

Grant Kohrs Ranch Fence Report



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Executive Summary

The fences at Grant-Kohrs Ranch National Historic Site (GRKO) were assessed in summer 2010 to determine which have been installed by the National Park Service (NPS) and which were present prior to NPS acquisition of the park. All fences in the Pasture/Hayfields, Upland Pasture, Riparian Woodlands, and Development Zone Component Landscapes were assessed. About half of these fences have been installed by the NPS, and most of these still serve their intended purposes. However, some should be considered for removal in the near future including the cross fences of Westside Hayfields 1-4 and Effluent Fields 1-4. Discussion of the implications of these removals and suggestions for additional fence modifications/removals are included.

An additional objective of this research was to visually assess the impacts of grazing on the ranch, relative to fence locations. The area in which the most prominent damage was noticed includes a section of Johnson Creek located east of the Kohrs-Manning Ditch flume and south of stock shelters HS-24, HS-27, HS-29. It is recommended that this area be rehabilitated to improve ecological integrity and usefulness. Suggestions for improvements at Johnson Creek and additional areas within fields that exhibited minor undesirable vegetation, soil, and/or water characteristics are discussed within the specific field subsections.

Lastly, research on wildlife-friendly fencing techniques that GRKO can implement to facilitate co-existence with animals that frequent the ranch are included in an appendix. Suggestions on installing drop sections, alternatives to using five- and six-strand barbed wire, and ways to enhance visibility are presented to help minimize harm to deer, elk, and birds. These options should be implemented with careful consideration to GRKO's primary goal of conveying historical accuracy.

Introduction

Fences represent an important component of the historically and culturally significant Grant Kohrs Ranch National Historic Site (GRKO). They have an impact on ranch management, visitor experiences, and the ability to interpret its history. Fences also aid in conveying the spatial arrangement and historical uses of the fields within the cultural landscape, an objective that is central to the park's overall mission ⁽¹⁸⁾. However, since the acquisition of GRKO by the National Park Service (NPS) in 1972, many changes to the fences have occurred - over half of the existing fences were installed by the NPS in new locations. Although most of the individual replacements, additions, and removals of fences are inconsequential when considered singularly, the cumulative effects of these actions can negatively impact the ability of the ranch to convey the expansive, wide open feel that is characteristic of the historic GRKO.

The primary goal of this research project was to determine if existing fence locations and material types date to the historic period of the ranch (1860s - 1971/87), or if they were installed by the NPS and why. In addition, this project determined how the presence/absence of fences impacts ecological and cultural characteristics, and the report offers recommendations to alter fences to improve historical accuracy and ecological integrity of certain areas. After surveying the ranch to determine types and locations of fences as they existed in summer 2010, various sources of information including aerial and ground-based photographs, written documents, Section 106 Compliance Reports, and maps, were consulted to determine which fences were built by the NPS and which existed prior to NPS acquisition of the park. This information was used to update the GRKO GIS fence locations database and to create a map differentiating between NPS and non-NPS installed fences.

Of the fences assessed during this project, more than half were installed by the NPS and are therefore, non-historic. Recommendations on removing non-essential NPS-installed fences

to facilitate historical accuracy, while maintaining a functional ranch, are provided. The primary source on which these recommendations are based is from interviews with GRKO interpretive, maintenance, and resources staff. Staff members provided insightful, but often opposing opinions, as to which fences should be removed or retained. If there was no strong consensus or disagreement among interviewed staff, and if the authors of the report did not determine any strong ecological reasons for fences built after 1972 to be removed, then no recommendations are provided in that specific section of the report. It appears that most of the newer fences (post 1972) do indeed aid ranch management, and although they potentially impair the visual “openness” of the landscape, it should be noted that many of the fences cannot be seen from the areas which visitors frequent.

The second goal of this project was to identify areas within fields that display undesirable ecosystem attributes (soil erosion, compaction, loss of vegetation, etc.); recommendations, including non-fencing techniques, to mitigate damages in these areas are also provided. Where fencing is not currently recommended, it may be a viable approach should the extent of the damage increase over time. In addition to descriptions of these areas in this report, they are located on the fence map that was created from this project.

The main text of this report addresses the project’s primary goal, as described above. It is organized by Component Landscapes, as defined in the 2004 Cultural Landscape Report Part I, with each one presented in its own section. Following a brief overview of the characteristics and uses of the Component Landscape, the section is subdivided by fields, and the research results and recommendations are discussed in detail. The exception to this is the Development Zone Component Landscape, which is rather small and therefore, is not subdivided into sections based on the fields contained within it. For clarity, a satellite photograph of the field and fences being

discussed are often provided to supplement the written descriptions.

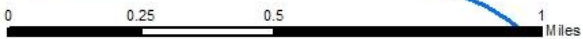
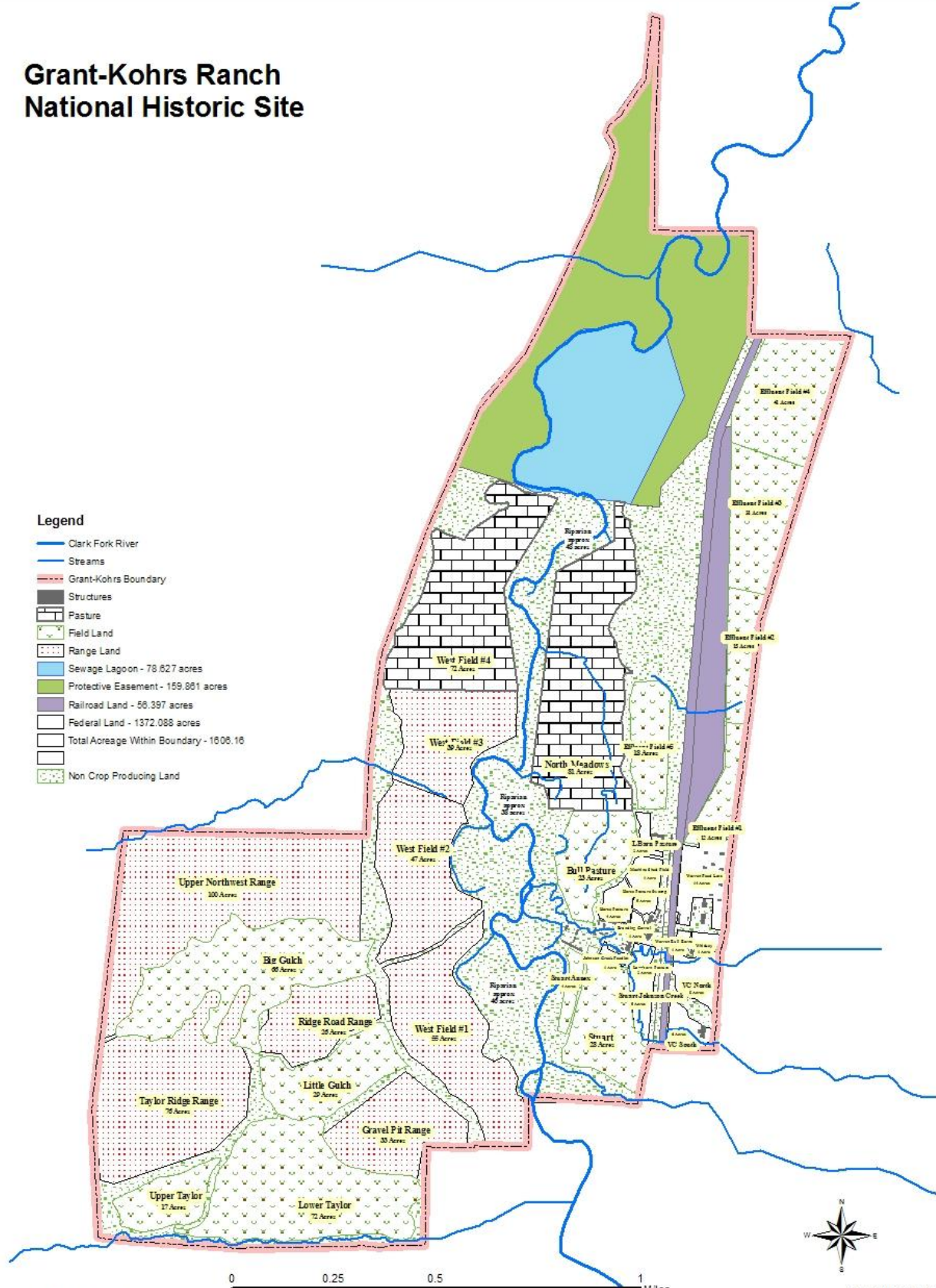
There are two additional areas that were identified during the course of this project which exhibit undesirable impacts due to overuse that do not belong to any of the Component Landscapes researched in this report. These are described near the end in a separate section titled 'Other Areas of Concern'. In addition to the main report, information about wildlife compatible fence techniques that GRKO could implement in future fence installations is also included. However, because this is not directly related to the primary goal of the project, it is presented in a separate appendix at the end of the main text.



Grant-Kohrs Ranch National Historic Site

Legend

- Clark Fork River
- Streams
- Grant-Kohrs Boundary
- Structures
- Pasture
- Field Land
- Range Land
- Sewage Lagoon - 78,627 acres
- Protective Easement - 159,801 acres
- Railroad Land - 56,397 acres
- Federal Land - 1372,088 acres
- Total Acreage Within Boundary - 1608.16
- Non Crop Producing Land



Produced by GRKO GIS

November 2009

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Pasture/Hayfield Component Landscape

Overview

Most of the fields within the Pasture/Hayfield Component Landscape are situated in the low-lying areas on either side of the Clark Fork River, except for Effluent Fields 1-4, which are located north of the Warren Hereford Ranch. Fields within this component landscape are used for grazing and hay production, and are separated from one another with various fence types. Although most fence locations and material types are historic, many have been installed by the NPS. Of the 55 fence segments assessed in this landscape, 29 (53%) are non-historic, and 24 (44%) are historic, and two sections (0.4%) have both historic and non-historic elements.

Stuart Field

The east boundary fence of Stuart Field is jackleg, in its original location and in-kind material type. The south half of this fence was installed first and existed as of 1947^(1a), while the north half was present by 1972. The south boundary fence, which is also the north boundary fence of the Cottonwood Creek Riparian area, is also jackleg. The exact date of construction for this fence is not known, but it was between 1983 and 1988^(10,11,1g). Its primary function appears to be as a protective barrier to prevent damage to the Cottonwood Creek Riparian Area, and therefore, is not recommended for removal. The north boundary of Stuart Field is marked by the Clark Fork River Bridge Road that runs east-west, and immediately to the north of this road is a vertical board fence with sections of jackleg on either side. This north boundary as it exists currently is representative of the historic era^(1j,2,4,11).

The west boundary fence of Stuart Field, which follows the east side of the Kohrs-Manning Ditch, is also jackleg and was installed in 1995⁽⁷⁾ or 1996⁽¹¹⁾ to create a new pasture for livestock management. It was not intended to be a permanent installation and because of this, it was decided that the impact of this fence would have ‘no effect’ on the cultural and historical landscape of the ranch⁽⁷⁾. In addition to the west fence, there is a short section of jackleg

extending from it to a wood gate that crosses the Clark Fork River Bridge Road, and another section of jackleg that connects the gate to the north boundary fence (Photo 1). Although the exact date of this installation is unknown, it was after the construction of the west fence in 1996. Its intended purpose was the same as the west fence, to facilitate efficient livestock management ⁽¹²⁾. The presence of the west boundary fence likely eliminates any adverse impacts to the Kohrs-Manning ditch because it restricts access by cattle from Stuart Field. Because of this, and the fact that these fences and the gate facilitate cattle management (e.g., pasture rotation and enhancing visitor contact with the animals) ⁽¹⁹⁾, as per their original intention, these sections are not recommended for removal. However, if GRKO is true to its mission of preserving the historical integrity of the ranch, these sections should be removed because they were installed by the NPS ⁽¹⁹⁾. If this is done, alternatives should be developed (e.g. hiring more staff) to ensure that management goals can still be achieved without the fence ⁽⁹⁾.

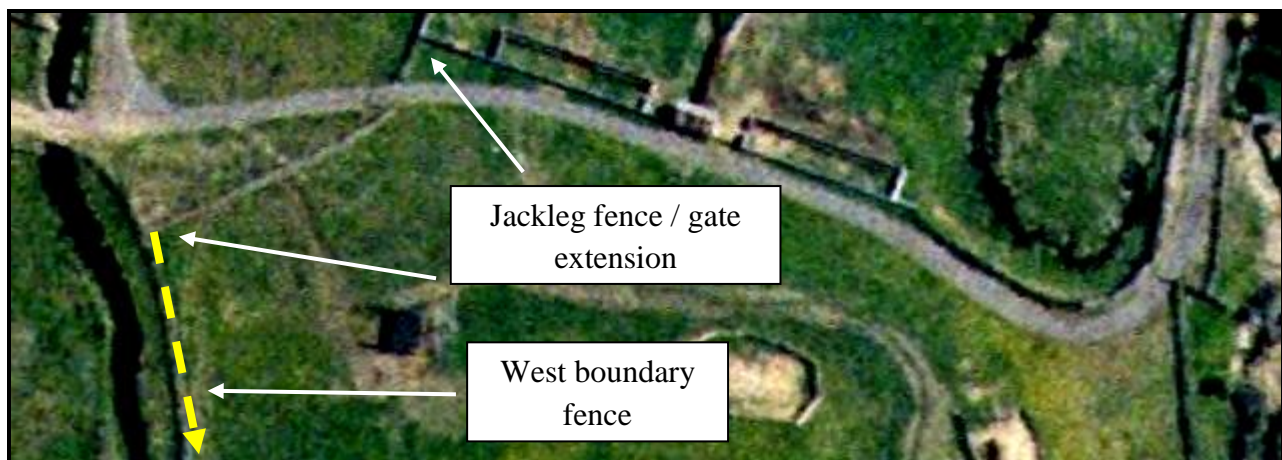


Photo 1. Northwest corner of Stuart Field with jackleg fence and gate extension from the west boundary fence.

Stuart Annex

Jackleg fences characterize all boundaries of Stuart Annex. The fence on the west boundary of Stuart Annex, which also marks the east boundary of the South Riparian portion of the Riparian Woodland Component Landscape, was originally installed by the NPS between 1983 and 1988 ^(1f,1g). However, it was moved further west towards the Clark Fork River in the summer of 2001 to provide horses with shelter in the winter and shade in the summer ⁽⁷⁾. The south boundary of Stuart Annex is essentially a continuation of this west boundary fence; thus, it is assumed that it was constructed and subsequently rerouted at the same time as the west fence. None of the fences in this field are historic; however, they serve as important barriers to exclude livestock from the adjacent Cottonwood and South Riparian areas. To avoid ecosystem degradation due to overgrazing, and to ensure that livestock and people are not harmed by the concentrations of heavy metals in the area ⁽¹¹⁾, these fences are not recommended for removal (see ‘Riparian Woodland Component Landscape’ section for alternatives to complete removal).

The fence on the east boundary of Stuart Annex, just beyond the Kohrs-Manning Ditch serves as the barrier to Stuart Field. Because the majority of the length of the ditch in Stuart Annex appears to be in good condition, and it provides cattle access to water, a fence is not recommended currently. However, there are two locations that were identified as areas of concern and should be monitored to ensure that further damage is not incurred. The first section is on the north end of the ditch, where it appears that excessive widening of the channel is occurring due to pugging and hummocking. Pugging and hummocking result from grazing on moist soils, and cause soil compaction and uplift, respectively (Photo 2). These are undesirable characteristics because they can reduce land quality and usefulness. The second damaged area is near the middle of the field where cattle cross the ditch, thus exposing the soil (Photo 3). The

map that is associated with this report, located in GRKO GIS database, can be consulted for exact locations and aerial extent of the damage.



Photo 2. Pugging and hummocking along the Kohrs-Manning Ditch in the Stuart Annex Field at the Clark Fork River Bridge Road.

Photo 3. Exposed soil where cattle cross the Kohrs-Manning Ditch in Stuart Annex Field.

If damage along the streambank increases to an unacceptable level, and because Stuart Annex is subjected to greater grazing pressure than Stuart Field, a more appropriate location for the fence might be on the west side of the Kohrs-Manning Ditch. With the inclusion of water gaps in the new fence, overall impact to the streambank might be reduced. That said, this is an irrigation ditch and therefore, its purpose is not to represent a natural system but rather, to serve as a tool for water movement on the ranch. Thus, damages to this channel can be repaired with a backhoe.

There is an additional, unnamed area in the north of the Stuart Annex field that contains historic-era farming equipment and is fenced with jackleg. It is located between the current north fence of Stuart Annex and the fence along the Clark Fork River Bridge Road (Photo 4). This north fence of this section, along the Clark Fork River Bridge Road, was part of the jackleg installation on the east side of the Kohrs-Manning Ditch in Stuart Field in 1995 ⁽⁷⁾ or 1996 ⁽¹¹⁾. The rest of this area was fenced between 1994 and 2001 ^(1j, 11). Historically, a portion of this area was used to stack hay, and when doing so, was enclosed with a temporary fence. This area is still used for that purpose, although the fenced area is larger than in the past.

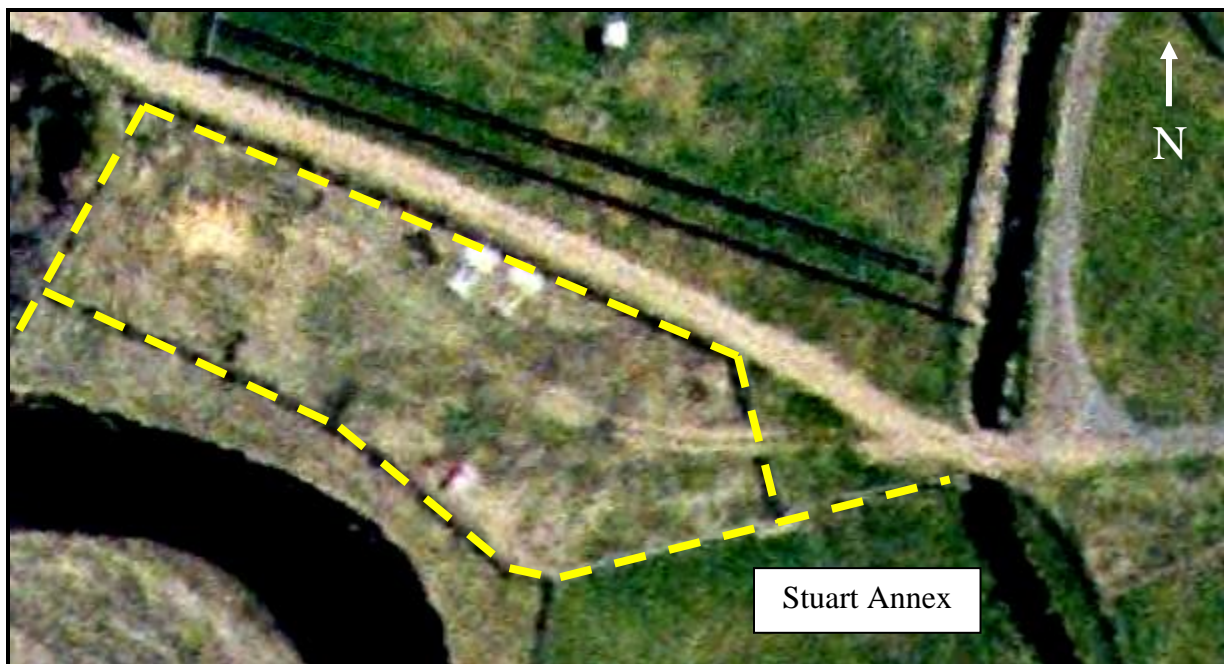


Photo 4. Non-historic fenced area between the north side of Stuart Annex and the Clark Fork River Bridge Road.

Through conversations with GRKO staff, there are conflicting thoughts about this area. One staff member indicated the desire to remove the portion of the jackleg fence along the Clark Fork River Bridge Road because it impedes visitors' ability to view the historic farming

equipment ⁽⁸⁾. Conversely, this section facilitates effective cattle management ⁽¹⁹⁾, similar to fences in Stuart Field. The jackleg fence used is consistent in type with the majority of fences used in this area historically. Consequently, it does not impede greatly on the ability to interpret the history of the ranch as GRKO intends. However, if the difficult viewing of the machinery is of major concern to the park, there are two potential compromise solutions between the two opposing viewpoints presented above. First, GRKO could relocate the farming equipment to an area that is more readily apparent, and keep the fence. Second, GRKO could remove the portion of the fence along the road, thus enhancing viewing of the equipment, and simply erect a temporary fence when it is needed to protect hay. The removal of this fence would not greatly affect cattle management because the gate on the south boundary (north boundary of Stuart Annex) of this area would serve as the barrier to prevent cattle from leaving or entering Stuart Annex.

Bull Pasture

This field is fenced entirely with jackleg. The north boundary fence that separates the Bull Pasture from the North Meadows was created between 1979 and 1983 ^(1e,1f) by the NPS, and no fence existed prior. The east jackleg fence that separates the Bull Pasture from L-Barn Field South appears to represent the historic era, with the exception of the portion that was extended northward in 1975, when the NPS created the Boneyard (see section 'Effluent Field 5' for details about the Boneyard) (Photo 5). The southeast fence that parallels the west side of the Kohrs-Manning Ditch is not historic, as it was built between 1983 and 1988 ^(1f,1g,11). The south boundary of the Bull Pasture is currently jackleg. This was installed in 1995 and replaced a historic fence constructed of a patchwork of various materials that posed a safety risk to people and livestock ⁽⁷⁾. The new fence was placed in the same location as the historic fence and jackleg

was chosen because of the wet conditions in the area. The west boundary fence was installed between 1984 and 1988 ^(1f,1g) to exclude cattle from the Clark Fork River riparian area. Because of the valid justifications of adding and altering non-historic fences to this field, and because of the importance of The Boneyard in daily operations of GRKO, no changes to fences in this field are recommended.

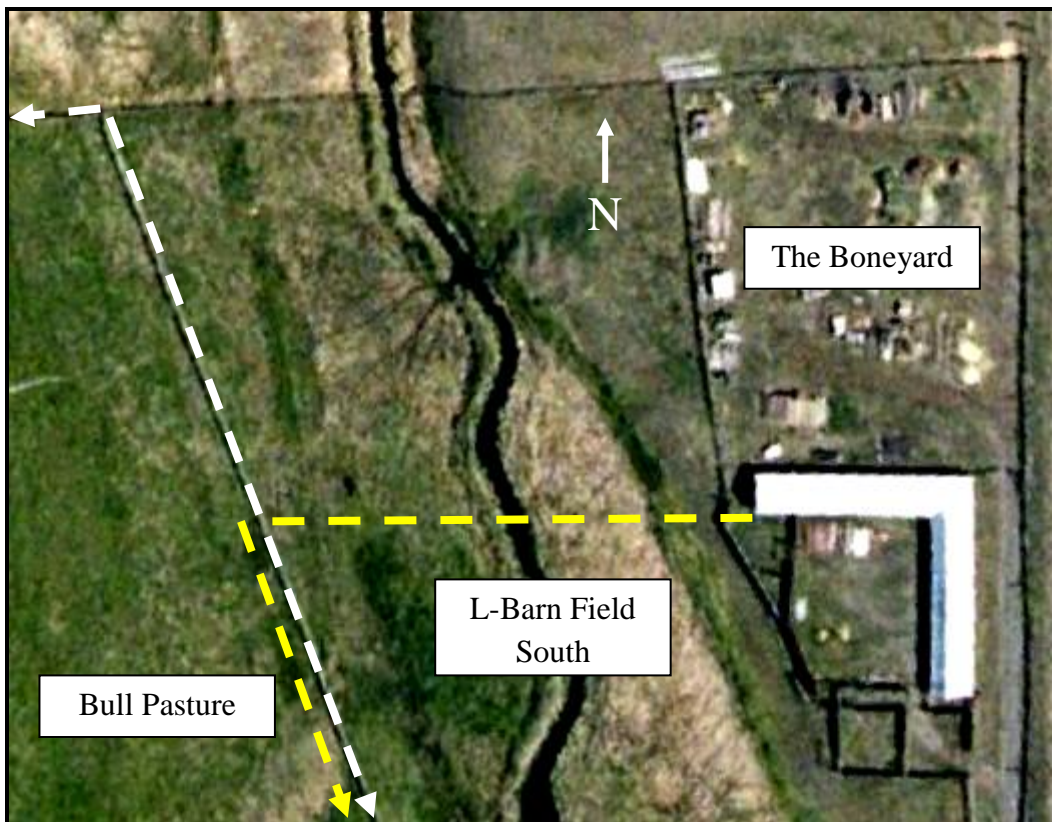


Photo 5. Historic (yellow line) and current (white line) boundaries of the Bull Pasture and north historic boundary (yellow line) of L-Barn Field South.

Effluent Field 5 (AKA L-Barn Field)

The south boundary of Effluent Field 5 is a jackleg fence. Although built with traditional materials⁽⁴⁾, it is not historic in its placement. Prior to the construction of The Boneyard by the NPS in 1975 ⁽¹⁰⁾, the fence came directly off the north side of the L-Barn, traveling west, and terminating in the northwest corner of L-Barn Field South ^(1b,1d,2,4). With the creation of The

Boneyard, the south boundary fence of Effluent Field 5 was moved north from the L-Barn, to where it lies currently (Photo 6). Although the creation of The Boneyard is within the period of significance, it is a NPS installation and therefore is not historical.



Photo 6. Historical and current southern boundaries (yellow and white lines, respectively) of Effluent Field 5.

The north and east boundary fences of Effluent Field 5 are currently constructed of metal posts and barbed wire. The original fences were present by 1947^(1a) however, the original material used for this fence is unknown. The current fence is most likely a NPS replacement, as the fence is in very good condition. It may have been part of the fencing that Montana

Conservation Corps (MCC) did in summer 1995 because it is identical to the fences that MCC installed on the east and west boundaries of the nearby L-Barn Field North ⁽¹⁴⁾. However, there is no documentation to support this unequivocally. It is probable that the original material for this fence was indeed barbed wire with metal or wood posts, because barbed wire was used extensively in fields away from the Home Ranch area, and the use of metal posts date to about 1940 ⁽¹¹⁾. Also, the railroad corridor, which is immediately to the east, was fenced prior to 1983 ⁽¹¹⁾; therefore, the fences on the north and east boundary will be considered historic.

The fence along the west boundary of Effluent Field 5 is constructed primarily from metal posts and barbed wire and was installed between 1994 and 2001 ^(1j,11). The exception to the metal post and barbed wire fence on this boundary occurs in the northwest corner of the field. There is a short remnant section of metal post and barbed wire fence that has been abandoned in favor of a length of jackleg fence (Photo 7). This section travels west to cross the Kohrs-Manning Ditch and then northeast to meet the gate on the Warren Pumphouse Road. It was installed in 1995 at the time the west boundary fence of L-Barn Field North was constructed ⁽⁷⁾.

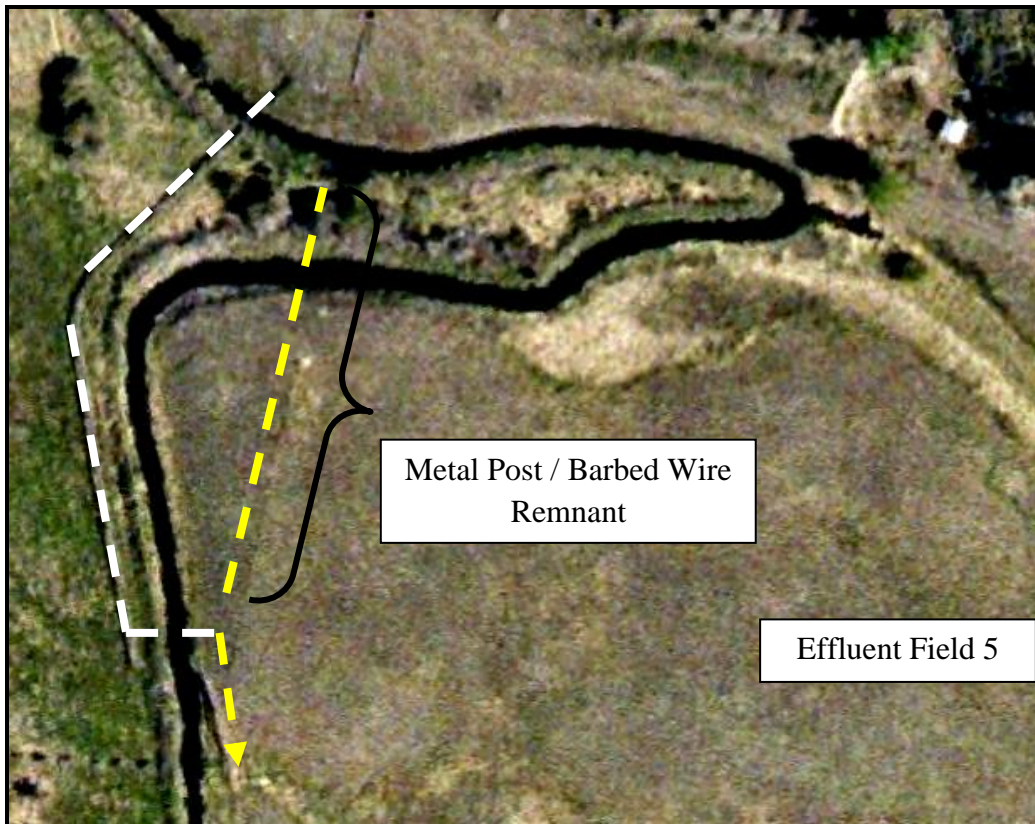


Photo 7. Metal post and barbed wire remnant and existing fences (yellow line) and jackleg fence (white lines) in the northwest corner of Effluent Field 5.

L-Barn Field North

The north boundary of L-Barn Field North is characterized by a wood post and barbed wire fence and was present by 1947^(1a). Although the fence that is present now is most likely not the original fence, there is no documentation of any substantial replacements or alterations to the fenceline as it lies today. The west fenceline is constructed from metal posts and barbed wire, and parallels the Kohrs-Manning Ditch. It was installed by the NPS in 1995^(10,7,5). There is essentially no south boundary to this field, as the east and west fences converge at a gate on Warren Pumphouse Road.

The east boundary fence of the L-Barn Field North adjacent to the Barrow Pit was present by 1947^(1a). In summer 1995, MCC installed a replacement that was constructed from

metal posts and barbed wire. The original material used for this fence, as well as the portion surrounding The Dump, is a mixture of different types, as can be seen from the ‘before and after’ photos from this installation ⁽¹⁴⁾. Specifically, the old fence around The Dump appears to be jackleg braces with woven wire or a combination of woven wire and barbed wire (Photo 8). Beyond the dump to the north, the pre-existing fence was made of cedar posts, with metal posts as needed (probably for repairs through time), and a mixture of woven wire, smooth wire, and barbed wire (Photo 9). Thus, the present location of the fence is historic, but the type of material chosen for the replacement is ambiguous as to its historical significance.



Photo 8. Fence around The Dump before replacement by Montana Conservation Corp in summer 1995.



Photo 9. Old fence north of The Dump before replacement by Montana Conservation Corps in summer 1995.

North Meadows

The north boundary fence of North Meadows is constructed from metal posts and barbed wire and was present by 1947 ^(1a). The west fence is also made of metal posts and barbed wire was installed in 1994 ⁽¹¹⁾. The south boundary of the North Meadows is characterized with jackleg fence, which exists because of the extension of the jackleg fence from the northwest corner of L-Barn Field South, westward across the Clark Fork River (see section ‘Lower Yard Fields’ for details). The east side of the North Meadows has no fence, as the Kohrs-Manning Ditch serves as the barrier to L-Barn Field North and Effluent Field 5.

Effluent Fields 1-4 (AKA Front Fields)

The north, east, and west outer-boundary fences surrounding Effluent Fields 1-4 consist of metal posts and barbed wire. The east and west fences were installed by 1947 ^(1a) and the north fence was present by 1965 ^(1b). The south boundary of Effluent Fields 1-4 borders the

Warren Hereford Ranch Component Landscape, and consists of several fences/materials on each side of the entrance gate. To the west of the gate, the fence posts alternate wood and metal, with a combination of woven wire and barbed wire. To the east of the entrance gate, the fence is vertical board, followed by the back wall of cow shed HS-73, and then a section of post and rail that meets with the metal post and barbed wire fence of the entire east boundary of Effluent Fields 1-4 (Photo 10). This group of fences can be considered historical, in terms of placement⁽¹¹⁾, but the exact type of fencing materials used historically has not been determined.



Photo 10. South boundary fence types of Effluent Field 1, east of the entrance gate.

There are three cross fences that separate the four Effluent Fields, all of which run east-west and are constructed from metal posts and barbed wire. The fence between fields 1 and 2 was installed by Con Warren, prior to 1965^(1b). The other two were constructed in 1997, at the time when GRKO decided to utilize the City of Deer Lodge's effluent water for irrigation of Effluent Fields 1-4, as well as Effluent Field 5⁽⁷⁾. The purpose of the additional cross fences was to employ approximately a five-day rotation schedule with each field (including Effluent Field 5, presumably) in one of four phases: irrigation, drying, grazing, or resting. In compliance forms

from 1997 it was acknowledged that these fences would have an impact on the visual landscape. However, it was determined that this negative aspect outweighed the possibility of revitalizing the Effluent Fields, while providing a service to the City of Deer Lodge out of concern for the environment ⁽⁷⁾. Because these cross fences aid in cattle management and most visitors do not tour this area, it is not necessary to remove the fences. However, if in the future the area is frequented by visitors, then park management may want to consider the fences' impact on the cultural landscape.

West Hay Fields

Each of the four West Hay Fields are bounded on the west by the Kohrs Ditch, the Kohrs Ditch Road, and wood post and barbed wire fence sections which was installed in 1940 ^(10,11). There are three cross fences running east-west that separate West Hay Fields 1-4; they are constructed from metal posts and barbed wire. The first of these cross fences was installed in 1995 ^(15,16), thereby separating Field 4 from the rest of the West Hayfield. The purpose of this fence was to supply additional pasture in the summer and the West Hayfield 4 was chosen because it was difficult to provide adequate irrigation to that area for hay production, the traditional use ⁽⁷⁾. In the NPS compliance report for this project it was decided that the addition of this non-historic fence would be unobtrusive to the visual landscape. The remaining two cross fences were constructed in 1997, thereby creating West Hayfields 1, 2, and 3 ^(11,16).

The following details focus on fences that are unique to each West Hayfield that were not previously described:

Field 1

The east boundary fence, north of the South Pumphouse is jackleg and was originally installed by the NPS between 1979 and 1983 ^(1e,1f). In summer 2001, this fence was moved east toward the Clark Fork River to provide shelter for stock ⁽⁷⁾. In the compliance report for this project, it was noted that this alteration was acceptable because it more closely mimicked the placement of the original fence installed in that area by Con Warren. However, through this research, no fence was identified to have existed prior to the NPS installation between 1979 and 1983. South of the South Pumphouse, the fence is metal post and barbed wire and was erected by the NPS between 1972 and 1979 ^(1c,1e). The south boundary fence of Western Hay Field 1 is wood posts and barbed wire and was installed ca. 1930s ⁽¹¹⁾.

Field 2

The east boundary fence is primarily jackleg, with the exception of a small stretch of metal post and barbed wire on the north end of the east fence. The jackleg section was built between 1979 and 1983 ^(1e,1f) and the barbed wire section was built in 1994 ⁽¹¹⁾.

Field 3

The east boundary fence is metal post and barbed wire and was installed in 1994 ⁽¹¹⁾. The cross fence separating Field 3 from Field 4 is nearly all metal post and barbed wire, as mentioned above; however, there is a short section of jackleg on the west side of the entrance gate to Field 4 (Photo 11). It is not known if this portion was built in 1995 at the time the rest of the cross fence was installed.

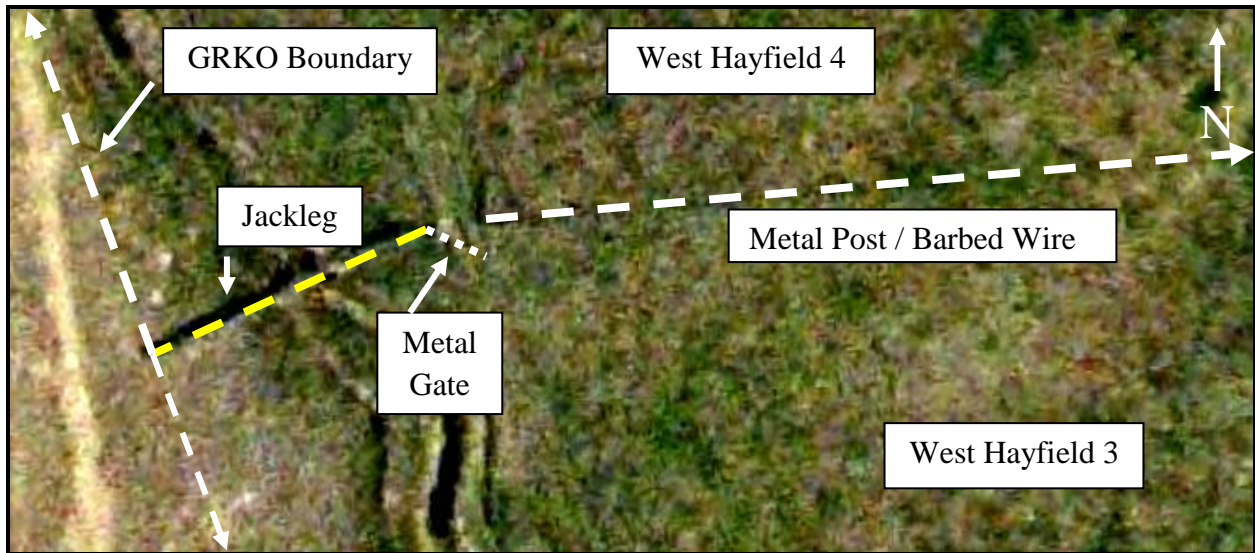


Photo 11. Cross fence between Western Hayfields 3 and 4.

Field 4

The north boundary fence is made from metal posts and barbed wire and was present by 1965^(1b). The east boundary fence is also metal post and barbed wire and was installed in 1994⁽¹¹⁾.

The cross fences themselves are not a visual distraction from a distance, but the way they are utilized and managed (e.g. hay, pasture), if different on adjacent fields, can create a discontinuous or “chopped up” feel of what used to be one large expanse. This is especially apparent towards the end of the summer and into the fall when haying occurs. GRKO staff has indicated the desire to reduce the number of these fences or eliminate them altogether. If all fences were eliminated it would increase the need to move cows and possibly install temporary electric fences so that areas that they prefer do not receive too much pressure. It is recommended that the fences be removed in stages, so management plans can be developed to avoid overgrazing. The cross fence between Fields 2 and 3 causes the most visual intrusion from a distance; therefore, this fence is recommended to be removed first. The fence between Fields 1

and 2 that parallels the Clark Fork River Bridge Road is not as much of a concern because the road splits those two fields anyway. The fence that separates Field 3 from Field 4 should be the last priority because of its distance from the main visitor areas. Also, inadequate irrigation to this field reduces its productivity for hay as compared to the other fields, but provides a useable pasture for cows ⁽¹⁹⁾.

Upland Pasture Component Landscape

Overview

The Upland Pasture Component Landscape became part of the historic Grant, Kohrs, and Warren Ranch in the 1930s and the property boundary was fenced about the same time. Traditional uses of this area include grazing and hay production, and irrigation is provided via lateral ditches sourced from Taylor Creek on the park's southern boundary and the West Side Ditch from the Clark Fork River. Of the 24 fence segments assessed in the Upland Pasture, 12 (50%) are non-historic and 12 (50%) are historic. All of the interior fences in the Upland Pasture were installed by the NPS ^(18,11).

Upper and Lower Taylor Fields

There is no fence that separates Upper Taylor from Lower Taylor, but the two are separated by the Westside Ditch and the Upland Pasture Road. The south, east, and west boundary fences are constructed from wood posts and barbed wire, and identify the GRKO park boundary. They were installed ca. 1930s ⁽¹¹⁾. On the north boundary is a metal post and barbed wire cross fence that separates these two fields from Taylor Ridge Range and Little Gulch. This fence was installed in 1998 ^(6,10,11,7) to control grazing pressure. The northeast boundary is marked by the Gravel Pit Road and a metal post and barbed wire fence that was installed in 1993 to protect the newly reclaimed Gravel Pit pasture area ⁽¹¹⁾.

In addition to the main fences that mark the outsides of the Taylor Fields, there are three sections within the fields themselves that are fenced. First, there is an electric fence along the north side of a ditch just west of the east boundary fence. It follows the length of the ditch from near the Gravel Pit Range Road to the GRKO property line on the south (Photo 12). The precise installation date of this fence is not known, but it was probably between summer 2005 and spring 2008, at which time the ditch was lined with plastic by the NPS to prevent flooding of nearby

private residences to the east ⁽⁷⁾. The second and third fenced areas within the Taylor Fields are along the south boundary fence that parallels Taylor Creek, where there are two small sections of fence that completely enclose the waterway. On the south of these two sections is the same wood post and barbed wire fence that marks GRKO property boundary, and the other three sides are constructed of metal posts and barbed wire. These two exclosures represent two stretches of Taylor Creek that were rerouted when the Westside Prison Road was upgraded in the mid-1990s ⁽⁶⁾. They were most likely installed to exclude cattle, thereby increasing the probability of successful restoration of these new Taylor Creek sections.



Photo 12. Approximate start and end points of the electric fence that follows the contour of the ditch at the east edge of Lower Taylor Field near GRKO property boundary (yellow lines).

Taylor Ridge Range

The fence that marks the west boundary of the Taylor Ridge Range is wood post and barbed wire and identifies the GRKO park boundary. It was constructed ca. 1930s ⁽¹¹⁾. The south boundary fence is the same metal post and barbed wire cross fence that is shared with the north boundary of the Taylor Fields. It was installed in 1998 ^(6,10,11,7) to control grazing pressure. Upon nearing the Upland Pasture Road, this metal post and barbed wire fence crosses it and the Westside Ditch and continues east to delineate the Taylor Fields from Little Gulch. However, at

this point an electric fence travels north and marks the east boundary of Taylor Ridge Range (Photo 13). It follows the Upland Pasture Road and meanders to the west to form the northern boundary of the Taylor Ridge Range. This electric fence does not completely enclose the Taylor Ridge Range because just before meeting the main GRKO boundary fence on the west, it turns and travels north. This electric fence was installed by the NPS ca. 2002 ⁽¹¹⁾.

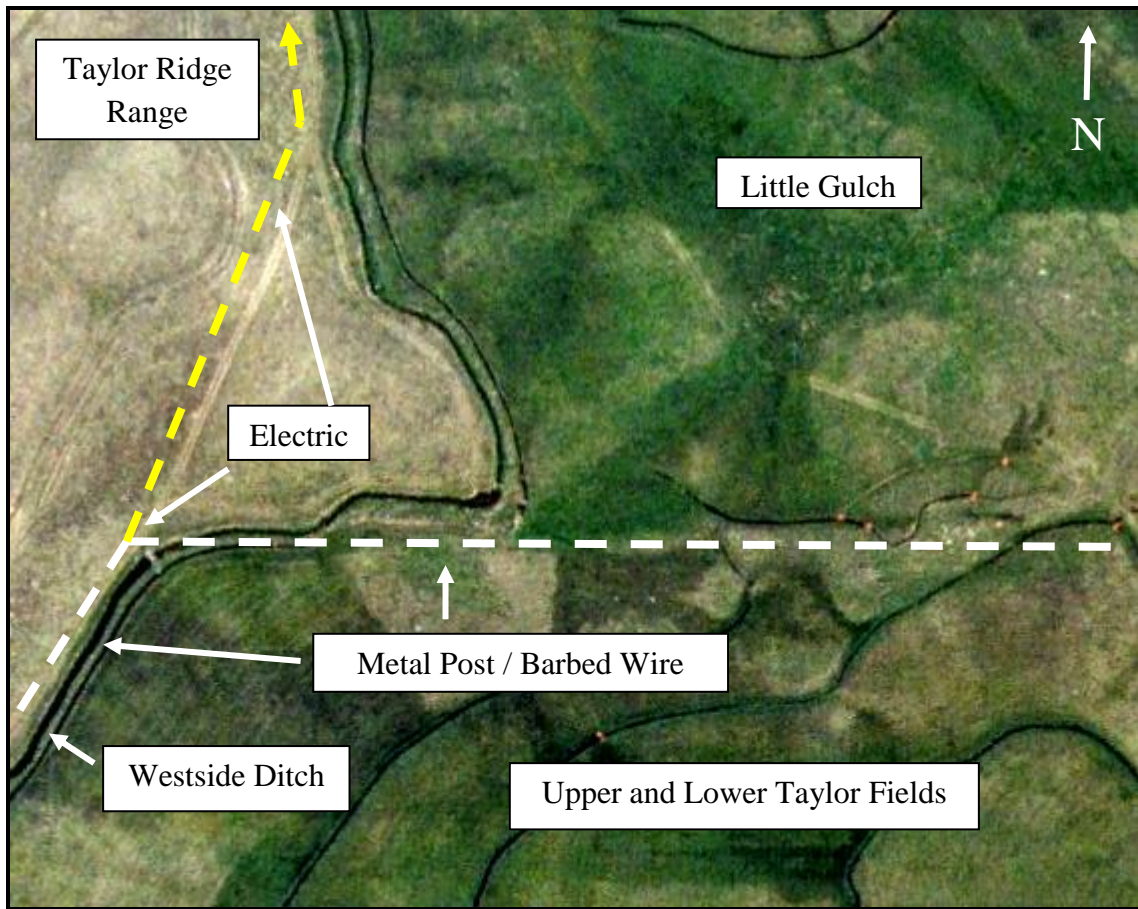


Photo 13. Cross fences (white lines) and electric fence (yellow line) that separate Upper and Lower Taylor Fields, Little Gulch, and Taylor Ridge Range.

Big Gulch

Big Gulch is surrounded on three sides with the electric fence that shares boundaries with the Upper Northwest Range and the Taylor Ridge Range. It was installed by the NPS ca. 2002⁽¹¹⁾. The east boundary of Big Gulch, near where the Clark Fork River Bridge Road and the Kohrs Ditch Road intersect, consists of a wood post and barbed wire fence and two wire gates. The wood post and barbed wire fence was installed ca. 1930s⁽¹¹⁾.

Upper Northwest Range

The north, east, and west fences of the Northwest Range are constructed from wood posts and barbed wire and mark GRKO property boundary. They were originally constructed ca. 1930s⁽¹¹⁾. The south boundary is delineated by the electric fence installed by the NPS ca. 2002 that meanders around the Taylor Ridge Range and Big Gulch.

Little Gulch

The east edge of Little Gulch is marked with the wood post and barbed wire fence that follows the Kohrs Ditch Road. This was installed ca. 1930s⁽¹¹⁾. The southeast boundary is marked by the same metal post and barbed wire fence that identifies the northwest edge of the Gavel Pit Range. It was installed by the NPS in 1993⁽¹¹⁾. The south boundary of Little Gulch is the metal post and barbed wire cross fence that was installed by the NPS in 1998^(6,10,11,7) to separate it from the Taylor Fields. There is no fence to mark the west boundary, as the Westside Ditch serves as a barrier. There is also no fence to mark the northern boundary, but instead is an auxiliary ditch and the uphill slope of the Ridge Range.

Gravel Pit Range

The northeast boundary of the Gravel Pit Range is the wood post and barbed wire fence that was installed ca. 1930s⁽¹¹⁾ and follows the Kohrs Ditch Road. Upon reaching the south

boundary of GRKO property, this fence makes a 90° turn to the west, thereby marking the south boundary of the Gravel Pit Range. This wood post and barbed wire fence again makes a 90° turn to head south and mark the east boundary of the Gravel Pit Range as well GRKO property boundary (Photo 14). This fence was installed ca. 1930s⁽¹¹⁾. The northwest boundary of the Gravel Pit Range is marked by the metal post and barbed wire fence that is the shared fence with the southeast border of Little Gulch. This fence turns to form the southwest border of the Gravel Pit Range, paralleling the Gravel Pit Range Road (Photo 14). It was installed in 1993⁽¹¹⁾.

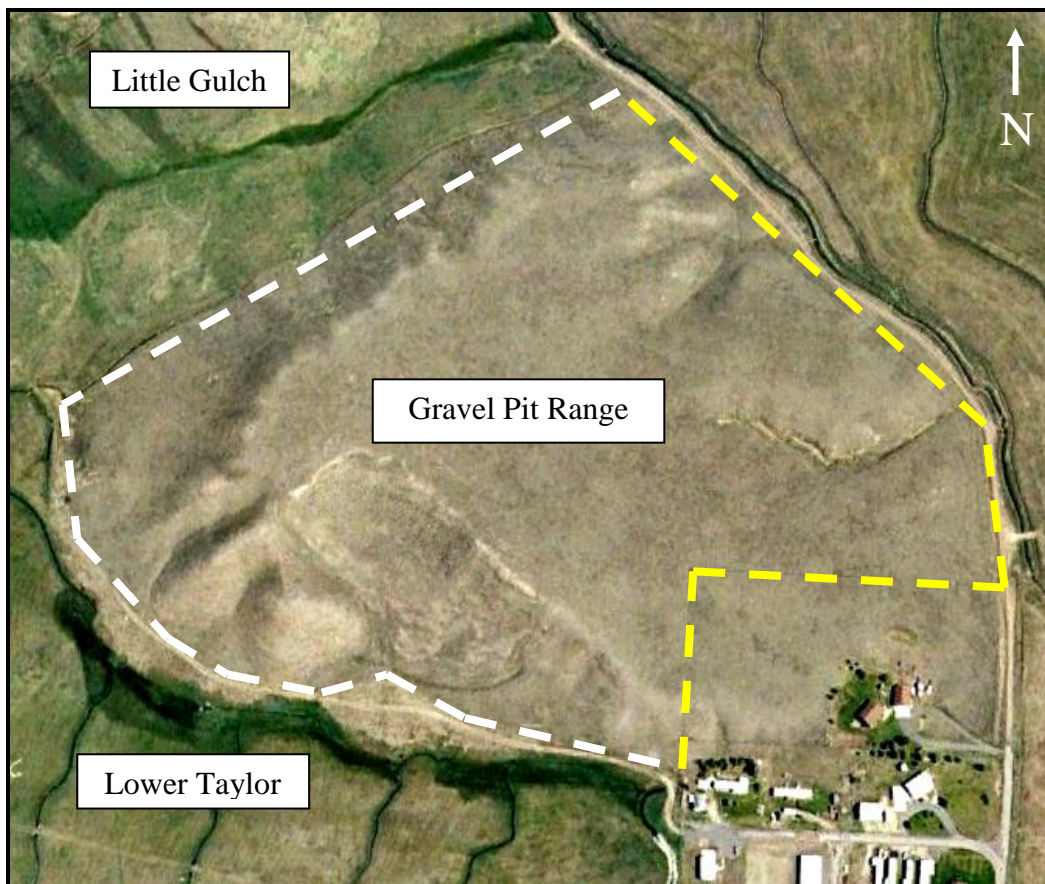


Photo 14. Metal post (white lines) and wood post (yellow lines) barbed wire fences of the Gravel Pit Range.

Riparian Woodlands Landscape

Overview

The Riparian Woodland Component Landscape includes the Clark Fork River, Johnson Creek, and Cottonwood Creek, and their floodplains. Areas within the Riparian Woodland were fenced beginning in the 1980s, and by 1994 all sections were fenced ⁽¹¹⁾. These fences serve to exclude cattle and were installed for two main reasons. First, these areas are the most ecologically diverse spots on the ranch, containing numerous native and non-native species, and preservation of this diversity is important ⁽¹¹⁾. Second, some areas contain high concentrations of heavy metals from mine tailings that have been distributed downstream to GRKO from Butte and Anaconda. These mine tailings represent potential health hazards to people and livestock; as such, the area was fenced. These two reasons for fencing provide the additional benefit of preservation of the greater Clark Fork River ecosystem ⁽¹¹⁾. Of the 20 fence sections assessed in this area, 16 (80%) are non-historic, 3 (15%) are historic, and the historic status of one fence section (0.5%) is unknown.

North Riparian

The east and west borders of this area are fenced with metal posts and barbed wire and were installed by the NPS by 1994 ⁽¹¹⁾. The north boundary fence, installed prior to 1947 ^(1a), is also metal post and barbed wire, but appears to be rather old and in one section along the Clark Fork River, is in need of replacement (Photo15). The south boundary fence is jackleg on both sides of the Clark Fork River, and was installed between 1979 and 1983 ^(1e,1f).

There is a section of the west boundary fence that crosses the Clark Fork River that is constructed from PVC pipes that hang from just above the water line. It was installed in 2006 to prevent neighboring cattle from trespassing on Grant Kohrs Ranch ⁽⁷⁾. This type of fence was

chosen because it deters cattle from crossing the park boundary, yet allows for navigation of the river by recreationists ⁽⁷⁾. Although this fence is visually unappealing, it is not recommended for removal because it still serves its intended purpose, and does not interfere with visitor experience due to its distance from the Home Ranch area.

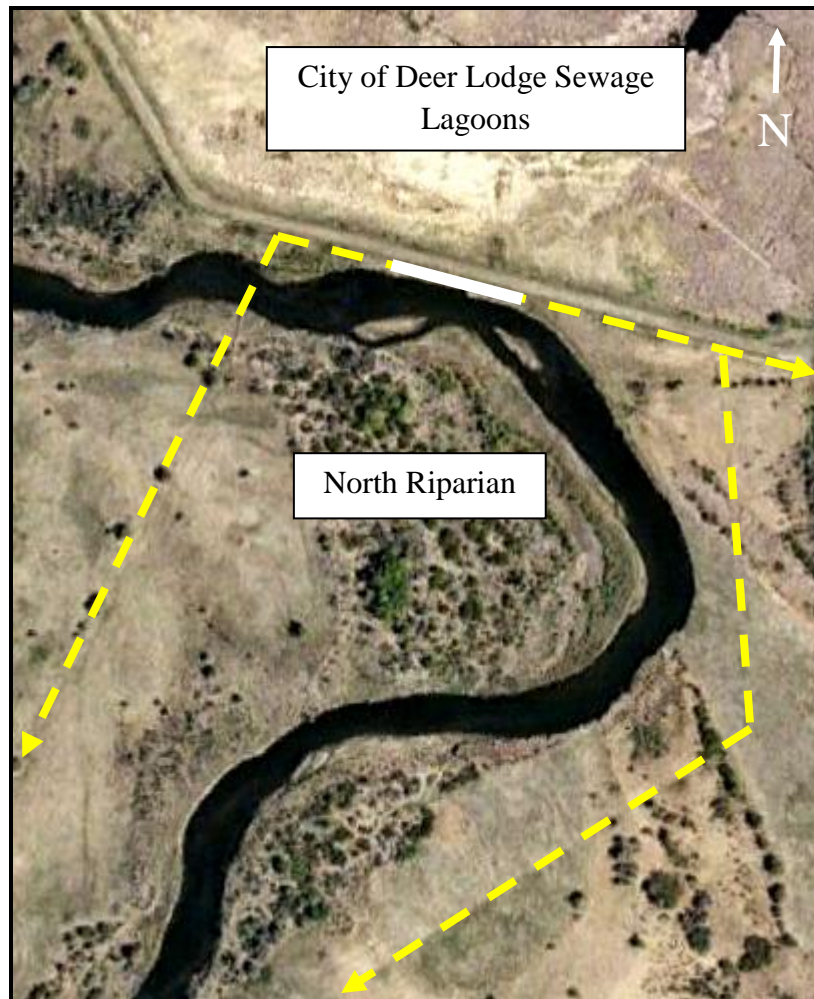


Photo 15. Northern portion of North Riparian area and the damaged section of metal post and barbed wire fence (white line) along the Clark Fork River.

Cottonwood Riparian

The small Cottonwood Riparian area (not to be confused with Cottonwood Creek Riparian area) is located west of the Clark Fork River and is situated among West Hayfields 2

and 3 and the North and Middle Riparian areas. It is enclosed with a combination of fences (Photo 16). The south boundary fence is jackleg and was installed between 1979 and 1983 ^(1e,1f). The southwest and northwest fences are barbed wire and metal posts and represent portions of fencelines of West Hayfields 2 and 3, respectively. The east boundary is an older barbed wire section and is a combination of wood and metal posts. When this fence was originally installed has not been determined, but it may be a remnant section that was not removed when the west boundary (east boundary of the West Hayfield 3) was fenced in 1994. Additionally, the reason for this installation was not obtained through this research. However, because it seems that this short remnant section serves little purpose presently, it could be removed provided appropriate compliance was completed. If it is removed, this area would become part of the North Riparian Area.

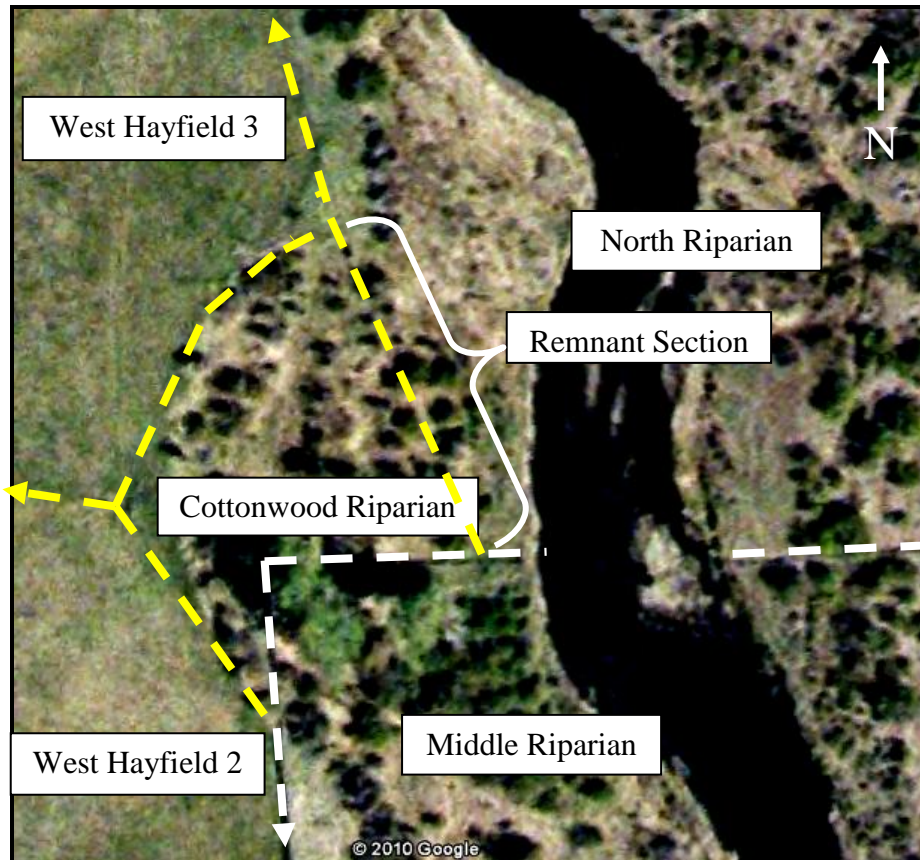


Photo 16. Metal and wood post barbed wire (yellow lines) and jackleg (white lines) fences of Cottonwood Riparian area.

Middle Riparian

The north boundary of this area is the same jackleg fence, installed between 1979 and 1983^(1e,1f), of the south boundary of the North Riparian area. The Middle Riparian east boundary is also the west jackleg fence of the Bull Pasture and was installed by the NPS between 1984 and 1988^(1f,1g,11). The south boundary follows the Clark Fork River Bridge Road and is constructed from two types of fencing. First, east of the Clark Fork River Bridge the fence is jackleg and the second type occurs west of the bridge and is made from wood posts with woven wire and barbed wire (Photo 17). They were installed between 1984 and 1988^(1f,1g). The west boundary of the Middle Riparian area is characterized by the same jackleg fence that identifies the east side of West Hayfield 2 and was installed between 1979 and 1983^(1e,1f).

South Riparian

The north boundary of this area is similar to the south boundary of the Middle Riparian, just on the opposite side (south) of the Clark Fork River Bridge Road: jackleg to the east of the Clark Fork River Bridge and to the west, the fence is constructed from wood posts with woven wire and barbed wire. However, unlike the woven and barbed wire section of middle riparian that starts right at the bridge, there is a section of approximately 100 ft where there is no fence (Photo 17). The woven wire and barbed wire section of the north boundary of South Riparian also defines a portion of the west boundary because it curves southward before meeting a section of jackleg that terminates at the Clark Fork River (Photo 17). These fences were built by the NPS between 1984 and 1988 ^(1f,1g). The remainder of the west boundary is the jackleg fence that is also the east boundary of Western Hayfield 1 and was originally built by the NPS in 1984 ⁽⁷⁾. The south boundary of the South Riparian area is a jackleg fence, which is also short section of Grant Kohrs Ranch property boundary. It was originally installed ca. 1930s ⁽¹¹⁾.



Photo 17. Wood post with woven wire and barbed wire (yellow lines) and jackleg (white lines) fences on the southern boundary of the Middle Riparian area and the north and west boundaries of South Riparian area.

Cottonwood Creek Riparian

This area is surrounded entirely with jackleg. The north and east boundary fences were installed by the NPS between 1983 and 1988 ^(10,11,1g). The south boundary is Grant Kohrs Ranch property boundary and was installed ca. 1930s ⁽¹¹⁾. There is no fence on the west, as it is bounded by the Clark Fork River.

Development Zone Component Landscape

This small component landscape includes all of the areas around the visitor center including Stuart Homestead Field, Stuart Pasture, the curatorial building, restrooms, bookstore, the parking lot, and walkway leading from the parking lot to the Grant-Kohrs Residence. Also included in this component landscape is the Cottonwood Creek Nature Trail. All of the fences on the interior of this area are jackleg and were installed by the NPS after 1975. They serve to direct visitors and provide easy viewing of cattle ⁽⁶⁾ and therefore, are not recommended for removal. All of the fences that surround the Development Zone were installed prior to 1965 ^(1a,1b) and all are jackleg except for two. The two exceptions are the east boundary fence that runs adjacent to Business Loop I-90, north of the visitor center entrance road, which is constructed from wood posts and some metal posts with woven and barbed wire. Second, the north boundary fence that lies on either side of the Warren Residence is made from wood posts with woven and barbed wire, while the fence that abuts the house is white picket.

When surveying this area for undesirable ecological impacts, an important characteristic of the black cottonwood (*Populus balsamifera*) and willow (*Salix* spp.) populations in this area was noticed along Johnson Creek, just behind the Warren Residence. It appears that most of the black cottonwoods are rather old, and there are very few middle-aged trees and even fewer young trees present. Because cottonwoods represent an important cultural aspect of the ranch ⁽¹¹⁾, it is important that ecological succession is ensured. However, cottonwoods are dependent on flood disturbance for seed establishment ⁽¹⁷⁾ and this ecosystem process is probably largely subdued, plus cattle grazing appears to be impeding the survival of saplings. To ensure that cottonwood trees persist in this area, and everywhere else around the ranch, it is recommended that what few saplings are present be fenced to exclude grazing by cattle or browsing by wildlife. The map that is associated with this report identifies saplings that have not yet been damaged,

and if enclosed with a small fence, will help to facilitate their growth. It is important that if any cottonwood trees are fenced, that they exhibit one main stem only, as this will ensure the desired growth habit of a tree. If the top is removed, then apical dominance is removed, and the growth habit will be shrub-like⁽³⁾ (Photo 18). Similarly, the willow populations in this area, although not particularly old, do not contain many young plants. In fact, no willow saplings were located that could be fenced and therefore, this information is not on the map. If GRKO decides that they want to enclose willows to promote sapling survival it is not important that there is only one main stem, as the natural growth habit of most willows is shrub-like.



Photo 18. Example of a black cottonwood exhibiting shrub-like growth as a result of grazing or browsing.

Another potential undesirable characteristic that was noticed along Johnson Creek behind the Warren Residence is the occasional widening of the stream channel. The natural channel appears to be very narrow, but in some places may be widening due to trampling by cattle. However, the extent of the damage is not severe, as there is no bare soil and therefore, no cause

for immediate concern. Nonetheless, the areal extent of spots to monitor is shown on the map and can be consulted in the future to determine if channel width is increasing.

Other Areas of Concern

Johnson Creek Stock Shelters

This section of Johnson Creek is located just east of the Kohrs-Manning Ditch Road and the Kohrs-Manning Ditch Flume, and immediately south of three stock shelters (HS-24, HS-27, HS-29). It is of concern because of the mixture of historic and non-historic fences and their impact on the cultural landscape and the ecological integrity of the area ⁽⁹⁾.

Currently, there are numerous historic and non-historic jackleg fences crossing and paralleling the creek (Photo 10). Historically, stock kept in these corrals had open access to Johnson Creek. However, this practice is now viewed as unsustainable and ecological damage caused by doing so includes streambank erosion and widening due to trampling, thereby increasing sedimentation, as well as increased nitrate levels in the water from stock waste. In turn, this has the potential to, and visually appears to be degrading habitat for aquatic organisms, reducing desired ecosystem functioning, and increasing non-point source pollution. In an attempt to combat these issues, additional fences were constructed in 1996 ^(7,11). One fence was installed along the north bank of the creek, from HS-27 to HS-24, thus blocking access to the creek in these areas. To provide water, a trough was installed and shared by the animals in each of the corrals. It was constructed such that water flowed freely in and out of the trough, although this trough is currently in disrepair ⁽¹²⁾. In the HS-29 corral, a trough was not installed, but a water gap was constructed to allow stock access to a small portion of the creek. The ground was initially covered with a layer of gravel in an attempt to reduce trampling, and the gap was narrow enough to preclude loitering by cattle, yet the size was adequate to allow for drinking ⁽⁷⁾. In the NPS compliance report for this project, it was determined that this installation of non-historic fences would have no adverse impact on the historical qualities of GRKO.

The fences that are present other than the ones from the 1996 addition are historical in type and location ⁽⁴⁾. However, there is one currently missing fence that is present in 1974 Historic American Buildings Survey photos (Photo 19). The reason for removal, as well as the precise date of removal is unknown, although it was sometime after 1987 ⁽¹³⁾.

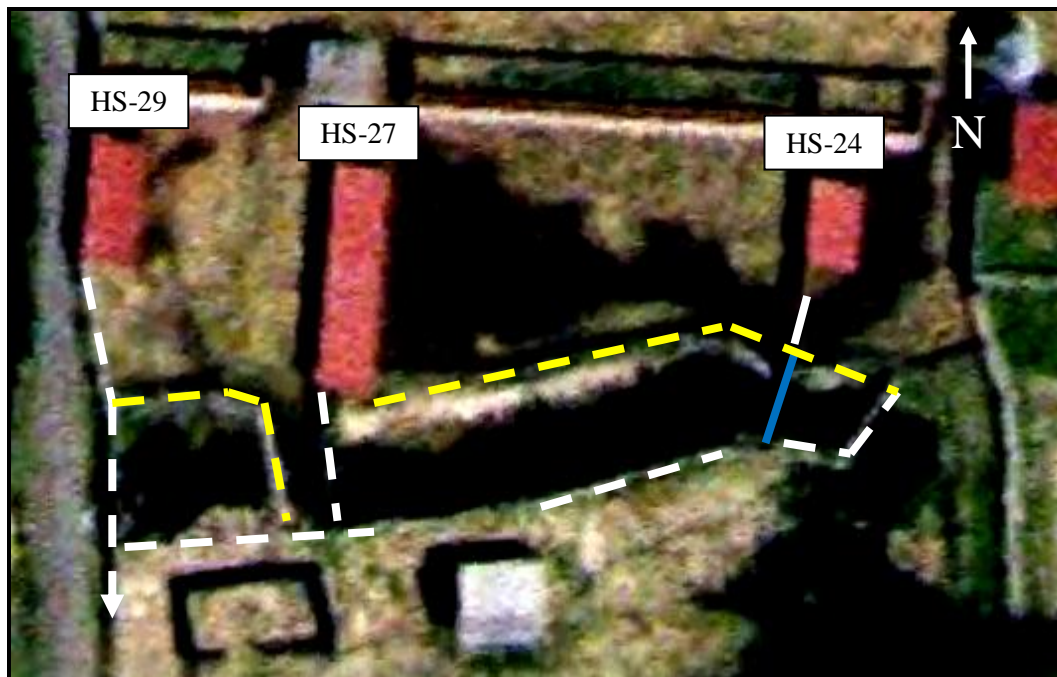


Photo 19. Fences in the Johnson Creek area east of the Kohrs-Manning Ditch Road: historical, but currently absent (blue line), historical fences that are currently present (white lines), and NPS-installed fences that are currently present (yellow lines).

Impacts to hydrologic, stream channel, and vegetation characteristics in this area are noticeable. Specifically, water flow is minimal and the stream channel has widened. This has created stagnant conditions optimal for colonization by cattails and algae. A combination of factors, including livestock use in a small, confined area, short depth to the water table, and slow natural flow-rate are presumably responsible for current conditions.

It is assumed that the 1996 fence installation was meant to limit the impacts to the stream, and to reduce stream widening; however, the water flow appears to be impeded by the presence

of the Kohrs-Manning Ditch Road (Photo 20), and without active streambank restoration to direct the water to the culvert, this area may remain in the current condition.



Photo 20. Stagnant water and channel widening of Johnson Creek at the Kohrs-Manning Ditch Road and Stock Shelters HS-24, 27, and 29.

Soil compaction and vegetation loss due to stock use has occurred along the fences that were installed in 1996 on the north bank of the creek (Photo 21). It appears that trampling has exposed and compacted the soil, and because it is close to the stream, has created consistently muddy conditions, thus further impacting hydrologic, streambank, soil, and vegetation characteristics. To help improve this area, it is recommended that two objectives be evaluated. First, active restoration of the north bank of Johnson Creek should be implemented to narrow the channel and to direct water towards the culvert underneath KM Ditch Road. Second, the east-west fences along the north bank of Johnson Creek should be relocated approximately 8 - 10 feet northward, thereby putting them at slightly higher elevation than they are currently. This will

reduce the probability that future trampling along the fences reaches the water table, and muddy conditions, excessive soil compaction, and loss of vegetation will be reduced.

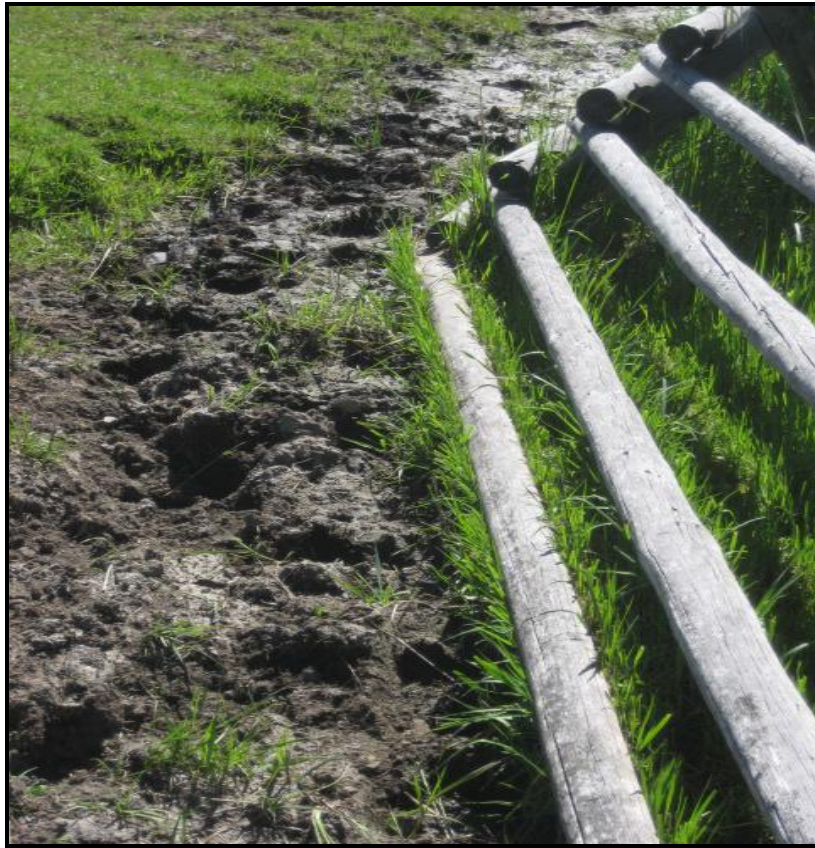


Photo 21. Soil compaction and vegetation loss along the fence on the north bank of Johnson Creek at Stock Shelter HS-29

To be used in combination with these two suggestions, two additional recommendations to improve this area are provided:

1. Remove the water gap at HS-29 so livestock do not have access to Johnson Creek.

This would necessitate improvement or replacement of the water trough between HS-24 and HS-27, and installation of a water trough at HS-29. If this option is chosen, the fences that cross Johnson Creek would not be needed; therefore, they should be removed to increase water flow rate.

2. Install a geo-textile product in the ground at the water gap of HS-29, thus limiting further soil compaction and streambank widening.

Horse Pasture

On a section along Kohrs-Manning Ditch, in the northern section of the Horse Pasture, a water gap is present on what is otherwise a completely fenced boundary. It may be beneficial that livestock use is concentrated in one small area to eliminate impacts to the rest of Kohrs-Manning Ditch in the Horse Pasture; however, this area exhibits intensive use (Photo 22). Soil compaction and erosion, as well as vegetation loss are noticeable, and could be reduced or eliminated in this area. Similar to recommendations provided above for the Johnson Creek Stock Shelters, the area would benefit from either fencing off the water gap entirely and installing a water trough, or installing a geo-textile product to reduce further soil compaction and erosion.



Photo 22. Excessive soil compaction and vegetation loss at the Horse Pasture water gap.

Conclusions and Additional Recommendations

Overall, the fences at GRKO contribute to the mission of preservation and interpretation. Although more than half of all fences assessed for this project are non-historic, they are generally constructed in a similar manner and using the same type of materials used in the past and thus, help to convey the historical significance of the ranch. The cross fences that were installed on the ranch in the mid-late 1990s, most importantly in the West Hay Fields, are the exception to this, and thus should be the primary focus for removals. Although adequate justification for adding these fences was given, each of these installations has created the cumulative effect of creating a ranch that may be too discontinuous or “chopped up”. This may not be a concern currently, because areas such as the Upland Pasture and Effluent Fields are not visited by the average tourist. However, it has been suggested that options to visitors be expanded to include wagon rides to the Upland Pasture⁽¹⁸⁾. If this occurs, visitors will be provided with views of GRKO from a higher elevation, thus ensuring that they see the entire ranch. Then, all of the non-historic cross fences will be visible and may misconstrue the history of the open range that GRKO strives to convey.

Concerning impacts to natural resources due to fences, anecdotal evidence suggests good overall health on the ranch. The areas that do exhibit undesirable characteristics such as soil compaction and streambank widening are uncommon and when present, are concentrated in small areas. Furthermore, locations along irrigation ditch banks that display excessive erosion are readily improved with the use of a backhoe. Nonetheless, areas discussed in this report and presented on the map should be monitored to determine if changes in the severity or extent of damage are occurring over time. The area that is at the most risk - stock shelters HS-24, 27, and 29 at Johnson Creek - should be the first priority for improvement. Another consideration that may improve the ecological integrity of the ranch is to reduce or eliminate fences that cross

waterways or are submerged in the channel. This is because debris accumulates in these fences, creating stagnant water conditions optimal for the colonization by algae and cattails. Ideally, fences submerged in water would be replaced with fences that simply stretch from bank to bank. At the very least, yearly efforts should be made to clear these fences of debris to avoid pooling on the upstream side.

There is interest in incorporating grazing into the Riparian Woodlands and the un-irrigated portions of the Upland Pasture ⁽¹⁹⁾. Both of these areas represent sensitive habitats, and if grazing is implemented it should be done in a spatially- and temporally-limited manner. With careful and timely management, cattle grazing could be implemented successfully in these habitats. However, due to the sensitivity of these areas, the logistics and resources needed to accomplish this should be identified prior to introducing cattle to avoid overgrazing and thus, detrimental environmental impacts. The primary concern with grazing in the Riparian Woodlands would be degradation of the banks of the Clark Fork River which could release mine tailings currently not exposed, thus polluting the river. Additionally, grazing could damage cottonwood and willow saplings, thus decreasing age-class diversity. The un-irrigated fields of the Upland Pasture would be at risk of overgrazing, which would impact soil characteristics and species diversity, if not carefully monitored. A limiting factor for active grazing in the uplands is water, but this could be avoided with the use of water troughs filled daily by GRKO staff, or by creating water gaps in fences so that cattle can access nearby ditches. A combination of troughs and water gaps would be preferable to avoid overuse.

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Appendix: Wildlife Compatible Fences

Within the approximately 1600 acres that is within GRKO property, resources for wildlife are abundant and thus, a diverse array of animals including birds, ungulates, and coyotes, are present. Integrating wildlife compatible fences into the GRKO ranch landscape will help to maintain and improve ecological integrity throughout the ranch and the surrounding areas by providing reliable access to important habitats on the ranch, as well as providing unhindered routes to escape from predators, primarily for birds and ungulates. However, since GRKO's primary goal is to maintain historical accuracy as best possible, any modifications to fences must be evaluated carefully through Section 106 compliance reports.

Much research has been conducted on techniques that allow native wildlife to co-exist alongside cattle without sacrificing ranch management goals. In general, fences that are too high to jump, too low to crawl under, are difficult to see, or have loose wires, are problematic for different wildlife species and can hinder travel and escape from predators (Page 2008). GRKO has many fence types on the ranch, but very few, if any, are considered wildlife-friendly. This appendix discusses commonly used fence types on the ranch and how they hinder or allow wildlife travel, and presents techniques to modify existing fences to improve accessibility by wildlife. Lastly, recommendations on how to ensure that future fence installations meet criteria satisfactory for wildlife passage are presented.

The majority of the fence types in the assessed areas for this project are barbed wire or jackleg, and a smaller proportion of fences are made from woven wire or electric. Barbed wire fences with five-strands or greater, which are common on the ranch, hinder wildlife travel because the lower strand is placed too close to the ground to crawl under and the middle strands make passing through the fence difficult. Also, if the height of the top strand is over 42 inches it decreases the possibility of jumping over, especially for young deer and elk. Another problem

with wire fences is that they are difficult for wildlife to see. This is especially hazardous for low flying birds such as grouse and sandhill cranes when fleeing from predators. All of these issues are further exacerbated when wires are loose because it increases the chance of entanglement. Many interior fences on the ranch, particularly in areas with the highest concentration of visitors, are jack-leg. Although these fences are often considered wildlife friendly, they can hinder wildlife travel if they are too tall, too wide, or if the rails are spaced too closely together. Woven wire fences create a complete barrier for animals that are too young or unable to jump over because there is no room to crawl under. This problem is further exacerbated when the woven wire is topped with a single string of barbed wire because it increases the overall height and the chance of entanglement. GRKO implements this fence type on the ranch, most notably along both sides of the Clark Fork River Bridge Road, west of the bridge. Electric fencing, used extensively in the Upland Pasture Component Landscape, is one of the most wildlife friendly fence types. This is because they are usually highly visible and when used with fiberglass posts, are flexible, thus allowing for unhindered escape. However, high profile electric fences are unsightly and cause a visual intrusion on visitor experience at GRKO.

GRKO can increase wildlife compatibility of some of the existing fences on the ranch by implementing regular inspections and making some minor adjustments, as detailed below. Before using any of these techniques however, it is important to identify routes that are used most often by animals and incorporate modifications at those sites. This can be done by inspecting fences for tufts of hair or by recognizing game trails.

- Barbed Wire: First, it is pertinent that there are no loose wires. This is especially important along roads, where animals are moving quickly and can become entangled.

Another technique that can be used is to periodically detach the lower- and/or upper-most

wires on two adjacent poles, and, with the use of small diameter PVC, adjoin them to the next closest wire (see photo). This allows for safe passage under and over the fence.

Also, because visibility is often a problem with wire fences, markers can be placed on the wires to reduce the chances of birds becoming entangled. This can be done with the use of clips crafted from vinyl trim strips hung from the wires (e.g. www.SuttonCenter.org) placed along the fence.

- Jackleg: This fence type can easily be incorporated into a wildlife-compatible fencing scheme by periodically dropping the top rail when a pasture is not in use by livestock.
- Woven Wire: When a strand of barbed wire is present above the woven wire, it should be removed to facilitate wildlife travel as much as possible.
- Electric: The use of a high profile tape or a polymer-coated wire on the top will increase visibility. The overall fence height should be no higher than 42 inches, and the second wire should be placed 18-30 inches above the ground to facilitate passage under the fence.

Future fence installations should incorporate as many wildlife-compatible techniques as possible, while maintaining the cultural landscape. First, woven wire fences should be replaced and their use avoided in the future. Replacements of barbed wire fences should be constructed with a combination of smooth and barbed wire, with a total of four strands, which is typically adequate to contain livestock (Page 2008). It would be preferable to place a high visibility, high tensile smooth wire as the top strand, and should be no higher than 42 inches from the ground. The lowest wire, which should also be smooth, should be no lower than 18 inches. The middle two strands can be barbed wire, but the first strand should be installed 12 inches from the top smooth wire. In all future installations, regardless of material type, drop sections should be

incorporated periodically, as this is any easy way of facilitating wildlife travel. Drop sections are lengths of fence that can easily be laid on the ground when a particular field is not in use by cattle, and can be implemented regardless of material type. It would be best if these were in areas or along paths known to be commonly used by wildlife. A similar approach that requires no modification to fences is to simply leave open all gates when possible.

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