# ABSTRACT

## Urban and Public Lands (BLM) Oil and Gas Site Planning, Drilling, Construction, and Production - Techniques to Reduce or Eliminate Surface Estate Value Impacts and Environmental Damages

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Major land based oil and gas resources are currently being drilled and produced in valuable urban areas and environmentally sensitive rural areas. The development of subsurface minerals is often achieved at the expense or reduction in market value of the surface estate, or if the surface is developed first, it results in a reduction in the present and future value of the subsurface mineral estate. This paper explores contemporary and cost-effective planning, construction, drilling, and production techniques that can allow the full development of both the surface and subsurface estates without one necessarily impending on the economic or utility value of the other. Maximum rates of return and land utility can be achieved which benefit all stakeholders which include but is not limited to; mineral owners, landowners, tenants, future surface uses/users, governmental ad valorem taxing authorities, and owners/shareholders of the various land and mineral development companies. Recommendations and changes in regard to public and private minerals and oil and gas lease terms are offered (Key words: oil, natural gas, minerals, urban land, public land, BLM, highest and best use).

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## Introduction

The strategic and economic importance of U.S. domestic oil and gas production cannot be overstated. Price increases of crude oil and natural gas of approximately 38% have occurred in 2003-2004 for the following reasons:

1) Increased worldwide demand by fast-growing economies of the U.S., China, and developing countries
2) The 30% loss in value of the U.S. dollar is reflected immediately in the import prices, sixty-five percent of all American oil (65%) that is imported. (Cheaper dollars = more expensive oil)
3) Dropping oil production and reserves being reported by the major oil companies and producers of the world (Shell, British Petroleum etc.) and Sandi Arabia, etc.
4) Supply disruptions due to political risks (Iraq, Saudi Arabia, etc.)
5) Transportation risks (terrorist, war, tanker ships, and pipeline sabotage)
6) Continual drop in U.S. domestic oil and gas production, although there have been many recent new discoveries and drilling and completion and technologies developed.
7) Low productivity and rapid production decline curves for U.S. oil and gas wells relative to foreign countries (Table 1).

Increased petroleum prices in 2003-2004 have caused a 30% increase in U.S. land-based active drilling rigs from 806 rigs in December 2002 to 1114 the week of December 2003 (Oil and Gas Journal, 2004). These factors combined with new drilling/ completion technologies and higher petroleum prices will continue to increase drilling activities in urban areas (Texas, Michigan, New York, California, etc.) and environmentally sensitive areas (New Mexico, Colorado, Montana, Alaska, etc.)

Many of the "new" productive areas where wells are being drilled are located in areas that in the past were either closed to oil and gas leasing/ drilling (U.S. public lands, parks natural seashores) or very close to rapidly growing suburban or urban areas of the U.S. ( Dallas/Fort Worth, Texas; Trenton, Michigan; etc.)

Most Americans equate oil and gas drilling as activities occurring "somewhere else." This represents the classic NIMBY (Not In My Back Yard) syndrome as consumers complain about gasoline, electricity and natural gas prices increasing 40-50% in 2003. The reality is that oil and gas wells were drilled in 30 of the 50 states during 2003 and totaled 24, 103 wells drilled through November of 2003 (Oil and Gas Journal/ Rig Data Well Start Statistics, 2004) (Table 2).

Table 1

| Average Productivity of Crude Oil by Countries<br>By: John S. Baen Ph.D. University of North Texas | | | |
|---|---|---|---|
| **Country/State** | **No. Oil Wells** | **1997 Ave. B/Day** | **Average B/D/Well** |
| Saudi Arabia (e) | 1,400 | 8,083,000 | 5,773 |
| Former Soviet Union | 123,970 | 7,385,917 | 60 |
| United States | 573,962 | 6,451,592 | 11 |
| Iran (e) | 1,090 | 3,632,700 | 3,332 |
| China | 72,255 | 3,189,915 | 44 |
| Venezuela (e) | 14,694 | 3,182,000 | 216 |
| Norway | 626 | 3,150,126 | 5,032 |
| Mexico | 3,605 | 3,119,323 | 865 |
| United Kingdom | 1,288 | 3,476,122 | 1,922 |
| Nigeria | 2,035 | 2,281,900 | 1,121 |
| Abu Dhabi (e) | 1,200 | 1,873,000 | 1,560 |
| Kuwait (e) | 790 | 1,836,000 | 2,324 |
| Canada | 50,756 | 1,408,708 | 28 |
| Indonesia | 8,535 | 1,364,200 | 160 |
| Texas | 175,532 | 1,344,783 | 8 |

Source: *Oil and Gas Journal*, Nov. 1996

Table 2

Mineral Ownership and U.S. Drilling Activity/Number of Wells Drilled in 2003 by State

By John S. Baen

| States | 2003 Wells Drilled* | Projected New Wells | Predominant Surface Ownership | Predominant Mineral Ownership |
|---|---|---|---|---|
| Texas | 8,341 | 8,000+/year | Private | Private or State |
| California | 2,203 | 2,000+/year | Private | Private |
| Oklahoma | 2,156 | 2,000+/year | Private | Private |
| Louisiana | 1,855 | 1,800+/year | Private | Private |
| Wyoming | 1,619 | *10,000+ | U.S. Public/Private | U.S. Gov./BLM |
| New Mexico | 1,197 | *10,000+ | U.S. Public/Private | U.S. Gov./BLM |
| Kansas | 1,165 | 1,000/year + | Private | Private |
| Colorado | 1,044 | * pending # | U.S. Public/Private | U.S. Gov./BLM |
| Alaska | 222 | * pending # | U.S. Public | U.S. Gov. |
| Gulf of Mexico (deep water) | 256 | *pending # | U.S. Public | U.S. Gov. |
| Total Reported | 22,061 ** or 110,305 Surface Acres/year 91% of total | | | |

*2003 Well data from *Oil and Gas Journal*/Rig Data Well Start Statistics

**Activity depends on Public Policy and Permitting

**Total surface disruption =110,305 Acres per year @ 5 acres ±/well-site

## Justification for Research and Literature Review

Little has been written in the real estate or land planning academic literature about the interaction of mineral rights on the value and future value of real estate. Baen (1988, 1996) published related research in the areas of mineral rights in land appraisals and the impact of mineral rights and oil and gas activities on agricultural land values. Simons (1998) has researched the related oil and gas infrastructure topic of pipeline ruptures and value impacts on residential neighborhoods. Much of the literature that exist on the topic of reduction of surface impacts from oil and gas activities has been found in scattered references and articles found in the *Oil and Gas Journal* and generally relate to specialized drilling and production techniques proposed for "super sensitive" drilling environments such as: Prudhoe Bay, Alaska; Columbian Rain Forest Projects; etc.

If each U.S. land-based drilling rig (1,114 rigs/2004) drills twenty-five wells per year (27,850 total wells per year) each well (drill site/production site/access road, etc.) averages a conservative five acres of long-term use of land (10-30 years of production /well), a total of 139,250 acres of land or 217 square miles of U.S. private or public land will be directly affected and dedicated to energy production this year and every year in the future so long as petroleum prices remain high and economic deposits can be leased or obtain a drilling permit.

This research attempts to offer a balanced view of past, current and possible future approaches to oil and gas leases, oil and gas development, policies and procedures. This paper offers suggestions to improve future leases to include specific provisions for land use and drill-site planning, ultimate highest and best land uses or areas to be preserved and to suggest that basic preliminary land use planning and site planning often, at little additional cost to any oil and gas well proposed, is the correct approach to sound resource management. Another section of this paper will address improvements to oil and gas leases and their development that will improve on the contemporary oil and gas business model while minimizing surface estate damages and impacts.

Historically, private surface/mineral owners negotiated with oil and gas companies in confidential long-term leases that remain in effect so long as oil and gas production is maintained, which is quite often 30-50 years. Dry hole attempts also temporarily cause surface disruptions, which can be returned to a natural state over time. Few surface/mineral owner leases contain specific mineral development surface estate land plans and an extremely limited number of owners conduct long-term (30+ years) land use plans for the ultimate highest and best use their of surface estates prior to drilling. Once a typical oil and gas lease is signed, the surface estate generally becomes subservient to the leaseholder of the subsurface mineral estate. The oil and gas companies have totally different objectives (maximization oil and gas production) and are not in the real estate development, investment, or land preservation business. Their objective is to maximize oil and gas production at a minimal surface development cost and expense in order to maximize shareholder value. Community and landowner relations are important to large oil and gas (O&G) companies who try to accommodate surface owner's wishes; however, the process is only on a case-by-case basis with many landowners having low levels of sophistication in regards to the potential of their land beyond grazing.

This scenario has become extremely complicated, politically charged and dangerous to reasonable stewardship of the surface estate while allowing reasonable access to the mineral estate. This is particularly awkward when the following "split estate" between the surface estate, mineral estate and mineral development access to/through land owned by other private parties occurs. Access to much of the Western U.S. reserves are located on public land (BLM) with access only through privately owned lands, to the very lands the private land owner leases for grazing. If access is denied, is condemnation an appropriate method to gain access for the "public good?" (i.e. Royalty income to the U.S. Government/citizens). Range wars and legal battles on surface rights, subsurface rights, subsurface water rights, surface water rights, and mineral rights may be reduced with wise land planning of mineral development of surface estates.

Table 3
Different Estates in Land/Mineral/Access
By John S. Baen, UNT 2004 Baen@unt.edu

| **Variable Types of Ownership** | **Oil and Gas Lease Negotiations** | **Surface Estate Damages** |
|---|---|---|
| 1) Private Fee Owned/ Surface and Mineral | Surface Owner and Oil Company Private Negotiation | Negotiable if part of lease by separate agreement prior to, during, or after drilling activities |
| 2) Private fee owned/ No mineral rights (retained by previous owners or government) | Mineral Owner and Oil Company No Surface Owner Input | Outside of lease/ Subservient surface owner |
| 3) Publicly/Gov. owned Surface and Mineral (surface leased for grazing to third party) | U.S. Government Agency or/ State and Oil Company No agricultural tenant input. | Varies by agricultural lease document but generally none |
| 4) Publicly owned minerals / Gov. owned surface and minerals only access through adjoining private lands (private owner may have public surface land lease adjoining private land) | U.S. Government Agency/ State and Oil Company Questionable rights of access through private land * | Outside of lease/ Subservient surface agreement by separate agreement negotiation or planning. |

*The right of condemnation through private land to gain access to public mineral rights appears by this researcher to be a reasonably and potential use of condemnations laws for a public use. More public and commercial access roads constructed by oil companies to extract minerals owned by the public does change the very nature of otherwise wild lands adjoining private property.

## Various U.S. Oil and Gas Development Stakeholders

Mineral Owners- Those who own undeveloped minerals (private persons, federal and state governments) are generally open to mineral activities to maximize returns on their assets (mineral owners receive $200-250/acre signing bonus when signing a lease (North Texas). The amounts vary widely on land-based drilling).

Oil and Gas Companies – Exploration and drilling activities are commenced to create cash flow and maximize share hold or values and identify long-term reserves having economic value.

Royalty Owners- Mineral owners who participate in gross income (12.5-20%) from oil and gas product generally add to the local economy where they reside or anywhere. Many royalty owners live far removed from the mineral resource locations. In Denton County, Texas during 2003, over $600 million in oil and gas royalties were paid from 1,700 wells drilled since 2001. The present value of productive urban/suburban, mineral/royalty rights based on average production per well is $12,500 per acre (Table 4).

Surface Owners- Surface owners (private or government) may or may not own subsurface minerals. As separate estates, surface and minerals rights can cause conflicting land uses and constraints or friction in the process of drilling wells. It is this author's opinion that both minerals and surface estates should be land planned prior to commencement of any well, even if both estates are owned by the same party (private parties, BLM, etc.).

1) Surface owners should be compensated on actual and verifiable surface damage to the land ($5,000 - $10,000/location in North Texas)
2) Drilling water used ($2,500-6,000/well in North Texas) or water well drilled and donated to surface owner
3) Pipeline easements and damages ($8-18 per linear foot in North Texas; varies on value of land and impact on future use potential of surface).
4) Properly negotiated mineral leases should include compensation for surface damages and well locations rather than by separate negotiations, after land is encumbered by a dominant oil and gas lease. There are some legal theories that conclude that no compensation is due to surface owners or tenants as the mineral estate and oil and gas leases are the dominate estate (i.e., Texas) and that any compensation granted is out of benevolence rather than legal principles.

Surface Tenants – Agricultural and commercial ground leases may or may not include any compensation provisions for oil and gas activities (damages) or pipeline right-of-ways (by negotiation or condemnation). If three acres are disturbed by a drill-site and two acres by a new access road (varies widely) on a short-term cattle grazing lease (year to year) with the tenant paying $0.50 per acre per year, then only $2.50 ($0.50/acre x 5 acre) total in damages would be appropriate in the case of Federal BLM grazing leases/permits. The amount of economic damages or lease payments "rebated" would be $5.00 total ($0.50/acres x 5 acres total). On private land, $10.00 per acre damages would total $50.00.

Surface tenants also complain about other indirect unverifiable damages such as loss of security to their cattle operation due to additional traffic, loss of control of ingress and egress due to roads to otherwise remote areas (hunters, fishermen, campers, four-wheelers, etc.)

Many of these issues such as tenant compensation, restricted access and locked gate control, etc. should also be addressed in the initial oil and gas lease rather than negotiated or litigated during exploration and drilling activities.

States and Tax Payers of the Resident of the States- Mineral rights are generally not taxed on their present value of undeveloped oil and gas reserves but one taxed in two ways, which benefit the states.

a) Severance Taxes based on production reported monthly by producers at the well-head and by gatherers, pipeline companies, etc.:
   - Texas Oil Tax = 4.61% of gross/value (1.61/BBL@$35/BBL)
   - Texas Natural Gas Tax= 7.5% of gross ($0.41/1000 cubic feet @ $5.50/MCF)

b) State Well Application Fees

c) State Property Taxes on value of oil and gas property, equipment, PV of production (not in Texas)

d) State Royalties Exxon Mobil was required to pay the State of Alabama 3.6 Billion in 2004 for shortage in Royalties paid (Dallas Morning News March 30, 2004)

Local Tax Payers – county, school, and city taxing authorities assess ad valorem property taxes on the present value of each producing oil and gas lease and well based or known operational expenses and the "market value" or present value of the subject years income. Variables include but are not limited to quality of the oil and gas, pipeline pressure, commodity price fluctuations, etc. Discount rates are formulated on oil and gas property comparable sale and industry standards. One operator in Denton County, Texas paid, $315 million in local taxes (Denton County Tax Assessor's Office 2003 Data).

Local Residence and Communities- A drilling boom in urban and remote rural land can cause major changes in traffic types (commercial vehicles vs. auto traffic ) and changes to the area's environment (visual short-term noise factors, and new commercial/residential demand for property).

Mineral activity can also add significantly to the economic base of an area during the drilling phase and less so during routine long-term production operations.

Citizens of the United States- Any domestic oil and gas production that reduces the reliance of the U.S. on foreign sources adds to the national economy, reduces the international balance of payment problems and improves the strategic well-being of the country and consumers. All U.S. citizens are stakeholders also directly benefit financially as follows:

a) Corporate Income Taxes are paid annually on all domestic production
b) Mineral Rights Bonuses (federal lands) are paid at the time a lease is signed, auctioned or a request for proposal (RFP) is accepted on federally-owned

land/minerals. These revenue streams are significant and paid even if a federal lease is not drill or if a wells is a dry holes.

a. Oil and Gas Royalties are paid directly into the U.S. Treasury for all wells drilled on federally-owned lands or private land in which the government has retained mineral rights when the land was sold or homesteaded.

See the following tables:

Table 4: Two Contrasting Drilling Environments Study Areas
Table 5: Barnett Shale Gas Production Evaluation Summary
Table 6: Dallas Ft.Worth Metropolitan Area Barnett Shale Oil and Gas Economic Analysis 2001-2004
Table 7: Baen's Barnett Productivity / "Cash Flows" Oil and Gas Reserve and Cashflow Analysis

Table 4

Two Contrasting Drilling Environments Study Areas
By John S. Baen, University of North Texas, 2004. (baen@unt.edu)

| | **Urban-Suburban Dallas-Fort Worth Metro Area** | **San Juan Basin Northwest New Mexico and Southwest Colorado** |
|---|---|---|
| **Environment** | Urban/Suburban | Wild lands/Rangeland/ Forest/BLM |
| **# of Counties** | 11 | 4 |
| **Land Ownership** | Private | Public-BLM/ Indian Tribal Lands |
| **Mineral Ownership** | Private | Primarily Public/USA |
| **Target Zone** | Barnett Shale/Gas | Fruitland Coal/Methane Gas |
| **Formation Type** | "Blanket" Formation | "Blanket" Formation |
| **# of Wells Drilled** | 2,923 (2001-2004) | 10,000 Proposed (2004-2006) |
| **# of Dry Holes** | 3 | <10% |
| ***Land Planning Potential** | High | High |
| **Lease Type** | Private Party Negotiation | BLM Lease |
| **Access** | Private Lands via Lease Provisions | Remote Public Lands/BLM And frequently through hostile privately-owned land |
| **Surface Owner Damages** | $5,000-10,000/Well | Generally None |
| **Pipeline Damages** | $6-18/linear foot | Generally None |

*Due to generalized and known blanket formation throughout the region. Allows geology to yield to sensitive locational factors found on the surface estate (Existing and future land uses, subdivisions, parks, archeological areas, and special wilderness/"wild" areas)

Table 5
Barnett Shale Gas Production Evaluation Summary
By: John S. Baen, University of North Texas (baen@unt.edu)
Data compiled by Michael E. (Gene) Powell, Jr. mepowll@charter.net Aug. 22, 2003
Production Reporting Period Ending June 1, 2003

| Barnett Shale Producers Fort Worth Basin | | | | | |
|---|---|---|---|---|---|
| **County** | **No. Wells Reporting** | **Total MCF Gas to June 1, 2003** | **Total BO to June 1, 2003** | **County Average MCF Gas** | **County Average Barrels Oil** |
| Clay | 4 | 31,934 | 5,664 | 7,983.5 | 4,416.0 |
| Cooke | 1 | 0 | 0 | 0.0 | 0.0 |
| Dallas | 2 | 156,043 | 0 | 78,021.5 | 0.0 |
| Denton | 1,092 | 289,343,611 | 1,079,141 | 264,966.7 | 988.2 |
| Hood | 9 | 156,542 | 784 | 17,393.6 | 87.1 |
| Jack | 2 | 93,202 | 422 | 41,601.0 | 211.0 |
| Johnson | 14 | 406,004 | 0 | 29,000.3 | 0.0 |
| Montague | 18 | 115,954 | 69,0073 | 6,441.9 | 2,170.7 |
| Palo Pinto | 1* | 12,988 | 0 | 12,988.0 | 0.0 |
| Parker | 13 | 883,109 | 411 | 67,931.5 | 31.6 |
| Tarrant** | 193 | 38,962 | 2,010 | 201,876.2 | 10.4 |
| Wise | 1,069 | 447,453,865 | 1,215,595 | 418,572.4 | 1,137.1 |
| Total= | 2,418 | 777,605,363 | 2,373,100 | 321,590.3 | 981.4 |

* Well production is in Newark East (Barnett Shale) Field but well's production was Conglomerate. GP
** Only 9 of 193 wells were drilled prior to 2000. GP

OVER A THREE (3) YEAR PERIOD 2001-2004
ESTIMATED SURFACE DISRUPTION = 7,254 ACRES
(2418 Wells x 3 Acres/Well, Drill-site, Roads, Pipelines, etc.)

The data above is accumulated by well. A few wells not reporting are WOPL (waiting on pipeline) after IPCAOF. Several big horizontal wells have not had their production reported.

## Table 6
## Dallas Ft. Worth Metropolitan Area Barnett Shale Oil and Gas Economic Analysis 2001-2004

By John S. Baen Ph.D. University of North Texas 2004. (Baen@unt.edu) based data Table 2)

| Value Impact 2,418 Wells | $2.2 Billion @ $900,000/well @ Cost (± 20%) (Cost of Wells) | $3.9 Billion @ $5/MCF Gas (Gross) (Gas Sales/Total) | $75 Million @ $32/BBL (Gross) (Oil Sales/Total) | $1.6 Million per day @ $5.00/MCF (Gross) (Av/Day) | $31,000/day @ $32/BBL (Gross) (Av Income/Day) |
|---|---|---|---|---|---|
| Damages paid to Landowner @ $10,000/well | $24.2 Million | | | | |
| Water Purchaser/Landowner @ 6000/well | $14.5 Million | | | | |
| Mineral Royalties Paid @ 18.75% to individual land/ mineral owner | N/A | $731 Million | $14 Million | $2 Million/day | $5,812/day |
| Total Acres @ "40" Acres/ Well Leased (Horizontal @ 120± Acre/ well) | 96,720 Acres (Held by Production) | | | | |
| Tax Benefits @ 81.25% Fed Income Tax @ 30% | | $950 Million | | | |
| Royalty Owner @ 30% Fed Income Tax | | $219 Million | $4.2 Million | $90,000/day | $1,743/day |
| Texas Severance Tax State Gas Taxes @ 7.5%/MCF | N/A | $292.5 Million | N/A | $ 120,000/day | N/A |
| State Oil Taxes @ 4.615/BBL | N/A | N/A | $3.5 Million | N/A | $1,429 |
| Ad Valorem Taxes County, City, School Taxes Assume 2.8% Average (Not all in cities) assumes @ cost) | $61.6 Million/year | | | | |
| Jobs "created" or imported for 60 Drilling Rigs @ 12 onsite/ or Admin Jobs per Rig | 720 New Jobs | | | | |
| 80 Work over and servicing rigs @ 4 persons/Rig | 320 New Jobs | | | | |
| Multiplier Effect and Total New Jobs | 5,200 Total New Jobs | (5x Multiplier Effect Estimated Pipelines, Compressors, Pampers, Accounting, parts, supplies, etc.) | | | |
| Total Salary (Impact to Dallas/ Ft. Worth Economic/year @ $152,000/year | $270 Million/ Year | | | | |

# TABLE # 7 Baen's Barnett Productivity / "Cash Flows"
## Oil and Gas Reserve and Cashflow Analysis


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***Oil and Gas Leasing***
***Lease Negotiating***
***Land/Well Planning***
***Estate Planning/Mineral Valuation/Appraisal***


| | | | | DECLINES | | ESCALATION | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *PRICES:* | | *EXPENSES:* | |
| *LEASE:* | N/A | *SER.TAX, O:* | 4.61% | *GAS, YR1:* | 50% | *GAS, YR2:* | 3.25% | *EXP, YR2:* | 3.25% |
| *FIELD* | | *SER.TAX, G:* | 7.50% | *GAS, YR2:* | 25% | *GAS, YR3:* | 3.25% | *EXP, YR3:* | 3.25% |
| *COUNTY:* | Denton | *AD Valor:* | 2.40% | *GAS, YR3:* | 10% | *GAS, YR4:* | 3.25% | *EXP, YR4:* | 3.25% |
| *STATE:* | Texas | *OP EXP/MO:* | $1000 | *GAS, YR4:* | 10% | *AFTER:* | 3.25% | *AFTER:* | 3.25% |
| *OPER:* | | *# WELLS:* | 1 | *AFTER:* | 10% | | | | |
| *OWNER:* | | *OIL, $/BO:* | $25.00 | | | | | | |
| *BCPD:* | 1.0 | *OIL, MAX$:* | $40.00 | *OIL, YR1:* | 50% | *OIL, YR2:* | 3.25% | | |
| *MCFD:* | 577 | *GAS, $/MCF:* | $4.00 | *OIL, YR2:* | 25% | *OIL, YR3:* | 3.25% | | |
| *WI:* | 0.000% | *GAS, MAX$:* | $10.00 | *OIL, YR3:* | 10% | *OIL, YR4:* | 3.25% | | |
| *W. NRI:* | 0.000% | *CAP. EXPS:* | $750,000 | *OIL, YR4:* | 10% | *AFTER:* | 3.25% | | |
| ***ORRI:(*)*** | **18.750%** | *DISC FACT:* | 10.00% | *AFTER:* | 10% | | | | |

| YEAR | OIL | | GAS | | | REVENUE | | EXPENSES | | | NET INCOME | | DISCOUNT C/FLW | | PRICES | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *BARRELS* | | *MCF* | | | | | | | | *NET* | | | | *OIL* | *GAS* |
| | *GROSS* | *NET(*)* | *DAILYAVG* | *GROSSYR* | *NET(*)* | *OIL* | *GAS* | *TAXES* | *LOE* | *ADVAL/TAX* | *C/FLW/YR* | *CUM C/FLW* | *NET 10%* | CUM 10% | *$/BO* | *$/CF* |
| 1 | 263 | 49 | 577 | 210,605 | 39,488 | 1,233 | 157,954 | 11,903 | 0 | 3,375 | 143,908 | 143,908 | 130,826 | 130,826 | $25.00 | $4.00 |
| 2 | 132 | 25 | 289 | 105,303 | 19,744 | 636 | 81,544 | 6,145 | 0 | 1,688 | 74,347 | 218,256 | 61,444 | 192,270 | $25.81 | $4.13 |
| 3 | 99 | 18 | 216 | 78,977 | 14,808 | 493 | 63,145 | 4,759 | 0 | 1,266 | 57,614 | 275,870 | 43,286 | 235,556 | $26.65 | $4.26 |
| 4 | 89 | 17 | 195 | 71,079 | 13,327 | 458 | 58,678 | 4,422 | 0 | 1,139 | 53,575 | 329,444 | 36,592 | 272,148 | $27.52 | $4.40 |
| 5 | 80 | 15 | 175 | 63,971 | 11,995 | 426 | 54,526 | 4,109 | 0 | 1,025 | 49,818 | 379,262 | 30,933 | 303,081 | $28.41 | $4.55 |
| 6 | 72 | 13 | 158 | 57,574 | 10,795 | 395 | 50,669 | 3,818 | 0 | 923 | 46,323 | 425,585 | 26,148 | 329,229 | $29.34 | $4.69 |
| 7 | 65 | 12 | 142 | 51,817 | 9,716 | 367 | 47,084 | 3,548 | 0 | 830 | 43,073 | 468,658 | 22,103 | 351,332 | $30.29 | $4.85 |
| 8 | 58 | 11 | 128 | 46,635 | 8,744 | 341 | 43,753 | 3,297 | 0 | 747 | 40,050 | 508,707 | 18,683 | 370,016 | $31.27 | $5.00 |
| 9 | 52 | 10 | 115 | 41,972 | 7,870 | 317 | 40,657 | 3,064 | 0 | 673 | 37,238 | 545,945 | 15,793 | 385,808 | $32.29 | $5.17 |
| 10 | 47 | 9 | 103 | 37,774 | 7,083 | 295 | 37,781 | 2,847 | 0 | 605 | 34,623 | 580,568 | 13,349 | 399,157 | $33.34 | $5.33 |
| 11 | 42 | 8 | 93 | 33,997 | 6,374 | 274 | 35,108 | 2,646 | 0 | 545 | 32,191 | 612,760 | 11,283 | 410,440 | $34.42 | $5.51 |
| 12 | 38 | 7 | 84 | 30,597 | 5,737 | 255 | 32,624 | 2,459 | 0 | 490 | 29,930 | 642,689 | 9,536 | 419,976 | $35.54 | $5.69 |
| 13 | 34 | 6 | 75 | 27,538 | 5,163 | 237 | 30,316 | 2,285 | 0 | 441 | 27,826 | 670,515 | 8,060 | 428,037 | $36.70 | $5.87 |
| 14 | 31 | 6 | 68 | 24,784 | 4,647 | 220 | 28,171 | 2,123 | 0 | 397 | 25,871 | 696,386 | 6,813 | 434,849 | $37.89 | $6.06 |
| 15 | 28 | 5 | 61 | 22,305 | 4,182 | 204 | 26,178 | 1,973 | 0 | 357 | 24,052 | 720,438 | 5,758 | 440,607 | $39.12 | $6.26 |
| 16 | 25 | 5 | 55 | 20,075 | 3,764 | 188 | 24,326 | 1,833 | 0 | 322 | 22,359 | 742,797 | 4,866 | 445,473 | $40.00 | $6.46 |
| 17 | 23 | 4 | 49 | 18,067 | 3,388 | 169 | 22,605 | 1,703 | 0 | 290 | 20,781 | 763,578 | 4,111 | 449,584 | $40.00 | $6.67 |
| 18 | 20 | 4 | 45 | 16,261 | 3,049 | 152 | 21,005 | 1,582 | 0 | 261 | 19,315 | 782,893 | 3,474 | 453,058 | $40.00 | $6.89 |
| 19 | 18 | 3 | 40 | 14,635 | 2,744 | 137 | 19,519 | 1,470 | 0 | 235 | 17,952 | 800,844 | 2,935 | 455,994 | $40.00 | $7.11 |
| 20 | 16 | 3 | 36 | 13,171 | 2,470 | 123 | 18,138 | 1,366 | 0 | 211 | 16,684 | 817,529 | 2,480 | 458,474 | $40.00 | $7.34 |
| 21 | 15 | 3 | 32 | 11,854 | 2,223 | 111 | 16,855 | 1,269 | 0 | 190 | 15,507 | 833,035 | 2,095 | 460,569 | $40.00 | $7.58 |
| 22 | 13 | 2 | 29 | 10,669 | 2,000 | 100 | 15,662 | 1,179 | 0 | 171 | 14,412 | 847,447 | 1,770 | 462,339 | $40.00 | $7.83 |
| 23 | 12 | 2 | 26 | 9,602 | 1,800 | 90 | 14,554 | 1,096 | 0 | 154 | 13,395 | 860,842 | 1,496 | 463,835 | $40.00 | $8.08 |
| 24 | 11 | 2 | 24 | 8,642 | 1,620 | 81 | 13,525 | 1,018 | 0 | 138 | 12,449 | 873,291 | 1,264 | 465,099 | $40.00 | $8.35 |
| 25 | 10 | 2 | 21 | 7,777 | 1,458 | 73 | 12,568 | 946 | 0 | 125 | 11,570 | 884,861 | 1,068 | 466,167 | $40.00 | $8.62 |
| 26 | 9 | 2 | 19 | 7,000 | 1,312 | 66 | 11,679 | 879 | 0 | 112 | 10,753 | 895,614 | 902 | 467,069 | $40.00 | $8.90 |
| 27 | 8 | 1 | 17 | 6,300 | 1,181 | 59 | 10,852 | 817 | 0 | 101 | 9,994 | 905,608 | 762 | 467,832 | $40.00 | $9.19 |
| 28 | 7 | 1 | 16 | 5,670 | 1,063 | 53 | 10,085 | 759 | 0 | 91 | 9,288 | 914,896 | 644 | 468,476 | $40.00 | $9.49 |
| 29 | 6 | 1 | 14 | 5,103 | 957 | 48 | 9,371 | 705 | 0 | 82 | 8,632 | 923,528 | 544 | 469,020 | $40.00 | $9.79 |
| 30 | 6 | 1 | 13 | 4,592 | 861 | 43 | 8,611 | 648 | 0 | 74 | 7,933 | 931,461 | 455 | 469,474 | $40.00 | $10.00 |
| **Total** | **1329** | **249** | **2916** | **1064344** | **199564** | **$7,645** | **$1,017,540** | **$76,668** | **$0** | **$17,056** | **$931,461** | **$19,997,216** | **$469,474** | **$12,025,797** | | |

***$469,474/40AcUnits=$11,736/Ac**
**Value of Minerals**

Table 7

***No future profits may be promised and productivity varies widely***
***** Projections only, based on "average" to "above average well"***
****All wells are "different", perform "differently" and are unique***
*****Variables over time are significant and can alter results (gas prices, gas contracts, line pressure, BTU content and supply/demand for gas)***

## Contemporary Exploration, Drilling, Well Completion, and Production Technologies that Reduce or Eliminate Surface Estate Disruption

The use of various new technologies has greatly reduced the number of "dry" holes and therefore has had a major impact on reducing surface disruptions as the drill-sites are never constructed or disturbed. This is important in that land for access roads and drilling pad sites for "dry" holes nearly equals the amount of land disturbed for successful oil and gas wells. The only difference is that wells determined to be "dry" generally do not have subsurface flow lines and pipelines installed.

Advanced technology in the areas of exploration, drilling, completion and production has served to greatly reduce surface disruptions and allowed drilling from less "sensitive" urban and rural/wilderness areas, reaching over and under more sensitive surface environments such as subdivisions, schools, state parks, natural seashores, wetlands, lakes, etc. Examples of successful applications of the contemporary oil and gas technologies will follow with brief explanations.

I. New Explorations Technologies Reduced surface disruptions through fewer "dry" holes.

1) Computer enhanced historic seismic data, which is reformulated and reformatted from "flat" one-dimensional (1D) subsurface geological topography maps at a single known depth, to two-dimensional (2D)explorations maps of multiple zones, and depths.
2) Three-dimensional (3-D) seismic technology allows expansion of subsurface geological maps to include potentially productive zones both above and below the "target" zone of interest. An interview with a well known independent operator (Bright, 2004) who found a completely unknown productive zone at 2000± feet while seeking oil and gas at 3,000-5,000 feet, stated the following, " We have basically stopped 'wildcatting' and replaced our 'dry' hole budgets with high-tech 3-D seismic. Not only have economically viable drilling success ratios often been raised from 15% to 90%, the significant and most important dividend is perhaps that many fewer surface locations are disturbed or "wasted" on dry holes.
3) Geographic Information Systems (GIS) surface correlation with subsurface economic productive zones has had some success in more shallow productive zones
4) Satellite Imagery Correlation (Remote Sensing)
5) Spectrographic Analysis, which uses oil and gas detection from surface soil emissions.

II. New Drilling Technologies yield fewer wells or well sites with greater economic benefits to oil and gas operators and generally less surface disruption and significantly fewer drilling pad-sites, roads, pipelines, and less surface equipment. The following well types also offer energy companies the opportunity to drill to super-sensitive areas from remote less-sensitive land drill-sites (See Figures 1-4).

1) Traditional Vertical Wells, (See Figure 1) utilize high-tech explorations resulting in fewer dry hole well sites. Often one vertical test hole is drilled followed by multiple directional or horizontal wells being drilled from the same pad-site.

2) Directional Wells, (See Figure 2) are generally engineered to extend to productive zones under environmentally sensitive areas such as urban areas/subdivisions, parks and wetlands, i.e. Cities of Fort Worth, TX, Bryan-College Station, TX (1991); Denton, TX (2004); Long Island National Seashore (2004); Falcon State Park, TX (1992-1998). The horizontal surface distances that can be reached from a remote drilling pad-site have many variables (depths, type, foundations, etc.) and are not always an option, but they can extend up to 3,000 feet laterally from a surface location, in any directions, in North Central Texas as many as five wells have been drilled to five, 40-acre drilling units from a single two acre pad-site due to existing urban land uses or negotiated mineral lease terms prior to drilling. Directional well drilling saved or preserved four two-acre drill-sites that would have not only changed the future surface use, plotting and road layout for the 250 acres, but would have also resulted in eight acres ($200,000) being economically lost to the surface owners and local taxing authorities together with improvements that would have been built there on.
3) Horizontal Wells, (See Figure 3) which are drilled vertically and then utilize precision engineering and "drilling motors" or bits that are "driven" through the target zone for up to 5,000 feet results in the highest economic returns for specific types of formations: shales, chalks, and various gas bearing "coal zones." When geologically appropriate and economically feasible, horizontal wells will eliminate up to three, two-acre drilling pad-sites per lateral depending on the length of the horizontal hole and spacing rules of state oil and gas regulatory agencies.
4) Multilateral Wells (See Figure 4) from the same "bore-hole" can produce from several formations or productive zones simultaneously. The first multilateral wells in the U.S. were completed in 2000 and 2001. Further development of these engineering and drilling technologies in the near future could allow up to acres to be fully produced from one drilling location if the radius of a star shaped drilling horizontal or multilateral drilling program were perfected and appropriate for the type of productive formations such as the Barnett Shale Gas Field in North Texas.

In 2001, B.P. Explorations (Alaska) Inc. drilled the Schrader Bluff Kuparak River Unit and Miline Point Production Unit near Prudhoe Bay Alaska based on a single new drill site plus 2-4 extensions that would drain a 10,000-foot radius using 7.5 miles of new pipeline and one mile of new road. This highly specialized and energized project could theoretically and economically "preserve" 7200 acres of land and disrupt relatively small areas of land (pad-sites, road and pipeline). While many would debate if drilling should occur at all, this should remain a local (state), mineral owner (U.S. Governments) and explorations company decision. Unfortunately, these long horizontal wells and very expensive drilling techniques are only economically viable in areas that have extremely prolific and untapped petroleum reserves. The lower forty-eight U.S. states will likely not see lateral wells drilled longer than 3,000 feet and then only if economically warranted and being difficult areas to drill (urban locations, national seashores, under lakes and bays). The drilling and productions cost/benefits of multiple traditional wells must be greater than the cost benefit analysis of these new and exciting drilling technologies. The good news is that the technologies are rapidly developing and drilling and production costs have dropped significantly making them a viable option for preserving land in all types of drilling environments.

Multilateral wells show a great promise in land-based drilling to offshore oil and gas reserves as well as limiting surface disruptions in urban areas, wilderness, or "wild land" recreational areas and will preserve surface land uses or allow higher and better use and land planning without, for example, a typical forty acre spacing grid.

igure 1-1
Indisturbed Drill sites
'ypical 40 acre well spacing/
60 acre lease vertical well
Barnett Shale Gas Formation
Dallas/Fort Worth Metro
Area North Texas

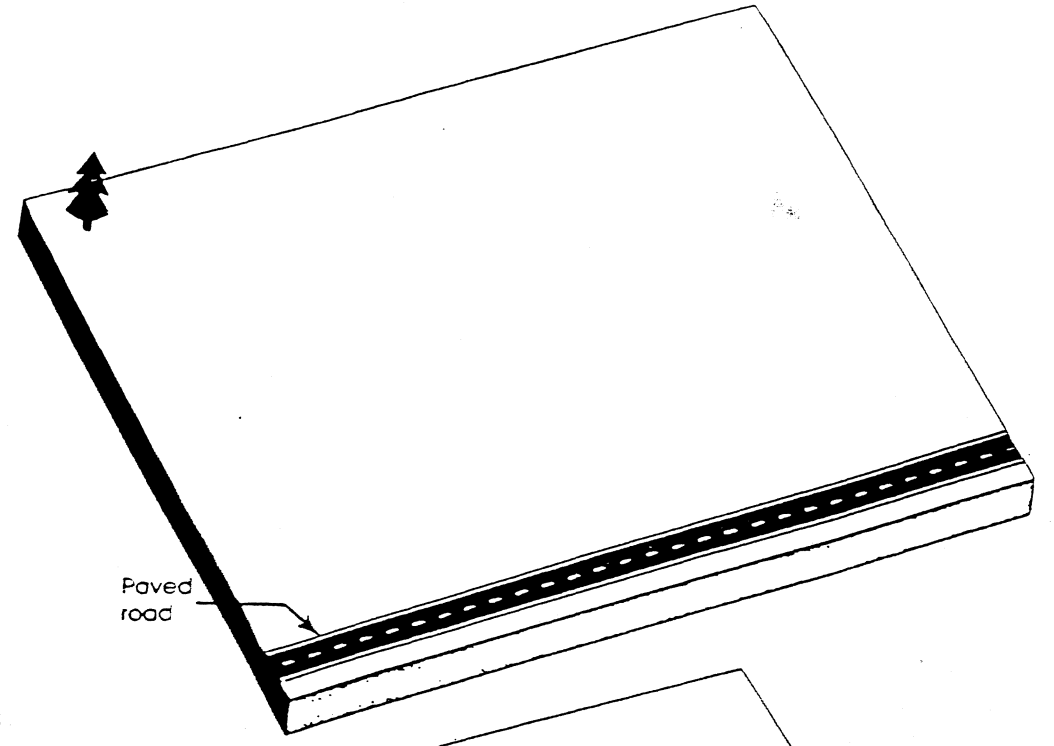



Figure 1-2
Typical Drill Site and
Production-Site/ 40 Acres
Well Spacing/ 360 Acre Lease
Unplanned Oil and Gas
Development without regard to
future surface use or land value
implications. Poor use of surface
estate and no surface or planning
found in mineral lease document.

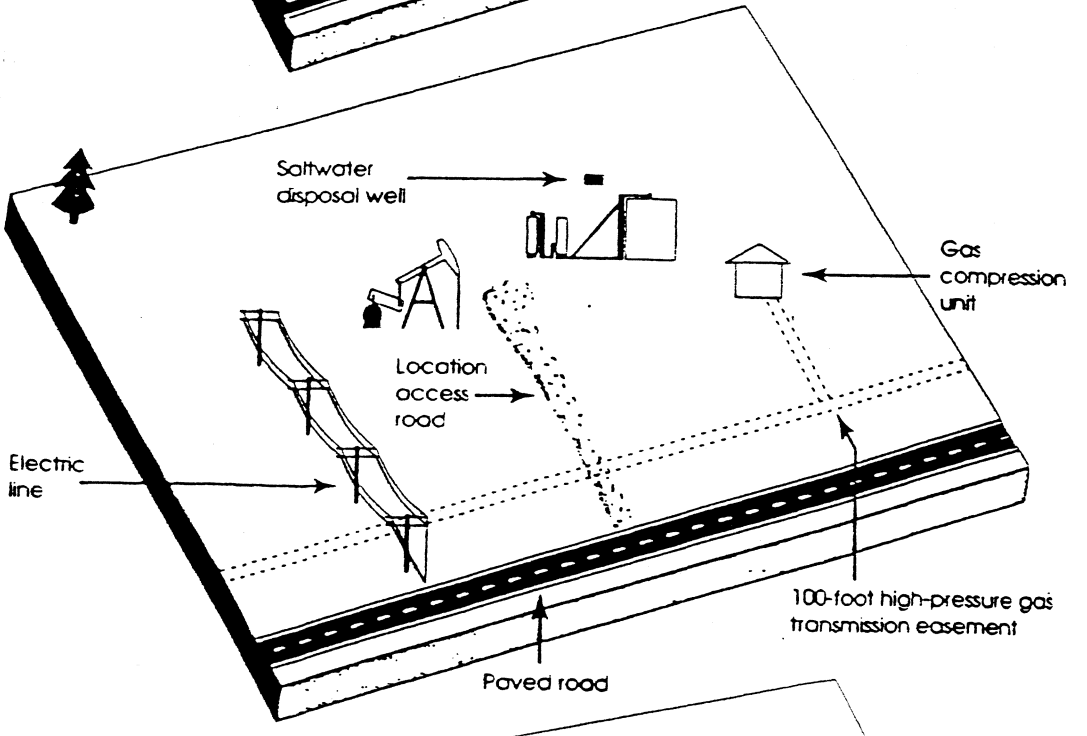
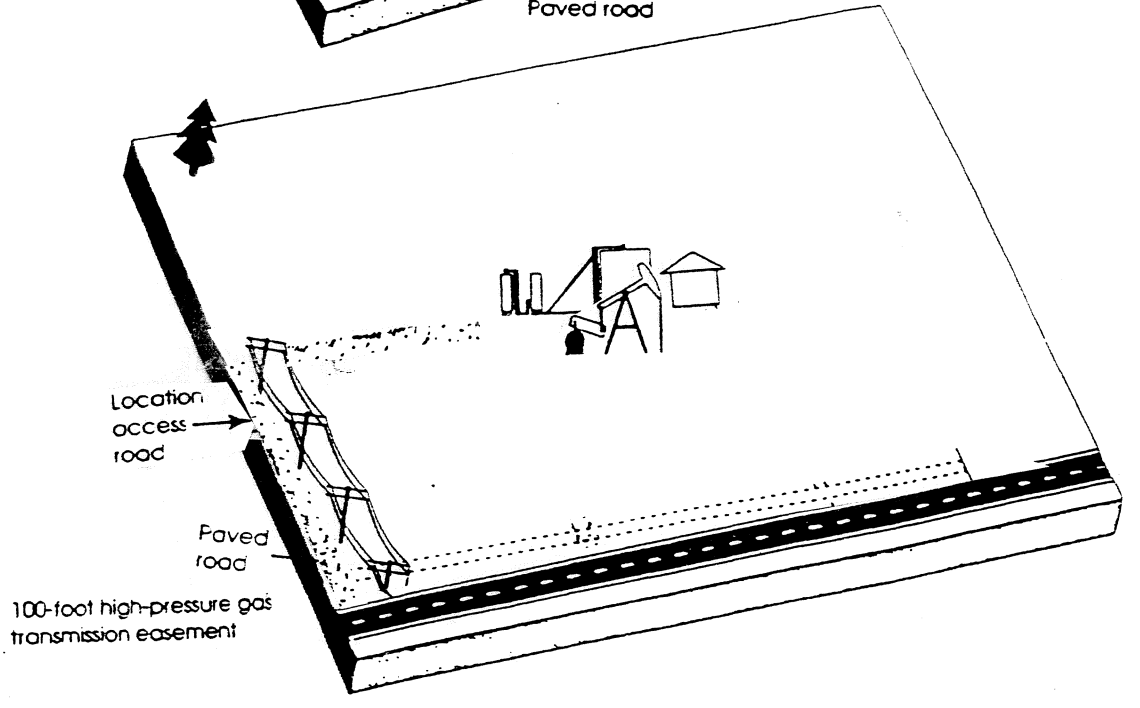



Figure 1-3
Highly Planned Oil and
Gas Location
10-Acre well spacing
concentrate surface use,
equipment, and preserves
surface estate. Accomplished
by mineral lease provisions
or voluntary by responsible
Oil and Gas Companies with
landowner input.



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**GAS PIPELINES**

**AERIAL VIEW OF TRADITIONAL VERTICAL WELLS USING "GRID SYSTEM"**

**360 ACRE LEASE/ 40 ACRE SPACING WELL 9 SURFACE DRILL SITES AT 2 ACRES EACH**

**TOTAL SURFACE DISRUPTION= 28.9 ACRES (9%)**

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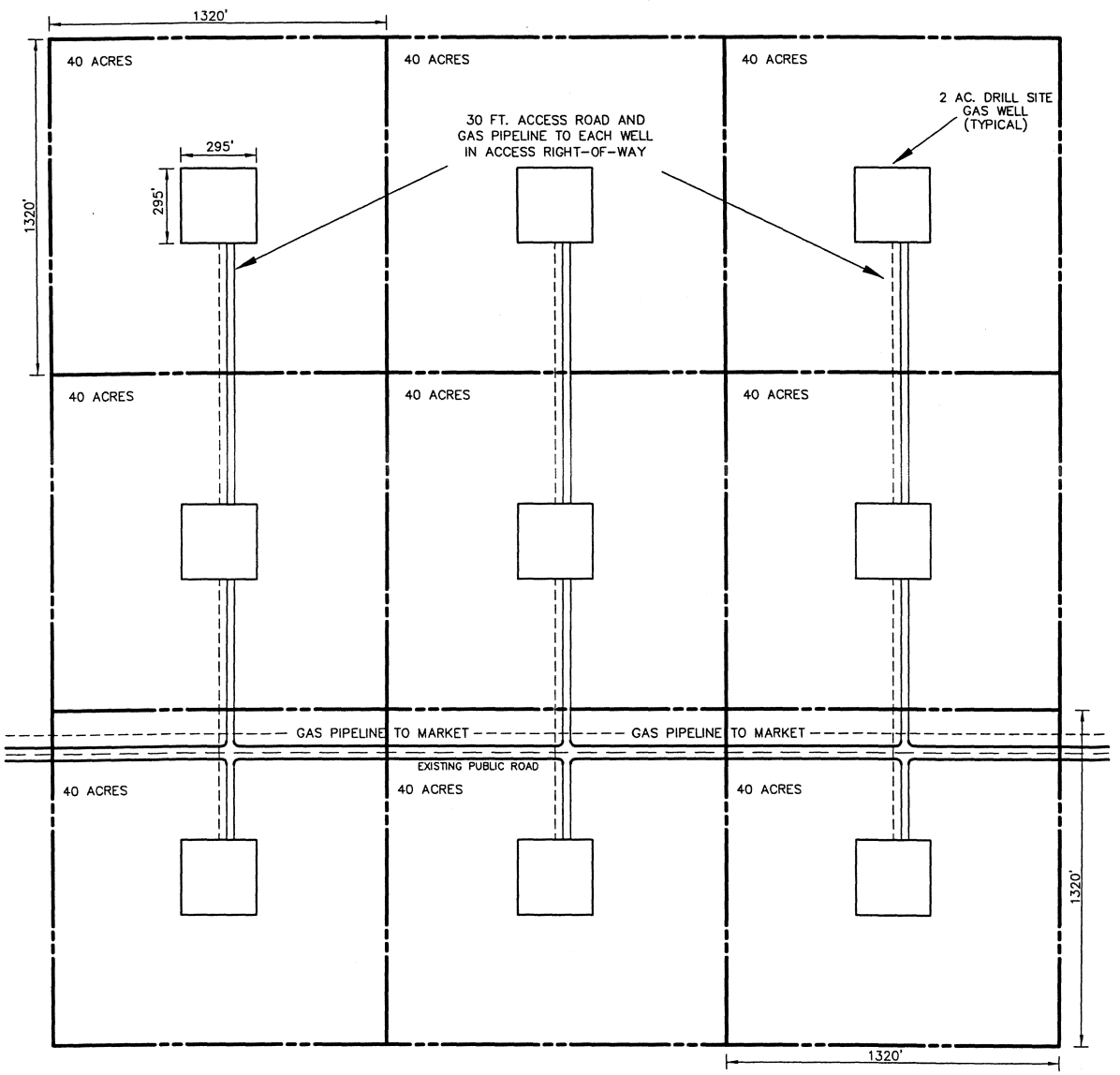
## Figure 1-4

Aerial view of traditional vertical Oil and Gas wells and Mineral drainage development for a 360-acre parcel of land
By John S. Baen Ph.D. University of North Texas 2004. (assumes blanket geological productive zone)
Traditional Vertical Wells using commonly used "Grid System" assumes 40 acres spacing (varies by formations depth and state guidelines) and 2-acre drill-sites and all flow lines, eclectic lines and pipelines planned within 2-acre pad-sites actions sites, and 35-foot (width) oil and gas access road.

Total surface use:

| | |
|---|---|
| a) 9 Drill-sites at 2 acres (295'x 295' each) = | 18 acres |
| b) 7920 ft of oil and gas access roads x 35' wide = | 6.4 Acres |
| c) 7920 ft of gas pipeline x 33' = | 6.4 (easement an in road). |
| d) 3960 ft gas pipeline x 50' in width = | 4.5 acres (easement) |
| *Total surface Disruption = | 28.9 Acres |
| Or 28.9 acres / 360 acres = | 8% |

* total disruption soil only, additional daily oil and gas traffic, visual effects, and stigmas have additional surface value implications which are often mitigated by drill-sites "damages" negotiated with surfaces estate owners. Needless to say, the traditional vertical well "Grid-System" severely disrupts, curtails and limits future highest and best use for the subject 360-acre property, except for grazing uses (For a visual example of surface equipment at each location see Baen 1996).



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**GAS PIPELINES**

**AERIAL VIEW OF DIRECTIONAL DRILLING OF OIL & GAS WELLS**

**360 ACRE LEASE/**
**40 ACRE SPACING WELL**
**1 SURFACE DRILL SITE (5 AC.)**
**1 ACCESS ROAD (0.5 AC.)**

**TOTAL SURFACE DISRUPTION= 5.5 AC. (2%)**

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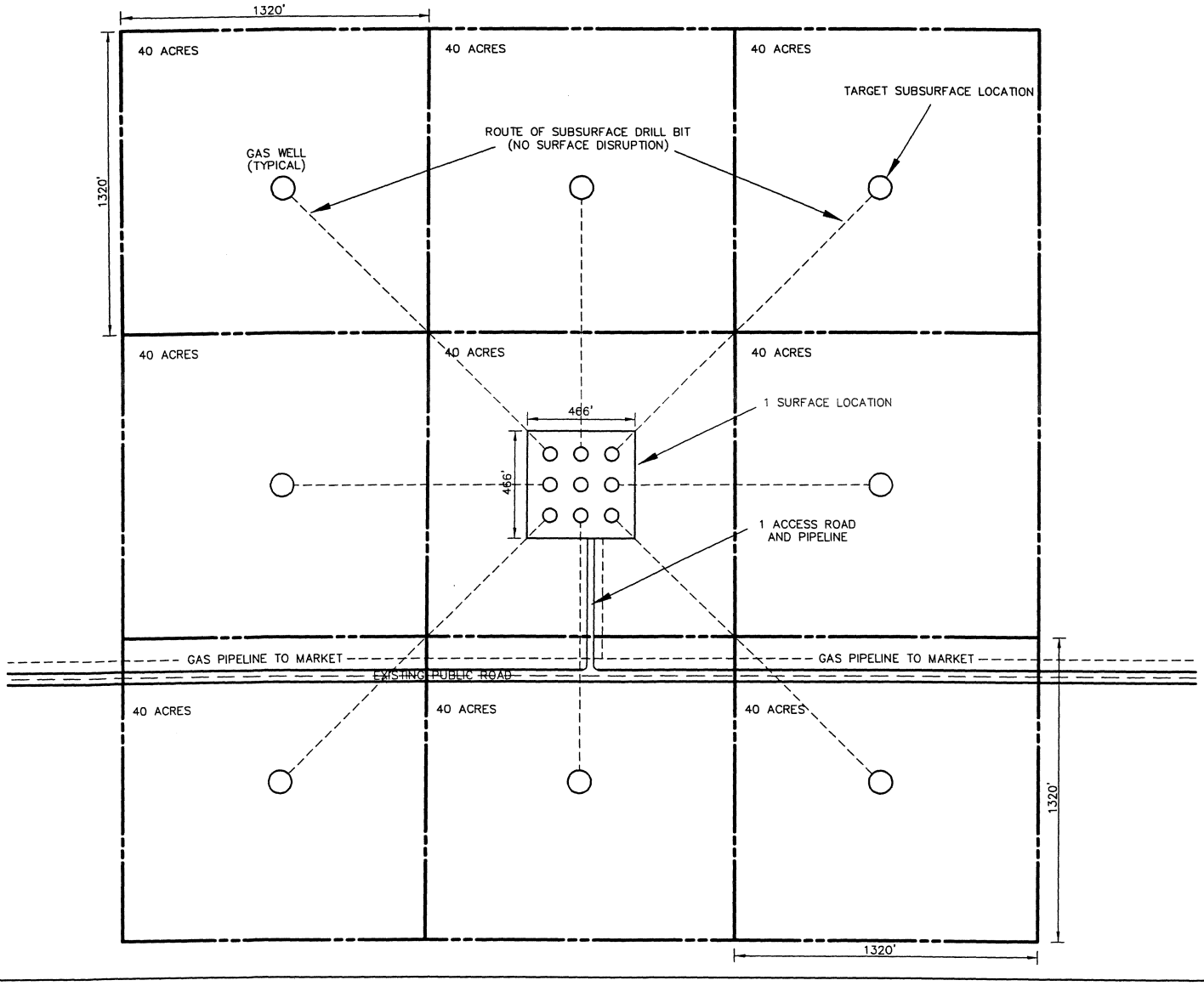
## Figure 2

Aerial View of Directional Drilling of Oil and Gas Wells and Mineral Drainage Development for a 360-acre parcel of land.
By John S. Baen Ph.D. University of North Texas 2004. (assumes blanket geological productive zone and 40 acre spacing)
Directional drilling of nice wells in a "star" shaped pattern from one drill-site and production area totaling five acres in a central location. Wells are targeted and drilled to areas relative to the central surface location that are 1320 feet to 2000 feet away.

Total Surface Use:

| | |
|---|---|
| a) 1 Drill-site at 5 acres (466 feet * 466 ft sq.)= | 5 acres |
| b) 660 ft of oil and gas access road x 35' in width= | .53 ac |
| c) 660 ft of gas pipeline Easement x 50' in width (included on/under road) = | .73 acre -.53 acre = .23 acre net effect |
| d) 3960 ft gas pipeline along public road x ft width = | 4.5 ac |
| Total Surface Disruption = 10.26 Acres or 10.26 acres /320 acres = | 3.2% |

It should be noted that in urban or environmentally sensitive areas that the single central drilling/production location could be located anywhere on the 320 acre tract of land after consideration of topography, views, soil types, archeological areas, wetland, occupied building, future highest and best use of surface estate if a land plan and drill site as negotiated as a part of any lease.



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**GAS PIPELINES**

**AERIAL VIEW OF HORIZONTALLY DRILED OIL & GAS WELLS FROM ONE SURFACE LOCATION**

**360 ACRE LEASE/**
**72 ACRE DRAINAGE PER WELL**
**1 SURFACE LOCATION (5 AC.)**
**5 HORIZONTAL WELL BORES**
**1 ACCESS ROAD (0.5 AC.)**

**TOTAL SURFACE DISRUPTION= 5.5 ACRES (2%)**

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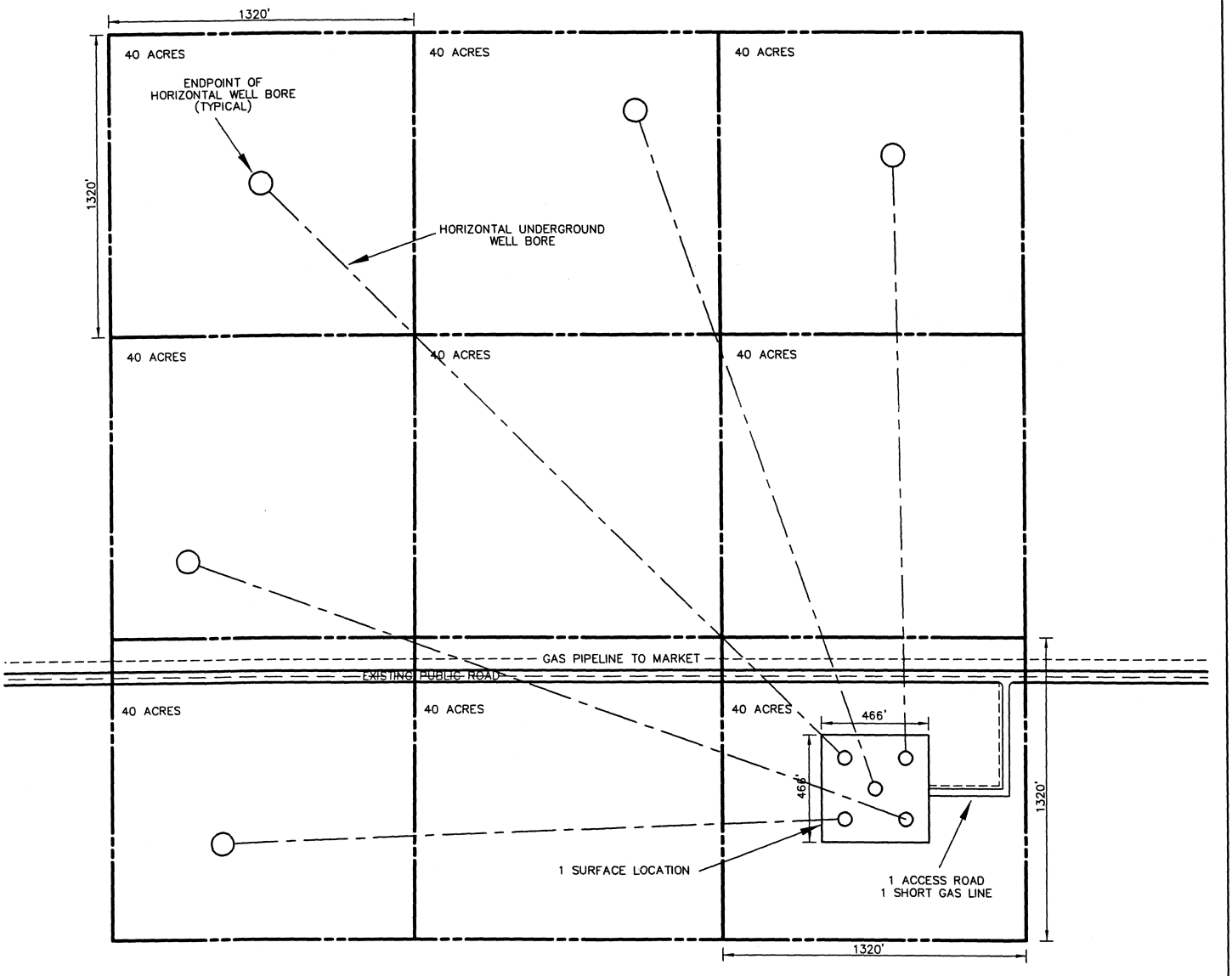
## Figure 3

Aerial View of Horizontal Drilling of Oil and Gas Wells and Mineral Drainage Development for a 360-acre parcel of land
By John S. Baen Ph.D. University of North Texas 2004. (Assumes blanket geologically productive zone and 40 acre spacing)
Horizontal wells are drilled and completed with slotted line or multiple staged fracs that drain all the oil and gas along the well-bore that is drilled horizontally through the productive formation. While the drilling and completion costs are 200% of a traditional well, the wells make 300-400% more in a shorter period of time.

Total Surface Area Used:

| | |
|---|---|
| a) 1 drill-site at 3 acres (361 ft x 361 ft) = | 3 acres |
| b) 1320 ft of oil and gas access road x 35 feet in width = | 1.1 acres |
| c) 1320 ft of gas pipeline easement (included on /under road) x 50 ft in width (1.5 acres – 1.1 Road = | .4 net addition acre) |
| d) 3960 ft of Gas pipeline along public road x 50 ft in width = | 4.5 acres |
| Total Surface Disruption= 9.0 acres or 9 acres/360 acres= | 2.5% |



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**SIDE VIEW OF MULTI-LATERAL WELL**

**1 SURFACE LOCATION UP TO 7,000 ACRES OF COVERAGE IN ECONOMICALLY VIABLE AREAS. (ALASKA)**

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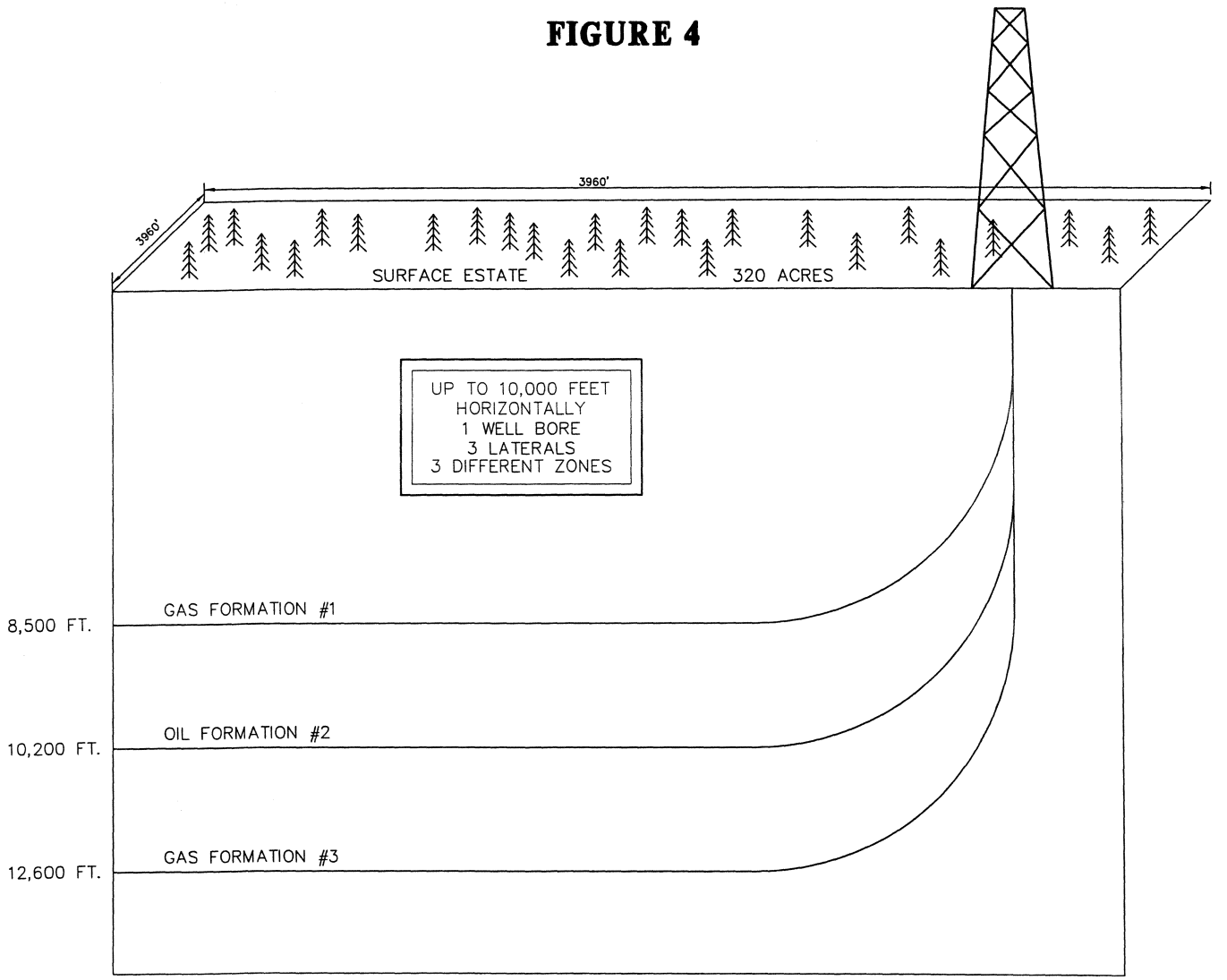
## Figure 4

Side View of Multilateral Drilling of Oil and Gas Wells and Mineral Drainage Development for a 360-acre parcel of land
By John S. Baen Ph.D. University of North Texas 2004. (Assumes blanket geologically productive zone and 40 acre spacing)

Figure 3 depicts the same surface land use required for multilateral wells on the subject property. The difference is that in many productive oil and gas areas, there are multiple productive oil and gas zones under the same property. Prior to the development of multilateral well technology, each zone required a new well or sets of wells to be drilled into each zone. Now several zones can be produced through the same well bore having off shoots or "side tracks" that allow for multiple zones production. This new technology reduces surface area impact and damages while maximizing the subsurface mineral production.

# FIGURE 4



## Examples of Reducing the Impacts of Drilling on the Surface Environment- Beyond Innovative Exploration and Drilling Techniques

These concepts and techniques are generalized and may or may not be economical in regard to the cost/benefit analysis of the target oil and gas zones. They may be implemented voluntarily, required by the lease document or by regulations.

1) Well-planned drill-site access and minimum sized drill-site pad-site
2) Minimum sized drilling pit (either pit or self-contained metal pits)
3) Environmentally-friendly paint color for all surface equipment to match the surrounding environment:
    a) sandstone beige (San Juan Basin)
    b) forest green (Federal Lands)
    c) desert tan (decent environment)
    d) sage green (sagebrush environment)
4) Short production tanks (eight feet vs. fourteen feet) to reduce visibility
5) Earthen berms and landscaping (urban areas)
6) Underground (buried) electrical service with pumping units or gas-operated pumping with superior noise muffling systems
7) Buried flow lines and reseeded areas of soil disturbance
8) Well-planned and clustered production pad-sites that when possible, are out of site from the public using natural topography and vegetation (There are many wells located on the very tops of hills and plateaus that easily could have been planned off of the summit)
9) Controlled drilling times in periods of high traffic or high area visitation, such as hunting seasons (New Mexico), football games (University of North Texas), when campuses are closed (Texas Woman's University), etc.
10) High-Security fencing of production-site equipment and facilities in urban area.
11) Radio and remote-control well monitoring equipment with automatic shut-off valves and well problem indications (very common in Texas.)
12) Posted security numbers, emergency numbers and other signing to indicate a safety plan is in effect at all entrance gates and well sites.
13) Well and well-site monitoring by independent consultants, environmental engineering, or regulations to reduce or eliminate any environmental problems or potential maintenance issues, perhaps as part of an annual operation for paid by oil companies on a per well basis.

## The Realistic Risks of Drilling and Production in Urban an Environmental Surface Areas

In urban drilling environments, the higher the population density the greater the safeguards that should that be put in place during drilling and production operations for the remote possibility of a well blowout. In remote and wild drilling environments, the lower the population density of humans the greater the environmental standards and enforcement that should be put in place for the reduction in surface-use impacts on the surface environment. For both urban and remote drilling locations, there are no greater risks to blowouts, fires, gas leaks or accidents than those near any other light-industrial surface use focused in urban areas. These are slight chances for health and safety risks, which should be a topic for further research and include, but are not limited to, the following:

Flaring Gas during the drilling and/or completion phase of well can occur and is generally controlled by engineering techniques that are a part of the planning process of every well. Of 1719 wells drilled in the Dallas, Ft. Worth Metro Area, only four (4) wells were flared. One was safely flared for us on three (3) days and nights on the urban campus of Texas Woman's University (TWU) in Denton, Texas. No injuries or deaths occurred.

Oil-Well Sabotage has occurred in Canada as oil companies have suffered hundreds of incidents ranging from petty vandalism to bombings of oil and natural-gas wells (Carlisle, 1998, Wall Street Journal 1998). One company tallied over 160 incidents over an 18 month period in Northwest Alberta due to surface owners (farmers and ranchers) not owning any mineral rights although they were paid surface damages. Although similar acts would be federal, state and/or local violations of law, there is a concern that Federal Lands minerals could cause similar situations and occurrences in the U.S. Friction between citizens and the U.S. government has already occurred in New Mexico due to access and/or proposed drilling areas (Gold, "New Mexico Drilling Suit Filed"; AP Wire Service "New Mexico Rancher Held Without Bail Following Run-in with Federal").

Salt Water and Disposal Well Pollution of underground aquifer can also occur. For areas that rely on under region drinking water, the injection or re-injection of produced water can invade freshwater zones and contaminate water supplies. There are many references and cases of law available on this topic but is beyond the scope of their research.

Accidents at production pad-sites can occur if security and constructions of safety guidelines are not enforced. Examples have been well-head collision with vehicles, storage tank fires due to carelessness by trespassers, target practice by vandals involving oil an gas surface equipment, etc.

Poison Gas Leaks rarely occur in the U.S. oil fields and are produced only from rare formations. Poison gas production and drilling should be avoided in urban environments.

## Current Status of Oil and Gas Surface Use and Drilling Regulations in the U.S.

Oil companies, government regulators, anti-drilling landowners, and political functions currently have the following environmental laws and regulations, which apply to oil and gas activities on public and private lands.

1) Federal Laws and Regulations:
   c) Clean Air Act, and its amendments, which governs air emissions
   d) Clean Water Act, which governs discharges to waters of the United States
   e) Comprehensive Environmental Response, Compensation and Liability Act, which imposes liability where hazardous releases have occurred or are threatened to occur
   f) Resource Conservation and Recovery Act, which governs the management of solid waste
   g) Oil Pollution Act of 1990, which imposes liabilities resulting from discharges of oil into navigable waters of the United States
   h) Emergency Planning and Community Right-to-Know Act, which requires reporting of toxic chemical inventories
   i) Safe Drinking Water Act, which governs the underground injection and disposal of wastewater
   j) U.S. Department of Interior regulations, which imposes liability for pollution cleanup and damages
   k) Endangered Species Act.
2) State Laws and Regulations
   Oil and Gas Commissions (varies by state)
3) County Ordinances and Regulations
   County drilling permits and regulations (example: Moffit Co., Colorado)
4) City Drilling Ordinances

   While companies routinely and ethically obtain drilling and operational permits, there should be internal corporate objectives to minimize surface damages and loss of potential land uses while drilling for oil and gas. This will require surface land planners, geologists, and engineers to plan well sites and access routes or an oil and gas development team.

   The oil and gas industry does not need additional federal, state, or local regulations but company mission statements which simply include a balanced and economically feasible approach to land use and well placements that are sensitive to the surface environment when appropriate and when practicable. It is also my opinion that surface owners who also own the minerals should have the right to waive county and city land use regulations, zoning for oil and gas drilling and well placement ordinances at their option.

## Recommendations to City, County, and State Governments Who Regulate Drilling Permits and/or Related Ordnances, and Activities

1) Good site planning, reasonable access, specific operations and safety guidelines and justifiable fees for drilling permits should all address specifically in any city, county, or state laws or ordinances.
2) Regional planning for pipeline right-of-ways should identify and perhaps reserve areas for oil and gas collection and distribution lines. Related wellheads, gas facilities, compressor tanks, surface equipment, valves, gas loops, should not be located where auto traffic accidents could occur and cause danger to the commuters.
3) Oil and gas lease and pipeline signs should clearly post oil and gas operators home and emergency telephone numbers.
4) Any oil and gas well, pipeline, flow line and/or surface equipment should be located on official planning maps and/or plats, which clearly indicate both surface and subsurface structures and equipment.
5) In highly-developed urban areas, drilling activities are sometimes limited to daytime hours only. This is not recommended for two important reasons.
    a. The rig and workers are on site 30 rather than 10
    b. The oil companies pay the rigs by the day ($15,000/day) or by the foot drilled. Limited daylight drill time extends both the expense and drill time for the community.
6) Any government charging a "drilling permit fee" should be required to provide safety constraints, surface inspections, and long-term monitoring services to reduce public risk and assure safety standards. Violations of ordinances by oil and gas operators should be meaningful.
7) Any surface owner who also owns the mineral rights should have the right, but not the obligation, to be partially-exempt from site specific regulations in regard to well and equipment placement on said lands.

## Recommendation to Those Leasing Minerals to Oil Companies – Protections to Land Provisions, Private Owners, U.S. Governments/BLM, State Governments and Cities

1. Obtain qualified help in negotiation of leases, lease bonus/signing bonus, royalty amounts and surface damages. Oil and gas companies, independent land men/leasing agents and most oil and gas attorneys generally focus all their expertise in maximizing income and care little or cannot "see" the long term surface-use conflicts with placements of wells, pipelines, roads, etc.
2. Damage compensation or mitigations should be specifically addressed in each lease based on unique features and potential for the land's highest and best use. Damages for drill sites, roads, and pipelines should be specific at market and fair to all parties based on total impact to land, not on specific acreage damaged.
3. A long-term or eventual highest and best use land plan should be prepared for the surface estate without oil and gas wells. This should become a base map for identifying locations for potential well sites and access roads/rights-of-ways, etc. The plan should also identify valuable parts of the property to be avoided, such as (avoiding road frontage, wetlands, mature forest areas, and high visibility locations such as top of a plateau in northwest New Mexico. Whether the well are drilled first or the surface estate is developed into urban/suburban uses, the land plans and/or plat should clearly identify potential drill sites for buyers, tenants, and public officials, they maybe be fully informed during long term regional planning, annexations, plotting and/or subdivision.
4. Lease provisions should allow at a minimum for drill sites, pipelines and acres to be agreed on prior to any soil disruption. Release of surface rights by oil companies should include all precisely defined land not designated or "held" by productions (This allows for residential land, mortgages and title policies, to be obtained that are not subject to oil and gas surface disruption).
5. Persons or governments owning/ controlling mineral rights but no surface rights should not sign (although they have the right) standard leases that give to others 100% "reasonable" access to surface rights/estate. Reasonable access should be defined in the event that the surface owner is not willing to sign a voluntary agreement or treaty with the oil company.
6. Federal (BLM) and state oil and gas leases should contain the same planning, surface damage awards (for drill sites, roads, pipeline right-of-ways) and compressor site ground leases that are commonly found in private land leases. Surface tenants should be compensated based on reasonable economics of the partial use lost (grass destroyed by actual numbers of acres lost to road or drill site). Either reduction in future rent or rebate of per acre lease monies paid is a reasonable and fair approach. Future BLM agriculture surface leases or permits should clearly state a "non-exclusive use" and address how oil and gas damage will be paid to surface owner (U.S. Gov, BLM, etc.) only with x% paid to one year tenant/ permit holder.

## An Example of Economically Viable Technology Use in an Environmentally Sensitive Area:

Falcon State Park, Falcon Heights Texas

The Federal Government donated 572 acres (surface estate only) of prime Falcon Lake Frontage to the State of Texas for camping, bird watching and boating in 1950. After the park was fully developed and operational (1954), deep natural gas was discovered under the lake and park. The minerals and full access to develop them were leased in 1991 and developed by Sanchez- O'Brian Oil and Gas and El Paso Natural Gas Corp. A total of 42 deep gas wells (12,000± ft.) were drilled, slant drilled or directionally drilled from a total of three, three-acre pad-sites which were environmentally planned, highly-concentrated areas of drilling and production totally within the boundaries of the park. Natural brush and well-planned limited access roads to the production pad-sites have very successfully allowed the full development of the surface use (state park) and mineral estate (the drilling of 42 wells) with little to no impact on the two highest and best uses of the same property. This which defies a basic principle of real estate: any property shall only have one highest and best use at any given time. No significant change in Falcon State Park's total revenue and visitor numbers were observed during or after drilling activities commenced.

| Year | Revenue($)/Year |
|---|---|
| 1991 | 110,000 |
| 1992 [1] | 114,639 |
| 1993 | 130,526 |
| 1994 | 130,189 |
| 1995 | 110,237 |
| 1996[2] | 99,260* |
| 1997[3] | 101,269 |

* Slight decline attributed to low lake levels due to drought, and similar to water-level drops in 95 other Texas Parks.

1) Drilling activities commenced.
2) Drilling activities completed.
3) Lawsuit filed: Cause No. DC-97-280; The County of Starr, Texas vs. Coastal Oil and Gas Corporation. In the 229th Judicial District Court, Starr County, Texas alleged economic harm to county and tourism due to drilling activities; case was dismissed after experts report and dispositions presented.

## Political and Economic Evolution of Urban/ Rural Drilling

1. First Well Drilled: no city/county drilling ordinances in existence; land population is worried about safety, land values, wells near their property, noise vibrations, perceptions of danger, etc.
2. City/County Drilling Moratorium Declaration to allow time for obtaining sample ordinance and citizen input.
3. Injunctions against oil companies are issued to stop drilling although state permits are granted and mineral leases signed. Drilling rig owner threatens damages against city, county, and residents for $16,000 per day lost income.
4. Tough Drilling Ordinance is implemented that is over restrictive and does not allow reasonable access, sometimes no access to minerals/oil and gas.
5. Lawsuit filed by mineral owners and oil companies against city/counties claiming a "taking" without compensation. The damages sought include the present value of the minerals oil production over 30 years with a reasonable discount rate under the whole area. This would bankrupt the city/county.
6. The city/county softens the drilling ordinances and grants many various exceptions due to political power of land/mineral owners who desire the royalty income.
7. Drilling boom commencers if economics and geology support investments in oil and gas wells (200+ wells drilled in 24 months in Dallas/ Ft. Worth Metro Area).
8. Property and Business Taxes are collected and distributed to state, county, city ,school districts, etc. ($65,000 per well per year in North Texas).
9. Mineral Royalty Owners collect 15-20% of gross income from each well. The local economy grows.
10. City-owned and county-owned land, churches, and schools lease their land/minerals and become tax-free royalty owners in addition to collecting taxes.
11. Wells become part of the urban/rural landscape and have little impact on the market value of properties in the area except the drilling/production pad-sites.

## References


AP Wire Service. "New Mexico Rancher Held without Bail Following Run-in with Federal. April 1, 2004.

Baen, John S. "Oil and Gas Mineral Rights in Land Appraisal." *The Appraisal Journal.* April 1988. pp 205-216.

Baen, John S. "The Impact of Mineral Rights and Oil and Gas Activities or Agricultural Land Values." *The Appraisal Journal.* January 1996. pp 67-74.

Baker, Hughes. "Rig Count." *Oil and Gas Journal.* June 9, 2003 (Source Baker Houghs Inc., Oil, and Gas Journal Data Base).

Carlisle, Tamsin. "Oil-Well Sabotages in Canada Reflects Tension with Farmers." *Wall Street Journal.* October 30, 1999. pp A17

Compton A. et, al. "Coalbed Methane and the Environment." *Oil and Gas Investor Coalbed Methane Special Edition.* December 2003. pp 20.

Cummins, Chip. "Shell Head Apologizes on Reserves 19% Reduction in Royal Dutch/ Shell Energy-reserves." *Wall Street Journal.* February 6, 2004.

*Dallas Morning News.* March 30, 2004.

Despres, Cliff. "City OKs New Drilling Ordinance." *Denton Record-Chronicle.* March 4, 2004. pp1.

"Devon Sues City of Reno over Drilling Access." *Wise County Messenger.* January 15, 2004. pp 1.

"Devon Suing Roanoke." *Wise County Messenger.* February 23, 2003.

Farmers and Merchants State Bank. "Mineral Rights Acknowledgment and Agreement." Mortgage Document attachment dates July 30, 2002.

*Fort Worth Star Telegram* and. "Map of the Barnett Shale in 13 Counties in the North Texas." *U.S. Geological Survey.* March 25, 2004.

Frost, Teresa. "Texas Land Title Association August Regional Seminar-Key Title Issues. Session II." Exhibit Form t-19: Restricts, Encroachments, Mineral Endorsement/Schedule B Exceptions form coverage and Express Insurance. October 8, 2002. pp5.

Gold, Russell. "New Mexico Drilling Suit Filed." *Wall Street Journal.* February 5, 2004. pp1.

Johnston, Dav. "Technological Advances Expand Potential Pay." *Oil and Gas Journal.* January 19, 2004.

"Kancher Wins Case Charging BLM Employees with Racketeering." *Livestock Weekly.* February 28, 2004. pp 15. (Access through private deeded land case).

Lawrence, Fredrick J. "State of the U.S. Oil and Natural Gas Industry." *America's Independent Oil and Gas Journal.* January 2004. pp 8-12.

"Leading Crude oil Producing Regions." *Oil and Gas Journal.* December 28, 1998. pp37.

Rach, Nina M. "Drilling Expands in Texas Largest Gas Field." *Oil and Gas Journal.* January 19,2004. pp 45-50.

Reed, S. and Anderson, S. "Saudi Arabia: A Saudi Oil Shortage?" *Business Week.* April 5, 2004. pp 62-64.

Simons, Robert A. "The Effect of Pipeline Ruptures on Non-Contaminated Residential Easement-Holding Property." Paper Presented at the American Real Estate Society Meeting April 1998. (Author Contact 216-687-5258 or roby@wolf.csuoho.edu)

Texas Parks and Wildlife. "Natural Gas Development at Falcon State Park." (Brochure available % Park Superintendent, Falcon State Park PO Box 2, Falcon Heights, TX 78545). 1998.
"The Environment and Energy: Gas Warfare-The Next Big Environmental Row Could be in the Rocky Mountains." *The Economist.* January 31, 2004. pp 29.
"U.S. Drilling." *Oil and Gas Journal.* February 16, 2004. pp 42.
Williams, Scott. "Gas Drilling Ready to Go On Padre Island National Seashores." *Dallas Morning News*. February 8, 2004. pp 3A

Figure 5

Theoretical Perfect World Development that maximizes Rate of Return of Mineral
Surface/ subsurface and surface estates with minimum cost to each

Preliminary Geology

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Traditional Oil and Gas Leases Offered

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Surface owner conducts detailed highest and best use 50-year land plan

1) **Existing Urban Plan**
Seek available drill sites in urban areas

a) Industrial land
b) Vacant tract with comparing for planning mixed gas uses (including oil and gas products)
c) Public open spaces with compensations or mitigations

Evaluate urban road capacity for high tonnage equipment weight.
Evaluate Realistic Surface Disrupts Effect and options to reduce or illuminate negative impact to urban economics.

- Location factor
- Public health and welfare and safety factor
- Shell building screening
- Visual, noise reduction equipment

2) **Futurists Suburban Plan**

a) Land plan total tract for eventual highest and best use, density, etc. assuming no oil and gas
b) Select least harmful drill site locations within land plan
- Compatible uses
- Open spare integration
- Possible innovations

c) Investigate innovative and cost effective drilling/mineral drill options.
- Traditional vertical wells
- Directional wells drilled under high value real estate
- Horizontal drilling up to 4000 feet in a star shaped pattern from a location varies on formations, depth, and type

d) Evaluate long-term drill site access road and pipeline/ utility access routes.
e) Evaluate cost benefit analysis and visual surface and screening and no wise reduction optimize
- Screen fences
- Barns
- Hedge/ Tree Planting
- Landscaping
- Etc.

3) Rural and Public Recreation Land Plan
   a) select least harmful drill site location
      - Location
      - Visually
      - Terrain
      - Slope of land
      - Vegetation
      - Etc.

**Conduct Cost of Benefit Analysis of surface and subsurface areas**

Negotiate limited surface disruption oil and gas lease with specific development and open guidelines including right to move, change access visuals, pipelines, etc.

Execute mutually agreeable and economically beneficial oil and gas lease (assume any well drilled and long term production)

Figure 6

## City of Argyle, Texas Drilling Ordinance Compliance

(Ordinance No 2003-6 by Richard Tucker, Mayor,
J.S. Baen O&G Consultant and City Council)*

1) Review Article 4.700 of the Argyle Code of Ordinances relating to "Oil and Gas Drilling Activity" adopted in Ordinance No. 1999-05 on January 26, 1999. Also, review Ordinance No. 2003-06 amending the foregoing Ordinance in certain respects and Appendix A Article 1.000 for permit fees.
2) Obtain permit (see §4.704). Permit is issued for one year [§4.712(1) (A)]. Permits may be extended by filing a renewal application [§4.712(2)]. Supplemental permits required for deep drilling [§4.714].
3) Comply with notice [§4.704(e)], application [§4.704(f)] and Council approval [§4.704(g)] requirements].
4) Complete application and deliver to City Secretary (§4.705) for distribution and review by Development Review Committee (DRC) (§4.706). Fees include $4.00 for each notification letter sent to property owners within 5,000 feet and 2,000 feet, respectively, of proposed drill site perimeter as to a high impact area permit [§4.707(a)(3)] or rural permit [§4.707(b)(1)].
5) DRC shall review the application within 45 days of the application being filed with the City [§4.706(c)]. DRC shall make a written report and recommendation to the City Council regarding site plan design, construction, installation, operation and maintenance and other factors enumerated in §4.706(c) within 60 days of application receipt or 30 days following receipt of consultant (if one is used) [§4.706(f)]. Additional time may be granted DRC by City Council if necessary to make recommendations [§4.706(f) and §4.707(a) (4)].
6) Fencing, screening and landscaping may be required as determined by DRC [§4.706(d)].
    a) If fencing is required, it must be completed with 30 days following completing or reworking of well, or within 30 days following activation of an idle well in a high impact or urban area [§4.706(d) (7)].
    b) If landscaping is required, it must be completed within 60 days following completion or reworking of well or within 60 days after activation of an idle well [(§4.706(d)(8)].
    c) If permit renewal is sought, compliance with §4.706(d)(9)] with respect to fencing and landscaping will be required.
7. Access roads requirements must be complied with prior to commencement of oil or gas operations [§4.706(e)].
8. Processing of Applications.
    a) High Impact Area Permits; Rural Permits. Applications required. Public hearing required. To be held no earlier than 15 days from date notice is published [§4.707(a)(2)].
    b) Seismic Permits. Applications required. No public hearing required.

9. See §4.709 for criteria to be used in granting or denying permits. Granting of permit expressly conditioned on receipt of security instrument within 30 days of City Council approving permit.
10. Security Instrument requirements contained in §4.710, including requirement that the principal amount of the security instrument shall never be less than $500,000.
11. Insurance requirements set forth in §4.711.

*Cities and interested parties may request complete copies of city Argyle, Texas Drilling Ordinances 1999-05 and 2003-06 from the City Secretary at cdelcambre@argletx.com or calling 940-464-7273. Other North Texas cities having new Drilling Ordinances include: Ft. Worth, Ponder, Flower Mound, Denton, and Bartonville.