

# Greater Sage Grouse: Colorado Synthesis Report

## I. Introduction

The U.S. Fish and Wildlife Service (FWS) is poised to propose a listing decision for the Greater Sage Grouse (GrSG) under the Endangered Species Act by 2015. Eleven states are host to habitat for the species, and the FWS has indicated its intent to make a single range-wide listing decision, rather than a state-specific determination. Federal, state, local, and private entities have become actively involved in activities to conserve GrSG habitat in an effort to avert a listing.

## II. Background: The Colorado Package

In 2008, the (then) Colorado Division of Wildlife (now Colorado Parks and Wildlife (CPW)) developed a comprehensive *Colorado Greater Sage-Grouse Conservation Plan*. Among the components of that plan is a section entitled “Conservation Strategy,” which identifies key issues facing GrSG conservation. For each issue, objectives are listed that would contribute to mitigation of the issue; for each of these objectives, a number of specific strategies are described. Each strategy, in turn, includes a list of responsible parties with a lead agency identified where possible, an estimated timeline, and an approximate cost associated with implementation. This Colorado Conservation Plan is available at: <http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Birds/Pages/GreaterSageGrouseConsPlan2.aspx>

In 2012, Colorado sought to undertake a comprehensive update to the Conservation Plan. For each strategy enumerated in the Conservation Plan, described above, the Department of Natural Resources (DNR) compiled information from stakeholders identified in the matrix to summarize implementation of the strategies to meet objectives. The result was the Colorado Package<sup>1</sup>.

The completed Colorado Package was sent to the Bureau of Land Management (BLM) for inclusion in its Northwest Colorado RMP revision, as an Appendix common to all alternatives being considered. The Package was also submitted to the FWS for its review, and in August, 2013 that agency provided feedback to the state. Areas that were considered strong include communication among stakeholders, identification of the biology and related issues, acquisition of conservation easements, and habitat

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<sup>1</sup> <http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Birds/Pages/GreaterSageGrouseConsPlan2.aspx>

improvement work. Areas where the FWS has requested more information come from threats identified in the Conservation Objectives Team (COT) Report:

- *Implementation of oil and gas rules in GrSG habitat, pursuant to HB 07-1298.* While the Colorado Oil and Gas Association (COGCC) rules are well documented in the Package, the FWS is interested in detailed data that show whether implementation of those rules has resulted in effective conservation of GrSG habitat on the ground to date, and whether there are opportunities for improved implementation going forward.
- *Exurban development at the county level.* Some counties have zoning regulations and related approaches on the books that seek to manage development in GrSG habitat within their borders. The FWS is interested in the implementation of those regulations, again with a focus on the extent to which they have been effective in protecting habitat. Additionally, the agency would like us to project future development pressure and consider how habitat protection can be assured going forward.
- *Livestock management.* The FWS is also interested in a broad-scale evaluation of livestock management and range condition on state and private land. The agency recommended the use of State Land Board data on grazing practices across the northwest part of the state as a tool for approximating a more comprehensive evaluation.

The State of Colorado now submits this synthesis report at the request of the FWS. This report draws from data collected in the Package, information contained in the COT report, and information obtained from county, state, federal, and private stakeholders. State and local entities were integral to the production of this synthesis, and while DNR took the lead on writing the report, it is a statewide document. In addition to the three specific items listed above, this report also includes updated information on a number of other conservation actions that should be considered by the USFWS in its listing decision.

### **III. Implementation of oil and gas rules in GrSG habitat, pursuant to HB 07-1298.**

Colorado's General Assembly passed House Bill 07-1298 in 2007, and the COGCC developed regulations to implement its provisions that are contained in the agency's 1200-Series Rules (see Appendix A). The statute and these rules provide, among other things, an opportunity for CPW officials to consult with oil and gas companies when drilling is proposed in certain habitat areas. These Sensitive Wildlife Habitat (SWH) or Restricted Surface Occupancy (RSO) areas are depicted in maps maintained and periodically

updated by the COGCC and encompass habitat for a number of species that may be impacted by oil and gas development, including GrSG.

While regulations make consultation between oil and gas operators and CPW mandatory when drilling is proposed in SWH or RSO areas, CPW lacks regulatory authority to require measures arising from this consultation. Instead, such measures are provided to COGCC and to operators as recommendations to minimize adverse impacts to wildlife. We sought to explore the extent to which implementation of recommendations was happening on the ground. To accomplish this, we hired a contractor (Tetra Tech) to conduct the analysis, by reaching out to individual operators and to field managers with CPW.

Results show very high correlation between Best Management Practices (BMPs) recommended by SPW for protection of GrSG habitat and voluntary adoption. In other words, CPW met with operators every time a permit for drilling in GrSG habitat was sought. During those consultations, CPW recommended a series of actions designed to minimize or eliminate impacts on habitat. Adoption of those recommendations by an operator is entirely voluntary under the 1200-series regulations, but our analysis suggests that they are adopted 97% of the time. Please see Appendix B for the full report.

One problem our contractor had in developing that analysis was pervasive difficulty in obtaining data. Ultimately, he relied on conversations and paperwork from CPW and Form 2As filed with the COGCC by operators. Data on voluntary avoidance, minimization, and mitigation was much harder to collect. Colorado will move forward with a more comprehensive tracking system that can happen in real time; that is, as consultations take place and companies begin operations, they will be required to enter their protective practices in a centralized database. In this way, we hope to have our fingers on the implementation results without having to launch a separate study. Stakeholders in the development of a tracking system include state agencies, industry, and local governments. We will begin to develop this process in 2014.

#### **IV. Exurban development at the county level**

There are two dimensions to the issue of exurban development: the threat of expanding residential development and the county level response to that threat. With only a few exceptions, the northwest part of the state has not seen extensive housing development in recent years; indeed, many rural areas have little or no exurban development. In order to understand the nature of the threat of exurban development to the 8 counties that overlap with GrSG habitat, we contracted with Conservation Science Partners (CSP). Using parcel data, census data, and groundwater well data, CSP estimated past growth and

generated projections for future development. These data proved to be occasionally misleading; well data, in particular, may suggest residential development when in fact it indicates stock ponds or other agricultural use. Additionally, it is important to note that growth rates are highly uneven across the region. Some counties have little to no growth while others, especially resort areas, experience consistently higher levels of growth.

Results show that for the years 1980-2010, residential units across the eight-county area grew by more than 50% in GrSG habitat; perhaps more importantly, however, priority habitat saw an annual increase of development of only 1.8%. Currently, 11% of total priority habitat has residential development at a density higher than one unit per 160 acres. Projections suggest that future growth will add 55,683 acres to that number, an increase of 1.43%. The full report is attached in Appendix C.

The second component of this issue is the county level response to exurban development. Colorado statute authorizes counties to establish planning and zoning commissions (CRS 30-28-103), and describes a range of duties those commissions are authorized to accomplish (CRS 30-28-111). Pursuant to these authorities, many counties have placed stipulations on plats based on issues of concern including important wildlife habitat. Enforcement of those stipulations is then left to the counties. Similarly, counties are authorized to conduct master planning (CRS 30-28-106(3)(a)(XI)) to guide land use and development; that provision identifies threatened and endangered species as a topic counties may include in their planning documents.

Colorado counties have approached the planning and zoning challenge differently, in part due to variation in the perceived threat. Please refer to the Colorado Package for details about related efforts by counties; the information below is specific to GrSG habitat.

Jackson:

- Nearly all of the priority habitat for GrSG is located within the county's designated Ranching District Zone. Under county regulations, the R zone is managed as follows:
  - Uses that are permitted in the R zone include ranching, general agriculture, ponds and reservoirs, limited sand and gravel operations, low impact recreation facilities, and oil and gas exploration and development.
  - All other uses require a Special Use permit or Conditional Use Permit. All such uses generally require a public hearing on the application with written notice published in a newspaper of general circulation. Among the attendees at these hearings is Colorado

Parks and Wildlife, which is invited to provide recommendations for protecting wildlife habitat.

- Since 2008, the county has approved 21 building permits for new residential dwelling units. Of those, five were approved for new structures on existing ranches, 10 were approved for residential structures and cabins outside of the PPH, and only two were approved within the boundaries of the PPH. One of those approvals was for a very small cabin in the historic ghost town of Coalmont, and the other was for a new residence within the Eagles Watch Planned Unit Development near Walden.

Garfield:

- Recently completed Comprehensive Plan 2030<sup>2</sup>, a document that details current and future growth projections.
  - Relevant sections include the stated goal to “ensure that natural, scenic, ecological, and critical wildlife habitat resources are protected and/or impacts mitigated,” (p. 61). To achieve this goal, “the county will encourage and cooperate with the protection of critical habitat including state and federally protected, threatened, or endangered species.” (p. 62)
- 30% of GrSG mapped habitat in the county falls into Open Space / Public Lands designation. The remaining 70% is private, and falls into the county designation of Resource Production / Natural. These areas are prioritized for resource extraction within significant environmental constraints. The only permitted residential use in that designation is one dwelling per 35 acres.

Grand:

- Grand County Master Plan (2011) prioritizes wildlife habitat and provides county-wide direction for planning. Planning and Zoning Regulations<sup>3</sup> consistent with Master Plan.
- Growth boundaries are detailed in the Master Plan and favor clustered development.
- All proposed new developments and all applications for higher impact Special Use Permits must be reviewed by CPW.

Mesa:

- Approximately 14,200 acres of GrSG habitat exists in the “Sunny Side” area of Mesa County between Collbran and DeBeque. Of those, 12,000 acres are privately owned. Of those, 22% are protected through conservation easements.

<sup>2</sup> [http://www.garfield-county.com/community-development/comprehensive\\_plan2030.aspx](http://www.garfield-county.com/community-development/comprehensive_plan2030.aspx)

<sup>3</sup> <http://co.grand.co.us/208/Planning-Zoning-Regulations>

- Ranching and oil and gas development are the primary activities anticipated in this habitat area. There is little residential development.
- Mesa County Land Development Code, Sec. 7.6.4 is entitled Wildlife Habitat Protection and includes the requirement that “Any project on any parcel that falls within the current Wildlife Composite Map for Mesa County ... shall require consultation with the Colorado Division of Wildlife [now CPW] to substantiate the basis for the potential impact and to address various, specific measures to avoid, minimize, or mitigate negative impacts to wildlife and its habitat.”

Moffat:

- Has authority through the County Planning and Zoning Commission to establish sage grouse development stipulations; to date, no such stipulations have been deemed necessary, and therefore none have been placed on subdivisions.
- Planning and zoning subdivision regulations allow CPW review of subdivisions, new developments, and Conditional Use permits (Article IV P.19).
- The Moffat County / City of Craig Master Plan prioritizes responsible wildlife habitat management as follows: “Moffat County shall support recovery planning efforts for sensitive, threatened, and endangered species, which evaluate, mitigate, and support Moffat County’s custom and culture and economic viability.” (p14)

Rio Blanco:

- County Master Plan policy NR-1D states that the County will work with federal and state agencies to protect wildlife habitat, including restricting development in the most sensitive habitat and mitigating impacts in other critical areas.
- Standards for wildlife management apply to all land use approvals, and provide design features and other prescription for buffers, non-native plants and animals, refuse disposal, fencing, domestic animals, and exterior lighting. Land Use Resolution Section 259 also describes development review criteria for consideration of wildlife impacts, and addresses previously undisturbed areas, disruption of life cycle functions, species reliance on habitat features, habitat removal / alteration / fragmentation, and proposed mitigation efforts to address potential impacts.

Routt:

- Over 90% of the County is zoned Agriculture and Forestry.<sup>4</sup> Lot size was established in 1995 as a minimum of 35 acres (Sec. 5.2.1). Since then, only one subdivision has been proposed and it was subsequently withdrawn.
- Commercial activity in the Agriculture and Forestry Zone requires a Special Use Permit. By county policy, those permit applications are sent to CPW for review and comment. Based on those comments, conditions such as timing constraints, disturbance extent and reclamation requirements are frequently written into new permits.

**V. State Land Board & Grazing**

The Colorado State Board of Land Commissioners (SLB) is a constitutionally created state agency to which the State of Colorado delegated its fiduciary and management responsibility for the state trust lands of eight public trusts in Colorado. The state trust lands were lands transferred as an endowment to Colorado by the federal government around the time of statehood to be managed for the benefit of public education and public institutions. Today these assets include approximately three million surface acres of land that are leased for agricultural, grazing, recreational, commercial real estate, rights-of-way, renewable energy and other uses; and approximately four million acres of mineral estate that are leased for oil, natural gas, coal and other solid mineral extraction uses. Revenues generated by the state trust lands through surface leases, rights-of-way and mineral production royalties go to the trust beneficiaries, capital investment, and board operations.

In 1996, the voters of Colorado passed Amendment 16 to the state constitution, which requires that state trust lands be managed both for reasonable and consistent revenue and the preservation of long-term asset values – both economic and natural.

The SLB currently has 164 grazing and multiple use leases that contain, in whole or in part, state trust lands within GrSG priority and general habitat areas. These leases total 264,116 acres of GrSG habitat and occur in five of the seven GrSG populations in the northwest part of the state. Of those state trust lands leased for grazing and/or recreational uses, 49% fall within Priority Habitat and 18% fall within General Habitat (see Appendix D).

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<sup>4</sup> Routt County Master Plan available at: [www.co.routt.co.us/DocumentCenter/View/275](http://www.co.routt.co.us/DocumentCenter/View/275)

Cattle grazing is the predominant type of grazing on state trust lands in GrSG habitat areas. Fencing in these leases amounts to 166 miles of woven-wire fence and 439 miles of barbed wire fence; there is roughly one mile of fence per section. Per SLB grazing lease, lessees are responsible for maintaining the fences on their property.

Recreational use is another important use on state trust lands containing GrSG habitat. Approximately 67% of the SLB grazing leases in GrSG habitat have all or part of their lands enrolled in the CPW Public Access Program. Another 17% have private recreation leases, predominantly hunting.

State trust lands are typically inspected by District Managers once every five years; grazing leases are inspected at least 18-30 months prior to a lease expiration date, and whenever a new use is proposed. Since 1999, nearly 16,000 acres (16%) of SLB's grazing leases in GrSG habitat have been inventoried by a private range specialist. In many cases, those inspections resulted in improved grazing management practices and treatment for noxious weeds. The SLB is now developing a Greater Sage Grouse Stewardship Action Plan that will include range inventories using a rapid assessment tool for at least 200,000 acres of GrSG habitat. This inventory has been integrated into the agency's 2013 Strategic Plan as follows.

Strategic Objective #2.2: Enhance stewardship of all trust lands through an increased use of sustainable practices in land management.

- Complete systematic inventory of natural resources on state trust lands.
- Increase management and monitoring of state trust lands.
- Develop a comprehensive set of BMPs to guide all uses on state trust lands.
- Develop SLB Stewardship Action Plans (SAPs) for special ecosystems on state trust lands.
- Develop and strengthen stewardship partnerships with land management agencies, appropriate Non-Governmental Organizations and citizen volunteers.
- Develop Integrated Resource Management Plans for our most significant properties.

Pursuant to this objective, the SLB has begun to develop Stewardship Action Plans (SAP) for its properties. An SAP is a landscape-scale management plan for a targeted species (e.g. GrSG) or type of natural resource (e.g. wetland fens). SAPs are outcome-based and pragmatic. They incorporate an adaptive management framework that sets goals and priorities, develops strategies and action steps, measures results and regularly re-evaluates those elements to make sure they are still relevant.



The SAP will assess the quality of state trust lands for the identified natural resource or species – in this case, GrSG -- propose strategies to enhance and/or restore those lands, and determine the best management practices for generating revenue through existing and new uses, including emerging ecosystem services marketplaces.

In 2013, SLB initiated the field work associated with the preparation of a GrSG SAP for state trust lands located in NW Colorado. The effort will provide the SLB with additional information about its properties and identify strategies that may allow the SLB to avoid or minimize the impacts associated with a listing decision. Most importantly, the inventory will provide vegetation monitoring data to support adaptive management techniques to improve habitat, including the potential to revise grazing plans as needed.

In 2014, staff plans to continue the field assessments associated with the GrSG and Gunnison Sage Grouse SAPs. In March 2014, the Board endorsed the project, authorized staff time and directed staff to include the project's cost in the agency's base budget. SLB anticipates the GrSG SAP will be completed by 2016.

## **VI. Additional Activities in Colorado**

### **a. Colorado Habitat Exchange**

The Colorado Habitat Exchange (Exchange) is a new tool for conserving and creating GrSG habitat, currently under development. It creates new incentives for private landowners, public land managers, and development companies to reduce impact, as well as conserve, enhance, and restore critical habitat for the species. The Exchange is a market-based mechanism that quantifies conservation outcomes (credits) and impacts from human activities (debits), defines standards for market transactions, and reports the overall progress from implementation of conservation actions throughout the GrSG range in Colorado. The Exchange establishes the market infrastructure and tools necessary to facilitate effective and efficient conservation for the species, which include the habitat quantification tool (HQT) and protocols (i.e. processes and rules) to ensure conservation benefits are measurable and repeatable. The Exchange is intended to provide regulatory certainty for industries by addressing compensatory mitigation needs whether or not the species is listed under the Endangered Species Act.

The Exchange abides by the following guiding principles:

- Produce high-quality conservation where it makes the greatest ecological difference.
- Enable sound decision-making based on the best available science.

- Create an efficient marketplace, where every transaction will result in a net benefit for the GrSG.
- Foster transparency, accountability, and credibility.
- Improve the effectiveness and efficiency through programmatic management of the Exchange.

The Exchange will cover the entire occupied range for GrSG in Colorado, as mapped by the BLM as part of the National Planning Strategy for the species. Credits are generated by projects that create benefits for GrSG habitat, and debits are accrued from impacts to habitat. The Exchange scope can be expanded to support additional conservation needs and to correspond with revisions to habitat and management maps in the future. For example, the Exchange will also include Mule Deer habitat in the future.

The development of the Exchange is currently led by a diverse Working Group that includes representatives from Environmental Defense Fund, DNR, Colorado Cattlemen’s Association, CPW, Partners for Western Conservation, and the Colorado Oil & Gas Association.

The steps for generating and transacting credits are depicted as follows, and described in further detail in the Colorado Habitat Exchange Manual, which is anticipated to be released in May 2014.



Overview of the process steps to generate and purchase credits

The orange Track and Transfer connector represents the role of the Exchange Administrator who provides the platform for transactions to occur. In addition to the operational steps outlined above, the Exchange Administrator will manage the Exchange under a transparent and inclusive process that is designed to improve the efficiency and effectiveness of the Exchange over time. This process includes an annual cycle of reporting on Exchange performance, executing strategic monitoring and evaluation, and systematically improving Exchange tools and operations.

A series of operational design rules will ensure net benefit for the species. Key operational features include the following:

- *Mitigation Ratios* make the total functional acres of credit greater than the functional acres of debit.
- *Outcome-Based Quantification & Performance-Based Credit Release* links the release of credits to on-the-ground functional habitat that is known to support populations.

- *Verification with Performance & Financial Assurances* creates strong incentives for Credit Developers to generate functional habitat that is durable.
- *Reserve Account* creates an insurance pool of credits that can be used in cases where projects unexpectedly cease to produce functional habitat, so that the program overall ensures sufficient credits are available to offset debits.

The Exchange's Habitat Quantification Tool (HQT) is the method for quantifying habitat function in functional acres and determining debits and credits. The HQT uses a set of metrics, applied at multiple spatial scales, to evaluate vegetation and environmental conditions related to GrSG habitat quality and quantity. The HQT enables the Exchange to create incentives to generate credits on the most beneficial locations for the GrSG, and to minimize impacts to existing high quality habitat. The HQT is used to calculate scores for each type of seasonal habitat, including summer, winter, and breeding habitat. The metrics are applied at four spatial scales derived from the Habitat Assessment Framework. To calculate credits or debits, pre- and post-project conditions are measured at the site to determine functional acre scores. The debit/credit score is adjusted to account for indirect effects of the local area surrounding the site. Mitigation ratios are applied to ensure that the functional acres of credit acquired are greater than the functional acres of debit. Actual conditions at the site are verified using the HQT, and credits are released according to the habitat quality achieved.

The Working Group is in the process of finalizing the Exchange Manual and HQT for release in May 2014. Additionally, the Working Group is drafting an Exchange Agreement that will authorize the use of the Exchange for GrSG mitigation upon USFWS approval. The Exchange intends to execute pilot transactions in summer 2014 to further test and improve the draft HQT and protocols.

#### **b. Habitat Protection through Conservation Easements: Updated Information**

In addition to the habitat protection program through CPW, Colorado is host to a number of private land trusts. Many of these organizations have been focused on protecting GrSG habitat in recent years.

Summary data from these public / private partnerships indicates strong protection both of core habitat and linkage areas. Total acres protected in each GrSG population is as follows:

Meeker/White River:	6,248.9 acres
Middle Park:	26,183.5 acres
North Eagle/South Routt:	11,520.15 acres
North Park:	26,786.9 acres
Northwest Colorado:	48,939.4 acres

Parachute/Piceance/Roan:	4,852 acres
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In addition, the following linkage habitat has been protected:

Between Meeker and Northwest populations:	3,954 acres
Between North Park and Middle Park:	173 acres
Between North Eagle/South Routt and Northwest:	1,293 acres

Please see Appendix E for complete conservation easement summary data.

## **APPENDICES**

- A** Colorado Oil and Gas Conservation Commission 1200-series Regulations
- B** Tetra Tech Report: Analysis of Oil and Gas Permitting in GrSG Habitat
- C** Conservation Science Partners Report: Summary of Status and Trends of Residential Growth in Northwestern Colorado
- D** Map: State Land Board Sections in GrSG Habitat
- E** Conservation Easement Matrices and Maps
- F** Grazing White Paper

## APPENDIX A: COGCC 1200 Series Regulations

### PROTECTION OF WILDLIFE RESOURCES

#### 1201. IDENTIFICATION OF WILDLIFE SPECIES AND HABITATS

Prior to the preparation of a Comprehensive Drilling Plan or the submittal of a Form 2A for a proposed new oil and gas location, an operator shall review the Sensitive Wildlife Habitat map and the Restricted Surface Occupancy map maintained by the Commission on its website and attached as Appendices VII and VIII to determine whether the proposed oil and gas location falls within Sensitive Wildlife Habitat or a Restricted Surface Occupancy area. The operator shall include this determination in the Form 2A or Comprehensive Drilling Plan.

#### 1202. CONSULTATION

- a. The purpose of consultation under Rule 306.c is to allow the Director to determine whether conditions of approval are necessary to minimize adverse impacts from the proposed oil and gas operations in the identified sensitive wildlife habitat or restricted surface occupancy area, in an order increasing well density, or in a basin-wide order involving wildlife resource issues and to evaluate requests for variances from the provisions of the 1200-Series Rules. For purposes of this rule, minimize adverse impacts shall mean wherever reasonably practicable, to (i) avoid adverse impacts from oil and gas operations on wildlife resources, (ii) minimize the extent and severity of those impacts that cannot be avoided, (iii) mitigate the effects of unavoidable remaining impacts, and (iv) take into consideration cost-effectiveness and technical feasibility with regard to actions taken and decisions made to minimize adverse impacts to wildlife resources, consistent with the other provisions of the Act.
- b. Unless excepted as set forth in Rule 1202.d, when a proposed new oil and gas location is located in sensitive wildlife habitat or a restricted surface occupancy area, the Colorado Division of Wildlife shall consult with the operator, the surface owner, and the Director in accordance with Rule 306.c prior to approval of a Form 2A to identify possible conditions of approval.
- c. Any conditions of approval resulting from such consultation shall be guided by the list of Best Management Practices for Wildlife Resources maintained on the Commission website. In selecting conditions of approval from such Best Management Practices or other sources, the Director shall consider the following factors, among other considerations:
  - (1) The Best Management Practices for the producing geologic basin in which the oil and gas location is situated;
  - (2) Site-specific and species-specific factors of the proposed new oil and gas location;
  - (3) Anticipated direct and indirect effects of the proposed oil and gas location on wildlife resources;
  - (4) The extent to which conditions of approval will promote the use of existing facilities and reduction of new surface disturbance;
  - (5) The extent to which legally accessible, technologically feasible, and economically practicable alternative sites exist for the proposed new oil and gas location;
  - (6) The extent to which the proposed oil and gas operations will use technology and practices which are protective of the environment and wildlife resources;
  - (7) The extent to which the proposed oil and gas location minimizes surface disturbance and habitat fragmentation;

- (8) The extent to which the proposed oil and gas location is within land used for residential, industrial, commercial, agricultural, or other purposes, and the existing disturbance associated with such use; and
- (9) Permit conditions, lease terms, and surface use agreements that predate December 11, 2008.

d. Consultation under Rule 306.c shall not be required if:

- (1) The Director or Commission has previously approved a Form 2A or Comprehensive Drilling Plan which includes the proposed new oil and gas location;
- (2) The Colorado Division of Wildlife has previously approved, in writing, a wildlife mitigation plan or other wildlife protection or conservation plan that remains in effect for the area that includes the proposed new oil and gas location and the oil and gas location is in compliance with such plan;
- (3) The operator demonstrates that the identified habitat and/or species, where applicable, is not in fact present to support the identified species and use, such as where the proposed oil and gas location is located in a high density area, designated pursuant to Rule 603.b, or within an incorporated homeowners association or city or town limits;
- (4) The proposed new well would involve a one-time increase in surface disturbance of one (1) acre or less per well site at or immediately adjacent to an existing well site;
- (5) The operator applies for and obtains a Commission order pursuant to Rule 503 providing that there will not be more than three (3) well sites per section, with ground disturbing activity during the period from January 1 to March 31 (or other biologically appropriate alternative period up to ninety (90) consecutive days as determined by the Director for bighorn sheep winter range, elk production areas, bald or golden eagle nest or roost sites, columbian or plains sharp-tailed grouse production areas, greater or Gunnison sage grouse production areas, black-footed ferret release areas, or lesser prairie chicken production areas) limited to one (1) such well site, as determined by the Director. This exemption from consultation shall not apply to operations in occupied greater sage grouse sensitive wildlife habitat in Moffat, Routt, or Jackson Counties or in occupied Gunnison sage grouse sensitive wildlife habitat in Delta, Mesa, Gunnison, San Miguel, Dolores, or Montezuma Counties;
- (6) The Director grants a variance pursuant to Rule 502.b; or
- (7) The Colorado Division of Wildlife waives the consultation requirement.

e. No permit-specific condition of approval for wildlife habitat protection under this rule shall be imposed without surface owner consent, including any permit-specific conditions for wildlife habitat protection that modify, add to, or differ materially from the general operating requirements in Rules 1203 and 1204. If the surface owner fails to consent to any such permit-specific condition of approval, then the parties shall consult with the surface owner regarding alternative conditions of approval acceptable to the surface owner.

### **1203. GENERAL OPERATING REQUIREMENTS IN SENSITIVE WILDLIFE HABITAT AND RESTRICTED SURFACE OCCUPANCY AREAS**

a. **General Operating Requirements.** Within sensitive wildlife habitat and restricted surface occupancy areas, operators shall comply with the operating requirements listed below.

- (1) During pipeline construction for trenches that are left open for more than five (5) days and are greater than five (5) feet in width, install wildlife crossovers and escape ramps where the trench crosses well-defined game trails and at a minimum of one quarter (1/4) mile intervals where the trench parallels well-defined game trails.
  - (2) Inform and educate employees and contractors on wildlife conservation practices, including no harassment or feeding of wildlife.
  - (3) Consolidate new facilities to minimize impact to wildlife.
  - (4) Minimize rig mobilization and demobilization where practicable by completing or re-completing all wells from a given well pad before moving rigs to a new location.
  - (5) To the extent practicable, share and consolidate new corridors for pipeline rights-of-way and roads to minimize surface disturbance.
  - (6) Engineer new pipelines to reduce field fitting and reduce excessive right-of-way widths and reclamation.
  - (7) Use boring instead of trenching across perennial streams considered critical fish habitat.
  - (8) Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitoes with Bti (*Bacillus thuringiensis v. israelensis*) or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
  - (9) Use wildlife appropriate seed mixes wherever allowed by surface owners and regulatory agencies.
  - (10) Mow or brushhog vegetation where appropriate, leaving root structure intact, instead of scraping the surface, where allowed by the surface owner.
  - (11) Limit access to oil and gas access roads where approved by surface owners, surface managing agencies, or local government, as appropriate.
  - (12) Post speed limits and caution signs to the extent allowed by surface owners, Federal and state regulations, local government, and land use policies, as appropriate.
  - (13) Use wildlife-appropriate fencing where acceptable to the surface owner.
  - (14) Use topographic features and vegetative screening to create seclusion areas, where acceptable to the surface owner.
  - (15) Use remote monitoring of well production to the extent practicable.
  - (16) Reduce traffic associated with transporting drilling water and produced liquids through the use of pipelines, large tanks, or other measures where technically feasible and economically practicable.
- b. **Exceptions.** If the operator believes that any of the foregoing operating requirements should be waived for any proposed oil and gas location, it shall so specify in a Form 2A for Director consideration.



## 1204. OTHER GENERAL OPERATING REQUIREMENTS

- a. The operating requirements identified below shall apply in all areas.
- (1) In black bear habitat west of Interstate 25 and on Raton Mesa east of Interstate 25, operators shall install and utilize bear-proof dumpsters and trash receptacles for food-related trash at all facilities that generate such trash.
  - (2) In designated Cutthroat Trout habitat, as identified on the Colorado Division of Wildlife Species Activity Mapping (SAM) system, operators shall disinfect water suction hoses and water transportation tanks withdrawing from or discharging into surface waters (other than contained pits) used previously in another river, lake, pond, or wetland and discard rinse water in an approved disposal facility. Disinfection practices shall be repeated after completing work or before moving to the next water body. Disinfection may be performed by removing mud and debris and then implementing one of the following practices:
    - A. Spray/soak equipment with a disinfectant solution capable of killing whirling disease spores; or
    - B. Spray/soak equipment with water greater than 140 degrees Fahrenheit for at least 10 minutes.
  - (3) To minimize adverse impacts to wildlife resources, plan new transportation networks and new oil and gas facilities to minimize surface disturbance and the number and length of oil and gas roads and utilize common roads, rights of way, and access points to the extent practicable, consistent with these rules, an operator's operational requirements, and any requirements imposed by federal and state land management agencies, local government regulations, and surface use agreements and other surface owner requirements, and taking into account cost effectiveness and technical feasibility.
  - (4) Establish new staging, refueling, and chemical storage areas outside of riparian zones and floodplains.
  - (5) Use minimum practical construction widths for new rights-of-way where pipelines cross riparian areas, streams, and critical habitats.
- b. **Exceptions.** If the operator believes that any of the foregoing operating requirements should be waived for any proposed oil and gas location, it shall so specify in a Form 2A for Director consideration.

## 1205. REQUIREMENTS IN RESTRICTED SURFACE OCCUPANCY AREAS

- a. Operators shall avoid Restricted Surface Occupancy areas to the maximum extent technically and economically feasible when planning and conducting new oil and gas development operations, except:
- (1) When authorized following consultation under Rule 306.c.(3);
  - (2) When authorized by a Comprehensive Drilling Plan;
  - (3) Upon demonstration that the identified habitat is not in fact present;
  - (4) When specifically exempted by the Colorado Division of Wildlife; or
  - (5) In the event of situations posing a risk to public health, safety, welfare, or the environment.

- b. As set forth in Rule 1205.a, new ground disturbing activities are to be avoided in Restricted Surface Occupancy areas, including construction, drilling and completion, non-emergency workovers, and pipeline installation activity, to minimize adverse impacts to wildlife resources. Production, routine maintenance, repairs and replacements, emergency operations, reclamation activities, or habitat improvements are not prohibited in Restricted Surface Occupancy areas. Notwithstanding the foregoing, non-emergency workovers, including uphole recompletions, may be performed with prior approval of the Director on a schedule that minimizes adverse impacts to the species for which the restricted surface occupancy area exists.
  
- c. **Applicability.** The requirements of Rule 1205 are not applicable to Applications for Permit-to-Drill, Form 2, or Oil and Gas Location Assessments, Form 2A, which are approved prior to May 1, 2009 on federal land or April 1, 2009 on all other land. The requirements of Rule 1205 are also not applicable until January 1, 2010, for any proposed oil and gas location in a Restricted Surface Occupancy area where the operator has in good faith initiated and is diligently pursuing consultation on the proposed oil and gas location begun prior to May 1, 2009 on federal land or April 1, 2009 on all other land, pursuant to Rule 306.c or Rule 216.

## Appendix B

### **Analysis of Oil and Gas Permitting in Greater Sage Grouse Habitat**

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## **1.0 INTRODUCTION**

The passage of Colorado State House Bill (HB) 07-1298 requires consultation with the Colorado Department of Parks and Wildlife (CPW) for activities conducted within sensitive wildlife habitat (SWH) and restricted surface occupancy (RSO) areas. Greater sage grouse (GrSG) is one species CPW designated as having SWH and RSO areas. The GrSG is currently being proposed for listing under the Endangered Species Act by the U.S. Fish and Wildlife Service (USFWS).

In response to the proposed listing, Colorado Department of Natural Resources (DNR) provided the USFWS a report detailing the actions Colorado has implemented to minimize disturbances in GrSG habitat. The USFWS responded to DNR's report requesting additional data demonstrating, among other items, whether the implementation of HB 07-1298 has resulted in effective conservation of GrSG habitat and whether there are opportunities for improved implementation.

Tetra Tech, Inc. (Tetra Tech) was contracted by DNR to conduct an analysis of oil and gas permitting in GrSG habitat in an effort to provide the USFWS data documenting the implementation of HB 07-1298 by oil and gas operators. This document provides the results of Tetra Tech's analysis of oil and gas operations in GrSG habitat.

## 2.0 METHODOLOGY

The following discussion details the steps taken and assumptions made to obtain the quantifiable data requested by DNR (the Project). The Project is broken down into the following four phases:

1. Data collection from the Colorado Oil and Gas Conservation Commission (COGCC) website
2. Operator input
3. CPW and COGCC consultations
4. Identification of best management practice (BMPs) outside of permit approvals or wildlife mitigation plans

Each phase is described below.

### 2.1 Data collection from the COGCC Website

Oil and gas permit- related data was obtained from the COGCC website ([www.cogcc.com](http://www.cogcc.com)). The data was obtained following the steps below.

1. Retrieval of geographic information system (GIS) well permit data, as well as the GrSG data layer from the website
2. Use of a GIS Intersect tool, reduce the number of permits to those located in GrSG habitat
3. Reduction of the number of permits to those implemented since passage of HB 07-1298

The initial evaluation of permitted wells in GrSG habitat totaled 3,183 wells, some of which pre-dated passage of HB 07-1298. To reduce the number of wells for detailed analysis, a sample was selected of up to 100 individual drill site locations, differentiating between sites managed by large operators and sites managed by small operators. A large operator is defined as a well-established oil and gas company. The small operator is defined as a lesser known oil and gas company. Considering both large and small operators helps to determine the extent to which small operators are engaged in GrSG habitat protection and may indicate a need for additional outreach or other action on the part of, for example, the COGCC or the Colorado Oil and Gas Association (COGA). This analysis relied on documents available through hyperlinks on the COGCC website associated with individual permits. Available documents are Form 2, Form 2A, and associated documents that provide general discussion of BMPs.

The final dataset was entered into a spreadsheet (Appendix A) that identifies the following information:

- Permitted well locations by county
- Surface and mineral rights ownership (listed as fee, state, federal, or Native American)
- Whether permitted wells are located within GrSG SWH versus RSO areas
- BMPs listed in Form 2, Form 2A, or associated documents
- Acreages assigned to wells, when provided on Form 2 or Form 2A

## **2.2 Operator Input**

The publicly- available data from the COGCC website was limited to voluntary BMPs and subsequent concurrence letters from CPW. Tetra Tech, therefore, contacted targeted operators in GrSG habitat, based on the sample described above, to verify BMPs and to obtain additional information regarding minimization and/or avoidance actions that were implemented but which do not appear in the publicly-available documents.

Tetra Tech targeted a subset of operators using the list and specific contact information resulting from the data collection. Tetra Tech also contacted several COGA member operators who are aware of this project, have agreed to assist with data gathering, and have operations in GrSG habitat. To preserve anonymity among the operators, Tetra Tech identifies the operators numerically in this report and spreadsheet.

Tetra Tech conducted outreach with individual operators by phone and email. To increase the response rate, Tetra Tech provided text for an email to be issued by COGA to individual operator contacts announcing the outreach effort and indicating that Tetra Tech would follow up by phone. Tetra Tech assumed a single email and up to two phone contacts with individual operators.

Tetra Tech requested the following information from operators:

- Specific avoidance actions in response to GrSG habitat, including locations and acreages
- Specific minimization actions in response to GrSG habitat, including locations, acreages, and actions
- Specific mitigation actions in response to GrSG habitat, including locations, acreages, and actions

Tetra Tech predicted that responses would describe actions, such as well pad development (with approximate dimensions) that were relocated to avoid GrSG habitat, use of specialized equipment, or minimization of road development (with approximate dimensions).

## **2.3 CPW and COGCC Consultations**

Tetra Tech conducted outreach to CPW and COGCC to supplement the information provided from the COGCC website and to identify additional measures that were not included in the available information. The Energy Liaison with CPW was consulted to identify operator specific agreements that would affect the operator's avoidance, minimization, or mitigation in GrSG habitat. Tetra Tech consulted with the Permitting Supervisor and the Oil and Gas Location Assessment Supervisor with COGCC was consulted to identify the consultation process and to determine if COGCC had conducted field evaluations of agreed wildlife BMPs.

## **2.4 BMPs Outside of Permit Approvals or Wildlife Mitigation Plans**

In some instances, BMPs or other commitments resulted directly from negotiations with landowners. That information was indicated on Form 2, Form 2A, surface agreement documents, or correspondence documents available on the COGCC website. The specific BMPs and commitments, however, either were not specified or required follow-up with individual

operators. Tetra Tech contacted individual operators, as well as CPW to obtain this information; to the extent it was available.



## **3.0 RESULTS**

### **3.1 Data Collection from the COGCC Website**

A review of publically- available data from COGCC's website was conducted from October 21 through October 26, 2013. The data, finalized on October 26, 2013, is the basis for the evaluation and review of the well permits. It was necessary to create a data collection end point for this analysis since the COGCC website is updated daily. The dataset for this exercise was limited to wells permitted since implementation of HB 07-1298 within GrSG habitat (Project area). GrSG habitat is defined by the CPW as a combination of SWH and RSO datasets. The wells were identified by county, operator, land ownership, mineral ownership, and location of well within an RSO or SWH.

#### **3.1.1 Wells by County**

The mapped GrSG areas cover a total of eight counties (Eagle, Garfield, Grand, Jackson, Moffat, Rio Blanco, Routt, and Summit) (Figure 1, Appendix B). The following five counties are represented in the spreadsheet: Garfield, Jackson, Moffat, Rio Blanco, and Routt (Appendix A). Eagle and Summit counties did not have permitted wells within the GrSG habitat boundaries. In Grand County, permitted wells were identified, but were permitted prior to passage of HB 07-1298. The Grand County wells, therefore, were eliminated from further evaluation. Operators provided supplemental data for analysis in four of the five counties. The operators with permitted wells in Jackson County did not participate in this analysis. The wells were identified by land ownership, mineral ownership, and location of the well within an RSO or SWH.

#### **3.1.2 Wells by Operator**

Review of the COGCC website database identified 30 operators that have at least one well permitted in the Project area. Five of these operators were eliminated from the analysis because they did not specifically address GrSG or GrSG habitat in the COGCC website database. The 25 remaining operators were divided into large operators versus small operators. Nine large operators were identified as having at least one permitted well in GrSG habitat in the Project area. All nine of these operators are represented in the spreadsheet. A total of 16 small operators were identified as having at least one permitted well in GrSG habitat in the Project area. Of these, two small operators applied for permits on behalf of one of the large operators and, therefore, were removed from additional analysis to avoid duplication. Of the remaining 14 operators, 11 were selected at random for additional analysis. The total sample size of large and small operators represented in the spreadsheet is 20 operators (9 large and 11 small).

The 20 operators represent a total of 293 permitted wells in GrSG habitat. The permitted wells evaluated for this analysis exceeded the anticipated number of wells (100) by 293 percent. The 293 permitted wells are 28 percent of the potential 1,039 permitted wells in GrSG habitat since the passage of HB 07-1298. Figure 1 in Appendix B shows the permitted well locations by county and GrSG habitat type. Of the 293 permitted wells evaluated, 227 permitted wells (77 percent) had quantifiable data provided to the COGCC by the operators. Figure 2 in Appendix B shows the permitted wells together with operator- provided data. The lack of quantifiable data for the other wells likely is due to the grouping of large numbers of permits under one Wildlife Mitigation Agreement (WMA), or by the grouping of several wells under one set of BMPs.

#### **3.1.3 Wells by Land and Mineral Ownership**

The surface and mineral rights for the permitted wells are either private (fee) or federal. None of the permitted wells identified had state or tribal surface or mineral rights. Private surface rights constituted 89 percent of the total evaluated. The remaining 11 percent were federal surface rights. Private mineral rights constituted 84 percent of the total evaluated. The remaining 16 percent were federal mineral rights.

### 3.1.4 Wells in GrSG SWH versus RSO areas

The analysis includes 279 permitted wells (95 percent) in SWH areas. A total of 14 permitted wells (less than 5 percent) are located in RSO areas.

## 3.2 Operator Input

To meet Project timelines, initial contact with operators was conducted by phone on November 21-22, 2013. Additional contact by phone was conducted on December 2-3, 2013, with follow-up emails sent December 3-4, 2013. Tetra Tech continued to contact operators at least once a week for those operators who did not respond to the initial email or phone requests. In addition, COGA issued an email to its members on December 14, 2013 requesting their participation in the Project. Tetra Tech participated in two COGA Wildlife Subcommittee conference calls with COGA members during which members were introduced to the Project and were requested to participate with data.

Nine operators did not respond to outreach conducted for the Project. Three operators declined to participate in the Project (Table 1). The operators are listed in Table 1. Explanations for nonresponses included the following:

- Company restructuring prevented the allocation of time required to respond
- Company chose, instead, to focus efforts on national GrSG actions
- Company agreed to participate, but did not provide data

The remaining eight operators, of the 20-operators sample, provided data. Of these, however, one operator sold all but one company asset located in GrSG habitat. The company's remaining asset is active but no quantifiable actions have been implemented. A second operator has permitted wells but no quantifiable data for the wells. A total of five operators (four large and one small operator), therefore, provided quantifiable data for this analysis. Details for the operator data are provided in Section 4.0, Data Analysis.

**Table 1. Operator Size and Participation**

Operator	Operator Size	Participation
1	Large	Yes
2	Large	Yes
3	Large	No Response
4	Large	Declined
5	Large	No Response
6	Large	Yes
7	Large	Yes
8	Large	Yes
9	Large	Yes

Operator	Operator Size	Participation
10	Small	Declined*
11	Small	Declined*
12	Small	No Response
13	Small	Yes
14	Small	No Response
15	Small	No Response
16	Small	Yes
17	Small	No Response
18	Small	No Response
19	Small	No Response
20	Small	No Response

\* The operator expressed interest, set timelines to provide data, but no data was received.

### 3.3 CPW and COGCC Consultations

#### 3.3.1 CPW Consultation

The CPW is consulted when the COGCC identifies a well location within a SWH or RSO. During the consultation, the operator may provide a list of BMPs for CPW review, or CPW may recommend BMPs. Some operators have separately developed WMPs that address wildlife issues in instances when the operator plans to develop a large number of well locations. CPW reviews the operator BMPs or WMP and either concurs with them or provides comments. Once CPW concurs with BMPs or a WMP, CPW provides a concurrence letter, email, or verbal concurrence to COGCC to facilitate permit approval. For the purposes of this review, BMPs listed on Form 2A are assumed to be implemented.

Initial contact with CPW was initiated on November 26, 2013 with follow up on December 2, 2013. The CPW offered to provide records of communication resulting from the consultation process with individual operators. Tetra Tech followed up with CPW on December 12, 2013 and December 19, 2013. CPW provided the communication logs for operator consultations in GrSG RSO areas on January 3, 2014 with GrSG SWH areas arriving February 18, 2014. The data consisted of 51 consultations covering 51 well pad locations with 17 different operators. All 17 operators were targeted by Tetra Tech for input. A comparison of the communication logs requesting specific BMPs by CPW with the approved BMPs found on Form 2A obtained from the COGCC website was conducted by Tetra Tech. Table 2 confirms operators agreed to BMPs recommended by CPW a majority of the time (97 percent). The most frequently requested BMPs related to seasonal restrictions, reclamation, and reducing vehicle speeds in greater sage habitat. Operators consented to these BMPs 98 percent of the time. Table 2 provides details of the comparison. In instances where the operator declined to commit to the recommended BMP, the communication log provided by CPW identified the following reasons:

- Operator was unable to move the well pad location but agreed to limit activities outside active lekking period.
- Operator is entering into a Wildlife Mitigation Agreement with the surface owner that will contain GrSG protection measures. Operator agreed to limit activities on an existing well to outside the active lekking period.
- The landowner did not want to initiate consultation with CPW.

**Table 2. CPW Consultation Analysis**

<b>CPW Recommended Best Management Practice</b>	<b>Total Requested</b>	<b>Total Accepted</b>	<b>Percentage Accepted</b>
Conduct well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the lekking season (March 1 to May 15).	50	49	98%
Reclaim/restore greater sage-grouse habitats with native grasses, forbs, and shrubs conducive to optimal greater sage-grouse habitat and other wildlife appropriate to the ecological site.	48	47	98%
Use certified, weed free grass hay, straw, hay or other mulch material used for the reseeded and reclamation of disturbed areas.	11	9	82%
Use only certified weed-free native seed mixes, unless use of non-native plant materials is recommended by CPW	28	27	96%
Use local seed when available	15	15	100%
Avoid aggressive non-native grasses in greater sage grouse reclamation	5	5	100%
Lek avoidance is from March 1 through May 15 for major activities	31	29	94%
4-mile buffer for GrSG March 1-June 30 (4-months)	15	13	87%
reducing visits to pads through the SCADA system	17	17	100%
25 mph limit for all roads/ reduce speeds to minimize wildlife mortality	50	49	98%
No surface occupancy within 0.6 mile of any known lek	34	32	94%
Phase and concentrate all development activities so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites.	14	14	100%
Use centralized hydraulic fracturing operations	14	14	100%
Transport water through centralized pipelines in lieu of water trucks	16	16	100%
Maximize use of state-of-the-art drilling operations technology	14	14	100%
Minimize surface disturbance and fragmentation of greater sage grouse habitat	16	16	100%
Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows, and ravens.	36	35	97%
Provide access to CPW research personnel for ongoing sage grouse population research	18	18	100%
Site new disturbance so as to use topographic features to shield leks from new disturbance when feasible.	19	19	100%
Schedule pipeline construction and installation (not including lines along roads) outside of the Critical Habitat Season.	18	18	100%
Restrict new disturbance within nesting and brood-rearing habitat as much as possible from April 15 to July 1.	18	18	100%
Use solar panels for on-location production, where feasible.	18	18	100%
Operator agrees to use hospital grade mufflers for compressors, pump jacks, or other motors necessary to run operations.	14	14	100%
Operator will implement a weed management plan as part of mitigation	4	4	100%
Close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.	3	2	67%
Car pool to minimize commuting	6	6	100%
Implement fugitive dust control measures	6	6	100%
Combine utility infrastructure alongside access roads to avoid the use of separate utility corridors.	1	1	100%
<b>Total</b>	<b>539</b>	<b>525</b>	<b>97%</b>

### **3.3.2 COGCC Consultation**

Initial contact with COGCC staff was initiated on November 25, 2013. On December 4, 2013, Tetra Tech and COGCC discussed the permitting process and the role of COGCC in well permitting. COGCC is the agency that reviews and permits wells and well locations. A Form 2A is required for each new well location. Since the implementation of HB 07-1298 on April 1, 2009 a review of CPW's SWH and RSO areas have been required. If the proposed new well location is identified in either a SWA or RSO, then a consultation with CPW is required. Consultation between CPW and the operator is conducted through COGCC.

### **3.3.3 BMPs Outside of Permit Approvals or Wildlife Mitigation Plans**

Each operator that provided data was contacted to identify measures they may have implemented that was not included in the COGCC website. No operator could recall a measure conducted outside of the permitting process that affected GrSG or GrSG habitat. One operator, through discussions with the landowner was able to obtain access for CPW to conduct GrSG population surveys.

## **4.0 DATA ANALYSIS**

Section 3.0, above, described the results of research conducted through the COGCC database and directly with operators and agencies. This section provides an analysis of the data obtained from the COGCC database, operators, and agencies. The analysis is based on quantifiable avoidance, minimization, and mitigation measures. A table with data collected by operator is provided in Appendix A.

### **4.1 Avoidance Data**

The BMPs identified in Appendix B list actions that constitute avoidance of GrSG habitat. Actions that operators have implemented but are not quantifiable include:

- Verbal agreements between CPW and the operator to move well pad locations outside of GrSG SWH and/or RSO areas
- Re-aligning roads outside of GrSG habitat
- Increasing the spacing between well pads

Several operators are developing multiple wells from a single well pad using directional drilling. This practice benefits both the operator and GrSG habitat. There are economic benefits to the operator to reduce the number of well pads which also benefits wildlife habitat by disturbing less acreage. Table 3 provides an analysis of the benefits of directional drilling on GrSG habitat. The acreage calculations are based on a worst case scenario in which each permitted well requires a well pad. The average well pad size is operator and terrain specific. Access roads (when provided by the operator) also are included in this table to demonstrate another avoidance measure resulting from the use of directional drilling.

**Table 3. Acres of Avoidance by Operator**

Operator	Operator Size	Wells	Potential Well Pads	Avg. Well Pad Size	Potential Acreage of Disturbance	Actual Well Pads	Actual Wells per Pad	Well Pad Acreage Total	Road size <sup>1</sup> per Well Pad	Potential Road Disturbance per Well	Actual Road Disturbance	Total Acres of Avoidance
1	Large	77	77	4.98	383.50	22	3.50	109.60	1.56	120.12	34.32	359.70
2	Large	294	294	4.00	1176.00	14	21	56.00	1.44	423.36	20.16	1523.20
6	Large	40	40	9.00	360.00	4	10.00	36.00	-	-	-	324.00
7	Large	78	77	4.00	308.00	7	11.14	44.00	0.06	4.68	0.66	268.02
9	Large	6	5	3.80	19.00	4 <sup>2</sup>	1.20	15.20	-	-	-	3.80 <sup>2</sup>
13	Small	26	26	5.19	134.94	10	2.60	51.90	0.22	5.72	2.18	86.58
<b>Totals</b>	-	<b>521</b>	<b>519</b>	<b>30.97</b>	<b>2,381.44</b>	<b>57</b>	<b>49.44</b>	<b>366.70</b>	<b>3.28</b>	<b>553.88</b>	<b>57.32</b>	<b>2,565.30</b>

<sup>1</sup> Road size is calculated by multiplying the road width (30ft.) by the average length of the access road to the well pad.

<sup>2</sup> One well pad was moved out of GrSG habitat after CPW consultation.

## 4.2 Minimization Data

Several actions described in operator BMPs minimize activities in GrSG habitat. One operator, for example, after coordination with CPW, moved a well pad from a GrSG RSO area to an SWH area. This relocation effort avoided approximately 4 acres of disturbance to a known GrSG lek (a.k.a., an RSO) but is considered minimization, rather than avoidance, because the well pad continues to be located in GrSG habitat. Other actions identified in operator BMPs to minimize activities in GrSG habitat include the following:

**Routing pipelines and roads in previously disturbed areas** – Operators confirmed that when feasible, construction of roads and pipelines would be placed in already disturbed areas. These areas consisted of existing roads or pipelines. Data to calculate the use of existing pipeline and road ROW was not available for this analysis.

**Reducing the widths of roads and pipeline ROWs** – Operators on average use between a 25 and 30 foot ROW for road construction. CPW confirmed that road and pipeline ROWs on federal lands are restricted to the agencies regulations. On private lands, road and/or pipeline construction can vary depending topography as well as landowner agreements. A potential method for calculating road and pipeline widths would take the ROW widths required on federal lands versus the constructed ROW widths on private lands. Data to calculate the width reduction of pipeline and road ROW's was not available for this analysis.

**Implementing fugitive dust control measures** – Operators typically use water trucks to suppress fugitive dust during construction activities.

**Using a remote monitoring system to reduce the frequency for operator visits to each well pad** – Operators use the supervisory control and data acquisition (SCADA) system to limit the number of visits to each well pad. This reduced frequency limits the potential for wildlife mortality, dust emissions, and noise disturbances in GrSG habitat.

**Early reclamation of disturbance areas** – Operators agreed to implement interim reclamation upon completion of well pads. This action reduces the GrSG habitat recovery time.

**Requiring reduced speeds to reduce wildlife mortality** – Operators agreed to implement a speed reduction in GrSG habitat. Operators include, during safety training, a section on wildlife and require drivers to reduce their vehicle speed to limit the potential for wildlife mortality.

**Conducting site visits outside of GrSG brood rearing periods** – Operators agreed to conduct site visits outside of GrSG brood rearing periods, when applicable and unavoidable.

**Installing noise reduction equipment for compressors, pump jacks, and other motors** – When applicable, operators have agreed to install hospital grade mufflers to aid noise and vibration reduction. Hospital grade mufflers can be expected to reduce noise level from 35 to 42 dBAs.

## 4.3 Mitigation Data

Each operator in this analysis agreed to provide mitigation through approved BMPs for areas disturbed during well pad development. Types of mitigation that were identified include the following:



- Reclaiming or restoring GrSG habitat with grasses, forbs, and shrubs optimal for GrSG habitat
- Enacting weed control measures
- Installing wildlife netting over reserve/completion pits

Quantifiable data used for calculating acreages of mitigation included the implementation of interim reclamation during well pad construction and reclamation of roads. Construction of well pads requires the disturbance of an area greater than the area needed for well pad operations. Operators reclaim the temporary construction area after the well pad is operational. In addition, one operator reclaimed one access road. The operator reclaimed an alternate access road that was no longer needed for the well pad. Table 4 identifies the acreage of mitigation by operator for the well pad reclamation and road reclamation that has been implemented.

#### **4.4 Acreage Data**

A review of the data provided on the COGCC website identified approximately 2.5 million acres of GrSG habitat in Colorado. The habitat is located on private, state, and federal lands. The oil and gas industry owns or leases approximately 109,000 acres of land considered GrSG habitat or four percent of the total GrSG habitat. The land ownership for oil and gas industry occupies approximately 51,200 acres of federal land and 58,000 acres of private or other lands. Table 5 lists operator provided data including disturbance acreages.

The table represents 588 of the 1,039 (57 percent) of the wells permitted since the implementation of HB 07-1298. The 588 wells were located on 57 well pads with a total disturbance of 339 acres (well pad plus access road). Further analysis of the disturbance calculations could not be determined for this, but, based on the currently available data, the disturbance acreages of greater sage grouse habitat by oil and gas operators would likely be less than one percent of the total GrSG habitat in Colorado. This estimate is based on calculating the available data provided by the operators representing 57 percent of the total data. With 57 percent of the oil and gas leased or owned land (62,130 acres) being the total potential land disturbed by oil and gas development and 339 acres of land disturbed by well pad construction and associated road development. The total percent disturbed land within the oil and gas leased or owned would be less than 0.5 percent. The calculation is only an estimate as other land disturbing activities that may occur (ex. Pipeline development) are not taken into account.

**Table 4. Acres of Mitigation by Operator**

Operator	Operator Size	Total Well Pads	Number of Wells Pads with Interim Reclamation	Total Well Pad Disturbance (acres)	Total Reclamation (acres)	Total Road Disturbance (acres)	Reclaimed Road Disturbance (acres)	Total Mitigation (acres)
1	Large	23	23	114.54	59.57	-	-	54.97
2	Large	14	14	56	18.2	-	-	37.8
6	Large	4	4	40.40	15.00	-	-	25.40
7	Large	7	4	28.00 <sup>1</sup>	8.00 <sup>2</sup>	-	-	8.00 <sup>2</sup>
9	Large	4	4	24.37	5.00	-	-	19.37
13	Small	10	10	55.30	43.20	3.28	1.94	14.04
<b>Totals</b>	-	<b>48</b>	<b>45</b>	<b>234.61</b>	<b>122.77</b>	<b>3.28</b>	<b>1.94</b>	<b>151.58</b>

<sup>1</sup> Calculation based on 7 well pads. 3 well pads did not have reclamation at the time of analysis.

<sup>2</sup> Calculation based on approximate interim reclamation of 2 acres per well pad.

**Table 5. Disturbance Acres by Operator**

Operator	Average Well Pad Size (acres)	Actual Well Pads	Well Pad Acreage Total	Actual road Disturbance (acreage)	Well Pad Acreage Post Interim Reclamation	Total Disturbance	Total Disturbance Post Interim Reclamation
1	4.98	22	109.56	34.32	54.97	143.88	88.91
2	4	14	56	5.53	37.8	61.53	23.73
6	9	4	36	-	25.4	36	10.6
7	4	7	28	0.66	8	28.66	20.66
9	3.8	4	15.2	-	5	15.2	10.2
13	5.19	10	51.9	2.18	14.04	54.08	40.04
<b>Totals</b>	<b>5.16</b>	<b>57</b>	<b>296.66</b>	<b>42.69</b>	<b>145.21</b>	<b>339.35</b>	<b>194.14</b>

## **5.0 CONCLUSION AND RECOMMENDATIONS**

### Data Availability

The analysis conducted for this Project was based on available data from the COGCC website database, and communication with individual operators, CPW, and COGCC. The COGCC website database provided the foundation for the analysis. The data reviewed from the website included BMPs and surface ownership agreements. The BMP information was found in several locations, including attachments to forms 2 and 2A, links to correspondence, and links to BMPs. At times, agreements from consultation with CPW were noted on Form 2A, but the contents of the agreements were not attached to Form 2A. The information, therefore, was gathered, when available, through contact with the operator and CPW.

### Operator Responsiveness

Of the 20 operators contacted, nine provided responses. Eight of these operators provided data. The level of participation varied depending on the staff resources within the company and the data each operator either tracked or to which they had access. Each operator interviewed stated that the BMPs listed on Form 2A were treated as a regulatory requirement, rather than a voluntary action. Providing quantifiable data regarding implementation of the BMPs proved to be challenging. The operators that provided data did not have a tracking system in place to ensure that BMPs were implemented. The data, instead, was obtained through internal coordination within each operator's company.

### Patterns of Development

Development of oil and gas operations in GrSG habitat since implementation of HB 07-1298 has shown evidence of operator involvement to reduce impacts in GrSG habitat. Through consultation with CPW, operators have implemented BMPs that are beneficial to GrSG habitat. For quantifiable BMPs, however, operators communicated that they did not track measurable data.

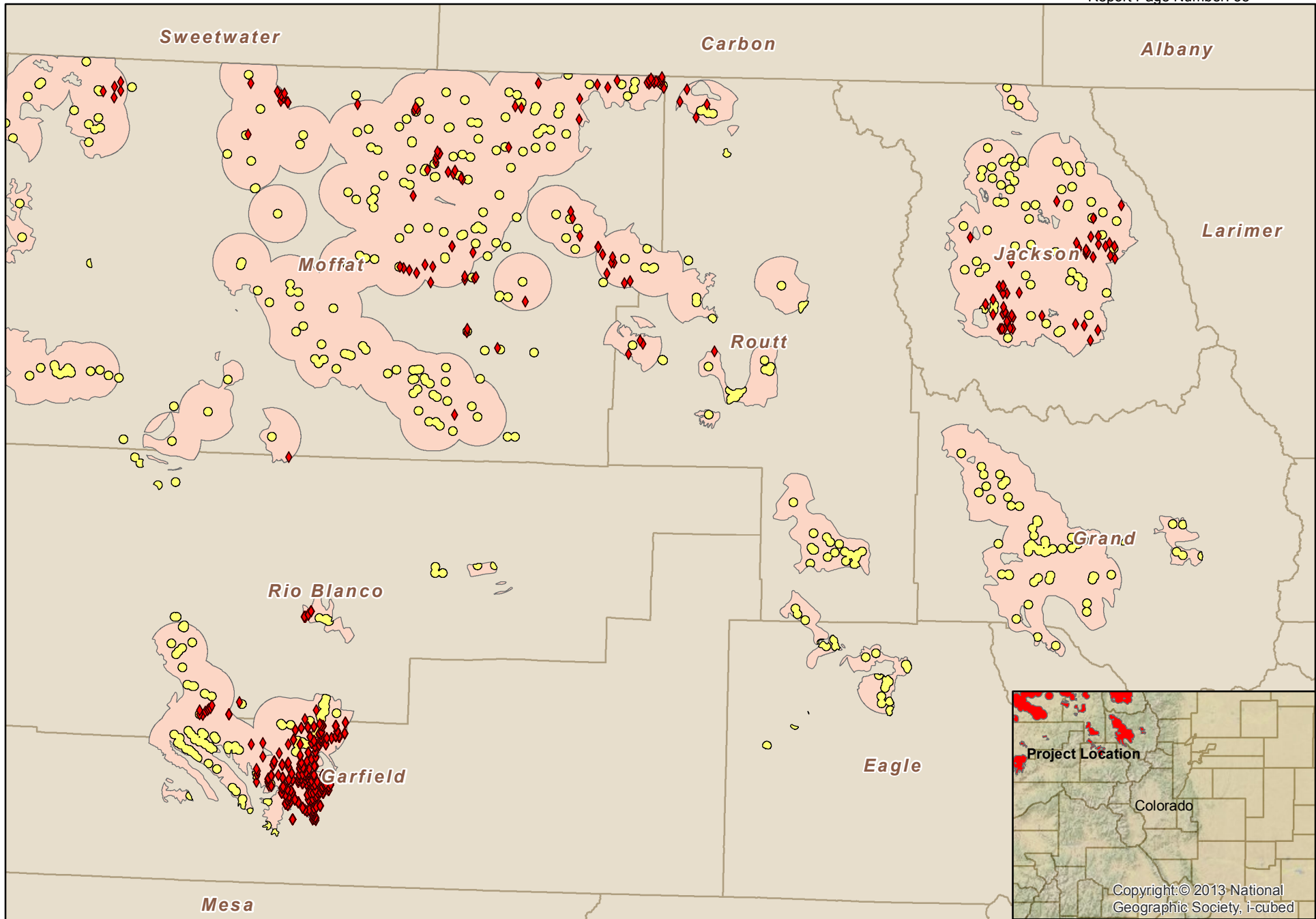
Two of the large operators discussed future well pad placement and the number of wells per well pad as mechanisms for reducing disturbances in, not only GrSG habitat, but all wildlife SWHs and RSOs in Colorado. These operators have been working with CPW to produce a well pad development plan to limit future disturbances in wildlife SWHs and RSOs. The well pad development plan would call for greater spacing between well pads (from 10- acre spacing to 20- acre spacing), as well as increasing the number of wells per pad (up to 20 wells per pad). Implementing these measures would reduce the acreage impacts of oil and gas development, as well as reduce habitat fragmentation.

### Recommendations for Future Data Collection

The data collected for this analysis was limited to those operators willing to participate. In order to get a more complete understanding of oil and gas operations in GrSG, greater participation is necessary. To increase participation, CPW could consider follow-up consultation with individual operators regarding implementation of BMPs with advance guidance on metrics to track in the field. Additional metrics could be implemented to aid in tracking disturbance in GrSG as follows:

- There is no mechanism for tracking minimization or avoidance efforts undertaken by the operator. Tracking well pad location adjustments, road alignments, road width adjustments, pipeline right-of-way alignments and widths could demonstrate reduced disturbances agreed to by operators. This data was not available through CPW or the operators.
- The disturbance acreages rely solely on input from each operator. To increase participation, CPW could consider follow-up consultation with individual operators regarding implementation of BMPs with advance guidance on metrics to track in the field.

## **APPENDIX A FIGURE**

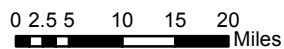


Sources: County Data from ArcGIS Online. All other data from <http://cogcc.state.co.us/>



**Legend**

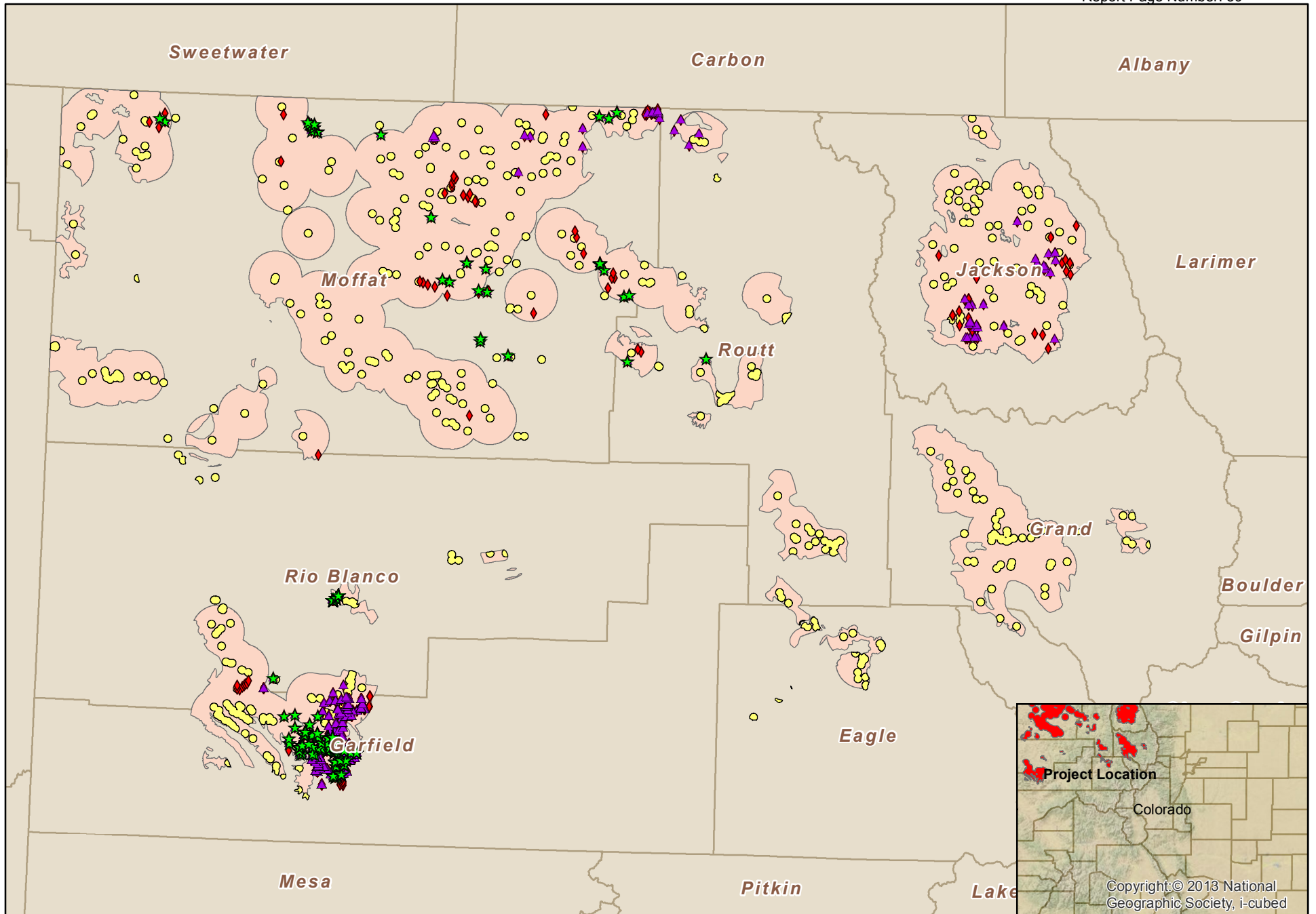
- ◆ Wells Permitted since HB 07-1298
- Restricted Surface Occupancy
- Sensitive Wildlife Habitat



**Figure 1**  
**Oil and Gas Wells Permitted Since HB 07-1298**  
**in Greater Sage Grouse Habitat**

JANUARY, 2014

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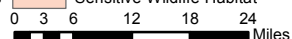


Sources: County Data from ArcGIS Online. All other data from <http://cogcc.state.co.us/>



**Legend**

- ★ Wells with Data from Operators
- ▲ Permitted Wells included in Analysis
- ◆ Wells Permitted since HB 07-1298
- Restricted Surface Occupancy
- Sensitive Wildlife Habitat



**Figure 2**  
**Permitted Oil and Gas Wells for Analysis**  
**In Greater Sage Grouse Habitat**

JANUARY, 2014

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## **APPENDIX B OPERATOR DATA**



Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
1	Large	Garfield	77	Not Listed	7/2/13	Fee	Fee	Sensitive	2	21-Nov-13	2-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<p><b>Conditions of Approval (COA)</b>            A Wildlife Mitigation Plan was developed in consultation with CPW.</p> <p><b>Best Management Practices (BMPs)</b>            BMPs are for all operations within the Piceance Basin.            An annual Plan of Development is required which includes the following:</p> <ul style="list-style-type: none"> <li>• Avoid GrSG Sensitive Wildlife Habitat (SWH).</li> <li>• Avoid or minimize activities near and within lek sites.</li> <li>• Avoid at a minimum 66% of GrSG SWH.</li> <li>• Avoid lek sites from March 1 through May 15 for major activities.</li> <li>• 4-mile buffer for GrSG March 1 through June 30.</li> <li>• Use approved seed mixes for sagebrush restoration. High priority habitats (lek areas and adjacent lands) may require additional restoration discussion and BMPs.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
<p><b>Avoidance</b>            Operator has 77 wells operating on 23 well pads. Operator averages 4.98 acres per pad. If all wells were placed on individual pads, 383.5 acres would be developed. Currently there are 109.6 developed acres. Operator has future plans to develop 8 additional pads at 20 acre spacing and 16 well pads at 10 acre spacing.</p> <p><b>Minimization</b></p> <p><b>Mitigation</b>            Operator has 23 well pads all of which have entered into interim reclamation: Total reclamation = 54.97</p> <p><b>Landowner terms</b></p>												
Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
2	Large	Garfield	8	Not Listed	7/17/09	Fee	Fee	Sensitive	2	21-Nov-13	2-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<p><b>Conditions of Approval</b>            Reclaim and/or restore GrSG habitat with native grasses, forbs, and shrubs conducive to optimal GrSG habitat and other wildlife appropriate to the ecological site. Establish guidelines to minimize wildlife mortality from vehicle collisions on roads.</p> <p><b>BMPs</b>            No BMPs are available in the COGCC website database.</p>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator declined to participate												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
3	Large	Garfield	15	3.7	9/17/09	Fee	Federal	Sensitive	2	22-Nov-13	2-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW recommends that activities within 4 miles of GrSG lek sites are limited to the period outside of March 1 through June 30. CPW noted this was not a COA but a recommendation.												
<b>BMPs</b>												
No BMPs are available in the COGCC website database.												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												
Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
4	Large	Rio Blanco	39	Not Listed	6/14/12	Fee	Fee	Sensitive	2, 2A	21-Nov-13	25-Nov-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW confirms that the wells fall within the operators WMP. The WMP sufficiently addresses wildlife and wildlife habitat concerns.												
Specific BMPs would be found in the WMP and are not listed in individual well permits.												
<b>BMPs</b>												
Form 2 states that the BMPs are located within the approved WMP for this operator.												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator is currently in a restructuring process and is not available to participate.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
5	Large	Jackson	1	Not Listed	4/13/10	Federal	Federal	Sensitive	2, 2A	22-Nov-13	3-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW consultation not available in the COGCC website database.												
<b>BMPs</b>												
Where drilling and/or completion activities occur within 4 miles of GrSG leks or within GrSG breeding or summer habitat, the operator will limit activities outside the period between March 1 and June 30.												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												
6	Large	Rio Blanco	5	5.1	4/29/10	Fee	Fee	Sensitive	2, 2A <i>Correspondence</i>	11/22/2013	12/3/2013	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
Operator entered into a WMA with the surface owner.												
The WMA will identify requirements related to the operator's activities, the installation of surface equipment, reclamation and revegetation of disturbed areas, and offsite GrSG habitat improvement.												
<b>BMPs</b>												
<ul style="list-style-type: none"> <li>A total of five wells will be directionally drilled from the existing well pad. Directional drilling has enabled the operator to reduce the number of well pads required for gas recovery and will minimize surface damage.</li> <li>The well pad will be constructed adjacent to an existing access road. This eliminates the need to construct an additional road for access and avoids additional surface disturbance.</li> <li>The reserve/completion pit will be fenced/flagged and/or netted to prevent entry of wildlife (including birds) and livestock.</li> <li>Noxious weeds will be controlled.</li> <li>During the reclamation phase, all areas of soil disturbance will be smooth graded, cultivated to provide a loose seed bed of a minimum of 6 inches in depth, fertilized with 250 pounds of 46-0-0 per acre, seeded with the seed mixture specified by the surface owner, and mulched with 1-1/2 tons of grass hay crimped into the soil.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
<b>Avoidance</b>												
Operator has 40 wells operating on 4 pads with each pad averaging 9 acres. The total disturbance is 36 acres. If a well pad was developed for each well the total acreage of disturbance for the 40 wells would be 360.												
<b>Minimization</b>												
Operator had no quantifiable minimization activities.												
<b>Mitigation</b>												
Total well pad disturbance from well pad construction 40.4 acres (for all 4 well pads). Well pad size after interim reclamation totaled 15 acres (for all 4 well pads). Total mitigation for the operator in GrSG habitat is 25.4 acres.												
<b>Landowner terms</b>												
No landowner terms associated with GrSG were recorded.												

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
7	Large	Garfield	77	4.0 per pad	5/19/10	Fee	Fee	Sensitive Restricted	2A	21-Nov-13	25-Nov-13	COGCC

**COGCC-CPW Consultation**

**Conditions of Approval**

CPW divided the consultation by type of GrSG area (SWH and restricted surface occupancy (RSO)).

For activities in GrSG SWHs, the operator will follow the CPW approved BMPs listed below.

For activities in GrSG RSOs, the operator and land owner will enter into a separate WMA which will include additional measures beyond those established by the SDA for the protection of GrSG.

**BMPs**

- Maximize directional drilling to minimize habitat fragmentation/loss.
- Phase and concentrate development activities so large areas of undisturbed habitat remain.
- Minimize rig mobilization and demobilization where practicable by completing or recompleting all wells from a given well pad before moving rigs to a new location.
- To the extent practicable, share and consolidate new corridors for pipeline rights-of-way and roads to minimize surface disturbance.
- Engineer new pipelines to reduce field fitting and reduce excessive right-of-way widths and, therefore, subsequent reclamation requirements.
- Plan new transportation networks and new oil and gas facilities to minimize surface disturbance and the number and length of oil and gas roads through the utilization of common roads, rights-of-way, and access points to the extent practicable.
- Post speed limits and caution signs to the extent practicable.
- Use remote monitoring of well production to the extent practicable.
- Construct habitat improvement projects as practical.
- Use wildlife appropriate seed mixes wherever allowed by surface owners and regulatory agencies.
- Control weeds.
- Educate employees.
- Treat waste water pits and other mosquito breeding grounds with Bti (*Bacillus thuringiensis v. israelensis*) to limit the spread of West Nile Virus to wildlife.

**CPW Input**

Agency Representative: Michael Warren, Energy Liaison, CPW

**Comments**

**Operator Input (Actions, Locations, Acreages)**

**Avoidance**

Operator has a total of 77 permitted wells. The 77 wells are located on 7 well pads. As part of their BMPs, the operator has used directional drilling to limit impacts (both for economic and wildlife benefits). Average size well pad is 4 acres. The operator has disturbed approx. 30 acres of land not already impacted. Operator would have disturbed 280 acres of additional GrSG habitat using standard drilling techniques. The operator also limited its ROW disturbance by the use of directional drilling. The average road width is 24ft of disturbance. An additional 9,400 feet of road would have been required without the use of directional drilling. This is approximately 5.18 acres of disturbance avoided (9,400 feet X 24 feet). The total area of avoidance is 285.18 acres.

**Minimization**

The area of minimization would be related to pipeline width reduction or road width reduction. This data was not available from the operator.

**Mitigation**

5 of the 7 well pads have had partial or "interim" reclamation post construction disturbance. The average initial size of each well pad is 4 acres. The average size of the pad after the interim reclamation is 2 acres. Operator averages 2 acres of reclamation during the well operations. Currently they have reclaimed approximately 10 acres of GrSG habitat. Note: the habitat has not been fully reclaimed to original structure as this will take years of natural regeneration to occur. Reclamation refers to the re-seeding and contouring of the disturbed land to pre-construction topography.

**Landowner terms**

No Landowner terms applied to GrSG habitat conservation.

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
8	Large	Moffat	2	3.0	11/23/11	Fee	Fee	Sensitive	2A, BMPs	21-Nov-13	22-Nov-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW approved the BMPs listed by the operator.												
<b>BMPs</b>												
<ul style="list-style-type: none"> <li>The operator will conduct post-development well site visitations between the hours of 9:00 a.m. and 4:00 p.m. and reduce well site visitations between March 1 and July 30 - (GrSG brood rearing period). Emergencies exempted.</li> <li>The operator will use hospital grade mufflers for compressors, pump jacks or other motors necessary to run operations at the site. Mufflers will be pointed upward to dissipate potential vibration.</li> <li>Interim and final reclamation will match existing vegetation.</li> <li>The operator will include a weed management plan and implement the plan as part of reclamation.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator reviewed their records and found that they have no permitted wells operating within GrSG habitat. The wells on record were part of a joint venture with Shell and Shell is now the owner of those wells. While these wells were permitted, they were never constructed.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												
Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
9	Large	Routt	5	3.8	9/26/13	Fee	Fee	Sensitive	2A, Correspondence	21-Nov-13	2-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
Email correspondence states that CPW consultation took place during an onsite visit. No additional information was available on the COGCC website database.												
<b>BMPs</b>												
BMPs were provided to CPW by the operator during an onsite visit. CPW affirms the BMPs are sufficient to address wildlife concerns at this location and has no further recommendations. The BMPs were not available in the COGCC website database.												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
<b>Avoidance</b>												
Operator moved one well outside of GrSG habitat at CPW request (approximatley 4 acres of avoidance).												
<b>Minimization</b>												
Operator moved one well pad outside of an RSO at CPW request (approximately 4 acres of minimization).												
<b>Mitigation</b>												
<b>Landowner terms</b>												
Landowner requested CPW not participate. Operator worked with landowner to develop GrSG plan and, through consultations between the operator, the landowner, and CPW; CPW is now been granted access to their property to gather GrSG data.												

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
10	Small	Garfield	17	320.0	4/14/10	Fee	Fee	Sensitive	2, 2A, BMPs	11/21/2013	12/3/2013	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW notes that they concur with the operator provided BMPs.												
<b>BMPs</b>												
<ul style="list-style-type: none"> <li>• Use early and effective reclamation techniques, including an aggressive interim reclamation program, to return habitat to use by GrSG as quickly as possible.</li> <li>• Reclaim/restore GrSG habitats with native grasses, forbs, and shrubs conducive to optimal GrSG habitat and other wildlife appropriate to the ecological site.</li> <li>• Use approved CP-4D (GrSG) seed mixes, based on soil type, precipitation, and elevation, available from Farm Service Agency or Natural Resources Conservation Service, or other seed mixes approved by CPW.</li> <li>• Avoid aggressive non-native grasses in GrSG habitat reclamation.</li> <li>• Restore disturbed sagebrush sites with the appropriate sagebrush species or subspecies on disturbed sagebrush sites. Use locally collected seed for reseeding where possible.</li> <li>• Reclaim mapped summer habitat with a substantially higher percentage of forbs (&gt; 15 percent cover post establishment) than used in other areas.</li> <li>• Utilize native and select non-native forbs and legumes in seed mixes as they are a vital component of brood-rearing habitat.</li> <li>• Identify seasonal habitats and migratory patterns of GrSG. Map all seasonal habitats using CPW habitat selection models as they become available.</li> <li>• No surface occupancy within 0.6 mile of any known GrSG lek.</li> <li>• After drilling and completions activities reduce visits to well-sites through remote monitoring (i.e. SCADA) and the use of multi-function contractors.</li> <li>• Schedule, as best as possible, well site visitations to portions of the day between 9:00 a.m. and 4:00 p.m. during the active lek season (March 1 to May 15).</li> <li>• Phase and concentrate all development activities, so that large areas of undisturbed habitat for wildlife remain and thorough reclamation occurs immediately after development and before moving to new sites. Development should progress at a pace commensurate with reclamation success.</li> <li>• Implement the species appropriate Drilling and Production Operations Wildlife Protection Measures found in Section II D. of the CPW Wildlife BMP document (listed below).</li> </ul>												
<b>Section II D. DRILLING AND PRODUCTION OPERATIONS WILDLIFE PROTECTION MEASURES:</b>												
The purpose of these measures is to reduce disturbance on the actual drill site and the surrounding area, to reduce direct conflict with wildlife and hunters, and to prevent wildlife access to equipment.												
<ul style="list-style-type: none"> <li>• Use centralized hydraulic fracturing operations.</li> <li>• Transport water through centralized pipeline systems rather than by trucking.</li> <li>• Where possible, locate pipeline systems under existing roadways, or roadways that are planned for development.</li> <li>• Maximize use of state-of-the-art drilling technology (e.g., high efficiency rigs, coiled-tubing unit rigs, closed-loop or pitless drilling, etc.) to minimize disturbance.</li> <li>• Conduct well completions with drilling operations to limit the number of rig moves and traffic.</li> <li>• Install exclusionary devices to prevent bird and other wildlife access to equipment stacks, vents and openings.</li> <li>• During pipeline installations install trench plugs, earthen ramps, or other means as necessary to ensure that open pipeline trenches do not trap wildlife, and that pipe strings do not impair wildlife movements.</li> <li>• Minimize surface disturbance and fragmentation of GrSG habitat through use of the smallest facility footprints possible, use of multiple well pads, clustering of roads and pipelines, and the widest possible spacing of surface facilities.</li> <li>• Where applicable design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.</li> <li>• Where needed, install raptor perch deterrents on equipment, fences, cross arms and pole tops in GrSG habitat.</li> <li>• Remove all unnecessary infrastructure.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
The operator agreed to participate, but did not provide data.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
11	Small	Routt	3	2.2	1/24/13	Federal	Federal	Sensitive	2 Surface Use Plan	21-Nov-13	2-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW affirms the stipulations, COAs, and/or other status assigned to this permit by the BLM to address wildlife.												
<b>BMPs</b>												
The BLM stipulations are listed below.												
<ul style="list-style-type: none"> <li>• No activity between March 1 through June 30.</li> <li>• Timing restrictions from March 1 through May 15 to limit activity between 9:00 a.m. and 4:00 p.m.</li> <li>• Implement noise reduction measures.</li> <li>• Avoid nearby GrSG lek site.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator agreed to participate but did not provide data.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												
Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
12	Small	Moffat	1	Not Listed	6/3/09	Federal	Federal	Sensitive Restricted	2, 2A	22-Nov-13	3-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW provided COGCC with COAs but affirms that the lease stipulations and COAs assigned to the permits by the Federal government suffice to address wildlife habitat and mitigation concerns. The COAs and lease stipulations are not available in the COGCC website database.												
<b>BMPs</b>												
No BMPs were available in the COGCC website database.												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
13	Small	Moffat	26	5.19	6/22/09	Federal	Federal	Sensitive	2 Surface Use Plan	21-Nov-13	2-Dec-13	COGCC

**COGCC-CPW Consultation**

**Conditions of Approval**

CPW provided COGCC with COAs but affirms that the lease stipulations and COAs assigned to the permits by the federal government suffice to address wildlife habitat and mitigation concerns. The COAs and lease stipulations are not available in the COGCC website database.

**BMPs**

No BMPs were available in the COGCC website database.

**CPW Input**

Agency Representative: Michael Warren, Energy Liaison, CPW

**Comments**

**Operator Input (Actions, Locations, Acreages)**

**Avoidance**

Operator has 26 wells operating on 10 well pads. Each well pads averages 5.19 acres. The total disturbance is 51.6 acres. Total potential disturbance is 134.94 if each well was constructed on its own well pad. Each access road is approximately 0.22 acres or a potential disturbance of 5.72 acres. The actual disturbance for the 10 well pads is 2.18 acres. The total acres of avoidance is 86.58.

**Minimization**

No minimization acreages were provided.

**Mitigation**

Operator has a total disturbance for the 10 well pads of 55.3 acres. The total acreage of the well pads after reclamation is 43.2. Total road disturbance for all well pads is 3.25 acres. After road reclamation the total road disturbance is 1.94 acres. The total mitigation for the operator is 14.04 acres.

**Landowner terms**

No landowner stipulations were associated with the operator permits.

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
14	Small	Moffat	1	Not Listed	7/6/09	Fee	Federal	Sensitive	2	22-Nov-13	3-Dec-13	COGCC

**COGCC-CPW Consultation**

**Conditions of Approval**

CPW provided COGCC with COAs but affirms that the lease stipulations and COAs assigned to the permits by the federal government suffice to address wildlife habitat and mitigation concerns. The COAs and lease stipulations are not available in the COGCC website database.

**BMPs**

Reclaim and/or restore GrSG habitats with native grasses, forbs, and shrubs conducive to optimal GrSG habitat and other wildlife appropriate to the ecological site.

**CPW Input**

Agency Representative: Michael Warren, Energy Liaison, CPW

**Comments**

**Operator Input (Actions, Locations, Acreages)**

Operator did not respond to solicitations.

**Avoidance**

**Minimization**

**Mitigation**

**Landowner terms**



Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
15	Small	Jackson	9	3.0	7/16/09	Fee	Fee	Sensitive	2	21-Nov-13	3-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b> Since these pads are located on an existing, already disturbed locations, CPW concurred with the existing stipulations within the Surface Use Agreement (SUA).												
<b>BMPs</b> The SUA for these permitted wells requires topsoil reclamation and the restoration of the site as reasonably practical.												
<b>CPW Input</b> Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b> Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
16	Small	Moffat	2	4.7	6/14/13	Fee	Fee	Sensitive Restricted	2A	22-Nov-13	3-Dec-13	COGCC

**COGCC-CPW Consultation**

**Conditions of Approval**

Landowner requested CPW not participate in onsite consultation. CPW reviewed the pad location using remote sensing data with the following analysis:

- The well pad is 1.9 miles from an GrSG SWH. The proposed access road is 0.5 mile from a GrSG SWH.
- The SWH "Lay Creek #1" is the largest lek in Colorado.

CPW makes the following comments:

- Avoid oil and gas operations within 4 miles of any known GrSG lek, and within mapped GrSG breeding, summer, and winter habitat outside the 4 mile buffer. Select sites for development that will not disturb suitable nest cover or brood-rearing habitats within 4 miles of an active lek, or within identified nesting and brood-rearing habitats outside the 4-mile perimeter. Where oil and gas activities must occur within 4 miles of GrSG leks or within other mapped GrSG breeding or summer habitat, conduct these activities outside the period March 1 through June 30.
- Where oil and gas activities must occur in elk winter concentration areas, conduct these activities outside the time period from December 1 through April 15.
- Restrict post-development well site visitations to between the hours of 9:00 a.m. and 4:00 p.m. December 1 through May 15, to accommodate elk winter concentration area, and the GrSG brood rearing period.
- No human encroachment or construction activity within 0.5 mile of any active golden eagle nest December 15 through July 15.
- Locate facilities in vegetation types other than sagebrush to avoid impacts to sage-grouse breeding and wintering habitat.
- Establish company guidelines to minimize wildlife mortality from vehicle collisions on roads.
- Gate single purpose roads and restrict general public access to reduce traffic disruptions to wildlife.
- In consultation with landowner, close and immediately reclaim all roads that are redundant, not used regularly, or have been abandoned to the maximum extent possible to minimize disturbance and habitat fragmentation.
- Treat waste water pits and any associated pit containing water that provides a medium for breeding mosquitos with Bti or take other effective action to control mosquito larvae that may spread West Nile Virus to wildlife, especially grouse.
- In consultation with CPW and landowner, replace any permanently impacted, disturbed, or altered GrSG seasonal habitats by enhancing marginal sagebrush steppe communities (big sagebrush and related communities) and grasslands within or immediately adjacent to mapped seasonal GrSG habitat.
- Include a weed management plan and implement the plan as part of reclamation.
- Restore appropriate sagebrush species or subspecies on disturbed sagebrush sites. Use locally collected seed for reseeding where possible. Avoid aggressive non-native grasses and shrubs in GrSG, and elk habitat restoration.

**BMPs**

There were no BMPs available in the COGCC website database.

**CPW Input**

Agency Representative: Michael Warren, Energy Liaison, CPW

**Comments**

**Operator Input (Actions, Locations, Acreages)**

Operator did not have quantifiable data.

**Avoidance**

**Minimization**

**Mitigation**

**Landowner terms**

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
17	Small	Jackson	1	5.8	9/21/13	Fee	Fee	Sensitive	2, 2A	22-Nov	3-Dec	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
No COAs were available in the COGCC website database.												
<b>BMPs</b>												
<ul style="list-style-type: none"> <li>• Establish company guidelines (e.g., speed limits, report bird strikes, restrict firearms in vehicles, no pets) to minimize wildlife mortality during operational activities.</li> <li>• Use noise reduction equipment on compressors or other development and production equipment.</li> <li>• Muffle or otherwise control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.</li> <li>• Use early and effective reclamation techniques, including an aggressive interim reclamation program, to return habitat to use by GrSG as quickly as possible.</li> <li>• Reclaim/restore GrSG habitats with native grasses, forbs, and shrubs conducive to optimal GrSG habitat and other wildlife appropriate to the ecological site (work with BLM where appropriate to meet this BMP and work with private surface owner where appropriate).</li> <li>• Avoid aggressive non-native grasses in GrSG habitat reclamation.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
18	Small	Routt	1	2.5	11/5/11	Fee	Fee	Sensitive	2, 2A, BMPs	see notes	see notes	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
No COAs were available in the COGCC website database.												
<b>BMPs</b>												
<ul style="list-style-type: none"> <li>• Pad construction and drilling will occur outside of the GrSG and sharp-tailed breeding and nesting period (March 1 through July 30).</li> <li>• Operator agrees to conduct drilling activities for additional and/or subsequent wells outside the period March 1 through July 30.</li> <li>• Operator will make a good-faith effort to schedule and conduct post-development well site visitation between the hours of 10:00 a.m. and 3:00 p.m. and reduce well site visitations March 1 through July 30.</li> <li>• Operator will use hospital grade mufflers for compressors, pump jacks or other motors necessary to run operations at the site as applicable. Mufflers will be pointed upward to dissipate potential vibration. Control exhaust noise from pump jacks and compressors so that operational noise will not exceed 49 dB measured at 30 feet from the source.</li> <li>• Design tanks and other facilities with structures such that they do not provide perches or nest substrates for raptors, crows and ravens.</li> <li>• CPW is open to the idea of flexibility/amending the elk winter concentration timing stipulations in order to protect sage and sharp-tailed grouse habitat and lek activities.</li> </ul>												
On-going and future discussions between CPW and Operator will be necessary to determine if/how the elk timing stipulation can be amended for this site.												
<ul style="list-style-type: none"> <li>• Interim and final reclamation will match existing vegetation.</li> <li>• Operator will include a weed management plan and implement the plan as part of reclamation.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator Data

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
19	Small	Moffat	3	5.0	7/11/10	Fee	Fee	Sensitive	2, 2A, BMPs	11/22/2013	12/3/2013	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
No COAs were available in the COGCC website database.												
<b>BMPs</b>												
<ul style="list-style-type: none"> <li>• Routine well site visitations to the Mud Gulch 23 -32 pad would be restricted to the period of 9:00 p.m. to 4:00 p.m. during the lekking season (March 1 through May 15). Exceptions would be made in the event of emergency repairs.</li> <li>• Operator guidelines would be established to minimize wildlife mortality from vehicle collisions</li> <li>• (posted speed limits, plus notifications of all employees and contractors to drive cautiously and within those speed limits).</li> <li>• Operator is researching and will make a good faith effort to design tanks, fences, and other facilities to prevent raptor/raven/crow perching and nesting, where feasible.</li> <li>• Operator will use early and effective reclamation techniques, to return habitat used by GrSG as quickly as possible,</li> <li>• Operator will reclaim/restore GrSG habitat with native grasses, forbs, and shrubs, conducive to optimal GrSG habitat.</li> <li>• Operator will use a high diversity reclamation seed mix/approved CP-4D seed mix.</li> <li>• Avoid aggressive non-native grasses in GrSG habitat reclamation.</li> <li>• Combine utility infrastructure (gas and water pipelines) alongside the access road to avoid the use of a separate utility corridor.</li> <li>• Implement fugitive dust control measures. (watering)</li> <li>• To reduce vehicle-animal collisions, Operator will either house the drilling crew on the location to minimize commuting, or strongly recommend carpooling to the pad site to reduce traffic.</li> <li>• Vehicle parking will be restricted to disturbed areas.</li> <li>• As stated above, activity would be scheduled to avoid the sensitive time period for GrSG.</li> </ul>												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												

Operator ID	Operator Size	County	Permitted Wells	Acres	Permit Date	Surface Ownership	Mineral Ownership	GRSG Habitat	COGCC Forms	1st Contact	2nd Contact	GIS Data
20	Small	Moffat	2	Not Listed	7/8/09	Fee	Federal	Sensitive	2	22-Nov-13	3-Dec-13	COGCC
<b>COGCC-CPW Consultation</b>												
<b>Conditions of Approval</b>												
CPW provided COGCC with COAs but affirms that the lease stipulations and COAs assigned to the permits by the federal government suffice to address wildlife habitat and mitigation concerns. The COAs and lease stipulations are not available in the COGCC website database.												
<b>BMPs</b>												
Reclaim and/or restore GrSG habitats with native grasses, forbs, and shrubs conducive to optimal GrSG habitat and other wildlife appropriate to the ecological site.												
<b>CPW Input</b>												
Agency Representative: Michael Warren, Energy Liaison, CPW												
<b>Comments</b>												
<b>Operator Input (Actions, Locations, Acreages)</b>												
Operator did not respond to solicitations.												
<b>Avoidance</b>												
<b>Minimization</b>												
<b>Mitigation</b>												
<b>Landowner terms</b>												



## **A Summary of Status and Trends of Residential Growth in Northwestern Colorado**

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The purpose of this report is to summarize the status and trends of development in Northwestern Colorado, including the extent and pattern of residential and commercial growth patterns in northwest Colorado, particularly Eagle, Garfield, Grand, Jackson, Moffat, Rio Blanco, and Routt counties – especially the area that intersects with greater sage grouse habitat. More specifically, this report:

- compares patterns through the past 30 years (1980-2010) in terms of number of housing units, estimating growth rates of houses as well as potential growth (through platted lots); and
- estimates future threats by examining patterns of growth that would likely occur given current planning and zoning policies.

Generally, there is strong and consistent evidence that residential growth in the greater sage grouse habitat of northwestern Colorado has occurred at annual rates of 1.8 to 3.2%. If future growth occurs at rates consistent with a 30-year average, then an additional nearly 55,600 acres of priority habitat and 31,200 acres of general habitat may be affected by likely future residential development in 2040. Basic results are summarized, followed by a brief description of data sources and methods. Note that the primary source of data for this analysis were from parcels, but parcel level data were not available for Jackson County, and attributes on parcels in Garfield County were limited. Therefore, conclusions about trends for these counties are less certain because they are based on groundwater well data.



## Data overview

I used two main data sources in this analysis to examine status and trends in residential growth. The first is land owner parcel data, typically produced and managed by county assessors and/or planning departments. When these data are available, they provide the most detailed insight – but are of varying level of completeness. A second source of data is from groundwater well data – which indicates growth in rural portions of counties that do not use a central water supply that is often found in more densely settled towns or cities. It is consistent across counties, and is available for all 7 counties in the study area, although because domestic and ag wells are not carefully distinguished, some caution is needed in interpreting these data.

## County-level status and trends

The 7 counties that contain the significant portions of sage grouse habitat in Colorado are: Eagle, Garfield, Grand, Jackson, Moffat, Rio Blanco, and Routt. Based on parcel data, there were 58,776 total housing units in 2010 in these counties (except for Jackson County, which contains roughly 1% of housing units in the 7-county region). The estimate developed from the parcel data is likely conservative (lower than actual) because a fair number of records did not have a reasonable value for the year-built attribute (which should range from 1950-2010, but often had values of 0). Therefore, I removed these records (parcels) from the count. Another reason would be missing housing units that occur as multi-units per parcel, though there may be other legitimate reasons why there is a discrepancy due to definitional issues.

An additional 37,000 parcels existed in 2010 that were created through a subdivision process by their owners -- but these parcels do not presently contain a housing unit or building. That is, these lots provide a rough measure of the availability or potential for future housing development. Based on parcel-level data, housing units have grown by 5.1% annually in the counties over the past 30 years. Although parcel level-data likely underestimate the total number of housing units, the calculation of the rates of growth is not likely to be biased, especially because the data quality for more recent development (i.e. since 1970) is typically higher.

## Trends within sage grouse habitat

Based on examining data on groundwater wells (for residential/commercial uses only, excluding agricultural uses), the number of residential units has grown by over 50% from 1980 to 2010 in sage grouse habitat (Figures 1 & 2). In 2010 there were 1,438 units in priority habitat, 3,311 in priority and general habitat, and 3,610 units in priority, general, and linkage habitat (Figure 1). A simple estimate of the long-term (40-year) trend is that growth of residential units increased between 15 and 44 units *annually*. Growth occurred at roughly half the rate (15 per year) for priority habitat as compared to priority and general habitat (39 per year). Note that the operating assumption here is that each residence uses its own well, though there may be cases where multiple residences are tied to a single well. Thus, this estimate of the number of housing units based on groundwater well numbers is conservative. Also note that although wells that were specifically





attributed as Stock Tank or Agricultural were NOT included in this analysis, that it is possible that some of the Domestic use wells are stock tanks/agricultural use. To determine the precise number of location of these would require a well-by-well analysis, which was beyond the scope of this work. Moreover, the intent of providing the analysis of the groundwater well data is to: (1) provide an indication of the general trends, and (2) to provide specific information for counties that did not provide parcel-level data (i.e. Jackson). Therefore, for counties that do have parcel-level data available, the intention is to make recommendations using parcel data (see section below).

Figure 1. Number of domestic/municipal groundwater well permits located in Greater Sage Grouse habitats of Colorado.

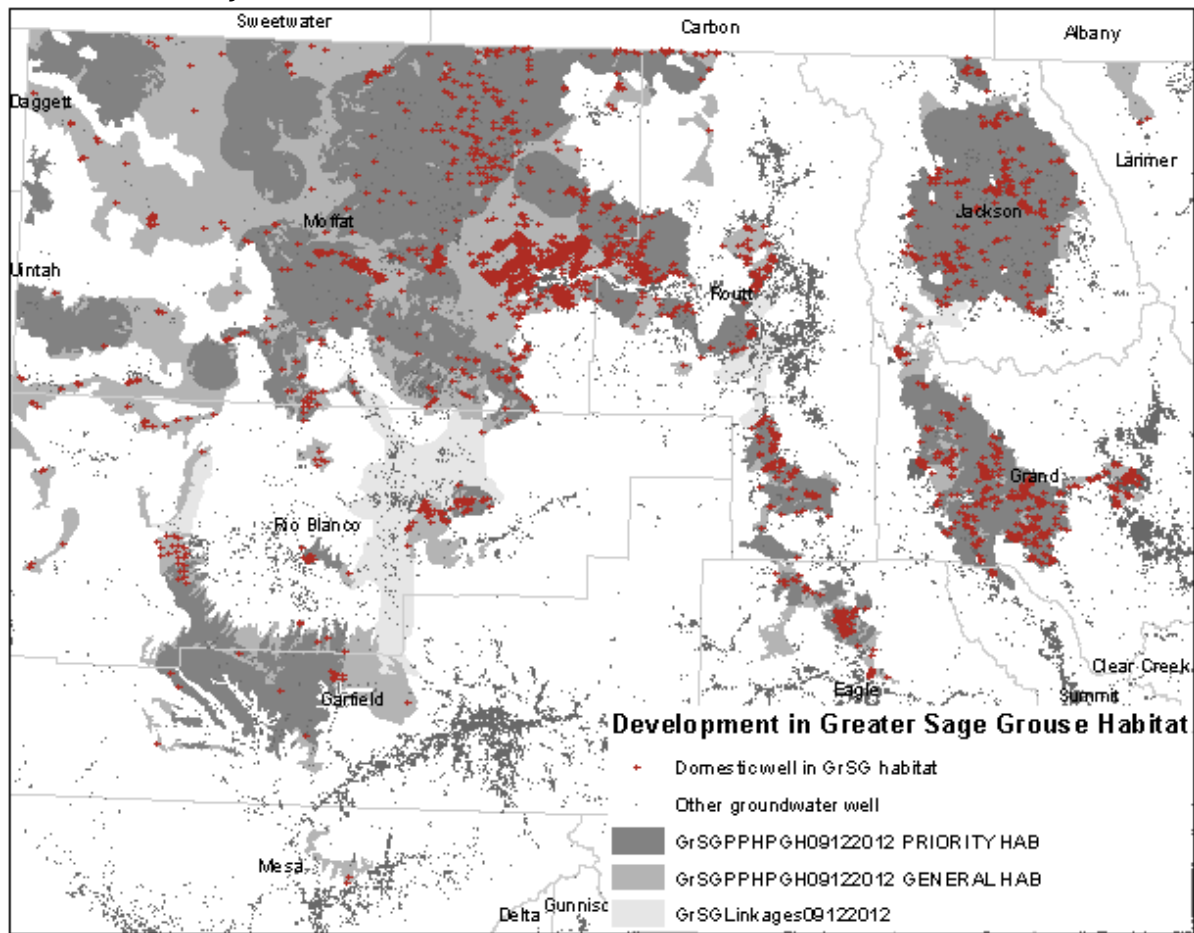
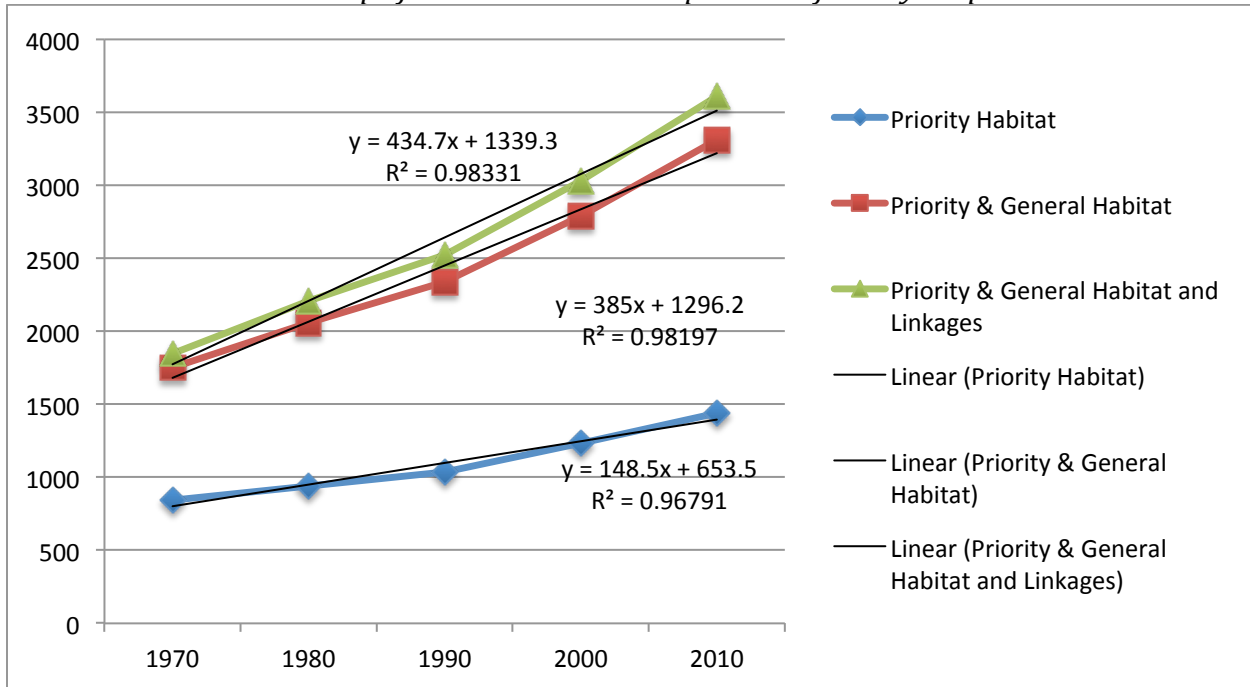




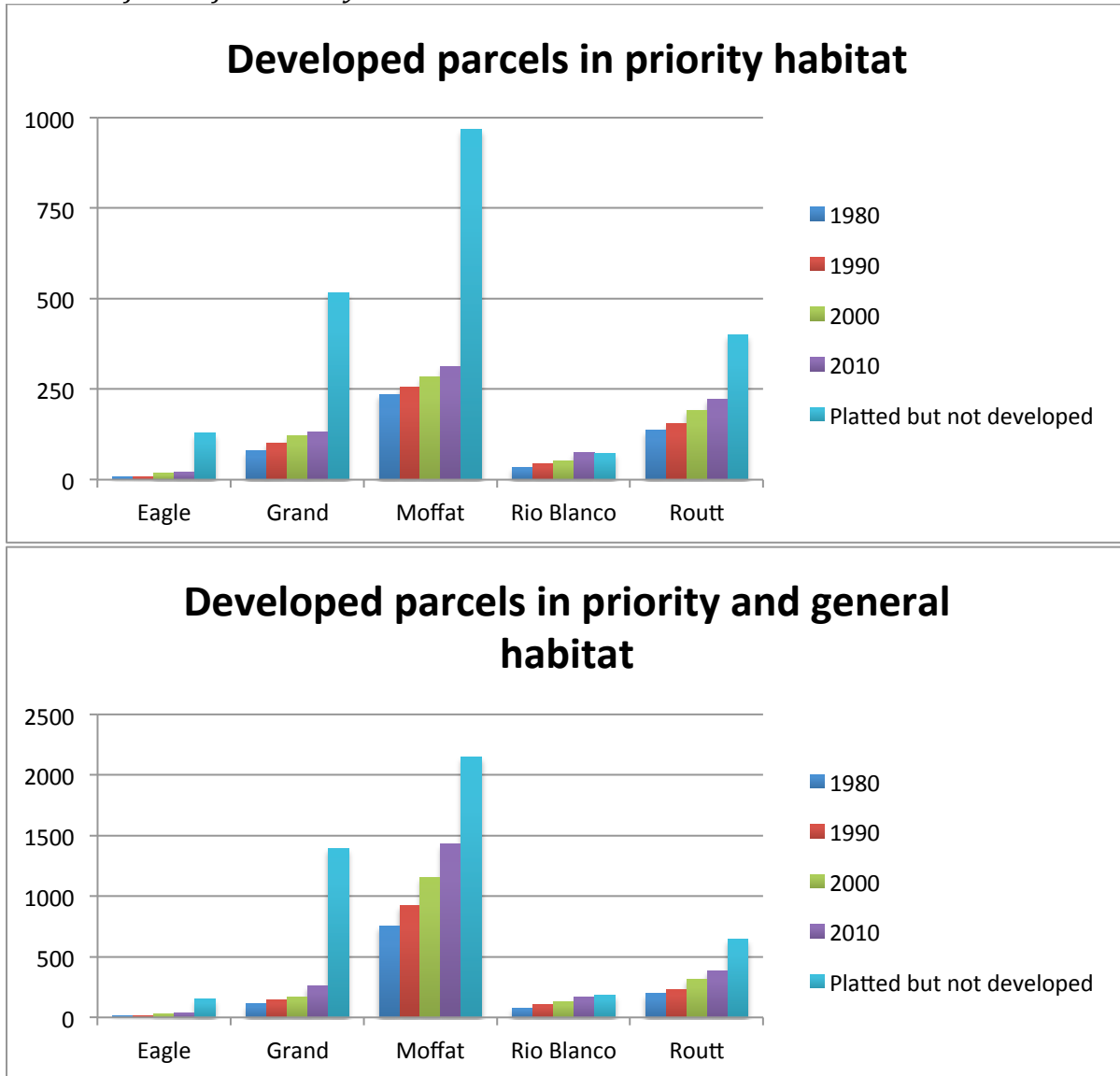
Figure 2. Trends in the number of residential use groundwater wells in sage grouse habitat of Colorado. Note that the slope factor on the linear equation is for 10 year periods.



Based on parcel data (excluding Garfield and Jackson due to data limitations), the number of housing units in priority habitat grew from 491 to 763 (1980-2010), an annual increase of 1.8% (Figure 3). The number of housing units in priority and general habitat grew from 1,154 to 2,274 (1980-2010), an annual increase of 3.2%. There are 2,084 additional parcels in the priority habitat, and 4,522 in the priority and general habitat that were undeveloped in 2010, but presumably are developable without further subdivision. These privately-owned parcels vary in size, from small-lot (<1 acre) to ranchlands (>1,000 acres).



Figure 3. Developed parcels in greater sage grouse priority & general habitat. Note that parcel data were not available for Jackson County, and year-built attributes were not available for Garfield county.



**Forecasted growth**

I forecasted residential development based on recent growth trends and assumptions tied to county and state planning and zoning regulations – what is called a “base case”. That is, it assumes all development will occur according to existing zoning and minimum lot standards and recent (30 years) growth trends. Population projections by county for 2040 were obtained from the Colorado State Demography Office, and projected



populations were converted to housing units using a representative value of 2.5 people per unit estimated based on the average number of occupants per unit.

About 11% (130,249 acres) of the roughly 1.2 million acres of priority habitat in 2010 had residential development at a density higher than 1 unit per 160 acres (Table 1). An additional 130,593 acres of general habitat also had development in 2010. The area of priority habitat that would likely be affected under forecasted growth would increase by 1.43 – that is, an additional 55,683 acres. The area of general habitat that would likely be affected under forecasted growth would increase by 1.24 – that is, an additional 31,276 acres.

*Table 1. Total number of acres of greater sage grouse habitat and area disturbed by development (i.e. residential density higher than 1 unit per 160 acres) for current and base-case future development in northwestern Colorado, by county.*

County	Total area (acres)		In 2010		Forecasted		Acres increase	
	Priority habitat	General habitat	Priority habitat	General habitat	Priority habitat	General habitat	Priority habitat	General habitat
Eagle	36,610	34,291	4,838	2,606	14,521	15,186	9,684	12,580
Garfield	148,971	72,328	1,171	336	5,540	3,503	4,369	3,166
Grand	203,630	55,667	28,230	13,775	37,217	16,076	8,987	2,302
Jackson	384,212	36,730	29,731	4,235	32,223	4,259	2,492	24
Moffat	129,776	971,767	34,771	78,113	50,353	84,706	15,582	6,593
Rio Blanco	94,179	194,363	4,866	10,848	5,428	13,310	562	2,462
Routt	195,660	91,687	26,643	20,680	40,649	24,829	14,007	4,149

## Data and methods

### *Sage grouse habitat*

Data on high priority greater sage grouse habitat (dated 20120309) was obtained from: <http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Birds/Pages/GreaterSage-grousePriorityHabitat.aspx>

### *Parcel data*

Parcel data from counties ~2010 for all but Jackson counties.

Processed parcel data to remove parcels that were public owned or with known conservation easements, using COMAP v8.

### *Groundwater data*

Data were obtained from the Colorado Division of Water Resources:

<http://water.state.co.us/datamaps/gisandmaps/pages/gisdownloads.aspx>

Data were filtered to retain only domestic, household, municipal, or industrial uses.



### *Build-out scenario\**

To estimate current housing density, I combined data from three sources: county-level parcels, state-engineer groundwater wells, and US Census of Housing for 2010. Parcel-level data are likely to be the most accurate form of information on residential development. I obtained electronic parcel data where available and combined them with county assessor information to provide relevant attributes for the housing density and build-out analyses, including number of residential units, year built, property type, structure type, number of structures, subdivision, and ownership. In addition, I attributed parcels with lot requirements, maximum densities and other restrictions based on county zoning documents.

Digital parcel information was available for 6 of the 7 counties in the study area (except for Jackson). To fill in for Jackson County, I used state engineer groundwater well data, and block-level census records for more urban areas (i.e. Walden). I converted the parcel, groundwater well, and census block datasets to points that represent individual housing units. For parcel data with only one housing unit in it (most of the parcels for current housing density), the point was placed in the centroid of the parcel polygon. For parcels with multiple units per parcel (which happened occasionally for multi-family tracts, or frequently when forecasting housing units in 2040), a corresponding number of points were randomly placed within the parcel boundary. This same procedure was followed to generate points within census block groups. Kernel density surfaces were then generated independent of the other residential datasets using 400 m radii, where the effect. The kernel density values represents the potential impact of each housing unit on the surrounding landscape and declines from 1.0 at the point location to 0.0 at the radius distance. A distance of 400 m distance to be consistent with greater sage grouse models.

To generate the final map of housing density, I combined the kernel density surfaces by finding the maximum density value from among the three data sources. I classified the housing density (dwelling units per acre; dua) into the eight density classes (Table 2).

*Table 2. Residential density classes used in the analysis.*

<b>Density Class (Dwelling Units per Acre)</b>
Residential - high (>10 dua)
Residential - med (1.6-10 dua)

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\*This work builds significantly on a previous report: Reed, S, DM Theobald, and D Harrison-Atlas. 2012. *Developing key datasets to support prioritization of wildlife habitat in Colorado and New Mexico*. Unpublished report to Colorado Division of Wildlife. August, 24<sup>th</sup> 2012.



Residential - low (0.4-1.6 dua)
Residential - exurban (0.1-0.4 dua)
Residential - exurban low (0.025-0.1 dua)
Residential - rural (0.006-0.025 dua)
Residential - rural low (0.001-.0.006 dua)
Undeveloped (<0.001 dua)

The base-case built-out scenario represents a plausible future development pathway that is linked directly with county and state planning and zoning regulations: a baseline that assumes all development will occur according to existing zoning and minimum lot standards. Building lots or parcels that have not been created through a formal subdivision process typically are eligible to be subdivided in accordance with minimum lot sizes as specified in county zoning regulations. Parcels that have been previously subdivided but not yet developed and are at least 0.1 acres are assumed to be “buildable” and receive one unit in this scenario. Previously subdivided parcels that are currently developed are not considered buildable in this analysis. A minimum lot size of 2.29 acres was assigned to parcels lacking explicit zoning regulations – this is a common threshold of the minimum lot size for lots with septic systems.

The year 2040 was selected as the time frame for the forecasting analysis. Population projections by county for 2040 were obtained from the Colorado State Demography Office, and I converted population projections to housing units using a representative value of 2.5 people per unit estimated based on the average number of occupants per unit. In addition, the number of new secondary homes were estimated using the proportion of secondary homes to primary residences per county based on U.S. census data.

Parcels considered exempt are precluded from receiving additional residential units in each of the build-out scenarios. Exempt parcels include those that are publicly owned, right-of-ways, residential open space, belong to a homeowner’s association, pertain to religious/educational interests, or are otherwise designated exempt in the assessor records. In addition, each of the build-out scenarios assumes development is prohibited on public lands and properties protected through a conservation easement. I identified protected areas within Colorado using the Colorado Ownership Management and Protection (COMaP) spatial database version 8.

Where available, parcel data were attributed with number of residential units, year built, property type, structure type, number of structures, subdivision, ownership lot requirements, maximum densities and other restrictions based on county zoning



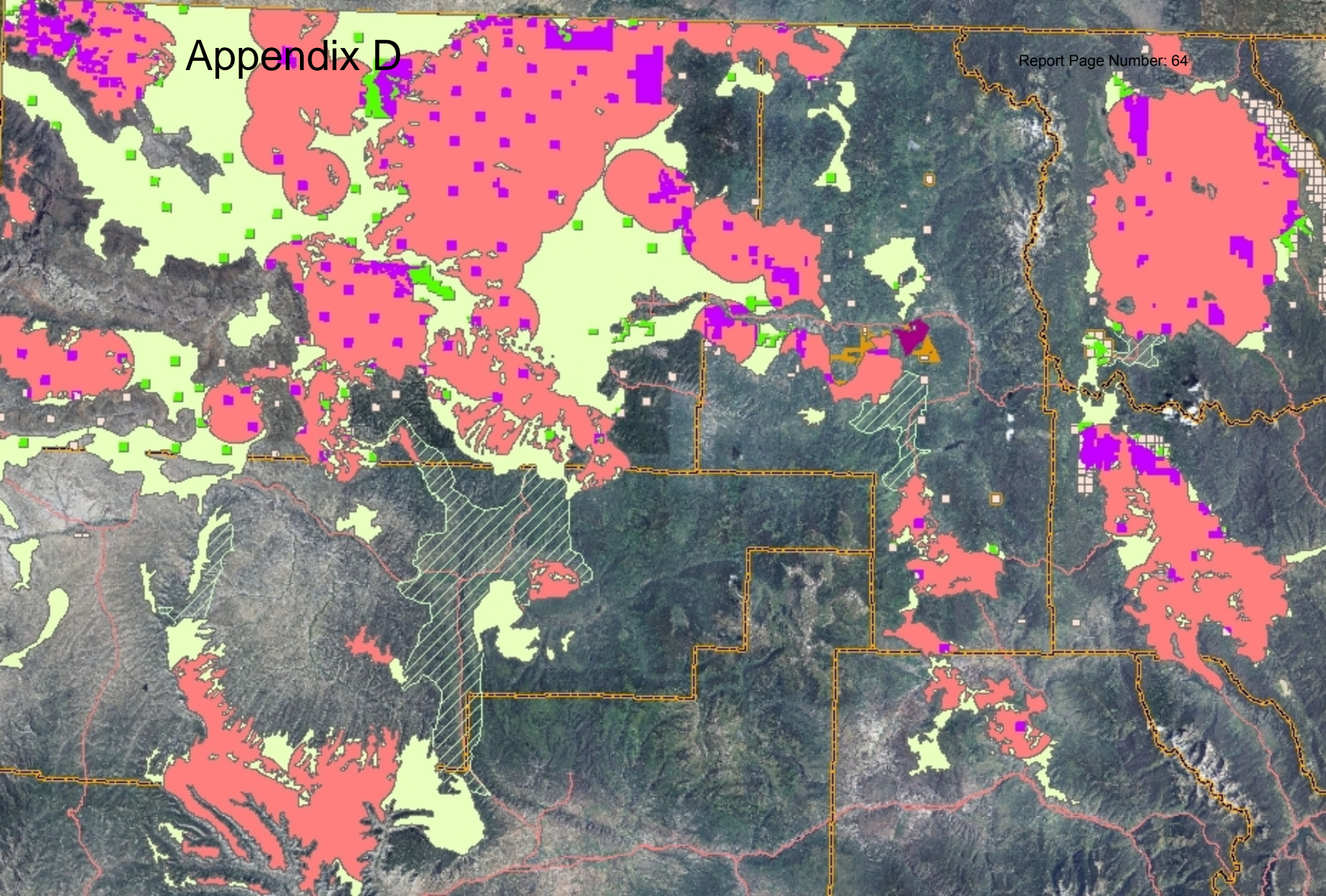
documents. PUD and City zoning districts were given a minimum lot size of 0.125 acres in scenario 1 to represent higher densities typical of these lands. Districts excluding residential development as a principal land use were marked as exempt from additional development under all four scenarios.

Parcels containing residential units, or commercial/industrial development were marked as “developed”. Parcels created as part of previously approved subdivisions were identified using the subdivision fields contained in the assessor database. In this analysis, parcels classified as previously subdivided and currently “developed” as described above were considered ineligible for further subdivision.

I identified parcels most likely to be developed by weighting them with a value representing travel time to the nearest urban area. To account for uncertainty in future growth patterns, I then estimated the probability of development as a function of inverse travel time and a random value ranging between 0 and 1. I then selected the probability of development threshold value such that it would produce the desired number of new housing units developed in each county by 2040 (as specified by the population projections). Points representing the location of new units developed were randomly placed within each parcel.

For those counties lacking sufficient parcel data (Jackson County), I employed an alternative build-out methodology wherein I created a grid of points within each county. For consistency with the parcel-based methodology, I excluded areas of future development within urban areas (> 0.5 dwelling units per acre), protected areas, and water bodies. I estimated the probability of development based on the randomized travel time surface, “developing” those points whose development probability fell within the threshold associated with the number of new housing units projected for each county.

# Appendix D





# Appendix E

Acreage Protected by Conservation Easements in Greater Sage Grouse Habitat March 2014	Colorado Cattlemen's Agricultural Land Trust	Colorado Open Lands	Aspen Valley Land Trust	Mesa Land Trust	American Farmland Trust and Summit Co.	Legacy Land Trust	Colorado Headwaters Land Trust	The Nature Conservancy	Rocky Mountain Elk Foundation	Yampa Valley Land Trust	Colorado Parks and Wildlife	TOTALS	
<b>Linkage Habitat</b>												<b>0</b>	
Rio Blanco County	1004	452	0	0	0	0	0	0	0	2332	166	3954	
North Park	173	0	0	0	0	0	0	0	0	0	0	173	
Routt County	178	0	0	0	0	0	0	0	105	491	519	1293	
<b>Total</b>	<b>1355</b>	<b>452</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>105</b>	<b>105</b>	<b>2823</b>	<b>685</b>	<b>5420</b>
<b>PPH Habitat</b>													
Meeker/White River	0	0	0	0	0	0	0	0	0	132	1520	1652	
Middle Park	643	0	0	0	160	0	2238	0	2471.5	0	11775	17287.5	
North Eage/South Routt	1495.8	1039.25	0	0	0	0	0	483	77.5	2827.4	2129	8051.95	
Northwest Colorado	5077.6	0	0	0	0	0	0	5698	156	3478	20593	35002.6	
North Park	9452	0	0	0	0	3284	0	8689	0	1636.6	38	23099.6	
Parachute/Piceance/Roan	0	0	583	0	0	0	0	0	1382	0	0	1965	
<b>Total</b>	<b>16668.4</b>	<b>1039.25</b>	<b>583</b>	<b>0</b>	<b>160</b>	<b>3284</b>	<b>2238</b>	<b>14870</b>	<b>4087</b>	<b>8074</b>	<b>36055</b>	<b>87058.65</b>	
<b>PGH Habitat</b>													
Meeker/White River	495.5	0	0	0	0	0	0	0	0	2040.4	2061	4596.9	
Middle Park	7001	165	0	0	120	0	161	0	628	0	821	8896	
North Park	2508	0	0	0	0	778	0	90.3	0	311	0	3687.3	
North Eage/South Routt	191	569.5	0	0	0	0	0	132.7	697.5	1876	1.5	3468.2	
Northwest Colorado	2152	0	0	0	0	0	0	2346.7	922	2285.6	6230.5	13936.8	
Parachute/Piceance/Roan	0	0	542	2197	0	0	0	0	0	0	148	2887	
<b>Total</b>	<b>12347.5</b>	<b>734.5</b>	<b>542</b>	<b>2197</b>	<b>120</b>	<b>778</b>	<b>161</b>	<b>2569.7</b>	<b>2247.5</b>	<b>6513</b>	<b>9262</b>	<b>37472.2</b>	
<b>GRAND TOTAL</b>	<b>30370.9</b>	<b>2225.75</b>	<b>1125</b>	<b>2197</b>	<b>280</b>	<b>4062</b>	<b>2399</b>	<b>17439.7</b>	<b>6439.5</b>	<b>17410</b>	<b>46002</b>	<b>129950.9</b>	



# Appendix F

## Grazing and the Greater Sage-Grouse

### *Overview*

Grazing is not necessarily a threat to conservation of Greater Sage-Grouse (GrSG) habitat. Indeed, grazing by domestic and wild ungulates plays an important role in shaping and maintaining vegetative communities in sage-grouse range. The BLM's Conservation Objectives Team report notes that "livestock grazing is the most widespread type of land use across the sagebrush biome and almost all sagebrush areas are managed for livestock grazing," (COT 2013, p. 44). In a recent letter to Wyoming Governor Mead, the USFWS reiterated the point: "We do not consider grazing as an activity to be a significant threat to the GrSG as a species," (USFWS 2013).

However, certain livestock management practices may contribute to degradation of habitat at a local level, and the challenge facing ranchers in NW Colorado is to identify which practices have been clearly linked to negative habitat impacts. The USFWS uses the term "improper grazing" to label practices known to be harmful to GrSG.

The intent of this white paper is to summarize Colorado's understanding of the role played by grazing in the state's ongoing effort to conserve habitat for the GrSG. Since this is an overview piece intended for a non-scientific audience, only limited scientific data and citations are provided. Extensive research exists on the topic, and readers are encouraged to explore the literature for more detail.

### *Brief Summary of the Science*

In all cases, grazing practices are evaluated based on local ecological conditions. This means that a single, one-size-fits-all definition for "improper grazing" doesn't exist. Instead, the literature echoes state and local plans that indicate that properly monitored, evaluated and managed resources are complimentary both to the grouse and grazing. Any grazing management system that does not take into account sage-grouse habitat requirements and other needs could be considered 'improper grazing for sage-grouse'.

Maintaining or restoring healthy sagebrush and native grass and forb communities is the most important objective for conservation of GrSG habitat. Scientists agree that "grazing management is important because it affects the height and density of herbaceous material available for hiding cover and food," (Cagney, p. 3). These variables depend on season of use and habitat type; achieving conservation objectives therefore means attention to local ecological conditions, including soil types, precipitation zones, vegetation composition and drought conditions. Ranchers must consider stocking levels, season of use, and utilization levels. Treatments (such as removing sagebrush or shrub cover to increase forage for livestock) have also been a wide ranging concern; however, some vegetation treatments, if carefully designed and executed, can be beneficial to some seasonal sage grouse habitats.

Indirect impacts are also relevant. For example, livestock management infrastructure such as properly designed fencing and water improvements can serve to move grazing pressure away from sensitive landscape features, including critical sage-grouse habitat features. Again, site-specific conditions would need to be evaluated to determine whether particular developments will contribute to a decline in habitat suitability.

## ***Conservation Strategies***

The 2008 Conservation Plan and the 2013 progress update to that plan (Colorado Package) shed additional light on the need for site-specific management. The Plan emphasized research and monitoring, with a focus on local participation. Additionally, the Plan describes strategies that address domestic and wild herbivore management, stressing the importance of properly managing both sources of grazing and their impacts on vegetative structure. Developing grazing systems and management plans that would achieve desired vegetation composition and structure, including shrubs, forbs, and grasses, should benefit both GrSG and domestic and wild ungulates.

Of note, the State Land Board (SLB) holds a total of 661 sections in NW Colorado. Many of those sections are leased for grazing, giving the SLB an opportunity to survey for consistent management practices and provide habitat assessments. Grazing and multiple use (grazing with recreation) leases that overlap at least partially with GrSG habitat total over 393,000 acres. Between 2001 and 2012, the SLB conducted inventory on nearly 80,000 acres of state trust lands, and is in the process of developing a long-term assessment of GrSG habitat on over 200,000 additional acres.

## ***Monitoring***

Perhaps most importantly, the Conservation Plan, along with the COT Report, reiterates the importance of education, continuous monitoring, and adaptive management.

The Colorado Rangeland Monitoring Guide, developed and endorsed by academic institutions, federal and state agencies (BLM, NRCS, USFS), and the Colorado Association of Conservation Districts and Colorado Cattlemen's Association, provides detailed guidance for both short and long term rangeland monitoring. As noted in that document, monitoring is only valuable when it is conducted within the context of defined goals. Conserving greater sage grouse habitat is one such goal, and the tools provided in the Guide ensure consistency across agencies and land ownership types.

## **Resources**

Cagney, Jim, et.al. 2010. Grazing Influence, Objective Development, and Management in Wyoming's Greater Sage-Grouse Habitat. University of Wyoming: Laramie, WY.

Colorado Department of Natural Resources. 2013. Colorado Package. Available at: <http://wildlife.state.co.us/WildlifeSpecies/SpeciesOfConcern/Birds/Pages/GreaterSageGrouseConsPlan2.aspx>

Colorado Division of Wildlife. 2008. Colorado Greater Sage-Grouse Conservation Plan. DOW: Denver, CO.

U.S. Department of the Interior. 2013. Greater Sage-grouse Conservation Objectives: Final Report. Fish and Wildlife Service: Washington, DC.

U.S. Fish and Wildlife Service. 2013. Letter to Wyoming Governor Matthew Mead, dated July 23, 2013.