5.0 Introduction (Cumulative Impacts)

NEPA requires an assessment of potential cumulative impacts. Federal regulations (40 CFR 1500-1508) define cumulative impacts as:

> …the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Potential cumulative impacts are assessed at the resource level. This discussion of potential cumulative impacts assumes the successful implementation of the environmental protection and mitigation measures discussed in the various appendices and Chapter 4.0 of this EIS, as well as compliance with the 2008 Rawlins RMP and all applicable federal, state, and local regulations and permit requirements. The analysis of cumulative impacts addresses both potential negative and positive impacts and is applicable to all alternatives. Please also see Section 1.6.2 of this EIS with regard to the Final Wind Energy Development Programmatic EIS and BLM IM WO-2009-043. As appropriate, the BLM intends to incorporate information, like Section 6.4.3 regarding related transmission line construction, from that Final EIS into future project-specific NEPA analyses.

5.0.1 Past, Present, and Reasonably Foreseeable Actions

- Oil exploration and extraction;
- Natural gas exploration and extraction;
- Pipeline construction;
- Electric transmission line construction;
- Wind power generation projects;
- Coal gasification; and
- Uranium exploration and extraction.

5.0.2 Historical Land Use

- Grazing;
- Road development; and
- Private land actions.

5.0.3 Physical and Temporal Boundaries of Cumulative Impacts

The CIA area includes past, existing, and reasonably foreseeable actions that may generate cumulative impacts. The CIA physical and temporal boundaries of cumulative impacts will vary depending on the resource under consideration. For example, the CIA area for air quality effects is regional in nature; therefore, the scope of cumulative impacts considered due to project activities is necessarily broad. In contrast, the CIA area for geology and minerals considers the area associated with the proposed project; therefore, the scope of potential cumulative activities considered is much narrower. For wide-ranging wildlife, such as elk, the cumulative impact area may include offsite habitats that are used by onsite populations and that are subject to impacts from development in the offsite areas. And, for water resources, the cumulative impact area includes all of the HUC-12 sub-watersheds that have a portion of the Application Area within their boundary.

Although these are only examples, they illustrate that cumulative impact boundaries may not only differ considerably among resources, but that the boundaries may be either natural or artificial (see the CIA for each resource below).

5.0.4 Current and Planned Projects

Past, present, and potential future actions are considered in the analysis to identify whether and to what extent the environment has been degraded or enhanced, whether ongoing activities are causing impacts, and trends for activities in and impacts on the area. Projects and activities are evaluated on the basis of proximity, connection to the same environmental systems, potential for subsequent impacts or activity, similar impacts, the likelihood a project will occur, and whether the project is reasonably foreseeable.

Effects of past actions and activities are manifested in the current condition of the resources, as described in the affected environment (see Chapter 3). Reasonably foreseeable future actions (RFFAs) considered in the cumulative analysis include those that have either been permitted or are in the permitting process and considered reasonably foreseeable (**Table 5.0-1** and **Figure 5.0-1**). Per the BLM NEPA handbook, "Reasonably foreseeable future actions are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends."

Table 5.0-1 List of Current and Planned Projects

Project	Owner/Proponent	Location	County	Timing in Relation to CCSM Construction (Existing, Concurrent, After)
Mining				
Jonathon Project Limestone Quarry	Pete Lien	North of Laramie	Albany	Existing and Concurrent
Lost Creek in situ Uranium Project	UR Energy	North of Rawlins/ Wamsutter	Sweetwater	Concurrent
Medicine Bow Fuel & Power Coal-to-Liquids Project	Medicine Bow Fuel & Power	South of Medicine Bow	Carbon	After
Other mine projects	Various	Various	Sweetwater, Carbon, Albany	After
Oil and Gas				
Atlantic Rim Natural Gas Field Development Project	Anadarko E&P Company, and other operators	Atlantic Rim Project Area (ARPA)	Carbon	Existing and Concurrent
Continental Divide-Creston Natural Gas Development Project Area	British Petroleum America Production company and other operators	N and S of I-80 near Wamsutter	Carbon and Sweetwater	Concurrent

Table 5.0-1 List of Current and Planned Projects

Project	Owner/Proponent	Location	County	Timing in Relation to CCSM Construction (Existing, Concurrent, After)
Desolation Flats Natural Gas Field Development Project	Marathon Oil Company and other operators	South Central Wyoming	Carbon and Sweetwater	Existing and Concurrent
Echo Springs TXP4 Gas Treatment Plant Expansion	Williams, Inc. dba Wamsutter LLC	Near Wamsutter	Carbon	Existing
South Baggs Area Natural Gas Development Project	Merit Energy Company	South-central Carbon County, near the Wyoming/Colorado border	Carbon	After
Other oil and gas projects	Various	Various	Sweetwater, Carbon, Albany	Existing and Concurrent
Road				
Highway 71 Improvement Project	Dept of Transportation	Rawlins south 53 miles to intersection with WSH 70	Carbon	Concurrent
Other roads	Various	Various	Carbon	Existing and After
Transmission Line				
Gateway South Transmission Project (http://www.blm.gov/wy/st/en/info/NEPA/documents/hdd/gateway_south.html)	PacifiCorp Energy	Wyoming to central Utah	Carbon, Sweetwater	Concurrent
Gateway West Transmission Project (http://www.wy.blm.gov/nepa/cfodocs/gateway_west/)	PacifiCorp Energy and Idaho Power	Windstar Substation at Glenrock, Wyoming, to the 20 miles southwest of Boise, Idaho	Converse, Natrona, Albany, Carbon, Sweetwater, Lincoln, and west into Idaho	Concurrent

Table 5.0-1 List of Current and Planned Projects

Project	Owner/Proponent	Location	County	Timing in Relation to CCSM Construction (Existing, Concurrent, After)
TransWest Express Transmission Project (http://www.blm.gov/pgdata/content/wy/en/info/NEPA/documents/hdd/transwest.html)	TransWest Express LLC and Western Area Power Administration	South of Rawlins to Northwest Colorado, through Utah and terminating in Las Vegas, Nevada	Carbon, Sweetwater	Concurrent
Zephyr Transmission Project http://wyia.org/projects/transmission-projects/zephyr-project-ztp/)	Duke American Transmission	Southern Wyoming and Idaho south to Las Vegas, NC	Carbon, Sweetwater	After
Other transmission line projects	Various	Various	Carbon	Existing
Wind				
Dry Creek Wind Power Project	Eurus Dry Creek LLC	North of Medicine Bow	Carbon	After
Dunlap Wind Energy Project	PacifiCorp Energy	North of Medicine Bow	Carbon	Existing
Foote Creek Wind Energy Project Phase I	SeaWest, PacifiCorp Energy, Eugene Water and Electric Board (EWEB), and Bonneville Power Administration (BPA)	Near Arlington	Carbon	Existing
Foote Creek Wind Energy Project, Phases II, III, and IV	SeaWest, PacifiCorp Energy, EWEB, and BPA	Near Arlington	Carbon	Existing
High Plains and McFadden Ridge Wind Energy Projects	PacifiCorp Energy	Near McFadden	Albany and Carbon	Existing
Middlewood Wind Power Project	Eurus Middlewood Wind LLC	South-central Carbon County	Carbon	After
Sand Hills Ranch Wind Farm	Shell Wind Energy LLC	Near Rock River	Albany	Concurrent
Seven-Mile Hill Wind Energy Project	PacifiCorp Energy	West of Medicine Bow	Carbon	Existing

Table 5.0-1 List of Current and Planned Projects

Project	Owner/Proponent	Location	County	Timing in Relation to CCSM Construction (Existing, Concurrent, After)
White Mountain Wind Energy Project	Teton Wind, LLC (subsidiary of Tasco Engineering)	Top of White Mountain, west, north-west of Rock Springs	Sweetwater	Concurrent
Other wind projects	Various	Various	Carbon	Existing

5.0.4.1 Other Oil and Gas Projects

An oil and gas lease grants the lessee the “right and privilege to drill for, mine, extract, remove, and dispose of all oil and gas deposits” in the leased lands, subject to the terms and conditions incorporated in the lease (BLM Form 3100-11, Lease for Oil and Gas). The Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases; therefore, restrictions are imposed on the lease terms.

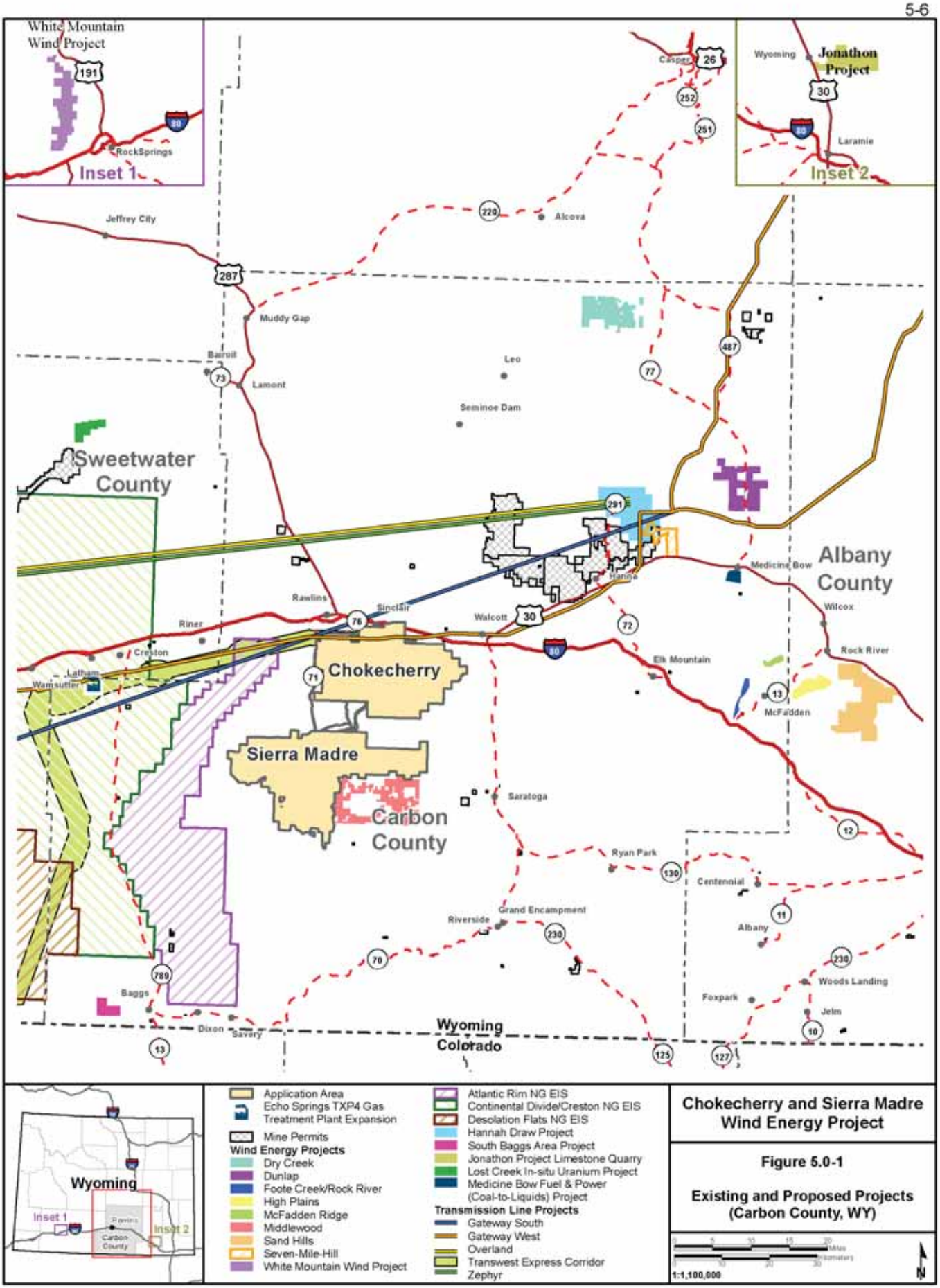
Oil and gas development could occur in the Application Area if there are valid existing rights or in areas that may not be used by the CCSM project. Any proposed well locations, road and/or pipeline alignments, and/or other facilities/infrastructure would require applicable permitting and NEPA analysis. Due to the large number of variables involved, potential future oil and gas projects are not included in the cumulative impact assessment.

5.0.5 Other Wind Projects

Development of other wind projects could occur in the Application Area, but none are far enough along in the planning process to define the location, scale, and impacts of their potential development. Therefore, potential future wind energy projects are not included in the cumulative impact assessment.

5.0.6 Other Transmission Line Projects

Development of other transmission projects could occur in the Application Area, but none are far enough along in the planning process to define the location, scale, and impacts of their potential development. Therefore, potential future transmission projects are not included in the cumulative impact assessment.



Chokecherry and Sierra Madre Wind Energy Project

Figure 5.0-1

Existing and Proposed Projects (Carbon County, WY)

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5.1 Cumulative Impacts to Air Quality

The CIA area for air quality includes the CCSM Application Area plus a 5 km buffer beyond the boundary. A screening level analysis of fugitive dust emissions from scrapers, trucks, and other mobile and construction equipment shows that the concentrations typically fall below detectable levels of about 1 $\mu g/m^3$ at distances less than 5 km from the source. Therefore, there would be little chance for cumulative impacts, attributable to emissions from activities associated with this project, to occur from any other development activities in the region.

The CIA area also includes any Class I areas, as defined in Section 162 of the CAAA (CAAA 1990), within 100 km of the project boundary. To ascertain potential cumulative impacts, this CIA area was chosen to include areas that are likely to be directly affected by emissions from the proposed project. The CIA area was chosen to be large enough to address concerns by USEPA and other stakeholders regarding impacts related to regional ozone formation, visibility in Class I areas, and climate change.

Activities related to construction of the proposed project would be a source of PM_{10} and $PM_{2.5}$, as well as the ozone precursors NO_X and VOCs from internal combustion engines associated with construction of roads, WTG pads, WTG installation, and transmission lines. Other reasonably foreseeable projects in the CIA area occurring during the proposed 5-year construction period that could contribute to these cumulative impacts include:

- Atlantic Rim Natural Gas Field Development Project;
- Gateway South Transmission Line;
- Gateway West Transmission Line;
- Highway 71 Improvement project;
- Middlewood Wind Power Project;
- TransWest Express Transmission Line Project; and
- Other mine projects located in Carbon County.

All projects listed above would have emissions of PM_{10}, $PM_{2.5}$, NO_X, CO, SO_2, VOCs, and HAPs, since they involve traffic and combustion sources.

The prevailing winds are strong enough to disperse the ozone precursor pollutants in such a manner that it is highly unlikely that ozone would form and accumulate to the extent that the project would cause or contribute to regional ozone levels above the NAAQS. The emissions of ozone precursors (VOCs) from CCSM would not form ozone to such an extent that the ozone NAAQS would be threatened or violated in the CIA area. Wintertime ozone formation in the Pinedale anticline region of western Wyoming has led to some concern that other projects might also result in high ozone levels during months that have not been considered “ozone season.” This clearly is not the situation for the CIA area. Winter ozone occurs where there are strong temperature inversions, low winds, snow cover, bright sunlight, and VOC emissions. The prevailing winds would tend to disperse the pollutants during all seasons of the year, and emissions from construction vehicles would occur during the summer construction season.

Federal Class I areas are protected by the regulation of AQRVs within their borders. Federal land managers are responsible for the management of PSD Class I areas. Since it is unlikely that the moderate to low levels of emissions from the proposed project would affect Bridger Wilderness Area and Rawah Wilderness Area, which are roughly 150 km from the development area, cumulative impacts would not be anticipated.

Historic and existing roadway traffic within the CIA area and roads providing direct access are primarily associated with ranching, grazing, and outdoor recreation. Existing traffic is relatively low in volume, seasonal in nature, and not anticipated to increase substantially.

The following oil and gas projects have a temporal and/or areal overlap with CCSM CIA area:

- Atlantic Rim Natural Gas Field Development Project;
- Continental Divide-Creston Natural Gas Development Project Area;
- Desolation Flats Natural Gas Field Development;
- Echo Springs TXP4 Gas Treatment Plant Expansion;
- Medicine Bow Fuel & Power Coal-to-Liquids Project;
- South Baggs Area Natural Gas Development Project; and
- Other oil and gas projects proposed to be located in Carbon County.

These project may cause or contribute to cumulative impacts, particularly if drilling, field development and production activity in these fields were to increase in response to higher oil and natural gas prices. WY 76/CR 407 (CIG Road), which would be the primary access route to the CCSM project area and internal haul road, also provides access to the CIG natural gas pipeline compressor plant, to ranches, and to the pipeline and utility corridors near I-80.

If oil and natural gas activity were to increase substantially during CCSM construction, the CCSM project's contribution to cumulative effects would be primarily associated with emissions from cars and pickups used by commuting workers, since most heavy vehicle traffic related to hauling construction materials for the project are anticipated to arrive by rail at an RDF located on the northwest boundary of the CCSM project area or at an alternate RDF located east of Sinclair and be transported to the site via WY 76/CR 407. Cumulative effects from vehicle emissions associated with oil and gas activity on the access routes providing direct access to the CCSM project would be unlikely, given that these routes do not access currently known oil and gas fields.

Planned improvements to Highway 71 by the county and state may generate cumulative effects if the road improvement construction occurred on the affected segment of the highway during the first 2 years of CCSM construction. Cumulative impacts associated with highway construction would be minimal and short-term. Temporary and localized effects would be more noticeable under Alternative 2, which has a haul road alignment paralleling Highway 71.

Construction and operations of the Lost Creek In-situ Uranium Project are unlikely to contribute to cumulative air quality impacts within the project area or CIA area due to the limited extent of air impacts from the project.

Development and operations of the Medicine Bow Fuel & Power LLC's (MBFP 2007) Coal-to-Liquids Project near Medicine Bow would primarily occur outside of the air quality impacts CIA area. These potential cumulative impacts would be short-term, temporary, and only occur in the April through October period of each year when CCSM construction activities would occur.

The wind energy projects listed in **Table 5.0-1**, other than the Middlewood Wind Power Project, are unlikely to contribute to cumulative air quality impacts in the CIA area because of their location in the eastern portion of Carbon County, which is far downwind of the CCSM, although WTGs and other construction materials could be transported by heavy trucks on the segment of I-80 near the CCSM project area depending on the origins of those materials. If the proposed RDF at either the preferred or alternate location were to be used for delivery of equipment and materials for construction of other wind or energy development projects, minor cumulative impacts could occur if the construction schedule for those projects were to coincide with the construction schedule for the CCSM project. Cumulative effects

also could occur at the I-80 Exit 221 interchange if other wind projects were to use the RDF during CCSM project operations. CCSM's contribution to such cumulative effects would primarily be associated with vehicle emissions related to workforce commuting and operations materials, equipment and supplies deliveries. CCSM's long-term contributions to cumulative transportation effects at Exit 221 would be minor.

Long-term cumulative effects from traffic and vehicle-related air emissions including PM_{10}, $PM_{2.5}$, CO, NO_X, SO_2, and VOCs also would arise during operations of the Middlewood Wind Power Project; however, such effects would be minimal.

Construction schedules for the CCSM and the Carbon County portions of the Gateway West, TransWest Express, and the Gateway South transmission line projects could overlap. The CCSM contribution to cumulative effects of those three projects would be limited to traffic and vehicle-related air emissions of PM_{10}, $PM_{2.5}$, CO, NO_X, SO_2, and VOCs from workforce commuting and materials delivery on I-80 and within Rawlins. The CCM contribution to the cumulative impacts would be similar to the Gateway West, TransWest Express and Gateway South projects.

BLM recognizes the importance of climate change and the potential effects it may have on the natural environment. Several activities that may occur within the CCSM could generate emissions of climate changing pollutants. For example, oil and gas development, large fires, and recreation using combustion engines, can potentially generate CO_2 and methane. Wind erosion from disturbed areas and fugitive dust from roads along with entrained atmospheric dust has the potential to darken glacial surfaces and snow packs resulting in faster snowmelt. Other activities may help sequester carbon, such as managing vegetation to favor perennial grasses and increase vegetative cover, which may help build organic carbon in soils and function as "carbon sinks."

5.1.1 Impacts to Climate

The assessment of climate-changing pollutant emissions and climate change is in its formative phase; therefore, it is not yet possible to know with confidence the net impact to climate. However, the Intergovernmental Panel on Climate Change (IPCC 2007) recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures because the mid-20th century is very likely due to the observed increase in anthropogenic [man-made] greenhouse gas concentrations." The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts, so there is no established mechanism to accurately predict the effect of resource management–level decisions on global climate change. The GHG emissions from construction of the proposed CCSM project would be very minor in terms of impacts to climate change. The first year of construction would produce less than 45,000 tons of CO_2. This would be a small fraction of regional emissions since the GHG emissions from existing sources and from the other projects listed in **Table 5.0-1** would be much greater than the GHG from CCSM. Statewide activities in Wyoming accounted for approximately 56 million metric tons (MMt) of carbon dioxide equivalent (CO_2e) emissions in 2005, an amount equal to 0.8% of total U.S. gross GHG emissions (Bailie 2007).

5.1.2 Impacts from Climate Change

Potential impacts to air quality and other resources due to climate change are likely to be varied. The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts from global climate change. For example, if global climate change results in a warmer and drier climate (IPCC 2007), increased particulate matter impacts could occur due to increased wind-blown dust from drier and less stable soils. Spatial ranges of cool season plant species are predicted to move north and to higher elevations, and extinction of endemic threatened/endangered plants may be accelerated (IPCC 2007). Due to loss of habitat, or due to competition from other species whose ranges may shift northward, the population of some animal

species may be reduced. Less snow at lower elevations (IPCC 2007) would be likely to impact the timing and quantity of snowmelt, which, in turn, could impact aquatic species.

Potential cumulative air quality effects would not vary substantially among the alternatives because all four alternatives reflect a 5-year construction schedule and comparable VMT during construction, decommissioning and operations. Potential cumulative transportation effects between Alternative 1R and Alternatives 3 and 4 vary only by the differences discussed in Chapter 4.0 in conjunction with the alternative RDF associated with the construction of fewer WTGs in the Sierra Madre portion of the CCSM Application Area, and even then would occur only given concurrent activity with other projects (e.g., the Middlewood Wind Power Project).

Alternative 2 would have a haul road that parallels Highway 71. This would result in more haul truck traffic in the shared corridor and would cause higher emissions of PM_{10}, $PM_{2.5}$, NO_X, CO, SO_2, VOCs, and HAPs in the area. These emissions would result in higher concentrations of these pollutants along portions of the highway paralleled by the haul road, and thus would have higher cumulative impacts in the vicinity of Highway 71 than Alternative 1R.

5.2 Cumulative Impact for Cultural Resources

The CIA area for cultural resources encompasses the Application Area plus a 5-mile buffer, and was defined to encompass any historic properties where the setting could be visually affected by past, present, and RFFAs. Past and present actions and RFFAs expected to produce incremental and cumulative impacts within the CIA area are identified in **Table 5.0-1** and shown in **Figure 5.0-1**. It is unknown as to the number of NRHP-eligible sites that have been adversely affected by past and present actions, and would be adversely affected by RFFAs. As such, the following analysis of cumulative impacts to cultural resources is a qualitative assessment rather than a quantitative assessment.

As directed by law, cultural resources inventories are conducted for any actions (e.g., wind farms, pipelines, oil and gas development) involving public lands, and adverse effects to NRHP-eligible sites avoided or mitigated as appropriate. Avoidance through project redesign is the preferred method of mitigation; however, when avoidance is not feasible, data recovery (archaeological excavation) or other forms of mitigation are implemented prior to ground-disturbing activities

Past, present, and RFFAs located in the cultural resources CIA area include the following:

- Middlewood Wind Power Project;
- Dry Creek Wind Project;
- Atlantic Rim Natural Gas Field Development Project;
- Highway 71 Improvement Project;
- Various mine permits; and
- Electric transmission line projects, which include TransWest Express, Gateway South, and Gateway West.

The types of impacts that have occurred and could occur as a result of the proposed project and the above-listed actions include direct, indirect, and visual impacts. As stated previously in Section 4.2, direct impacts are associated with physical disturbance that can directly damage or destroy known and unknown (buried) NRHP-eligible sites, including properties of traditional religious and cultural importance to Native Americans. Indirect impacts occur later in time or are farther removed in distance (e.g., erosion, vandalism and illegal collecting of artifacts as a result of increased access). Visual impacts are associated with visual intrusions such as wind turbines, electrical transmission lines, or other aboveground structures. Other potential cumulative impacts to visual resources are discussed in greater detail in Section 5.12.

In order to analyze cumulative impacts, impacts first must be identified for the proposed project before cumulative impacts with past and present actions and RFFAs can occur. As such, the cumulative impact analysis should be linked to impacts associated with the proposed project. Without an impact, there would be no incremental impacts to the potential impacts of other past, present, and RFFAs. As identified in Section 4.2.5.1 of this document, impacts to cultural resources as a result of the proposed project include direct impacts to known and unknown cultural sites during ground-disturbing project activities; indirect impacts such as erosion, soil compaction, off-road vehicle traffic associated with construction or maintenance activities, inadvertent damage to cultural sites, and illegal artifact collection; and, visual impacts to historic properties (e.g., Overland Trail) where setting is an aspect of integrity.

Impacts associated with construction and operation of the Middlewood and Dry Creek wind energy projects would be similar to those identified for CCSM. The result of these combined projects would be a long-term cumulative loss of NRHP-eligible sites. As stated previously, direct impacts to known NRHP-eligible sites would be avoided or, if avoidance is not feasible, mitigated through data recovery or other appropriate means of mitigation. Data recovery gathers a significant amount of data from the site, which are then integrated into the regional archaeological database; however, the site ultimately is destroyed by the project. Over time, this represents a long-term cumulative loss. Indirect effects of these projects also would be similar to those from the proposed project. Incremental damage to cultural sites or loss of artifacts through increased access and increased numbers of people in the CIA area would occur over the life of these projects. Installation of wind turbines would cumulatively impact historic properties (e.g., Overland and Cherokee trails) in which setting is an important aspect of integrity. These projects would cumulatively alter the landscape surrounding these types of properties to the point where the integrity of the setting would no longer contribute to the eligibility of the site. Cumulative visual impacts would occur over the life of the projects as discussed further in Section 5.12.

Cumulative effects associated with the Atlantic Rim Natural Gas Field Development Project would be similar to those described for the wind projects. However, cumulative visual impacts to historic properties (in particular the Overland Trail) in which setting is an important as aspect of integrity are expected to be less than those associated with the wind projects because the gas wells are not as visually intrusive as wind turbines.

The Highway 71 improvement project would occur concurrently with the construction of the proposed project. Improvements to Highway 71 would result in linear disturbance within an already disturbed corridor. Therefore, while potential effects to cultural resources would occur as a result of the proposed CCSM project, no cumulative effects to cultural resources would be expected to occur as result of improvements to the highway.

Mining projects would contribute to direct and indirect effects to cultural resources, and would be similar to those described for the wind projects. However, the incremental loss of NRHP-eligible sites through data recovery most likely would be higher for mining projects because in many instances it is more difficult to avoid NRHP-eligible sites through project redesign. Cumulative visual impacts to historic properties in which setting is an important aspect of integrity would be expected to occur, but to a lesser degree.

Cumulative direct and indirect effects to cultural resources as a result of the proposed electric transmission line projects would be the same as described for the wind projects. The transmission line structures and the transmission lines themselves would create a cumulative visual intrusion within the CIA area over the life of the projects.

In summary, direct cumulative effects would occur as a result of the proposed project when combined with past, present, and RFFAs located in the CIA area, but would be minimized or mitigated through data recovery or other appropriate mitigation measures in compliance with historic preservation laws. As a result of data recovery, cumulative benefits would occur as recovered site data are integrated into the regional archaeological database. However, the sites ultimately are lost, resulting in long-term cumulative loss. Indirect effects are difficult to mitigate as most of the damage has occurred by the time it

is discovered. Indirect effects, such as illegal collecting of artifacts, have occurred and most likely would continue to occur in the CIA area through increased access, development, and increased human presence, as a result of the proposed project combined with past, present, and RFFAs. Cumulative visual effects to historic properties and properties of traditional religious and cultural importance to Native Americans where the setting is an important aspect of integrity are expected to occur. The proposed project combined with past, present, and RFFAs have altered and most likely would continue to alter the landscape surrounding these properties. The incremental loss of integrity would diminish the values that make these properties significant.

Under Alternative 2, the development footprint would be expanded to the east in the Chokecherry area resulting in a greater visual contrast thereby increasing the potential for cumulative adverse effects to the setting of the Overland Trail compared to Alternative 1R. Under this alternative, direct and indirect cumulative effects would be the same as Alternative 1R.

For Alternative 3, visual effects to the Overland Trail would be slightly reduced compared to Alternatives 1R and 2 due to the exclusion of the western and southern portions of the Sierra Madre area, thereby reducing the potential for cumulative effects to the trail setting. The proposed haul road would cross a contributing segment of the Overland Trail resulting in direct cumulative effects. Cumulative effects associated with placement of the transmission line relative to the Overland Trail would be the same as Alternatives 1R and 2. Overall direct and indirect cumulative effects would be the same as Alternative 1R.

Under Alternative 4, the location of WTGs and aboveground collector lines would be distributed over a larger development footprint, which would increase adverse effects to the Overland Trail's setting compared to Alternatives 1R, 2, and 3. The increase in adverse effects would in turn result in an increase in cumulative visual effects to the trail setting, compared to the other alternatives. Cumulative direct effects to the trail by the proposed transmission line and haul road would be the same as Alternative 3. In general, direct and indirect effects would be the same as Alternative 1R.

5.3 Cumulative Impacts for Geological and Mineral Resources

The CIA area for mineral resources is Carbon County since it provides an adequate area of analysis in which to compare the relative effects of the Proposed Action with overall mineral activity in the area. The CIA area for geological hazards for direct, indirect, and cumulative impacts is the Application Area and associated ROWs. The CIA area for geological hazards was chosen since geological hazards are localized and not comparative to areas outside of the Application Area. All projects shown in **Figure 5.0-1** and **Table 5.0-1** are located within the CIA area. There is little difference between the potential cumulative impacts of the four alternatives.

5.3.1 Minerals

Since there are no anticipated impacts to oil and gas access during construction or operation, there would be no contribution to cumulative impacts associated with those mineral resources. Since aggregate for the proposed project would be derived from non-local sources under all alternatives during construction, there would be no contribution to cumulative impacts associated with aggregate demand. One other wind energy project within the CIA area for mineral resources (the Middlewood project located southwest of the Sierra Madre portion of the proposed project) is located within the Kindt Basin and, similar to the proposed project and alternatives, has the potential to limit future access to coal resources during operation.

5.3.2 Geological Hazards

Incremental effects of the proposed project are difficult to quantify because of varying site conditions and construction. However, given appropriate design or avoidance, geologic hazards are not expected to contribute to cumulative impacts in the CIA area.

5.4 Cumulative Impacts for Land Use and Realty

The CIA area for land use and realty is the RFO. The basis for the CIA area is that the project in combination with other current and reasonably foreseeable projects could potentially result in cumulative impacts to management actions and land use designations established in the Rawlins RMP. All projects shown in **Figure 5.0-1** and **Table 5.0-1** are located within the CIA area. The incremental impacts from the CCSM project, in combination with other ongoing and proposed projects in the vicinity identified below, could result in cumulative impacts to SD/MA designations. In addition, impacts could limit the achievement of RMP goals and change opportunities for designated utility corridors and ROW authorizations designated through the RMP. Cumulative effects could also result from potential land use conflicts resulting from public land development (as allowed through the RMP), and from developments on private or state lands.

There is considerable overlap between potential land use impacts and impacts to grazing, recreation, visual resources, socioeconomics, minerals, and wildlife habitat; therefore, potential impacts to these resources are discussed in their respective section only and are not repeated here. Cumulative impacts to the Overland Trail are discussed in Section 5.2. The potential cumulative impacts to these resources and land use designations would occur primarily from the long-term operations of the indicated current and reasonably foreseeable projects. The CCSM project's contribution to cumulative impacts to land uses and land management actions would be very similar under all action alternatives unless otherwise noted.

Cumulative effects have the potential to limit the achievement of established RMP goals for some designated SD/MAs, including the Upper Muddy Creek Watershed/Grizzly WHMA, Red Rim-Grizzly WHMA, and the Overland Trail SD/MAs as indicated in **Table 5.4-1**. The CCSM project, in combination with Atlantic Rim Natural Gas Field Development Project and TransWest Express Transmission Project, may not be compatible with the intent of these SD/MAs and may constrain certain goals, as described below. It is anticipated that the majority of effects to resources within the SD/MAs would be avoided or mitigated through siting, design features, and mitigation measures to reduce or eliminate adverse impacts to protected resource values.

Table 5.4-1 Cumulative Effects to Land Use and Land Management within the CIA Area

Type of Project	Project	Affected Lands and Realty Management from the Project and Current or Reasonably Foreseeable Projects
O&G	Atlantic Rim Natural Gas Field Development Project	• Special Management Areas: Upper Muddy Creek Watershed/Grizzly WHMA, Red Rim-Grizzly WHMA • Avoidance Areas: managed for Controlled Surface Use for O&G projects • Historic Trails: Overland Trail
Transmission	Gateway South Transmission Project	• Designated ROW Corridors: I-80 Corridor, Rock Springs to Dave Johnson corridor, Westwide Energy corridor
	Gateway West Transmission Project	• Designated ROW Corridors: I-80 Corridor, Rock Springs to Dave Johnson corridor, Westwide Energy corridor
	TransWest Express Transmission Project	• Designated ROW Corridors: I-80 Corridor, Rock Springs to Dave Johnson corridor Westwide Energy corridor • Historic Trails: Overland Trail

More specifically, the Atlantic Rim Project contains about 19 percent of the Upper Muddy Creek Watershed/Grizzly WHMA (BLM 2006), and CCSM Alternatives 1, 2, and 4 also would use portions of the WHMA (see **Figures 4.14-1**, **4.14-2**, and **4.14-4**). The WHMA is managed with specific goals and

objectives for wildlife habitat and fisheries (see Sections 4.14 and 5.14 for impacts and cumulative impacts to wildlife habitat and fisheries in the WHMA). Similarly, the Atlantic Rim Project and Alternative 1R overlaps a small portion of the Red Rim-Grizzly WHMA (see **Figure 4.14-1**). The Atlantic Rim Project would implement protection measures to maintain the suitability of habitats for wildlife and sensitive fishes, so that impacts would not be significant (BLM 2006).

In summary, the Atlantic Rim Project and CCSM Alternatives 1, 2, and 4 would conflict with the intent of WHMA designations for the Upper Muddy Creek Watershed/Grizzly WHMA and Red Rim-Grizzly WHMA. However, successful implementation of ACMs and mitigation measures for these projects would avoid impacts to stated WHMA management objectives and potentially affected species within these areas.

Incremental effects of the CCSM project in combination with other past, present, and RFFA projects could result in changes to opportunities for designated utility corridors and ROW authorizations designated through the RMP. As identified in the 2008 Rawlins RMP, land tenure adjustments for the checkerboard area near communities such as Rawlins present an opportunity to acquire land for expansion; however, reasonably foreseeable projects within the checkerboard may limit these options. For example, public land being considered for disposal near Rawlins in the Application Area includes T21N, R87W, Sections 32 and 34, and part of Section 35. These parcels identified for disposal would be crossed by the Gateway West Transmission Project, the TransWest Express Transmission Project, and the proposed project Alternative 2 haul road. Current and planned projects in these parcels l would remove public lands from consideration for land tenure adjustments for entities other than foreseeable project proponents. This impact could represent a loss of opportunity for acquisition of land for other public or private uses, such as the expansion of the City of Rawlins.

Alternative 2 would potentially result in cumulative impacts to designated utility corridors that also could be used by the Gateway West Transmission Project, Gateway South Transmission Project, and the TransWest Express Transmission Project. Consolidation of TransWest, Gateway West, and portions of Gateway South transmission projects in the Westwide Energy Corridor would concentrate resource impacts to the area within the corridor boundaries, and reduce or eliminate cumulative effects to resources outside of the corridor. However, transmission project ROWs would need sufficient separation through offsets to meet reliability and outage criteria. South of Sinclair and Rawlins, between the Application Area and WY 71, there would be potentially insufficient corridor width to accommodate these projects in addition to the off-site Alternative 2 haul road. Alternative 2 would contribute to potential challenges of siting current and planned linear projects, as transmission projects are required to maintain minimum offsets within designated corridors. There would be no cumulative impact from Alternatives 1R, 3, and 4 to the designated corridors and the ROWs.

Potential land use conflicts could result from development of public lands, as allowed through the RMP, as well as from developments on private and state lands. These conflicting land uses could result from incremental effects of the CCSM project in combination with other past, present and RFFA projects. Potential conflicts would include residential uses on private lands or recreation uses of state lands experiencing the sights and sounds of industrial type developments on adjacent public land. Past activities that affect land use and realty include municipal development in the checkerboard land ownership pattern (notably the cities of Rawlins and Sinclair, and residential developments in unincorporated Carbon County), industrial developments, oil and gas fields, I-80, and existing ROWs and leases as shown on **Figure 3.4-1**. The checkerboard land ownership pattern is one of the most prominent land management considerations in the CIA area, as it consists of a large swath of land approximately 40 miles wide that runs from east to west across the RFO. There are seventeen current and planned projects located within the checkerboard, including the proposed CCSM project and seven other wind projects, which are listed in **Table 5.0-1**. These wind projects are the Dunlap Wind Energy Project, Foote Creek Wind Energy Project, High Plains and McFadden Ridge Wind Energy Projects, Middlewood Wind Power Project, Sand Hills Ranch Wind Farm, and Seven-Mile Hill Wind Energy Project. As shown in **Figure 5.0-1**, the CCSM project is one of the largest of the proposed projects. All

project alternatives, in combination with industrial-scale wind development and associated transmission and road infrastructure, would make land use conflicts with nearby landowners more pronounced.

5.5 Cumulative Impacts for Paleontological Resources

Carbon County was chosen as the CIA area for paleontological resources because of the large number of energy related projects in the county. All projects shown in **Figure 5.0-1** and **Table 5.0-1** are located within the CIA area for paleontology.

Cumulative impacts to paleontological resources would result from surface disturbance related to industrial developments (e.g., oil and gas and wind energy), unauthorized collection, and natural erosion processes in the CIA area. With the implementation of the recommended mitigation measures, the proposed CCSM project, when added to past, present, and RFFAs, would not be expected to significantly contribute to cumulative impacts to paleontological resources in the CIA area. A cumulative beneficial impact could result from the discovery of important fossil localities because of construction of the proposed CCSM project or other RFFAs in previously undisturbed areas. There is little difference between the cumulative impacts of the four alternatives.

5.6 Cumulative Impacts for Range

The CIA area includes the 14 allotments within the Application Area (i.e., Cottonwood Draw, Fillmore, McCarty Canyon, North Savery, Pine Grove/Bolton, Platte River, Sage Creek, Sixteen Mile, Emigrant, Doolittle, Middlewood Hill, Grizzly, Beaver Dams, and Sulphur Springs allotments) in their entirety. The CIA area was chosen because these allotments intersect and extend beyond the Application Area that also could be affected by other RFFAs in addition to the CCSM project. Of the past and present actions and RFFAs identified in **Table 5.0-1** and shown on **Figure 5.0-1,** the projects listed below have the potential to result in cumulative impacts within the CIA area:

- Atlantic Rim Natural Gas Field Development Project;
- Gateway South Transmission Line Project;
- Gateway West Transmission Line Project;
- TransWest Express Transmission Line Project;
- Middlewood Wind Power Project; and
- Highway 71 Improvement Project.

For the life of the CCSM Project there would be a long-term impact to the grazing resource resulting in a net loss of total annual forage production (the majority of which would be on the proponent's allotments). This net loss may not meet the 10 percent significance criteria, but would still need to be addressed through livestock management and possibly through adjusting stocking rates. Dust impacts to vegetation, as stated in Section 4.6, can lower palatability as well as cause lower weight gain and health issues. Other projects that are constructed and operated during the same timeframe and within the same allotments would result in cumulative impacts to total forage production and/or quality. These impacts would increase, but the actual effect to each livestock operation would vary depending on the type of operation, proximity of activities, and time of year.

Increased traffic and overall access from the multiple projects identified above could affect several of the allotments in the CIA area. Many of these allotments are only accessible for a portion of the year, changing access to year round could further increase recreational trespass and associated issues such as open gates and private property damage. In contrast to other areas within the RFO, many of the allotments within this CIA area have very little current oil and gas development and provide these livestock operations with relatively undisturbed rangeland with few management constraints.

Other cumulative impacts to livestock grazing include damage to facilities, and death, loss, or injury of animals due to vehicle collisions and consumption of poisonous plants/weeds. While difficult to quantify the scope of these impacts to grazing operations, the impacts can be significant. For instance, when fences are breached by power lines or road development and not repaired, there is an increase in associated labor costs rounding up livestock, possibly reduced weight gains, increased potential disease transmission, and an overall reduction of time for other ranch work. Death, loss, or injury to animals can greatly depend on the kind and class of livestock and effectiveness of compliance stipulations. However, improved roads often just lead to greater vehicle speeds and potential collisions with animals. Poisonous plants/weeds increase with disturbance and reduce the usable grazing land available to permittees. For example, halogeton has greatly increased in the oil and gas development areas and has led to direct mortality in sheep. Although no permittee within the CIA area runs sheep, vast patches of halogeton could have adverse impacts to livestock if not controlled adequately.

The potential cumulative impacts for Alternatives 1R through 4 vary only by the permanent displacement of acreage as discussed in Section 4.6. Alternative 2 would have the highest potential cumulative effects as measured by reductions to AUMs. The Cottonwood Draw, Middlewood Hill, Pine Grove/Bolten, Sage Creek and Sixteen Mile allotments would likely be affected by projects other than CCSM project as follows:

- Pine Grove/Bolten Allotment: The Gateway South, Gateway West, and TransWest Express Transmission Line Projects would occur in the northern portion of the allotment. Their construction schedules are expected to overlap with the CCSM construction schedule. TOTCO is the lessee of the Pine Grove/Bolten allotment, which is a wholly owned affiliate of The Anschutz Corporation along with the CCSM project proponent. The Highway 71 Improvement Project would cross the allotment. It is very likely that this work would be conducted during the same timeframe as CCSM construction activities.
- Sixteen Mile Allotment: The Gateway South, Gateway West, and TransWest Express Transmission Line Projects would occur in the northern portion of the allotment. Their construction schedules are expected to overlap with the CCSM construction schedule. The Atlantic Rim Natural Gas Field Development Project would occur in the western portion of the allotment. This is an ongoing project that is expected to continue for 30 to 50 years. The Highway 71 Improvement Project would occur along the eastern boundary of the allotment. It is very likely that this work would be conducted during the same timeframe as CCSM construction activities. The incremental contribution from the CCSM Wind Energy Project to cumulative impacts to this allotment is minimal; however, this allotment would incur the greatest amount of cumulative impacts by other RFFAs in the CIA.
- Cottonwood Draw, Middlewood Hill, and Sage Creek Allotments: The Middlewood Wind Power Project area overlaps with these allotments. At this time it is not anticipated the construction schedule for Middlewood Wind and CCSM would overlap; however, if they do it would likely be toward the end of the CCSM construction schedule when construction is planned to focus on the Chokecherry portion of the CCSM project. The Highway 71 Improvement Project would occur along the eastern boundary of the Sage Creek allotment and the western boundary of the Middlewood Hill allotment. It is likely that this work would be conducted during the same timeframe as CCSM construction activities.

There is little difference in the cumulative effects between alternatives. Under every alternative, a total of six different projects would contribute to the cumulative effects to five allotments within the project area. Impacts would be in the form of displaced forage vegetation, damage to rangeland improvements, injury or death of livestock, the spread of noxious weeds, and issues associated with trespass.

5.7 Cumulative Impacts for Recreation Resources

The CIA area for recreation resources includes the Application Area and surrounding visible recreation sites and use areas that are generally within the 30-mile visual resource analysis area in Section 4.12.

The CIA area encompasses the recreation sites directly affected by the CCSM project as well as changes in the project's viewshed that have the potential to degrade recreation experiences and displace users. Cumulative effects to visual impacts are addressed in Section 5.12.

The project in combination with current and RFFA projects listed in **Table 5.0-1** in the CIA area would result in cumulative construction and operational impacts that affect the quality of recreation opportunities. These effects would include the sights and sounds of project-related activities, the long-term loss of opportunities for scenery-viewing and solitude, and long-term beneficial and adverse OHV access for dispersed recreation. Past, present, and RFFAs located in the recreation resources CIA area that would result in cumulative impacts in combination with the CCSM project include the following:

- Highway 71 Improvement Project;
- Oil and gas projects, including: Atlantic Rim, Continental Divide-Creston, the Desolation Flats, and Hanna Draw;
- Mine permit projects along Seminoe Road;
- Two wind projects, including : Middlewood and Seven-Mile Hill; and
- The transmission line projects, including: Gateway South, Gateway West, TransWest Express, and Zephyr.

Specific recreational sites and areas directly affected by the project in combination with cumulative projects include the Continental Divide National Scenic Trail (CDNST), the Overland Trail (see Section 5.2), Teton Reservoir, and the North Platte River. Short-term construction and long-term operations of the project combined with cumulative projects do not preclude the use of these sites and areas for dispersed activities such as hunting, camping, fishing, and OHV uses; however, the quality of the recreation experience would be reduced for the majority of users who continue to use these areas.

As stated in Section 4.7, the CDNST SRMA is an exclusion area and no action alternatives would cross the CDNST or occur within the 0.25-mile CDNST SRMA. However, all action alternatives would degrade the CDNST viewshed (see **Table 4.12-7**). The four transmission line projects listed in **Table 5.0-1** would directly cross the trail and/or CDNST SRMA. Construction and operation of these transmission lines, if within the CDNST SRMA, would not likely meet the prescribed middle country (semi-primitive motorized) setting for the CDNST in accordance with the 2008 Rawlins RMP or the 2009 CDNST Plan. The indirect effects of the project in combination with the indirect and direct effects of past, current, and RFFA projects would impact the CDNST to a greater extent in the checkerboard, specifically the area 20 miles south of I-80. Within this 20 mile area, the haul road and transmission line under Alternative 2 and the transmission line under Alternatives 3 and 4 would be within 0.3 mile of the CDNST in the off-site corridor. The 2009 CDNST Plan acknowledges that human modifications may dominate views from the trail in roaded natural, urban, and private ROS classes.

The project under all action alternatives would be visible from the Overland Trail between Bridger Pass (the Continental Divide) and Elk Mountain within the checkerboard. Most recreational use of the Overland Trail in this area occurs at public road crossings since continuous travel on the Overland Trail is constrained due to private land restrictions. The recreation experience would be affected by the project in combination with cumulative noise and visual impacts from visible portions of the Atlantic Rim Natural Gas Field Development Project (concurrent with CCSM project construction and operations) and the Middlewood Wind Power Project (current with CCSM project operations).

Recreation activities at Teton Reservoir Recreation Area would be affected by noise and visual intrusions from the project under all alternatives, and specifically from facilities in Alternative 2 (off-site haul road and transmission line) and Alternatives 3 and 4 (off-site transmission line) that occur within 0.25 mile of the reservoir as described in Section 4.7. Incremental effects would occur to the Teton Reservoir Recreation Area from construction of the project in combination with concurrent Highway 71 construction activities, which also would occur 0.25 mile from the reservoir. Temporary access

limitations, the sights and sounds of heavy vehicles, and dust from construction traffic along the highway would noticeably diminish the experience of outdoor fishing, camping, scenery-viewing, and hiking in the natural setting of the Teton Reservoir.

Past projects that affect North Platte River recreation include residential developments in unincorporated Carbon County, I-80, and existing ROWs and leases as shown on **Figure 3.4-1**. Current and RFFA projects within the river viewshed include the four transmission line projects that would cross the river north of I-80 and would be constructed concurrently with the project under all alternatives. As discussed in Section 4.7, no construction or operation activities or facilities would occur within the North Platte SRMA or cross the North Platte River, and no WTGs would be located within 1 mile of the river under any project alternative. However, WTGs and the Water Extraction Site from all action alternatives would be visible from portions of the river and adjacent public land and easements. The CCSM project would contribute incremental effects in combination with past developments and these two transmission projects to river recreation experiences from Saratoga to 10 miles north of I-80 during construction and operation.

OHV use is increasing throughout the CIA area, although constrained in the checkerboard due to private land restrictions. Past activities that have constructed roads include oil and gas development, residential developments, grazing, and dispersed recreation (user-created routes). Alternatives 1R and 4 would create and improve roads south of T18N, thereby indirectly increasing recreational access to contiguous public lands. Current and RFFA projects that would create and improve roads on contiguous public lands include Atlantic Rim Natural Gas Field Development Project (concurrent with CCSM project construction and operations) and the Middlewood Wind Power Project (current with CCSM project operations). OHV riders may have more opportunities available as a result of Alternatives 1R and 4. New access roads used for construction and operations provide additional avenues for riders to gain access to locations that were previously off limits or more difficult to access. Increased routes would be a beneficial effect for OHV users. At the same time, however, authorized and unauthorized OHV use is likely to result in an increase in trespassing complaints from landowners and dissatisfaction from hunters and recreationists that value remote settings with few roads. As road density increases, there would be a need for additional enforcement and physical barriers to protect some areas. Increases in OHV use could result in further degradation of native vegetation, which would be compounded by the effects of habitat fragmentation on hunting opportunities. Cumulative impacts of road construction and OHV activity on public lands south of T18N would be greatest under Alternative 1R, which has the largest conceptual area of development in the Sierra Madre area; and the smallest under Alternatives 2 and 3, which are located only within the checkerboard.

In summary, the degradation or a perception of degradation in the quality of recreation resources on large areas of public, state, and private land on visible lands up to 30 miles from construction and operation of cumulative projects in the CIA area could decrease levels of satisfaction among some residents and area visitors. This could result in their displacement to other areas of the region. Indirect cumulative effects could include a decline in tourism and visitor use that would affect local businesses, such as guides and outfitters that depend on the quality of outdoor recreational activities in the CIA area.

5.8 Cumulative Impacts for Socioeconomics

The CIA area for socioeconomic conditions includes Carbon County and the eastern portion of Sweetwater County. This area encompasses the communities where the majority of project-related workforce would be expected to reside and socioeconomic effects would occur, creating the potential for cumulative effects. Although Carbon and Sweetwater counties contain an abundance of mineral and energy resources, the current potential for cumulative socioeconomic effects in the CIA area is associated with the past, ongoing, and RFFAs summarized in **Table 5.0-1**. Past, present, and RFFAs located in the socioeconomics CIA area that would be most likely to result in cumulative impacts in combination with the CCSM project include the following:

- Oil and gas projects, including: Atlantic Rim, Seminoe Road, Desolation Flats, South Baggs, and Continental Divide-Creston;
- Medicine Bow Fuel & Power Coal-to-Liquids (CTL) Project;
- Lost Creek In-Situ Uranium;
- Middlewood Wind Power Project; and
- The transmission line projects, including: Gateway South, Gateway West, and TransWest Express.

Potential cumulative socioeconomic effects include changes in employment, workforce migration, resident population, and housing, public facilities and services demand. Fiscal effects, including changes in revenues and public expenditures to serve demand for public facilities and services, also are foreseeable. Because most of the cumulative developments involve temporary construction workforces that are larger than the corresponding operational workforces, the potential for adverse cumulative socioeconomic effects within the CIA area arise primarily during periods of concurrent construction activity of two or more projects. In contrast, the beneficial effects on public sector revenues would tend to be more favorable over the longer term. Cumulative effects also could occur in association with future reclamation or abandonment activity, again when such activity would overlap in time with construction and operations of other activities. However, assessing such future cumulative effects is difficult due to the uncertainties regarding the timing of such activity and the other development and the extended time horizons involved.

Challenges in assessing potential cumulative socioeconomic effects also arise in conjunction with the influence of other factors on decisions of whether to proceed, postpone or continue operations of an activity. Two such factors include uncertainty regarding the timing of necessary regulatory approvals and changing economics of resource development and production in response to market prices. A delay or postponement of a project because of such factors can substantially increase or diminish the potential for cumulative socioeconomic effects with the CCSM project.

While many of the reasonably foreseeable projects identified in **Table 5.0-1** would require future regulatory approval, the drilling and field development activities associated with the previously authorized Atlantic Rim, Seminoe Road, Desolation Flats, and South Baggs Area natural gas development projects and authorized interim drilling associated with the Continental Divide - Creston Natural Gas Development Project could all increase rapidly in response to higher natural gas prices. Increases in employment, workforce immigration, population, and demands on temporary housing and public facilities and services would accompany such resurgence in activity, substantially altering the socioeconomic setting in which the CCSM project would occur.

In addition to the projects above, the foreseeable projects having the highest potential to generate cumulative socioeconomic effects with the CIA area are the Medicine Bow Fuel & Power CTL Project, which has received authorization and is seeking financing, and the Lost Creek In-Situ Uranium, Continental Divide Creston Natural Gas Development, and one or more of three transmission line projects -- Gateway West, Gateway South and the TransWest Express lines. The latter are currently in the environmental assessment and permitting stages. Subject to the completion of the permitting process, successful arrangement of electrical energy sources to be conveyed, and project financing; construction and development activities for one or more of these projects could overlap with CCSM project, resulting in temporary and short-term cumulative socioeconomic effects.

For all of these projects, the potential adverse cumulative socioeconomic effects within the CIA area would arise primarily during periods of concurrent construction and development. The potential for concurrent construction and development exists for the Middlewood Wind Power Project, due to its location and seasonal construction schedules associated with timing stipulations, and for one or more components of one or more of the transmission line projects, particularly in the latter years of the CCSM construction. With the exception of the Medicine Bow Fuel and Power CTL Project, future employment

levels and demands on housing and local government services associated with these projects would decrease dramatically as each project transitions from construction to operation. The cumulative gains in long-term operations employment, income, and population would generally be considered beneficial.

Cumulative fiscal effects, including both additional revenues and increases in public expenditures to serve demand for public facilities and services, also are foreseeable. State and local sales tax revenues are generally higher during construction but then decrease, while ad valorem (property) tax revenues would increase and wind energy production taxes are generated. However, ad valorem tax revenues associated with energy production in unincorporated areas accrues primarily to counties, school districts, the state and other districts, rather than to the municipalities in which most energy-related workers live.

It is not possible to foresee which of these projects would have construction schedules that coincide with that for the CCSM. If construction levels were to overlap for all of these projects, and natural gas drilling levels were to increase to near or above 2007-2008 levels, another “boom” would ensue in the CIA area. In that case, potential cumulative impacts on area socioeconomic conditions would include increased economic activity resulting in an increase in local income, employment and population accompanied by increases in local and state government taxes and royalties and increases in demand for local services.

Concurrent development of two or more of the cumulative projects would result in a greater temporary population influx, with potentially adverse cumulative effects including demand for temporary and long-term housing resources that exceed local supplies by a substantial margin, demand for local government services that may exceed current service capacities, and changes in local social conditions that could include social disruption in some communities. Increased employment opportunities in relatively high paying construction and energy development jobs would result in competition for workers to the detriment of private and public sector employers who could lose existing employees, then experience difficulty in recruiting new employees. On the other hand, workers could benefit from higher wages and salaries resulting from such competition.

Deficits in temporary housing resources could be mitigated by the development of temporary housing facilities. Medicine Bow Fuel & Power has proposed such facilities to accommodate construction workers on its CTL Project and PCW has committed to building such facilities for CCSM should the need for such be determined during the future WISC permit application process. It also is common for some firms in the natural gas industry to develop such camps; three such camps and several rig camps and dormitory units placed in mobile home parks were operational locally in 2007-2008.

The pace of new residential construction in communities in the CIA area would need to increase substantially over current levels to accommodate cumulative demand for longer-term housing units. Several subdivisions were approved in Rawlins and Wamsutter in recent years and others were in the permitting process, but weak market conditions halted progress on some of the proposed subdivisions. The development of temporary housing facilities could free up spaces in mobile home parks, providing a resource for longer-term demand until the conventional housing market would be able to respond.

Demands on local government services associated with CCSM construction, the three major transmission line projects, the Middlewood Wind Power Project, and much of the foreseeable natural gas development would be seasonal, presenting challenges for counties and communities to provide services and expand staff. Demands associated with the transmission line projects would be temporary as the locus of construction proceeds south and westward. Excess capacity exists in most public utility infrastructure systems (e.g., water and wastewater systems) in the local communities that would likely host the bulk of the construction and natural gas development workforce. The recent experience in the CIA area has been that few families and school age children have accompanied construction and natural gas workers to the area, consequently school enrollment would not be anticipated to increase substantially in the near term and could likely be accommodated with the existing capacity of area schools.

Community services such as law enforcement, emergency response, social services and road and bridge departments, which have experienced reductions in revenues and services and in some cases staff cutbacks in recent years, would be required to respond to increased demand from a diminished level of service. For most projects, substantial sales and use tax revenues do not flow until well into the construction phase, which coupled with a 2-month lag in distribution of revenues from the state to local governments, would require local governments to respond to increased demand without a corresponding increase in revenues in the beginning months of the boom. This lack of revenue, coupled with competition for workers and the difficulty in staffing for seasonal demand could present substantial challenges for local governments in the early years of a boom, although the increases in demand may arise incrementally over time.

The counties, local school districts and special districts will benefit from substantially increased revenues once ad valorem and production related revenues, and energy production tax revenues in the cases of the CCSM and Middlewood Wind Power projects. However, municipalities would typically benefit only indirectly from these revenues.

Cumulative development in the CIA area also holds potential to affect local attitudes, opinions and lifestyles and these effects are likely to be mixed. Development of the projects listed above coupled with a moderate increase in natural gas development would result in economic growth, increased employment opportunities in relatively high-paying jobs in Carbon and eastern Sweetwater counties. These changes create the prospect for improvements in the financial status of many residents, which would correspondingly increase support for cumulative development activities, particularly among those segments of the community that benefit directly or indirectly from the increased economic activity. On the other hand, those residents whose economic activities and/or recreation activities use the same areas as the projects listed in **Table 5.0-1**, including ranchers, outfitters, hunters and other recreationists, are among those most likely to be dissatisfied. Moreover, if area residents perceive that wildlife habitat, scenic vistas and other resources are being degraded by development, levels of dissatisfaction could become greater and more widespread.

Following the short-term population gains in response to cumulative activities, Carbon County's population would decline as construction on cumulative projects is completed, perhaps dramatically. Given the cyclical nature of natural gas development and the potential for other energy development to occur, it is difficult to predict development and associated population levels with any certainty. But if population were to fall dramatically, businesses that have expanded or been developed to accommodate the temporary population influx would need to transition to accommodate the decreased demand. Effects on area housing conditions could be moderate if much of the construction and natural gas development industry were accommodated in temporary housing facilities or if housing to accommodate the temporary workforce was developed with a post-boom use in mind. In those cases, communities near the study area would be unlikely to have substantial unoccupied conventional housing after construction is completed or if a slowdown in natural gas development were to occur. Similarly, the fact that most community infrastructure water and sewer systems are already in place should help communities avoid substantial debt that would be difficult to service when population levels decrease.

Potential cumulative socioeconomic effects would not vary substantially among the alternatives because all four alternatives reflect a 5-year construction schedule, comparable temporary workforce and housing requirements during construction and decommissioning, long-term effects during operations.

5.9 Cumulative Impacts for Soil Resources

The CIA area for soil resources consists of TOTCO and includes the Application Area, off-site features, and the Sage Creek watershed (**Figure 5.9-1**). This CIA area was chosen because it encompasses the watersheds that would be impacted by project activities and nearby RFFAs that affect soil resources. Existing and reasonably foreseeable projects that would be expected to produce incremental and cumulative impacts within the CIA area are summarized in **Table 5.0-1** and discussed in further detail

below. These projects would contribute incremental changes to the current level of effects to soil resources in the CIA area from historic and ongoing management activities.

Historic impacts to soil resources include activities such as sheep and cattle grazing, road development, oil and natural gas exploration and development projects, pipeline construction, water development, mining, recreation, wildfire, and other natural and anthropogenic activities within the CIA area. Mining impacts typically have localized impacts to soil quality and productivity. Where public and private lands are grazed, soils generally see an increase in compaction, a decrease in soil cover, and an increase in invasive weeds, resulting in accelerated runoff and erosion and a reduction in soil quality. However, due to intensive grazing management, the Standards and Guidelines Assessment showed the overall condition of rangeland within the Lower North Platte Watershed and Upper Colorado River Basin to be trending upward. The exceptions to this are the riparian zones and wetlands in the Wolfe, Platte River, Middlewood Hill, Dana Ridge, Dana Meadows South, Sixteen Mile, and Pine Grove/Bolten allotments (BLM 2004, 2002). These allotments are discussed in further detail in Section 3.6.4.

Past, present, and RFFAs (as shown on **Figure 5.9-1**) that contribute to impacts to soil resources in the study area include the following:

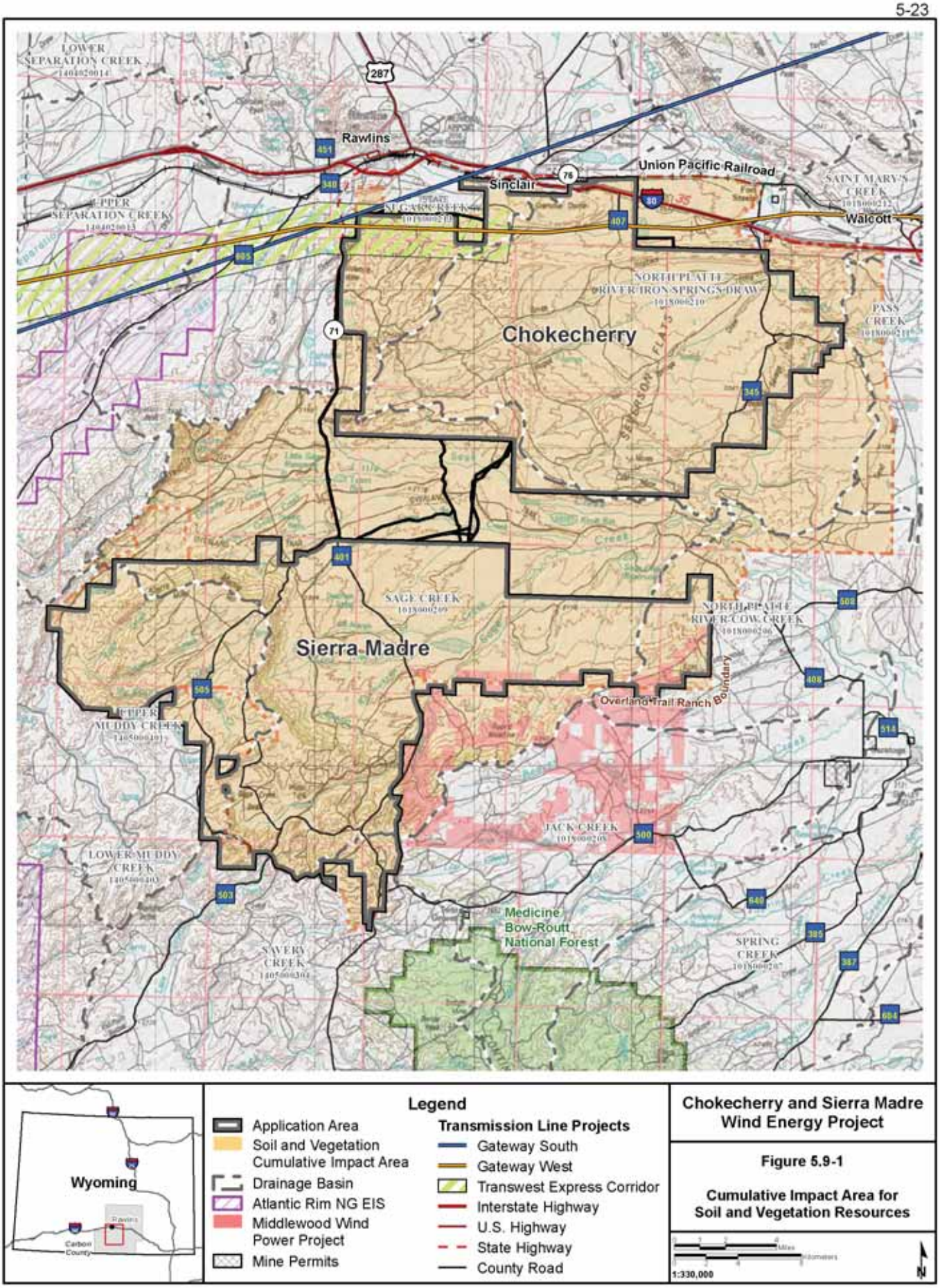
- Middlewood Wind Power Project;
- Past mining projects;
- Electric transmission line construction including,
  - TransWest, Gateway South, and Gateway West;
- Two-track, natural surface, graveled, and paved roads; and
  - Highway 71 Improvement Project.

Impacts to soils from construction and operation activities associated with the Middlewood Wind Power Project would be similar to those described in Section 4.9. Construction of this project would occur after the CCSM construction and would add to cumulative impacts in the CIA area. Numerous roads and turbine pads would result in long-term impacts to soils including removal of vegetation, exposure of the soil to erosive forces, mixing of soil horizons, soil compaction, loss of topsoil productivity, and increased susceptibility of the soil to erosion. These impacts could increase runoff, erosion, and off-site sedimentation.

Past mining impacts have resulted in localized impacts to soil resources. Sand and gravel mines have resulted in multiple depressions that may or may not be re-vegetated once mining is complete. The quarries are located next to the North Platte River, and the pits filled with water once excavation was complete due to groundwater inflow. Generally a loss or reduction in soil productivity and quality has occurred at these locations, which would contribute to cumulative impacts in the CIA area.

Transmission line construction typically results in linear surface disturbance to soils with short-term impacts within the right-of-way and long-term impacts where tower foundations or facilities are located. The TransWest, Gateway South, and Gateway West transmission lines are currently undergoing NEPA analysis and would occur within the northern portion of the CIA area. Construction of each of the transmission line projects is planned to occur concurrent with the CCSM project. During construction an increase in erosion and compaction would be anticipated. Long-term to permanent impacts to soil quality would be anticipated where tower foundations and facilities are located.

The Highway 71 improvement project would occur concurrently with the construction of the CCSM project. This project would result in linear disturbance along an already disturbed corridor. Short-term increases in erosion and sedimentation would be expected until successful reclamation is achieved.



Chokecherry and Sierra Madre Wind Energy Project

Figure 5.9-1

Cumulative Impact Area for Soil and Vegetation Resources

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The potential cumulative effects discussed vary only by the project-specific impacts discussed in Chapter 4.0. Alternative 2 would result in the highest surface disturbance to soil resources (8,569 acres), whereas Alternative 1R would result in the least amount of surface disturbance to soil resources (7,733 acres). The alternatives would add to the surface disturbance to soil resources in both the short-term and long-term resulting in significant impacts to soil resources if successful interim and final reclamation is not achieved.

5.10 Cumulative Impacts to Transportation and Access

The CIA area for transportation includes Carbon County and more specifically the highway transportation network where the majority of CCSM traffic and related transportation effects would occur, creating the potential for cumulative effects. Cumulative effects are considered for two geographies: 1) the CCSM analysis area and the highways and roads that provide immediate access to the area; and 2) the segment of I-80 in the vicinity of Rawlins serving the Application Area and streets within the City of Rawlins, where most of the project workforce would be housed.

Past, ongoing, and RFFAs that would be expected to produce incremental and cumulative impacts within the CIA area are summarized in **Table 5.0-1**. Past, present, and RFFAs located in the transportation CIA area that would be most likely to result in cumulative impacts in combination with the CCSM project include the following:

- Oil and gas projects, including: Atlantic Rim, Seminoe Road, Desolation Flats, South Baggs, and Continental Divide-Creston;
- Medicine Bow Fuel & Power CTL Project;
- Lost Creek In-Situ Uranium;
- Middlewood Wind Power Project; and
- The transmission line projects, including: Gateway South, Gateway West, and TransWest Express.

Cumulative effects on transportation would include changes in traffic, that when combined with traffic associated with the CCSM project, would affect overall conditions on the CIA area transportation network.

As discussed in Section 4.10, historic and existing traffic within the CCSM analysis area and the highways and roads providing direct access are primarily associated with ranching, grazing, and outdoor recreation. This traffic is relatively low in volume, seasonal in nature, and not anticipated to increase substantially. Because the CCSM project is the only RFFA anticipated to be located in the immediate CCSM analysis area, other RFFA projects would not directly contribute to increased traffic in the area. Therefore cumulative transportation and access impacts within the analysis area would not differ substantially from those directly attributable to Alternative 1R or other action alternatives.

WY 76/CR 407 (CIG Road), which would be the primary access route to the CCSM Application Area and internal haul road, also provides access to the CIG natural gas pipeline compressor plant, to ranches, and to the pipeline and utility corridors near I-80.

WY 71/CR 401 (Sage Creek Road) generally runs north-south, west of the Chokecherry site and through the eastern portion of the Sierra Madre site, providing access from the Rawlins area and I-80 to public and private lands in southern Carbon County and is one access route to the Medicine Bow National Forest. WY 71 also provides access to rural residential development and the Rawlins water treatment plant south of Rawlins. Although WY 71/CR 401 provides access to public and private lands open for oil and gas exploration, it does not provide direct access to known oil and gas fields. At present, planned improvements to the Sage Creek Road by the county and state are the only anticipated actions that would generate cumulative effects. Unless highway or road improvement construction occurred on the

affected segment of Sage Creek Road during the second and third years of CCSM construction, cumulative impacts associated with highway construction would be minimal, short-term, and temporary.

Cumulative effects from the projects listed in **Table 5.0-1** are not anticipated on WY 76/CR 407 or WY 71/CR 401. Although as noted above, WY 71/CR 401 provides access from I-80 to the Medicine Bow National Forest, cumulative impacts associated with increases in forest visitor travel would be minimal given the relatively moderate volumes of traffic on WY 71/CR 401 associated with the CCSM project. Increases in Medicine Bow National Forest visitor traffic could be intermittently impeded at the point where the CCSM internal haul road crosses CR 401 (Sage Creek Road) during the 7 months of the first three CCSM project construction years when road and WTG construction would occur in the Sierra Madre site west of CR 401, but delays would be short-term and temporary. PCW may station flaggers at this intersection to allow traffic on CR 401 to pass, which would further reduce the potential for delay.

Cumulative effects on transportation conditions along I-80 near the Application Area and on streets within Rawlins could occur from the effects of the CCSM project in combination with other projects listed in **Table 5.0-1**. Cumulative effects could occur in association with the existing and reasonably foreseeable future oil and gas projects listed in **Table 5.0-1**, particularly if drilling, field development and production activity in these fields were to increase in response to higher oil and natural gas prices. If oil and natural gas activity were to increase substantially during CCSM construction, the CCSM project's contribution to cumulative effects would be primarily associated with workforce commuting, since most construction materials for the project are anticipated to arrive by rail. Such materials would arrive at an RDF located on the northwest boundary of the Application Area, or at an alternate RDF located east of Sinclair, from which they would be transported to the site via WY 76/CR 407.

Cumulative transportation effects associated with oil and gas development would be limited primarily to additional traffic on I-80 and traffic, congestion, delay and deterioration of LOS on streets and at key intersections in the Rawlins area. If a major increase in oil and natural gas activity were to coincide with CCSM construction activity, the congestion, delay and decreases in LOS could be substantial at some intersections.

Cumulative transportation effects associated with oil and gas activity on the access routes providing direct access to the CCSM Application Area would be unlikely, given that these routes do not access currently known oil and gas fields.

Construction and operations of the Lost Creek In-Situ Uranium Project could contribute to cumulative traffic impacts along I-80, although equipment coming from the north would likely access the Lost Creek project on U.S. 287 from I-25. Construction and operations materials coming from the east or west on I-80 would travel through Rawlins to access U.S. 287, and a portion of the project's construction and operations workforce would likely reside in Rawlins, both of which would result in cumulative transportation effects within the city if the two project's construction schedules were to coincide. Cumulative effects associated with development and operations of the Medicine Bow Fuel & Power's CTL Project (MBFP 2007) near Medicine Bow would primarily occur on I-80 and within the City of Rawlins. Some construction materials could arrive from the west on I-80 although rail delivery is anticipated and a more likely route for highway transport may be via U.S. 30 from Laramie. The Wyoming Industrial Siting Permit Application submitted for the project forecast that 47 direct workers would locate in Rawlins during the first year of construction and 247 workers would locate in Rawlins during the second and third years. It further assumes that MBFP would construct a 200-bed construction camp in Rawlins (MBFP 2007). If the construction schedules for the MBFP and CCSM Projects were to coincide, additional congestion, delays and reductions in LOS on streets and at key intersections in Rawlins would be anticipated. These cumulative impacts would be short-term, temporary, and only occur in the April through October period of each year when CCSM construction activities would occur.

The wind energy projects listed in **Table 5.0-1**, other than the Middlewood Wind Power Project, are unlikely to contribute to cumulative transportation effects in the CIA area because of their location in the

eastern portion of Carbon County, although WTGs and other construction materials could be transported on the segment of I-80 near the CCSM Application Area depending on the origins of those materials. If the proposed RDF at either the preferred or alternate location were to be used for delivery of equipment and materials for construction of other wind or energy development projects, cumulative impacts could occur if the construction schedule for those projects were to coincide with the construction schedule for the CCSM project. Cumulative effects also could occur at the I-80 Exit 221 interchange if other wind projects were to use the RDF during CCSM project operations. CCSM's contribution to such cumulative effects would primarily be associated with workforce commuting and operations materials, equipment and supplies deliveries. CCSM's long-term contributions to cumulative transportation effects at Exit 221 would be minor.

Construction of the Middlewood Wind Power Project could result in short-term and temporary cumulative increases in traffic and traffic-related effects on WY 71/CR 401, if development were to occur concurrently with the CCSM project. Long-term cumulative effects also would arise during operations; however, such effects would be minimal.

Construction schedules for the CCSM and the Carbon County portions of the TransWest Express, Gateway West, and the Gateway South transmission line projects could overlap. The CCSM contribution to cumulative effects of those projects would be limited to workforce commuting and materials delivery on I-80 and within Rawlins. Cumulative effects of these three projects on transportation conditions on I-80 would be minimal. Cumulative effects on streets and at key intersections in Rawlins would likely be moderate, short term and temporary.

It is possible that construction schedules for all of the above listed projects could coincide with increased oil and gas activity in the transportation and access CIA area. Under these circumstances, cumulative effects would occur on I-80 near the CCSM Application Area and in Rawlins and could be substantial in these areas. Few cumulative transportation effects on the direct access routes leading to the CCSM Application Area would be anticipated.

Potential cumulative transportation effects would not vary substantially among the alternatives because all four alternatives reflect a 5-year construction schedule and comparable traffic levels during construction, decommissioning and operations. Potential cumulative transportation effects vary between Alternative 1R and Alternatives 2 through 4 only by the differences discussed in Chapter 4.0 in conjunction with the alternative RDF location and traffic on WY71/CR 401 associated with the location of fewer WTGs in the Sierra Madre portion of the CCSM project area. Even then, project-related differences would result in cumulative effects on transportation conditions only given concurrent activity with other projects (e.g., the Middlewood Wind Power Project).

5.11 Cumulative Impacts for Vegetation

5.11.1 Vegetation

The CIA area for vegetation resources, including noxious and invasive weeds consists of the TOTCO Ranch and includes the Application Area, off-site features, and the Sage Creek area. This CIA area was chosen because it encompasses the watersheds that would be impacted by project activities and nearby RFFA's that affect vegetation resources. Of the existing and RFFA projects shown in **Table 5.0-1** and **Figure 5.0-1**, the following projects (as shown in **Figure 5.9-1**) have the potential to produce incremental and cumulative impacts within the CIA area: Middlewood Wind Power Project; Gateway South Transmission Line Project; Gateway West Transmission Line Project; TransWest Express Transmission Line Project; Highway 71 Improvement Project; and an unnamed sand and gravel quarry (classified as "Other Mine Project"). In combination with the CCSM project, these projects would contribute incremental changes to the current level of effects to vegetation resources in the CIA area from historic and ongoing management activities.

Historic impacts include grazing and soil-disturbing activities such as road development, water development, mining, and building development. These activities and supporting developments are common in this rural landscape throughout the CIA area. Evidence of human activity in the CIA area from past, present, and RFFAs include roads paved with asphalt or surfaced with gravel, numerous two track roads, oil and natural gas exploration and extraction projects, overhead electric transmission lines, pipelines, coal gasification projects, extraction activities, and water development.

These projects generally consist of large soil disturbing activities that have and will continue to impact the existing native vegetation. Some of the soil disturbance, especially older projects, likely mixed topsoil with subsoils and used weedy nonnative species as part of the reclamation effort. These techniques have had long-lasting impacts in changing the vegetation communities to more disturbance-oriented communities. In more recent years, improved techniques have been implemented from a greater understanding of the preservation of topsoil and other suitable soil horizons, in addition to using native plant species for reclamation.

The alternatives would add to the cumulative removal of vegetation in both the short-term and long-term. The most abundant vegetation communities, Wyoming big sagebrush and mountain big sagebrush, would be impacted the most; however, impacts to these communities would be only part of the overall impacts to native communities in the CIA area. In addition, although restoration approaches for the more dominant communities such as big sagebrush, saltbush, and grasslands are fairly well understood, there is limited research or application of successful reclamation on the more pristine communities such as cushion plant communities. The reclamation of cushion plant communities would likely require a higher level of experimentation and likely some unsuccessful attempts. In addition, there is a lack of native seed sources for many of the forbs in these communities that make it challenging to achieve long-term species composition objectives. However, with successful reclamation of the majority of native communities, cumulative effects to vegetation would be relatively minor.

Indirect effects from the action alternatives could generate cumulative impacts in combination with existing and proposed roads from other developments. These impacts may result from dust deposition and desertification. Dust accumulation on vegetation would reduce photosynthetic activity as well as plant palatability. In turn, these effects may change plant species composition, cover, and productivity. In addition, more extensive road systems would collect runoff that otherwise would have drained and infiltrated across the landscape. The resulting modifications of upland hydrology may lead to desertification which, if not adequately mitigated, could be significant in some vegetation communities formerly supported by greater moisture contributions.

The potential cumulative impacts for Alternatives 1R through 4 vary only by the permanent displacement of acreage as discussed in Section 4.11. Alternative 2 would have the highest potential cumulative effects, followed by Alternatives 1R, 4, and 3. The CIA area would be affected by projects other than the CCSM Wind Energy Project as follows:

- The Gateway South, Gateway West, and TransWest Express Transmission Line Projects would occur in the northern portion of the CIA area. Their construction schedules are expected to overlap with the CCSM construction schedule.
- The Highway 71 Improvement Project would occur in the southern portion of the CIA area. It is anticipated that the construction schedule for the Highway 71 Improvement Project would occur concurrently within CCSM construction activities.
- The Middlewood Wind Power Project would occur in the southern portion of the CIA area. It is anticipated that the construction schedule for the Middlewood Wind Power Project would occur after the CCSM construction timeframe; however, Middlewood Wind Power Project operations activities would likely occur concurrently with CCSM operations.
- The existing past mining projects in the northern portion of the CIA area resulted in localized impacts to vegetation resources. These sand and gravel mines have resulted in multiple

depressions that may or may not be re-vegetated once mining is complete. Generally a loss or reduction in native vegetation cover has occurred at these locations where vegetation was not re-established or native species were not restored, which would contribute to cumulative impacts in the CIA area.

5.11.2 Noxious Weeds

Noxious and invasive weeds are present throughout the landscape, with heavier occurrences in areas that have been previously disturbed. Soil-disturbing activities have created opportunities for noxious and invasive species to gain a foothold and spread. Linear projects such as roads, transmission lines, and pipelines provide some of the greatest opportunities for weeds to disseminate. With greater understanding of the harm that noxious and invasive weeds species can cause, proper application of new techniques to minimize their spread, and careful diligence in controlling those weeds that do appear, the cumulative effect from the CCSM project would be relatively low. There is little difference between the cumulative effects among the alternatives.

5.11.3 Wetlands

Cumulative impacts to wetlands would not be expected from the proposed project or alternatives when added to other past, present, or RFFAs (**Table 5.0-1**) in the general project vicinity. This is due to protections provided to wetlands by the CWA, Executive Order (EO) 11990, and other regulations that strive to meet the national goal of “no net loss” of the nation’s wetlands. Any project that does not avoid wetland impacts altogether would be required to get a permit from the USACE and either restore the wetlands or create a replacement as compensation.

5.12 Cumulative Impacts for Visual Resources

The CIA area for visual resources includes the visible area within 30 miles of all proposed project facilities, from the Application Area to beyond the background distance zone as defined in Section 3.12. Thirty miles is the distance at which visual impacts from the project would become negligible (AECOM 2011). Most BLM lands within the CIA area are managed with VRM Class III and IV objectives. Existing and reasonably foreseeable projects that would be expected to produce long-term, cumulative impacts within the CIA area to SQRUs, SRLUs, and VRM classes also affected by the proposed project include two wind energy projects, four natural gas development projects, and four transmission line projects. Past, present, and RFFAs located in the visual resources CIA area that would result in cumulative impacts in combination with (i.e., within view of) the CCSM project includes the following:

- Highway 71 Improvement Project;
- Oil and gas projects, including: Atlantic Rim, Continental Divide-Creston, the Desolation Flats, and Hanna Draw;
- Mine permit projects along Seminoe Road;
- Two wind projects, including: Middlewood and Seven-Mile Hill; and
- The transmission line projects, including: Gateway South, Gateway West, TransWest Express, and Zephyr.

Altered landscapes resulting from the CCSM project and other RFFAs would be visible by relatively large numbers of viewers from federal and state highways, and communities within the boundaries of the CIA area. The cumulative visual contrasts of the past, present, and RFFA projects is dependent on the ability of intervening terrain to screen project components from view and the proximity of the cumulative projects to each other. Cumulative impacts are similar for all project alternatives unless otherwise noted.

Historic uses are evident in the rural landscapes throughout the CIA area, and include grazing, road development, recreational activities, and private land actions. Evidence of human activity in CIA area

landscapes from past, present, and RFFAs include roads paved with state and federal highways, asphalt or surfaced with gravel, numerous two-track roads, oil and natural gas exploration and extraction projects, overhead electric transmission lines, pipelines, coal gasification projects, uranium exploration and extraction activities, and wind energy development, especially along the I-80 corridor as shown in **Figure 3.4-1**. Additional activities on private lands in the CIA area include urban areas, industrial activities, oil and gas development, commercial development, private residences, and other land uses typical of a regional economy based on the development of natural resources. Wind energy development is a relatively recent activity in the CIA area.

Many of the landscapes in the visual resources CIA area generally are characterized by moderate to high scenic integrity, in that they appear as natural landscapes where human modifications are not visible or may be seen but do not attract attention. Aside from the CCSM project, two proposed wind development projects in the CIA area are Middlewood and Seven-Mile Hill, which are located on uplands and ridges that would be visible for long distances from highways and communities. Wind projects create stronger visual impacts over longer distances than most other types of projects, and mitigation strategies for wind energy development and the accompanying high-voltage transmission lines are limited in the ability to reduce the appearance of large scale facilities spread over large areas. The Middlewood Wind Power Project would be visible in the background views from WY 130, the Town of Saratoga, and the Overland Trail. The Seven-Mile Hill Wind Energy Project would be visible from U.S. 287, WY 487, and the Town of Hanna. Motorists along highways view expansive vistas that may be occupied by one or more existing and proposed wind energy projects. Some locations would provide views of more than one wind energy project in the CIA area, including some segments of I-80 and Elk Mountain. The proposed project under all alternatives would contribute to cumulative visual impacts in combination with these proposed large scale wind energy projects in the CIA area.

Transmission line projects that would contribute to cumulative impacts would be located primarily in utility corridors and ROWs along I-80 and in the checkerboard north of I-80. The four transmission line projects along the I-80 designated utility corridor would be visible to large numbers of motorists and residents of communities. The proposed project under all alternatives would contribute to cumulative visual impacts from the addition of large scale industrial facilities that include transmission structures as well as WTGs as seen from I-80, Rawlins, Sinclair, and from the CDNST and North Platte River crossings of the highway and utility corridors.

Long-term operating facilities for the Atlantic Rim Natural Gas Field Development Project, the Continental Divide-Creston Natural Gas Development Project, the Desolation Flats Natural Gas Project, the Hanna Draw Project, and mine permits are generally low in profile, and would be briefly visible to motorists on nearby roadways. The majority of these project facilities would not be visible to viewers on highways or in communities, as most of the project areas are not within highly used viewsheds. For example, the Atlantic Rim Project is in close proximity to the proposed project but would be screened by the intervening Atlantic Rim landform. The proposed project would not contribute to cumulative visual impacts of the four oil and gas development projects in the CIA area due to distance, low-profile facilities and intervening terrain.

Cumulative projects also would be within viewsheds of sensitive viewing areas that include the CDNST and other recreation areas. Past projects that affect the CDNST viewshed include the cities of Rawlins and Sinclair, residential developments in unincorporated Carbon County, roads, industrial developments, oil and gas fields, I-80, and existing ROWs and leases as shown on **Figure 3.4-1**. Six current and RFFA projects listed in **Table 5.0-1** also would potentially degrade the CDNST viewshed and would be constructed during the same construction timeframe as the proposed CCSM project under all action alternatives: the Highway 71 Improvement Project, Atlantic Rim Natural Gas Field Development Project, Gateway South Transmission Line Project, Gateway West Transmission Line Project, the TransWest Express Transmission Line Project, and the Zephyr Transmission Line Project. The Middlewood Wind Power Project also would be visible from the CDNST within the life of the project. Exploration and production of oil, natural gas, and coal resources also may occur (BLM 2012a,b; also see Section 5.7), as the majority of land along the CDNST south of I-80 is open to leasing with minor constraints

(BLM 2008a). The Atlantic Rim boundary and potential coal development areas are located in close proximity to the CDNST SRMA; however, land surface elevations within the Atlantic Rim boundary and the coal development areas are blocked from most CDNST viewpoints by the long, north-south trending, high elevation Atlantic Rim ridge (see **Figure 4.12-3**). Oil and gas lease sale parcels in an area rated as high potential for oil and gas occurrence are located within the viewshed of the CDNST in close proximity to the trail south of T19N (BLM 2004b).

These projects are within the checkerboard, which along with I-80 and the City of Rawlins is the context through which the CDNST passes in the RFO. As described in Section 4.12 and Section 5.7, the CDNST in the checkerboard is primarily a connection to landscapes outside of the checkerboard with higher scenic, recreation, and cultural values. Effects to the visual quality of the CDNST and the Teton Reservoir Recreation Area settings would be greater under Alternative 2 than the effects to visual resources from the other action alternatives.

The visual impact of construction traffic on the haul road would occur concurrently with the Highway 71 Improvement Project. After construction the appearance of the Highway 71 would be very similar to the existing condition; therefore, the Highway 71 Improvement Project would not contribute to long-term cumulative visual impacts.

Based on the past, current, and RFFA actions discussed above, the cumulative effects of activities in the CIA area would increase the potential for adverse impacts to inventoried visual resources for the RFO (Otak, Inc. 2011). The size and number of WTGs associated with the project under any action alternative, combined with other similar facilities, and other resource, wind energy, and transmission development in the CIA area would have adverse impacts to visual resource inventory ratings. The contribution of the proposed project in combination with ongoing and future projects to inventoried visual resources is substantial because the project would have a high level of visibility relative to other cumulative projects, and the project would alter large areas of the CIA area from natural and rural landscapes to rural landscapes with a noticeable industrial component.

The proposed project in combination with ongoing and future projects would meet VRM Class IV objectives, which accommodates major changes in the landscape.

5.13 Cumulative Impacts for Water Resources

The CIA area used for assessing potential cumulative impacts to water resources is defined as all 6th order, HUC-12 Sub-watersheds (Berelson et al. 2001) that have a portion of the Application Area included within their boundary (**Table 3.13-1** and **Figure 3.13-1**). Because all water resource impacts are related to land disturbance, only those sub-watersheds with a portion of the Application Area where Project-related disturbance might occur were included in this cumulative impact analysis for water resources. A total of 21 sub-watersheds were included in the analysis, and the total area encompassed by these sub-watersheds is approximately 640,000 acres or 1,000 miles^2.

Within this CIA area, past and present land disturbance has been largely quantified through GIS analysis as part of the wildlife analyses. Analysis of greater sage-grouse required land disturbance quantification within 11 miles of the Application Area, which includes all of the water resources CIA area with the exception of the northern-most tip near Seminoe Reservoir (furthest downstream), consisting of approximately 1,200 acres. The remainder of the past and present disturbance in the CIA area is detailed in **Table 5.13-1**.

Past and present disturbance is greatest in the sub-watersheds that contain the towns of Rawlins and Sinclair. Disturbance from roads can be seen in all sub-watersheds to some extent. Sub-watersheds that include a gas plant, recreation areas, and oil and gas development show minor disturbance. Only the sub-watersheds with the towns exhibit disturbance greater than 1 percent. The operation of Alternative 1R would not increase present disturbance above 1 percent in any of those sub-watersheds. The four sub-watersheds with the town development present are the only sub-watersheds with more than

1 percent disturbance. As shown in **Table 5.13-1** the total cumulative impact for each alternative would be the same.

The RFFA projects identified within the water resources CIA area are the Gateway West Transmission Line, Gateway South Transmission Line, TransWest Express Transmission Line, Middlewood Wind Power, and numerous mine permits (**Table 5.0-1**). Other planned projects listed in **Table 5.0-1** that do not fall within the CIA area for water resources (e.g., Zephyr transmission project) are not included in the CIA area. The majority of these related projects in the area lie north and northeast of the project, generally downstream on the North Platte River. The Middlewood Wind Power Project and one small 40-acre mine permit area lie to the southeast of the Sierra Madre site. A small portion of a mine permit area is partially within the Upper Colorado River drainage.

The potential for water quality impacts from the RFFA projects is similar in nature to the proposed project due to land disturbance during both construction and operation stages. Because the land disturbance for RFFA projects has not been determined, it is assumed their disturbance will be similar in magnitude to the proposed project; therefore, the total project areas were used as a surrogate for comparison. The total of the RFFA project areas are presented in **Table 5.13-2** to assess the potential for cumulative impacts. Although Upper Sage Creek-Upper Platte River and Rasmussen Creek sub-watersheds both show large portions covered by the project areas (85.8 and 95.9 percent, respectively), the expected land disturbance within the same sub-watersheds would be minimal (less than 1 percent of the sub-watersheds). When this disturbance is considered along with other cumulative disturbance (**Table 5.13-1**), it can be concluded that the cumulative impact to water quality and quantity would not affect any current users of the water, nor alter channel geometry beyond that expected under natural conditions. This is similar to the conclusions of the project-specific impact analysis presented in Section 4.13.

5.14 Cumulative Impacts for Wildlife and Fisheries Resources

5.14.1 Cumulative Impact Assessment Methodology

The primary CIA area for wildlife and fisheries encompasses the entire RFO, an area of approximately 11.2 million acres in south-central and southeastern Wyoming. This area was considered and, in some cases, subsequently expanded or reduced for a species or taxonomic group using recognized management areas and considering species seasonal movements. Any changes from using the RFO as the CIA area are presented in the analyses for specific wildlife species.

As with all other resources, the cumulative analysis for wildlife and fisheries resources focuses on past, present, and RFFAs presented in **Table 5.0-1** and the proposed CCSM project assuming that: 1) human use of the CIA area would increase with the implementation of the proposed CCSM project; 2) wildlife habitats currently are at their respective carrying capacities in and adjacent to the Application Area; and 3) the overall region has been previously affected by at least some level of historic and current development activities and would be affected by RFFAs.

5.14.2 Projects and Activities Considered

Projects that have either been permitted or are in the permitting process within close proximity are described in **Table 5.0-1**. Because the primary CIA area for wildlife and fisheries is so large, all of the listed projects would have a cumulative impact to various wildlife resources. However, in the analyses for specific wildlife species, some projects may contribute to cumulative impacts because I-80 is a movement barrier for most of the land mammals.

Table 5.14-1 Past and Present Disturbance within the Water Resources CIA Area

Sub-watershed Name	Past and Present Disturbance							Project Operation Alternatives				Grand Total with Project Operation Alternatives			
	City (acres)	Gas Plant/ Refinery (acres)	Recreation (acres)	Roads (acres)	Well Pads (acres)	Total Disturbance (acres)	Total Disturbance (percent)	Alt 1R (percent)	Alt 2 (percent)	Alt 3 (percent)	Alt 4 (percent)	Alt 1R (percent)	Alt 2 (percent)	Alt 3 (percent)	Alt 4 (percent)
North Platte Basin															
North Platte River-First Cottonwood Draw				157		157	0.3	0.1	0.1	0.1	0.1	0.5	0.5	0.4	0.4
Little Jack Creek				109		109	0.3	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.3
Upper Sage Creek-North Platte River [1]				184	3	186	0.5	0.2	0.1	0.1	0.2	0.7	0.6	0.6	0.6
Rasmussen Creek [1]				28		28	0.1	0.7	0.6	0.6	0.7	0.8	0.7	0.7	0.8
Lower Sage Creek-Upper North Platte River [1]				20	3	22	0.1	0.4	0.5	0.4	0.4	0.5	0.6	0.5	0.5
Miller Creek [1]				92		92	0.3	0.5	0.4	0.4	0.5	0.8	0.7	0.7	0.8
Upper Little Sage Creek [1]				183	17	199	0.6	0.0	0.1	0.0	0.0	0.6	0.7	0.7	0.7
Lower Little Sage Creek [1]				34	10	44	0.3	0.2	0.1	0.2	0.2	0.5	0.4	0.5	0.5
North Platte River-Coal Mine Draw				60		60	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.4
North Platte River-Lost Springs Draw			116	245		359	0.8	0.0	0.0	0.0	0.0	0.8	0.8	0.8	0.8
Iron Springs Draw				25		25	0.1	0.6	0.7	0.8	0.7	0.7	0.9	0.9	0.9
Hugus Draw				5		5	0.0	0.7	0.8	0.9	0.8	0.8	0.8	0.9	0.8
Grenville Dome	42	62		156		259	1.2	0.6	0.7	1.3	1.2	1.7	1.9	2.5	2.4
Pass Creek-Stage Station Springs				193	10	203	0.6	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6
Middle Sugar Creek	2,961			323	16	3,115	12.5	0.1	0.4	0.2	0.1	12.6	12.9	12.7	12.6
Lower Sugar Creek	3,063	398		404	3	3,357	7.8	0.5	0.5	0.3	0.3	8.3	8.3	8.1	8.1

Table 5.14-1 Past and Present Disturbance within the Water Resources CIA Area

Sub-watershed Name	Past and Present Disturbance							Project Operation Alternatives				Grand Total with Project Operation Alternatives			
	City (acres)	Gas Plant/ Refinery (acres)	Recreation (acres)	Roads (acres)	Well Pads (acres)	Total Disturbance (acres)	Total Disturbance (percent)	Alt 1R (percent)	Alt 2 (percent)	Alt 3 (percent)	Alt 4 (percent)	Alt 1R (percent)	Alt 2 (percent)	Alt 3 (percent)	Alt 4 (percent)
101800021304 (Sugar Creek)[2]	209			2		210	1.9	1.0	1.1	0.7	0.5	2.9	3.0	2.6	2.5
North Platte Basin Subtotal	**6,274**	**460**	**116**	**2,221**	**61**	**8,433**	**1.6**	**0.3**	**0.3**	**0.3**	**0.3**	**1.9**	**1.9**	**1.9**	**1.9**
White-Yampa Basin															
North Fork Savery Creek				126		126	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4
Little Savery Creek				116	3	119	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4
Muddy Creek-Littlefield Creek[3]				134		134	0.4	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4
McKinney Creek[3]				93		93	0.3	0.3	0.2	0.0	0.1	0.6	0.5	0.3	0.4
White-Yampa Basin Subtotal				**469**	**3**	**472**	**0.4**	**0.1**	**0.0**	**0.0**	**0.0**	**0.4**	**0.4**	**0.4**	**0.4**
Grand Totals[4]	**6,274**	**460**	**116**	**2,690**	**64**	**8,904**	**1.4**	**0.2**	**0.3**	**0.2**	**0.2**	**1.6**	**1.6**	**1.6**	**1.6**

[1] Sub-watersheds included in Sage Creek watershed improvement project.

[2] Some 12-digit sub-watersheds (HUs) were assigned the HUC-12 number when no GNIS name was identified on the DRGs. The name in parentheses indicates the HUC-10 name.

[3] Sub-watersheds included in Upper Muddy Creek Watershed/Grizzly WHMA improvement project.

[4] Discrepancies in total acreage due to rounding.

Table 5.14-2 Sub-watersheds with Reasonably Foreseeable Actions and Associated Project Areas within CIA Area

Sub-watershed Name	CCSM		Other Project Areas Considered for Cumulative Impacts							
	Application Area Total (acres)	Percent of Sub-watershed	Mine Permits (acres)	Gateway West T-Line (acres)[1]	Gateway South T-Line (acres)[1]	TransWest Express T-Line (acres)[1]	Middlewood Wind Power (acres)	Cumulative Total (acres)	Percent of Sub-watershed	Percent Change Due to Other Projects
North Platte Basin										
North Platte River-First Cottonwood Draw	6,926	14.8					4,099	11,025	23.5	8.7
Little Jack Creek	8	0.0	36				11,604	11,648	32.6	32.5
Upper Sage Creek-North Platte River	28,140	68.7					6,965	35,105	85.8	17.0
Rasmussen Creek	23,140	98.5					87	23,227	98.9	0.4
Lower Sage Creek-Upper North Platte River	8,742	43.5					500	9,242	46.0	2.5
North Platte River-Lost Springs Draw	3,347	7.1	240	190	99			3,875	8.2	1.1
Grenville Dome	13,734	62.3		352				14,086	63.9	1.6
Middle Sugar Creek	5,814	23.4		142	276	146		6,378	25.6	2.3
Lower Sugar Creek	1,733	4.0			350			2,083	4.9	0.8

Table 5.14-2 Sub-watersheds with Reasonably Foreseeable Actions and Associated Project Areas within CIA Area

	CCSM		Other Project Areas Considered for Cumulative Impacts							
Sub-watershed Name	**Application Area Total (acres)**	**Percent of Sub-watershed**	**Mine Permits (acres)**	**Gateway West T-Line (acres)[1]**	**Gateway South T-Line (acres)[1]**	**TransWest Express T-Line (acres)[1]**	**Middlewood Wind Power (acres)**	**Cumulative Total (acres)**	**Percent of Sub-watershed**	**Percent Change Due to Other Projects**
101800021304 (Sugar Creek)[2]	8,891	80.5		195		208		9,295	84.2	3.7
White-Yampa Basin										
North Fork Savery Creek	3,380	11.0	4					3,384	11.0	0.0
Totals[3]	**229,077**	**35.8**	**280**	**879**	**724**	**355**	**23,255**	**254,570**	**39.8**	**4.0**

[1] Acreage calculated from miles of proposed transmission line within sub-watershed times an assumed ROW of 350 feet.

[2] Some 12-digit sub-watersheds (HUs) were assigned the HUC-12 number when no GNIS name was identified on the DRGs. The name in parentheses indicates the HUC-10 name.

[3] Total sums all sub-watersheds in CIA area, including those not shown here. Discrepancies in total acreage due to rounding.

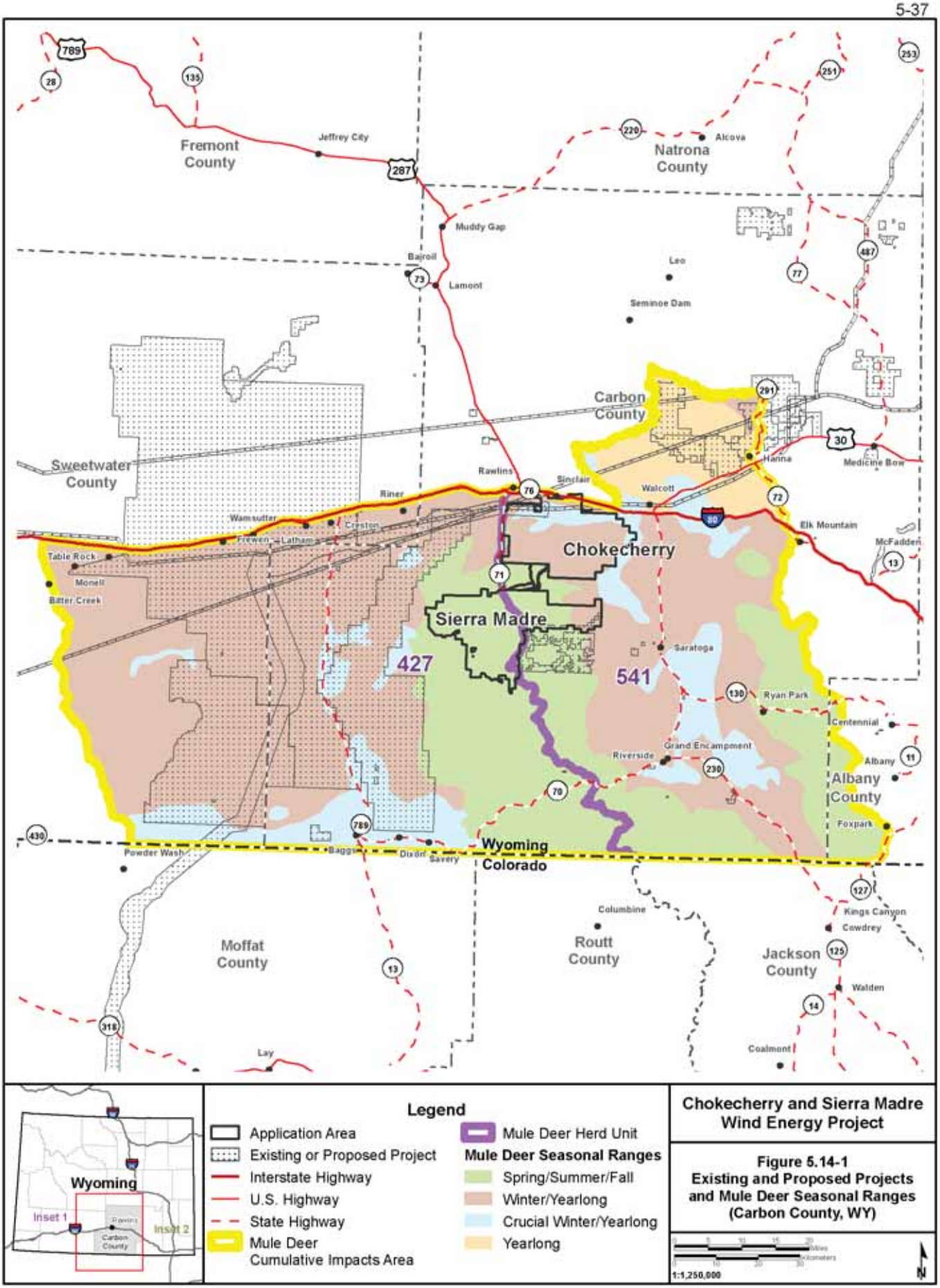
5.14.3 Cumulative Impacts for Wildlife Resources

Cumulative impacts to wildlife resources would primarily be related to habitat loss, habitat fragmentation, and animal displacement. Long-term surface disturbances incrementally add to wildlife habitat losses, habitat fragmentation, and may result in animal displacement. In areas where energy development (including oil, gas, wind, and coal gasification) has occurred, habitat loss may have disrupted seasonal use patterns or migration routes. Historic, current, and future developments in the vicinity of the Application Area may reduce the carrying capacity for some species through a reduction in available cover, forage, and breeding areas. Most of the existing and future surface disturbance in the CIA area is associated with energy development, including construction of well pads, pipelines, wind turbines, transmission lines, and road networks. However, other activities such as housing development, livestock grazing, and private land actions also contribute to cumulative impacts on wildlife and their habitats. Among big game species, elk and mule deer are especially susceptible to these impacts because of their sensitivity to habitat loss and human disturbance associated with energy development. The big game habitat within each respective CIA area is displayed in **Figures 5.14-1** through **5.14-3**. Other wildlife species, such as raptors and greater sage-grouse, also would be susceptible to these cumulative impacts, since encroaching human activities in the region have resulted and/or would result in habitat loss, animal displacement, and potential fragmentation. Many of the local wildlife populations (e.g., small game, reptiles and amphibians) that occur in the CIA area likely would continue to occupy their respective ranges and breed successfully, although the population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.

While surface disturbance generally corresponds to associated wildlife habitat loss, accurate calculations of cumulative wildlife habitat loss cannot be determined because the direct impacts of habitat disturbance are species-specific and dependent upon: 1) the status and condition of the population(s) or individual animals being affected; 2) seasonal timing of the disturbances; 3) value or quality as habitat of the disturbed sites; 4) value or quality of adjacent habitats for the affected species; 5) the type and duration of surface disturbance; and 6) other variables that are difficult to quantify (e.g., habitat avoidance due to increased noise and human presence). Nonetheless, surface disturbance remains a useful indicator of direct habitat loss and is commonly used as standard metric by analysts conducting cumulative impacts within the RFO.

It is anticipated that indirect impacts to habitat for most species associated with human presence and noise would be greatest during construction and incrementally decrease to some degree in the CIA area during the life of the proposed project; however, there would be an overall increase in indirect loss of habitat for some species from the present. Indirect cumulative impacts from wind energy and other development within the CIA area would include:

- Animal displacement. Displaced individuals could be forced into already occupied and/or less suitable habitats, possibly resulting in reduced quantity and quality of habitat. Use of less suitable habitat and increased competition for resources could affect the body condition of individual animals and their ability to successfully reproduce.
- Decreased reproduction success and survival. A decrease in body condition and an increase in stress may lead to lower survival and reproductive success.
- Increased mortality and harassment. An increase in traffic levels (associated with construction and operation) on roadways has the potential to increase the risk of vehicle/wildlife collisions. Increased human utilization of resources would expose wildlife to potential human harassment (and poaching), either inadvertent or purposeful.



Chokecherry and Sierra Madre Wind Energy Project

Figure 5.14-1
Existing and Proposed Projects and Mule Deer Seasonal Ranges (Carbon County, WY)

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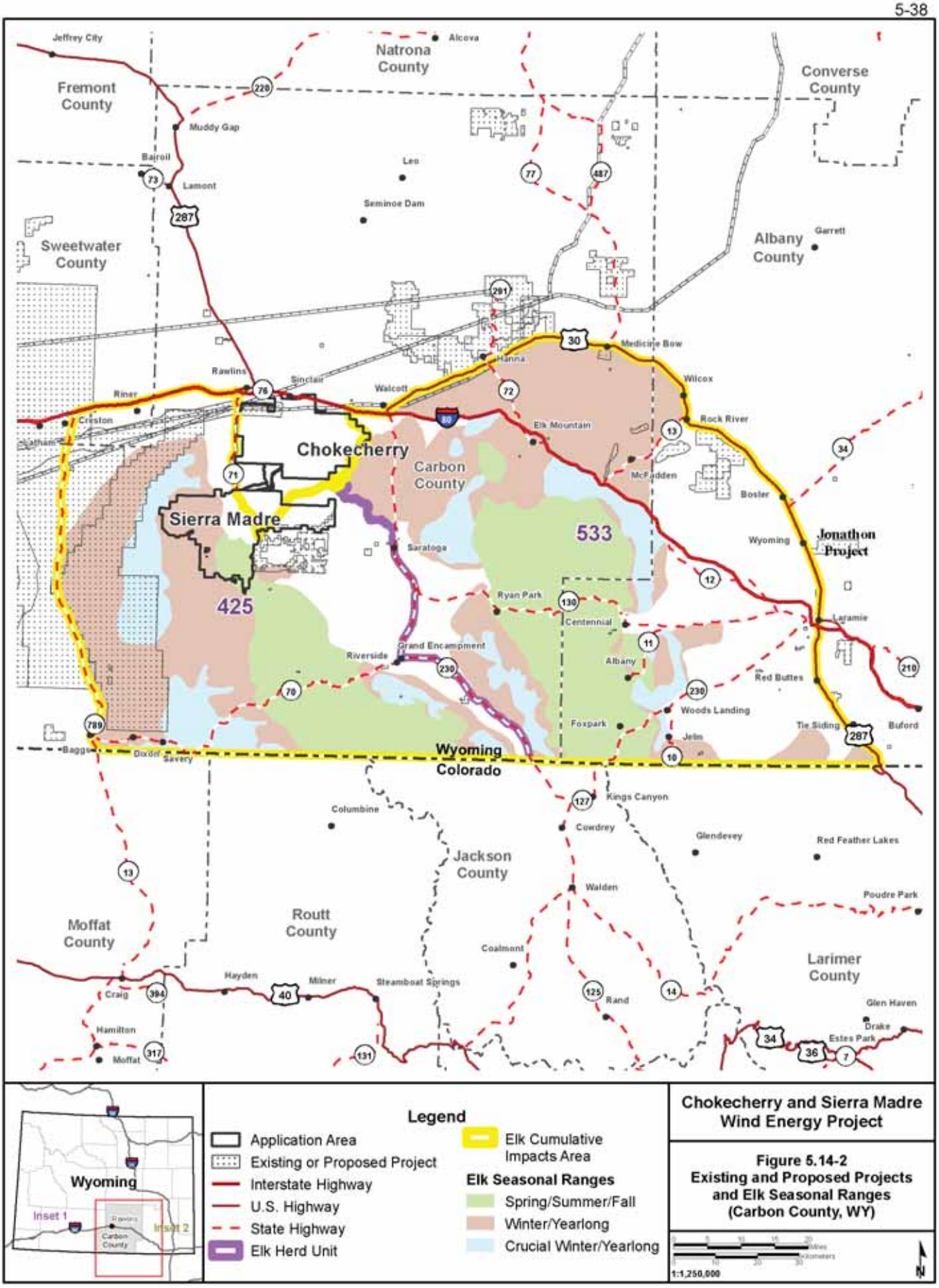
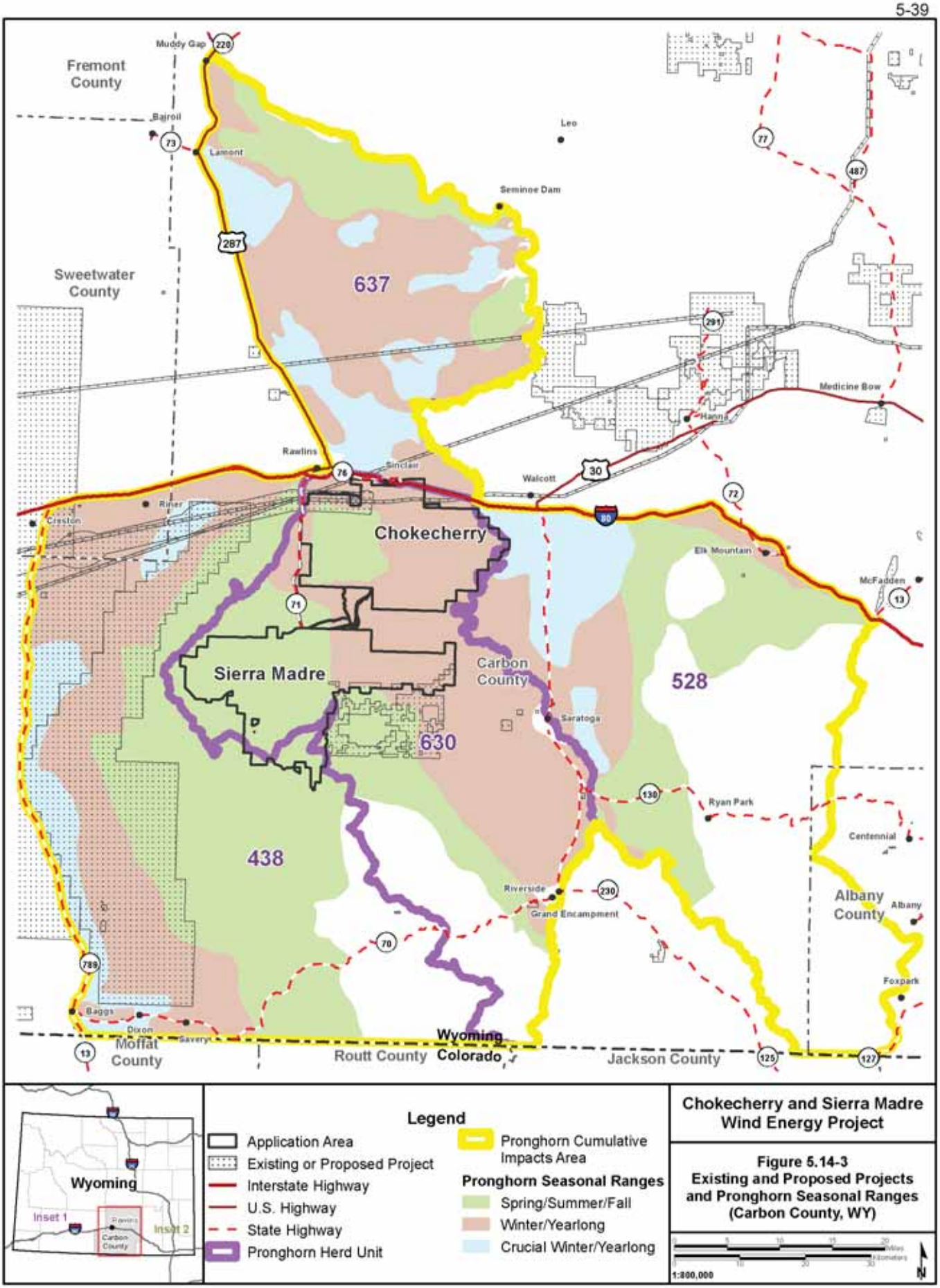


Chokecherry and Sierra Madre Wind Energy Project

Figure 5.14-2
Existing and Proposed Projects and Elk Seasonal Ranges (Carbon County, WY)



Chokecherry and Sierra Madre Wind Energy Project

Figure 5.14-3
Existing and Proposed Projects and Pronghorn Seasonal Ranges (Carbon County, WY)

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- Based on these direct and indirect cumulative impacts, ongoing and future energy development and livestock grazing in the CIA area would cumulatively and incrementally reduce the ability of wildlife habitats to support wildlife at their current levels for the lifetime of this wind energy facility (30 years). Incremental cumulative impacts from the CCSM wind project would continue until such time that reclamation is deemed successful (approximately 10 to 100 years depending on the vegetation cover type) and the project is decommissioned.

5.14.3.1 Big Game

Most big game species are migratory and require large tracts of land to meet their seasonal habitat requirements. Accordingly, the potential impacts of development may not be exceptionally high in one seasonal range (e.g., winter or summer), but when seasonal ranges are considered together, the cumulative effects could become biologically significant to the affected populations. Therefore, the CIA area for big game is based on herd units rather than the entire RFO. When assessing cumulative impacts to big game, the construction of roads and other infrastructure represents the primary source of impact(s). The construction of roads and other infrastructure reduce the amount of habitat available for animals through direct habitat loss, indirect habitat loss (i.e., behavioral avoidance), and fragmentation. The preponderance of evidence suggests these roadway impacts can have population-level effects on both terrestrial and aquatic communities (Benitez-Lopez et al. 2010; Fahrig and Rytwinski 2009; Trombulak and Frissell 2000). However, the thresholds at which roads or other development features create movement barriers or population-level effects to big game are rarely known (Frair et al. 2008) and can vary from species to species.

5.14.3.2 Mule Deer

The CIA area for mule deer encompasses herd units 427 (Baggs) and 541 (Platte River) (**Figure 5.14-1**). Past, present and reasonably foreseeable projects identified in the Baggs herd unit included the Atlantic Rim, Continental Divide/Wamsutter, and Desolation Flats gas development projects. Studies conducted in the Atlantic Rim Project Area show that a portion of the mule deer that winter in and adjacent to the Atlantic Rim Project Area migrate 20 to 40 miles to summer ranges in the Sierra Madre area within the Baggs herd unit (Sawyer 2007; Sawyer et al. 2009a,b). Other studies have documented mule deer and elk from the Powder Wash and Desolation Flats area migrating east/northeast to summer ranges in the Baggs herd unit (Porter 1999). Gas development can displace mule deer to less-preferred habitat and create indirect habitat loss considerably larger than the direct habitat loss (Sawyer et al. 2006). New road construction increases the potential for wildlife-vehicle collisions, poaching, and general disturbance resulting from increased human activity. Increased traffic levels on WY 789 associated with gas field development have increased mule deer-vehicle collisions and prompted WGFD and WYDOT to construct a wildlife underpass approximately 7 miles north of Baggs. Development in the Sierra Madre area will result in additional impacts to the spring/summer/fall range of the Baggs deer herd – a herd whose winter and yearlong ranges have been, or will be, impacted by other projects. In contrast, the past, present and reasonably foreseeable projects identified in the Platte Valley herd unit were restricted to some mining activity north of I-80, near Hanna (**Figure 5.0-1**). Although these mining projects are within the boundaries of the Platte River herd unit, I-80 is a barrier to big game movement. Given mule deer movements are restricted to either side of the interstate, there were no other projects identified that are likely to contribute to cumulative impacts of the Platte Valley deer herd. Of the herd units in the CIA area, potential impacts are highest in the Baggs herd unit. Potential cumulative effects on mule deer do not vary by alternative.

5.14.3.3 Elk

The CIA for elk encompasses herd unit 533 (Snowy Range). Past, present and reasonably foreseeable projects identified in the Snowy Range herd unit included the Atlantic Rim and Continental Divide/Wamsutter gas development project along the western border, and several wind power projects (e.g., Foote Creek Rim, McFadden Ridge) along the eastern border (**Figure 5.14-2**). However, only the Atlantic Rim project occurs within the seasonal ranges of the Snowy Range elk herd. Elk avoidance of roads is well-documented (Cole et al. 1997; Rowland et al. 2000) and disturbance in parturition areas

can have demographic consequences (Phillips and Alldredge 2000). New road construction increases the potential for wildlife-vehicle collisions, poaching, and general disturbance resulting from increased human activity. Development in the western portion of the Sierra Madre area will further impact the spring/summer/fall and winter/yearlong range of this elk herd. Potential cumulative effects on elk do not vary by alternative.

5.14.3.4 Pronghorn

The CIA area for pronghorn encompasses herd units 438 (Baggs), 630 (Iron Springs), 528 (Elk Mountain), and 637 (South Ferris). Past, present and reasonably foreseeable projects identified in the Baggs herd unit included the Atlantic Rim and Continental Divide/Wamsutter gas development projects that cover most of the crucial and winter/yearlong range within the herd unit (**Figure 5.14-3**). Pronghorn tend to increase vigilance and reduce their feeding time in areas with heavy traffic (>200 vehicles/week) (Berger et al. 1983). This response to roads (i.e., vigilance and reduced feeding) increases with traffic levels (Gavin and Komers 2006). New road construction increases the potential for wildlife-vehicle collisions, poaching, and general disturbance resulting from increased human activity. Development within the southernmost portion of the Sierra Madre area will further impact the spring/summer/fall range of the Baggs pronghorn herd. In contrast to the Baggs herd unit, no past, present or reasonably foreseeable projects were identified in the Iron Springs, Elk Mountain, or South Ferris herd units. Of the herd units in the CIA, potential impacts are highest in the Baggs herd unit. Potential cumulative effects on pronghorn do not vary by alternative.

5.14.3.5 Bats

Because very little bat roosting or foraging habitat would be directly impacted by removal of vegetation in the Application Area, habitat impacts to both migratory and non-migratory bats, including the BLM sensitive species of bats in the project region, are expected to be low and no significant cumulative impacts are likely. Similarly, because fatality rates of non-migratory bats are expected to be relatively low, no cumulative impacts associated with turbine fatalities are expected for non-migratory bat species. On the other hand, potential fatality impacts to long-distance migratory tree bats are rather unique, in that the impacted populations are likely not local, but breed north of the project region, such as in the Pacific Northwest or forested areas of northern Wyoming, Idaho, Montana, and western Canada. Cumulative impacts to long-distance migratory tree bats would primarily be associated with wind energy development along their entire migration corridor, from Canada to Mexico. Therefore, for bats the CIA area includes all of western North America.

Over 20 states have enacted laws requiring a portion of the electricity supply to come from renewable energy (AWEA 2006) and a similar federal law is being considered. Generating 20 percent of U.S. electricity supplies from wind energy by 2030 is technically feasible (USDOE 2008). As of June 2009 (AWEA 2009b), the 17 western U.S. states had 19,951 MW of installed capacity, which represents 68 percent of all installed wind energy in the U.S. There are an additional 800 MW of existing wind energy in western Canada (Canadian Wind Energy Association [CWEA] 2009). Using an average of 2.1 bat fatalities/MW/year for existing wind energy facilities in western North America (Johnson and Stephens 2011) would imply that as many as 43,577 bat fatalities could occur per year in this region, a large percentage being migratory tree bats. The existing wind energy development and the projected increase in wind energy development throughout western North America as well as other forms of development that result in direct fatalities would cumulatively impact migratory tree bat populations, especially hoary and silver-haired bats. However, there is inadequate information on the populations of these species to determine if the fatalities resulting from this project would contribute significantly to a change in population sizes. The potential cumulative effects vary only by the project-specific impacts discussed in Section 4.14. The potential for cumulative impacts is primarily related to the number turbines. Therefore, because Alternatives 1R, 2, and 3 all have up to 1,000 turbines, these three alternatives would have similar impacts, while impacts associated with Alternative 4 would be somewhat lower as that alternative has up to 846 turbines.

5.14.3.6 Birds

The CIA area for birds is the RFO. There are no other existing or proposed wind energy facilities within the home range of breeding raptors and other birds using the Application Area. However, other sources of mortality could include vehicle collisions on regional and local highways, impacts from other energy development and industrial activities in the CIA area. Currently, no quantitative data exist on how these other factors affect population sizes. There is a chance that most resident and/or migratory birds using the Application Area will come into contact with other wind facilities, increased traffic associated with energy development, and other risk factors. For most species, such as passerines, collision mortality associated with 3,000 MW of wind energy development is not expected to result in cumulative impacts through population reductions. A recent publication that examined effects of collision mortality from buildings and communication towers found that although millions of birds are killed every year in North America by collisions with manmade structures, this source of mortality has had no discernible effect on populations (Arnold and Zink 2011). The Wildlife Society prepared a landmark publication on wind energy and wildlife and concluded that fatalities of passerines from turbine strikes generally are not significant at the population level (Arnett et al. 2007). Also, the NAS (2008) recently reviewed wind energy impacts on birds, and came to the following conclusion: “At the current level of wind energy development (approximately 11,600 MW of installed capacity in the United States at the end of 2006, including the older California turbines), the committee sees no evidence that fatalities caused by wind turbines result in measurable demographic changes to bird populations in the United States, with the possible exception of raptor fatalities in the Altamont Pass area.”

Few studies have examined the potential for cumulative impacts to birds associated with wind energy development. The potential for population-level impacts caused by avian collision mortality associated with 6,700 MW of existing and proposed wind energy development in the Columbia Plateau Ecoregion of eastern Oregon and Washington was estimated based on results of 12 existing mortality studies in the ecoregion (Johnson and Erickson 2010). Estimated breeding population sizes were available for most birds in the ecoregion based on Breeding Bird Survey data. Predicted fatality rates for avian groups as well as species of concern were compared to published annual fatality rates. Because the additional wind energy associated mortality was found to comprise only a small fraction of natural fatality rates, population level impacts would not be expected for the ecoregion as a whole, but local impacts to some species could occur (Johnson and Erickson 2010). In the only study to quantitatively assess potential population level impacts, Hunt (2002) conducted a 4-year radio telemetry study of golden eagles at the Altamont Pass Wind Resource Area APWRA and found that the resident golden eagle population appeared to be self-sustaining despite high levels of fatalities, but the effect of these fatalities on eagle populations wintering within and adjacent to the APWRA was unknown. All 58 territories occupied by golden eagle pairs in the APWRA in 2000 remained active in 2005 (Hunt and Hunt 2006).

Because most raptors, and especially eagles, are long-lived species with relatively low reproductive rates, the additional collision mortality associated with 3,000 MW of wind energy development may lead to significant cumulative impacts. However, development of an Avian Protection Plan (APP) and Eagle Conservation Plan (ECP) to avoid, minimize and mitigate impacts to eagles and other raptors could result in impacts below cumulative impact thresholds.

The potential cumulative effects related to avian collision mortality vary only by the project-specific impacts discussed in Chapter 4.0. The potential for cumulative impacts is primarily related to the number turbines. Therefore, because Alternatives 1R, 2, and 3 all have up to 1,000 turbines, these three alternatives would have similar impacts, while impacts associated with Alternative 4 would be somewhat lower as that alternative would have up to 846 turbines.

Although direct impacts are not considered cumulatively significant for most birds, indirect impacts to sagebrush obligate birds, including several BLM sensitive species, including mountain plovers, were considered significant in the Application Area. Most of the other existing and proposed developments such as oil and gas development and power lines will lead to additional loss of habitat and further indirect impacts through displacement and habitat fragmentation. Therefore, cumulative impacts to sagebrush

obligate species and mountain plovers are considered significant. The potential cumulative effects vary only by the project-specific impacts discussed in Chapter 4.0. The potential for cumulative impacts due to loss and fragmentation of habitat is related to the acreage of long-term disturbance. There is very little difference in total long-term disturbance between the alternatives. Alternative 2 has the highest acreage of long-term disturbance (1,610 acres), followed by Alternative 4 (1,529 acres), Alternative 1R (1,510 acres) and Alternative 3 (1,491 acres). Measures to mitigate for impacts to wildlife and fisheries considered significant are provided in **Appendix C**; **Table C-4**. In addition, an APP will be developed in consultation with the BLM, USFWS, and WGFD, and will require approval from those agencies before it is finalized. Any project constraints and mitigation measures identified through the development of the APP will be approved prior to issuance of any notice to proceed for the project and, in turn, associated stipulations would be incorporated into the ROW grants.

5.14.4 Cumulative Impacts for Fisheries

Cumulative impacts to fisheries include erosion and sedimentation from surface disturbance, water depletions from the North Platte and White-Yampa River basins, and the potential for leaks or spills of contaminants during construction and maintenance within the North Platte and White-Yampa basins. The CIA area for fisheries includes the 21 sub-watersheds identified in Section 3.13 and assessed in Section 4.13 of the North Platte and White-Yampa River basins as well as downstream extending into central Nebraska within the Platte River, and into northwest Colorado within the Colorado River.

The cumulative impacts analysis for water resources (see Section 5.13) considered impacts on sub-watershed basin and concluded that the cumulative impact to water quality and quantity would not impact any current users of the water, nor alter channel geometry beyond that expected under natural conditions. This is similar to the conclusions of the project-specific water resources impact analysis presented in Section 4.13. The cumulative impact analysis for soil resources identified that construction activities associated with past and present activities, RFFAs and the CCSM project could result in an incremental increase in runoff, erosion, and off-site sedimentation. An increase of fine inorganic sediment in rivers and streams may impact fish spawning, fish rearing, and feeding behavior (USFWS 2002a,b,c,d). Past and present surface disturbance including oil and gas development and livestock grazing within each of the 21 sub-watersheds was summarized in **Table 5.13-1**. The past and present total surface disturbance within the sub-watersheds that contain important trout fisheries including Upper Sage Creek-North Platte River; North Platte River-Coal Mine Draw; and McKinney Creek, are estimated to be 0.5, 0.2, and 0.3 percent of total sub-watershed, respectively. In these watersheds, past and present disturbances include roads and well pads. With the addition of the project, the percent of total surface disturbance within each of these sub-watersheds would slightly increase from 0.1 to 0.3 percent, depending on the alternative selected (see **Table 5-13.1**). It is likely that increased erosion and subsequent sediment yield would occur locally within these sub-watersheds with implementation of the project, increasing cumulative impacts to fisheries habitat. There is little difference between the cumulative impacts of the four alternatives on fisheries, with the exception of Alternative 3 that does not result in construction in the Upper Muddy Creek Watershed/Grizzly WHMA. For further discussion regarding cumulative impacts on sensitive fish species that occur in the White-Yampa River Basin see Section 5.15.3.

As for RFFAs identified within the CIA area, several transmission lines, numerous mine permits, and other projects may be implemented in the future. The majority of these projects lie north and northeast of the project, generally downstream on the North Platte River. One small 40-acre mine permit area lies to the southeast of the Sierra Madre site. Section 5.13 describes that the potential for water quality impacts from these projects are similar in nature to this project based on land disturbance. Areas within these sub-watersheds, particularly the North Platte River-Lost Springs Draw sub-watershed, would likely experience an increase in erosion and subsequent sediment yield resulting in additional contribution to cumulative impacts to fisheries in these areas.

Water depletions also might impact fisheries resources, including aquatic habitats within the North Platte and White–Yampa River basins. It is anticipated that water needs for construction and maintenance of

the proposed project would be obtained primarily with water from the North Platte Basin through a Temporary Use Agreement associated with existing agricultural water rights. Existing authorized water usage would directly and indirectly consume water from the North Platte Basin, which would ultimately cause reductions in flow downstream within the Platte River. Reductions in flows could adversely affect fisheries habitat. These effects are discussed in greater detail in the water resources assessments in Sections 4.13 and 5.13.

Activities within or adjacent to the 100-year floodplains of the rivers or within drainages leading to these rivers may increase the potential for a release of contaminants into these drainages. Leaks or spills of contaminants may lead to habitat degradation and mortality of fish. Development activities in proximity to these aquatic resources within the CIA area require special construction practices and spill prevention measures for projects that have the potential to impact the fisheries.

5.15 Cumulative Impacts for Special Status Species

5.15.1 Cumulative Impact Assessment Methodology

Incremental effects to special status species from past, present, and RFFAs and the resulting direct impacts from the CCSM project would generally be the same as discussed in Section 5.14 for wildlife; however, on BLM-managed lands (and private lands in many cases), surveys typically are required in potential or known habitats of threatened, endangered, or otherwise special status species. Surveys help determine the presence of any special status wildlife species or extent of habitat, and protective measures generally are taken to avoid or minimize direct disturbance in these important areas. Given the status of the greater sage-grouse population, the Colorado River endangered fish, and downstream Platte River species, cumulative impacts for the greater sage-grouse, Colorado pikeminnow, razorback sucker, humpback chub, bonytail chub, whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid may be more pronounced than for other special status species. The CIA areas for special status species differ with respect to species. This analysis examines the wildlife and aquatic habitat within respective CIA areas that may be disturbed from all past, present, and RFFAs. Notwithstanding, in assessing cumulative impacts, it was not possible to specifically determine where future impacts would occur within the CIA areas. Projects and activities considered in this cumulative assessment are the same as those described in Section 5.14 and presented in **Table 5.0-1** and shown in **Figure 5.0-1**.

5.15.2 Cumulative Impacts for Federally Listed Species

5.15.2.1 Wyoming Species

<u>Black-footed ferret</u>

The CIA area for black-footed ferrets is limited to areas with white-tailed prairie dog colonies within or partially within the Application Area. Of the existing and RFFA projects identified in **Table 5.0-1**, the following projects (as shown in **Figure 5.9-1**) have the potential to produce incremental and cumulative impacts within the CIA for black-footed ferrets: the Middlewood Wind Power Project, the Gateway West Transmission Project, and the Transwest Express Corridor. The potential for impacts on black-footed ferret from these projects is similar in nature to the project due to disturbance during construction and operation stages. Where there is potentially suitable habitat for white-tailed prairie dog colonies a reduction in prairie dog habitat may lead to a decrease in habitat, including prey for black-footed ferrets. All alternatives for the CCSM contain a portion of the non-block cleared potential black-footed ferret area defined as the Bolten Ranch Complex. The CCSM project, as well as Middlewood Wind Power Project, Gateway West Transmission Project, and Transwest Express Corridor may directly impact black-footed ferret habitat, thus surveys for white-tailed prairie dog towns would be required by the USFWS before construction of the proposed project. If prairie-dog towns are identified within the construction area and meet the definition of potential black-footed ferret habitat, black-footed ferret surveys will be completed using the USFWS (1989) survey guidelines in non-block cleared areas. These surveys will be conducted to minimize impacts directly to black-footed ferrets, however habitat modifications may occur. If

black-footed ferrets are detected, additional discussions with the USFWS would occur and the project would be modified so as to avoid impacts to the species. Thus, direct cumulative impacts upon this species would be avoided. The potential cumulative impacts for Alternatives 1R through 4 vary only by the permanent displacement of acreage as discussed in Section 4.15. Alternative 4 would have the highest potential cumulative impacts, followed by Alternatives 3, 1R, and 2.

Colorado Butterfly Plant and Ute Ladies'-Tresses Orchid

The CIA area assessed for Colorado butterfly plant and Ute ladies'-tresses orchid consists of the entire Application Area. Indirect concerns across the area include the possibility of a general reduction or loss of pollinators, invasion of weeds from development into occupied habitats, and increased risk of habitat disturbance resulting from human presence.

BLM policy avoids disturbance activities within identified special status plant habitats, thus direct cumulative impacts to these species should be avoided. Furthermore, site-specific surveys will be conducted to identify any unknown populations at risk from development. Standard mitigation and BMPs will allow for avoidance of impacts if such a population(s) should be found. Potential cumulative impacts do not vary by alternative.

5.15.2.2 Platte River System

Whooping Crane, Interior Least Tern, Piping Plover, Pallid Sturgeon, and Western Prairie Fringed Orchid

The Platte River System in central Nebraska provides habitat for the whooping crane, interior least tern, piping plover, pallid sturgeon, and western prairie fringed orchid which are federally listed species. The CCSM project would utilize water from the North Platte River, thus CIA area for this project would potentially extend to central Nebraska relative to water depletions. The amount of water required for construction and maintenance and possible sources of water were identified by PCW (PCW 2010a,b). No new depletions would result to the Platte River under any of the action alternatives as all of the potential sources of water represent a change of existing use. This change in use would require a Temporary Use Agreement from the WSEO that would protect existing water rights and specify measures that must be implemented to prevent new depletions. Nevertheless, this change in use would be considered a new water related activity under the Platte River Program and thus the existing depletions would result in a *May Affect, Likely to Adversely Affect* determination, and the BLM would need to initiate the ESA consultation process. However, because the water is a change in use the Wyoming Depletions Plan would cover this use (i.e., act as the Reasonable and Prudent Alternative) and the USFWS would use the streamlined ESA consultation as described in the plan and nothing more is required. Therefore, the actions associated with any of the action alternatives would likely not affect the target flows for these species. During the consultation process, the cumulative impacts associated with projects listed in **Table 5.0-1** would be considered and any impacts attributed to this project would be mitigated to the extent possible. The potential cumulative impacts for Alternatives 1R through 4 vary only by the amount of water extracted from the Platte River system as discussed in Section 4.15. Alternative 2 would have the highest potential cumulative impacts, followed by Alternatives 4, 3, and 1R.

5.15.2.3 Colorado River System

Colorado Pikeminnow, Razorback Sucker, Humpback Chub, Bonytail Chub

The Colorado River System provides habitat for the Colorado pikeminnow, razorback sucker, humpback chub, bonytail chub which are federally listed species. The CCSM project would utilize water from the Colorado River System, thus the CIA area for this project would potentially extend downstream relative to water depletions. The potential water depletion associated with any of the action alternatives from the Colorado River System would total 50 acre-feet during construction over the 5-year construction phase, according to information provided by PCW (PCW 2010a,b). This use would be considered a depletion and would result in a *May Affect, Likely to Adversely Affect* determination, and the BLM would need to initiate the ESA consultation process. The Atlantic Rim, Creston/Blue Gap, Continental Divide/Wamsutter II, and South Baggs Application Areas fall partially within the Little Snake River Basin

of the Colorado River System and would be considered during the consultation process and any impacts attributed to this project would be mitigated to the extent possible. The potential cumulative impacts for Alternatives 1R through 4 vary only by the amount of water extracted from the Colorado River system as discussed in Section 4.15. Alternative 2 would have the highest potential cumulative impacts, followed by Alternatives 4, 1R, and 3.

5.15.3 Cumulative Impacts for BLM Sensitive Species

Cumulative impacts for BLM sensitive mammals, birds, reptiles and amphibian species were considered under their respective classifications in Section 5.14. Site-specific surveys for BLM sensitive species will be completed prior to construction associated with CCSM project, with the intent of avoiding currently occupied habitat. However, this does not ensure that habitat would not be affected. This project as well as others would result in the loss of potential habitat for BLM sensitive species, with fragmentation of habitat for some species possible. However, without site specific surveys to determine the presence and extent of habitat for special status wildlife species, particularly Wyoming pocket gopher and pygmy rabbit, it is not possible to quantify the cumulative loss or extent of fragmentation that may occur. As discussed in Section 4.15.6 and presented in the wildlife monitoring and protection plan, presence/absence surveys for sensitive species would be conducted following appropriate protocols. If these surveys conclude a sensitive species occurs, then protective measures would be applied to minimize the potential impact from the CCSM project and thus reducing any incremental effect.

<u>Greater Sage-grouse</u>

As presented in Section 4.15, Impacts to Special Status Species, the project does not include surface disturbance within greater sage-grouse core areas, however, it was determined that the methods provided in BLM Instruction Memorandum (IM) WY-2010-019 and the Wyoming Governor's EO 2011-5 were appropriate for determining cumulative impacts to greater sage-grouse associated with each project alternative.

BLM IM WY-2010-019

Based on IM WY-2010-019, in combination with BLM's guidance document (*Chokecherry/Sierra Madre Wind Project Greater Sage-grouse Habitat Evaluation*) and a follow-up meeting with the BLM (BLM RFO, April 13 and 14, 2010), the following parameters were used to calculate greater sage-grouse habitat disturbance and energy development density within an established CIA area for the CCSM Wind Energy Project. The CIA area was defined as an 11-mile radius around the project alternative boundaries following recommendations in the IM for large-scale projects. According to the IM, evaluation of the area encompassed by an 11-mile radius around the boundary of large projects is required to encompass the majority of seasonal habitats that may be impacted based on recommendations in Connelly et al. 2000.

All of the area within designated greater sage-grouse core areas was considered greater sage-grouse habitat. In addition, areas identified as being greater sage-grouse habitat outside core areas based on BLM data were included in the analysis. The acres of greater sage-grouse habitat in each cumulative impacts analysis area ranged from a low of 719,128 acres for Alternative 3 to a high of 856,893 acres for Alternative 4 (**Table 5.15-1**).

Once all greater sage-grouse habitat was mapped within the 11-mile radius, existing and proposed disturbances resulting in direct habitat loss were overlaid and the amount of greater sage-grouse habitat loss, separated by core and non-core areas, was calculated. Disturbances considered for this analysis included: 1) highways and improved roads (defined as crowned and ditched roads); 2) well pads; 3) wind turbines; 4) cities, rest/recreation areas; 5) designated energy corridors; 6) gas plants, compressor stations and substations; and 7) gravel pits and mines. Features not included in the direct impact analysis because they were determined not to impact greater sage-grouse or had little ground disturbance associated with them included 1) individual cabins or small subdivisions of <10 homes; 2) agricultural lands; 3) unimproved roads (two-track and four-wheel drive roads); 4) reservoirs and

Table 5.15-1 Acres of Greater Sage-grouse Habitat Categories within the Cumulative Impact Analysis Area 11-mile Buffer

Habitat Category	Alternative 1R	Alternative 2	Alternative 3	Alternative 4
Core Area Greater Sage-grouse Habitat	657,516	596,817	520,144	657,525
Non-core Area Greater Sage-grouse Habitat	199,367	198,983	198,983	199,367
Total Greater Sage-grouse Habitat	**856,883**	**795,800**	**719,128**	**856,893**
Non-Greater Sage-grouse Habitat	365,846	314,570	256,977	365,865
Total Area	**1,222,729**	**1,110,371**	**976,105**	**1,222,758**

campgrounds; 5) oil and gas water disposal/injection wells; 6) plugged and abandoned wells; 7) meteorological towers, radio towers, communication towers; and 8) power lines.

Next, existing and proposed energy production and transmission structures were overlaid on the same analysis area, and the number of energy production and transmission structures per 640 acres was calculated for both core and non-core areas. Energy and transmission structures used in this analysis included the following: 1) wind turbines; 2) gravel pits and mines; 3) gas plants; 4) compressor stations and substations; 5) oil and gas wells; 6) highways and improved roads; 7) oil and gas fields; 8) designated ROW corridors; 9) cities, rest/recreation areas; 10) pipelines; 11) utility corridors; and 12) fiber optic lines.

Using this IM, if the total proposed and existing surface disturbance of the CIA area is less than 5 percent, and if the mean number of proposed and existing structures is less than 1 per 640 acres, the IM assumes that impacts to greater sage-grouse would not be associated with the project being analyzed. However, because the 11-mile radius around proposed disturbances/structures associated with the CCSM Wind Energy Project is so large, using this method tends to dilute the potential impact of the project on greater sage-grouse. The State of Wyoming appears to have recognized this limitation, and therefore they developed a similar method to assess cumulative impacts on greater sage-grouse using a beginning buffer of four, rather than 11 miles. Therefore, we also used this method to assess cumulative impacts to greater sage-grouse.

Wyoming Executive Order Density Disturbance Calculation Tool Analysis for Greater Sage-Grouse

The State of Wyoming, through the Governor's EO 2011-5, mandates that new development or land uses within Core Areas should be authorized or conducted only when it can be demonstrated that the activity will not cause declines in greater sage-grouse populations. The EO included a method for use in determining compliance with the EO for new projects, referred to as the Density and Disturbance Calculation Tool (DDCT). The DDCT is used to determine if the proposed new disturbance, combined with existing and permitted disturbances in the area, are below 5 percent of the DDCT area and result in an average of less than 1 disruptive activity (defined as oil and gas wells, wind turbines and mines) per 640 acres within the area impacted by the project. Based on scientific literature, it is assumed that as long as the maximum disturbance is less than 5 percent of the DDCT area and the density of disruptive activities is less than 1 per 640 acres, the proposed activity should not result in declines in greater sage-grouse populations. Even though the Project is not sited in a greater sage-grouse core area, the DDCT method provided in EO 2011-5 for determining impacts to greater sage-grouse is applicable in core as well as non-core areas. The DDCT tool developed by the State of Wyoming has been recognized by both the BLM and USFWS as an effective tool to evaluate impacts to greater sage-grouse. Therefore,

we applied this tool to examine potential cumulative impacts of the alternatives on greater sage-grouse in the Application Area.

To determine the DDCT analysis area, a 4-mile buffer was placed around the project boundary each alternative to determine which occupied leks may be impacted by the project. Project boundaries were defined by conceptual turbine development areas (see **Figures 2-3** through **2-6**). Next, a 4-mile buffer was placed around the perimeter of each potentially impacted occupied lek. The 4-mile buffer of the project alternative boundary and the 4-mile buffer of the impacted occupied leks were merged to create the DDCT analysis area for each alternative.

Shapefiles of turbine locations and the proposed disturbance associated with each alternative were used to determine the number of proposed disruptions (turbines) and the proposed new disturbance acreages. Shapefiles of other proposed disturbances in the DDCT area (e.g., Gateway West and Gateway South transmission lines) also were used to determine disturbances. The acreage of existing surface disturbance within the DDCT analysis area was digitized using ArcGIS Version 10 on 2009 True Color National Agricultural Imagery Program (NAIP) aerial imagery at a scale of 1:5,000. Surface disturbances digitized were limited to those anthropogenic in nature, and included roads (except two-tracks), oil and gas wells, crop fields, cities and other developed areas (e.g., airport, refinery), railroads, transmission line rights-of-way, water developments greater than 10 acres in size, pipeline scars, and other forms of miscellaneous disturbance.

In addition to surface disturbance, all disturbances associated with oil and gas wells, wind turbines, and mining activities were considered anthropogenic disruptions for determining if the disruption threshold of an average of one disruption per 640 acres was exceeded. Once all input variables were determined, the model described in the Wyoming Game and Fish Department's DDCT Manual was run to calculate percent surface disturbance and disruption density associated with each project alternative.

Results

BLM IM 2012-019

Footprints of existing disturbances within the CIA area range from a low of 15,412 acres for Alternative 3 to a high of 17,700 acres for Alternative 4, while proposed long-term disturbances associated with the CCSM Wind Energy Project range from a low of 1,164 acres for Alternative 4 to a high of 1,377 acres for Alternative 2 (**Table 5.15-2**). When proposed long-term disturbance associated with construction of the CCSM Wind Energy Project is added to existing disturbance, the footprint disturbance ranges from a low of 16,582 acres for Alternative 3 to a high of 19,053 acres for Alternative 1R. Together, existing and proposed disturbances for all four alternatives represent anywhere from 1.94 to 2.22 percent of all greater sage-grouse habitat in the CIA area, depending on alternative (**Table 5.15-2**).

The number of existing structures within greater sage-grouse habitats in the CIA area is 59 for Alternative 3 and 74 for each of the other three alternatives, and the number of proposed structures in greater sage-grouse habitat ranges from 701 for Alternative 4 to 947 for Alternative 1R (**Table 5.15-3**). Combined, the number of existing and proposed structures ranges from a low of 775 structures for Alternative 4 to a high of 1,021 structures for Alternative 1R. The total number of proposed and existing structures results in a mean structure density ranging from 0.58 to 0.85 structures/640 acres (**Table 5.15-3**).

Because all four alternatives would result in total disturbance of less than 5 percent and a structure density of less than 1/640 acres within the CIA area, they would all be in compliance with BLM IM WY-2010-019. Therefore, cumulative impacts would not be expected using this analysis method.

Wyoming Executive Order DDCT Analysis

New disturbance associated with construction of each of the alternative for the CCSM Wind Energy Project was lowest for Alternative 1R (6,672.33 acres) and was greatest for Alternative 2

(7,533.13 acres) (**Table 5.15-4**). Other proposed disturbance associated with the Gateway West and Gateway South transmission lines, assuming a 100-foot right-of-way, ranged from 325.25 acres for Alternative 1R to 388.27 acres for both Alternatives 2 and 3 (**Table 5.15-4**). The total amount of existing disturbance in each DDCT analysis area (**Figures 5-15.1** through **5.15-4**) was fairly similar among alternatives, ranging from 16,818.6 acres for Alternative 4 to 18,025.76 acres for Alternative 2 (**Table 5.15-4**). Existing disturbance in each DDCT analysis area totaled anywhere from 3.46 percent of the DDCT area for Alternative 4 to 3.95 percent of the DDCT area for Alternative 3. However, when the existing disturbance was combined with the proposed disturbances, the disturbances covered greater than 5 percent of each DDCT area, ranging from 5.04 percent for Alternative 4 to 5.65 percent for Alternative 3 (**Table 5.15-4**). Based on these figures the proposed and existing disturbance would be above the 5 percent threshold known to cause impacts to greater sage-grouse populations for all four alternatives and significant impacts would be assumed under the Wyoming EO DDCT analysis.

The mean density of disruptions in the DDCT area, based on presence of the proposed wind turbines and existing oil/gas well pads, ranged from 1.15 disruptions/640 acres for Alternative 4 to 1.47 disruptions per 640 acres for Alternative 3 (**Table 5.15-4**). The mean number of disruptions throughout the entire DDCT analysis area, which includes the turbine development area and minimum buffer of 4 miles, exceeds the threshold of 1 disruption per 640 acres for all four alternatives. If just the proposed turbine development areas are considered without any kind of buffer (**Figures 2-3** through **2-6**), the turbine density within these relatively substantial areas, which vary in size from 84,321 acres to 123,220 acres among the alternatives, ranges from 4.4 disruptions per 640 acres for Alternative 4 to 7.6 disruptions per 640 acres for Alternative 1R. This disruption density is well above the density of oil and gas wells known to cause greater sage-grouse population impacts for all four alternatives.

Much debate has occurred recently regarding the potential impacts of wind-energy facilities on greater sage-grouse and prairie grouse (Pruett et al. 2009 a,b; USFWS 2012, 2004b), although little data have been collected to measure actual response of greater sage-grouse to wind energy developments (Johnson and Holloran 2010). Under a previous set of voluntary guidelines, the USFWS took a precautionary approach and recommended wind turbines be placed at least 5.0 miles (8 km) from known greater sage-grouse lek locations (USFWS 2003). Under the new guidelines for land-based wind energy, the USFWS (2012) does not suggest any buffers but does state that development within 3 to 5 miles (or more) of active greater sage-grouse leks may have significant impacts on the population. Also, in its recent 12-month finding of whether to list the greater sage-grouse, the USFWS (2010) stated that they anticipate that potential impacts from direct habitat losses, habitat fragmentation through roads and power lines, noise and increased human presence associated with wind energy facilities will generally be similar to those for nonrenewable energy development. If that is the case, then cumulative impacts to greater sage-grouse associated with any of the four alternatives would be considered significant.

Sensitive Fish Species

The CIA for the BLM sensitive fish species includes the Upper Muddy Creek Watershed/Grizzly WHMA, which is part of the McKinney Creek sub-watershed. The cumulative impacts to BLM sensitive fish species include the impacts of this project, those associated with the Atlantic Rim project, current livestock operations, and possible oil and gas development on state land within the Upper Muddy Creek Watershed/Grizzly WHMA. Of primary concern to aquatic species would be water depletions resulting in changed water conditions and habitat degradation. Past and present water depletions within the Upper Muddy Creek Watershed/Grizzly WHMA consist of primarily of evaporation from reservoirs and impoundments associated with livestock operations. Currently, there is an ongoing BLM effort to inventory all the reservoirs and springs within this area. However, because this inventory is not complete it is not possible to estimate the total depletions due to evaporation. The proposed action for the Atlantic Rim project EIS identified a significant impact on the habitat of the three warm-water species including the bluehead sucker, roundtail chub, and flannelmouth sucker within the Upper Muddy Creek Watershed/Grizzly WHMA based on the impacts of new roads and other facilities on the habitat features.

Table 5.15-2 Existing and Proposed Long-term Disturbance Calculations for Greater Sage-grouse Cumulative Impacts

Feature	Alternative 1R						Alternative 2					
	Existing Disturbance			Long-Term Disturbance			Existing Disturbance			Long-Term Disturbance		
	Core	Non-Core	Total[1]	Core	Non-Core	Total[1]	Core	Non-Core	Total[1]	Core	Non-Core	Total[1]
Highways, improved roads (crown and ditched)	10,116	2,505	12,621	0	898		9,106	2,498	11,604	0	959	959
Well pads	92	10	102	0	0	0	91	10	102	0	0	0
Wind turbines	0	0	0	0	168	168	0	0	0	0	160	160
Cities, rest/recreation areas, etc.	2,769	2,457	5,226	0	0	0	2,769	2,457	5,226	0	0	0
Linear energy facilities(including facilities within designated utility corridors)	0	0	0	0	288	288	0	0	0	0	258	258
Gas plants, compressor stations, substations	0	0.5	0.5	0	0	0	0	0.5	0.5	0	0	0
Gravel pits, mines	0	0	0	0	0	0	0	0	0	0	0	0
Combined Footprint	**12,833**	**4,867**	**17,699**	**0**	**1,354**	**1,354**	**11,823**	**4,860**	**16,682**	**0**	**1,377**	**1,377**
Existing Disturbance + Proposed Disturbance						**19,053**						**18,059**
Proposed Facilities Disturbance to Greater Sage-grouse Habitat (percent)[2]						**2.22**						**2.11**

Table 5.15-2 Existing and Proposed Long-term Disturbance Calculations for Greater Sage-grouse Cumulative Impacts

Feature	Alternative 1R						Alternative 2					
	Existing Disturbance			Long-Term Disturbance			Existing Disturbance			Long-Term Disturbance		
	Core	Non-Core	Total[1]	Core	Non-Core	Total[1]	Core	Non-Core	Total[1]	Core	Non-Core	Total[1]
Highways, improved roads (crown and ditched)	7,871	2,498	10,369	0	832		10,116	2,505	12,622	0	855	855
Well pads	55	10	65	0	0	0	92	10	102	0	0	0
Wind turbines	0	0	0	0	159	159	0	0	0	0	125	125
Cities, rest/recreation areas, etc.	2,769	2,457	5,226	0	0	0	2,769	2,457	5,226	0	0	0
Linear energy facilities(including facilities within designated utility corridors)	0	0	0	0	180	180	0	0	0	0	184	184
Gas plants, compressor stations, substations	0	0.5	1	0	0	0	0	0.5	1	0	0	0
Gravel pits, mines	0	0	0	0	0	0	0	0	0	0	0	0
Combined Footprint	**10,552**	**4,860**	**15,412**	**0**	**1,171**	**1,171**	**12,833**	**4,867**	**17,700**	**0**	**1,164**	**1,164**
Existing Disturbance + Proposed Disturbance						**16,582**						**18,864**
Proposed Facilities Disturbance to Greater Sage-grouse Habitat (percent)						**1.94**						**2.20**

[1] For disturbance calculations, disturbances in non-core and core habitat do not always sum to the total. This is due to overlapping disturbances not being counted twice.

Table 5.15-3 Number of Energy Production and Transmission Structures within Greater Sage-grouse Cumulative Impacts Analysis Area

Feature	Feature Density Calculation	Alternative 1R						Alternative 2					
		Existing Disturbance			Long-Term Disturbance			Existing Disturbance			Long-Term Disturbance		
Included in Energy Production and Transmission Structures Analysis		**Core**	**Non-Core**	**Total[1]**	**Core**	**Non-Core**	**Total[1]**	**Core**	**Non-Core**	**Total[1]**	**Core**	**Non-Core**	**Total[1]**
Oil and gas wells	Each well pad location counts as 1.	36	4	40	0	0	0	36	4	40	0	0	0
Power lines	Each power line counts as 1.	5	4	9	0	6	6	5	4	9	0	3	3
Pipelines	Each pipeline counts as 1.	9	14	23	0	0	0	9	14	23	0	0	0
Compressor station or substation	Each compressor station or substation counts as 1.	0	1	1	0	6	6	0	1	1	0	3	3
Wind turbines	Each wind turbine counts as 1.	0	0	0	0	935	935	0	0	0	0	894	894
Gas Plant/Refinery		0	1	1	0	0	0	0	1	1	0	0	0
Total Number of Facilities				**74**			**947**			**74**			**900**
Existing Facilities + Proposed Facilities							**1,021**						**974**
Proposed Facilities per 640 acres							**0.76**						**0.78**

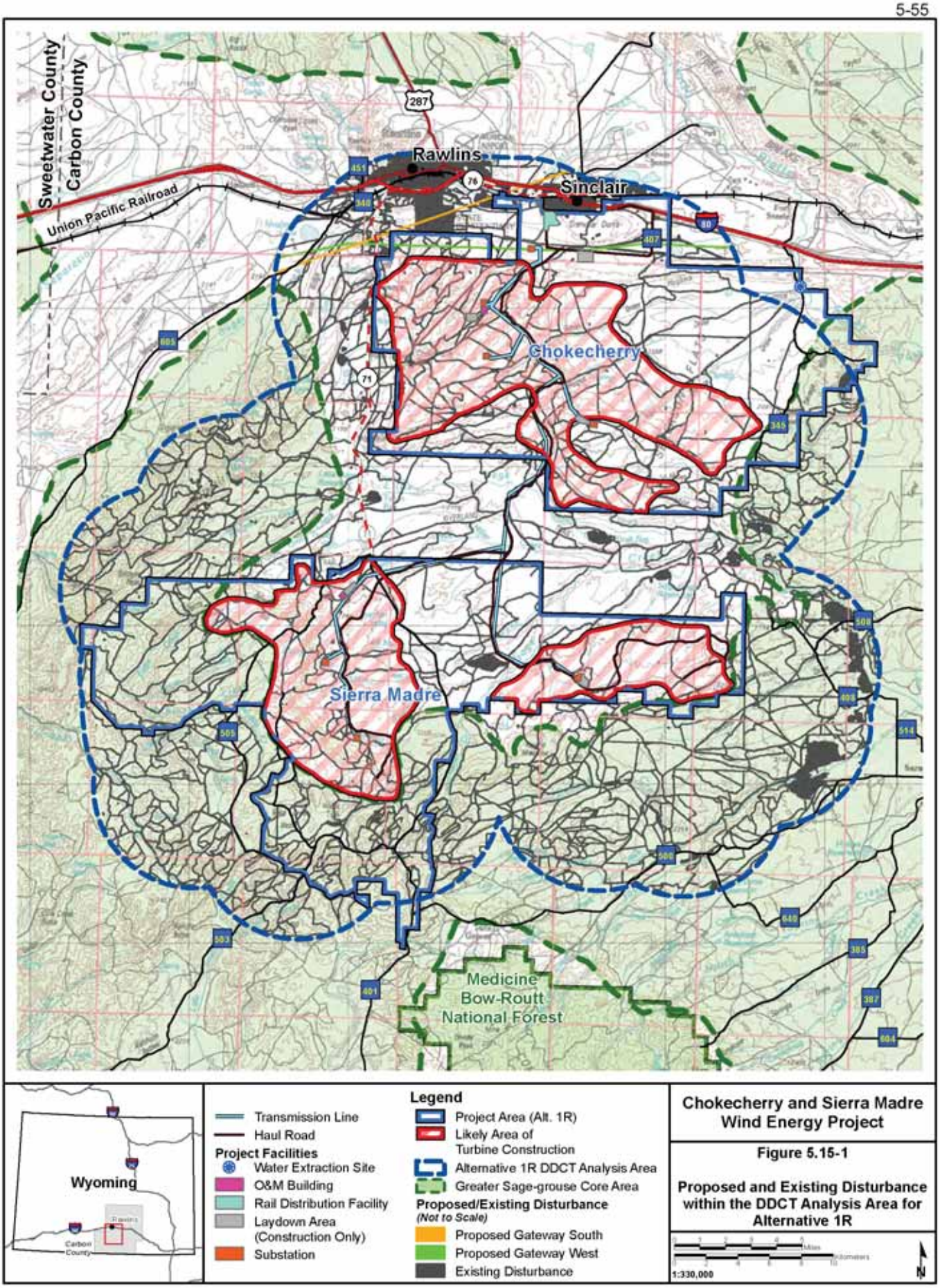
Table 5.15-3 Number of Energy Production and Transmission Structures within Greater Sage-grouse Cumulative Impacts Analysis Area

Feature	Feature Density Calculation	Alternative 1R						Alternative 2					
		Existing Disturbance			Long-Term Disturbance			Existing Disturbance			Long-Term Disturbance		
Included in Energy Production and Transmission Structures Analysis		**Core**	**Non-Core**	**Total[1]**	**Core**	**Non-Core**	**Total[1]**	**Core**	**Non-Core**	**Total[1]**	**Core**	**Non-Core**	**Total[1]**
Oil and gas wells	Each well pad location counts as 1.	21	4	25	0	0	0	36	4	40	0	0	0
Power lines	Each power line counts as 1.	5	4	9	0	2	2	5	4	9	0	3	3
Pipelines	Each pipeline counts as 1.	9	14	23	0	0	0	9	14	23	0	0	0
Compressor station or substation	Each compressor station or substation counts as 1.	0	1	1	0	2	2	0	1	1	0	3	3
Wind turbines	Each wind turbine counts as 1.	0	0	0	0	888	888	0	0	0	0	695	695
Gas Plant/Refinery		0	1	1	0	0	0	0	1	1	0	0	0
Total Number of Facilities				**59**			**892**			**74**			**701**
Existing Facilities + Proposed Facilities							**951**						**775**
Proposed Facilities per 640 acres							**0.85**						**0.58**

[1] For facility disturbance calculations, facilities in non-core and core habitat do not always sum to the total. This is due to overlapping disturbances in core and non-core habitat not being counted twice.

Table 5.15-4 Types and Acres of Disturbance for each Alternative Density and Disturbance Calculation Tool Analysis Area

Disturbance Type	Acres			
	Alt 1R	**Alt 2**	**Alt 3**	**Alt 4**
Proposed Disturbance				
Wind Energy Development	6672.33	7533.13	7211.46	7290.04
Gateway South Transmission Line	117.90	131.19	131.19	123.75
Gateway West Transmission Line	207.35	257.08	257.08	249.86
Existing Disturbance				
Agriculture	2954.09	3039.97	3039.97	3039.97
Airport	7.71	0	0	0
City	5193.83	5097.68	5097.68	4023.58
Developed, Open Water	1281.98	1601.81	1593.95	1613.48
Gas Plant/Refinery	777.60	903.25	903.25	903.25
Oil/Gas Development	500.62	263.51	254.76	266.05
Other Development	579.13	1382.85	1382.37	1214.77
Railroad	89.12	140.07	139.78	133.16
Roads	4862.78	5195.65	4830.13	5255.94
Pipeline Scar	265.42	325.64	323.75	293.07
Well Pads	75.33	75.33	52.12	75.33
Total Disturbance	**23,585.18**	**25,947.16**	**25,217.49**	**24,482.24**
Total Area in DDCT	**463,332**	**476,911**	**446,142**	**485,789**
% Disturbance in DDCT	**5.09%**	**5.44%**	**5.65%**	**5.04%**
Disturbance Type	**Density Count**			
Proposed Turbines	1000	1000	1000	846
Existing Well Pads	31	31	23	31
Total	**1031**	**1031**	**1023**	**877**
Total Area in DDCT	**463,332**	**476,911**	**446,142**	**485,789**
Ratio	**1.42 : 640 acres**	**1.38 : 640 acres**	**1.47 : 640 acres**	**1.15 : 640 acres**
Turbine density in development area	**7.6 : 640 acres**	**7.2 : 640 acres**	**7.2 : 640 acres**	**4.4 : 640 acres**



Chokecherry and Sierra Madre Wind Energy Project

Figure 5.15-1

Proposed and Existing Disturbance within the DDCT Analysis Area for Alternative 1R

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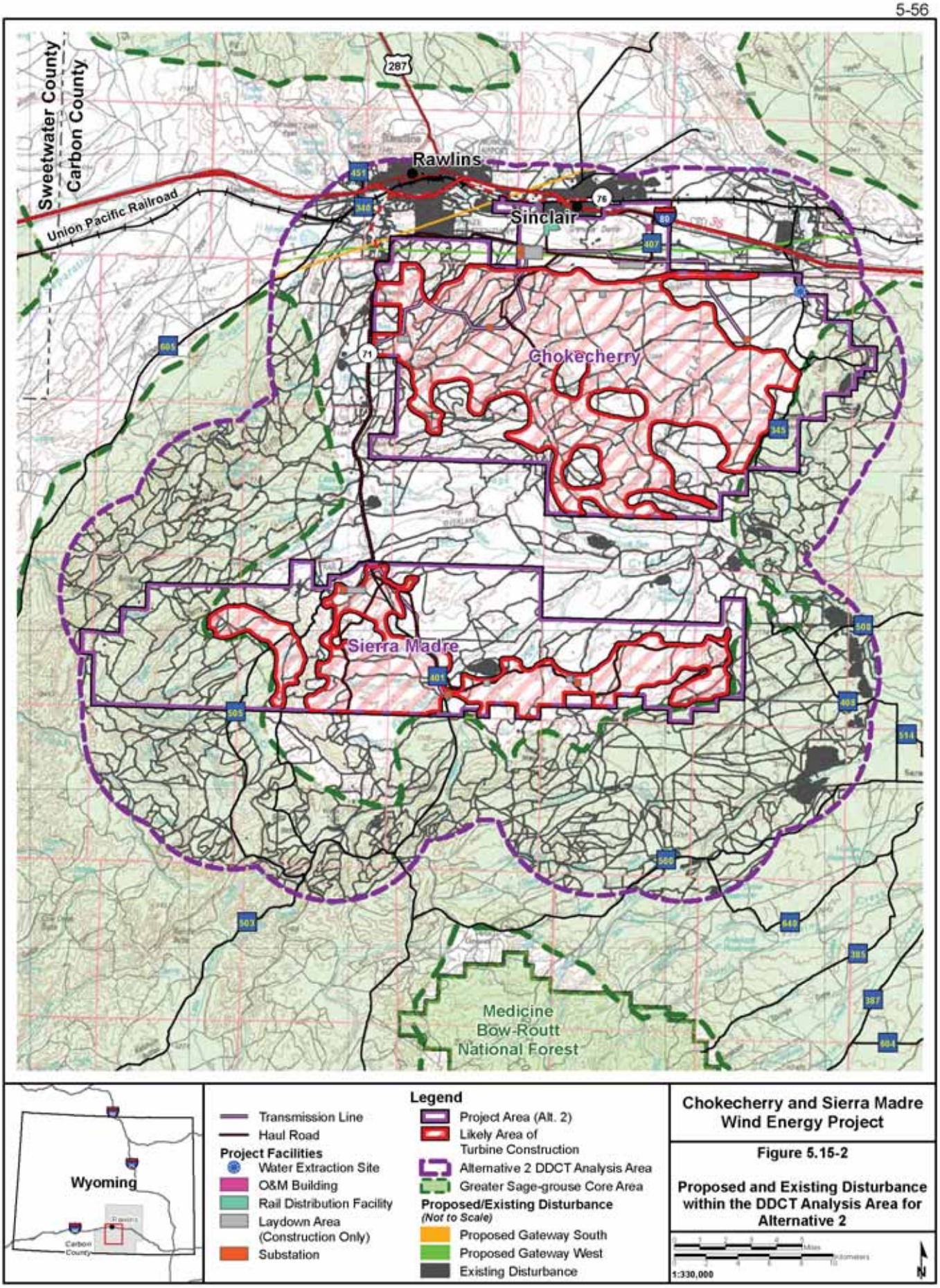

Chokecherry and Sierra Madre Wind Energy Project

Figure 5.15-2

Proposed and Existing Disturbance within the DDCT Analysis Area for Alternative 2

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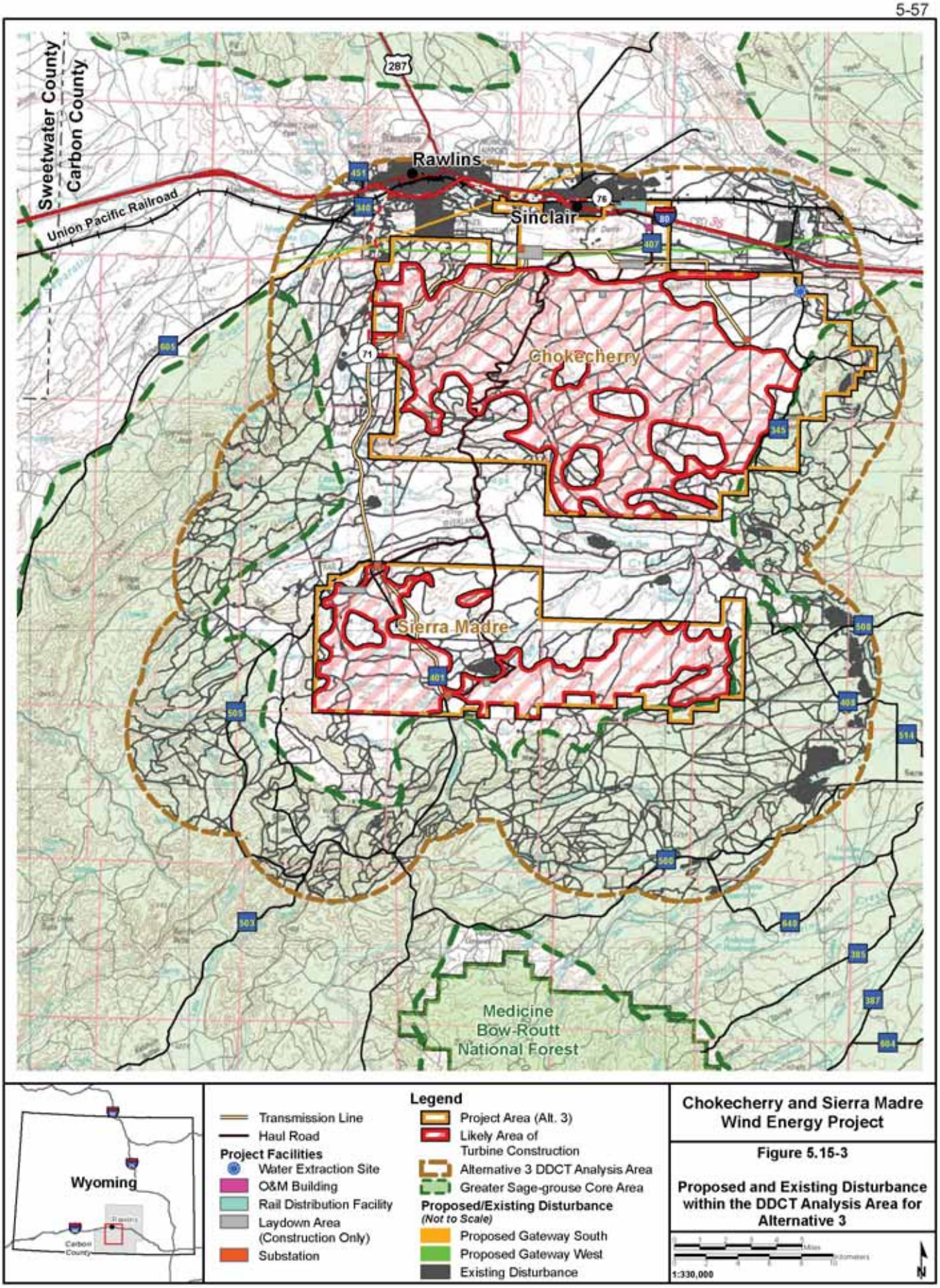

Chokecherry and Sierra Madre Wind Energy Project

Figure 5.15-3

Proposed and Existing Disturbance within the DDCT Analysis Area for Alternative 3

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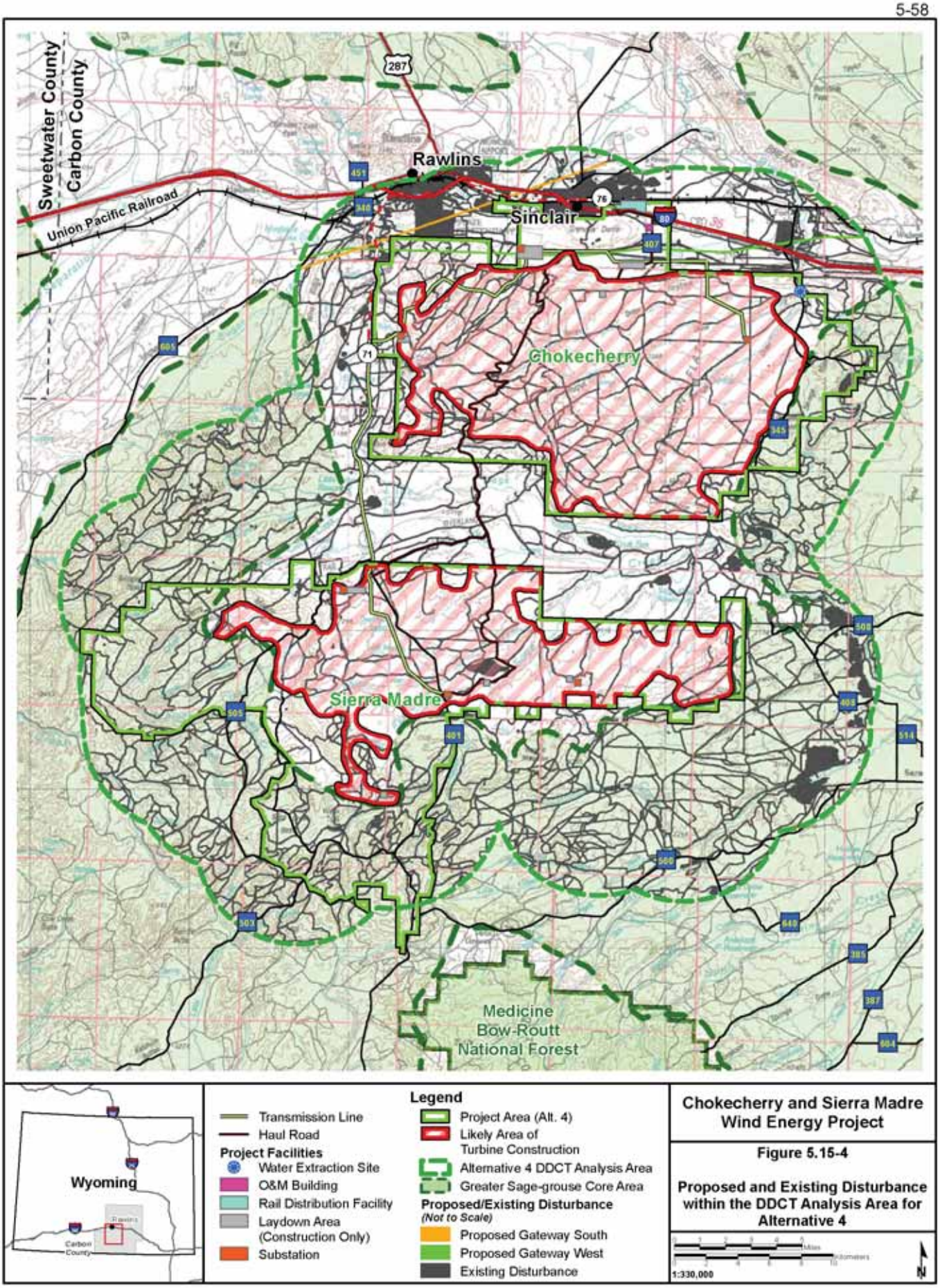

Chokecherry and Sierra Madre Wind Energy Project

Figure 5.15-4

Proposed and Existing Disturbance within the DDCT Analysis Area for Alternative 4

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It also is possible that habitat fragmentation may occur, denying these species access to required habitats. Many best management practices including detailed mitigation measures were proposed to mitigate these impacts (BLM 2006).

Under alternatives 1R, 2, and 4 there is potential for surface disturbance within the Upper Muddy Creek Watershed/Grizzly WHMA, however the magnitude of the potential impacts to the sensitive fish species resulting from possible construction within the Upper Muddy Creek Watershed/Grizzly WHMA cannot be determined without the final layout. Based on the current conceptual layout for Alternatives 1R, 2, and 4 project development will generally be concentrated in higher-altitude upland areas away from streams and reservoirs with the exception of road-stream crossings. According to **Table 5.13-1**, the past and present disturbance within McKinney Creek sub-watershed equals 93 acres which is approximately 0.3 percent of the sub-watershed. Alternatives 1R, 2 and 4 would increase the total surface disturbance in that watershed to approximately 0.6, 0.5, and 0.4 percent, respectively. Alternative 3 would not result in any development within the Upper Muddy Creek Watershed/Grizzly WHMA, thus that alternative would not contribute to any cumulative impacts on these fish species.

Sensitive Plant Species

The CIA area of influence assessed for BLM sensitive plant species consist of the area depicted in **Figure 5.9-1**. This CIA area was chosen because it encompasses the watersheds that would be impacted by project activities and nearby RFFA's that have the potential to affect sensitive plant species and is consistent with the soil and vegetation analysis areas. Indirect concerns across the area include the possibility of a general reduction or loss of pollinators, invasion of weeds from development into occupied habitats, and increased risk of habitat disturbance resulting from human presence.

BLM policy avoids disturbance activities within identified special status plant habitats, thus direct cumulative effects upon these species should be avoided. Furthermore, site-specific surveys would be conducted to identify any unknown populations at risk from development. As presented in Appendix 24 of the Final EIS for the Rawlins RMP (BLM 2008b), mitigation to reduce impacts to special status plants primarily consists of avoidance if such a population(s) should be found.

5.16 Cumulative Impacts for Noise and Human Health

The CIA area for noise impacts is the Application Area with a 1,400-foot buffer. This CIA area was chosen due to the limited range of noise and human health impacts. Noise emanating from within the area of analysis currently consists of normal rural background noise such as wildlife, agriculture (grazing), wind, and occasional traffic.

The TransWest Express, Gateway South, and Gateway West transmission line projects are located within the northern boundary of the Chokecherry portion of the Application Area. These projects are expected to be constructed concurrently with the CCSM project. The Middlewood Wind Power Project and the Highway 71 Improvement projects are located adjacent to the southeast boundary of the Sierra Madre portion of the Application Area and the western boundary of the Chokecherry portion of the Application Area, respectively. These projects are listed in **Table 5.0-1** and shown in **Figure 5.0-1**. Potential cumulative impacts from the transmission line projects would include short-term temporary construction noise, and corona discharge and substation noise during operations. Construction noise would likely exceed 55 dB(A) at 1,400 feet, but would be short-term and temporary. Noise from Corona discharge typically is near 39 dB(A) at 50 feet which equals the noise being generated in a library (BPA 1996). This is similar to the noise level from substations at 1,400 feet. During operations the additional noise sources would contribute little to the overall noise produced within the Application Area. The Wyoming State Penitentiary is over 0.5 mile away from the nearest proposed project, Gateway West. The nearest residence is located over 1 mile away from the nearest proposed project, Gateway West. As a result of the distance between the proposed projects and sensitive receptors within the

Application Area, it is expected that there would be negligible cumulative impacts to human health. Cumulative impacts under all the alternatives would be similar.

Potential impacts from the Highway 71 improvement project include short-term construction noise from heavy machinery such as bulldozers and front-end loaders, and noise from increased light truck traffic. Construction may begin concurrent with construction for the CCSM project. While noise from the CCSM project would potentially overlap with construction noise from the proposed Highway 71 improvement project, noise impacts would be short-term and temporary in nature. Potential impacts from the Middlewood Wind Power Project would include noise from wind turbine operations and associated facilities such as power lines and substations. Noise levels are expected to be near 35 dB(A) at 1,400 feet for wind turbine and substation noise, and 39 dB(A) at 50 feet for power line noise. Both these noise levels approximately equal the noise being generated in a library. The Middlewood Wind Power Project is expected to be constructed after the project. Cumulative impacts to human health from the Middlewood Wind Power Project, such as wind turbine syndrome, shadow flicker, and the looming effect, are expected to be negligible as a result of the rural nature of the project area and the distance between the proposed project and residences within the Application Area. Cumulative impacts under all the alternatives would be similar.