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Mineral Development and Land Conservation in the Rocky Mountains:

Potential Impacts to Conservation Values and Strategies for Mitigation

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Why Consider Potential Impacts?

- Severed mineral estates are common in the Rocky Mountain region. Oil and gas development, and occasionally other subsurface mining, are therefore possible on conserved lands because:

  1) Tax deductibility of conservation donations may be retained as long as "conservation purposes" are met, and
  2) The conserving organization may decide that potential impacts are acceptable.

- ***Conservation values*** are the resources that the conservation arrangement is meant to protect. Any impairments to conservation values are termed ***impacts*** in this presentation.

- When subsurface mining is possible on a proposed conservation project, the conserving organization needs to evaluate potential impacts to conservation values because:

  1) Need to determine if overall impacts are acceptable for the mission of the organization and the public benefit.
  2) May need to advise donor on tax deductibility implications.
  3) May need to devise mitigation strategies and techniques.

Types of Impacts

- Impacts may range from inconsequential to severe; they may occur instantly or only develop over time; and they may be obvious or subtle.

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- ***Direct impacts*** occur at the same time and place as the mineral development activity. ***Indirect impacts*** occur later in time, or at a different location. Time lags between development activities and impact responses are common, and some indirect impacts may take years to develop.

- ***Short-term impacts*** occur at the time of mineral activity, and do not persist for long after the activity ceases. ***Long-term impacts*** may begin at the same time as short-term impacts, but persist over longer periods.

How to Identify Potential Impacts Beforehand

- Responsibility lies with the conserving organization contemplating the project. The professionals of the conserving organization should:

  1) Be familiar with the conservation values and their vulnerabilities to subsurface mineral development. Information source: *Mineral Development and Private Land Conservation: A Handbook for Conservation Professionals* (Colorado Coalition of Land Trusts, in press 2007).
  2) Carefully review the property and the proposed project. Inspect the site, review any baseline documentation, and the minerals assessment prepared by a geologist.
  3) Consider how and where on the property mineral development could occur, and determine the potential impacts to conservation values. To do this, use resource-specific information such as that provided in CCALT (2007). When necessary, seek advice from resource professionals at government agencies or conservation groups, or engage professional consultants. Where possible, discuss potential development with the mineral leaseholder or operator.

Impacts to Agricultural Values

- Agricultural lands in the Rocky Mountains may ***rangeland*** or f***armland.*** Farmlands can be ***dryland crops*** (unirrigated), ***irrigated prime farmland*** (on NRCS-defined prime soils), ***irrigated not prime farmland*** (on other types of soils), or ***high potential farmland*** producing specialty crops or concentrated commercial uses. Irrigated farmland is one of the most important agricultural land resources in the region, and in some places at high risk from urban development.

- Impacts can result from:

  1) Conversion of cropland or rangeland to well pads, roads, or support infrastructure such as pipelines or compressor stations.
  2) Damage to existing road surfaces, fences, or gates.
  3) Changes in surface water or groundwater availability due to altered surface flow or groundwater recharge.

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4) Changes in water quality. Inappropriate disposal of waste liquids and solids can contaminate surface or groundwater. Some actions such as coalbed methane extraction remove large quantities of "produced water" from underground. The water is often salty and may be contaminated with substances used in drilling processes. Improper disposal of produced water can contaminate existing surface water and groundwater.
5) Beneficial impacts to agriculture from mining may include improvements to private roads, fences and gates, and income from leases (where mineral rights are owned by the agricultural operator).

Impacts to Open Space and Public Recreation

- The conservation value is the experience felt by humans as they pass through or near the landscape. On conserved lands without public access, the public open space value is defined by the landscape's location, visual appearance, and sounds. For conserved lands with public access, the degree to which other humans are encountered may also be important.

- Impacts can result from:

1) Introduced geometric structures such as buildings, roads, installed machinery and utilities, pits, or piles of soil or rock. Long linear features such as pipelines, roads, or utility lines can be visible from great distances.
2) Increased encounters of recreationists with mine workers and vehicles, reducing the quality of the recreationists' outdoor experience.
3) Noise generated by on-site equipment and vehicle traffic.

- Impacts of oil and gas development on open space values are typically more prominent during exploration and development phases, and less so during production and reclamation. However, some equipment can generate considerable noise throughout the production phase.

- Impacts to open space resources tend to be greater in agricultural lands or prairies, due to the flat terrain and short vegetation of homogenous color. Impacts are likely to be of concern in lands protected for their natural character, public recreational use, or wildlife habitat.

Impacts to Ecological Values

- Federal tax regulations broadly define these ecological conservation values as "relatively natural habitat for fish, wildlife, or plants, or similar ecosystems". Conservation professionals often define more specific ecological values such as critical habitats for certain wildlife species, habitat for plants or animals listed as federally threatened or endangered, and rare or sensitive ecosystem components such as wetlands or riparian areas. Landscape-scale factors such as habitat connectivity are increasingly recognized as conservation goals.

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- Impacts can result from:

1) Loss of habitat from surface disturbance and vegetation clearing.
2) Fragmentation of wildlife habitat or sensitive communities.
3) Direct mortality of plants or animals by site disturbance and vegetation clearing, vehicle collisions, collision or electrocution from transmission lines, increased avian predation when structures provide hunting perches for raptors (a potential impact in open country), or poaching caused by increased road access.
4) Disturbance of wildlife during sensitive seasons, such as big game on winter ranges or birds of prey during nesting. Sublethal impacts of disturbance can be difficult to detect and measure because of geographic separation and lag times between cause and effect.
5) Introduction and spread of invasive plants that degrade natural ecosystems.
6) Changes to surface water quantity and quality.

- Impacts may occur throughout construction and operation phases. Some impacts such as noxious weed spread and groundwater contamination or discharge may persist indefinitely.

Impacts to Historic Lands or Structures

- The conservation values could include historically important land areas, or a structure or site certified by a State Historic Preservation Office (SHPO) or similar authority. Certified sites are given protection from damage by law, but potentially eligible sites not yet protected could be vulnerable. Some sites may be of local historical or cultural value, but lack legal protection.

- Impacts may occur from removal of or damage to historical structures, or development within the viewshed of a historic site or land area that impairs the historic character of the site.

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Managing Impacts through Mitigation

- First, understand the requirements of federal, state, and any local laws and regulations. These may constrain oil and gas development on the property in various ways, and limit some potential impacts to conservation values.

- ***Mitigation*** (defined broadly) means steps to eliminate impacts, or reduce impacts to acceptable levels. The following are commonly accepted ***mitigation strategies***, beginning with the most desirable:

  1) Avoid the impact by not taking a certain action or parts of an action.

  2) Minimize impacts by limiting the degree or magnitude of the action and its implementation.

  3) Rectify the impact by repairing, rehabilitating, or restoring the affected environment.

  4) Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.

  5) Compensate for the impact by replacing or providing substitute resources or environments.

- Mitigation actions and considerations may include:

  1) Secure a commitment to ***performance standards***.

  2) Use ***siting*** restrictions to protect sensitive areas.

  3) Use ***timing*** restrictions for actions during critical times.

  4) Conduct r***esource inventories*** if necessary to document the location or importance of special resource features such as wetlands or rare plant occurrences.

  5) Identify and specify ***Best Management Practices*** (BMPs) representing the latest current knowledge in natural resources management and environmental protection. Sources of BMPs for oil and gas development include:

Best Management: General Construction
BMP Sources: Gold Book (BLM and USFS 2007) Coalbed Methane Best Management Practices Handbook (Western Governors Association 2006) EPA National Menu of Stormwater Best Management Practices (EPA 2007) U.S. Forest Service, Low-Volume Roads Engineering: Best Management Practices Field Guide (Keller and Sherar 2003) Mitigating Bird Collisions with Powerlines (APLIC 1994) Suggested Practices for Raptor Protection on Powerlines (APLIC 1996)

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Terrain and soil	Minimize the area disturbed, and maintain the reclamation potential of the site to the extent possible. Segregate and stockpile topsoil for later reclamation.
Stormwater	Manage stormwater by proper grading, culvert and stream crossing design, and erosion control structures and features.
Pipelines and flowlines	Avoid steep sloes and watercourses. Bury beneath roads where possible, to reduce site disturbance and provide better access or leak detection, maintenance, and repair. Minimize vegetation clearing width and follow best practices for general construction. Observe special considerations for sensitive areas such as stream crossings.
Overhead utility lines	Follow best practices to minimize bird strike and electrocution hazards, particularly in areas where birds may congregate such as near wetlands, grain fields, or migration corridors. Avoid or properly mitigate for impacts to wildlife from increased raptor hunting perches in open country. Assess and mitigate for visual resource impacts.

Hazardous Materials and Waste Disposal

Disposal of fluids and solids is typically regulated by various federal and state laws, requiring environmentally sensitive procedures. Produced water is of particular concern in coalbed methane, some hardrock mines where acid mine drainage or metals contamination could occur, and geothermal developments. Temporary reserve pits are used for oil and gas operations and exploratory drilling for other minerals to store or dispose of produced water, drilling mud, and cuttings. Mining for solid minerals is likely to produce waste rock (rock and soil removed from the mine to reach the ore), which is typically piled on site. Produced oil and gas are hazardous materials typically transported in pressurized pipelines. All mining operations use fuels, solvents, and other hazardous materials that must be handled and disposed of properly to avoid pollution.

Best Management: Hazardous Materials and Waste Disposal	
BMP Sources: Gold Book (BLM and USFS 2007) Coalbed Methane Best Management Practices Handbook (Western Governors Association 2006)	
Produced water and disposed fluids	Avoid water disposal or reserve pits in shallow groundwater areas or near watercourses. Follow best practices to properly operate and reclaim reserve pits. Where necessary, use fencing at reserve pits to exclude wildlife and livestock, and netting to exclude birds.
Hazardous materials	Follow best management practices to handle hazardous materials on site, and properly contain and clean up spills. Where appropriate employ containment structures and leak detection systems.

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Protecting Visual Resources

Mining creates visual impacts, and even subsurface mines require above-ground site disturbance of some kind. However, a variety of practices can help reduce visual impacts of mining operations and protect scenic values of conserved lands.

Best Management: Visual Resources	
BMP Sources: Gold Book (BLM and USFS 2007) Coalbed Methane Best Management Practices Handbook (Western Governors Association 2006) La Plata County Oil and Gas Impact report (La Plata County 2002)	
Siting	Site operations to minimize visibility to the public, especially in foreground and mid-ground locations. Examples: use base of slopes instead of ridge tops, use existing vegetation and topography as screening, avoid long straight runs for roads and pipelines.
Structural characteristics	Use construction techniques and materials to reduce visual impacts. Examples: minimize structure height, use paints and nonmetallic materials to reduce visual contrast with background.
Lighting	Minimize lighting, and shield the lights that are necessary.
Vegetation clearing and restoration	Where dense vegetation must be cleared, feather the edges of clearings to reduce visually obvious edges. Revegetate disturbed sites with natural-appearing vegetation.

Noise

Because perceived noise levels decrease with distance from the source, siting can be used to maximize the distance between noise-generating equipment and noise-sensitive humans and wildlife, especially in foreground and mid-ground locations. This is often the best and most economic mitigation option.

Best Management: Noise
BMP Sources: Gold Book (BLM and USFS 2007) Coalbed Methane Best Management Practices Handbook (Western Governors Association 2006) La Plata County Oil and Gas Impact report (La Plata County 2002) Industrial Noise Control (Bell 1982)

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Siting	Keep noise-generating facilities beyond the foreground distance (0.25 miles) from public receptors. Use natural screening by vegetation or topography to break line-of-sight between noise sources and public receptors. Where necessary, noise barriers can be constructed.
Facility/equipment characteristics	Select quieter equipment, install mufflers, insulate structures containing noisy equipment.

Controlling Human Presence

Human presence associated with mining can disturb wildlife, affect scenic values, and reduce the recreational value of conserved lands open to the public. These management practices are aimed at reducing the impacts of human presence.

Best Management: Controlling Human Presence	
BMP Sources: Gold Book (BLM and USFS 2007) Coalbed Methane Best Management Practices Handbook (Western Governors Association 2006) Colorado Division of Wildlife, Best Management Practices (CDOW 2007) Wildlife Management Guidelines for Oil and Gas Development (Colorado Wildlife Federation 2006)	
Reduce total human presence	Consolidate facilities and access corridors to reduce the number of sites requiring human presence. Consolidate tasks in time to reduce the duration of human presence in sensitive areas. Use remote technology where possible for tasks such as well monitoring to reduce the frequency of human visits.
Schedule human presence	Limit or prohibit human entry into designated sensitive areas during critical time periods, for example big game winter season, raptor or sage-grouse breeding season, or important recreation seasons for properties open to the public.
Control human activities	Require workers and vehicles to remain on designated routes or avoid designated sensitive areas, impose vehicle speed limits.

Protecting Plant Communities and Agricultural Productivity

Some of the management practices mentioned above for general construction will help to manage impacts to desirable plant communities and agricultural lands. Minimizing the amount of land disturbed and preserving the site's reclamation potential are the key concepts. Some additional considerations for protecting vegetation are revegetation and noxious weed management. While rapid revegetation of disturbed sites is important for controlling soil erosion and stormwater runoff, the most easily established ground cover may not be the best vegetation for restoring ecological values. This is particularly true in arid sites where native grass and

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shrub species may be difficult to establish quickly, or at all. A good revegetation plan needs to be site-specific and must consider the ecological site characteristics—in other words, the plant community the site can reasonably be expected to support. A revegetation plan may require compromises between rapid establishment of ground cover and restoration of original vegetation, but if the original plant community is an important part of the property's conservation value, returning the site to its original community should at least be among the revegetation goals. If agricultural values are paramount, then reclamation should be specified to reestablish the site's productivity as rangeland or cropland.

The introduction and spread of noxious weeds by mining operations is a serious concern on conserved lands. Noxious weeds can hamper reclamation of disturbed sites, and may spread on the property far form operational sites and seriously impair natural plant communities or agricultural productivity. Noxious weed management should be a prominent part of every Surface Use Agreement for mining on conserved lands.

Best Management: Protecting Plant Communities and Agricultural Productivity	
BMP Sources: Gold Book (BLM and USFS 2007) Colorado Division of Wildlife, Best Management Practices (CDOW 2007) Wildlife Management Guidelines for Oil and Gas Development (Colorado Wildlife Federation 2006) Colorado State University Noxious Weed Information (CSU 2007) Federal Noxious Weed Plan (USDA 2007) County Weed Management Programs	
Ecological restoration	Implement revegetation as part of reclamation plan. Include goals to restore desired plant communities when relevant to the conservation values of the property. Where appropriate specify native seed mixes of locally adapted varieties. Include monitoring and adaptive management practices, particularly on sites that are arid or otherwise more difficult to revegetate.
Agricultural restoration	Specify revegetation to restore or improve the agricultural productivity of the site based on pre-mine conditions and desirable future production. Ensure adequate water for initial establishment or long-term irrigation, where applicable. Manage livestock and wildlife grazing by fencing or other means where necessary to ensure vegetation establishment.
Manage noxious weeds	Collect baseline data on noxious weed presence and distribution prior to disturbance. Require monitoring and effective treatment of noxious weeds during mining operations and subsequent reclamation and abandonment phases.

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