

Impacts of Mineral Exploration & Development on Conservation Values

Lynn Connaughton

BIO-Logic Environmental, Montrose CO

www.bio-geo.com

lynnc@bio-geo.com



Types of Mineral Resources

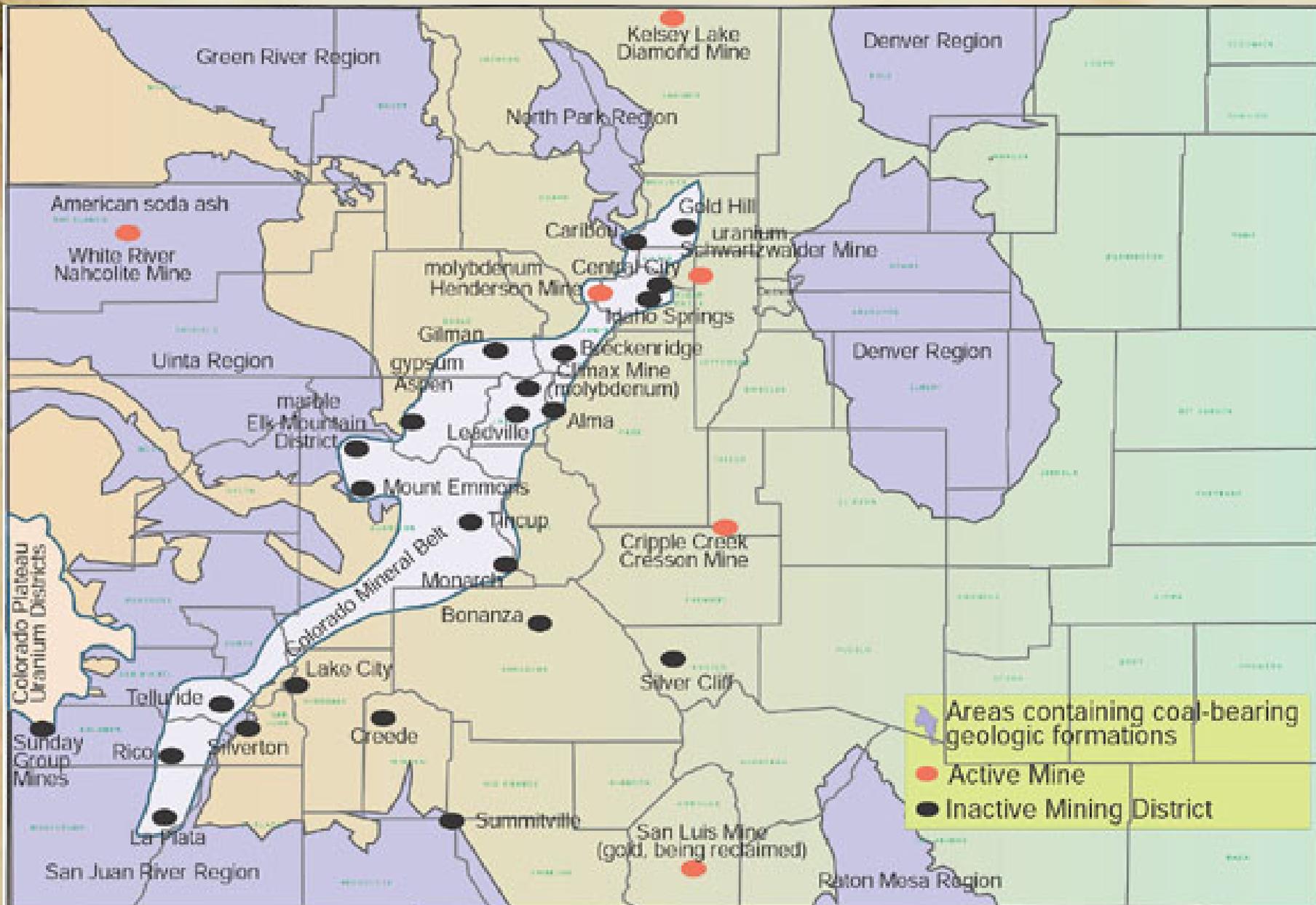


Solid Minerals
Subsurface Fluids
Geothermal

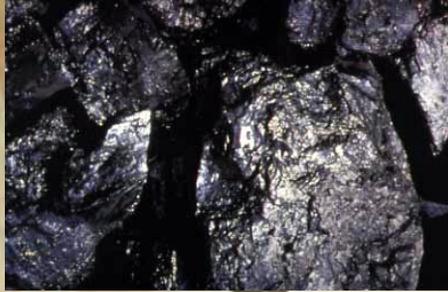
Types of Mineral Resources: Locatable Minerals



- Locatable Minerals include all minerals subject to exploration, development, and production under the 1872 Mining Law. Includes metals (gold, silver, lead, zinc, copper, etc) and industrial minerals (sulfur, fluorspar, gypsum, etc). Basically everything not excluded by other laws. Usually claims (lode, placer) are in mining districts.
- Can be mined using surface or subsurface methods depending on geologic factors.



Types of Mineral Resources: Leasable Minerals



- Leasable Minerals include fuels and certain other minerals regulated under the Mineral Leasing Act of 1920 which excluded them from the 1872 Mining Law. Geothermal Steam Act of 1970 added Geothermal Energy to list of Leasable Minerals.
- Can be mined using surface or subsurface methods depending on geologic factors (oil/gas/CBM/geothermal energy mined as subsurface fluids).
- Examples: coal, oil, gas, oil shale, potash, sodium, native asphalt, bituminous rocks, phosphate coal, geothermal energy.

Types of Mineral Resources:

Salable Minerals



- Minerals regulated by the Federal Materials Act of 1947 and the Multiple Surface Use Act of 1955 must be purchased from federal government except where mineral rights are privately owned.
- Usually low unit values for short ton, and need to be accessible to be profitable.
- Clay, dimension stone, marble, volcanic rocks, sand, gravel, pumice, petrified wood (since 1963). Other common minerals (sometimes uncommon varieties may be locatable).
- Sand & gravel are generally considered part of the surface estate in Colorado unless specifically reserved; requires attorney or legal counsel review.



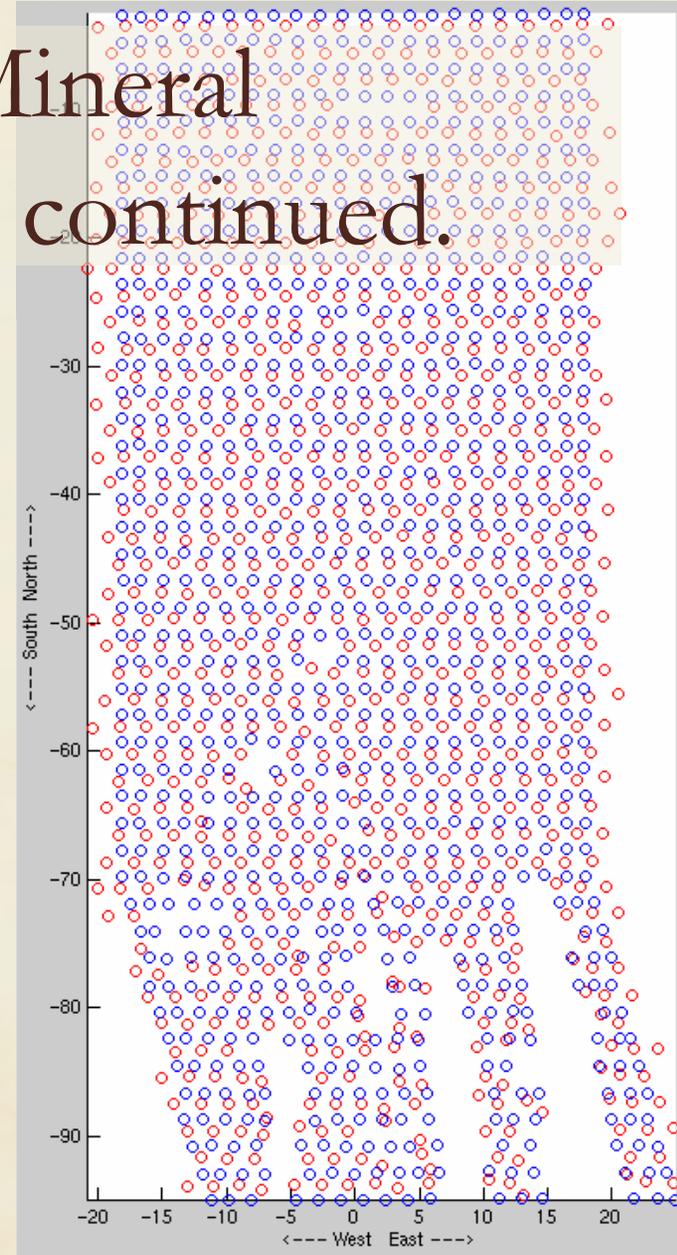
Mineral Exploration Methods

- **Remote Sensing** - the use of remotely sensed data, i.e.: satellite imagery, is a typical first step for the exploration industry. Remote sensing is used to explore for favorable localities of solid minerals and for petroleum exploration.
- **Various Aerial Techniques** - used for determining possible target zones and narrowing down the area to be covered by detailed ground geophysical studies.

Data is collected from equipment aboard a low flying (250 ft above ground) aircraft at small line intervals which serves to cut ground exploration time/cost & make geologic maps.

Remote and on-site Mineral Exploration Methods continued.

- **Remote Sensing & Aerial Techniques** serve to identify target areas and geologic anomalies from a regional to detailed view. Helps focus ground studies (drilling, coring) on high potential areas.
- **Ground Techniques** – field mapping; sampling of stream sediments, water, rock, soil for indicator minerals; coring; wildcat drilling; seismic survey.



Every 5th geophone location is shown as a blue circle, every sixth shot is shown as a red circle. South is at the bottom of the figure.

Mineral Development (Mining)

Methods

- Surface Mining

-- mining a seam of mineral ore by first removing all of the soil and rock above it (the overburden). “Removes a colossal amount of material.”



http://abyss.kgs.ku.edu/pls/abyss/pubcat.phd1.View_Photo?f_id=39&f_hd=Y



http://abyss.kgs.ku.edu/pls/abyss/pubcat.phd1.View_Photo?f_id=517&f_hd=Y



FOTOSERACH

Surface Mining Methods (Cont'd)

- Open Pit Mining
 - Open-pit mines are typically enlarged until the mineral reserve is exhausted.



http://www.earthscienceworld.org/images/search/results.html?Keyword=Open%20Pit%20Mines#nullbyss.kgs.ku.edu/pls/abyss/pubcat.phd1.View_Photo?f_id=39&f_hd=Y



<http://www.tennesseevalleymarble.com/sample.html>



<http://www.earthscienceworld.org/images/search/results.html?Keyword=Open%20Pit%20Mines#null>

Surface Mining Methods (cont'd)

Mountaintop Removal (MTR)

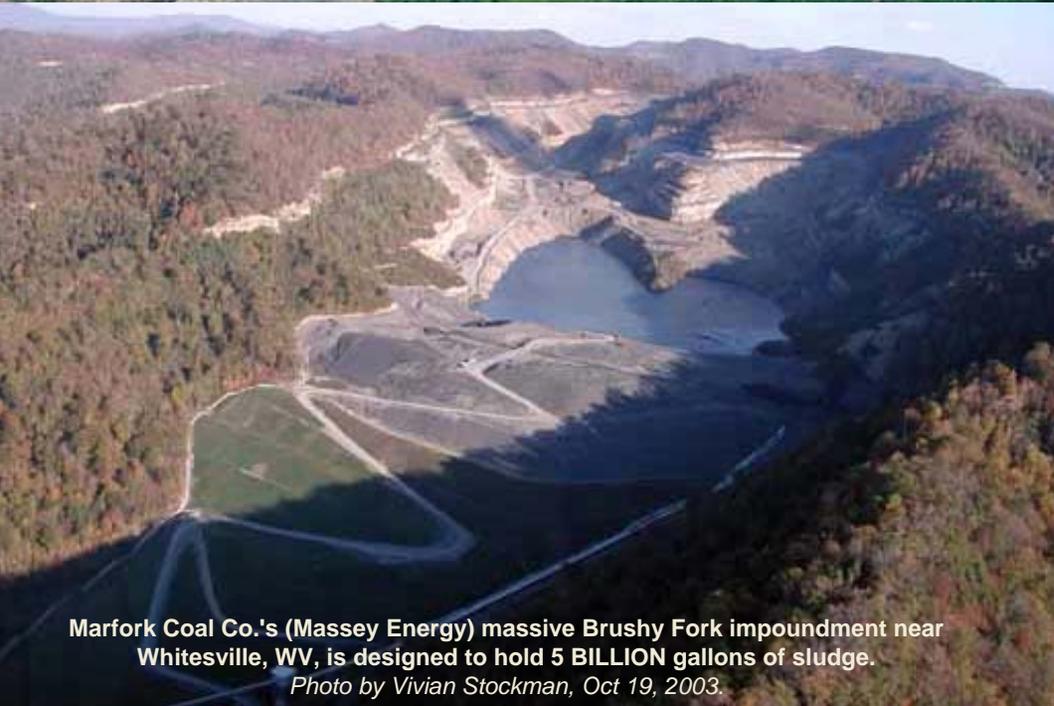
- relatively new form of coal mining used to reach sediment as deep as 1,000 feet below the surface. Mountaintop removal requires that the targeted land be first clear-cut and then leveled by explosives. The overburden is pushed into a nearby valley or hollow, creating a pile below called *valley fill*. Machinery removes the coal and it is transported to a processing plant and washed. Millions of gallons of waste from coal processing, called *slurry*, is often stored in earthen dams nearby. Because coal usually exists in multiple seams separated by rock, miners can repeat this process over a dozen times on a single mountain, lowering its height with each seam mined (drastically cuts workforce, KY & WVa).



http://www.ohvec.org/galleries/mountaintop_removal/007/

Mountaintop removal/valley fill coal mining in southern West Virginia in May 2003

Photo by Vivian Stockman, May 30, 2003



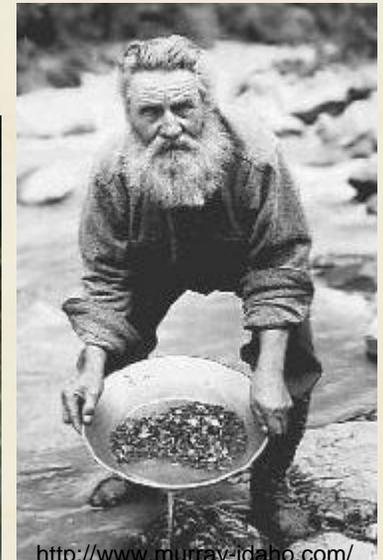
Marfork Coal Co.'s (Massey Energy) massive Brushy Fork impoundment near Whitesville, WV, is designed to hold 5 BILLION gallons of sludge.

Photo by Vivian Stockman, Oct 19, 2003.

Surface Mining Methods (Cont'd)



- Dredging/Placer Mining
 - **Dredging** is a method often used to bring up underwater mineral deposits.
 - **Placer Mining** removes metals from alluvium commonly by panning or sluicing.



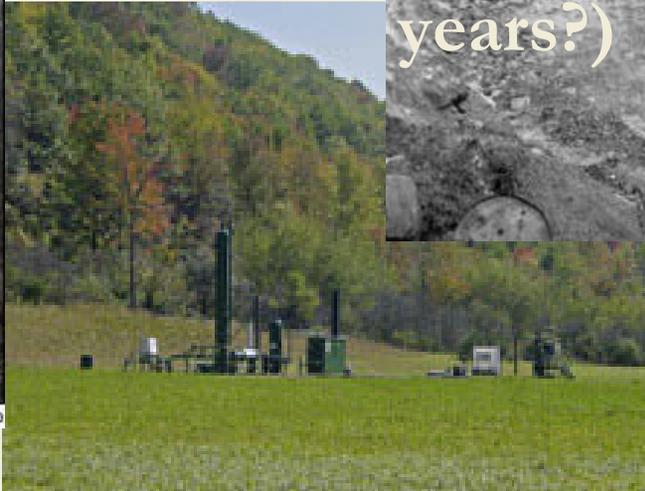
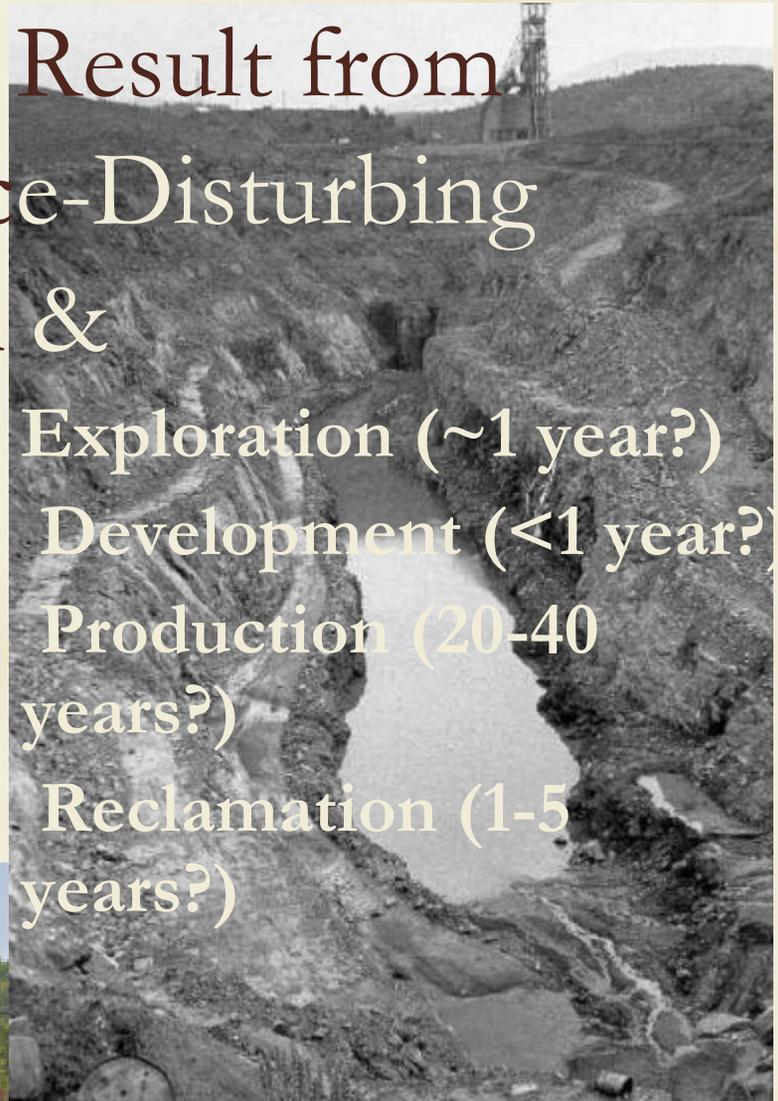
Subsurface Mining Methods

- Oil/Gas/Geothermal Wells
- Borehole Mining
- Hard rock Mining (shaft/stope/underground)



Surface Impacts Can Result from Each Phase of Surface-Disturbing Actions (Exploration & Development):

- Exploration (~1 year?)
- Development (<1 year?)
- Production (20-40 years?)
- Reclamation (1-5 years?)



Post file photo

Impacts of Mineral Exploration & Development on Conservation Values



- Impact severity tends to depend on:
 - Type of mineral resource extracted
 - Activity duration & density
 - Associated infrastructure
 - Seasonal timing of human entry
 - Success of mitigation
 - Primary conservation values

Impacts of Mineral Exploration & Development on Conservation Values

- Duration of impact varies:
 - Exploration phase
 - Development (mining) phase
 - Some will persist due to weed infestation, erosion problems, water quality issues
 - Impact duration may vary for different conservation values



Typical Conservation Values



- Agriculture (prime irrigated crop land or native rangeland)
- Natural habitats for plants and animals
- Wildlife
- Open space (scenic value)



Possible impacts to agriculture:

- Lost crop or pasture.
- May have positive impacts on roads and fences.
- Impacts to water resources
 - Wastewater disposal, groundwater contamination, disturbance of aquifer yields or flow patterns; erosion.
- Often easiest to reclaim.



http://www.landtrusttn.org/leipers_fork/gallery.html



Possible impacts to natural habitats:

- Lost/degraded rare and sensitive habitats such as wetlands or riparian areas.
- Surface disturbance can destroy and/or create edges, fragmentation.
- Noxious weeds can degrade, especially wetlands and arid sites.
- Surface water flow patterns, ground water recharge areas, aquifers can be disturbed, degraded.



© 2002 Fero Badnar, www.wmp.sk



Possible impacts to wildlife:



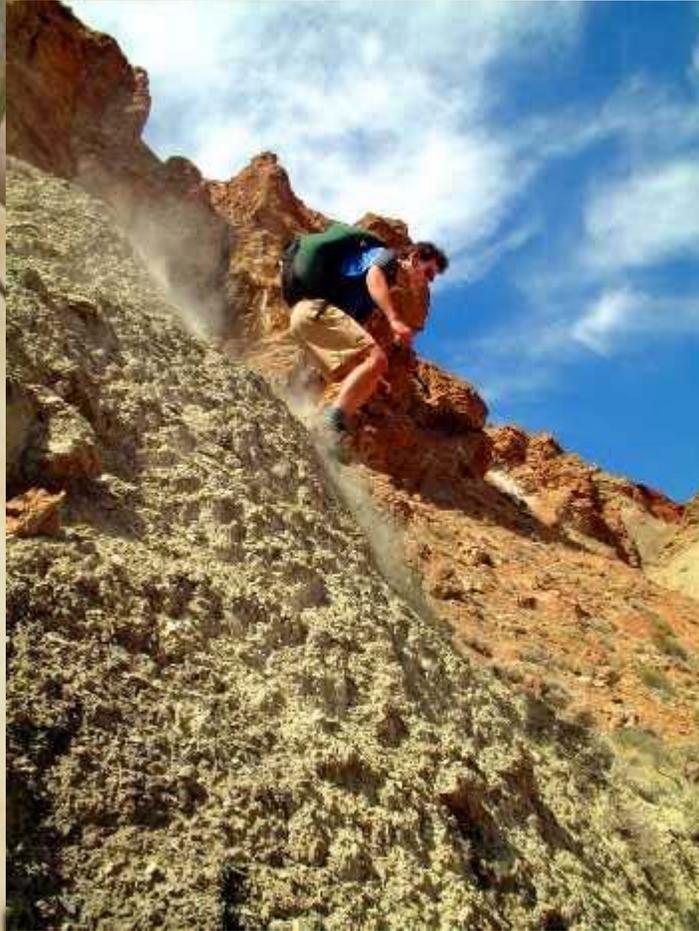
- Some impacts are harder to mitigate than others.
- Such as species that need space (like big game), that are easily disturbed (raptors, sage-grouse).
- Mortality can be caused by vehicles, avian collisions, avian predation, and poaching.
- Disturbance, affecting habitat use or reproduction.
- Surface disturbance and noxious weeds can destroy or fragment habitat.

Possible impacts to scenic values:

- How much do scenic values depend on “pristine”?
- What is visible to the public?
- What is the duration?



Impacts of Mineral Exploration on Conservation Values



- Remote/Aerial exploration methods result in little to no impacts to conservation values.
- Field exploration methods will range in level of impact depending on transportation type and route, season, type of site characteristics (soil type, degree of slope, moisture level, etc.), and specific conservation values.
- Examples: 2 geologists walking across the landscape in summer time. ATV-ing in mud season.

More examples of Exploration Impacts



- Heavy (40,000 lb) vibroseis equipment performing a seismic survey in mud season.

High Country News

http://www.hcn.org/servlets/hcn.Article?article_id=11212



“Known in the industry as "vibroseis vehicles," the trucks move in a straight line across miles of terrain, stopping in 220-foot increments to send sound waves into the ground. The waves rebound off various geologic features below the earth's surface, and then are picked up by arrays of sensors or "geophones" inserted into the ground. The sound is conveyed via miles of cables and battery packs to a central recording bank. The result is a highly detailed picture that can show an area as large as 300 square miles, and thousands of feet deep. “



Avoid & Mitigate Impacts



- Avoid if possible
- Identify severed/split mineral estate early in the project.
- Mitigate impacts (expert consultation, industry BMPs, etc.).
- Maintain a dialogue with mineral interests and their contractors.

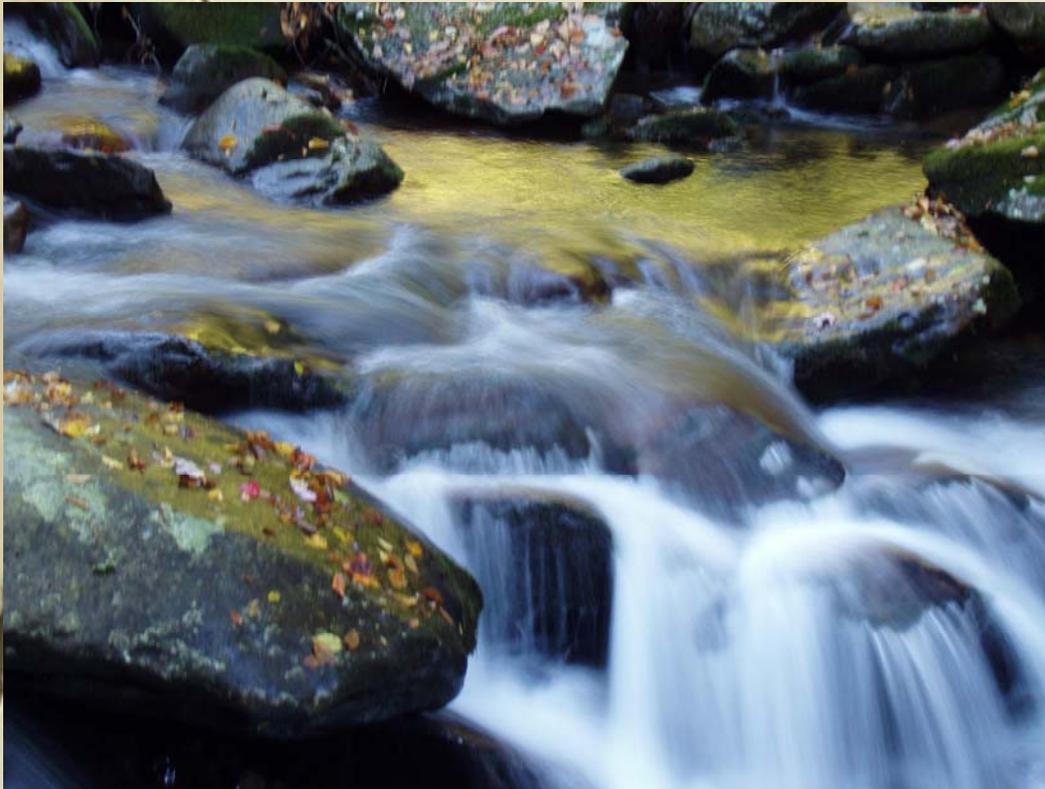
Legal & Tax Issues: Mineral Estates

Lynn Connaughton

BIO-Logic Environmental, Montrose CO

www.bio-geo.com

lynnc@bio-geo.com

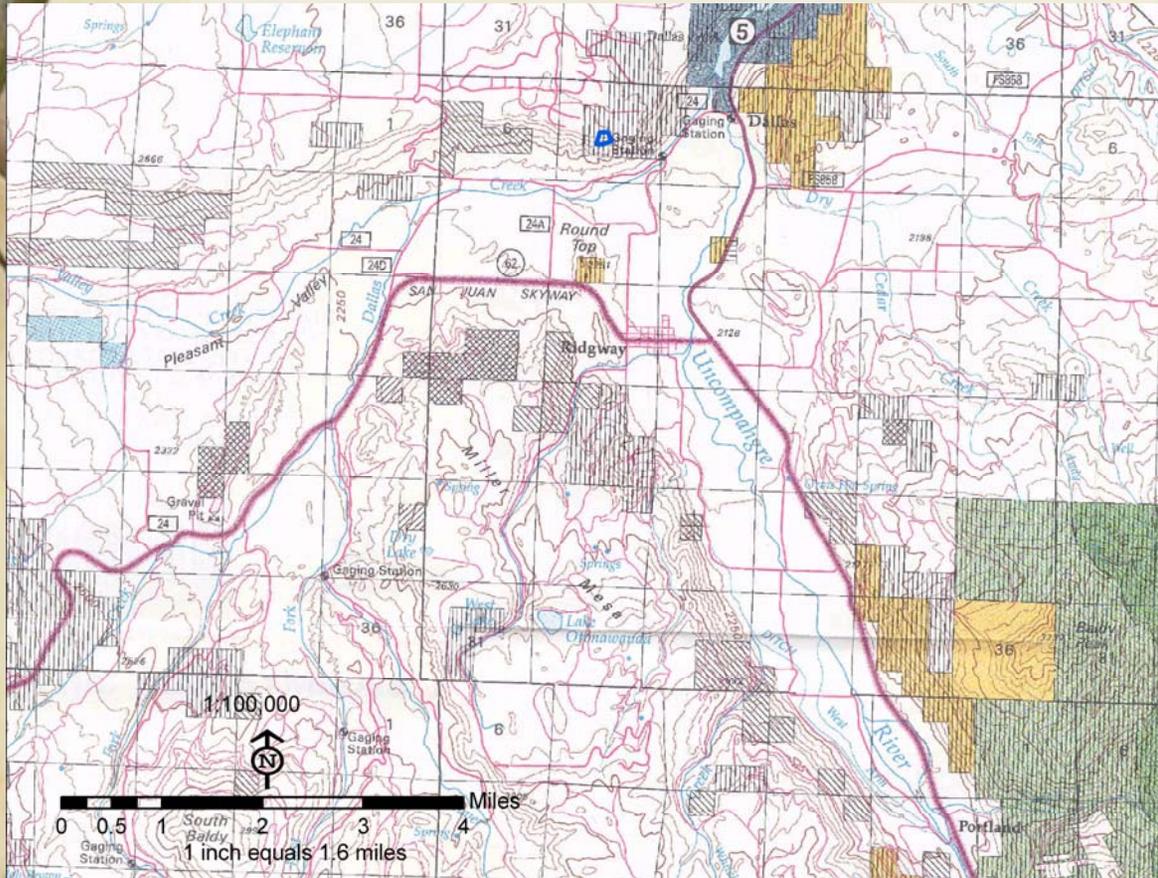




Definition of Severed Mineral Right (Split Estate)

- Mineral rights are the right of ownership of the mineral resources under/in a tract of land (generally subsurface).
- A mineral interest is severed if the surface owner does not own all or part of the minerals. Called split estate since portions or all of subsurface estate is not owned by the surface estate owner. Surface owner cannot deny mineral owner right to their mineral estate.
- Land surface (surface estate) can be owned by federal, state, local governments and agencies such as BLM, USFS, DOE, Colorado, Municipalities or “Private” landowners.
- Mineral estate can also be owned by federal, state, local governments and agencies such as BLM, USFS, DOE, Colorado, Municipalities or “Private” owners.

Mineral estate ownership can be very complicated!



- Different owners can own all the rights to specified minerals, a percentage of the rights to all the minerals, or a combination. Portions of a property can have privately reserved mineral rights or government-reserved rights. Sometimes only royalties are reserved.
- Private reservations are trumped by government reservations made when land was patented.

Two ways to split or sever mineral rights

- Split by **Deed** --party owning both the surface and subsurface rights sells or grants by deed all/part of the mineral rights. Recorded by county register of deeds. (Generally used by private parties.)
- Split by **Reservation** --party owning both the surface and subsurface rights sells or grants by deed or patent the surface rights of the property but retains all/part of the mineral rights. Recorded by county register of deeds, if Federal Patent then also at General Land Office. (Used by federal & state governments, railroads, lending institutions, private parties.)
- Surface owner cannot deny mineral estate owner's property rights.



Leases

- Privately-owned minerals are leased by companies seeking to develop them. Leases may have a specific primary term which may be extended by mining operations or production, or may have a renewable fixed term.
- There is no standard form of mining lease for fee property. Lease terms and conditions are highly variable and often depend on the skill level of the negotiators.





Leases: Key Components

- Mineral(s) covered by the lease, those reserved by the lessor, and provisions relating to conflicting development;
- Term of the lease;
- Production royalties payable to lessor;
- Minimum royalties, if any, payable to lessor, and crediting of minimum royalties against production royalties;
- Restrictions on mining methods allowed; and
- Provision that requires the lessor's consent in connection with assignment or sublease.



Leases

- Contracts, sometimes recorded but not always. Can be elusive in title searches.
- Allow lessor and assigns rights to explore and develop minerals for a renewable term “the land hereinafter described, with the exclusive right for the purpose of exploring by geophysical and other methods, and operating for and producing therefrom oil, gas, and other hydrocarbons and all other minerals or substances, whether similar or dissimilar, including, but not limited to, coalbed methane, helium, nitrogen, carbon dioxide, condensate, distillate, casinghead gas, casinghead gasoline and all substances produced in association therewith from coal bearing formations or elsewhere, that may be produced from any well drilled under the terms of this lease, with rights-of-way and easements for laying pipe lines and servicing or drilling other wells in the vicinity of said lands, and erection of structures thereon to produce, save and take care of said products, including the right to inject salt water, production fluids, gases and other fluids into strata below those providing fresh water from wells located on the herein leased lands or on adjacent lands, all that certain tract of land, together with any reversionary, remainder and executory rights therein, situated in _____ County, State of KANSAS, described as follows: “



Leases

- **Arrange for pooling** “For purposes of promoting the development of shallow gas and associated hydrocarbons produced in conjunction therewith, Lessee is granted the power to pool and unitize all or portions of this lease into a development unit containing not more than 3,000 acres. This grant shall only be effective if Lessee drills or has drilled at least Two (2) wells within the pooled unit no later than one (1) year from declaration of pooling and in no event later than one (1) year after the expiration of the primary term hereof. This special pooling grant is only effective as to formations hereby defines as geologic formations located from the surface of the earth to one hundred feet (100') below the top of the Pre-Cambrian formation. The pooled unit must consist of all contiguous acreage with at least one common corner.”
- **Allow for other surface uses and surface owner stipulations (if any)** “Lessee shall have the right to use, free of cost, gas, oil and water produced on said land for Lessee's operation thereon, except water from the wells of Lessor. 7. When requested by Lessor, Lessee shall bury Lessee's pipeline below plow depth. 8. No well shall be drilled closer than 200 feet from the house or barn now on said premises without written consent of Lessor. 9. Lessee shall pay for damages caused by Lessee's operations to growing crops on said land. 10. Lessee shall have the right at any time to remove all machinery and fixtures placed on said premises, including the right to draw and remove casing.”
- **Examples of contracts at**
<http://contracts.onecle.com/type/98.shtml>



Surface Use Agreements

- Think of a SUA as a “development agreement” between the surface owner and mineral estate owners/developers.
- Content is totally variable.
- **Varies by State.** Several state courts have modified the reasonable use doctrine to require that mineral developers accommodate existing surface uses, and some states have limited the common law doctrine by statute. States also have varying statutes protecting the surface owner from certain damages relating to mineral development, such as subsidence.



Surface Use Agreements

- Contract may arrange for timing of exploration and development, location/citing, best management practices, compensation for surface damages, reclamation, amount of advance notification of exploration/development activities, accepted rights of way, baseline studies (existing surface condition, surface and/or ground water quality and quantity, special habitats or features), fire plan, emergency plan, weed management plan, mitigation plan, noise control plan, dust control plan, fencing, lighting, worker sanitation, waste water disposal,...things that are important to all parties.
- Good information available from many surface owner rights advocate organizations. Consult with a knowledgeable attorney.
- http://www.earthworksaction.org/oil_and_gas.cfm (Oil and Gas Accountability Project)

Due Diligence: Information Resources

Lynn Connaughton

BIO-Logic Environmental, Montrose CO

www.bio-geo.com

lynnc@bio-geo.com





Mineral Due Diligence: Information Resources

- General information on minerals and mining policies
 - Federal Government
 - BLM, U.S. Geologic Survey, U.S. Bureau of Mines & Reclamation, U.S. EPA
 - <http://www.geocommunicator.gov>
 - Online GIS mapping utility with active & closed leases & permits for solid minerals, oil/gas/geothermal leases, mining claims, range allotments & rural school sale parcels.
 - http://www.blm.gov/bmp/Split_Estate.htm
 - BLM split estate brochure, slide show, & current policy updates
 - <http://www.blm.gov/bmp/goldbook.htm>
 - 4th Edition of BLM Gold Book
 - <http://energy.cr.usgs.gov/oilgas/noga/>
 - National oil/gas assessment program, descriptions of basins, plays and GIS data
 - <http://energy.er.usgs.gov/coalres.htm>
 - National coal assessment program and data
 - State Government
 - State Department of Natural Resources or environment; State Geologic Surveys; State Mineral Boards; State Oil & Gas Commissions
 - To find your state's geologic survey go to: <http://www.stategeologists.org/> and use their map links.
 - Local Government
 - Land Use/Building/Environmental Health Departments of municipalities and counties.

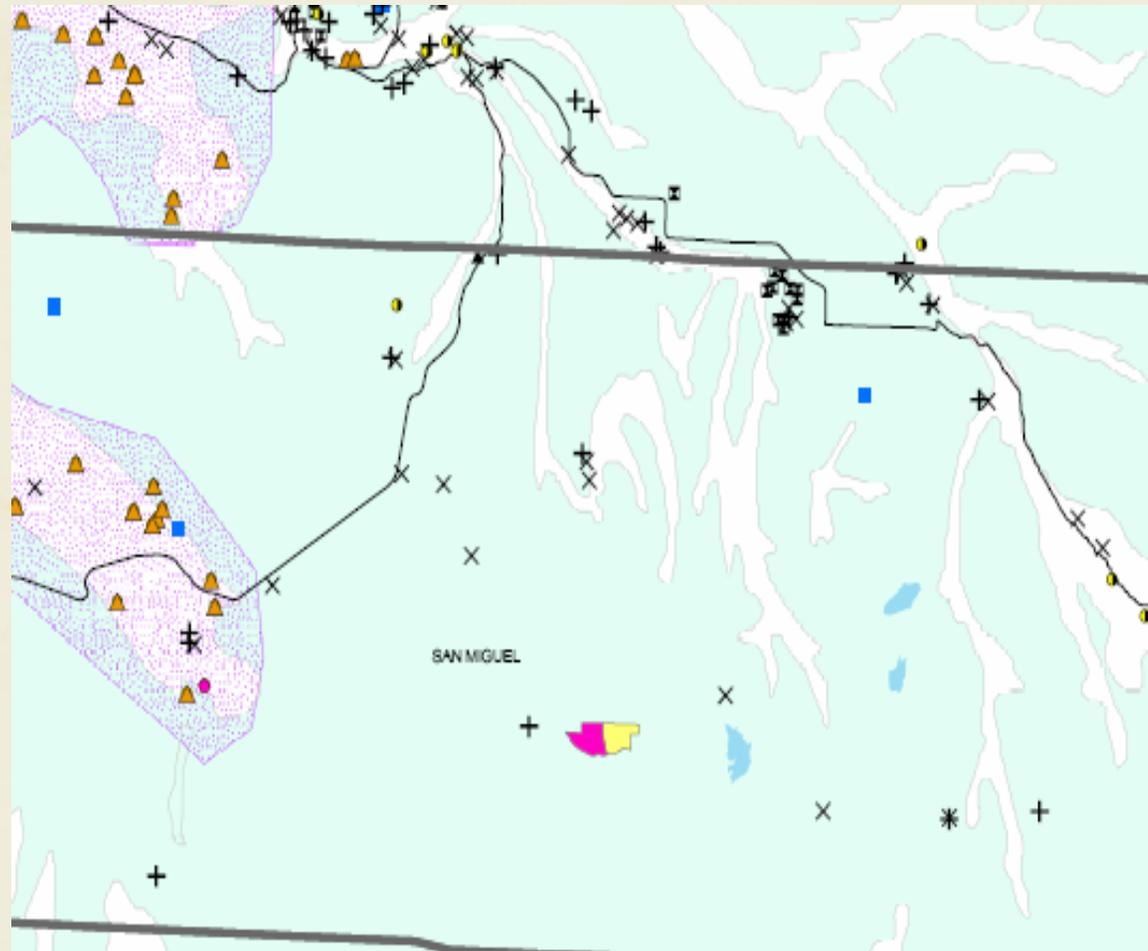


Mineral Due Diligence: Information Resources

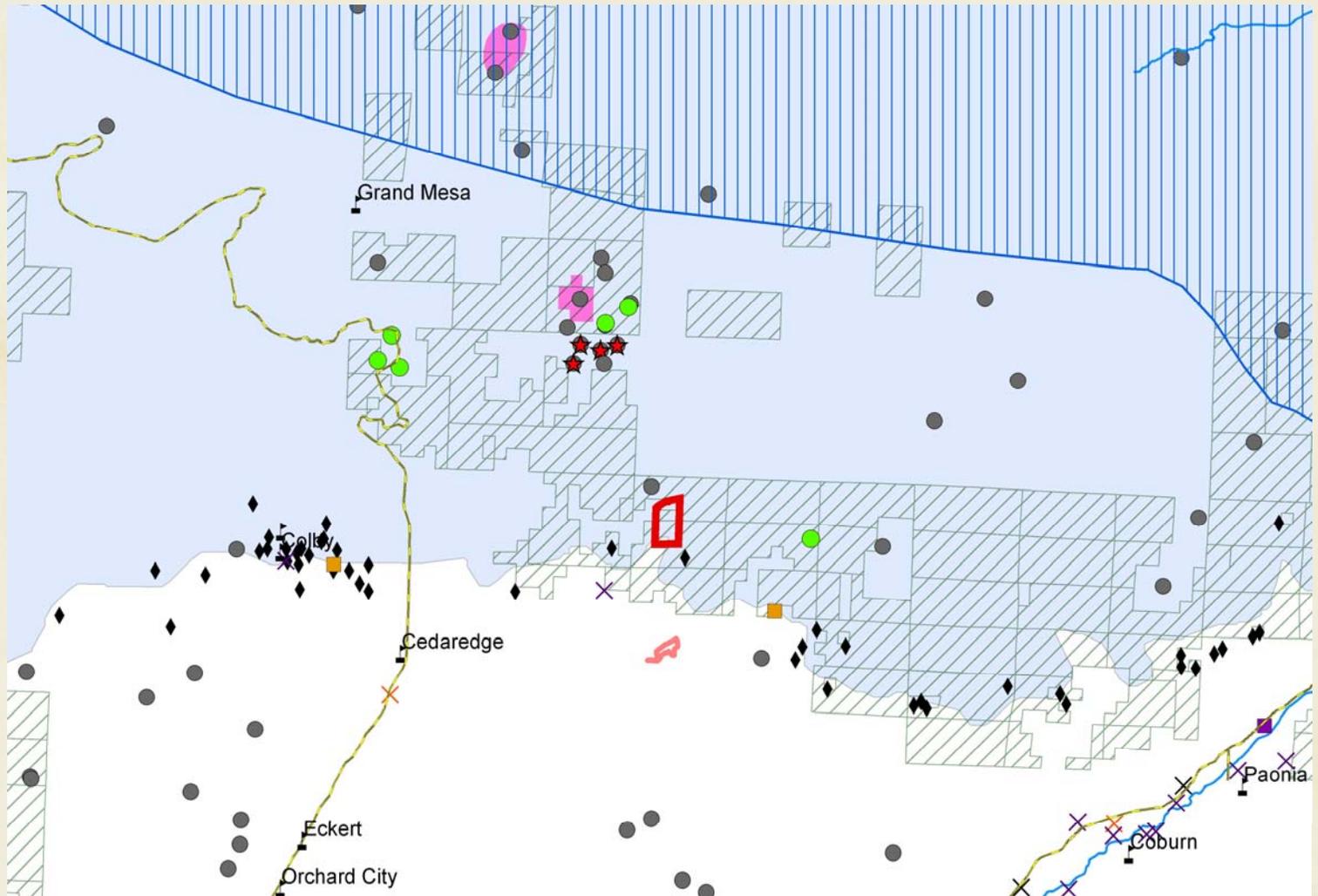
- Mineral estate ownership: Title Commitment with legal description of property showing Schedule B-2 (Exceptions to ownership). ALSO compare with:
 - Federal Government
 - BLM 1:100,000 Mineral Management Status Maps (\$4-\$7 at BLM field offices and/or State Office
 - General Land Office Records (Patents). Can search online and download a copy of the patent in many cases at: <http://www.glorerecords.blm.gov/>
 - State Government
 - State land or mineral board maps
 - Local Government
 - County assessor's office, County/Municipality Recorder's office
- Locations of mining operations and mineral resources
 - All the above AND
 - Publications of professional geological associations such as GSA, AIPG, AAPG, RMAG, etc.
 - Interlibrary Loan, many publications are out of print. U.S. and state geological surveys have been downsized and many mining companies conduct proprietary investigations (unpublished).
- Other useful GIS data sources
 - www.geocommunicator.gov, www.charttiff.com sources of aerial photos (DOQQs) and topographic base maps (DRGs)
 - Public land Survey System: download township, section, government lot boundaries:
 - www.geocommunicator.gov/GeoComm/lis_home/home/index.html
 - USGS Geo Data Explorer <http://geode.usgs.gov/>

Be familiar with your area

- GIS Map of a conservation property and solid mineral mining/mineral features



Consider Mineral/Mining Potential early!
If there are severed mineral rights there is no guarantee of remoteness.



Exploration and development of minerals can impact conservation values.

- GIS Map of a conservation property and oil/gas mining features.

