CHARLES M. RUSSELL & UL BEND NWR REPORT ON WILDERNESS CHARACTER MONITORING

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CMR Proposed & UL Bend Wilderness

A Product of the FWS National Wildlife Refuge System Wilderness Fellows Program

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Report on Wilderness Character Monitoring

CHARLES M. RUSSELL & UL BEND NATIONAL WILDLIFE REFUGES

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BACKGROUND

Today, Charles M. Russell National Wildlife Refuge and UL Bend National Wildlife Refuges (NWR) are collectively managed as a single refuge. They each, however, were founded separately for distinct purposes.

Charles M. Russell National Wildlife Refuge

In 1936, the Fort Peck Game Range was established to sustain sharp-tailed grouse and pronghorn antelope. The Game Range was renamed the Charles M. Russell National Wildlife Range in 1963, and finally became a 'National Wildlife Refuge' in 1976. The establishing language for Charles M. Russell also distinctly indicates that forage produced on the refuge beyond the needs of wildlife should be made available to domestic livestock.

Charles M. Russell NWR consists of a narrow corridor of 1.1 million acres along 125 miles of the Missouri River in central Montana. The topography of the refuge is rugged and largely shaped by erosional forces. It is referred to as the 'Missouri Breaks'. The eastern end of the refuge contains the Fort Peck Dam, which controls flow of the Missouri River and creates an artificial lake, the Fort Peck Reservoir. Purview of the Fort Peck Reservoir and Missouri River is under the United States Army Corp of Engineers, and not the U.S. Fish and Wildlife Service.

In 1974, 158,619 acres of the Charles M. Russell became proposed wilderness. The proposed wilderness acreage is divided into 15 separate proposed wilderness areas. Several areas are contiguous, but others standalone. The below table summarizes each of the proposed wilderness areas:

Proposed Wilderness Area	Managing Field Station	Acreage
Alkali Creek	Sand Creek	6,592
Antelope Creek	Sand Creek	5,062
Billy Creek	Sand Creek	10,916
Burnt Lodge	Sand Creek	21,576
Crooked Creek	Sand Creek	6,842
East Beauchamp	Sand Creek	5,246
East Hell Creek	Jordan	14,744
East Seven Blackfoot	Jordan	11,744
Fort Musselshell	Sand Creek	8,303
Mickey Butte	Sand Creek	16,893
Sheep Creek	Jordan	11,784
Wagon Coulee	Fort Peck	10,480
West Beauchamp	Sand Creek	6,736
West Hell Creek	Jordan	11,896
West Seven Blackfoot	Jordan	6,456

There are currently no efforts, known by the refuge, underway to encourage Congress to accept the recommendation to make these areas designated wilderness. In 2009, however, Charles M. Russell NWR published a Draft Comprehensive Conservation Plan (CCP) and Environmental Impact Statement (EIS). The preferred alternative within this CCP and EIS recommends the addition of eight wilderness study areas (WSA) constituting 19,749 acres. All WSAs are contiguous with existing proposed wilderness areas. With the addition of these WSAs at Charles M. Russell NWR the total wilderness acreage would be 178,368 acres. If all wilderness within Charles M. Russell NWR were designated, the refuge would have the fourth largest wilderness complex in the National Wildlife Refuge System in the lower 48 states.

UL Bend National Wildlife Refuge

The UL Bend National Wildlife Refuge was established in 1967. Its establishing purposes emphasize use as a sanctuary for the nesting, resting, and feeding of migratory birds. UL Bend NWR consists of 46,264 acres. UL Bend is a large peninsula created by a hairpin turn in the Missouri River. The peninsula is a flat basin which provides a marked contrast to the 'Breaks' topography common within the Charles M. Russell National Wildlife Refuge. The basin and rugged ridges and coulees along the river itself contain grassland-sagebrush, marsh-meadows, and conifer vegetation types. UL Bend NWR provides important prairie dog and black-footed ferret habitat. It also serves as an important winter migration corridor for pronghorn antelope.

In 1976, 20,890 acres of UL Bend NWR were designated as wilderness. The designation created 17,909 acres of contiguous wilderness on the peninsula of UL Bend and one separate 2,984 rectangle of wilderness in the northeast corner of UL Bend NWR. In 1978, 71 acres were removed from the National Wilderness Preservation System in UL Bend in order to provide vehicular access to Fort Peck Reservoir for recreational fishing (refuge road #446).

Wilderness Management at CMR and UL Bend NWR

Efforts within the last decade at Charles M. Russell and UL Bend National Wildlife Refuges have sought to bring refuge wilderness management closer to the spirit of both The Wilderness Act of 1964 and U.S. Fish and Wildlife Service Wilderness Policy. From 1974 to 2002, 39 miles of roads remained opened to vehicular and motorized use within proposed wilderness areas. In 2002, these roads were closed per the U.S. DOI memo entitled 'Charles M. Russell Road Policy Challenged'. In 2011, fire management ceased authorizing use of mechanized equipment, such as chainsaws, in proposed, but not designated, wilderness without use of the Minimum Requirements Analysis process. In general, the refuge is re-emphasizing use of Minimum Requirements Analyses before use of motor vehicles, mechanized equipment, and mechanical transport is authorized for use by refuge staff, which has not always been the case (ex. use of power mowers in UL Bend designated wilderness in the early 2000s for black-footed ferret restoration work).

Management has struggled with enforcement of wilderness policy in one wilderness unit—East Hell Creek. This unit contains a significant inholding and associated access roads. The inholding owners have repeatedly degraded the untrammeled and undeveloped nature of this proposed wilderness area by using ATVs off road and allowing livestock trespass. Between 2009 and 2011 the refuge considered recommending that Congress no longer consider this area for designation as wilderness and included this in the 2009 Draft CCP and EIS. This recommendation resulted in significant public comment and The Wilderness Society, Montana Wilderness Association, and Central Montana Wildlands Association expressed significant concern via public comment. In mid-2011, CMR management re-evaluated the impacts off-road use, livestock trespass, and unauthorized road improvements have had on wilderness character in East Hell Creek PWA and decided to revoke this recommendation. Going forward, CMR will redouble efforts to enforce wilderness policy and cooperation with the inholding owner within East Hell Creek.

In general, wilderness management is a complex affair at Charles M. Russell NWR. The six Montana counties surrounding the refuge—Valley, Phillips, Fergus, Petroleum, Garfield, and McCone—have historically not supported wilderness within the refuge. The closure of roads in 2002 was met with public disfavor and the addition of WSAs via the 2009 CCP and EIS also was questioned via the public comment process. The allowed use of hand carts in proposed, but not designated, wilderness increases law enforcement complexity and requires educating the public so that they are aware that use is not allowed in UL Bend designated wilderness. The fifteen wilderness areas are scattered throughout the refuge from east to west and both north and south of the Missouri River and management is divided between the three field stations—Fort Peck (1 PWA), Sand Creek (9 PWAs, plus UL Bend designated wilderness), and Jordan (5 PWAs). Eight habitat management units with active livestock grazing overlap with proposed and designated wilderness.

Wilderness at CMR and UL Bend NWRs contains critical wildlife habitat. More than 50% of bighorn sheep habitat on the refuge is found within proposed wilderness areas. Several large and active prairie dog towns are within UL Bend designated wilderness and these prairie dog towns may become future sites for black-footed ferret restoration. Pronghorn antelope are known to migrate across the refuge and cross the Missouri River via UL Bend Wilderness and through the Burnt Lodge and West Seven Blackfoot proposed wilderness areas. Winter sage grouse tracking found that grouse migrating from northern Montana and Canada use habitat within the Burnt Lodge PWA and surrounding areas in the winter. CMR wilderness in combination with adjacent BLM wilderness study areas may increasingly provide critical habitat corridors for pronghorn, sage grouse, and other wildlife in the future.

The CCP and EIS currently being approved sets the immediate tone for wilderness management at CMR and UL Bend NWRs. The preferred alternative establishes five wilderness objectives:

1. Over 15 years, continue to manage UL Bend Wilderness as a class I air shed.
2. Within two years, finalize the wilderness study and submit recommendations to the Service Directorate and Secretary for the Department of the Interior.
3. Over 15 years, on approval by the Department of the Interior, explain wilderness protection in eight units totaling about 19,749 acres in eight proposed wilderness areas.
4. Continue the practice of allowing the use of game carts in proposed wilderness units.
5. Implement the wilderness character monitoring protocols developed in 2011.

The CCP indicates that these objectives are intended to 'restore biological diversity, integrity, and environmental health of the refuge while providing for quality wildlife-dependent uses'. In addition to the objectives listed above, the CCP includes intentions to close roads adjacent to and within (WSAs only) wilderness to 'increase security for wildlife, reduce habitat fragmentation, invasive species infestations, and provide other positive wildlife benefits'.

The wilderness character monitoring measures developed for CMR and UL Bend NWRs take into account the goals and objectives in the preferred alternative of the 2009 Draft CCP, as well as the establishing purposes for the two refuges. They were developed with an eye on capturing the current state of wilderness character and anticipating future changes and threats. While this report summarizes all measures and data for both CMR and UL Bend NWRs, separate wilderness character monitoring database entries have been made for each refuge.

Sheep Coulee in the Burnt Lodge proposed wilderness area in July 2011. Fort Peck Reservoir and East Seven Blackfoot proposed wilderness area are visible in the background.

CHARLES M. RUSSELL NWR STAFF

RICK POTTS, *Project Leader*
Rick has been project leader at Charles M. Russell NWR since April 2011. Prior to CMR, he spent 27 years as a National Park Service employee working at parks in Virginia, Alaska, Hawaii, and Wyoming. Between 2000 and 2004 he was National Wilderness Training Program Manager at the Arthur Carhart National Wilderness Training Center. He has taught wilderness stewardship and consulted on wilderness issues both domestically and internationally, and for a period of four years served as the National Wilderness Coordinator for the National Park Service.
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BILL BERG, *Deputy Project Leader*
Bill's input provided data for measures relating to livestock grazing, riparian habitat health, and water issues. Bill has completed the Arthur Carhart Wilderness Institute's wilderness stewardship training course.
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JACKIE FOX, Payroll / Human Resources Specialist
Jackie began at Charles M. Russell NWR as a STEP student in the role of Biological Technician. She has since become a permanent U.S. Fish & Wildlife Service employee stationed at CMR as a Payroll / Human Resources Specialist. Jackie is pursuing a graduate certificate in wilderness management via the wilderness management distance education program at the University of Montana. She has also completed the Arthur Carhart Wilderness Institute's wilderness stewardship training course.
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RANDY MATCHETT, *Wildlife Biologist*
Randy's research focuses primarily on black-footed prairie dogs and the endangered black-footed ferret, but he also oversees all wildlife biology staff at CMR and conducts most of the by-air wildlife surveys (elk, mule deer, bighorn sheep, and pronghorn antelope). Randy is the keeper of most of the GIS data for CMR and contributed most of the data for measures related to the natural quality of wilderness. Randy does not have any formal wilderness training, but conducts much of his prairie dog and ferret work on the edge of UL Bend's wilderness.
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NEIL KADRMAS, *Wildlife Biologist*
Neil contributed all data related to sage and sharp-tail grouse and also maintains much of the GIS data for the refuge. Neil does not have any formal wilderness training.
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BOB SKINNER, *Wildlife Biologist*
Bob's work focuses maintaining healthy vegetative communities to support wildlife populations. He contributed by providing locations of research installations in wilderness areas. Bob does not have any formal wilderness training.
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BEVERLY SKINNER, *Refuge Wildlife Specialist*
Beverly provided guidance on inclusion of birds in wilderness character monitoring measures. Beverly oversees much of the refuge handling of paleontological specimens and therefore contributed to two measures related to paleontological resources. She also executed a wilderness excavation of a prehistoric marine reptile in CMR's Burnt Lodge proposed wilderness area in July 2011. Beverly does not have any formal wilderness training.
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DANIELLE KEPFORD, *Realty Specialist*
Danielle has been CMR's real estate specialist since 2002. Her property expertise allowed her to contribute extensively to measures related to the inholding and remoteness from outside wilderness indicators. Danielle does not have any formal wilderness training.
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MIKE GRANGER, *Fire Management Officer (FMO)*
In his tenure at CMR, Mike has spent weeks managing fires in most of CMR's designated and proposed wilderness areas. He provided all data for monitoring measures that related to prescribed fire, wildfire, and thinning treatments for fuel reduction. Mike does not have any formal wilderness training.
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MATT DEROSIER, *Sand Creek Field Station Manager*
Matt has manages the Sand Creek field station. Sand Creek oversees more wilderness acres than any other CMR field station. Sand Creek includes six proposed wilderness areas (Fort Musselshell, Antelope Creek, West Beauchamp, East Beauchamp, Mickey Butte, and Burnt Lodge) as well as the UL Bend designated wilderness. Matt contributed information on invasive plants (species and treatment efforts) and miscellaneous authorized or unauthorized trammeling or motorized/mechanized uses of equipment or vehicles.
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DAN HARRELL, *Range Technician*
Dan is a range technician out of the Sand Creek field station. Dan provided data regarding developed structures, research installations, and livestock grazing in the proposed wilderness areas that Sand Creek manages. He does not have any formal wilderness training.
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DEB GOEB, *Law Enforcement (LE)*
Deb oversees law enforcement out of the Sand Creek field station. She spends most of her time on the ground on the refuge and is attuned to public use. She contributed information for all measures that address unauthorized activities—from paleontological removals to motorized vehicle use. She also is aware of all emergency situations that occur in wilderness. Deb is a proponent of consistent regulations being instituted across designated and proposed wilderness on the refuge, as it minimized confusion among the public and make law enforcement easier. Deb does not have any formal wilderness training.
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NATHAN HAWKALUK, *Jordan Field Station Manager*
Nathan manages the Jordan field station. Jordan oversees eight proposed wilderness areas: Soda Creek, Crooked Creek, East Seven Blackfoot, West Seven Blackfoot, Billy Creek, West Hell Creek, East Hell Creek, and Sheep Creek. Nathan provided information about invasive plant surveying and treatment, livestock grazing, and miscellaneous authorized or unauthorized trammeling or motorized/mechanized uses of equipment or vehicles. He does not have any formal wilderness training.
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AARON JOHNSON, *Fort Peck Field Station Manager*
Aaron manages the Fort Peck field station. Fort Peck oversees only one proposed wilderness area—Wagon Coulee. Aaron provided information about invasive plant surveying and treatment, livestock grazing, and miscellaneous authorized or unauthorized trammeling or motorized/mechanized uses of equipment or vehicles. He does not have any formal wilderness training.
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LINDY GARNER, *Montana Invasive Strike Team Coordinator and Regional Invasive Species Specialist*
Lindy's invasive plant strike team visits Red Rock Lakes NWR once a year to work on critical invasive plant projects. Her team also provides excellent maps and data detailing all projects they work on. Lindy is based out of the Benton Lakes NWR office in Great Falls, MT.
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Aerial view of Charles M. Russell National Wildlife Refuge that demonstrates the ruggedness of the 'Missouri Breaks' landscape and the importance that water plays in shaping the topography.

SELECTING WCM MEASURES AT CHARLES M. RUSSELL NWR

An initial set of wilderness character monitoring measures was developed in two meetings attended by a handful of CMR NWR staff. These meetings allowed for group discussion of potential measures to fulfill each of the 13 indicator categories in the WCM framework. Each meeting lasted 1.5 hours and occurred a month apart.

The meetings resulted in the generation of a list of 46 possible measures. Individual meetings were then held with all staff, plus other contributing partners (such as Lindy Garner). In individual meetings the efficacy of each measure was reviewed along with available data sources and the best ways to quantify the data to meet the purposes of the wilderness character monitoring program. These discussions resulted in the elimination of some proposed measures due to lack of sufficient data, problematic definitions, redundancy, and resource issues. The meetings also resulted in the addition of several measures (i.e. acres of state inholdings). After several rounds of refinement the final list of measures totaled 43. A breakdown by character quality follows:

Character Quality	# of measures
Untrammeled	10
Natural	12
Undeveloped	13
Solitude and/or primitive recreation opp.	8

Once data was obtained for each measure, invested staff members made informed decisions about frequency, significant change values, condition, data confidence, and priority for each measure.

Decisions regarding the appropriate weight for each measure were not made until all data was collected. Weights were assigned in a meeting attended by Rick Potts, project leader, and Bill Berg, deputy project leader. A breakdown by priority follows (unimplemented measures were not prioritized):

Priority	# of measures
High	19
Medium	20
Low	4

Further details about measure priorities can be found in the Priority Ranking of Measures Appendix of this document.

2011 was established as the baseline for all measures. In most cases, attempts were made to obtain and input data for both 2010 and 2011. The earliest data provided was from 2000 and related to fires in refuge wilderness.

WILDERNESS CHARACTER MONITORING MEASURES

UNTRAMMELED

A definition of untrammeled from Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System: The Wilderness Act states that wilderness is "an area where the earth and its community of life are untrammeled by man," and "generally appears to have been affected primarily by the forces of nature." In short, wilderness is essentially unhindered and free from modern human control or manipulation. This quality is degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness.

Monitoring Question: What are the trends in actions that control or manipulate the "earth and its community of life" inside wilderness?

Indicator: Actions **authorized** by refuge manager that manipulate the biophysical environment

Measure 1. Percent of natural fire starts that are manipulated within the boundaries of wilderness

Description: Percent of natural fire starts (i.e. lightning ignitions) manipulated while within the boundaries of wilderness. Calculated in this manner: the number of natural ignition fires manipulated by fire managers divided by the total number of natural ignition fires, multiplied by 100. This measure does not account for natural fires that are ignited outside of wilderness and are suppressed before reaching the wilderness boundary.

Context: The mosaic of ecosystem types at Charles M. Russell NWR & UL Bend wilderness have varying historical fire return intervals. Historically, natural fires would have been a critical element in areas of the refuge dominated by ponderosa pine stands, as ponderosa is a fire-dependent species. The current landscape, suppression history, and management goals of the refuge, however, have created an environment in which the infrequent natural fires which ignite in wilderness may require manipulation, especially to protect sagebrush habitat for sage grouse. CMR's CCP (Alternative D—preferred alternative) indicates that "in adherence with an approved fire management plan and using historical fire frequency data and current fire conditions, the Service would evaluate each wildfire to determine the management response and whether the wildfire would be used in the patch-burning program". In 2011, there was one wildfire in CMR proposed wilderness and zero wildfires in UL Bend. The CMR wildfire occurred in the West Beauchamp PWA and was suppressed using hand tools. Data was provided since 2000 for this measure.

Relevance: Ideally, manipulation attempts will strive to insure that natural fire starts achieve conditions historically maintained or created by fire, in spite of changes in plant mixtures and vegetation density caused by invasive plants and recent fire suppression. Climate change may shift the frequency of fire on this landscape.

Data source: FMIS online database.

Data adequacy: Measure is a reflection of fire manipulation and not the extent of natural fire's impacts on the landscape. Data supplied is of high confidence.

Process used to compile or gather data: Mike Granger, FMO, reviewed FMIS and provided data.

Priority & significance factor: High / Any change will be considered significant.

Measure 2. Acres of prescribed burning

Description: Number of wilderness acres prescribed burned each year.

Context: Fire suppression at Charles M. Russell settlement in the 1800s has resulted in altered vegetation structure and species mixtures. CMR intends to utilize prescribed fire to maintain plant diversity and health in combination with wild ungulate herbivory and/or prescriptive grazing. Prescribed fire will also be used to restore the natural fire regime and to reduce hazardous fuels in conifer stands. No prescribed burning has been conducted in proposed or designated wilderness in the last decade.

Relevance: The difficultly of executing prescribed fires without the assistance of motorized vehicles or equipment has been one reason why prescribed fire has been predominantly executed outside of wilderness. This trend is likely to continue for the foreseeable future.

Data source: All prescribed fire activities on the refuge are logged in the FMIS online database.

Data adequacy: Data supplied is of high confidence.

Process used to compile or gather data: Mike Granger, FMO, reviewed FMIS and provided data.

Priority & significance factor: High / A 50% change in acreage will be considered significant.

Measure 3. Acres of plant removal projects

Description: Acres of wilderness where invasive plants were pulled or removed, plus removals of native plants (trees, shrubs, etc.) for thinning or fuel reduction projects.

Context: Although invasive plants are present in CMR and UL Bend wilderness, efforts have not been taken to control populations of these plants in wilderness, given the added difficult of accessing the sites. Fuel reduction projects are another form of plant removal, and like invasive plant treatment, this has not yet occurred in wilderness areas on the refuge. In the future, however, this may change.

Relevance: These management activities—whether to restore native plant communities or restore historical fuel levels—modify the natural functioning of these ecosystems in their current state. There may also be unintended impacts of these activities that alter the 'forces of nature'.

Data source: All field station managers, Mike Granger, FMO, and Lindy Garner, Strike Team Coordinator.

Data adequacy: Data supplied is of high confidence.

Process used to compile or gather data: Inquiries sent to all station managers and Mike. Wilderness Fellow reviewed data supplied by Bill Sparklin that summarized efforts of the Montana Invasives Strike Team at CMR over the last three years.

Priority & significance factor: Low / A 100% change will be considered significant.

Measure 4. Acres of herbicide application

Description: Number of wilderness acres surveyed and treated with herbicide.

Context: Herbicide is used as a treatment for controlling invasive plants at CMR NWR. To date, herbicide treatments have been used solely outside wilderness areas, but in the future herbicide use may also occur in designated or proposed wilderness areas.

Relevance: Herbicides are intended to target only a specific invasive plant species, but impacts, albeit minor, occur beyond that single stem or group of stems treated. While this management activity constitutes trammeling, it is an effort intended to improve the natural state of wilderness.

Data source: All field station managers and Lindy Garner, Invasives Strike Team Coordinator.

Data adequacy: Data supplied is of high confidence.

Process used to compile or gather data: Inquiries sent to all station managers. Wilderness Fellow reviewed data supplied by Bill Sparklin that summarized efforts of the Montana Invasives Strike Team at CMR over the last three years.

Priority & significance factor: Low / A 30% change will be considered significant.

Measure 5. Number of livestock AUMs

Description: Number of livestock AUMs actively used in wilderness that year.

Context: Accounts for grazing that is used as a management tool in Charles M. Russell NWR and UL Bend wilderness areas. There are eight grazing permittees that have utilized AUMs in wilderness areas over the last decade. Since 2006 the number of AUMs used in wilderness has increased (from approximately 2000 to 2500 AUMs per year).

Year	CMR PWA AUMs	UL Bend AUMs
2006	2075	40
2007	2093	40
2008	3021	40
2009	2507	40
2010	2593	40
2011	Not available	40

The total number of 2011 AUMs for CMR PWAs was unavailable at the time this report was compiled, as Bills for Collection were not yet complete for two habitat units (Snow Creek/Hill Coulee and Seven Blackfoot).

Relevance: Livestock AUMs are utilized on the refuge to mimic herbivory patterns of native grazers and to achieve ecological goals. There is recognition, however, that impacts vary from those of wildlife.

Data source: Permittee Bills for Collection kept in the Lewistown office files, with some confirmations provided by Dan Harrell, range technician, Jody Jones, wildlife refuge specialist, and Nathan Hawkaluk, Jordan field station manager.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed all permittee grazing files in the Lewistown office. Emailed Dan, Jody, and Nathan to supply several 2011 AUM totals and to confirm some values.

Priority & significance factor: Medium / An increase or decrease of 500 AUMs year over year will be considered significant.

Measure 6. Number of authorized removals of paleontological resources

Description: Number of authorized removals of paleontological resources by Special Use Permit in a given year.

Context: Beartooth shale deposits throughout eastern Montana are rich with fossilized remains of dinosaurs and prehistoric marine reptiles. Many paleontological resources have been excavated from Charles M. Russell NWR including *Tyrannosaurus rex*, *Triceratops*, *Albertosaurus*, *Mosasaurus*, and Hadrosaurs. Collection of fossils is not permitted without a special use permit and a semi-exclusive relationship for extractions have been established with The Museum of the Rockies. In 2011, one extraction occurred in CMR proposed wilderness and no removals

An authorized removal of a prehistoric marine reptile in the Burnt Lodge PWA in July 2011. The removal resulted in significant, but temporary, impacts to the streambed.

occurred in UL Bend. A plesiousaur (prehistoric marine reptile) was extracted by an associate of The Museum of the Rockies from a coulee within the Burnt Lodge PWA.

Relevance: The process of extracting fossils from bedrock on the refuge can have lasting impacts on the landscape and may also necessitate the use of motorized vehicles or equipment.

Data source: Special Use Permit files found in the Lewistown office.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed all Special Use Permits from 2000 through present.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 7. Number of animals banded, tagged, collared, etc.

Description: Number of animals captured and leg banded, ear tagged, web tagged, nasal tagged, radio collared, fin clipped, chips or other devices surgically implanted each year, etc. Count includes all animals handled within wilderness or tagged outside wilderness whose habitat range includes refuge wilderness areas.

Context: Research conducted at Charles M. Russell NWR often includes the handling of animals. Over the last decade the majority of marking is accounted for by prairie dog and black footed ferret research conducted in UL Bend, but the majority of this work does not overlap with wilderness. More recently, mountain lions have been captured and radio collared. GPS data from these mountain lion collars will not be available until 2012, so it is currently unknown whether the range of these animals overlap with wilderness. 2012 data will reflect whether the range of any lions included wilderness. Given that radio collar data is not yet available zero animals will be considered banded, tagged, or collared in CMR PWAs and UL Bend.

Relevance: The handling of animals detracts from their 'wildness' and may impact their future behavior in the presence of humans. Occasionally an animal dies or is injured as a result of a handling effort. Visitors who detect collars or other markings are alerted to this wilderness management and research activity. The tracking of mountain lions also requires the use of low flying aircraft.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is low, given that it is not yet known whether collared mountain lions are using wilderness habitat.

Process used to compile or gather data: Request for counts sent via email to Randy.

Priority & significance factor: Medium / A 100% change will be considered significant.

Indicator: Actions **not authorized** by the Federal land manager to manipulate the biophysical environment

Measure 8. Number of human-ignited wildfires

Description: Number of wildfires ignited by human actions that ended up burning within a wilderness area. The ignition may have occurred outside wilderness.

Context: Recreational users or arsonists may be the cause of wildfire ignitions, especially given a century of fire suppression. During times of extremely high wildfire risk restrictions of fire use are put in place, but recreational visitors may disobey the restrictions. In 2011, fire restrictions were in place in September and October. Deb Goeb, LE, reports not citing anyone for campfire use in 2011 in CMR PWAs or UL Bend.

Relevance: Human-ignited fires may burn in areas where, ecologically, fire is not beneficial. In the past decade human-ignited fires haven't been a common occurrence at CMR.

Data source: FMIS online database.

Data adequacy: Confidence in data is high. Although fires may have been ignited and not detected, the size of these fires would be too small to be of significant concern.

Process used to compile or gather data: Mike Granger, FMO, queried FMIS database and provided information.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 9. Number of unauthorized removals of paleontological resources

Description: Unauthorized removals of paleontological resources including dinosaur and prehistoric marine reptile fossils and concretions. In 2011, LE cited removal of these resources as 'removals of government property'. The citation will change and be more specific once the new paleontology act is in place.

Context: See Measure 6. Number of authorized removals of paleontological resources. In 2011, LE did not cite any visitors for removal of paleontological resources in CMR PWAs or UL Bend.

Relevance: These unauthorized removals impact the landscape and remove resources of scientific and historical significance. They likely do not take into account wilderness character when removing the resource.

Data source: Deb Goeb, LE.

Process used to compile or gather data: A in-person meeting was held with Deb Goeb at the Sand Creek field station.

Data adequacy: Confidence of data is medium given that removals likely occurred but were not detected. The process currently in place relies on Deb remembering instances.

Priority & significance factor: Low / A 200% change will be considered significant.

Measure 10. Number of miscellaneous unauthorized actions

Description: A count of all miscellaneous unauthorized actions observed by Charles M. Russell NWR staff and volunteers or reported by the public.

Context: The public and grazing permittees sometimes undertake unauthorized actions in wilderness that manipulate the environment in unplanned and impactful ways. This can include grazing without authorization (i.e. livestock trespass, exceeding allotted AUMs, grazing at unauthorized times, etc.), poaching, removal of shed antlers, use of salt licks to attract wildlife, etc. To date, centralized, written records of unauthorized grazing are not kept at CMR so 2011 data does not reflect any instances of such trammeling. Record keeping may be instituted in the future.

In 2011, there were two unauthorized trammeling actions in CMR PWAs and zero instances of unauthorized trammeling in UL Bend. Both CMR PWA actions were the removal of shed antlers by archery hunters—one set of antlers was removed from West Beauchamp PWA and another set was removed from the Fort Mussellshell PWA.

Relevance: These unauthorized actions do not take into account ecological goals, impacts, or sustainability. They also constitute a management or law enforcement burden that takes away from other refuge activities.

Data source: All field station managers and Deb Goeb, LE.

Process used to compile or gather data: Inquiry was sent to all field station managers. A in-person meeting was held with Deb at the Sand Creek field station.

Data adequacy: Confidence of data is low given that other unauthorized actions may occur but are not observed and given the fact that unauthorized grazing is not tracked and accounted for. The process currently in place relies on LE staff remembering actions.

Priority & significance factor: High / A 50% change will be considered significant.

NATURAL

A definition of natural from Keeping It Wild: The Wilderness Act states that wilderness is "protected and managed so as to preserve its natural conditions." In short, wilderness ecological systems are substantially free from the effects of modern civilization. This quality is degraded by intended or unintended effects of modern people on the ecological systems inside the wilderness since the area was designated.

Monitoring Question: What are the trends in terrestrial, aquatic, and atmospheric natural resources inside wilderness?

Indicator: Plant and animal species and communities

Measure 11. Number of prairie dog towns

Description: Number of prairie dog towns or colonies that overlap with wilderness.

Context: Prairie dog habitat on Charles M. Russell NWR has declined significantly over the last decade, as prairie dog towns have struggled with a sylvatic plague transmitted by fleas carrying the bacteria *Yersina pestis*. Not only are prairie dogs an important species to the refuge, the also provide a critical food source for the black-footed ferret (a threatened species). In 2010, there were 14 active prairie dog towns in CMR (6) and UL Bend (8) wilderness. In 2003, there were 16 active prairie dog towns in CMR (12) and UL Bend (8) wilderness. Although only two towns have ceased being active, total prairie dog town acreage in wilderness has declined by 507 acres (38%) over these seven years.

Relevance: Prairie dogs are an important native species that contribute to wildlife diversity at CMR NWR. They also act as important habitat creators. Their grass eating and clipping habits create open plains that are important bird habitat. Prairie dogs also act as important food sources for black-footed ferrets, coyotes, badgers, and birds of prey. The CMR CCP indicates an objective to "maintain viable prairie dog towns totaling no less than 5,000 acres and no more than 10,000 acres on suitable areas with sizes and patterns desirable for black-footed ferrets". Acres of wilderness prairie dog will contribute to this refuge-wide goal.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium, due to the fact that four prairie dog towns were not surveyed in 2010.

Process used to compile or gather data: Wilderness Fellow reviewed prairie dog ArcGIS layers provided by Randy.

Priority & significance factor: High / Any change will be considered significant.

Measure 12. Number of black-footed ferrets

Description: Number of black-footed ferrets known to live in prairie dog towns that overlap with wilderness.

Context: Black-footed ferrets are a critically endangered species and CMR NWR supports the only population in Montana. In 1994, FWS released black-footed ferrets into prairie dog towns on the refuge. Since then significant efforts have been made on a yearly basis to insure survival of the population, which has suffered from canine distemper and starvation due to the decimation of their main food source, prairie dogs, by the sylvatic plague. Since prairie dog habitat exists in CMR and UL Bend wilderness, black-footed ferrets could conceivably be present in wilderness. The last known ferret to live in a wilderness prairie dog town died in 2007 during a plague episode.

Relevance: Black-footed ferrets are an endangered species that CMR NWR works very hard to preserve. The intensive care and management of the species may not be wholly compatible with wilderness and 'wildness', but the presence of black-footed ferrets in prairie dog towns that overlap with wilderness would be an indicator of likely improving survival rates among the species on the refuge.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed prairie dog and black-footed ferret ArcGIS layers provided by Randy.

Priority & significance factor: High / Any change will be considered significant.

Measure 13. Active grouse lek sites

Description: Percent of grouse lek sites, in wilderness or on wilderness boundaries, found to be active when surveyed. This measure accounts for both sage grouse and sharp-tail grouse leks.

Context: Sharp-tail grouse is a trust species at Charles M. Russell NWR and founding legislation provided specific grouse population targets for the refuge. Since that time, sage grouse have become a candidate species for threatened or endangered status and equal, or greater, attention is now given to sage grouse. Active leks are an indicator of the health of grouse populations and of their reproductive health. In late spring each year CMR conducts a survey of known leks to determine whether they are in active use. There are 39 leks in wilderness or on wilderness boundaries that have been included in past surveys (34 CMR PWA and 5 UL Bend). Not all survey leks are visited each year, and wilderness leks, in particular, have a low sampling rate because of the effort required to reach the leks. In 2011,

six wilderness leks were surveyed. Of these six, four were active (67%). In 2010, 13 wilderness leks were surveyed. Ten were found to be active (77%). The below tables provide more details:

CMR Proposed Wilderness Areas Lek Surveys

	Number of leks surveyed		Number of active leks		
Survey Year	Sage grouse	Sharp-tail	Sage grouse	Sharp-tail	% active
2010 *	0	8	0	6	75%
2011 **	0	4	0	2	50%

* Leks were in Burnt Lodge (3), Wagon Coulee (2), East Beauchamp (2), and West Beauchamp (1) PWAs.
** Leks were in East Beauchamp (3) and Mickey Butte (1).

UL Bend Wilderness Lek Surveys

	Number of leks surveyed		Number of active leks		
Survey Year	Sage grouse	Sharp-tail	Sage grouse	Sharp-tail	% active
2010 *	3	2	3	1	80%
2011	1	1	1	1	100%

* In 2010 all known leks in UL Bend Wilderness were surveyed.

Relevance: Both species of grouse are critical wildlife species on CMR NWR. It is possible that grouse populations in wilderness portions of the refuge may exhibit different population patterns due to different management of wilderness. This measure will allow the refuge to examine whether survey results in wilderness deviate from results across the refuge as a whole. In 2011, sage grouse were heard at 9% of the leks surveyed across the refuge. In contrast, the results in wilderness were 100%, but with a sample size of only one lek this is not statistically significant. Sharp-tail results refuge wide in 2011 were 35% active. In wilderness, 60% were active (n=5).

Data source: Neil Kadrmas, wildlife biologist.

Data adequacy: Confidence in data is low given small sample sizes.

Process used to compile or gather data: Wilderness Fellow reviewed geospatial database provided by Neil using ArcGIS. Refuge-wide results were obtained from 'Results from 2011 Grouse Listening Station Survey' memorandum distributed by Neil in July 2011.

Priority & significance factor: High / A change of ±25% will be considered significant.

Measure 14. Population of bighorn sheep

Description: Number of Rocky Mountain bighorn sheep counted during a yearly survey. If surveys are conducted multiple times a year (ex. July and December) results are taken from whichever survey produced a higher number of animals.

Context: The 1986 EIS established a target population of a minimum of 160 observed animals. Alternative D of the CCP sets a management target of 25-30 ewes in the Mickey

Butte PWA and an overall refuge target of 225 sheep, ±10%, observed via aerial surveys. In 2011, 77 sheep were observed in a July aerial survey. 34 (18 ewes) were observed in the Mickey Butte PWA and 43 (26 ewes) in the Burnt Lodge PWA. These numbers are significantly below targets. In 2010, 119 sheep were observed in a July on-the-ground survey (59 ewes).

Relevance: Almost all bighorn sheep habitat is found within proposed wilderness areas of CMR, namely Burnt Lodge PWA and Mickey Butte PWA. Suitable habitat also exists in the East and West Seven Blackfoot PWAs, although there are no sheep currently on the south side of the Missouri River within the refuge. Bighorn sheep are also surveyed outside of wilderness east of the Burnt Lodge PWA. Wilderness, therefore, will be the most significant contributor to bighorn sheep targets. This measure is not relevant to UL Bend Wilderness.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium given that survey methods produce only an estimated population.

Process used to compile or gather data: Wilderness Fellow reviewed ArcGIS data provided by Randy.

Priority & significance factor: Medium / A 20% change will be considered significant.

Measure 15. Population of elk

Description: Five-year average of elk population (elk per sq. mile) collected via late fall aerial surveys. Only aerial survey blocks that are >40% wilderness are included in calculating these population values (Antelope Creek, Crooked Creek West, Herman Point, Larb Hills, Billy Creek, Hell Creek, Crooked Creek East, and Sheep Creek).

Context: The 1986 EIS provides a management target of 2.5 elk per square mile. The desirable gender ration is 20-30 bulls : 100 cows. This measure will be updated every five years. For the 2006-2010 survey period there was an average of 6.7 elk per square mile in CMR PWAs and 18.2 elk per square mile in UL Bend. (Note: Sample data were not available for 2010 for CMR PWAs and for 2008 and 2010 for UL Bend Wilderness.)

Relevance: Hunting, other disturbance factors, and habitat may be different in wilderness areas of the refuge, which may result in larger populations of elk residing in wilderness. The data from 2006-2010 suggests that elk populations are much higher than targets in wilderness, especially in designated wilderness in UL Bend.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium given that survey methods produce only an estimated population.

Process used to compile or gather data: Wilderness Fellow reviewed ArcGIS data provided by Randy.

Priority & significance factor: Medium / An increase or decrease of 1.25 elk per square mile will be considered significant.

Measure 16. Population of deer

Description: Five-year average of mule deer per square mile collected via late fall aerial surveys. Only aerial survey blocks that are >40% wilderness are included in calculating these population values (Antelope Creek, Crooked Creek West, Herman Point, Larb Hills, Billy Creek, Hell Creek, Crooked Creek East, and Sheep Creek).

Context: The 1986 EIS provides a management target of 10 over wintering mule deer per square mile (total estimated population, not the density of deer observed during aerial surveys). The desirable gender ratio is 25:100 mature bucks to does (a mature buck has 4+ points on at least one antler). For the 2006-2010 survey period there was an average of 5.1 deer per square mile in CMR PWAs and 10.6 deer per square mile in UL Bend. (Note: Sample data were not available for many CMR PWAs every year and for 2008 for UL Bend.)

Relevance: Hunting pressure may be different in wilderness areas of the refuge, which may result in larger populations of deer residing in wilderness habitat. The data from 2006-2010 suggest that deer populations in UL Bend Wilderness meet targets and populations in CMR PWAs are below targets.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium given that survey methods produce only an estimated population.

Process used to compile or gather data: Wilderness Fellow reviewed ArcGIS data provided by Randy.

Priority & significance factor: Medium / An increase or decrease of two deer per square mile will be considered significant.

Measure 17. Number of non-native, invasive plants

Description: Number of non-indigenous, invasive plant species known to exist in refuge wilderness.

Context: As of 2011, there are 7 non-native, invasive plant species likely present in CMR PWAs and UL Bend Wilderness. These species are leafy spurge, salt cedar, Japanese brome, yellow sweet clover, Canada thistle, and Russian olive. Surveys of wilderness for invasive plants have not been performed, so this species list was generated as 'likely' present by the field station managers.

Relevance: Non-native, invasive plants claim growing space and compete with native plants, often to the extent of displacing natives. CMR uses Montana Conservation Corps, USFWS Montana Invasives Strike team, and seasonal staff to control current invasive plant populations, but all of this work to date has been performed outside of wilderness. At some point in the future efforts may extend to surveying and treating invasive plants in wilderness.

Data source: All field station managers and Lindy Garner, Montana Invasives Strike Team Leader.

Data adequacy: Confidence in data is low given that surveys have not been performed. The Wilderness Fellow observed salt cedar and yellow sweet clover in several wilderness areas.

Process used to compile or gather data: Inquiry sent to all field station managers and Lindy.

Priority & significance factor: Low / Any change will be considered significant.

Measure 18. Number of non-plant, non-native, invasive species

Description: Number of non-plant, non-native, invasive species established on the refuge. Accounts for both aquatic and land species. Includes non-native diseases.

Context: On a smaller scale than plants (currently), vertebrate, invertebrate, and viral species have been introduced and become established in CMR and UL Bend Wilderness. These species compete with and displace native species. In 2011, six non-plant invasives are present—ring-necked pheasants, Hungarian/grey partridge, turkey, starling, rock doves (pigeons), sylvatic plague (*Yersina pestis* bacteria vectored by fleas), and West Nile disease.

Relevance: The competition these species provide may disrupt the natural ecosystem and displaces native species. Sylvatic plague has been particularly devastating and has significantly reduced prairie dog and black-footed ferret populations. West Nile disease is also of significant concern.

Data source: Inquires made with Randy Matchett, wildlife biologist, and Beverly Skinner, refuge wildlife specialist.

Data adequacy: Confidence in data is medium, given that surveys have not been explicitly conducted in wilderness.

Process used to compile or gather data: Compilation of responses from Randy and Beverly.

Priority & significance factor: High / Any change will be considered significant.

Indicator: Physical Resources

Measure 19. Air quality

Description: This measure of refuge wilderness air quality will be entered nationally by the I&M program.

Context: Air quality is deemed a nationally important natural physical resource.

Relevance: Air quality is important to maintain for overall ecosystem health and for enjoyment of the visiting public.

Data source: National I&M program.

Data adequacy: N/A

Process used to compile or gather data: N/A

Priority & significance factor: High / Significance will be set at national level.

Measure 20. Number of wilderness watersheds rated not functioning or functioning at risk

Description: Refuge watersheds are rated by these categories: proper functioning condition (healthy), functioning at risk (healthy, but with problems), and not functioning. This measure tallies wilderness watersheds that receive a rating of functioning at risk or not functioning.

Context: In August of 2009, lotic wetland health assessments were conducted on streams across the Charles M. Russell National Wildlife Refuge. This assessment was also conducted between 1995 and 1997. The assessment resulted in a status of riparian health for each individual stream by taking into account ecological functions such as sediment trapping, stream bank building and maintenance, water retention, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary biotic production. The 2009 assessment included 12 watersheds in CMR proposed wilderness areas and an assessment of UL Bend was also provided. In 2009, eight CMR PWA watersheds were rated not functioning and four were rated functioning at risk. In UL Bend, there are three watersheds: one rated not functioning, one functioning at risk, and the third was not surveyed. The refuge-wide assessment of riparian health in 2009 was functioning at risk.

Wilderness Area	Watershed	Health Assessment	1997-2009 Trend
Antelope Creek	Antelope Creek	Not functioning	Degrading
Billy Creek	Billy Creek	Not surveyed	Not sampled in '97
	Missouri River-Widow Coulee	Not surveyed	Not sampled in '97
Burnt Lodge	Kill Woman Creek	Not functioning	Not sampled in '97
	Missouri River-Chippy Creek	Not surveyed	Not sampled in '97
	Missouri River-Cart Trail Coulee	Not surveyed	Not sampled in '97
Crooked Creek	Soda Creek	Not functioning	Static
	Crooked Creek-Fort Peck Reservoir	Not functioning	Static
East & West Beauchamp Creek	Lower Beauchamp Creek	Functioning at risk	Improving
East Hell Creek	Lower Hell Creek	Functioning at risk	Improving
	Missouri River-Lower Eighth Coulee	Not functioning	Degrading
	Crooked Creek	Not functioning	Static
East Seven Blackfoot	Lower Seven Blackfoot Creek	Not surveyed	Not sampled in '97
Fort Musselshell	Missouri River-Nichols Creek	Not functioning	Degrading
Mickey Butte	Missouri River-Deadman Coulee	Functioning at risk	Improving
	Valentine Creek	Functioning at risk	Improving
Sheep Creek	Gilbert Creek	Not surveyed	Not sampled in '97
Soda Creek	Musselshell River-Fort Peck Reservoir	Not functioning	Not sampled in '97

UL Bend	Valentine Creek	Functioning at risk	Improving
	Jim Wells Creek	Not surveyed	Not sampled in '97
	Hawley Creek	Not functioning	Improving
Wagon Coulee	Missouri River-Cabin Coulee	Not surveyed	Not sampled in '97
West Hell Creek	Missouri River-Snow Creek	Not surveyed	Not sampled in '97

Relevance: Functioning riparian habitats are critical for maintaining healthy wildlife and plant communities on the refuge. This measure will help elucidate whether riparian health and trends in wilderness areas differs from the refuge-wide assessment.

Data source: Land ownership by sub-watershed and riparian functionality map produced by USFWS Region 6 Water Resources Division and provided by Bill Berg, deputy project leader. As well as the Riparian Health Assessment Report from March 2010.

Data adequacy: Confidence in data is medium. Not all watersheds in wilderness were included in the 2009 assessment. These watersheds have not been assessed: Chippy Creek (Burnt Lodge PWA), Cart Trail Coulee (Burnt Lodge), Billy Creek (Billy Creek PWA), Widow Coulee (Billy Creek), Lower Seven Blackfoot Creek (East Seven Blackfoot PWA), Cabin Coulee (Wagon Coulee PWA), Snow Creek (West Hell Creek PWA), and Gilbert Creek (Sheep Creek PWA).

Process used to compile or gather data: Wilderness Fellow review of map and supporting documentation provided by Bill.

Priority & significance factor: High / Any change will be considered significant.

Measure 21. Wilderness watersheds significantly affected by dams

Description: Any watershed with more than one dam per square mile is considered significantly altered.

Context: A regional committee is currently assessing impacts of dams on watersheds in the region. The committee has set a threshold of one or more dams per square mile as an indicator of a significantly modified, and therefore compromised, watershed. In 2011, two watersheds within CMR proposed wilderness areas have more than one dam per square mile—Valentine Creek within the Mickey Butte PWA (1.02 dams per square mile) and Kill Woman Creek within the Burnt Lodge PWA (1.71 dams per square mile). All dams within these watersheds are located north of the refuge on BLM and private land. UL Bend is not included in the regional assessment, so this measure is not applicable to UL Bend Wilderness.

Wilderness Area	Watershed	Dams Per Square Mile
Antelope Creek	Antelope Creek	0.69
Burnt Lodge	Kill Woman Creek	1.71
	Missouri River-Chippy Creek	0.14
	Missouri River-Cart Trail Coulee	0.39
Billy Creek	Billy Creek	0.21
	Missouri River-Widow Coulee	0.23

Crooked Creek	Soda Creek	Unknown
	Crooked Creek-Fort Peck Reservoir	0.33
East & West Beauchamp Creek	Lower Beauchamp Creek	0.75
East Hell Creek	Lower Hell Creek	0.15
	Missouri River-Lower Eighth Coulee	0.03
	Crooked Creek	0.32
East Seven Blackfoot	Lower Seven Blackfoot Creek	0.77
Fort Musselshell	Missouri River-Nichols Creek	0.39
Mickey Butte	Missouri River-Deadman Coulee	0.42
	Valentine Creek	1.02
Sheep Creek	Gilbert Creek	0.13
Soda Creek	Musselshell River-Fort Peck Reservoir	0.35
UL Bend	UL Bend	Unknown
Wagon Coulee	Missouri River-Cabin Coulee	0.19
West Hell Creek	Missouri River-Snow Creek	0.07

Relevance: Functioning watersheds are critical for maintaining healthy wildlife and plant communities on the refuge. This measure will help bring attention to wilderness watersheds significantly affected by developed structures upstream.

Data source: Watershed analysis map and accompanying documentation provided by Bill Berg, deputy project leader.

Data adequacy: Confidence in data is medium, given that the main stream of a watershed may not actually be located within the proposed wilderness area. It is also unknown how many dams per square mile are present in Soda Creek.

Process used to compile or gather data: Wilderness Fellow review of map and supporting documentation provided by Bill.

Priority & significance factor: Medium / Any change will be considered significant.

Monitoring Question: What are the trends in terrestrial, aquatic, and atmospheric natural processes inside wilderness?

Indicator: Biophysical processes

Measure 22. Departure from natural fire regime index

Description: This measure reflects the percent of expected acres of fire on the landscape over the timeframe evaluated given the average fire return interval.

Context: The average fire return interval across Charles M. Russell and UL Bend National Wildlife Refuges is 25 years. Given this interval, Mike Granger, FMO, calculated the departure from natural fire regime as follows: The total acreage of wilderness is divided by

25 to obtain the number of acres of fire expected in a given year. For CMR PWAs, this is 6,344 acres per year. For UL Bend PWAs, this is 833 acres per year. In order to establish a 2011 baseline we looked at fires that have occurred in wilderness since 2000 (11 years). The expected acreage burned over 11 years in CMR PWA is 69,784 acres and in UL Bend Wilderness is 9,163 acres. Over the last 11 years, however, 52,037 acres have burned in CMR PWAs and 2,453 acres in UL Bend Wilderness. By dividing the total number of acres that have burned by the number of acres expected to burn over that duration a percent of the average expected wildfire acres is obtained. For CMR PWAs between 2000 and 2011 is 74.6% and 26.8% for UL Bend Wilderness.

Relevance: Portions of wilderness that have deviated from the average fire return interval are likely to have higher fuel loads than desirable, increasing risks of high severity fires when fire does occur. Regeneration of fire dependent species, such as ponderosa pine (*Pinus ponderosa*), may also be limited in these areas, causing shifts in vegetation communities.

Data source: FMIS fire database, refuge ArcGIS fire layers, and Cecil Frost's fire return interval work on the refuge.

Data adequacy: Confidence in data is low given that the calculation of these values doesn't take into account the geospatial aspects of these burns, i.e. if the same area burned twice during this timeframe. It also doesn't account for varying fire return intervals across the landscape in different vegetation communities and the severity of burns that did occur.

Process used to compile or gather data: Acreage for all fires were obtained from the FMIS fire database and from ArcGIS data. Mike developed system for calculating departures from the expected fire regime and totaled fire acreages to calculate % of the average expected as described above in Context.

Priority & significance factor: Medium / An increase or decrease of 10 in the % of the average expected wildlfire acres will be considered significant.

UNDEVELOPED

A definition of undeveloped from Keeping it Wild: The Wilderness Act states that wilderness is "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation," "where man himself is a visitor who does not remain," and "with the imprint of man's work substantially unnoticeable." This quality is degraded by the presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment, or mechanical transport that increases people's ability to occupy or modify the environment.

Monitoring Question: What are the trends in non-recreational development inside wilderness?

Indicator: Non-recreational installations, structures, and developments

Measure 23. Miles of fence

Description: This measure tallies miles of fence within wilderness and excludes fence on wilderness boundaries. It includes all fence types (electric, barbed wire, wildlife friendly, etc.) even if not actively used that year and dropped down.

Context: Fencing is used primarily at CMR NWR to segment portions of the wilderness into livestock grazing units. Most fence is barbed wire and is not dropped down when grazing isn't active. In 2011, the following amount of fence is present in wilderness:

Antelope Creek PWA	0.9 miles
Billy Creek PWA	0.7 miles (should be confirmed in 2012)
Burnt Lodge PWA	5.7 miles
East Beauchamp PWA	0 miles
East Hell Creek PWA	5.4 miles (should be confirmed in 2012)
East Seven Blackfoot PWA	1.1 miles (should be confirmed in 2012)
Fort Musselshell PWA	4.2 miles
Mickey Butte PWA	1.4 miles
Sheep Creek PWA	0.5 miles (should be confirmed in 2012)
UL Bend Wilderness	4.7 miles
Wagon Coulee PWA	5.8 miles
West Beauchamp PWA	0.8 miles
West Hell Creek PWA	2.0 miles (should be confirmed in 2012)
West Seven Blackfoot PWA	0.7 miles (should be confirmed in 2012)

There is a total of 33.9 miles of fence within wilderness.

Relevance: While fence performs a very important role in CMR PWAs and UL Bend Wilderness to protect sensitive ecological areas from non-wildlife grazing and allows refuge managers to selectively graze only certain areas, fence is a hindrance to wilderness recreational users and serves as a reminder of man's presence. This measure does not

distinguish between types of fence utilized in wilderness, but serves to encourage the refuge to reduce fence use, regardless of type, within wilderness.

Data source: The refuge maintains a GIS data layer of all fence.

Data adequacy: Confidence in data is low. Discrepancies exist between refuge-wide GIS data files provided and information provided by the Jordan field station.

Process used to compile or gather data: Fence layer in ArcGIS used to isolate wilderness fence and calculate total mileage.

Priority & significance factor: High / A 10% change will be considered significant.

Measure 24. Number of water control structures

Description: Number of water control structures, developments, and impoundments in wilderness areas including, but not limited to, livestock reservoirs, stock ponds, stock tanks, and wells.

Context: When wilderness areas were proposed and/or designated at Charles M. Russell NWR and UL Bend a number of water control structures were in place, some that were established before the national wildlife refuge was founded. Most of these structures have remained in place. In 2011, there were 24 such water control structures in CMR PWAs (21 reservoirs, two wells, one stock tank) and 10 water control structures in UL Bend designated wilderness (nine reservoirs and one well).

Relevance: These water control structures alter the movement of wildlife and may also impact the natural functioning of watersheds within the wilderness. They also represent a human development footprint.

Data source: Dan Harrell provided a binder of maps that show locations of all fence, reservoirs, stock ponds, vegetation exclosures, and wells under the purview of the Sand Creek field station. Nathan Hawkaluk provided digital maps showing locations of structures within the Jordan field station PWAs. There is a map on the wall in the Fort Peck office that shows the location of all Wagon Coulee infrastructure.

Data adequacy: Data confidence is high.

Process used to compile or gather data: Inquiries made with all field station managers. Wilderness Fellow reviewed binder provided by Dan and digital maps sent by Nathan. Aaron provided a list of all Wagon Coulee reservoirs, stock ponds, stock tanks, and wells via email.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 25. Number of research structures and equipment installed

Description: Number of permanent or temporary research and monitoring structures and equipment installed in the wilderness. Includes exclosures, weather stations, etc.

Context: Research and ongoing data collection projects may require permanent or temporary installation of structures and equipment in wilderness. At CMR NWR this constitutes primarily

vegetation exclosures. In 2011, there were 10 exclosures in CMR PWAs. All were located in the Fort Musselshell PWA. There are no research structures or equipment present in UL Bend.

Relevance: The value of these installations is clear, but the structures and equipment do serve to remind recreationists of the presence of man and can impact the feeding and movement of native wildlife. A goal for the refuge should be to minimize installations to the fewest absolutely necessary and to, when possible, install equipment only temporarily.

Data source: Dan Harrell provided a binder of maps that provided locations for all vegetation exclosures in CMR PWAs under the Sand Creek field station's purview. Bob Skinner provided locations of exclosures in Jordan and Fort Peck PWAs. Randy Matchett indicated via email that he is not aware of any research structures or installations in wilderness.

Data adequacy: Confidence in data is low. Additional installations likely identify research transects or plots that the current staff is unaware of. Seasonal technicians can assist by taking GPS coordinates of installations they find while performing field work in 2012.

Process used to compile or gather data: Wilderness Fellow reviewed all maps provided by Dan Harrell and made inquiries with Bob and Randy about other possible structures or installations.

Priority & significance factor: Medium/ Any change will be considered significant.

Indicator: Inholdings

Measure 26. Number of private inholdings

Description: Number of private inholdings within wilderness. A private inholding is considered within wilderness if it is surrounded by wilderness on all sides, excluding any parcel edges that correspond with the executive order boundary.

Context: At the time that the Charles M. Russell PWAs were established there were several private parcels within the refuge executive order boundaries and surrounded entirely by wilderness. These private parcels are highly desirable for refuge acquisition and will likely be additions to wilderness at that time. As of 2011, there are three private inholdings in CMR PWAs: one inholding is between East and West Seven Blackfoot PWAs, one is within East Seven Blackfoot PWA, and another is within East Hell Creek PWA. UL Bend does not contain any inholdings, so this measure is irrelevant.

Relevance: Private or state inholdings have the potential of impacting all qualities of wilderness, but more often than not contain developed structures that detract from a wilderness' undeveloped state. The inholding in the East Hell Creek PWA has also presented a number of law enforcement issues, as inholding owners have a history of taking ATVs off of their private land into adjacent wilderness areas. Livestock trespass has also frequently occurred.

Data source: Danielle Kepford, realty specialist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Danielle.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 27. Acres of private inholdings

Description: Acres of private inholdings within wilderness. A private inholding is considered within wilderness if it is surrounded by wilderness on three or more sides.

Context: At the time that the Charles M. Russell PWAs were established there were several private parcels within the refuge executive order boundaries and surrounded entirely by wilderness. These private parcels are highly desirable for refuge acquisition and will likely be additions to wilderness at that time. As of 2011, there are three private inholdings in CMR PWAs comprising 960 acres. The breakdown of acreages by parcel are as follows: inholding between East and West Seven Blackfoot PWAs is 320 acres, inholding within East Seven Blackfoot PWA is 80 acres, and inholding within East Hell Creek PWA is 560 acres. UL Bend does not contain any inholdings so this measure is irrelevant.

Relevance: See Measure 26. Number of private inholdings. The larger the inholding, the greater the likely impact on wilderness character.

Data source: Danielle Kepford, realty specialist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Danielle.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 28. Acres of state inholdings

Description: Acres of state-owned land within wilderness.

Context: The state of Montana owns a checkerboard of 640 acre parcels (referred to as sections) across the entire state, including Charles M. Russell NWR. Some of these state sections fall within CMR PWAs and UL Bend Wilderness. The state leases many of these sections. CMR holds some of the leases. The American Prairie Foundation (APF), a neighboring conservation partner, has obtained most of the leases for state sections within UL Bend. Grazing permittees and private owners of land within or adjacent to CMR hold some of the other state leases. In 2011 there are 1280 acres of state-owned land within UL Bend Wilderness and 4,000 acres of state-owned land, across eight state sections, within CMR PWAs. Lessees of these state leases break out as follows: two sections leased by APF, three sections leased by USFWS, and three sections leased by adjacent private landowners (McKeever and Tumblin' T).

Relevance: State sections leased by private landowners may be used for grazing. In those cases livestock are not fenced within the state section, but allowed to roam in the broader PWA in which the state section falls. The transfer and sale of state sections is a complex process, but ideally, over time, USFWS intends to lease the state sections in order to reduce potential impacts on wilderness and to avoid access issues that may arise. Long-term planning will assess potential acquisition of these state leases.

Data source: Danielle Kepford, realty specialist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Danielle.

Priority & significance factor: High / Any change will be considered significant.

Measure 29. Miles of road associated with inholdings

Description: Miles of road within wilderness that are maintained in order to provide access to private or state inholdings.

Context: A 2002 lawsuit by the Central Montana WIldlands Association resulted in the closure of all roads in CMR PWAs that are not justified by providing access to state or private inholdings. This left 6.4 miles of road in the East Hell Creek PWA to provide access to the inholding owned by Murnion (numbered roads 469 and 470). There are no inholdings in UL Bend Wilderness.

Relevance: The sight and sound of vehicles on these roads detracts from wilderness character. The presence of the road also encourages motor vehicle trespass in the proposed wilderness area, something that has proved to be a problem in the East Hell Creek PWA.

Data source: ArcGIS layer containing all refuge roads.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: ArcGIS layer provided by Randy Matchett. Wilderness Fellow reviewed the roads layer to extract wilderness road mileage.

Priority & significance factor: High / Any change will be considered significant.

Measure 30. Miles of wilderness boundary adjacent to private land

Description: Miles of wilderness boundary abutting private land—both within and outside the executive order refuge boundary.

Context: Twelve private parcels abut proposed wilderness areas at CMR NWR. There is no private land within or adjacent to UL Bend Wilderness. In 2011, these twelve parcels had 19.35 miles of boundary abutting CMR PWAs. The 2011 figure does not include the private parcel northeast of the Antelope Creek PWA that was acquired in late 2011.

Relevance: These private parcels may provide sights and sounds that detract from wilderness character. Many of these private holdings have been prioritized for acquisition in the hopes of enhancing wilderness on the refuge.

Data source: Montana Cadastral site: http://svc.mt.gov/msl/mtcadastral/. Danielle Kepford, realty specialist, provided information about 2011 acquisition.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: The Cadastral website provides a tool for measuring mileages of boundaries.

Priority & significance factor: Medium / Any change will be considered significant.

Monitoring Question: What are the trends in mechanization inside wilderness?

Indicator: Use of motor vehicles, motorized equipment, and mechanical transport

Measure 31. Number of authorized uses on fire details

Description: Number of days when a motor vehicle, motorized equipment, or mechanical transport were authorized for use on a fire detail.

Context: At CMR NWR historically the FMO has been given permission to approve the use of motor vehicles, motorized equipment, or mechanical transport use on fire details without performing a Minimum Requirements Analysis. Until 2011, fire crews operated under a belief that chainsaw use was allowed in proposed wilderness areas, but not designated wilderness. The FMO is now aware that proposed wilderness, per Fish & Wildlife Service policy, is to be managed as if were designated wilderness. Hence, chainsaw use is not allowed. It remains to be seen whether CMR will continue to allow the FMO to authorize motor vehicle, motorized equipment, or mechanical transport use in CMR proposed wilderness areas without utilizing the Minimum Requirements Analysis. In 2011, there was authorized use of a motor vehicle for one day on a fire detail. Between 2007 and 2010, there was an average of three days of motor vehicle, motorized equipment, or mechanical transport use on fire details each year. There has not been any use in UL Bend Wilderness since 2000.

Relevance: The use of motor vehicles, motorized equipment, or mechanized transport can leave lasting impacts on the landscape that detracts from the undeveloped quality of wilderness. The use also reduces the opportunity for fires to achieve natural ecological impacts, although it is likely that fire will continue to be managed on CMR NWR to protect critical sagebrush habitat.

Data source: FMIS online database and the memory of Mike Granger, FMO.

Data adequacy: Confidence in data provided since 2007 is high. Data for 2000 through 2006 does not provide a breakdown of the number of days of use, only the number of fires on which use was authorized by the FMO. In 2003 and 2005, use was authorized on four fires.

Process used to compile or gather data: Data compiled and provided by Mike.

Priority & significance factor: High / Any change is considered significant.

Measure 32. Miscellaneous authorized uses

Description: Number of days of authorized motor vehicle, motorized equipment, and mechanical transport uses in or over wilderness (excluding authorized uses of motorized vehicles or equipment on fire details). This measure does not include low-altitude flights initiated by refuge staff to survey wildlife, find missing livestock, etc. CMR NWR would like to implement a separate measure in the future to monitor wildlife disturbance by low-altitude flights (see Measure G. Number of authorized low-altitude flights).

Context: Some refuge management activities are deemed to require motor vehicle, motorized equipment, and mechanical transport use. Before any such use, however, a Minimal Requirements Analysis should be performed in order to validate that this mechanized or motorized use is absolutely necessary. In 2011, there was one day of authorized use of a helicopter in the Burnt Lodge PWA. It was used to pick up the fossilized remains of a plesiosaur that was extracted from the PWA. The helicopter touched down and removed approximately 1 ton of materials from the site. There were no authorized uses in UL Bend Wilderness. This measure does not account for the use of hand-carts in wilderness, which Charles M. Russell NWR allows in proposed wilderness areas, but not in UL Bend Wilderness.

Relevance: The Wilderness Act of 1964 provides provisions for the Minimal Requirements Analysis process to be used to authorize occasional uses of motor vehicles, motorized equipment, and mechanical transport in wilderness areas for management purposes.

Data source: All field station managers, as well as the deputy project leader, were asked to recall any authorized uses of motorized vehicles, mechanized equipment, or motorized transport. The Wilderness Fellow was involved in the plesiosaur extraction and therefore was aware that the helicopter was used for one day. Ideally, going forward, Minimal Requirements Analysis paperwork will be filed in the Lewistown office for all miscellaneous authorized uses. All motorized vehicles and equipment used for the Fort Musselshell PWA fence replacement in 2011 operated on the wilderness boundary and not within wilderness.

Data adequacy: Confidence in data is high. The refuge project leader or deputy project leader are made aware of all authorized uses and the Minimal Requirements Analysis process formalizes the decision-making process and ensures that detailed records are kept.

Process used to compile or gather data: Inquiries made with all field station managers and deputy project leader.

Priority & significance factor: High / Any change will be considered significant.

Measure 33. Number of unauthorized uses

Description: Number of unauthorized motor vehicle, motorized equipment, and mechanical transport uses in or over wilderness. (Including citations issued for off-road vehicle activity and known violations without issued citations.)

Context: Most wilderness boundaries at CMR NWR are marked, but the public, grazing permittees, or refuge volunteers and seasonal employees may, either knowingly or unknowingly, use motor vehicles, motorized equipment, or mechanical transport in wilderness.

In 2011, law enforcement did not cite any members of the public for unauthorized uses in wilderness and there are no known unauthorized uses by CMR staff.

Relevance: Unauthorized uses of motorized or mechanical vehicles, equipment, and transport can be particularly damaging and may leave longstanding evidence of their presence.

Data source: Deb Goeb, LE, and all field station managers.

Data adequacy: Confidence in data is medium, given that instances of unauthorized use may not be observed.

Process used to compile or gather data: Inquiries made all field station managers via email. In person meeting with Deb.

Priority & significance factor: High / Any change will be considered significant.

Measure 34. Number of emergency uses

Description: Number of authorized motor vehicle, motorized equipment, and mechanical transport uses in or over wilderness for emergency purposes.

Context: The safety of the public and refuge staff may sometimes trump restrictions on motorized and mechanical use in wilderness. In 2011, there were no emergency situations that occurred in wilderness that required motorized vehicles, motorized equipment, or mechanical transport.

Relevance: Safety comes first, but emergency uses of motorized and mechanical vehicles, equipment, and transport may possibly leave longstanding evidence of their presence.

Data source: Deb Goeb, LE, and all field station managers.

Data adequacy: Confidence in data is high, given that emergency situations are easily recalled and noted.

Process used to compile or gather data: Inquiries made with all field station managers via email. In person meeting with Deb Goeb.

Priority & significance factor: High / Any change will be considered significant.

Monitoring Question: What are the trends in cultural resources inside wilderness?

Indicator: Loss of statutorily protected cultural resources

Measure 35. Number of disturbances of cultural resources

Description: Disturbances to cultural resources can include human vandalism (carvings, spray paint, removal of resources) or animal-caused damage (from rubbings, collisions, etc.).

Context: See Relevance.

Jim Well's cabin in UL Bend designated wilderness.

Relevance: This indicator specifically references 'statutorily protected' cultural resources. There are no resources at CMR NWR or in UL Bend Wilderness that are statutorily protected via the National Historic Register. If anything is added in the future, such as Jim Well's Cabin in UL Bend Wilderness, a decision will be made then how to assess disturbances to that resource. Until that time a zero will be captured for this measure.

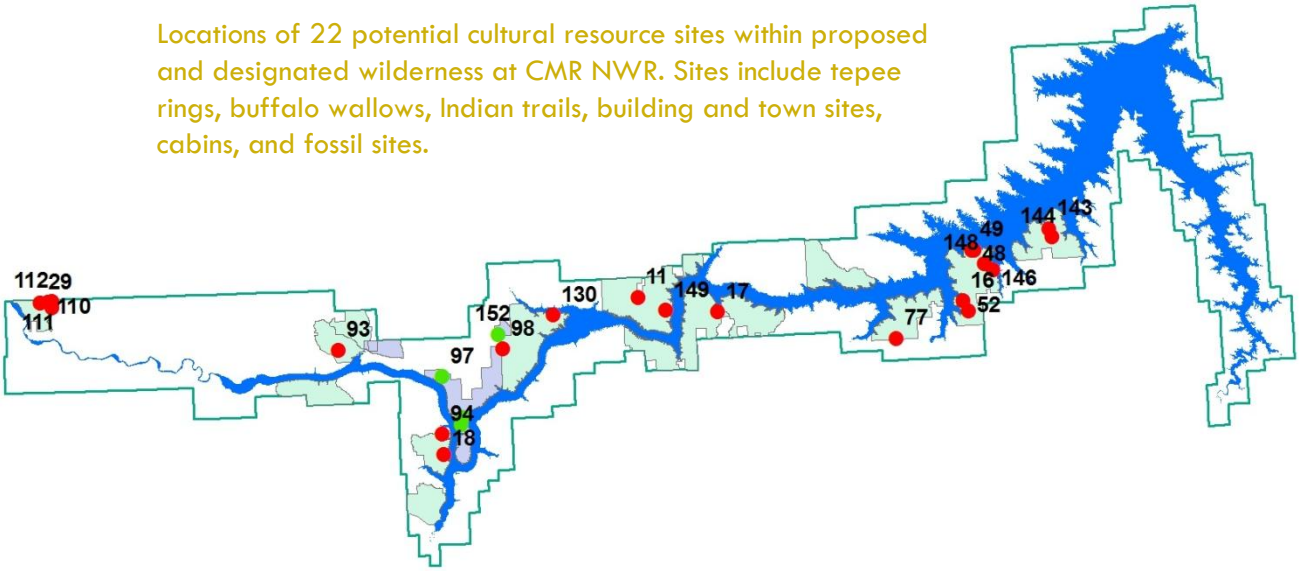
Data source: A zero will be recorded for this measure until any resources on CMR NWR or UL Bend are statutorily protected.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: N/A

Priority & significance factor: High / Any change is considered significant.

Locations of 22 potential cultural resource sites within proposed and designated wilderness at CMR NWR. Sites include tepee rings, buffalo wallows, Indian trails, building and town sites, cabins, and fossil sites.



Key:

Fort Musselshell/Herichival town site = 18
Hell Creek fossil area = 77
Wiederrick cabin = 11
Old cabin = 52, 148
Old building site = 16
Old corral = 144

Fossil site = 93, 94, 98, 146, 149
Bone Trail = 17
Buffalo wallow = 48, 143
Tepee rings = 110, 111, 112, 113, 130
Stanton gravesite = 49
Indian Trail = 29

SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

A definition of solitude or a primitive and unconfined type of recreation from Keeping It Wild: The Wilderness Act states that wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This quality is about the opportunity for people to experience wilderness; it is not directly about visitor experiences per se. This quality is degraded by settings that reduce those opportunities, such as visitor encounters, signs of modern civilization, recreation facilities, and management restrictions on visitor behavior.

Monitoring Question: What are the trends in outstanding opportunities for solitude inside wilderness?

Indicator: Remoteness from sights and sounds of people inside the wilderness

Measure 36. Miles of defacto or maintained trail

Description: Miles of defacto trail (i.e. closed roads) or maintained trail within wilderness.

Context: In 1992, CMR NWR began to enforce off-road travel across the refuge, including wilderness areas. In 2002, 39 miles of road within wilderness was closed per the US DOI memo entitled 'Charles M. Russell Road Policy Challenged' resulting from legal action initiated by the Central Montana Wildlands Association. At the time of closure, and since, no restoration efforts have been made to integrate the roads back into the natural landscape. The mileage of closed road by proposed wilderness area is as follows: Fort Mussellshell-1.2 miles, East Beauchamp-1.5 miles, Mickey Butte-10.9 miles, Burnt Lodge-10 miles, Wagon Coulee-1 mile, West Hell Creek-0.7 miles, East Hell Creek-3.6 miles, and Sheep Creek-10.1 miles. There are no roads in UL Bend Wilderness that were closed in the last fifteen years. There is no maintained trail in UL Bend Wilderness or CMR PWAs.

Relevance: These closed roads are still visible and are commonly used as trails. Defacto or maintained trail may concentrate use and increase visitor interactions. This measure is not used for UL Bend Wilderness.

Data source: ArcGIS data.

Data adequacy: Confidence in data is high. There is a roads layer that isolates just the roads that were closed.

Process used to compile or gather data: Wilderness Fellow compiled all road lengths using ArcGIS.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 37. Miles of cherry-stemmed road

Description: Miles of road within wilderness that have been cherry-stemmed, via legislation, for vehicular access.

Context: Roads within wilderness may exist because the proposal or legislation that created the wilderness provided for them. Within CMR PWAs, the only cherry-stemmed roads are present due to inholdings in the wilderness area. Within UL Bend Wilderness, there is one legislatively cherry-stemmed road created to provide recreational fishing access to Fort Peck Reservoir. The cherry stemmed road was created through the withdrawl of 28 acres of designated wilderness from the National Wilderness Preservation System via Public Law 98-140 on 10/31/1983.

In 2011, the inholding roads total 6.4 miles and are in the East Hell Creek PWA. The UL Bend cherry-stemmed road totals 2 miles. The road that separates the East Beauchamp PWA from the West Beauchamp PWA is not considered cherry-stemmed road, but instead is considered boundary road, since it is on the edge of each of these units.

Relevance: These roads create both sights and sounds that detract from solitude within the wilderness.

Data source: ArcGIS road layer.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed GIS data.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 38. Acres of contiguous wilderness

Description: Maximum number of connected, contiguous wilderness acres on the refuge.

Context: Wilderness at CMR NWR consists of 15 separate proposed wilderness units, many of which do not abut other wilderness units, and three disconnected designated wilderness areas within UL Bend. Across CMR and UL Bend, there are, however, several areas where wilderness units are contiguous and form large wilderness areas.

Water can be a barrier to visitor experiences at CMR. For the purposes of identifying contiguous wilderness the Fort Peck Reservoir was seen as a barrier to visitors. The Missouri River was not considered a barrier. Given this, the largest area of contiguous wilderness is made up of the Crooked Creek PWA (6,842 acres), UL Bend (16,227 acres), and the Mickey Butte PWA (16,893 acres). The total acreage of contiguous wilderness is 39,962 acres.

If water was not considered a barrier, the largest contiguous area would be made up of Burnt Lodge PWA (21,576 acres), West Seven Blackfoot PWA (6,456 acres), East Seven Blackfoot PWA (11,744 acres), and Billy Creek PWA (10,916 acres). The total acreage would be 50,692 acres.

Relevance: Larger wilderness areas result in fewer visitor encounters, especially at CMR and UL Bend NWRs where none of the wilderness areas contain maintained trails. They also provide fewer chances of encountering sights and sounds of people from outside wilderness, with the exception of overhead aircraft. Future management objectives for wilderness might prioritize adding wilderness acreage to this contiguous area before other wilderness units.

Data source: ArcGIS data.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow used ArcGIS to calculate acreages of all contiguous parcels.

Priority & significance factor: High / Any change will be considered significant.

Indicator: Remoteness from occupied and modified areas outside the wilderness

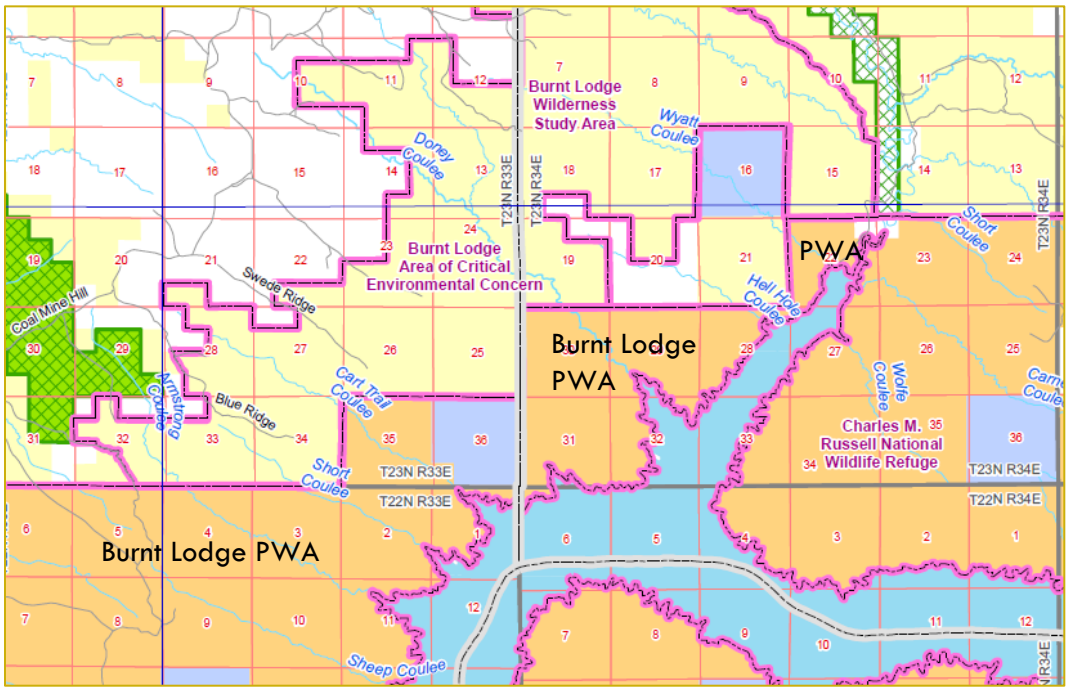
Measure 39. Miles of boundary abutting other wilderness areas

Description: Miles of National Wildlife Refuge System wilderness boundary abutting wilderness areas maintained by other agencies (i.e. BLM).

Context: Much of the land on the executive order boundary outside CMR NWR is BLM land. Both north and south of CMR NWR the BLM has created wilderness study areas (WSA). In late 2011, an announcement indicated that the BLM is considering adding several more wilderness study areas to the CMR vicinity, one of which may be adjacent to the East Beauchamp PWA. In 2011, four proposed wilderness areas are bordered by BLM WSAs—Antelope Creek PWA (3.8 miles), East Seven Blackfoot PWA (4.4 miles), West Seven Blackfoot PWA (3.0 miles), and Burnt Lodge PWA (8.4 miles). Currently UL Bend Wilderness does not abut any BLM wilderness.

Relevance: The 'buffering' of CMR NWR wilderness by BLM wilderness outside the refuge executive order boundary further decreases any likely sights and sounds from outside disrupting solitude within wilderness, with the exception of low flying aircraft.

NRIS map depicting the BLM Burnt Lodge wilderness study area, which is adjacent to the CMR NWR Burnt Lodge PWA.



Data source: NRIS public land maps at http://nris.mt.gov/gis/ownmaps.asp.

Data adequacy: Confidence in data is high, as NRIS maps are updated on a yearly basis.

Process used to compile or gather data: Wilderness Fellow reviewed all NRIS maps in order to locate BLM WSA abutting CMR NWR PWAs. Since BLM WSAs start and end on state section lines, which are 1 mile squares, it was easy to calculate mileage of boundary visually.

Priority & significance factor: Medium /Any change will be considered significant.

Measure 40. Miles of road on wilderness boundaries

Description: Miles of road on wilderness boundaries.

Context: In 1992, CMR NWR began to enforce off-road travel across the refuge, including wilderness. The closure of roads within wilderness areas in 2002 did not include roads on wilderness boundaries. In 2011, there is 34.4 miles of road on CMR PWA boundaries. There is 7.9 miles of road on UL Bend Wilderness boundaries. The CCP currently being finalized will result in the closure of several PWA boundary roads.

Relevance: The presence of road on wilderness boundaries increases both the frequency with which wilderness visitors are subjected to human sights (presence of cars, motorcycles, bicyclists, etc.) and sounds (automobile and motorcycle engine noise, etc.). They also increase the risk of unauthorized motorized vehicle or mechanized transport trespass.

Data source: ArcGIS layer of all CMR NWR roads used to isolate and measure all roads on wilderness boundaries. Randy Matchett, wildlife biologist, provided ArcGIS data.

Data adequacy: Confidence in data is high given accuracy of ArcGIS data.

Process used to compile or gather data: Wilderness Fellow used measure length tool in ArcGIS to calculate distance of all individual road segments along wilderness boundaries.

Priority & significance factor: Medium /Any change will be considered significant.

Monitoring Question: What are the trends in outstanding opportunities for primitive and unconfined recreation inside wilderness?

Indicator: Facilities that decrease self-reliant recreation

Measure 41. Number of recreational signs

Description: Number of signs aiding or informing recreational users within wilderness. Excludes signs on wilderness boundaries.

Context: Recreational signs are used to provide guidance to recreational users as well as to inform them of restrictions on their activities while in wilderness. Currently, there is signage on CMR PWA and UL Bend Wilderness boundaries to inform visitors that they are entering wilderness. Since these signs are on boundaries they are not tallied for this measure. In 2011, there are no known signs within wilderness areas.

Relevance: Signs can be used to restrict recreational user opportunities in wilderness. They also may reduce a visitor's need to rely on their own skills for navigation.

Data source: Nathan Hawkaluk, Jordan Field Station Manager, Matt DeRoiser, Sand Creek Field Station Manager, and Aaron Johnson, Fort Peck Field Station Manager.

Data adequacy: Confidence in data is medium. Field station managers attempted to recall signs from memory and there was not time to ground-truth data.

Process used to compile or gather data: Inquiries made of all field station managers.

Priority & significance factor: Medium / Any change will be considered significant.

Measure 42. Number of improved boat landing sites

Description: Number of boat landing sites on the Missouri River within a wilderness unit. Improvements may have been performed by Fish & Wildlife Service or U.S. Army Corps of Engineers.

Context: The U.S. Army Corps of Engineers (USACE) has primary jurisdiction over Fort Peck Reservoir and the associated shoreline. To date, they have not pursued any permanent developments along the reservoir shoreline of either proposed or designated wilderness, but it is possible that there might be interest in this in the future.

Relevance: The presence of improved boat landing sites would likely increase the number of users within wilderness and would reduce the effort required to access wilderness sites. It may also lead to individuals using their boats for overnight wilderness stays.

Data source: Professional knowledge of Bill Berg, deputy project leader.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Bill.

Priority & significance factor: Medium / Any change will be considered significant.

Indicator: Management restrictions on visitor behavior

Measure 43. Number of restrictions on visitor behavior

Description: Including restrictions on camping, fire use, etc.

Context: There are no permanent restrictions on visitor behavior in place for Charles M. Russell proposed wilderness areas and UL Bend Wilderness. There are, however, occasional temporary restrictions used to minimize wildfire risk. In 2011, for example, there was a ban on all fire use from mid-September to early October when wildfire risk was severe.

Relevance: Restrictions can reduce opportunities for primitive recreation.

Data source: Bill Berg, deputy project leader, and Deb Goeb, LE.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made to Bill and Deb. Wilderness Fellow took note of refuge emails that relayed fire ban.

Priority & significance factor: High / Any change will be considered significant.

Aerial view of Sheep Coulee in the Burnt Lodge proposed wilderness area. Areas in yellow are yellow sweet clover in bloom, a non-native plant that was aerially seeded in the 1970s in order to improve forage for livestock and wildlife. Yellow sweet clover is now a dominant plant in many areas of the refuge. In the summer of 2011, following a spring with unusually high rainfall, it was not unusual to find areas in which yellow sweet clover grew head high.

CONSIDERED, UNIMPLEMENTED MEASURES

Measure A. Number of annual wilderness visitors

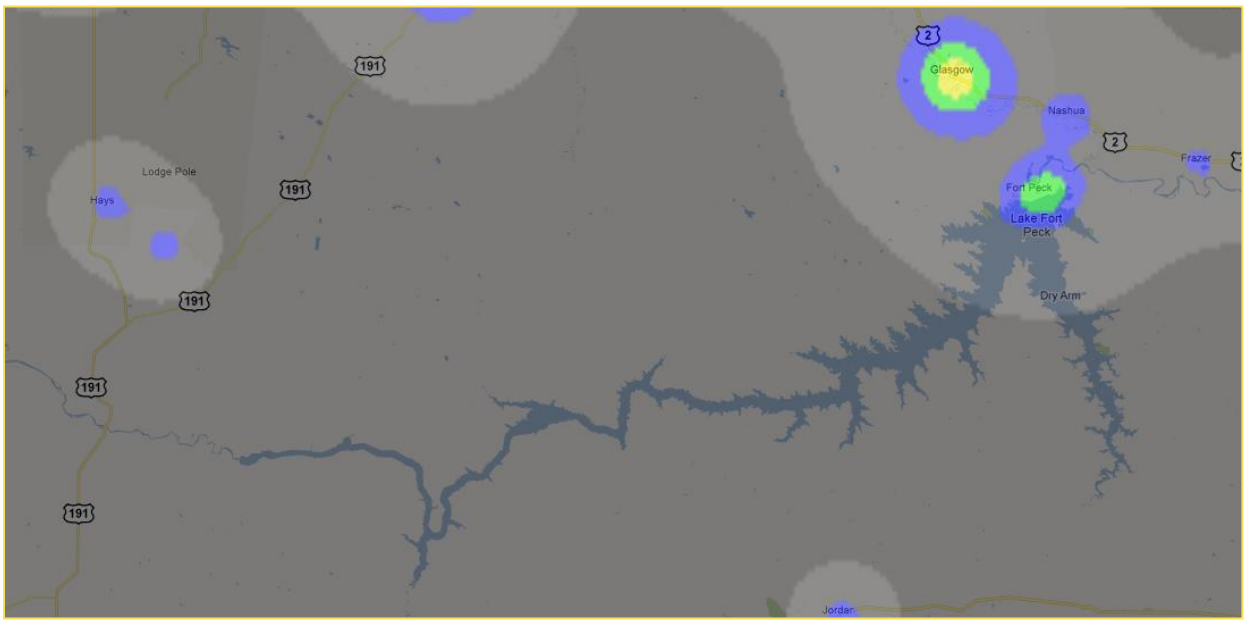
Quality / Indicator: Solitude / Remote from inside

Why not used: No data is available. Wilderness Fellow pursued having a question added to the visitor survey that inquires whether they visited wilderness during their refuge stay.

Measure B. Night sky darkness

Quality / Indicator: Solitude / Remote from outside

Why not used: No data available. There are three significant sources of night brightness on the refuge: lights on the Fort Peck dam and surrounding area, spotlighting by public for fish on the Missouri River, and spotlighting by refuge staff for black-footed ferret work. Refuge staff indicated that spotlighting in the vicinity of ferret camp is visible from the other side of the Missouri River. Any measure that was developed would have to take into account the transient nature of the spotlighting by both the public and refuge staff and also the differential in night sky brightness across the 125-mile long refuge (Fort Peck Dam is at the eastern most end).



Light pollution overlay on Google Maps produced using satellite data from the fall 2001. The source of light at the eastern edge of the refuge is Fort Peck—both the dam and the community. Source: World Atlas of Artificial Sky Brightness. Source: https://sites.google.com/site/3davel/home/light-pollution/lp2001/gmap

Measure C. Soundscape

Quality / Indicator: Solitude / Remote from outside

Why not used: No data currently available. Discussed using calls from the public issuing noise complaints, but this information would not be very conclusive. Boats and fireworks on holidays would be the two most significant sources of non-natural sound.

Measure D. Number of refuge-maintained facilities

Quality / Indicator: Solitude / Facilities decreasing self-reliant recreation

Why not used: No refuge-maintained facilities currently exist within CMR PWAs or UL Bend and the probability of adding any was low enough to preclude this measure.

Measure E. Sentinel plant health

Quality / Indicator: Natural / Plant & animal species and communities

Why not used: Bob Skinner, wildlife biologist, and Dan Harrell, range technician, are using exclosures to monitor the impacts of herbivory on a collection of plants that have been deemed 'sentinels'. Unfortunately, not enough of this study is occurring in wilderness to include it as a monitoring measure. The measures defined for the 'Plant & animal' indicator do not thoroughly address vegetation communities on the refuge. Hopefully, additional plant-focused measures can be added in the future, but that will be dependent on refuge priorities and research approaches.

A winterfat plant within an exclosure at the time the exclosure was installed (2004). Photo credit: Dan Harrell

Measure F. Songbird monitoring

Quality / Indicator: Natural / Plant & animal species and communities

Why not used: New protocols are being put in place to monitor songbird populations on the refuge. Survey locations originally didn't include wilderness, which would preclude this data from being included in wilderness monitoring. A suggestion was made to include a collection of wilderness survey sites. It remains to be seen whether wilderness will be included.

Measure G. Authorized low-altitude flights

Quality / Indicator: Natural / Plant & animal species and communities

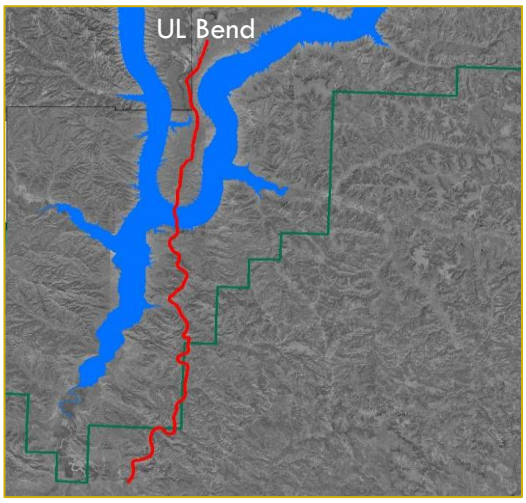
Why not used: At CMR NWR the main impact of low altitude flights is not on human solitude, but on wildlife. This measure would track the frequency with which refuge staff are using low-altitude flights

for management purposes, which inadvertently may result in a wildlife disturbance, particular for bighorn sheep and pronghorn antelope. Inconsistent methods are used to track refuge-initiated flights today. Standardization is needed. The Federal Aviation Administration has issued a Notice to Airmen that a minimum altitude of 2,000 feet above the terrain (or above the uppermost rim of a canyon or valley) over wilderness be voluntarily observed by all aircraft. Given the desire to monitor wildlife disturbance, a more appropriate altitude 'ceiling' may be approximately 1,500 feet above ground level.

Measure H. Pronghorn antelope migration

Quality / Indicator: Natural / Plant & animal species and communities

Why not used: Pronghorn antelope are known to use UL Bend Wilderness, as well as CMR PWAs, as important corridors during migration. To date, extensive monitoring of pronghorn migration through the refuge is not being conducted. Given that this species is a trust species for CMR NWR, however, this monitoring may occur in the future. If it does, a measure should be implemented to monitor the extent to which migration occurs in proposed or designated wilderness areas. In 2010, Randy Matchett, wildlife biologist, observed a significant number of pronghorn antelope moving through UL Bend Wilderness, crossing the Missouri River, and continuing south beyond the refuge executive order boundary.



Left: Tracks left by approximately 200 pronghorn antelope moving south through UL Bend Wilderness observed by Randy Matchett, wildlife biologist, via plane on December 22, 2010. Right: The red line depicts route taken by pronghorn antelope migrating across Charles M. Russell National Wildlife Refuge via UL Bend Wilderness. Photo and map credit: Randy Matchett

CONCLUSIONS

Management of wilderness at Charles M. Russell and UL Bend NWRs tends to take a hands-off approach. Invasive species are not controlled in wilderness, law enforcement tends to focus on road corridors and recreation areas, and research and monitoring efforts predominantly occur outside of wilderness. Aircraft patrols and wildlife monitoring projects over wilderness areas are conducted periodically. In the near term, it is unlikely that this approach will shift. The size of Charles M. Russell NWR (1.1 million acres spread east to west along a 125-mile corridor of the Missouri River) creates a significant spatial management challenge for refuge staff, especially given the impassability of unpaved refuge roads during and following precipitation events. This creates a management reality wherein areas inaccessible by road go largely unmanaged.

One of the main realizations of implementing wilderness character monitoring measures at CMR NWR in 2011 has been an increased understanding of USFWS Wilderness Policy. CMR NWR staff are aware that policy states that "once the Secretary transmits the recommendation to the President, we consider the area 'proposed wilderness' and will manage it as designated wilderness". As a result of this heightened awareness, there should be increased consistency in management of proposed and designated wilderness at CMR NWR, particularly in the case of fire management activities.

The 2009 Draft CCP and EIS sets an expectation that a Wilderness Management Plan will be created for CMR and UL Bend Wilderness within two years of finalization of the CCP and EIS. This Wilderness Management Plan (WMP) will be a critical step in setting a trajectory for CMR and UL Bend wilderness areas. The WMP will hopefully reinforce the wilderness character monitoring measures established in 2011, complete recommendations for eight new WSAs, and establish management direction, beyond national wilderness objectives, for wilderness at CMR and UL Bend NWR.

In 2011, measures were developed for Charles M. Russell and UL Bend NWR during a six-month assessment guided by a Wilderness Fellow. The measures developed emphasize important game species: bighorn sheep, elk, mule deer, and grouse, as well as important wildlife species in decline such as black-footed prairie dogs and black-tailed ferrets. The measures do not, however, specifically emphasize the refuge's trust species: sharp-tailed grouse and pronghorn antelope. The movement of antelope is not currently monitored, but there may be interest in implementing monitoring in the future (see Measure H. Pronghorn antelope migration). In the case of sharp-tail grouse, too little monitoring of that species alone occurs in wilderness, so the developed measure evaluates sage grouse and sharp-tail grouse collectively.

Another emphasis of the measures developed is the scattered nature of wilderness areas across the refuge. Measures that look at private and state inholdings, BLM wilderness on CMR PWA wilderness boundaries, private land adjacent to CMR PWAs, and acres of contiguous wilderness all attempt to explicate the checkerboard of wilderness and non-wilderness areas. Ultimately, this checkerboard can be related to opportunities for and barriers to wildlife movement and the establishment of landscape scale corridors.

As a result of my work as a Wilderness Fellow I'd like to offer Charles M. Russell NWR staff the following wilderness recommendations:

- To ease enforcement of wilderness restrictions strive to formalize tracking processes and standardize visitor wilderness restrictions across proposed and designated wilderness. Formalized tracking will be particularly valuable in the following arenas:

- Unauthorized grazing: Whether by private inholding owners, grazing permittees, or owners of private land adjacent to wilderness areas, written records, beyond habitat management unit yearly write-ups, that detail instances of livestock trespass, permittees exceeding allotted AUMs, grazing at unauthorized times, etc., in should be kept in a centralized location and in such a fashion that the information can be easily viewed either by the name of the individual incurring the infraction or by the wilderness area impacted.

- Encourage law enforcement staff to flag cited violations that occur in wilderness or likely occurred in wilderness. Ideally, there would be hardcopy or digital files that document these instances that could be reviewed by staff and wouldn't require asking law enforcement to recall incidents on a yearly basis. Violations could include unauthorized removal of paleontological resources, removal of shed antlers, removal of bison bones, use of motor vehicles, motorized equipment, or mechanical transport in wilderness, and damage to cultural resources, such as wilderness cabins.

- Even though there may not be implications for wilderness regulation enforcement, wilderness character monitoring would benefit from standardizing record keeping and tracking for these activities as well:

  - **Special Use Permits** Should clearly identify whether the authorized activity will take place in wilderness or require transport through wilderness.

  - **Minimum Requirement Analysis (MRA)** Use this policy-mandated tool to assess whether planned management activities should allow the use of motor vehicles, motorized equipment, or mechanical transport. Fire management activities should not be exempt from the MRA process. Minimum Requirements Analysis documents should be stored in a centralized location.

  - **Track refuge authorized flights over wilderness areas** Tracking currently occurs, but processes are different for tracking wildlife survey flights vs. livestock trespass identification flights, etc. Ideally, tracking should be able to quantify number of hours refuge flights spend over wilderness areas, which is more exacting than tallying the number of flights that passed over wilderness. See Measure G. Authorized low-altitude flights for more details.

- Review and revise the current Minimum Requirements Analysis authorizing visitor use of hand carts in wilderness areas. The MRA in place is not signed and does not clearly elucidate that visitor use of hand carts is necessary in order to accomplish refuge management goals for ungulate populations.

- Implement visitor survey questions that would allow CMR NWR to estimate the number of wilderness users. Use this information to inform research, law enforcement patrols, and to promote wilderness in the local community.

- Consider emphasizing the collection of research and monitoring data in wilderness for already existing wildlife sampling, i.e. grouse survey listening stations. The baseline wilderness character monitoring data reviewed in 2011 suggests that trends among wildlife populations may be different in wilderness vs. non-wilderness areas. For example, populations of deer and elk may be more numerous in wilderness and active sage and sharp-tail grouse lek rates may be higher.

- Engage wilderness advocates to improve the volume of monitoring and research data collected in wilderness. In particular, there may be opportunities to partner with the Montana Wilderness Association or students of Professor David Naugle to improve the sampling rate of leks and grouse listening stations located in CMR PWAs and UL Bend Wilderness. These types of sampling do not require formal scientific background or training.

- Encourage key members of Charles M. Russell NWR staff to attend formal wilderness training. Highest priority should be given to training for wildlife biologists, fire managers, and field station managers. The Arthur Carhart Wilderness Institute provides wilderness stewardship training (http://www.wilderness.net/index.cfm?fuse=NWPS&sec=courses), but biological staff should be encouraged to search out wilderness training that emphasizes wilderness research methods or take the form of a field course or conference.

Charles M. Russell National Wildlife Refuge contributes a significant number of acres to the National Wilderness Preservation System, and current recommendations for additional wilderness study areas will further add to the extent of wilderness on CMR NWR. In the lower 48 states, the following five refuges contain the most wilderness:

Ranking	Refuge (state)	Wilderness Acres *
1.	Cabeza Prieta (AZ)	803,418
2.	Kofa (AZ)	516,200
3.	Okefenokee (GA)	353,981
4.	CMR/UL Bend (MT)	199,187
5.	Red Rock Lakes (MT)	32,350

* CMR/UL Bend wilderness acreage includes designated, proposed, and CCP recommended WSAs. Acreage for all other refuges accounts only for designated wilderness.

Not only does Charles M. Russell and UL Bend NWRs contribute sizeable acreage to the National Wilderness Preservation System, but the refuges' wilderness is also significant to conservation of the American prairie grassland ecosystem, which has been identified, by organizations such as the World Wildlife Fund and The Wilderness Society, as one of the least protected biomes in the world. CMR and UL Bend NWR wilderness may play a pivotal and promising role in the continued conservation of important northern great plains species such as bighorn sheep, sage grouse, black-tailed prairie dogs, black-footed ferrets, and mountain lions.

With the preparation and adoption of a new Wilderness Management Plan in the next few years, CMR NWR will re-emphasize what wilderness on CMR NWR brings to the larger National Wilderness Preservation System, as well as the National Wildlife Refuge System, and will have the opportunity to initiate active management in wilderness. The data collected for all wilderness character monitoring measures developed in 2011 will inform the development of that plan and will allow the CMR NWR staff to demonstrate an enhanced wilderness consciousness and lead to the implementation of a management plan informed by monitoring data.

DOCUMENTS CONSULTED

Ecological Solutions Group, LLC, 2010. Riparian health assessment of the Charles M. Russell National Wildlife Refuge and UL Bend National Wildlife Refuge: Analysis of change from 1995, 1996, and 1997 to 2009. 121p.

Landres P., Barnes C., Dennis J.G., Devine T., Geissler P., McCasland C.S., Merigliano L., Seastrand J., Swain R., 2008. Keeping it wild: an interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System. Gen. Tech. Rep. RMRS-GTR-212. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, 77p.

U.S. Fish and Wildlife Service, 1974. Charles M. Russell National Wildlife Range Wilderness Study Summary. 24p.

U.S. Fish and Wildlife Service, 1974. UL Bend National Wildlife Refuge Wilderness Study Summary. 16p.

U.S Fish and Wildlife Service, 1985. Charles M. Russell National Wildlife Range Wilderness Study Report. 322p.

U.S. Fish and Wildlife Service, 2009. Charles M. Russell National Wildlife Refuge and UL Bend National Wildlife Refuge: Draft comprehensive conservation plan and environmental impact statement.433p.

U.S. Fish and Wildlife Service, Region 6 Water Resources Division, July 2010. Land ownership by sub-watershed and riparian functionality map, Charles M. Russell National Wildlife Refuge.

U.S. House Document No. 93-403, December 4, 1974. Proposed additions to the National Wilderness Preservation System. 23p.

APPENDICES

Priority ranking of measures

Those measures with the highest overall scores are the highest priority for assessing trends in wilderness character.

A. Level of importance (the measure is highly relevant to the quality and indicator of wilderness character, and is highly useful for managing the wilderness):

High = 3 points, Medium = 2 points, Low = 1 point

B. Level of vulnerability (measures an attribute of wilderness character that currently is at risk, or might likely be at risk over 10-15 years):

High = 3 points, Medium = 2 points, Low = 1 point

C. Degree of reliability (the measure can be monitored accurately with a high degree of confidence, and would yield the same result if measured by different people at different times):

High = 3 points, Medium = 2 points, Low = 1 point

D. Degree of reasonableness (the measure is related to an existing effort or could be monitored without significant additional effort):

High = 1 point, Low = 0 point

Key:
Total score ≥9 = High priority
Total score 7-8 = Medium priority
Total score ≤6 = Low priority

		Criteria for Prioritizing Potential Measures				
Quality	**Measure**	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	**TOTAL SCORE**
Untrammeled	% natural fire starts that are manipulated within the boundaries of wilderness	3	3	3	1	10
	Acres of prescribed burning	2	3	3	1	9
	Acres of plant removal projects	1	1	2	1	5
	Acres of herbicide application	1	1	2	1	5
	# of livestock AUMs	2	2	3	1	8
	# of authorized removals of paleontological resources	2	2	3	1	8
	# of animals banded, tagged, collared	2	2	3	1	8
	# of human-ignited wildfires	3	1	3	1	8
	# of unauthorized removals of paleontological resources	2	2	1	0	5
	# of miscellaneous unauthorized actions	3	3	3	1	10

		Criteria for Prioritizing Potential Measures				
Quality	**Measure**	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	**TOTAL SCORE**
Natural	# of prairie dog towns	3	3	2	1	9
	# of black-footed ferrets	3	3	2	1	9
	# of grouse lek sites	3	3	3	1	10
	Population of bighorn sheep	2	2	2	1	7
	Population of elk	2	2	2	1	7
	Population of deer	2	2	2	1	7
	# of non-native, invasive plant species	2	1	2	1	6
	# of non-plant, non-native, invasive species	3	3	3	0	9
	Air quality data	2	3	3	1	9
	Number of wilderness watersheds rated not functioning or functioning at risk	3	3	3	1	10
	Number of watersheds significantly affected by dams	2	2	3	1	8
	Departure from natural fire regime index	3	3	1	1	8
Undeveloped	Miles of fence	3	2	3	1	9
	# of water control structures	3	1	3	1	8
	# of research structures	2	1	3	1	7
	# of private inholdings	3	1	3	1	8
	Acres of private inholdings	3	1	3	1	8
	Acres of state inholdings	2	3	3	1	9
	Miles of roads associated with inholdings	3	3	3	1	10
	Miles of wilderness boundary adjacent to private land	2	2	3	1	8
	# of authorized uses on fire details	3	3	3	1	10
	Miscellaneous authorized uses	3	3	3	1	10
	# of unauthorized uses	3	3	2	1	9
	# of emergency uses	3	2	3	1	9
	# of disturbances of cultural resources	3	3	2	1	9

Solitude and/or opportunities for primitive recreation	Miles of defacto or maintained trail	2	1	3	1	7
	Miles of cherry-stemmed road	2	1	3	1	7
	Acres of contiguous wilderness	3	2	3	1	9
	Miles of boundary abutting other wilderness	2	1	3	1	7
	Miles of road on wilderness boundaries	2	2	3	1	8
	# of recreational signs	3	1	3	1	8
	# of improved boat landing sites	2	2	3	1	8
	# of restrictions on visitor behavior	3	3	3	1	10

Names of team members filling out this worksheet: Beverly Skinner, Danielle Kepford, Mike Granger, Rick Potts, Aaron Johnson, Erin Clark

Effort required for wilderness character monitoring

Wilderness Fellow effort per measure

Quality	Measure	Data Source (Office paper files, computer files, or field work)	Time spent (in whole hours)	Comments
Untrammeled	% natural fire starts manipulated within the boundaries of wilderness	FMIS online database	1	
	Acres of prescribed burning	FMIS online database	1	
	Acres of plant removal projects	Professional knowledge	1	Field stations keep track of projects
	Acres of herbicide application	Professional knowledge	1	Field stations keep track of herbicide application
	# of livestock AUMs	Permittee office files	5	
	# of authorized removals of paleontological resources	Special use permits (filed in Lewistown)	1	
	# of animals banded, tagged, collared	Unknown	1	
	# of human-ignited wildfires	FMIS online database	1	
	# of unauthorized removals of paleontological resources	Professional knowledge	1	Deb Goeb recalled instances from memory
	# of miscellaneous unauthorized actions	Professional knowledge	1	Deb Goeb recalled instances from memory
Natural	# of prairie dog towns	ArcGIS data	3	
	# of black-footed ferrets	ArcGIS data	1	
	Active grouse lek sites	ArcGIS data	3	Plus 2011 lek report from Neil Kadrmas
	Population of bighorn sheep	ArcGIS data	2	
	Population of elk	ArcGIS data	2	
	Population of deer	ArcGIS data	2	
	# of non-native, invasive plant species	Professional knowledge	1	
	# of non-plant, non-native, invasive species	Professional knowledge	1	
	Air quality data	N/A	1	

Natural	# of wilderness watersheds rated not functioning or functioning at risk	Paper map	3	
	Wilderness watersheds significantly affected by dams	Paper files provided by Bill Berg	1	
	Departure from natural fire regime index	FMIS database & ArcGIS data	3	
Undeveloped	Miles of fence	ArcGIS data	3	
	# of water control structures	Paper maps provided by Dan Harrell & professional knowledge	2	
	# of research structures		2	
	# of private inholdings	Refuge map	1	
	Acres of private inholdings	Cadastral / NRIS websites	1	
	Acres of state inholdings	Refuge map	1	
	Miles of roads associated with inholdings	ArcGIS data	2	
	Miles of wilderness boundary adjacent to private land	Cadastral / NRIS websites	2	
	# of authorized uses on fire details	FMIS online database	1	
	Miscellaneous authorized uses	Professional knowledge	1	Hopefully in the future minimum requirements analyses will be filed
	# of unauthorized uses	Professional knowledge	1	
	# of emergency uses	Professional knowledge	1	
	# of disturbances of cultural resources	Professional knowledge	1	
Solitude and/or opportunities for primitive recreation	Miles of closed road	ArcGIS data	2	
	Miles of cherry-stemmed road	ArcGIS data	1	
	Acres of contiguous wilderness	Refuge map	1	
	Miles of boundary abutting other wilderness	NRIS website	2	
	Miles of road on wilderness boundaries	ArcGIS data	2	
	# of recreational signs	Professional knowledge	1	

	# of improved boat landing sites	Professional knowledge	1	
	# of restrictions on visitor behavior	Refuge map, professional knowledge, fire restriction emails	1	

Refuge staff effort

Title of staff involved	Time to identify, prioritize, and select measures (in whole hrs)	Comments
Project Leader	6	
Deputy Project Leader	4	
Wildlife Biologists (3)	9	Randy: 5, Neil: 2, Bob: 2
Range Technician	3	
AFMO	9	
Field station managers (3)	9	Sand Creek: 2, Fort Peck: 2, Jordan: 4.
LE	2	One in person meeting.
Refuge Wildlife Specialist	5	
Realty Specialist	5	

Miscellaneous Wilderness Fellow Effort

Time to identify, prioritize, and select all the measures (in whole hours)	Time to enter all data into the WCM database application (in whole hours)	Time on other tasks directly related to WCM (e.g. reading CCP, giving presentations) (in whole hours)	Time doing other Refuge tasks not related to WCM (in whole hours)
20	12 (CMR=8, UL Bend=4)	59 *	273 **

*	Measure selection meetings & preparation	10 hours
	Final presentation	1 hour
	CCP and background review	8 hours
	Final report preparation	40 hours
**	Sage grouse research sampling	45 hours
	Private acquisition priority framework	7 hours
	Prehistoric marine reptile excavation	55 hours
	CCP wilderness revisions & meetings	80 hours
	East Hell Creek administrative record	8 hours
	Wilderness outfitter shadowing	40 hours
	Vegetation exclosure site visits	13 hours
	Montana Listening Session	7 hours
	Montana Wilderness Society hike	8 hours
	The Wilderness Society meetings	3 hours
	Flights (EcoFlight & antelope survey)	7 hours

Detailed description of data sources and how the data were gathered

UNTRAMMELED

Measure 1. Percent of natural fire starts that are manipulated within the boundaries of wilderness

Data source: FMIS online database.

Data adequacy: Measure is a reflection of fire manipulation and not the extent of natural fire's impacts on the landscape. Data supplied is of high confidence.

Process used to compile or gather data: Mike Granger, FMO, reviewed FMIS and provided data.

Measure 2. Acres of prescribed burning

Data source: All prescribed fire activities on the refuge are logged in the FMIS online database.

Data adequacy: Data supplied is of high confidence.

Process used to compile or gather data: Mike Granger, FMO, reviewed FMIS and provided data.

Measure 3. Acres of plant removal projects

Data source: All field station managers, Mike Granger, FMO, and Lindy Garner, Strike Team Coordinator.

Data adequacy: Data supplied is of high confidence.

Process used to compile or gather data: Inquiries sent to all station managers and Mike. Wilderness Fellow reviewed data supplied by Bill Sparklin that summarized efforts of the Montana Invasives Strike Team at CMR over the last three years.

Measure 4. Acres of herbicide application

Data source: All field station managers and Lindy Garner, Invasives Strike Team Coordinator.

Data adequacy: Data supplied is of high confidence.

Process used to compile or gather data: Inquiries sent to all station managers. Wilderness Fellow reviewed data supplied by Bill Sparklin that summarized efforts of the Montana Invasives Strike Team at CMR over the last three years.

Measure 5. Number of livestock AUMs

Data source: Permittee Bills for Collection kept in the Lewistown office files, with some confirmations provided by Dan Harrell, range technician, Jody Jones, wildlife refuge specialist, and Nathan Hawkaluk, Jordan field station manager.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed all permittee grazing files in the Lewistown office. Emailed Dan, Jody, and Nathan to supply several 2011 AUM totals and to confirm some values.

Measure 6. Number of authorized removals of paleontological resources

Data source: Special Use Permit files found in the Lewistown office.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed all Special Use Permits from 2000 through present.

Measure 7. Number of animals banded, tagged, collared, etc.

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is low, given that it is not yet known whether collared mountain lions are using wilderness habitat.

Process used to compile or gather data: Request for counts sent via email to Randy.

Measure 8. Number of human-ignited wildfires

Data source: FMIS online database.

Data adequacy: Confidence in data is high. Although fires may have been ignited and not detected, the size of these fires would be too small to be of significant concern.

Process used to compile or gather data: Mike Granger, FMO, queried FMIS database and provided information.

Measure 9: Number of unauthorized removals of paleontological resources

Data source: Deb Goeb, LE.

Process used to compile or gather data: A in-person meeting was held with Deb Goeb at the Sand Creek field station.

Data adequacy: Confidence of data is medium given that removals likely occurred but were not detected. The process currently in place relies on Deb remembering instances.

Measure 10: Number of miscellaneous unauthorized actions

Data source: All field station managers and Deb Goeb, LE.

Process used to compile or gather data: Inquiry was sent to all field station managers. A in-person meeting was held with Deb at the Sand Creek field station.

Data adequacy: Confidence of data is low given that other unauthorized actions may occur but are not observed and given the fact that unauthorized grazing is not tracked and accounted for. The process currently in place relies on LE staff remembering actions.

NATURAL

Measure 11. Number of prairie dog towns

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium, due to the fact that four prairie dog towns were not surveyed in 2010.

Process used to compile or gather data: Wilderness Fellow reviewed prairie dog ArcGIS layers provided by Randy.

Measure 12. Number of black-footed ferrets

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed prairie dog and black-footed ferret ArcGIS layers provided by Randy.

Measure 13. Active grouse lek sites

Data source: Neil Kadrmas, wildlife biologist.

Data adequacy: Confidence in data is low given small sample sizes.

Process used to compile or gather data: Wilderness Fellow reviewed geospatial database provided by Neil using ArcGIS. Refuge-wide results were obtained from 'Results from 2011 Grouse Listening Station Survey' memorandum distributed by Neil in July 2011.

Measure 14. Population of bighorn sheep

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium given that survey methods produce only an estimated population.

Process used to compile or gather data: Wilderness Fellow reviewed ArcGIS data provided by Randy.

Measure 15. Population of elk

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium given that survey methods produce only an estimated population.

Process used to compile or gather data: Wilderness Fellow reviewed ArcGIS data provided by Randy.

Measure 16. Population of deer

Data source: Randy Matchett, wildlife biologist.

Data adequacy: Confidence in data is medium given that survey methods produce only an estimated population.

Process used to compile or gather data: Wilderness Fellow reviewed ArcGIS data provided by Randy.

Measure 17. Number of non-native, invasive plant

Data source: All field station managers and Lindy Garner, Montana Invasives Strike Team Leader.

Data adequacy: Confidence in data is low given that surveys have not been performed. The Wilderness Fellow observed salt cedar and yellow sweet clover in several wilderness areas.

Process used to compile or gather data: Inquiry sent via email to all field station managers and Lindy.

Measure 18. Number of non-plant, non-native, invasive species

Data source: Inquires made with Randy Matchett, wildlife biologist, and Beverly Skinner, refuge wildlife specialist.

Data adequacy: Confidence in data is medium, given that surveys have not been explicitly conducted in wilderness.

Process used to compile or gather data: Compilation of responses from Randy and Beverly.

Measure 19. Air quality

Data source: National I&M program.

Data adequacy: N/A

Process used to compile or gather data: N/A

Measure 20. Number of wilderness watersheds rated not functioning or functioning at risk

Data source: Watershed analysis map provided by Bill Berg, deputy project leader, and Riparian Health Assessment Report from March 2010.

Data adequacy: Confidence in data is medium. Not all watersheds in wilderness were included in the 2009 assessment. These watersheds have not been assessed: Chippy Creek (Burnt Lodge PWA), Cart Trail Coulee (Burnt Lodge), Billy Creek (Billy Creek PWA), Widow Coulee (Billy Creek), Lower Seven Blackfoot Creek (East Seven Blackfoot PWA), Cabin Coulee (Wagon Coulee PWA), Snow Creek (West Hell Creek PWA), and Gilbert Creek (Sheep Creek PWA).

Process used to compile or gather data: Wilderness Fellow review of map and supporting documentation provided by Bill.

Measure 21. Wilderness watersheds significantly affected by dams

Data source: Watershed analysis map and accompanying documentation provided by Bill Berg, deputy project leader.

Data adequacy: Confidence in data is medium, given that the main stream of a watershed may not actually be located within the proposed wilderness area. It is also unknown how many dams per square mile are present in Soda Creek.

Process used to compile or gather data: Wilderness Fellow review of map and supporting documentation provided by Bill.

Measure 22. Departure from natural fire regime index

Data source: FMIS fire database, refuge ArcGIS fire layers, and Cecil Frost's fire return interval work on the refuge.

Data adequacy: Confidence in data is low given that the calculation of these values doesn't take into account the geospatial aspects of these burns, i.e. if the same area burned twice during this timeframe. It also doesn't account for varying fire return intervals across the landscape in different vegetation communities and the severity of burns that did occur.

Process used to compile or gather data: Acreage for all fires were obtained from the FMIS fire database and from ArcGIS data. Mike developed system for calculating departures from the expected fire regime and totaled fire acreages to calculate % of the average expected as described above in Context.

UNDEVELOPED

Measure 23. Miles of fence

Data source: The refuge maintains a GIS data layer of all fence.

Data adequacy: Confidence in data is low. Discrepancies exist between refuge-wide GIS data files provided and information provided by the Jordan field station.

Process used to compile or gather data: Fence layer in ArcGIS used to isolate wilderness fence and calculate total mileage.

Measure 24. Number of water control structures

Data source: Dan Harrell provided a binder of maps that show locations of all fence, reservoirs, stock ponds, vegetation exclosures, and wells under the purview of the Sand Creek field station. Nathan Hawkaluk provided digital maps showing locations of structures within the Jordan field station PWAs. There is a map on the wall in the Fort Peck office that shows the location of all Wagon Coulee infrastructure.

Data adequacy: Data confidence is high.

Process used to compile or gather data: Inquiries made with all field station managers. Wilderness Fellow reviewed binder provided by Dan and digital maps sent by Nathan. Aaron provided a list of all Wagon Coulee reservoirs, stock ponds, stock tanks, and wells via email.

Measure 25. Number of research structures and equipment installed

Data source: Dan Harrell provided a binder of maps that provided locations for all vegetation exclosures in CMR PWAs under the Sand Creek field station's purview. Bob Skinner provided locations of exclosures in

Jordan and Fort Peck PWAs. Randy Matchett indicated via email that he is not aware of any research structures or installations in wilderness.

Data adequacy: Confidence in data is low. Additional installations likely identify research transects or plots that the current staff is unaware of. Seasonal technicians can assist by taking GPS coordinates of installations they find while performing field work in 2012.

Process used to compile or gather data: Wilderness Fellow reviewed all maps provided by Dan Harrell and made inquiries with Bob and Randy about other possible structures or installations.

Measure 26. Number of private inholdings

Data source: Danielle Kepford, realty specialist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Danielle.

Measure 27. Acres of private inholdings

Data source: Danielle Kepford, realty specialist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Danielle.

Measure 28. Acres of state inholdings

Data source: Danielle Kepford, realty specialist.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Danielle.

Measure 29. Miles of road associated with inholdings

Data source: ArcGIS layer containing all refuge roads.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: ArcGIS layer provided by Randy Matchett. Wilderness Fellow reviewed the roads layer to extract wilderness road mileage.

Measure 30. Miles of wilderness boundary adjacent to private land

Data source: Montana Cadastral site: http://svc.mt.gov/msl/mtcadastral/. Danielle Kepford, realty specialist, provided information about 2011 acquisition.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: The Cadastral website provides a tool for measuring mileages of boundaries.

Measure 31. Number of authorized uses on fire details

Data source: FMIS online database and the memory of Mike Granger, FMO.

Data adequacy: Confidence in data provided since 2007 is high. Data for 2000 through 2006 does not provide a breakdown of the number of days of use, only the number of fires on which use was authorized by the FMO. In 2003 and 2005, use was authorized on four fires.

Process used to compile or gather data: Data compiled and provided by Mike.

Measure 32: Miscellaneous authorized uses

Data source: All field station managers, as well as the deputy project leader, were asked to recall any authorized uses of motorized vehicles, mechanized equipment, or motorized transport. The Wilderness Fellow was involved in the plesiosaur extraction and therefore was aware that the helicopter was used for one day. Ideally, going forward, Minimal Requirements Analysis paperwork will be filed in the Lewistown office for all miscellaneous authorized uses. All motorized vehicles and equipment used for the Fort Musselshell PWA fence replacement in 2011 operated on the wilderness boundary and not within wilderness.

Data adequacy: Confidence in data is high. The refuge project leader or deputy project leader are made aware of all authorized uses and the Minimal Requirements Analysis process formalizes the decision-making process and ensures that detailed records are kept.

Process used to compile or gather data: Inquiries made with all field station managers and deputy project leader.

Measure 33: Number of unauthorized uses

Data source: Deb Goeb, LE, and all field station managers.

Data adequacy: Confidence in data is medium, given that instances of unauthorized use may not be observed.

Process used to compile or gather data: Inquiries made all field station managers via email. In person meeting with Deb.

Measure 34. Number of emergency uses

Data source: Deb Goeb, LE, and all field station managers.

Data adequacy: Confidence in data is high, given that emergency situations are easily recalled and noted.

Process used to compile or gather data: Inquiries made with all field station managers via email. In person meeting with Deb Goeb.

Measure 35. Number of disturbances of cultural resources

Data source: A zero will be recorded for this measure until any resources on CMR NWR or UL Bend are statutorily protected.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: N/A

SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

Measure 36. Miles of closed road

Data source: ArcGIS data.

Data adequacy: Confidence in data is high. There is a roads layer that isolates just the roads that were closed.

Process used to compile or gather data: Wilderness Fellow compiled all road lengths using ArcGIS.

Measure 37. Miles of cherry-stemmed road

Data source: ArcGIS road layer.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow reviewed GIS data.

Measure 38. Acres of contiguous wilderness

Data source: ArcGIS data.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Wilderness Fellow used ArcGIS to calculate acreages of all contiguous parcels.

Measure 39. Miles of boundary abutting other wilderness areas

Data source: NRIS public land maps at http://nris.mt.gov/gis/ownmaps.asp.

Data adequacy: Confidence in data is high, as NRIS maps are updated on a yearly basis.

Process used to compile or gather data: Wilderness Fellow reviewed all NRIS maps in order to locate BLM WSA abutting CMR NWR PWAs. Since BLM WSAs start and end on state section lines, which are 1 mile squares, it was easy to calculate mileage of boundary visually.

Measure 40. Miles of road on wilderness boundaries

Data source: ArcGIS layer of all CMR NWR roads used to isolate and measure all roads on wilderness boundaries. Randy Matchett, wildlife biologist, provided ArcGIS data.

Data adequacy: Confidence in data is high given accuracy of ArcGIS data.

Process used to compile or gather data: Wilderness Fellow used measure length tool in ArcGIS to calculate distance of all individual road segments along wilderness boundaries.

Measure 41. Number of recreational signs

Data source: Nathan Hawkaluk, Jordan Field Station Manager, Matt DeRoiser, Sand Creek Field Station Manager, and Aaron Johnson, Fort Peck Field Station Manager.

Data adequacy: Confidence in data is medium. Field station managers attempted to recall signs from memory and there was not time to ground-truth data.

Process used to compile or gather data: Inquiries made of all field station managers.

Measure 42. Number of improved boat landing sites

Data source: Professional knowledge of Bill Berg, deputy project leader.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made of Bill.

Measure 43. Number of restrictions on visitor behavior

Data source: Bill Berg, deputy project leader, and Deb Goeb, LE.

Data adequacy: Confidence in data is high.

Process used to compile or gather data: Inquiry made to Bill and Deb. Wilderness Fellow took note of refuge emails that relayed fire ban.