

Chapter 2 DESCRIPTIONS OF ALTERNATIVES

The proposed action is to stabilize a localized section of the streambank upstream of the Landmark in an effort to protect the Landmark and reduce further channel migration. Currently, there are two channels in the Snake River that have formed and merged, and are the primary focus of this EA. Looking downstream, the main (left) channel merges with the historic (right) channel and is hereafter referred in this report as the *main channel*. The section of the river below the confluence of the two merged channels is referred to as the *downstream reach*.

This chapter presents the following alternatives being considered for the implementation of the bank stabilization project based on current engineering practices and Tribal input.

- Alternative 1 – No Action
- Alternative 2 (Preferred Alternative) – Stone Toe and Upper Bank Revetment
- Alternative 3 – Stone Spurs
- Alternative 4 – Stone Toe with Earthfill Curve Shaping and Bioengineering (Main Channel); Stone Spurs (Downstream Reach)
- Alternative 5 – Stone Spurs (Main Channel); Stone Toe (Downstream Reach)

NEPA typically defines the No Action Alternative as the most likely future condition without the proposed action. The No Action Alternative serves two purposes:

- It identifies future environmental conditions without taking measures to stabilize the bank or protect the Landmark.
- It is the basis (baseline condition) by which all other alternatives are compared.

The four action alternatives (2, 3, 4, and 5) provide different techniques to accomplish the purpose and need for the action. For ease of comparison, the alternatives are summarized in Table 2-1 in Section 2.8. This chapter also identifies alternatives examined but eliminated from further consideration.

2.1 Similarities among Alternatives

The following actions would apply to all the alternatives:

- Adhere to Federal laws and regulations; Shoshone-Bannock Tribal laws; and if applicable, State and County laws and regulations.
- Prior to any ground disturbing activities, conduct the appropriate level of site-specific NEPA analysis and public involvement.
- Prior to any ground disturbance, complete a Class III survey, Ground Penetrating Radar (GPR), and augering of areas of potential effect for this project.
- Prior to any ground disturbance and during project implementation, comply with Section 106 of NHPA by consulting with the Tribes, SHPO, and interested parties regarding site identification, eligibility, effects, and mitigation.
- During implementation, insure all ground-disturbance activities are monitored by a professional archaeologist.
- Comply with current accessibility regulations and standards required for Tribal lands.
- Ensure proposed action is within the authority of the applicable agency.

Alternative 4 considers bioengineering techniques which includes some degree of vegetative planting above the high water mark for increased bank stability. Alternatives 3 and 5 eliminated earthfill and bioengineering to allow natural sedimentation fill to accumulate over time and establish natural vegetation. All alternatives, other than the No Action Alternative, would use a rock source.

The existing demonstration project constructed cooperatively by the Tribes, BIA, NRCS, and Reclamation in 2002 would be left in place and incorporated into each of the four alternatives under consideration in this EA. Construction of the stone toe in either Alternative 2 or 4 would overlap onto and bury the existing rock barbs and buried logs with rootwads where these existing features tie into the river bank. The barbs and logs would be allowed to extend through the stone toe and project out into the river channel to locally deflect flows and reduce stream velocities. The intersections of the stone toe with the buried logs with rootwads would be enlarged by placement of additional rock to account for expected decomposition of the logs over time which would lead to settlement and displacement of the overlying stone toe. Construction of the spur field in Alternatives 3 and 5 would incorporate the existing rock barbs by enlarging them to the design dimensions of the spurs and including them as members of the spur field. The existing buried logs with rootwads would be left in place to encourage sediment deposition in between individual spur elements and to accelerate natural recruitment of riparian vegetation along the river bank.

2.2 Alternative 1 – No Action

The No Action Alternative represents continuation of the current conditions which would leave the river channel and its banks to meander and erode naturally over time. It does not address the historical site or associated environmental problems due to changes in the channel course. No work to repair or enhance bank stability or preserve and protect the Landmark would occur under this alternative.

2.3 Alternative 2 (Preferred Alternative) – Stone Toe and Upper Bank Revetment

The Preferred Alternative features a bank height stone toe that does not include bioengineering or curve shaping. A rock barrier would be placed over and adjacent to the current river bank for a length of 3,800 feet (Figure 2-1). There is no bank excavation required for placement of the rock barrier. Soil or additional rock would be needed to bring the existing vertical undercut bank to an angled slope of 1.5 to 1 (horizontal distance to vertical distance) (Figure 2-2).

The outside ends of the stone toe would include a feature called a “key-in.” Under this alternative, the key-in would be comprised of sheet pile (interlocking “S” shaped steel plates) driven into the ground (Figure 2-1). The sheet pile extends from the outside ends of the stone toe and is angled into the bank for 200 feet on the upstream end and 30 feet on the downstream end. This feature creates a rigid barrier to prevent undercutting and the stream from circumventing the stone toe. There would be approximately 20 – 30 feet of excavation into the bank to secure the stone toe to the sheet pile. The zone of this disturbance for sheet pile placement is approximately 2 feet wide by 15 feet deep for a distance of 200 feet on the upstream end and a distance of 30 feet on the downstream end.

Key features of Alternative 2 (Preferred Alternative) include:

- Stone toe revetment construction along the total length of the bank – 3,800 feet (Figure 2-3)
- Sheet-pile key-in feature upstream – 200 feet
- Sheet-pile key-in feature on the downstream reach – 30 feet
- Estimated rock volume for construction of stone toe on the main channel – 8,184 cubic yards (yd³); stone toe on downstream reach (including key-in) – 8,952 yd³
- Estimated volume of material disturbed on the main channel – 250 yd³; on the downstream reach – 250 yd³
- Estimated zone of disturbance due to excavations where sheet pile ties into the stone toe upstream – 200 feet; downstream – 30 feet

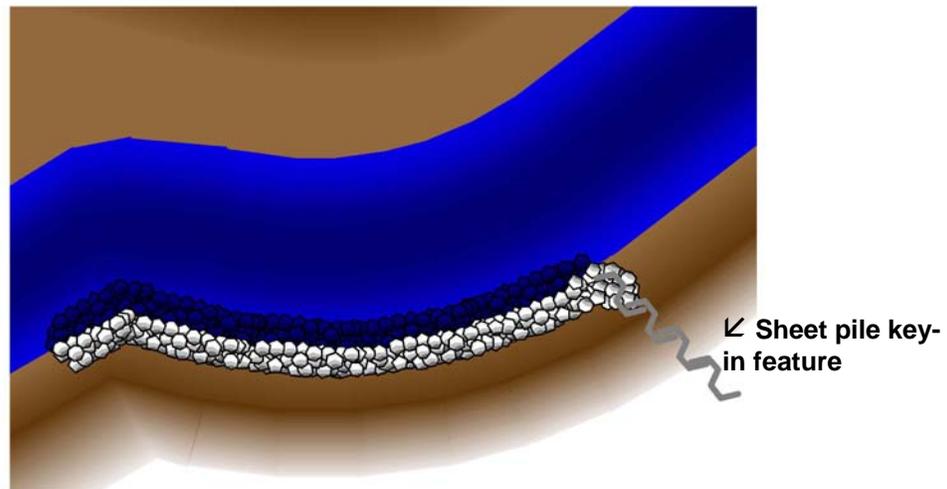


Figure 2-1. Conceptual rendering of Alternative 2 – stone toe and upper bank revetment with sheet pile key-in feature (plan view)



Figure 2-2. Conceptual rendering of Alternative 2 – stone toe construction (profile view)

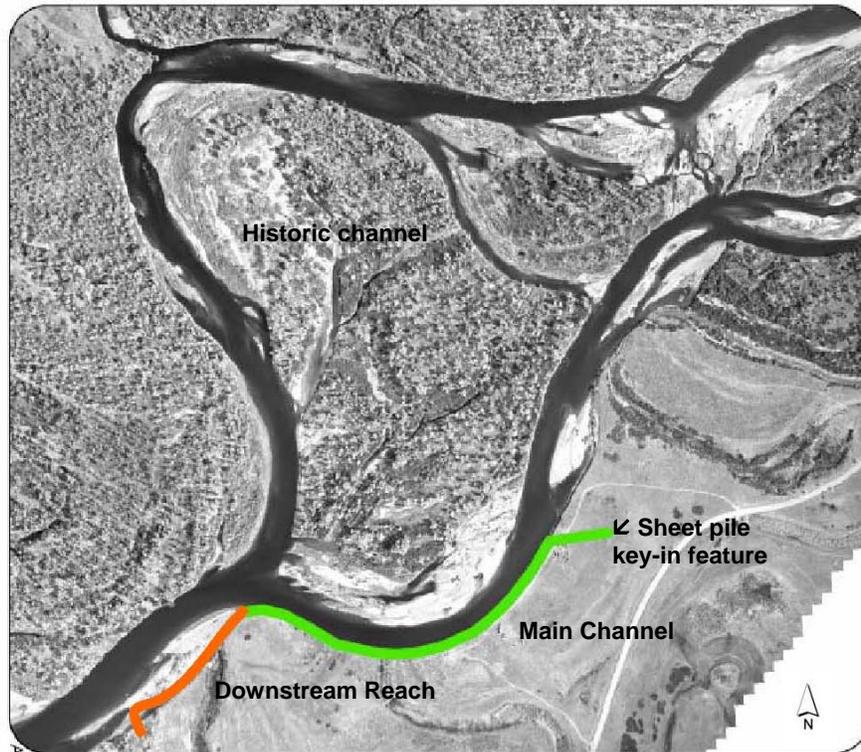


Figure 2-3. Aerial view of bank sections for Alternative 2 (Preferred Alternative) showing *approximate* location of stone toe protection for the entire length of the bank

2.4 Alternative 3 – Stone Spurs

Alternative 3 uses stone spurs to reshape the outside edge of the curve and concentrate the flow away from the bend (Figure 2-4). The spurs block the flow and would over time create spaces for natural sediment deposition and vegetation growth.

The stone spurs would be spaced approximately 150 feet apart, angled slightly upstream, and be tied into the bank for 20 feet (Figure 2-5). A transition zone is required for the area where the historic channel joins the main channel (Figure 2-6). The transition zone would consist of rock revetment with no excavation for approximately 100 feet and would be placed between

two stone spurs. This revetment would provide bank stabilization if a future increase occurs in the amount of flow in the historic channel.

Key features of Alternative 3 include:

- Stone spurs (15) construction on main channel – 60 feet in length; stone spurs (5) on downstream reach – 100 feet in length
- Key-in trench construction upstream – 425 feet
- Revetment treatment on the downstream reach – 30 feet; tie back excavation into the river bank – about 5 feet
- Estimated rock volume for construction of spurs and transition zone on the main channel – 26,700 yd³; spurs on downstream reach (including revetment) – 10,500 yd³
- Estimated volume of material disturbed on the main channel – 5,500 yd³; on the downstream reach – 150 yd³

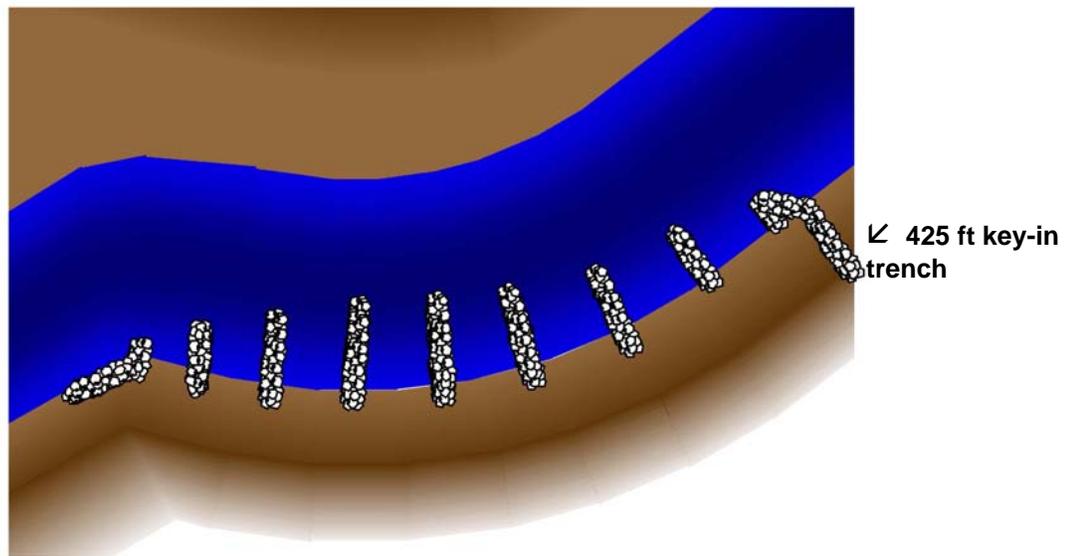


Figure 2-4. Conceptual rendering of Alternative 3 – stone spurs with no earthfill curve shaping and bioengineering on main channel (plan view)

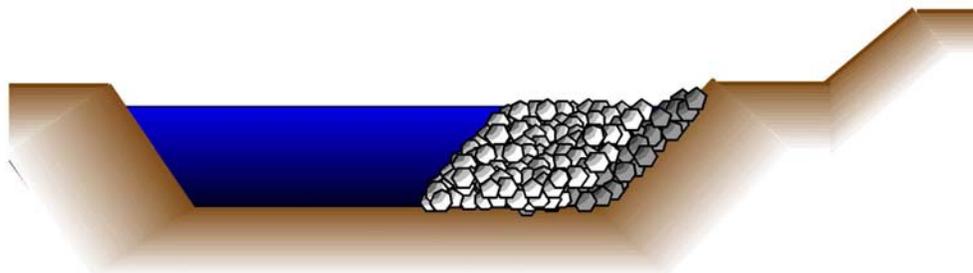


Figure 2-5. Conceptual rendering of stone spur construction (profile view)

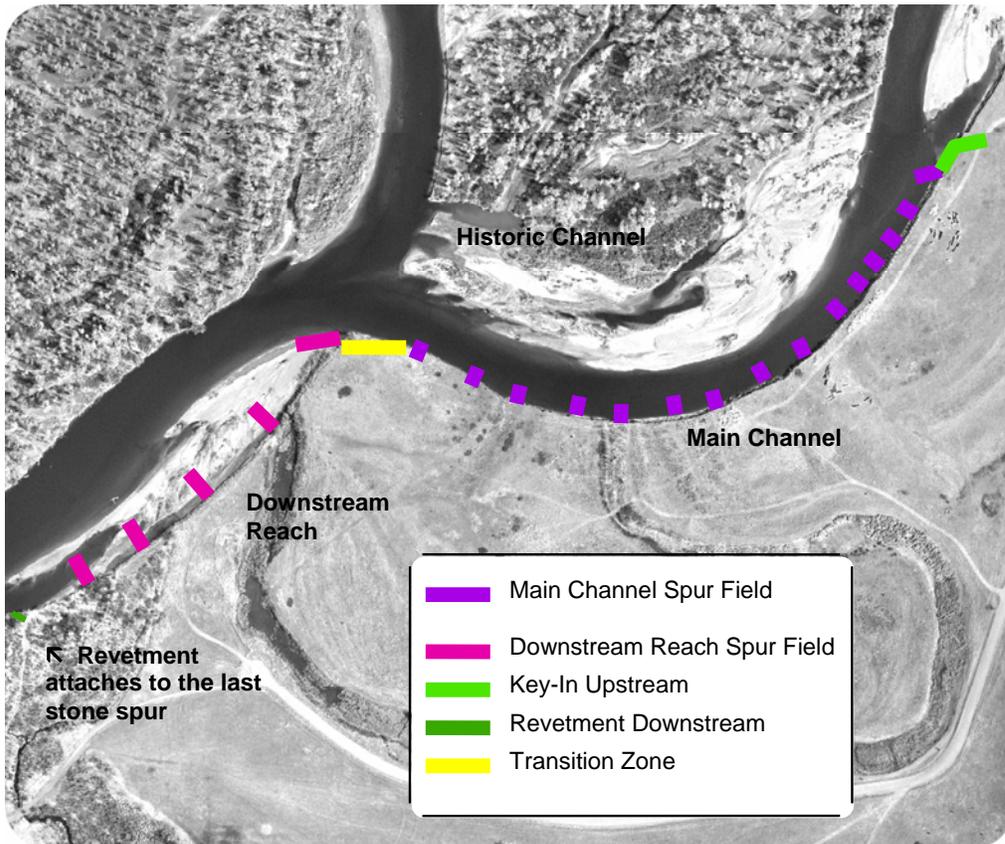


Figure 2-6. Aerial view of bank sections for Alternative 3 showing *approximate* location for stone spurs and transition zone

2.5 Alternative 4 – Stone Toe with Earthfill Curve Shaping and Bioengineering (Main Channel); Stone Spurs (Downstream Reach)

This alternative combines some features of Alternatives 2 and 3. Stone toe would offer improved bank protection while stone spurs would minimize ground disturbance.

A transition zone would be required for the area where the historic channel joins the main channel (Figure 2-7) The transition zone would consist of rock revetment with no excavation for approximately 100 feet and would connect the stone toe with the first stone spur on the downstream reach. This revetment would provide bank stabilization if a future increase occurs in the amount of flow in the historic channel.

Alternative 4 also includes earthfill curve shaping and a bioengineered terrace. These activities would have the greatest disturbance effect of all the alternatives by lowering the bank height by 3 feet for a distance of 24 feet along the entire 2,200 feet of river bank.

Key features of Alternative 4 include:

- Stone toe construction with earthfill curve shaping and bioengineering on main channel – 2,200 feet; stone spurs (5) construction on downstream reach – 100 feet
- Key-in trench construction upstream – 425 feet
- Revetment treatment on the downstream reach – 30 feet
- Rock volume for construction of stone toe and transition zone on the main channel – 6,900 yd³; stone spurs on downstream reach (including revetment) – 10,500 yd³
- Estimated volume of material disturbed on the main channel – 22,000 yd³; on the downstream reach – 150 yd³

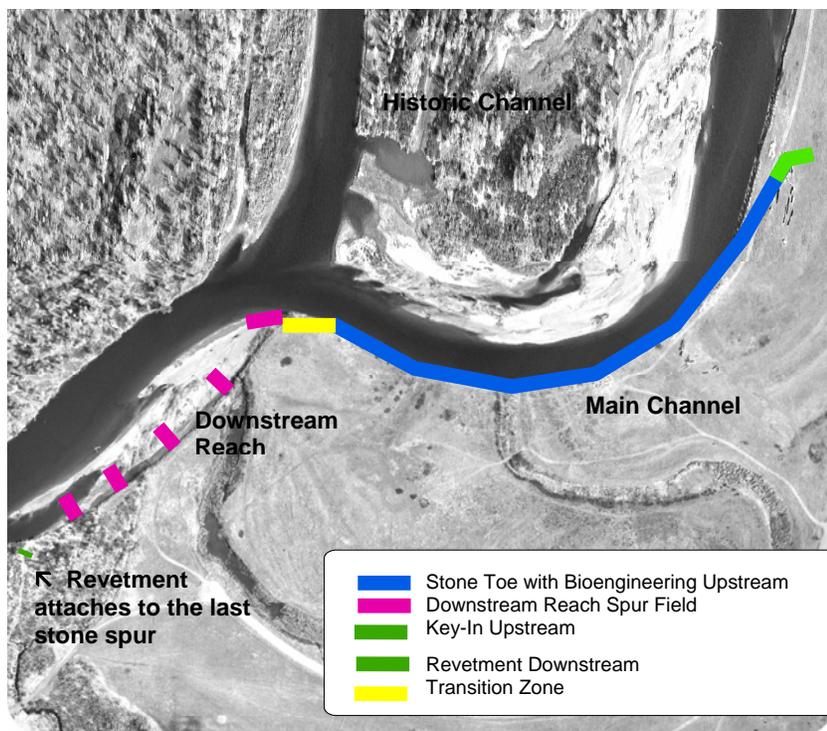


Figure 2-7. Aerial view of bank sections of Alternative 4 showing approximate locations of stone spurs, stone toe, key-in feature, and transition zone

2.6 Alternative 5 – Stone Spurs (Main Channel); Stone Toe (Downstream Reach)

Alternative 5 uses stone toe protection (no earthfill curve shaping or bioengineering) which would offer improved bank protection (Figure 2-8). The stone spurs without the earthfill curve shaping would minimize ground disturbance and be more suitable for protecting any cultural and natural resources. Key features of Alternative 5 include:

- Stone spur (15) construction on main channel – 61 feet long; stone toe construction on downstream reach – 1,600 feet long
- Key-in trench construction upstream – 100 feet
- Key-in trench on the downstream reach (tied into bank) – 10-30 feet
- Rock volume for construction of spurs on main channel – 26,700 yd³; stone toes on downstream reach (including key-in) – 9,000 yd³
- Estimated volume of material disturbed on the main channel – 3,300 yd³; on the downstream reach – 250 yd³

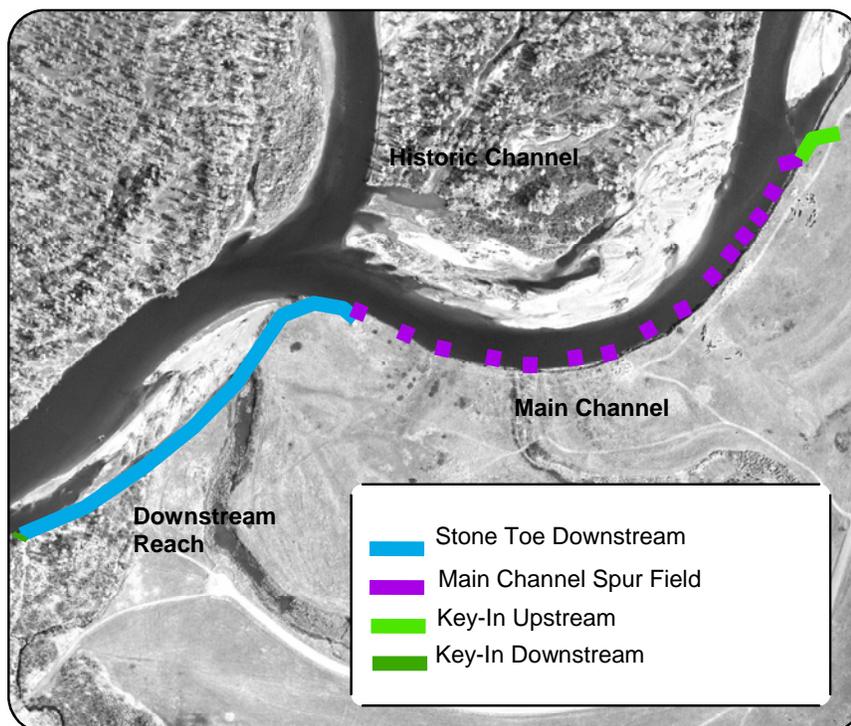


Figure 2-8. Aerial view of bank section for Alternative 5 showing approximate location of stone spur construction on main channel, stone toe, and revetment downstream

2.7 Alternatives Eliminated from Further Study

Several other alternatives were discussed early in the evaluation process but were eliminated from further study.

- Bendway Weir Transverse Features – With this alternative, the rock weirs are pointed upstream and installed below the water level. The disadvantage of this alternative is that high flow events may erode the rock weirs or shift the entrance angle of the flow. Although this alternative has a low initial cost, the maintenance costs are higher and provides only short-term bank protection.
- Channel Relocation – This alternative includes excavation to relocate the river channel and the use of stone dikes to block flow from returning into the old channel, creating a new oxbow and straightening the main flow. The disadvantages of this alternative are the high cost and the potential of altering the channel thereby increasing other future maintenance problems.
- Recapture Prevention – This alternative would block the historic channel forcing all flow into the main channel. This alternative would increase the flow into the main channel, and therefore, accelerate present bank erosion rates creating future maintenance problems.

2.8 Summary Comparison of the Environmental Impacts of the Alternatives

The environmental impacts of each alternative are compared below in Table 2-1 against the environmental impacts that would result under Alternative 1 – No Action Alternative. The environmental consequences of the alternatives arranged by resource are described in detail in Chapter 3. The terms “environmental consequences” and “environmental impacts” are synonymous in this document.

Table 2-1. Summary comparison of alternatives

Issue	Alt 1 – No Action	Alt 2 (Preferred Alternative) – Stone toe and upper bank revetment	Alt 3 – Stone spurs	Alt 4 – Stone toe with earthfill curve shaping & bioengineering (main channel); stone spurs (downstream reach)	Alt 5 – Stone spurs (main channel); stone toe (downstream reach)
Land use Livestock, agriculture, recreation	Bank erosion would continue.	Would provide highest level of protection; alternative would provide little access for wildlife to reach water; would allow the smallest amount of ground disturbing impacts to land within Landmark boundaries.	Streambank stability would be improved; alternative would provide possible access for wildlife to reach water.	Would provide intermediate amount of protection within the existing uses of livestock, agriculture, and recreation.	Would provide moderate protection while preserving natural and cultural resources.
Geology and soils	Bank erosion leads to loss of tribal lands and Landmark.	Effects limited to area of construction of an upstream 200-foot key-in structure for sheet piling. Effects limited to areas where toe keys into bank and at 30-foot revetment. Alternative has least risk for future bank erosion.	Effects limited to areas where spurs tie into bank and at 425-foot key-in trench; alternative has some risk for upstream flanking and future bank erosion. Effects limited to areas where spurs tie into bank and at 30-foot revetment.	Curve shaping and bioengineered terrace affect approx. 75 to 100-foot-wide zone along 2,200-foot-long treatment area plus 425-foot key-in trench; alternative has lower risk for future bank erosion. Effects limited to areas where spurs tie into bank and at 30-foot revetment.	Effects limited to areas where spurs tie into bank and at 100-foot key-in trench; alternative has some risk for upstream flanking and future bank erosion. Effects limited to areas where toe keys into bank and at 30-foot revetment.
Water quality	No change, bank erosion would continue.	Brief periods of high turbidity in main channel; no change in downstream reach.	Brief periods of high turbidity in main channel, greater than Alternatives 2 & 4; no change in downstream reach.	Brief periods of high turbidity in main channel; no change in downstream reach.	Brief periods of high turbidity in main channel, greater than Alternatives 2 & 4, similar to Alternative 3; no change in downstream reach.
Wetlands	Bank erosion would continue.	Due to construction of access road, oxbow area would be disturbed but restored. Water would continue to seep into wetland areas. Potential future impacts due to temporary access roads for monitoring and periodic maintenance.	Due to construction of access road, oxbow area would be disturbed but restored. Water would continue to seep into wetland areas. Potential future impacts due to temporary access roads for monitoring and periodic maintenance.	Due to construction of access road, oxbow area would be disturbed but restored. Water would continue to seep into wetland areas. Potential future impacts due to temporary access roads for monitoring and periodic maintenance.	Due to construction of access road, oxbow area would be disturbed but restored. Water would continue to seep into wetland areas. Potential future impacts due to temporary access roads for monitoring and periodic maintenance.

2.8 Summary Comparison of the Environmental Impacts of the Alternatives

Issue	Alt 1 – No Action	Alt 2 (Preferred Alternative) – Stone toe and upper bank revetment	Alt 3 – Stone spurs	Alt 4 – Stone toe with earthfill curve shaping & bioengineering (main channel); stone spurs (downstream reach)	Alt 5 – Stone spurs (main channel); stone toe (downstream reach)
Vegetation	Existing vegetation would be subject to continued erosion.	A total of 3,800 feet of main channel bank would be disturbed and some temporary loss of vegetation could occur during construction structures. The stone toe would benefit and protect upslope plants from disturbance caused by erosion. Potential impacts due to temporary access roads for monitoring and periodic maintenance activities.	Disturbance limited to spur and access locations on the main channel; vegetation and slopes between spurs would remain undisturbed; minimal disturbance of vegetation in downstream reach as spurs would be placed on existing point bar. Potential impacts due to temporary access roads for monitoring and periodic maintenance activities.	Similar disturbances as Alternatives 2 and 3 where temporary removal of existing vegetation would occur; this alternative would require extensive bioengineering revegetation for the main channel. Potential impacts due to temporary access roads for monitoring and periodic maintenance activities.	Similar disturbances as Alternatives 2 and 3 where temporary removal of existing vegetation would occur. Potential impacts due to temporary access roads for monitoring and periodic maintenance activities.
Fish and wildlife	Bank erosion would continue; bare soils would become increasingly unstable; minor levels of sedimentation may affect aquatic/semi-aquatic species.	A total of 3,800 feet of main channel bank would be disturbed dislodging sediment into the river, creating some turbidity. During construction this would have temporary effects on aquatic and semi-aquatic species distribution and habitat. The stone toe in the downstream reach would have little or no impact to fish. Some temporary loss to terrestrial and upland species habitat would occur.	Slightly less bank disturbance, minor dislodging of sediment into the river creating temporary turbidity; moderate disturbance during construction having temporary effects on aquatic/semi-aquatic species; long-term beneficial effects on species as structures would control erosion, reduce sediment, turbidity in river, and create backwater pools/habitat; minimal impacts to fish or wildlife; spurs may benefit species by providing habitat.	Main channel would be disturbed dislodging sediment into the river creating temporary turbidity; moderate/temporary effects on aquatic/semi-aquatic species distribution/habitat; stone toe would be least beneficial to terrestrial, riparian zone, semi-aquatic species due to loss of potential habitat near the waterline; upland species would benefit through improvements from planted vegetation & terraced slopes.	Similar to Alternative 3 with sediment dislodging into river creating temporary turbidity; minimal effect on aquatic/semi-aquatic species distribution/habitat; stone spurs more beneficial to terrestrial, riparian zone, semi-aquatic species due to continued use of potential habitat near waterline; minimal disturbance or benefit to upland species.
Threatened and endangered species	Bank erosion would continue.	No effect on the threatened gray wolf or bald eagle;	No effect on the threatened gray wolf or bald eagle; no	No effect on the threatened gray wolf or bald eagle; no	No effect on the threatened gray wolf or bald eagle; no

Issue	Alt 1 – No Action	Alt 2 (Preferred Alternative) – Stone toe and upper bank revetment	Alt 3 – Stone spurs	Alt 4 – Stone toe with earthfill curve shaping & bioengineering (main channel); stone spurs (downstream reach)	Alt 5 – Stone spurs (main channel); stone toe (downstream reach)
		no effect on the endangered Utah valvata snail. If surveys reveal the presence of Ute ladies'-tresses, there could be a potential short-term effect due to construction of temporary access road for oxbow.	effect on the endangered Utah valvata snail. If surveys reveal the presence of Ute ladies'-tresses, there could be a potential short-term effect due to construction of temporary access road for oxbow.	effect on the endangered Utah valvata snail. If surveys reveal the presence of Ute ladies'-tresses, there could be a potential short-term effect due to construction of temporary access road for oxbow.	effect on the endangered Utah valvata snail. If surveys reveal the presence of Ute ladies'-tresses, there could be a potential short-term effect due to construction of temporary access road for oxbow.
Cultural resources	Bank protection measures would not be implemented; no immediate effect on the Landmark; however, no action increases potential of the Landmark being lost or suffering extensive damage in the future.	Main channel – Utilizes system to place riprap from above the bank and eliminates bioengineering and curve shaping. Northern 200-foot key-in of sheet pile reduces impacts from key-in excavation, lessening threat to cultural resources. Minimal visual impacts. Downstream reach – Intact portions of Landmark avoided; effects in Landmark boundaries limited to areas where toe keys into bank and recent gravel bar. Installation of sheet pile eliminates need for excavated key-in trench.	Main channel - Limits surface disturbance to tie-back trenches for 15 spurs & access ramps, thus limiting potential impacts to sub-surface cultural resources accordingly. Northern 425 foot excavated key-in trench poses threat to sub-surface cultural resource deposits. Possible visual effects from unnatural spur appearance. Downstream reach – Intact portions of Landmark avoided; effects in Landmark boundaries limited to areas where the 5 stone spurs would tie into existing riprap on the recent gravel bar. Possible visual effects from spur configuration.	Main channel reach – Bioengineering & curve shaping entirely disturb a 2,200 foot x 24 foot area along the bank, posing a threat to any subsurface cultural deposits. A northern excavated 425 foot key-in trench poses a threat to any subsurface cultural resource deposits. Visual impacts due to bioengineering & curve shaping. Downstream reach – Same as Alternative 3, downstream reach.	Main channel reach – Same as Alternative 3, main channel, except a 100 foot x 30 foot northern key-in trench is proposed, reducing potential impacts to sub-surface cultural deposits compared to alternatives 3 and 4. Possible visual effects from unnatural spur appearance. Downstream reach – Intact portions of Landmark avoided; effects in Landmark boundaries limited to areas where toe keys into bank and recent gravel bar. Excavated key-in trench could expose subsurface archaeological deposits.
Indian sacred sites	Bank protection measures would not be implemented; no immediate effect on the Landmark; however, no action increases potential of the Landmark being	Use of sheet pile construction for the main channel key-in reduces the likelihood that human skeletal remains or other sacred site or materials would be disturbed.	Burials or other sacred sites in the Landmark – unaffected. Along the main channel, 15 spurs and key-in trench could increase potential for finding human remains or other	Burials in Landmark are unaffected. On main channel, there is more potential to impact sacred sites and natural vistas relative to other alternatives. Access ramps, bank-shaping/sloping,	Burials or other sacred sites in the Landmark – unaffected. Fewer visual impacts to Landmark than from stone spurs. On main channel, there is less potential to impact sacred sites

2.8 Summary Comparison of the Environmental Impacts of the Alternatives

Issue	Alt 1 – No Action	Alt 2 (Preferred Alternative) – Stone toe and upper bank revetment	Alt 3 – Stone spurs	Alt 4 – Stone toe with earthfill curve shaping & bioengineering (main channel); stone spurs (downstream reach)	Alt 5 – Stone spurs (main channel); stone toe (downstream reach)
	lost or suffering extensive damage in the future.	Downstream of Landmark, disturbance would only occur on the recently-formed gravel bar, burials or other sacred places within the Landmark boundaries would be unaffected.	sacred materials. Possible visual effects from spur configuration on natural sacred vistas.	terracing, stone toe placement, and bioengineering would completely disturb 2,200-feet by 24-feet wide surface area along existing bank.	relative to stone toe. Downstream key-in trench has potential to expose subsurface archaeological deposits.
Indian trust assets Reservation lands; right to hunt/fish, right to water, right to minerals	Erosion would continue on Tribal lands with some effects to resources associated with the land; the right to hunt/fish continues; no impacts to federally-reserved water rights; no known minerals at this site.	Construction sites would stabilize some Tribal lands with temporary effects to associated resources. The right to hunt/fish continues; no impacts to federally-reserved water rights; no known minerals at this site.	Construction sites would stabilize some Tribal lands with temporary effects to associated resources. The right to hunt/fish continues; no impacts to federally-reserved water rights; no known minerals at this site.	Construction sites would stabilize some Tribal lands with temporary effects to associated resources. The right to hunt/fish continues; no impacts to federally-reserved water rights; no known minerals at this site.	Construction sites would stabilize some Tribal lands with temporary effects to associated resources. The right to hunt/fish continues; no impacts to federally-reserved water rights; no known minerals at this site.
Socio-economics	Bank erosion continues.	No adverse impacts.	No adverse impacts.	No adverse impacts.	No adverse impacts.