Wightman Fork to Terrace Reservoir; dead tree management in upper watershed	<ul style="list-style-type: none"> <li>• Perform detailed streambank assessment and prioritize problem areas</li> <li>• Identify any dead trees to be removed from channel or banks</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal with conceptual design for stream restoration</li> <li>• Consult with USFS and obtain authorization</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>

**Table 5-6. Implementation Steps for Each Project in Preferred Alternative**

Project	Implementation Steps
31) Riparian buffer zone	<ul style="list-style-type: none"> <li>• Make contacts with major landowners to determine level of support and preferences for buffer zone</li> <li>• Develop general criteria for the buffer zone such as width, allowed activities and prohibited activities</li> <li>• Make contacts with local governments to determine level of support for projects and process for establishing regulations</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal including plan for creating buffer zone</li> <li>• Plan is implemented</li> </ul>
38) Recreation/access/conservation easements	<ul style="list-style-type: none"> <li>• Prioritize locations for each type of easement</li> <li>• Initial discussions with property owners to gauge level of interest</li> <li>• Real estate analysis to estimate cost per acre</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal including plan for obtaining and managing easements</li> <li>• Plan is implemented</li> </ul>
9) Purchase water rights for instream flow	<ul style="list-style-type: none"> <li>• Determine if there are any willing sellers</li> <li>• Examine historical usage including quantity and type of crop</li> <li>• If land is to be sold, determine a management approach for the land</li> <li>• Determine storage location for the water right</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal with plan for obtaining and utilizing an identified water right</li> <li>• Plan is implemented</li> </ul>
2) Stream restoration from Gomez Bridge to Gunbarrel Road; Revegetation, dead tree management, noxious weed management, and grazing management in lower watershed	<ul style="list-style-type: none"> <li>• Evaluate the existing Rosgen conceptual design and determine any necessary changes to that design</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal with conceptual design of stream restoration</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>
23) Reclamation of abandoned mines (Pass-Me-By Mine only)	<ul style="list-style-type: none"> <li>• Determine landowner interest in project</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal with conceptual design of project elements</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>
22) Sediment trap pilot project with water quality best management practices on Alum Creek	<ul style="list-style-type: none"> <li>• Conduct feasibility study/alternatives analysis to determine best construction techniques, materials, and sediment disposal locations</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal including conceptual plan of structural and water quality elements</li> <li>• Consult with USFS and obtain authorization</li> <li>• Complete engineering design</li> <li>• Complete construction</li> <li>• Schedule sediment removal</li> <li>• Evaluate monitoring results and determine if design should be modified</li> </ul>
20/4) Lower watershed sediment deposition locations combined with stream restoration from County Road 10 to County Road 13	<ul style="list-style-type: none"> <li>• Perform detailed channel assessment and determine problem areas</li> <li>• Prepare conceptual design</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>
12) Trade of direct flow diversion right for storage of instream flow water rights in Terrace Reservoir (no new water source)	<ul style="list-style-type: none"> <li>• Determine Terrace Irrigation Company interest and preferences</li> <li>• Determine legal requirements of project</li> <li>• Create budget and schedule</li> <li>• Project sponsor creates plan for implementing project</li> <li>• Project sponsor submits proposal for project</li> </ul>

**Table 5-6. Implementation Steps for Each Project in Preferred Alternative**

Project	Implementation Steps
41) Increased access to Terrace Reservoir	<ul style="list-style-type: none"> <li>• Determine Terrace Irrigation Company, Forest Service, and watershed residents’ preferences for project</li> <li>• Prepare site plan</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>
24) Small mainstem lake for water quality	<ul style="list-style-type: none"> <li>• Determine Forest Service requirements for project</li> <li>• Determine legal and permitting requirements for project</li> <li>• Conduct alternative feasibility study</li> <li>• Prepare conceptual design for selected alternative</li> <li>• Create budget and schedule</li> <li>• Project sponsor submits proposal</li> <li>• Consult with USFS and obtain authorization</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>
15/45) Increase Terrace Reservoir spillway capacity to remove storage restriction (in return for instream flow storage); PMF Study	<ul style="list-style-type: none"> <li>• Project sponsor submits proposal for feasibility study</li> <li>• Conduct initial geotechnical and site assessments</li> <li>• Conduct PMF study</li> <li>• Complete feasibility study to determine most efficient method to increase spillway capacity and estimate cost</li> <li>• Project sponsor submits proposal for design and construction</li> <li>• Complete engineering design</li> <li>• Complete construction</li> </ul>

Note: all projects must be monitored for effectiveness after implementation\

## 5.5 Monitoring Plan

Monitoring plans will be developed and included in each specific project proposal. Monitoring activities will be different depending on the type of project as described below. The Trustee Council and Foundation will monitor project results. In many cases volunteers can be mobilized from the local community (e.g., students, environmental groups) to perform monitoring tasks. Volunteers can be trained and can work in teams with subject matter experts. However, volunteers should only be used when appropriate given their experience and availability.

### 5.5.1 Reporting Responsibilities of the Alamosa River Foundation

The Alamosa River Foundation should report on the progress of the Master Plan with a written report on an annual basis. Reporting parameters should include:

- Statement of income and expenditures
- Grant applications completed
- Description of projects implemented
- Description of monitoring plans and summary of results
- Statement of plans for the next year

This annual report is expected to be undertaken by the Foundation as part of their regular duties and will not require the purchase of additional equipment. The report could be posted to the Foundation’s website and posted in public locations at minimal cost.

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Additionally, the Foundation should schedule a mid-year meeting or conference call with the Trustee Council to report on progress.

### **5.5.2 Stream Restoration Monitoring**

Stream restoration project success, comparing conditions prior to the project, during implementation, and after project completion, can be monitored using established reference cross sections. The cross sections can be evaluated periodically using surveys, photo records, and aerial photos. Cross section spacing is dependent on specific characteristics of the reference reach, and would vary from 1,000 to 5,000 feet.

### **5.5.3 Vegetation Monitoring**

The status of revegetation areas and the riparian zone can be monitored by comparing conditions prior to the project, during implementation, and after project completion. A combination of the following methods can be used:

- Photograph documentation of the present condition of the existing environment. Photographs will be taken from established locations on a yearly basis for monitoring purposes. Fixed-point photograph stations would be established in restoration/enhancement areas as well as in reference, or baseline, locations for comparison.
- Monitoring of randomly placed transects established within or across the river corridor, as appropriate to provide an accurate representation of riparian zones. Transects would be permanently established in revegetation/enhancement areas as well as in reference, or baseline, locations for comparison. The start and end points of the transects would be staked in the field and mapped using a global positioning system (GPS) unit so that they can be repeated. Along each transect, quadrats would be placed at suitable intervals. Vegetation analysis, including species composition and percent areal cover by species and stratum, would be surveyed within each quadrat. Species composition is calculated by identifying all species within a quadrat, then categorizing them as desirable versus undesirable. Percent areal cover is calculated by individual species within each vegetative stratum (i.e., tree layer, shrub layer, herbaceous/grass layer). This data would provide information on nuisance/noxious weeds as well.
- Surveying plantings for survivability. Plantings will be inventoried, then surveyed after an established period of time to track survival. The inventory would determine individual species survival, and overall survival of plantings.

A specific plan would be necessary for each individual revegetation project.

### **5.5.4 Water Quality Monitoring**

The approach to water quality monitoring should balance the needs of data gathering with cost. Any best management practice (BMP) implemented in the watershed should be monitored for effectiveness. BMP monitoring usually includes water quality sampling of the inflow and outflow of the structure.

Due to their experimental nature, pilot projects should be monitored more extensively than abandoned mine reclamation projects, which are likely to follow well-documented procedures.

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The most important water quality parameters in the Alamosa River are metals and pH. Metals analysis is labor intensive and lab cost intensive, whereas, pH can be measured continuously using a meter or can be measured using low-cost methods. Conductivity and pH meters are often installed concurrently. Conductivity is directly related to dissolved metals concentration and can be used as an indication of changes in dissolved metals. It is recommended that both the sediment trap pilot project and mainstem lake project be implemented with a continuous pH meter immediately upstream and downstream to measure the effectiveness of the project. If funds are available, conductivity meters should also be installed. Both projects should also utilize periodic metals analysis to directly determine their effectiveness in removing metals.

Data collected by CDPHE as part of the Summitville project should be used whenever possible to compare conditions before, during, and after implementation of restoration projects. However, it will be important to isolate changes due to restoration projects from changes due to progress at the Summitville site as well as natural variation in water quality.

### **5.5.5 Water Quantity Monitoring**

The success of the instream flow project can be monitored through the following activities:

- CDWR diversion records
- Stream gage records for the “Alamosa River Below Terrace Reservoir” gage
- Periodic analysis of stream stage at selected locations such as Gunbarrel Road and County Road 10 in the lower Alamosa River to estimate streamflow.

These activities can be completed at minimal cost. Trained volunteers may be capable of doing some of the monitoring tasks such as summarizing diversion and stream gage records, surveying the stream stage, and estimating streamflow.

### **5.5.6 Recreation Monitoring**

Recreation can be challenging to monitor. A typical way to monitor recreation is to track user-days at campgrounds and facilities, such as the proposed new facilities at Terrace Reservoir.

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