Filling the Gaps

How to Improve Oil and Gas Reclamation and Reduce Taxpayer Liability

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Prepared by
Kuipers and Associates

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Filling the Gaps: *How to Improve Oil and Gas Reclamation and Reduce Taxpayer Liability*

Foreword

WORC is a regional network of seven grassroots community organizations that include 9,500 members and 45 local chapters. WORC helps its member groups succeed by providing training and coordinating issue work. WORC's mission is to advance the vision of a democratic, sustainable, and just society through community action. WORC is committed to building sustainable environmental and economic communities that balance economic growth with the health of people and stewardship of their land, water, and air resources. WORC's member groups are: Dakota Resource Council (North Dakota), Dakota Rural Action (South Dakota), Idaho Rural Council, Oregon Rural Action, Northern Plains Resource Council (Montana), Powder River Basin Resource Council (Wyoming), and Western Colorado Congress.

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Copies of this guide can be ordered from the Western Organization of Resource Councils or the report can be accessed electronically at http://www.worc.org/energy/bonding/report.html.

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FILLING THE GAPS: *HOW TO IMPROVE OIL AND GAS RECLAMATION AND REDUCE TAXPAYER LIABILITY*

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Executive Summary

More than two million wells have been drilled in the search for oil and gas in the United States, with approximately 520,000 producing oil wells and 360,000 producing natural gas wells in 2002. These numbers will most likely more than double in the next 10 years. For example, in the San Juan Basin of New Mexico there are currently 18,000 wells, with the Bureau of Land Management (BLM) proposing an additional 12,500 wells in just one portion of the basin. In the Powder River Basin of Wyoming and Montana BLM has proposed 77,000 new wells.

Along with the boom comes a vast grid of associated infrastructure: wells, well pads, roads, power line and pipeline corridors, waste water impoundments, compressor stations, processing plants, and other associated facilities. This development is significantly impacting public and private lands, water resources, crops and soils, air quality, and property values. Those impacts largely have been ignored by both the present administration and the state and federal regulatory agencies involved in the permitting process.

As a matter of basic fairness, when an oil or gas company's actions result in expensive damages to land, water supplies, and other natural resources, the burden of cleanup should be borne by the company, not taxpayers or landowners. This report focuses on the impacts caused by oil and gas development and the reclamation planning and financial assurance practices that can be used to mitigate both the affects and the liabilities associated with those activities. It proposes four changes that will ensure better protection for taxpayers and landowners.

Major Findings

This report examines reclamation practices and financial assurance (sometimes referred to as "bonding") requirements for oil and gas development on state, federal and private lands in Colorado, New Mexico, North Dakota, Montana, and Wyoming and is applicable to other states and regions. The major findings are:

1) Oil and gas drilling can cause major impacts to public and private resources. These include extensive disturbance to surface resources (land and vegetation), in addition to impacts to water resources, crops and soils, wildlife, and property values. In the majority of cases the impacts are either not identified or inadequately addressed.
2) Current state and federal requirements for reclamation plans are grossly inadequate and fail to result in productive post-development reclamation of damaged sites. Current guidelines lack standards necessary to prevent impacts to land and water resources and loss of use to other public land users and private landowners.
3) Financial assurance only works when it is sufficient to cover reclamation costs. In all cases examined in this report, the blanket bond approach currently in use is grossly inadequate and fails to provide sufficient funds for reclamation to be performed by the responsible agencies in the event an operator defaults on its obligation. This results in liabilities for individual projects ranging from $100,000 to $6,000,000 or more, and suggests a total industry-wide liability - or risk to taxpayers – of billions of dollars.

Major Recommendations

1) Regulatory agencies should require site-specific reclamation plans for each operation that identify all impacts to surface lands and other resources.
2) Regulatory agencies should develop reclamation planning and implementation requirements, such as performance standards, for oil and gas operations consistent with those required for other extractive industries affecting public and private resources.
3) Regulatory agencies should require financial assurance estimated by a professional engineer, in an acceptable form that covers the full cost of performing all reclamation tasks based on site-specific project analyses, prior to issuance of drilling permits.
4) Land management agencies should review and update reclamation plans and financial assurance every year.

FILLING THE GAPS: *HOW TO IMPROVE OIL AND GAS RECLAMATION AND REDUCE TAXPAYER LIABILITY*

Introduction

Oil and gas development is booming throughout the West. With the boom comes an extensive network of wells, well pads, roads, power line and pipeline corridors, waste water impoundments, compressor stations, processing plants, and other associated facilities. Oil and gas drilling and its related infrastructure can damage public and private land, water resources, crops and soils, air quality, and property values.

In an effort to encourage greater domestic oil and gas production, the Bush Administration and Congress have offered an array of tax breaks to the oil and gas industry while easing regulations and speeding up the issuance of drilling permits. Coupled with high oil and gas prices, the push for oil and gas drilling has resulted in a record number of drilling applications. State-level oil and gas commissions and the Bureau of Land Management (BLM) have issued record numbers of oil and gas permits.

WORC and its member groups believe that oil and gas companies must be obligated to reclaim damaged land, protect water resources, and bear the risk of clean-up costs – not taxpayers or landowners. A simple two-step formula would ensure responsible behavior. First, land management agencies should require site specific reclamation plans based on clear standards; Second, companies must demonstrate prior to drilling that they have sufficient financial resources to accomplish the reclamation by providing financial assurance based on the full cost of reclamation.

The West is at a crossroads: one path leads to a balanced future in which oil and gas drilling co-exists with other industries. Down the other path is a continuance of the current situation in which oil and gas companies could, by defaulting on their obligations, burden taxpayers and western landowners with billions of dollars of cleanup costs to restore land and water supplies damaged by drilling. By adopting this report's recommendations, BLM and state-level land management agencies can help hold companies responsible for their drilling practices. WORC hopes this report will be a significant contribution toward a balanced future.

Most state regulations don't clearly define reclamation or the activities necessary to reclaim areas disturbed by oil and gas drilling. Accepted reclamation standards are needed to provide guidance and set minimum requirements for operators. The following description of reclamation is from the BLM/Forest Service Draft publication, *Surface Operating Standards for Oil and Gas Exploration and Development "Gold Book," Fourth Edition, 2005*, and is provided as an example definition of reclamation*:*

> **"The primary objective of final reclamation is eventual ecosystem reconstruction. In most cases, this means returning the land to a condition approximating or equal to that which existed prior to the disturbance. This involves restoring the original landform or creating a landform that approximates and blends in with the surrounding landform. It also involves salvaging and reusing all available topsoil (whatever soil is on top) in a timely manner, revegetating disturbed areas to native species, controlling erosion, and monitoring results. Reclamation measures begin as soon as possible after the disturbance and are continued each year until successful reclamation is achieved. With proper reclamation measures, over time, additional local native species will re-colonize the site and the area will regain its original productive and scenic potential.**
>
> **"Reclamation can generally be judged successful when a self-sustaining, vigorous, diverse, native (or otherwise approved) plant community is established on the site with a density**

sufficient to control erosion and re-establish habitat or forage. Erosion control is generally sufficient when water naturally infiltrates into the soil and gullying, headcutting, slumping, and deep or excessive rilling is not observed."

The use of financial assurance to ensure reclamation is pervasive in the extractive natural resource industries in the U.S. and worldwide. Programs requiring detailed reclamation plans and corresponding financial assurance have been in place in the U.S. coal and hardrock mining industries for more than 30 years. The basic concept of financial assurance is that in the event the developer refuses or otherwise fails to perform the required reclamation activities, the activities can be performed at the direction of the responsible party (federal or state land administrator or private landowner) by a third party contractor. The intent is simple – the industrial user of lands and resources is required to insure that they pay for the reclamation.

Why the need for this report?

Although reclamation and financial assurance has been required for oil and gas development on public lands, and has sometimes been part of activities on private land, evidence increasingly suggests that reclamation in many (or most) cases fails to meet intended standards. The use of blanket bonds – prescribed bond amounts for a given industry - instead of financial assurance calculated by actual disturbed areas has resulted in funds that fall grossly short of actual costs. In fact, because blanket bonds were intended to encourage reclamation, but were not intended to provide the state and federal agencies the necessary funds to perform reclamation and other activities in the event the operator failed to do so, they do not actually constitute real financial assurance.

Twenty years, ago when oil and gas drilling was less aggressive in many areas, the amount of land disturbed seemed relatively miniscule and impacts were generally isolated and easy to dismiss. However, during the boom of the last five to ten years, in the western U.S. in particular, drilling has occurred at a relatively unchecked pace and the impacts are now widespread and easily discernable. One cannot fly over the western U.S. without seeing evidence of the impacts of coal bed methane (CBM) and oil and gas drilling, in terms of intrusion onto the surface of public and private lands, and of the impacts to those lands.

As regulators admit, and those who use public lands for grazing, recreation and other purposes already know, existing reclamation plans lack detail in most cases, and in many cases are non-existent. Discussion is on-going about reclamation standards and requirements. Financial assurance is often based on statewide or nationwide blanket bonds that are limited to a maximum of $25,000 or $150,000 per company, respectively. Private landowners, meanwhile, are rarely provided financial assurance to protect their interests when oil and gas drilling occurs on their land.

This guide focuses on reclamation planning and financial assurance for oil and gas drilling on public and private land. The first section describes a tale of two ranches in New Mexico to highlight present reclamation and financial assurance issues. This is followed by a description of disturbances caused by oil and gas drilling. A summary of five case studies then illustrates in detail various aspects of reclamation planning and financial assurance as presently practiced, with a focus on potential costs and liabilities. This is followed by a focus on state and federal reclamation and financial assurance regulations and an examination of the concepts of reclamation planning and standards with recommendations for best practices. Finally, the report explores the concept of financial assurance and techniques for direct and indirect cost estimation and provides recommendations for calculating effective amounts and forms of financial assurance.

This guide intentionally focuses on reclamation planning and financial assurance, which is just one of many issues that exist with respect to oil and gas development. To find out more about split-estates and landowner rights, as well as information on development impacts and concerns from a layperson's perspective, the authors strongly recommend ***Oil and Gas at Your Door? A Landowner's Guide to Oil and Gas***

Development available from the Oil and Gas Accountability Project (www.ogap.org).

A note on terminology: While the title of this document specifies oil and gas, this includes coal bed methane. Coal bed methane (CBM) or Coal bed natural gas (CBNG) is a form of natural gas found in association with coal seams. Natural gas can be found during oil extraction (associated gas) and in the absence of oil (non-associated gas). Oil and gas are also found in conventional and non-conventional deposits. Non-conventional gas includes coal bed methane and that found in tight sands formations.

Examples of Oil and Gas Reclamation and Financial Assurance Issues

In 2001, Emerald Restoration & Production abandoned 120 oil wells in Campbell County, Wyoming. Plugging and reclaiming these 120 wells will cost the BLM and state of Wyoming an estimated $4 million, or approximately $33,000 per well. The company's financial assurance was a blanket bond of $125,000 for 56 wells on state lands or fee minerals – $3.875 million short of actual reclamation costs. The Wyoming Conservation Fund supplied $2.6 million for plugging costs for the 56 wells covered by the company's bond. More than 60 of Emerald's wells on federal lands have yet to be plugged because of the lack of federal funds.

According to the Wyoming Oil and Gas Commission, seven operators in the state operate more than 1,000 wells (http://wogcc.state.wy.us/cfdocs/2003STATS_files/sheet006.htm). For these operators, the state's $75,000 statewide blanket bond results in a financial assurance of $75 per well – an amount that is laughable when one considers the actual costs of plugging a well or performing other reclamation activities.

In Colorado, EnCana Oil & Gas, Inc. has 3,652 wells on record. The company's statewide blanket bond amount is $235,000, or $64 per well.

In Montana, Fidelity Exploration and Production Company has 571 wells and state bonding totaling $270,000, or $473 per well.

A Tale of Two Ranches

Oil and gas reclamation and financial assurance issues affect both private and public lands. Two ranches in New Mexico are experiencing oil and gas development, but in very different ways. One, the Blancett Ranch, illustrates the problems that can arise with lax enforcement of surface reclamation requirements. The second, Vermejo Park Ranch, demonstrates responsible drilling practices as guided by a strong surface use agreement. The differences are striking.

Blancett Ranch

Blancett Ranch Property Tweeti Blancett

At the Blancett Ranch, oil, gas, and CBM development is located on BLM administered public lands and privately owned surface land in northwestern New Mexico. Federally managed surface land is leased to the Blancett Ranch; mineral rights are leased to 10 exploration and production companies. Burlington Resources Oil & Gas Company (Burlington) has drilled or proposes to drill more than half of the nearly 450 wells on the ranch.

The Blancett Ranch and the leased federal allotment cover approximately 32,000 acres in parts of five townships. The entire area is affected by the Burlington wells and the wells of the other nine companies. The total disturbance area for well pads alone is estimated at a minimum of 2,500 acres, with the total disturbance area much greater.

Because much of the surface on the Blancett Ranch and allotment is exposed rock formations or steep canyon walls and lacks vegetation, grazing is limited under even undisturbed conditions. Use of the level areas for oil and gas pads and facilities further reduces availability for ranch uses. Given the nature of the land, 50% or more of the usable area is impacted by oil and gas operations.

Lack of enforcement by the BLM has resulted in large areas of land where reclamation has not been completed, leaving pipeline rights of way and well pads suffering from erosion and covered with noxious weeds. Roads exceed the widths prescribed in BLM management plans and well permits. Damage to rangeland has seriously reduced the livestock carrying capacity. Pits containing ethylene glycol, wastewater high in hydrocarbons, and other chemicals, are unfenced or poorly fenced, resulting in livestock and wildlife deaths.

<u>Vermejo Park Ranch</u>

The Vermejo Park Ranch (Vermejo) CBM project is also located in northern New Mexico. The 588,000 acre ranch was purchased by Ted Turner in 1996 from Pennzoil, which retained the mineral rights. The purchase agreement included a stipulation that any mineral development would

have to be negotiated with Turner. A mineral extraction agreement between Vermejo and El Paso Energy, which now owns the mineral rights, was created to allow CBM development in an environmentally responsible manner.

The agreement includes these key elements:

- Sensitive areas, covering about 30 percent of the ranch, are completely off limits to CBM production.
- The total number of producing wells at any given time is limited and the total number of wells allowed to be drilled over the life of the project is set.
- Only one well site is allowed for every quarter section (160 acres.)
- Allowable disturbed areas are limited to 0.6 acres for well pads, 2 to 4 acres for other facilities, 20 foot wide roads, and 10 to 30 foot wide pipeline corridors.
- All produced water must be reinjected unless otherwise approved by Vermejo.
- The developer must submit an Annual General Plan of Development to Vermejo for review.
- At the conclusion of the project, all infrastructure, wells, compressors, and other items must be removed from the property. The developer must put up a reclamation bond; the bond is reviewed and increased on an annual basis as the project grows. The bond is based on the cost of reclamation plus 25 percent.
- Interim reclamation is required annually, and includes grading, top soil replacement and hydro-seeding with a native and certified weed-free seed mixture.
- Vermejo has final approval over all facility locations prior to construction.
- Vermejo and the developer have a joint hydrogeologic monitoring program to monitor the effects of coal seam dewatering from CBM development.

On the Vermejo Ranch, pipelines, power lines (the majority of which are underground), and roads are located in a common corridor. Visual impacts are minimized and noise abatement equipment is required in some areas. The maximum number of vehicles and workers on the ranch at any one time is limited. Drilling and construction activities are not allowed in the fall.

Between 400 and 600 wells and four central collection facilities are scattered around the ranch. Where possible, existing roads were used to develop the wells. Before drilling began in 1999, the ranch had 1,200 miles of road; this amount has only increased by 10 percent since then.

Vermejo Park Ranch CBM Development Skytruth

Oil and Gas Development Surface Impacts

Oil and gas drilling impacts surface resources through a variety of activities and disturbances described in the following sections. These include:

- Exploration
- Roads
- Drill Sites/Well Pads
- Gathering/Metering Facilities
- Pipeline and Utility Corridors
- Storage Impoundments
- Land Application Disposal Areas

Exploration – Exploration activities include surface reconnaissance, seismic, and limited drilling activities that typically result primarily in roads and drill site pads. Some types of seismic activities can impact groundwater resources and affect local water supplies. Exploration activities are not always addressed during reclamation.

Roads – Roads may consist of relatively primitive two-track roads and improved roads. The typical disturbed area of improved roads during construction and operations is based on a 15 foot road width expanded to 25 feet width in cut and fill areas. Two track roads are typically 10 feet wide. On that basis, improved roads disturb 2.01 acres per mile of road, and two-track roads disturb 1.21 acres per mile. Because each pad has a road to it, depending on the density of wells per section, roads may make a significant impact.

Drill Sites/Well Pads – Drill sites and/or well pads include the wellheads themselves, wellhead enclosures, above grade pumping and control equipment, and may also contain tanks and waste disposal pits.

CBM Wells: An area of ground large enough to contain drilling equipment is leveled. The disturbed area typically ranges from 0.2 acres to 1.0 acres. Following drilling the wellhead equipment is installed and the operations-disturbed area is reduced to about 0.1 acres. Wells are frequently drilled on a grid pattern, with anywhere from 20 to 160 acres per well.

Oil and Natural Gas Wells: A much larger area is typically leveled for oil and other types of natural gas wells, measuring as much as 6 acres per well pad during construction and 1 acre during operations. Oil and gas well pads may include waste pits containing drilling fluids and other potentially hazardous wastes. These well pads may have temporary reserve pits or emergency pits located at the well. Pits typically measure 75 feet by 150 feet.

Ancillary Facilities – Gathering and metering facilities or central processing/battery sites can

take up to an average of 200 feet by 200 feet for each site during construction. During operations the disturbed area is usually reduced to an average of 175 feet by 175 feet. One of these facilities serves many wells. The facility may also include compressors and generator stations.

Pipeline and Utility Corridors – In many cases, buried pipelines and power cables are located in the same corridor, reducing the total disturbed area.

Overhead Power Lines and Electrical substations: Substations, or at the least, pad mounted transformers, may be found in drilling areas. Overhead power lines are frequently extended instead of installing underground lines.

Buried Gas and Water Lines and Power Cables: High pressure gas lines affect an area typically 25 feet wide and low pressure gas lines affect an area typically 15 feet wide for both construction and operations. Both water lines and buried power cables disturb 15 foot wide areas each. The combined weighted unit area for high and low pressure gas lines is 1.93 acres per mile and water pipelines and power cables each disturb an area of 1.82 acres per mile.

Storage Impoundments – Storage impoundments for produced water are typical to CBM development only. The construction disturbed area for storage impoundments varies widely, from less than an acre to hundreds of acres. The operations disturbed area usually is slightly less than the construction area.

Two types of storage ponds are used: on-channel and off-channel. On-channel ponds are located within an existing drainage basin, including perennial, intermittent, and ephemeral-defined drainages, lakes, reservoirs, and wetlands. Off-channel ponds are located on upland areas, outside of natural drainages and alluvial deposits associated with these natural drainages. Typically, ponds are constructed by excavating a rectangular pit with sloped sides and berms around the perimeter.

Land Application Discharge Area – Typical to CBM development only may be a center pivot or other type of irrigation system covering up to a section of land or more for produced water disposal during operations.

CBM-produced water is frequently characterized by high sodium adsorption ratios, high levels of total dissolved solids, and other constituents that impact the soils and native vegetation. Remediation, including soils treatment and other measures, may be necessary for several years after land application has concluded.

Other Disturbance Types – Oil production may include drilling numerous fresh water wells to dilute poor quality water or constructing water treatment plants. Produced water from conventional and non-conventional natural gas may also need treatment before disposal. Some CBM recovery techniques result in coal refuse that is burned on-site in a burn pit. In some areas, oil companies may use a non-agricultural area for land farming – spreading oil or hydrocarbon-contaminated soils over the land – to decrease the levels of hydrocarbons.

All of the surface impacts described in this chapter are the result of oil and gas development. Unless

adequately reclaimed, they continue to negatively impact public and private lands, water resources, crops and soils, and property values long after the oil and gas resources are gone. Reclamation plans and financial assurance estimates should address all of the disturbances caused by exploration and development.

Other Oil and Gas Development Impacts

In addition to the typical surface impacts described in the prior section, a wide variety of additional impacts can occur from oil and gas projects. As an example, Windsor Energy Group LLC is drilling natural gas wells in northern Wyoming in the Bennett Creek and Line Creek drainages.

The drilling sites are characterized by a number of problems that the developer and state do not appear to be addressing adequately or at all. Among the issues of concern are:

- the location of a water well on the well pad near pits;

- Construction and use of unlined pits;
- leaking and spillage of condensate around production tanks and in vicinity of the water well;
- spills of drilling fluid, and runoff of drilling fluid with well site materials off-site, onto a county road, into an irrigation ditch, onto private property, and into Line Creek;

- covering unlined wet pits with a large volume of gravel, allowing continued leaching of material to surface;
- covering well pad and unlined pits with gravel; and

- forty-seven toxic and hazardous components of drilling fluids allowed into the air, surface waters and groundwater.

Reclamation and Financial Assurance Case Studies

To illustrate reclamation planning and financial assurance estimation on both public lands and private split-estate lands, five case studies were chosen representing a variety of development types, land administration and ownership situations, and geographic locations. The five studies are:

- **No. 1 - Fidelity Tongue River Coal Bed Methane Projects, Tongue River Basin, MT**
- **No. 2 - Yates TD Southwest Coal Bed Methane Project, Powder River Basin, WY**
- **No. 3 - Yates Plateau CS Coal Bed Methane Project, Powder River Basin, WY**
- **No. 4 - EnCana Grass Mesa Natural Gas Drilling Project, Garfield County, CO**
- **No. 5 - Zinke & Trumbo Foreman Butte Oil Drilling Project**, **McKenzie County, ND**

For each case study, information was gathered from state and federal regulatory submittals that describe proposed development activities, reclamation plans, and financial assurance amounts. These documents, which are referenced, form the basis for each study. In many cases, the available documentation lacked important details with respect to activities and reclamation plans. In many cases, the documents did not address costs or financial assurance. Where information was not available, data from comparable projects or from recommendations contained in subsequent chapters of this guide was used together with the professional experience of the authors.

The assumptions used in developing the case studies are detailed in Appendix A of this report; the complete case studies are also included. The appendix can be accessed at: http://www.worc.org/energy/bonding/appendix.html. The following section includes a summary of results, conclusions, and recommendations, and a one page synopsis of each case study.

Table 1 (see page 10) summarizes the results for each case study. Areas for the various types of disturbances at each case study site are listed in addition to direct and indirect reclamation financial assurance cost estimates. The table also contains the actual financial assurance required for each case study site and calculates "potential liability" based on the difference between the estimated and actual financial assurance amounts. The potential liability amount assumes that 100 percent of the available financial assurance listed in the table applies to these particular projects. In fact, that would not be the case, as most of the financial assurance amounts listed here are federal and state blanket bonds that cover hundreds or thousands of drilling sites.

The disturbed areas vary widely among the case studies. Case studies 2, 3, and 4, Yates TD Southwest, Yates Plateau CS, and Encana Grass Mesa respectively, are the smallest and range in size from approximately 31 to 147 acres. Case study 5, Zinke & Trumbo Foreman Butte, is moderate in size and disturbs approximately 511 acres. Case study 1, Fidelity Tongue River, a combination of four different disturbance areas, is large with 1,776 acres disturbed.

The percentage of disturbed acres over the entire project areas ranges from about two percent to eight percent. At first glance this amount of disturbance seems minimal. The numbers don't tell the whole story and should be placed in the right geographic context. Many of these developments are occurring on rangeland in dry, rugged terrain typical of the Rocky Mountains, Great Basin, and High Plains. Rocky, inaccessible ridges and steep mountainsides can reduce the amount of useable rangeland significantly.

Estimated financial assurance amounts to fully fund reclamation range from $174,000 to $7.3 million for the various projects. Cost estimates are based on the disturbed acreage, common unit costs, and the indirect cost factors described in Appendix A.

Table 1. Case Study Summary
Oil and Gas Reclamation
and Financial Assurance

	Case Study No.				
	1	**2**	**3**	**4**	**5**
	Fidelity Tongue River, MT	**Yates TD Southwest, WY**	**Yates Plateau CS, WY**	**EnCana Grass Mesa, CO**	**Zinke & Trumbo Foreman Butte, ND**
Disturbed Areas, Acres					
Combined Construction Areas	212.45	6.89	14.30	94.70	215.00
Well Pads	32.77	0.98	11.50	18.00	215.00
Gathering/Metering Facilities	9.84	0.70	0.70		
Improved Roads	58.03	2.44	4.94	21.82	71.52
2-Track Roads	99.77				
Gas Pipeline outside Corridor	247.39	4.40	7.94	16.36	
Water Pipeline outside Corridor	61.27	0.38	0.69		9.09
Buried Power Cable outside Corridor	78.95				
Proposed Discharge Points	0.15	0.01	0.04		
Storage Impoundments	315.00	11.70	24.26		
Land Application Discharge (LAD) Area	660.00				
Total Disturbed Area	1,775.6	30.5	64.4	147.0	510.6
Direct Cost Estimates					
Combined Construction Areas	$559,343	$26,128	$37,673	$250,318	$589,420
Well Pads	$682,316	$20,314	$239,439	$374,774	$4,476,469
Gathering/Metering Facilities	$40,852	$2,918	$2,918		
Improved Roads	$153,247	$6,434	$13,057	$57,618	$188,860
2-Track Roads	$263,476				
Gas Pipeline outside Corridor	$338,046	$6,012	$10,846	$22,360	
Water Pipeline outside Corridor	$83,725	$522	$941		$12,422
Buried Power Cable outside Corridor	$107,873				
Proposed Discharge Points	$394	$30	$109		
Storage Impoundments	$1,598,984	$59,395	$123,177		
Land Application Discharge (LAD) Area	$1,574,862				
Estimated Total Direct Costs	**$5,403,118**	**$121,753**	**$428,161**	**$705,070**	**$5,267,172**
Indirect Costs	**$1,863,643**	**$52,602**	**$184,983**	**$290,517**	**$1,816,753**
Total Estimated Financial Assurance	**$7,266,761**	**$174,355**	**$613,143**	**$995,587**	**$7,083,924**
Total Actual Financial Assurance	**$420,000**	**$52,802**	**$150,000**	**$535,000**	**$250,000**
Potential Liability (Estimated minus Actual)	**$6,846,761**	**$121,553**	**$463,143**	**$460,587**	**$6,833,924**

Calculation of costs on a per acre basis is useful for comparison purposes. The costs for the various case studies on a per disturbed acre basis area as follows:

Case	Total Unit Cost $/disturbed acre
1	$4,093
2	$5,717
3	$9,521
4	$6,773
5	$13,874

The Case 1 estimate is predominated by costs for reclamation of CBM-produced water storage impoundments and land application discharge (LAD) areas and has the lowest total unit cost at $4,093 per acre. Case 2, also a CBM project, also has a lower-range unit cost at $5,717 per acre. Case 3, the third CBM project, has a higher unit cost of $9,521 because the documentation showed larger well pad disturbed areas and a much higher number of storage impoundments compared to Case 2 (a project similar in size and geographic location.) Case 4, a drilling project to extract natural gas from tight sands formations, has a total unit cost of $6,773 per acre, similar to the CBM projects. Case 5, an oil field producing associated gas, has the highest total unit cost of the case studies at $13,874 per acre due to larger well pad areas and waste pit reclamation costs.

The actual financial assurance provided by the exploration and drilling companies ranges from almost $53,000 to $535,000 per project. In terms of potential liability, the case studies ranged from approximately $122,000 to $6.8 million.

Conclusions and Recommendations

In no case examined by this guide does the financial assurance provided by the companies exceed the estimated costs for reclamation should the developers engaged in and profiting from their activities refuse to perform the reclamation activities required by regulation or law, either during operations or after they cease. Shortfalls of actual financial assurance range from $120,000 to as much as $6.8 million, with the smaller shortfalls typical to smaller operations and the larger shortfalls typical to those operations with a larger number of wells. These shortfalls represent only the liabilities for a single area of operations. In many cases operators have multiple operations covered by a single blanket bond. The case study analyses assume all of the financial assurance in a blanket bond could be used for reclamation at one site. The shortfalls on a company basis, therefore, are much greater than portrayed here.

The case studies are clear examples that existing requirements for reclamation plans and financial assurance amounts are grossly inadequate to prevent public taxpayer and private landowner liability. The importance of reclamation to ensure long-term productivity of public and private lands is evident. Financial assurance is necessary to guarantee that either the developer/polluter completes the requisite reclamation activities, or the agency or landowner is able to do so without risk of expense. Based on the results of these case studies, it is recommended that state and federal agencies and lawmakers enact clear and concise reclamation and financial assurance rules and regulations and provide the incentives and funding to ensure that they are adequately permitted and enforced.

Case Study No. 1 – Fidelity Tongue River Coal Bed Methane Projects Tongue River Basin, MT

The Fidelity Tongue River CBM Projects are located on BLM-administered public lands in Montana; mineral rights are leased to Fidelity Exploration and Production Company (Fidelity). The Fidelity sites include four distinct drilling and exploration projects: CX, Badger Hills, Dry Creek, and Coal Creek.

Within the Tongue River project area, Fidelity has proposed constructing:

- 571 CBM wells,
- 14 gathering and metering facilities,
- 65 discharge points,
- 60 new and existing storage impoundment areas,
- 82 miles of two-track roads,
- 29 miles of improved roads,
- 206 miles of underground gas lines, water lines, and power lines, and
- a 660 acre land application discharge area.

The disturbed areas will affect an estimated 1,776 acres.

Site specific reclamation plans for the Fidelity Projects were not available. The Tongue River CBM Environmental Assessment (EA) contained a limited description of general activities planned for reclaiming well pads, gathering and metering facilities, roads, pipelines, and underground power routes. The EA did not include information for reclaiming discharge points, storage impoundments, land application discharge areas, or for long-term maintenance and monitoring.

Reclamation earthwork quantities for storage impoundments, pipelines, underground power, roads, and other features were derived from the Plans of Development, Surface Use Plans and Water Management Plans, and the EA for the various Fidelity projects. Where data was not available, projects of similar scope were used to estimate quantities.

Table 1 shows the total disturbed acres for each feature in the project. Estimated unit costs for reclamation financial assurance range from $1,366 per acre to $20,821 per acre depending on the feature (well pad versus roads, for example) and the reclamation activity (see Appendix).

Table 1 shows the direct cost estimates for each reclamation activity. The combined total direct cost estimate for the four Tongue River projects is $5,400,000. The total indirect cost estimate is $1,860,000. (The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology in Appendix A.) Based on the direct and indirect costs, the total reclamation financial assurance amount is estimated at $7,270,000.

Fidelity supplied financial assurance in the amount of a $150,000 federal blanket bond, seven individual $10,000 federal bonds, and a $200,000 blanket bond to the state of Montana for the four Tongue River projects. Based on an estimated reclamation financial assurance amount of $7,270,000, the potential liability represented by the financial assurance shortfall is approximately $6.8 million for these projects.

Case Study No. 2 - TD Southwest Coal Bed Methane Project
Powder River Basin, WY

The Yates TD Southwest project is located on a section of state land in northeastern Wyoming. An adjacent ranch leases the surface rights and Yates Petroleum Corporation (Yates) has leased the mineral rights.

Don Spellman

Within the TD Southwest project area, Yates has proposed constructing:

- 17 CBM wells,
- one compressor site,
- two discharge points under Option 1 and three discharge points under Option 2,
- two off-channel pits under Option 1 and three on-channel reservoirs under Option 2,
- two miles of improved two-track road,
- eight miles of underground gas lines, water lines, and power lines.

The disturbed areas will affect an estimated 31 acres over a 640 acre total project area, including some areas not on the state section. The proposed compressor site and a section of the road and utilities, located on privately owned surface land, are included in the reclamation totals. The cost estimate includes five storage impoundments.

Reclamation plans were not available for the TD Southwest site. Aside from cost estimates on reclaiming the two off-channel pits, reclamation information was not included in the Water Management Plan or in the NPDES permit.

Reclamation earthwork quantities for storage impoundments, pipelines, underground power, roads, and other features were derived from maps and statements of work in the Water Management Plan. Where data was not available, the Tongue River Projects and other projects of similar scope were used to estimate quantities.

Table 1 shows the total disturbed acres for each feature in the project. Estimated unit costs for reclamation financial assurance range from $1,366 per acre to $20,821 per acre depending on the feature (well pad versus roads, for example) and the reclamation activity (see Appendix).

Table 1 shows the direct cost estimates for each reclamation activity. The total direct cost estimate for the TD Southwest site is $121,750. The total indirect cost estimate is $52,600. (The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology in Appendix A.) Based on the direct and indirect costs, the total reclamation financial assurance amount is estimated at $174,400.

Yates supplied the state of Wyoming reclamation bonds totaling $52,802 for the two off-channel storage impoundments only. This is slightly more than the line item reclamation cost estimate of $50,500 for these two impoundments arrived at by the unit cost method used in this case study.

Based on an estimated reclamation financial assurance amount of $174,400, the potential liability represented by the financial assurance shortfall is approximately $121,550 for these projects.

Case Study No. 3 – Plateau CS Coal Bed Methane Project
Powder River Basin, WY

The Plateau CS federal Plan of Development (POD) CBM Project is located on both privately owned surface lands and federally managed surface lands in northeastern Wyoming. Yates Petroleum Corporation (Yates) has leased the federal mineral rights at this site.

Within the Plateau CS project area, Yates has proposed constructing:

- 23 CBM wells,
- 18 discharge points and numerous rubber tire stock tank sites,
- 17 off-channel pits and one on-channel reservoir,
- an unknown number of metering/gathering facilities,
- an unknown amount of roads, underground gas lines, water lines, or power lines.

The total project area will cover portions of seven sections (approximately 640 acres per section.) The disturbance area is estimated to affect 64 acres, including both private and federal surface lands.

Reclamation procedures for only the storage impoundments were described in the Water Management Plan. Additional limited information was taken from the Surface and Damage Agreement Yates entered into with the surface landowners. The landowners, a ranching family, have expressed deep concerns over the number, size, and placement of the storage impoundments; the fact that Yates does not plan to line the impoundments, which will likely result in damage to the land from the produced water; and that re-injection of produced water is not being considered, using an existing re-injection well on their property.

Reclamation earthwork quantities for storage impoundments were derived from the Water Management Plan. Where data was not available, the TD Southwest project, similar in scope and located in the same area, was used to estimate quantities.

Table 1 shows the total disturbed acres for each feature in the project. Estimated unit costs for reclamation financial assurance range from $1,366 per acre to $20,821 per acre depending on the feature (well pad versus roads, for example) and the reclamation activity (see Appendix).

Table 1 shows the direct cost estimates for each reclamation activity. The total direct cost estimate for the Plateau CS site is $428,000. The total indirect cost estimate is $185,000. (The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology in Appendix A.) Based on the direct and indirect costs, the total reclamation financial assurance amount is estimated at $613,000.

Yates supplied financial assurance in a $150,000 federal blanket bond for the Plateau CS project. Yates has not yet supplied financial assurance to the BLM for this particular project. The engineer's analysis in the Water Management Plan estimates that a total of $247,665 would be needed to reclaim the 18 storage impoundments. This is considerably more than the line item reclamation cost estimate of $185,571 for these impoundments arrived at by the unit cost method used in this case study, supporting the conservative methodology used in the estimate.

Based on an estimated reclamation financial assurance amount of $613,000, the potential liability represented by the financial assurance shortfall is approximately $463,000 for these projects.

Case Study No. 4 – EnCana Grass Mesa Natural Gas Drilling Project Garfield County, CO

This EnCana Grass Mesa natural gas drilling project is located on BLM administered public lands and privately owned surface land in western Colorado. Federal mineral rights are leased to EnCana Oil & Gas, Inc. (EnCana).

Within the Grass Mesa project area, EnCana has proposed constructing:

- up to 100 natural gas wells using one existing well pad and 16 new well pads,
- six miles of new roads,
- nine miles of underground gas and water lines.

A typical well location will include the wellhead, a separation and dehydration unit, above ground storage tanks, and a temporary reserve and/or production pit. EnCana will use existing compressor stations and an existing water treatment facility.

The total project area will cover approximately 15.3 sections or 9,792 acres. BLM administers over 40 percent of this area, and nearly 60 percent is owned by private landowners. The total disturbance area will affect about 150 acres.

Site specific reclamation plans, including interim reclamation procedures, for some aspects of the Grass Mesa site were described in the Grass Mesa Environment Assessment (EA). General reclamation requirements for oil and gas development were described in the Oil and Gas Leasing and Development Draft Supplemental Environmental Impact Statement (DSEIS).

Reclamation earthwork quantities for well pads, reserve and production pits, pipelines, underground power, roads, and other features were derived from the Surface Use Plan in the EA for the EnCana project.

Table 1 shows the total disturbed acres for each feature in the project. Estimated unit costs for reclamation financial assurance range from $1,366 per acre to $20,821 per acre, depending on the feature (well pad versus roads, for example) and the reclamation activity (see Appendix).

Table 1 shows the direct cost estimates for each reclamation activity. The total direct cost estimate for the site is $705,000. The total indirect cost estimate is $290,000. (The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology in Appendix A.) Based on the direct and indirect costs the total reclamation financial assurance amount is estimated at $996,000.

EnCana supplied financial assurance in the amount of a $300,000 federal blanket bond and a $235,000 blanket bond to the state of Colorado for the Grass Mesa project. Based on an estimated reclamation financial assurance amount of $996,000, the potential liability represented by the financial assurance shortfall is approximately $461,000 for this project.

Case Study No. 5 – Zinke & Trumbo Foreman Butte Oil Drilling Project McKenzie County, ND

The Foreman Butte oil drilling and associated natural gas project is located on private surface, state surface, and BLM and Forest Service administered public land in North Dakota. Federal and state mineral rights are leased to Zinke & Trumbo, Inc. (Zinke & Trumbo).

Cindy Klein

Within the Foreman Butte project area, Zinke & Trumbo has proposed constructing:

- 43 oil wells,
- 43 temporary reserve and/or production pits,
- an unknown number of gathering and metering facilities,
- 15 miles of improved roads,
- an unknown number of miles of underground gas and oil lines, produced water lines, and power lines.

Though documents that Zinke & Trumbo submitted to regulatory authorities stated otherwise, the company is also drilling a number of water wells which may affect nearby domestic wells.

The total project area will affect parts of three townships and the total estimated disturbance area will cover over 500 acres.

Except for limited information on reclaiming reserve pits, site specific reclamation plans for the Foreman Butte site were not available. The Cultural Resources Inventory Report (CRIP), BLM Surface Use Plans (SUP), State Sundry Notices (Sundry Notices), and the Dakota Prairie Grasslands Oil and Gas Leasing Record of Decision (ROD) provided some information on aspects of the project, such as well pad areas and lengths of some new roads.

Reclamation earthwork quantities for reserve pits, roads, well pads, and other features were derived from the SUPs, CRIP, and Sundry Notices for the Foreman Butte site.

Table 1 shows the total disturbed acres for each feature in the project. Estimated unit costs for reclamation financial assurance range from $1,366 per acre to $20,821 per acre depending on the feature (well pad versus roads, for example) and the reclamation activity (see Appendix).

Table 1 shows the direct cost estimates for each reclamation activity. The total direct cost estimate for the site is $5,300,000. The total indirect cost estimate is $1,820,000. (The basis for the indirect cost percentages is described in section 2.2 of Case Studies Approach and Methodology in Appendix A.) With direct and indirect costs the total reclamation financial assurance amount is estimated at $7,080,000.

Zinke & Trumbo supplied financial assurance in a $150,000 federal blanket bond and a $100,000 blanket bond to the state of North Dakota for the Foreman Butte project. Based on an estimated reclamation financial assurance amount of $7,080,000, the potential liability represented by the financial assurance shortfall is approximately $6.8 million for this project.

State and Federal Regulations

Federally-owned oil and gas resources lie under lands administered by the Bureau of Land Management (BLM) or other federal agencies and under lands with non-federal surface ownership. Lands with federal surface management and underlying federal oil and gas leases are usually managed by the BLM in cooperation with the federal surface management agency. On Forest Service lands, the Forest Service has the approval authority for the surface portion of the oil and gas operation.

Surface/subsurface ownership and leasing combinations are frequently referred to as "split-estates." Lands with non-federal surface ownership and federally-owned subsurface resources are one case of a split-estate. A second type of split-estate on federal land involves privately leased federal surface land with federal mineral rights leased to another party. State-owned oil and gas resources generally underlie state-owned lands. A third example of a split-estate is when state surface land is leased to one party and the state mineral rights are leased to another party. Other surface/subsurface ownership and leasing combinations exist but are not addressed here. The mineral estate is generally considered dominant over the surface.

Depending on the ownership or lease holding of the surface and mineral rights, different state and federal regulations apply to surface reclamation and financial assurance requirements. If a developer leases oil or gas from the federal government, the developer (known as the mineral lessee or operator) usually must adhere to both federal and state laws that govern oil and gas development. If a developer leases from a state government he or she must adhere to state laws, and may be subject to federal laws as well (such as the Clean Water Act). Where federal mineral rights are separated from private land ownership, the BLM is responsible for permitting, bonding, and overseeing the reclamation. In some cases federal agencies may share jurisdiction with state agencies (e.g. oil and gas commissions).

Federal rules and most of the rules and laws for the states considered in this guide state that, while the surface owner or lessee cannot legally prevent oil and gas development on his or her property, the surface owner can have some influence over how development and reclamation occur. Surface owners frequently find that reality is far different and that they have few protections. Laws and regulations often are not enforced, state and federal agencies are seriously understaffed and unable to keep up with the pace of development, and the regulations themselves have loopholes that developers take advantage of. Surface owners who are not informed of their rights will find themselves at the mercy of developers.

Federal Requirements

Only federal requirements that concern reclamation and financial assurance of oil and gas development are covered here. A multitude of federal statutes and rules regulate other aspects of oil and gas development and its effects on water and air quality, wildlife, and other environmental and habitat concerns. Generation and disposal of hazardous materials and waste are also regulated, as well as public safety and health.

Reclamation

The BLM has had authority to require reclamation since passage of the Federal Land Policy Management Act of 1976. According to the BLM, "wells abandoned prior to that time were reclaimed haphazardly at best and primarily as *gratis* by the companies involved" and "natural reclamation" was relied upon to stabilize and revegetate the site (from *Draft Supplemental Environmental Impact Statement*, Oil and Gas Leasing Development, Glenwood Springs Resource Area, June 1998.) Specific oil and gas

regulations for the BLM are contained in 43 CFR subpart 3100. The primary requirements for reclamation planning are contained in 43 CFR Section 3162.5-1, Environmental Obligations, which requires that:

> **"Upon the conclusion of operations, the operator shall reclaim the disturbed surface in a manner approved or reasonably prescribed by the authorized officer."**

These regulations do not specify re-vegetation requirements or specific reclamation standards.

Rather than promulgate specific regulations, the BLM, for the most part, has left reclamation planning (and financial assurance requirements) up to area management with minimal national guidance. Beginning in the late 1980's and 1990's, some BLM districts, primarily in response to increased proposals for development, began to draft reclamation policies, and in some cases, standards. In addition, reclamation requirements were incorporated into various environmental assessments and land and water use plans.

The BLM and Forest Service developed the Surface Operating Standards for Oil and Gas Exploration and Development "Gold Book" for use primarily in the Rocky Mountain states. It provides general guidance to oil and gas companies based on onshore orders, notices to lessees, and other regulations. By itself, the Gold Book is not considered to have legal standing. If the agency's authorized officer incorporates all or part of the Gold Book into a permit, it then becomes enforceable.

Chapter 6 of the third edition (1989) of the Gold Book describes reclamation procedures that oil and gas companies should follow after completing operations in an area. A reclamation plan should be included in an operator's Surface Use Plan. Following is a list of the general components of a reclamation plan:

- Pit reclamation
- Revegetation
- Pipeline and flow line reclamation
- Well plugging and site reclamation
- Road reclamation

Procedures for carrying out the reclamation activities are described in more detail in the Gold Book.

The fourth edition of the Gold Book is currently in draft form and out for public comment. It appears that this edition will address some aspects of reclamation in greater depth and with more emphasis on "ecosystem restoration." For example, the draft states that native perennial species or other plant materials specified by the agency will be used for revegetation and that planning for reclamation prior to development is crucial for successful reclamation. However, it is important to remember that the Gold Book is a standard, not an enforceable regulation, unless adopted as part of a permit. The effectiveness of reclamation more often depends on the management at the local level.

In 2004, the BLM issued a Best Management Practice (BMP) policy (http://www.blm.gov/bmp/Technical_Information.htm) that instructs field offices to incorporate appropriate BMPs into development applications and approvals. The BMPs include the following:

- The goal of final reclamation is to return all disturbed areas to a condition where, over time, the disturbed areas will be absorbed back into the seamless, natural landscape.
- Wells going into production should undergo interim reclamation to reduce visual contrast and to benefit other resources values.
- If the well is a "dry hole," final reclamation should begin as soon as practical to restore the land to its previous productive use.
- Recontour the well location back to the original contour or a natural looking

contour that blends with the surrounding topography.
- Respread topsoil that had been salvaged.
- Roughen the surface to trap moisture and seed.
- Consider the use of fertilizer and mulch for sites subject to erosion.
- Revegetation should be with native species and native species recolonization over time.
- Nearly all oil and gas roads should be reclaimed following abandonment of producing wells.
- Most roads need to be recontoured back to the original contour so that they absorb back into the seamless landscape.

Financial Assurance

The primary requirements for financial assurance are contained in 43 CFR Section 3104.1, Bond Obligations, which states that:

"Prior to the commencement of surface disturbing activities related to drilling operations, the lessee, operating rights owner (sublessee), or operator shall submit a surety or a personal bond, conditioned upon compliance with all of the terms and conditions of the entire leasehold(s) covered by the bond, as described in this subpart. The bond amounts shall be not less than the minimum amounts described in this subpart in order to ensure compliance with the act, including complete and timely plugging of the well(s), reclamation of the lease area(s), and the restoration of any lands or surface waters adversely affected by lease operations after the abandonment or cessation of oil and gas operations on the lease(s) in accordance with, but not limited to, the standards and requirements set forth in Sec. 3162.3 and 3162.5 of this title and orders issued by the authorized officer."

The standard compliance bond amounts (for each company) are: $10,000 per lease, a $25,000 statewide blanket bond (covering all the leases in one state), or a $150,000 nationwide blanket bond (covering all leases, regardless of number).

Where split estates occur, a company leasing federal minerals is required to enter into good faith negotiations with the private surface owner or lessee to reach an agreement concerning access to the land and/or compensation for certain types of property damage. The BLM has not specified what "good faith" entails. If the subsurface lessee cannot reach agreement with the surface landowner, the subsurface lessee must post an additional surface use bond with the BLM for the protection of the surface owner.

The *surface use bond*, which must exceed $1,000 and be provided to the surface owner/lessee, covers damages to crops, permanent improvements, and grazing value. If the surface owner/lessee thinks the bond is insufficient, he or she can challenge it with the BLM. However, the BLM has narrowly defined damages to crops as those for feeding domestic animals but leaves out many other crops. Also, according to the BLM, tangible or permanent improvements do not include nonagricultural development, leaving surface owners who are not involved in agriculture without apparent recourse for damages. The surface use bond does not cover damages caused by roads, well pads, produced water discharge, or containment ponds, and so is not considered a reclamation bond.

The *compliance bond* is intended to provide incentives for the reclamation of wells and affected lands and surface waters. If the surface owner/lessee thinks the amount of the compliance bond is insufficient, he or she can request that BLM increase the bond. In some cases, the bonding amount is increased.

State Requirements

This section looks specifically at reclamation and financial assurance requirements in Colorado, Montana, North Dakota, New Mexico, and Wyoming. Legislation is under consideration in several western states to strengthen the laws regarding reclamation and financial assurance for oil and gas development.

The clarity, accessibility, and scope of these states' reclamation and financial assurance statutes and regulations vary considerably. Some states make it comparatively easy for a taxpayer or concerned surface owner to find the regulations that might be applicable to his or her situation. On the other hand, regulations in other states are scattered throughout the code, rules are hard to locate, and applicability difficult for the lay person to understand.

Reclamation

The scope of reclamation requirements vary from state to state. Some states' rules and regulations clearly address specific types of disturbances (well sites, roads, pipelines) and reclamation requirements in detail. Some states address only abandoned wells and plugging requirements. Table 2 summarizes state reclamation requirements applicable to oil and gas development. This table was compiled based on the rules and regulations of the land management agencies to highlight the different requirements amongst states. Site-specific reclamation requirements may be different due to the discretion the regulations afford each agency.

Colorado and North Dakota have relatively comprehensive regulations compared to the other states' requirements (Table 2). Colorado is one of the few states with county regulations that require the reclamation of well sites. Montana and New Mexico rely primarily on general reclamation requirements without detailed specifications. Wyoming has developed some more detailed guidelines but the statutory authority to enforce those guidelines is not clear.

In comparison to reclamation requirements and specifications for coal mines and hardrock mines in all the states, reclamation requirements for oil and gas are, without exception, much less specific and descriptive.

Financial Assurance

Financial assurance or bonding requirements also vary from state to state. Table 3 summarizes bonding requirements for the five states.

All the states depend upon a blanket compliance bond system, which allows for the same bond amount once an operator develops a certain number of wells, regardless of the number of wells developed. This has resulted in the same amount of bond whether the operator has 10, 1000, or 10,000 wells. Obviously, this practice cannot result in the necessary amount of financial assurance to perform reclamation.

Blanket compliance bonding in the state and federal regulations differs significantly from the performance bonding that is applied for financial assurance purposes in other natural resource extraction activities, such as coal and hardrock mining. Those activities, like oil and gas production, result in impacts to public and private lands and resources. Each of the states mentioned has highly detailed and specific performance-based financial assurance requirements for coal and hardrock mining, including full bonding for the cost of the agencies themselves to perform the necessary reclamation tasks in the event the operator fails to perform them.

Table 2. State Reclamation Requirements

Feature	Colorado	Montana	New Mexico	North Dakota	Wyoming
Well Plugging Requirements	Wells are required to be plugged.	Wells are required to be plugged.	Wells are required to be plugged.	Wells are required to be plugged.	Wells are required to be plugged.
Surface Reclamation Requirements	Requires compaction alleviation and the site must be leveled to its original grade and contour.	All disturbed lands should be reclaimed to their previous grade and productive capacity.	The location must be leveled and the site restored to a safe and clean condition.	Topsoil must be distributed over the site and the site must be revegetated and all junk should be removed.	Performed in accordance with the resonable wishes of the landowner .
Interim Reclamation	Required within 3 months for all debris and waste material and all disturbed areas except those areas reasonably needed for production.	Not required.	No regulations.	Unused portion of well site should be reclaimed within a year.	No regulations.
Reclamation Timeline	Completed within 3 months on crop land and 12 months on non-crop land.	Site reclamation required within one year of well plugging.	No time line.	Should begin within a reasonable time but no longer than a year after plugging the well.	Pits should be reclaimed within a year.
Top Soil Salvage Specifications	Soil horizons A, B and C must be separated on crop lands and protected from erosion. On non-crop lands only the A horizon or top 6 inches.	May be specified on drilling permit.	No specifications.	Required for all drill sites, access roads, and all associated facilities. At most only 8” must be salvaged.	Required where practical.
Drill Pits Procedure and Specifications	All drilling fluids should be disposed of in accordance with the rules and the pit should be leveled and revegetated.	Reclaimed to previous grade and productive capacity within a year of well plugging.	Leveled and the site must be safe and clean.	All pit water and oil must be removed. Drilling waste should be encapsulated in the pit and covered with at least four feet of backfill and topsoil. Should be reclaimed within 1 year after well completion.	Should be completed within a year of last use. Squeezing is prohibited.
Associated Facilities	Closed, graded and recontoured and reclaimed as a surface disturbance.	Required if defined by the Board as part of the well site.	No regulations.	Reclaimed as closely as practical to the original condition.	Not specifically required but all related facilities should be reclaimed.
Access Road Reclamation Required	Closed, graded and recontoured and reclaimed as a surface disturbance.	Not required.	Not required.	Reshaped to the original contour.	Not specifically required but all disturbed areas should be reseeded.
Flow lines and Pipelines	All risers should be removed.	Should be removed from the surface.	No requirements.	Flow lines shall be purged in a manner approved by the director. Flow lines shall be removed if buried less than three feet below final contour.	No requirements.
Surface Revegetation Requirements	Based on pre-disturbance vegetation and seed mixes should be derived from local conservation commissions.	Reclaimed to previous productive capacity.	Not required.	The site should be revegetated with native species or to the wishes of the surface owner.	Required based on approximate pre-disturbance vegetation, guidelines provided.
Noxious Weeds	All disturbed areas should be kept free of noxious weeds.	No requirements.	No requirements.	No requirements.	No requirements.

Table 3. Comparison of State Bonding Requirements

Colorado: $5,000 per well, OR a statewide blanket bond in the amount of $30,000 for the drilling and operation of less than 100 wells, OR $100,000 for the drilling and operation of 100 or more wells. On split estates, with surface owners who are not parties to a lease or have not signed a surface damage agreement, operators shall post a bond of $2,000 per well for non-irrigated land and $5,000 per well for irrigated land or blanket financial assurance of $25,000. Exploration and production waste facilities should have a $50,000 bond. Inactive wells: if an operator's inactive well count exceeds such operator's financial assurance amount divided by $5,000, such additional wells shall be considered 'excess inactive wells'. For each such well the bond should be increased by $5,000. The director has discretion in determining the overall amount for inactive well bonds. Natural gas processing and underground storage facilities require a $50,000 blanket bond unless the facility processes less than 5 million standard cubic feet per day; then only a $5,000 bond is required.

Montana: $1,500 to $10,000 per well (depending on depth), or a multiple well bond of $50,000. Under current regulation, these amounts can be, at most, doubled, at the discretion of the director.

New Mexico: $5,000 to $12,500 per well (depending on county where well is located and depth of well), or a blanket bond, maximum of $50,000. Agency procedure does not allow wells that have been non-producing for two years and are sold to be covered by a blanket bond. These wells must be covered by a county bond, usually $5,000 for wells less than 5,000 feet deep, $7,500 for wells between 5,000-10,000 feet deep and $10,000 for wells over 10,000 feet deep.

North Dakota: $15,000 per well, OR a blanket bond of $50,000 for ten wells or less, OR a blanket bond of $100,000 for more than ten wells (with some restrictions). If operator has more than 5 wells under the $50,000 blanket bond, or 10 wells under the $100,000 blanket bond where (1) the well is a dry hole and not properly plugged and reclaimed, or (2) a well has been abandoned and not properly plugged and reclaimed, then all permits for which drilling has not commenced are suspended. The commission may also require higher bond amounts based on expected plugging and reclamation costs.

Wyoming: $10,000 per well less than 2,000 feet in depth, $20,000 per well 2,000 feet or more in depth, OR blanket bond of $75,000 covering all wells drilled by one owner/operator. Each off-channel pit constructed since 2003 must be independently bonded. In addition, if the operator and surface owner fail to reach a surface agreement through good faith negotiations, a $2,000 per well bond will be required. Increased bonding may be required: $3.00 per foot for idle wells if the operator's idle well footage exceeds 8,300 feet or 25,000 feet, depending on which blanket bond is in place.

Reclamation Planning and Standards

All regulatory agencies require minimal site reclamation of oil and gas developments, although substantial differences exist in the nature and extent of the various regulations. In nearly all cases, they require plugging wells to protect groundwater or other natural resources; sometimes this is the only requirement. Surface reclamation, if addressed, is often described as a requirement without specific details or standards other than to recreate the pre-existing landscape or environment.

The primary objective of reclamation is to return the affected land to a condition capable of supporting the uses it could support prior to oil and gas development activities. This means rehabilitating the land surface, or re-creating a land surface comparable to the original, that blends in with the surrounding land. The land should generally retain the pre-development features, such as gently rolling terrain, and drainage patterns.

The objective of a reclamation plan is to describe the activities and features which will impact the surface and the resources (such as air and water quality), and to identify effective methods for reclamation. The plan should address measures to protect public health and safety and the environment. Site specific reclamation plans are crucial to the determination of financial assurance, as they are the basis on which the reclamation tasks, and subsequently the costs, are founded.

It is critical to successful reclamation that the reclamation plan for a particular site or project be developed *before* construction begins. Reclamation will be more effective, less expensive, and less difficult if sufficient topsoil is salvaged and stockpiled at the beginning of the project. Interim reclamation should be a part of the plan, and should take place on an ongoing basis throughout the duration of the project. As wells are completed, portions of well pads can be reclaimed. After pipelines and power lines are buried, the ground surface can be revegetated and erosion controlled.

This section describes a recommended set of general requirements for reclamation plans for oil and gas development projects as well as standards which should be used in implementing those requirements.

Reclamation Plans

Reclamation plans for oil and gas development should contain the following components:

1. Regulatory requirements

Requirements or standards provide the basis for, and a description of, the end product or condition to be achieved -- to return the land to a condition capable of supporting the uses it could support prior to the disturbance. The basis for the reclamation plan, in terms of regulatory requirements and applicable regulatory standards, should be stated at the beginning of the document. Standards and requirements are usually identified in NEPA documents such as Environmental Assessments or Environmental Impact Statements; agency documents, such as the BLM/FS Gold Book or individual Surface Use Plans; permits, such as for water quality under the National Pollutant Discharge Elimination System (NPDES); or in applicable state water quality standards.

Standards and other requirements apply to a wide variety of issues and may include the following:

- Water Quality – numeric and narrative water quality standards for any discharges following reclamation.
- Stability – standards for mass stability and erosion.
- Revegetation – requirements for acceptable vegetation and sustainable ecosystem requirements.

- Post-Development Land Use (PDLU) – requirements for acceptable post development land use to allow for designated activities such as grazing, wildlife, industrial or forest.
- Mitigation – requirements to compensate for damage to or loss of wetlands; groundwater aquifers; wildlife habitat; or recreational, cultural, or other resources.
- Monitoring/Maintenance – requirements for protection and monitoring of the project.
- Safety – worker and public safety requirements, including Occupational Safety and Health Administration (OSHA) requirements.
- Hazardous Waste/Hazardous Substances – Resource Conservation and Recovery Act (RCRA) requirements for storage, removal, and treatment of hazardous waste and substances.
- Demolition – solid waste disposal requirements.
- Operation/Maintenance – requirements to ensure the integrity and operation of facilities and systems whose failure could endanger or harm public health or the environment.

2. Location of the features and facilities

Maps should be provided to show all surface features identified in the plan. Adequate maps should be at appropriate scales and contours for the information displayed. They should include the location of off-site facilities that are not necessarily part of the operation to be reclaimed, but are necessary for reclamation, such as borrow areas, landfills, hazardous materials disposal sites, water treatment plants, sludge disposal sites, etc. The maps should identify each feature and such details as acreage, volume, tonnage, slope angles, and other dimensions needed to quantify reclamation tasks.

3. Description of surface disturbances

Each surface disturbance feature should be described in detail. Any information previously mentioned and not included on a map or other drawing should be provided. The description should also include the type of surface disturbance, including contained and exposed material characteristics that could affect geotechnical (physical) stability and reclamation/revegetation. This description should include both narratives and design drawings showing plan views, layouts, cross sections and profiles. It should also include the location, types (specifications) and volumes of borrow materials required for reclamation, such as growth medium and rip-rap material.

4. Description of facilities and equipment

Each type of facility and equipment associated with or separate from the facilities should be described in detail. Complete dimensions (length, width, height) and construction details (i.e. type of foundation, materials of construction) should be provided, as well as gross weights and/or volumes. This should include information on the quantity and size of equipment and may include narrative descriptions and/or design drawings showing plan views, layouts, cross-sections and profiles.

5. *Description of maintenance*

Information on features that will require maintenance, such as storm water conveyances and storage features, revegetation maintenance, cover repairs, and access needs, should be described. The capacity and dimensions of ditches and catchments, together with a schedule for their periodic maintenance, should be provided. Fertilization, weed control, and replanting or additional planting schedules should be provided. Cover systems should be described, along with performance

criteria and expected cover life. Any access roads or routes that will need to be maintained to accomplish operations, maintenance, monitoring, or other activities should be described, along with their lengths and other characteristics.

6. *Description of monitoring*

Information on monitoring requirements should be provided in the reclamation plan, including surface and groundwater monitoring schedules and analytical requirements; surface flow monitoring requirements and stations; groundwater level monitoring requirements and locations and depths; and vegetation, wildlife and other monitoring requirements with appropriate schedules and detail.

7. *Description of mitigations*

Information on mitigation requirements, including locations of wetlands and required restoration or replacement measures, surface flow augmentation including locations and volumes and times (annual and overall), and/or groundwater injection plans, should be provided in the reclamation plan.

8. A timeline for reclamation

The timeline should include interim reclamation goals and the overall reclamation goal.

Reclamation Standards

The minimum and best practice standards described in Table 4 are recommended, based on reclamation standards that have been developed for oil and gas development and for other natural resource development activities conducted on private and public lands.

Table 4. Oil and Gas Recommended Standards

Reclamation Area	Minimum Standard[1]	Best Practice Standard[2]
Reclamation Timeline	Reclamation shall be conducted within two years of well abandonment	Reclamation shall be conducted within six months of well abandonment
Interim Reclamation	Areas which will no longer be disturbed shall be reclaimed within one year of construction	Areas which will no longer be disturbed shall be reclaimed immediately following construction
Soil Salvage and Use	All soil up to a minimum thickness of 1 foot if available shall be salvaged and stored and used solely for reclamation.	All soil up to a minimum thickness of 2 ft if available shall be salvaged, stored and used solely for reclamation. Soil horizons should be separated
Well Plugging	All wells shall be plugged in accordance with state and federal requirements for well abandonment	All wells shall be plugged to prevent contamination of groundwater or other resources including solid grouting in all areas of well permeation, surface penetration and high value groundwater.
Recontouring	Areas shall be regraded to the original contour or natural looking contour that surrounds with surrounding topography	Add … contouring to achieve geomorphic stability over time. Slopes not to exceed 3 horizontal to 1 vertical.
Revegetation	Use native species or species consistent with surrounding area. Use mulch, fertilizer and other enhancements as indicated to promote revegetation	Add…revegetation success to be measurable and achieve equivalent density and diversity of surrounding area within 5 years. Add… and organic matter and soils SAR amendments if necessary.
Weed Control	Weed control shall be included as a part of the reclamation plan	Use non chemical means if possible
Roads	All unnecessary and non-permanent roads shall be reclaimed	Add… to original contours

[1] The minimum standard was derived from a review of state and federal statues and regulations. It represents the current legal threshold for reclamation.
[2] The Best Practice Standard represents, in the professional opinion of the author, the future desired legal requirement for reclamation.

Financial Assurance

The purpose of a financial assurance estimate is to ensure that, in the event the company fails to reclaim the disturbed area, the responsible agency or agencies have the necessary funds available to conduct the cleanup activities using third party contractors and prevailing wage rates. Financial assurance is like an insurance policy. It ensures reclamation of a project will happen even if the company is bankrupt or does not perform. Financial assurance insures performance by providing the agencies with the necessary funds to complete all aspects of reclamation.

Blanket bonding for oil and gas development employed by federal and state agencies falls far short of the intent of real financial assurance. While blanket bonds may provide some ancillary incentive to encourage operators to conduct reclamation activities, blanket bonds do not ensure that reclamation will actually be performed by either the operator or the agencies without the use of additional public funds. Blanket bonds fall far short of the financial requirements to perform reclamation, and give the false impression that effective bonding exists.

Real performance-based bonds as financial assurance are the only acceptable means to ensure reclamation and eliminate public liability. The operator does not have to absorb the full cost of the financial assurance, as in most cases they are able to obtain bonds from surety/insurance providers for pennies on the dollar.

As a well or well-field becomes less and less profitable, it may no longer be in the interest of the company to maintain its operations and conduct such activities as reclamation. In many cases, the assets are sold to smaller companies, which, in turn, frequently go bankrupt. In that event, the reclamation responsibility becomes that of the state or federal agencies -- or, in some cases, private landowners.

Financial assurance cost estimation uses the same fundamental principles as all engineering cost estimates, except it assumes the hiring of a third party contractor under agency regulations. An important point is that if the company undertakes the reclamation itself, it usually costs less than having the government perform reclamation. Thus, financial assurance requirements encourage operators to do their own reclamation and protect public taxpayers from liability.

Detailed reclamation cost estimates are more likely to result in adequate financial assurance estimates. An adequate amount of financial assurance will ensure that reclamation is completed and the surface restored to its previous condition, whether the exploration and production company or a government agency undertakes the reclamation.

Recommended Principles of Cost Estimation

Too often, financial assurance estimates result from negotiations between developers and regulators. This is largely the situation with respect to blanket bonding, which is being used by BLM and most states. It is not a neutral, impartial process. Usually, companies successfully negotiate an agreement that underestimates the real costs of third-party reclamation and closure.

The estimator of an oil or gas development project's financial assurance costs must calculate two types of costs: direct costs and indirect costs. Direct costs are those stemming from the necessities of physical reclamation, e.g. the cost of regrading and revegetating a well pad. Indirect costs are those accrued by a developing company's default—that is, the additional cost involved when a third-party contractor revegetates a slope versus what it would have cost the developing company to revegetate the slope.

Reclamation costs can be estimated using a variety of methods. The preferred method involves an objective, qualified professional engineer using fundamental principles of engineering cost estimation. This approach relies on an informed assessment of site characteristics, such as hydrology and soil quality, and an accurate estimate of material quantities, distances, and other site-specific quantifiers to determine direct costs. Recognized sources are used to determine equipment, labor, materials and supply costs that can be converted into per-unit costs. Industry-accepted references are used, including the *Caterpillar Performance Handbook*, *Means Heavy Construction Cost Data*, and actual vendor and/or contractor quotes for the same or similar requirements.

Another method is for a mining company or a third-party contractor employed by the company to make the cost estimate. Companies and their contractors often cut corners to reduce these cost estimates.

In some cases, a company submits the majority of cost estimate information. In other cases, governing agencies generate the necessary information. It is generally accepted in principal, but often not carried out in practice, that the government regulator is responsible for ensuring that the reported conditions accurately represent the site-specific situation. Government regulators' lack of adequate time and knowledge often leads to insufficient oversight.

Accurate information is necessary for an accurate cost estimate. This is probably the single most important aspect of oil and gas reclamation planning. Unfortunately, as demonstrated by the case studies in this guide, all too often accurate and detailed information is not provided.

Following the estimation of direct costs, indirect costs must also be estimated to reflect the amount of financial assurance actually necessary. Combined total indirect costs are typically 40 percent to 60 percent of direct costs. However, state and federal agencies currently apply indirect costs of 0 percent to 45 percent. This is one of the most common sources of underestimation. Indirect costs should include, at a minimum:

- **Contingency** costs, which generally reflect the level of detail and completeness of the cost estimate, as well as the degree of uncertainty of the various factors and assumptions used in the estimate. The less complete the reclamation plan, the higher the contingency costs. Contingency costs range from 2 percent to 10 percent of direct costs.

- **Mobilization and demobilization** costs for the transport of equipment and materials, (offices, facilities, man camps) to and from the project site, as well as infrastructure needs. These costs range from 0.2 percent to 2.0 percent of direct costs.

- **Engineering redesign** costs, stemming from lack of detailed information and/or plan development sufficient for an accurate cost estimate. In most cases of company bankruptcy during the past 10 years, little or no detailed information has been available for reclamation, and significant engineering redesign has been necessary. Unless detailed plans are available, engineering redesign costs range from 2 percent to 5 percent of direct costs.

- **Engineering, procurement and construction management** costs, which generally range from 5 percent to 10 percent of direct costs.

- **Contractor overhead**: administrative, management, public relations, safety, environmental, legal, performance bonding and other costs of doing business. Overhead costs range from 10 percent to 20 percent or more of direct costs, depending on such requirements as governmental administrative oversight, and safety and health requirements.

- **Contractor profit**, which generally ranges from 5 percent to 15 percent of direct costs.

- **Agency administration** costs incurred by state and federal agencies when sites are abandoned or the operator fails to behave responsibly. In many cases the agencies, lacking available and experienced personnel, are forced to hire contractors to perform oversight and other duties. The cost of agency administration can range from 2 percent to 10 percent of direct costs.

- **Cost escalation**: cost estimates are typically based on information and costs for a particular year, making it necessary to account for inflation for the period of proposed financial assurance. The recommended cost escalation is based on an estimated 3 percent per year, which is roughly equivalent to the average cost escalation incurred over the past 25 years.

Types of Financial Assurance

Usually mandated by the regulating authority, financial assurance is a form of insurance provided by the operator before development begins. In theory it ensures that, should an oil or gas development operator be unable or unwilling to pay to reclaim the project site when production ceases, the regulating authority can use the assurance to fund reclamation. Financial assurance can be provided in one of three general forms, with varying allowances in each state or by each federal agency. It is not uncommon for one development operation to be assured using combinations of forms, including combinations of all three types.

Forms of cash or equivalent. Cash or its equivalent is the preferred form of financial assurance, as it is the most secure and readily available in the event of operator default. Forms of cash or equivalents include irrevocable letters of credit (bank guarantees), certificates of deposit, government bonds and trust funds. Cash financial assurance, together with an accurate assessment of reclamation requirements, is the best protection for taxpayers against paying for clean-up.

Surety bonds. Bonds are guarantees from an insurance company or its equivalent for the performance of reclamation work. Surety bonds are generally assumed to be applicable to low-risk circumstances where the surety bond company, in the event of operator default, can expect to hire another contractor to perform the work. Surety bonds are for a set amount of money and have the option of being cancelled or renewed on a regular (typically yearly) basis. Although surety bonds are considered an acceptable form of financial assurance, experience has shown that the amount of payout is likely to be reduced by 10 percent to 20 percent or more as a result of negotiation by the surety company. A surety company also has the option of performing the work (although this is rarely done). Government agencies often erroneously assume that a surety bond will pay out all the funds at once, whereas surety companies are almost certain to make the payments as reclamation activities occur. An additional risk to taxpayers is the stability of the surety companies. Some surety companies have gone bankrupt during the past decade.

The typical cost to the operator for a surety bond is less than 2% per year of the total bond amount, and for companies in good financial condition it may be 0.25% per year or less. The percentage typically reflects the risk of the operator defaulting on the performance. Operators that are unable to obtain surety bonds are generally considered to be of unacceptable risk for other than cash forms of financial assurance.

Self-guarantees. A corporate self-guarantee is a pledge made by a company or its parent company. Although corporate self-guarantees are sometimes accompanied by financial tests as a measure of qualification, in some states the financial test amounts to little more than the existence of a business license. In states

where financial tests exist, experience has shown that companies have gone bankrupt, but continued to meet those tests right up to the moment of their filing for bankruptcy protection. No hard assets, cash, or cash equivalents stand behind a corporate self-guarantee. While they are allowed in some states, self-guarantees should not be considered an acceptable form of financial assurance, because any payout at all is doubtful. Replacing a corporate self-guarantee with another form of financial assurance once a company experiences financial difficulty is problematic.