

ERRATA
Modifications and Corrections To The
Desolation Flats Natural Gas Field Development Project
Final Environmental Impact Statement

The Errata Section of the Record of Decision describes changes to the Final EIS to correct errors or omissions identified from comments received to the final EIS.

Correction

Several comments to the final EIS were received that pointed out the BLM's response to a comment submitted by Mr. Ken Kreckle was not adequate. The BLM, in reviewing its response in the final EIS found that its comments were indeed not sufficient due to an oversight. The BLM's response to Mr. Kreckle's comments is as follows.

Ken Kreckle

1. *Since the document fails to present any locations of environmentally suitable well pad locations, etc., and no definable plans for field development, the "no action" alternative should be adopted, or, in the words of DEIS, to, "defer any action at this time until a clearer, more definable full field development scenario is presented by the Operators."*

BLM Response

In part, the nature of the geology in the DFPA makes it difficult, if not impossible, to determine the location of wells far enough in advance to accurately predict their location. Results from new wells often significantly impact the location of subsequent wells based on the success and geologic conditions encountered. The operators have predicted that 385 wells at 361 locations with a success rate of 65% should provide enough wells to extract the minerals they hold leases for.

At this time the location of all future well sites and other disturbance cannot be determined with 100% accuracy by any process the proponents or BLM are aware of. "Setting in stone" well locations in the EIS would require predicting well locations with information in hand, and ignoring the fact that each well provides additional information that is utilized to help determine future actions, including the number of wells and well site locations. Currently, generalized areas of interest are being explored through the interim drilling process to further develop our knowledge of the geology and potential of the DFPA. Adaptive management of oil and gas resource development is very much a reality in that utilization of new information from drilling produces more effective drilling programs with correspondingly reduced effects upon the environment. The number of wells, well locations, timing of drilling, and construction is controlled in part by the location of gas and oil resources as they are found and developed, within the context of BLM's responsibility to ensure surface disturbance is managed in accordance with both the law and sound resource management.

The BLM has a general idea of facility locations, but not specific sites. While the operator and BLM know in general where to place the various actions proposed such as well sites and roads, the exact location will depend on the location of the natural gas resource as discovered, guidance from the DFPA EIS, results from earlier drilling activities, and opportunities and conditions in the field that allow for minimization of environmental impacts, mitigations, and costs. Locating a ground-disturbing activity just a few feet one way or another can often greatly reduce, or increase, the impacts of the action. For any detailed site-specific proposal not fully covered by DFPA EIS, an environmental assessment must be performed and a decision made. This is consistent with the BLM NEPA handbook, the Code of Federal Regulations (43 CFR 3162.5-1, Environmental Obligations) and NEPA. Site specific proposals for individual actions will receive site specific NEPA analysis under the tiering concept utilized by the BLM.

The alternative selected by the BLM for adoption or implementation will be disclosed in the Record of Decision when it is released.

2. *The nature of the geology makes it impossible to locate the number of wells envisioned in the DEIS. Because production is controlled by stratigraphy [HENDRICKS, 1995], and the sandstone reservoirs occur as isolated, separate, over pressurized compartments [Surdam, 1995], it is difficult to predict 'sweet spots' in these stratigraphic reservoirs except with nearby well control. The results of each new well will significantly impact the location of the subsequent wells. Hence, the development of these reservoirs will occur along trends which can only be defined on a well-by-well basis. It follows that any long range plan involving hundreds of wells cannot be specific.*

BLM Response

We agree with this assertion, it appears reflective of the results observed with exploratory drilling at the DFPA to date.

3. *Obviously, the results of these wells will determine the course of future development. If such development is warranted, it can be considered at that time. Therefore, due to the geology of the area, a case-by-case consideration of wells and other facilities is the only appropriate alternative.*

BLM Response

The BLM believes this assertion to be true. Each APD and other proposal for disturbance activities will receive a site-specific environmental analysis under NEPA based upon the specifics of the proposal, tiered to a Record of Decision (ROD) to the Desolation Flats project.

4. *The rejection of the multi-well pad alternative, where 2 to 8 wells could be drilled per each surface location, was largely based on the experience on one operator in the Wamsutter Field. The DEIS states that the technical limits of directional drilling were reached at about 50% deviation. Since the deviations drilled in the Wamsutter case ranged from 15 to 32 degrees, technical capacity was not a limiting factor. Essentially the justification to reject alternative was simply cost. Location costs were cited to be 10 to 20% higher and drill times 30 to 40% higher.*

BLM Response

Mandating multi-well pad drilling within the DFPA was considered but eliminated from detailed study. The reasons are detailed in part beginning on page 2-43 of the DEIS. BLM believes directional drilling can constitute a reasonable alternative in some and perhaps many cases depending on the site specific conditions found at the proposal area. But mandating all drilling in all cases with no exception or allowance for geologic, surface, or economic conditions is not reasonable as detailed in the EISs and other associated documents. Cost, while a consideration, is only one of many factors considered in BLM's decision on how to proceed with a proposal under NEPA.

5.
 - *Considering the large number of wells envisioned in the DEIS, it is reasonable to assume economies of scale will reduce these costs.*
 - *Given the project length, 20 to 40 years, it is extremely likely that these costs, over time, will further decrease as technology provides increased efficiency.*
 - *The inevitable increase in the price of natural gas over this time frame, as the resource becomes more scarce, will also favorably impact the economics.*

BLM Response

The BLM feels these assertions may well prove to be true over the life of the DFPA.

6. *Therefore, in the Desolation Flats area, deviated 'slant' wells represent an economically viable means to produce reserves from under No Surface Occupancy leases. This also points the way for an economically sound utilization of multi-well pads.*

BLM Response

The BLM agrees that slant wells may represent an economically viable means to produce reserves in some, perhaps many parts of the Desolation Flats area, depending on site specific conditions including the geologic and environmental conditions present.

7. *I recommend that the use of multi-well pads be mandated for this development. Assuming 640 acre spacing, a single well pad could service four wells, using deviated wells of about 2000' vertical displacement [10 to 16 degree deviations]. Obviously this would provide a large decrease in the number of locations, and a corresponding decrease in roads and pipelines, thereby drastically reducing the surface impacts. Even if this approach would result in some increase in today's costs, although the undocumented 20% cited is likely overstated, this consideration should not be the overriding determinant. The resultant large scale protection of the environment will justify those costs.*

BLM Response

Mandating multi-well pad drilling within the DFPA was considered but eliminated from detailed study. The reasons are detailed in part beginning on page 2-43 of the DEIS. BLM believes directional drilling can constitute a reasonable alternative in some perhaps many cases depending on the site specific conditions found at the proposal area. But mandating all drilling in all cases with no exception or allowance for geologic, surface, or economic conditions is not reasonable as detailed in the EISs and other associated documents. Costs of implementing a proposal, while a consideration in some cases, is only one factor considered when making a decisions in these matters.

8. *Because of the long time frame envisioned in this DEIS, it is reasonable to predict that advances in technology which can impact this development plan will occur. The spectacular advances in horizontal drilling, artificial fracturing, and seismic over the last twenty years are well known. Work continues in these and other field which will have a direct impacts of the development of this area.*

BLM Response

BLM agrees with your statement.

9. *There are currently many areas proposed, for NSO status, crucial winter ranges and ACEC's, as well as mountain plover nesting concentration. (please refer to the Biodiversity Conservation Alliance alternative for the Great Divide) In addition, 2-mile buffers for sage-grouse leks and 1-mile buffers for raptor nests, (see DEIS pp5-20—5-22) have been proposed.*

BLM Response

Thank you for your comment. The controlling RMP in this case is the Great Divide RMP approved in November, 1990 in which applicable mitigations were reviewed and approved. This proposal is consistent with the Great Divide as detailed in the draft EIS.

10. In addition, this area may be an excellent candidate for industry-government cooperative venture, similar to the Table Rock example above. Working together, methods can be found to achieve the economic exploitation of the natural gas reserve without adversely affecting the environment.

BLM Response

The BLM agrees with your assertion, and welcomes such proposals. Within the framework of an approved ROD for DFPA, we believe this is doable under all alternatives.

11. *The No Action alternative will allow further study of on-going environmental protection efforts such as the Adobe Town Potential Wilderness. There are other efforts underway, for example, the Powder Rim ACEC and big game crucial ranges, seeking NSO stips on leases. It would be premature to allow a conceptual plan to interfere with these efforts. In any case, it is essential that specific locations be presented to allow their impacts to be accurately assessed, and suitable alternatives considered. Obviously one cannot assess the impacts of a conceptual well location, one that has no definition in space and time. This assessment needs to occur at the time the well locations are firm.*

BLM Response

BLM believes you are discussing two elements in the "Adobe Town Potential Wilderness" you mention. One is the existing Adobe Town Wilderness Study Area, which is established in the RMP and is managed for wilderness characteristics. The other is the Citizen's wilderness proposal, elements of which are being assessed under the Rawlins RMP revision process. Expanded wilderness was considered but not carried forward for detailed study as outlined in the draft EIS at 2.6.1, page 2-42. Consideration of establishment of additional wilderness areas is outside the scope of the DFPA, and cannot be properly considered in this EIS / ROD process. There is no Powder Rim ACEC in the Great Divide RMP, although one may be developed through the RMP revision process in the future. BLM is unaware of any proposals for NSO stips on leases and this is not being considered by the DFPA. If you mean approval of the DFPA EIS/ ROD would be premature for the consideration of those efforts, the BLM disagrees. The DFPA EIS / ROD is ripe for decision. We agree that all the impacts of conceptual well locations cannot be completely analyzed. This will be done under site specific NEPA analysis as proposals come forward. We agree that site specific NEPA assessments need to occur at the time the well locations are firm.

Thank you for your comments to the Desolation Flats Draft EIS.



Kenneth Kreckel
Oil & Gas Geosciences

3070 Placid Drive
Casper, Wyoming
Phone: (307)325-3505
email:
kreckel1@yahoo.com

Thursday, June 26, 2003

Bureau of Land Management
Rawlins Field Office
John Spehar, Project Coordinator
PO Box 2407
Rawlins, WY 82301



Re:DEIS, Desolation Flats Natural Gas Exploration and Development Project

Dear Mr. Spehar :

After a careful review of the DEIS, Desolation Flats Natural Gas Exploration and Development Project, I have prepared the attached comments recommending deferring action at this time, or adopting Alternate B-No Action. These comments can be summarized as follows:

- No plan was presented. There are no specific locations for any of the proposed wells, pipelines, producing facilities, etc. It is not possible to assess the environmental impacts of conceptual locations.
- A case by case consideration of this development is the only appropriate approach considering the geology and nature of the exploration and development for these tight gas sands.
- The use of multi-well pads should be required. This alternative is not adequately examined in the DEIS. Multi-well pads are technically and economically feasible and will significantly reduce the surface impacts of this development. A dubious estimate of higher costs, referencing examples based on shallower depths, is used to justify rejecting this technology. No cost/benefit analysis of lessening the surface impacts is presented.
- Current and emerging technologies, notably the hydraulic fracturing of horizontal wells, which have a high potential for reducing the impact of this

development, especially when considering the long time frames envisioned [20 to 40 years], were not adequately addressed.

- Directional and horizontal wells can be used to drain reserves under currently protected sites, as well as proposed NSO areas. The DEIS should specifically address this issue.
- Additional time to examine individual surface impacts, as well as the Proposed Adobe Town Wilderness, is necessary, especially in view of the factors above.
- Development of these gas sands can continue under existing decisions. Exploitation of this valuable natural resource will not be unduly impeded.

I am a geophysicist and former Exploitation Manager with thirty years experience in oil & gas exploration and development. [see attached resume] Much of this experience was gained in tight gas sand developments very similar to Desolation Flats. As Exploitation Manager of the Southern Region [Tyler, Texas] with Marathon Oil Company, I was directly responsible for the development of several tight gas sand fields analogous to the subject development, and have drilled and completed over a hundred wells in such sands. Several of these wells were drilled directionally and subsequently hydraulically fractured with great success. In addition, I have extensive experience with horizontal wells. My background includes several years of work in Wyoming as well, and I am very familiar with the geology of the Greater Green River Basin.

This DEIS is premature and ill defined. I urge any action be deferred at this time until a "clearer, more definable full field development scenario is presented by the Operators."

Sincerely,



Kenneth Kreckel

Kenneth Kreckel
3670 Placid Drive
Casper, Wyoming 82604-4984
307-235-3505
kreckell@yahoo.com

HIGHLIGHTS

Manager with twenty seven years major oil company experience in the exploration and development of oil and gas reserves in the U.S. and Europe. Specific expertise in geophysics. Currently interested in short to intermediate term consulting assignments. Particularly suited for mentoring, prospect audits and confirmation, corporate evaluations, geophysical evaluations, 3-D survey design, and project management. Career highlights are:

- Proven Oil & Gas finder, with several hundred MMBOE discovered. Personally led the initiation, discovery and subsequent development of the Cotton Valley Reef play.
- Extensive experience in the development of tight gas sand and fractured reservoirs.
- Confirmed judgment in prospect evaluations
- Many years experience managing multidisciplinary teams in successful exploration and development projects.
- Prepared, presented and defended annual budgets amounting in excess of fifty million dollars.
- Proficient at partner and contractor negotiations. Experienced with contracts.
- Performed numerous evaluations of company exploration assets.
- Many years as on-campus recruiter. Skilled in interviews and new employee evaluations.
- Particular ability with office relocations, and the establishment of new exploration offices.
- Recent experience in managing an exploration workstation support team.
- Personally designed and carried out numerous 3-D surveys. Particular expertise in cost-effective, suited-to-purpose surveys.
- Excellent at supervising seismic acquisition, processing and interpretation projects.
- Superior communication skills, especially written.
- Geographically experienced in most U.S. Onshore basins, particularly Gulf Coast and Rocky Mountains. Recent experience in NW Europe offshore basins. Work locations in the U.S. and Europe.

WORK EXPERIENCE

Consulting

2001-Current Casper, Wyoming Consultant

Engaged in reviewing oil & gas exploration and development projects.

Marathon Oil Company

1998-2000 London, England Manager of Exploration Support

Responsible for the technical quality of interpretations of several geophysicists working throughout NW Europe. Managed UNIX workstation support department. Designed and carried out several large 3D surveys.

1990-1998 Tyler, Texas Exploitation Manager

Directed over thirty professionals engaged in exploration and development in East Texas, Gulf Coast onshore and Louisiana. Personally responsible for the initiation and successful development of the Cotton Valley Reef Play, discovering several fields totaling in excess of 200BCF, largely through the application of 3D technology. Also very active in the Austin Chalk and tight gas sand development. Initiated, presented, and secured \$50MM annual budgets.

1988-1990 Midland, Texas Region Geophysicist

Responsible for the technical excellence of seismic interpretations in West Texas, the Mid-Continent, and Michigan Basin. Designed and carried out numerous seismic projects, from acquisition through interpretation.

1978-1988 Cody & Casper, Wyoming Geophysicist and Exploration Supervisor

Interpreted and acquired seismic data throughout the Rocky Mountain Region, particularly the Thrust Belt, Paradox and Powder River Basins. Involved in the discoveries in the Paradox Basin. Supervised exploration teams working Utah and southwest Wyoming.

Texaco, Inc

1974-1978 Bellaire, Texas Geophysicist & Geologist

Developed fields in the Vicksburg of South Texas. Explored in the Atlantic margin, Illinois Basin, and offshore Gulf.

EDUCATION

Michigan Technological University B.S. Geology with Honor 1974

ORGANIZATIONS

Active member of the SEG; longtime member of MENSA

REFERENCES

Supervisors:

Robert J Duenckel
205 Waterford Dr
Southlake, TX 76092
817-416-7388

Employees:

Randolph White
Geophysical Manager
Sinclair Oil Corporation
P.O.Box 30825
Salt Lake City, Utah 84130
rwhite@sinclairoil.com

Tom Tatum
Sr Staff Geophysicist
Anadarko Petroleum
P.O.Box 1330
Houston, Texas 77251
tom_tatum@anadarko.com

Fred Taylor
Geologist
Lake Ronel
4607 Dundee
Tyler, Texas
tatlorfw@aol.com

DESOLATION FLATS PROJECT AREA
Reasons in Support of Deferring Action, or Alternate B-No Action

The Desolation Flats DEIS is Only Conceptual

The proposal is a concept, not a plan. There are no specific locations for wells, pipelines or other facilities identified. The Desolation Flats DEIS states in Chapter 1:

"This DEIS analyzes the effects of well pad locations, access roads, production facilities, pipelines, and other facilities associated with natural gas development on resources and land use within the project area."

"Factors considered during the environmental analysis process regarding the natural gas development project include the following:

- The location of environmentally suitable well pad locations, access roads, pipelines, and other production and ancillary facilities that best meet other resource requirements and minimize surface resource impacts yet honor the lease rights within the project area.
- A determination of impacts resulting from the proposed action and alternatives on the human environment, when conducted in accordance with applicable regulations and lease stipulations, and the development of mitigation measures necessary to avoid or minimize these impacts."

- 1 | Since the document fails to present any locations of environmentally suitable well pad locations, etc., and no definable plans for field development, the 'No Action' alternative should be adopted, or, in the words of the DEIS, to:

"defer any action at this time until a clearer, more definable full field development scenario is presented by the Operators."

Geology of the Area Precludes All Alternatives Except B-No Action

- 2 | The nature of the geology makes it impossible to locate the number of wells envisioned in the DEIS. Because production is controlled by stratigraphy [Hendricks, 1995], and the sandstone reservoirs occur as isolated, separate, overpressured compartments [Surdam, 1995], it is difficult to predict 'sweet spots' in these stratigraphic reservoirs except with nearby well control. The results of each new well will significantly impact the location of the subsequent wells. Hence, the development of these reservoirs will occur along trends which can only be defined on a well-by-well basis. It follows that any long range plan involving hundreds of wells cannot be specific.

Alternative B 'No Action' does allow the drilling of an estimated 57 development wells under existing decisions. Additionally the document estimates another 21 wells outside of these areas will be drilled. As stated in the DEIS:

"Additional infrastructure necessary to support existing wells within the DFPA and future wells drilled under the No Action Alternative would be considered on a case-by-case basis."

- 3 | Obviously, the results of these wells will determine the course of future development. If such development is warranted, it can be considered at that time. Therefore, due to the geology of the area, a case-by-case consideration of wells and other facilities is the only appropriate alternative.

Alternatives for Multi-Well-Single Pad Were Not Adequately Addressed

- 4 | The rejection of the multi-well well pad alternative, where 2 to 8 wells could be drilled per each surface location, was largely based on the experience of one operator in Wamsutter Field. The DEIS states that the technical limits of directional drilling were reached at about 50 degree deviation. Since the deviations drilled in the Wamsutter case ranged from 15 to 32 degrees, technical capability was not a limiting factor. Essentially the justification to reject this alternative was simply cost. Location costs were cited to be 10 to 20% higher and drill times 30 to 40% higher.

There are some problems with the Wamsutter case, especially the magnitude of the angles. The Wamsutter Field, located on the Wamsutter Arch, produces from significantly shallower depths, up to 5000' less than Desolation Flats [map, Surdam, 1995]. Due to its location near the deepest portion of the Washakie Basin, drilling depths at Desolation Flats range from 9000' to 14500'. Using the average vertical displacement of 1425' from the Wamsutter example, corresponding angles will range from 5 to 10 degrees at Desolation Flats, far less than the 15 to 32 degrees cited. Deviations of this magnitude are so small as to be considered near vertical, and should present no significant completion problems.*

Due to these lower deviations, any increase in costs associated with the use of multi-well pads will be significantly less than the undocumented 20% cited in the DEIS. Even if we assume the 20% increase is correct, this need not translate to a 20% in costs *over the life of the project*. Three other factors will lower costs:

- 5A | • Considering the large number of wells envisioned in the DEIS, it is reasonable to assume economies of scale will reduce these costs.

*Moreover, since the geologic dip on the flanks of the basin range from 8 degrees to 15 degrees [Love, 1970], even vertical wells will encounter similar angles relative to the stratigraphy. It is well understood in the industry that unsteered 'vertical' wells tend to drift updip, effectively reaching deviations up to the magnitude of the geologic dip. Hence, in these cases, even vertical wells are not truly vertical, but instead may naturally 'deviate' as much as the 5 to 10 degrees suggested for Desolation Flats.

- 5B | • Given the project length, 20 to 40 years, it is extremely likely that these costs, over time, will further decrease as technology provides increased efficiency.
- 5C | • The inevitable increase in the price of natural gas over this time frame, as the resource becomes more scarce, will also favorably impact the economics.

6 | Therefore, in the Desolation Flats area, deviated 'slant' wells represent an economically viable means to produce reserves from under No Surface Occupancy leases. This also points the way for an economically sound utilization of multi-well pads.

In a study of the Almond Formation in Echo Springs Field in the Green River Basin, near Desolation Flats, Iverson et al [1995] concluded "With the confirmation of Standard Draw draining numerous stacked reservoirs, continued focus on vertical or slant hole completions may be justified." They go on to state "Considering the additional cost of horizontal drilling, economics likely favor vertical or slant hole completions." Note that vertical and slant holes are treated as equivalent, as distinct from horizontal wells. This study focused on the Amoco 254 B-2H well, comparing results from the slant hole portion of the well, which was hydraulically fractured, and the horizontal well, which in 1995, was not. In this case, artificially fractured slant wells were found to be economic.

Slant holes may be justified from a geologic basis as well. In this basin, production is controlled by stratigraphy [Henricks, 1995]. Surdam et al [1995] state: "Sandstone bodies within the overpressured shale section are subdivided stratigraphically and diagenetically into relatively small, isolated, gas saturated, anomalously pressured compartments." Economic production depends on intersecting as many as these 'sweet spots' as possible. These bodies may not vertically coincide. Therefore, slant holes hold the potential of intersecting more of these bodies, thereby increasing production from a single wellbore.

7 | I recommend that the use of multi-well pads be mandated for this development. Assuming 640 acre spacing, a single well pad could service four wells, using deviated wells of about 2000' vertical displacement [10 to 16 degree deviations]. Obviously this would provide a large decrease in the number of locations, and a corresponding decrease in roads and pipelines, thereby drastically reducing the surface impacts. Even if this approach would result in some increase in *today's* costs, although the undocumented 20% cited is likely overstated, this consideration should not be the overriding determinant. The resultant large scale protection of the environment will justify those costs.

Current and Future Advances in Technology Have the Potential to Impact This Development

8 | Because of the long time frame envisioned in this DEIS, it is reasonable to predict that advances in technology which can impact this development plan will occur. The spectacular advances in horizontal drilling, artificial fracturing, and seismic over the last twenty years are well known.

Work continues in these and other fields which will have a direct impact on the development of this area. To quote an especially pertinent one:

Table Rock Field, Frontier Formation

"Union Pacific Resources' Rock Island 4-H well, located on the north plunge of Table Rock Field, Sweetwater County, Wyoming, was the culmination of a project with the US Department of Energy (DOE) Federal Energy Technology Center (FETC) and Gas Research Institute (GRI). The goal was to find technologies to produce significant tight gas resources from southwestern Wyoming.

Milestones of the project include:

Reducing the drilling time and cost for deep vertical wells by less than half.

Discovering one of the deepest horizontal tight gas sandstone wells in the world (14,950 ft TVD).

Reaching one of the world's deepest horizontal cores.

Maintaining one of the highest gas flow capacities in the tight-gas Frontier Formation in Wyoming.

Initiating future plans for a horizontal drilling effort.

Horizontal drilling for low permeability gas allows large well spacings, improving per well recoveries and reducing the environmental impact. The Rock Island 4-H horizontal well reached 16,784 ft (14,950 ft TVD) in the Frontier formation at 270° F and 10,000 psi."

Tight gas sands generally require artificial fracturing to be economically productive. The main objection to the use of horizontal wells is the difficulty of applying artificial fracturing. This case, completed in 1995, illustrates that it can be done:

Halliburton Fractures World Record Well For Mobil New Natural Gas In Germany

"The Soehlingen Z-10 horizontal well, located about 40 miles southwest of Hamburg, was drilled into an extremely tight sandstone in the Rotliegendes formation to a vertical depth of 15,688 feet -- a world record for horizontal wells -- where it was deviated horizontally for 2,066 feet into the natural gas reservoir. Including the horizontal section, the well was drilled to a total depth of 18,860 feet.

In addition to being the world's deepest horizontal well, the well set a world record for the deepest multiple fractures. Hydraulic fracturing was employed to improve the natural gas flow from the extremely low permeable rock. Halliburton's EuroFrac Team successfully completed a total of four hydraulic fractures along the horizontal section of the wellbore using a highly-efficient and environmentally- friendly fracturing system that included Halliburton's HyBor Gel fracturing fluids and its Liquid Gel Concentrate."

These two projects were successfully completed in onshore tight gas formations very similar in geology and depth to Desolation Flats. Together they illustrate that artificially fractured horizontal wells are technically feasible today. Moreover there is a high potential for advances in these technologies that will directly impact this area. Although the drilling and, more importantly, hydraulic fracturing of horizontal wells in tight gas sand formations are not yet commonplace, these two projects establish the likelihood that they will be more commonly utilized in the near future. As these, and other technologies, become generally available, the number of wells envisioned for Desolation Flats could be significantly reduced. It is imperative that decisions based on today's practices are not taken that effect the next 20 to 40 years. A case-by-case consideration of this development will allow for the consideration of these and other technologies as they become available, without unduly affecting the subject development. Indeed, the development of this area may ultimately benefit by the employment of more efficient technologies.

Directional Wells Can Be Used for the Protection of Currently Identified Sites

- 9 | There are currently many areas proposed, for NSO status, crucial winter ranges and ACEC's, as well as mountain plover nesting concentrations. (please refer to the Biodiversity Conservation Alliance alternative for the Great Divide) In addition, 2-mile buffers for sage grouse leks and 1-mile buffers for raptor nests, (see DEIS pp 5-20--5-22) have been proposed.

As illustrated by the examples above, technology is available to drill and hydraulically fracture even horizontal wells in tight gas sands. Highly deviated and horizontal wells could be utilized to capture reserves under these protected areas. Horizontal wells have the potential to reach 2,000 to 4,000 feet from a surface location. Hydraulic fracturing of these wells can allow them to effectively drain a 640 acre area. Thus it is possible to produce reserves even under the two-mile buffers proposed. Although more costly, horizontal wells can achieve higher recoveries, so the economics regarding their use is not necessarily a prohibitive factor.

- 10 | In addition, this area may be an excellent candidate for industry-government cooperative ventures, similar to the Table Rock example above. Working together, methods can be found to achieve the economic exploitation of the natural gas reserves without adversely affecting the environment.

Time for Study of Potential Protected Areas

- 11 | The No Action alternative will allow further study of ongoing environmental protection efforts such as the Adobe Town Potential Wilderness. There are other efforts underway, for example, the Powder Rim ACEC and big game crucial ranges, seeking NSO strips on leases. It would be premature to allow a conceptual plan to interfere with these efforts. In any case, it is essential that specific locations be presented to allow their impacts to be accurately assessed, and suitable alternatives considered. Obviously one cannot assess the impact of a conceptual well location,

12 | one that has no definition in space or time. This assessment needs to occur at the time the well locations are firm.

Development Will Continue Under the No Action Alternative

13 | Deferring action will not preclude current development. As stated in the DEIS, up to 78 wells may be drilled under the No Action alternative. Hence, development of this valuable natural resource will not be impeded, and continued exploitation of these natural gas reserves can continue.

References

Dunn, Thomas L., Bernabe Aguado, John Humphreys, and Ronald C. Surdam, "Cements and in-situ widths of natural fractures, Almond formation, Green River Basin, Wyoming", 1995 Field Conference Guidebook, Wyoming Geological Association, 1995.

Halliburton Energy Services, "Halliburton Fractures World Record Well For Mobil New Natural Gas In Germany", Press Release, March 21, 1995.

Hendricks, Michael L., "A review of the components and controls on basin-centered gas in the Greater Green River Basin, southwestern Wyoming", 1995 Field Conference Guidebook, Wyoming Geological Association, 1995.

Iverson, William P., Thomas L. Dunn, and Ronald C. Surdam, "Improvements to formation evaluation, Almond Formation, Green River Basin, Wyoming", 1995 Field Conference Guidebook, Wyoming Geological Association, 1995.

Petroleum Technology Transfer Council, "Exploiting Tight Gas Sand Sweet Spots", Internet page, 1999. [*Based on a workshop cosponsored by PTTC's Rocky Mountain Region on April 26, 1999, in Denver, CO. Contributor: Lee Krystinik and Frank Lim, Union Pacific Resources Co., "Horizontal Well from Table Rick Field, Frontier Formation"*]

Stewart, Wallace W., "Horizontal Wells in Wyoming through 1994", 1995 Field Conference Guidebook, Wyoming Geological Association, 1995.

Surdam, Ronald C, Zung S. Jiao and Jie Liu, "Pressure regime in the Upper Cretaceous shales and sandstones in the Washakie Basin, Wyoming", 1995 Field Conference Guidebook, Wyoming Geological Association, 1995.