EXHIBIT "A"

Impacts of the Carbondale to Crested Butte Trail on health of the Crystal River

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Purpose and Approach

I analyzed impacts of a proposed new trail and options for bridges on the Crystal River. Plan sheets for the Redstone segment of the proposed Carbondale to Crested Butte Trail describe two alterative trail alignments and 14 bridge options from 7 Oaks Subdivision to McClure Pass. The sheets provide a qualitative evaluation of environmental impacts for alternative trail alignments based on wildlife, vegetation and wetland, and cultural resources, but the do not adequately consider impacts that the trail and bridges would have on the river. This study provides an evaluation of river impacts so that river health can be taken into account in planning the future of the trail.

For background, I evaluated past reports on the condition of the Crystal River including the Crystal River Management Plan by Lotic Hydrological, 2016, and the Crystal River section of Malone and Emerick's 2007 Catalog of Stream and Riparian Habitat Quality for the Roaring Fork River and Tributaries (See Sheet 1). I mapped the alternative trail Alignment And bridge options described in the plan sheets with Google Earth to evaluate impacts using recent and past aerial imagery and also spent time on site making field observations. The evaluation considers potential long-term impacts to critical components of river health (Table 1) as well as temporary impacts from construction for each of the 19 trail sections and 14 bridge options described in the plan sheets.

Table 1: Components of river health used to analyze potential impacts derived from the Colorado Stream Health Assessment Framework.

Flow Regime	Amount and timing of water supply
Sediment Regime	Amount, timing, and type of sediment supply
Water Quality	Physicochemical properties of water
Landscape	Buffer capacity and aquatic and terrestrial habitat connectivity
Floodplain Function	Frequency, extent, and duration of floodplain saturation or inundation
Riparian Condition	Riparian habitat condition, including vegetation structure and diversity
Organic Materials	Supply of wood and detritus
Morphology	Reach morphology including stream evolutionary state, planform, dimension, and profile
Stability	Ability of the reach to maintain form via resistance, dynamic equilibrium, and resilience
Physical Structure	Physical habitat including water depth, velocity, structural components, and substrate

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Crystal River Background

Confinement and natural river type

For most of its length through the Redstone segment of the Carbondale to Crested Butte Trail (from 7 Oaks to McClure Pass) the Crystal River runs through a narrow valley that is geologically confined. This geological setting supports a naturally entrenched plane-bed river form with rapids, cascades, and step-pools. River morphology, stability, and physical structure are conferred by highly resistant bed and bank material. The confined river is a threshold channel that rarely moves or erodes except during extreme events. Some reaches, such as the appropriately named Narrows section (Figure 1), are so narrowly confined that there is no natural floodplain, and riparian vegetation is limited to thin strips along the banks. Very confined reaches have flood-prone area width less than about 1.5 times the bankfull width of the river. Moderately confined reaches, however, have natural floodplain "benches" that support bands of riparian habitat on valley bottoms between the canyon walls that are between 1.5 and 2.2 times the river's bankfull width. The Andrews (Figure 2) and Nettle Creek sections (Figure 3) are examples of typical confined river reaches on this segment of the Crystal. Reaches where flood-prone area approaches 3 times bankfull river width are still considered confined, but they have marginally wider floodplains and riparian areas, and the river tends to be braided. Portions of the Castle, Janeway North, Avalanche (Figure 4), and Red Wind Point sections (Figure 5) meet this transitional classification.

The McClure Pass section and portions of Filoha (Figure 6) and Janeway South (Figure 7) are classified as partially confined. The valley floor is wider on these reaches, and flood-prone area is between about 3 and 7 times the river's bankfull width. These reaches are lower-gradient sections of the canyon that have filled with alluvial sediment over geologic history to create relatively flat, wider floodplains that support a very different river type that is naturally unentrenched, sinuous, branching and braided. These alluvial rivers regularly migrate across broader floodplains and vegetated riparian wetland areas, adjusting to changes in sediment and water flows in dynamic equilibrium. As a result, they are much more sensitive to disturbance than confined reaches.

Existing roads, railroad, bridges, and development

Every one of the confined reaches on this segment of the Crystal River has been encroached upon, to some degree, by Highway 133. The highway is constructed on top of armored (rip-rap or concrete) fill placed within the already-narrow valley bottom (Figure 5). Given that the river types in these sections are naturally resistant threshold channels adapted to confined valleys, the effects of encroachment and armoring on river geomorphology and riparian condition are not as great as they would be on unconfined rivers which need wide floodplains and riparian zones to maintain form, function, stability, and ecological function. On the partially confined reaches of the McClure Pass, Filoha, and Janeway South sections, Highway 133 encroachment is less since the road is cut into upland rather than as fill in the valley bottom (Figure 6). In addition to its geomorphic impacts, the highway is a migration and dispersal barrier that inhibits terrestrial habitat connectivity and limits buffer capacity on both confined and partially confined reaches. In addition to being migration barriers, paved roads and paths are impermeable surfaces that do not allow infiltration, so runoff during storms or snowmelt happens much faster. Water running off of pavement can be much warmer than normal and concentrated with chemical contaminants, increasing the risk of water quality impairment. While there are some small

paved surface areas on the east side of the river, most of the pavement impacts are on the west side along the highway.

An abandoned railroad line runs along the east side of the Crystal River downstream of Redstone. Like the highway, portions of the old railroad line were constructed on armored fill within the valley bottom. All the river sections from the Narrows through Crystal River Country Estates are impacted from the old railroad (Figures 1-3). Impacts are greatest on the Red Wind Point and Janeway sections where railroad fill effectively isolates significant portions of the floodplain and riparian areas from the river (Figures 5 and 7). An important difference between the abandoned railroad line and Highway 133 is that railroad fills are not paved, not permanent, and could potentially be removed and remediated to reduce impacts in the future. The paved highway and any new paved bike path, on the other hand, are here to stay.

Thirteen full-span bridges cross the Crystal River on this segment. These bridges confine the river by consolidating flows through spans that are typically narrower than the natural width of the valley and floodplain. The degree of impact is generally proportional to the width of floodplain and riparian area cut off by fill for approaches on either side of the span (Figures 8 and 9). Because of this, bridges tend to be less impactful when the cross naturally confined reaches compared to locations that are not naturally confined. All of the existing bridges are cross the river in relatively confined areas except for the ones on the Castle and Filoha sections (Figure 10).

Development is the other important stressor on this segment of the Crystal. The river was channelized and riparian areas east of the channel were cleared for agricultural use on both the Filoha (Figures 6, 10, and 11) and Janeway sections (Figures 7 and 12), causing impairment to habitat connectivity, floodplain function, riparian condition, river morphology, stability, and structure. Residential development affects most of the river sections, but the effects are minimally impactful except where high-density development occurs along the river on the Hawk Creek (Figure 9), Castle, Wild Rose (Figure 13), Crystal River Country Estates (Figure 14), Nettle Creek, and 7 Oaks sections, and where it occurs within the riparian zone on the Filoha, Avalanche (Figure 15), Janeway North, and Perham sections. In addition to floodplain encroachment and riparian degradation, riverside development impairs terrestrial habitat connectivity and buffer capacity.

Impact of Proposed Bridges

Bridge Impacts	Bridge 1	Bridge 2	Bridge 3	Bridge 4	Bridge 5	Bridge 6	Bridge 7	Bridge 8	Bridge 9	Bridge 10	Bridge 11	Bridge 12	Bridge 13	Bridge 14
														

Table 2 Impact evaluation summary for the 14 proposed bridge options. Any new bridge will have significant impact on the Crystal River. The least severe options (1, 4, 5, 10) use existing bridges. More severe options (7, 12) propose new bridges on confined reaches, and most severe options (2, 3, 6, 8, 9, 11, 13, 14) would construct bridges on reaches with active floodplain and functioning riparian areas.

Key to Impacts	
	Less severe
	More severe
	Most severe

Bridges present the greatest risk of impacts to river health by the proposed trail. Bridge impacts are summarized in Table 2, and a detailed impact analysis is provided in Sheet 2. Of the 14 proposed bridge options, only 4 are deemed to have minor impact because they use bridges that are already present. The other 10 options would require new bridge construction which means a high degree of temporary impact during construction and moderate to high levels of long-term impact on river health.

Of these 10, options 7 and 12 are less impactful since they cross the river in narrow locations that are geologically confined. Because they have little to no natural floodplain or riparian area, and because the small floodplain/riparian areas that are present are already impaired, there would be less impact from new full-span bridges at these locations. There is already an existing bridge near option 7, and neither option 7 nor 12 would require any additional trail construction to connect them to trails on alignments A and B.

The remaining 8 bridge options would have high to very high levels of impact to the river because they cross at areas where the river has active floodplain and wider riparian area. The degree of impact is more or less proportional to the width of floodplain and riparian area that would be filled to construct the bridge and approach trails. In general, the wider the river and floodplain, the greater the risk of impairment by a new bridge. Because of this, bridge options 2, 3, 6, 8, 9, 11, 13, and 14 rank the highest in terms of severity of impacts because they cross the river on reaches that have naturally wide floodplains (Figures 16 - 19). Building bridges in these locations would likely involve channelizing and armoring segments of the river and filling portions of active and functional floodplain with native riparian vegetation.

Impact of Proposed Trail

Trail Section	7 Oaks	Crystal River Parcel	Nettle Creek	Red Wind Point	CR Country Estates	Andrews	Perham	Janeway North	Janeway South	Avalanche	Narrows	Filoha	Wild Rose	Castle	Hawk Creek	Hays Falls	Bear Creek	Placita	McClure Pass
A	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
B	🟢	🟢	🟡	🔴	🟢	🟡	🟡	🔴	🔴	🟢	🟡	🟢	🟢	🟢	🟢		🟢		🟢

Table 3 Impact evaluation summary for proposed trail alignments A and B on the trail 19 sections. Any new trail along the Crystal will have some impact. Impacts are less severe on Alignment A where the trail would be run along Highway 133 and on sections of Alignment B where it would run on existing roads through developed areas. More severe river health impacts would be incurred on sections of Alignment B where a new paved path is proposed through riparian areas. The most severe impacts are for Alignment B on Red Wind Point and Janeway where a new paved path would be constructed on fill that that would cut off large areas of floodplain and riparian habitat from the river.

Key to Impacts	
🟢	Less severe
🟡	More severe
🔴	Most severe

The proposed trail along the Crystal River would pose new impacts to river health on all sections, but the degree of impact varies according to the type of new trail proposed and its location relative to the river, floodplain, riparian zone, buffer, and other infrastructure. Trail impacts associated with proposed alignments A and B are summarized for each of the 19 sections in Table 3, and a detailed impact analysis is provided in Sheet 3.

Trail Alignment A

The proposed trail Alignment A calls for a 10-foot-wide paved path up to Redstone (7 Oaks through Wild Rose sections) adjacent to Highway 133. The trail would be constructed within the highway right-of-way, increasing the width of existing paved surface along the west side of the river from about 30 feet (existing highway) to about 40 feet (existing highway plus a new 10-foot path). The river is already significantly impacted by Highway 133 and/or by residential development on this side. Increasing the width of paved surface along this side of the river would add additional stress, but far less than would be added if a paved surface were constructed along a reach that wasn't already paved. Constructing a trail on the existing highway foundation will impact riparian vegetation where trees and shrubs would have to be cleared along the right-of-way to make room for a trail, but additional armoring or floodplain encroachment should not be necessary. The highway is already a significant migration barrier that impairs terrestrial habitat connectivity on one side of the river, and adding a trail along the highway would not significantly increase its impact to habitat connectivity. Temporary impacts during trail construction would also be minimal given the easy construction access along the highway and use of the existing road foundation.

Trail Alignment B

Alignment B provides an alternative to Alignment A on all sections except for Hays Falls and Placita. Potential river impacts for Alignment B are least on sections where the trail follows existing roads in developed areas on the Hawk Creek, Castle, Crystal River Country Estates, Crystal River Parcel, and 7 Oaks sections. The McClure Pass, Bear Creek, Wild Rose, Filoha, and Avalanche sections of Alignment B would also have comparatively low levels of impact where the trail is routed away from the river on upland hillsides.

More impact can be expected for Alignment B on the Narrows, Perham, Andrews, and Nettle Creek sections. On these sections, a minimum 20-foot-wide course of disturbance will be necessary to construct the 10-foot-wide paved path that is proposed on the abandoned railroad line where it runs through existing riparian areas. The footprint of the path, itself, is a swath where no riparian vegetation will ever grow, and a band of riparian vegetation on either side would be at least temporarily impacted for years due to construction disturbance. Native riparian vegetation takes years or decades to recover at this elevation, even when it is properly planted and managed, and there is risk for establishment of noxious weeds and invasive species. In addition to the riparian impairment, this alignment would introduce a significant new terrestrial habitat connectivity barrier on the east side of the river. All of the other impacts associated with pavement and armored fill would also be increased. Sections of the rail line that have been eroded away by the river would have to be reconstructed to fulfill Alignment B, and this would require new floodplain fills, encroachment, and channel armoring along unimpaired sections of the river. Repurposing the rail line as a trail would also eliminate future opportunities for restoration on these reaches.

Alignment B also follows the abandoned rail line on the Janeway and Red Wind Point sections, but constructing a trail on these sections would involve significantly greater impact to floodplain function and riparian condition (Figures 20-. On these sections, the old rail line runs through the middle of floodplain benches and riparian zones, rather than along the edge, effectively cutting off large areas from the river. The cutoff riparian areas are marginally functional and could be restored to improve both the river and wetland. Terrestrial habitat connectivity is currently excellent on the right side of the river through these sections, but this condition would be significantly decline if the trail was routed along Alignment B since it would introduce a new migration barrier where none currently exists.

Recommended alignment

Because bridges present such a high level of impact and risk to river health, avoiding the need for new bridges should be a primary goal in planning a this trail. From the point of view of river health, Alignment A is the environmentally preferable alternative for most of the segment. The only exceptions are through the 7 Oaks and Bear Creek sections, where Alignment B is slightly preferred. Using Alignment B on the 7 Oaks section would require construction of at least one very-high-impact bridge, however, and impacts from that would far outweigh any gains made by using Alignment B instead of A through 7 Oaks. Switching from Alignment A to B for the Bear Creek section could would not require bridges or any other additional impact, and is therefore recommended. Above Bear Creek, there is no significant difference in impact between Alignment A and B.

This segment of the Crystal is generally a very healthy river, and special care is needed to protect it. Building a new trail up the valley will introduce long-term impacts to river health, and these impacts will be difficult or impossible to reverse in the future. It is important to weigh these sacrifices to river health, alongside other environmental impacts such as wildlife, vegetation and wetland, and cultural resources, against the social benefits of a trail. River impacts are especially important in this case, and considering these impacts when planning a project as big as the Carbondale to Crested Butte Trail is critical in order to minimize the amount of permanent damage to a healthy river that, itself, provides great social benefits. River impairment would be minimized by constructing the trail up to Redstone as a shoulder along Highway 133 on the west side of the river (Alignment A), rather than as a new paved path on the east side (Alignment B). Upstream of Redstone, the best alignment for the proposed single track trail is along the shoulder of Highway 133 up to Bear Creek (Alignment A) and then on the hillside west of the highway along Alignment B through the Bear Creek section. New bridges, and the severe impacts to river health associated with them, are unnecessary and should be avoided.

Figure 1 A typical reach through a very confined valley on the Narrows section. Encroachment and armored banks from Highway 133 (left) and the abandoned railroad (right) extend the length of this reach. Bridge option 2 is in the foreground.

In this and all the figures that follow, dark blue lines show Trail Alignment A, light blue lines show Alignment B, and white lines show spur trails associated with bridge options. All of the figures are from Google Earth, imagery dated 6/23/2017.

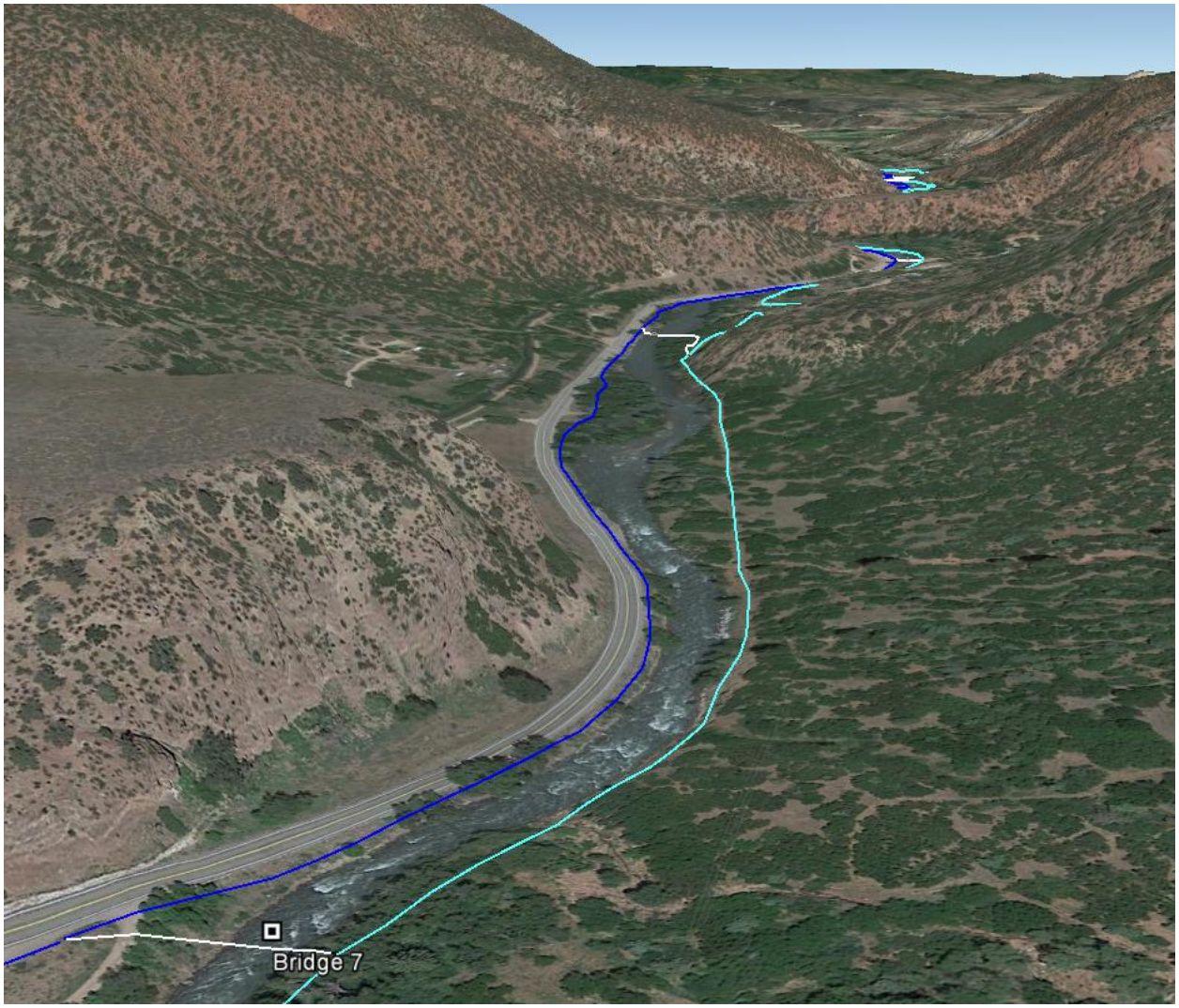


Figure 2 Typical confined reach on the Andrews section. The photo shows encroachment on the left where Highway 133 is constructed on armored fill on the valley bottom in the riparian zone and the abandoned railroad line on the right. Trail Alignment A follows the highway and B follows the railroad line. Bridge option 7 is in the foreground, and bridge option 6 is farther downstream.

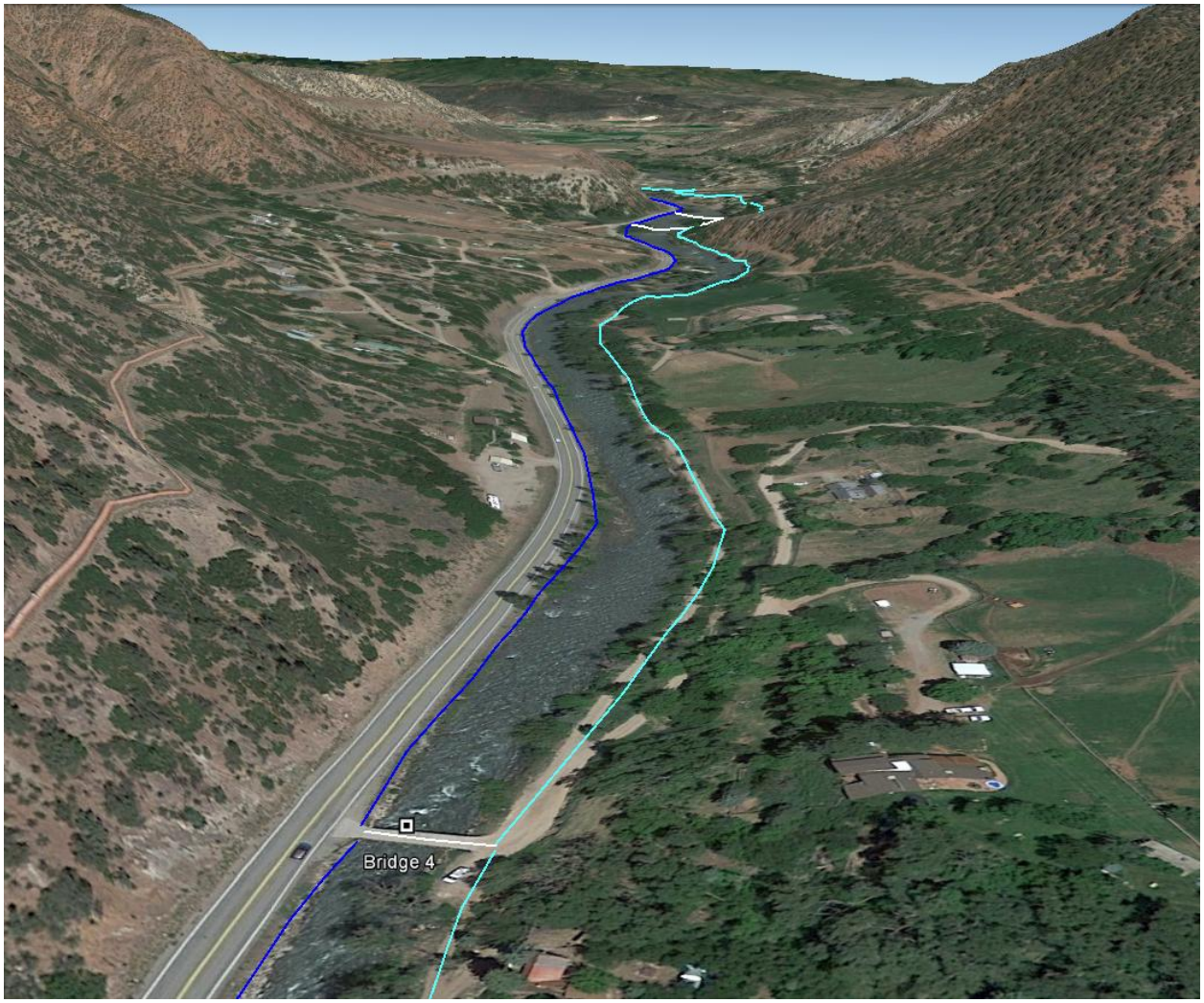


Figure 3 Another typical confined reach on the Nettle Creek section. Highway 133 is again on the left, and here the old railroad line on the right has been repurposed as a road. Bridge option 4 in the foreground is an existing bridge between the Crystal River Country Estates section (upstream) and the Nettle Creek section.

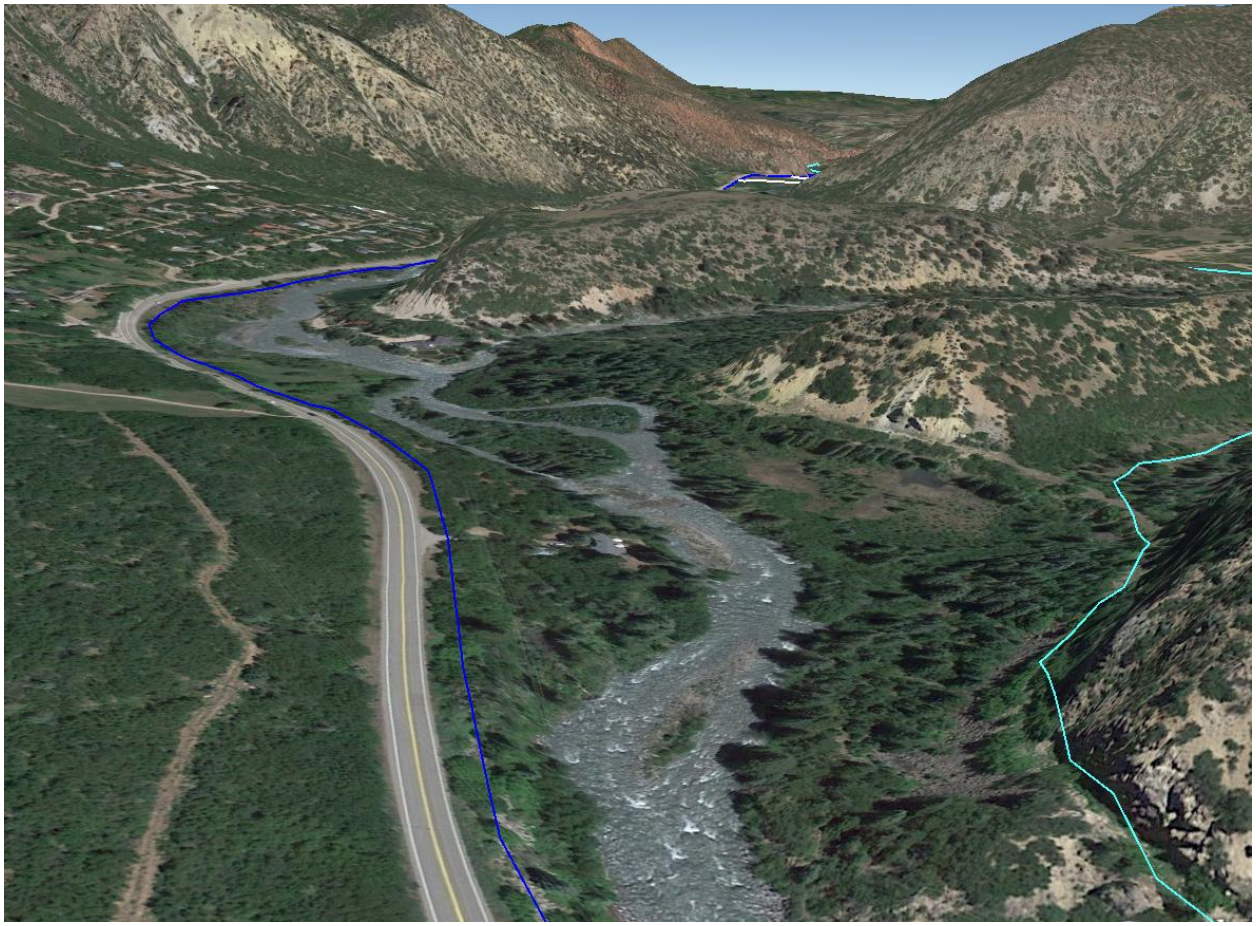


Figure 4 A typical transitional reach on the Avalanche section. This reach is geologically confined (width of the flood-prone area is less than 3 times bankfull river width) but because the valley bottom is wider than other confined reaches, it has wider floodplain benches, more riparian area, and a braided planform. Trail Alignment A follows the highway on the upland hillside. Alignment B detours away from the Crystal up the Avalanche Creek drainage.

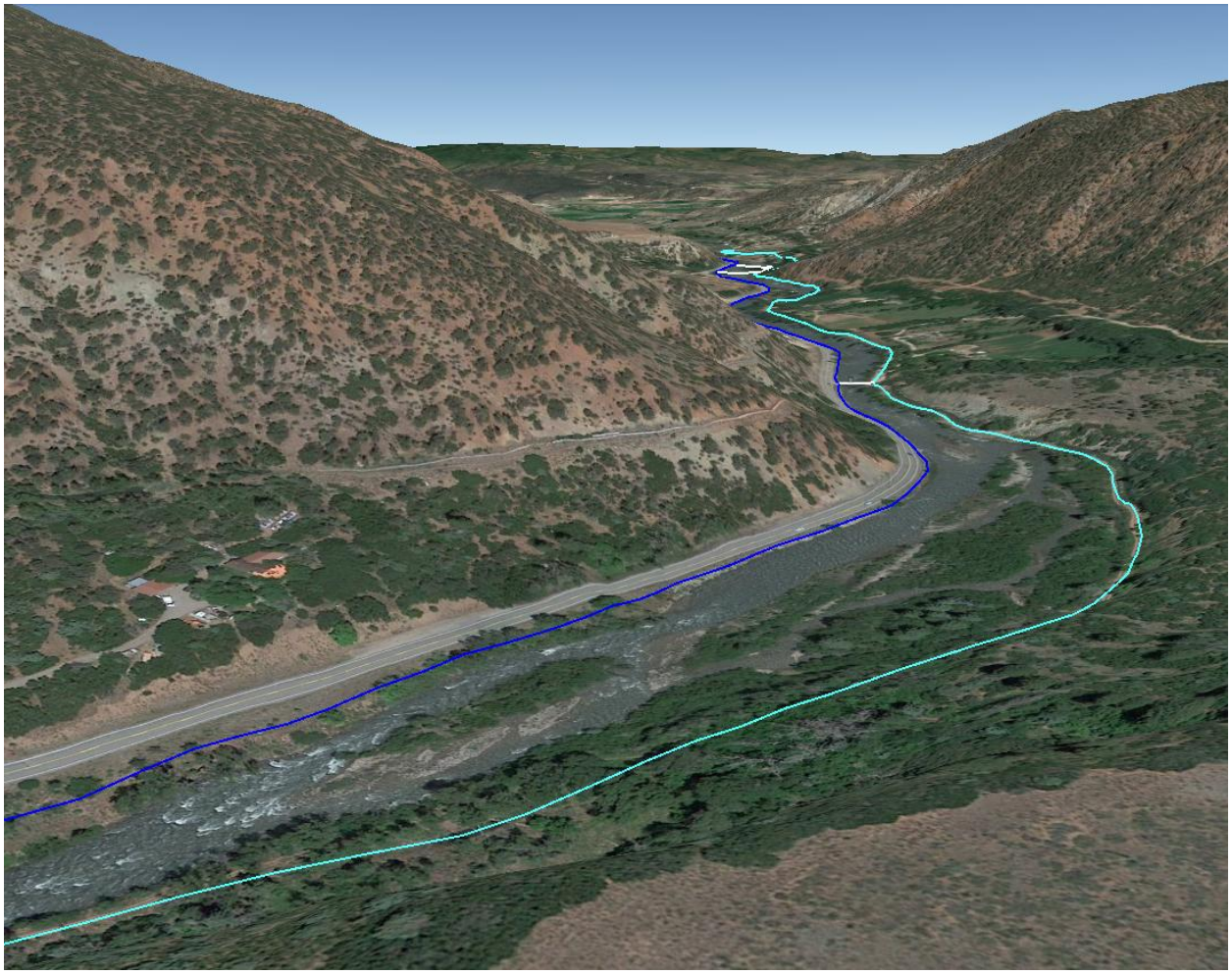


Figure 5 The Red Wind Point section is another example of the transitional confined valley and river type. Alignment B follows the abandoned railroad grade which runs up the right riparian area, effectively isolating a portion of the floodplain and riparian area from the river. If the railroad line is not repurposed, it could potentially be remediated for river and riparian restoration.

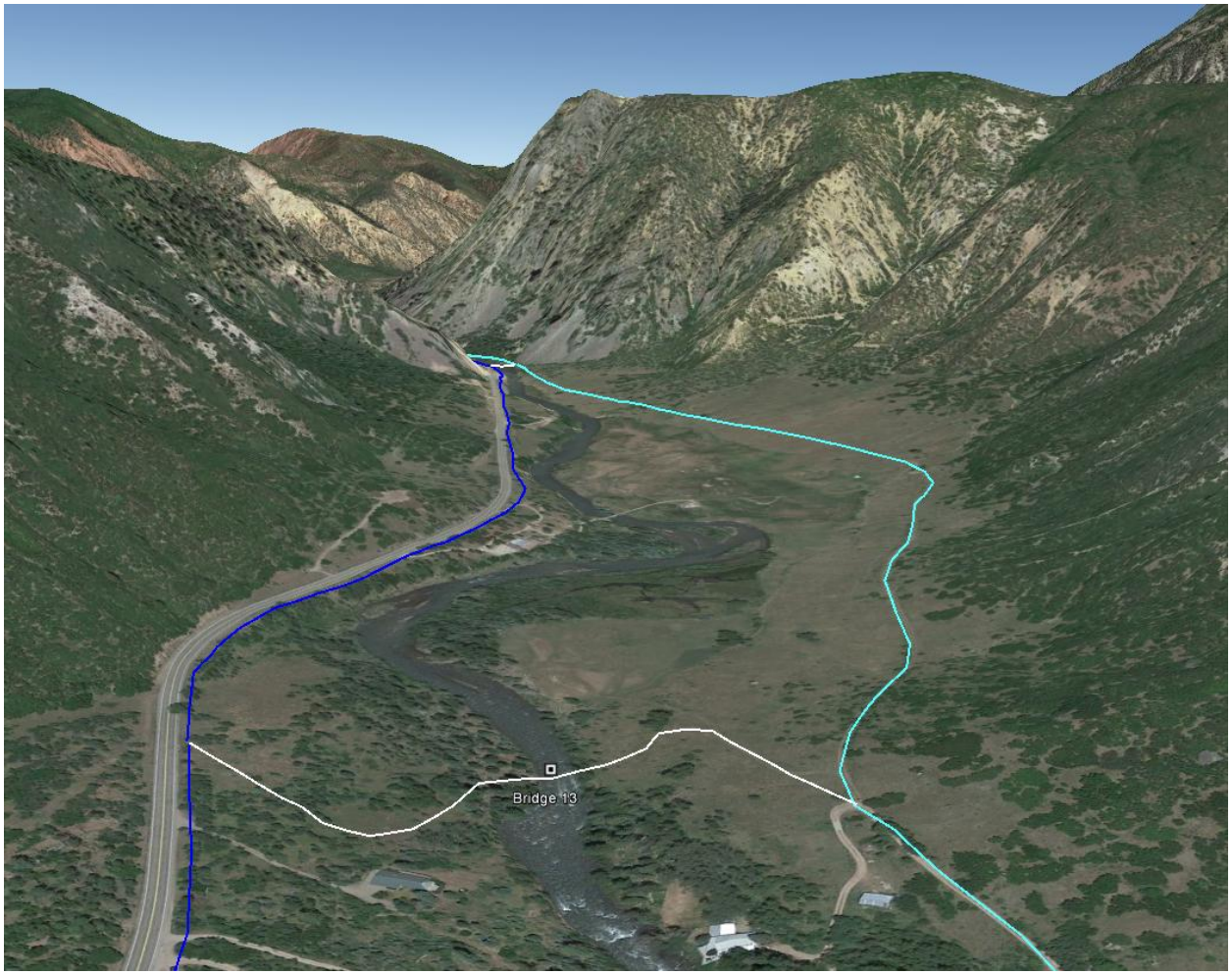


Figure 6 An example of the partially confined valley type on the Filoha section. Most of the east (right) riparian area has been cleared for land use, though patches of native vegetation and wetland remain intact. The highway and east-side railroad line along this reach are on upland hillsides, above the valley bottom. Neither of the trail alignments on this section have much impact on the river, but the proposed bridge option 13 and its 0.3-mile spur trail would be highly impactful.

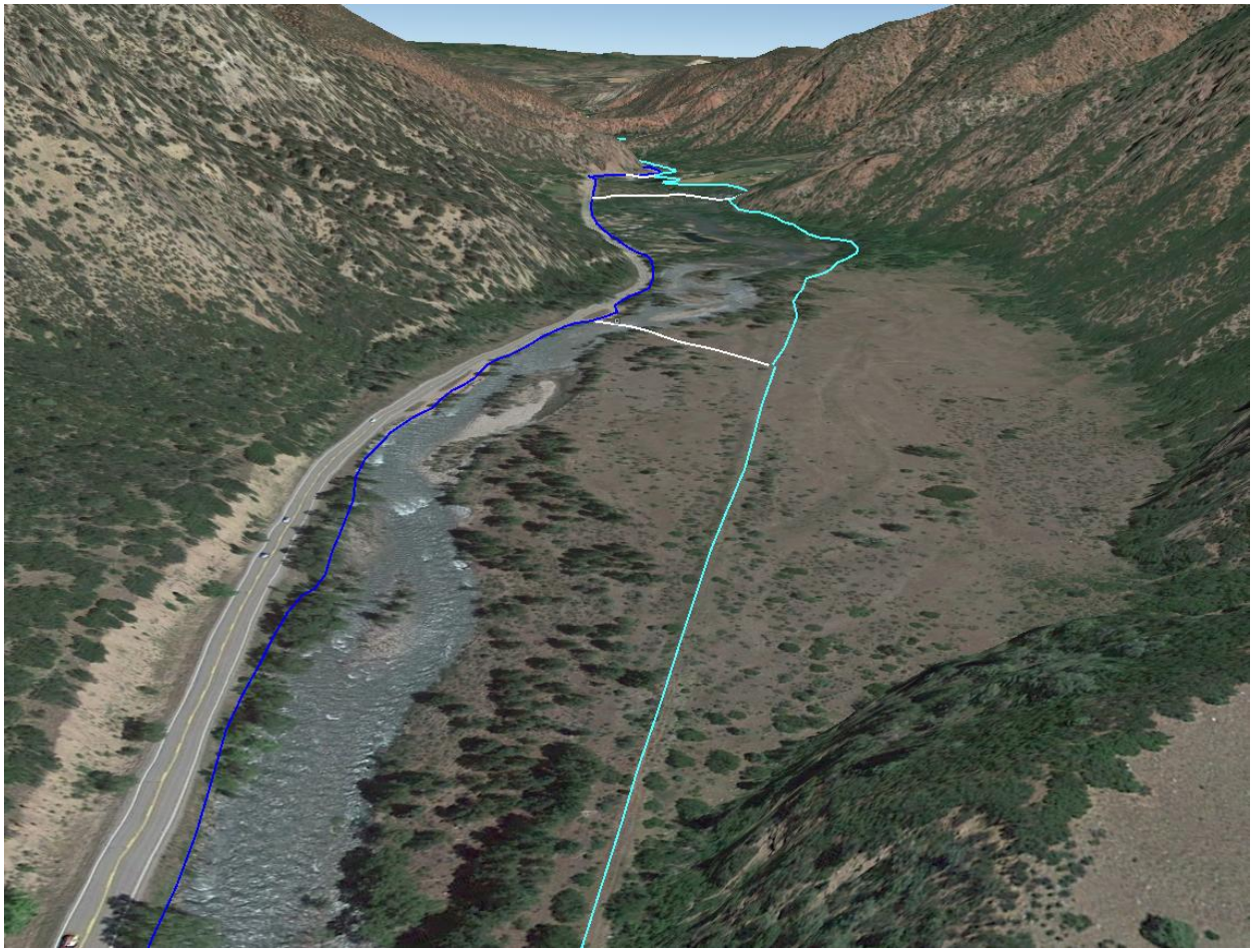


Figure 7 A typical partially confined reach on the Janeway South section. On this reach, native vegetation on the floodplain and riparian area on the east (right) side of the river has been cleared and historical fluvial feature are evident. The abandoned railroad line (highlighted by the light blue line marking trail Alignment B) effectively isolates the area to the east from the river. This large riparian area could potentially be restored if the railroad line is not repurposed. Bridge options 9 (foreground) and 8 (farther back) would entail a high levels of impact.

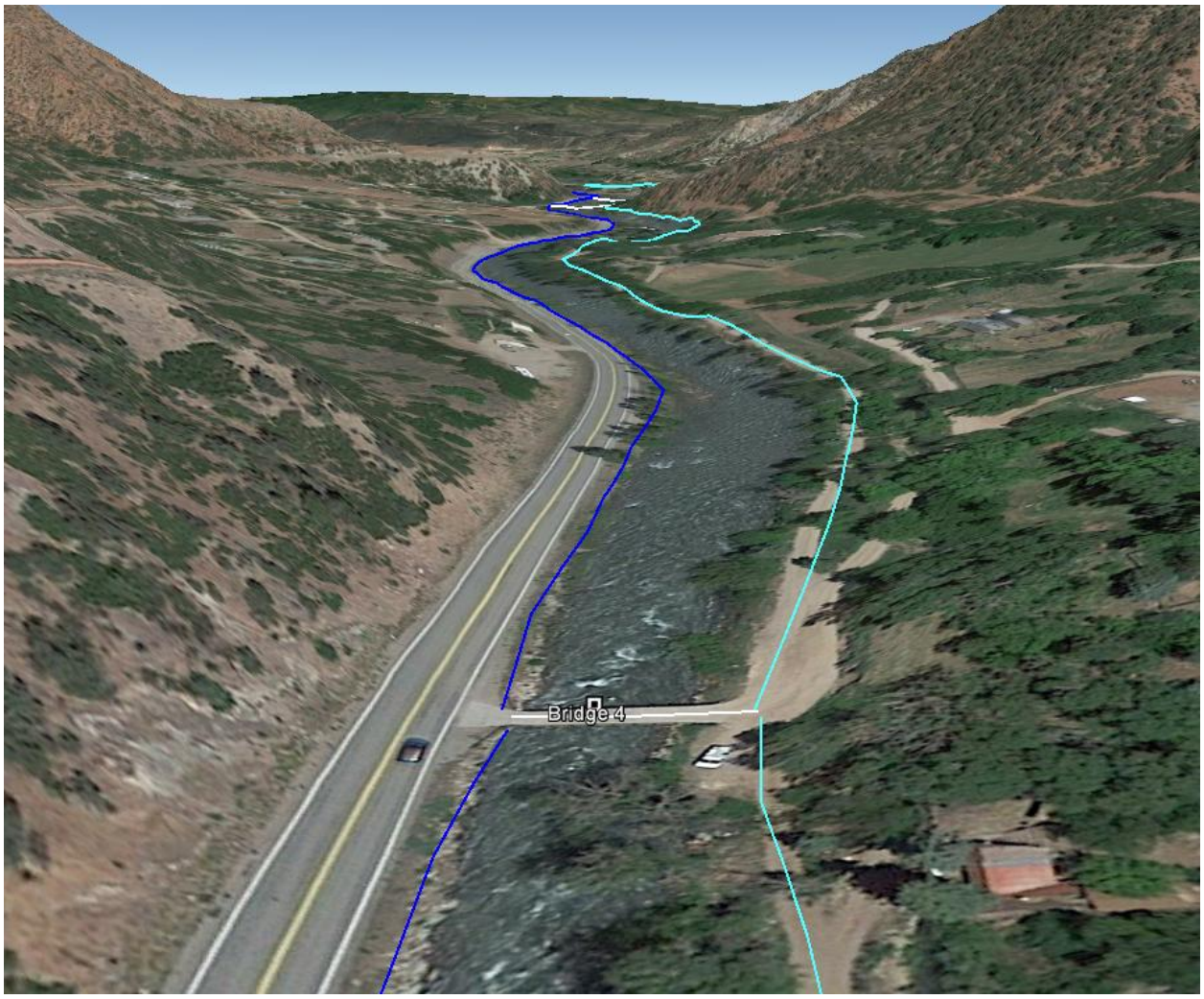


Figure 8 Existing bridge on a confined reach between the Red Wind Point and Nettle Creek sections. Alignment B uses follows the abandoned rail line, portions of which have been repurposed as roads, through the Nettle Creek segment.

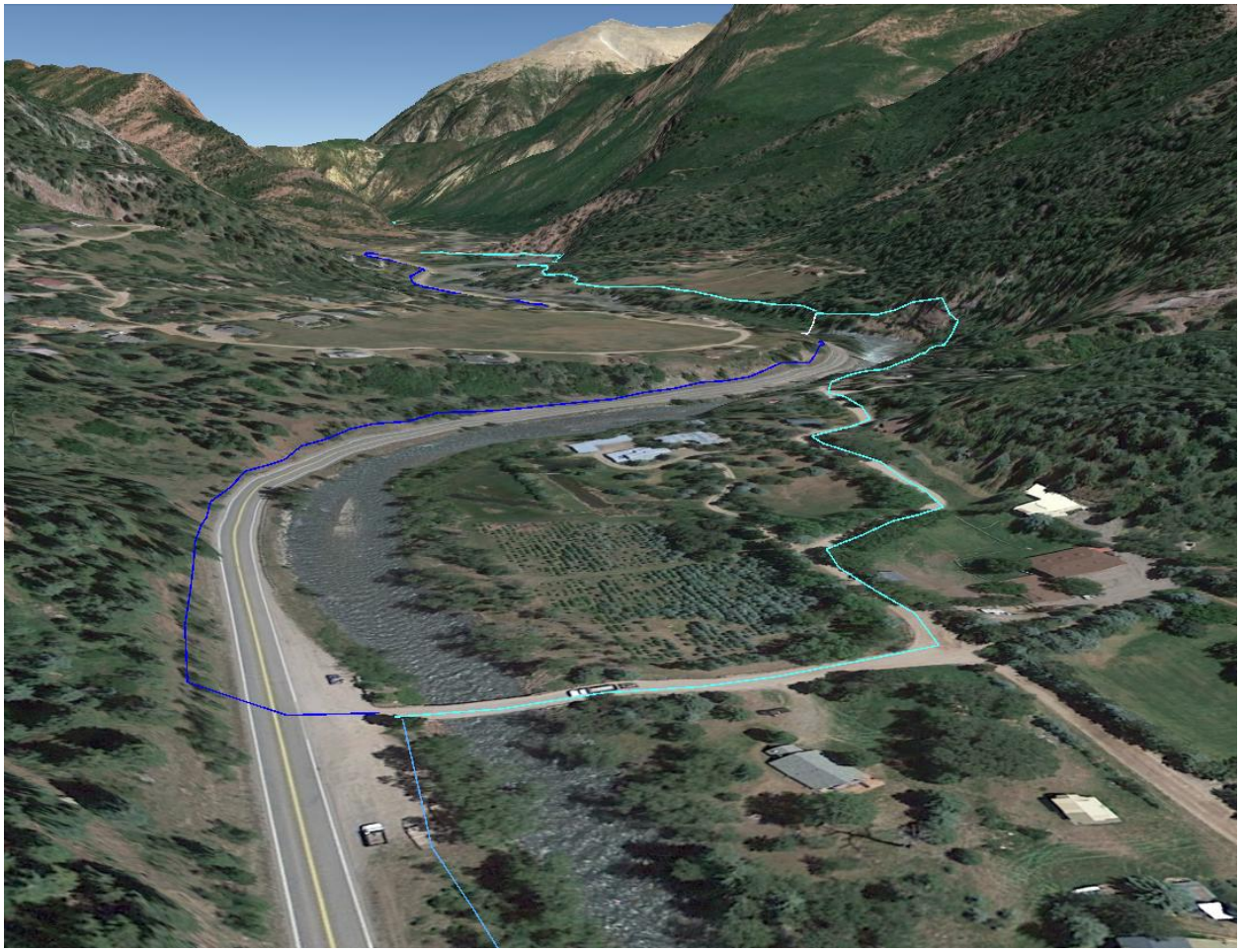


Figure 9 Existing bridge on an intermediate confined/partially confined reach between the Hays Falls and Hawk Creek sections. High-density residential development and development on historical riparian area are also significant stressors on the Hawk Creek section.

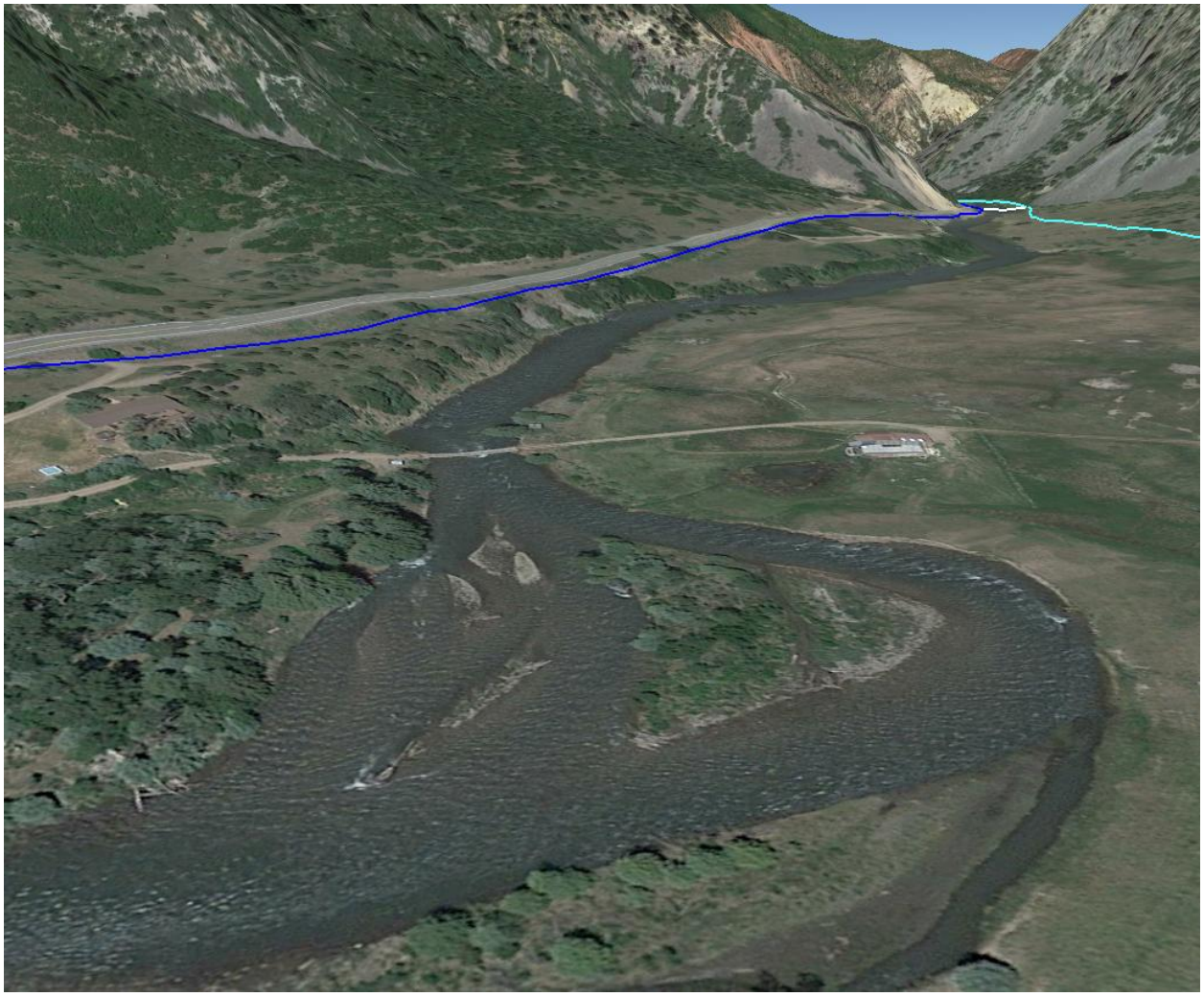


Figure 10 The existing bridge on the partially confined Filoha section is an important geomorphic and ecological river health stressor.

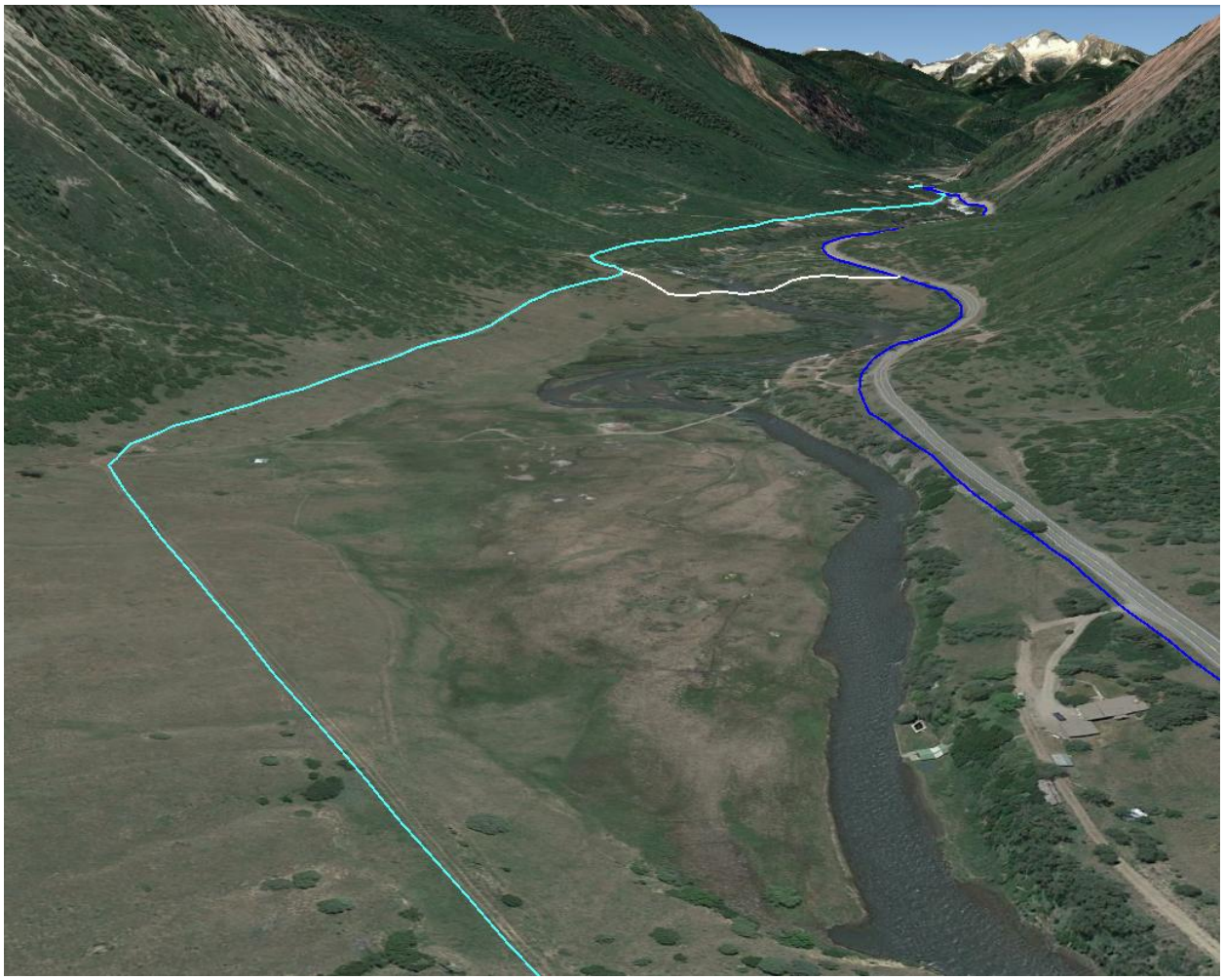


Figure 11 Looking upstream at the Filoha section where the river in the foreground is channelized and riparian vegetation on the east side (left in photo) has been cleared for agricultural use. Alignment B follows the old rail line on the upland hillslope above valley bottom.

Figure 12 On the Janeway South section, riparian vegetation was cleared from the east side riparian area (left in photo) which is also disconnected from the river by the abandoned railroad line that runs though the center of the valley bottom. Routing the trail along this line in Alignment B would probably eliminate river and riparian restoration potential on this impaired reach.

Figure 13 High density residential development on the Wild Rose section. Alignment A and B are both on upland hillslopes above the valley bottom through this section.

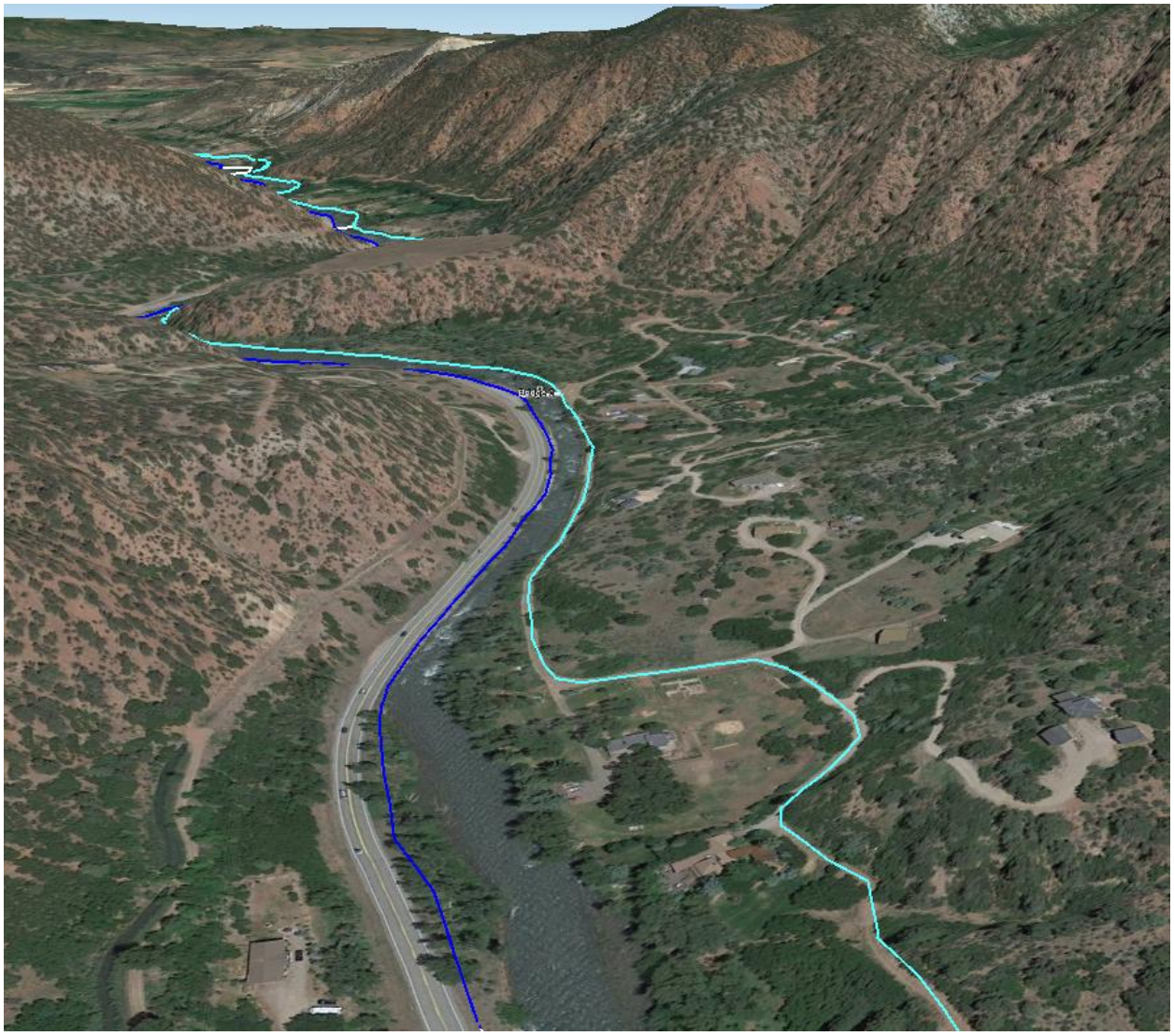


Figure 14 High density residential development on the Crystal River Country Estates section. Alignment B follows existing roads through the developed areas on this section.

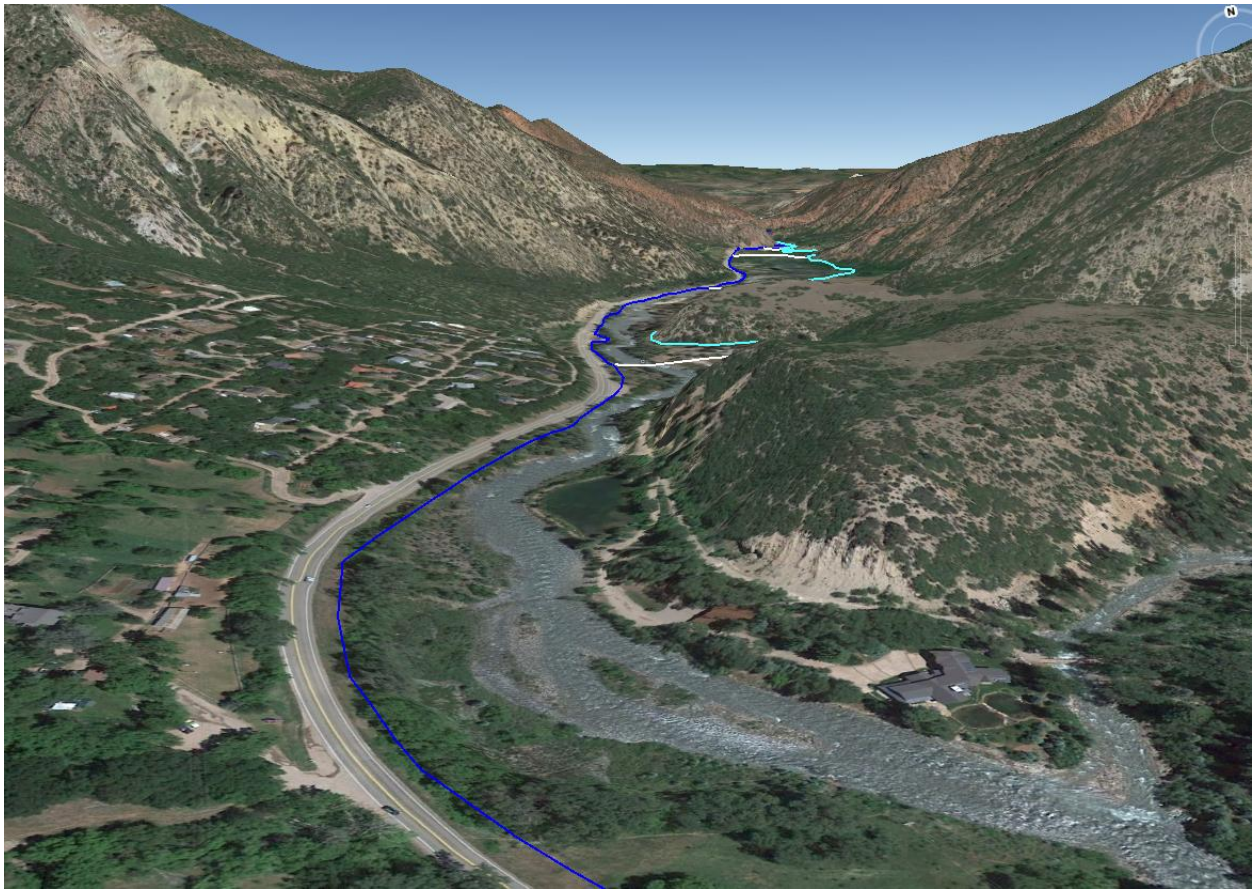


Figure 15 High density residential development (left) and development on the floodplain (right) on the Avalanche section. Alignment B detours away from the Crystal River altogether on this reach, but it could have impacts to Avalanche Creek.

Figure 16 Proposed bridge option 2 location.

Figure 17 Another view of the proposed bridge option 2 location.

Figure 18 Proposed bridge option 11 location.

Figure 19: Proposed bridge option 14 location.

Figure 20 For Alignment B on the Janeway North section, a 10-foot-wide paved path would be constructed on the abandoned rail line that runs through the middle of the wide riparian area east of the river.

Figure 21 Another view showing where a paved path would be constructed for alignment B on the Janeway North section.

Figure 22 The rail line east of the river on the Red Wind Point section is now used as an un-surfaced access road that isolates the floodplain and riparian area (right) from the river (left). For Alignment B, a paved path would be constructed.

Figure 23 Another section of the rail line upon which a paved path would be constructed for Alignment B on the Red Wind Point section. The rail line fill cuts off the floodplain and riparian area from the river. Constructing a paved path would introduce significant impacts and probably eliminate any future opportunity to restore connectivity.

Figure 24 Riparian area isolated from the river on the Red Wind Point section. The elevated rail-bed is seen on the left.

Sheet 1: Past Reports

Past reports on Crystal River health and habitat quality inform the analysis of existing condition on sections of the Crystal River that will be impacted by the trail. The left table shows river health grades from the Crystal River Management Plan (Lotic Hydrological, 2016) for reaches affected by each trail section and bridge option. Habitat quality assessment scores (left riparian, aquatic, and right riparian) from the Roaring Fork Habitat Quality Catalog (Malone and Emerick, 2007) are shown in the right table.

Crystal River Functional Assessment Grades

Crystal River Management Plan (2016)

Key to Grades	
A	Reference standard
B	Highly functional
C	Functional
D	Functionally impaired
F	Nonfunctional

Trail Section	CRMP reach number	Average grade	Bridge option	CRMP reach number	avg grade
7 Oaks	28	B	Bridge 1	28	B
CR Parcel			Bridge 2	28	B
Nettle Creek	27	B-	Bridge 3	28	B
Red Wind Point	26,25	B	Bridge 4	27	B-
CR Country Estates	25	B+	Bridge 5	25	B+
Andrews			Bridge 6	25	B+
Perham	24	B-	Bridge 7	24	B-
Janeway N	23	B	Bridge 8	24	B-
Janeway S			Bridge 9	23	B
Avalanche	22	A-	Bridge 10	22	A-
Narrows	22,21,20	B+	Bridge 11	20	A-
Filoha	19	B	Bridge 12	20	A-
Wild Rose	18	B	Bridge 13	18,19	B
Castle	16	B+	Bridge 14	15,16	B+
Hawk Creek	15	B			
Hays Falls	15	B			
Bear Creek	15	B			
Placita	14	B+			
McClure Pass	13,12	A-			

Roaring Fork Habitat Quality Catalog

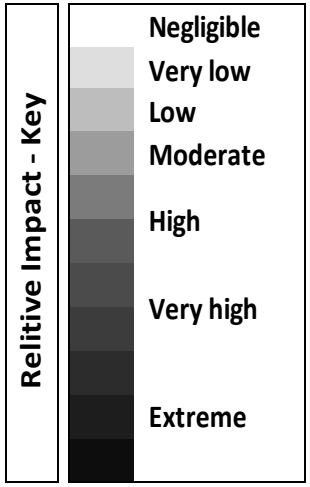
Malone and Emerick (2007)

Key to Grades	
HQ	High quality
SM	Slightly modified
MM	Moderately moified
HM	Heavily modified
SD	Severely degraded

Trail Section	Section	Left riparian	Aquatic	Right riparian	Bridge option	Section	Left riparian	Aquatic	Right riparian
7 Oaks	8	HM	HM	HM	Bridge 1	8	HM	HM	HM
CR Parcel					Bridge 2				
Nettle Creek					Bridge 3				
Red Wind Point					Bridge 4				
CR Country Estates					Bridge 5				
Andrews					Bridge 6				
Perham	7	SD	SD	SD	Bridge 7	7	SD	SD	SD
Janeway N					Bridge 8				
Janeway S					Bridge 9				
Avalanche	6	M	HM	M	Bridge 10	6	MM	HM	MM
Narrows		M		M	Bridge 11				
Filoha	5	HM	M	SM	Bridge 12				
Wild Rose	4	HM	M	M	Bridge 13	5	HM	MM	SM
Castle	3	HM	HM	HM	Bridge 14	3	HM	HM	HM
Hawk Creek									
Hays Falls	2	SD	HM	HM					
Bear Creek									
Placita									
McClure Pass	1	SM	SM	SM					

Sheet 2: Bridge Impact Analysis

River health impacts of the 14 proposed bridge options were also evaluated with the same framework used to evaluate trail alignments. The evaluation considers temporary impacts from construction as well as long-term impacts on flow regime, sediment regime, water quality, habitat connectivity and buffer capacity, floodplain function, riparian condition, river morphology, stability, and physical structure.



Crystal Trail Bridge and Spur
Qualitative Evaluation - River Impacts

Spur length (miles)	New or existing	Bridge option	Overall limpacts	Temporary impacts	Flow regime	Sediment regime	Water quality	Connectivity/buffer	Floodplain function	Riparian conndition	Morphology	Stability	Physical Structure
N/A	Existing	Bridge 1											
0.16	New	Bridge 2											
0.10	New	Bridge 3											
N/A	Existing	Bridge 4											
N/A	Existing	Bridge 5											
0.12	New	Bridge 6											
0.04	New	Bridge 7											
0.18	New	Bridge 8											
0.10	New	Bridge 9											
0.13	Existing	Bridge 10											
0.07	New	Bridge 11											
N/A	New	Bridge 12											
0.29	New	Bridge 13											
0.07	New	Bridge 14											

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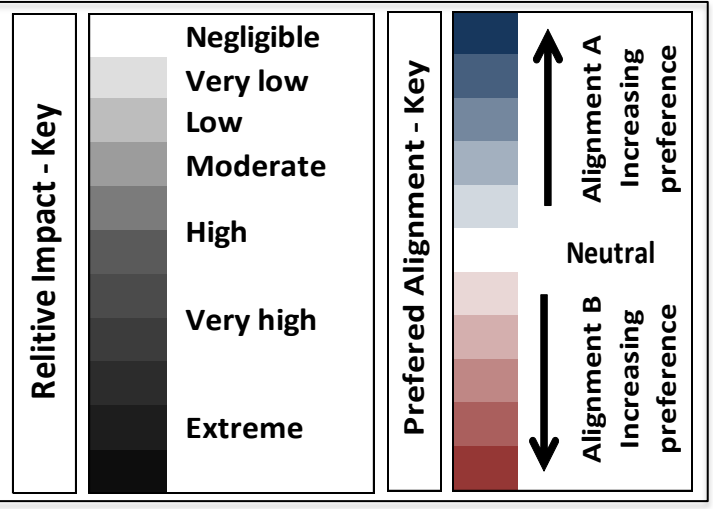
Sheet 3: Trail Impact Analysis

Potential river health impacts of the two proposed alignments of the Redstone segment of the Carbondale to Crested Butte Trail were qualitatively evaluated so that river health could be included as a factor in assessing environmental impacts. The evaluation considers temporary impacts from construction as well as long-term impacts on the critical aspects of river health: Flow regime, sediment regime, water quality, habitat connectivity and buffer capacity, floodplain function, riparian condition, river morphology, stability, and physical structure.

Degree of shading on the left chart below indicates the relative level of impact for the two proposed trail alignments. The ecologically preferred alignment (A or B) was determined by comparing impacts for each of the 19 trail sections. Blue shading indicates a river health preference for alignment A, and red for B. The keys at right provide interpretation.



Crystal Trail
Qualitative Evaluation - River Impacts

Trail Alignment A												Section	Trail Alignment B											
Note	Temporary impacts	Flow regime	Sediment regime	Water quality	Connectivity/buffer	Floodplain function	Riparian condition	Morphology	Stability	Physical Structure	Trail Alignment A	Row height scaled to river length	Trail Alignment B	Temporary impacts	Flow regime	Sediment regime	Water quality	Connectivity/buffer	Floodplain function	Riparian condition	Morphology	Stability	Physical Structure	Note
												7 Oaks												
												CR Parcel												
												Nettle Creek												
												Red Wind Point												1
												CR Country Estates												
												Andrews												
												Perham												
												Janeway N												1
												Janeway S												1
												Avalanche												2
												Narrows												
												Filoha												
												Wild Rose												
												Castle												
												Hawk Creek												
3												Hays Falls												3
												Bear Creek												
3												Placita												3
												McClure Pass												

Note 1: Impact evaluation includes lost opportunity to restore railroad impacts.
Note 2: Impact evaluation includes impacts to Avalanche Creek.
Note 3: Only one alignment proposed.

Crystal Trail
Prefered alignment for river health

Section	Relative preference (Blue = A, Red = B)	Prefered alignment
Row height scaled to river length		
7 Oaks		B
CR Parcel		
Nettle Creek		A
Red Wind Point		A
CR Country Estates		
Andrews		A
Perham		A
Janeway N		A
Janeway S		A
Avalanche		
Narrows		A
Filoha		A
Wild Rose		A
Castle		A
Hawk Creek		A
Hays Falls		
Bear Creek		B
Placita		
McClure Pass		

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