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IN THE UTAH SUPREME COURT

MARION ENERGY, INC.; STATE OF UTAH, SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION, Plaintiffs and Appellants, vs. **KFJ RANCH PARTNERSHIP,** Defendant and Appellee.	**CORRECTED AND AMENDED BRIEF OF AMICUS CURIAE UTAH PETROLEUM ASSOCIATION IN SUPPORT OF APPELLANTS MARION ENERGY, INC., and STATE OF UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION** Case No. 20090796-SC

APPEAL

From a Decision of the Seventh Judicial District Court for the District of Utah
Case No. 09070027, the Honorable George M. Harmond

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INTEREST OF AMICUS CURIAE

The Utah Petroleum Association (hereinafter "**UPA**") is a non-profit industry trade association representing Utah's oil and gas extractive industries. UPA members include major and independent oil and gas producers and refiners. Application of the Utah eminent domain statute to the exploration and production of hydrocarbons is important to UPA and its members. More importantly, this case is one of first impression.. This Court's construction of Utah's mineral-condemnation provisions will affect the way UPA members develop energy in the future. That, in turn will affect access to mineral resources, industry-related jobs, energy resources, revenue, and royalties that benefit the state. For example and emphasis, in 2008, the Utah petroleum industry produced $2 Billion of crude oil, including natural gas liquids, and $ 2.7 Billion of gas.[1]

STATEMENT OF FACTS

Amicus Curiae adopts the Appellants' statement of facts and statement of the case.

SUMMARY OF THE ARGUMENT

The district court erred in reading Utah Code Ann. § 78B-6-501 (2008) narrowly to exclude oil and gas, and by so doing ignored this Court's directives to apply that statute expansively. It ignored 150 years of "plain meaning" of "mining" and "mineral deposits," of "oil mining" and "oil and gas mining operations." It ignored historical context, the Utah experience, the compelling weight of American jurisprudence, and decades of Utah decisional law, to read oil and gas out of the statute. It ignored the 1907

[1] Michael D. Vanden Berg, *Utah's Energy Landscape*, 95 UTAH GEOLOGICAL SURVEY PUB. INFO. SERIES 18, 24 (2009). *See* discussion on Financial Analysis of Oil and Gas Mining Operations in Utah *infra* Part IV.C.

amendments adding "working of mines" and "minerals"—expanding in UPA's view, rather than narrowing statutory reach. It ignored that at no place in section 78B-6-501(6) are minerals identified by name, class, chemical composition, location, extent of dispersion, or other typing to read-in or out any isolated mineral. Finally, it ignored construction of identical statutes by sister jurisdictions that included oil and gas even when the statutes do not mention these by name and only refer to "minerals" and "mining." All this dictates a ruling in favor of Appellants.

ARGUMENT

UPA makes no pretense. It whole-heartedly embraces Appellants' position and views of the case. UPA unequivocally advocates that the Utah eminent domain statute (the "**Act**") at inception, as now, covers oil and gas mining operations. Because Appellants ably set forth the legal principles, UPA refrains from reprising them, except perhaps to add shade and nuance and provide historical, factual, and jurisprudential context for this Court's expansive reading.

UPA views its task as three-fold: (1) to bring a global, industry perspective to legal principles advanced by Appellants; (2) to analyze mining jurisprudence at the time of the Act's inception, recodifications, and recompilations; and (3) to provide public policy, social, and economic reasons why holding that oil and gas operations are now and always were contemplated by the Act is a logical, practical, just and legal outcome of this case.

I.

EMINENT DOMAIN STATUTES SHOULD BE CONSTRUED EXPANSIVELY.

From the earliest interpretations of the Act, the Utah Supreme Court has consistently construed broadly the public purposes for which condemnation is available. In the leading case of *Nash v. Clark*, the Court held that the "public purposes" were to be construed broadly. *See* 27 Utah 158, 75 P. 371, 373 (1904), *aff'd*, 198 U.S. 361 (1905)(irrigation ditch case). The Court stated that a public use is one "that will promote the public interest, and which use tends to develop the great natural resources of the commonwealth." *Id.* at 373 (water and irrigation are critical to Utah, an arid, western state).

In three major cases, the Court applied an expansive or liberal reading of "mines and minerals" as a public purpose. In *Highland Boy Gold Mining Co. v. Strickley*, the Court recognized mining to be second in importance to irrigation as a public use for condemnation purposes and held that when the legislature declared a public use or purpose, the courts were to respect that public purpose unless it was clearly unconstitutional. 28 Utah 215, 231-32, 78 P. 296 , 297, 299 (1904), *aff'd*, 200 U.S. 527 (1906)[2](condemnation of an adjacent mining claim for an areal tramway). In *Monetaire Mining Co. v. Columbus Rexall Consol. Mines Co.*, the Court stated that "[w]e think it is

[2] In *Strickley,* the United States Supreme Court affirmed, indeed adopted, the Utah approach of expansive reading of eminent domain statute. Most recently, the Supreme Court noted that since *Strickley* it had "repeatedly and consistently rejected that narrow test ever since." *See also Kelo v. City of London,* 545 U.S. 469, 480 (2005), *reh'g denied,* 545 U.S. 1158 (2005)(citing both *Strickley* and *Nash* to reject an argument that the City of London could not condemn private property for a future private use).

generally agreed that where the right of eminent domain is granted for a particular purpose, then the statute must be given a liberal construction in furtherance of such purpose." 53 Utah 413, 422, 174 P. 172, 175 (1918). In *Utah Copper Co. v. Stephen Hayes Estate, Inc.*, the Court stated that "[the eminent domain] statute must be construed . . . with as much liberality as its language may permit. . . ." 83 Utah 545, 554, 31 P.2d 624, 627 (1934). Moreover, the Tenth Circuit later reiterated the expansive scope of Utah's eminent domain statute, stating "[a] statute granting the right of eminent domain for a particular purpose must be liberally construed in furtherance of such purpose." *Freeman Gulch Mining Co. v. Kennecott Copper Corp.*, 119 F.2d 16, 19-20 (10th Cir. 1941); *see also Summary of Utah Law: Land Use, Zoning and Eminent Domain*, B.Y.U. J. LEGAL STUD. 274-75 (1979) (stating Utah follows broad view of eminent domain); 2A NICHOLS ON EMINENT DOMAIN § 7.02[3] (3d ed. 2005) (discussing broad view where "public use" means "public advantage").

UPA urges the court to follow its precedents and hold that oil and gas development is a public use because: (1) it tends to develop the natural resources of the state (*Nash v. Clark*); (2) the purpose is clearly constitutional (*Highland Boy*); and (3) when the general statutory purpose of section 78B-6-501 is mining, and oil and gas is mining, oil and gas mining is a public purpose.

II.

PRECEDENT FROM OTHER STATES AND PUBLIC POLICY SUPPORT CONSTRUING SECTION 78B-6-501 TO INCLUDE OIL AND GAS AS MINERALS AND MINERAL DEPOSITS.

Precedent from other jurisdictions supports the view that the term "minerals" includes oil and gas. Indeed, almost the precise issue now before this Court was decided in the important Wyoming case of *Coronado Oil Co. v. Grieves*, 603 P.2d 406 (Wyo. 1979). In *Coronado Oil Co.*, the Wyoming Supreme Court held that a power of condemnation for "minerals"—in a statute very similar to the Act—included power to access an oil and gas well-site. *Id.* *See also Amoco Prod. Co. v. Guild Trust*, 636 F.2d 261, 265 (10th Cir. 1980), *cert. denied*, 452 U.S. 967 (1981) (holding that under Wyoming law the reservation of "coal and other minerals" serves to reserve oil and gas). As with the Act, Wyoming's eminent domain statutes identified specific uses for which condemnation is authorized. Moreover, Wyoming's eminent domain statutes like Utah's do not identify minerals by type, but did refer to "mining" and "minerals." *See Coronado Oil Co.*, 603 P.2d at 408-09 (citing WYO. STAT. ANN. § 1-26-401). The same public policies applied in that case apply here in Utah.

In reaching its decision, the *Coronado Oil* court made the following pertinent observation about natural resource public policy:

> We think it plain beyond any doubt that the intended purpose of the cited constitutional provision and statutes was to facilitate the development of our state's resources. We will hereafter construe the word "mining" to include the exploration for oil and gas, and that now is hardly unique or expansive of that term and is nothing more than a reasonable and sound construction which carries out the intent of the constitution and related statutes, as well as permitting development of the resources of this state for the common good.

Coronado Oil Co., 603 P.2d at 411. The Wyoming court also was impressed that with the adoption in the 1890's of the applicable Wyoming statutory and constitutional

provision, oil was considered a mineral and an oil well was considered a mine—the precise situation which prevailed when Utah enacted its own eminent domain statute. The Wyoming court stated:

> The constitution, of course, was adopted in 1890 and §1-26-401 was originally enacted in 1907. At that time oil was considered generally to be a mineral and an oil well to be a mine. This categorization, while not absolutely accurate in a scientific sense, was widely accepted and persists to this day. . . . We hold that the exploration for oil and gas is "mining" within the meaning of the statutes here in question. . . . And that would by a reasonable construction include a "mine truck haul road" as a way of necessity in that it is necessary to haul out the mined petroleum product, as well as to haul in the necessary oil well drilling equipment and supplies. The words speak for themselves.

Id. at 411-12. *Cf. Skeen v. Lynch*, 48 F.2d 1044, 1047 (10th Cir. 1931), *cert. denied*, 284 U.S. 633 (1931) (holding statutory reservation of "coal and other minerals" includes a valid reservation of oil and gas). This Court should recognize these same public policy considerations and construe Utah's condemnation statute to include oil and gas as a mineral and mineral deposit. Finally in the more recent case of *Wyoming Resources Corp. v. T-Chair Land Co.*, the court held that an access road for coalbed methane development is a public purpose. 2002 WY 104, ¶ 9, 49 P.3d 999, 1001-02.

Finally, public policy considerations support the result Appellants now urge. The Act defines the exploration and searching for minerals and mineral deposits as a "public use." The Act's articulated policy encourages the development of oil and gas. Exploration, drilling, and the development of oil and gas directly benefit the people of Utah. No sensible public policy would say that the power of eminent domain can be exercised only to certain limited mineral types and mineral deposits and exclude one of

the most important of all mineral groups, oil and gas. This, of course, is especially true today as our dependence on foreign oil supplies has left our domestic supplies more vulnerable than ever before. The Court should construe Section 78B-6-501 to include oil and gas as a mineral and oil and gas reservoirs to constitute mineral deposits.

We note, however, that the Colorado and Montana courts have determined that oil and gas operations are not public purposes. *See McCabe Petroleum Corp. v. Easement and Right-of-Way Across Township 12 North, Range 23 East, PMM*, 87 P.3d 479 (Mont. 2004) (Montana statute where the term "mineral deposits" is absent and distinguishing Wyoming's constitutional and statutory regimen); *Coquina Oil Corp. v. Harry Kourlis Ranch*, 643 P.2d 519 (Colo. 1982) (dismissing for lack of standing because government/lessor not a party).

III.

AMERICAN JURISPRUDENCE AT THE TIME OF ENACTMENT, RECODIFICATION, AND RECOMPILATION OF THE UTAH EMINENT DOMAIN STATUTE SUPPORT AN EXPANSIVE READING OF THE ACT TO INCLUDE OIL AND GAS MINING AND OPERATIONS.

Should the Court decide that the statutory terms "working of mines" and "mineral deposits" are ambiguous, and resort to legislative intent or other means of statutory construction,[3] the meaning of the Act must be derived from its proper context. Historically, the mining industry in Utah is second in importance only to agriculture and irrigation. *See Highland Boy Gold Min. Co. v. Strickley*, 78 P. 296, 297 (Utah 1904).

[3] *See* Gohler v. Wood, 919 P.2d 561, 563 (Utah 1996) ("Only when we find ambiguity in the statute's plain language need we seek guidance from the legislative history and relevant policy considerations.")

The essential questions in this appeal are twofold. First, whether or not "minerals" and "mineral deposits" include oil and gas. Second, whether "mining" comprehends oil and gas operations. American courts nearly universally hold that oil and gas is a mineral, and that "mining" includes oil and gas operations.

A. "Mining" Was Understood at the Time of Statehood and Thereafter to Include Oil and Gas Operations—an American Rule.

Since the early Twentieth Century, the United States Supreme Court has provided a roadmap for construing mineral reservations, grants, and statutes attempting to determine if oil and gas is a "mineral" in the first instance and susceptible of "mining" in the second.

Kinney-Coastal Oil Co. v. Kieffer is a leading federal oil and gas rights case addressing the relative rights of owners of stock-raising homestead patents under which minerals had been reserved and leased under the new limited states oil and gas lease.[4] 277 U.S. 488 (1928). The statute provided for a reservation of minerals in the United States but allowed leasing of such minerals with the right "to prospect for, mine and remove the same." *Id.* at 506. Throughout the case, the Court identifies the extraction operations as "mining operations" and the equipment and facilities as "mining equipment." *Id.* at 504-08.

Another influential case is *Burke v. Southern Pac. R. Co.*, 234 U.S. 669 (1914). In *Burke*, the Court was called upon to construe the mineral exception and reservation

[4] United States Oil and Gas Lease dated December 29, 1924. Congress established a leasing system for oil and gas and other minerals in the Mineral Lands Leasing Act of 1920. 41 Stat. 437 (codified as amended 30 U.S.C. §§ 181 *et seq.*)

provisions of the transcontinental railroad acts to determine if the lands at issue were "mineral lands" excepted from the railroad grant, and if oil and gas were included in the railroads' exceptions and reservation of coal and other minerals.

The *Burke* Court took judicial notice of the history of "oil mining." *Burke*, 234 U.S. at 677, 679 (citing *Gill v. Weston*, 110 Pa. 312, 317, 1 A. 921, 923 (1885)). The judicial notice included decisional precedent, as well as, federal treatment of oil and gas as a mineral in its public lands and other statutes. *Id.* at 677.[5] Then, based upon that history, the Court restated what it felt was a self-evident truth, that petroleum[6] had long been popularly regarded as a "mineral." *Id.* at 679. Finally, based upon the same history, it restated the corollary that oil and gas operations were "mining."[7] *Id.* at 677-79. Courts

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[5] *Burke* cites the following authority in support of its position: Funk v. Haldeman, 53 Pa. 229, 1867 WL 7381 (1866); Williamson v. Jones, 39 W. Va. 231, 256, 25 L.R.A. 222, 19 S.E. 436 (1894); Kelley v. Ohio Oil Co., 57 Ohio St. 317, 328, 39 L.R.A. 765, 63 Am. St. Rep. 721, 49 N.E. 399 (1897); Murray v. Allard, 100 Tenn. 100, 39 L.R.A. 249, 66 Am. St. Rep. 740, 43 S.W. 355 (1897); Wagner v. Mallory, 169 N.Y. 501, 505, 62 N.E. 584 (1902). "Congress at different times has spoken of it as a mineral (15 Stat. 59, ch. 41, § 1; *id.* 167, ch. 186, § 109; 29 Stat. 526, ch. 216, U.S. Comp. Stat. 1901, p. 1434; 32 Stat. 702, ch. 1369, § 42; 36 Stat. 847, ch. 421, U.S. Comp. Stat. Supp. 1911, p. 593), and this court did so in Ohio Oil Co. v. Indiana, 177 U.S. 190, 202, 44 L. ed. 729, 20 Sup. Ct. Rep. 576 (1900)." *Burke*, 234 U.S. at 676-77.

[6] Petroleum's derivation means "rock oil," an oily substance so named because found naturally oozing from crevices in rocks. Its existence in this country was known from very early times. By the latter quartile of the Nineteenth Century, extraction of oil from its natural reservoir in subterranean rocks had come to be a promising industry and was extending over an increasing area through discoveries of new oil fields. *See, e.g., Burke*, 234 U.S. at 676-77 (and cases cited therein).

[7] Funk v. Haldeman, 53 Pa. 229, 1867 WL 7381 at 15 (finding that the series of contracts and conveyances providing for created rights of full development of oil in which "they might mine for oil in their own way."); Cochran v. Pew, 159 Pa. 184, 188, 28 A. 219, 220 (Pa. 1893) ("oil mining"); Gueno v. Medlenka, 117 So.2d 817, 820 (La.

are not deterred in their reasoning—that petroleum is a mineral—by petroleum's transformational properties that unlike traditional minerals defy temporal confinement. *See Ohio Oil Co. v. State of Indiana,* 177 U.S. 190, 203-04 (1900).[8]

The leading state case is *Funk v. Haldeman,* 53 Pa. 229, 1867 WL 7381—the case cited by the *Burke* Court. The landowner granted the right of "prospecting, digging, excavating and boring, and erecting thereon frames, vats engines, or anything necessary for the prospecting, experimenting or searching to find any . . . *oil . . .or other mineral,* and of taking the same out of the earth." *Id.* at 7. The court ultimately determined that the grant created a license for mining oil. *See id.* at 7, 13. Thereafter, with rare exception, courts followed the *Funk v. Haldeman* analysis. *See., e.g.,* 4 W.L. SUMMERS, THE LAW OF OIL AND GAS § 135 & n.30 (2d ed. 1954). In terms of its evidentiary value, judicial notice has now been codified in both the federal and state rules of evidence in American jurisdictions. *See, e.g.,* UTAH R. EVID. § 201; FED. R. EVID. § 201.

1960); Great Western Petroleum Corp., 16 F. Supp. 247, 249-50 (S.D. Cal. 1936).

[8] The *Indiana* court, calling on Pennsylvania precedent, was not distracted by the peculiar properties of oil and gas and its nature to change its physical state from gas to liquid, to percolate as does water, or to transmigrate from one close to the other. If oil and gas can be reduced to possession as might a wild animal or water by the owner of the close, and defy mineral precedents and description, yet so long as there are yet precedents in the law that provide for its reduction to possession by means commonly associated with mining, they are no less mineral in character despite its power to transform. *See Ohio Oil Co.*, 177 U.S. at 203-204 (1900). *See also* Brown v. Vandergrift, 80 Pa 147, 148 (1875); Hague v. Wheeler, 157 Pa. 324, 27 A. 714 (Pa. 1893).

Thereafter, leases, licenses, and contracts taken in oil and gas producing states granted rights during the late Nineteenth and early Twentieth Century, containing granting clauses, in essence, as follow:

> [F]or the sole and only purpose of mining and operating for oil and gas and of laying of pipe lines and building tanks, power stations and structures thereon to produce, save and take care of said products.[9]

Pacific-Wyoming Oil Co. v. Carter Oil Co., 226 P. 193, 195 (Wyo. 1924) (identifying 1919 contract allowing parties to obtain valid right to "develop and operate lands for oil and gas mining purposes"); *Young v. Jones*, 222 S.W. 691, 691 (Tex. 1920) (1917 Oil and Gas Lease granting premises "for the sole and only purpose of mining and operating for oil and gas and of laying of pipe lines, and building tanks"); *Fremont Lumber Co. v. Starrell Petroleum Co.,* 364 P.2d 773, 774 (Or. 1961) (discussing 1954 Oil and Gas Lease "for the purpose of investigating, exploring, prospecting, drilling and mining for and producing oil, gas, sulphur and all other minerals. . . ."); *Franz Corp. v. Fifer,* 295 F. 106, 106-07 (9th Cir. 1924) (construing Oil and Gas Lease granting property "for the sole purpose of mining and operating for oil and gas and of laying of pipe lines and building tanks, power stations and structures thereon to produce, save and take care of said products"); *Mullendore v. Minnehoma Oil Co.,* 246 P. 837, 838 (Okla. 1926) (construing Oil and Gas Lease where "granting clause of the oil and gas lease conveyed the premises

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[9] It is worth noting that the A.A.P.L. Form 675 Oil and Gas Lease, which is still in use today, contains largely the same language ("Lessor . . . does hereby grant, lease and let unto Lessee for the purposes of exploring, **prospecting**, drilling and **mining for and producing oil and gas** and all other hydrocarbons, laying pipe lines, building roads, tanks . . . .") (emphasis added). "A.A.P.L" stands for the American Association of Professional Landmen, where forms are widely used in American oil and gas producing states.

for the sole and only purpose of mining and operating for oil and gas"); *Barnsdall v. Bradford Gas Co.,* 74 A. 207, 207 (Pa. 1909) (identifying 1906 instrument granting property "for the sole and only purpose of mining and operating for oil, gas and other minerals and of laying pipe lines and of building tanks, stations and structures thereon to take care of the said products"); *Cortelyou v. Barnsdall,* 86 N.E. 200, 201 (Ill. 1908) (construing 1905 Oil and Gas Lease granting "the exclusive right to mine for and produce petroleum and natural gas"); *McCullough v. Smith*, 243 F. 823, 825 (8th Cir. 1917) (construing 1912 Oil and Gas Lease granting property "for the purpose of prospecting, mining, drilling, boring, or digging for oil, gas, asphaltum, lead, zinc, coal and copper and all and every other kind or kinds of valuable minerals"); *MacMaster v. Onstad*, 86 N.W.2d 36, 39 (N.D. 1957) (construing Oil and Gas Lease granting "exclusive right of mining, exploring..., and operating for and producing therefrom oil, gas, casinghead gas, casinghead gasoline, and all other minerals"). This was the general rule of American oil and gas jurisprudence at the time the Utah legislature gave first expression to the Act, which allowed the exercise of eminent domain to gain access for the "working of mines."[10] *See* discussion *infra* Part III.B. The "working of mines" language has survived all codifications and recompilations of the Act, and beginning 1907, adds "mineral deposits" to the enumerated uses therein.[11]

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[10] UTAH REV. STAT. § 3588(6) (1898).

[11] UTAH COMP. L. § 3588(6) (1907); UTAH REV. STAT. 104-61-1(6) (1933); UTAH CODE ANN. § 104-61-1(6) (1943).

Early in the development of oil and gas and continuing in some cases to today, courts described oil and gas mining variously as "boring,"[12] "digging,"[13] and "sinking,"[14] and in relationship to the conventional method of reaching oil and gas-bearing reservoir rock by "drilling."[15] These terms, and each of them, have their origins in the mining vernacular.

B. Utah Adopts the American Rule that Operators Mine for Oil and Gas.

This was the precise situation in *Meagher v. Uintah Gas Co.*, 112 Utah 149, 185 P.2d 747 (Utah 1947). In *Meagher,* the parties called upon this Court to construe a continuous operations clause to determine whether or not cessation of production coupled with the operator's removal and sale of the well and associated surface equipment, structures, and facilities breached the express lease covenants to maintain production in paying quantities or restore production or commence a new well within 60 days after

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[12] 'Boring" is defined as "[t]he cutting or drilling of a hole for blasting, water infusion, exploration, or water or firedamp drainage . . . [t]he drilling of deep holes for the exploitation or exploration of oilfields . . and . . . similarly in connection with metalliferous deposits." U.S. DEP'T OF THE INTERIOR, BUR. OF MINES, A DICTIONARY OF MINING, MINERAL, AND RELATED TERMS "Boring" 126 (Paul W. Thrush, comp. 1968 reprint 1990)[hereinafter "DICTIONARY"].

[13] "Digging" is defined as "[m]ining operations in coal or other minerals." DICTIONARY, *supra* note 12, at 327.

[14] "Sinking" means "[t]he process by which a shaft is driven. . . [;] [e]xtending excavations downward at or near the vertical plane." DICTIONARY, *supra* note 12, at 1018.

[15] "Drilling" means "a. [t]he act or process of making a circular hole with a drill. . . . b. [t]he operation of tunneling or stoping, whether with a compressed-air rock drill, a jackhammer, or a drifter . . . . d. [t]he operation of making deep holes with a drill for prospecting, exploration, or valuation." DICTIONARY, *supra* note 12, at 352.

production ceased. The 1924 Oil and Gas Lease contained the traditional granting clause authorizing oil and gas operations "for the sole and only purpose of mining and operating for oil and gas and of laying of pipe lines and building tanks, power stations and structures thereon to produce, save and take care of said products." *Id.* at 751. Notably, the Dissent employed the word "digging" to describe the exploration phase of oil mining operations. *Id.* at 754 (Wade Dissenting); *Barnsdall Oil Co. v. Leahy,* 195 F. 731, 732 (8th Cir. Okla. 1912) ("boring for petroleum and natural gas"); *Parish Fork Oil Co. v. Bridgewater Gas Co.,* 42 S.E. 655, 655 (W. Va. 1902) (for the sole purpose of "boring, mining, and operating for oil and gas"); *Munsey v. Mills & Garitty,* 115 Tex. 469, 472, 283 S.W. 754, 755 (Tex. 1926) (operating agreement dated August 9, 1897 to "bore" two or more wells).

The applicable historical context is that at the time Meagher gave his lease and certainly at the time of the 1933, 1943, and 1953 recodifcations and recompilations, if not at the time of the territorial enactment, one "mined" for oil and gas. It follows, that for this and other reasons to be discussed in Argument IV, *infra*, construing "mines" and "mineral deposits" to comprehend oil and gas is consistent with, and compelled by Utah's adoption of the American rule.

IV.

THE HISTORY OF OIL AND GAS DEVELOPMENT IN UTAH SUPPORTS APPELLANTS' POSITION THAT OIL AND GAS OPERATIONS WERE CONTEMPLATED BY THE TERMS "MINES" AND "MINERAL DEPOSITS."

The historical context of oil and gas development in Utah supports Appellants' proposition that oil and gas are minerals and that oil and gas operations are mining within the language of the Act.

A. The 1872 Mining Law and Location of Petroleum Placers.

First, and most compelling, at the time the Territorial legislature conceived and passed the Act in 1888, and during the period the Act passed through the 1898 and 1907 re-codifications, oil and gas on federal public domain lands were locatable as a placer mining claim under the Mining Law of 1872. *See* Mining Resource Act of May 10, 1872, ch. 152, 17 Stat. 91 (codified as amended at 30 U.S.C.A. §§ 22-24, 26-30, 33, 34, 37, 39-42 (West 2008)) (hereinafter **"1872 Mining Law"**). Temporary doubt as to the applicability of the 1872 Mining Law to petroleum minerals was dispelled by enactment of the Petroleum Placer Act of February 11, 1897, 29 Stat. 526. *See generally* 1 LAW OF FEDERAL OIL & GAS LEASES § 2.05 & n.1 (2008). *See also* 1 AMERICAN LAW OF MINING § 8.01[4][g] (2007). Petroleum remained a locatable mineral for mining purposes from 1872 until passage of the Mineral Lands Leasing Act of 1920, under which Congress converted petroleum minerals to a leasing regimen. During the nearly 50-year period, prospectors located hundreds of petroleum placer claims on conventional oil and gas deposits and less conventional oil shale claims.

From 1850 to the time of statehood in 1896, most of Utah's 52.7 million acres[16] (84,916 square miles) was federal public domain and from 1872 on, most of that was

[16] U.S. DEP'T OF THE INTERIOR, BUREAU OF LAND MGMT., 198 PUBLIC LAND STATISTICS 2008 8 (May 2008)[hereinafter **"Land Stats"**](reported BLM managed lands

open to mineral location, except for those portions withdrawn for Indian and military reservations, later national forests, and even later national parks and monuments.[17] Mining played a significant role in the economy of Utah. *See Highland Boy Gold Mining Co. v. Strickley*, 78 P. 296, 297 (Utah 1904). It could hardly escape the legislature's attention that petroleum minerals were located, maintained, developed, and mined under the federal 1872 Mining Law in the same manner as for conventional "veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin copper, or other valuable deposits. . . ." *See* 1872 Mining Law, ch. 152, §§ 2, 9, 17 Stat. 91, 94; *Webb v. American Asphaltum Min. Co.,* 157 F. 203, 205 (8th Cir. Utah 1907). As late as 1911, over ten years after statehood, Congress confirmed the procedures for annual assessment work on placer mining claims.

During this period, the major metal discoveries in Big and Little Cottonwood Canyons, copper in Bingham and other "West Valley" canyons, Park City, and other locations were made and major mines opened. It would be disengenuous, indeed, to argue that the Utah territorial and state legislatures were oblivious to the these happenings and to the location of petroleum and oil shale placers in the state.

B. Oil Development in Ascendency.

Petroleum was first identified by Mormon pioneers in 1847 in oil seeps near the Utah-Wyoming border. They used the oil tar for wagon-wheel lubricant and to water-

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figures have decreased since statehood due to homesteading, creation of national parks and monuments, and expansion of forests).

[17] *See* Land Stats, *supra* note 16; UTAH, 100 YEARS OF EXPLORATION, *Map of Land Ownership* at 4 (Updated 2006)[hereinafter **"Exploration History"**].

proof their boots. Osmond L. Harline, *Utah's Black Gold: The Petroleum Industry*, 31 UTAH HIST. Q. 291, 291 (1963) (citing William Clayton, *William Clayton's Journal: A Daily Record of the Journey of the Original Company of "Mormon" Pioneers from Nauvoo, Illinois, to the Valley of the Great Salt Lake* 289 (Salt Lake City, 1921)). In 1850, Captain Howard Stansbury of the United States Corps of Topographical Engineers located other oil seeps on the north shore of the Great Salt Lake. UTAH DIV. OF OIL, GAS AND MINING, UTAH'S OIL AND GAS PROGRAM: CELEBRATING 50 YEARS (2005) [hereinafter **"50 Years"**].

In 1882, E. L. Goodridge located his first petroleum claim on oil seeps near Bluff, Utah, and in 1907 brought in his Crossing No. 1 Well. This launched the San Juan Field in which 27 wells would be drilled by 1911. U.S. GEOLOGICAL SURVEY, U.S. DEP'T OF THE INTERIOR, BULL. 471—A-4, E.G. Woodruff, *Geology of the San Juan Oil Field, Utah*, CONTRIBUTIONS OF ECON. GEOLOGY 72, 73, 94-95 (1912).

The years 1891-1892 saw the discovery of Utah's first gas field, the Farmington Field, on the eastern shore of the Great Salt Lake. Ultimately, 20 gas wells produced gas for almost two years to a wooden pipeline to Salt Lake City for residential lighting. *See* 50 Years; Exploration History, *supra* note 17, at 6; CARLTON H. STOWE, UTAH'S OIL AND GAS INDUSTRY: PAST, PRESENT AND FUTURE 1 (1979). From 1891 through 1917 prospectors and venture capitalists established the San Juan Field near Bluff Utah (ultimately 25 wells), the Virgin Field and vicinity near Virgin City, Utah (Washington County 15 test wells) and ultimately 140 wells, and operated into the 1970's. *See* 50 Years, at 1, 3; 100 Years at 6; H. D. Heist, *Geological Position of Test Wells Drilling*

Eastern Utah Oil Fields, 11 THE SALT LAKE MINING REV. No. 19 (April 15, 1922); U.S. GEOLOGICAL SURVEY, U.S DEP'T OF THE INTERIOR, Bull. 726—C, Harvey Bassler & John B. Reeside, Jr., *Oil Prospects in Washington County, Utah* 87, 88, 91-95 (1921); Exploration History, *supra* note 17, at 6 ; UTAH GEOLOGICAL AND MINERAL SURVEY, UTAH DEP'T OF NATURAL RES., Symposium, HISTORY OF OIL AND GAS POSSIBILITIES BY AREAS, THE OIL AND GAS POSSIBILITIES OF UTAH (1949, reprint 1952). For a history of wells drilled 1891-1948 *see* UTAH GEOLOGICAL AND MINERALOGICAL SURVEY, UTAH DEP'T OF NATURAL RES., Symposium, LOCATION PLOT OF WELLS DRILLED IN UTAH 127-1978 (1949, reprint 1952). For a drilling record of all wells as of 1952 *see* UTAH GEOLOGICAL AND MINERALOGICAL SURVEY, UTAH DEP'T OF NATURAL RES., Bull. 50, DRILLING RECORDS FOR OIL AND GAS IN UTAH (George E. Hansen & H.C. Scoville, comps. 1955). The point of this history is to demonstrate that during the period surrounding the enactment of the Act and the 1898 statehood re-codification, a score of wells had been drilled, others commenced and abandoned. By the time of the 1907, 1933, and 1943 re-codifications and compilations, hundreds of wells had been drilled. *See id.*

Once again, it is difficult to conceive that the legislature had buried its head in the sand. The drilling history coupled with 50 years of petroleum placer mining experience stretches the limits of credulity to think that legislators intended one segment of the "mining" industry to benefit from remedies afforded hard and soft-rock minerals but denied to their oil mining counterparts.

C. Financial Analysis of Oil and Gas Mining Operations in Utah.

In 2009, the State of Utah collected $76,570,137.00 in oil and gas rentals, bonus bids, and royalties from oil and gas mining activities on state lands and $140,108,655.41, representing its share of oil and gas royalties from BLM administered lands.[18] In 2008, oil and gas severance taxes provided $65,510,506 to Utah's general fund.[19] According to the Governor's Office of Planning and Budget, the oil and gas mining operations provided 1,340 direct oil field service jobs with a total payroll of $25,010,117.00 for the second quarter of 2009.[20] Some of these jobs would be at risk if the industry cannot access potentially productive areas due to adjoining landowner opposition. Such a development would be unfortunate given the State's current economic condition.

Moreover, there are 2,647 active State of Utah Oil, Gas and Hydrocarbon Leases[18a] affecting 1,672,081.9 acres and 2,473 active United States Oil and Gas Leases[21]

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[18] *See* SITLA Fiscal Year 2008 14th Annual Report, *available at* http://www.trustlands.com/news/annual_reports.html (last visited Jan. 6, 2010). *See* 30 U.S.C. § 191; Total Reported Revenue Values for Utah, *available at* http://www.mrm.mms.gov/MRMWebStats/Home/aspx (last visited Jan. 7, 2010).

[19] Utah State Tax Comm'n, Annual Report 2008 Fiscal Year, *available at* http://tax.utah.gov/research/reports.html (last visited Jan. 6, 2010).

[20] *See* Utah Dep't of Workforce Serv., Utah Statewide Wage and Employment Data 2nd Quarter 2009, with 53 business reporting *available at* http://jobs.utah.gov/jsp/wi//utalmis/gotoIndustry.do (last visited Feb. 8, 2010). State and County Historical Economic Data, Non-Agricultural Payroll Employment by NAICS Industry, *available at* http://governor.utah.gov/dea/historicalecondata.html (last visited Jan. 6, 2010).

[20a] E-mail from Alice Kearney, SITLA, to Phillip Wm. Lear (Feb. 4, 2010, 13:50 MST) (on file with counsel for UPA); E-mail from Lisa Wells, SITLA Research Analyst, to Susan R. Parker, Lear & Lear (Feb. 11, 2010, 12:17 MST) (on file with counsel for UPA).

[21] *See* "Land Stats," *supra* note 16, at Tables 3-13, and 3-14.

affecting 2,964,285 acres of Utah lands. UPA has no figures for active tar sands, oil shale, combined hydrocarbon, and geothermal leases, and private lands lease in the State of Utah. Oil and gas mining makes a significant contribution to Utah's economy and the well-being of its residents.

V.

THE LAW SHOULD ADAPT TO CHANGED CONDITIONS AND THE MEANING OF WORDS ALSO CHANGE TO MEET EACH CHANGED CONDITION.

KFJ argued below that by omitting the terms "oil and gas," the Utah legislature could never have intended oil and gas development to be "mining" under the Act. *See* KFJ Memorandum in Support at 5-12.

KFJ's position should not deter the Court. The law is dynamic and should adapt to meet changed conditions and with those changed conditions the meaning of words should change. This is an accepted principle. *See Luse v. Boatman,* 217 S.W. 1096, 1098-99 (Tex. Civ. App. 1919) (construing an 1887 deed); *Gill v. Weston*, 110 Pa. 312, 317, 1 Atl. 921 (Pa. 1885). In *Luse v. Boatman* the Texas court acknowledged that at the time the deeds were signed in 1887, the common man in Eastland, Texas, may not have considered oil and gas to be a mineral due to its properties and relative obscurity. *Luse*, 217 S.W. at 1097-98. Now, twenty years later, all parties acknowledged circumstances had changed and that oil and gas was a mineral and minable. *Id.* at 1099-1100. But the grantees under the deed argued that the lay grantee would not have anticipated oil and gas to have been covered in a reservation of "coal and minerals." *Id.* Citing as authority *Nephi Plaster & Manufacturing Co. v. Juab County,* 93 P. 53 (Utah 1907), the court

acknowledged changed circumstances, rejected classification by legal and scientific definition, and adopted a construction more consistent with practical, common understanding of the word "minerals." In sum, if one digs in the ground to remove a substance, the act and operation is "mining." *See Luse*, 217 S.W. at 1100-1101.[22]

VI.

PRIOR, UNREPORTED CASES.

UPA is aware of eight eminent domain cases involving oil and gas operators who sought to condemn access roads and/or well sites for oil and gas mining operations. The cases, their styles, venues, parties, and dispositions are identified in Addendum "15"

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[22] The reasoning reads, as follows:

> But the appellees contend that by the use of the expression that grantor or his assigns might go upon the premises in controversy "for to mine and remove the same," it is evident that the parties to the deed intended to reserve only such minerals as were "mined," and that that term is limited to operations involving excavations, sinking of shafts, etc., similar to the operations required for extracting coal or other solid minerals. "A mine is an excavation in the earth for the purpose of obtaining minerals." Bouvier's Law Dictionary. The verb "mine" is defined in the Standard Dictionary as meaning: "To obtain by digging out of the earth; also, to make diggings into for ore or the like; as, coal is mined; they mined rich veins of silver." The word "mine" is derived from the Latin word "minare," signifying "ducere," to lead or draw, with reference to subterranean passages. Bryan, Law of Petroleum and Gas, § 1; Bainbridge, Mines and Minerals, pp. 1-3. "Mining" is a generic term which includes the whole mode of obtaining metals and minerals from beneath the surface of the ground. Williams v. Toledo Coal Co., 25 Or. 426, 36 Pac. 159, 42 Am. St. Rep. 799. Hence we think the term "mine" is broad enough to include the process of boring into the ground for the purpose of reaching and extracting oil or gas; that it makes no difference whether the means used for extracting the mineral sought is that of pick and shovel or other implement used for excavating, or by drill or bit.

hereto and are incorporated herein by reference.[23] Of the eight cases, four involved orders of immediate occupancy,[24] two settled in favor of access,[25] and two resulted in orders dismissing or memorandum decisions denying condemnation.[26] Courts in Duchesne, Summit, Uintah, and Utah Counties held oil and gas mining to be a public use within the meaning of the Act.[27] Courts in Carbon and Grand Counties found that it is not.[28] Of those courts authorizing condemnation, three authorized condemnation of well-site locations, four authorized condemnation for access roads or rights-of-way, and one court authorized condemnation of an ATV trail for access to well-sites for pumping purposes; and one court authorized condemnation for natural gas gathering lines and

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[23] Counsel for UPA participated in five of the eight cases. *See* Addendum "15." There may be other cases unknown to counsel.

[24] Mountain Fuel Supply Co. v. Smith (1972), Richardson Operating Co. v. Thousand Peaks Ranches, Inc. (1995), El Paso Production Oil & Gas Co. v. Stricklen (2001), and FIML Natural Reserces LLC v. The Estate of Robert C. Pyles, Deceased (2007). *See* Addendum "15."

[25] Mountain Fuel Supply Co. v. Thousand Peaks Ranches, Inc. (1983); ANR Production Co. v. Burkley (1995).

[26] The Anschutz Corp., v. Cunningham Ranches, Inc. (1977); Marion Energy, Inc., KFJ Ranch Properties (2009).

[27] *See* Mountain Fuel Supply Co. v. Smith (1972) (rights-of-way); Richardson Operating Co. v. Thousand Peaks Ranches, Inc. (1995) (well-sites and ATV trail, but denying immediate occupancy for access roads for lack of necessity); El Paso Production Oil & Gas Co. v. Stricklen (2001) (well-sites and easements for access roads, natural gas gathering line, and power line); and FIML Natural Resources LLC v. The Estate of Robert C. Pyles, Deceased (2007) (well-sites and access road).

[28] *See supra* note 26 and cases cited therein.

power lines.[29] In each case the oil and gas operator argued the application of the Act. UPA offers this data as history, not precedent, to show that the pending case, though first in time before this Court is not an isolated circumstance never to recur.

Access is critical to petroleum miners. Access in Utah is complicated by diverse and fractionated ownership patterns: the federal and state-land checkerboard, the expanse of Indian lands, and the multiplicity of federal withdrawals and reservations for national parks, national monuments, large military reservations, national forests, and modicum of private lands.[30] Particularly in Utah, checker-boarded as it is with school grant lands and over which is, superimposed by Indian, State of Utah, and private lands. *See, e.g.,* U.S. DEP'T OF THE INTERIOR, BUREAU OF LAND MGMT. UTAH STATE OFFICE, *Utah-Areas of Responsibility and Land Ownership* (May 2006) (constituting a map of surface ownership in Utah). Blocked access means denied quiet enjoyment, unfulfilled economic expectations, and under utilized budgets. Oil miners would much prefer to negotiate themselves onto their leaseholds or mineral estates. Coming to terms with surface owners far surpasses the costs in time and expense of litigating access.

CONCLUSION

This case is momentous. It will not merely adjudicate the rights of the respective parties. It will define oil and gas mining rights, particularly for access and surface rights. As Utah is one of the top oil and gas producing states, the ramifications are significant, not only for Utah operating companies, but for sister states similarly situated that will feel

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[29] *See supra* note 27 and cases cited therein.

[30] *See* Exploration History, supra note 17, at 4, attached hereto as Addendum "14."

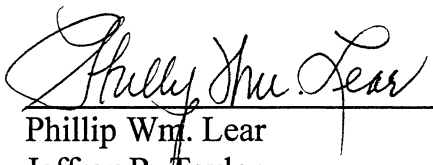
the ripple of this Court's decision. Certainly in a time when the national policy is to regain some energy independence and stimulate onshore drilling, this case will have regional, if not national significance. For the above-stated reasons *Amicus Curiae* UPA respectfully requests that this Court reverse the district court's judgment and enter judgment for the Appellants.

ADDENDUM

Pursuant to Rule 24(a)(11) of the Utah Rules of Appellate Procedure, *Amicus Curiae's* addendum of important documents is bound as part of this brief.

DATED this 12th day of February 2010.

LEAR & LEAR LLP



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CERTIFICATE OF SERVICE

I, Phillip Wm. Lear, certify that on the 12th day of February, 2010, I served two copies of the attached **Corrected and Amended Brief of Amicus Curiae Utah Petroleum Association in Support of Appellants Marion Energy, Inc. and State of Utah School and Institutional Trust Lands Administration,** by mailing it first class mail with sufficient postage prepaid to the following addresses:

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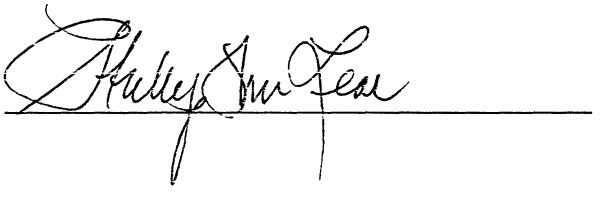

ADDENDUM

1. Utah Code § 104-61-1 (1943) Uses for Which Right May be Exercised.

2. Utah Comp. L. § 35888 (1907) Exercised in Behalf of What Uses.

3. Utah Rev. Stat. § 104-61-1 (1933) Uses for Which Right May be Exercised.

4. H.D. Heist, *Geological Position of Test Wells Drilling Eastern Utah Oil Fields*, 11 THE SALT LAKE MINING REVIEW No. 19 (April 15, 1922).

5. Michael D. Vanden Berg, *Utah's Energy Landscape*, 95 UTAH GEOLOGICAL SURVEY PUB. INFO. SERIES 1 (2009).

6. Osmond L. Harline, *Utah's Black Gold: The Petroleum Industry*, 31 UTAH HISTORICAL QUARTERLY 291, 291 (1963)

7. U.S. DEP'T OF THE INTERIOR, BUR. OF MINES, A DICTIONARY OF MINING, MINERAL, AND RELATED TERMS (Paul W. Thrush, comp. 1968 reprint 1999)

8. U.S. Geological Survey, U.S. Dep't of the Interior, Bull. 726—C, Harvey Bassler & John B. Reeside, Jr., *Oil Prospects in Washington County, Utah* (1921)

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15. List of Condemnation Cases

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UTAH CODE ANNOTATED
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TITLE 104

CODE OF CIVIL PROCEDURE

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heimer v. Mountain States Supply Co., 56 U. 190, 188 P. 1117.

Where plaintiff in forcible detainer action is held liable on counterclaim, time for appeal is not governed by ten-day limitation of this section, but is controlled by 104-41-2, allowing six months in which to appeal, ten-day limit of this section being applicable only to judgments in forcible detainer authorized by 104-60-13. Dunbar v Hansen, 68 U. 398, 250 P. 982.

Ten-day period for appeal provided in forcible entry and detainer cases is inapplicable to appeal from money judgment entered for landlord after recovery of possession, six-month period of general statute, 104-41-2, being applicable. Belnap v. Fox, 69 U. 15, 251 P. 1073.

Where pleadings, the evidence offered, the findings of fact, the conclusions of law, and the judgment reflected an action for unlawful detainer, any appeal from such judgment must be within ten days, although such judgment rested upon construction of occupant's lease, as to whether it was terminated upon sale of the property; and if the action had been brought for a declaratory judgment construing the lease, an appeal would lie after ten days. Brandley v. Lewis, 97 U. 217, 92 P.2d 338.

2. Bond or undertaking.

On appeal from judgment rendered by justice's court in forcible entry and detainer, undertaking provided in 104-77-6 and 104-77-7 must be given to perfect appeal. Hoffman v. Lewis, 31 U. 179, 87 P. 167.

3. Review of findings.

In accordance with well settled general rules of appellate practice, the court's findings under this section will not be disturbed by the appellate court unless the preponderance of the evidence against findings is so apparent and marked that the court can have no hesitancy in declaring that the particular findings under review are against the evidence. Brooks v. Warren, 5 U. 118, 13 P. 175.

CHAPTER 61

EMINENT DOMAIN

104-61-1. Uses for Which Right May Be Exercised.
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104-61-1. Uses for Which Right May Be Exercised.

Subject to the provisions of this chapter, the right of eminent domain may be exercised in behalf of the following public uses:

(1) All public uses authorized by the government of the United States.

(2) Public buildings and grounds for the use of the state, and all other public uses authorized by the legislature.

(3) Public buildings and grounds for the use of any county, city or incorporated town, or board of education; reservoirs, canals, aqueducts, flumes, ditches, or pipes for conducting water for the use of the inhabitants of any county or city or incorporated town, or for the draining of any county, city or incorporated town; the raising of the banks of streams, removing obstructions therefrom, and widening, deepening or straightening their channels; roads, streets and alleys; and all other public uses for the benefit of any county, city or incorporated town, or the inhabitants thereof.

(4) Wharves, docks, piers, chutes, booms, ferries, bridges, toll roads, byroads, plank and turnpike roads, roads for transportation by traction engines or road locomotives, roads for logging or lumbering purposes, and railroads and street railways for public transportation.

(5) Reservoirs, dams, watergates, canals, ditches, flumes, tunnels, aqueducts and pipes for the supplying of persons, mines, mills, smelters or other works for the reduction of ores, with water for domestic or other uses, or for irrigation purposes, or for the draining and reclaiming of lands, or for the floating of logs and lumber on streams not navigable.

(6) Roads, railroads, tramways, tunnels, ditches, flumes, pipes and dumping places to facilitate the milling, smelting or other reduction of ores, or the working of mines, quarries, coal mines or mineral deposits; outlets, natural or otherwise, for the deposit or conduct of tailings, refuse or water from mills, smelters or other works for the reduction of ores, or from mines, quarries, coal mines or mineral deposits; mill dams; gas or oil pipe lines, tanks or reservoirs; also any occupancy in common by the owners or possessors of different mines, quarries, coal mines, mineral deposits, mills, smelters, or other places for the reduction of ores, or any place for the flow, deposit or conduct of tailings or refuse matter.

(7) Byroads leading from highways to residences and farms.

(8) Telegraph, telephone, electric light and electric power lines, and sites for electric light and power plants.

(9) Sewerage of any city or town, or of any settlement of not less than ten families, or of any public building belonging to the state, or of any college or university.

(10) Canals, reservoirs, dams, ditches, flumes, aqueducts and pipes for supplying and storing water for the operation of machinery for the purpose of generating and transmitting electricity for power, light or heat.

(11) Cemeteries and public parks.

(12) Pipe lines for the purpose of conducting any and all liquids connected with the manufacture of beet sugar.

(13) Sites for mills, smelters or other works for the reduction of ores and necessary to the successful operation thereof, including the right to take lands for the discharge and natural distribution of smoke, fumes and dust therefrom, produced by the operation of such works;

provided, that the powers granted by this subdivision shall not be exercised in any county where the population exceeds twenty thousand, or within one mile of the limits of any city or incorporated town; nor unless the proposed condemner has the right to operate by purchase, option to purchase or easement, at least seventy-five per cent in value of land acreage owned by persons or corporations situated within a radius of four miles from the mill, smelter or other works for the reduction of ores; nor beyond the limits of said four-mile radius; nor as to lands covered by contracts, easements or agreements existing between the condemner and the owner of land within said limit and providing for the operation of such mill, smelter or other works for the reduction of ores; nor until an action shall have been commenced to restrain the operation of such mill, smelter or other works for the reduction of ores. (C. L. 17, § 7330.)

History.
This section differs materially from 2 Comp. Laws 1888, § 3841. Other predecessor sections, see R. S. 1898, § 3588; Comp. Laws, 1907, § 3588.

Comparable provisions.
Cal. Civil Proc. Code, § 1238, Idaho Code, 1940 Supp., § 13-701, Mont. Rev. Codes, § 9934 (designating the public uses, in behalf of which, right of eminent domain may be exercised).
Iowa Code 1939, § 7806 (conferring the right to take private property for public use)

Cross-references.
No person to be deprived of property without due process of law, Const. Art. I, § 7; private property not to be taken or damaged for public use without just compensation, Const. Art. I, § 22; property and franchises of private corporations subject to eminent domain, Const. Art. XII, § 11; county commissioners to exercise for state roads, 36-2-6; roads crossing patented lands, 36-1-10; by city or town for water, waterworks system and water supply, 15-7-4; mosquito abatement districts may exercise, 56-0-8; condemnation by foreign corporation, 18-8-6; right of entry by railroads, 77-0-5, subd. (3); for ditches and reservoirs, 100-1-6.

1. Constitutional guaranty in general.
Injuries cognizable at common law or in equity are ordinarily not covered by constitutional provisions authorizing compensation for taking or damaging property. Lund v. Salt Lake County, 58 U. 546, 200 P. 510.

Where, by contract between a city and another, the latter agreed to build and maintain a waterworks system for supplying water to the city, and such party, relying on the terms of the contract and the good faith of the city, constructed, at a cost of many thousands of dollars, a satisfactory water system, a decree holding the contract void because of any informality in its execution, and that the city was the owner of the waterworks system, and was entitled to the rents which had been collected, would have amounted to a violation of Const. Art. I, § 22. Ogden City v. Bear Lake & River Waterworks & Irrigation Co., 28 U. 25, 76 P. 1069.

2. Definitions in general.
A "taking," under Const. Art. I, § 22, may occur although there is no physical trespass where the enjoyment of the property is so impaired as to make it useless. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502. (Wolfe and Hanson, JJ., dissenting.)

Total destruction of property or rendering property valueless amounts to "taking" within meaning of Const. Art. I, § 22. Lund v. Salt Lake County, 58 U. 546, 200 P. 510.

Any substantial interference with private property which destroys or materially lessens its value, or by which the owner's right to its use and enjoyment is in any substantial degree abridged or destroyed, constitutes a "taking" within the meaning of Const. Art. I, § 22, notwithstanding the title and possession of the owner remain undisturbed. Stockdale v. Rio Grande Western Ry. Co., 28 U. 201, 77 P. 849.

Under Const. Art. I, § 22, property is taken for a public use when the taking is for a use which will promote the public interest and tend to develop the resources of the state. Nash v. Clark, 27 U. 158, 75 P. 371, 1 L. R. A. (N. S.) 208, 101 Am. St. Rep. 953, 1 Ann. Cas. 300, aff'd 198 U. S. 361, 49 L. Ed. 1085, 25 S. Ct. 676.

The expression "private property" in Const. Art. I, § 22, means all kinds of private property, and the word "taken" embraces the appropriation by any method, and the phrase "just compensa-

tion" includes any appropriate compensation, whether in money or benefits, providing the compensation is a just one —a fair equivalent for the property parted with. People v. Daniels, 6 U. 288, 298, 22 P. 159, 5 L. R. A. 444.

3. Liberal construction of statutes in general.

Statute granting right of eminent domain for particular purpose must be liberally construed in furtherance of such purpose. Monetaire Min. Co. v. Columbus Rexall Consol. Mines Co., 53 U. 413, 174 P. 172; Freeman Gulch Min. Co. v. Kennecott Copper Corp., 119 F.2d 16.

4. Constitutionality of section.

Former analogous statute held constitutional. Highland Boy Gold Min. Co. v. Strickley, 28 U. 215, 78 P. 296, 1 L. R. A. (N. S.) 976, 107 Am. St. Rep. 711, 3 Ann. Cas. 1110, aff'd 200 U. S. 527, 50 L. Ed. 581, 26 S. Ct. 301.

5. Construction and application of section.

6. — highways.

The state road commission may acquire right of way for state road purposes. Barnes v. Wade, 90 U. 1, 6, 58 P.2d 297.

Term "public use" has been given liberal interpretation and includes taking of land for public streets and highways. Town of Perry v. Thomas, 82 U. 159, 22 P.2d 343.

Whether land will be devoted to a public use is determined by character of its use rather than the extent of its use, so that if way is opened for use by all, it is a public use whether advantage be taken of the street by few or many persons, and hence, contention in eminent domain proceeding that use was not public use because road would only serve three or four farms, was held without merit. Town of Perry v. Thomas, 82 U. 159, 22 P.2d 343.

7. — irrigation.

Canals and ditches and other means of conveying water for beneficial purposes are hereunder declared to be public uses, and the right of condemnation for such purposes is thereby allowed, without regard to whether the right is sought by the public or a private individual. Alcorn v. Reading, 66 U. 509, 243 P. 922.

In action to adjudicate rights of appropriators from stream, held prior appropriator could not be compelled to submit its reservoir to common storage of its own and subsequent appropriator's waters, and if no agreement could be reached, only other alternative was action to condemn under this section. Gunnison Irr. Co. v. Gunnison Highland Canal Co., 52 U. 347, 174 P. 852.

Under this section, owner of farm could condemn right of way through another's ditch for purpose of carrying water to his land for irrigation purposes. Nash v. Clark, 27 U. 158, 75 P. 371, 1 L. R. A. (N. S.) 208, 101 Am. St. Rep. 953, 1 Ann. Cas. 300, aff'd 198 U. S. 361, 49 L. Ed. 1085, 25 S. Ct. 676.

8. — mining.

This statute must be construed and applied to any particular case with as much liberality as its language will permit in order to carry out purpose which legislative power had in mind, which was to declare mining generally a public use in aid of which power of eminent domain may be invoked. Utah Copper Co. v. Stephen Hayes Estate, Inc., 83 U. 545, 31 P.2d 624.

Phrase "works for the reduction of ores" held to include copper mining company's dump so that tract of land which was natural outlet for waters from dump could be condemned. Utah Copper Co. v. Stephen Hayes Estate, Inc., 83 U. 545, 31 P.2d 624.

Copper-bearing waters belonged to mining company as long as they remained in dump, but they became property of adjoining landowner upon entering latter's propery, so that mining company could not condemn tract of land upon which such waters flowed after leaving dump for purpose of recapturing waters and extracting copper therefrom, thus depriving adjoining landowner from doing likewise. Utah Copper Co. v. Stephen Hayes Estate, Inc., 83 U. 545, 31 P.2d 624. (Hansen, J., dissenting.)

Copper mining company having easement to dump residue on certain part of adjoining claim and to remove same at any time is entitled to condemn adjoining property for excavation of tunnel and erection of pipe line to divert waters from dump containing commercially valuable deposits of copper as a result of seepage through residue in dump, and where owner of adjoining claim had been precipitating copper after water left dump, plaintiff was entitled to interlocutory order giving it immediate possession under 104-61-10, pending final determination of suit. Utah Copper Co. v. Montana-Bingham Consol. Min. Co., 69 U. 423, 255 P. 672.

Mining is public use, in furtherance of which right of exercise of eminent domain may be applied with full force and effect. Monetaire Min. Co. v. Columbus Rexall Consol. Mines Co., 53 U. 413, 174 P. 172. (Corfman and McCarty, JJ., dissenting.)

Where tunnel was not used by owner and possessor thereof to its full capacity, right to joint use of tunnel could be con-

demned upon proper compensation being made to owner. Monetaire Mining Co. v. Columbus Rexall Consol. Mines Co., 53 U. 413, 174 P. 172. (Corfman and McCarty, JJ., dissenting.)

Construction and operation of roads and tramways for the development and working of mines constitutes a public use within contemplation of Const. Art. I, § 22. Highland Boy Gold Min. Co. v. Strickley, 28 U. 215, 78 P. 296, 1 L. R. A. (N. S.) 976, 107 Am. St. Rep. 711, 3 Ann. Cas. 1110, aff'd 200 U. S. 527, 50 L. Ed. 581, 26 S. Ct. 301.

One mining company could bring action against another mining company to condemn surface of tracts for dumpage and storage thereon of overburden, waste, rock, ores, and other materials, where property sought to be condemned was not at such time a mining property and prospects of discovering minerals therein in paying quantities was exceedingly doubtful. Freeman Gulch Min. Co. v. Kennecott Copper Corp., 119 F.2d 16.

9. —railroads.

A railroad could not subject private property in a city to the burden of being subjected to the running of cars and engines over a switch laid over adjoining property, without proceeding under the law of eminent domain, as contemplated by Const. Art. I, § 22. Stockdale v. Rio Grande Western Ry. Co., 28 U. 201, 77 P. 849. (Bartch, J., dissenting in part.)

10. —taxes.

Where property is taken for public purpose through taxation in excess of benefits conferred, such action is unconstitutional and void. Bothwell v. Salt Lake County Drainage Dist. No. 2, 85 U. 415, 39 P.2d 737.

Const. Art. I, § 22, has no application to and does not limit state's power of taxation. Kimball v. Grantsville City, 19 U. 368, 57 P. 1, 45 L. R. A. 628, overruling Kaysville City v. Ellison, 18 U. 163, 55 P. 386, 43 L. R. A. 81, 72 Am. St. Rep. 772.

11. —telegraphs and telephones.

Fact that telegraph company of another state was interested in local such company held not to have affected latter's right to maintain proceedings to condemn right of way. Postal Tel. Cable Co. v. Oregon Short Line R. Co., 23 U. 474, 65 P. 735, 90 Am. St. Rep. 705.

Decisions from other jurisdictions.

—California.

Under the provisions of section 1238 of the Code of Civil Procedure, plaintiff could not have a right of way through defendant's mine condemned for its use in working its own mine; the mine of defendant was his private property, and plaintiff could not prevail in its request for the condemnation in order that it might appropriate a way through that property for its private use. Amador Queen Min. Co. v. Dewitt, 73 Cal. 482, 15 P. 74, writ of error dismissed 145 U. S. 627, 36 L. Ed. 850, 12 S. Ct. 239.

The legislature must designate, in the first place, the uses in behalf of which the right of eminent domain may be exercised, and this designation is a legislative declaration that such uses are public and will be recognized by the courts; but whether, in any individual case, the use is a public use, must be determined by the judiciary from the facts and circumstances of the case. Hercules Water Co. v. Fernandez, 5 Cal. App. 726, 91 P. 401.

The business of mining for the benefit of the mine owner is as much a private affair as that of the farm or factory, and the right of eminent domain cannot be invoked in aid of it. County of Sutter v. Nicols, 152 Cal. 688, 93 P. 872, 15 L. R. A. (N. S.) 616, 14 Ann. Cas. 900.

As to what constitutes a "public use," the California supreme court has consistently held that "public use" means "use by the public," and that to make a use public a duty must devolve on the person or corporation holding property appropriated by right of eminent domain to furnish the public with the use intended, and the public must be entitled, as of right, to use or enjoy the property taken. University of Southern California v. Robbins, 1 Cal. App.2d 523, 37 P.2d 163, certiorari denied 295 U. S. 738, 79 L. Ed. 1685, 55 S. Ct. 650.

Eminent domain is the right of the people or government to take private property for public use, and the complaint must show that the use for which the property is to be taken is a public use, so declared by the legislature; however, the mere declaration by the legislature of a purpose for which property may be taken for a public use is not conclusive and does not preclude a person whose land is being condemned from showing upon the trial that, as a matter of fact, the use sought to be subserved is a private one, or from assailing the complaint on the ground that it so appears therefrom; the character of the use, and not its extent, determines the question of public use. Stratford Irr. Dist. v. Empire Water Co., 44 Cal. App.2d 61, 111 P.2d 957.

A. L. R. notes.

Combination of public and private uses or purposes, 53 A. L. R. 9.

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mental projects for improvement of housing conditions (slum clearance), 105 A. L. R. 911.
Exercise of eminent domain for purpose of increasing right or interest which petitioner already owns or relieving the property or petitioner of some burden or obligation in respect of property, 108 A. L. R. 1522.
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Public benefit or convenience as distinguished from use by the public as ground for exercise of eminent domain, 54 A. L. R. 7.
Right to condemn property in excess of needs for public purposes, 68 A. L. R. 837.
State power of eminent domain as affected by interstate character of uses to which property taken is to be devoted, 90 A. L. R. 1032.

104–61–2. Estates and Rights that May Be Taken.

The following is a classification of the estates and rights in lands subject to be taken for public use:

(1) A fee simple, when taken for public buildings or grounds or for permanent buildings, for reservoirs and dams and permanent flooding occasioned thereby, or for an outlet for a flow, or a place for the deposit, of debris or tailings of a mine, mill, smelter or other place for the reduction of ores; *provided,* that where surface ground is underlaid with minerals, coal or other deposits sufficiently valuable to justify extraction, only a perpetual easement may be taken over the surface ground over such deposits.

(2) An easement, when taken for any other use.

(3) The right of entry upon, and occupation of, lands, with the right to take therefrom such earth, gravel, stones, trees and timber as may be necessary for some public use. (L. 19, p. 346, § 7331.)

History.

This section differs materially from 2 Comp. Laws 1888, § 3842. Other predecessor sections, see R. S. 1898, § 3589; Comp. Laws 1907, § 3589.

Comparable provisions.

Cal. Civil Proc. Code, § 1239 (classifies estates and rights in lands subject to be taken for a public use; subd. 1 is identical through the words "tailings of a mine"; pertains also to protection of water bearing lands from drought, and to taking of property by mutual water system or water district or other political subdivision; subd. 2 includes identical provision as herein, but is coupled with lengthy proviso; subd. 3 is substantially identical with subd. 3 herein).

Idaho Code, § 13–702, Mont. Rev. Codes, § 9935 (substantially identical, except that subd. 1 concludes with words: or tailings of a mine").

1. Easements.

In proceeding to condemn easement in land for laying of gas pipe line, taking of easement was held not to constitute taking of fee. Wasatch Gas Co. v. Bouwhuis, 82 U. 573, 26 P.2d 548.

One easement may be superimposed on another easement through condemnation. Monetaire Min. Co. v. Columbus Rexall Consol. Mines Co., 53 U. 413, 174 P. 172.

Right to run water through defendants' irrigation canal might be condemned, although defendants had only easement. Whiterocks Irr. Co. v. Mooseman, 45 U. 79, 141 P. 459.

104–61–3. Private Property Which May Be Taken.

The private property which may be taken under this chapter includes:

(1) All real property belonging to any person.

(2) Lands belonging to the state, or to any county, city or incorporated town, not appropriated to some public use.

(3) Property appropriated to public use; *provided,* that such property shall not be taken unless for a more necessary public use than that to which it has been already appropriated.

(4) Franchises for toll roads, toll bridges, ferries, and all other franchises; *provided,* that such franchises shall not be taken unless for free highways, railroads, or other more necessary public use.

(5) All rights of way for any and all purposes mentioned in section 104-61-1, and any and all structures and improvements thereon, and the lands held or used in connection therewith, shall be subject to be connected with, crossed or intersected by any other right of way or improvement or structure thereon; they shall also be subject to a limited use in common with the owners thereof, when necessary; but such uses of crossings, intersections and connections shall be made in the manner most compatible with the greatest public benefit and the least private injury.

(6) All classes of private property not enumerated may be taken for public use when such taking is authorized by law. (C. L. 17, § 7332.)

History.

This section is practically identical with 2 Comp. Laws 1888, § 3843. Other predecessor sections, see R. S. 1898, § 3590; Comp. Laws 1907, § 3590.

Comparable provisions.

Cal. Civil Proc. Code, § 1240 (designating private property which may be taken under title pertaining to Eminent Domain).

Idaho Code, § 13-703, Mont. Rev. Codes, § 9936 (substantially the same).

Cross-references.

Property and franchises of private corporations subject to eminent domain, Const. Art. XII, § 11.

1. Public lands.

Under Const. Art. III, § 2, and section 3 of Enabling Act, by which the people forever disclaimed all right and title to unappropriated public lands lying within boundaries thereof, public lands are not subject to state power of eminent domain either directly or indirectly, without consent of United States. Utah Power & Light Co. v. United States, 230 F. 328, 337, 4 A. L. R. 535.

2. Land granted by Congress for railroad rights of way.

Under subdivision (5), sufficient ground for a tipple site may be condemned, but a coal company cannot condemn any portion of a right of way, used for railroad purposes and granted by Congress, for a tipple site, regardless of how convenient that would be, and even though it would indirectly benefit the public. Ketchum Coal Co. v. Pleasant Valley Coal Co., 50 U. 395, 168 P. 86.

3. Property appropriated to public use in general.

Generally, property which is being held for or devoted to public use by one person may not be taken by another to be used for same purpose and in the same manner. Utah Copper Co. v. Stephen Hayes Estate, Inc., 83 U. 545, 31 P.2d 624.

Property devoted to one public use may, under general statutory authority, be taken for another public use, where taking will not materially impair or interfere with, or is not inconsistent with, use already existing. Freeman Gulch Min. Co. v. Kennecott Copper Corp., 119 F.2d 16.

4. More necessary public use.

Proceeding by power company to obtain right to connect flume with city's canal for purpose of discharging water into it was not suit to condemn land belonging to city as it owned only easement over land, and hence it was not necessary to show that use by power company was more necessary public use than that by city. Salt Lake City Water & Electrical Power Co. v. Salt Lake City, 25 U. 441, 71 P. 1067.

Land, which is part of railroad's right of way but is not used for any purpose and is not essential to enjoyment of railroad's franchise and property, may be appropriated to use of duly incorporated telegraph company for purpose of constructing and maintaining its lines, since such appropriation is for more necessary public use. Postal Tel. Cable Co. of Utah v. Oregon Short Line R. Co., 23 U. 474, 65 P. 735, 90 Am. St. Rep. 705.

5. Joint use or use in common.

Where tunnel was not used by owner and possessor thereof to its full capacity, right to joint use of tunnel could be condemned upon proper compensation being made to owner. Monetaire Min. Co. v. Columbus Rexall Consol. Mines Co., 53 U. 413, 174 P. 172. (Corfman and McCarty, JJ., dissenting.)

Subdivision (5) limits the interference with rights of way to "crossings, intersections, and connections" by other rights of way, and also makes a right of way subject "to a limited use in common with the owners thereof," although such use is clearly and manifestly a use for which the original right of way was obtained and is being used, and no other. Ketchum Coal Co. v. Pleasant Valley Coal Co., 50 U. 395, 168 P. 86.

Proceeding by city against irrigation company to obtain right to enlarge irrigating canal owned by defendant so as to convey water from river for use of its inhabitants was controlled by principles involved in exercise of right of eminent domain. Salt Lake City v. East Jordan Irr. Co., 40 U. 126, 121 P. 592.

6. Interest in land of person contracting to purchase from state.

In proceedings by city to condemn against one in possession of land under contract to purchase from state title to which was in United States, where pending the proceedings defendant in possession assigned his right in land to corporation of which he was president and director, which received patent therefor from state and was afterwards made party to proceedings, held original defendant had interest in land when proceedings were commenced which was subject to condemnation and was same interest which passed to defendant corporation and ripened into title relating back to contract of sale by state. Brigham City v. Rich, 34 U. 130, 96 P. 220.

7. Effect, on rights of owner, of condemnation of easement.

Use of land condemned for railroad right of way for exclusive use permanent in its nature precludes owner from entering on or using any part of land, except by condemner's consent, or unless statute or court limits easement by reserving certain rights to owner. Bingham & G. Ry. Co. v. North Utah Min. Co. of Bingham, 49 U. 125, 162 P. 65.

A. L. R. notes.

Capital stock of public utility, condemnation, 81 A. L. R. 1071.

Dower rights, condemnation, 5 A. L. R. 1347.

Property previously condemned or purchased for public use but not actually so used, right to condemn, 12 A. L. R. 1502.

Property to be exchanged for other property required for public use, power to condemn, 68 A. L. R. 442.

Public property, taking for another public purpose, right to compensation, 56 A. L. R. 365.

Right of municipality or other governmental body seeking to acquire public utility to proceed in the manner prescribed generally for exercise of eminent domain, 109 A. L. R. 384.

Right to take property under eminent domain as affected by fact that property is already devoted to cemetery purposes, 109 A. L. R. 1502.

State power of eminent domain over property of United States, 4 A. L. R. 548.

104–61–4. Conditions Precedent to Taking.

Before property can be taken it must appear:

(1) That the use to which it is to be applied is a use authorized by law;

(2) That the taking is necessary to such use; and,

(3) If already appropriated to some public use, that the public use to which it is to be applied is a more necessary public use.

(C. L. 17, § 7333.)

History.

This section is practically identical with 2 Comp. Laws 1888, § 3844. Other predecessor sections, see R. S. 1898, § 3591; Comp. Laws 1907, § 3591.

Comparable provisions.

Cal. Civil Proc. Code, § 1241 (subd. 1 is identical with subd. 1 herein; subds. 2 and 3 are prefaced with language identical with subds. 2 and 3, respectively, herein, but are coupled with lengthy provisos).

Idaho Code, § 13–704 (identical).

Mont. Rev. Codes, § 9937 (identical, except that subd. 3 is coupled with provision specifying that appeal to supreme court is permissible from finding or judgment, but such appeal does not stay further proceedings under this chapter).

1. More necessary public use.
Proceeding by power company to obtain right to connect flume with city's canal for purpose of discharging water into it was not suit to condemn land belonging to city as it owned only easement over land, and hence it was not necessary to show that use by power company was more necessary public use than that by city. Salt Lake City Water & Electrical Power Co. v. Salt Lake City, 25 U. 441, 71 P. 1067.

A. L. R. notes.
Necessity of taking particular property for drainage purposes as affecting exercise of eminent domain, 65 A. L. R. 504; property previously condemned or purchased for public use but not actually so used, right to condemn, 12 A. L. R. 1502; right to condemn property in excess of needs for public purposes, 68 A. L. R. 837; right to take property under eminent domain as affected by fact that property is already devoted to cemetery purposes, 109 A. L. R. 1502.

104-61-5. Right of Entry for Survey, etc.

In all cases where land is required for public use, the person, or his agent, in charge of such use may survey and locate the same; but it must be located in the manner which will be most compatible with the greatest public good and the least private injury, and subject to the provisions of this chapter. The person, or his agent, in charge of such public use may enter upon the land and make examinations, surveys and maps thereof, and such entry shall constitute no cause of action in favor of the owners of the lands, except for injuries resulting from negligence, wantonness or malice. (C. L. 17, § 7334.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3845. Other predecessor sections, see R. S. 1898, § 3592; Comp. Laws 1907, § 3592.

Comparable provisions.
Cal. Civil Proc. Code, § 1242, Idaho Code, § 13-705, Mont. Rev. Codes, § 9938 (substantially identical, reading in part: "* * * the state, or its agents in charge of such use *")

104-61-6. Venue of Action—Complaint to Be Verified.

All proceedings under this chapter must be brought in the district court for the county in which the property or some part thereof is situated. The complaint in such cases must be verified. (C. L. 17, § 7335.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3846. Other predecessor sections, see R. S. 1898, § 3593; Comp. Laws 1907, § 3593.

Comparable provisions.
Cal. Civil Proc. Code, § 1243 (includes provision similar to first sentence herein; designating "superior court").
Idaho Code, § 13-706 (similar to first sentence herein; "* * * for the county in which the property is situated").
Mont. Rev. Codes, § 9939, as amended by Laws of 1937 (includes provision identical with first sentence herein).

1. Constitutionality.
This section does not conflict with Const. Art. VIII, § 5, so as to preclude telegraph company from bringing action to condemn railroad's right of way, which extends through several counties, for construction of its lines in one of such counties. Postal Tel. Cable Co. v. Oregon Short Line R. Co., 23 U. 474, 65 P. 735, 90 Am. St. Rep. 705.

104-61-7. Complaint—Contents.

The complaint must contain:

(1) The name of the corporation, association, commission or person in charge of the public use for which the property is sought, who must be styled plaintiff.

(2) The names of all owners and claimants of the property, if known, or a statement that they are unknown, who must be styled defendants.

(3) A statement of the right of the plaintiff.

(4) If a right of way is sought, the complaint must show its location, general route and termini, and must be accompanied by a map thereof, so far as the same is involved in the action or proceeding.

(5) A description of each piece of land sought to be taken, and whether the same includes the whole or only part of an entire parcel or tract. All parcels lying in the county and required for the same public use may be included in the same or separate proceedings, at the option of the plaintiff, but the court may consolidate or separate them to suit the convenience of parties. (C. L. 17, § 7336.)

History.

This section is practically identical with 2 Comp. Laws 1888, § 3847. Other predecessor sections, see R. S. 1898, § 3594; Comp. Laws 1907, § 3594.

Comparable provisions.

Cal. Civil Proc. Code, § 1244, Mont. Rev. Codes, § 9940 (subds. 1, 2, 3 and 4 are substantially identical with same numbered provisions herein; subd. 5 is similar to subd. 5 herein, and is coupled with provision pertaining to condemnation of right of way for purpose of sewerage).

Idaho Code, § 13-707 (includes substantially the same provisions).

1. In general.

Mere fact that person contemplates having certain land condemned for public use, or that such land is necessary for such use, gives him no right of entry prior to condemnation, and condemnation cannot be had by way of counterclaim in action against him for damages for, and to restrain, his trespassing on land. Peterson v. Bean, 22 U. 43, 61 P. 213.

2. Necessary allegations.

While as a general rule the condemner seeks to acquire the property of another, it is not ground for dismissal that plaintiff asserts paramount title in itself. Both parties in some instances claim title to the property sought to be condemned. Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737, 4 A. L. R. 619.

Condemner may allege that it acquired title subsequent to institution of the condemnation action. Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737, 4 A. L. R. 619.

Allegations or averments of value of property affected held not necessary in any of pleadings. Tanner v. Provo Bench Canal & Irrigation Co., 40 U. 105, 121 P. 584, aff'd 239 U. S. 323, 60 L. Ed. 307, 36 S. Ct. 101.

Person who had filed homestead entry on tract of land, and thereafter relinquished and canceled the entry pursuant to a contract with state board of land commissioners, by which they agreed to select the lands under grant to the state from the United States, to preserve the entryman's rights, and to sell the land to him at a certain price, all of which was done, the entryman thereafter remaining in possession of and claiming the land, was an "owner" within meaning of this section. Brigham City v. Chase, 30 U. 410, 85 P. 436.

3. Sufficiency of allegations.

Where town sought to condemn certain land burdened with an easement and additional adjoining lands and neither in complaint or evidence was adjoining land described in a manner that jury would know precise amount of land taken from each owner, land sought to be taken was not sufficiently described. Town of Perry v. Thomas, 82 U. 159, 22 P.2d 343.

4. Amendment.

If neither original complaint nor supplemental complaint in the nature of an amendment to original complaint states a cause of action, judgment for defendant will be affirmed. Pahvant Mercantile & Investment Co. v. Wind, 78 U. 381, 3 P.2d 257.

In eminent domain proceeding after order giving full and exclusive possession, pending action, of certain defined tracts, parts of strip sought to be condemned for permanent railroad right of way, and entry upon and improvement of such tracts, and after defendant in former and in present trial had submitted all its evidence on theory that condemner would exclude it from tracts, condemner had no right to amend as matter of course, so as to permit defendant to have joint possession of part of tract. Bingham & G. Ry. Co. v. North Utah Min. Co. of Bingham, 49 U. 125, 162 P. 65.

5. Waiver of defects.

In proceedings to condemn land, where no demurrer was interposed to complaint and no objection respecting its sufficiency made, either before or during trial, defect that complaint failed to state that attempted condemnation pro-

ceedings were authorized as required by statute being jurisdictional was not waived. Town of Tremonton v. Johnston, 49 U. 307, 164 P. 190.

A. L R notes.

Right to abandon and effect of abandonment of eminent domain proceedings, 121 A. L. R. 12.

104-61-8. Who May Appear and Defend.

All persons in occupation of, or having or claiming an interest in, any of the property described in the complaint, or in the damages for the taking thereof, though not named, may appear, plead and defend, each in respect to his own property or interest, or that claimed by him, in the same manner as if named in the complaint. (C. L. 17, § 7337.)

History.

This section is practically identical with 2 Comp. Laws 1888, § 3849. Other predecessor sections, see R S 1898, § 3595; Comp Laws 1907, § 3595.

Comparable provisions.

Idaho Code, § 13-709 (identical).

Mont. Rev. Codes, § 9942 ("All persons named in the complaint, in occupation of, * * * or in the damages for the taking thereof, though not named, may appear, answer, or demur, each in respect to his own property or interest").

1. In general.

Right to run water through defendant's irrigation canal may be condemned, though defendants had only easement, and owners of land were not parties to proceeding Whiterocks Irr. Co. v. Mooseman, 45 U 79, 141 P. 459.

Under this section, purchaser of property at tax sale who has received certificate of sale may be made a party to the proceeding, or may voluntarily intervene and have his lien established and the amount thereof ascertained. Oregon Short Line R Co. v. Hallock, 41 U 378, 126 P. 394.

In proceeding by city to condemn against one in possession of land under contract to purchase from state title to which was in United States, where pending the proceedings defendant in possession assigned his right in land to corporation of which he was president and director, which received patent therefor from state and was afterwards made party to proceedings, held original defendant had interest in land when proceedings were commenced which was subject to condemnation and was same interest which passed to defendant corporation and ripened into title relating back to contract of sale by state. Brigham City v. Rich, 34 U. 130, 96 P. 220.

Under this section, failure to make all claimants in interest parties is not fatal. Brigham City v. Chase, 30 U. 410, 85 P. 436.

Under this section, it is not necessary that claimant of an interest be made a party in the complaint in order to appear and defend such interest. Brigham City v Chase, 30 U. 410, 85 P. 436.

In suit to condemn right of way over land conveyed under trust deed, the owners and the trustee should be made parties to complaint. Oregon Short Line & U. N. Ry. Co v Mitchell, 7 U. 505, 27 P. 693.

2. Intervention.

See also "in general," annotation 1, this section.

This section does not permit persons interested only as taxpayers to intervene Town of Perry v Thomas, 82 U. 159, 22 P.2d 343

104-61-9. Powers of Court or Judge.

The court or judge thereof shall have power:

(1) To determine the conditions specified in section 104-61-4; to determine the places of making connections and crossings, and to regulate the manner thereof and of enjoying the common use mentioned in section 104-61-3 (5).

(2) To hear and determine all adverse or conflicting claims to the property sought to be condemned, and to the damages therefor.

(3) To determine the respective rights of different parties seeking condemnation of the same property. (C. L. 17, § 7338)

History.

This section is practically identical with 2 Comp Laws 1888, § 3850 Other predecessor sections, see R S 1898, § 3596; Comp Laws 1907, § 3596.

Comparable provisions.
Cal. Civil Proc. Code, § 1247, Idaho Code, § 13–710 (substantially the same).

1. In general.
Under our statute, an action to condemn lands is commenced, conducted, and tried in the same courts and in the same manner as all other actions affecting real property. Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 355, 159 P. 737, 4 A. L. R. 619.

2. Jury trial.
A party is not deprived of his right to a jury trial because the question of title is tried in the original proceeding rather than in a separate action or proceeding. If the question respecting title is equitable, no party is, as a matter of right, entitled to a jury trial, and, if the question is purely legal, then all questions, whether with regard to the title or the damages, may be tried and submitted at the same time to the jury that is impaneled in the case. Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737, 4 A. L. R. 619.

A. L. R. notes.
Admissibility, and effect of admission, in condemnation proceedings of plans and specifications as regards the work to be done on, or the particular use to be made of, the land in question, 89 A. L. R. 879; constitutionality of provisions as to tribunal which shall fix the amount of compensation for taking of property in eminent domain, otherwise than objections that a trial by jury is necessary, 74 A. L. R. 569; right of court to reduce or increase award in condemnation and confirm it as reduced or increased, 61 A. L. R. 194.

104–61–10. Occupancy of Premises Pending Action.

The plaintiff may move the court or a judge thereof, at any time after the commencement of suit, on notice to the defendant, if he is a resident of the state, or has appeared by attorney in the action, otherwise by serving a notice directed to him on the clerk of the court, for an order permitting the plaintiff to occupy the premises sought to be condemned pending the action, and to do such work thereon as may be required for the easement sought according to its nature. The court or a judge thereof shall take proof by affidavit or otherwise of the value of the premises sought to be condemned and of the damages which will accrue from the condemnation, and of the reasons for requiring a speedy occupation, and shall grant or refuse the motion according to the equity of the case and the relative damages which may accrue to the parties. If the motion is granted, the court or judge shall require the plaintiff to execute and file in court a bond to the defendant with sureties to be approved by the court or judge, in a penal sum to be fixed by the court or judge, not less than double the value of the premises sought to be condemned and the damages which will ensue from condemnation, as the same may appear to the court or judge on the hearing, and conditioned to pay the adjudged value of the premises and all damages in case the property is condemned, and to pay all damages arising from occupation before judgment in case the premises are not condemned, and all costs adjudged to the defendant in the action. The sureties shall justify before the court or judge after a reasonable notice to the defendant of the time and place of justification. The amounts fixed shall be for the purposes of the motion only, and shall not be admissible in evidence on final hearing. The court or judge may also, pending the action, restrain the defendant from hindering or interfering with the occupation of the premises and the doing thereon of the work required for the easement. (C. L. 17, § 7339.)

History.
Predecessor sections, see R. S. 1898, § 3597; Comp. Laws 1907, § 3597.

1. Constitutionality.
Former statute held not invalid under Const. Art. I, § 22. Salt Lake City Wa-

ter & Electrical Power Co. v. Salt Lake City, 24 U. 282, 67 P. 791. (Baskin, J., dissenting.)

2. Discretion of court.

Power to grant immediate occupancy of premises to plaintiff hereunder, pending final determination of condemnation proceeding, is largely discretionary; but in exercise of such discretion, court may well require plaintiff to make showing not only as to necessity for speedy occupation, but also a prima facie showing of his right to condemn, if that is controverted Utah Copper Co v. Montana-Bingham Consol Min. Co, 69 U. 423, 255 P. 672

3. Interlocutory character of occupancy-order.

Order granting immediate possession to plaintiff in condemnation proceeding as herein provided is interlocutory and not appealable. Plaintiff may be required to make prima facie showing of right to condemn and necessity for speedy occupation, and before final determination defendant may adduce evidence controverting interlocutory order, which is in no wise res adjudicata of issues. Utah Copper Co. v Montana-Bingham Consol Min. Co, 69 U. 423, 255 P. 672.

A. L. R. notes.

Right to interest in condemnation proceedings during owner's retention of possession, 32 A. L. R. 98.

104-61-11. Compensation and Damages—How Assessed.

The court, jury or referee must hear such legal evidence as may be offered by any of the parties to the proceedings, and thereupon must ascertain and assess:

(1) The value of the property sought to be condemned and all improvements thereon appertaining to the realty, and of each and every separate estate or interest therein; and if it consists of different parcels, the value of each parcel and of each estate or interest therein shall be separately assessed.

(2) If the property sought to be condemned constitutes only a part of a larger parcel, the damages which will accrue to the portion not sought to be condemned by reason of its severance from the portion sought to be condemned and the construction of the improvement in the manner proposed by the plaintiff.

(3) If the property, though no part thereof is taken, will be damaged by the construction of the proposed improvement, the amount of such damages.

(4) Separately, how much the portion not sought to be condemned, and each estate or interest therein, will be benefited, if at all, by the construction of the improvement proposed by the plaintiff; if the benefit shall be equal to the damages assessed under subdivision (2) of this section, the owner of the parcel shall be allowed no compensation except the value of the portion taken; but if the benefit shall be less than the damages so assessed, the former shall be deducted from the latter, and the remainder shall be the only damages allowed in addition to the value of the portion taken.

(5) As far as practicable compensation must be assessed for each source of damages separately. (C. L. 17. § 7340.)

History

This section is practically identical with 2 Comp. Laws 1888, § 3851. Other predecessor sections, see R. S. 1898, § 3598; Comp. Laws 1907, § 3598.

Comparable provisions.

Idaho Code, § 13-711 (similar).

Mont. Rev. Codes, § 9944 (designating duties of commissioners, who are appointed by the court or judge under provisions of section 9943).

1. In general.

State has right to take or damage private property when necessary for public use, but not without payment of just compensation. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502.

Damages arising out of carelessness or negligence or indifference in construction of a utility upon land taken for public use are not damages contemplated by statutes as recoverable under principles of law pertaining to eminent domain proceedings. Thomas E. Jeremy Estate v. Salt Lake City, 87 U. 370, 49 P.2d 405.

Under Const. Art. I, § 22, owner of property entered upon and appropriated to public use without compliance therewith may waive tort and sue for compensation. Salt Lake Inv. Co. v. Oregon Short Line R. Co., 46 U. 203, 148 P. 439, aff'd 246 U. S. 446, 62 L. Ed. 823, 38 S. Ct. 348.

Damages may be recovered for any improvements made by a trespasser, but not from a mere technical trespasser who is not actuated by an improper and fraudulent motive. Chase v. Jemmett, 8 U. 231, 30 P. 757, 16 L. R. A. 805.

2. Constitutional guaranty in general.

Damages for which compensation is *allowed under Const. Art. I, § 22, are* such as are the direct consequences of lawful exercise of right of eminent domain, and, ordinarily, such damages are unavoidable. Lund v. Salt Lake County, 58 U. 546, 200 P. 510.

Injuries cognizable at common law or in equity are ordinarily not covered by constitutional provisions authorizing compensation for taking or damaging property. Lund v. Salt Lake County, 58 U. 546, 200 P. 510.

3. Damaging property without physical taking of it in general.

Framers of Constitution did not intend to give rights granted by Const. Art. I, § 22, and then leave citizen powerless to enforce such rights, and this is so whether injury complained of is considered a taking or a damaging of property. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502. (Wolfe and Hanson, JJ., dissenting.)

Const. Art. I, § 22, does not require compensation for damages not recognized as actionable at common law, but for a damaging of property to an actionable degree, it intends the landowner to have just compensation equally with the landowner whose property was physically taken. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502.

A party whose property is about to be specially damaged in any substantial degree for public use has the same rights and is given the same remedies for the protection of his property from the threatened injury as would be accorded him if his property were actually taken and appropriated for such use. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502 (Wolfe and Hanson, JJ., dissenting); Stockdale v. Rio Grande Western Ry. Co., 28 U. 201, 77 P. 849.

Total destruction of property or rendering it valueless amounts to "taking" within meaning of Const. Art. I, § 22. Lund v. Salt Lake County, 58 U. 546, 200 P. 510.

In action by owner of fish ponds against county to recover damages for injury to fish ponds and destruction of fish contained therein as result of county allowing impure water to flow into fish ponds from reservoir maintained by county in connection with its water supply system, held plaintiff was not entitled to recover for taking and damaging property for public use. Lund v. Salt Lake County, 58 U. 546, 200 P. 510.

To deprive one of the ordinary beneficial use and enjoyment of his property is, in law, equivalent to the taking of it, and is as much a taking within contemplation of constitutional provisions relative thereto as though the property itself *were actually taken. Oregon Short Line* R. Co. v. Jones, 29 U. 147, 80 P. 732.

4. "Compensation" as contemplating "money."

Just compensation for property taken contemplates payment in money, and no matter how valuable the property offered in lieu of money, it cannot be substituted against the wishes of the condemnee. Shurtleff v. Salt Lake City, 96 U. 21, 82 P.2d 561.

Owner is entitled to compensation in money, and need not accept any substitute therefor, such as conjoint possession or occupancy, subordinate to condemner's use. Bingham & G. R. Co. v. North Utah Min. Co. of Bingham, 49 U. 125, 162 P. 65.

Compensation within meaning of this section contemplates money. Oregon Short Line R. Co. v. Fox, 28 U. 311, 78 P. 800.

5. "Just compensation" as judicial question.

What constitutes just compensation is a judicial question which landowner has the right to have determined in accordance with the general rules established for eminent domain in Utah, and officers of state cannot force him to submit determination thereof to legislature or to board of examiners. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502. (Wolfe and Hanson, JJ., dissenting.)

6. Applicability of rules of equity in determining just compensation.

Where property is condemned for purpose of joint use or use in common, whole

matter of determining what is reasonable compensation is regulated according to rules of equity. Monetaire Min. Co. v. Columbus Rexall Consol. Mines Co., 53 U. 413, 174 P. 172. (Corfman and McCarty, JJ., dissenting.)

7. Limitation of actions.

Action for damages from depreciation in value of property, as result of construction and operation of railroad in street in front of it, is subject to four-year-limitation period of 104–2–30. Johnson v. Utah-Idaho Cent. Ry. Co., 68 U. 309, 249 P. 1036.

Right of abutting owner to recover damages resulting from change of street grade is given by Const. Art. I, § 22, and action to recover such damages is governed by 104–2–30, limiting actions not otherwise provided for to four years from time of accrual of cause of action. Webber v. Salt Lake City, 40 U. 221, 120 P. 503, 37 L. R. A. (N. S.) 1115.

8. Witnesses.

In eminent domain cases, the qualification of witnesses to express opinion as to market value necessarily is question to be largely determined by trial judge, and if it is shown that witness is competent to express opinion as to values, no matter what source of qualifying information may be, he should be permitted to testify. Salt Lake & U. R. Co. v. Schramm, 56 U. 53, 189 P. 90.

In action by railroad to condemn land, testimony of landowner who occupied and used premises all her life, and had been interested in making inquiry as to its value, held properly admitted. Salt Lake & U. R. Co. v. Schramm, 56 U. 53, 189 P. 90.

In determining question of just compensation for property taken, testimony of contractor and builder, who had constructed buildings in various parts of state, and whose business it was to be posted as to values, held properly admitted. Salt Lake & U. R. Co. v. Schramm, 56 U. 53, 189 P. 90.

In railroad's proceedings to condemn land, court properly permitted road, on cross-examination of landowner's witness, to show that witness had option to purchase land at certain price. Ogden L. & I. Ry. Co. v. Jones, 51 U. 62, 168 P. 548.

9. Evidence.

10. —presumptions and burden of proof.

In proceeding to take private property for public use, burden is on owner of property to prove amount of his damages. Tanner v. Provo Bench Canal & Irrigation Co., 40 U. 105, 121 P. 584, aff'd 239 U. S. 323, 60 L. Ed. 307, 36 S. Ct. 101.

11. —admissibility and sufficiency.

In proceeding to condemn easement in land for laying of gas pipe line, admissibility of evidence by landowners of market value per acre of the respective tracts without easement and depreciation of land affected but not taken was proper. Wasatch Gas Co. v. Bouwhuis, 82 U. 573, 26 P.2d 548.

For the purpose of proving value, it is proper to show rental value of premises and what rents were paid therefor at and for reasonable time before action was commenced. Ogden L. & I. Ry. Co. v. Jones, 51 U. 62, 168 P. 548.

In proceeding by town to condemn waters of spring, testimony of owner of spring, on cross-examination, that 15 years before filing declaration of homestead he had stated value of land and spring to be much less than he testified their value to be at trial was improperly elicited from him, evidence being too remote. Town of Tremonton v. Johnston, 49 U. 307, 164 P. 190.

In proceeding to condemn strip of land on which to erect poles bearing wires heavily charged with electricity, if presence of wires would expose to danger persons and live stock on land of defendant not taken, and thus depreciate market value of such land, defendant was entitled to show such fact. Telluride Power Company v. Bruneau, 41 U. 4, 125 P. 399, Ann. Cas. 1915 A 1251.

In action for injuries to plaintiff's house by jar of defendant's passing trains and by smoke and cinders, evidence was admissible for plaintiff of cracking of walls, settling of floors, and of other specific effects, though there was expert evidence as to diminution in value of property, especially where experts differed widely in their evidence as to value, as jury could better weigh expert testimony in light of actual results, and this notwithstanding fact that cause of action was single, for which all damages must be recovered in one action, to be assessed as of time when first injury to property occurred, however slight it was. O'Neill v. San Pedro, L. A. & S. L. R. Co., 38 U. 475, 114 P. 127.

12. Instructions to jury.

In eminent domain case, court's charge to jury that in passing on question of market value, they should take into consideration existing business or wants of community, correctly stated law under circumstances and conditions in record. Salt Lake & U. R. Co., v. Schramm, 56 U. 53, 189 P. 90.

13. Drainage canals.

Where contract between grantor and city with reference to conveyance of right of way to city for construction of

drainage canal recited that consideration was $1 and covenants of grantee to do work in manner not to damage property of grantor, grantor was fully compensated and neither he nor his successors had right to again collect for the right of way. Thomas E. Jeremy Estate v. Salt Lake City, 87 U. 370, 49 P.2d 405.

14. Grades of streets and sidewalks.

Under Const. Art. I, § 22, if city, by establishing a first or an initial grade of street, injuriously affects property of adjoining or abutting landowner, such owner is entitled to be compensated for such damages. Richards v. Salt Lake City, 49 U. 28, 161 P. 680.

Where plaintiff purchased and improved lot after street grade had been established and after major portion thereof had been lowered approximately to established grade, except space for sidewalk which had been left in its natural state and was considerably higher than portion of street which had been brought to grade, such property owner could not recover from city for damage to property by bringing sidewalk to established grade. Coalter v. Salt Lake City, 40 U. 293, 120 P. 851.

In action by abutting owner to recover damages resulting from change of street grade, held city was not liable for whatever diminution of value was caused to plaintiff's lot by removal of trees growing in street. Webber v. Salt Lake City, 40 U. 221, 120 P. 503, 37 L. R. A. (N. S.) 1115.

Abutting owner was entitled to recover consequential damages to real property caused by public improvements made by city in changing street grade in front of plaintiff's property. Kimball v. Salt Lake City, 32 U. 253, 90 P. 395, 10 L. R. A. (N. S.) 483, 125 Am. St. Rep. 859; Hempstead v. Salt Lake City, 32 U. 261, 90 P. 397.

In suit by abutting owner to recover consequential damages to real property caused by change in street grade by city, measure of damages was difference in market value of property affected between date of commencement of work and date of its completion less direct benefits. Kimball v. Salt Lake City, 32 U. 253, 90 P. 395, 10 L. R. A. (N. S.) 483, 125 Am. St. Rep. 859.

15. Irrigation.

Present and future damages resulting from seepage from properly constructed canal are recoverable. Utah Lake Irr. Co. v. Jensen, 49 U. 19, 161 P. 677.

In proceeding to obtain permission to enlarge certain irrigating canals belonging to irrigation company, that defendants would be affected in control of canals and in making repairs if any were necessary, held not to entitle defendants to substantial damages, where defendants were neither unduly interfered with nor hampered in their control work of canals, and hence could not be injured or damaged in that regard. Tanner v. Provo Bench Canal & Irrigation Co., 40 U. 105, 121 P. 584 (Straup, J., dissenting), aff'd 239 U. S. 323, 60 L. Ed. 307, 36 S. Ct. 101.

In proceeding to obtain permission to enlarge certain irrigating canals belonging to irrigation company, held irrigation company was limited in its recovery by amount of damages suffered, and could not recover for any benefit plaintiff might receive. Tanner v. Provo Bench Canal & Irrigation Co., 40 U. 105, 121 P. 584 (Straup, J., dissenting), aff'd 239 U. S. 323, 60 L. Ed. 307, 36 S. Ct. 101.

16. Municipal waterworks.

In proceeding by city against irrigation company to obtain right to enlarge irrigating canal owned by defendant so as to convey water from river for use of its inhabitants, measure of damages to which irrigation company was entitled was amount of decrease, if any, in value of use of canal for canal purposes, and use by city for its purposes being exercised jointly with use of defendant for its canal purposes. Salt Lake City v. East Jordan Irr. Co., 40 U. 126, 121 P. 592. (Straup, J., dissenting.)

17. Pipe lines.

In ascertaining amount of compensation to which landowner in whose lands perpetual easement for laying pipe line was granted, it was not value of right of way of easement acquired, but value of lands, or interest therein taken from owner and damage to lands injuriously affected and not taken. Wasatch Gas Co. v. Bouwhuis, 82 U. 573, 26 P.2d 548.

18. Public improvements in general.

Contractor and individual members of state road commission should be enjoined from constructing viaduct along portion of street, unless road commission submits to hearing in manner provided by law upon question of landowner's damages, since road commissioners are not authorized to either take or damage property without so proceeding. State v. Fourth Judicial District Court, 94 U. 384, 78 P.2d 502. (Wolfe and Hanson, JJ., dissenting.)

Consequential damages to property which are caused by making public improvements are recoverable under Const. Art. I, § 22, and not by virtue of statute, and property owner was not prevented from recovering such damages by reason of having paid special tax levied for improvements. Coalter v. Salt Lake City, 40 U. 293, 120 P. 851.

Where owner continues in use and enjoyment of his property and property rights after completion of public improvement to same extent and for same purpose as before, his property has not been "taken" within Const. Art. I, § 22, and it cannot be "damaged" within that provision except by the invasion of a theoretical legal right. Salt Lake City v. East Jordan Irr. Co., 40 U. 126, 121 P. 592.

19. Railroads.

Action may be maintained for damages from depreciation in value of property as result of construction and operation of railroad in street in front of it. Johnson v. Utah-Idaho Cent. Ry. Co., 68 U. 309, 249 P. 1036.

Plaintiff's property is "damaged" within the meaning of Const. Art. I, § 22, by erection of a viaduct by a railroad, as required by city ordinance, for which he is entitled to compensation. Cook v. Salt Lake City, 48 U. 58, 157 P. 613.

In case of a steam railroad, measure of recovery is the depreciation in the market value of property, if any, produced by careful construction and operation of the railroad. Whatever legitimately affects value of property may be considered in determining depreciation or appreciation thereof, but the several elements depreciating the value may not be considered as separate and independent items of damage. Jordan v. Utah R. Co., 47 U. 519, 156 P. 939.

In case of a steam railroad, neither emission of smoke nor noise incident to operation of trains can be shown as a separate and independent element of damages. But the casting of cinders or offensive matter upon property and polluting the atmosphere with smoke may be considered in so far as that affects value of property and tends to depreciate it, but rule is different with regard to noise necessarily incident to operation of trains. Jordan v. Utah R. Co., 47 U. 519, 156 P. 939.

Change of grade of street by construction of railroad may be considered to show that owner's property was thereby depreciated in value. Jordan v. Utah R. Co., 47 U. 519, 156 P. 939.

General benefits as contradistinguished from special benefits should not be offset against the damages, if any, sustained by that portion of the land not taken or appropriated by condemner. Therefore, general benefits from establishment of a railroad cannot be deducted from the damages to owners whose land was taken for right of way. Salt Lake & U. R. Co. v. Butterfield, 46 U. 431, 150 P. 931.

Except for provisions contained in Const. Art. I, § 22, action would not lie for mere consequential injuries to real property by reason of construction and operation of railroad. O'Neill v. San Pedro, L. A. & S. L. R. Co., 38 U. 475, 114 P. 127.

Church could not recover damages from railroad because ringing of bells, sounding of whistles, and noises emanating from railroad locomotives disturbed meetings and exercises conducted in church building, where there was no physical interference with church property. Twenty-Second Corp. of Church of Jesus Christ of Latter-Day Saints v. Oregon Short Line R. Co., 36 U. 238, 103 P. 243, 23 L. R. A. (N. S.) 860, 140 Am. St. Rep. 819.

Action by abutting owner of property against railroad to recover damages to property by reason of construction and operation of railroad in public street in front of his property by which ingress and egress to and from property was impeded, and use was otherwise directly affected, came within Const. Art. I, § 22. Morris v. Oregon Short Line R. Co., 36 U. 14, 102 P. 629.

In action by abutting owner of property against railroad to recover damages to property by reason of construction and operation of railroad in public street in front of his property by which ingress and egress to and from property was impeded, held that measure of damages was amount that property had depreciated in market value. Morris v. Oregon Short Line R. Co., 36 U. 14, 102 P. 629.

In action by railroad to condemn certain strip of ground used for school purposes to be used for railroad, measure of damages was diminution in value of property when used for school purposes which was caused by construction and operation of railroad. San Pedro, L. A. & S. L. R. Co. v. Board of Education of Salt Lake City, 35 U. 13, 99 P. 263.

Where a railroad company, on constructing a line across a landowner's premises, abandoned an old line across the same premises a mile distant, the railroad was not entitled to have any benefit from the abandonment of the old line set off against the damage done the land adjoining the new line, the benefit which it could set off being only such as inured to the land adjacent to the right of way sought to be condemned, the railroad being under no obligation to relinquish its old right of way. Oregon Short Line R. Co. v. Fox, 28 U. 311, 78 P. 800.

20. Interest on award.

In eminent domain proceeding, interest on award should not be computed from date of commencement of action, but

rather from date of order of occupancy. Salt Lake & U. R. Co. v. Schramm, 56 U. 53, 189 P. 90.

In action by railroad to condemn certain strip of ground used for school purposes to be used for railroad, interest on damages for land condemned should have been computed from time railroad took possession of land, and not from date of judgment. San Pedro, L. A. & S. L. R. Co. v. Board of Education of Salt Lake City, 35 U. 13, 99 P. 263.

In suit by abutting owner to recover consequential damages to real property caused by change in street grade by city, plaintiff was entitled to recover interest on damages from time of completion of grade injuring property. Kimball v. Salt Lake City, 32 U. 253, 90 P. 395, 10 L. R. A. (N. S.) 483, 125 Am. St. Rep. 859.

Where the owners of property condemned for railroad purposes remained in possession and had the use of the property until the final order of condemnation, the service of summons was not a taking of the property, within the meaning of the constitutional provision that "private property shall not be taken or damaged for public use without just compensation," and hence they were not entitled to interest on the assessment of condemnation from the date of the service of summons in the action to verdict, less rents and other benefits of possession received by them during that period. Oregon Short Line R. Co. v. Jones, 29 U. 147, 80 P. 732.

A. L. R. notes.

Admissibility, and effect of admission, in condemnation proceedings of plans and specifications as regards the work to be done on, or the particular use to be made of, the land in question, 89 A. L. R. 879.

Admissibility on issue of value of real property of evidence of sale price of other real property, 118 A. L. R. 869.

Are different estates or interests in real property taken under eminent domain to be valued separately, or is entire property to be valued as a unit and the amount apportioned among separate interests, 69 A. L. R. 1263.

Benefits to part of tract not taken, offsetting, 17 A. L. R. 64.

Consequential damages, right to recover in other than eminent domain proceeding, 20 A. L. R. 516.

Constitutionality of provisions as to tribunal which shall fix the amount of compensation for taking of property in eminent domain, otherwise than objections that a trial by jury is necessary, 74 A. L. R. 569.

Damages due to negligence on delayed prosecution of condemnation proceedings, 92 A. L. R. 379.

Different estates or interests, valuation separately or as a whole, 69 A. L. R. 1263.

Distinction between income or profits from business on land and income or profits from use of land, as affecting admissibility of evidence in that regard on question of damages in eminent domain, 134 A. L. R. 1125.

Elements and measure of compensation for power lines or other wire lines over private property, 124 A. L. R. 407.

Fixtures or chattels used in connection with real property taken or damaged, compensation, 90 A. L. R. 159.

Good will as element of damages for condemnation of property on which business is conducted, 41 A. L. R. 1026.

Improvements by body having power of eminent domain before exercise of such power, right to compensation for, 34 A. L. R. 1082.

Inchoate dower interest, compensation for, 5 A. L. R. 1347.

Income as an element in determining value of property taken in eminent domain, 65 A. L. R. 455.

Interference with view as matter for consideration in eminent domain, 127 A. L. R. 106.

Land left outside of levee, right to compensation, 20 A. L. R. 302.

Landlord and tenant, rights inter se, 53 A. L. R. 686.

Limitation applicable to action or proceeding by owner for compensation where property is taken in exercise of eminent domain without antecedent condemnation proceeding, 123 A. L. R. 676.

Measure and items of compensation or damages for flooding property under the right of eminent domain, 106 A. L. R. 955.

Measure of compensation in condemnation of right to pollute stream, 47 A. L. R. 43.

Measure of damages or compensation where property is taken to widen street, 64 A. L. R. 1513.

Mortgagees' rights, protection in condemnation, 58 A. L. R. 1534.

Profits derived from business conducted on property as evidence of market value, 7 A. L. R. 163.

Protection of rights of mortgagee in eminent domain proceedings, 110 A. L. R. 542.

Provision of lease or statute relating to rights and compensation of lessee, validity, construction, and effect, 98 A. L. R. 254.

Public property taken for another public purpose, right to compensation, 56 A. L. R. 365.
Right of court to reduce or increase award in condemnation and confirm it as reduced or increased, 61 A. L. R. 194.
Right of owner of fee burdened with easement in nature of street, private or public, to compensation on condemnation of property for public street, 17 A. L. R. 1249.
Right of tenant to remove buildings or other fixtures as affecting his right to compensation in respect to such improvements in condemnation proceeding, 75 A. L. R. 1495.
Right to compensation in eminent domain on basis of entire extent of property or complete use ultimately contemplated in excess of present requirements, 75 A. L. R. 855.
Right to have view by jury in condemnation proceedings, 103 A. L. R. 163.
Right under constitutional provision against taking or damaging, to recover in other than an eminent domain proceeding, for consequential damages to property no part of which is taken, 20 A. L. R. 516.
Riparian rights, compensation for actual or potential value, 58 A. L. R. 796.
Special value or adaptability of property for purpose for which it is taken, as an element of, or matter for consideration in fixing, damages in condemnation proceedings, 124 A. L. R. 910.
Street widening, measure of damages or compensation, 64 A. L. R. 1513.
Temporary appropriation of or injury to real property by municipality or other public authority, measure of damages, 87 A. L. R. 1384.
Temporary conditions incident to public improvement, damage from as taking or damaging property within constitutional provisions, 98 A. L. R. 956.
Tenant's expense in removing fixtures or personal property, compensation for, 34 A. L. R. 1523.

104-61-12. Id. When Right to, Deemed to Have Accrued.

For the purpose of assessing compensation and damages, the right thereto shall be deemed to have accrued at the date of the service of summons, and its actual value at that date shall be the measure of compensation for all property to be actually taken, and the basis of damages to property not actually taken, but injuriously affected, in all cases where such damages are allowed, as provided in the next preceding section. No improvements put upon the property subsequent to the date of service of summons shall be included in the assessment of compensation or damages. (C. L. 17, § 7341.)

History.

This section is practically identical with 2 Comp. Laws 1888, § 3852. Other predecessor sections, see R. S. 1898, § 3599; Comp. Laws 1907, § 3599.

Comparable provisions.

Cal. Civil Proc. Code, § 1249 (includes provision identical with first sentence herein, except as being worded in part: * * * accrued at the date of the issuance of summons * * *").

Idaho Code, § 13-712 (substantially identical; "* * * to have accrued at the date of the summons * * *").

Mont. Rev. Codes, § 9945 (similar).

1. Time as of which value and damages to be determined.

In condemnation of water right of way, value and damages should be measured as of time of service of summons, subject to proof that value or damages, either or both, have been lost as result of the condemnation. Hyde Park Town v. Chambers, 99 U. 118, 104 P.2d 220. (Larson, J., dissenting.)

In proceeding by railroad to condemn land, trial court properly fixed date that landowner's counsel entered voluntary appearance in open court which amounted to general appearance as time for determining the value of land taken and the damages to the portion not taken. Ogden L. & I. Ry. Co. v. Jones, 51 U. 62, 168 P. 548.

If condemnation proceedings are instituted against trustee in deed of trust and summons is served upon him, and afterwards real owners enter their appearance and waive summons, the measure of damages is value of land at time of entry of appearance, and not at date of summons issued against trustee. Oregon Short Line & U. N. Ry. Co. v. Mitchell, 7 U. 505, 27 P. 693, applying 2 Comp. Laws 1888, § 3852.

A. L. R. notes.

Interest on damages for period before judgment for injury to, or detention, loss, or destruction of, property, 111 A. L. R. 1299; right to compensation for improvements made under authority, or

color thereof, by body having power of eminent domain, before exercise of that power, 34 A. L. R. 1082; right to interest in condemnation proceedings during owner's retention of possession, 32 A. L. R. 98.

104–61–13. When Title Sought Found Defective—Another Action Allowed.

If the title attempted to be acquired is found to be defective from any cause, the plaintiff may again institute proceedings to acquire the same as in this chapter prescribed. (C. L. 17, § 7342.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3853. Other predecessor sections, see R. S. 1898, § 3600; Comp. Laws 1907, § 3600.

Comparable provisions.
Cal. Civil Proc. Code, § 1250, Idaho Code, § 13–713, Mont. Rev. Codes, § 9948 (identical).

104–61–14. Payment of Award—Bond from Railroad to Secure Fencing.

The plaintiff must, within thirty days after final judgment, pay the sum of money assessed; and, if the plaintiff is a railroad company, it shall also execute to the defendant a bond, with sureties, to be determined and approved by the court or judge, conditioned that the plaintiff will build proper fences within six months from the time the railroad is built on or over the land taken. In an action on the bond all damages sustained and the cost of the construction of such fences may be recovered. (C. L. 17, § 7343.)

History.
This section was 2 Comp. Laws 1888, § 3854. Other predecessor sections, see R. S. 1898, § 3601; Comp. Laws 1907, § 3601.

104–61–15. Id. Execution for—Annulment of Proceedings on Failure to Pay.

Payment may be made to the defendants entitled thereto, or the money may be deposited in court for the defendants and distributed to those entitled thereto. If the money is not so paid or deposited, the defendants may have execution as in civil cases; and if the money cannot be made on execution, the court upon a showing to that effect must set aside and annul the entire proceedings, and restore possession of the property to the defendants, if possession has been taken by the plaintiff. (C. L. 17, § 7344.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3855. Other predecessor sections, see R. S. 1898, § 3602; Comp. Laws 1907, § 3602.

Comparable provisions.
Cal. Civil Proc. Code, § 1252, Idaho Code, § 13–715, Mont. Rev. Codes, § 9950 (substantially identical).

1. Enforcement of judgment or order.
The enforcement of a judgment or order entered in a condemnation proceeding may be compelled by mandamus. Ketchum Coal Co. v. Christensen, 48 U. 214, 159 P. 541; Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737, 4 A. L. R. 619.

Though form of proceeding may be one to punish for contempt of court, yet court may look beyond form of proceeding, and if sole purpose of application is to enforce order or judgment entered in a condemnation proceeding, it may be so treated. Ketchum Coal Co. v. Christensen, 48 U. 214, 159 P. 541.

Judgment or order entered in condemnation proceedings may be enforced by proceedings in form to punish for contempt of court. Ketchum Coal Co. v. Christensen, 48 U. 214, 159 P. 541;

Ketchum Coal Co v. District Court of Carbon County, 48 U. 342, 159 P. 737, 4 A. L. R. 619.

Decisions from other jurisdictions.

—Federal.

A reading of the entire Idaho statute on the subject of eminent domain gives assurance that constitutional guaranty against taking of private property without just compensation first ascertained and tendered has been reasonably safeguarded. Weiser Valley Land & Water Co. v. Ryan, 190 F. 417.

A. L. R. notes.

Liability upon abandonment of eminent domain proceedings for loss or expenses incurred by property owner, 31 A. L. R. 352.

104–61–16. Judgment of Condemnation—Recordation—Effect.

When payments have been made and the bond given, if the plaintiff elects to give one, as required by the last two preceding sections, the court must make a final judgment of condemnation, which must describe the property condemned and the purpose of such condemnation. A copy of the judgment must be filed in the office of the recorder of the county, and thereupon the property described therein shall vest in the plaintiff for the purpose therein specified. (C. L. 17, § 7345.)

History.

This section is practically identical with 2 Comp. Laws 1888, § 3856. Other predecessor sections, see R. S. 1898, § 3603; Comp. Laws 1907, § 3603.

Comparable provisions.

Cal. Civil Proc. Code, § 1253, Idaho Code, § 13–716, Mont. Rev. Codes, § 9951 (identical; specify "final order" in lieu of "final judgment").

1. Conclusiveness of judgment or order of condemnation.

That plaintiff in proceeding to condemn strip of land had legal right to condemn, and that condemnation was for public use, was settled by lower court's order of condemnation authorizing plaintiff to take possession of and improve strip. Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737, 4 A. L. R. 619.

A. L. R. notes.

Judgment (or final order) affecting title or interest in real property as subject to collateral attack because of insufficiency of description in the pleadings, 111 A. L. R. 1200; right of court to reduce or increase award in condemnation and confirm it as reduced or increased, 61 A. L. R. 194.

104–61–17. Possession by Plaintiff Pending Appeal or Further Proceedings—Deposit—Payment, Effect.

At any time after the entry of judgment, or pending an appeal from the judgment to the supreme court, whenever the plaintiff shall have paid into court for the defendant the full amount of the judgment, and such further sum as may be required by the court as a fund to pay any further damages and costs that may be recovered in said proceedings, as well as all damages that may be sustained by the defendant, if for any cause the property shall not be finally taken for public use, the district court in which the proceeding was tried may, upon notice of not less than ten days, authorize the plaintiff, if already in possession, to continue therein, and if not, then to take possession of and use the property during the pendency of and until the final conclusion of the litigation, and may, if necessary, stay all actions and proceedings against the plaintiff on account thereof. The defendant entitled to the money paid into court for him upon any judgment shall be entitled to demand and receive the same at any time thereafter upon obtaining an order therefor from the court. It shall be the duty of the court or a judge thereof, upon application being made by such defendant, to order

and direct that the money so paid into court for him be delivered to him upon his filing a satisfaction of the judgment, or upon his filing a receipt therefor, and an abandonment of all defenses to the action or proceeding, except as to the amount of damages that he may be entitled to in the event that a new trial shall be granted. A payment to a defendant as aforesaid shall be held to be an abandonment by such defendant of all defenses interposed by him, excepting his claim for greater compensation. (C. L. 17, § 7346.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3857. Other predecessor sections, see R. S. 1898, § 3604; Comp. Laws 1907, § 3604.

Comparable provisions.
Cal. Civil Proc. Code, § 1254, Idaho Code, § 13-717 (include substantially identical provision).

Decisions from other jurisdictions. — California.
Under section 1254 of the Code of Civil Procedure, as expressly provided therein, the money deposited in court must, under order of court, be paid to the defendant upon his filing a satisfaction of the judgment. G. H. Deacon Inv. Co. v. Superior Court of Los Angeles County, 220 Cal. 392, 31 P.2d 372.

A. L. R. notes.
Provisions for taking or retaining possession pending appeal in condemnation proceeding, 55 A. L. R. 201.

104-61-18. Costs.

Costs may be allowed or not, and if allowed, may be apportioned between the parties on the same or adverse sides, in the discretion of the court. (C. L. 17, § 7347.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3858. Other predecessor sections, see R. S. 1898, § 3605; Comp. Laws 1907, § 3605.

Comparable provisions.
Cal. Civil Proc. Code, § 1255, Idaho Code, § 13-718, Mont. Rev. Codes, § 9953 (identical).

Cross-references.
Costs generally, 104-44.

1. "Costs" construed.
"Costs," under this section, includes only those costs which are taxable in an action or proceeding; that is, such costs and fees as are fixed and regulated by statute. McCready v. Rio Grande Western Ry. Co., 30 U. 1, 83 P. 331, 8 Ann. Cas. 732.

2. Allowance and taxation.
If condemner claims ownership, the condemnee may, either by general demurrer or otherwise, admit his claim, and where that is the case, the condemner is entitled to judgment upon the merits, and the condemnee is entitled to go hence with his costs. Ketchum Coal Co. v. District Court, of Carbon County, 48 U. 342, 357, 159 P. 737, 4 A. L. R. 619.

Rule governing allowance and taxation of costs in civil actions must control in proceedings to condemn land. McCready v. Rio Grande Western Ry. Co. 30 U. 1, 83 P. 331, 8 Ann. Cas. 732.

A. L. R. notes.
Liability upon abandonment of eminent domain proceedings for loss or expenses incurred by property owner, 31 A. L. R. 352.

104-61-19. Rights of Cities and Towns Not Affected.

Nothing in this code must be construed to abrogate or repeal any statute providing for the taking of property in any city or town for street purposes. (C. L. 17, § 7349.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3860. Other predecessor sections, see R. S. 1898, § 3607; Comp. Laws 1907, § 3607.

Comparable provisions.
Cal. Civil Proc. Code, § 1263 (identical).
Idaho Code, § 13-720 (includes substantially identical provision).

Mont. Rev. Codes, § 9956 (similar; for the taking of property in any city, town, or county for road or street purposes").

104-61-20. When Right of Way Acquired—Duty of Party Acquiring.

A party obtaining a right of way shall without delay construct such crossings as may be required by the court or judge, and shall keep them and the way itself in good repair. (C. L. 17, § 7350).

History.
Predecessor sections, see R. S. 1898, § 3608; Comp. Laws 1907, § 3608.

1. Railroad crossings.
Where owner's land is divided by construction of a railroad through it, he usually has the right to construct a passageway over or under the road for his convenience in passing from one part of his land to another, which right is usually reserved. Bingham & G. R. Co. v. North Utah Min. Co. of Bingham, 49 U. 125, 162 P. 65.

CHAPTER 62

VOLUNTARY DISSOLUTION OF CORPORATIONS

104-62-1. Application to District Court.
104-62-2. [Id.] Contents.
104-62-3. Id. Authority to Make — Verification.
104-62-4. Notice of Hearing—Publication.
104-62-5. Objections.
104-62-6. Hearings — Notice — Judgment.
104-62-7. Judgment Roll—Appeals.

104-62-1. Application to District Court.

A private corporation may be dissolved by the district court of the county where its office or principal place of business is situated upon its voluntary application for that purpose. (C. L. 17, § 7418.)

History.
This section is practically identical with 2 Comp. Laws 1888, § 3834.

Comparable provisions.
Idaho Code, § 29-301 (identical, except that word "private" is omitted).
Mont. Rev. Codes, § 9922 (identical, except as being worded in part: "A corporation * * * where its principal place of business is situated * * *").

Cross-references.
Receiver may be appointed, 104-20-1, 104-20-2; quo warranto to dissolve corporation, 104-66-12; suspension and liquidation of banks, 7-2; of building and loan associations, 7-5-15; dissolution of co-operative banks, 7-7-23; involuntary dissolution of corporations, 18-1-2, 18-1-3; expiration or forfeiture of charter, 18-1-2; withdrawal of foreign corporation, 104-63.

1. Right to dissolution.
Power to wind up affairs of a corporation and to dissolve it is not one which inheres in the courts; it is dependent upon statute. Union Savings & Investment Co. v. District Court of Salt Lake County, 44 U. 397, 140 P. 221.
There is no statute in this state authorizing courts to dissolve corporations in general without their consent. Union Savings & Investment Co. v. District Court of Salt Lake County, 44 U. 397, 403, 140 P. 221.
Minority stockholders had no power to prevent dissolution of corporation against will of majority. Geddes v. Anaconda Copper Min. Co., 245 F. 225, 243.

2. Effect of dissolution.
Effect of legal dissolution of a corporation is to do away with and terminate the legal entity existing while the corporation was a going concern. Platz v. International Smelting Co., 61 U. 342, 213 P. 187.

3. Sale of all property of corporation.
Sale of all property of corporation will not ipso facto dissolve corporation, since ownership or possession of property is not essential to corporate

Tab 2

THE

COMPILED LAWS

OF THE

STATE OF UTAH

1907

Compiled, annotated, and published by authority
of an act of the Legislature by

JAMES T. HAMMOND,
GRANT H. SMITH,
Compilation Commissioners.

Together with the Constitution of the United States,
the Constitution of the State of Utah, the
Enabling Act, and the Naturali-
zation Laws.

the entry of the judgment, within which time the tenant, or any sub-tenant, or any mortgagee of the term, or other party interested in its continuance, may pay into court for the landlord the amount of the judgment and costs, and thereupon the judgment shall be satisfied, and the tenant be restored to his estate; but if payment, as herein provided, be not made within the five days, the judgment may be enforced for its full amount, and for the possession of the premises. In all other cases the judgment may be enforced immediately.

Cal. C. Civ. P., § 1174*.

Treble damages for forcible entry, etc., § 3510.

A plaintiff in a case for damages for forcible entry or unlawful detainer is entitled to recover treble damages.
Eccles v. U. P. Coal Co., 15 U. 14; 48 P. 148.

3585. Pleadings verified. The complaint and answer must be verified.

Cal. C. Civ. P., § 1175.

Complaint in justice's court to be verified, §§ 3685, 3724.

3586. Appeal within ten days. Undertaking. Stay. Either party may, within ten days, appeal from the judgment rendered. But an appeal by the defendant shall not stay the execution of the judgment, unless, within said ten days, he shall execute and file with the court or justice his undertaking to the plaintiff, with two or more sureties, in an amount to be fixed by the court or justice, but which shall be not less than twice the amount of the judgment and costs, to the effect that, if the judgment appealed from be affirmed or the appeal be dismissed, the appellant will pay the judgment and the costs of appeal, the value of the use and occupation of the property, and damages justly accruing to the plaintiff during the pendency of the appeal. Upon taking the appeal and filing the undertaking, all further proceedings in the case shall be stayed.

Cal. C. Civ. P., § 978*.

Provisions of sections 3747, 3748, made applicable to appeals in forcible entry, etc., proceedings.
Hoffman v. Lewis, 31 U. ——; 87 P. 167.

Appeal in forcible entry, etc., same as in other cases. There is no distinction between an appeal from a judgment rendered by a justice's court in forcible entry and detainer and an appeal from a justice's court in other cases.
Id.

3587. Civil procedure applicable. The provisions of this code, relative to civil actions, appeals, and new trials, so far as they are not inconsistent with the provisions of this chapter, apply to the proceedings mentioned in this chapter.

Cal. C. Civ. P., § 1177*.

CHAPTER 65.

EMINENT DOMAIN.

3588. Exercised in behalf of what uses. Subject to the provisions of this chapter, the right of eminent domain may be exercised in behalf of the following public uses:

1. All public uses authorized by the government of the United States;

2. Public buildings and grounds for the use of the state, and all other public uses authorized by the legislature;

3. Public buildings and grounds for the use of any county, incorporated city or town, or school district; reservoirs, canals, aqueducts, flumes, ditches, or pipes for conducting water for the use of the inhabitants of any county, or incorporated city or town, or for draining any county, or incorporated city

or town; for raising the banks of streams, removing obstructions therefrom, and widening, deepening or straightening their channels; for roads, streets, and alleys, and all other public uses for the benefit of any county, incorporated city or town, or the inhabitants thereof;

4. Wharves, docks, piers, chutes, booms, ferries, bridges, toll roads, by-roads, plank and turnpike roads, roads for transportation by traction engines or road locomotives, roads for logging or lumbering purposes, and railroads and street railways for public transportation;

5. Reservoirs, dams, water-gates, canals, ditches, flumes, tunnels, aqueducts, and pipes for supplying persons, mines, mills, smelters, or other works for the reduction of ores, with water for domestic or other uses, or for irrigating purposes, or for draining and reclaiming lands, or for floating logs and lumber on streams not navigable;

6. Roads, railroads, tramways, tunnels, ditches, flumes, pipes, and dumping places to facilitate the milling, smelting, or other reduction of ores, or the working of mines, quarries, or mineral deposits; outlets, natural or otherwise, for the deposit or conduct of tailings, refuse, or water from mills, smelters, or other works for the reduction of ores, or from mines, quarries, or mineral deposits; mill dams; natural gas or oil pipe lines, tanks, or reservoirs; also an occupancy in common by the owners or possessors of different mines, quarries, mineral deposits, mills, smelters, or other places for the reduction of ores, of any place for the flow, deposit, or conduct of tailings or refuse matter;

7. By-roads leading from highways to residences and farms;

8. Telegraph, telephone, electric light, and electric power lines, and sites for electric light and power plants;

9. Sewerage of any city or town, or of any settlement of not less than ten families, or of any public building belonging to the state, or of any college or university;

10. Canals, reservoirs, dams, ditches, flumes, aqueducts, and pipes for supplying and storing water for the operation of machinery for the purpose of generating and transmitting electricity for power, light, or heat;

11. Cemeteries or public parks;

12. Pipe lines for the purpose of conducting any and all liquids connected with the manufacture of beet sugar. Am'd '01, p. 19; '07, p. 143.

Cal. C. Civ. P., § 1238*. See Sup. (1893) p. 995, and Sup. (1895) p. 33, § 1233*.

Eminent domain for pipes, tanks, etc., for natural gas, § 1552; for right of way for canals, ditches, etc., § 1288x21; for railroads, for right of way and for water, § 434, sub. 3; for drainage district, § 767; for city, for water, § 206x2.

Property and franchises of private corporations subject to eminent domain, Con. art. 12, sec. 11.

Private property shall not be taken or damaged for public use without just compensation, Con. art. 1, sec. 22, and note

No person shall be deprived of property without due process of law, Con. art. 1 sec. 7, and note.

Constitutional limitation on power of eminent domain. Con art. 1, sec. 22, providing that private property shall not be taken or damaged for public use without just compensation, is a limitation on exercise of power of eminent domain.

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Ogden City Railway Company v. Ogden City, 7 U. 207; 26 P. 288.

Condemnation of railroad right of way for a telegraph line. Land which is a part of a railroad's right of way, but not used for any purpose and not essential to the enjoyment of such railroad's franchise and property, may be appropriated to the use of a duly incorporated telegraph company for the purpose of constructing and maintaining its lines, since such appropriation is for a more necessary public use. Measure of damages.

Postal Tel. & C. Co. v. O. S. L R. R. Co, 23 U. 474; 65 P. 735.

A city council cannot authorize a permanent switch track, for a private business only, along a street and across a sidewalk, from a steam railroad in the street, to the detriment of people residing on the street and to the damage of their abutting property; the streets being dedicated to public use.

Cereghino v. O. S. L R. R. Co., 26 U. 467, 73 P. 634.

A party whose property is about to be damaged in a substantial degree for public use is given

same remedies as would be accorded him if his property were actually appropriated for public use.

Stockdale v. R. G. W. Ry. Co., 28 U. 201; 77 P. 849.

Railroad cannot subject private property in a city to burdens to which it will be subjected by running of cars and engines over a switch laid over adjoining property, without proceeding under law of eminent domain.

Id.

CANALS, MINES, ETC.:

Condemnation of public use for another public use. The provisions of this section and §§ 3590, 3596, render, under ordinary circumstances, property appropriated for a public use liable to condemnation for another public use.

Salt Lake City v. Water & El. P. Co., 24 U. 249; 67 P. 672.

On condemning right to connect with city's canal. A proceeding by a power company under the eminent domain statute to obtain the right to connect a flume with a city's canal for purpose of discharging water into it, under the provisions of this section and § 3590, is not a suit to condemn land belonging to the city, and it is not necessary to show, as provided in § 3591, that the use to which it is to be applied by power company is a more necessary public use than that to which the city devotes it. (On rehearing, 25 U. 456; 71 P. 1069.)

Salt Lake City v. Water & El. P. Co., 24 U. 249; 67 P. 672.

Right to enlarge another's irrigation ditch. Property is taken for a public use, within the provision of the constitution declaring that private property shall not be taken for public use without just compensation, when the taking is for use that will promote the public interest, and will tend to develop the resources of the state. In this case a right of way for an irrigation ditch.

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Land condemned for mine tramway. The construction and operation of roads and tramways for the development and working of mines is a public use.

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Change of street grade after once established. Where a street grade was established but not carried into effect, and thereafter buildings were erected, the city was liable for damages resulting from the change of grade. The fact that the improvements were made before the adoption of Con. art. 1, sec. 22, does not relieve liability.

Kimball v. S. L. City, 32 U. ——; 90 P. 395.
Hempstead v. S. L. City, 32 U. ——; 90 P. 397.
Felt v. S. L. City, 32 U. ——; 90 P. 402.

3589. Estates and rights subject to condemnation. The following is a classification of the estates and rights in lands subject to be taken for public use:

1. A fee simple, when taken for public buildings or grounds, or for permanent buildings, for reservoirs and dams, and permanent flooding occasioned thereby, or for an outlet for a flow, or a place for the deposit of debris or tailings of a mine, mill, smelter, or other place for the reduction of ores;

2. An easement, when taken for any other use;

3. The right of entry upon, and occupation of, lands, and the right to take therefrom such earth, gravel, stones, trees, and timber as may be necessary for some public use.

Cal. C. Civ. P., § 1239*.

3590. Property subject to condemnation. The private property which may be taken under this chapter includes:

1. All real property belonging to any person;

2. Lands belonging to the state, or to any county, or incorporated city or town, not appropriated to some public use;

3. Property appropriated to public use; *provided,* that such property shall not be taken unless for a more necessary public use than that to which it has been already appropriated;

4. Franchises for toll roads, toll bridges, ferries, and all other franchises; *provided,* that such franchises shall not be taken unless for free highways, railroads, or other more necessary public use;

5. All rights of way for any and all purposes mentioned in § 3588, and any and all structures and improvements thereon, and the lands held or used in connection therewith, shall be subject to be connected with, crossed, or intersected by any other right of way or improvement or structure thereon; they shall also be subject to a limited use in common with the owners thereof, when necessary; but such uses of crossings, intersections, and connections shall be made in the manner most compatible with the greatest public benefit and the least private injury;

THE

COMPILED LAWS

OF THE

STATE OF UTAH

1907

Compiled, annotated, and published by authority
of an act of the Legislature by

JAMES T. HAMMOND,
GRANT H. SMITH,
Compilation Commissioners.

Together with the Constitution of the United States,
the Constitution of the State of Utah, the
Enabling Act, and the Naturalization Laws.

the entry of the judgment, within which time the tenant, or any sub-tenant, or any mortgagee of the term, or other party interested in its continuance, may pay into court for the landlord the amount of the judgment and costs, and thereupon the judgment shall be satisfied, and the tenant be restored to his estate, but if payment, as herein provided, be not made within the five days, the judgment may be enforced for its full amount, and for the possession of the premises In all other cases the judgment may be enforced immediately.

Cal C Civ P, § 1174*

Treble damages for forcible entry, etc, § 3510

A plaintiff in a case for damages for forcible entry or unlawful detainer is entitled to recover treble damages

Eccles v U P Coal Co, 15 U 14, 48 P 148.

3585. Pleadings verified. The complaint and answer must be verified

Cal C Civ P, § 1175

Complaint in justice's court to be verified, §§ 3685, 3724

3586. Appeal within ten days. Undertaking. Stay. Either party may, within ten days, appeal from the judgment rendered But an appeal by the defendant shall not stay the execution of the judgment, unless, within said ten days, he shall execute and file with the court or justice his undertaking to the plaintiff, with two or more sureties, in an amount to be fixed by the court or justice, but which shall be not less than twice the amount of the judgment and costs, to the effect that, if the judgment appealed from be affirmed or the appeal be dismissed, the appellant will pay the judgment and the costs of appeal, the value of the use and occupation of the property, and damages justly accruing to the plaintiff during the pendency of the appeal. Upon taking the appeal and filing the undertaking, all further proceedings in the case shall be stayed.

Cal C Civ P, § 978*.

Provisions of sections 3747, 3748, made applicable to appeals in forcible entry, etc, proceedings

Hoffman v Lewis, 31 U, ——, 87 P 167

Appeal in forcible entry, etc, same as in other cases There is no distinction between an appeal from a judgment rendered by a justice's court in forcible entry and detainer and an appeal from a justice's court in other cases

Id

3587. Civil procedure applicable. The provisions of this code, relative to civil actions, appeals, and new trials, so far as they are not inconsistent with the provisions of this chapter, apply to the proceedings mentioned in this chapter

Cal C Civ P, § 1177*

CHAPTER 65.

EMINENT DOMAIN.

3588. Exercised in behalf of what uses. Subject to the provisions of this chapter, the right of eminent domain may be exercised in behalf of the following public uses:

1 All public uses authorized by the government of the United States;

2. Public buildings and grounds for the use of the state, and all other public uses authorized by the legislature;

3 Public buildings and grounds for the use of any county, incorporated city or town, or school district, reservoirs, canals, aqueducts, flumes, ditches, or pipes for conducting water for the use of the inhabitants of any county, or incorporated city or town, or for draining any county, or incorporated city

or town; for raising the banks of streams, removing obstructions therefrom, and widening, deepening or straightening their channels; for roads, streets, and alleys, and all other public uses for the benefit of any county, incorporated city or town, or the inhabitants thereof;

4. Wharves, docks, piers, chutes, booms, ferries, bridges, toll roads, by-roads, plank and turnpike roads, roads for transportation by traction engines or road locomotives, roads for logging or lumbering purposes, and railroads and street railways for public transportation;

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6. Roads, railroads, tramways, tunnels, ditches, flumes, pipes, and dumping places to facilitate the milling, smelting, or other reduction of ores, or the working of mines, quarries, or mineral deposits; outlets, natural or otherwise, for the deposit or conduct of tailings, refuse, or water from mills, smelters, or other works for the reduction of ores, or from mines, quarries, or mineral deposits; mill dams; natural gas or oil pipe lines, tanks, or reservoirs; also an occupancy in common by the owners or possessors of different mines, quarries, mineral deposits, mills, smelters, or other places for the reduction of ores, of any place for the flow, deposit, or conduct of tailings or refuse matter;

7. By-roads leading from highways to residences and farms;

8. Telegraph, telephone, electric light, and electric power lines, and sites for electric light and power plants;

9. Sewerage of any city or town, or of any settlement of not less than ten families, or of any public building belonging to the state, or of any college or university;

10. Canals, reservoirs, dams, ditches, flumes, aqueducts, and pipes for supplying and storing water for the operation of machinery for the purpose of generating and transmitting electricity for power, light, or heat;

11. Cemeteries or public parks;

12. Pipe lines for the purpose of conducting any and all liquids connected with the manufacture of beet sugar. Am'd '01, p. 19; '07, p. 143.

b, 13 Cal. C. Civ. P., § 1238*. See Sup. (1893) p. 995, and Sup. (1895) p. 33, § 1233*.

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Property and franchises of private corporations subject to eminent domain, Con. art. 12, sec. 11.

Private property shall not be taken or damaged for public use without just compensation, Con. art. 1, sec. 22, and note

No person shall be deprived of property without due process of law, Con. art. 1 sec. 7, and note.

Constitutional limitation on power of eminent domain. Con. art. 1, sec. 22, providing that private property shall not be taken or damaged for public use without just compensation, is a limitation on exercise of power of eminent domain.

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A city council cannot authorize a permanent switch track, for a private business only, along a street and across a sidewalk, from a steam railroad in the street, to the detriment of people residing on the street and to the damage of their abutting property; the streets being dedicated to public use.

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A party whose property is about to be damaged in a substantial degree for public use is given

same remedies as would be accorded him if his property were actually appropriated for public use.

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CANALS, MINES, ETC.:

Condemnation of public use for another public use. The provisions of this section and §§ 3590, 3596, render, under ordinary circumstances, property appropriated for a public use liable to condemnation for another public use.

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Change of street grade after once established. Where a street grade was established but not carried into effect, and thereafter buildings were erected, the city was liable for damages resulting from the change of grade. The fact that the improvements were made before the adoption of Con. art. 1, sec. 22, does not relieve liability.

Kimball v. S. L. City, 32 U. ——; 90 P. 395.
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Felt v. S. L. City, 32 U. ——; 90 P. 402.

3589. Estates and rights subject to condemnation. The following is a classification of the estates and rights in lands subject to be taken for public use:

1. A fee simple, when taken for public buildings or grounds, or for permanent buildings, for reservoirs and dams, and permanent flooding occasioned thereby, or for an outlet for a flow, or a place for the deposit of debris or tailings of a mine, mill, smelter, or other place for the reduction of ores;

2. An easement, when taken for any other use;

3. The right of entry upon, and occupation of, lands, and the right to take therefrom such earth, gravel, stones, trees, and timber as may be necessary for some public use.

Cal. C. Civ. P., § 1239*.

3590. Property subject to condemnation. The private property which may be taken under this chapter includes:

1. All real property belonging to any person;

2. Lands belonging to the state, or to any county, or incorporated city or town, not appropriated to some public use;

3. Property appropriated to public use; *provided,* that such property shall not be taken unless for a more necessary public use than that to which it has been already appropriated;

4. Franchises for toll roads, toll bridges, ferries, and all other franchises; *provided,* that such franchises shall not be taken unless for free highways, railroads, or other more necessary public use;

5. All rights of way for any and all purposes mentioned in § 3588, and any and all structures and improvements thereon, and the lands held or used in connection therewith, shall be subject to be connected with, crossed, or intersected by any other right of way or improvement or structure thereon; they shall also be subject to a limited use in common with the owners thereof, when necessary; but such uses of crossings, intersections, and connections shall be made in the manner most compatible with the greatest public benefit and the least private injury;

Tab 3

REVISED
STATUTES OF UTAH
1933

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Authority of an Act of the Legislature
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Together with the Constitution of the United States,
the Constitution of the State of Utah, the Enabling Act,
and the Naturalization Laws of the United States.

shall be restored to his estate; but if payment as herein provided is not made within the five days, the judgment may be enforced for its full amount, and for the possession of the premises. In all other cases the judgment may be enforced immediately. (C. L. 17, § 7324.)

Fees of Sheriff, 28-2-4.
Fees of Constable, 28-3-3.

Damages—Measure of—Element included—What may be trebled. Forrester v. Cook, 77 U. 137, 292 P. 206.
Cannot be recovered unless expressly authorized by statute, only remedy being restitution of premises. Forrester v. Cook, 77 U. 137, 292 P. 206.
Treble in forcible entry and unlawful detainer action. Eccles v. U. P. Coal Co., 15 U. 14, 48 P. 148.

104-60-14. Appeals—Time for — Undertaking —Stay.

Either party may, within ten days, appeal from the judgment rendered. But an appeal by the defendant shall not stay the execution of the judgment, unless within said ten days he shall execute and file with the court or justice his undertaking to the plaintiff, with two or more sureties, in an amount to be fixed by the court or justice, but which shall be not less than twice the amount of the judgment and costs, to the effect, that if the judgment appealed from is affirmed or the appeal is dismissed, the appellant will pay the judgment and the costs of appeal, the value of the use and occupation of the property, and damages justly accruing to the plaintiff during the pendency of the appeal. Upon taking the appeal and filing the undertaking all further proceedings in the case shall be stayed.

(C. L. 17, § 7326.)

Appeal—Time for—The provision prescribing a special time for appeal is valid and the general provision for time of appeal is not applicable. Hunsaker v. Harris, 37 U. 226, 109 P. 1; Murphy v. Paumie, 37 U. 228, 109 P. 2. See also: Ottenheimer v. Mtn. States Supply Co., 56 U. 190, 188 P. 1117.
Effect of counterclaim on special statute relating to time for. Dunbar v. Hansen, 68 U. 398, 250 P. 982.
Special statute does not apply in action for rent. Belnap v. Fox, 69 U. 15, 251 P. 1073.
Bond—Appeals from justice court. Hoffman v. Lewis, 31 U. 179, 87 P. 167.

GENERAL ANNOTATIONS
Election of Remedy—Judgment in suit for rent and in action for possession, how far a bar. Voyles v. Straka, 77 U. 171, 292 P. 913.
Jury Trial—May be demanded. Robertson v. Christensen, 62 U. 159, 218 P. 122. See also: Williams v. Nelson, 65 U. 304, 237 P. 217.
Estoppel—Tenant may not challenge his landlord's title. Williams v. Nelson, 65 U. 304, 237 P. 217.
Injunction—By tenant to restrain action in order to protect and enforce any equity or right he may have in the premises. Dunbar v. Hansen, 68 U. 398, 250 P. 982.
Vendor and Purchaser—Forfeiture of executory cotract and suit for possession—Damages—Attorney's fees. Forrester v. Cook, 77 U. 137, 292 P. 206.

CHAPTER 61

EMINENT DOMAIN

104-61-1. Uses for Which Right May be Exercised.

Subject to the provisions of this chapter, the right of eminent domain may be exercised in behalf of the following public uses:

(1) All public uses authorized by the government of the United States.

(2) Public buildings and grounds for the use of the state, and all other public uses authorized by the legislature.

(3) Public buildings and grounds for the use of any county, city or incorporated town, or board of education; reservoirs, canals, aqueducts, flumes, ditches, or pipes for conducting water for the use of the inhabitants of any county or city or incorporated town, or for the draining of any county, city or incorporated town; the raising of the banks of streams, removing obstructions therefrom, and widening, deepening or straightening their channels; roads, streets and alleys; and all other public uses for the benefit of any county, city or incorporated town, or the inhabitants thereof.

(4) Wharves, docks, piers, chutes, booms, ferries, bridges, toll roads, byroads, plank and turnpike roads, roads for transportation by traction engines or road locomotives, roads for logging or lumbering purposes, and railroads and street railways for public transportation.

(5) Reservoirs, dams, watergates, canals, ditches, flumes, tunnels, aqueducts and pipes for the supplying of persons, mines, mills, smelters or other works for the reduction of ores, with water for domestic or other uses, or for irrigation purposes, or for the draining and reclaiming of lands, or for the floating of logs and lumber on streams not navigable.

(6) Roads, railroads, tramways, tunnels, ditches, flumes, pipes and dumping places to facilitate the milling, smelting or other reduction of ores, or the working of mines, quarries, coal mines or mineral deposits; outlets, natural or otherwise, for the deposit or conduct of tailings, refuse or water from mills, smelters or other works for the reduction of ores, or from mines, quarries, coal mines or mineral deposits; mill dams; gas or oil pipe lines, tanks or reservoirs; also any occupancy in common by the owners or possessors of different mines, quarries, coal mines, mineral deposits, mills, smelters, or other places for the reduction of ores, or any place for the flow, deposit or conduct of tailings or refuse matter.

(7) Byroads leading from highways to residences and farms.

(8) Telegraph, telephone, electric light and electric power lines, and sites for electric light and power plants.

(9) Sewerage of any city or town, or of any settlement of not less than ten families, or of any public building belonging to the state, or of any college or university.

(10) Canals, reservoirs, dams, ditches, flumes, aqueducts and pipes for supplying and storing water for the operation of machinery for the purpose of generating and transmitting electricity for power, light or heat.

(11) Cemeteries and public parks.

(12) Pipe lines for the purpose of conducting any and all liquids connected with the manufacture of beet sugar.

(13) Sites for mills, smelters or other works for the reduction of ores and necessary to the successful operation thereof, including the right to take lands for the discharge and natural distribution of smoke, fumes and dust therefrom, produced by the operation of such works; *provided,* that the powers granted by this subdivision shall not be exercised in any county where the population exceeds twenty thousand, or within one mile of the limits of any city or incorporated town; nor unless the proposed condemner has the right to operate by purchase, option to purchase or easement, at least seventy-five per cent in value of land acreage owned by persons or corporations situated within a radius of four miles from the mill, smelter or other works for the reduction of ores; nor beyond the limits of said four-mile radius; nor as to lands covered by contracts, easements or agreements existing between the condemner and the owner of land within said limit and providing for the operation of such mill, smelter or other works for the reduction of ores; nor until an action shall have been commenced to restrain the operation of such mill, smelter or other works for the reduction of ores. (C. L. 17, § 7330.)

No person shall be deprived of property without due process of law, Const Art. 1, Sec. 7.

Private property shall not be taken or damaged for public use without just compensation, Const. Art. 1, Sec. 22.

Property and franchises of private corporations subject to eminent domain, Const. Art. 12, Sec. 11.

County Commissioners to exercise for state roads, 36-2-6.

Roads crossing patented lands, 36-1-10.

By city or town for water, waterworks system and water supply, 15-7-4.

Mosquito abatement districts may exercise, 56-0-8.

Condemnation by foreign corporation, 18-8-6.

Right of entry by railroads, 77-0-5 (3).

For airports and landing fields, 4-0-17, 4-0-18.

For ditches and reservoirs, 100-1-6.

Constitution, Art. 1, Sec. 22, providing that private property shall not be taken or damaged for public use, without just compensation, is a limitation on exercise of power of eminent domain. Kimball v. Grantsville City, 19 U. 368, 57 P. 1.

Nature of Proceedings—Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737; International Smelting Co. v. Tooele County, 54 U. 591, 182 P. 841.

Statutes—Should be liberally construed. Monetaire M. Co. v. Columbia Rexall Consolidated Mines Co., 53 U. 413, 174 P. 172.

Courts—Jurisdiction sufficient to dispose of all issues legal and equitable. Ketchum Coal Co. v. District Court of Carbon County, 48 U. 342, 159 P. 737.

Injunction—Unless eminent domain be resorted to. Stockdale v. Rio Grande Western Ry. Co., 28 U. 201, 77 P. 849.

Waiver of Tort and Suit for Compensation—Salt Lake Investment Co. v. O. S. L. Ry Co., 46 U. 203, 148 P. 439.

Exercise of power by State—State may, under police power, reasonably regulate use of property, but may not, without compensation, deprive owner of all reasonable use thereof. Bountiful City v. De Luca, 77 U. 107, 292 P. 194.

Municipal Corporations—Statutory procedure must be strictly followed—Ordinance Necessary. Town of Tremonton v. Johnston, 49 U. 307, 164 P. 190.

Waters. Town of Tremonton v. Johnston, 49 U. 307, 164 P. 190; Salt Lake City v. East Jordan Irrigation Co, 40 U. 126, 121 P. 592, 9 A. L. R. 583.

Electricity—Right of way for pole line. Telluride Power Co. v. Bruneau, 41 U. 4, 125 P. 399, 49 A. L. R. 692.

Highways—May be vacated by condemnation—Compensation only to those showing special interest. Tuttle v. Sowadzki, 41 U. 501, 126 P. 959.

Mines—For roads and tramways. Highland Boy M. Co. v. Strickley, 28 U. 215, 78 P. 296, 1 L. R. A. ns. 976, 54 A. L. R. 7.

A public use which can be furthered by exercise of the right of eminent domain. Monetaire M. Co. v. Columbus Rexall Consolidated Mines Co., 53 U. 413, 174 P. 172.

Tunnels—Joint use with owner. Montaire M Co. v. Columbus Rexall Consolidated Mines Co., 53 U. 413, 174 P. 172.

For right of way for ditch to collect and divert waters percolating through an ore dump and carrying minerals in solution. Utah Copper Co. v. Montana-Bingham Consol. Mining Co., 69 U. 423, 255 P. 672.

Coal Mining—Tipple sites. Ketchum Coal Co. v. Pleasant Valley Coal Co., 50 U. 395, 168 P. 86.

Interference with railroad. Ketchum Coal Co. v. Pleasant Valley Coal Co., 50 U. 395, 168 P. 86.

Railroads—Spur track to car barns. Whitmeyer v. S. L. & O. Ry. Co., 46 U. 491, 151 P. 48.

Joint use of right of way. Ketchum Coal Co. v. Pleasant Valley Coal Co., 50 U. 395, 168 P. 86. See also: Bingham & Garfield R. Co. v. No. Utah Mining Co. of Bingham, 49 U. 125, 162 P. 65.

Railroad condemning school property—S. P., L. A. & S. L. R. Co. v. Board of Education, 32 U. 305, 90 P. 565.

Telegraphs and Telephones—Right of way on railroad right of way. Postal Tel. Cable Co. v. O. S. L. R. Co., 23 U. 474, 65 P. 735.

Damages nominal. Postal Tel. Cable Co. v. O. S. L. Ry. Co., 23 U. 474, 65 P. 735.

Waters—Canals—A public use. Salt Lake City v. East Jordan Irrigation Co., 40 U. 126, 121 P. 592; Tanner v. Provo Bench Canal & Irrigation Co., 40 U. 105, 121 P. 584. See also: Whiterocks Irrigation Co. v. Mooseman, 45 U. 79, 141 P. 459, 239 U. S. 323.

Enlargement. Salt Lake City v. East Jordan Irigation Co., 40 U. 126, 121 P. 592; Tanner v. Provo Bench Canal & Irrigation Co., 40 U. 105, 121 P. 584.

Resulting damages from seepage. Utah Lake Irrigation Co. v. Jensen, 49 U. 19, 161 P. 677.

For irrigation ditches. Nash v. Clark, 27 U. 158, 75 P. 371, 1 L. R. A. ns. 208, 27 A. L. R. 519, 54 A. L. R. 1, 9 A. L. R. 583.

For use of flume. S. L. C. Water & Electrical Power Co. v. Salt Lake City, 25 U. 441, 71 P. 1067.

Municipal Corporations—Town of Tremonton v. Johnston, 49 U. 307, 164 P. 190; Salt Lake City v. East Jordan Irrigation Co., 40 U. 126, 121 P. 592.

Reservoir—Cannot be impressed with burden of common reservoir in suit to quiet title. Gunnison Irrigation Co. v. Gunnison Highland Canal Co., 52 U. 347, 174 P. 852.

104-61-2. Estates and Rights That May be Taken.

The following is a classification of the estates and rights in lands subject to be taken for public use:

(1) A fee simple, when taken for public buildings or grounds or for permanent buildings, for reservoirs and dams and permanent flooding occasioned thereby, or for an outlet for a flow, or a place for the deposit, of debris or tailings of a mine, mill, smelter or other place for the reduction of ores; *provided,* that where surface ground is underlaid with minerals, coal or other deposits sufficiently valuable to justify extraction, only a perpetual easement may be taken over the surface ground over such deposits.

(2) An easement, when taken for any other use.

(3) The right of entry upon, and occupation of, lands, with the right to take therefrom such earth, gravel, stones, trees and timber as may be necessary for some public use.

(L. 19, p. 346, § 7331.)

Easement on easement. Whiterocks Irr. Co. v. Mooseman, 45 U. 79, 141 P. 459; Montaire M. Co. v. Columbus Rexall Consolidated Mines Co., 53 U. 413, 174 P. 172. See also: Tanner v. Provo Bench Canal & Irr. Co., 40 U. 105, 121 P. 584; Salt Lake City v. East Jordan Irrigation Co., 40 U. 126, 121 P. 592.

Tab 4

GEOLOGICAL POSITION OF TEST WELLS DRILLED IN EASTERN UTAH OIL FIELDS

By H. D. Heist*

In the geological column here presented it is the intention to show the geological position of the principal test oil wells drilled in eastern Utah.

On account of the great variance in thickness and character of the several formations shown, the column in a sense is a theoretical one. The Tertiary and Cretaceous measures are according to measurement made on the face of the Book Cliffs by Lupton.

The information regarding the coal found in the Ferron and Dakota sands of the Lower Cretaceous was obtained from the log of the Ohio Oil Company well at Huntington, Emery county, Utah.

No coal is found in these formations where they outcrop on that continuous escarpment beginning east of Ferron and running in a curved line past Farnham to Green River.

The Emery coal field at the south end of Castle Valley is in the Ferron sandstone, which sand is about 75 feet thick at Farnham and about 800 feet in the coal field.

This Ferron sandstone is equivalent to the Wall Creek of Salt Creek, Wyoming, and for this reason was the objective of the Ohio Oil company test at Huntington.

The Jurassic formation on the column is, according to measurements made in the vicinity of the San Rafael swell; about 3000 feet are shown.

The Triassic series is thinner in the Castle Valley section than in southeastern Utah and the measurement as shown on the column was made in the vicinity of the San Rafael Swell, where about 800 feet is the thickness.

The upper part, Chinle in the Castle Valley area, is about 300 feet thick, this correlates with the Dolores shale of the San Juan region where it exceeds 1300 feet in thickness.

The underlying Shinarump Conglomerate, is a very uniform member, from 80 to 100 feet in thickness, wherever exposed in the vicinity of the Wasatch Plateau, which in the San Juan region is known as the Oljato and DeChelly sandstone and varies in thickness from 20 to 382 feet.

The formations lying below the Shinarump are the ones interesting to the oil geologist, as in these measures the many saturated oil sands of eastern Utah are found.

The column shows about 400 feet as measured in the escarpment of the San Rafael Swell and also shows where outcrops of oil sands occur.

There is a great difference of opinion as to geological classification of this measure and for this reason the term Moencopi was coined by L. F. Ward in the Navajo reservation, while Gregory places it on the Permian. On the column both names are used as on the San Rafael Swell it has been customary to name the upper 200 feet Moencopie and the lower 200 feet Permo-Carboniferous on account of the sharp lithologic break, which is very prominent in the San Juan country, where the upper measure is about 1260 feet in thickness and the lower measure, known as the Goodridge, over 1500 feet in thickness.

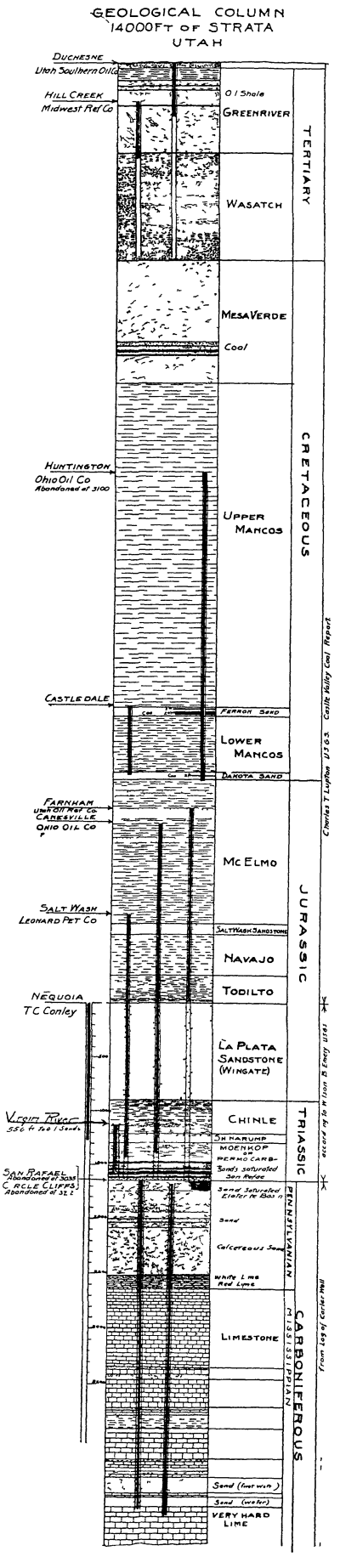
Referring now to the column, it will be noted that the oil horizon above referred to is the only horizon from which commercial oil has ever been produced in Utah, as the Virgin River oil field has produced oil from it for the past 15 years, and the San Juan oil field for about 20 years. It also is the objective of the wells now drilling on the Farnham, Cainville, Salt Lake and Nequoita structures shown in the column and the proposed test of the Monutmental Oil Company in the San Juan field, not shown on the column.

The information on the column concerning the Carboniferous formation was obtained from the log of the Carter Oil Company's well on the San Rafael Swell, which shows a preponderance of limestone.

It is evident that there is a decided change in the stratigraphy of this horizon east of the San Rafael Swell as the log of the Big Six well at Moab, after passing through the 800-foot bed of limestone near the top of the formation, has now been drilled into about 1200 feet of carbonaceous shales and, at about 2170 feet, gas and showings of oil are reported. For this reason, it would be an injustice to the Moab field to show this well on the column, as their conditions are entirely different.

The Crescent Eagle well at Crescent, Grand county, is not shown on the column for the reason that the geological conditions are different in that section. This well starts in the Lower Cretaceous. The Ferron member is entirely missing here and in place of it there is a sandstone member about 400 feet from the base of this formation, which is believed to be a reservoir for gas and oil.

The object of this column is to graphically reproduce our eastern Utah strata and to show the position of the well known oil horizon.



*Of Crocker & Heist, civil and mining engineers, Salt Lake City, Utah.

Around the State

At the request of mine operators in Utah, investigations have been made by the bureau of mines regarding the use of delayed-action detonators in coal mines and the installation of 500-volt trolley wires in metal mines.

R. H. Officer & Co., long engaged in the business of conducting an assay and chemical and engineering business in Salt Lake, have filed articles of incorporation. The company has a capital stock of $100,000, divided into 1000 shares having a par value of $100. Incorporators are Marion E. Sears, Stanley C. Sears, Daniel Neill Officer, Rolin F. Officer and Frank B. Stevens.

Lesses operating in the property of the old Scotia Mining Company in the West Tintic district near Jericho, on the Salt Lake Route, are preparing a carload of ore for shipment to a local smelter. Although activity is being conducted on a limited scale, according to C. T. Van Winkle, consulting engineer of the company, conditions prevail in the property which justify a more intensive exploration work.

The Grey Eagle Mining & Milling Company, with a capital stock of $100,000, divided into 1,000,000 shares of a par value of 10 cents, filed articles of incorporation on the 5th. The stock is paid for by the transfer to the company of various mining claims in the Robinson mining district, n White Pine county, Nevada. J. W. Walker, Thomas C. French, J. L. Lynch, John Payne, Samuel Jordan and J B. Budke are incorporators.

The Alta Tunnel & Transportation Company has began he development of the Dutchman fissure at a point 1,500 feet rom the portal of the tunnel. It is confidently expected that mportant disclosures will be made in this fissure before long. Shipments of ore from the stock pile are continuing regularly. There is said to be $6,000 to $8,000 worth of this accumulated ore to be moved before hauling from the mine will again be possible, owing to the accumulated snow near the mine.

A. C. Nebeker, who for the past year has been in charge f the development work at the property of the Zuma company, has resigned in order to devote his attention to his mining claims in the Milford district. Mr. Nebeker is succeeded by Timothy Harrington, who was employed under ack May at the Tintic Standard and who recently has been ssisting Mr. May in leasing operations at the Grand Central mine.

A two days' conference of the Intermountain Electrical ooperative League was held last week at the Newhouse otel. There were eighty-seven electrical men in attendnce, representing all parts of Utah and southern Idaho, the urpose of the meeting being to discuss methods of further evelopment of the electrical industry in the Intermountain rritory. It was decided by a unanimous vote to hold these nferences semi-annually in Salt Lake, and the next meetg was called for early in October.

W. E. Mendenhall, Paul Ramsey and M. W. Morse, ho recently started down the Colorado river on a prosecting trip, were forced to return to Moab owing to the aking boats. The boats were canvass lined, but the mater l was defective to such a degree as to endanger safety. ne men have constructed a wooden boat, sixteen feet long, uipped with a motor and have again started down the eam. As a delay of a week was caused, they will not go far as Lee's Ferry, but will prospect between Moab and e point where the Green river enters the Colorado.

Reports of operations by the Bingham Mines Company, rning and operating the Victoria and the Eagle & Blue ell at Eureka and the Dalton and Lark group and the Yosemite property at Bingham, show that the earnings for the corporation during the year 1921 were $199,208.17. After deducting $77.832.01 for development work at the Dalton and Lark and Victoria mines, a gain of $121,376.16 was left. Dividends of the company received from the Eagle & Blue Bell Mining Company amounting to $42,949.10 brought the total net gain and income for the year to $164,325.26.

A new strike, and one of considerable importance, has been made on the 1875 foot level of the Victoria mine at Tintic. For some time Supt. William Owens has been driving out after this ore, which is a continuation of the deposit from which regular shipments are being made on the levels above. The strike on the 1875 was of course expected but Mr. Owens admits that he cut the deposit a bit sooner than he anticipated. A few days before the values were encountered there was little to indicate the close proximity of the ore.

J. C. McChrystal, manager of the Eureka Mines Company, has forwarded to the shareholders a report of mining operations for the year 1921, together with a financial statement. After detailed information regarding work performed at the property during the year, Mr. McChrystal says that development work is now being carried on on the 1000 and 1100 foot levels on a continuation of the east-west fissure on which a portion of the ore system made from the 900 and 950 foot levels. Both drifts are in mineralized lime and vein matter and the indications of ore are most favorable. Mr. McChrystal says the Eureka Mines showed a small profit for the year and that the outlook is quite promising for 1922.

The May Day Mining & Milling Company, held its first "annual meeting" in three years the other day. George H. Dern, J. C. Dick, George F. Wasson, Sherman Armstrong and August Reeves, were elected directors. The new board organized by electing Geo. H. Dern president, J. C. Dick vice-president, Sherman Armstrong treasurer and A. Reeves secretary. A report submitted by Mr. Dern showed that while the company owed $3,500, there were at present only 375,411 shares of stock outstanding, as against the original issue of 800,000 shares. During the suspension of operations there had accumulated in the workings forty-five to fifty carloads of ore mined by leasers. With resumption of shipments it will take some time to hoist and ship this accumulated ore.

TRADE AND CONSTRUCTION NOTES

The Thomas Electric Repair Co. has moved from 344 S. State St., to 433 S. Main St.

The General Engineering Company have received instructions from the Stargo Mines of Morenci, Ariz., to proceed at once with the design and construction of a 100 ton plant to treat ore from the Stargo Mines at Morenci. Construction work will start at an early date and it is expected that the plant will go into operation next September.

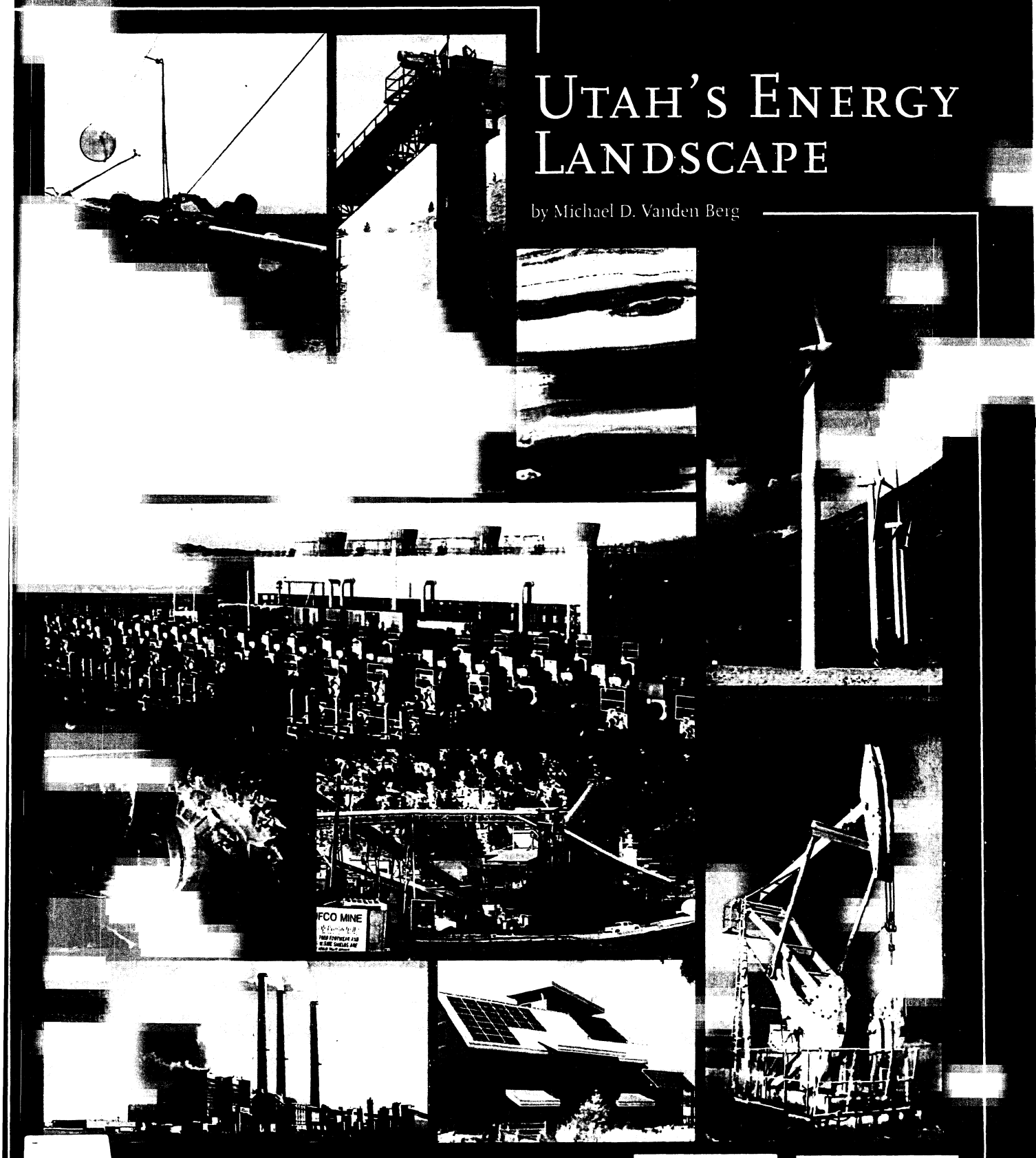
Announcement is made that the plant and interests of the Pelton Water Wheel Co., of San Francisco, has been acquired by the William Cramp & Sons Ship & Engine Building Co., of Philadelphia. The Pelton Water Wheel Co. will continue under the old corporate name, with no material change in policy.

The General Engineering Company of Salt Lake City and 120 Broadway, New York, have been appointed by the Annapolis Lead Company of St. Louis, Mo., their metallurgical engineers in the design and construction of a 500 ton concentrating plant at Annapolis, Mo. The work will be under the personal charge of Mr. C. E. Chaffin, Eastern Manager of the General Engineering Co.

Tab 5

Utah's Energy Landscape

by Michael D. Vanden Berg



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UTAH'S ENERGY LANDSCAPE

by Michael D. Vanden Berg

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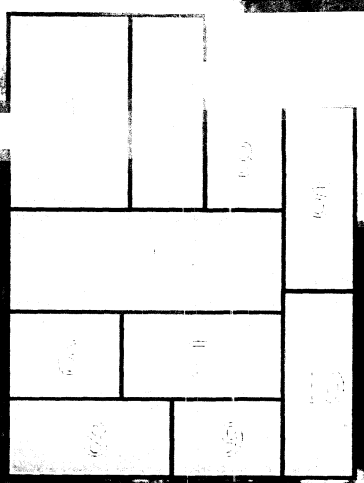

Cover photo captions

1. Utah State Energy Program (USEP) staff constructing a geometer anemometer tower. (Photo by Jason Berry)
2. Coal loadout at the Horizon mine.
3. Utah oil shale sample.
4. The Hatch geothermal electric plant. (Photo courtesy of Raser Technologies)
5. Spanish Fork wind farm.
6. Longwall mining machine at the Deer Creek coal m
7. Coal loadout at the SUFCO mine.
8. Hunter coal-burning power plant.
9. Swaner Nature Center in Park City. (Photo courtesy of Swaner Nature Center)
10. Crude oil pump jack from the Aneth oil field.

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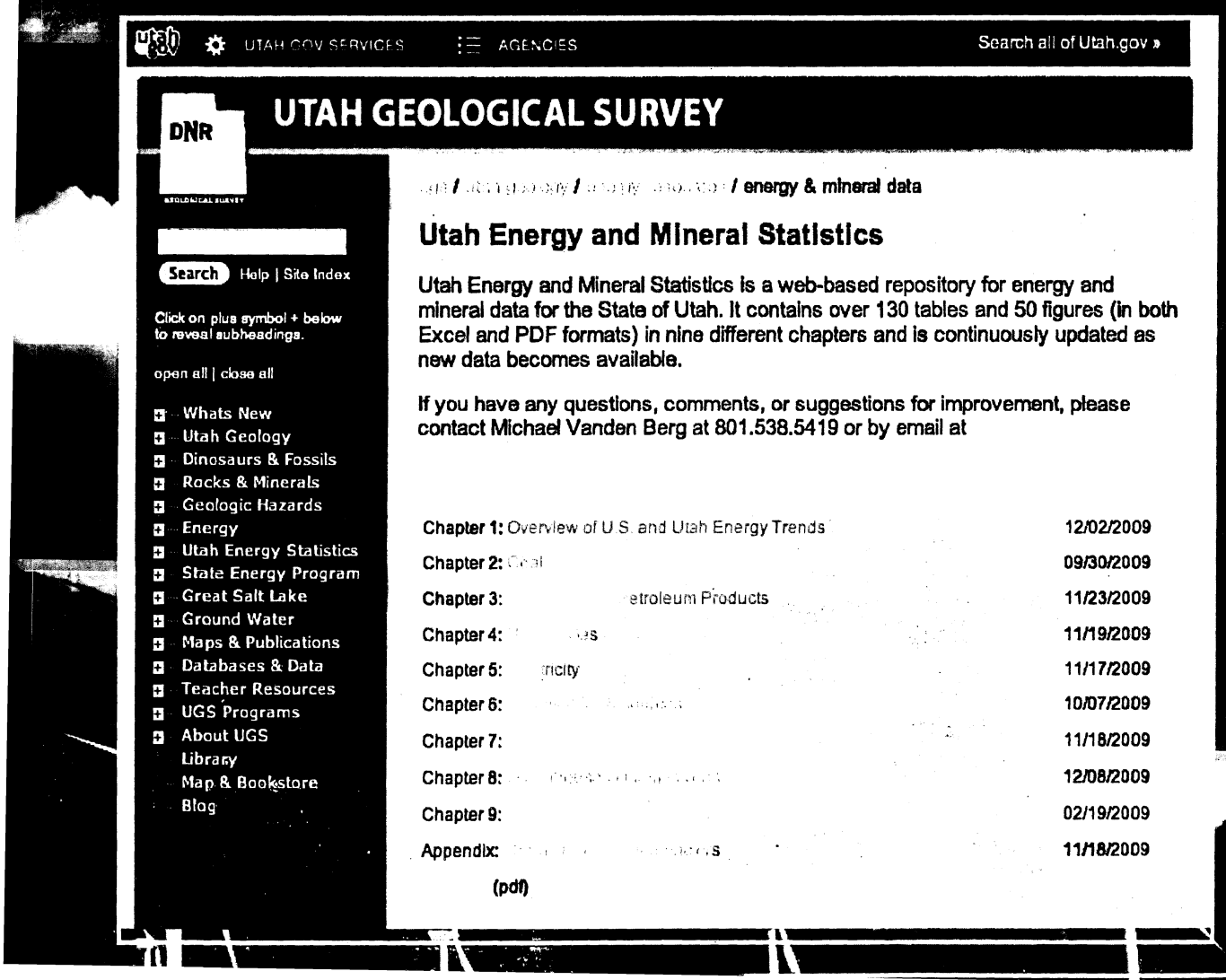
INTRODUCTION

The state of Utah is fortunate to have abundant and diverse energy resources including large reserves of conventional fossil fuels, several areas suitable for renewable resource development, and vast quantities of untapped unconventional fossil fuel energy sources. This publication, Utah's Energy Landscape, was created to offer a complete, visual-based, description of Utah's entire energy portfolio.

The graphs found within this document were created using data compiled by the Utah Geological Survey (UGS) from several different sources, including the U.S. Department of Energy's Energy Information Administration (EIA) and the Utah Division of Oil, Gas, and Mining (DOGM), as well as in-house surveys and conversations with individuals and companies.

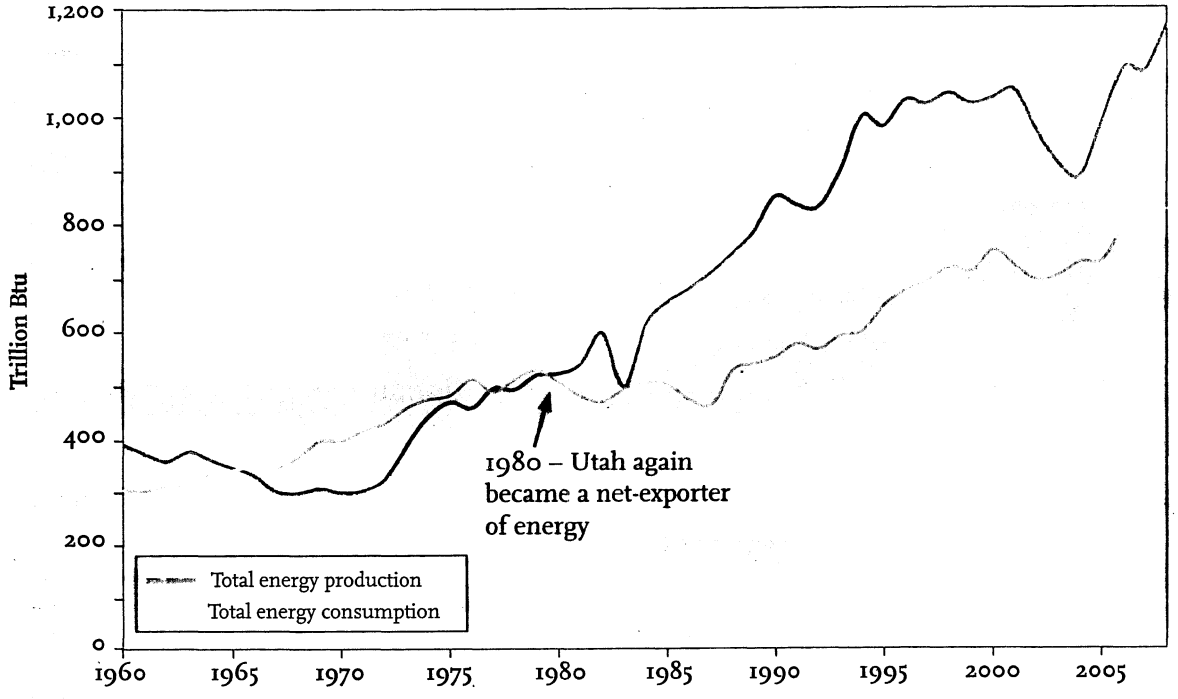
Utah Energy and Mineral Statistics (UEMS) is a Web-based data repository located on the UGS Web site (see screen shot below) and contains all the energy data used to create the graphs contained in this report. Each graph includes a reference table number, indicating where the data can be found and downloaded either as a Microsoft Excel® file or an Adobe® PDF file.

Utah Energy and Mineral Statistics Web page: http://geology.utah.gov/emp/energydata



Overview

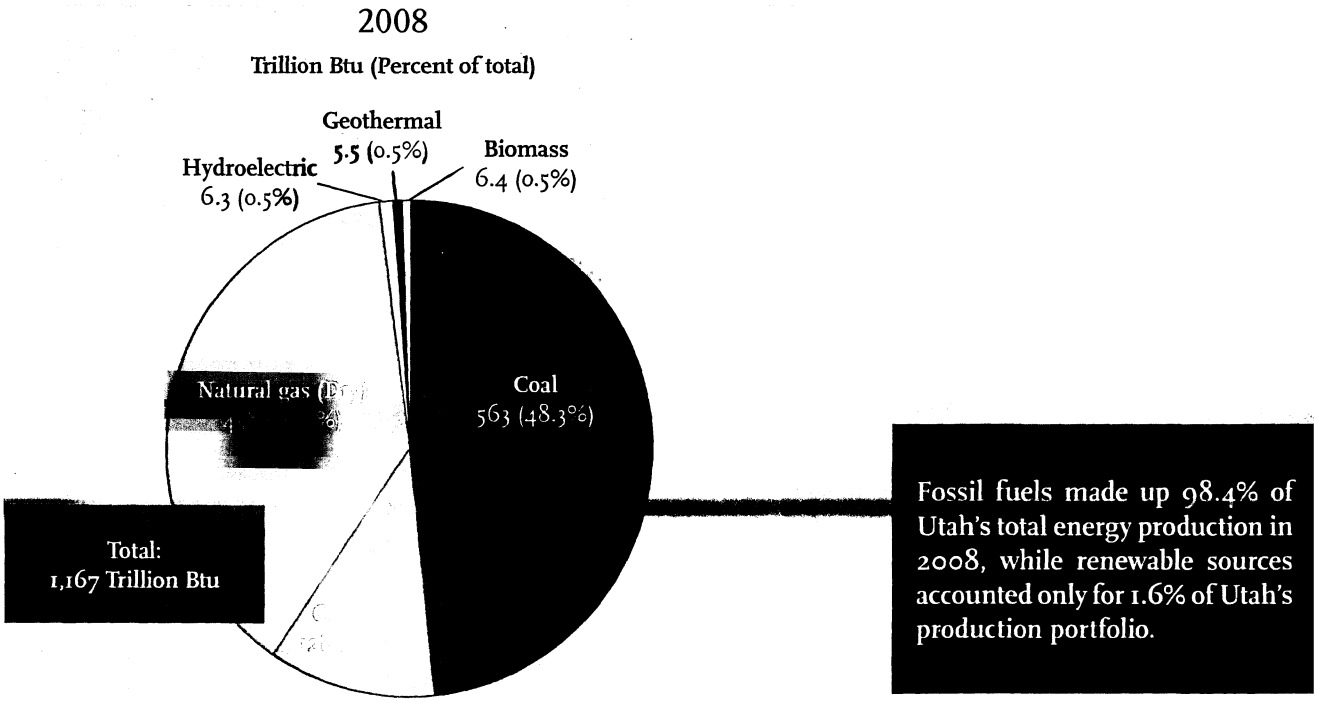
Utah Energy Balance: Production and Consumption, 1960–2008

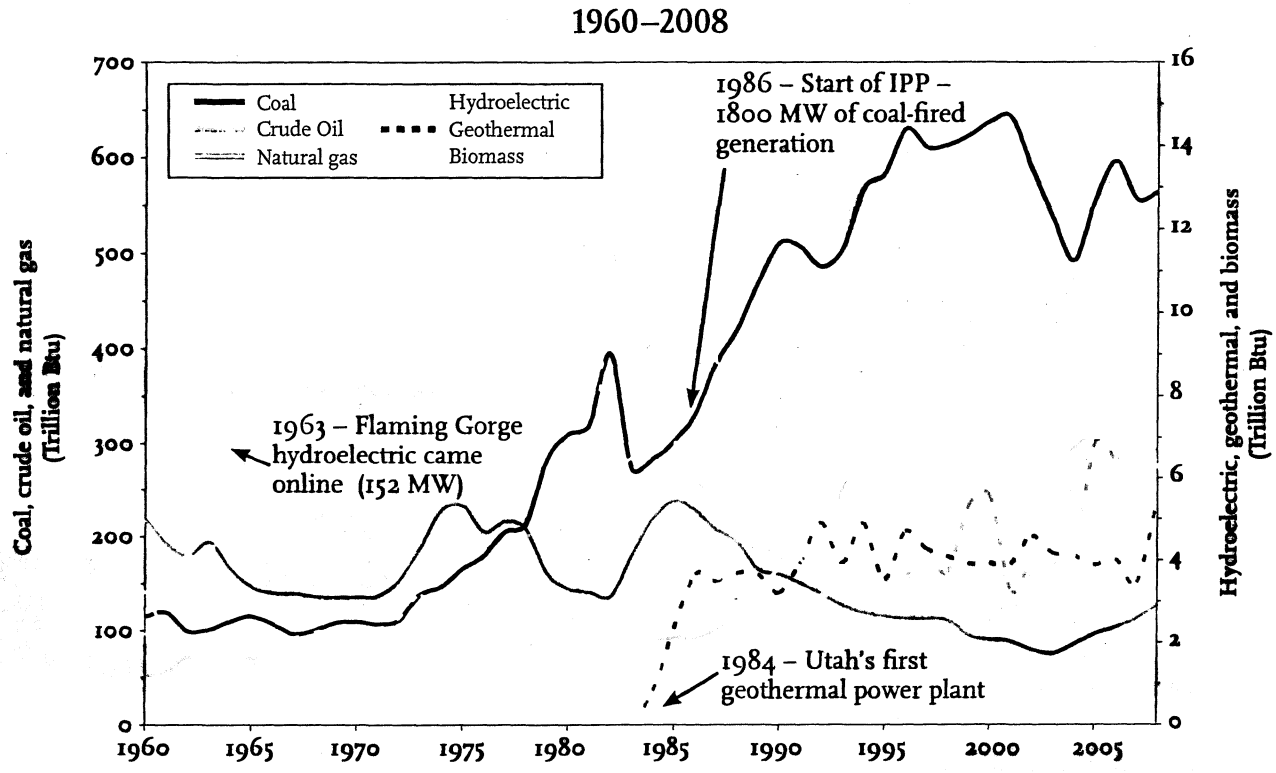


UEMS Web page table: Table 1.4
Source: EIA, UGS
Note: 2008 data is estimated.

Utah produced 29% more energy than it consumed in 2008, making the state a net-energy exporter. The majority of this excess energy was in the form of exported coal and natural gas. Utah also exports significant amounts of electricity, produced from both fossil fuels and renewable sources.

Energy Production in Utah by Source



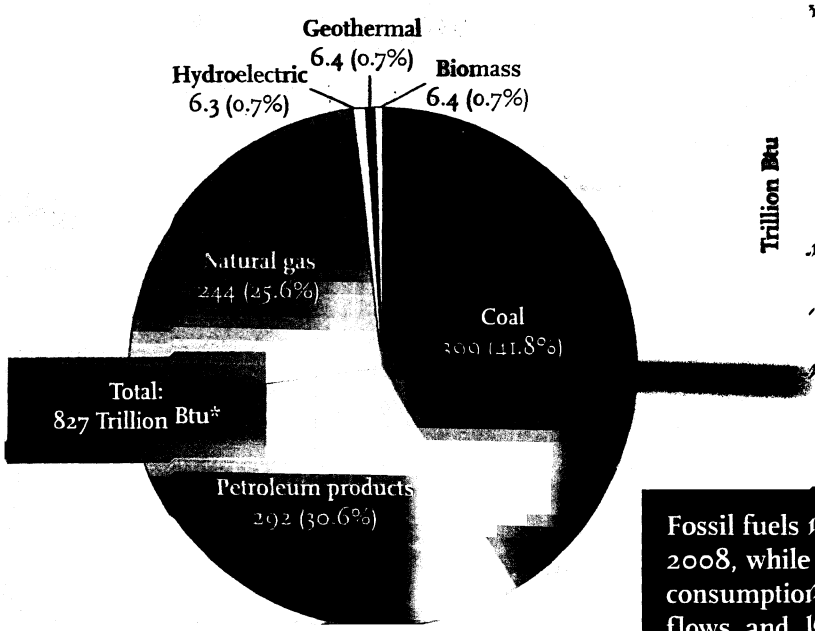


UEMS Web page table: Table 1.8
Source: EIA, UGS
Notes: 2008 data are estimated; production from wind and solar are negligible; IPP=Intermountain Power Project.

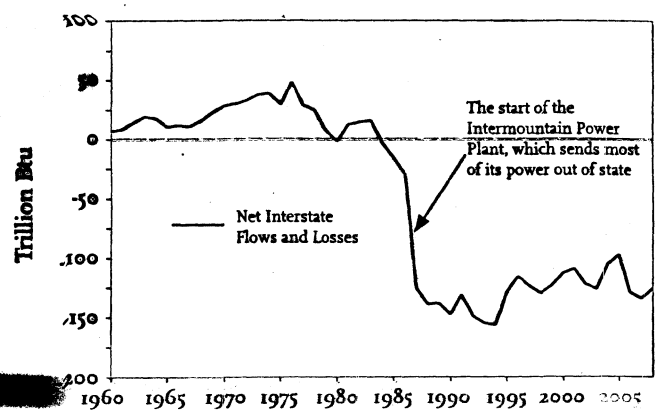
Energy Consumption in Utah by Source

2008

Trillion Btu (Percent of total)

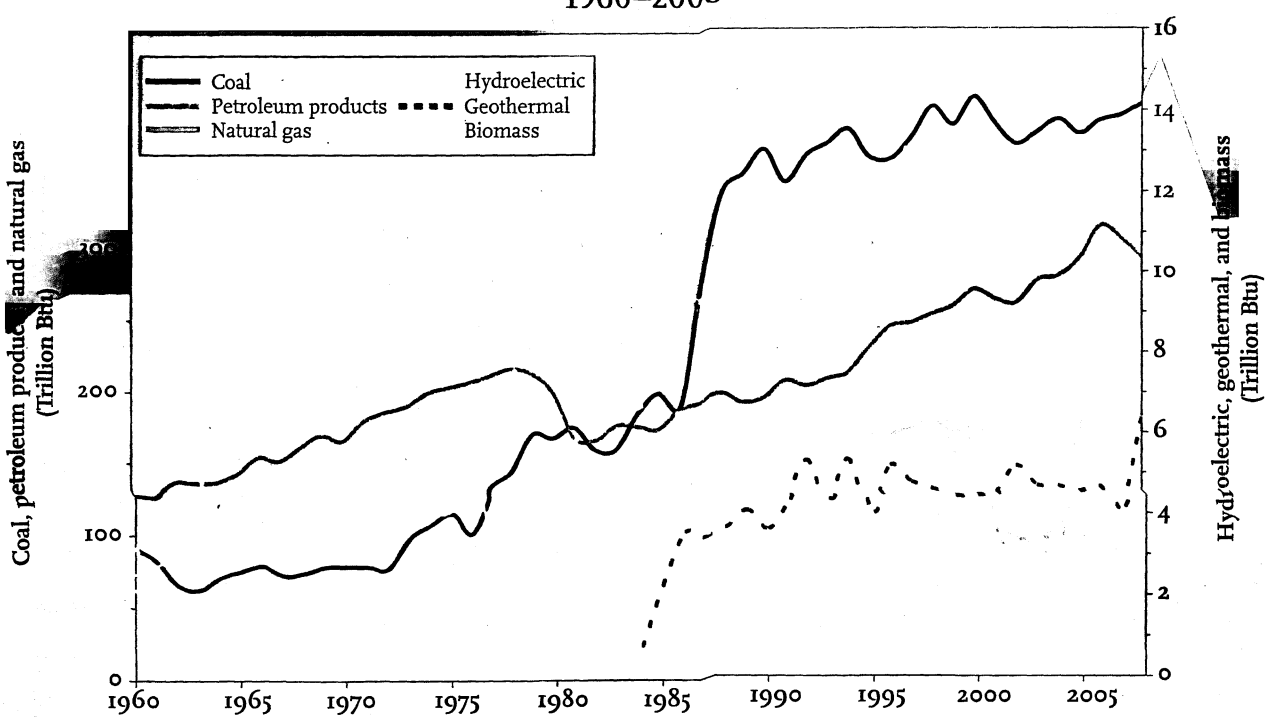


Net Interstate Flows and Losses in Utah, 1960–2008



Fossil fuels made up 98.0% of Utah's total energy consumption in 2008, while renewable sources only accounted for 2.0% of Utah's consumption portfolio. These graphs do not include net interstate flows and losses (see inset graph); Utah exported 127 trillion Btu of electricity (including losses) in 2008, thus reducing total consumption to 827 trillion Btu.

1960–2008



UEMS Web page table: Table 1.14

Source: EIA, UGS

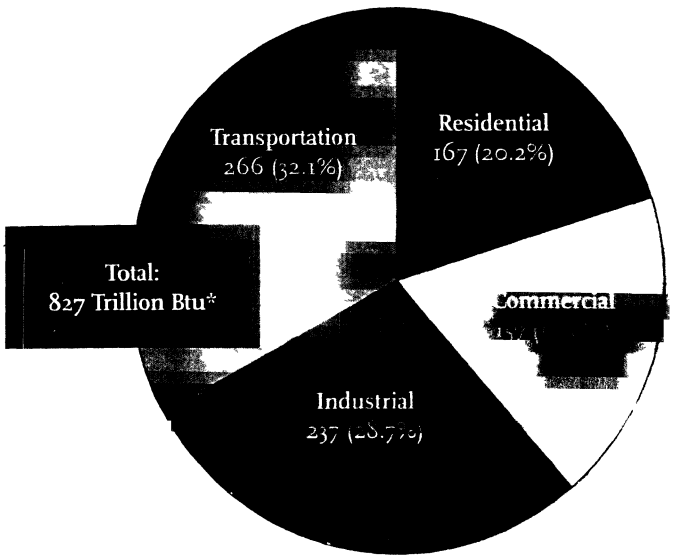
Notes: 2008 data are estimated; consumption from wind and solar are negligible.

**Total includes net interstate flows and losses. Net interstate flow of electricity is the difference between the amount of energy in the electricity sold within a state (including associated losses) and the energy input at the electric utilities within the state. A positive number indicates that more electricity (including associated losses) came into the state than went out of the state during the year; conversely, a negative number indicates that more electricity (including associated losses) went out of the state than came into the state.*

Energy Consumption in Utah by Sector

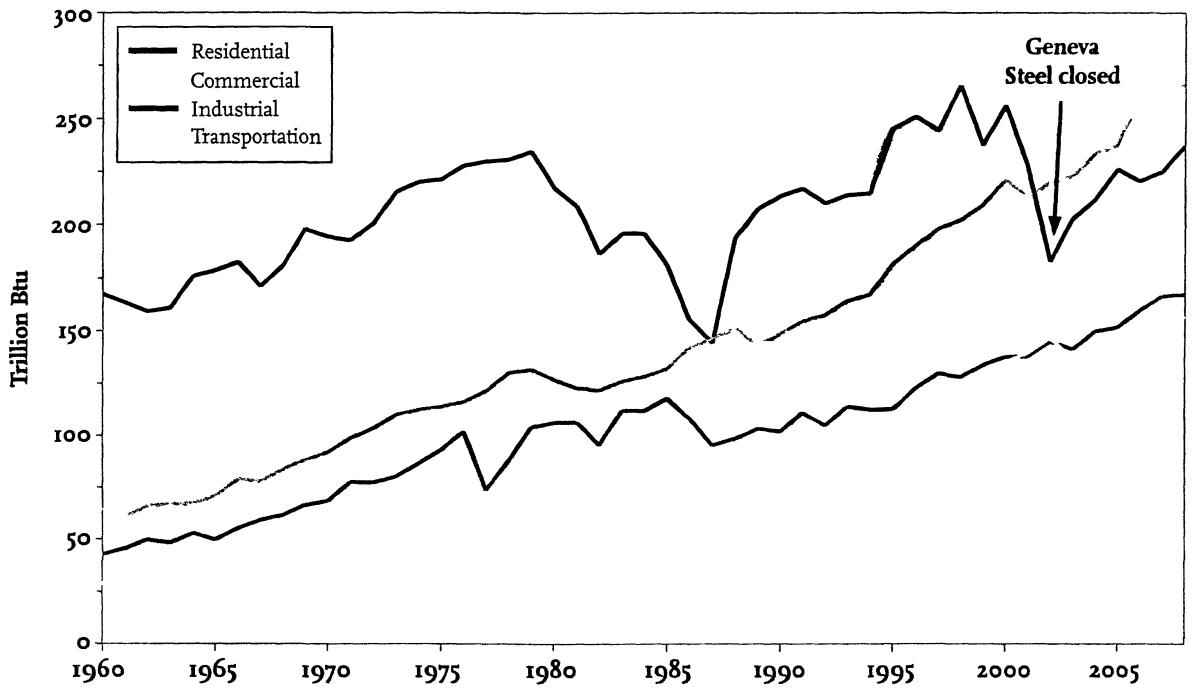
2008

Trillion Btu (Percent of total)



The transportation sector, mostly gasoline and diesel for vehicles, was the largest consumer of energy in Utah in 2008 (32.1%). The residential, commercial, and transportation sectors have all gradually increased over time, consistent with increasing population and increasing energy consumption per capita, while the industrial sector follows a pattern more closely tied to the national economy (e.g., an economy-related dip in the mid-1980s).

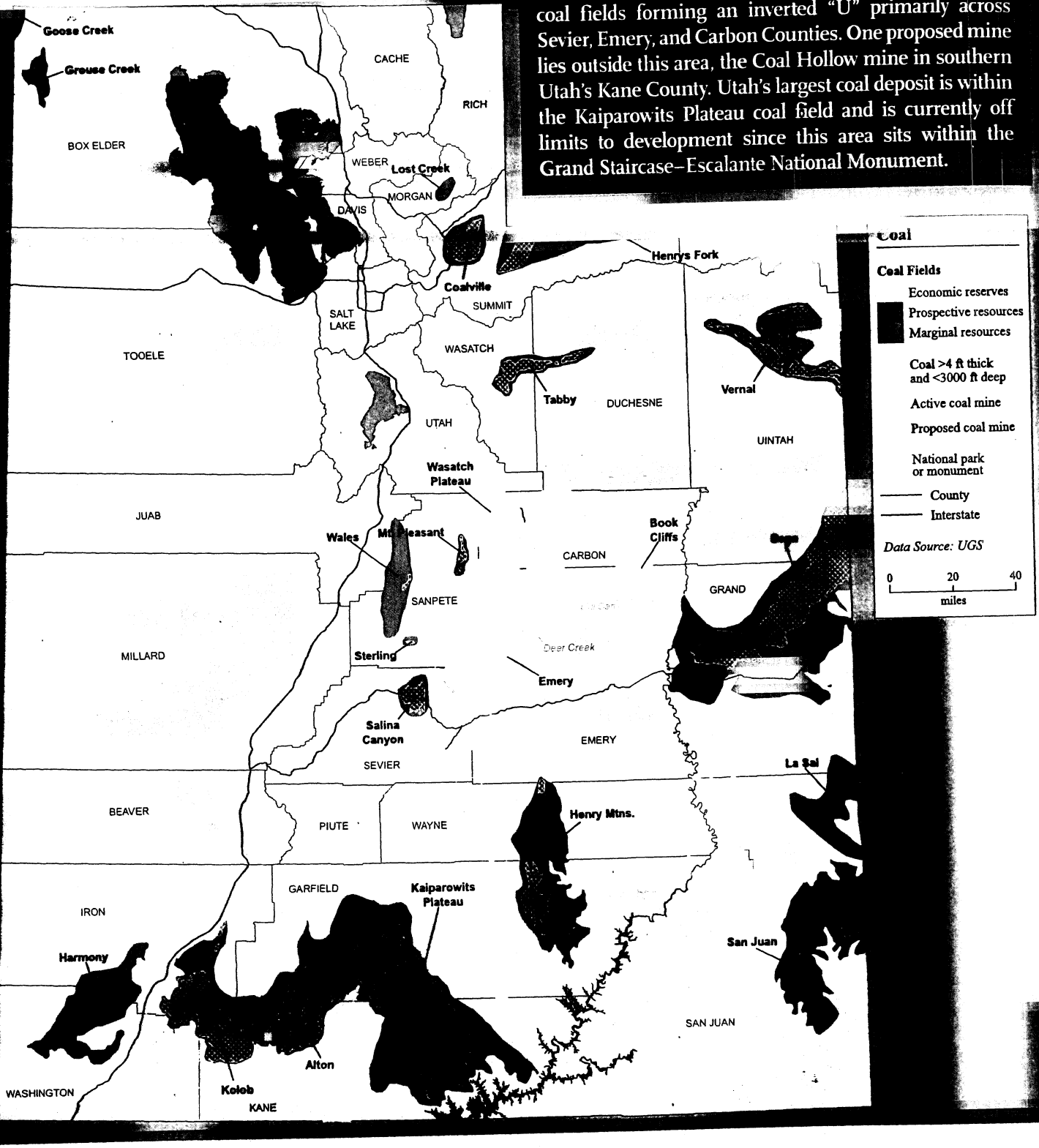
1960–2008



UEMS Web page table: Table 1.16
Source: EIA
Note: 2008 data are estimated
**includes net interstate flows and losses*

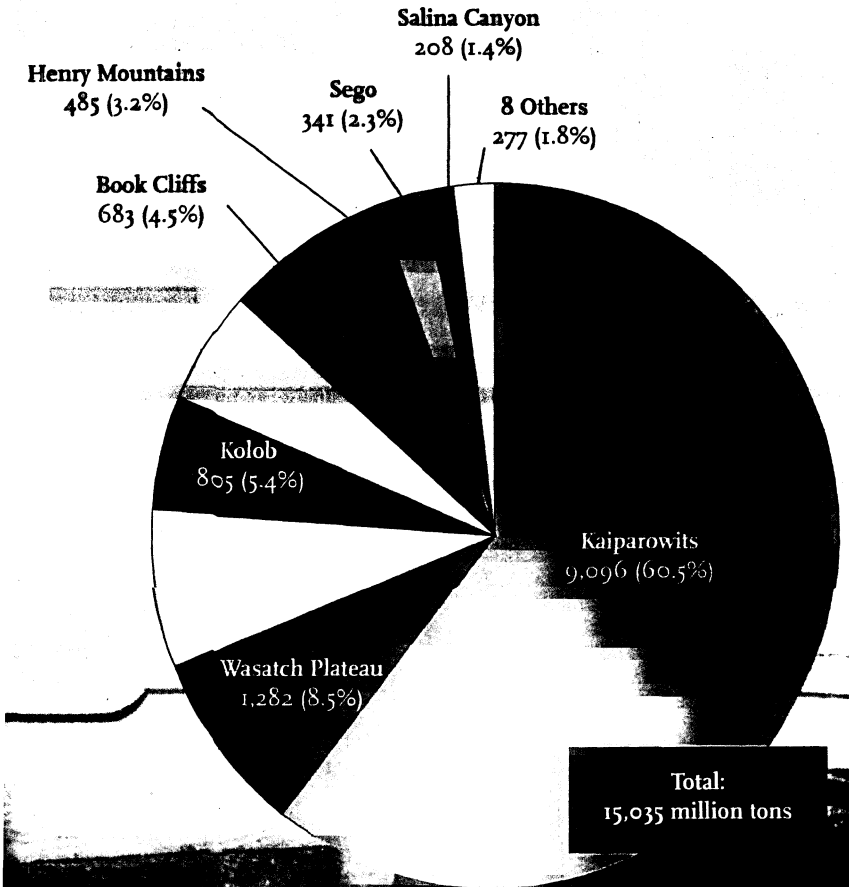
Coal

Utah's most economic coal reserves are located in three coal fields forming an inverted "U" primarily across Sevier, Emery, and Carbon Counties. One proposed mine lies outside this area, the Coal Hollow mine in southern Utah's Kane County. Utah's largest coal deposit is within the Kaiparowits Plateau coal field and is currently off limits to development since this area sits within the Grand Staircase–Escalante National Monument.



Utah's Recoverable Coal Resources by Coal Field, 2008

Million tons (Percent of total)

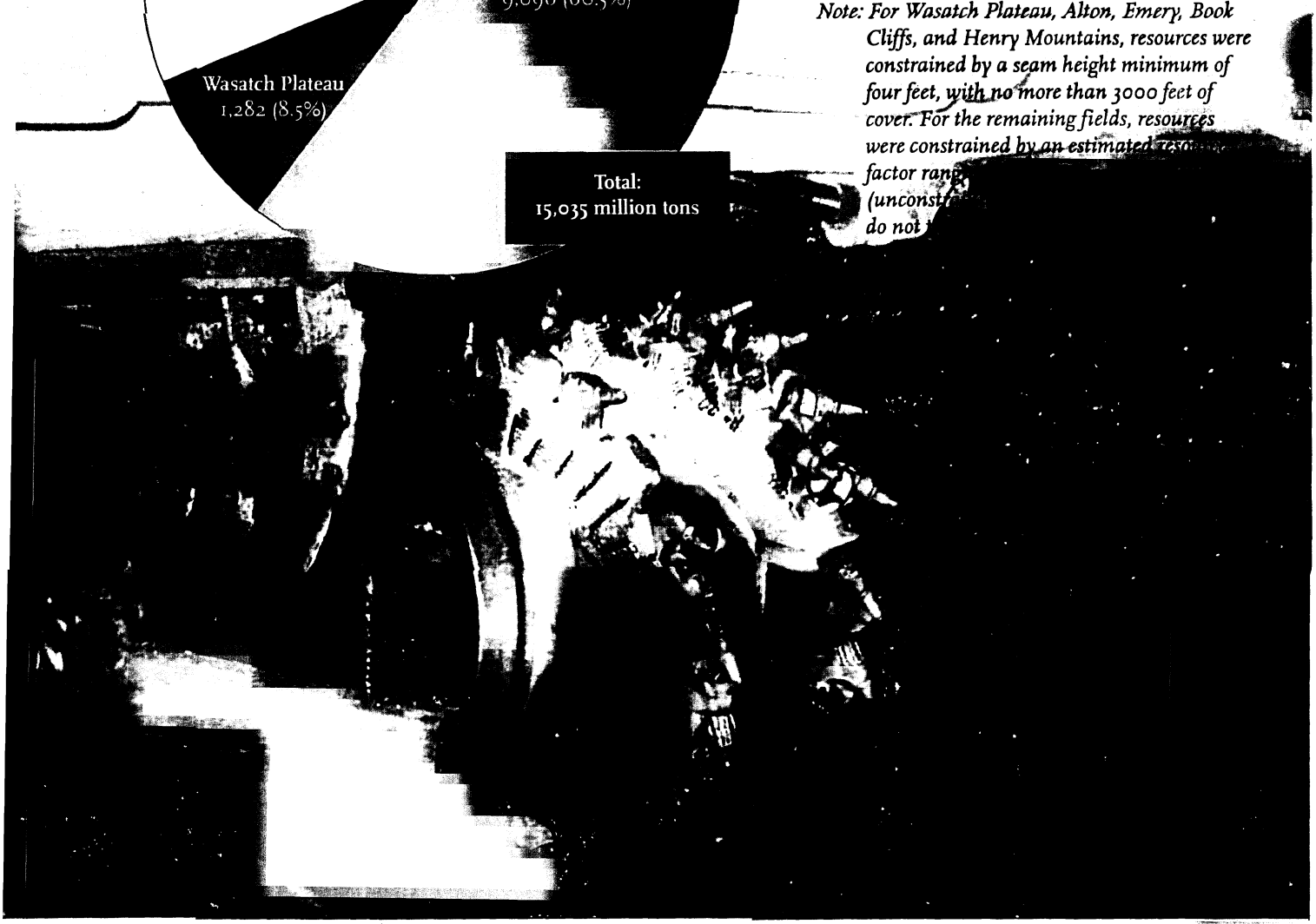


The majority of Utah's recoverable coal resources are located in the Grand Staircase–Escalante National Monument within the Kaiparowits coal field (60.5% of Utah's estimated recoverable coal, as of 2008). Only the Wasatch Plateau, Emery, and Book Cliffs fields currently contain economically recoverable reserves and active mines.

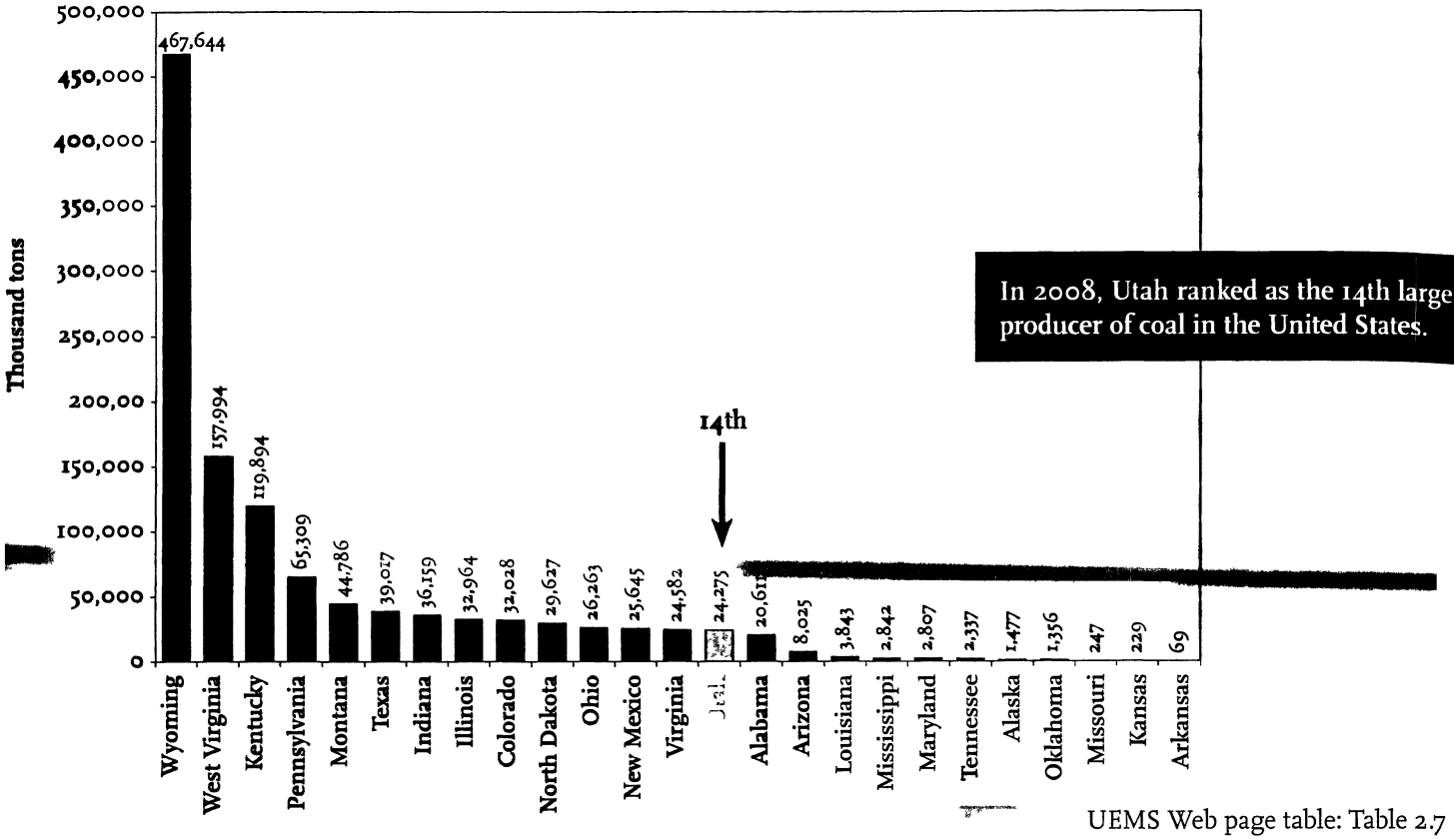
UEMS Web page table: Table 2.3

Source: UGS

Note: For Wasatch Plateau, Alton, Emery, Book Cliffs, and Henry Mountains, resources were constrained by a seam height minimum of four feet, with no more than 3000 feet of cover. For the remaining fields, resources were constrained by an estimated [illegible] factor rang[illegible] (unconst[illegible] do not [illegible]



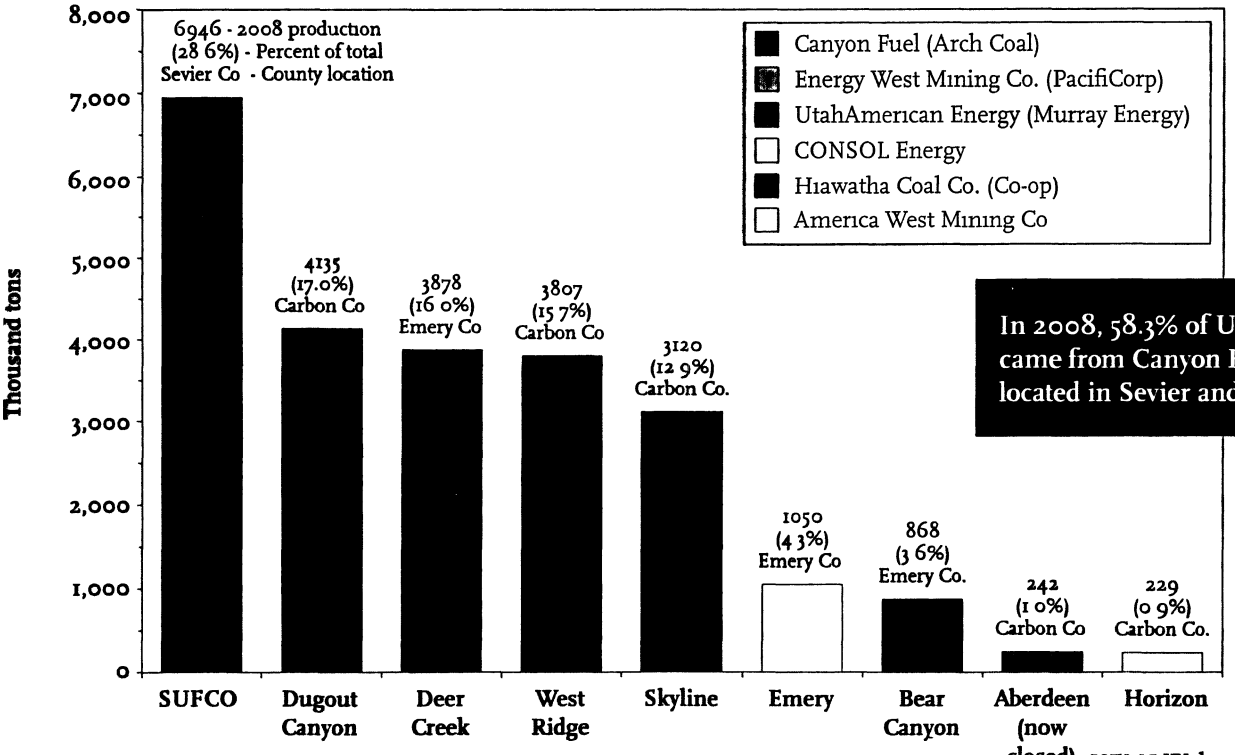
U.S. Coal Production by State, 2008



In 2008, Utah ranked as the 14th largest producer of coal in the United States.

UEMS Web page table: Table 2.7
Source: EIA, UGS

Utah Coal Production by Mine, 2008



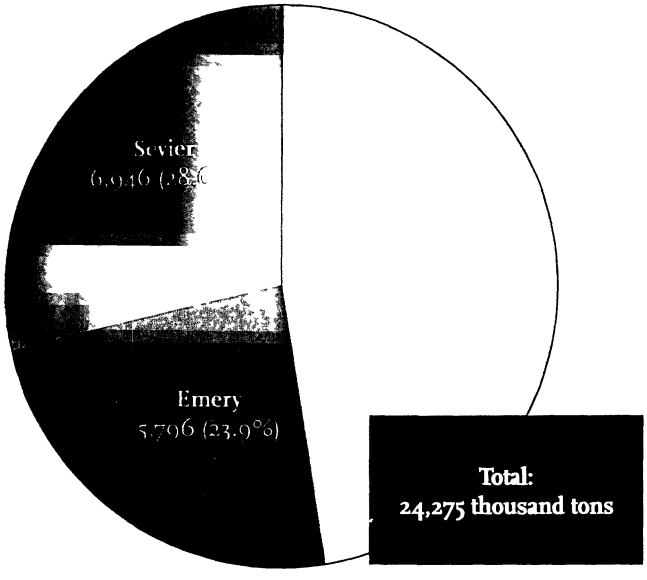
In 2008, 58.3% of Utah's coal production came from Canyon Fuel Company mines located in Sevier and Carbon Counties.

UEMS Web page table: Table 2.8
Source: EIA, UGS

Utah Coal Production by County

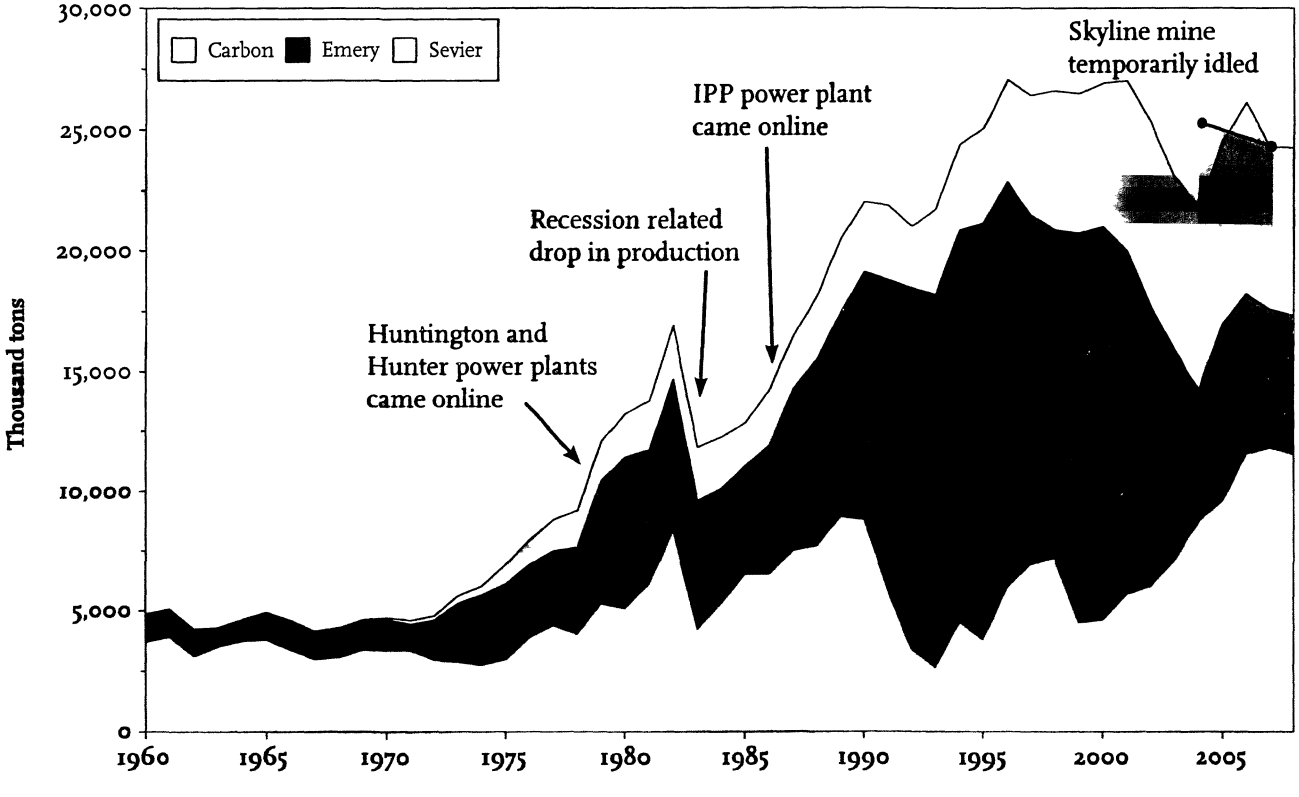
2008

Thousand tons (Percent of total)



In 2008, Utah produced its 1 billionth ton of coal. In recent years, coal production growth in Carbon County has outpaced that of Emery and Sevier Counties on strength of the West Ridge, Dugout, and Skyline mines. Only one large mine, Deer Creek, remains in Emery County, while the only coal produced in Sevier County is from the SUFCO mine. In the next few years, the percentage of coal mined from Emery County should increase when the new Lila Canyon mine commences production and mines in Carbon County deplete their reserves. In addition, the proposed Coal Hollow mine in the Alton coal field of southern Utah's Kane County could result in the first significant coal production outside Carbon, Emery, and Sevier Counties in over 50 years.

1960–2008

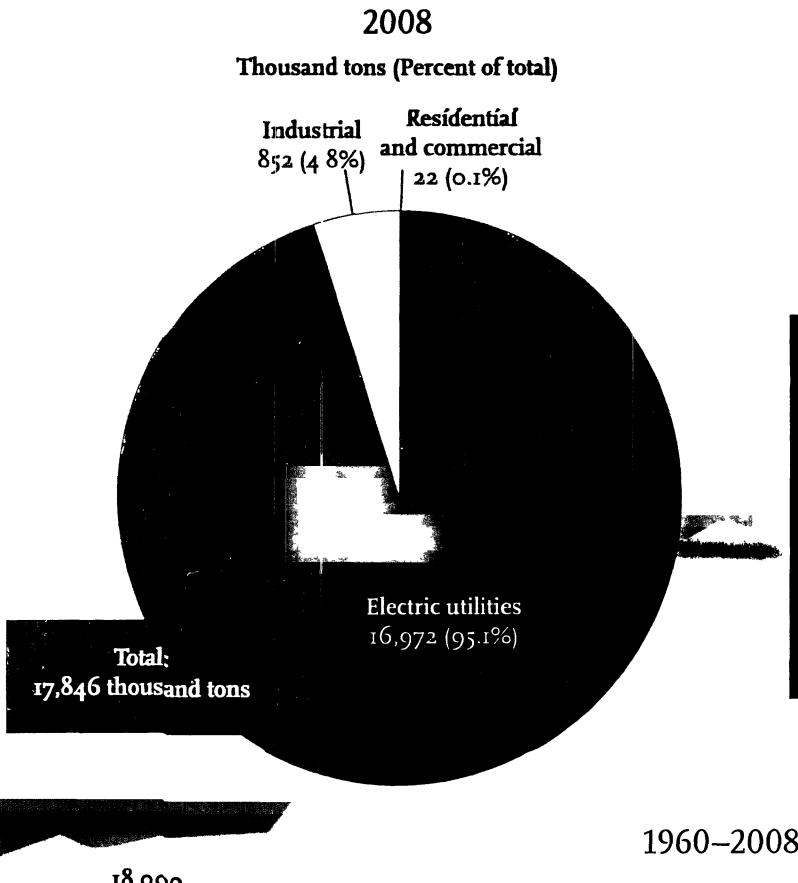


UEMS Web page table: Table 2.10

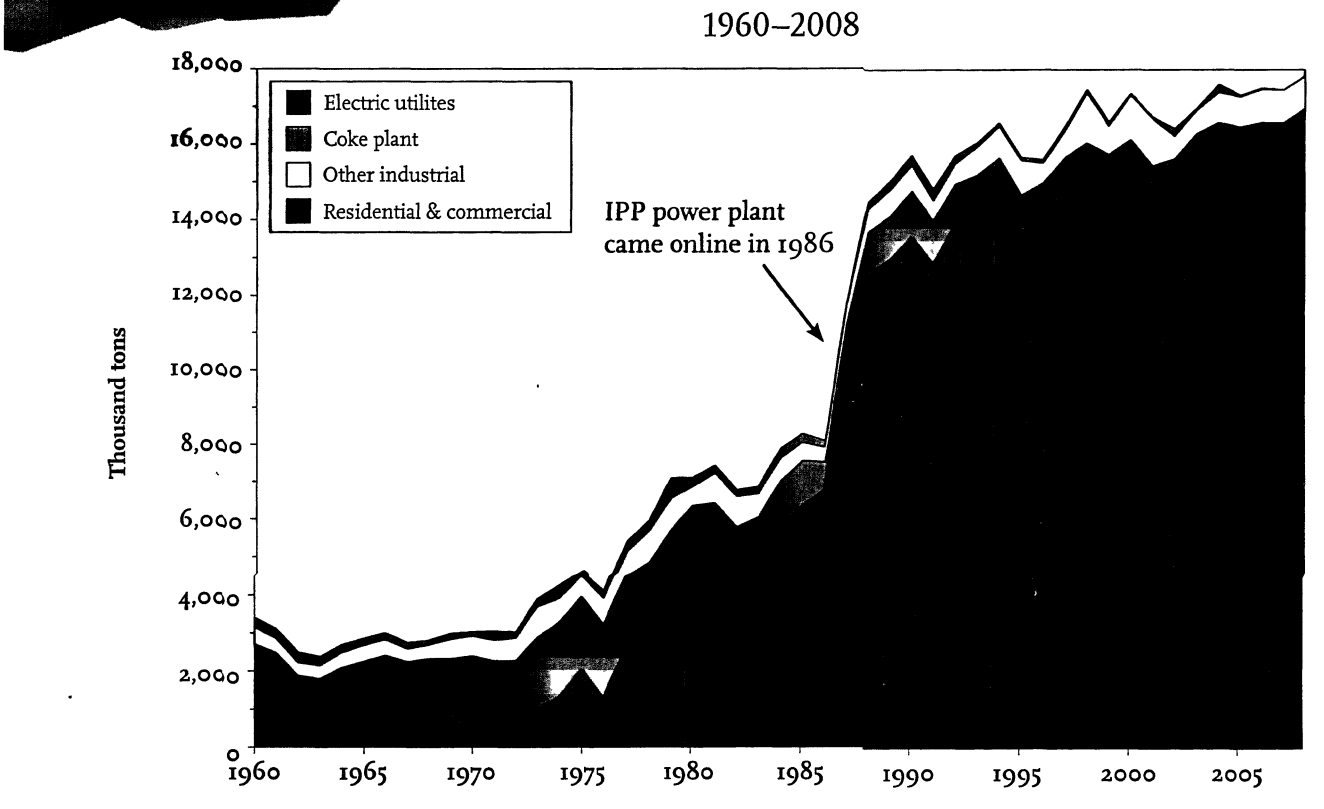
Source: UGS

Note: Production too small to be seen on graph was reported from Summit, Iron, and Kane Counties, mostly between 1960 and 1972.

Utah Coal Consumption by Sector

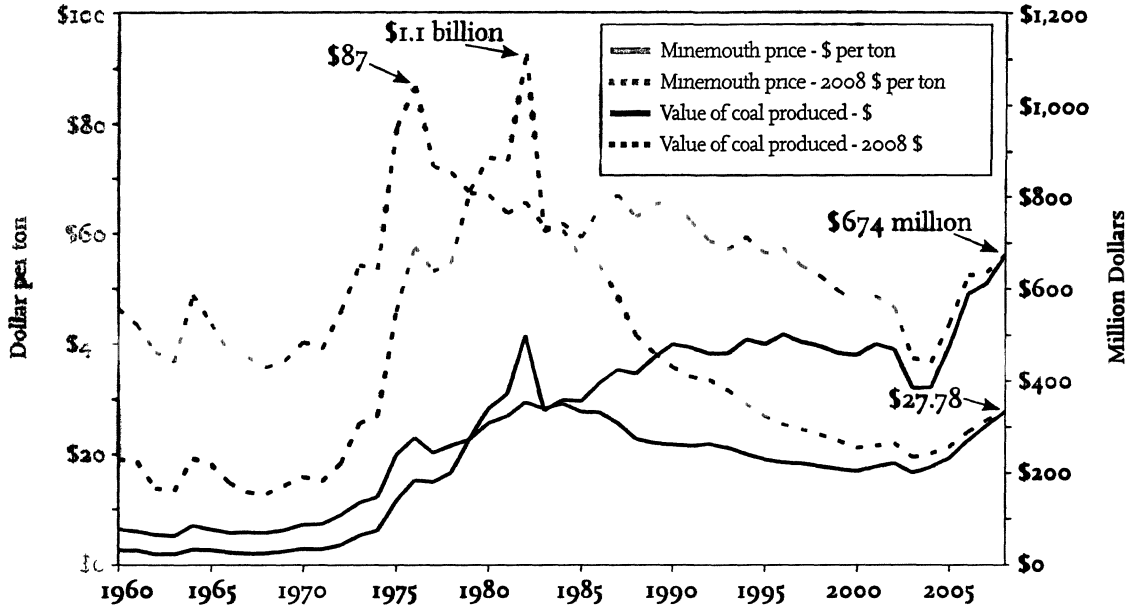


The vast majority of coal in Utah (95.1%) is consumed at electric power plants. The second-largest amount (4.8%) is consumed by the industrial sector at cement/lime plants and Kennecott Utah Copper's power plant which provides electricity for copper smelting. Coke consumption ceased in 2001 when Geneva Steel went out of business.



UEMS Web page table: Table 2.21
Source: EIA, UGS
Note: 2008 data are estimated.

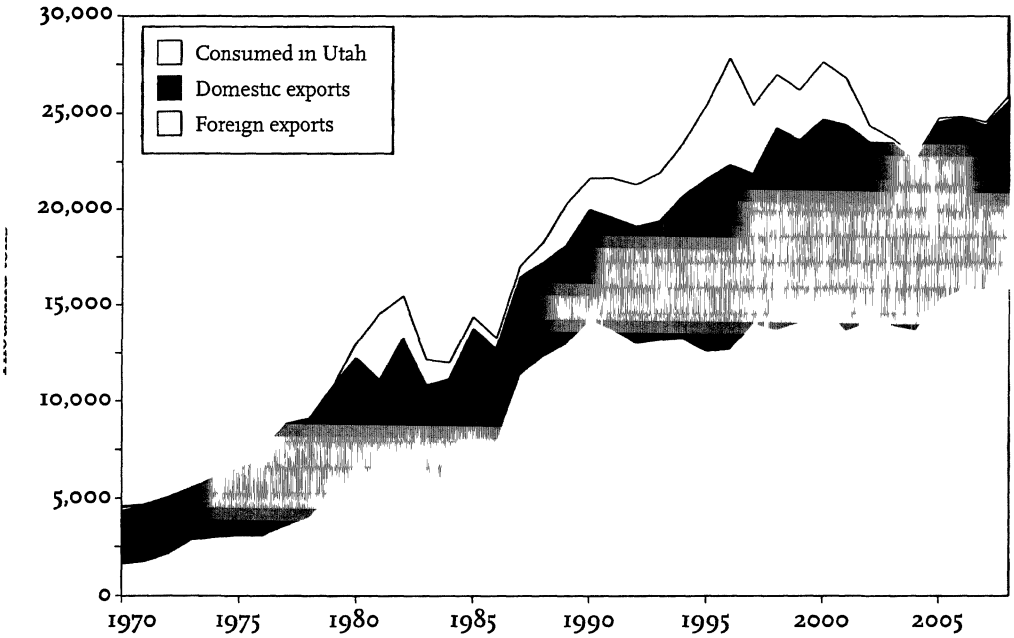
Average Minemouth Price and Value of Utah Coal, 1960–2008



Utah's minemouth price (the price at the mine) of $27.78 in 2008 was the 4th highest in history in nominal dollars, but was well below the inflation-adjusted high of $87 reached in 1976. The 2008 value of produced Utah coal equaled $674 million, a record in no less than the inflation-adjusted value of $1.1 billion recorded in 198

UEMS Web page table: Table 2.22
Source: *UGS*
Note: *2008 data are estimated.*

Distribution of Utah Coal, 1970–2008

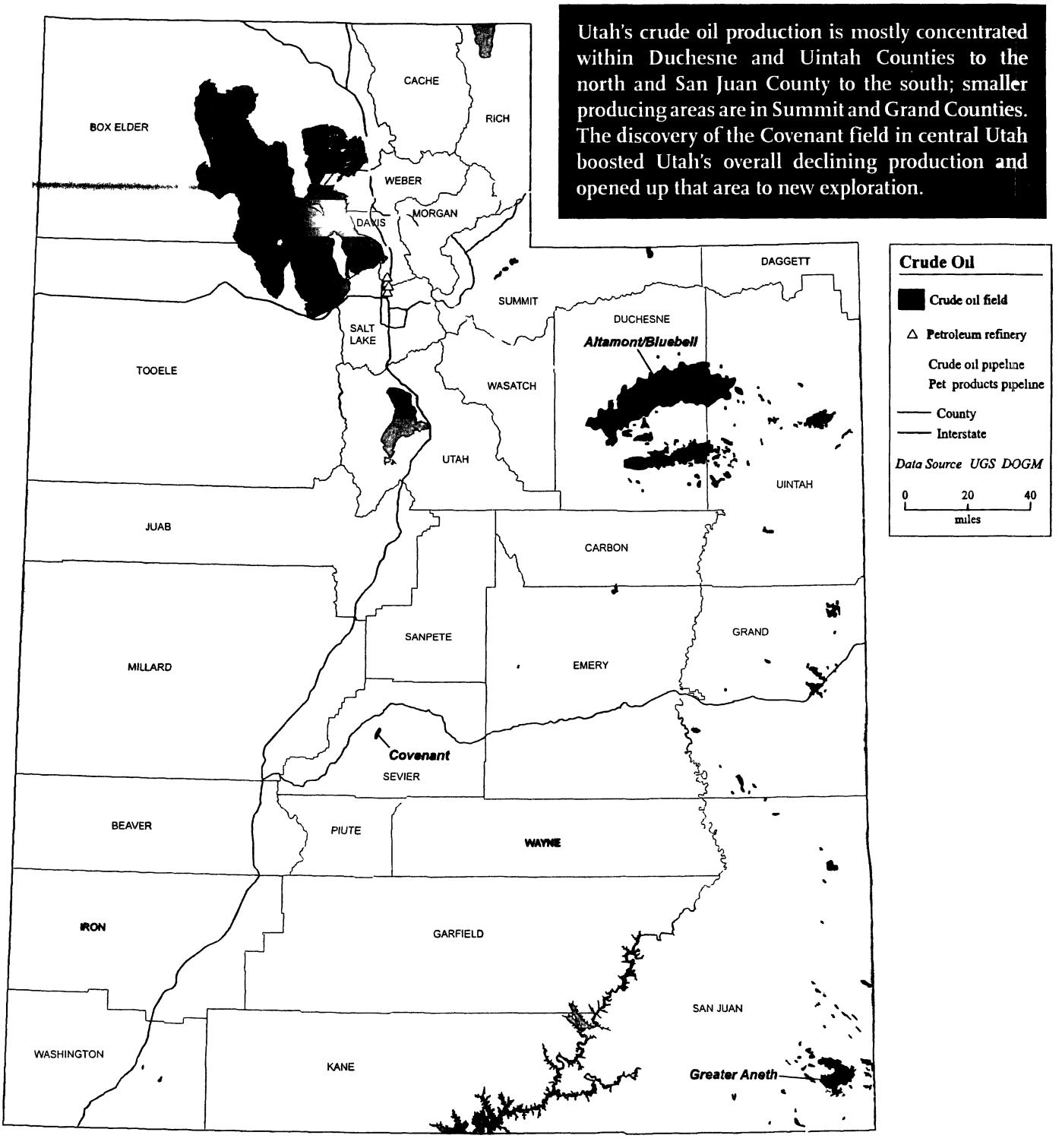


The majority of Utah coal, 65.6% in 2008, is used in state, while 33.2% was shipped out of state, and 1.2% was shipped to other countries. Foreign exports, mostly to Asia, peaked in 1996 when 5.5 million tons, or 19.7%, of Utah coal was shipped to foreign markets. This export market ceased to be economic as Australia and China increased productio

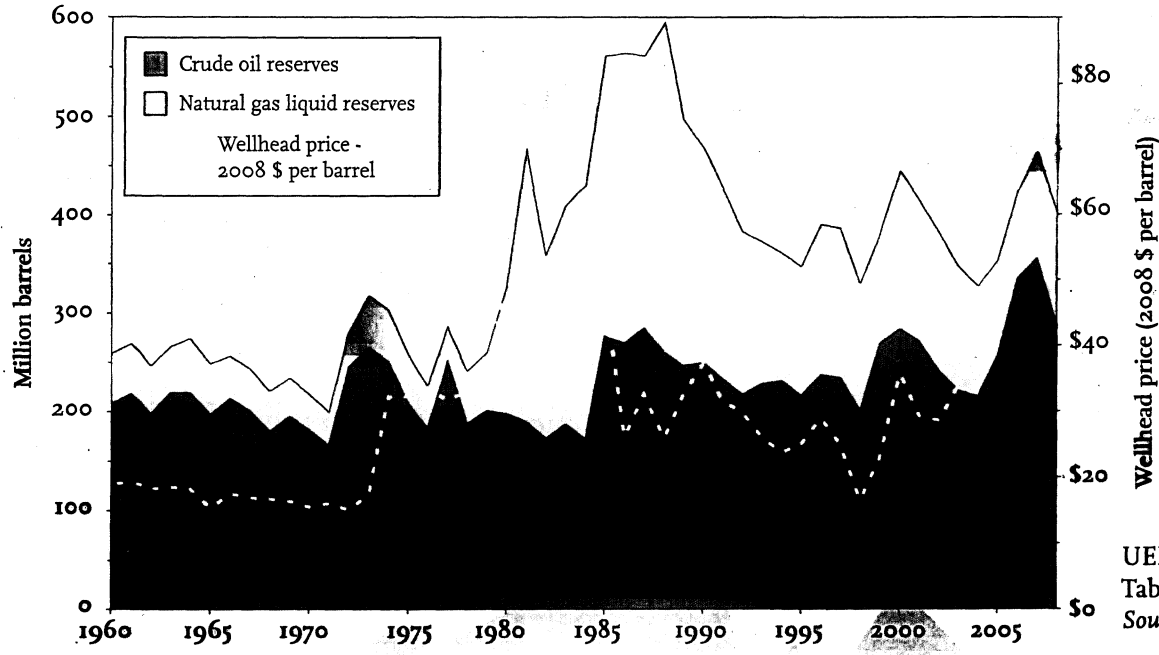
UEMS Web page table: Table 2.19
Source: UGS
Note. 2008 data are estimated.

Crude Oil and Petroleum Products

Utah's crude oil production is mostly concentrated within Duchesne and Uintah Counties to the north and San Juan County to the south; smaller producing areas are in Summit and Grand Counties. The discovery of the Covenant field in central Utah boosted Utah's overall declining production and opened up that area to new exploration.



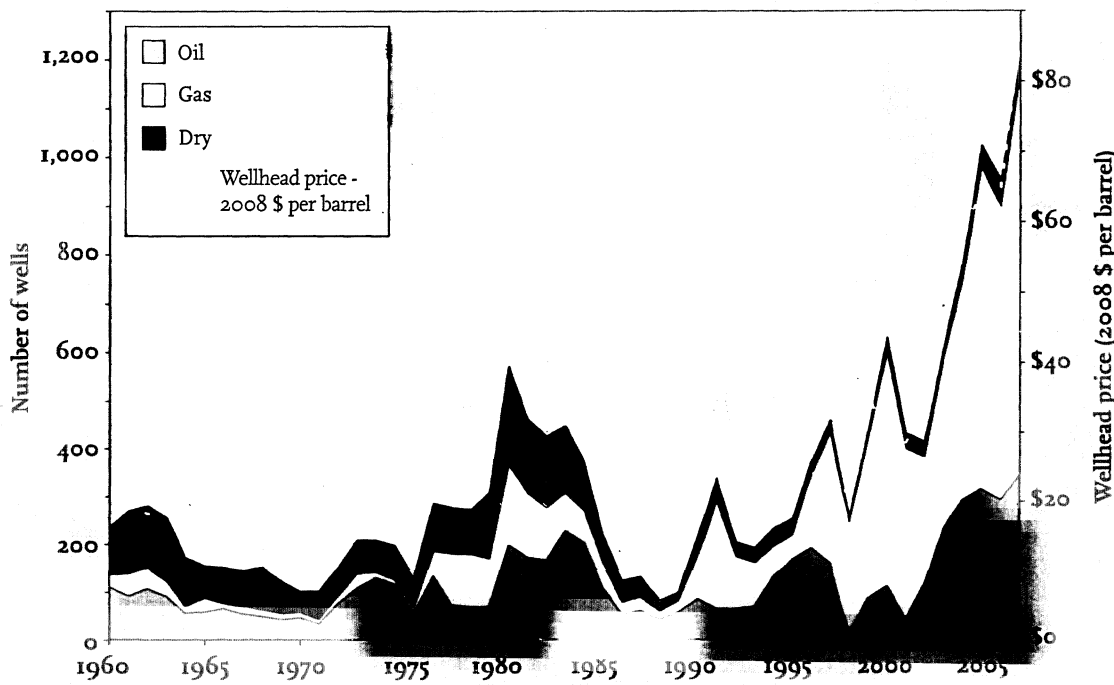
Crude Oil and Natural Gas Liquid Reserves in Utah, 1960–2008



UEMS Web page tables: Table 3.2 and Table 3.20
Source: EIA

Natural gas liquid reserves surged in 1979, coinciding with a spike in crude oil prices, and peaked in the late 1980s. The recent increase in crude oil price has translated into record crude oil reserves in 2007 (355 million barrels), but has since declined in 2008.

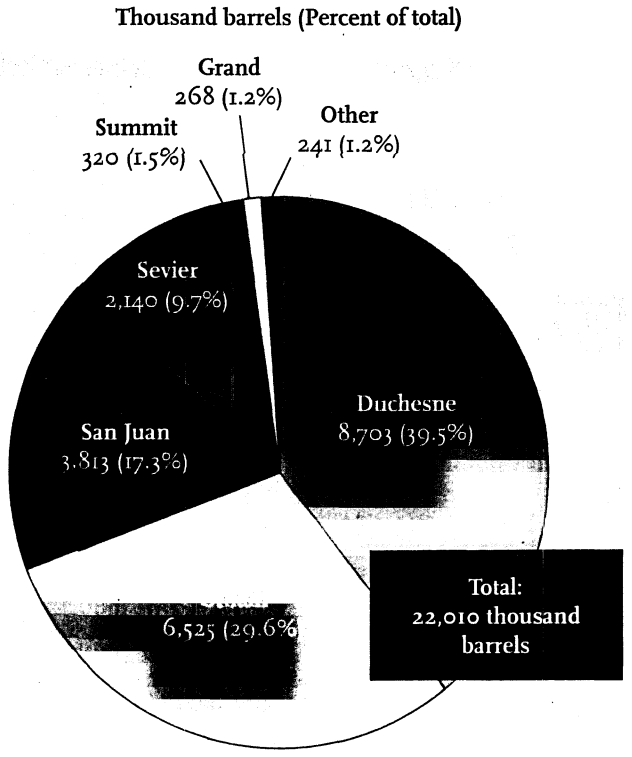
Oil and Gas Well Completions in Utah, 1960–2008



UEMS Web page tables: Table [illegible] 3.20
Source:

The number of well completions (both oil and gas) has tracked closely with wel in the early 1980s and again in recent years. The recent price surge has fac 1207 wells drilled in 2008. Also of note is the decrease in the number of dry wel drilling and exploration techniques have improved and high-risk wildcat drilling h

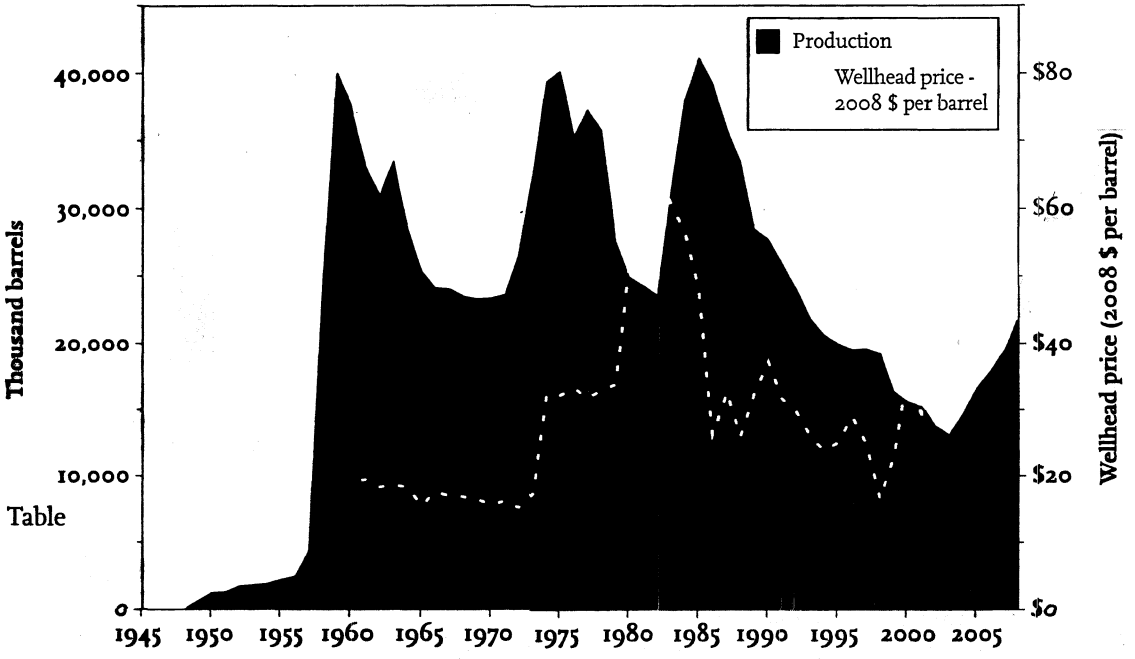
Utah Crude Oil Production by County, 2008



Crude oil production in Utah is mostly concentrated in Duchesne, Uinta, and San Juan Counties. Recently production has started in Sevier County with the discovery of the Covenant field in central Utah.

UEMS Web page table: Table 3.8
Source: DOGM
Note: "Other" includes Garfield, Carbon, Emery, Sanpete, and Daggett Counties.

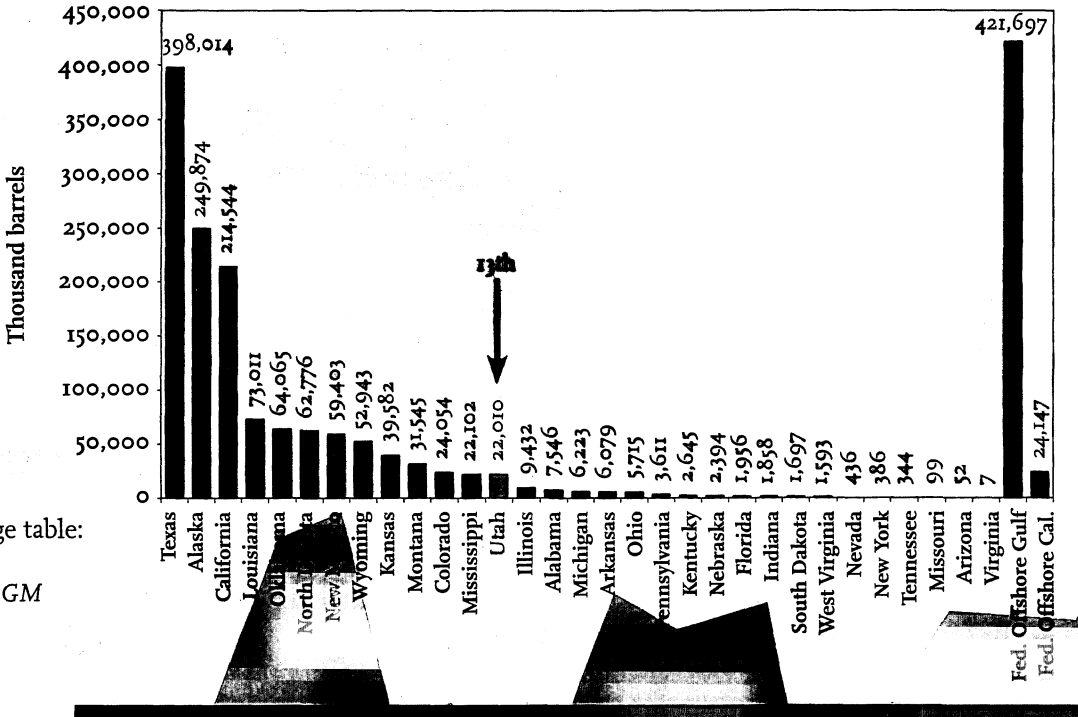
Utah Crude Oil Production, 1945-2008



UEMS Web page tables: Table 3.7 and Table 3.20
Source: DOGM, EIA

Utah has experienced three oil booms in the past 60 years and is currently defining a fourth. The first spike in crude oil production followed the discovery of the very large Bluebell and Greater Aneth fields in 1955 and 1956, respectively. The second spike coincided with a 1971 increase in wellhead price as well as the discovery of the Altamont field. The third spike in production resulted from the price spike of the early 1980s and followed the 1980 discovery of the Anschutz Ranch East natural gas field, which also produced large amounts of crude oil. The current rise in crude oil production is related to higher prices resulting in higher production from existing fields, as well as the discovery of the Covenant field in central Utah.

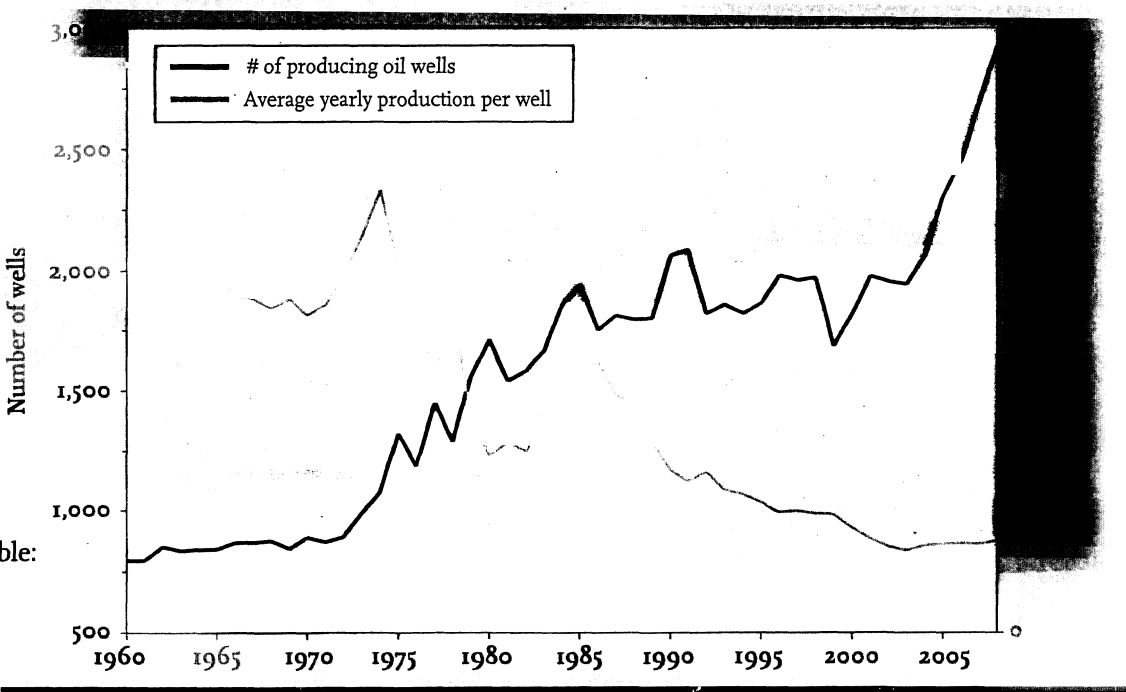
U.S. Crude Oil Production by State, 2008



In 2008, Utah ranked as the 13th largest producer of crude oil in the United States (not including federal offshore areas).

UEMS Web page table:
Table 3.6
Source: EIA, DOGM

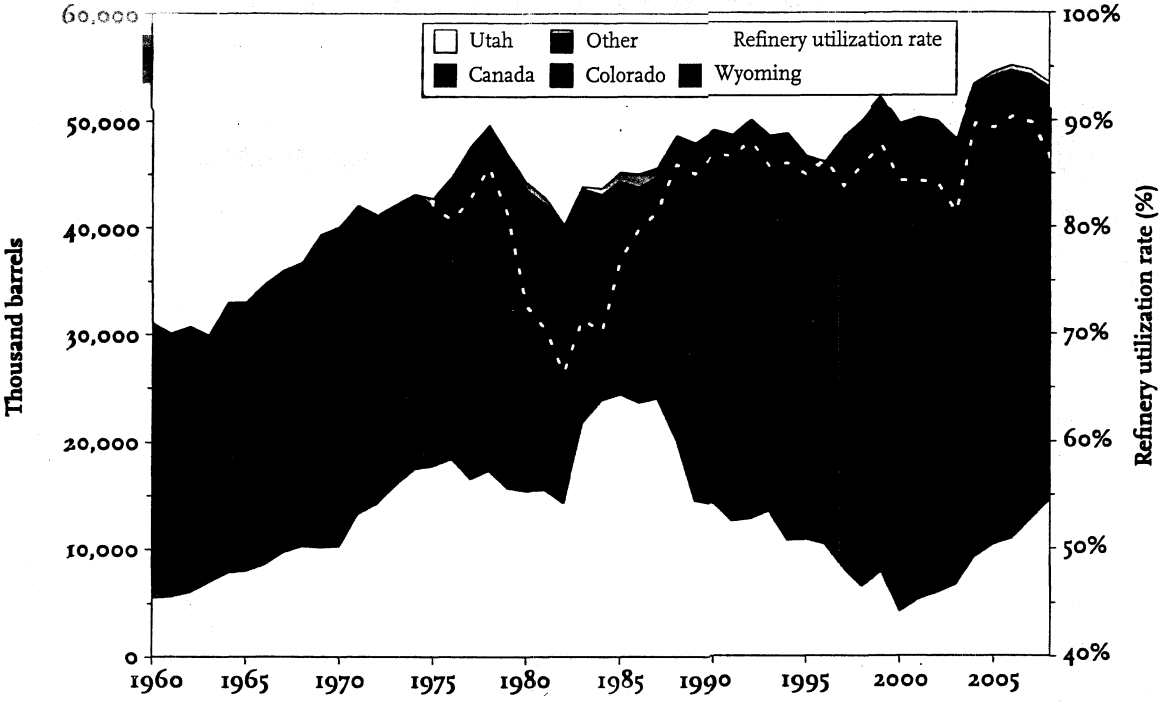
Number of Producing Crude Oil Wells in Utah Versus Average Yearly Production per Well, 1960–2008



As the total number of producing oil wells has increased over the years, the average yearly production per well has decreased. This graph illustrates how it requires more wells to produce the same amount of crude oil.

UEMS Web page table:
Table 3.7
Source: DOGM

Crude Oil Shipped to Utah Refineries by State or Country of Origin, 1960–2008

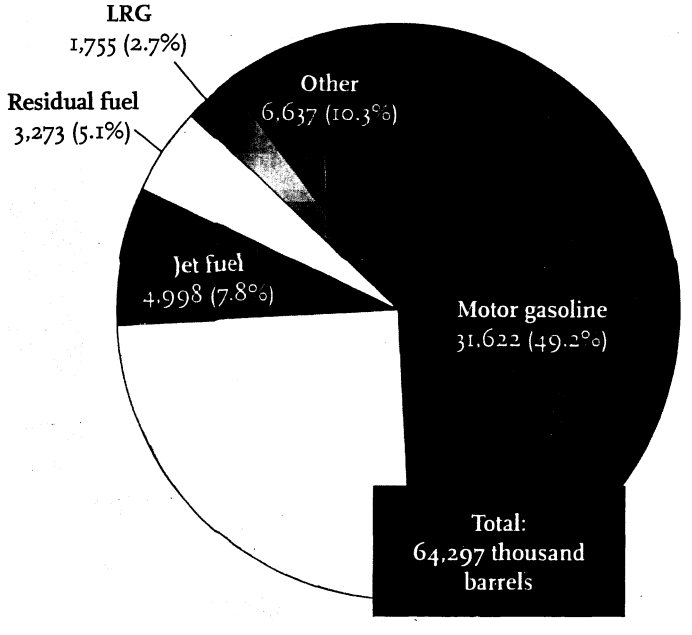


Utah refineries receive crude oil from four main sources: Utah, Colorado, Wyoming, and, as of 1995, Canada. Utah's refinery utilization rate, the average ratio of crude oil inputs to total refinery capacity, has averaged 86% over the past 20 years. In 2006, the average rate was greater than 90% for the first time since 1973, but has since dropped to 87% in 2008 as the high price of gasoline helped decrease demand.

UEMS Web page tables: **Table 3.15 and Table** 3.17
Source: EIA, UGS
Note: "Other" includes small amounts from Nevada, Montana, and New Mexico.

Utah Refinery Production by Product, 2008

Thousand barrels (Percent of total)



Utah refineries produced over 31 million barrels of motor gasoline in 2008, of which roughly 14 million barrels was shipped to surrounding states.

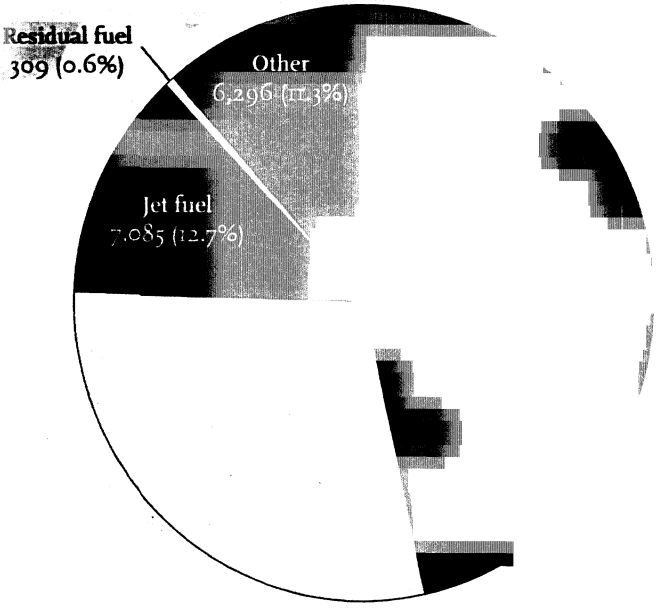
UEMS Web page table: Table 3.16
Source: EIA
Note: LRG = Liquefied refinery gases

Consumption of Petroleum Products in Utah

Motor gasoline was the most used petroleum product in 2007, accounting for 46.8% of all consumption. Distillate fuel ranked second at 28.6%, followed by jet fuel at 12.7%. Residual fuel use has declined greatly since the mid-1980s since it is no longer used as a fuel in power plants. Overall petroleum product consumption tracks well with Utah's population growth.

2007

Thousand barrels (**Percent of total**)

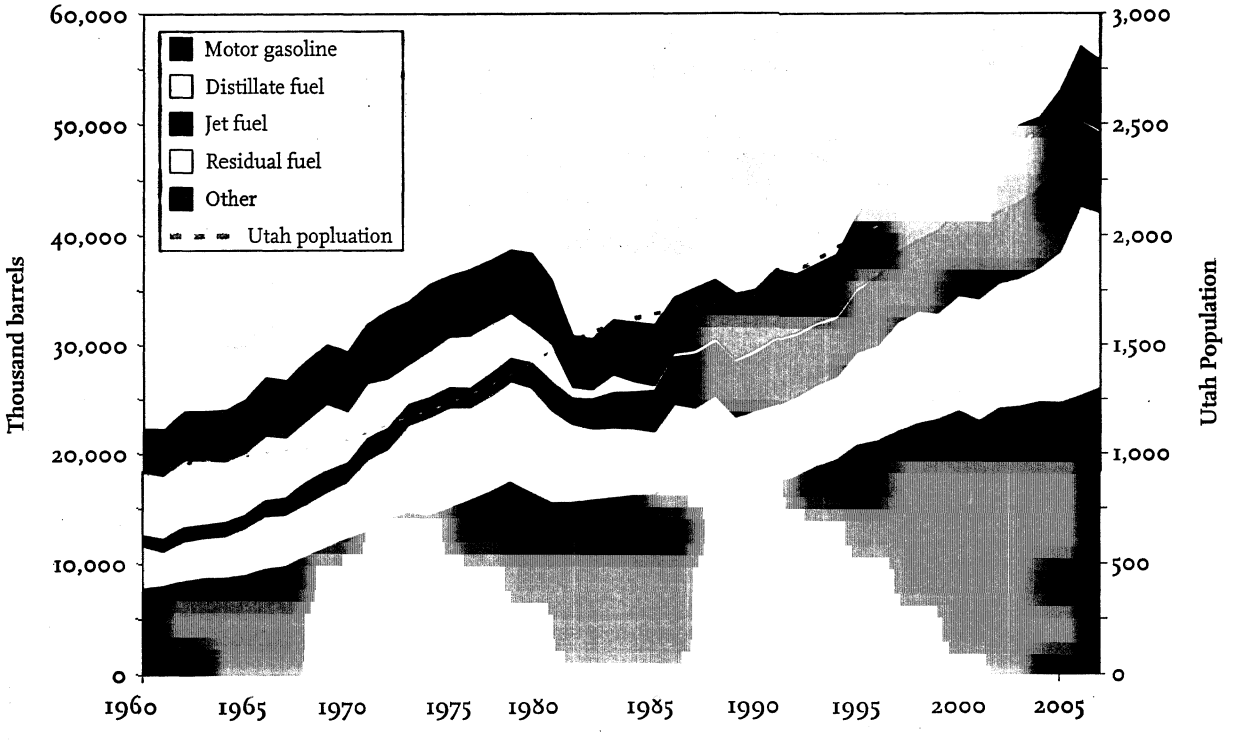


JEMS Web page table: Table 3.18

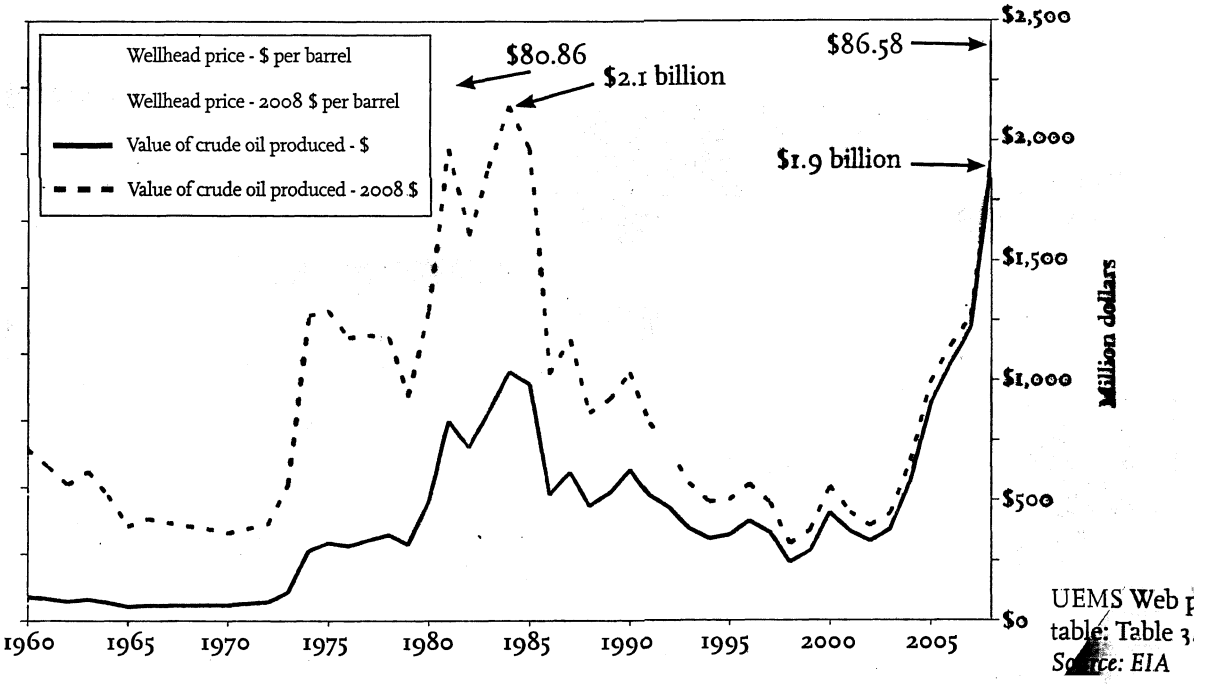
Source: EIA

Notes: 2008 data are not yet available; "Other" includes asphalt and road oil, aviation gasoline, kerosene; liquefied petroleum gases, lubricants, among others.

1960–2007



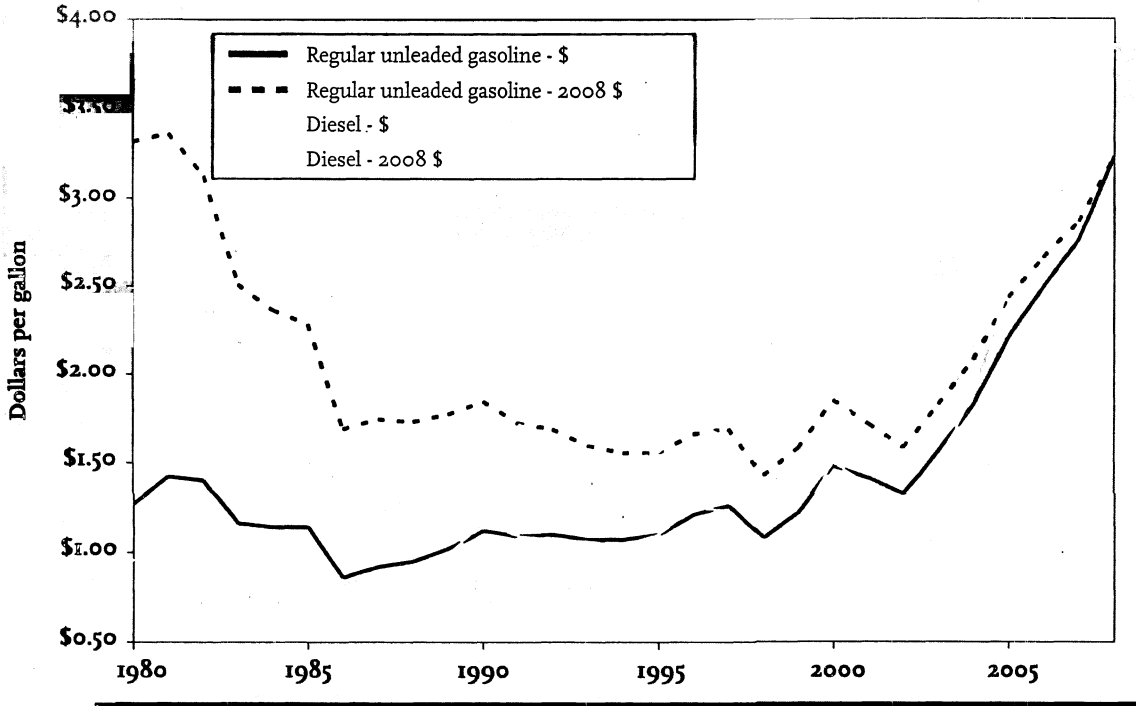
Average Wellhead Price and Value of Crude Oil in Utah, 1960–2008



UEMS Web p
table: Table 3
Source: EIA

Utah's crude oil wellhead price hit an all-time high of $86.58 per barrel in 2008, even when adjusted for inflation. The value of Utah's crude oil also reached a record high of $1.9 billion in nominal dollars, but is the third-highest value in inflation-adjusted dollars behind 1984 and 1985.

Utah Price of Motor Gasoline and Diesel, 1980–2008

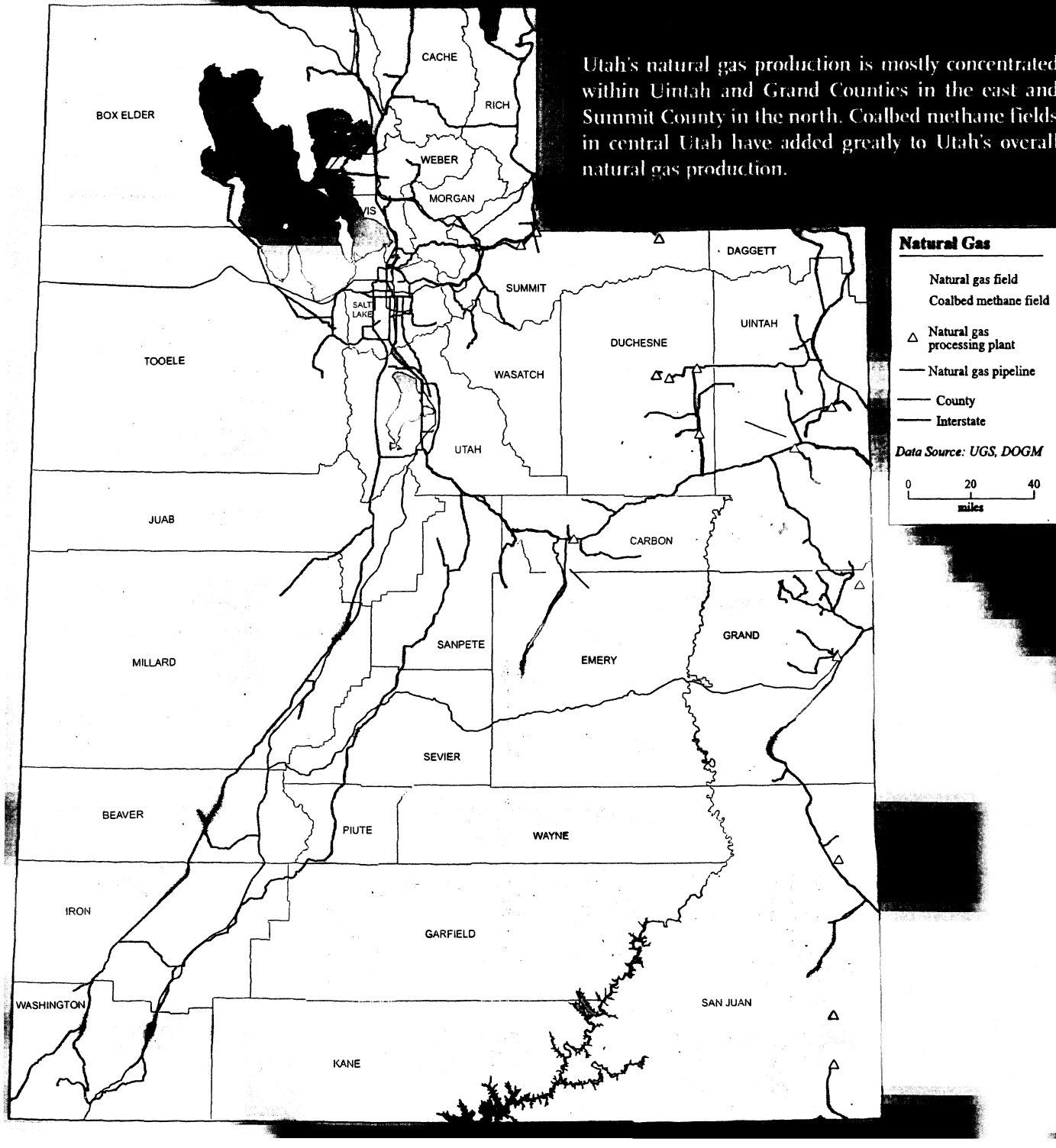


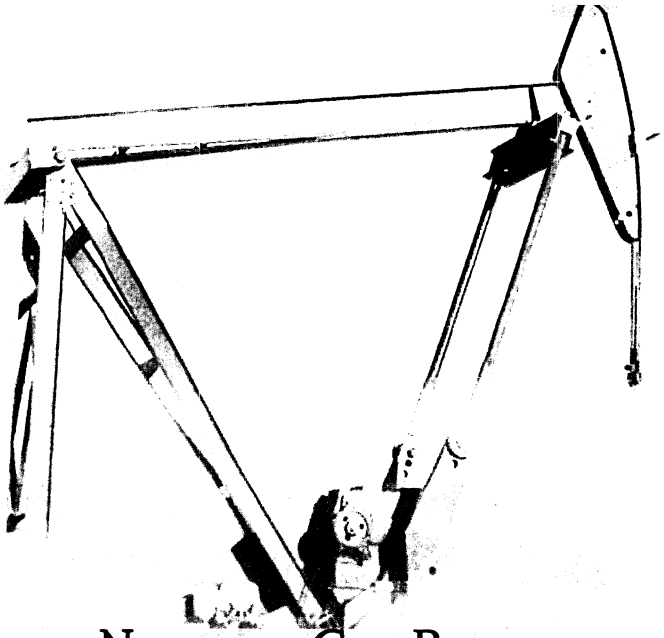
Source: UGS, EIA

Regular unleaded gasoline reached the highest inflation-adjusted level since 1981, averaging $3.23 per gallon in 2008, while diesel prices hit an all-time inflation-adjusted high of $3.86 per gallon in 2008.

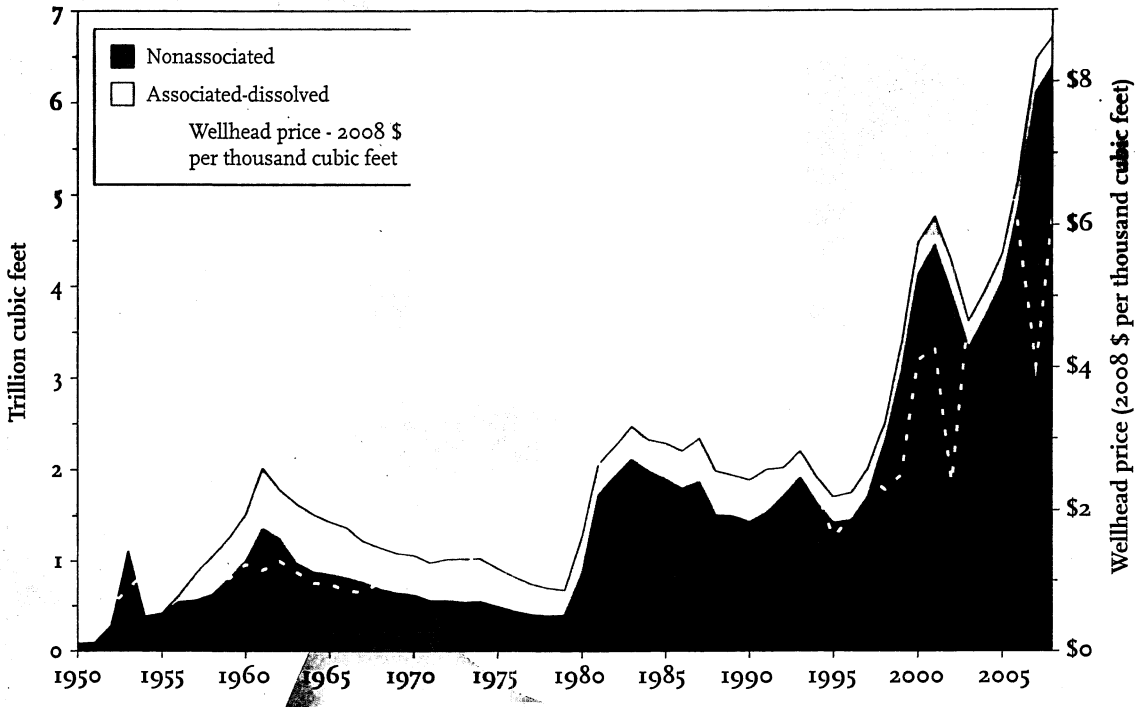
Natural Gas

Utah's natural gas production is mostly concentrated within Uintah and Grand Counties in the east and Summit County in the north. Coalbed methane fields in central Utah have added greatly to Utah's overall natural gas production.





Natural Gas Reserves in Utah, 1950–2008



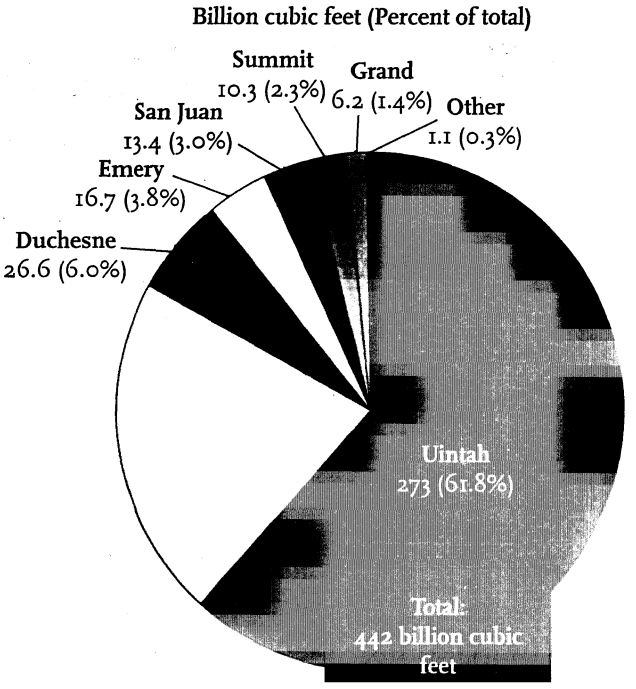
Natural gas reserves surged in 1980 and 1981, coinciding with an increase in wellhead price, and a second surge occurred in the late-1990s, coinciding with new development of coalbed methane. The current increase in reserves is again the result of higher prices.

UEMS Web page tables: Table 4.2 and Table 4.16

Source: EIA

***Note:** Nonassociated natural gas is not in contact with significant quantities of crude oil in the reservoir. Associated-dissolved natural gas occurs in crude oil reservoirs either as free gas (associated) or as gas in solution with crude oil (dissolved gas).*

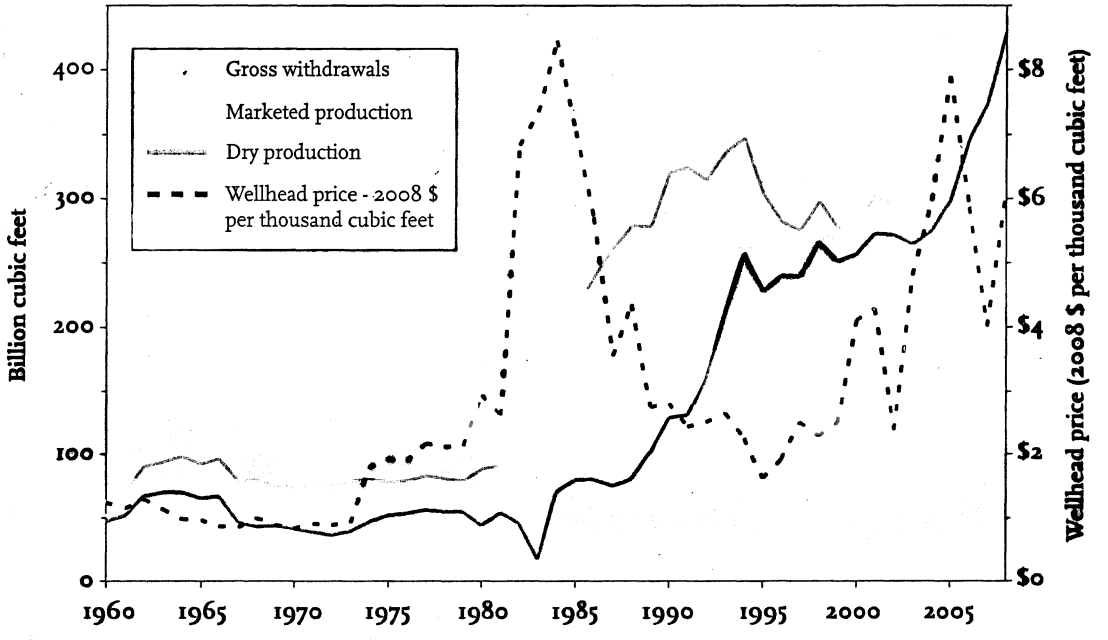
Utah Natural Gas Production (Gross) by County, 2008



Gross natural gas production in Utah is mostly concentrated in Uintah and Carbon Counties (Carbon County production is predominantly from coalbed methane).

UEMS Web page table: Table 4.6
Source: DOGM
Note: "Other" includes Daggett, Sanpete, and Garfield Counties

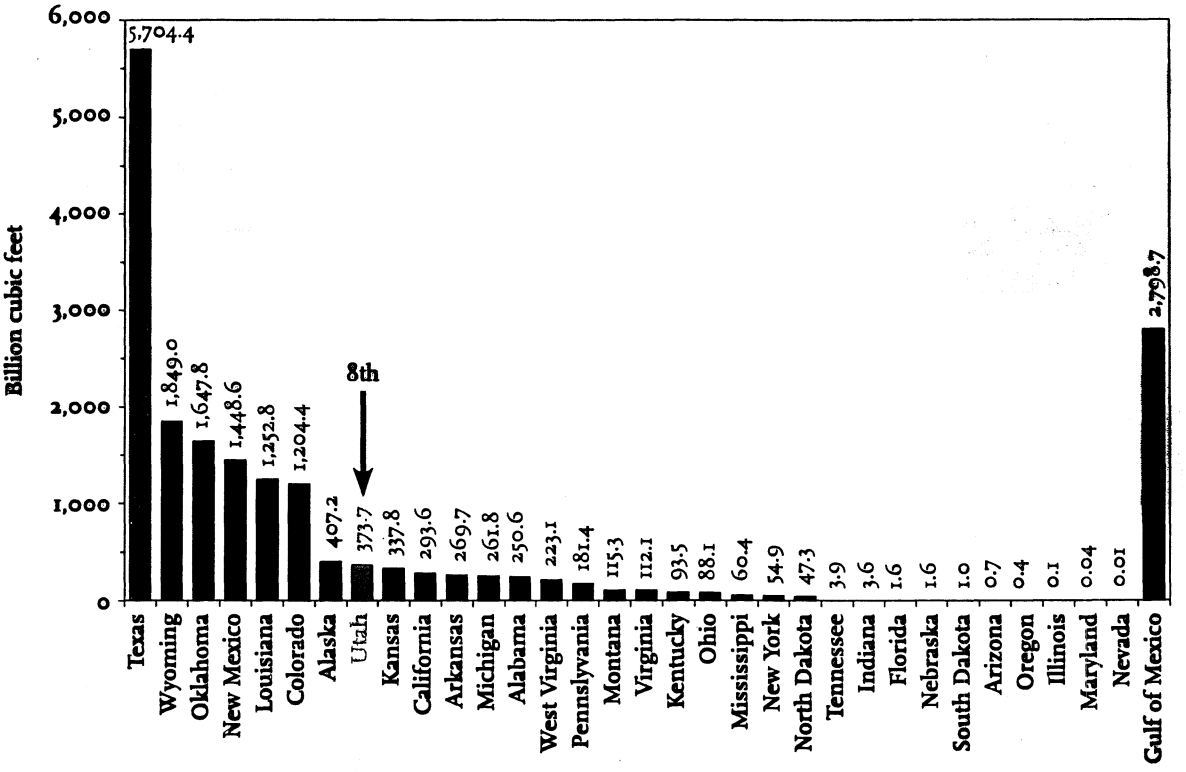
Utah Natural Gas Production, 1960–2008



The first major increase in natural gas production occurred in the mid-1980s, coinciding with a large spike in prices and the discovery of coalbed methane in central Utah. The current surge in production is also price related, with the majority of production centered in Uintah County.

UEMS Web page tables: Table 4.5 and 4.16
Source: DOGM, EIA

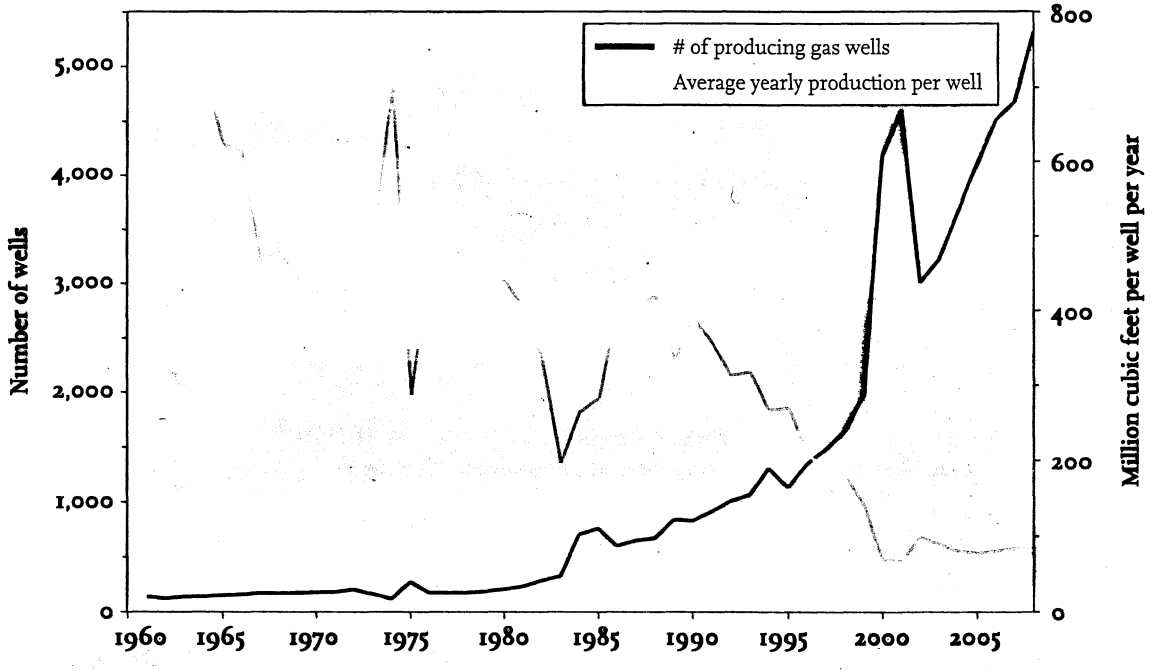
U.S. Natural Gas Production (Dry) by State, 2007



UEMS Web page table: Table 4.4
Source: EIA, DOGM
Note: 2008 data are not yet available.

In 2007, Utah ranked as the 8th largest producer of natural gas in the United States (not including production in the Gulf of Mexico).

Number of Producing Natural Gas Wells in Utah Versus Average Yearly Production per Well, 1961–2008



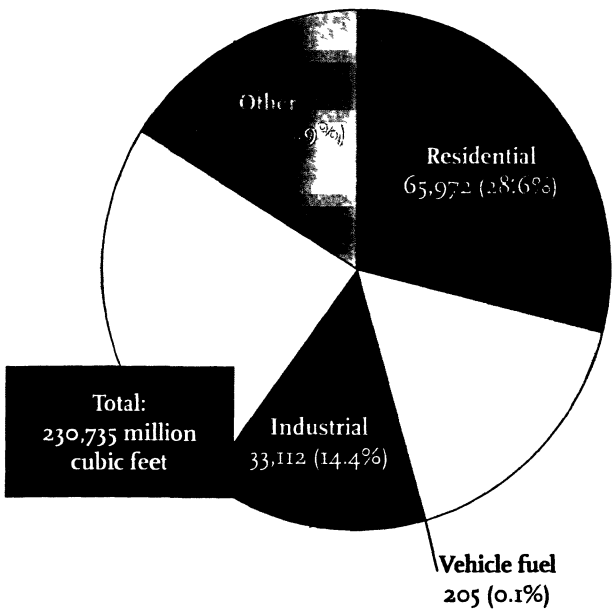
UEMS Web page table: Table 4.5
Source: DOGM

Similar to crude oil, as the total number of producing gas wells has increased over the years, the average yearly production per well has decreased.

Consumption of Natural Gas in Utah

2008

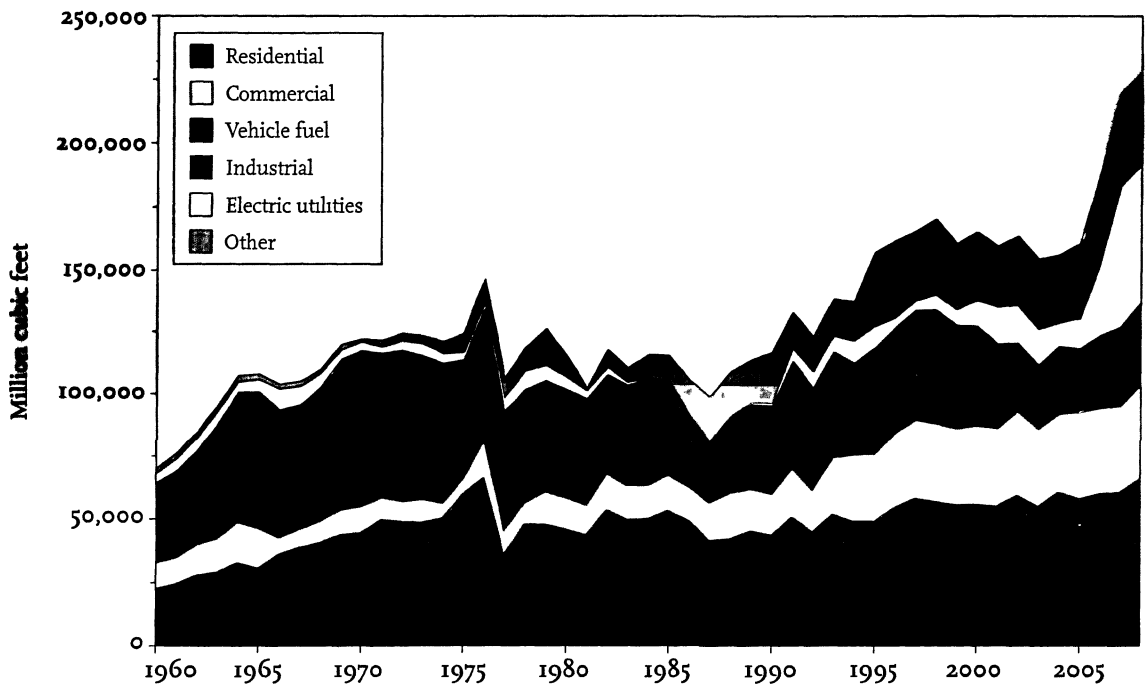
Million cubic feet (Percent of total)



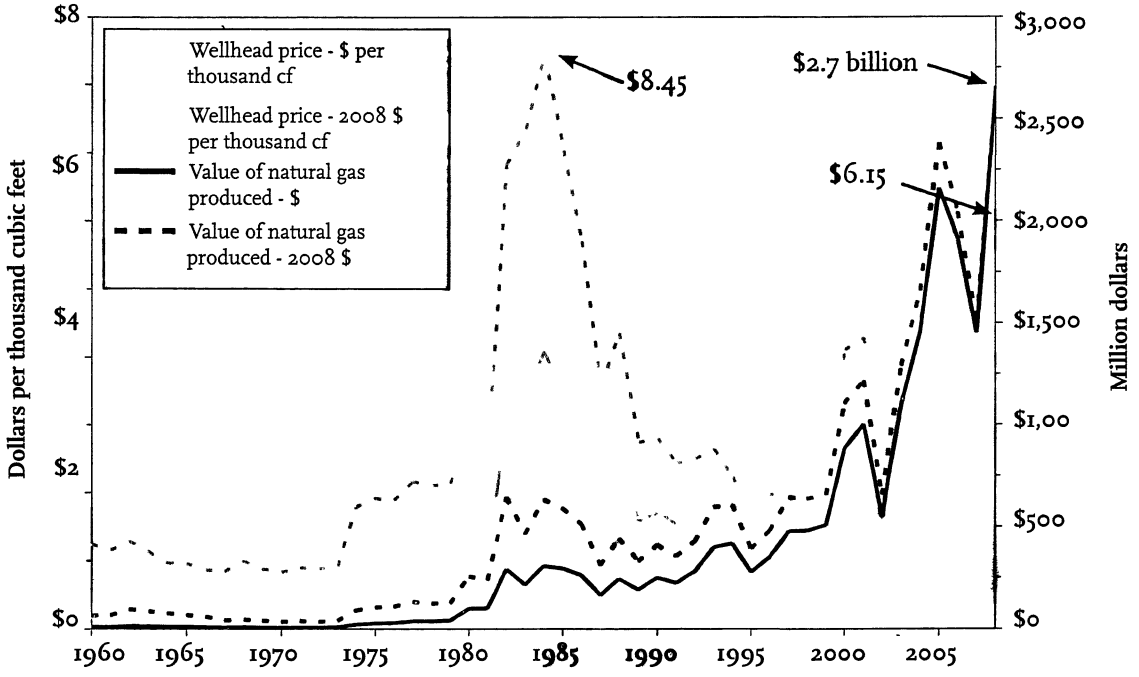
Natural gas is mostly used for home heating (residential, 28.6%), but starting in mid-2004, 1300 MW of new natural-gas-fired electric capacity have come online, greatly increasing the amount used by the electric utility sector (from 7.6% in 2005 to 24.8% in 2008).

UEMS Web page table: Table 4.15
Source: EIA
*Notes: 2008 **data** are estimated; "Other" includes **lease use**, plant use, and pipeline fuel.*

1960–2008



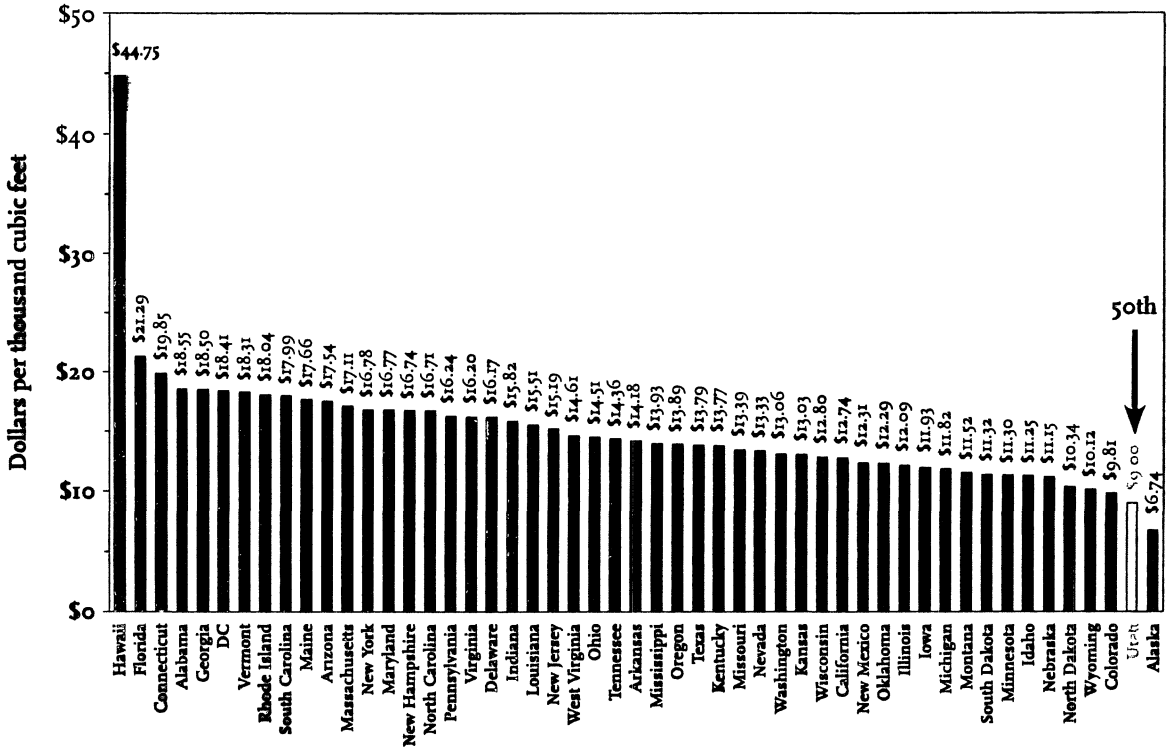
Average Wellhead Price and Value of Natural Gas in Utah, 1960–2008



UEMS Web page table: Table 4.16
Source: EIA

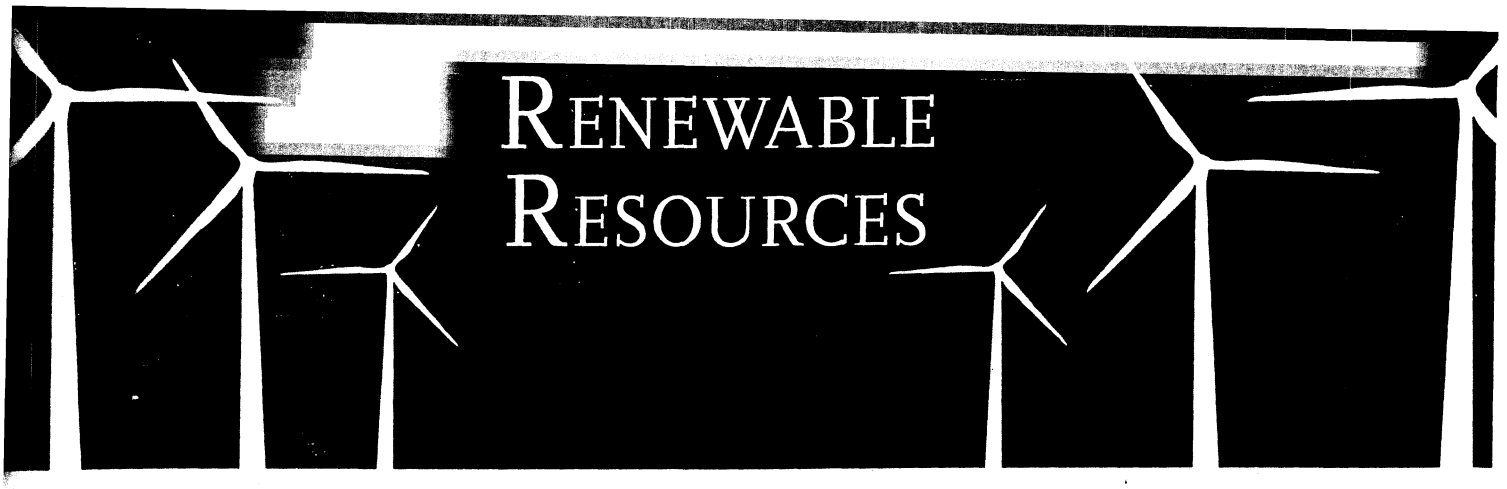
The value of Utah's natural gas production in 2008 reached an all-time high of $2.7 billion, even when adjusted for inflation. This dramatic increase was the product of record high production resulting from near-record-high wellhead prices.

Average Price of Residential Natural Gas by State, 2008



UEMS Web page table: Table 4.18
Source: EIA
Notes: 2008 data are preliminary; includes the District of Columbia.

In 2008, Utah had the second-lowest price for residential natural gas in the country, behind only Alaska.



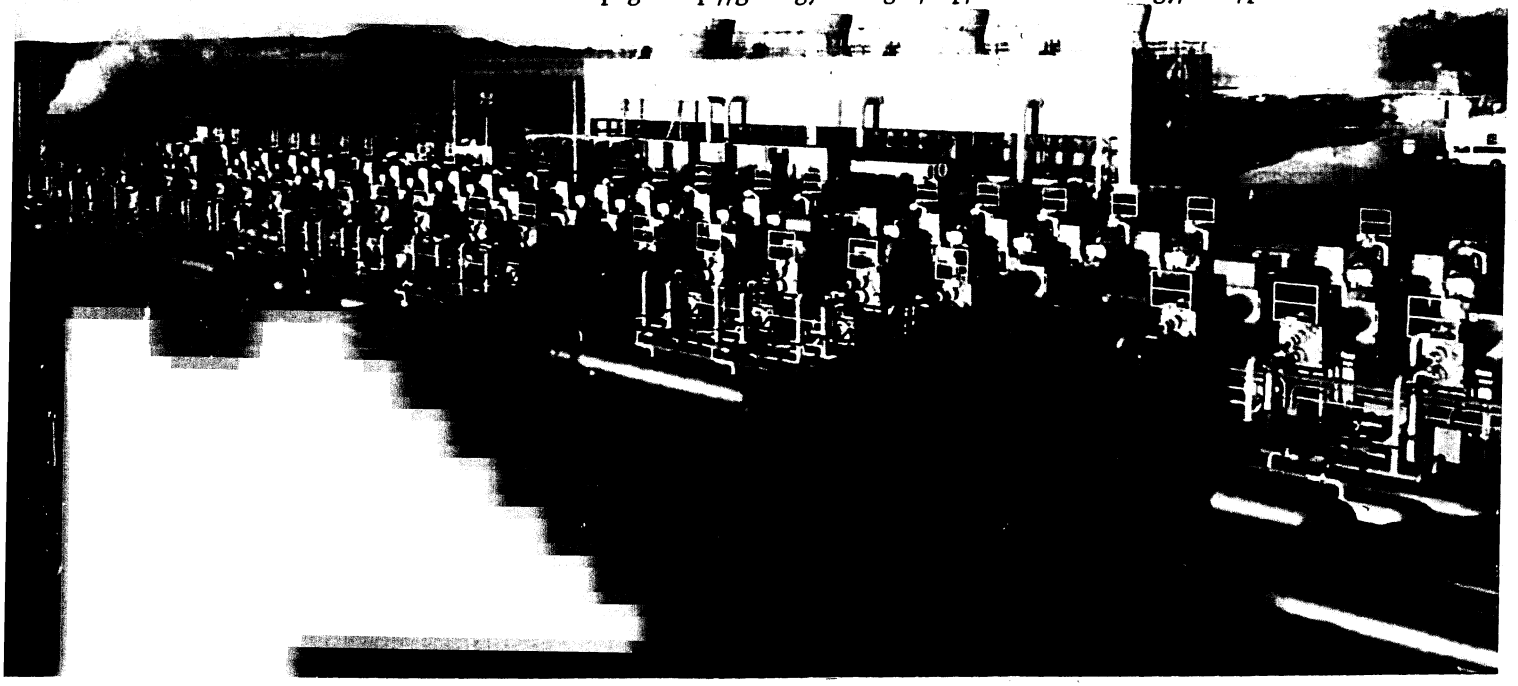
UTAH RENEWABLE ENERGY ZONES TASK FORCE PHASE I REPORT: RENEWABLE ENERGY ZONE RESOURCE IDENTIFICATION

To promote and identify Utah's utility-scale electrical renewable energy resources and to assess transmission to bring those resources to load centers in Utah, former Governor Huntsman commissioned the Utah Renewable Energy Zones (UREZ) Task Force to (1) identify geographical areas in Utah where utility-scale renewable energy development could occur (see maps on following pages); (2) assess the electrical generation potential of wind, solar, and geothermal technologies; and (3) identify new and existing transmission needed to bring renewable energy generation sources to market.

This study identified renewable energy zones totaling approximately 13,262 square miles and an estimated 837 gigawatts (GW) of electrical generating capacity. The multitude of factors that could not be taken into account at this point of the assessment include: project level resource data, site specific land use and environmental restrictions, and federal, state, and local regulatory policies that may complicate or restrict development.

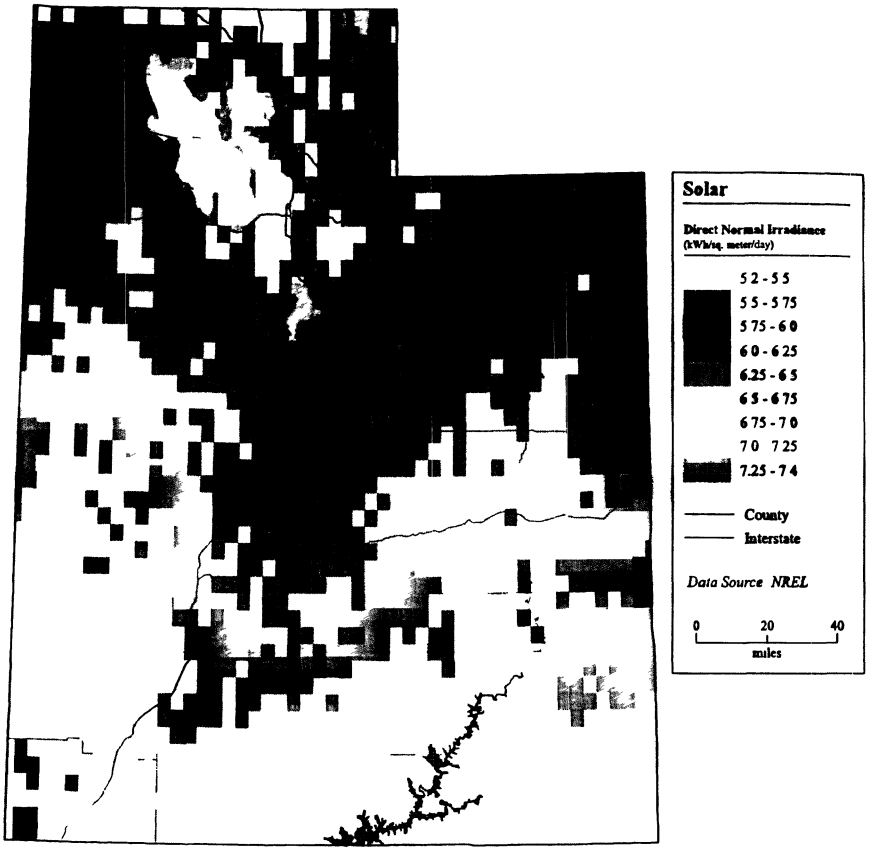
The scope of work for this phase of the UREZ process was not to assess the development potential from an economic perspective. Rather, analogous to estimating resources and reserves in the oil and gas industry, this project's scope of work was to identify the potential resources, within reason, for short-term (~<10 years) and long-term (~>10 years) potential. Again, similar to estimating conventional natural resource reserves, the quantity is a constantly changing value. More importantly, this macro-level assessment will identify likely areas of multiple resource zones that may have utility-scale generation potential.

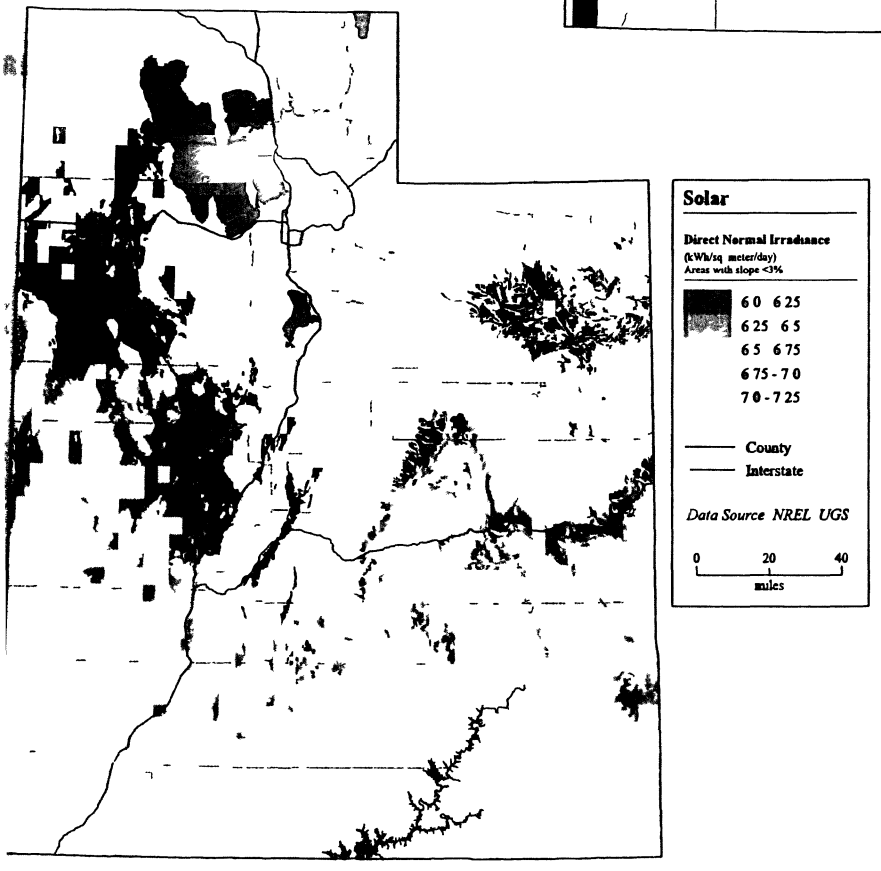
The entire document is available on the UGS Web page: http://geology.utah.gov/sep/renewable_energy/urez/phase1



SOLAR ASSESSMENT

Utah's solar resources are clearly abundant (map on right, no screening applied). The analysis identified 6,371 square miles of land that has a theoretical potential of about 826 gigawatts (GW) of utility-scale capacity. The solar analysis used several criteria to shape the methodology (map below): (1) measurements of Direct Normal Irradiance (DNI), with a threshold value of 6.0 kilowatt hours per meter squared (kWh/m^2)/ day or greater, (2) screening out steeper areas (slopes of 3% or greater) unable to accommodate a large solar collection field, (3) screening out environmentally sensitive areas such as national parks, wilderness areas, wetlands, etc., that are not available for development, and (4) applying proxy technology, of a 50 megawatt (MW) parabolic trough concentrating solar thermal power plant, to estimate electrical energy capacity.





Major findings from the solar assessment:

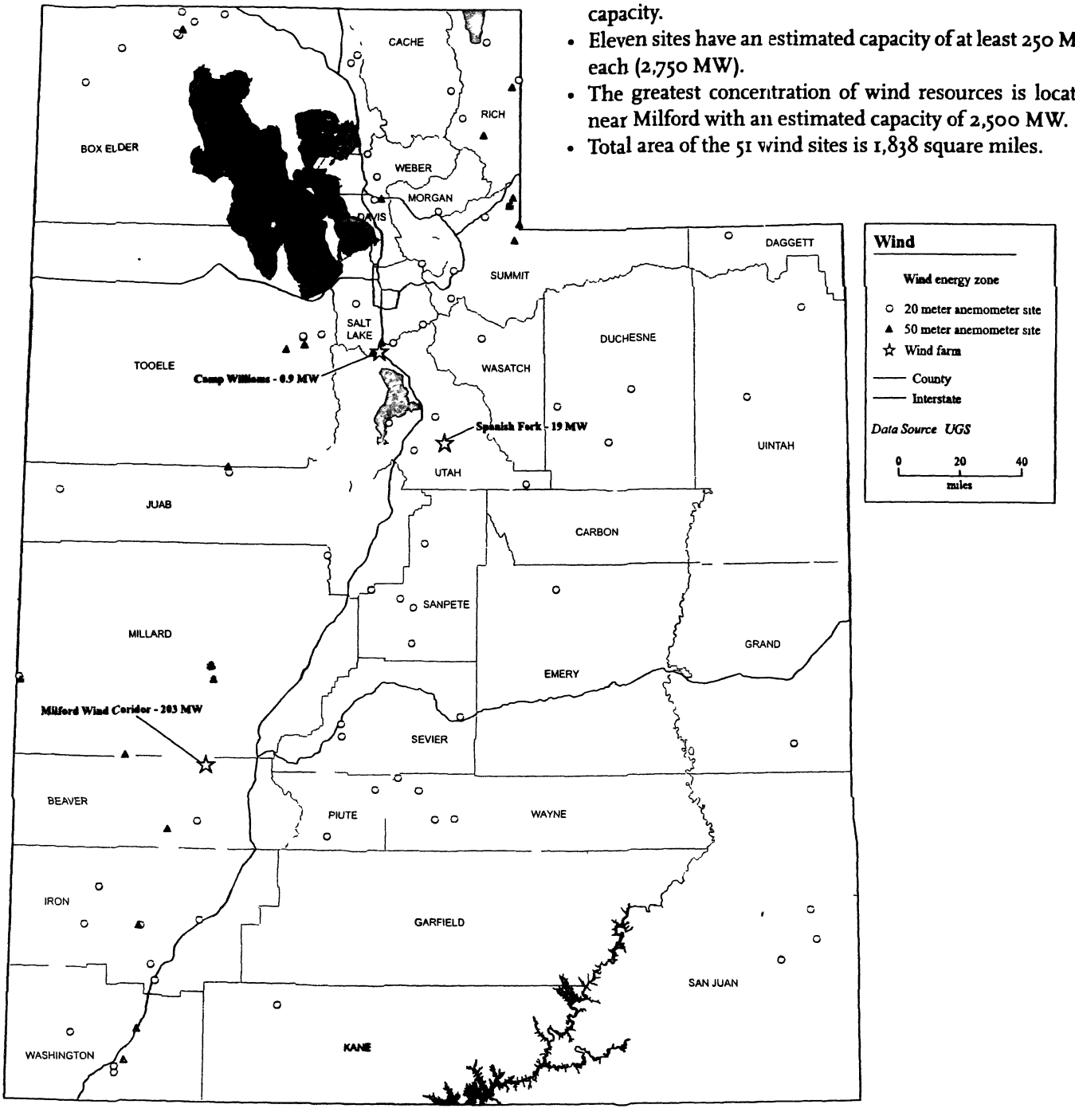
- Sixteen thousand five hundred (16,500) theoretically potential 50 MW solar Renewable Energy Zone (REZ) areas (1 km square zones) were identified (826 GW).
- The geospatial distribution of the quality of the solar resource follows a simple north to south trend.
- Southern Utah has the higher quality resources (6.5 kWh/m^2/day or greater), while northern Utah has a slightly lower quality solar resource (6.0 kWh/m^2/day or less).
- The prime solar REZ areas constitute less than 1.5% of the identified sites, while the majority of the sites (43.2%) have a lower resource potential.
- The total area of the solar REZs is 6,371 square miles.

WIND ASSESSMENT

Utah's extreme diversity in landscape and climate are well known. These factors significantly affect Utah's wind resources. As a result, Utah has a wide array of locations that may be viable options for wind energy development. The resource analysis to identify REZs was based upon wind data collected from 109 anemometer towers stationed throughout the state. The wind resource analysis incorporated several criteria to shape the methodology: (1) screening out environmentally sensitive areas, (2) setting a maximum elevation of 9,500 feet, (3) eliminating land too rugged for development, (4) deleting military operating airspace, and (5) using a proxy wind turbine, General Electric 1.5 sle model, to estimate electrical energy capacity from identified sites.

Major findings from the wind assessment:

- The combined technical electrical generating capacity is approximately 9,145 MW from the 51 wind REZs (orange areas on map).
- The estimated annual average gross capacity factor for the 51 REZ sites is 27.4%.
- Twelve sites have expected gross capacity factors of at least 30%, accounting for 1,830 MW or greater of generating capacity.
- Eleven sites have an estimated capacity of at least 250 MW each (2,750 MW).
- The greatest concentration of wind resources is located near Milford with an estimated capacity of 2,500 MW.
- Total area of the 51 wind sites is 1,838 square miles.

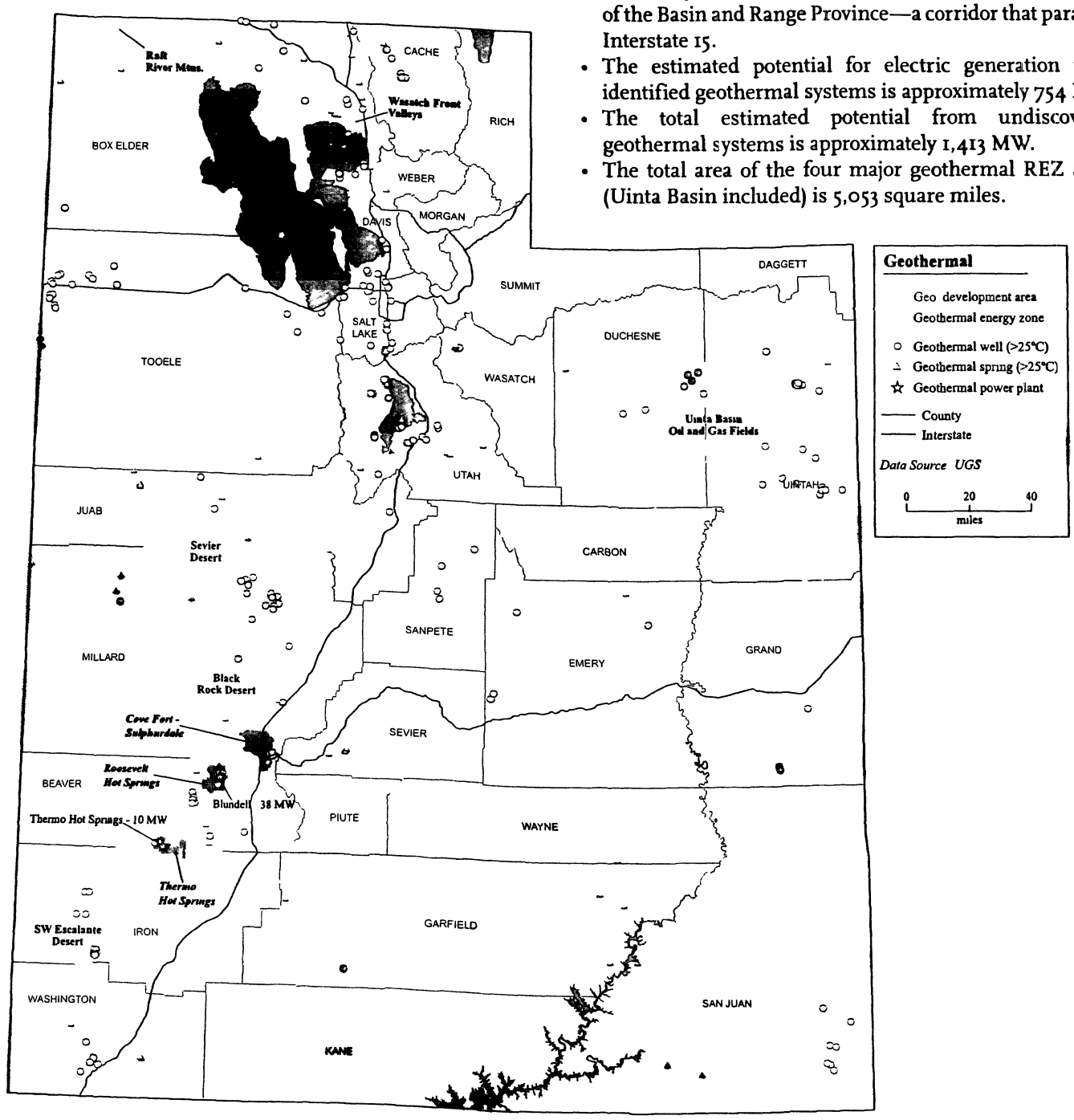


GEOTHERMAL ASSESSMENT

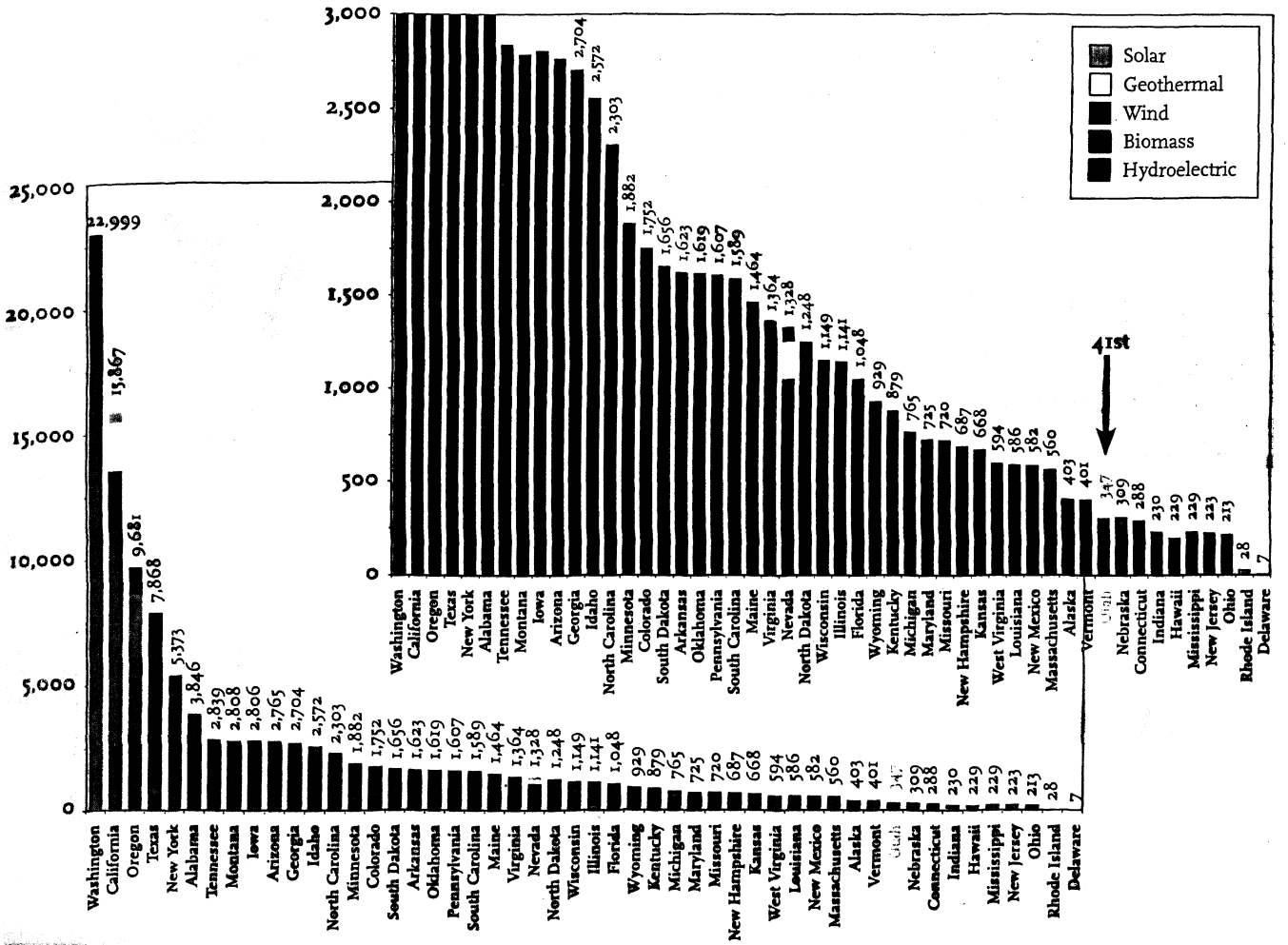
Although a number of geothermal power projects are currently underway, there is a general lack of subsurface drill-hole information for individual resource areas. The effort described here uses published information from various sources, but mostly relies on deep well data and shallow thermal-gradient information. Utah's identified higher-quality geothermal resources lie within a 50-mile-wide corridor along the eastern margin of the Basin and Range Province—a corridor that also parallels Interstate 15. Geothermal power generation projects are underway in southcentral and southwestern Utah. The geothermal analysis incorporated the following criteria to shape the methodology: (1) screening out environmentally sensitive areas not available for development, (2) calculating reservoir volume, and (3) factoring in porosity and sweep efficiency, which characterize the ability of the reservoir to transfer heat.

Major findings from the geothermal assessment:

- A total of 2,166 MW of geothermal development potential exists within the state (orange areas on map).
- Utah's identified higher-quality geothermal resources lie within a 50-mile-wide corridor along the eastern margin of the Basin and Range Province—a corridor that parallels Interstate 15.
- The estimated potential for electric generation from identified geothermal systems is approximately 754 MW.
- The total estimated potential from undiscovered geothermal systems is approximately 1,413 MW.
- The total area of the four major geothermal REZ areas (Uinta Basin included) is 5,053 square miles.



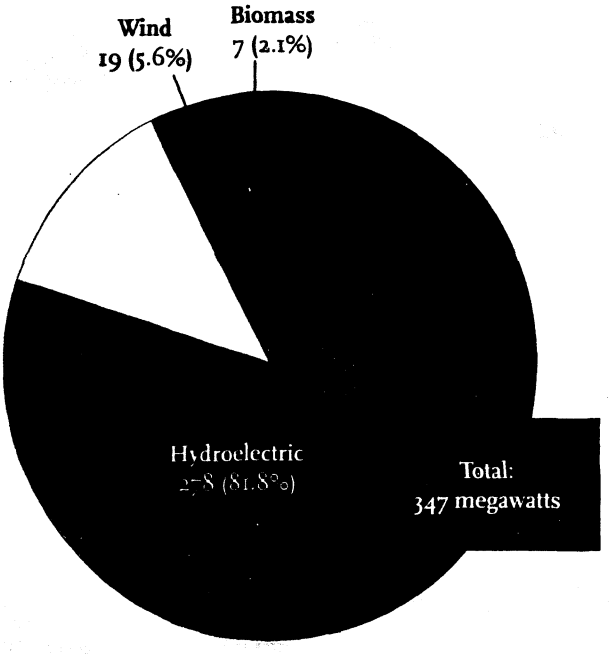
Renewable Net Summer Capacity by Energy Source and State, 2008



Utah ranked 41st in the nation in total renewable net electric capacity.

Utah's Renewable Net Summer Capacity by Energy Source, 2008

Megawatts (Percent of total)

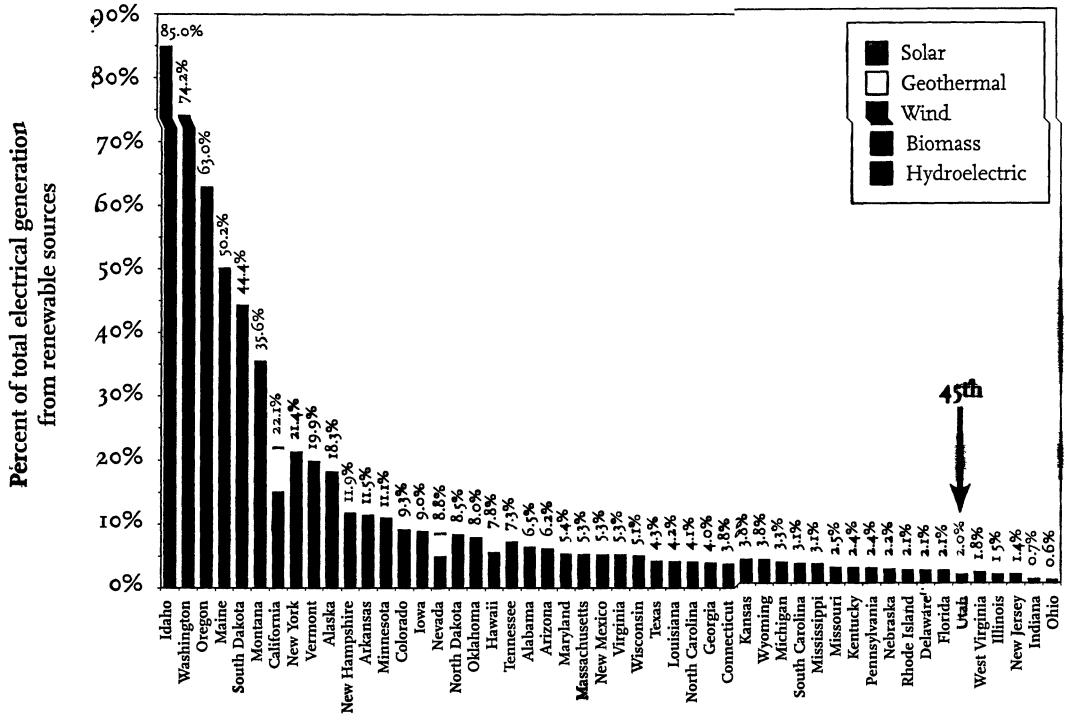


able electric capacity is dominated by hydroelectric ing Gorge), with increasing amounts from Raser Technologies is planning to build several scale geothermal plants in southwestern Utah) 03 MW Milford wind farm came online in late mass portion is mainly from Wasatch Front ations. The SunSmart solar array in St. George ility-owned solar installation, but at only 100 it is too small to be recorded by EIA or in the

table: Table 6.1

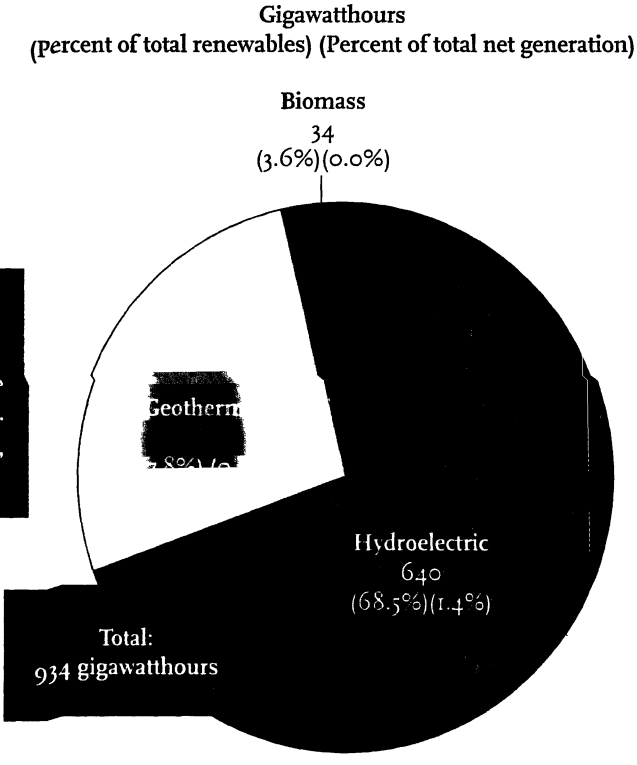
s utility scale capacity.

Renewable Electric Generation by State, 2008



In 2008, Utah ranked 45th in the nation in percent of total net electricity generation from renewable resources. Of particular note, Utah is one of only four states where electricity is generated from geothermal resources (two more states, Idaho and Montana, were added to this list in 2009).

Renewable Electric Generation in Utah, 2008

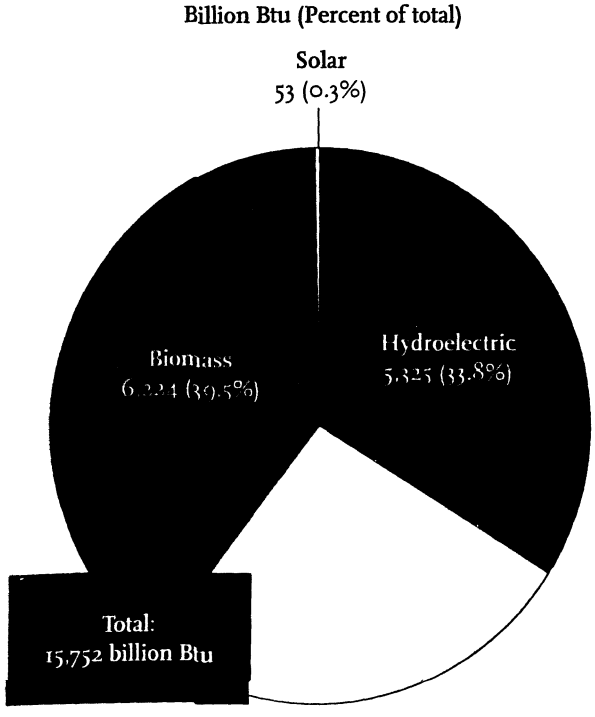


Utah's renewable electric generation is dominated by hydroelectric power, but electricity from geothermal and wind sources will increase in coming years. The biomass portion is electricity generated from burning landfill gases. Two smaller scale anaerobic digesters are located in Utah, but are not utility scale.

UEMS Web page table: Table 6.2
Source: EIA

Renewable Energy Consumption in Utah

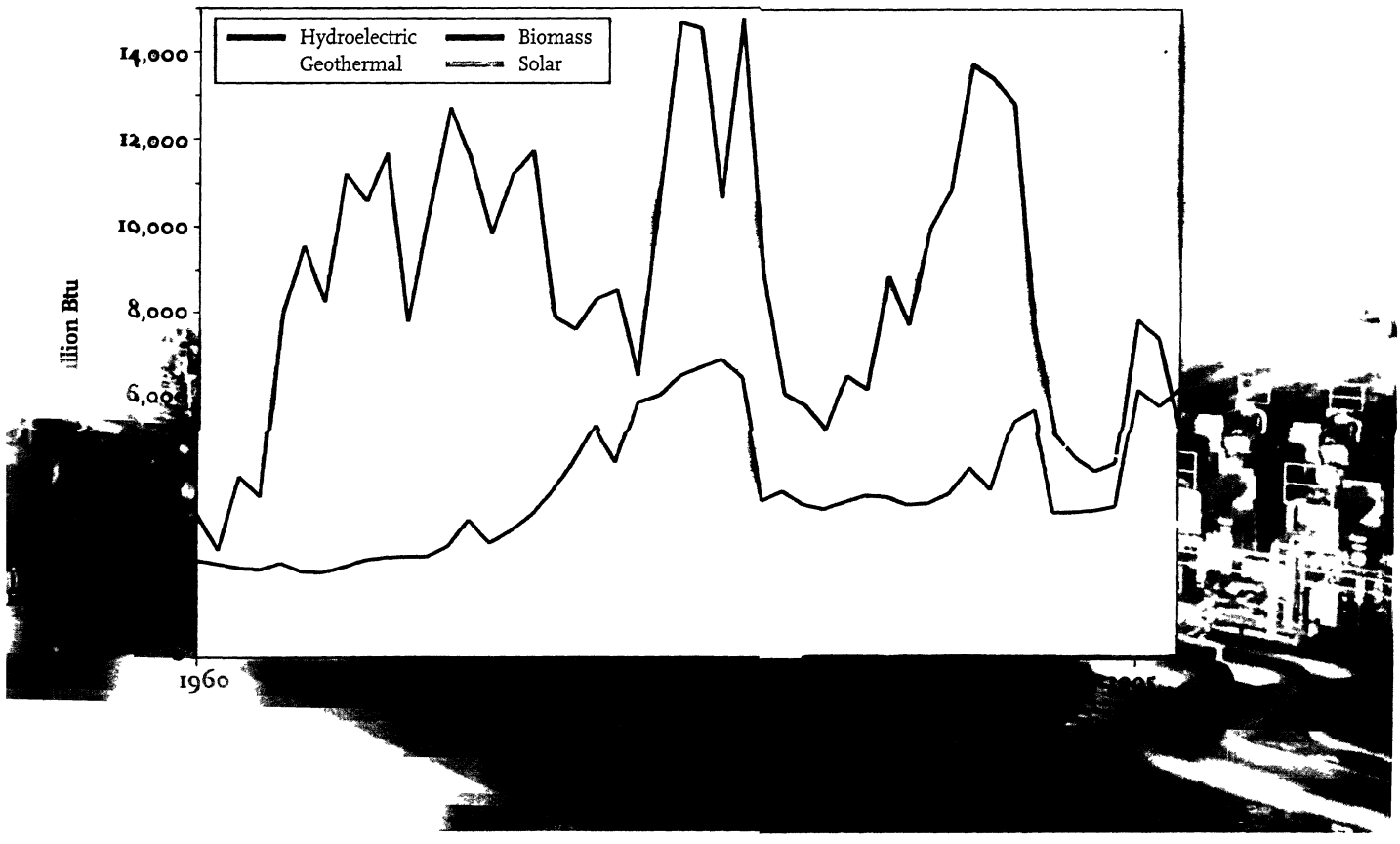
2007



Utah's 2007 consumption of energy from renewable sources was evenly split between hydroelectric, geothermal, and biomass, with very small amounts coming from commercial- and residential-scale solar photovoltaic arrays.

UEMS Web page table: Table 6.7
Source: EIA
Notes: 2008 data are not yet available; includes the electric utility sector; data on Utah wind energy consumption not available.

1960–2007



UNCONVENTIONAL PETROLEUM RESOURCES

The Utah Geological Survey recently completed a comprehensive oil shale resource assessment for deposits in the state of Utah. This assessment answers the questions of "where" and "how much" that many people ask about Utah's largest unconventional resource by providing detailed basin-wide resource maps and estimates of in-place shale oil.

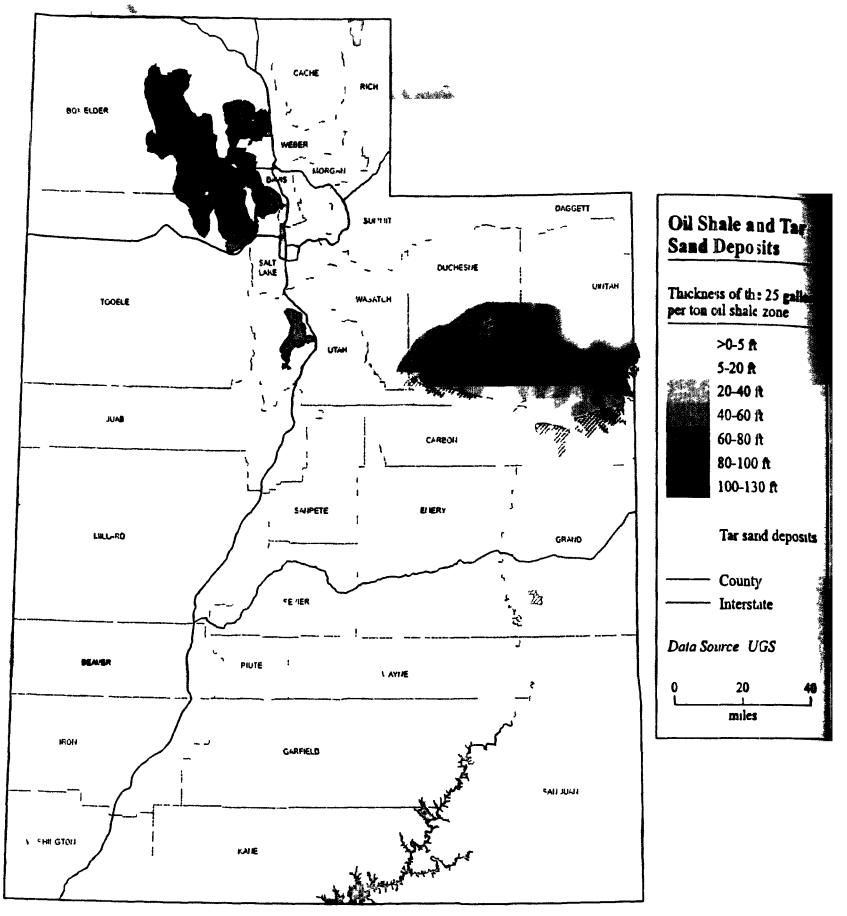
- A continuous interval of oil shale that averages 50 gallons of oil per ton of rock (GPT) contains an in-place resource of 31 billion barrels of shale oil.
- A continuous interval of oil shale that averages 35 GPT contains an in-place resource of 76 billion barrels of shale oil.
- A continuous interval of oil shale that averages 25 GPT contains an in-place resource of 147 billion barrels of shale oil (see included map).
- A continuous interval of oil shale that averages 15 GPT contains an in-place resource of 292 billion barrels of shale oil.

After calculating total in-place resource numbers, the UGS imposed several constraints on the total endowment to offer a more realistic impression of Utah's potentially economic oil shale resource. The constraints used were:

- deposits having a richness of at least 25 GPT (assumed minimum grade),
- deposits that are at least 5 feet thick (assumed minimum mining thickness),
- deposits under less than 3000 feet of cover (maximum underground mining depth),
- deposits that are not in direct conflict with current conventional oil and gas operations, and
- deposits located only on U.S. Bureau of Land Management, state trust, private, and tribal lands.

Accounting for these constraints, UGS estimates that approximately 77 billion barrels of shale oil are located in north-central Utah.

Currently, only a handful of companies are pursuing oil shale development in Utah, including the Oil Shale Exploration Company (OSEC), which was the only company awarded an oil shale research and development lease from the U.S. Bureau of Land Management.

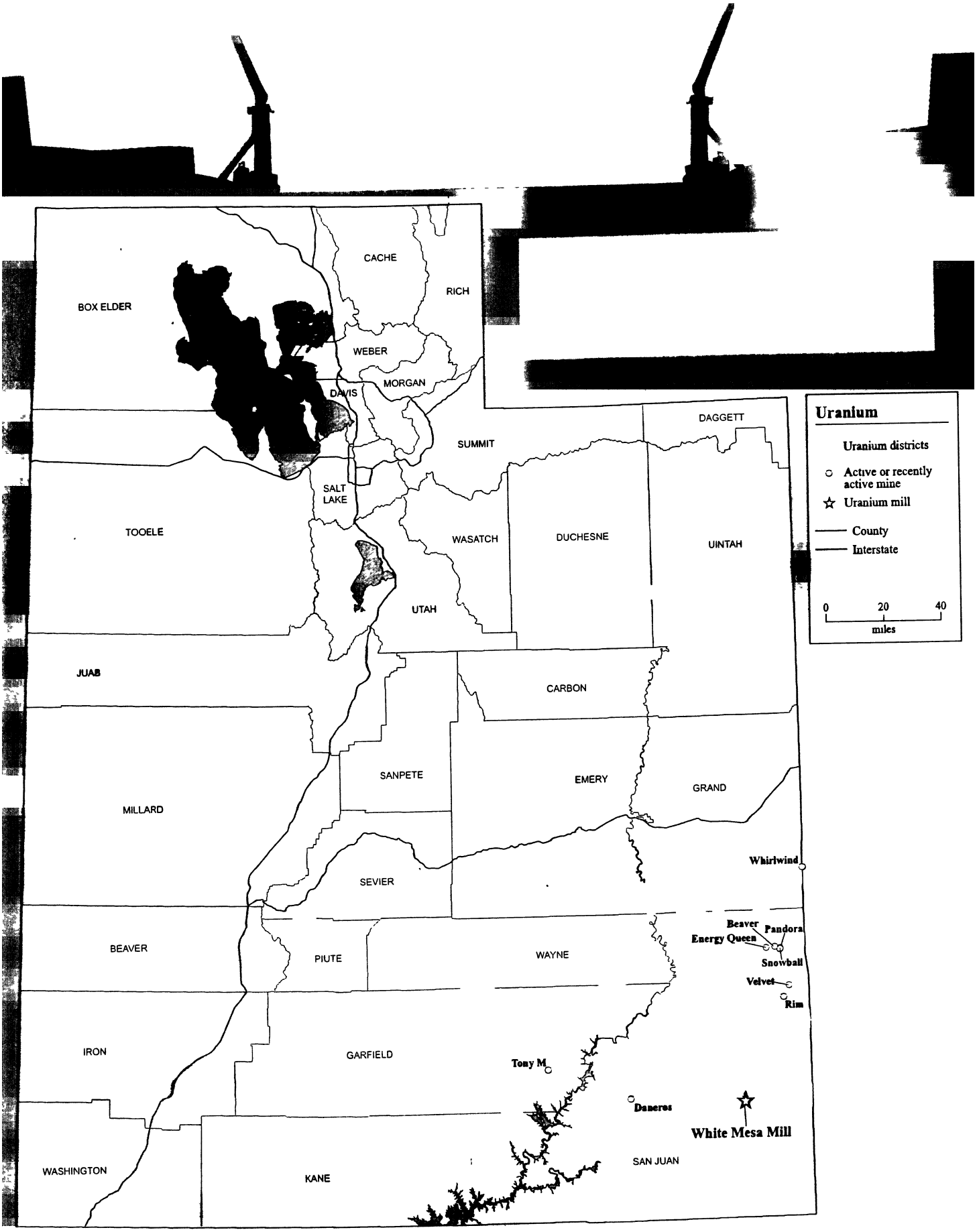


TAR SANDS

North America has the greatest tar sand resources in the world, the majority of which are in Canada. Utah's tar sand resource, though small in comparison to that of Canada, is the largest in the United States. Utah's tar sand deposits contain 14 to 15 billion barrels of measured in-place oil, with an additional estimated resource of 23 to 28 billion barrels. Twenty-four individual deposits exist in the Uinta Basin, mainly around its periphery, and an additional 50 deposits are scattered throughout the southeastern part of the state. Utah's major tar sand deposits individually have areal extents ranging from 20 to over 250 square miles, as many as 13 pay zones, gross thickness ranging from 10 to more than 1000 feet, and overburden thickness ranging from zero to over 500 feet.

With the current high price of crude oil as an incentive, new drilling, bitumen extraction, and upgrading techniques developed in Canada may provide the necessary knowledge for successful and sustainable development of tar sand in Utah in the near future. However, factors such as site accessibility, adequate infrastructure, water availability, environmental concerns, land access and permitting, and the problems associated with the heterogeneity of reservoir sands must be resolved before tar sand development can become a reality in Utah.

Currently, two companies are researching development of tar sands within the Asphalt Ridge deposit, and one company is looking at possible development in the PR Springs area.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EMERY
GRAND
MILLARD
SEVIER
Whirlwind
Beaver
Pandora
Energy Queen
Snowball
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Rim
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Tony M
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WASHINGTON
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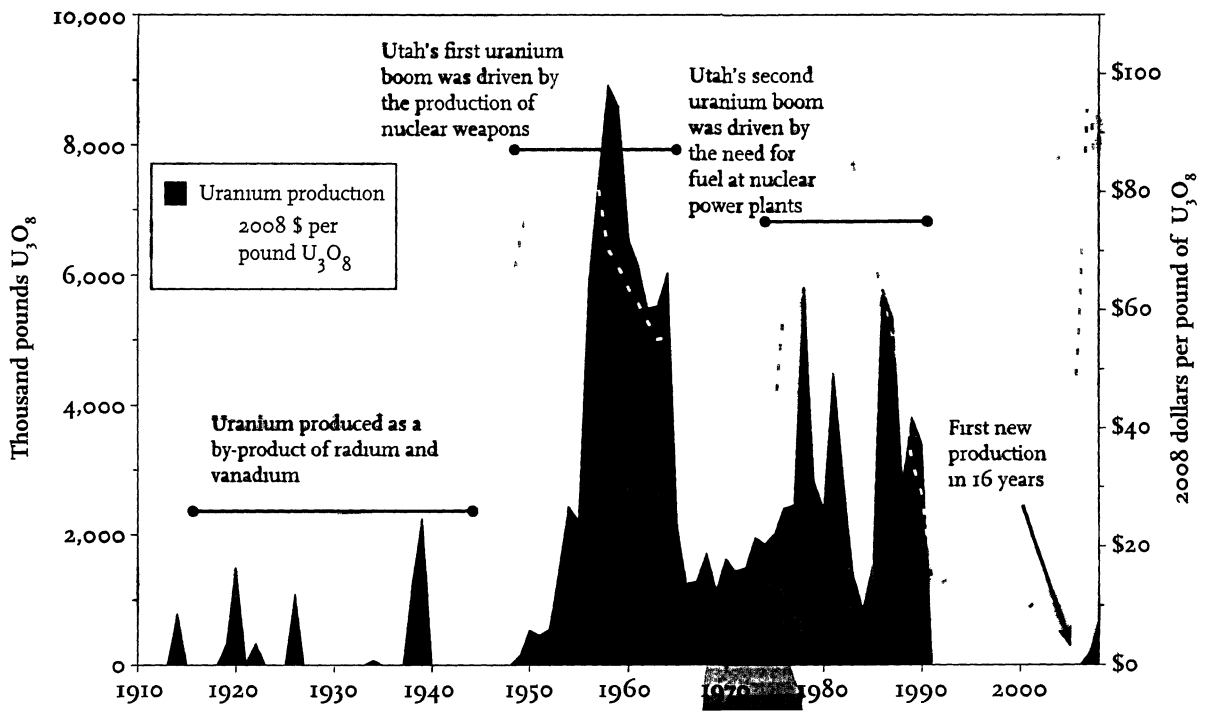
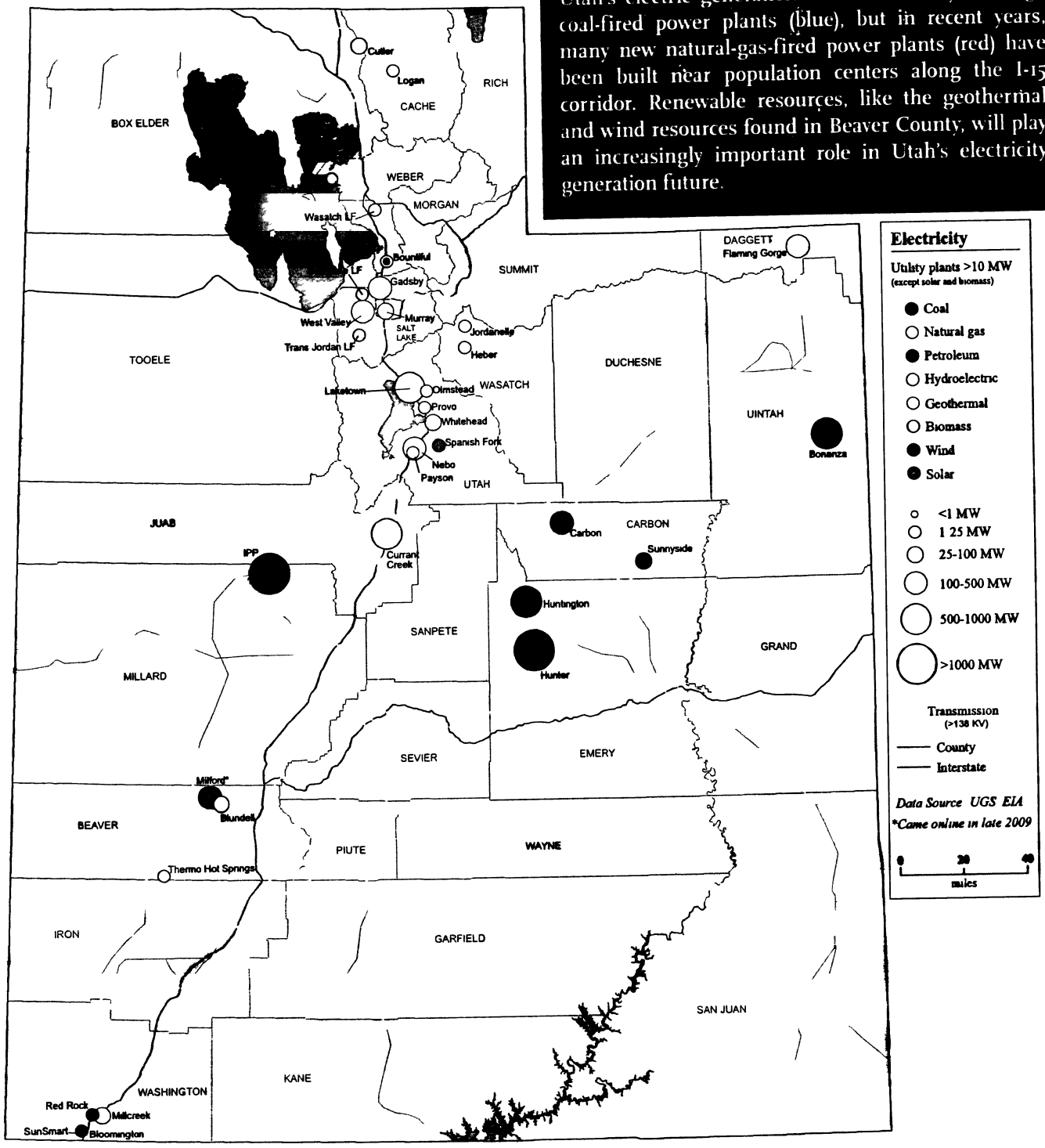
Uranium Production in Utah, 1910–2008



UEMS Web page table: Table 9.1
Source: EIA
Note: 2008 data are preliminary.

ELECTRICITY

Utah's electric generation is dominated by six large coal-fired power plants (blue), but in recent years, many new natural-gas-fired power plants (red) have been built near population centers along the I-15 corridor. Renewable resources, like the geothermal and wind resources found in Beaver County, will play an increasingly important role in Utah's electricity generation future.



LANTS, 2008
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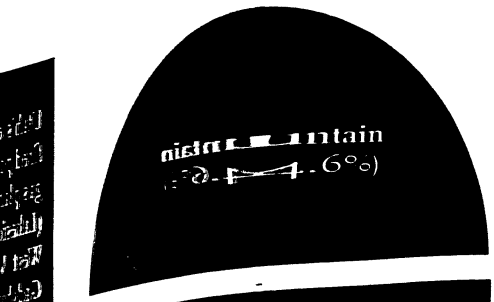
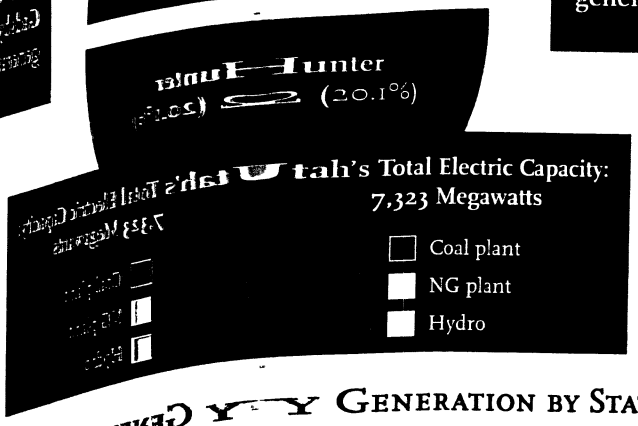
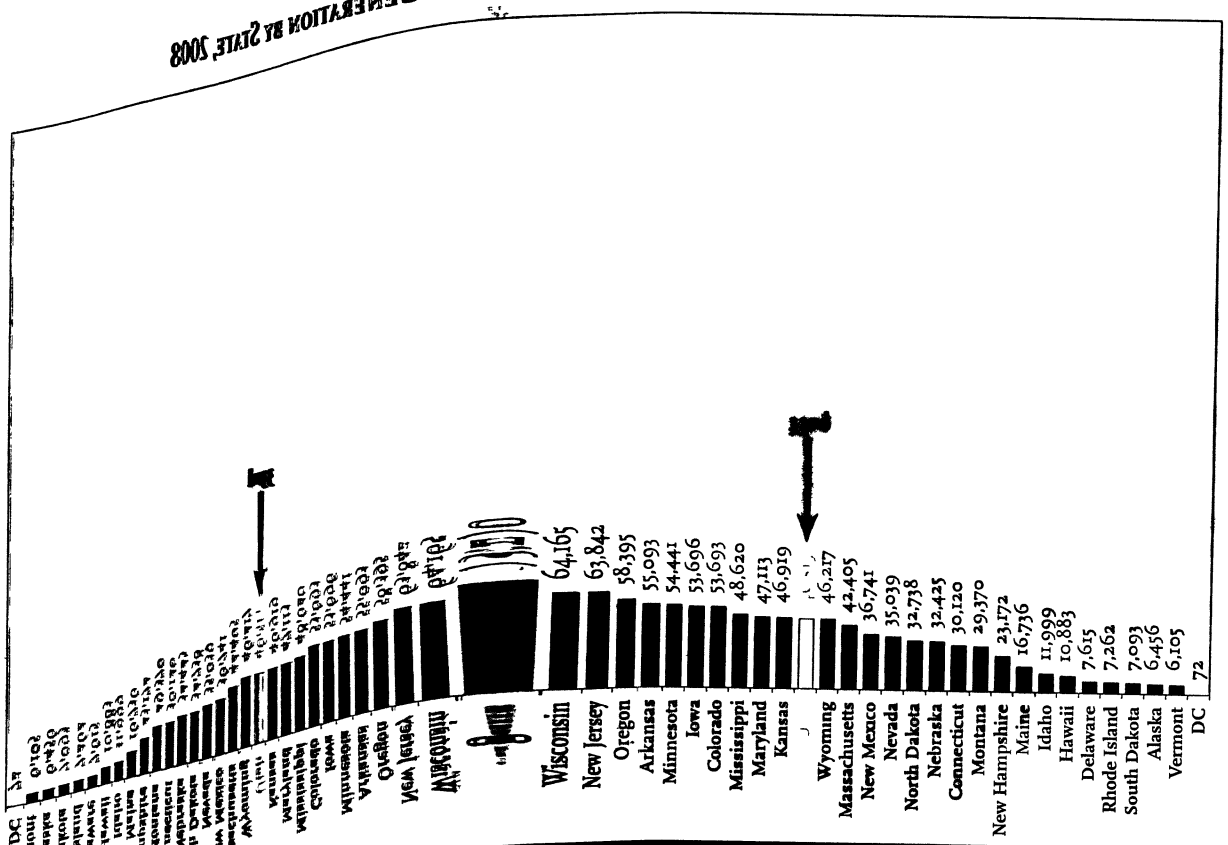




Utah's electricity portfolio is dominated by coal-fired power plants. However, several new natural gas plants have been built in the past eight years (Lakeside – 2007, Currant Creek – 2005–2006, West Valley – 2002, and three new units at Gadsby – 2002) decreasing our reliance on coal generation.

UEMS Web page table: Table 5.1
Source: EIA
Note: Only includes utility plants.

GENERATION BY STATE, 2008

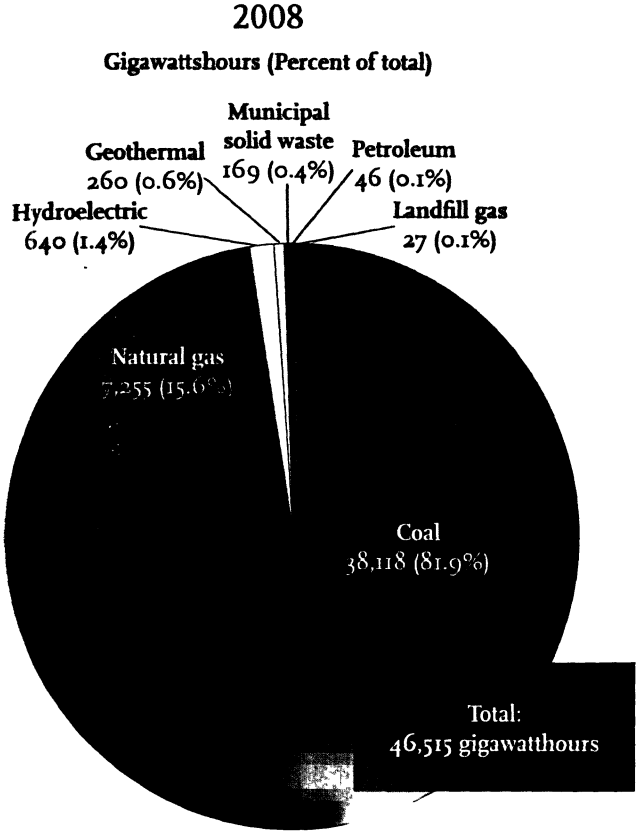


ricity ranked 33rd in the nation in 2008.

UEMS Web page table: Table 5.9
Source: EIA
Note: 2008 data are preliminary

Net Generation of Electricity in Utah by Energy Source

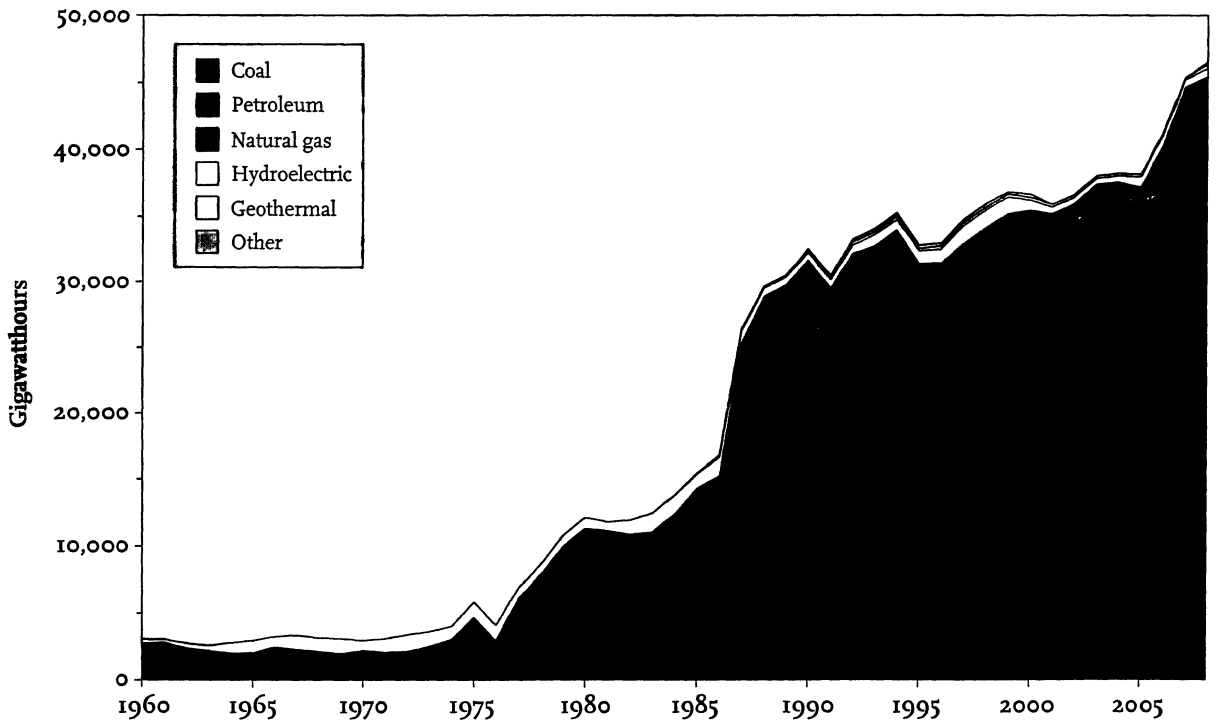
2008



Coal has always dominated Utah's electricity generation portfolio, accounting for 94.2% of Utah's total net generation in 2005. However, in the past five years, 1318 megawatts of new natural-gas-fired electric capacity were built, decreasing coal's overall share to 81.9% in 2008 and increasing natural gas's share to 15.6%.

UEMS Web page table: Table 5.10
Source: EIA
Notes: 2008 data are preliminary; "Other" includes municipal solid waste, landfill gas, and other gases derived from fossil fuels.

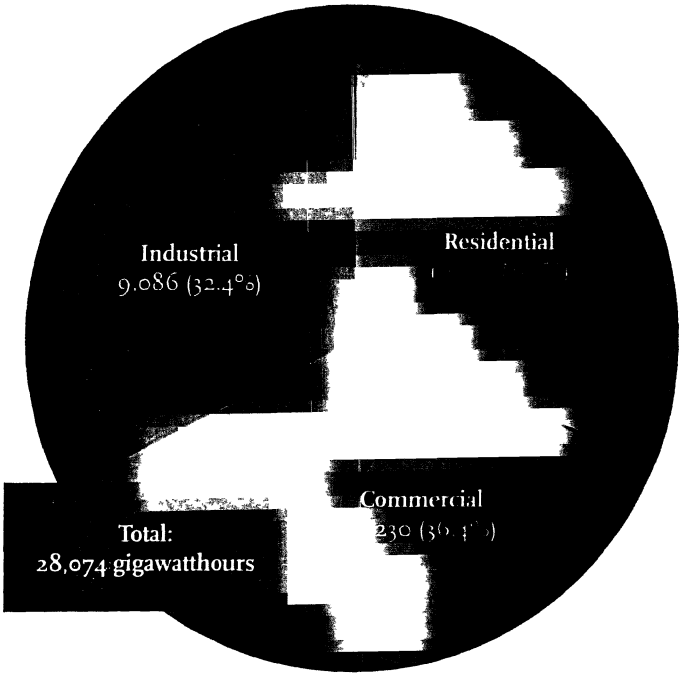
1960–2008



Sales of Electricity in Utah by Sector

2008

Gigawattshours (Percent of total)



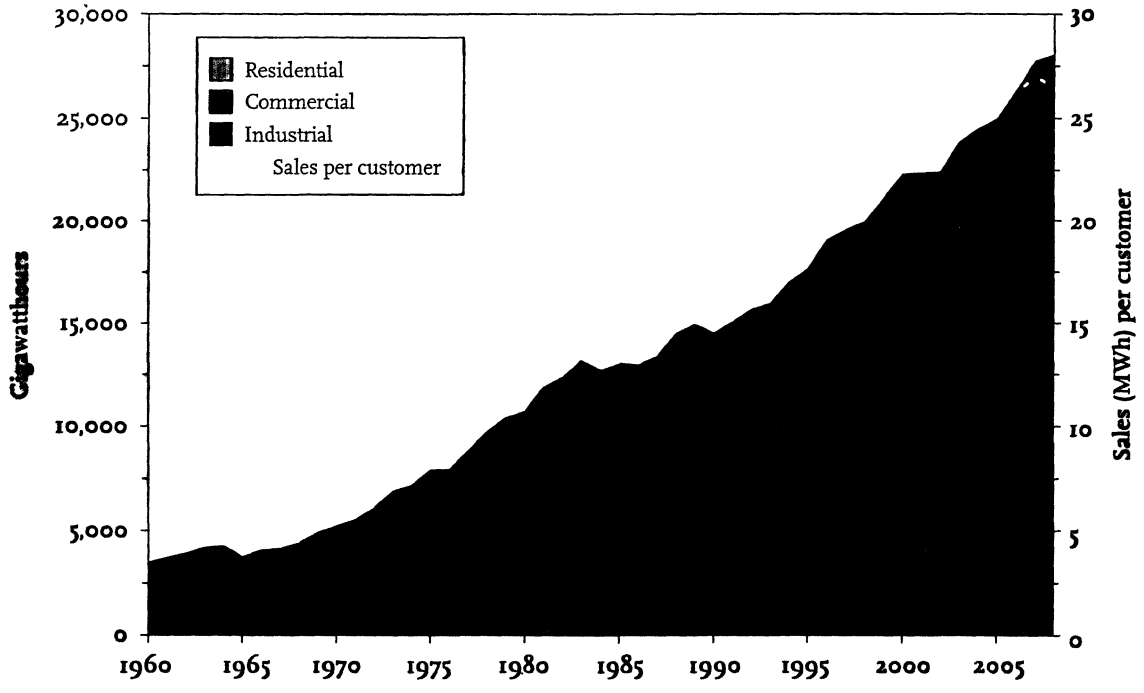
Electricity sales in Utah have averaged a 4.5% increase each year since 1960, roughly following increases in population (an average increase of 2.4% per year) and increases in per customer electricity use (an average increase of 3.0% per year). Each customer in Utah used roughly 13 MWh per year in 1960, and today each Utahn uses about 27 MWh per year.

UEMS Web page table: Table 5.19

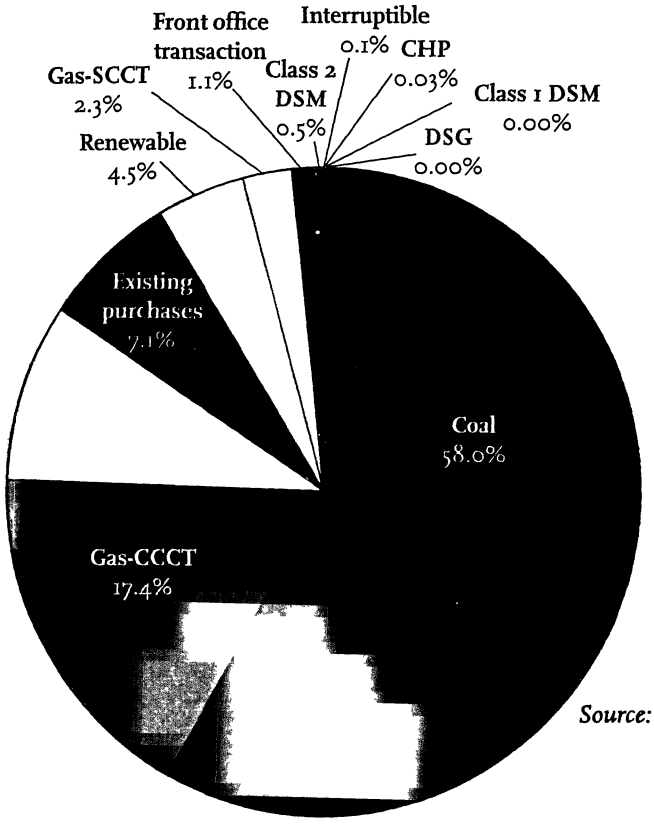
Source: EIA

Notes: 2008 data are preliminary; Electricity used by the transportation sector (UTA transit) is very small (35 GWh in 2008) and is not shown on the graphs.

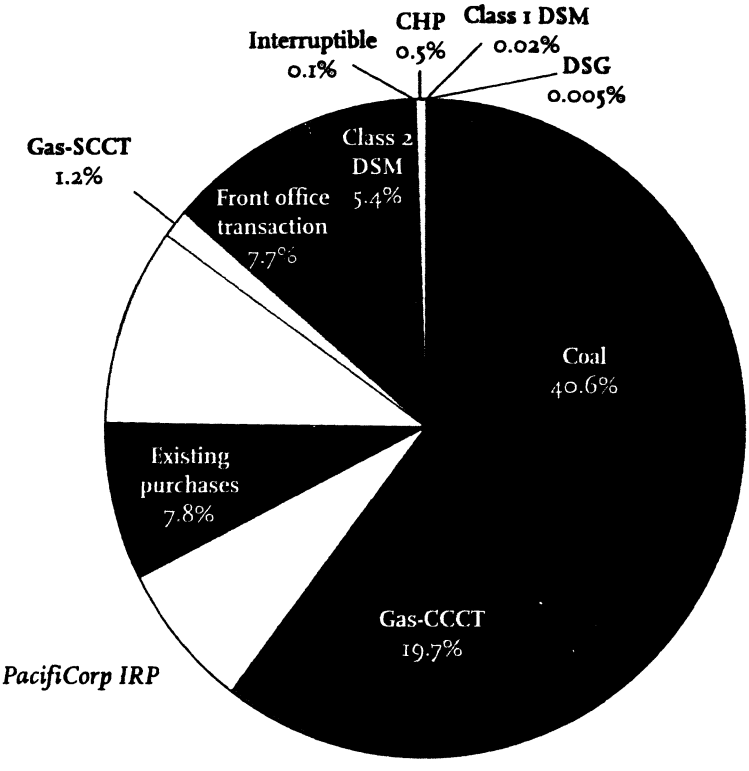
1960–2008



PACIFICORP'S 2009 RESOURCE ENERGY MIX



PACIFICORP'S 2018 PROJECTED RESOURCE ENERGY MIX



Source: PacifiCorp IRP

Utah's net generation portfolio shows the fuel used to generate electricity at power plants in Utah; however, it is not a reliable indicator of the source of the electricity we actually use since much of the electricity generated in Utah travels out of state (e.g., about 75% of the electricity generated at IPP is consumed in California). The source of the electricity at the customer's electric outlet can be estimated based on PacifiCorp's (Utah's largest electricity provider) resource energy mix. For example, in 2009, a PacifiCorp customer can assume that 4.5% of the electricity they consume was generated by renewable resources such as wind, solar, geothermal, or biomass and that 8.9% comes from hydroelectric sources.

CHP: Combined heat and power

Class 1 DSM: Demand side management (i.e., energy efficiency measures) – Class 1 programs are those for which capacity savings occur as a result of active company control or advanced scheduling. Once customers agree to participate in Class 1 DSM program, the timing and persistence of the load reduction is involuntary on their part within the agreed limits and parameters of the program. In most cases, loads are shifted rather than avoided.

Class 2 DSM: Demand side management (i.e., energy efficiency measures) – Class 2 programs are those for which sustainable energy and capacity savings are achieved through facilitation of technological advancements in equipment, appliances, lighting, and structures.

Class 2 programs generally provide financial and/or service incentives to customers to replace equipment and appliances in existing customer owned facilities (or to upgrade in new construction) to more efficient lighting, motors, air conditioners, insulation levels, windows, etc. Savings will endure over the life of the improvement.

DSG: Distributed standby generators

Existing Purchases: Power purchase agreements, PURPA qualified facilities (may include renewables).

Front Office Transactions: Proxy resources that represent procurement activity made on an annual forward basis to help the company cover short term positions (i.e., spot market purchases may include renewables).

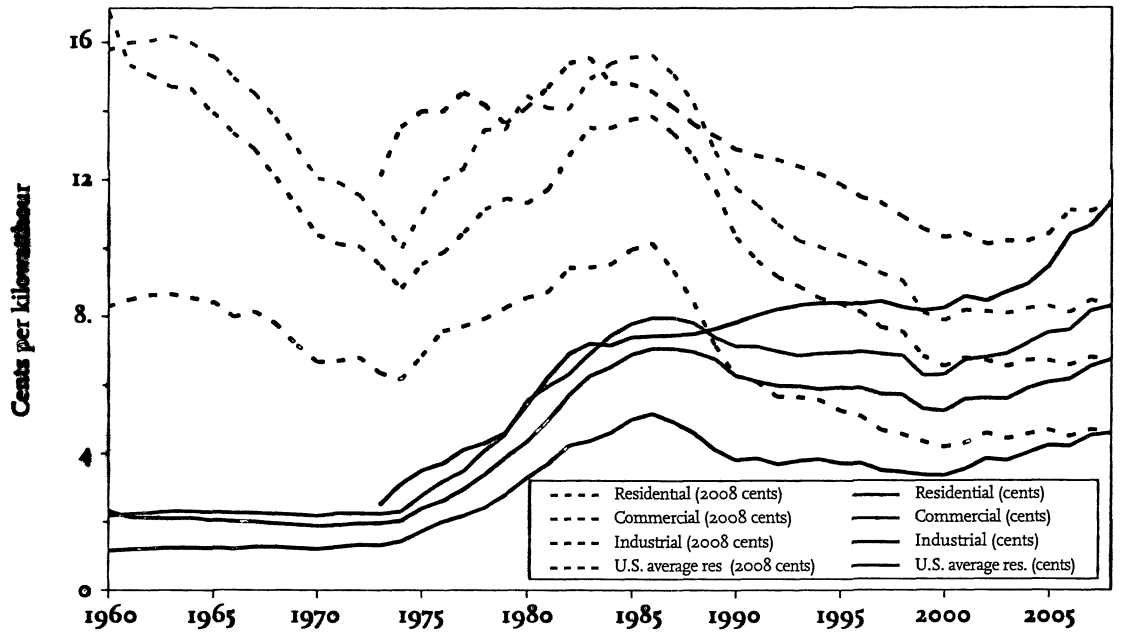
Interruptible: Directly curtailed loads

Gas-CCCT: Combined-cycle combustion turbine

Gas-SCCT: Simple-cycle combustion turbine

Renewable: Wind, geothermal, solar, and biomass

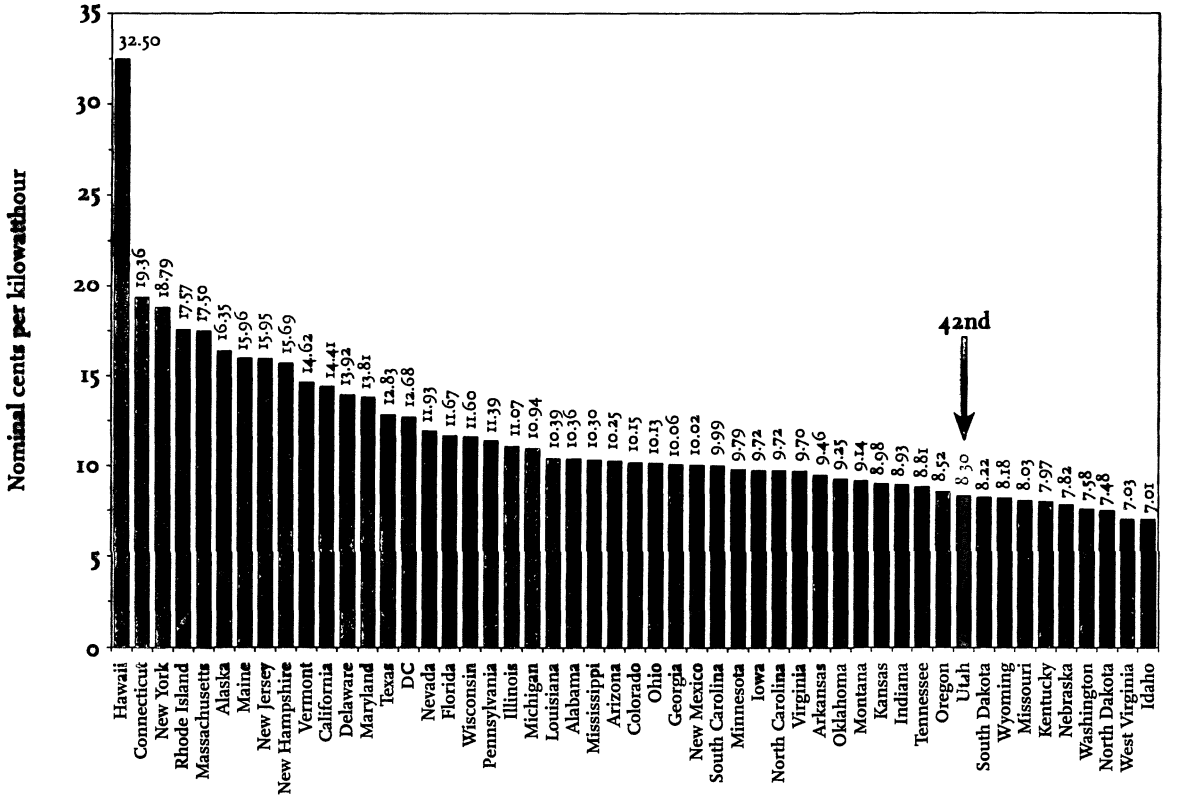
Price of Electricity in Utah by Sector, 1960–2008



UEMS Web page table:
Table 5.20
Source: EIA
Note: 2008 data are preliminary.

The price of electricity in Utah has generally decreased (when examining inflation-adjusted prices) over the years, with an average residential price of 8.3 cents per kilowatthour in 2008. Also, since 1989, Utah's residential price has averaged 1.7 cents less than the national average.

Average Residential Price of Electricity by State, 2008

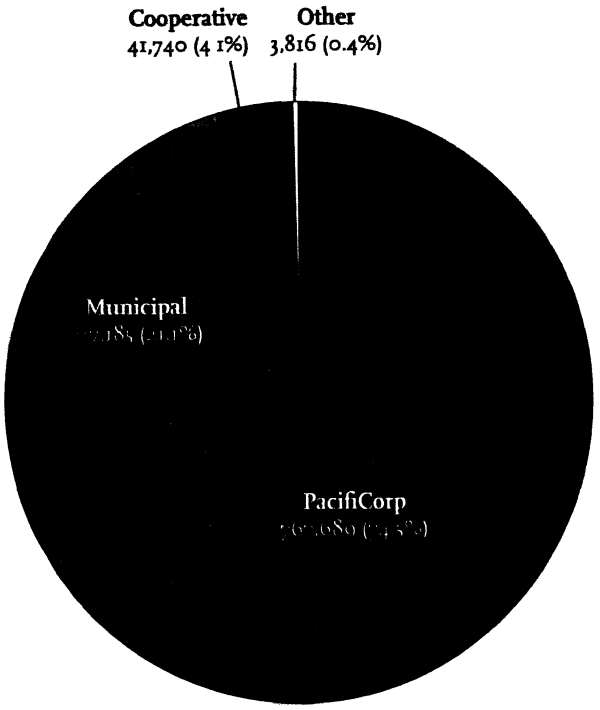


UEMS Web page table:
Table 5.21
Source: EIA
Notes: 2008 data are preliminary; includes District of Columbia.

Utah's average price of residential electricity ranked 10th lowest in the nation in 2008 because of Utah's fully amortized coal-fire generation.

Electric Utility Customers in Utah by Class of Ownership, 2007

# of customers (Percent of total)

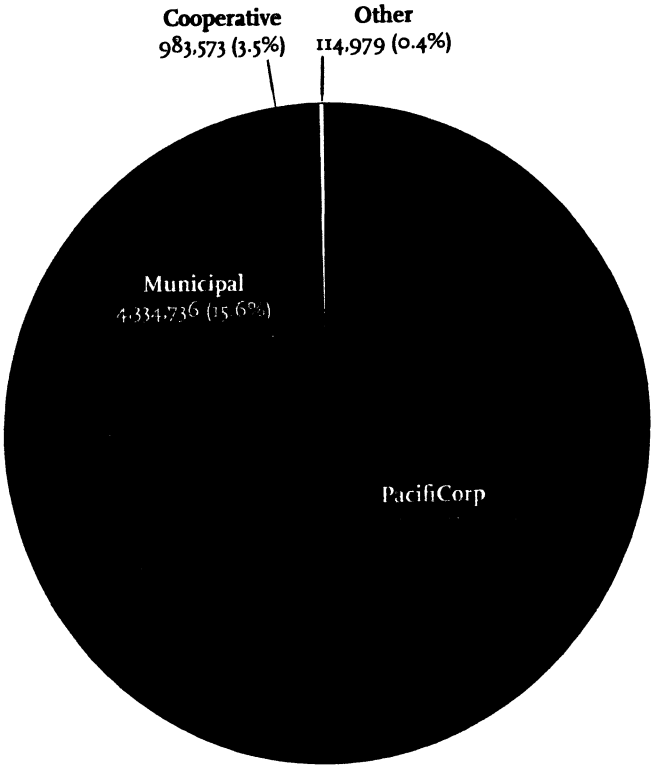


The majority of electricity in Utah is provided by PacifiCorp, supplying 75% of Utah customers and accounting for 80% of in-state sales. Thirty-eight municipal-owned utilities provide the next-largest contribution, followed by nine cooperative electric utilities.

UEMS Web page table: Table 5.24
Source: EIA
Notes: 2008 data are not yet available; "other" includes state, political subdivision, and federal.

Electric Utility Sales in Utah by Class of Ownership, 2007

Megwatthours (Percent of total)



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UTAH HISTORICAL QUARTERLY

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An artist's concept of famous Bingham Canyon about 1915. Prominent in the background is the decade-old Utah Copper Mine. Farther down the canyon are the Wall and Redwing mills and Winnamuck operations. Cogwheel railroads and tramways form part of the scene. DALE KILBOURNE, ARTIST

EDITOR ..... Everett L. Cooley
ASSOCIATE EDITOR ..... Margery W. Ward
ART EDITOR ..... Roy J. Olsen

UTAH'S BLACK GOLD: The Petroleum Industry

BY OSMOND L. HARLINE

This article (1) reviews briefly the development of Utah's crude-oil-producing industry, (2) summarizes the highlights of the establishment of Utah's petroleum-refining complex (which had its beginning even before commercial quantities of oil were found within the state) and (3) examines the significant events associated with the petroleum-related natural-gas-producing industry of Utah. The growth of these three aspects of the petroleum industry, all of which have contributed significantly to the economic advancement of the state, are an important chapter in Utah's mineral history.

Crude Oil Production

Petroleum in Utah first came to the attention of the white man in the form of an oil seep. On July 11, 1847, William Clayton chronicled the historic event in this manner:

> During the day some of the brethren [members of Brigham Young's first company of Mormon pioneers] discovered an oil spring. The substance which rises out of the ground resembles tar and is very oily. Some have oiled their shoes, others have gone to fill their tar baskets and are sanguine it will answer well to grease wagons . . . .[1]

The location of the discovery was about 82.5 miles east of Salt Lake City near the present Utah-Wyoming border on the old Pioneer Trail.

Dr. Harline is director of the Bureau of Economic and Business Research, University of Utah. Appreciation is expressed to the many individuals and companies in the industry whose significant contribution of information made this article possible. The research assistance of D. T. Verma, Charles J. Eidler, and Katherine L. Lueck, research analysts on the staff of the University Bureau, is also gratefully acknowledged.

[1] William Clayton, *William Clayton's Journal: A Daily Record of the Journey of the Original Company of "Mormon" Pioneers from Nauvoo, Illinois, to the Valley of the Great Salt Lake* (Salt Lake City, 1921), 289.

UTAH PETROLEUM COUNCIL

Oil drilling in Utah's vast plateau country of the Colorado and San Juan rivers region.

It was not until 1948, after a lapse of over a hundred years, that the frst well to produce petroleum in commercial quantities was brought in. Thus, Utah's crude-oil-producing industry was first born a century after the first Utah oil seep was discovered and almost a century after its big brother, the 1859 Titusville-Pennsylvania well, was completed.[2] Once established, however, the Utah industry lost little time, and in several years reached boom proportions as can be seen by examining the main features of its development.

The record of wells drilled in Utah, their exact location, date of completion, depth, information as to geologic formation, and results of the drilling are reasonably complete. Even so, much of the information is missing.[3] A close study of the available information shows that in the 72-year period, 1891 (when the first Utah well was drilled) to 1962, there were only about half a dozen years when no wells were drilled in the search for oil. Oil drilling during this span

[2] Sam H. Schurr and Bruce C. Netschert, *Energy in the American Economy 1850–1975, Its History and Prospects* (Baltimore, 1960), 84–85.

[3] George H. Hansen and H. C. Scoville, *Drilling Records for Oil and Gas in Utah*, Utah Geological and Mineralogical Survey *Bulletin 50* (Salt Lake City, 1955), for 1891–1954 period. See also, for period 1955 to date, reports of the Utah State Oil and Gas Conservation Commission, Salt Lake City, Utah.

appears to have been concentrated in three periods, 1907–1913, 1920–1932, and 1945 to date, more particularly 1956 to date. In addition to these periods, the annals show a considerable amount of oil prospecting and accompanying interest during the 1890's although the wells drilled were fewer in number. The "spudding-in" process[4] has occurred in all of Utah's 29 counties except four (Beaver, Morgan, Piute, and Rich).

The distinction of having drilled the first Utah oil well belongs to Bamberger and Millis.[5] Early in 1891, Simon Bamberger (later Utah governor from 1916 to 1920) financed the drilling of a hole near the track of the Denver & Rio Grande Western Railroad on the east side of the river south of the town of Elgin in Grand County. At 1,040 feet in depth the auger penetrated a stratum of gypsum; drilling was stopped, and the well was shut down with no reported oil production.

With these discouraging results, no additional efforts to drill for oil or gas in this locality were made for about 10 years. Three more wells were drilled in 1899 and 1900 with the same result. Ten years later, from 1910 to 1914, there was a revival of activity in the area of the "Green River Desert" during which time several more wells were drilled. None of the wells, which were probed to a depth of 1,400 to 1,800 feet, found more than a trace of oil; although some gas was found in one or two.[6]

For the second recorded drilling within the state the scene shifted to the Farmington area on the east shores of Great Salt Lake about one mile from the steep escarpment of the Wasatch Range. Drilling apparently started in the last part of 1891. No oil was found, but by March, 1892, there were four gas wells.[7] A dozen or more wells were drilled in the field, but as will be noted later, this beginning of the natural-gas industry in Utah soon played out. Meanwhile, the search for the first traces of black gold within the state moved elsewhere.

At the turn of the century there seems to have been little actual drilling, but excitement was apparently high. A 1901 editorial boldly announced:

> When it becomes generally known that the same conditions (as in California) exist in Utah . . . and that the area of oil bearing rocks are as great, we believe that the oil of this section will be brought as prominently before the public as are the oil bearing fields of either California or Texas, and we cannot but believe that in our time Utah will become famous the world over. . . .[8]

[4] "Spudding-in" is a term used in the petroleum industry to indicate the initial start in the drilling of a well.

[5] Charles T. Lupton, "Oil and Gas near Green River, Grand County, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 541, 1912* (Washington, D.C., 1914), Part II, 117.

[6] Arthur A. Baker, "Geology and Oil Possibilities of the Moab District, Grand and San Juan Counties, Utah," United States Geological Survey *Bulletin 841* (Washington, D.C., 1933), 80.

[7] E. B. Heylmun, "Farmington Field, Davis County, Utah," *A Symposium of the Oil and Gas Fields of Utah* (Salt Lake City, 1961).

[8] *Salt Lake Tribune*, October 3, 1948, p. 85.

In May, 1902, the "oil interests" of Utah and "investors" called together an "oil convention" at Price, Utah, to discuss the development of Utah oil fields, protect original locations of claims, and formulate plans for the organization of a bureau of information.[9] But events revealed the optimism was premature. Little drilling was done; none of it successfully until 1907–8. These two years marked the beginning of seven years of the most intensive drilling the state had experienced to date in its history. Activity centered in three areas — the Virgin field, near the town of Virgin in Washington County, the Mexican Hat field near the town of the same name in San Juan County, and the Rozell field on the north shores of Great Salt Lake in Box Elder County (the last was a failure).[10] Events occurring in the other two fields are of historical significance because it was these fields which gave the state its first production of oil, 18 years and several dozen wells after the first unsuccessful oil well was completed.

In 1907, about two miles northeast of the little town of Virgin, Washington County, the existence of oil seeps prompted some drillings. About 15 wells were drilled, and although most were failures, one well is said to have produced gas to make a flame several feet long from a two-inch pipe; one well produced oil temporarily; three are stated to have produced initially as high as 36 barrels a day.[11] Lack of a ready market and the financial panic of 1907, which cut the source of ready capital for exploratory work, caused activity to cease.

Eleven years later, 1918, the three producing wells were cleaned out and shot, pumping was started, and a small local refinery was built.[12] About 140 wells have been drilled at the Virgin field and in the immediate vicinity, mostly to depths of less than 1,000 feet.[13] At the present time a small topping plant in the field operates intermittently refining crude oil into fuel oil and diesel fuel for local sale.[14]

[9] *Ibid.*

[10] As a matter of fact the Rozell field has still to produce its first barrel of oil although at this writing it is again one of Utah's hottest areas of activity in oil and gas leasing.

[11] Harvey Bassler and John B. Reeside, Jr., "Oil Prospects in Washington County, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 726, 1921* (Washington, D.C., 1922), 94.

[12] *Ibid.*

[13] E. B. Heylmun, "Virgin Field, Washington County, Utah," *A Symposium.* The term field designates an area of oil or gas production; a field may contain many or only one well.

[14] Earl F. Cook, "Geology and Oil Possibilities of Washington County," *Oil and Gas Possibilities of Utah, Re-evaluated*, Utah Geological and Mineralogical Survey *Bulletin 54* (Salt Lake City, 1963), 313.

No area went unprospected in the search for oil. Even Great Salt Lake did not escape exploration as indicated in this photograph of drilling operations near Rozel, Utah.

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Even though this original 1907 exploration gave Utah its first actual oil-producing field, the field (because of small production) was not termed commercial. This is self-evident when we realize that the Virgin oil field's 55-year cumulative production, estimated to total about 195,000 barrels of oil,[15] would keep Utah's four oil refineries supplied for only two days.

The discovery of Utah's second oil field brought about the state's first oil boom. The location was the Mexican Hat area on the San Juan River in San Juan County. About the time Silas Smith left Cedar City, Utah, in April, 1879, to investigate the colonization possibilities of the territory to the south and east of the Colorado River for Mormon settlers, another explorer, E. L. Goodridge, left Animas City (the present Durango, Colorado, the oldest city in the Four Corners area). Goodridge's mission was different from that of Silas Smith. His purpose was to prospect the length of the San Juan River and on down the Colorado River to Lee's Ferry. In the Mexican Hat area he took note of oil seeps[16] and, in the spring of 1882, located the first claim.[17] As far as can be determined, this was Utah's first recorded oil land entry.[18] No drilling was done in the area, however, until 1907, when the first well, Crossing No. 1, was begun. This well en-

[15] Heylmun, "Virgin Field, Washington County," *A Symposium*

[16] John A. Frost, "Historical Background of the Four Corners Area," *Geology of the Parts of Paradox, Black Mesa and San Juan Basins* (Durango, 1955), 16–17.

[17] H. E. Gregory, "The San Juan Oil Field, San Juan County, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 431, 1909* (Washington, D.C., 1911), 21.

[18] C W. McCullough, "Thar She Blows," *Deseret News Magazine* (Salt Lake City), September 25, 1949, p. 5. The Hole-in-the-Rock expedition, it will be remembered, resulted in the establishment of Bluff 25 miles to the east of Mexican Hat on the San Juan River in 1880 The fact that the Mormon colonizers did not apparently participate in the filing and the oil-development activity leads one to conclude that the call of the Mormon Church officials to the Saints to "occupy the San Juan Valley" and choose the "choice places where there is grass and water" had been heeded.

One of the earliest oil wells in the San Juan region (1920's). Note the bailer (rod) blown out of the well in the oil gusher.

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countered oil on March 4, 1908, at a depth of 225 feet. It was a gusher, throwing oil to a height of 70 feet.[19]

The resulting stampede was reported to be not unlike the clamor for leases around wildcat discoveries today.[20] A United States Geological Survey report of 1909 stated that by July, 1909, nearly 10,000 locations had been recorded at Monticello, the county seat of San Juan County.[21] Other well drillings followed in rapid succession. Promoters considered building a pipeline south to the Santa Fe Railroad to Gallup, New Mexico.[22] At least two prospective routes for railroads into the field were considered and pronounced practical, although expensive, by engineers.[23] A map published in 1910, based on field work during July, 1909, shows 39 oil wells to have been drilled between the San Juan River and the small towns of Goodridge and Mexican Hat on the south, and the escarpment approximately 12 miles to the north.[24]

By 1912, however, the boom was over. The relatively small production, restricted local market, and difficulty of transporting the oil to larger markets proved the death knell of the field. There was a revival of activity in this area between 1920 and 1930 and again in 1947 to 1960.[25] No well drilled after the early period has found significant quantities of oil or gas. Altogether, the approximately 50 wells which were drilled resulted in 13 producing oil wells in Utah's second oil field. An estimated 50,000 to 75,000 barrels of oil from the Mexican Hat oil field have been produced.[26]

During the early period 1891 to 1913, there was probably a total of over 150 wells drilled in 10 of Utah's counties (Box Elder, Davis, Emery, Grand, Juab, Millard, San Juan, Uintah, Washington, and Wayne).[27] Although there was some sporadic activity during the balance of the decade, it was not until 1920 that the pace of drilling was renewed. Between 1920 and 1932, another period of drilling occurred during which time more than 250 additional wells were drilled. Washington County was the most active (in terms of number of wells drilled), followed by Grand, San Juan, and Uintah counties. To the 10 counties

[19] E. G. Woodruff, "Geology of the San Juan Oil Field, Utah," *Contributions to Economic Geology,* United States Geological Survey *Bulletin 471, 1910* (Washington, D.C., 1912), 98.

[20] Frost, "Four Corners Area, *Geology of San Juan Basins,* 17. Wildcat wells (as distinguished from development wells drilled in an already-established field) are wells drilled in areas of no known actual oil production.

[21] Gregory, "San Juan Oil Field," USGS *Bulletin 431.*

[22] Frost, "Four Corners Area," *Geology of San Juan Basins.*

[23] Woodruff, "San Juan Oil Field," USGS *Bulletin 471,* 100.

[24] *Ibid.,* Plate IX.

[25] Sherman A. Wengerd, "Mexican Hat Oil Field, Relation to the Paradox Basin and an Estimate of Future Possibilities," UGMS *Bulletin 54,* 475.

[26] *Ibid.,* 479.

[27] As noted earlier, the records of early drillings are not complete. Hansen and Scoville, *Drilling Records,* UGMS *Bulletin 50,* identify the dates and county locations of 104 wells for the period, but indicate that approximately 60 wells had been drilled in these same counties for which exact dates are not known. The discussion in this paragraph is based on the Hansen-Scoville compilation.

in which wells had been drilled during the 1891–1913 period, 11 more were added during the 1914–32 period (Cache, Carbon, Daggett, Duchesne, Garfield, Kane, Salt Lake, Sanpete, Summit, Tooele, and Utah counties).

The most important oil developments, however, were occurring in the Moab district of Grand and San Juan counties.[28] Results were both encouraging and discouraging. Oil and gas showings were reported in some wells, none in others; none of the drillings resulted in producing oil wells. Perhaps the most heartbreaking of the exploratory attempts was the Frank Shafer No. 1 well located on the Cane Creek anticline. In December, 1925, oil was found at a depth of 2,028 feet. Oil and gas gushed from the well, caught fire, and burned the rig. The blaze was extinguished, but water from a higher elevation could not be controlled. After a full year of periodic drilling, during which oil and gas were encountered again at lower depths, drilling was suspended. Encouraged by this first attempt, additional wells were started in the area; oil showings were encountered, but no gusher. Whether oil is there still remains an inscrutable question, a challenge to the Utah petroleum industry.

The Great Depression, followed by World War II, had its effect on the development of the Utah petroleum industry. Although approximately 75 wells (an average of about six a year) were drilled during this 12-year period, no producers were found, and no county, which had not already been drilled, added its name to the list of Utah counties which had drillings. It was during this period that one prominent Utah geologist is said to have made the rather start-

[28] Baker, "Moab District," USGS *Bulletin 841*, 80–81.

The Frank Shafer No. 1 oil well on the Colorado River, shortly before the well caught fire and burned in 1925.

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ling statement, "I will personally drink every barrel of oil that is ever produced in Utah."[29] He theorized that Utah's oil-bearing geologic formation had been exposed by the erosion of the deep canyons of the Colorado River and its tributaries, and over many past centuries any oil therein had washed out to sea. According to this theory the state's Gilsonite deposits in the Uinta Basin were a residue of what had once been a large oil field.

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September 10, 1948, J. L. (Mike) Dougan, left, watches oil flow from Utah's first commercial well, the Ashley Valley No. 1, about 10 miles southeast of Vernal, Utah.

With the end of World War II, interest in Utah's oil and gas possibilities was renewed. The annual well-completion rate during 1945, 1946, and 1947 was double the pre-1945 rate, and the stage was set for the birth of the state's commercial petroleum-producing industry. In contrast to the earlier years, there were numerous geologists who disagreed with the "no-oil-in-Utah" theory. A 1947 writer analyzing the resurge of interest in Utah's oil exploration noted, " . . . we have not been able to find a geologist who denies that Utah has favorable structures for oil."[30] The past failure to obtain commercial production was attributed to drilling "off-formation," inadequate equipment, and the absence of adequate knowledge or information.

The development of the Rangely oil field in northwestern Colorado caused interest in the early postwar period to center (although not exclusively) in the Uinta Basin. But the postwar explorations were no longer a simple matter of promoting a company with limited funds and sometimes doubtful skill. The "Majors" were active. The list included such companies as Phillips, Standard of California, Stanolind, Texas, Continental, Tidewater Associated, Pure Oil, Sinclair, Union Oil, Carter, and others. The Carter Company was one of the biggest operators in the Uinta Basin.[31]

[29] John H. Klas, "Utah's Forty Million Barrel Drink" (manuscript, Utah Petroleum Council, Salt Lake City). Some credence is given to this theory by well-respected early publications. See Woodruff, "San Juan Oil Field," USGS *Bulletin 471*, figure 2, p. 97.

[30] *Tribune*, December 7, 1947, p. B14.

[31] James A. Hoagland, "Oil Boom," *Deseret News Magazine*, October 14, 1951, p. 11. See also, "Uinta Basin Oil Find is a Story of Courage," *Tribune*, July 22, 1951, p. C7.

But the honor of bringing in the state's first commercial oil well went not to the "Majors" but to an "Independent"— the Equity Oil Company. Ashley Valley No. 1, located about 10 miles southeast of Vernal, Utah, came in at 1:43 p.m., September 18, 1948, with an initial flow of about 300 barrels a day from a depth of 4,152 feet. It is interesting to note that J. L. (Mike) Dougan, president and general manager of Equity and a Salt Lake City resident, had been drilling for oil in Utah for over 25 years.[32]

By the end of 1948, eight more wells were drilled, and in a little over a year development drilling[33] of the field had been completed. Production from Utah's first commercial field, since discovery, has averaged slightly less than a million barrels a year from the approximately 30 wells within the field, and until 1957, Ashley Valley was the state's largest producing oil field.[34]

Discovery of this first Utah commercial well touched off a vigorous drilling campaign. Unlike the earlier attempts, these drillings were not shallow depth drilling of 1,000 to 2,000 feet (falling short of what was now considered normal objectives),[35] but rather 5,000 to 8,000 feet and in some instances even deeper. The result was the discovery of the Roosevelt field in 1949, by the Carter Oil Company; the short-lived Gusher field by the California company in 1950; the Red Wash field by Standard of California, and the Duchesne field by the Carter Oil Company, in 1951; and the Brennan Bottom field by the Gulf Oil Corporation and the Chapita Wells field by Continental Oil Company, in 1953.[36]

Of all these Uinta Basin discoveries, the Red Wash was the most important. By 1952, the year after discovery, it was producing half as much as the Ashley Valley field and, at this writing, the Red Wash and its neighboring field, Walker Hollow, are producing over five times as much as Utah's first commercial field, the Ashley Valley. Unique among the Uinta Basin discoveries was the Roosevelt field with its high pour-point, highly paraffinic crude that sets into solid wax at ordinary room temperatures.[37]

But the big find, which was to move the state from anonymous inclusion in the "all other" column in national crude-oil production reports to a separate Utah listing, was still to come. This find was to occur in the complex of fields known as Greater Aneth located on either side of the San Juan River in the Paradox Basin in the extreme southeast corner of the state. The Boundary Butte

[32] *Ibid.*, and *Deseret News*, September 19 and 20, 1948. This marked the first time Dougan had found oil within the state, although his company had found producing wells in other areas.

[33] V. E. Peterson, "Ashley Valley Oil Field," *A Symposium.*

[34] Records of the Utah State Oil and Gas Conservation Commission (Salt Lake City).

[35] See "Penetration Chart of Oil and Gas Fields in Utah," *Guidebook to the Geology of the Uinta Basin* (Salt Lake City, 1957), facing 164.

[36] See discussion for each of these fields in *A Symposium of the Oil and Gas Fields of Utah.*

[37] The Red Wash-Walker Hollow crudes have much the same characteristics. See George H. Hansen, "History of Drilling Operations in Utah's Uinta Basin," and John T. Brewster, "The Rangely-Salt Lake Crude Oil Pipeline," *Geology of Uinta Basin*, 165–71.

field, discovered in 1947 almost on the Utah-Arizona border, had not been termed commercial. Shell Oil Company had made previous field discoveries in the Bluff field in 1951, at Desert Creek in 1954, and at Akah in 1955, but extensive drilling in the region did not begin until after the Aneth discovery.[38] The well which set off the exploration boom was drilled at a depth of 5,896 feet in Section 23, Township 40 South, Range 24 East by the Texas Company. Initial flow was at the rate of 1,704 barrels per day — which helps explain the excitement it created. The confirmation well was completed by Superior Oil Company. By the end of the year, 20 producing wells had been completed in the field, with daily initial flows ranging from 300 to 1,900 barrels and averaging 800 barrels.[39] Operators responsible for the drilling were the Texas Company, Superior Oil Company, Three States Natural Gas Company, Shell Oil Company, and Gulf Oil Corporation, which reads like a roster of the nation's foremost oil companies.

Greater Aneth actually includes five fields, Cahone Mesa (the smallest producer), White Mesa, Ratherford, Aneth, and McElmo Creek (the largest producer). The approximately 500 producing wells in these five related fields accounts for 70 per cent of Utah's present crude-oil production.

With the discovery and development of the Greater Aneth fields, Utah moved into the nation's top dozen producing states. In 1959, there were only 10 states which produced more crude oil than Utah's 40.1 million barrels,[40] certainly a far cry from the half-million barrels produced in Utah in 1949 — the first full year after commercial oil production began. In fact, in 1959, the value of Utah crude-oil production surpassed the value of the state's copper production, the most important mineral produced in the state (partly because of the prolonged work stoppage in the Utah copper industry). Since 1960, crude-oil production has ranked second (only copper is higher) and ahead of each of Utah's other minerals in value of product produced.

Since 1959, total barrels of crude oil produced within the state have declined somewhat. The decrease is due to (1) the usual production pattern of new fields to decrease after the initial peak and (2) the inauguration of conservation measures by the industry and the Utah State Oil and Gas Conservation Commission.

Expansion of Utah production in the future will depend primarily on the discovery of new fields. If oil- and gas-leasing activity, rate of exploratory

[38] W. Don Quigley, "Aneth Field and Surrounding Area," *Guidebook to the Geology of the Paradox Basin* (Salt Lake City, 1958), 247.

[39] U.S., Department of the Interior, Bureau of Mines, *Minerals Yearbook, 1956* (Washington, D.C., 1957), III, Area Reports, 1159. This publication is hereafter cited as *Minerals Yearbook*, with the year.

[40] *Minerals Yearbook, 1959*, II, 352. Another measure of the importance of Utah's crude-oil production is the comparison with coal production. Utah is the leading coal-producing state west of the Mississippi, yet in 1959, the oil produced in Utah was the equivalent (in terms of Btu. content) of more than twice the state's coal production.

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The life of a "roughneck" is not an easy one. In spite of all the technological advances, the work of many hands is needed in drilling for oil.

drilling, and the opinion of professional geologists are any indication, the possibility of such finds appears to be good. The discovery of the Lisbon field, south of Moab in 1960, is an example.

In August, 1959, the Pure Oil Company spudded in their Northwest Lisbon No.1 (later changed to No. 1 USA).[41] On January 5, 1960, the attention of the entire United States industry was focused on the Paradox Basin when the well became a producer. In fact, the Northwest Lisbon field was designated as the "discovery of the year"[42] by the national petroleum industry, because of the size of the field and because the area had heretofore been considered a poor prospect for oil and gas exploration. Pure Oil's exploration techniques are a good example of the approach now being used by the industry and bode well for the future of the Utah crude-oil-producing industry. To illustrate, the Four Corners Geological Society had this to say:

> Pure has shown how effective a team effort combining land, engineering geophysics, and geology can be . . . . When Major oil reserves become hard to find, this is not the time to reduce the professional staff, but rather a time to encourage imaginative thinking with full utilization of all exploration departments.[43]

Crude Oil Pipelines

The Utah crude-oil-producing industry could not have developed had it not been for the construction of pipelines to transport the crude to market. The Paradox Basin field is a good example. For those not familiar with the Paradox area a brief description is worthwhile: primitive, abrupt changes in relief, dry, largely uninhabited, in some cases deadly monotonous but in other areas wildly beautiful, characterized by slick rock, towering monuments, delicate

[41] Harrell Budd, "Notes on the Pure Oil Company Discovery at Northwest Lisbon," *Geology of the Paradox Basin Fold and Fault Belt* (Durango, 1960), 121–24.

[42] *Minerals Yearbook, 1960*, III, Area Reports, 1032.

[43] Budd, "Notes on the Pure Oil Company," *Geology of Paradox Basin*, 124.

arches and awe-inspiring natural bridges — but perhaps most significant, the area is inaccessible.

The area's inaccessibility can be illustrated by the experience of the Shell Oil Company in the Aneth Oil field in the exploratory period. Two of its wells on opposite sides of the San Juan River were three miles apart as the crow flies; yet in order to get from one well to another by automobile one had to travel the unbelievable distance of 170 miles. Today the areas are connected by a modern million-dollar bridge (built by the oil companies) and hard-surfaced roads (built by the Utah State Highway Department).

Many of the Utah fields discovered since 1948 have been large enough producers to warrant the construction of crude-oil-transporting pipelines. However, Utah's first crude-oil pipeline was not built to transport Utah-produced crude oil to market but rather to bring oil from areas outside the state to a Utah refinery for processing. In 1939, the Utah Oil Refining Company (now the American Oil Company) built a pipeline to transport petroleum from fields in Wyoming and Colorado to the company's Salt Lake refinery.[44]

The second Utah crude-oil pipeline was the 185-mile trunk line from Rangely, Colorado, which was constructed over the direct route west from the Rangely field through the Uinta Basin to Salt Lake. The line was completed from Rangely in 1948 by the Salt Lake Pipe Line Company, an affiliate of the Standard Oil Company of California. In 1951, a branch line from the Red Wash-Walker Hollow fields was built to transport Utah-produced petroleum from these Utah fields.[45] Several interesting sidelights are worth mentioning in connection with this pipeline.[46] The 9,569-feet elevation above sea-level, which the pipeline reaches at Wolf Creek Pass in traversing the Wasatch Range, is the highest altitude attained by any major oil pipeline in the world. The high paraffin-base crude from the Red Wash field must be heated to 180 degrees Fahrenheit in order to be moved along the seven-mile branch pipeline to the main pipeline, where it is diluted with lower pour-point Rangely crude so that it can be transported to Salt Lake City. The Rangely-Salt Lake City pipeline has been enlarged by "looping"[47] and the installing of additional pumps so that it now has a capability of moving 72,000 barrels of crude oil per day.

Utah's other crude-oil pipelines are located in San Juan County. It was not until they were built that oil production in quantity from the Paradox Basin oil fields could be achieved. As noted above, Aneth was discovered in 1956.

[44] Utah Oil Refining Company, *The Utoco Torch*, 50th Anniversary Issue, June, 1959, p. 5.

[45] Ashley Valley crude, Utah's first petroleum, was (and still is) trucked to Rangely and handled by the Service Pipeline Company.

[46] Brewster, "Rangely-Salt Lake Crude Oil Pipeline," *Geology of Uinta Basin*, 168–71.

[47] Looping a pipeline is a common practice which consists in the laying of a second (or more) additional pipeline alongside the first pipeline in the same right-of-way as the original.

That year a half-million barrels were produced from the Greater Aneth complex. During 1957, the Four Corners Pipeline Company, jointly owned by a number of companies, completed a 750-mile, 16-inch crude oil pipeline from Aneth to Los Angeles, California, with a capacity of 70,000 barrels a day. As a result, production from Aneth climbed from .5 million to 1.5 million barrels in 1957 and by 1958 to 20 million. In 1958, another 16-inch, 50,000-barrel crude-oil pipeline, the Texas-New Mexico Company's pipeline, was completed from Aneth to Jal, New Mexico, a distance of 512 miles where it connected with already-existing pipelines to the Gulf Coast.[48] This company is owned by Texaco, Incorporated; Sinclair Refining Company; Tidewater Oil Company; and Cities Service Oil Company. Because of these two pipelines, Utah is in the unique position of being able to transport Utah-produced crude from the Paradox Basin to both the Pacific Coast and the Gulf Coast for refining. In 1962, the Ute Pipeline in San Juan County was completed from Lisbon Valley to the Aneth area where it can deliver oil to the two foregoing pipelines.

Petroleum Refining

Utah's petroleum-refining industry is concentrated in a strip extending from Salt Lake City northward for about 10 miles to the town of Woods Cross in Davis County. Along this "refinery row" are located the state's four refineries with a combined processing capacity of over 101,000 barrels of crude oil per day. Of the Intermountain States, only Wyoming has a greater petroleum-refining capacity (110,000 barrels). But Wyoming's 10 refineries are scattered throughout the state. As a result, Utah's petroleum-refining complex, centered north of Salt Lake City, represents virtually the largest of its kind between the Mississippi River and the Pacific Coast.[49] This Utah development can best be understood by examining the establishment and growth of less than a half-dozen companies.

More than 40 years before petroleum was found in commercial quantities within the state, Utah's petroleum-refining industry was born.[50] On June 3, 1909, the Utah Oil Refining Company was incorporated in Salt Lake City with a capital of $30,000. John C. Howard, one of the original incorporators, was selected as the manager and first president. The primary purpose for organizing the company was to manufacture kerosene, greases, and lubricating oils. To do this, a "refinery"—consisting of a few secondhand tanks, a rather inadequate still, an old boiler, and a few other odds and ends of equipment—was gotten

[48] *Minerals Yearbook, 1957*, III, Area Reports, 1108.

[49] The exceptions are the large petroleum-refining centers of the Gulf Coast, the Kansas-Oklahoma area, and the Pacific Coast. See American Petroleum Institute, *Petroleum Facts and Figures* (New York, 1961), 62–63.

[50] Material for this section was obtained from various issues of *Utoco Torch*, especially the 50th Anniversary issue of June, 1959. See also Edward N. Bagley, "Utah Oil's Steady Growth Required Vision, Work," *Tribune*, May 8, 1949.

together on a quarter of an acre of ground not far north of downtown Salt Lake City. Plant capacity was seven barrels of crude oil per day which was received in railroad cars from fields in Wyoming, California, and Texas.

Problems of finding adequate working capital, obtaining necessary supplies of crude, keeping abreast of technical developments, marketing successfully a new product, rebuilding after fires, and many other challenging situations were encountered and successfully met. The foundation was laid for an expansion of capacity on a significant scale in 1917 when 50 per cent interest in the company was sold to the Midwest Refining Company. Midwest had crude oil in the Salt Creek field in Wyoming but inadequate outlets for it. The Utah Oil Refining Company had a refinery but no assured supply of vital crude oil. By means of a joint affiliation, the Utah Oil Company was able to procure crude without any cash payment. When refined and sold, this crude provided funds for growth. As a result, between 1918 and 1919 daily capacity was expanded to 4,000 barrels a day and Burton stills (the very latest technological development in the refining industry) were added in the 1919–21 period.

In July, 1921, the Standard Oil Company of Indiana acquired ownership of the Midwest Refining Company and, with it, Midwest's 50 per cent ownership in the Utah Oil Refining Company. Standard of Indiana later increased its stock ownership in the Utah Oil to 75 per cent and in the early 1950's to 100 per cent. The Utah company's products increased from three during this early period to almost 200. The brand names, Vico motor oils and greases and Pep 88 Gasoline, and later, Utoco, became familiar household words throughout Utah and Idaho, and later in eastern Nevada, parts of Wyoming, and eastern Oregon and Washington.

In 1961–62, an important event occurred when Standard of Indiana undertook a major change in its marketing operations. Several different brand names across the nation, including Utoco in the Western States, were dropped and the name "American" substituted. In the process on January 1, 1963, the Utah Oil Refining Company became a part of the American Oil Company (headquartered in Chicago) and the Utah staff was given additional responsibilities in expanding the western market of this nationwide company.

Today, the Salt Lake refinery of the American Oil Company has a capacity of 35,000 barrels a day. Utah's first refinery, which originally was little more than a skimming plant, has become a modern unit making use of the most up-to-date methods including catalytic cracking, ultraforming, polymerization, alkylation, and isomerization. The original seven employees have grown to over 400. In 1909, the company had no retail outlets; today, it has almost 100 wholesale bulk stations and approximately 1,000 independently operated retail outlets in the Intermountain marketing area.

Of the companies or refineries now making up Utah's oil refining industry, the Woods Cross Refinery of the Phillips Petroleum Company is the second oldest. The William Yeates Company, incorporated in 1932, started construction of a small refinery at Woods Cross early in 1932.[51] The capacity of the plant was projected at 1,000 barrels of crude oil per day. A cracking plant of this small capacity was something new in the industry, and when the plant was put in operation in late 1932, it did not function properly.

During this period the company had been negotiating with a number of producing oil companies for an assured supply of crude. Finally, a contract to purchase crude oil for a 10-year period was entered into with Skelly Oil Company of Tulsa, Oklahoma. Skelly, in return for the long-term crude contract in a new territory, sent refinery experts to Woods Cross to iron out technical difficulties.

Shortly after establishment the name of the company was changed to the Wasatch Oil Refining Company. Wasatch expanded, organizing the Idaho Re-

[51] Edward N. Bagley, "Vision, Tenacity Stimulated Wasatch Oil's Expansion," *Tribune*, July, 1949.

American Oil Company's refinery, northeast of Salt Lake City, is the oldest refinery in Utah.

AMERICAN OIL COMPANY

finery Company in 1937 and constructing a refinery at Pocatello. In 1938, the Inland Empire Refineries, Incorporated, was organized with a refinery at Spokane. During the 1940's, Wasatch also developed sources of crude oil by buying interest in properties in existing oil fields or in prospective oil fields.

In 1947–48, the Phillips Petroleum Company of Bartlesville, Oklahoma, purchased Wasatch Oil. The refinery at Woods Cross, which at the time of the purchase had a capacity of 4,200 barrels a day, has been expanded to 15,500 and includes catalytic cracking, catalytic reforming units, and H. F. Alkylation units. Most of the refinery's crude is transported over the Salt Lake Pipe Line Company's line (a common carrier owned by the California Oil Company) from the Rangely, Colorado, field.

The big expansion in Utah's petroleum-refining industry came in 1948, not because this was the year in which crude oil was first produced in quantity within the state, but because the Intermountain and Pacific Northwest market for refined petroleum products was growing. On March 4, 1948, Standard Oil Company of California broke ground on 150 acres of a 600-acre tract five miles north of downtown Salt Lake City, adjoining U.S. Highway 91 and the railroad trackage.[52] This was to become Utah's largest and most beautifully designed refinery. Whereas the others had started small and gradually grown, some in almost a topsy-turvy fashion, this refinery was producing full bloom within a few months.

Approximately $5 million were spent to construct a 27,000-barrel-per-day plant to produce regular grades of gasoline, stove oil, diesel fuel, and heavy fuel oil. An interesting feature of the installation was the construction later of a steam-heated line four miles long to deliver heavy residual fuel oil from the refinery to the new postwar-constructed Gadsby steam electric generation plant west of Salt Lake City. But the initial construction was only the beginning. A program undertaken during the 1950's expanded daily capacity to 45,000 barrels and added several catalytic crackers as well as a modern fresh-feed platformer to produce quality gasoline.

At the same time the refinery was built, the Salt Lake City-Rangely crude-oil pipeline was constructed. Thus, Standard of California in one year (1948) with the expenditure of more than $10 million, doubled the then-existing petroleum-refining industry of Utah. In 1950, a fully integrated installation was completed with the construction of a refined products pipeline to export petroleum products from the state.

[52] "Salt Lake Refinery and Salt Lake Pipe Line Company," *Know Your Company* (leaflet, Salt Lake Office, Standard Oil Company of California, n d.). See also *Deseret News*, October 24, 1948, p. B1; *Tribune*, June 27, 1948.

Utah's 1909 petroleum-refinery story was repeated in the case of the Western States Refinery. In 1946, several men sat down in a Salt Lake City restaurant to discuss the idea of establishing a small independent refinery. Three years later, in May of 1949, after numerous difficulties, the plant, Utah's then only independent refinery, went on stream with a rated capacity of 2,500 barrels a day. Crude oil was obtained via the Rangely-Salt Lake City pipeline from Rangely, Colorado. The crude was government oil made available to small independent refineries on a priority basis under Public Law 506 passed by Congress in 1946.[53]

The refinery now has a capacity of 7,500 barrels of crude oil per day. It has been acquired by the Frontier Refining Company and is known as the Beeline Refinery. In a recent expansion the most modern refining equipment was added to produce quality products for distribution throughout the Intermountain area.

For a number of years a Utah refinery operated in an area other than the Salt Lake City locality. This was a plant completed in 1941 at Jensen, Utah (in Uintah County), by the Equity Oil Company, to form a market for the company's crude-oil production from the Rangely oil field. The plant was later sold to the Uintah Oil Refining Company, which company operated the refinery until its subsequent sale to the Utah Cooperative Association in 1948.[54] The refinery had a capacity of 1,500 barrels of crude oil per day obtained from Equity Oil Company's wells in Rangely. The Jensen refinery has now closed down, and the Utah Co-op petroleum-refining operation moved to Colorado nearer the Rangely oil field. Products are distributed through outlets to members of the Utah Cooperative Association.

Refined Products Pipeline

Utah's petroleum-refining industry has been able to prosper and expand because of its ability to tap markets outside the boundaries of the state. It is estimated that 60 per cent of the petroleum products produced by the four Salt Lake refineries is sold in neighboring states. Just as the crude-oil pipelines have provided an outlet for Utah's once mountain-locked and desert-isolated petroleum, so have refined product pipelines provided a means of transporting to distant markets thousands of barrels of gasoline, diesel fuels, and other products of the Utah refining complex.

In the fall of 1950, a 569-mile pipeline from Salt Lake City to Pasco, Washington, capable of moving 15,000 barrels daily, was completed by Standard of California. During the following eight years the line was looped, additional pumping stations were added, and new delivery points were constructed. In 1953, an extension of the line from Pasco to Spokane lengthened the line to

[53] *Deseret News*, November 4, 1948, and December 14, 1949; *Tribune*, April 3, 1949.

[54] *Deseret News*, September 27, 1948, p. A6.

704 miles. Today this common carrier is capable of pumping and transporting a total of 56,000 barrels of finished products per day from all refineries northward to various distribution points in the states of Utah, Idaho, Oregon, and Washington. An interesting aspect of the line is worth mentioning.[55] Radioactive tracers called isotopes are inserted between various shipments of products, so that receiving points, by means of geiger counters, can determine the end of one shipment and the beginning of another. Constant pressure on the line which keeps the liquids moving forward at the rate of two to three miles per hour results in very little intermixing of the various products shipped — for example, gasoline and jet fuel.

Utah has a second refined products pipeline, the Pioneer Pipe Line Company owned by Continental Oil Company and Sinclair Refining Company.[56] This 10,000-barrel-per-day, 310-mile line, completed in 1952, brings refined products from the large refinery at Sinclair, Wyoming, to Salt Lake City for distribution in Utah and for trans-shipment northward by means of the Salt Lake-to-Spokane pipeline.

Natural Gas

Historically, most natural gas has been discovered while drilling for oil. This has been also true in the case of Utah. As noted earlier, oil drillings in the Farmington field, in Davis County in 1892, failed to find petroleum but discovered gas and thus marked the beginning of the state's natural-gas industry. In 1895, a nine-inch pipeline was built from the field to Salt Lake City, and customers were supplied with natural gas for 19 months.[57] But then the wells sanded-up, reserves dwindled, and the service had to be abandoned.

Utah's second natural-gas find, which was to supply a town with fuel, was from Ashley Valley, the field which gave Utah its first commercial oil production in 1948. In the spring of 1925, natural gas was discovered.[58] By 1928, a pipeline was built[59] to Vernal which supplied the town with natural gas until 1941, when the supply became exhausted and the service discontinued.

Also in the late 1920's the stage was being set for the eventual delivery and distribution of gas to Utah's populated Wasatch Front area. Between 1922 and 1927, natural gas in commercial quantities was discovered in three separate gas fields, all of them in the Baxter Basin of southwestern Wyoming, located south of Rock Springs near the Utah border. About this same time the steel industry

[55] Utah Petroleum Council, *Utah Petroleum Industry* (Salt Lake City, n.d.).

[56] *Tribune*, August 17, 1952, p. C11.

[57] Heylmun, "Virgin Field, Washington County," *A Symposium*.

[58] V. E. Peterson, "Ashley Valley Oil Field," *Ibid.*

[59] ElRoy Nelson, *Utah's Economic Patterns* (Salt Lake City, 1956), 150. This book is by far the best single source available on Utah's economy although it was written prior to many of the important developments occurring in Utah's petroleum industry.

Natural gas mains being installed on South Temple Street, Salt Lake City, about 1929.

developed thin-wall, large-diameter transmission pipe of higher tensile strength which made gas transmission to distant markets feasible.

The project to bring natural gas into Salt Lake Valley was initiated by the predecessor companies of the present Mountain Fuel Supply Company.[60] Control of the companies already distributing manufactured gas was first acquired — Salt Lake City and Ogden in 1928, and Provo in 1931. The next important step, that of linking the gas field and the market, was achieved between January and August, 1929, when a 200-mile pipeline between Baxter Basin and Salt Lake City was constructed. For this early period the achievement was significant, considering the distance and the terrain which had to be traversed. The arrival of gas in Salt Lake City was commemorated by lighting a huge flare of gas atop a 75-foot pipe on August 18, 1929. Public interest in the event was indicated by the huge crowd of about 15,000 people which turned out to see the torch despite a downpour of rain.

The most important of Utah's early gas fields, Clay Basin in the extreme northeast corner of Utah, was discovered in 1927 and connected to the transmission line in 1937. Additional gas fields have also been discovered in Wyoming and Colorado and later in Utah and connected to the line to satisfy the growing demand.

The magnitude of the demand for this preferred fuel was indicated by the expansion of distribution facilities beyond the Salt Lake City-Ogden area. In 1947–48, natural gas was brought to Provo, Springville, and Spanish Fork (all of which had been served with by-product gas from the Ironton plant of the Columbia Steel Company) as well as intervening towns. In 1957, Mountain

[60] Harold W Simpson, "A History of Gas Distribution in the Salt Lake Area and a History of Mountain Fuel Supply Company" (manuscript, Mountain Fuel Supply Company, Salt Lake City), 13.

Fuel Supply began the second major extension of its service area when gas was brought to Brigham City in Box Elder County and Logan in Cache County. In the next few years service was extended to 15 other communities in these counties. The latest developments include the planned introduction of natural-gas service into Wasatch County and Summit County and possibly the Carbon County area.

During the 1930's gas supplies were ample, but by 1941 demand had outgrown supply; consumption restrictions had to be placed first on industrial users and in 1949 on new residential users.[61] To meet the increased need for gas, the company expanded its exploration programs and by negotiating for the purchase of gas from other suppliers, largely alleviated the shortage by 1952. In 1953, further Utah supplies of gas were utilized with the purchase of gas from the Utah Natural Gas Company (now a subsidiary of the El Paso Natural Gas Company). The gas from Utah Natural Gas Company was delivered by pipeline from gas fields in the Carbon-Emery-Sanpete counties area and came from the Clear Creek, Flat Canyon, and Joe's Valley fields discovered in 1951, 1953, and 1956, respectively.

In 1956, another major purchase arrangement for natural gas was completed by Mountain Fuel, this time with the Pacific Northwest Pipeline Corporation (now El Paso Natural Gas Company). The gas comes from Utah, Colorado, and Wyoming fields along the pipeline and is delivered to Mountain Fuel where lines of both companies cross in Wyoming.

Early in 1961, Mountain Fuel Supply Company discovered gas in the Uinta Basin in the Island field. Additional supplies of gas were obtained by negotiating with well owners in neighboring fields. As a result, Mountain Fuel together with El Paso Natural Gas constructed a pipeline in 1961 from the Uinta Basin westward to connect with the Clear Creek-to-Orem pipeline, in which 50 per cent interest had been purchased by Mountain Fuel. The latest gas placed in Mountain Fuel's system is from a pipeline owned by the Mesa Pipe Line Company, which transports gas from new fields on the Colorado-Utah border in northern Grand County to the Uinta Basin-to-Clear Creek pipeline.[62]

The growth of Utah's most important natural-gas supply system is shown by the increase in customers from about 18,000 in 1929 to over 200,000 in 1963. Since 1929, the Mountain Fuel Supply Company and its predecessors have sold more than 1,000 billion cubic feet of gas (almost five times their beginning reserves); they still have available more than 2,000 billion cubic feet of gas (including reserves and contracted-for purchases). Besides the new pipelines, the original pipeline from Wyoming has been triple-looped and additional compressor facilities installed to enlarge its carrying capacity.

[61] *Tribune*, April 3, 1949.

[62] Mountain Fuel Supply Company, *1962 Annual Report* (March, 1963), 9.

Utah's other natural-gas developments are associated with fields in the Paradox Basin. The Pacific Northwest Pipeline Corporation (now consolidated with the El Paso Natural Gas Company) was formed in 1949 and was organized to link the gas reserves of the San Juan Basin in New Mexico with markets of the Pacific Northwest.[63] In 1954, authorization to serve markets in Colorado, Wyoming, Utah, Idaho, Oregon, and Washington was obtained, and a 1,487-mile, 26-inch pipeline was completed in 1955–56. The line, sometimes referred to as the "scenic-inch" because of the picturesque territory it traverses, crosses Utah's borders six times. Monticello and Moab are the two Utah towns which receive their gas from this pipeline of El Paso Natural Gas Company.

Natural gas from the oil and gas fields in southeastern Utah are processed by El Paso Natural Gas Company's Aneth processing plant in order to remove water vapor and natural-gas liquids such as propane, butane, and natural gasoline.[64] The plant, built in 1958–59, sends the natural gas by means of a 75-mile pipeline to Farmington, New Mexico, where gas is fed into El Paso Natural's 24-inch main transmission line across northern Arizona to the California border. The natural-gas liquids are sent through a 98-mile pipeline to El Paso Natural's Chaco plant south of Farmington and then to Wingate near Gallup, New Mexico, where the various components are shipped to consumers all over the nation.

Importance of the Petroleum Industry

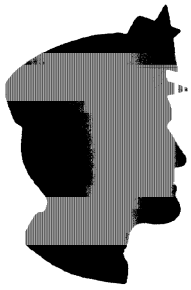
In the 116 years since Utah's first oil seep was discovered, the Utah oil and gas industry has grown to significant proportions. Not only have the state's petroleum resources furnished increasing amounts of low-cost, convenient fuel and energy to the Intermountain region, but they have furnished the foundation for important related industries including exploration, drilling, production, transportation, refining, and marketing. In the process of well-drilling, other resources have been discovered; carbon dioxide, helium, magnesium, and potash. Hitherto unexplored country has been opened up, roads and bridges built, and scenic wonders made accessible.

The economic indicators have also demonstrated the worth of the industry to the state: new payrolls, increased royalties, higher lease and rental payments for exploration on public lands, additional tax benefits, etc. The oil and gas finders and developers, goaded by eternal optimism, have brought a new era to Utah — an age of oil and gas. Even though the industry is young, its economic contribution to the state has been great; and there is reason to believe that the Utah industry's future can be viewed with optimism.

[63] Howard H. Walters, "Pacific Northwest Pipeline — The Scenic Inch," *Geology and Economic Deposits of East Central Utah* (Salt Lake City, 1956), 169–70.

[64] "Facts of Interest on El Paso Natural Gas Company's Aneth Facilities" (mimeograph copy, El Paso Natural Gas Company, Salt Lake City, n. d.).

Tab 7



a dictionary of mining, mineral, and related terms

compiled and edited
by Paul W. Thrush
and the Staff of
the Bureau of Mines

U.S. DEPARTMENT OF THE INTERIOR

1968

enamel frits. *Hansen.* On heating it loses water and forms metaboric acid, $H_2B_2O_4$; on further heating it forms tetraboric acid or the so-called pyroboric acid, $H_2B_4O_7$; on heating at a still higher temperature, it forms B_2O_3, anhydrous boron trioxide or boric oxide. It occurs as tabular triclinic crystals deposited near fumeroles, and it also occurs in solution in the hot lagoons of Tuscany, Italy. *C.T.D.*

boric oxide glass; boron oxide glass. A colorless, transparent glass or noncrystalline powder; hard and brittle; slightly bitter; B_2O_3; specific gravity, 1.83 to 1.88; boiling point, above 1,500° C; soluble in alcohol and in acids; slightly soluble in cold water with decomposition; and soluble in hot water. Used in the production of boron; in the chemical analysis of silicates; in heat-resistant glassware; and as a fire-resistant additive for paints. *CCD 6d, 1961.*

borides. A group of special ceramic materials. Typical properties are great hardness and mechanical strength, high melting point, low electrical resistivity and high thermal conductivity; impact resistance is low but the thermal-shock resistance is generally good. For the properties of specific borides see under the borides of the following elements: aluminum borides; barium borides; calcium borides; chromium borides; hafnium borides; molybdenum borides; niobium borides; silicon borides; strontium borides; tantalum borides; thorium borides; titanium borides; uranium borides; vanadium borides; tungsten borides; zirconium borides. *Dodd.*

borier. Corn. A drill. An instrument of iron that is steel-pointed to bore holes within large rocks, in order to blow them with gunpowder. *Hess.*

boring. a. The cutting or drilling of a hole for blasting, water infusion, exploration, or water or firedamp drainage. *See also* percussive boring; rotary boring. *Nelson.* b. The drilling of deep holes for the exploitation or exploration of oilfields. The term drilling is used similarly in connection with metalliferous deposits. *C.T.D.* c. Material removed by boring. *Standard, 1964.* d. A machining method using single-point tools on internal surfaces of revolution. *ASM Gloss.*

boring bar. a. A rod, made in various lengths, usually with a single chisel cutting edge, for hand drilling in rock. The blows are given by a sledge hammer. *Nelson.* b. A revolving or stationary bar carrying one or more cutters or drills for boring. *Fay.*

boring bit. Derb. A sharp piece of steel at the end of an auger stem or drill for cutting rock or other material by rotation of the auger. *See also* bit, a; bore bit, b. *Fay.*

boring contract. An agreement entered into between a producer and a contractor for the sinking of oil or gas wells on a propert, *Fay. See also* drill contract.

boring contractor. Synonym for drill contract· . *Long.*

boring head. a. The part of a drill machine more commonly called swivel head by persons associated with the diamond-drilling industry. *See also* swivel head, a. *Long.* b. Synonym for drill bit. *Long.* c. The cutting end of a boring tool, especially the cutter head of a diamond drill. *Webster 3d.* d. *See* drill head, a. *B.S. 3618, 1963, sec. 3.*

boring journal. A book which contains an accurate record of the progress of the boring work, day by day. It is usually kept by the drilling master. *See also* log, e. *Fay.*

boring log. Synonym for drill log. *Long.*

boring master. A man in charge of a well-boring outfit. *Fay.*

boring rod. A rod made up of segments, carrying at its lower end a tool for earth boring or rock drilling. *Webster 3d.*

borings. Used by the soil and foundation testing profession as a synonym for boreholes and/or the materials removed from a borehole. *Compare* cuttings, a; sample, b. *Long.*

Borium. Hard-facing welding rod, consisting principally of tungsten carbide. *Bennett 2d, 1962.*

Born equation. The free energy of solvation of an ion is

$$\Delta G = \frac{Nz^2e^2}{2r}\left[1 - \frac{1}{D}\right]$$

N is the Avogadro number, z the ionic valency, e its electronic charge, D the dielectric constant of the electrolyte and r the ionic radius. *Pryor, 3.*

bornhardtite. A cobalt selenide, Co_3Se_4, cubic (linnaeite group); from Trogtal, Hartz (Harz) Mountains, Germany. *Spencer 21, M.M., 1958.*

bornite. A valuable copper ore; a sulfide of copper and iron, Cu_5FeS_4, crystallizing in the cubic system. Also called erubescite; horseflesh ore; peacock ore; variegated copper ore; purple copper ore. *Sanford; Dana 17.*

boroaluminate. *See* aluminum borate. *Dodd.*

Borod. Hard-facing welding rod composed principally of tungsten carbide. *Bennett 2d, 1962.*

borolanite. A hypabyssal rock, having a granitoid texture and consisting essentially of orthoclase and melanite with subordinate nepheline, biotite, and pyroxene. A variety of melanite-nepheline syenite found at Loch Borolan, Scotland. *A.G.I.*

Borolon. Alumina, Al_2O_3, prepared by fusing bauxite; specific gravity 4; used as an abrasive and refractory. *Bennett 2d, 1962.*

boron. Element of atomic number 5, of group III in the periodic system. A very soft, brown, amorphous powder or yellow crystals; ignites in air; symbol, B; atomic weight, 10.81; valence, 3; specific gravity, 2.45; melting point, 2,300° C; hardness of monoclinic crystals, 9.3 Mohs' scale; soluble in concentrated nitric acid and sulfuric acid; and insoluble in water, in alcohol, and in ether. Used as a catalytic agent; in ceramics and in heat-resistant glassware (a glass in which boric oxide, B_2O_3, replaces the calcium oxide in ordinary lime-soda glass); in metallurgy (alloy steels, cementation of iron); in semiconductors; and in abrasives (crystals). *CCD 6d 1961; Handbook of Chemistry and Physics, 45th ed., 1964, p. B-103.*

boronatrocalcite. *See* ulexite. *Fay.*

boron carbide; tetraboron carbide. Probably not a true compound, but instead a solution of varying amounts of carbon in a slightly distorted boron lattice; B_4C; black; hexagonal rhombohedral crystals; ranking next to diamond in hardness, 9.3 Mohs' scale; and melting point, 2,350° C. Used in powder form as an abrasive and in molded form as an abrasion resister. *CCD 6d, 1961; Handbook of Chemistry and Physics, 45th ed., 1964, p. B-158.*

boron-edenite. A mineral, artificial $NaCa_2Mg_5(Si_{3.5}B_{0.5}O_{11})_2F_2$, containing 3.91 percent B_2O_3. *Spencer 21, M.M., 1958.*

boron hydride indicator. Unit tests for up to 0.1 parts per million (ppm) of pentaborane or decaborane in air and 0.1 parts per million (ppm) of diborane. Detector comprises a positive displacement hand pump, reagent solution, a dry reagent, color comparison card and a calibration chart. The number of pump strokes required to produce on filter paper a color to match a reference standard is the index of borane concentration. *Bests, p. 584.*

boron metasomatism. The replacement of minerals, as of a granite, by boron-bearing minerals, such as tourmaline, axinite, or rarely, datolite and danburite. *A.G.I.*

boron minerals. Many known minerals contain boron, but only a few are commercially valuable as a source of boron. The principal boron minerals are borax (tincal), $Na_2B_4O_7{\cdot}10H_2O$; kernite (rasorite), $Na_2B_4O_7{\cdot}4H_2O$; colemanite (borocalcite), $Ca_2B_6O_{11}{\cdot}5H_2O$; ulexite (boronatrocalcite), $CaNaB_5O_9{\cdot}8H_2O$; priceite (pandermite), $5CaO{\cdot}6B_2O_3{\cdot}9H_2O$; boracite (stassfurtite), $Mg_7Cl_2B_{16}O_{30}$; and sassolite (natural boric acid), H_3BO_3. Today the United States furnishes the bulk of world production from deposits of sodium boron minerals. Boron and boron compounds have numerous uses, including applications in glass, ceramics, welding compounds, soaps and detergents, plasters and paints, starches, fertilizers, steel, nonferrous metals, atomic reactors, radio tubes, solar batteries, abrasives, refractories, chemicals, plastics, motor fuel, antifreeze, insulation materials, adhesives, drugs, and cosmetics. *BuMines Bull, 630, 1965, pp. 149, 151.*

boron nitride. White; BN; hexagonal rhombohedral, crystals or powder; the powder has a hardness of 2, Mohs' scale; sublimes, about 3,000° C; and is anisotropic and some properties vary according to the method of preparation and the crystal form. Used as a refractory; a high-temperature lubricant, as in glass molds; in furnace insulation; and in molten-metal pump parts. *CCD 6d, 1961; Handbook of Chemistry and Physics, 45th ed., 1964, p. B-158.*

boron oxide. *See* boric oxide. *CCD 6d, 1961.*

boron-phlogopite. A mineral, artificial $KMg_3BSi_3O_{10}F_2$. *Spencer 21, M.M., 1958.*

boron phosphate. BPO_4; specific gravity, 2.81; vaporizes at 1,400° C; related structurally to high-cristobalite. It has been used as a constituent of a ceramic body that fires to a translucent porcelain at 1,000° C. *Dodd.*

boron phosphide. Symbol, BP; melting point, greater than 2,000° C but readily oxidizes, which limits its potential use. *Dodd.*

boron silicides. *See* silicon borides. *Dodd.*

boron steel. The addition of about 0.003 percent of boron confers increased hardenability to steels in the quenched and tempered condition. The addition of this percentage of boron to low carbon, 0.50 percent molybdenum steel in the normalized condition gives double yield strength and a 30-percent increase in tensile strength, but boron has only a very slight advantage when molybdenum is less than 0.35 percent. In amounts greater than 0.03 percent, boron causes difficulty in forging. As much as 2 percent may be added to steels used in nuclear engineering *Ham.*

borosilicate crown glass. An optical crown glass containing substantial quantities of silica and boric oxide. *ASTM C162-66.*

borosilicate glass. Any silicate glass having at least 5 percent of boron oxide, (B_2O_3)

-down pit; sunken pit. A pit that is below the surrounding area on all sides. *Nichols*

enite. A blue to black mineral associated with chalcocite, Cu_9S_5; isometric. *Dana 17.*

estion. Biochemical decomposition of organic matter whereby complex substances are broken down and resolved into simple and harmless matter. *Ham.*

gger. a. One that digs in the ground; as, a miner or a tool for digging. *Webster 3d.* b. A man who is paid by the ton for coal produced; a miner in the stricter sense. Originally the digger mined or undermined the coal; now the term is applied to the man who merely shoots out the coal. *Fay.* c. A machine for removing coal from the bed of streams, the coal having washed down from collieries of culm banks above. *Zern.* d. In Butte, Mont., means the clothing miners wear underground; a pair of denim bib overalls and a denim jacket. *Bureau of Mines Staff. See also* miner. *D.O.T. 1.*

digger edges. The formed serrated edges of the buckets used for digging purposes on a bucket loader. *ASA MH4.1-1958.*

digger tools. The formed tools, interspaced with the buckets of a bucket loader to aid in digging action. *ASA MH4.1-1958.*

digging. a. Mining operations in coal or other ... *ay.* b. Region; locality; quarters; lodging. *Webster 2d. See also* diggings. *Fay.* c. A sudden erratic increase in cutting depth or in the load of a cutting tool caused by unstable conditions in the machine setup. Usually the machine is stalled, or either the tool or the workpiece is destroyed. *ASM Gloss.*

digging bit. According to English drillers, a ... bit usually similar to a steel drag or mud bit. *Long.*

digging cycle. Complete set of operations a machine performs before repeating them. *Nichols, 2.*

digging height. *See* bank height. *Bureau of Mines Staff.*

digging line. On a shovel, the cable which forces the bucket into the soil. Called crowd in a dipper shovel, drag in a pull shovel, and dragline and closing line in a clamshell. *Nichols.*

digging resistance. The resistance which must be overcome to dig a formation. This resistance is made up largely of hardness, coarseness, friction, adhesion, cohesion, and weight. *Nichols, 3, p. 3-4.*

diggings. a. Applicable to all mineral deposits and mining camps, but as used in the United States applied to placer mining only. *See also* bar diggings. *Fay.* b. Superficial mining work. *Pryor, 3.*

digital computer. Machine which makes mathematical computations by methods in which digits are added or subtracted in accordance with the coding signals to which the machine is sensitive. *Pryor, 3.*

digital indicator. A device that indicates the magnitude of a measured quantity in digital numbers, usually in decimal or binary form. *ASM Gloss.*

diglycol monostearate; diethylene glycol monostearate. Small, white flakes; available in regular or water-dispersible types; $C_{17}H_{35}COOC_2H_4OC_2H_4OH$. Used as a temporary binder for ceramics and grinding wheels and as a mold-release lubricant for die casting. *CCD 6d, 1961.*

diglycol stearate; diethylene glycol distearate. A white, waxlike solid; faint fatty odor; $(C_{17}H_{35}COOC_2H_4)_2O$; disperses in hot water; soluble (hot) in alcohol, in oils, and in hydrocarbons; melting point, 54° to 55° C; and specific gravity, 0.9333 (at 20° C, referred to water at 4° C). Used as an emulsifying agent for oils, solvents, and waxes; as a temporary binder for abrasive powders for the manufacture of abrasive and grinding wheels; and also as a binder for clays for ceramic insulation. *CCD 6d, 1961.*

dihedral. Having two sides, as a figure; having two faces, as a crystal. *Fay.*

dihedral angle. The angle of penetration of one phase or grain between two adjacent grains. *VV. See also* angle, a.

dihydric alcohol; glycol. Alcohol containing two hydroxy groups; for example, $CH_2OH.CH_2OH$. *Bennett 2d; 1962.*

dike; dyke. a. A discordant tabular body of igneous rock that was injected into a fissure when molten, that cuts across the structure of the adjacent country rocks, and which usually has a high angle of dip. It should not be confused with a vein. *Bureau of Mines Staff.* b. An embankment of earth or stone to prevent flooding by the sea or by a stream; a levee. *Webster 3d.* c. An embankment of earth around a drill sump or tank. *Long.* d. An embankment to impound a body of water or mill tailing. *Long.*

diked land; diked marsh; polder. A tract of low land reclaimed from the sea or other body of water by dikes. *Schieferdecker.*

diked marsh. *See* diked land. *Schieferdecker.*

dikelet. A small offshoot or apophysis from a dike. *Standard, 1964.*

dike ridge. A wall-like ridge created when erosion removes softer material from along the sides of a dike. *Stokes and Varnes, 1955.*

dike rock. The solidified igneous rock, which, while molten, was injected into a fissure in older rocks. Not to be confused with rock forming a vein or sill. *See also* dike, c. *Long.*

dike set. A group of parallel dikes. *Billings, 1954, p. 307.*

dike swarm. A group of parallel dikes, but more numerous than in a dike set. *Billings, 1954, p. 307.*

diking; dyking; embanking. To surround or protect a tract of land or marsh with dikes. *Schieferdecker.*

diktyonite. A migmatite with a netlike structure. *Schieferdecker.*

dilatancy. a. The property of granular masses of expanding in bulk with change of shape. It is caused by the increase of space between the individually rigid particles as they change their relative positions. *Fay.* b. The expansion of cohesionless soils when subject to shearing deformation. *ASCE P1826.* c. The property of a silt which, when a pat is shaken vigorously in the palm of the hand, moisture will appear on the surface but can be worked back by pressing and squeezing. A clay does not exhibit this property. *Nelson.* d. Property of certain suspensions in which resistance to flow increases at a greater rate than the increase in rate of flow; for example, as in quicksand. *Bennett 2d, 1962 Add.* e. Behavior whereby there is an apparent decrease in the liquid content of a colloidal structure during mechanical agitation (because of the volume increases). *VV.*

dilatation. *See* dilation, b. *A.G.I.*

dilatational wave. Synonym for P-wave; compressional wave. *A.G.I.; A.G.I. Supp.*

dilation. a. The expansion of ice from the freezing of water in fissures. *A.G.I.* b. Deformation that is a change in volume, but not in shape. Synonym for dilatation. *Billings, 1954, p. 15.* c. In volcanology, the widening process of an initial fissure concomitant with the injection of magma. *A.G.I.*

dilation vein. One of the fat lenses in schists and thought to have been caused by the bulging of the schistose rocks under pressure transmitted by the mineralizing solutions. *Bateman, 1950, p. 111.*

dilatometer. An instrument for measuring the expansion or contraction in a metal resulting from changes in such factors as temperature or allotropy. *ASM Gloss.*

diligence. To prosecute drilling with due diligence to success or abandonment means, that there must be a product capable of division between the parties in the proportions mentioned in the lease. Unless this is done, drilling is not prosecuted to success. The rule is that whatever, under the circumstances, would be reasonably expected of operators of ordinary prudence, having regard to the interest of both lessor and lessee, is what is required. *Ricketts, II.*

dillenburgite. An impure chrysocolla containing copper carbonate. *Weed, 1918.*

dillue. Corn. To separate (tin ore) by washing in a hand sieve. *Webster 3d*

dillueing. The washing of small ore in a fine sieve. *Nelson.*

dilluer. Corn. A fine hair sieve for tin ore. *Fay.*

dilluing. Upgrading fine cassiterite by panning it in water in a close-meshed sieve. *Pryor, 3.*

dilly. a. Any of various horse-drawn vehicles (as a light wagon or cart). *Webster 3d.* b. A haulage system on a short incline in a mine. *Webster 3d.* c. N. of Eng. A counterbalance mounted upon two pairs of tram wheels by means of which the empty tubs are carried up an underground incline of a greater inclination than 1 in 3. *Fay.* d. A self-acting incline handling light loads. *Nelson.*

dilly boy. One who rides a dilly or attends it. *Fay. See also* incline man.

dilly brow. Eng. *See* balance brow. *SMRB, Paper No. 61.*

dilly hole. a. A small-diameter cased hole alongside the borehole proper. The dilly hole is as deep as the kelly or grief stem is long and acts as receptacle in which the kelly may be stored during round trips, casing, or other operations in which it is not used. *Long.* b. A small sludge-catchment basin placed between the collar of the borehole and the main drill sump. *Long.*

dilly rider. In bituminous coal mining, a laborer who rides and attends a dilly (light wagon, truck, or water cart) used to haul coal or water underground or at the surface of a mine, loading, unloading, and cleaning it. *D.O.T. 1.*

dilsh. a. S. Wales. Rubbish coal or culm. *Arkell.* b. S. Wales. Black argillaceous rock, clod, or rashings. *Arkell.* c. A band of inferior coal. *Nelson.*

diluent. a. That which dilutes or makes more fluid; a fluid that weakens the strength or consistency of another fluid upon mixing. *Fay.* b. Waste rock in ore. *Hess.* c. In solvent extraction, the inert liquid used to dissolve the extractant. This must be practically immiscible with water; and the one that is almost universally used is kerosine. *Newton, p. 440.* d. *See* carrier solvent.

one undergoing underground development. *Hoffman.* e. N. of Eng. Uses an electric or pneumatic twist drill to make shotholes in the coal. Shotholes in the gateway caunches are usually put on by the stoneman. *Trist.* f. *See* cable driller. *D.O.T. 1.*

driller helper. *See* prospecting driller helper. *D.O.T. 1.*

driller, machine. a. In anthracite and bituminous coal mining, one who operates a compressed-air or electric rotary drilling machine in working places in a mine to drill holes into the working face of coal so that the mass may be broken up by blasting with explosives that are inserted and set off in the holes. Also called drill engineer; drillman; power driller. *D.O.T. 1.* b. In the quarry industry, one who operates a heavy, mounted, compressed-air, percussion rock drilling machine on a ledge or the floor of a quarry to drill holes into the working face of the rock so that the mass may be broken up by blasting with an explosive that is inserted and setoff in the holes. May be designated according to type of drill or mounting used, as drifter drill operator or tripod drill operator. Also called drillman; stone driller. *D.O.T. 1.*

driller's mud. A mineral-laden fluid used as a circulation medium when drilling a borehole with a diamond- or rotary-drilling machine. *See also* mud. *Long.*

drill extractor. Tool for retrieving broken piece of drill from borehole. *Pryor, 3.*

drill feed. The mechanism for advancing the drill bit during boring. *Nelson.*

drill fittings. Devices, parts, and pieces of equipment used downhole in drilling a borehole. Also called downhole equipment. *Long.*

drill floor; drilling floor. A plank-covered work area around the collar of a borehole at the base of a drill tripod or derrick. *Long.*

drill fluid; drilling fluid. Usually water or mud-laden water (sometimes applied to compressed air, natural gas, or oil) circulated through a drill string to keep the bit cool and to wash cuttings produced away from the bit face. Also called circulation fluid; fluid circulation. *Long. See also* circulating fluid.

drill footage. The number of lineal feet of borehole drilled, usually expressed in number of feet per shift. *Long.*

drill frame. A drill mounting often made at the mine to suit the tunnel requirements. It usually comprises two or three arch girders strapped together to form a replica of the tunnel shape but smaller in size. The structure is mounted on wheels and provision is made for clamping the drills to various parts of the frame according to the drill-hole pattern in use. It contains a central opening to allow the passage of the loading machine, cars, or conveyor. *Nelson.*

drill free; drilling free. A condition occurring when the bit is no longer cutting because it is being held suspended above the bottom of the borehole by the drill rods or by a blocking or upstanding piece of core. Also called drill off. *Long.*

drill gage. The width across the cutting bit or diameter of the drilled hole. With tungsten-carbide bits it is possible to drill long holes without the loss of gage. *Nelson.*

drill head; swivel head. a. The assembly which applies the drilling pressure and rotation to the drill rods. Also called boring head. *B.S. 3618, 1963, sec. 3.* b. Obsolete synonym for drill bit. *Long.*

drill hole. a. A hole in rock or coal made with an auger or a drill. *Bureau of Mine Staff.* b. Technically, a circular hole drilled by forces applied percussively; loosely and commonly, the name applies to a circular hole drilled in any manner. *Long.* c. Used by diamond drillers as a synonym for borehole. *Compare* borehole. *Long.*

drill-hole counting. When the results of a survey indicate a possible ore deposit, test holes may be drilled and a special adaptation of a scintillation counter, called a drill-hole counter, may be lowered in the hole in an attempt to locate, outline, and assay an ore body. The drill-hole counter can distinguish between formations by their radiation intensity. *Dobrin, p. 392.*

drill-hole pattern. The number, position, depth and angle of the shot holes forming the complete round in the face of a tunnel or sinking pit. A good drill-hole pattern will ensure the maximum possible pull and the fragmentation for easy loading without excessive scatter of material. *Nelson.*

drill-hole record. A description of the borehole based on the daily logs from the driller and the samples and the report of the geologist. *Nelson.*

drill-hole returns. The circulation fluid and entrained cuttings overflowing the collar when drilling a borehole. *Long.*

drill-hole survey. *See* borehole survey. *Long.*

drill in; drilling in; drilled in. a. The act or process of setting or advancing casing or pipe through overburden with a drill machine by rotating a bit-shod string of casing or pipe. *Long.* b. To drill through the cap rock into an underlying oil-, water-, or gas-bearing formation. *Long.*

drilling. a. The act or process of making a circular hole with a drill. *See also* drill. *Compare* boring. *Long.* b. The operation of tunneling or stoping, whether with a compressed-air rock drill, a jackhammer, or a drifter. *C.T.D.* c. Use of a compressed-air rock drill to prepare rock for blasting. *Pryor, 3.* d. The operation of making deep holes with a drill for prospecting, exploration, or valuation. *Pryor, 3.* e. Two general methods of drilling have come to be recognized: (1) percussion systems, which consist of breaking up the ground by means of a sharp-pointed instrument of a particular form, which is made to strike the ground in a series of blows; and (2) rotary systems, which aim at the extraction of a core or permit all the disintegrated material to be washed away. *Fay.* f. Commonly used in prospecting for, and in the development of, ore or coal lands. *Fay.*

drilling column. The column of drill rods to the end of which the bit is attached. *B.S. 3618, 1963, sec. 3.*

drilling fluid. The thick fluid kept circulating in a borehole to clear the chippings and cool the chisel, etc. *See also* mud flush. *Nelson.*

drilling jig. a. A device very accurately made of cast or wrought iron which becomes a guide for the drilling of holes. The work is fastened in the jig, and the drill is guided through holes drilled in the face of the jig itself. The use of a jig makes interchangeable work easily obtainable. *Crispin.* b. A portable drilling machine worked by hand. *Fay.*

drilling life. *See* bit life. *Long.*

drilling line. In a churn drill, the cable that supports and manipulates the tools. *Nichols.*

drilling machine. A hand-operated, or power-driven machine for boring shot holes or boreholes, in coal, ore, mineral, or rock. *See also* drifter drill; percussive drill; rotary drill; rotary-percussive drill. *Nelson.*

drilling machine operator helper. In metal mining, one who shovels up loose ore or rock in the working place to facilitate setting up and operating drill. Also called drill operator helper. *D.O.T. 1.*

drilling mud. A suspension, generally aqueous, used in rotary drilling and pumped down through the drill pipe to seal off porous zones and to counterbalance the pressure of oil and gas; consists of various substances in a finely divided state among which bentonite and barite are most common. Oil may be used as a base of water. *A.G.I. Supp.*

drilling-mud weighting materials. Class name given to materials which are added to drilling mud to control gas, oil, water, or formation pressures and to aid in maintaining the walls of the open hole. *CCD 6d, 1961.*

drilling pattern. A plan showing the location, direction, length, and firing sequence of the drill holes in a round. *Fraenkel.*

drilling platform. Auxiliary equipment for drilling at heights above head level. The drilling platform is generally assembled and dismantled for each series of drilling operations. *Fraenkel.*

drilling pressure; drill pressure. *See* bit load. *Long.*

drilling rate. a. The depth of penetration achieved per unit of time with a given type of rock drill, bit diameter, air pressure, etc. Also called penetration rate. *Fraenkel.* b. The overall rate of advancement of the borehole. *B.S. 3618, 1963, sec. 3.*

drillings. a. Synonym for drill diamonds. *Long.* b. Incorrectly used as a synonym for cuttings. *Long.* c. Sometimes designates drill diamonds ranging from 4 to 23 stones per carat in size. *Long.*

drilling thrust. *See* bit load. *Long.*

drilling time. a. In rotary drilling, the time required for the bit to penetrate a specified thickness (usually 1 foot) of rock. The rate is dependent on many factors. *A.G.I.* b. The elapsed time, excluding periods when not actually drilling, required to drill a well. *A.G.I.*

drilling tools. An assembly of tools including the bit, drill pipe, etc., used in well drilling. *Shell Oil Co.*

drilling tower; drill tower. Synonym for derrick. *Long.*

drilling up. Preliminary digging out the clay in the taphole of a furnace. This is done usually by hand, air, or electric drill. *Fay.*

drilling weight; drill weight. Total weight, expressed in pounds or tons, applied to a bit while drilling. Also called bit load; bit thrust; drilling pressure; drilling thrust. *Long.*

drill jars; drilling jars. a. A loose-fitting or sliding connector in a drill stem by means of which a sharp, jarring blow can be delivered to a string of drill tools to dislodge the string when it is stuck in a borehole. *Long.* b. Incorrectly used as a synonym for drive hammer. *Long.*

drill line; drilling line. Sometimes used as a synonym for drill cable; drill string. *Long.*

drill log; drilling log. The record of the events and the type and characteristics of the formations penetrated in drilling a borehole. Also called boring log. *Compare* log. *Long.*

jars to give force to the upward jar in well-drilling with cable tools. *Webster, 3d.*

sinker-bar guides. Bars of iron (usually 4) fitted to the drill tools in order to increase their girth and render it impossible for the drill to deviate. *Fay.*

sinker drill. a. A one-man drill, ranging in weight from 25 to 80 pounds, that can be held in the hand but is frequently mounted. This drill has found wide application in sinking shafts and is made in several sizes, each suited for a particular kind of work. Also called plugger drill. *Lewis, p. 87.* b. A rock drill of the jackhammer type commonly used in shaft sinkings. Also called sinker. *Webster 3d.* c. A handheld compressed-air rock drill used in boring down holes as in shaft sinking. *Pryor, 3.*

sinker hoistman. In metal mining, one who operates a small power driven hoist to raise rock and lower supplies in shaft sinking operations. *D.O.T. 1.*

sinkers' hat. Scot. An oilskin or leather hat used for working in falling water, as in wet shafts. *Fay.*

sink-float processes. Processes that separate particles of different sizes or composition on the basis of specific gravity. When ore or coal particles are introduced into a liquid (or into a medium: a solid suspension), those having a specific gravity higher than that of the liquid will sink, while those that are lighter than the liquid will float. *Chemical Engineering, v. 56, No. 1, January 1949, pp. 106-107.*

sink-float separation. *See* dense media separation. *Pryor, 3.*

sinkhead. The same as riser. *ASM Gloss.*

sinkhole. A vertical hole worn by water into limestone rock along a joint or fracture. Such a hole is usually connected with an underground channel. The caving in of the roof may cause more extensive depression and the formation of a pond. The course of a joint is often marked by a row of sinkholes. Synonym for sink. *Standard, 1964.* Also called swallow hole. *Fay.*

sinking. a. The process by which a shaft is driven. *B.C.I.* b. Extending excavations downward at or near the vertical plane. *See also* raising; shaft sinking. *Nelson.*

sinking and walling scaffold. A platform or staging designed for use in shaft sinking to enable the operations of sinking and walling to be performed simultaneously. The late Prof. W. Galloway designed the original scaffold in 1875. The ropes used for supporting the walling scaffold were also used as guides for the kibble which passed through an opening provided in the center of the scaffold. *See also* multideck sinking platform. *Nelson.*

sinking bogie. Scot. A wheeled platform to cover a shaft while the bucket is being emptied. *Fay.*

sinking bucket. A large bucket for hoisting dirt in a shaft sinking. *See also* hoppit. *Nelson.*

sinking crew training. The instruction and intensive training of personnel in rapid shaft sinking methods, in order to achieve the high standard of safety, co-ordination, and timing necessary in modern shafts. Training enables rapid sinking to commence from the first shift. This is a new feature of South African sinking practice. *Nelson.*

sinking fire. A forge in which wrought-iron scrap or refined pig iron is partly melted or welded together by means of a charcoal fire and a blast. *Fay.*

sinking fund. Money reserved for amortization of wasting asset. *Pryor, 3.*

sinking head. The same as deadhead, b. *Fay.*

sinking in rock. Shaft sinking in rock usually comprises the following cycle: Drilling a round of holes, blasting, removing the broken rock, trimming the shaft to form, placing the sets or concrete in position and then preparing to drill the next round. *Lewis, p. 180.*

sinking kibble. A large bucket for raising the stones, etc., from a shaft being sunk. Sometimes called bowk; hoppett. *Peel.*

sinking lamp. An electric lighting fitting designed to be suspended, either singly or in a cluster, in a sinking shaft. *B.S. 3618, 1965, sec. 7.*

sinking lift. A lift (pump) of small size with especially heavy castings to resist the force of blasting: used in shaft sinking. *Standard, 1964.* A sinking pump, which is also sometimes called sinker. *Fay.*

sinking pit. Eng. A shaft in course of being sunk. *Fay.*

sinking plant. In a shaft, consists of the headframe, hoisting equipment, air-compressor for drills, concrete mixing equipment, and suitable pumps. May be either a temporary or permanent plant. *Lewis, pp. 179-180.*

sinking platform. A scaffold or staging designed for use during shaft sinking particularly during lining operations. *See also* sinking and walling scaffold. *Nelson.*

sinking pump. A long, narrow pump designed for keeping a shaft dry during sinking operations. It is usually large enough to deal with 1,000 gallons per minute from the greatest depth at which water will be encountered. A sinking pump must be slung from the surface and be fairly easy to raise and lower when shot firing takes place at the shaft bottom. Most are of the electrically driven centrifugal type and allow for additional stages to be fitted as the shaft depth increases. It may be suspended by a single drum, worm driven, capstan engine with a very slow speed. *Nelson.*

sinking tubing. Drawing tubing through a die or passing it through rolls without the use of an interior tool to control inside diameter, generally resulting in increased wall thickness and length. *ASM Gloss.*

sinkman. a. Scot. Same as sinker, d. *Fay.* b. *See* shaft sinker. *D.O.T. 1.*

sinks. a. Fractions with a defined lower limit of specific gravity and so described, for example, sinks 1.60 specific gravity. *B.S. 3552, 1962.* b. Lanc. Natural cavities found in iron mines. *See also* sink. *Fay.*

sinopis. A variety of red hematite used as a pigment. *CCD 6d, 1961.*

sinople. An aventurescent quartz with inclusions of a red iron mineral. From Hungary. Also spelled sinopal. *Shipley.*

sinter. a. Dross, slag. *Webster 3d.* b. To become or cause to become a coherent imporous mass by heating without melting. *Webster 3d.* c. To heat a mass of fine particles for a prolonged time below the melting point, usually to cause agglomeration. *ASM Gloss.* d. A ceramic material or mixture fired to less than complete fusion, resulting in a coherent mass, or the process involved. *ASTM C242-60T.* e. A chemical sediment deposited by a mineral spring, either hot or cold. Siliceous sinter, consisting of silica, is called geyserite and fiorite; calcareous sinter, consisting of calcium carbonate, is called tufa, travertine, and onyx marble. *Fay.* f. A process commonly used in making diamond bits, whereby powdered metal is compacted in a diamond-set mold or die and the temperature raised to a point just below melting, thus fusing the entire mass together. Also called sintered. *Long.*

sinter bit; sintered bit. A bit the crown of which is formed by applying heat and pressure to a mixture of powdered metals covering diamonds set inside a mold or die-shaped to the form of a bit crown. The bit crown thus formed may be a surface-set, multilayer, or impregnated type. *Long.*

sintered alumina. An abrasive manufactured by sintering (heating without thoroughly melting) mixtures relatively high in alumina but usually containing associated minerals, such as diaspore and various silicates. Commonly coarsely crystalline but sometimes microcrystalline. Also called alumina, manufactured. *ACSG, 1963.*

sintered carbides. Sintering as used in powder metallurgy consists in mixing metal carbide powders having different melting points, and then heating the mixture to a temperature approximating the lowest melting point of any metal included. In sintered carbides, powdered cobalt, having the lowest melting point, acts as the binder holding together the unmelted particles of the hard carbides. *Compare* cemented carbides. *C.T.D. Supp.*

sintered carbide-tipped pick. The pick generally used in coal cutters and cutter loaders, in which the sintered tip is brazed in various ways to the shank of the pick. In the external tip type, which is widely used, the sintered tip is brazed externally to the shank, which is usually a forging. It is self-gaging and as the tip wears down, the cutting edge maintains its shape and clearance. In the slotted type, the tip is brazed into a slot cut in the shank of the pick. In the inserted rod type, the sintered carbide takes the form of a rod inserted into a hollow in the shank of the pink which is a forging. These picks are widely used in the soft coal mines in Germany. *See also* coal cutter picks. *Nelson.*

sintered filter. A filter made from sintered glass, sintered silica or unglazed ceramic. *Compare* ceramic filter. *Dodd.*

sintered glass. Glassware of controlled porosity used for filtration, aeration, etc. It is made by carefully heating powdered glass so that the surfaces of the particles begin to melt and adhere to one another. *Dodd.*

sintered matrix. A bit-crown diamond-embedment metal or alloy produced by a sinter powder-metal process. *See also* sinter; sinter bit. *Long.*

sintered metal. *See* sintered matrix. *Long.*

sintered-metal bit. *See* sinter bit. *Long.*

sintering. a. The agglomerating of small particles to form larger particles, cakes, or masses; in case of ores and concentrates, it is accomplished by fusion of certain constituents. *C.T.D.* b. In powder metallurgy, (1) the bonding of adjacent surfaces of particles in a mass of metal powders or a compact, by heating; (2) a shaped body composed of metal powders and produced by sintering with or without prior compacting. *ASM Gloss.* c. A heat treatment

Tab 8

DEPARTMENT OF THE INTERIOR
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UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

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OIL PROSPECTS IN WASHINGTON COUNTY, UTAH

BY

HARVEY BASSLER

AND

JOHN B. REESIDE, JR.

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OIL PROSPECTS IN WASHINGTON COUNTY, UTAH.

By HARVEY BASSLER and JOHN B. REESIDE, Jr.

INTRODUCTION.

Washington County is the extreme southwestern county of Utah. It is reached most easily by autostage from stations on the Los Angeles & Salt Lake Railroad. Most of the traffic of the county passes through Lund by way of Cedar City, a distance of 90 miles from St. George, the county seat; part of it passes through Modena by way of Enterprise, a distance of 60 miles but at present a more difficult route. An automobile route, the Arrowhead Trail, connecting Salt Lake City and Los Angeles, crosses the central part of the county. From this route spur highways reach the main towns and Zion Canyon National Park, in the eastern part of the county. Except on these main roads automobile traffic is somewhat hazardous—indeed, for the greater part impracticable. (See fig. 9.)

The region is drained by Virgin River, one of the larger tributaries of the Colorado, and might be considered the northern extension of the Grand Canyon district. Erosion has produced a topography of marked relief, and over much of the area rock exposures, which are common in the steep slopes and canyon walls and along the ridges, make it relatively easy to observe stratigraphic and structural details.

The climate is arid, and farming, except on the upland plateaus, is practicable only where streams supply water for irrigation. Such streams are absent south of Virgin River and are not numerous north of it, there being only five of six of any importance. The climate makes it possible in these favored localities to produce many varieties of fruit and other products, some of them semitropical, upon which the population of the region now depends largely for its support. Sheep and cattle raising is an important industry, the high plateaus and mountain pastures being occupied for this purpose in the summer and the lowlands in the winter.

St. George is the chief town and county seat. It has a population of 2,215 (1920), with the usual complement of stores, banks, and other enterprises necessary for the trading center of an agricultural region. Other towns are scattered along Virgin River and its principal tribu-

taries. Leeds, 15 miles east of St. George, was formerly the center of a prosperous silver-mining district, but the industry has been idle since the late nineties.

Exploratory drilling for oil has not been extensive in Washington County. Drilling near Virgin City resulted in several small wells as early as 1907. About 15 test wells were then sunk, most of the

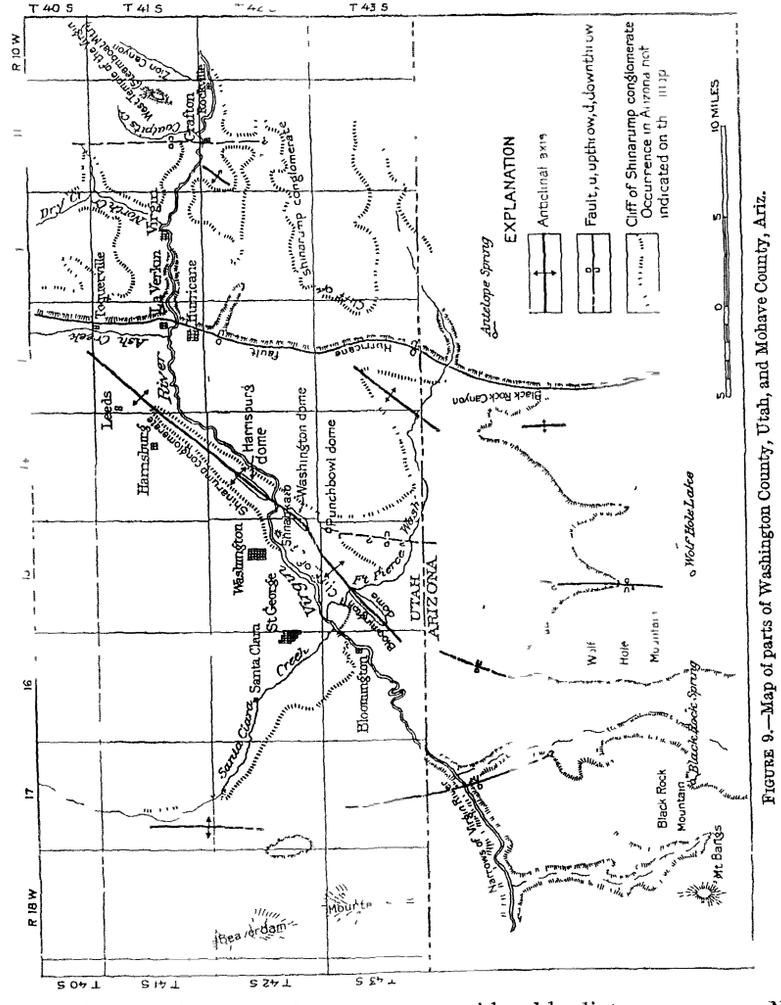


FIGURE 9.—Map of parts of Washington County, Utah, and Mohave County, Ariz.

grouped near Virgin City but some a considerable distance away. No further exploration was made for 10 years, when some of the old wells near Virgin City were cleaned out and several new wells were drilled. In 1919 a well was started on the Harrisburg dome and has reached a depth of 2,200 feet (September, 1920).

The writers spent part of the autumn of 1919 examining the region in reconnaissance. Some detailed work was done near Virgin City and on the three domes of the Virgin anticline, but much of the work was rapid, without a satisfactory base map, and accordingly lacks detail. Much assistance was given by several residents, for which the writers take this opportunity of expressing their thanks.

GEOLOGY.

STRATIGRAPHY.

The rocks of the region range in age from Mississippian to Tertiary, but those of greatest importance as possible sources of oil are the older rocks, beneath what is known as the Shinarump conglomerate—the relatively thin but resistant and sharply marked brown sandstone, bearing pebbles and many petrified logs, that forms an easily recognized and persistent cliff-making stratum over a large stretch of country. These older rocks are included in the Moenkopi formation, the Kaibab limestone, and a sandstone formation which represents the Coconino sandstone and Supai formation of the Grand Canyon area. The Moenkopi formation, of red sandstone, shale, and gypsum, with yellow earthy limestone in the lower part and a discontinuous conglomeratic limestone member at the base, was long believed to be of Permian age but is now considered Lower Triassic. It is from 1,800 to 2,000 feet thick in this region. The Kaibab limestone is at most points not a pure limestone formation but consists of two layers of very hard cherty gray limestone separated by softer shale, gypsum, and thin dark limestone. At many points the lower hard limestone is underlain by soft material similar to that above, and locally there is above the upper hard limestone a variable series of limestone, gypsum, and shale. The divisions vary much in thickness at different localities and may include beds at somewhat different horizons in the formation at different places. The entire formation ranges from 950 to 1,100 feet in thickness. In the past it has been considered of Pennsylvanian age, but it is now believed by many geologists to be Permian and is so classified by the United States Geological Survey.

Beneath the Kaibab limestone is a massive yellow and red sandstone, containing, in the St. George district, very few soft or shaly layers and attaining 1,500 feet in thickness. Farther east it contains a larger proportion of shaly layers. In the Grand Canyon the Kaibab limestone is underlain by the Coconino sandstone, a light-colored massive formation 300 feet thick, of Permian (?) age, which rests on the Supai formation, a succession of red sandstone and shale about 1,200 feet thick, of Pennsylvanian (?) age. In the general region of St. George the rocks underlying the Kaibab do not possess the precise

characteristic features of the Coconino and Supai of the Grand Canyon, but examination of a series of stratigraphic sections at intervals between these regions has revealed a gradual northwestward thinning of the typical Coconino until its identity is finally lost in the top of the sandstone beneath the Kaibab limestone. This sandstone in the same direction becomes increasingly more sandy and less red until in the Beaver Dam Mountains, west of St. George, there is no longer any really red material nor any shale throughout its thickness of more than 1,400 feet. In Virgin Canyon a dense gray siliceous limestone lies beneath the sandstone and is probably equivalent to the Redwall limestone of the Grand Canyon, which is in part Pennsylvanian and in part Mississippian.

Composite section for the region east of the Hurricane fault scarp.

Smith's Mesa, 3 miles north of Virgin City, Utah.

	Feet.
Shinarump conglomerate (Triassic):	
Sandstone, gray, platy, with a few pebbles	20
Shale, gray to green, with some fossil wood	20
Sandstone, coarse, gray-white on fresh surface, limonitic brown on weathered surface; locally filled with small black blobs of wad in appearance suggestive of specks of petroleum; contains lenses of pebbles of chert, variously colored, quartz, silicified wood, and igneous rock. Base is irregular. Unit contains abundance of fossil logs, mostly silicified though in part replaced by copper minerals and rarely by pockets of lignite	75
	115
Unconformity.	
Moenkopi formation (Lower Triassic):	
Sandstone, soft, and shale, brick-red to very deep red, with gypsum and a little lighter-colored shale	405
Shnabkaib shale member:[1] Shale, sandy, and sandstone, soft, fine grained, creamy white, with some pinkish layers and gypsum	360
Sandstone and shale, brick-red, with some reddish gypsum and light bluish-gray gypsum; lighter colored than the upper red beds	400
Virgin limestone member:[2]	
Limestone, yellow, earthy, fossiliferous	5
Shale, yellow and red	25

[1] Named for the striking isolated mesa 2 miles southwest of the town of Washington, on the northwest flank of the Washington dome. This member is more fully described in a forthcoming report on the stratigraphy of the region, by the authors of this report, which will form one of the chapters of Professional Paper 129.

[2] The Virgin limestone member, Rock Canyon conglomeratic member, and Harrisburg gypsiferous member are new names, used for the first time in this report, but the members are more fully described in a forthcoming report on the stratigraphy of the region, by the authors of this report, which will form one of the chapters of Professional Paper 129. The Virgin limestone member is named for Virgin City, where the limestone is well exposed; the Rock Canyon member is named for Rock Canyon, 5 miles north of Antelope Spring, Ariz.; and the Harrisburg member is named for its occurrence in the Harrisburg dome, 8 miles east of St. George.

	Feet.
Moenkopi formation (Lower Triassic)—Continued.	
Virginia limestone member—Continued.	
Limestone, yellow, earthy, fossiliferous	5
Shale, yellow, calcareous	25
Limestone, fairly massive, yellow, earthy, fossiliferous	20
	80
Sandstone and shale, brick-red, with gypsum	360
Rock Canyon conglomeratic member:[2] Irregular complex of limestone, limestone and chert conglomerate, shale, and gypsum. Absent locally	170
	1,775
Unconformity.	

Hurricane fault scarp, 6 miles south of Hurricane, Utah.

Kaibab limestone (Permian):	
Harrisburg gypsiferous member[2] (may include some beds of basal part of Moenkopi formation): Limestone, gray, thin bedded, some of it containing many small angular fragments of chert; and shale, gray or yellow	160
Limestone, massive, gray, with much brown chert; fossils abundant in chert; forms upper cliff	260
Shale, soft sandstone, and gypsum, the whole forming a gray slope	200
Limestone, gray, massive, with much brown chert; light colored on fresh surface; contains softer shaly layers near middle of unit; forms lower cliff	230
Limestone, sandy, cream-colored, and also thin bedded, dark drab; gypsum, white to gray; forms slope	80
	930

Black Rock Canyon, Ariz., 18 miles south of Hurricane, Utah.

Coconino sandstone (Permian?) and Supai formation (Pennsylvanian?):	
Sandstone, medium grained, gray-white on fresh surface, yellow-brown on weathered surface, medium-bedded, cross-bedded	200
Sandstone, like unit above but in thinner beds separated by softer brick-red sandstone	490
Sandstone, medium grained, cross-bedded, gray-white on fresh surface, yellow-brown on weathered surface, relatively thin bedded and forming a bench	155
Sandstone, like the unit next above but practically in one bed and forming a sheer wall; exposed	380
	1,225

[2] See footnote 2 on page 90.

Composite section for the region near St. George, Utah.

Harrisburg dome, 8 miles east of St. George.

	Feet.
——rump conglomerate (Triassic).....	100±
——nformity.	
——kopi formation (Lower Triassic):	
Shale and sandstone, brick-red; upper part very dark.....	320
Sandstone, yellow, medium grained; massive in upper part	75
Shale, red, with some sandstone and gypsum.....	80
Shnabkaib shale member: Shale, sandy, white to light gray, with gypsum and some pink shale.....	630
Shale, red, sandy, with gypsum.....	435
Virgin limestone member: Limestone, earthy, greenish yellow, in three thin bands separated by greenish-yellow and reddish-brown shale.....	160
Shale, red, some of it sandy, with gypsum and a little bluish gypsiferous shale.....	275
Shale, yellow, gypsiferous..	60
Rock Canyon conglomerate [illegible] at this locality, though present elsewhere in the region.	

Unconformity.

Kaibab limestone (Permian):

Harrisburg gypsiferous member: Limestone, light gray, blue-gray, yellow, and reddish, some of it with very characteristic white chert with platy fracture; shale, red and yellow, gypsiferous; gypsum.....	..7

Narrows of Virgin River, below Bloomington, Utah.

Limestone, thin bedded, gray, with some small chert fragments; may duplicate some of Harrisburg member described above..	70
Limestone, massive, uniform, fine grained, gray on fresh surface, brownish on weathered surface, filled with layers and nodules of brown chert.....	275
Breccia of limestone and chert in a limy matrix, whole mass weathers to a yellow-brown color. This unit with unit above forms a cliff.....	110
Gypsum, red shale, breccia of limestone and chert, and gray shale, forming a slope.....	80
Limestone, very massive, gray to light gray on weathered surface, cherty; forms cliff.....	220
Soft sandstone, yellow, gypsiferous; limestone, thin bedded and arenaceous; forms slope.....	65
	957

	Feet.
Coconino sandstone (Permian?) and Supai formation (Pennsylvanian):	
Coconino sandstone(?): Sandstone, cross-bedded, buff, coarse, above; sandstone, white on fresh surface, dark gray on weathered surface, cross-bedded, in middle; sandstone, white to cream-colored, earthy, below.....	45
Supai formation(?): Sandstone, medium-grained, cross-bedded, exceedingly massive. Lower part yellow and brown with a little irregular red staining; middle part similar but with much red staining and a few thin soft red sandstones; upper part at some places a uniform red but usually a clean yellow-brown. The unit is practically one continuous bed and can not be divided into definite subunits.....	1,490
Redwall limestone (Pennsylvanian and Mississippian)	
Limestone, siliceous, with some sandstone; mostly heavy bedded; light gray on fresh surface, red-brown to dark gray on weathered surface; exposed.....	500

STRUCTURE.

The region may be considered structurally as two districts separated by the Hurricane fault, which runs north and south on a line 15 miles east of St. George. East of the fault the rocks are relatively little disturbed. Some smaller faults and some low anticlines are present, but as a whole the district is one of low monoclinal dips without any large modifications. This structure is expressed topographically by flat-topped mesas and level benches of hard strata with intervening slopes of soft materials. West of the Hurricane fault folds and smaller faults of various sizes have so greatly changed the original attitude of the rocks that the district is structurally complex in comparison with that east of the fault. A north-south fault of considerable size lies along the east side of Heber Valley, 10 miles west of St. George. Another 10 to 20 miles south of St. George, east of Wolf Hole Mountain, may be a northward extension of the Grand Wash fault of the earlier geologists, but it has not yet been traced more than a short distance.

OIL PROSPECTS IN THE DISTRICT EAST OF THE HURRICANE FAULT.

FIELD NEAR VIRGIN CITY.

Oil was discovered in 1907 at a point 2 miles northeast of Virgin City, in sec. 13, T. 41 S., R. 12 W., and for a short time exploration was very active. About 15 wells were drilled, most of them grouped around Virgin City but a few at some distance from it. According to the best information now available most of these wells were failures, making only small or no showings of oil and gas; one in

Virgin City is said to have produced enough gas to make a flame several feet long from a 2-inch pipe; one well (No. 9, fig. 10) produced some oil; and three wells, the present producers, came in with production stated variously as high as 36 barrels a day but probably in reality not more than half that.

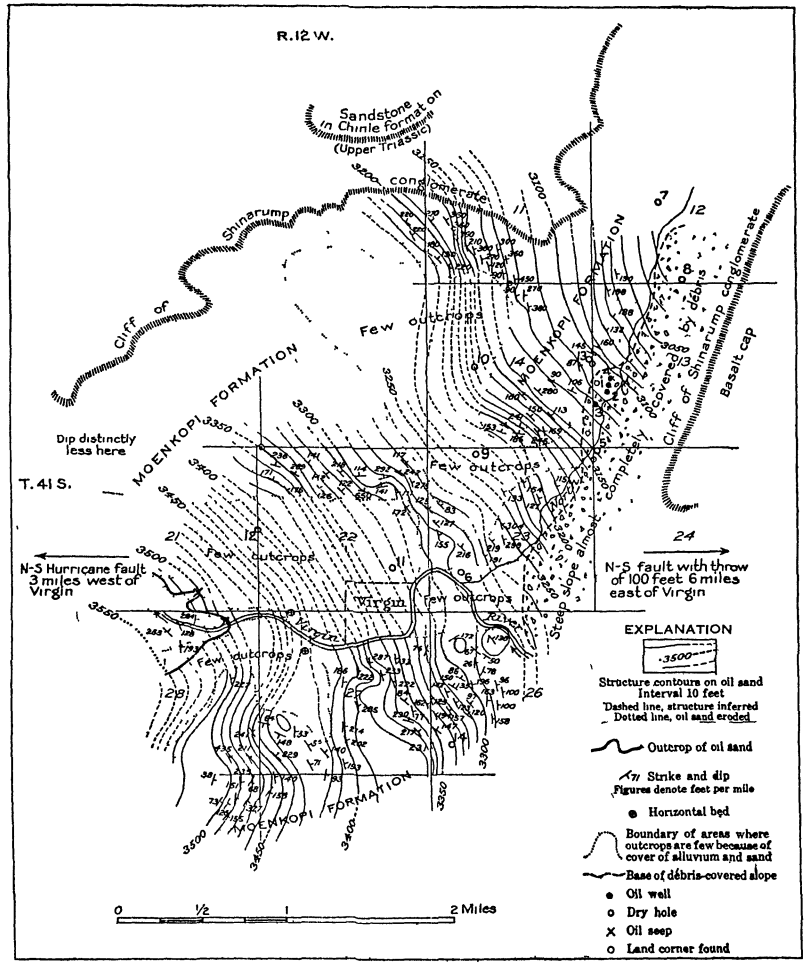


FIGURE 10.—Map of the oil field near Virgin City, Utah.

There was no market for the oil at the time of discovery except as fuel for further drilling, and as the financial panic of 1907 cut down the capital necessary for such exploratory work all activity ceased abruptly.

Nothing more was done in the field until 1918, when the three producing wells were cleaned out and shot, pumping was started, and a small local refinery was built. A new well was drilled near the old wells and has a production of 4 or 5 barrels a day; a second hole put down on the north bank of Virgin River, about a mile south of the first one, proved to be dry. The total production from the four wells, which are uncased holes 550 to 600 feet deep, is about 20 barrels a day (September, 1920). The bulk of this amount is coming from one well, the other wells pumping much more water than oil. The refinery will handle 800 gallons of crude oil per 8-hour shift, and the products find a ready local market.

The oil is reported to range in gravity from 25° to 35° Baumé, to have a paraffin base that includes some asphalt, and to contain some sulphur. It is dark brown and very fluid. There has been little gas in the wells, but the amount is increasing as pumping continues.

The oil comes from a 1-foot bed of limestone which is at the top of the basal Rock Canyon conglomeratic member of the Moenkopi. The wells appear to have met no oil until they pierced this layer and to have obtained no increase from lower beds. This bed is easily found on the outcrop west of Virgin City, and at some points oil and sulphur water are seeping from it, notably at one locality a mile west of Virgin City. The associated limestone contains many cavities, due to the removal of fossils by solution, which are filled with a very fluid oil, though none is apparent in the mass of the rock. Likewise certain sandstone layers in the red beds of the Moenkopi above the limestone contain enough oil to form when fragments are heated in a glass tube a brown ring of oil on the cold part of the tube.

The original source of the oil has not been determined. No carbonaceous matter is apparent anywhere near the oil sand, either in the red beds above it or in the limestone beneath. Over a distance of perhaps 25 miles there is evidence locally of oil in the basal Moenkopi without any apparent carbonaceous matter in either the overlying or underlying rock. At this horizon some miles northeast of Toquerville there are in the limestone many fossil cavities filled with oil. This is true also at the places west of Virgin City mentioned above and at other localities 5 or 6 miles south of Virgin City. At the localities on Rock Canyon and 2 miles southwest of Black Rock Canyon, described on pages 104–105, the basal Moenkopi contains much asphaltic material. In the absence of any other probable source of the oil, the layers of abundantly fossiliferous limestone seem to be the most probable place of origin. However, the higher oil-bearing layer described on page 98 is separated by thick intervals of rock from any known fossiliferous beds.

The accumulation of oil may be due to various causes. In many fields an anticlinal fold is the governing factor, the oil accumulating in the higher parts of the fold if water is abundant in the sands, on the flanks if water is not abundant, and in the intervening synclines

if the rocks are dry. In other fields the oil accumulates in a rock terrace formed by a steplike wrinkle in an inclined layer. The dip is low on the terrace but steeper toward the terrace on the high side and away from it on the lower side. In some fields an inclined oil-bearing layer is sealed by faulting or by overlap at its upper end by impervious rocks, so that oil can accumulate just beneath the seal. Some oil reservoirs are merely porous pockets in rock that is elsewhere relatively impervious, as, for example, sandstone lenses in a shale. Or the rock may be more porous at some places than at others, permitting a greater oil content locally because there is more space for it. In some regions oil accumulates in the favorable places which are nearer the source of the oil and is absent from places that are equally favorable except that they are farther away. For example, in some large structural basins that contain folds at different distances from the basin rim oil moving up from the central part of the basin accumulates in the folds that lie nearer the center of the basin rather than in those that lie farther out.

The accumulation of oil in the field at Virgin City has been attributed previously either to the presence of permeable sandstone lenses in impervious shale or to chance variations in the porosity of a sandstone layer—causes neither of which is determinable from the surface. However, there is a much more probable cause of accumulation in the structure of the field. The rocks of this field dip to the northeast at an average angle of not more than 2°, though the dip is not uniform but is modified by steepenings where it may rise to 5° or 6° and by flattenings where the rocks are nearly level. The contour lines on figure 10 show the form of the surface of the oil sand, as nearly as it may be determined from the surface. Contour lines that are close together indicate that this surface is relatively steep; lines that are widely separated indicate that it is relatively flat. The producing wells, Nos. 1 to 4 of the map, in the SW. ¼ sec. 13, are clearly situated on a flat area. Well No. 5, in the NW. ¼ sec. 24, known to have been a failure, lies at the foot of an area of relatively high dip. Well No. 6, in the SW. ¼ sec. 23, known to have been a failure, seems to lie on a flat area, though near the higher edge. Well No. 9, in the NW. ¼ sec. 23, reported to have been a small producer, lies apparently on a flat. Well No. 11, in the SW. ¼ sec. 22, a gas well in Virgin City, may lie on a flat, though the contour lines for the area near it are based on insufficient data. The information now available, though it is not very reliable, seems to indicate that wells Nos. 7 and 8, in sec. 12; No. 10, in the NW. ¼ sec. 14; No. 12, near the west quarter corner of sec. 22; No. 13, near the west quarter corner of sec. 13; and No. 14, in the SW. ¼ sec. 26, were all failures. It seems most probable on the evidence here presented that terraces, or areas of low dip, are favorable to the accumulation of oil in this field and that the steep slopes are unfavorable. To what extent, in addition, variations in porosity of the sand are a factor it is difficult to say, though they are probably of minor importance. There are no anticlines, faults, or other features closely enough associated with the producing field to offer an explanation for the accumulation of oil, so that the only likely factor left is that of accumulation on a terrace.

OTHER FAVORABLE LOCALITIES.

If the view above set forth is correct, there are several untested localities near Virgin City that are structurally as favorable at least as the small area from which oil is now obtained, and the producing wells are sufficiently close to these terraces to justify the recommendation that other localities where the structure is similar be tested. Approximate locations for such tests are the northwest corner of the NW. ¼ SW. ¼ sec. 23, T. 41 S., R. 12 W; the center of the NW. ¼ SW. ¼ sec. 23, T. 41 S., R. 12 W.; the center of the NE. ¼ NW. ¼ sec. 26. T. 41 S., R. 12 W.; the center of the SE. ¼ NW. ¼ sec. 26, T. 41 S., R. 12 W.; and the SE. ¼ SE. ¼ sec. 27, T. 41 S., R. 12 W.

If drilling at these places gives favorable results, a still more pronounced flattening in the W. ½ sec. 27, T. 41 S., R. 12 W., should be tested, though it lies so close to the outcrop of the oil-bearing beds that seepage at the outcrop may have allowed any oil present to escape, and it may not prove any better than the other locations. On the other hand, several fields lately brought in, such as the Upton-Thornton and Osage fields of Wyoming, produce from sands whose outcrop lies very close to the wells, and it is possible that a similar condition exists here.

A relatively pronounced structural terrace is visible on Virgin River 1 mile west of Grafton and 6 miles east of Virgin City, in secs. 5, 6, and 7, T. 42 S., R. 11 W. Old Grafton Wash cuts through it. The surface rock is the middle red-bed member of the Moenkopi formation. The fold trends northeast and southwest from the river. The dip on the southeast side is 6° to 8° SE., and the northwest side is flat or even slightly reversed. Farther northwest the low regional dip of about 2° SE. again prevails. This terrace is a duplicate on a somewhat larger scale and with more pronounced features of those near Virgin City. Under it the horizon of the producing sand at Virgin City lies at a depth of 800 to 900 feet. The locality where this terrace crosses San Juan River is only a mile west of the fault that passes in a north-south direction through Grafton. (See fig. 9.) Though toward the south the terrace diverges from the fault, the effect of the fault would be to cut down the area of rock that might contribute to a possible accumulation of oil on the terrace. A short distance north of San Juan River the fold passes under basalt and can not be traced farther, though it can not extend far before meeting

the fault. South of the river its full extent is not known, but it can be seen for several miles at least. The large size and apparent great extent of this fold in comparison with that producing at Virgin City make it worth a test.

Several miles east of Antelope Spring, Ariz., and about 20 miles south of Virgin City, where the general dip is 1°–2° NE., a reversed dip of 1°–3° W. in the Virgin limestone member of the Moenkopi formation betrays the presence of a low anticline whose axis extends apparently in a north-south direction. A reversed dip of 3° observed about 7 miles southeast of Antelope Spring probably indicates a southward extension of the axis to that locality. Little is known of the extent and character of this fold, as no study was made to determine its possibilities or select drill sites, but it is believed that its axis passes approximately through what would be sec. 19, T. 44 S., R. 12 W., if the Utah land subdivisions were extended into Arizona. The depth on this fold to the horizon of the sand that is productive at Virgin City should be 300 to 400 feet. A well drilled in 1907 about 4 miles east of Antelope Spring does not lie near enough to test this anticline, though it is said that gas was struck in the well.

HIGHER OIL SAND.

Another possible oil-bearing bed is in the upper part of the Moenkopi formation, in the midst of red beds, about 1,000 feet above the oil-yielding bed of the Virgin River field. This oil-bearing zone was noted on Dry Creek, 3 miles north of the Dixie Co.'s wells, where a 6-foot layer of brown sandy shale that smells strongly of oil when broken is overlain by 4 feet of contorted oil-stained shale containing nodules of gypsum. About 2 feet higher a 6-inch layer of shale and gypsum is crossed by stringers of pure black asphalt a quarter of an inch to an inch thick. Nothing was observed that would suggest the source of this oil and asphaltic matter. No carbonaceous material or fossils were seen in any of the beds above it up to the Shinarump conglomerate, and no carbonaceous matter or fossils occur between it and the Virgin limestone member. The containing beds themselves seem to include nothing that could have furnished oil. Where the structure is favorable and these beds lie 200 feet or more below the surface, they may be of greater value than the lower producing beds of the Virgin River field. Furthermore, wells sunk in such locations may reach down to the lower beds. No search was made by the writers to locate folds in the beds above this higher zone of oil-bearing rock, nor was it traced farther than the canyon of Dry Creek.

PROSPECTS FOR FUTURE PRODUCTION.

The present Virgin City field appears to be of value for supplying local demand. The thinness of the oil "sand" seems to preclude the possibility of production adequate to repay the expenses of distributing the oil to refineries outside the field. However, at some distance from Virgin City the oil-bearing beds may thicken so much that they will furnish an adequate reservoir for greater accumulation of oil. Therefore any pronounced anticlinal fold that may be detected in the beds of the Moenkopi formation in this general region should be prospected to test this possibility.

OIL PROSPECTS IN THE DISTRICT WEST OF THE HURRICANE FAULT.

The most prominent structural feature of the district west of the Hurricane fault is the Virgin anticline, with its three superimposed domes—the Harrisburg dome, the Washington dome, and the Bloomington dome. Minor anticlines were noted at several localities.

VIRGIN ANTICLINE.

The axis of the Virgin anticline trends southwestward through Tps. 41 and 42 S., R. 14 W., and T. 43 S., R. 15 W. Over most of its length this anticline exposes the red rocks of the Moenkopi formation, but at three places, where it has been affected by cross folds it brings up the Kaibab limestone. These cross folds form well defined domes, called the Harrisburg, Washington, and Blooming ton domes. The Harrisburg dome lies in secs. 8, 9, 16, and 17, T 42 S., R. 14 W., about 3 miles east of the town of Washington. The Washington dome lies in secs. 30 and 31, T. 42 S., R. 14 W., and secs. 25 and 26, T. 42 S., R. 15 W., several miles southwest of the Harrisburg dome and southeast of the town of Washington. The Bloomington dome lies in secs. 8, 9, 17, 18, and 19, T. 43 S., R. 15 W. 6 miles southwest of the Washington dome and 5 miles south of the town of St. George. These three domes offer the most promising locations for the accumulation of oil if any is present in the anticline and more time was spent in studying them. They are therefore described in some detail below, and the maps (figs. 11 and 12) show more detail than was procured regarding the other folds of the region.

Harrisburg dome.—The Harrisburg dome lies in secs. 8, 9, 16, and 17, T. 42 S., R. 14 W., just north of the place where Virgin River crosses the anticline, about 8 miles northeast of St. George and 3 miles east of Washington. An almost completely encircling outcrop of the Virgin limestone low in the Moenkopi formation and the high core of Kaibab limestone rising out of the red shales and sandstones mark it off, even to the layman's eye. The oil-bearing zone of Virgin City is not present over the crest of the dome and appears to be lacking also on the flanks. The dips are high, from 40° to 65°, and the folding is close—so close, in fact, that on the southeast flank a hinge fault has been formed on a line running 500

to 800 feet from the axis and parallel to it. (A hinge fault is a fault or crack starting in unbroken rock and gradually separating the broken ends of a given stratum farther and farther as it recedes

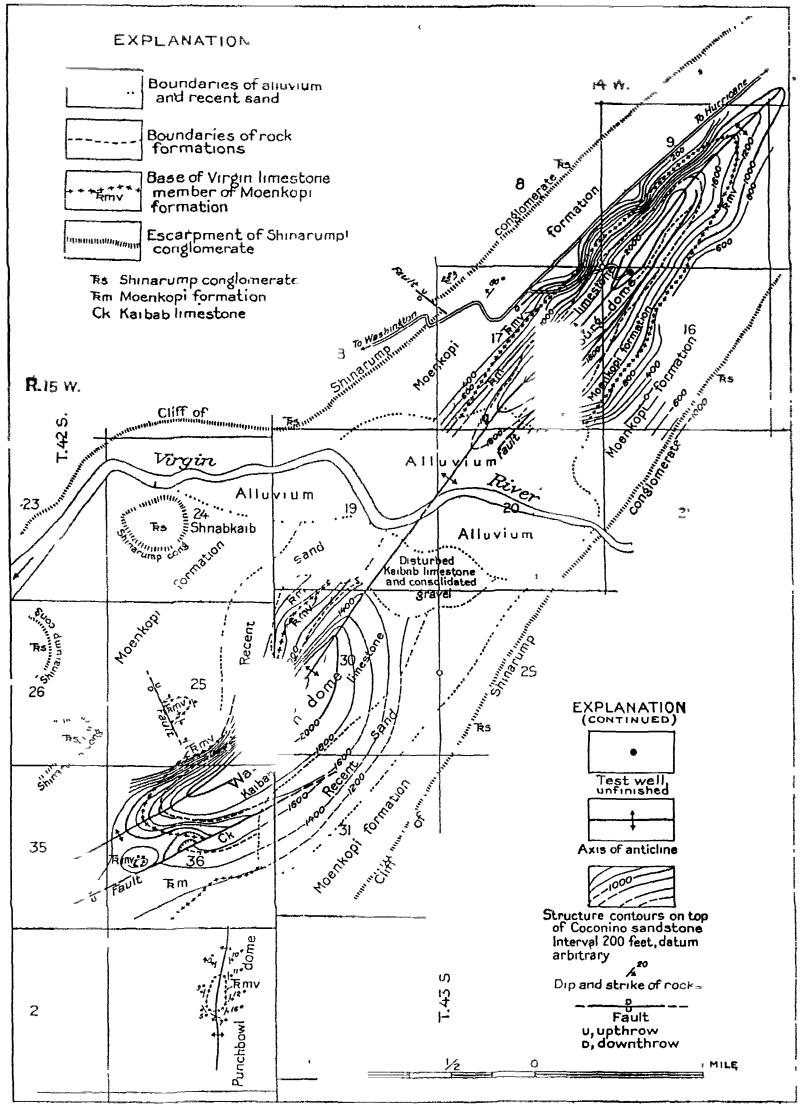


FIGURE 11.—Map of part of the Virgin anticline, Washington County, Utah, showing the Harrisburg and Washington domes.

from the unbroken part, somewhat as the two blades of an open pair of shears separate progressively outward from the pivot.) This fault begins near the north end of the dome, and the displacement increases southward until the rocks on the east are raised a distance of perhaps 500 feet at the southernmost exposure. The Kaibab limestone is only slightly eroded at the top of the dome, and practically its entire thickness must be pierced to reach the sandstone. As the thickness is over 900 feet in the Hurricane cliff, to the east, and in Virgin Canyon, to the west, it is likely that 950 feet is not an excessive estimate of the thickness under the dome. Reports of the rocks passed through in drilling the well on this dome seem to indicate that they included a little more than 1,000 feet of Kaibab strata. This larger figure may be due to a thickening along the crest of the fold produced during the folding.

This well, the only well now being drilled in the region, is near the northwest corner of sec. 16 and is close to the highest point structurally on the Harrisburg dome. It lies practically on the axis and is an adequate test of the upper part of the dome. At present (September, 1920) the well is reported to have reached a depth of 2,200 feet and therefore to have pierced the Kaibab limestone and most of the underlying sandstone. It is proposed to continue the well to a greater depth, but the prospect of success at lower horizons is very small. A light showing of oil was reported at approximately the horizon of the top of the sandstone, and water was found at several other horizons.

Washington dome.—The Washington dome lies across Virgin River from the Harrisburg dome, in secs. 30 and 31, T. 42 S., R. 14 W., and secs. 25 and 26, T. 42 S., R. 15 W. It is separated from the Harrisburg dome by an area where bedrock is concealed by river silt, gravels, and blown sand, but there is ample field evidence that the two domes are distinct. South of the river some evidence of faulting is shown by small outcrops of much disturbed Kaibab and Moenkopi rocks piercing this mantle, but this faulting is on a small scale and does not affect the dome itself. The dome shows topographically in the high core of Kaibab limestone rising from the softer and more eroded red rocks of the Moenkopi formation. The Virgin limestone member of the Moenkopi formation is exposed locally but is mostly buried under blown sand. The oil-bearing bed of the Virgin City field is not present over the crest of the dome and where present on the flanks shows no indication of oil. The best chance of finding oil in this dome is in the sandstone that represents the Coconino and Supai formations. The Kaibab limestone is not deeply eroded on the crest of the fold, and any well would have to pierce most of that formation to reach the sandstone beneath, the thickness being the same as under the Harrisburg dome—that is, 900 to 1,000 feet of Kaibab limestone must be penetrated. The Washington dome is unsymmetrical. The dips on the west side are from 40° to 60° or more, and those on the east side are com-

monly around 20°; the axis therefore lies much closer to the west side. Near the south end of the dome a fault of the same type as that in the Harrisburg dome cuts the southeast flank, but it seems to be of lesser extent, though the displacement reaches 700 or 800 feet at its visible maximum. This fault is exposed for a distance of three-quarters of a mile and passes under cover at each end of the exposure. The structurally highest part of the dome lies at the surface in the NW. ¼ SW. ¼ sec. 30, T. 42 S., R. 14 W., and the SE. ¼ SE. ¼ sec. 25, T. 42 S., R. 15 W., but owing to the unsymmetrical form any drilling to test the crest should be shifted 300 to 400 feet to the east, as in such folds the axis does not lie in depth immediately beneath its position at the surface.

Several minor domes occur near the Washington dome. One of them lies north of the south end, near the center of sec. 25, T. 42 S., R. 15 W., and is cut by a small fault on the west side. Another lies south of the south end of the Washington dome, near the west side of sec. 36, T. 42 S., R. 15 W. A more pronounced minor dome is that in sec. 1, T. 43 S., R. 15 W., known locally as the Punchbowl dome. It is a true dome, though much smaller than the three main domes. These minor domes are all in the Moenkopi formation and are shown clearly by the attitude of the light-colored Virgin limestone member in the midst of the darker-colored red beds. In all these smaller domes the horizon of the oil sand of the Virgin City field, judged by the outcrops on the main dome, is either absent or is barren of oil if present. The depth to the Coconino-Supai sandstone is about 1,400 feet in each of the domes. These smaller domes are less favorable locations for drilling than the larger ones, which should be tested first.

Bloomington dome.—The Bloomington dome, which is larger than the other two chief domes, extends through secs. 8, 9, 17, 18, and 19, T. 43 S., R. 15 W., about 5 miles south of St. George. (See fig. 12.) It is clearly defined by the encircling Virgin limestone member of the Moenkopi and the high core of Kaibab limestone. The oil-bearing bed of the Virgin City field is not present over the crest of the dome and contains no oil where present on the flanks. The best chance of finding oil is in the Coconino-Supai sandstone. Like the Washington dome, this dome is unsymmetrical, the western flank dipping 40° to 70° and the eastern flank less than 20°. On it are imposed several distinct high areas, so that it is really a close group of domes. The largest, areally, of these subordinate domes is at the south end of the main dome, its crest lying in the NE. ¼ NW. ¼ and NW. ¼ NE. ¼ sec. 19. It is broader and more nearly symmetrical than the others. The oldest rock exposed is practically the top of the Kaibab limestone, and 900 to 1,000 feet of rock must be penetrated to reach the sandstone. The next largest crest is that in the SE. ¼ SE. ¼ sec. 8. It brings to the surface the top of the upper harc limestone of the Kaibab, and therefore a shallower well, about 80C feet deep, would reach the sandstone. It is smaller than the southern minor dome. Between these two is a smaller and lower high area on the line between the NE. ¼ and the NW. ¼ sec. 17.

On the flank of the Bloomington dome in the SE. ¼ sec. 17 a minor dome has been formed. The surface rock is the Moenkopi formation beneath the Virgin limestone member. Another minor fold is present in the SW. ¼ sec. 19, on the east flank of the main dome.

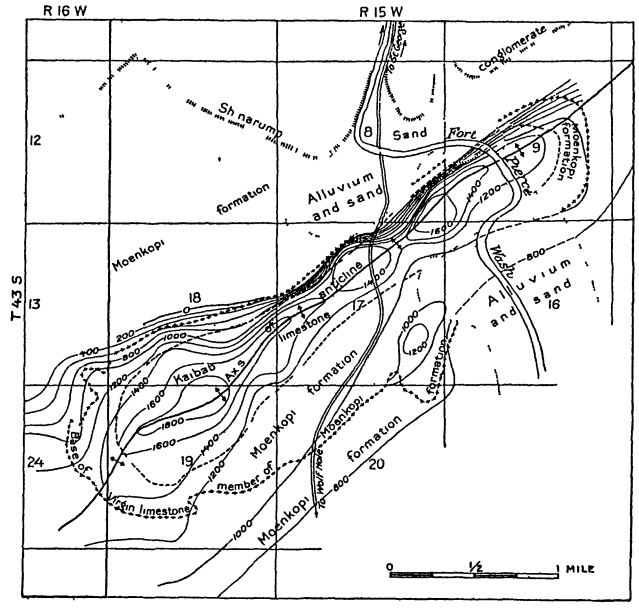


FIGURE 12.—Map of the Bloomington dome, Washington County, Utah

Fictitious "Kingman dome."—South and southwest of the Bloomington dome a very large, relatively flat area is reported locally to be occupied by what is termed the "Kingman dome." There is no such dome, however, but in the area it is supposed to cover there are merely several very small domes.

OTHER ANTICLINES.

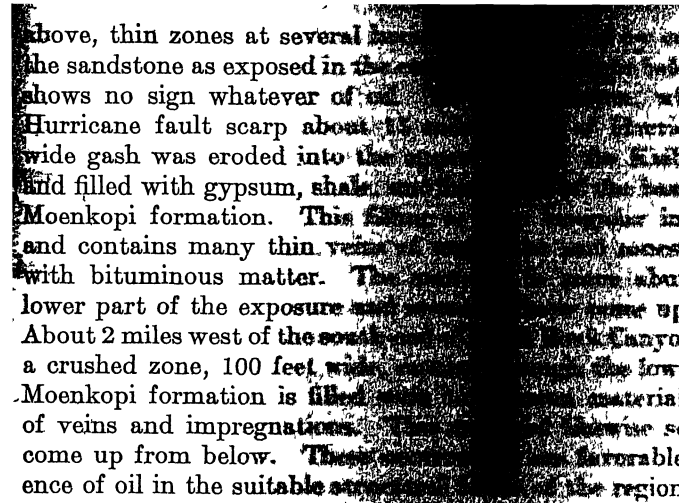
Smaller anticlines are present at several other places in this field. One of these extends through the eastern part of T. 41 S., R. 17 W., and is plainly shown where the Arrowhead Trail, the tourist route from St. George, Utah, to St. Thomas, Nev., crosses it, about 15 miles from St. George. The rocks exposed here are in the upper part of the Moenkopi formation. The axis of the fold trends nearly north and south and plunges to the north, and the dip of the flanks

is gentle. No study was made of this fold to determine its size or the presence of closed structure, but its axis extends 4 or 5 miles at least and is probably much longer. The oil-bearing zone of Virgin City may be present beneath it, and the Coconino-Supai sandstone is certainly there. At the locality where the Arrowhead Trail crosses the axis the former should lie about 1,500 feet beneath the surface and the latter about 2,500 feet. In the western part of T. 43 S., R. 13 W., about 15 miles south of east of St. George, another anticline, in rocks of the Moenkopi formation, extends in a northeasterly direction, the north end abutting against the Hurricane fault and the southern part passing over into Arizona. The axis of this fold plunges northeastward. The southeast limb dips steeply and is cut off obliquely by the fault. No detailed study was made of this fold, and its full extent and character are not known, but the axis extends at least 5 miles and is probably much longer. The Virgin City oil sand may be present beneath it, and the Coconino-Supai sandstone certainly is. The depth to these beds varies because of the plunging of the axis.

Farther south, in Arizona, at a place about 18 miles south of the town of Hurricane, Utah, and the same distance southeast of St. George, a small, low anticline with its axis trending north a mile west of the Hurricane fault is seen in rocks of the upper part of the Moenkopi formation. This fold is several miles in length and apparently closed. Its east limb is cut off by the Hurricane fault, but the west limb is not faulted so far as known. The Virgin City oil sand may be present beneath it, and the Coconino-Supai sandstone certainly is. Near Black Rock Spring, Ariz., 25 miles south of St. George, the valley between Black Rock Mountain and Wolf Hole Mountain contains a large number of small domes, the largest of them perhaps 3,000 feet across. These are in the lower part of the Moenkopi and the upper part of the Kaibab formation, but they are so numerous and so closely crowded together that their value is likely to be small. No detailed study was made of this area.

EVIDENCES OF OIL.

Evidence of oil in the rocks of this region is meager. The bed that furnishes the oil found at Virgin City is missing at the crests of the larger uplifts and if present elsewhere does not offer any indication of containing petroleum. The extreme top of the sandstone formation, where exposed in the Hurricane fault scarp 5 to 7 miles south of Hurricane, is stained along the face with oil, and the rock yields oil when heated in a glass tube. At a point 6 miles south of Hurricane this zone includes the upper 20 feet of the sandstone. Near Black Rock Canyon, Ariz., which lies 18 miles south of Hurricane, Utah, and is a distinct locality from Black Rock Spring, mentioned



above, thin zones at several [illegible]. However, the sandstone as exposed in the [illegible] below St. George shows no sign whatever of [illegible] which cuts the Hurricane fault scarp about [illegible] Hurricane, a deep, wide gash was eroded into the [illegible] Kaibab limestone and filled with gypsum, shale, [illegible] basal part of the Moenkopi formation. This [illegible] lower in composition and contains many thin veins [illegible] impregnated with bituminous matter. The [illegible] abundant in the lower part of the exposure [illegible] up from below. About 2 miles west of the south [illegible] Canyon, in Arizona, a crushed zone, 100 feet wide, [illegible] lower part of the Moenkopi formation is filled [illegible] material in the form of veins and impregnations. [illegible] seems to have come up from below. These [illegible] favorable to the presence of oil in the suitable structure [illegible] region in that they show at near-by points oil [illegible] whose continuation underlies the folds, though [illegible] a proof that oil occurs in the folds.

GROUND WATER.

The water conditions in the [illegible] of the region are but poorly known. Springs are rare, and so far as surface indications are valid the rocks seem to be dry. However, Virgin River crosses the outcrops of all the formations, and some water from this stream may seep into the rocks. Besides this the region has some rainfall, though small, and some of it must enter the rocks. In the well on the Harrisburg dome water was struck between 1,000 and 1,100 feet beneath the surface. It will probably be found at most points that the rocks below the surface contain water, a factor of great importance in the development of an oil field, for if water is present in abundance the highest parts of the anticlines and domes will usually contain any oil that may have accumulated.

PROSPECTS FOR COMMERCIAL PRODUCTION.

The value of this region as a possible producer of oil it is impossible, of course, to gage in advance of drilling. The region contains favorable structural features, and there are rocks in them capable of serving as reservoirs for oil. At certain places, as described above, there is evidence favorable to the assumption that these rocks carry some oil. Whether oil is actually present in these rocks in the anticlines and domes remains for the drill to determine. The well drilled on the Harrisburg dome is a fair test of a part of that fold. The fault on the east side, however, reduces the value of this test as a criterion for the region. However, no seepage along the fault is evident, and its largest effect is probably that of cutting off part

of the area of rock which might have contributed to any oil content of the dome. According to reports the drill penetrated 1,050 feet of limestone and about 1,200 feet of the Coconino-Supai sandstone without finding more than a light showing of oil. Failure of the well on this dome should not be taken as an absolute condemnation of the whole area, for the fault may have affected the dome adversely, whereas the other domes are still intact. Besides, if the rocks are only partly saturated with water oil may be absent on the crest and still be present down the dip. Nevertheless the crests of the domes should be tested first to determine the presence or absence of oil or water, before other locations are tried.

DIFFICULTIES OF EXPLORATION.

Drilling operations in Washington County, Utah, and the part of Arizona adjacent to it are in general carried on under some handicaps. No part of the region is less than 70 miles from a railroad by any practicable route, and much of it is 90 or 100 miles from a railroad. Much of the material for drilling must be brought from Los Angeles, Calif., or other distant center of supply. Away from a few main routes, such as that between Lund and St. George or that through Virgin City up the Virgin to Zion Canyon, the roads are mostly unkept trails. Fuel and water are expensive and hard to obtain at many localities. Electric power was used at the well on the Harrisburg dome but probably could not be supplied to many rigs at one time nor at places far from the transmission lines. The rocks of the Moenkopi formation are relatively soft and easy to drill, but those of the Kaibab limestone offer difficulties because of the abundance of chert, and drilling in them is slow and expensive.

RECOMMENDATIONS FOR DRILLING.

The localities near Virgin City suggested on page 97 as favorable places for drilling test wells lie near good roads and are easily accessible. Water in abundance may be obtained from ditches, from North Creek, or from Virgin River. Fuel is scarce, however, as the easily accessible timber has already been cut off, and coal, if used, must be hauled from Colob Plateau, some 30 miles to the north. Electric power is not now available in this district. The rocks to be drilled are relatively soft and offer little difficulty. Wells less than 600 feet deep should be sufficient.

Any test hole on the terrace near Grafton, described on page 97, should be located some distance south of Virgin River, perhaps in sec. 7, T. 42 S., R. 11 W., to get as far from the Grafton fault as possible. This locality would not be as easy of access as those near Virgin City, as the river would have to be forded and a road made to the south. Water could be piped or hauled from the river, but

fuel would have to be hauled a long distance. The rocks to be penetrated are relatively soft and easily drilled, and a 900-foot well should reach the horizon of the Virgin City oil sand.

The anticline east of Antelope Spring is not well enough known to justify the recommendation of localities for drilling. The rocks to be pierced are relatively soft and easy to drill, and water can be obtained from Antelope Spring, but the region is remote from the settlements and sources of supply, and fuel is scarce and must be hauled some distance.

The writers believe no further test should be made on the Harrisburg dome at present, at least not until showings elsewhere on the Virgin anticline justify it.

The first test on the Washington dome should be made near the northwest corner of the SW. ¼ SW. ¼ sec. 30, T. 42 S., R. 14 W. This locality is not easily accessible because of its high elevation and the rough topography, but a short road can be built to it from existing trails. Water can be obtained by piping or hauling from Virgin River. Fuel is very scarce and would have to be hauled a long distance unless electricity could be obtained to replace it. The use of electricity would entail the building of several miles of power line. The depth to the sandstone beneath the Kaibab limestone is 900 to 1,000 feet, and much of the rock is very cherty, tough material that is difficult to penetrate.

The first test on the Bloomington dome should be made near the center of the NW. ¼ NE. ¼ sec. 19, T. 43 S., R. 15 W. Conditions are much the same here as on the Washington dome except that the locality is more accessible. Water can be procured from ditches or from Fort Pierce Wash, but fuel is lacking. The depth to the sandstone is 900 to 1,000 feet, and the intervening rock is in large part tough and cherty. The second best locality on the Bloomington dome is in the southeastern part of the SE. ¼ SE. ¼ sec. 8, T. 43 S., R. 15 W. Here the depth to the sandstone is about 800 feet.

The minor domes near the Washington and Bloomington domes should not be tested unless the larger domes show good results or there is some indication that there is oil down on the flanks which might be present in the smaller domes.

The anticlines described briefly on pages 103–104 need further examination. The present data are insufficient to determine the presence or absence of closure, and without this knowledge recommendations are unwarranted.

Tab 9

Woodruff, E. G.

CONTRIBUTIONS TO ECONOMIC GEOLOGY

F1

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

BULLETIN 471—A-4

ADVANCE CHAPTER FROM

CONTRIBUTIONS TO ECONOMIC GEOLOGY

(SHORT PAPERS AND PRELIMINARY REPORTS)

1910

PART II.—MINERAL FUELS

PETROLEUM AND NATURAL GAS IN UTAH

BY
E. G. WOODRUFF

WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

GEOLOGY OF THE SAN JUAN OIL FIELD, UTAH.

By E. G. Woodruff.

INTRODUCTION.

LOCATION AND FIELD WORK.

The oil field described in this paper lies in southeastern Utah in the valley of the San Juan River and in the county of the same name. Goodridge and Mexican Hat are post offices recently established not far from the center of the field, and Bluff is an old Mormon settlement a few miles to the east. The location of the field is shown by the index map on Plate IX (p. 96). The area represented by the large map is 300 square miles, but not all of this is regarded as possible oil-producing territory. On the other hand, it is believed that this area does not embrace all of the oil-bearing strata in the region, but it probably includes all of the area in which development will occur in the present decade. In fact this belief was the chief factor which induced the writer to place the limits of the field where they are drawn.

The data on which the report is founded were collected during June, July, and August, 1910, by the writer with the assistance of A. J. Jarrett, K. C. Heald, and C. A. Atwell. For a short time Herbert E. Gregory cooperated with the writer in a study of the formations in an attempt to correlate them with formations exposed in adjacent regions. Prof. Gregory was somewhat familiar with the geology of the region, from his observations made during the previous year in a reconnaissance investigation of the Navajo Indian Reservation. As a result of his investigation, the public land in this field was withdrawn from entry by order of the President, and a detailed investigation was authorized by the Secretary of the Interior. Pursuant to this order, the present examination was undertaken for the primary purpose of obtaining data upon which to classify the public land and, secondarily, to prepare a geologic report which might assist in the economic development of the field.

ACKNOWLEDGMENTS.

The men mentioned above are entitled to credit for hearty cooperation in collecting the data included in this report. The writer is also indebted to residents in the field who unhesitatingly offered every possible assistance, especially to Messrs. E. L. Goodridge, A. L. Raplee, and L. H. MacMorran, who aided the party during the examination, supplied data concerning the early history of the field, and have kindly furnished information regarding development since the completion of the field work. The writer has made liberal use of the data presented in Prof. Gregory's preliminary report [1] and wishes to acknowledge his indebtedness for the information thus obtained.

HISTORICAL SKETCH.

Previous to the investigations noted in this report no detailed geologic examination of this field had been made. For a long time the region was well known only to the Navajo Indians who inhabit it but was visited occasionally by white traders who came to the Indians to exchange various articles for blankets of their weaving. Occasionally prospectors followed the river and examined the sand bars in search of gold. About 30 years ago a small Mormon colony was established at Bluff, and this has remained practically the only permanent settlement in the entire region. It is reported that some of the early prospectors found oil seeps and recognized their meaning, but they were not diverted from their search for what to them appeared to be the more valuable natural resource. Among these prospectors was E. L. Goodridge, who was attracted by the indications of oil and located the first claim in 1882. No drilling was done until 1907, when the first well, Crossing No. 1 (see Pl. IX), was begun. The development that followed is described in another place in this report.

The history of geologic investigation is brief and relates wholly to the last few years, though many of the earlier geologists examined surrounding areas. In 1897 Henry S. Gane [2] traversed the eastern part of the field while making a reconnaissance along the San Juan River valley from Mancos, Colo., to the junction of San Juan and Colorado rivers. Gane made a special study of the stratigraphy in order to correlate the formations with the strata exposed in the San Juan Mountains, but gave little attention to structure and was unattracted by economic conditions. In July, 1909, H. E. Gregory made the brief preliminary examination of the field already mentioned. In the short time at his disposal Prof. Gregory studied the structure and stratigraphy and gave especial attention to economic conditions, which he described briefly in his report.[3] Since the bringing in of the Goodridge well in 1908 several geologists engaged in

[1] Gregory, H. E., The San Juan oil field, San Juan County, Utah: Bull. U. S. Geol. Survey No. 431, 1911, pp. 11–25.

[2] Cross, Whitman, and Howe, Ernest, Red Beds of southwestern Colorado and their correlation: Bull. Geol. Soc. America, vol. 16, 1905, p. 476.

[3] Op. cit.

commercial work have visited the region and studied its structure and stratigraphy in order to determine its commercial importance. So far as the writer is aware, however, none of these men have contributed to the literature relating to it.

GEOGRAPHY.

The San Juan oil field lies in a sparsely settled semiarid region in southeastern Utah. It is isolated from regular lines of transportation and is reached with difficulty. The main line of the Denver & Rio Grande Railroad is 120 miles to the north and the Rio Grande Western narrow-gage line 80 miles to the east. It is necessary to travel a much greater distance, however, from these points to reach the field because the intervening country is rough. By stage it is 158 miles from Goodridge to Thompson and 106 miles to Dolores, the nearest points on the railroads above named.

The field is divided into about equal northern and southern portions by San Juan River. The portion north of the river is public land and subject to entry in the usual method; the area south of the river lies in the Navajo Indian Reservation, in which prospecting for oil and development can take place only by permission of the Commissioner of Indian Affairs.

TOPOGRAPHY.

The San Juan oil field is part of the Colorado Plateau, a great topographic unit drained by Colorado River and its tributaries. The province comprises broad, undulating plateaus, which are locally dissected into table-lands interrupted by cliffs and canyons. In places where the beds are tilted from the horizontal position there are ridges, hogbacks, combs, mesas, buttes, escarpments, and a great variety of youthful topographic forms. In the San Juan oil field the rocks are folded into gentle anticlines and synclines and have been eroded into the varied forms noted above.

The surface features of the field are shown by the reconnaissance contour map, Plate IX, which was made after the methods commonly employed in planetable mapping, but because the time at the disposal of the investigators was brief neither great accuracy nor much detail was possible. The main topographic features of the country are represented, and it is believed that locations are reliable and altitudes are sufficiently accurate for practical purposes. The contour interval is 100 feet. Because the altitude of the field had not been determined previously, the wagon bridge at Goodridge was taken as a datum, and all altitudes in the field were determined from this point. The altitude of the base was assumed to be 4,000 feet, which agrees closely with the altitude given on the Abajo reconnaissance topographic map of the United States Geological Survey.

The ground is not well protected from erosion because about 80 per cent of the land surface is destitute of a cover of vegetation. Rain seldom falls, and when showers come they are generally local but copious and produce considerable erosion. As a result the surface of the field is exceedingly uneven. It comprises broken plains, mesas, deep, narrow canyons and ravines, and monuments which remain after the surrounding rock has been eroded. Some of these features are portrayed by the topographic map, but others are too small to be represented on the scale used. In general, the field is an uneven plain, which is locally either sharply dissected or dotted with small mesas or buttes that rise above the general surface and render it very irregular. The most remarkable features are the two canyons of San Juan River, one between Comb Wash and Lime Creek, the other beginning at Goodridge Bridge and extending westward beyond the limit of the field. Across the eastern part of the field there is a high escarpment, the northern part of which is called Comb Ridge, which was formed by the unequal erosion of sharply upturned, unconsolidated sandy shale and massive hard sandstone above it. On the north the field is bordered by a high escarpment that forms the edge of Cedar Mesa. Besides these features there are many remarkable minor topographic forms, which give to the field a peculiar picturesqueness seen in few localities outside of the Navajo country. The most striking of these special features are Mexican Hat, Setting Hen, and Flag buttes and many minor buttes to the north of the field, where the name "Garden of the Gods" is applied to a group of erosion forms that are even more picturesque than those in the Garden of the Gods near Pikes Peak, Colo.

The surface is not so irregular as to prevent crossing it in certain directions. The river canyons, however, form absolute barriers except in the interval between Mexican Hat Butte and Goodridge Bridge, and also between the mouths of Comb Wash and Chin Lee Creek. The canyons are about 1,400 feet deep and have precipitous walls. In scenic beauty they are probably surpassed only by the greater canyon of the same type—the Grand Canyon of the Colorado—which lies about 150 miles southwest. The canyon cutting the east anticline is traversed with the greatest difficulty, although it can be penetrated easily for a considerable distance from either end. The canyon across the western part of the field can be traversed from Goodridge to a point 1½ miles downstream, but beyond that point it is impassable. Near the western limit of the field, however, the river can be reached by the Honaker trail, which was constructed by prospectors to reach the placer ground along the river. The trail is reported to cover a distance of about 3 miles to reach a point at the water's edge 1,400 feet almost directly below the place in the brink where the trail descends.

STRATIGRAPHY.

GENERAL OUTLINE.

Perhaps in no area in the world are the strata better displayed than in southeastern Utah, where the rocks are rapidly broken up and the débris quickly removed, leaving fresh exposures at almost every point As previously stated, approximately 80 per cent of the surface is without vegetation; hence the stratigraphic relations are not obscured. San Juan River carries a large amount of sand, chiefly quartz, which acts as a corrasive agent. With this agent the stream has cut a magnificent gorge across the field and exposed with remarkable clearness more than 1,400 feet of Paleozoic strata in a nearly horizontal position. Erosion has swept away the softer beds above the Paleozoic from the greater part of the field, but these beds are exposed in great escarpments on the north and east. More than 5,000 feet of strata, ranging from Carboniferous to Jurassic, inclusive, are exposed in the field. The character of these formations is shown by the columnar section in Plate VIII, and their relative age, thickness, and character are shown by the following table:

Section of strata exposed in the San Juan oil field.

System	Formation	Member	Thickness (feet)	Description
Jurassic	La Plata sandstone		[a] 500±	Massive tan sandstone
Triassic	Dolores shale		1,330	Very sandy, variegated shale This formation contains saurian remains
Unconformity?				
Permian?	Moencopie formation	Ojato sandstone	20–380	Massive tan sandstone
			1,260	Red sandy shale and massive tan sandstone beds
Pennsylvanian	Goodridge formation		1,542	Massive bedded crystalline limestone, soft, sandy shale and sandstone

[a] Only lower part exposed

DETAILED DESCRIPTION OF FORMATIONS.

GOODRIDGE FORMATION.

A mass of strata comprising limestone, sandstone, and sandy shale is the lowest formation outcropping in the San Juan oil field. The beds are excellently exposed in the canyon in the western part of the field. They were studied along the Honaker trail, where the beds are clearly exposed in their undisturbed relations. This trail is taken as the type locality, but the name Honaker has been used previously for a geologic formation in another part of the United States

fold out

There is a map that goes here, but due to the brittleness I could no copy it.

A Digital camera may work - the map is needed.

and consequently is not available here. The formation is therefore named from Goodridge post office, which is located near the center of the field and close to some excellent exposures of the upper part of the formation.

Section of the Goodridge formation from the top to the bottom of the Honaker trail.

	Feet.
68. Limestone, gray, hard, crystalline; fossil lot 155 (p. 79)	5
67. Shale, red, sandy; locally contains sandstone	24
66. Sandstone, gray, fossiliferous at base	9
65. Shale, sandy, red, merging into red sandstone at top	20
64a. Sandstone, gray, massive, fossiliferous; variable in thickness, being from 2 to 4 feet thicker than the normal at some places and an equal amount thinner at others	14
64. Limestone, crystalline, hard, gray, fossiliferous	2
63. Sandstone, pink, locally very shaly in middle; fossil lots 153 and 160	23
62. Sandstone, gray	3
61. Limestone, massive, gray; forms the "cap rock" at the head of the Honaker trail; fossil lots 152, 154, 156, and 179	25
60. Shale, sandy, pink	65
59. Sandstone, gray, shaly; fossil lots 157 and 178	6
58. Shale, sandy, pink	35
57. Sandstone, massive, gray; fossil lot 177	35
56. Shale, pink, sandy; locally becomes a sandstone in upper 8 to 10 feet	57
55. Limestone, hard, crystalline, drab; fossil lot 158	11
54. Shale, sandy, pink	24
53. Limestone, massive, crystalline, drab; *Spirifer* colored bright red by hematite abundant; fossil lots 159 and 176	19
52. Limestone, nodular, shaly	3½
51. Sandstone, gray	3½
50. Limestone, shaly, argillaceous, with intercalated beds of very sandy shale, which is salmon pink in lower part and gray in upper; contains *Spirifer* colored bright red by hematite; fossil lot 175	85
49. Limestone, massive, hard, crystalline, slightly shaly; nodular zone, 4 feet thick, 6 feet below top	33
48. Shale, dark gray, calcareous, very fossiliferous; fossil lot 174	9
47. Limestone, gray, crystalline in upper part and nodular in lower half	6
46. Shale, gray, sandy, with thin beds of shaly limestone	12
45. Limestone, hard, drab, massive, in two benches of about equal thickness; contains chert nodules; *Fusulina* abundant; fossil lot 173	14
44. Shale, gray, sandy	2
43. Limestone, hard, crystalline, nodular in upper and lower part, massive in middle	8
42. Shale, gray, sandy, soft	18
41. Limestone, crystalline, hard, drab, contains nodules of chert and jasper; fossil lot 172	3
40. Shale, soft, sandy, gray in upper part, drab below	59
39. Limestone, crystalline, gray, hard, massive; fossil lot 171	

	Feet.
38. Shale, gray, soft, sandy	17
37. Limestone, drab, crystalline, containing nodules of chert	18
36. Shale, gray, sandy	10
35. Limestone, same as No. 23	8
34. Shale, gray, sandy	2
33. Sandstone, gray	9
32. Shale, gray, sandy	2
31. Limestone, same as No. 23	9
30. Shale, sandy, gray, soft	14
29. Limestone, drab, cherty	4
28. Shale, soft, sandy, gray	28
27. Limestone, cherty, nodular; fossil lot 170	8
26. Shale, same as No. 24	6
25. Limestone, similar to No. 23	4
24. Shale, gray, sandy, with beds of limestone 6 inches to 1 foot in thickness in lower part	42
23. Limestone, massive, drab, cherty, very fossiliferous in upper part, weathers very rough; top of this bed forms the prominent point overlooking the canyon; fossil lot 169	75
22. Limestone, similar to No. 20	5½
21. Shale, gray, sandy	3½
20. Limestone, massive, drab, cherty; weathers very rough	45
19. Limestone, faint pink, massive in upper part but shaly, sandy, and cherty in lower part; forms a pink band midway between top and bottom of canyon; there is a suggestion of unconformity at the base of this bed	136
18. Shale, black, fissile	5
17. Limestone, sandy and shaly in lower part, and pure, hard, drab in upper part; contains some particles of sulphur; fossil lot 168	34
16. Limestone, hard, crystalline in several layers; contains chert.	61
15. Limestone, impure, gray, drab, argillaceous at base	12
14. Limestone, in several benches, contains layers of black chert; locally shaly and slightly sandy in irregular lenses; fossil lot 167	94
13. Sandstone, gray, soft, shaly	10
12. Limestone, massive, hard, crystalline, fossiliferous	23
11. Limestone, same as No. 9	3
10. Shale, greenish	3
9. Limestone, drab, crystalline, massive	24
8. Shale, black, carbonaceous, fissile	1½
7. Sandstone, greenish gray, nodular: fossil lot 166	5½
6. Limestone, drab, hard, crystalline; contains nodules of black chert	82
5. Sandstone, hard, greenish	9
4. Limestone, hard, drab, crystalline; weathers pitted in places; fossil lot 165	32
3. Limestone, drab, with 8 inches of shale at top	2
2. Limestone, drab, massive, crystalline; weathers pitted on surface	24
1. Talus	25
Water level.	

This section is shown graphically on Plate VIII. Fossils collect from the beds are indicated by lot numbers in the above sectio The fossils have been examined by George H. Girty, who makes t following statement concerning them:

With one exception all the collections are clearly of Pennsylvanian age and that (165) is an exception merely because it is not sufficiently diagnostic to show tha is not Mississippian. Furthermore, all the faunas have a facies resembling the Pe sylvanian of the Mississippi Valley rather than the later Carboniferous faunas of A and the Ural Mountains, to which many of our western faunas appear to be relat Consequently the faunas of these collections are to be compared rather with thos the San Juan region of Colorado (Rico, Hermosa) than with those of the Grand Can section (Kaibab limestone), which has a facies quite unlike the eastern Pennsylvan Wherever to my knowledge these two facies occur in the same section, the Asi comes above the typical Pennsylvanian facies.

I have already examined and reported upon a collection from the Honaker tr where a good portion of Mr. Woodruff's material was obtained. This collection made by Robert Forrester, of Salt Lake City, Utah. Mr. Forrester, who has d much work of a very accurate kind involving the Mesozoic and late Paleozoic ro of Utah, reports that his fossils came from what was called Lower Aubrey grou the reports of the Wheeler Survey, this Upper Aubrey being our Kaibab limesto The lists of fossils given by Meek as representing the fauna of the upper Redw limestone show the same general facies as Mr. Woodruff's collection. The typ Redwall we know to be of Pennsylvanian age in the upper part and Mississippian in the lower part, so that the facts at hand seem to indicate that the strata invol in Mr. Woodruff's collection represent the upper part of the typical Redwall li stone. I do not regard it as certain, however, that the marked dissimilarity of Kaibab fauna to anything which Mr. Woodruff found in his section may not be regic and that by gradual modification some of his faunas may not pass into the Kai fauna at the same geologic level.

Some of Mr. Woodruff's faunas resemble those of the Hermosa formation and oth resemble those of the Rico formation. Somewhat tentatively it may be inferred t both formations are represented in his section. It has always seemed to me, howe that the differences between the Rico and Hermosa faunas were such as might regional, which might occur earlier or later in other areas or be connected by grad transition instead of separated by a fairly abrupt change. In the Honaker trail s tion lots 165 to 176, inclusive, present the Hermosa facies, while lots 177 to 179 more like the Rico facies. The other collections do not entirely fall in with a co lation of the upper part of the section with the Rico formation. Lot 159 especia but also lots 154, 156, and 160 contain species which are not known to occur in Rico formation.

Carboniferous fossils from the San Juan oil field.

Lot 152.

Echinocrinus aff. ornatus.
Composita subtilita?
Bellerophon sp.
Platyceras parvum.

Lot 153.

Polypora sp.
Productus nebraskensis?
Composita subtilita.

Lot 154.

Productus nebraskensis.
Spirifer cameratus.
Ambocœlia sp.
Composita subtilita.
Aviculipecten sp.
Schizodus sp.
Bellerophon sp.

Lot 155.

Carboniferous fossils from the San Juan oil field—Continued.

Lot 156.

Lioclema? sp.
Polypora sp.
Spirifer cameratus.
Composita subtilita.

Lot 157.

Composita subtilita.

Lot 158.

Derbya crassa?
Edmondia gibbosa.
Edmondia sp.
Leda arata.
Deltopecten occidentalis.
Myalina subquadrata.
Myalina subquadrata var.
Pseudomonotis kansasensis.
Schizodus sp.
Bellerophon sp.
Gastropod indet.

Lot 159.

Crinoidal remains.
Stenopora sp.
Fistulipora sp.
Rhombopora lepidodendroides.
Lingulidiscina sp.
Derbya? sp.
Productus semireticulatus.
Productus nebraskensis.
Productus cora.
Pugnax utah.
Spirifer cameratus.
Spiriferina kentuckyensis.
Composita subtilita.
Hustedia mormoni.

Lot 160.

Stenopora sp.
Spirifer cameratus.
Composita subtilita.
Edmondia? sp.
Pinna peracuta.
Myalina subquadrata.
Schizodus insignis?
Sanguinolaria? sp.
Aviculipecten sp.
Bellerophon sp.
Euphemus inspeciosus?
Pleurotomaria sp.
Orthoceras sp.

Lot 165.

Syringopora sp.
Echinocrinus sp.

Lot 166.

Echinocrinus sp.
Chonetes sp.
Marginifera muricata.
Marginifera wabashensis.
Spirifer cameratus.
Squamularia perplexa.
Composita subtilita.

Lot 167.

Echinocrinus cratis.
Rhombopora lepidodendroides.
Rhipidomella pecosi.
Productus semireticulatus.
Spirifer cameratus.
Squamularia perplexa.
Composita subtilita.

Lot 168.

Orthothetina n. sp.
Productus cora.
Productus punctatus.
Productus semireticulatus.
Spirifer rockymontanus.
Schizostoma sp.

Lot 169.

Polypora sp.
Rhombopora sp.
Lingulidiscina missouriensis.
Derbya? sp.
Chonetes mesolobus.
Productus semireticulatus.
Productus sp.
Marginifera splendens?
Pugnax rockymontanus?
Spirifer scobinus?
Ambocœlia planiconvexa?
Aviculipecten sp.
Fish remains.

Lot 170.

Fusulina sp.
Composita subtilita.

Lot 171.

Lophophyllum profundum.
Productus punctatus?
Productus cora.

Carboniferous fossils from the San Juan oil field—Continued.

Lot 171—Continued.

Productus sp.
Spirifer cameratus.
Composita subtilita.

Lot 172.

Fusulina sp.

Lot 173.

Fusulina sp.
Crinoidal remains.
Productus cora.

Lot 174.

Lophophyllum profundum.
Fistulipora? sp.
Rhombopora lepidodendroides.
Derbya? sp.
Productus cora.
Spiriferina kentuckyensis.
Composita subtilita.
Hustedia mormoni.

Lot 175.

Hydreionocrinus sp.
Stenopora sp.
Polypora sp.
Rhombopora lepidodendroides?
Productus cora.
Productus nebraskensis.
Pugnax osagensis.
Spirifer cameratus.
Spiriferina solidirostris.
Composita subtilita.

Lot 176.

Stenopora sp.
Productus cora.

Lot 177.

Leda arata.
Deltopecten occidentale.
Myalina aff. parattenuata.
Allerisma terminale.
Pleurophorus sp.
Bellerophon tricarinatus.
Bellerophon sp.
Euphemus carbonarius.
Naticopsis sp.

Lot 178.

Productus nebraskensis.
Edmondia gibbosa.
Cardiomorpha? sp.
Deltopecten occidentalis.
Myalina sp.
Pleurophorus subcostatus?
Schizodus meekanus.
Monopteria polita?
Bellerophon sp.

Lot 179.

Productus cora.
Myalina perniformis.
Small gastropod.

Lots 152 and 165 to 179, inclusive, were collected along the Honal trail. The other lots were collected at various points in the fie The stratigraphic position of the fossils is shown by numbers in t section on pages 77–78.

The areal distribution of the Goodridge formation is shown Plate VIII, and the structural attitude by dip and strike symbols a by structure sections on the same plate. The top of this formati is a limestone which forms a floor of hard material from which t softer shale above has been eroded in the western part of the ar It is evident from the columnar section that the lower part of t formation is predominantly limestone, whereas the upper part co prises also sandstone and sandy shale. The Goodridge formati contains the oil sands of the San Juan field. A discussion of t phase of the subject is presented in a later part of the report.

MOENCOPIE FORMATION.

GENERAL CHARACTER.

The Moencopie formation consists in the lower part of brick-re sandy shale and argillaceous sandstone and in the upper part of light colored shaly sandstone and massive tan sandstone. Alkaline salts especially gypsum, are scattered throughout the formation, but th gypsum rarely occurs in massive beds as it does in this formatio elsewhere. Generally it seems to be a secondary accumulation i veins and stringers of the originally highly disseminated material The following section is introduced to show the character of th Moencopie formation:

Section of Moencopie formation in San Juan oil field.

[Two upper members measured near junction of Chin Lee Creek and San Juan River, lower members at Cedar Point.]

		Feet.
72.	Shale, light pink, sandy, and sandstone, slightly darker	475
71.	Shale, sandy, and brick-red argillaceous sandstone	370
70.	Shale, red, sandy, containing many layers of shaly sandstone..	190
	At this point there occurs a 6-inch bed of conglomerate composed of angular fragments of sandstone and limestone, which vary from half an inch to 1½ inches in greatest diameter.	
69.	Shale, red, sandy, containing many layers of sandstone	225
		1,260

The lower part of the formation, Nos. 69 and 70 in the section given above, displays remarkable uniformity in character and thickness throughout the field. In contrast to this regularity the upper part presents considerable variation. To the south it is composed chiefly of soft light-pink sandy shale, with darker shaly sandstone interbedded. To the north, however, the upper part of the formation consists of massive tan-colored sandstone beds forming Cedar Mesa and projecting southward into Cedar Point. The transition of the shale of the south into the sandstone of the north begins in the area of red beds north of San Juan River and southwest of Navajo Spring. In this area the shale beds that predominate to the south are interstratified with thin sandstone lenses which thicken rapidly to the north and replace the shale. In the northeastern part of the area represented by the map, in secs. 19, 20, 29, and 30, T. 40 S., R. 20 E., Salt Lake base and principal meridian, the lenses have developed into massive sandstone beds that have replaced the greater part of the shale. They are exposed on the divide between Comb Wash and Lime Creek in high cliffs and also in buttes which are outlier remnants of the formation. In this part of the field the massive sandstone beds in the upper part are less easily eroded than the shale below and they give rise to the escarpment which is so

the shale gives way to the developing sandstone members unt Cedar Point the whole upper part of the Moencopie formation b the Oljato sandstone member consists of a massive sandstone. topographic features which result from the erosion of the forma are very different in the two parts of the field. To the south shale in the upper part of the formation breaks down into soft, l débris which resembles crusted snow, whereas the sandstone to north forms escarpments, monuments, spires, and turrets.

OLJATO SANDSTONE MEMBER.

The Oljato sandstone is a massive, brown, slightly ferrugin gritty, cross-bedded, lenticular sandstone, which increases in thickn from the northeast toward the southwest. In the northwest cor of the field it is only 20 feet thick, but at Navajo Spring it is 175 f and at Moses Rock it forms a single massive bed 382 feet thi Gregory states that this sandstone increases in thickness to southwest and is one of the prominent formations in northeast Arizona. In it is carved the famous Canyon de Chelly and at Olj it forms the cliffs in Moonlight Valley. As a much better sect is displayed at the latter place than at any point in the San Ju field the name Oljato is given to this member. Nothing was fou in the sandstone to show its age. It contains fragments of fossiliz wood and pieces of charcoal, but they are not well enough preserv to indicate the types of plants which existed when the sandsto was deposited. It is probable that there is an unconformity at t top of the bed and possibly one marks the base, but no positi evidence of such unconformities was obtained in the San Juan fiel The Oljato sandstone is tentatively assigned to the Moencop though there is meager evidence for so doing, and it is recogniz that a study of this sandstone over a greater region may devel evidence to show that it is a distinct formation and later in a than the Moencopie.

CORRELATION.

The age of the Moencopie was not determined because no fossi were found in it. It is assigned tentatively to the Permian becau there is a sharp lithologic break between it and the Goodridg (Pennsylvanian) below and because it seems to be distinct from th Dolores (Triassic) above. The formation represents, in this are the "Red Beds" which extend over a great area in Arizona, Utal Colorado, and adjacent States. These beds have been studied i many localities and have received several names. The name adopte in this report was proposed by L. F. Ward[1] for a formation, similar i lithologic character and identical in stratigraphic position, exposed i

Moencopie Wash near Little Colorado River, Ariz. The correlation between the type locality and the San Juan oil field is based on lithologic similarity of the formations in the two areas, on their sharp differentiation from the Pennsylvanian strata below, and on oral information furnished by Prof. Gregory, who made reconnaissance examinations of both areas and the intermediate region during the summers of 1909 and 1910. None of the examinations, however, have produced any evidence to prove the age of the Moencopie.

The red beds of the San Juan field also closely resemble and occupy approximately the same position in the stratigraphic column as the Cutler formation described by Cross [1] in his folio on the Rico quadrangle, Colorado. However, they more closely resemble the Moencopie than the Cutler, and the covered interval separating the San Juan field from the region containing exposures of Moencopie is much shorter than that separating it from the nearest outcrop of Cutler. For these two reasons, proximity of outcrop and closer similarity of lithologic character, the formation is correlated with the Moencopie rather than the Cutler.

DOLORES SHALE.

The Dolores shale consists of a mass of variegated sandy shale which is easily eroded, hence the formation usually outcrops in a valley. In the eastern part of the field, north of San Juan River, it occupies Comb Wash valley, at the base of the escarpment to the east of the oil field, and south of the river the formation lies along the valley of Chin Lee Creek. The areal extent of the Dolores shale is shown on Plate VIII, and its character is shown by the following detailed section:

Section of Dolores shale in San Juan oil field.

	Feet.
85. Shale, red, sandy; this bed is a loose aggregation of sand grains with a little clay	590
84. Sandstone, shaly, fissile	2
83. Shale, pink, sandy	8
82. Limestone, impure, nodular	3
81. Shale, sandy, homogeneous	230
80. Shale, gray, sandy, unconsolidated, homogeneous	315
79. Shale, maroon, sandy, unconsolidated, homogeneous	27
78. Shale, variegated, with red and gray bands 1 to 8 inches thick, sandy, thinly bedded	75
77. Sandstone, gray, cross-bedded, gritty	1½
76. Shale, sandy, red	4½
75. Sandstone, gray, cross-bedded, gritty	6
74. Shale, dark red, sandy, slightly fissile	70
	1,332

[1] Cross, Whitman, Rico folio (No. 130), Geol. Atlas U. S., U. S. Geol. Survey, 1905, p. 4.

The determination of the age of the Dolores rests upon the iden fication of small collections of fossils which were submitted to T. Stanton and C. W. Gilmore for examination. Dr. Stanton repo as follows:

6780. No. 163. Three-quarters of a mile northeast of Moses Rock in strata 50 f below top of Dolores shale:

Unio cristonensis Meek?
Viviparus? sp.
Fragments of reptilian bones.

Probably Triassic. Similar invertebrates occur in the Dolores formation of the Plata Mountains.

Mr. Gilmore examined three small collections containing fragme of bones of vertebrate animals but found nothing which could identified without some doubt. He says "The reptile bones, wh not certainly identifiable, are suggestive of some of the Trias dinosaurs."

LA PLATA SANDSTONE.

The highest formation exposed in the field comprises two massi beds of sandstone separated by pink shale. The lower sandstone estimated to be 500 feet thick, the shale 100 feet, and the upper sar stone 400 feet. Only the lower sandstone is exposed in the San Ju oil field, and therefore that part alone was studied. The upper b of sandstone is exposed in the walls of the canyon at Bluff but not the oil field. The lower bed consists of a massive cross-bedded coar grained sandstone with local thin layers of conglomerate compos of small, well-rounded grains of quartz and feldspar. The La Pla sandstone forms the mesa along Chin Lee Creek, in the southeaste part of the field, and is exposed near San Juan River, where t steeply upturned sandstone forms a high, sharp point known as t Sawtooth, which stands out as a prominent landmark. This bed better known, however, as the massive sandstone that forms Cor Ridge, the escarpment in the northeastern part of the field. fosils were found in the sandstone and consequently its age could r be determined. Stratigraphically and lithologically it is correlat with the La Plata sandstone of the Rico quadrangle, Colorado, whi has been determined to be Jurassic.

GLACIAL(?) DEPOSITS.

In the southeastern part of the field there is a small area cover by débris which is believed to be of glacial origin. This material co sists chiefly of fragments of sandstone, but includes also a considera amount of shale and lesser amounts of interbedded limestone, co glomerate, and igneous rocks. The conglomerate is of two types (1) well-rounded pebbles, in general similar to the Dakota conglo erate which is exposed to the northeast of the field, and (2) apparen

metamorphosed conglomerate. Neither type resembles any of the other rocks exposed in this field. The igneous rocks comprise schist and gneiss. The deposit is a heterogeneous mass which shows no evidence of bedding, though some of the constituent blocks show traces of their original stratification. Fragments vary in size. One large block of conglomerate was found to be more than 100 feet in length. The mass rests in an old channel carved in the Moencopie and Dolores formations. The general trend of the channel is north and south, and it terminates at the south abruptly against a wall of shale and sandstone. Small garnets were found in the anthills on the top of the débris. These garnets are of interest in a study of the origin of the deposit, because similar ones were found scattered over the surface and in fragments of schist in the southeastern part of the field on the divide between Gypsum and Chin Lee creeks, where it is crossed by the wagon road. Sterrett[1] suggested the glacial origin of garnet beds immediately south of the San Juan field, where rocks similar to the igneous rocks in this field are scattered over the surface. Sterrett says:

The source of the garnet over the mesa country is in a stratum of coarse, unconsolidated drift or gravel that rests on the more elevated part of the red sandstone on the northwest of the area examined. This drift is over 100 feet thick and is composed of bowlders, which vary from stones weighing many tons to cobble size, mixed through a matrix of pebbles and sand. The gravel and bowlders consist of biotite granite gneiss, porphyritic biotite granite gneiss, hornblende or diorite gneiss, partly epidotized trap and basaltic rocks, epidote hornstone, soapstone, tremolite asbestos, sugary quartz, and large blocks of light-gray fossiliferous limestone of Carboniferous age. Just where the origin of this conglomeration is to be sought is not known. The general appearance of the drift is that of a glacial deposit. Glaciation has taken place in the San Francisco Mountains[2] of Coconino County, Ariz., and moraine deposits have been formed. The latter are thought to be of rather recent age, probably Quaternary. Whether there has been glaciation in the slightly higher country west and northwest of the garnet deposits is not known. It is probable that the garnet-bearing drift deposits are of greater age than the glacial deposits of the San Francisco Mountains, for the former are covered with a stratum of hard white sandstone and are at almost as great an elevation as any of the surrounding region. The presence of such quantities of crystalline and ancient rocks in the drift can not be explained by very recent action, as these rocks do not outcrop near the locality.

IGNEOUS ROCK.

Igneous rocks intrude sedimentary beds and come to the surface as dikes at three places in the field. The character of these rocks is described by E. S. Larsen, as follows:

The two specimens of augite minette from the Alhambra dike are dense greenish-gray rocks with prominent hexagonal plates of brown mica nearly a millimeter across.

[1] Sterrett, D. B., Mineral Resources U. S. for 1908, U. S. Geol. Survey, 1909, pp. 823–827.

[2] Ward, L. F., Glaciation of the San Francisco Mountains, Arizona: Jour. Geology, vol. 13, 1905, pp. 276–279. Robinson, H. H., Geology of the San Francisan volcanic field, Arizona: Prof. Paper U. S. Geol. Survey (in preparation).

The pocket lens reveals nearly or quite as many prisms of pale-green pyroxene i aphanitic ground. The biotite plates are in approximately parallel arrangement tend to give the rock a platy fracture. Inclusions of quartzite, limestone, etc. present in the hand specimen.

A study of the thin section under the microscope shows that the rock is porphy and that the phenocrysts are in moderate excess over the groundmass. The prominent phenocryst is biotite; augite is nearly as abundant. A very few ph crysts of orthoclase and sodic plagioclase are present. Small inclusions of limes are rather abundant. The groundmass has a trachytic texture and is made up ch of very small orthoclase laths, with some diopside, biotite, and opacite. The bi is much lighter in color and less strongly pleochroic than normal biotite, its angle is very small, and the axial plane is parallel to the plane of symmetry. I sections are hexagonal in appearance and show a narrow border which is much strongly colored than the main crystal. These data indicate that it is poor in and it is probably near phlogopite. It carries a few inclusions of apatite.

The pyroxene is also zoned. The main part of the crystals are nearly colorle the thin section and show an extinction angle on the side pinacoid of 40° (Z∧c) borders of the crystals are pale green and show extinctions as high as 52°. There places a succession of thin shells with alternating large and small extinction an Twinning is common. In some parts the biotite and augite are intergrown after manner of graphic granite; in others the inclusions of limestone have a fringe of a rods projecting out from the calcite and intergrown with biotite, and these augite may grade outward into a crystal of augite. It is possible that the limestone sir acted as a nucleus about which the augite and biotite crystallized, but it seems probable that these minerals were formed here by an interaction between the m and the limestone.

The specimen from the dike in secs. 7, 18, and 19, T. 41 S., R. 19 E., differs some from the rock of the Alhambra dike but was derived from a very similar magma is brownish green in color, has a very prominent original schistose texture fron fluidal arrangement of the biotite, and shows with the pocket lens very many l brown hexagonal plates of biotite, much pale-green augite, little feldspar, and small rounded areas of calcite. A microscopic examination of the thin section s that the rock differs from that of the Alhambra dike chiefly in the presence of æ and of scattered rounded areas of secondary calcite, analcite, and a birefracting ze The groundmass is coarser and the feldspars are not so well developed. The æ occurs as fringes about the augite phenocrysts and here and there completely rep the augite rods of the groundmass; it also occurs as crystals piercing the calcit analcite. It is probably secondary. It is grass-green, is strongly pleochroic, an an extinction angle (X∧c) of 3°. The roundish areas of calcite and zeolites are ably derived from primary leucite. The zeolite occurs in small lath-shaped cr piercing the calcite and analcite and collected along the border of the original cr It has two perfect cleavages parallel to the elongation and another across it. Th tinction is nearly parallel and the elongation is negative. The mean index of r tion as determined by the immersion method is 1.515: the birefringence is about to that of orthoclase. It is probably a zeolite. The analcite occupies an interme zone; the calcite occupies the core of the original crystal. There is probably a analcite in the groundmass. Except for the presence of a small amount of al leucite(?) the rock is a normal augite minette.

The position and extent of the dikes are shown on the map (Pl. V In general, the dikes are narrow, varying from 2 to 10 feet in wi Here and there, however, they are enlarged to 15 or 20 feet, an one point the dike of which the Alhambra dike is a part reach

maximum width of 100 feet. No perceptible displacement of the strata has occurred where the dikes traverse them and only slight metamorphism of the including rock. Within the igneous rocks there is a large amount of clastic material believed to be derived from the rocks below, through which the igneous magma passed. This material consists of granite and gneiss from the igneous rocks and sandstone and limestone from the sedimentary rocks. The fragments are generally angular and range from a fraction of an inch to 1 foot in greatest diameter.

So far as observed there is no connection, either direct or indirect, between the occurrence of petroleum and the igneous rocks. It is recognized that genetically oil may have come from the igneous rocks, but if this is the true source in the San Juan field, all surficial trace of such origin has disappeared. Furthermore, the accumulation of the oil does not seem to have been effected to any great extent by the dikes acting as a dam to the movement of the oil in the strata and consequently forcing its accumulation along the dike, as has been found in some of the Mexican oil fields. Practically no prospecting has been done in the vicinity of the intrusions, but no seeps or escaping oil have been found there to encourage prospecting.

STRUCTURE.

The structure of the San Juan oil field is only moderately complicated by north-south folds. In the western part of the field the beds lie approximately horizontal or dip very gently to the west. Near the central north-south line of the field they are moderately depressed into a syncline, the eastern limb of which rises abruptly and merges with the western slope of a slightly elevated flat-topped anticline. On the east side of the anticline the strata dip abruptly to the edge of the field, but a short distance beyond the eastern border the beds are flexed sharply again into a horizontal position and maintain that general attitude far to the east. The strata are folded most near the center of the field and gradually flatten into horizontal beds along both the north and south sides of the field. The apex of the anticline is south of San Juan River and southeast of Mexican Hat Butte and the lowest point in the syncline is a short distance south of the river, on the axis of the syncline shown on Plate VIII. The structure of the beds is shown by dip and strike symbols and by cross sections on Plate VIII.

The minor structural features of the field are unimportant. The beds are not perceptibly disturbed where traversed by dikes and are only slightly displaced by a fault in the southeastern part of the field. This fault is $1\frac{3}{4}$ miles long but has only a small displacement, with the upthrow on the west side. The maximum amount of throw

is about 200 feet, but in general it does not exceed 20 or 30 . The character of the fault is not clearly displayed, but it is beli to be of the thrust type. To the north the fault is a clear brea the strata, but to the south the displacement has taken place narrow zone 100 to 200 feet wide. No traces of oil or water spr were revealed by a careful examination of the line of the fault. is believed that the conditions affecting the accumulation of pe leum in the strata have not been seriously disturbed by this s break.

PETROLEUM.

GEOLOGIC OCCURRENCE.

All the oil found in the San Juan field is in the Goodridge fo tion. It generally occurs in sandstone, though traces have been fc in limestone in several wells. The formation contains nine bec sandstone, all of which are supposed by the prospector in the fiel contain enough oil to supply wells when they are drilled. The w was unable to verify this supposition, but from the data obtaine is inclined to think that probably all the sandstone beds contain s oil, but that the quantity in most of them is insufficient to war commercial exploitation. Seven of the nine oil sands have named by operators in the field, but the writer was unable to ide satisfactorily more than five of them. These are listed in the fol ing table. The stratigraphic distance between the sands is show the section on pages 77–78.

Names, stratigraphic position, and thickness of five important oil sands in the San field.

Name.	Number in columnar section on p. 77.	Thick (fee
Baby	66	
"Goodridge"	62 and 63	
Third	59	
Mendenhall	57	
Little Loop	51	

Of the four oil sands not shown in the above table, two have been named; the other two are called Honaker sand and Blue S sand. The Honaker is reported to occur just below water level a bottom of the Honaker trail and was not exposed at the time o amination. The Blue Shale, if properly described to the writer, sh occur immediately below No. 18 in the section, but it is not re sented along the Honaker trail. The Baby oil sand is very nea top of the Goodridge formation and shows in the Honaker trail sec

where it is 9 feet thick. It varies moderately in thickness, but the average is about that given in the Honaker trail section. At Goodridge bridge it is slightly thinner. Most of the wells in the field have penetrated the Baby sand, and a considerable number of them extend through it to lower beds. Several of the wells report finding oil in this sand, but none of them obtained enough to be productive. The "Goodridge" sand is reported to be one of the most productive oil sands in the field. It is 26 feet thick along the Honaker trail and seems to be fairly uniform throughout the field. It is made up chiefly of grains of clear quartz with calcareous cement and seems to be generally porous, though locally the interstices appear to be completely filled. A list of the wells that have penetrated this oil sand is presented in the discussion of development (p. 94). Opportunity was not afforded to study the other oil sands as minutely as the two described above, but they were observed in considerable detail, and their character is generally represented by the above description. It is believed also that the stratigraphy of the Goodridge formation is fairly uniform throughout the field, and that consequently a correct record of the strata at one point will not vary far from the true conditions at other points. If this supposition is true the columnar section already given will present to anyone investigating the field a fairly accurate idea of the character of rocks to be expected through a distance of 1,500 feet below the top of the Goodridge formation.

CHARACTER OF THE OIL.

Physical and chemical properties.—Samples of the oil were collected from four wells in the oil field and submitted to David T. Day, of the United States Geological Survey, under whose direction physical and chemical examinations were made as shown in the following table:

Chemical and physical properties of oil in the San Juan oil field, Utah.

Serial No.		Depth (feet).	Physical properties.		
			Gravity.		Color.
			Specific.	Degrees Baumé.	
Utah 4	Well No. 4, Goodridge townsite; E. L. Goodridge, Goodridge..	263	0.8264	39.4	Black.
Utah 5	Jackson well, sec. 5, T. 42 S., R. 19 E.; stray sand; Monumental Oil Co., Bluff.	625	.8314	38.4	Do.
Utah 6	Anderson well, sec. 5, T. 42 S., R. 19 E.; Baby or "Goodridge" sand; South Side Oil Co., Mexican Hat.	300	.8202	40.7	Do.
Utah 7	Arcola well No. 2, T. 42 S., R. 19 E; Mendenhall sand; Bluff.	600	.8388	36.9	Dark green.

Chemical and physical properties of oil in the San Juan oil field, Utah—Continue

Serial No.	Distillation by Engler's method.							Sulphur (per cent).	Paraffin (per cent).	Asphalt (per cent).	Uns rated drocar (per c
	Begins to boil (°C).	By volume.									
		To 150° C.		150°–300° C.		Residuum.		Total cubic centimeters.				Crude.
		Cubic centimeters.	Specific gravity.	Cubic centimeters.	Specific gravity.	Cubic centimeters.	Specific gravity.					
Utah 4	70	12.0	0.7245	36.0	0.7941	49.3	0.8974	99.3	0.26	6.09	0.80	20.4
Utah 5	78	11.0	.7235	35.0	.7976	51.0	.8946	97.0	.18	5.29	.60	14.8
Utah 6	73	12.0	.7130	36.0	.7941	49.5	.8975	97.5	.20	3.25	1.11	14.4
Utah 7	97	10.0	.7395	37.0	.8021	52.0	.8986	99.0	.40	6.79	.49	19.2

Concerning the character of the oil, Dr. Day further remarks:

These oils, as shown by the analyses, are unusually light in specific gravity. yield more than the average amount of gasoline and of burning oil. The light sp gravity of the burning oil fraction compared to the average, the considerable an of paraffin wax, and the comparatively low proportion of unsaturated hydroca show that these oils are somewhat similar to the oil from Lima, Ohio, with a sn proportion of sulphur. In fact, the amount of sulphur is less than in many o Illinois, which are refined without special apparatus for eliminating sulphur. T altogether, these oils are well suited for the manufacture of gasoline and kerosene there is every indication that the residuum would yield valuable lubricating c

FUEL VALUE.

It is believed that when oil from the San Juan field enters the c mercial market its principal use will be as a refining oil, becau contains a relatively high percentage of gasoline. But the fie distant from commercial centers where the more volatile oils in petroleum are demanded, and consequently its oil will probably come into competition as a fuel with petroleum from Texas on side and from California on the other and with coal from several f in Utah and adjacent States.

It is of interest, therefore, to know first the relative fuel valu the San Juan oil compared with other oil, and second the fuel effici of oil compared with coal. According to Dr. Day, it is probable for heating purposes no material difference exists between oil the San Juan field and that from Texas or California.

Some very exhaustive tests have been made by the United S Navy [1] on the fuel efficiency of oil and incidentally the relative ciency of coal and oil. The conclusions of the board which ducted these tests were that the relative evaporative efficiency and coal as a fuel is practically in the proportion of 15 to 10, but as oil can be stowed in somewhat less space than bituminous

[1] Report of the U. S. Naval Liquid Fuel Board, Bur. Steam Eng., Navy Dept., 1904.

the relative efficiency of oil and good steaming coal as fuel supply in warships may be regarded as in the ratio of 18 to 10.

SOURCE AND ACCUMULATION OF THE OIL.

The source of the oil is undetermined, and so far as the author was able to ascertain there are no peculiar conditions which give any direct evidence concerning its origin. The Goodridge formation, in which the oil is found, is locally very fossiliferous. The animals from which the fossils came may have contained the oil and have given it up when decaying. Then, the oil may have accumulated in the sandstone beds, which are porous and present favorable structural conditions. These are possibilities which can be taken by the believer in the organic origin of oil to support his theory. On the other hand, the strata are intruded by igneous rocks, which may have produced the oil, if oil is of inorganic origin and is derived from igneous rocks, as some are inclined to believe. There is no evidence, however, that such has been the origin of the petroleum in this field.

Whatever the initial source of the oil may have been, it certainly has followed definite structural lines in accumulating in its present position. The principles which have governed this accumulation follow the laws laid down in the well-known anticlinal theory. The basic principle of this theory is that oil will remain above water underground as it does aboveground. In regions where there is enough water to fill the rocks the oil is carried to the surface if it is not interrupted by some barrier. At many places, however, its escape is obstructed by impervious beds, especially if they are folded into an anticline. In such places the oil collects on the top of the water and accumulates under the arch of the anticline in any stratum which will serve as a reservoir under the impervious bed. In regions where there is insufficient water to raise the oil to the crest of the arch the uplift is only partly filled and the oil remains along the sides of the anticlines. An ultimate analysis of the theory requires that in strata which contain very little or no water, but in which oil occurs, the oil collects in the bottom of the synclines. The height to which the oil is raised, therefore, depends to a certain extent on the character of the oil-bearing stratum, but chiefly on the amount of water and oil available to fill it. This theory is believed to apply to the accumulation of oil in the San Juan field, and as there seems to be little water in the strata of that field it is assumed that the oil collects in the syncline or at least not far up the sides. Accordingly, it is believed that the chance of finding oil is better in the syncline than it is in the anticline, because in this region there is very little precipitation and there is ample opportunity for the water in the rocks above river level to escape into the canyons. The accumulation of the oil is also unusually influenced by the canyons, whose effect in draining

water and oil from the strata demands the most careful considerati Such deep incisions in the strata afford ample opportunity for escape of all fluids from the strata adjacent to them. Of course drainage extends to the lowest level and is most complete next to canyon, but undoubtedly it is effective for a considerable distai from the canyon, though possibly not to so great depth. Figure introduced to show the supposed conditions.

Within the area drained in this way there is no hope of finding accumulation of oil. Such drainage is believed to be especia effective in the San Juan field, because this field lies in an arid reg where rainfall is very light but the storms are violent and the p centage of run-off is high, therefore the strata do not receive mu water. The water which enters the strata has abundant opportun to escape. Near the canyons water wells will be dry until river le is reached, but away from the river the depth at which water or may occur is less. Except in a few places there are no springs ab

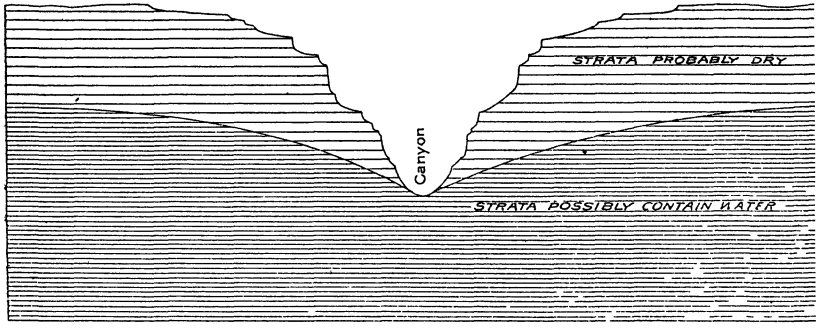


FIGURE 2.—Diagram showing the plane above which neither water nor oil may be expected.

river level. This condition is accepted as an indication that strata near the canyons are dry above the river and therefore t the oil is not held under the crest of the anticline, as in humid regio but has sought lower levels in the syncline. From this considerat it is believed that the most productive wells in the field will be fou in the syncline rather than along the crest of the anticline.

OIL SPRINGS.

Along San Juan River, west from Goodridge to the boundary of field, there are several oil springs. All these springs are near level of the river but not in the same strata because the beds rise the west and the river cuts into successively lower beds, some which are oil sands and give rise to oil springs. The highest se stratigraphically that were noted in the field are from the "Go ridge" oil sand, where it is exposed along San Juan River, near Go ridge bridge, and the lowest reported is at the foot of the Hona

trail. The stratigraphic distance between these two springs is 1,450 feet. The group of springs in the "Goodridge" sand occurs at intervals for about 200 feet along the river near the bridge. The seeps are discharging a little oil, which impregnates small areas of the rocks. At some places the oil seems to follow crevices; at others it saturates the unbroken rock. No evidence was found to show that the entire thickness of the "Goodridge" sand is impregnated with oil nor that any one part contains more oil than another. A close study of the sand, however, leads to the conclusion that some parts are better reservoirs than others. Locally the sand seems to be very calcareous and the interstices between the sand grains are completely filled. It is to be noted also that the oil does not come from any distinct horizon in the sandstone, as proved by the presence of seeps at several places between the top and bottom of the bed. It is believed, therefore, that the quantity of oil is variable in the sandstone and that locally there are barren areas. If this is true, a drill hole in any of these areas may penetrate the sandstone or pass completely through it without encountering oil; whereas an abundance of oil may be found in the same bed a short distance away. This variable character of the oil sand also renders it possible for adjacent wells to vary greatly in the amount of oil found, though structural conditions are identical.

The oil residue found in the seeps is black when exposed at the surface, but in the rocks and in unexposed crevices it is of a dark-brown color.

DEVELOPMENT.

Though oil springs must have been seen by prospectors and traders who operated along San Juan River, they seem to have received only casual notice until 1882, when E. L. Goodridge made the first location of a claim. No drilling was done, however, until the fall of 1907, when the first well, Crossing No. 1, was begun. This well encountered oil March 4, 1908, at a depth of 225 feet. It was a gusher, throwing oil to a height of 70 feet above the floor of the derrick, and led to considerable excitement. Other wells followed in rapid succession in 1908 and 1909, but most of them were only prospect holes put down to validate the titles to claims and not with serious intention of determining the oil resources of the field. By the summer of 1910 considerable capital had been enlisted to exploit the field. One standard rig was in operation and others were reported to have been ordered. There were 10 portable deep-well rigs in the area and several more on the way to it. During midsummer active development was somewhat retarded on account of the heat, but in the later part of August preparations were made to

renew operations with greater vigor than before. Reports received from reliable sources during the winter of 1910-11 indicate that the expectation of activity has been fully realized. On February 1, 1911, according to a report by A. L. Raplee, there were 27 drilling rigs in the field and equipment for more on the way. Two oil wells were brought in during the winter and there was considerable improvement at old wells. A small town had been established near Mexican Hat and the roads and general facilities much improved.

There are several factors which exert an unusual influence in the development of the San Juan field. The area is isolated, and practically all supplies of every kind used in the field must be transported from the railroad by wagon across an almost desert country, where only ungraded roads exist and where travel is insufficient to warrant the proper construction or maintenance of roads. The places to which supplies for the field are shipped by railroad are as follows:

Dolores, Colo.: Rio Grande Western Railway (Denver & Rio Grande System) narrow gage, 106 miles; stage daily.
Mancos, Colo.: Denver & Rio Grande Railroad, about the same distance.
Thompson, Utah: Denver & Rio Grande Railroad, standard gage, 158 miles; stage triweekly.
Farmington, N. Mex.: Denver & Rio Grande Railroad, 110 miles.
Gallup, N. Mex.: Atchison, Topeka & Santa Fe Railway, 175 miles.

Among these places Dolores is the most easily reached but is not the best place from which to obtain supplies, because it is situated on a narrow-gage railway which does not extend to any of the large cities from which material can be obtained. This railway connects with standard-gage lines, but supplies must be transferred from the standard gage to the narrow gage with considerable delay and additional expense.

Another factor which has retarded development is the exceptional aridity of the region. There is very little vegetation and no cultivated area in or near the field large enough to furnish food for horses employed in the work of development, consequently all hay and grain must be hauled by wagon at large expense. It is reported that the current price for hay is $70 a ton and for oats $90 to $100 a ton. Provisions for men likewise must be obtained from distant points. The aridity of the country further increases the cost of prospecting, because generally water must be hauled from the river to the camps. There are, however, small seeps of alkaline water from which a moderate quantity can be obtained for drilling. San Juan River furnishes almost the only potable water in the field.

Fuel is scarce. There are a few piñon on Cedar Mesa and a scant growth at the base of the escarpment around the mesa, but the acces-

sible wood is rapidly disappearing and there is probably no coal within a reasonable distance. The fuel most commonly used is oil from the producing wells in the field, which is hauled in barrels from the wells to the place where it is consumed. The common price of oil in the field is $1.25 a barrel.

Because the region is isolated and generally uninviting, the supply of labor is scarce and wages are high. Experienced drillers are obtained from oil fields in other States, mostly from California and Texas, though some come from more distant fields. These men can not be induced to come into this region unless they are promised high wages, and generally expenses while on the way; therefore experienced help is scarce, expensive, and retained with difficulty. Common labor can be obtained from settlements elsewhere in Utah and in adjacent States. So far as known, there has been no attempt to employ the Navajo Indians, who inhabit the region immediately to the south. These Indians are generally industrious and fairly intelligent. It is believed that their employment may help to settle the labor question so far as unskilled labor is concerned.

Transportation for the oil is requisite before the field can become commercially productive or economically important. The present method of hauling by team is so expensive that the oil can not be marketed profitably by that means even if an exceptionally high grade of oil is found in large quantities. In extensive fields two general methods are employed to transport oil—pipe lines and tank lines. Both of these methods are possible in the San Juan field. A pipe line could be constructed to any one of the railroad points mentioned on page 95. At least two lines of railroad into the field have been under consideration, both of which are pronounced practicable by engineers. There is little doubt that the transportation problem can be solved, but it will require considerable initial expense. It remains therefore with the prospector to show that there is enough oil in the field to warrant the expense of the pipe line or the railroad.

The following notes and well records, arranged in chronologic order, are prepared from data collected by Gregory in 1909, and by the writer in 1910, and also from information kindly supplied by Messrs. L. H. MacMorran, A. L. Raplee, and E. L. Goodridge. The locations of the wells are shown on Plate IX, with figures to correspond to the number used below.

1. Crossing No. 1 well, Oil Co. of San Juan; 226 feet deep; 8-inch hole; gusher, oil spouting to height of 70 feet. Oil now stands 95 feet from surface. Water was encountered immediately above the Baby sand and oil in the "Goodridge" sand.

Log of Crossing No. 1 well.

	Thickness.	Depth.
	Feet.	*Feet.*
Shale, red	130	130
Limestone	4	134
Sandstone (Baby sand)	5	139
Shale, red	60	199
Limestone	21	220
Sandstone ("Goodridge" sand)	6	226

2. Chicago well, Oil Co. of San Juan; 213 feet deep; 8-inch hole; gas encountered in the first shale penetrated by the drill. Touches top of "Goodridge" sand. "Well abandoned because water could not be controlled."

Log of Chicago well.

	Thickness.	Depth.
	Feet.	*Feet.*
Sandstone, red	20	20
Shale	71	91
Sandstone and limestone	23	114
Sandstone	17	131
Shale, red	7	138
Shale, brown	7	145
Shale, pink	10	155
Shale, red	7	162
Limestone	2½	164½
Sandstone ("Goodridge" sand)	49	213½

3. Golden Gate No. 7 well, Oil Co. of San Juan; sec. 15, T. 41 S., R. 19 E.; 105 feet deep; 8-inch hole. Slight flow from brown Baby sand. This well was sunk as assessment work. Encountered a strong flow of artesian water and a trace of oil. Good location for obtaining artesian water.

4. Monticello well; 263 feet deep. Oil stands 75 feet from surface. Oil from "Goodridge" sand. Data from Gregory's report; location not given.

Log of Monticello well.

	Thickness.	Depth.
	Feet.	*Feet.*
Shale	137	137
Landstone (Baby sand)	6½	143½
Simestone and red shale	9½	153
Shale, red	9	162
Sandstone, containing oil	3	165
Shale, red	11	176
Sandstone and shale	7	183
Sandstone, oil-bearing	10	193
Unreported	17	210
Sandstone ("Goodridge" sand penetrated to a depth of 53 feet)	53	263

5. Burlap well, Oil Co. of San Juan; 244 feet deep; 8-inch hole. Strong flow of gas and trace of oil was found at the top of the "Goodridge" sand and a "showing" of oil in the Baby sand. Work in progress August 1, 1909.

Log of Burlap well.

	Thickness	Depth.
	Feet.	*Feet.*
Shale, red	151	151
Limestone	5	156
Sandstone (Baby sand)	9	165
Shale, red	75	240
Limestone	4	244
Sandstone ("Goodridge" sand encountered at a depth of 244 feet).		

6. Oil City No. 5 well, San Francisco-San Juan Co.; 595 feet deep; 8-inch hole. Cuts "Goodridge" sand and goes into No. 3 sand. Gas was encountered. Well now full of oil and plugged.

7. Oil City No. 6 well, San Francisco-San Juan Co.; 165 feet deep; 8-inch hole. Cuts into top of Baby sand, where oil was struck. "Enough oil to hold claim."

8. Oil City No. 7 well, San Francisco-San Juan Co.; 140 feet deep; 8-inch hole. Cuts Baby sand, in which oil was found. "Enough oil to hold claim."

9. Oil City No. 8 well, San Francisco-San Juan Co.; 126 feet deep; 8-inch hole. Cuts Baby sand, where small flow of oil was found.

10. Conejos well, San Francisco-San Juan Co.; 450 feet deep; 8-inch hole. Cuts "Goodridge" sand and Baby sand, both of which yield oil. Oily water running from well July 23, 1909. Data from Gregory's report; location not given.

11. Bryce No. 1 well, Western Investment Co.; 165 feet deep; 8-inch hole. Cuts Baby sand, which yields oil. Drilling stopped for repairs. Well sunk in April, 1910, to a depth of 500 feet.

12. Bryce No. 2 (Oil Johnny No. 1) well, Western Investment Co.; 500 feet deep; 8-inch hole. Well sunk in a wash below the horizon of the "Goodridge" sand. At 200 feet oil was encountered in No. 3 sand. This oil and the water were cased off. Oil was again struck in the Mendenhall sand. Oil stands 150 feet from the surface. The well is plugged and shows strong flow of gas when cap is removed. Drilling continued in March, 1910.

13. MacMorran well; 200 feet deep; 8-inch hole. Cuts "Goodridge" sand, where oil and some gas were encountered.

14. Bitter Springs No. 1 well; 200 feet deep; 8-inch hole. Struck oil in "Goodridge" sand. Well is plugged. Data from Gregory's report; location not given.

15. Bitter Springs No. 2 well; 160 feet deep. Drilling stopped on account of repairs to rig. Data from Gregory's report; location not given.

16. Galloway well, Norwood Co.; Johns Canyon; 1,425 feet deep; 8-inch hole. Strong flow of gas encountered in "Goodridge" sand. Some oil in this and other sands. No water below 100 feet. Attempt made to reach the Honaker sand was abandoned because of lost tools. Drilling resumed March, 1910. This is the westernmost and also the deepest well in the field. It was put down with a standard rig to a depth of 1,425 feet. Operations were still in progress at the time of this survey. The well is situated at the top of the Goodridge formation. Traces of oil were found at 85, 600, and 1,170 feet. Only a small amount of gas was encountered. Operations were stopped for a month during the spring of 1909 on account of loss of tools. When the work was resumed it was found that oil had collected on the surface of the water in the well. This oil was taken from the well and bottled. It is believed by operators that the oil came from the sand at a depth of 1,170 feet.

17. Lone Cave Oil Co. well, drilled to a depth of 700 feet. This well was shot at a depth of 415 feet. It is reported that a good "show" of oil was obtained but no production.

18. Gooseneck Oil Co. has put a rig in place and made necessary preparations to drill.

19. San Juan-Dolores Co. has put a rig in place to drill.

20. Aztec Oil Co. has reached a depth of 610 feet with a large portable rig and has obtained a small "show" of gas at 237 feet and some oil at 495 feet. At the maximum depth no water had been encountered.

21. Pinnacle Oil Co. has entered into contract with a driller to sink a hole to a maximum depth of 5,000 feet. The contractor has erected a rig and completed most of the preparations for drilling.

22. Gibraltar Oil Co. has entered a contract for a deep hole.

23. London & San Juan Oil Co. drilled to a depth of 450 feet and obtained a good "show" of oil, but loss of tools in the well interrupted operations temporarily.

24. Pioneer Development Co. drilled in 1908 to a depth of 215 feet. A small amount of oil was reported at the maximum depth from a sand believed to be the "Goodridge." Recently this company has set a rig in place and is prepared to continue operations to a greater depth.

25. Jackson well; Monumental Oil Co. drilled to a depth of 635 feet. An oil sand was encountered at 525 feet. A fine "showing" of oil is reported in the "Goodridge" sand at 292 feet and again in a stray sand at 550 feet. At this lower point the well was shot. Oil now stands 90 feet below the surface. The writer is inclined to think that when proper correlation is made the sand encountered at a depth of 550 feet will be found to be not a stray sand but probably the Little Loop sand.

26. Anderson Oil & Developing Co. has drilled to a depth of 420 feet. A good "showing" of oil was found at a depth of 260 feet, and some oil was baled out for drilling, but the quantity was considered insufficient and it was cased off and the well drilled deeper.

27. Arcola No. 3 well, drilled to the "Goodridge" sand at 210 feet, where oil was found.

CONCLUSION.

Much remains to be determined before the San Juan field can be classed as a success or failure. However, the evidence gained in the examination described in the preceding pages points to certain conclusions regarding the most probable places for the accumulation of oil. As all the wells containing more than a good "showing" of oil are in the syncline, it is believed that the basin structure probably contains most of the oil. This condition has been demonstrated to exist regarding the upper oil sands and is believed to be true of the lower beds, though the lower ones may contain oil over a greater area. Furthermore, if there is a small amount of water present in the bottom of the syncline, the oil forms a border at the edge of the water, and no oil will be found in the lower beds in the center of the basin. Very little gas accompanies the oil and probably very little will be found, though wells in the anticline may find a moderate quantity but it will not show much pressure. Such gas is believed to be derived from the oil which is now in the syncline and to have risen into the anticline because it has a relatively low specific gravity. Practically all the geologic conditions point to the conclusion that very few flowing wells will be obtained. Reports of the wells drilled include one "gusher." For this well no adequate explanation has

been offered. From his study of the field the writer is inclined to believe that the areas in which the most favorable conditions occur are as follows:

T. 41 S., R. 18 E.: Secs. 23, 24, 25, 26, 35, 36.
T. 41 S., R. 19 E.: Secs. 19, 20, 21, 28, 29, 30, 31, 32.
T. 42 S., R. 18 E.: Secs. 1, 2, 11, 12, 13, 14, 24.
T. 42 S., R. 19 E.: Secs. 5, 6, 7, 8, 17, 18, 19, 20.

Surrounding areas may contain oil, but it is believed that the quantity will be less than in those listed above. The area south of the river is not surveyed, and the locations given are based on projections of the survey covering the area north of the river. The grade of the oil obtained from this field will most probably be high, but it is not expected that the production will be great.

POSSIBILITIES OF OIL FIELDS IN THE SURROUNDING REGION.

From personal observations and conversation with investigators who have visited southern Utah and northern Arizona, and also from a study of the geologic literature relating to the region, the writer is led to believe that this region contains other fields with geologic conditions similar to those of the San Juan field. Similar stratigraphic conditions were noted by the writer as occurring to the north as far as Moab, Utah, and to the west strata very much like those in the San Juan field are reported by Richardson [1] and others.

The writer has received from Mr. L. W. Galloway a sample of petroleum residue from an oil spring at a point on San Juan River 18 miles west of Mr. Galloway's well in Johns Canyon, and apparently reliable reports are received concerning oil springs near the junction of Escalante and Colorado rivers. It seems probable, therefore, that oil in varying quantities is distributed over a large area in southern Utah and contiguous regions to the south. If this supposition is true, conditions favorable to the accumulation of oil are to be sought by the prospector and geologist in this area. Present knowledge is insufficient, however, to do more than point out the geologic conditions to be desired. Wherever uniform stratigraphic conditions are known to exist, probably favorable locations will be found on anticlines and synclines, but as there are igneous intrusions and faults in the region, as well as other conditions which are known to affect the accumulation of petroleum elsewhere in productive fields, structural conditions alone are not sufficient to determine the character of a field. The writer is inclined to believe that this is a region in which arrested monoclines may offer favorable opportunities for the accumulation of oil.

[1] Richardson, G. B., Petroleum in southern Utah: Bull. U. S. Geol. Survey No. 341, 1908, p. 343.

MARSH GAS ALONG GRAND RIVER NEAR MOAB, UTAH.

By E. G. Woodruff.

While passing through Moab, Utah, in August, 1910, the writer was informed that natural gas was escaping along Grand River in that vicinity. Accordingly, a hasty investigation was undertaken to determine, if possible, the geologic conditions near the gas springs and the source and nature of the gas.

In this region Grand River is confined to a deep, moderately broad canyon, along the sides of which the structure of the rocks is clearly displayed. An examination showed the strata to be similar to those described in the preceding paper, on the San Juan oil field, Utah. About 12 miles above Moab the beds are bent into a slight anticline, which is a favorable structure for the accumulation of petroleum. As the stratigraphic and structural conditions were found to be favorable, and as gas was escaping from the surface of the water, prospectors were led to believe that the gas originated in rocks at considerable distance below the surface and that petroleum had accumulated in the deep-seated strata.

The writer's examination led him to believe that the gas did not have its origin in petroleum but from buried débris in the river channel and is marsh gas. In this area the river flows slowly and considerable débris has collected in the channel. At the request of the writer, a sample of the gas was collected by Mr. A. H. Rogers, of Moab, and analyzed in the laboratory of the United States Geological Survey, with the following results:

Analysis of gas from Moab, Utah.

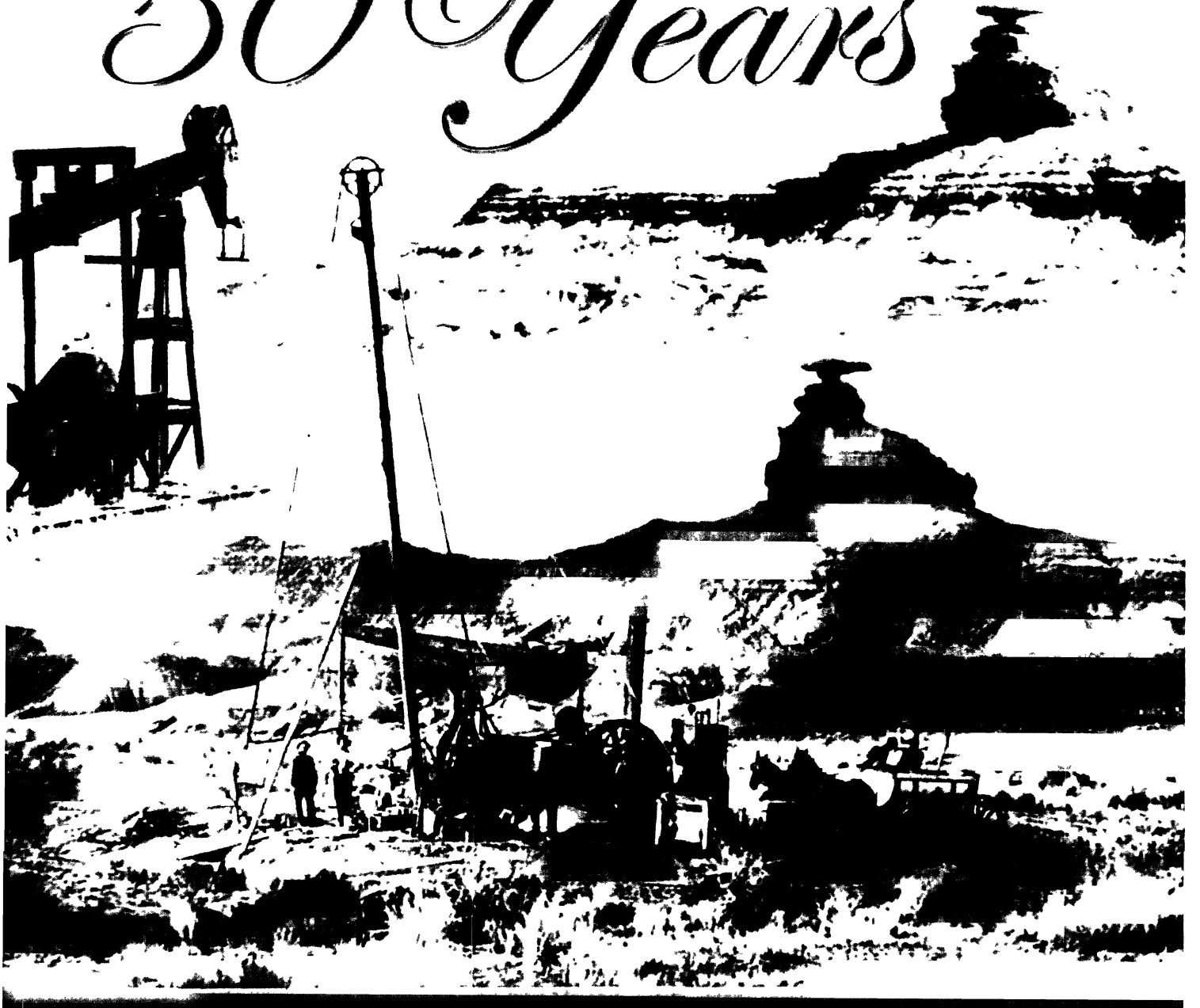
CO_2	3.5
O_2	0
CO	0
CH_4	90
N	6.5
	100

From this analysis it is evident that the gas is marsh gas. It should be noted, however, that although the gas escaping along the river is not derived from petroleum, this does not render the location impossible for the accumulation of oil and gas in subterranean strata. The character of the escaping gas indicates that its source is not deep-seated and that if the strata contain petroleum it is retained in the reservoirs and is not gradually liberated as has been supposed. The escaping gas is in no way an index of conditions below the river channel.

Tab 10

UTAH'S OIL AND GAS PROGRAM

Celebrating 50 Years

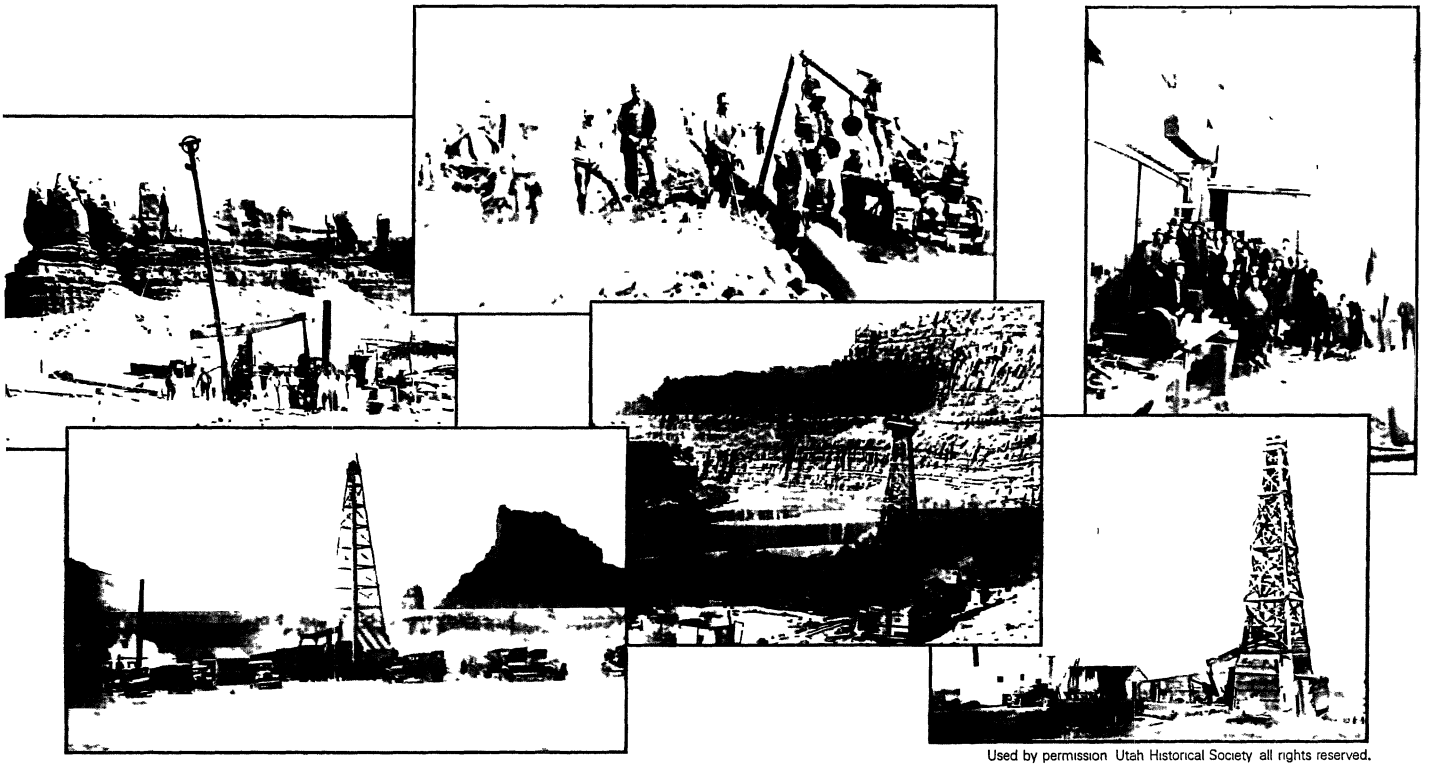


Division of Oil, Gas and Mining
Utah Department of Natural Resources

Chronology of Utah's Oil and Natural Gas Industry

Utah's oil and natural gas industry can trace its beginnings back to 1850 when Captain Howard Stansbury surveyed the Great Salt Lake for the Army Corps of Topographical Engineers. During that survey he discovered evidence of "petroliem" along the northern shore of the lake. In the 155 years since that discovery, the petroleum industry has contributed significantly to the state's economy. In 1957, Utah recorded 225 productive wells, jumping to 875 in 1968, and more than 1,300 in 1978. Today, more than 6,000 oil and gas wells contribute to our energy needs.

- **1891** - Utah Oil Company sinks a shallow well near Green River. A dry hole, it is abandoned after drilling to a depth of 1,000 feet.
- **1907** - First drillings in the Virgin Oil Field, Washington County.
- **1908** - Oil well at Mexican Hat on the San Juan River is a "gusher." In the next year, work is begun on at least 25 wells.
- **1909** - Utah Oil Refining Company constructs a refinery at the northern edge of Salt Lake City.
- **1912** - Utah's oil industry enters a slump that lasts until 1922. This period does see some test projects initiated on and around the Great Salt Lake.
- **1920s** - Oil companies gradually increase exploration in Utah through this decade.
- **1930s** - The Great Depression and World War II slow Utah's petroleum industry to a snail's pace. From 1930 to 1944 only 143 wells are drilled.



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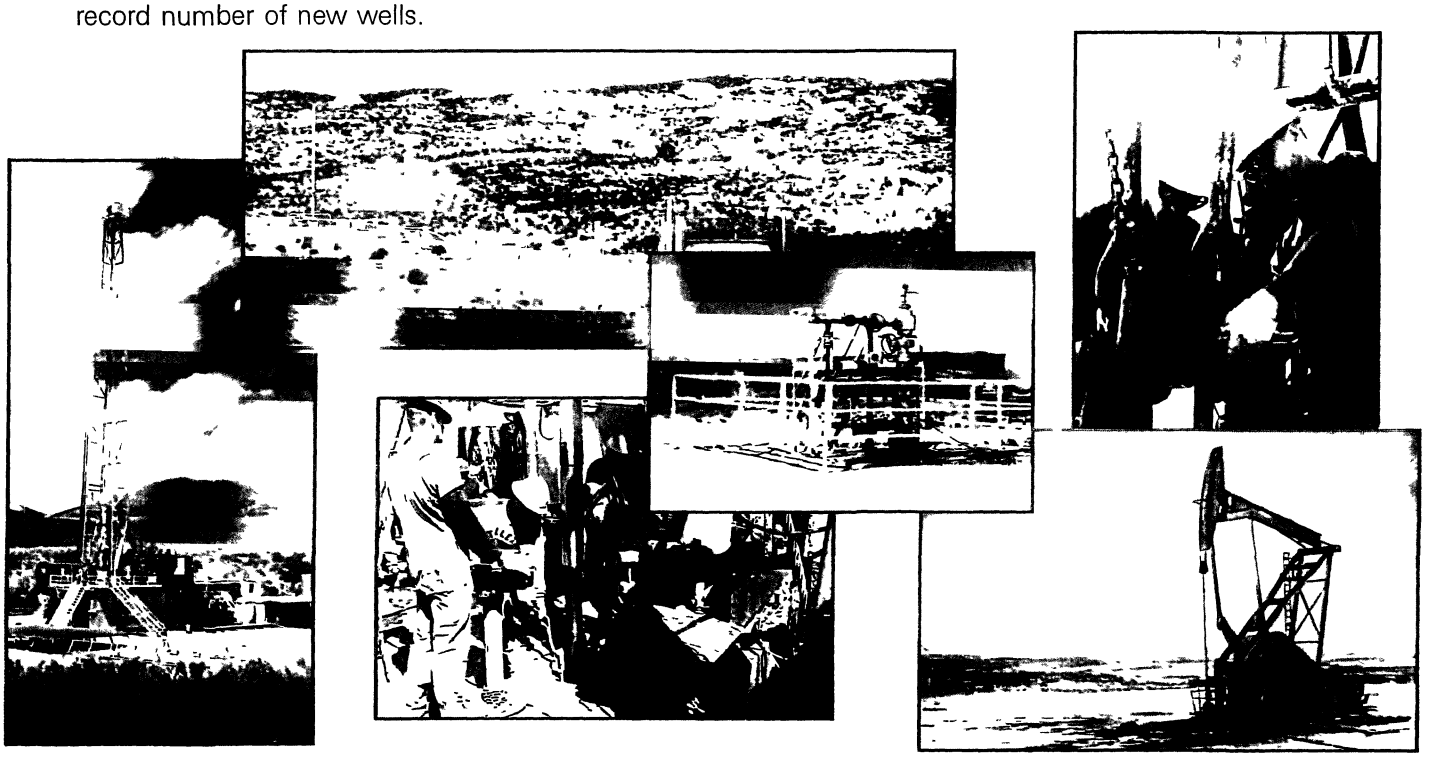
- **1945** - Major oil companies begin exploration activities in the Uinta Basin. The first commercial amounts of oil are found in Ashley Valley in 1948. During the next ten years, companies open major fields including, Roosevelt (1949), Red Wash (1951), Walker Hollow (1953), and Bluebell (1955).
- **1955** - Utah Oil and Gas Commission, now the Division of Oil, Gas and Mining, is created on July 1 to ensure ultimate recovery of resources and protect the public interest.
- **1956** - A well at Aneth, in southeastern Utah, leads to development of the Aneth Field. Other major oil companies in the region discover other fields, such as Ratherford (1956), McElmo Creek (1957), and White Mesa (1957).
- **1964** - Upper Valley Field, located 10 miles southeast of Escalante in Garfield County, is developed.
- **1975** - Summit County becomes a center for oil development and by the early 1980s a series of oil and gas fields are developed that include Lodgepole, Elkhorn Ridge, Anshutz Ranch, and Anshutz Ranch East.
- **1980s** - Anshutz Ranch East Field is developed and quickly becomes the state's biggest producer.
- **1990s** - Development of coalbed gas contributes nearly one-third of the state's natural gas production. The top coalbed gas producing area is the Drunkards Wash Field in Carbon and Emery Counties. Waterflooding of the Monument Butte area gains momentum and becomes a major contributor to the state's oil production.
- **2004** - Wolverine Gas and Oil completes a well in Sevier County producing 708 barrels of oil per day. Up to this time no well drilled in Sevier County had proved to be economic.
- **2005** - The highest number of drilling permits in Utah's history is issued and drilling is commenced on a record number of new wells.



Oil and Gas Firsts in Utah

1 *First Hydrocarbons Discovered*

Rozel Point

Box Elder County

While surveying the shores of the Great Salt Lake in 1850, Captain Howard Stansbury discovered evidence of "petroliem" along the northern shore. He did not record the exact location, but the rocks and shoreline of Rozel Point are coated in tar from seeps in the lake and are easily located to this day.

2 *First Oil Well Drilled*

Bamberger and Millis #1 Well

Grand County

Utah's first oil well was drilled in 1891 just south of the town of Green River. It reached a depth of about 1,000 feet but reported no oil or gas.

3 *First Gas Field*

Farmington Field

Davis County

While not normally associated with oil and gas development, Davis County is in fact the site of Utah's first gas field, discovered in about 1892. About 20 wells comprised the field and for almost two years provided gas for fuel lights of many Salt Lake City residents.

First Oil Field

Virgin Field

Washington County

The Virgin Field, first developed in 1907, is the oldest producing oil field in Utah. About 140 wells were drilled in the vicinity and it operated periodically into the 1970s. Processed oil was refined into fuel oil and diesel fuel and marketed locally.

First Commercial Oil Production

Equity #1 Well

Uintah County

Completed in September 1948, the Equity #1 Well produced 300 barrels of oil a day becoming Utah's first truly commercial oil production. It produced more than 300,000 barrels of oil during its life and is now plugged and abandoned.

6 *Utah Oil and Gas Commission Issues First Permit*

Sitton #4 Well

San Juan County

The Utah Oil and Gas Commission, what would eventually become the Utah Division of Oil, Gas and Mining, was created July 1, 1955. The new commission approved its first official drilling permit in October that same year.

7 *Number One Oil and Number One Gas Producer*

Anshutz Ranch East Field

Summit County

Utah's most prolific oil and gas well, the ARE W29-06A, is still productive today. Completed in July 1983 by Amoco Production Company, it has now produced 10 million barrels of oil and more than 286 billion cubic feet of gas.

8 *Deepest Producing Perforated Interval*

Altamont Field

Duchesne County

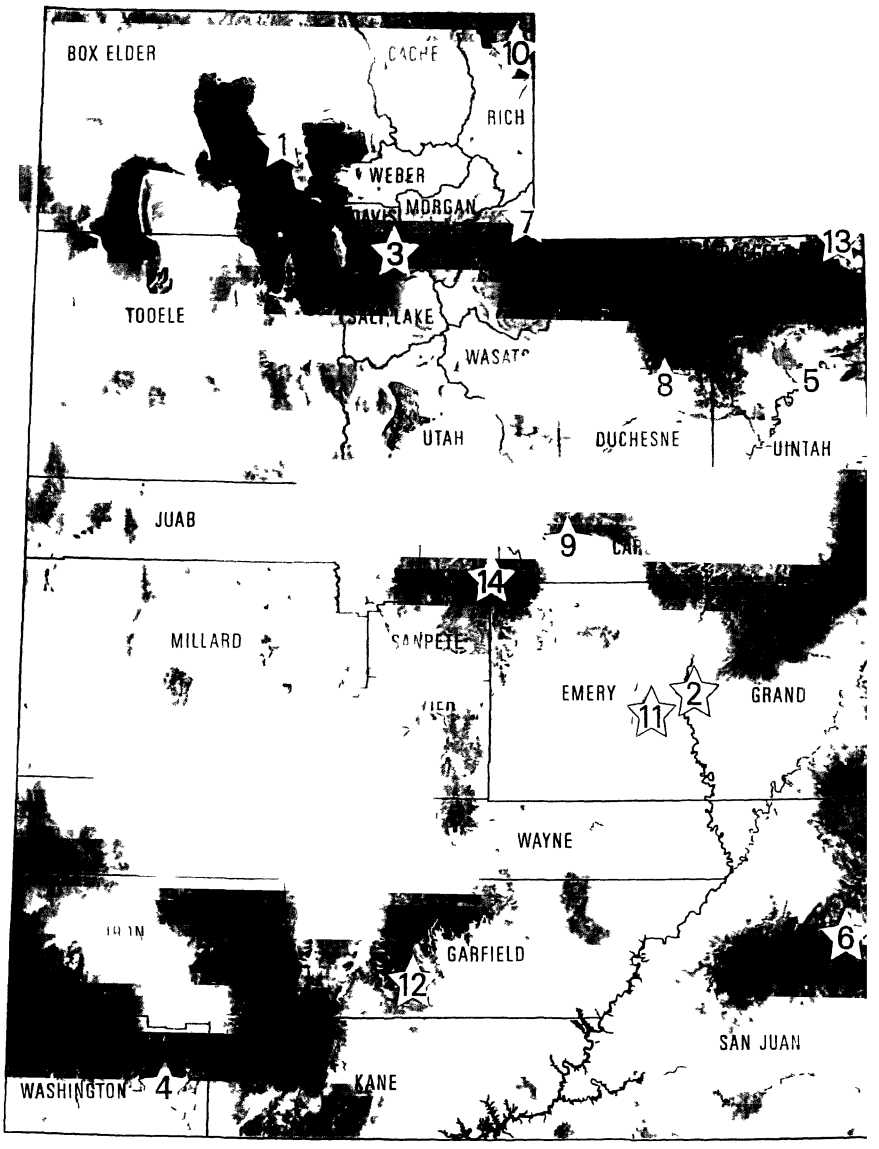
The Brotherson 2-14B4 well was begun in November 1983 and completed in November 1985 at a total depth of 20,600 feet.

9 *First Coalbed Methane Well*

Drunkards Wash Field

Carbon County

The first coalbed gas well, the Telonis 20-172, was drilled in 1985 and remained in a shut-in status until 1997 when a delivery pipeline was completed. It is now one of about 530 producing coalbed wells in the Drunkards Wash Field.



10 *Rich County's Only Commercial Producing Well*

Hogback Ridge Field

Rich County

The Hogback Ridge 20-1 well produced 22 million cubic feet of gas per day when completed in 1977 and over its life produced nearly five-and-a-half billion cubic feet of gas before being plugged and abandoned in 1982. It is the only well in Rich County known to have produced commercial quantities of gas.

11 *First Well Drilled in Emery County*

California-Utah Oil Co. #1 Well

Emery County

The well was drilled in 1899 and found oil at 1,100 feet and 1,600 feet.

12 *First Productive Well in Garfield County*

Upper Valley U #2 Well

Garfield County

The Upper Valley U #2 well was drilled in 1963 and sparked drilling activity on the Kaiparowits Plateau, leading to the formation of the Upper Valley Field that now contains 29 active wells.

13 *Daggett County's First Productive Well*

R.D. Murphy #1 Well

Daggett County

Located in the extreme northeast of Daggett County, the R. D. Murphy #1 well was drilled in 1927. It is now part of the Clay Basin Field with 16 producing wells.

14 *First Productive Well Drilled in Sanpete County*

Delhi-Taylor #3 Well

Sanpete County

Drilling began in Sanpete County in about 1918 with no success until the Delhi-Taylor #3 well was drilled in 1956. It produced 1.5 million cubic feet of gas per day at peak production and was plugged in 1976.

15 *First Productive Well Drilled in Sevier County*

Kings Meadow Ranches 17-1 Well

Sevier County

Wolverine Gas and Oil completed drilling this well on May 3, 2004. Initial production was more than 700 barrels of oil per day. Up to this date, no well drilled in Sevier County had ever been economic. This new discovery may signal a new era in the history of oil and gas exploration, development and production for the state.

Early Utah Division of Oil, Gas and Mining History

- **1955** - House Bill 17, with the support of Utah's petroleum industry, creates the Oil and Gas Conservation Commission Basic plugging, abandonment, and drilling standards are established A conservation fee on produced oil and gas provides funding

  Regulatory tasks are assigned to an Oil and Gas Conservation Commission of five members, each representing a specific district of the state The staff consists of the director, a petroleum engineer, and numerous accounting people charged with collecting the conservation fee and publishing production reports

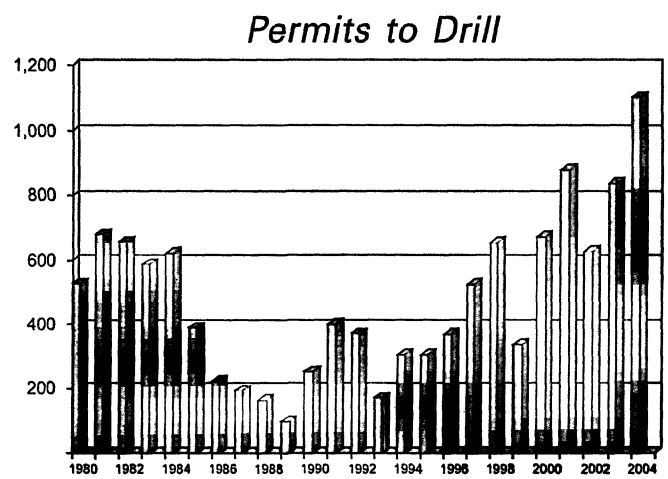
- **1967** - Senate Bill 171 transforms the Oil and Gas Conservation Commission into the Division of Oil and Gas Conservation, a subdivision of the new Department of Natural Resources.

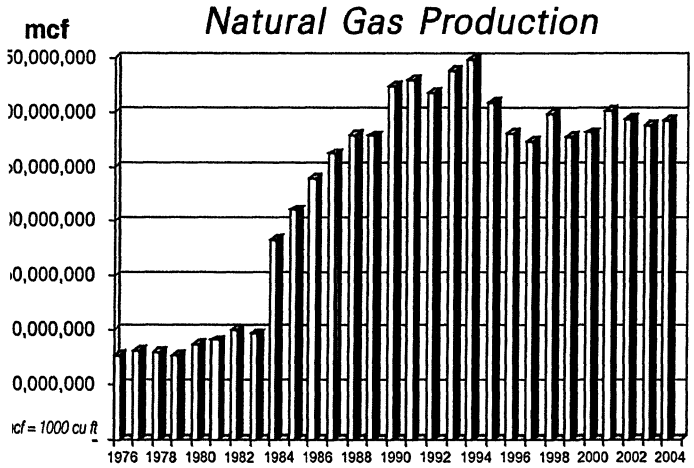
- **1975** - The division is given the task of regulating mined land reclamation and it becomes, by order of House Bill 243, the Division of Oil, Gas and Mining

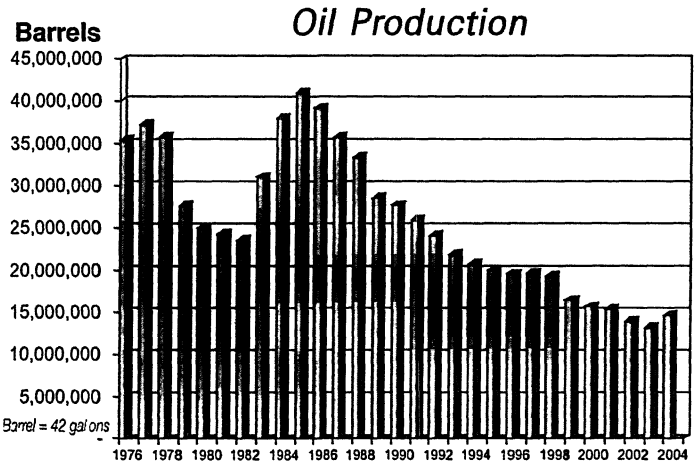
- **1979** - A statutory change gives the division a specific duty to regulate coal as a commodity separate from other minerals, and thus the division is eligible for and receives its first federal funds

- **1982** - Senate Bill 19 gives the division exclusive regulatory jurisdiction over the underground injection of fluids related to oil and gas operations and related disposal pits and ponds

  1983 - Senate Bill 157 recodifies the oil and gas regulatory statute Production audits, pre-site inspections, and additional staff for environmentally oriented work become a reality







Today
Utah Oil and Gas Program

Mission

The Oil and Gas Program within the Division of Oil, Gas and Mining:

- Promotes the exploration, development and conservation of oil and natural gas resources
- Fosters a fair economic return to the general public for those resources
- Maintains sound, reasonable oversight to ensure environmentally acceptable activities

Program Activities

Permitting

Staff technical experts issue permits for drilling and other oil field activities to oil and gas companies when the proposed operations are in compliance with all rules and orders of the Board of Oil, Gas and Mining.

Compliance

Oil and Gas Program staff monitor operations throughout the state to ensure rules and requirements are met. Enforcement action is taken when required.

Inspections

Field specialists routinely inspect field operations to verify that natural resources are not wasted and the environment is protected.

Audits

Staff auditors review the accuracy of production and disposition reports, gas processing plant reports, and tax credit claims. They also work to resolve complaints of royalty owners.

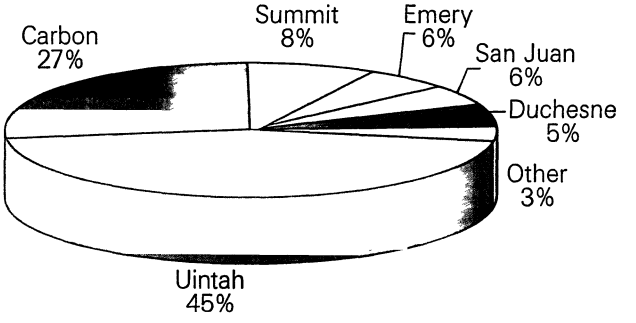
Well Plugging

The program petroleum engineer oversees the plugging of wells and the restoration of sites to guard against human and environmental injury. He also administers an orphan well plugging program and determines if bond money and/or state funds should be spent to plug older, non-active wells that have no known operator.

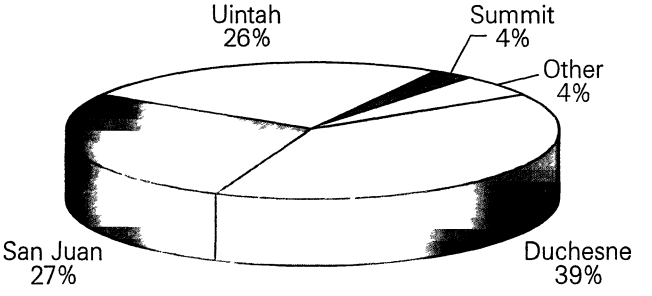
Public Outreach

Efforts are frequently made to educate members of the public and industry representatives regarding the functions and requirements of the Oil and Gas Program. Staff members participate in trade shows, issue publications, and make themselves available for teaching opportunities.

2004 Natural Gas Production by County



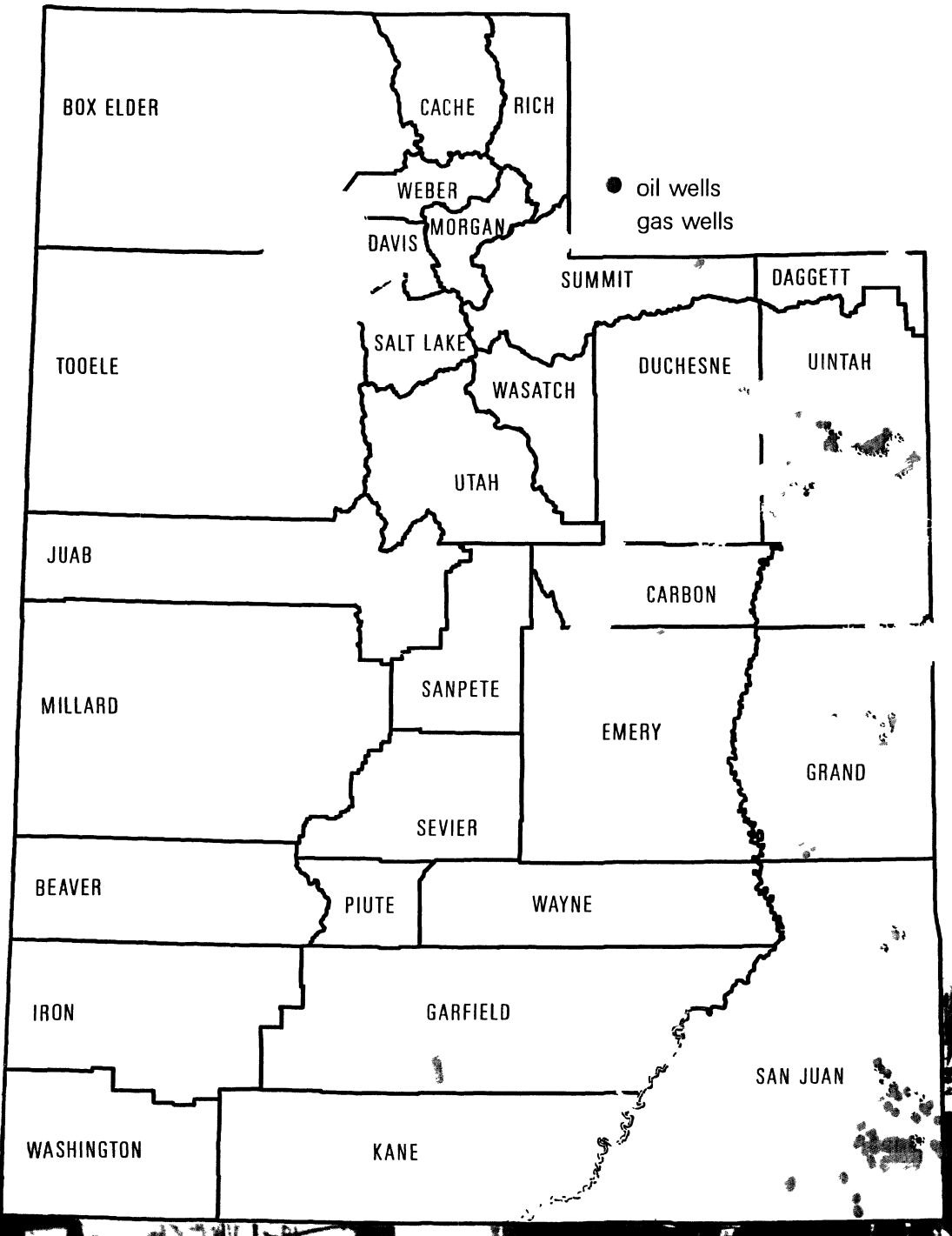
2004 Oil Production by County

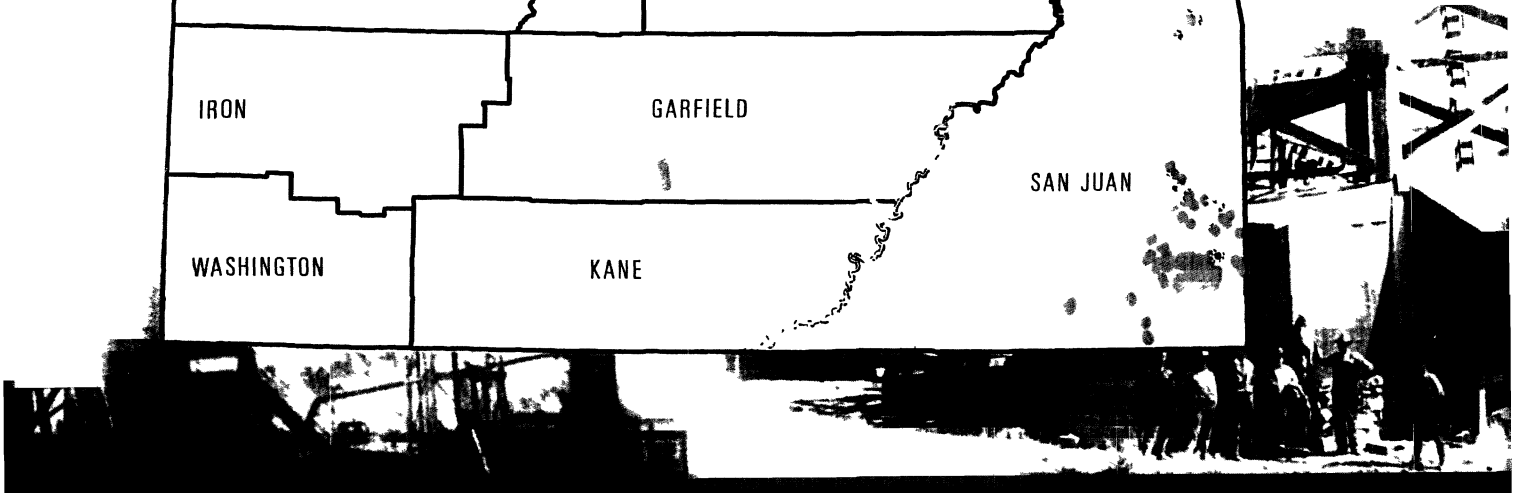


Information Services

The Oil and Gas Program has collected a wealth of oil and gas data during the course of executing its responsibilities. Information is available through the division's Public Information Center and web site at http://ogm.utah.gov/oilgas.

Producing Oil and Gas Wells





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College of Mines and Mineral Industries

UNIVERSITY OF UTAH

CHAPTER IV

HISTORY OF OIL AND GAS POSSIBILITIES BY AREAS

GRAND-SAN JUAN AREA

Pages 189 to 211

RS - 16

Reprinted August 1952

Price 75¢

CHAPTER IV

HISTORY OF OIL AND GAS POSSIBILITIES BY AREAS

For description of the structural features and the location of wells drilled for oil and gas, the State has been arbitrarily divided into four areas: Grand-San Juan, Uinta, Basin and Range, and High Plateaus (See Fig. 1). In some instances the areas defined embrace structural provinces within which the general geologic history may be considered as a unit. Under conditions of regional stratigraphic study, however, these arbitrary areas should not be considered as separate provinces. Some of the recognized oil and gas structures of the State are shown on Plate III (in folder).

Part I

GRAND-SAN JUAN AREA

The southeast portion of Utah, consisting of Grand and San Juan Counties, constitutes the Grand-San Juan area of approximately 11,453 square miles. The area is limited on the east and south by the Colorado and Arizona State lines. The Green and Colorado Rivers bound the area on the west and the southward-facing escarpment of the Book Cliffs limits the area on the north.

The section is part of the Colorado Plateaus, a large physiographic province embracing eastern Utah, northern Arizona, southwestern Colorado, and northwestern New Mexico. The Colorado Plateaus province, in general, is characterized by an arid climate, bare rock surfaces, high altitude, and an intricate system of cliff-walled canyons developed by perennial and intermittent streams. Large-scale structural features are common. Topographic features of the area are intimately related to the attitude and lithology of the rocks.

GENERAL

The Colorado salt basin and the Monument upwarp are the most important structural features of the region. Most of the effort to find petroleum has been influenced by surface expressions developed by these two factors. In the area, two important laccolithic mountains groups occur: the LaSal Mountains in southeast Grand County and the Abajo Mountains in central San Juan County.

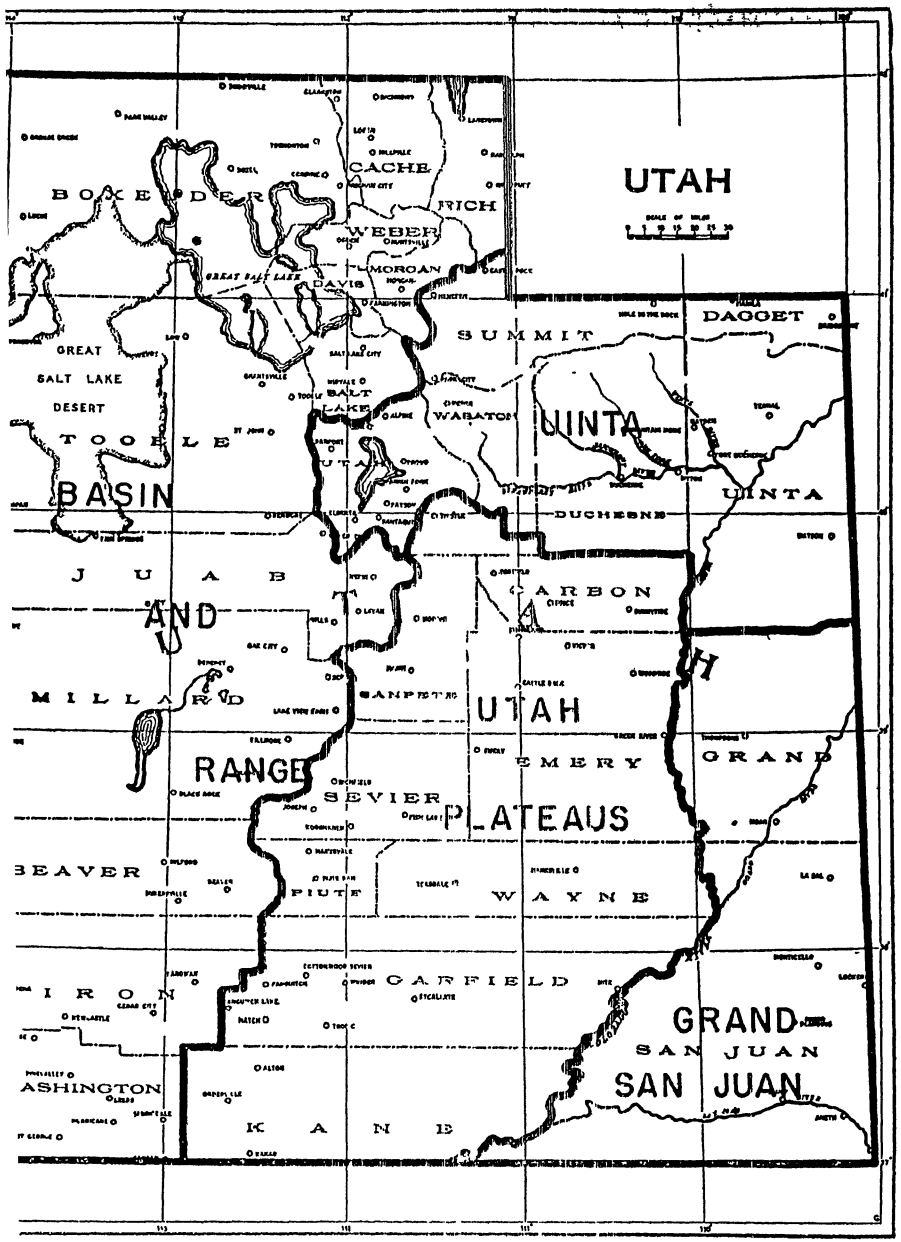


Figure 1.—Arbitrary divisions of Utah.

MONUMENT UPWARP

In size, the Monument upwarp is the major structural feature of San Juan County. The fold has a north-south trend and, according to Baker (1946), it extends from north of the junction of the Green and Colorado Rivers southward into northern Arizona, and is approximately 125 miles long, with a maximum width of about 75 miles. The northwestern part of the plunging north end of the anticline extends northwestward from Cataract Canyon approximately to the Emery-Wayne County line. This regional upwarp is crossed near its center in San Juan County by the San Juan River, and the Colorado River crosses the fold's axis near the mouth of Gypsum Canyon.

Gregory, (1938) describes the structure, as observed in San Juan County:

> Throughout its length the crest of the upwarp is poorly marked, over large areas the cap rocks lie nearly flat. The eastern flank is clearly marked by Comb Ridge, a monocline with dips exceeding 50°. The western flank is a region of plateaus and cliffs, in which the strata, with dips of ½° to 2°, extend 30 to 50 miles to the Colorado River and continue beyond the river as features of the downwarp in which rest the sediments of the Kaiparowits Plateau. Erosion of the upwarp has brought into view strata of Pennsylvanian age (Hermosa formation) and succeeding beds up to the Dakota (?) sandstone. The youngest formation exposed on the western flank is the Carmel (?); on the crest, the Wingate sandstone; on the eastern flank, the Navajo sandstone in Comb Ridge and the Morrison in Butler Wash. As thus outlined, the Monument upwarp is about 110 miles long and 40 to 60 miles broad, and represents a displacement of about 5,500 feet. However, its northern and western edges have not been defined, and the few measurements recorded are subject to revision.
>
> Though in general the Monument upwarp is characterized by a broad, nearly flat top, gentle westward slope, steep eastward slope, and moderate slopes at its north and south ends, none of its slopes have a consistently uniform attitude.

Elk Ridge Anticlines—Two anticlinal flexures referred to by Gregory (1938) as "West Elk anticline" and "East Elk anticline", occur on the crest near the northern extremity of the structure in San Juan County. (See Fig. 2.) The Midwest Exploration Company, in 1927, completed a test well on West Elk anticline in sec. 30, T. 34 S., R. 19 E., which started in the Rico formation and bottomed at a depth of 4,422 feet in schist, as is indicated by the accompanying log. No showings of oil or gas were recorded.

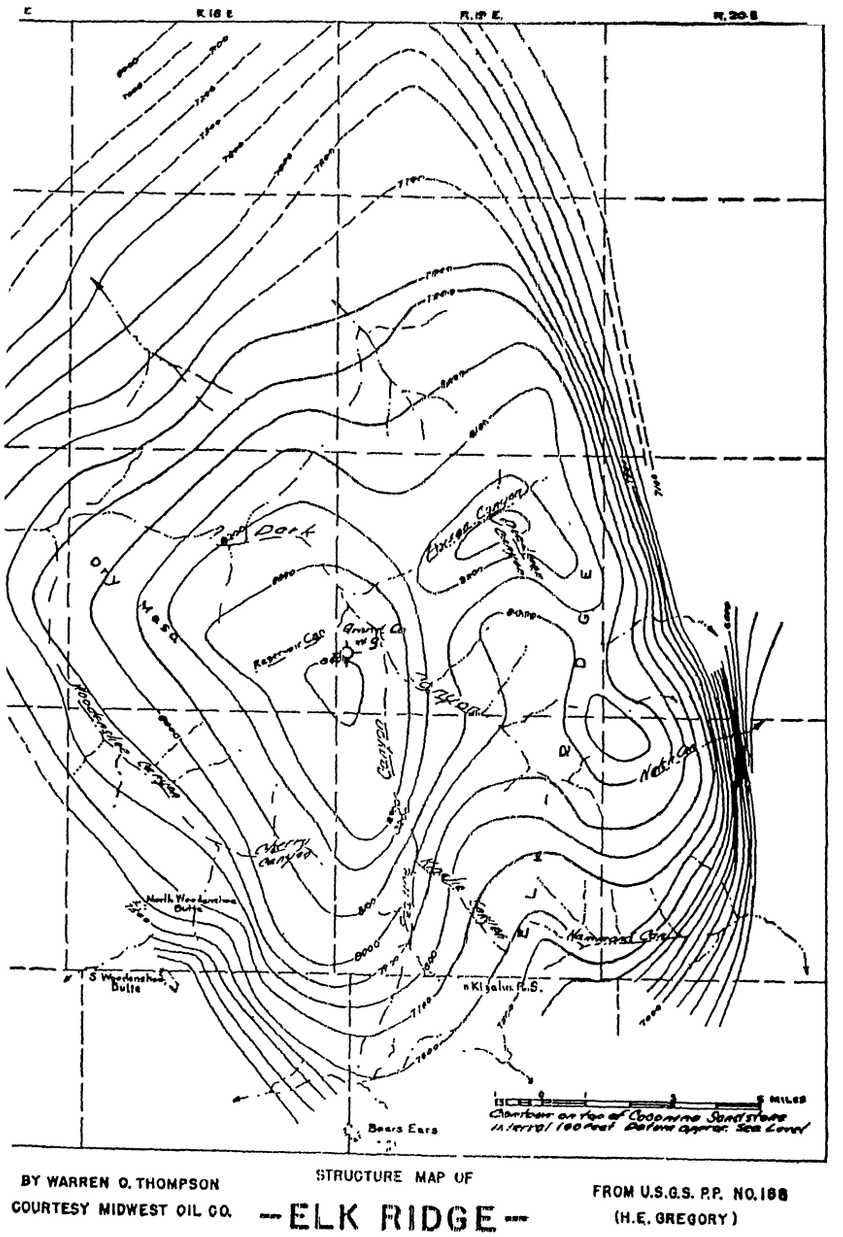


Figure 2.—Structural contour map of Elk Ridge.

SAN JUAN COUNTY

STRUCTURE: Elk Ridge
COMPANY: Midwest Exploration Co.
COMMENCED: Sept. 14, 1926
ELEVATION: 7,139 feet
BOTTOMED: Schist
WELL NO.: S. J. 9
LOCATION: Sec. 30, T. 34S, R. 19 E.
COMPLETED: Nov. 5, 1927
TOTAL DEPTH: 4,422 feet
REF.: U. S. Bureau of Mines

FORMATION	Thickness (feet)	Depth (feet)
Hard limestone	56	56
Red sandstone	9	65
Cream; red sandstone	42	107
Red; black sandy shale	10	117
Red sandstone	23	140
White; gray limestone	84	224
Sandstone	1	225
Hard white; black limestone	149	374
Sandy limestone	26	400
Sandstone	14	414
White limestone	46	460
Red shale	30	490
White limestone and brown shale	330	820
Black sandy limestone	10	830
White limestone; muddy shale	270	1,100
Black limestone	5	1,105
White and black limestone	100	1,205
White limestone and shale breaks	35	1,240
White limestone	25	1,265
Gray shale	10	1,275
Black limestone	5	1,280
White limestone	10	1,290
Muddy gray shale	15	1,305
Black shale	20	1,325
Gray shale	30	1,355
White limestone	30	1,385
Sandy gray limestone	25	1,410
Black limestone	12	1,422
Black; gray shale	73	1,495
White limestone	55	1,550
Black shale	68	1,618
Salt	32	1,650
Limestone	40	1,690
(?)	25	1,715
Salt	20	1,735
Black shale	45	1,780
White limestone; gray shale	50	1,830
Salt	15	1,845
Black limestone; shale; limestone	93	1,938
Salt	7	1,945
Gray and white limestone	155	2,290
Shale	3	2,293
Limestone	10	2,303
Pink shaly limestone	7	2,310
Varved shale	20	2,330
Pink shale	35	2,365
Red shale	45	2,410
Red limestone	20	2,430
Gray limestone	180	2,610
Red limestone	10	2,620
White limestone	15	2,635
Gray limestone	45	2,680
Pink shale	10	2,690
Gray limestone	345	3,035
Blue limestone	70	3,105
Gray limestone	110	3,215
Black limestone	35	3,250
Hard gray limestone	75	3,325
Black limestone	15	3,340
Gray limestone	310	3,650
Pink shales and limy shales	75	3,725
Gray shales and limy shales	40	3,765
Black limestone and sandy limestone with shales	105	3,870
Blue limestone	25	3,895
Black shale; gray sandstone and shale breaks	75	3,970
Gray sandstone	70	4,040
Brown sandstone	20	4,060
Gray sandstone	10	4,070
White sandstone	20	4,090
Gray limestone	5	4,095
White sandstone	31	4,126
White sandstone	89	4,215
Varved sandstone	40	4,255
Cherty limestone	35	4,290
Hard blue sandy shale	120	4,410
Very hard schist	12	4,422

MODIFYING FOLDS ON THE MONUMENT UPWARP

Mitten Butte or Halgaito Anticline—The Halgaito anticline ends roughly parallel to the Monument upwarp northward m the Utah-Arizona State line to and beyond the San Juan ver as a broad, somewhat irregular arch. Gregory (1917-38) applied the name "Mitten Butte anticline" to this fold. ker (1936) terms the anticlinal fold "Halgaito anticline." As erpreted by Gregory (1938). the axis of the Mitten Butte icline extends from the San Juan River near Honaker Trail rough the Bears Ears to Peavine Canyon; and where the s is along the San Juan River, it is essentially the summit the Monument upwarp. Baker (1936) interprets the axis the Monument upwarp as splitting into two subordinate es in the southern part of the fold, and maps the most stern of these subordinate axes as the Halgaito anticline e Figure 3.)

Baker (1936) describes the Halgaito anticline as follows:

The slightly sinuous axis of the Halgaito anticline, an elongated l, trends nearly due north through the eastern parts of Tps. 41 and S., R. 17 E The eastern flank of the anticline has an average dip about ½° for a distance of 2¼ miles east of the axis and then pens to a maximum observed dip of 6½°. The west flank of the icline is less regular than the east flank Near the San Juan River re is an uninterrupted westerly dip of 1° to 3½° extending for ut 15 miles from the crest of the anticline to the axis of the Oljeto cline. In the eastern part of T. 42 S., R. 17 E., however, the gently ping west flank of the anticline is modified by a narrow belt of steep t dips extending from sec. 2 to sec. 36 in which the maximum ob-ved dip is 24°. The steep dips are terminated by a small syncline, se axis extends from sec. 3 to sec. 27. T. 42 S., R. 17 E. West of syncline the beds rise at an angle of about 2° to the crest of a thward-plunging anticlinal nose which extends from sec 4 to sec. 32, 42 S., R. 17 E. West of this nose the beds dip 1°-4° W., to the axis the Oljeto syncline. There are two distinct structurally high points the Halgaito anticline, both of them rising to about the same altitude. center of the south dome is near the west quarter corner of sec. 13, 42 S., R. 17 E., and the center of the north dome is north of the San n River in the eastern part of sec. 14, T. 41 S., R. 17 E. The low nt in the saddle between these domes is in sec. 25, T. 41 S., R. 17 E., is about 100 feet below the apices of the domes (see Figure 3). At south end of the anticline the strata dip southward from the top he south dome to the Utah-Arizona State line. On the north side of north dome the axis of the anticline plunges to the northwest, but extent of the anticline north of the San Juan River is unknown.

The surface rocks over much of the anticline are in the Rico forma- and the Halgaito tongue of the Cutler formation floors a long dip e on the west flank of the anticline west of the rim of Douglas Mesa. oldest rocks exposed at the crest of the anticline in the canyon walls he San Juan River are about 1,020 feet below the top of the Hermosa nation, of Pennsylvanian age.

Balanced Rock Anticline—The axis of the Balanced Rock icline extends northward from the Utah-Arizona State

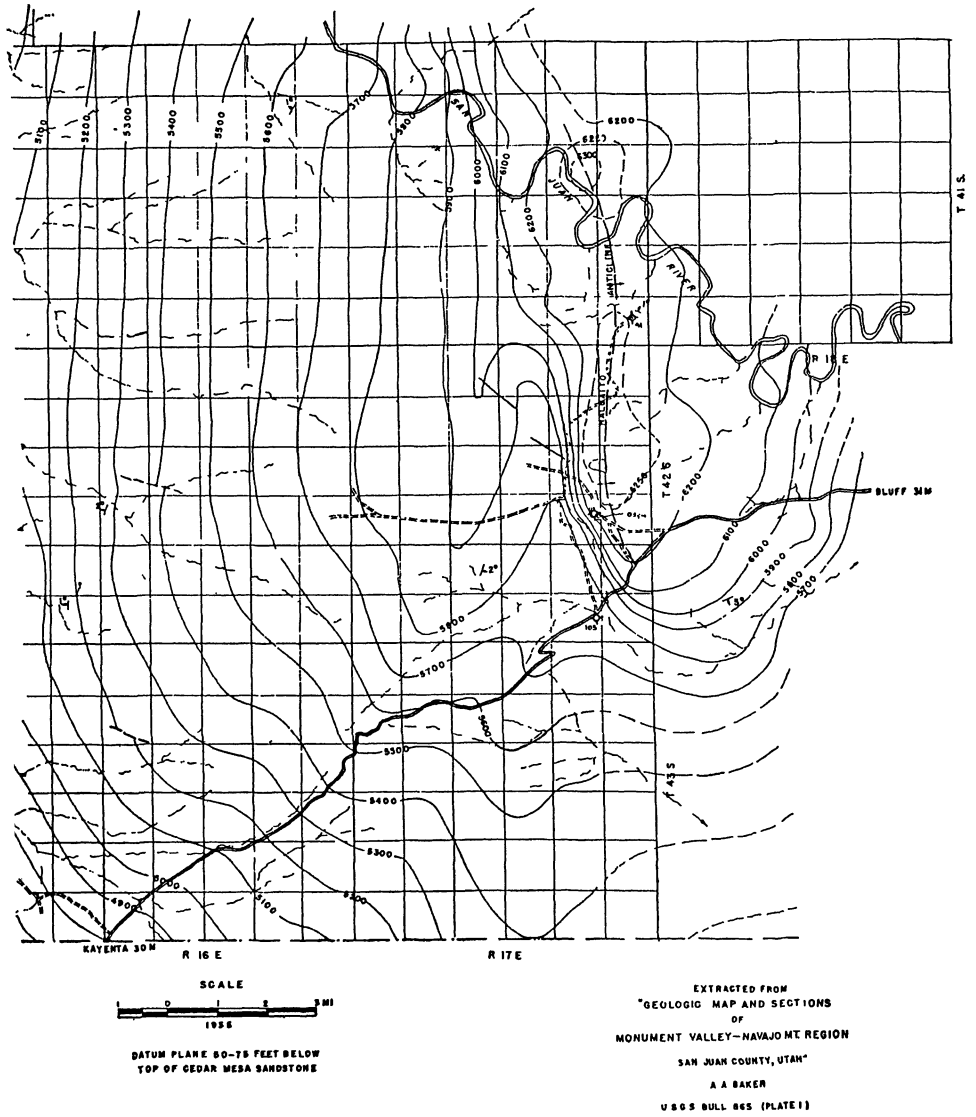


Figure 3.—Structural contour map of Halgaito anticline area.

ne near the southwest corner of sec. 35, T. 43 S., R. 12 E
the San Juan River at the northwest corner of sec. 22,
t S., R. 12 E. Near the river the axis of the anticline swing
the northeast and extends on north of the San Juan River

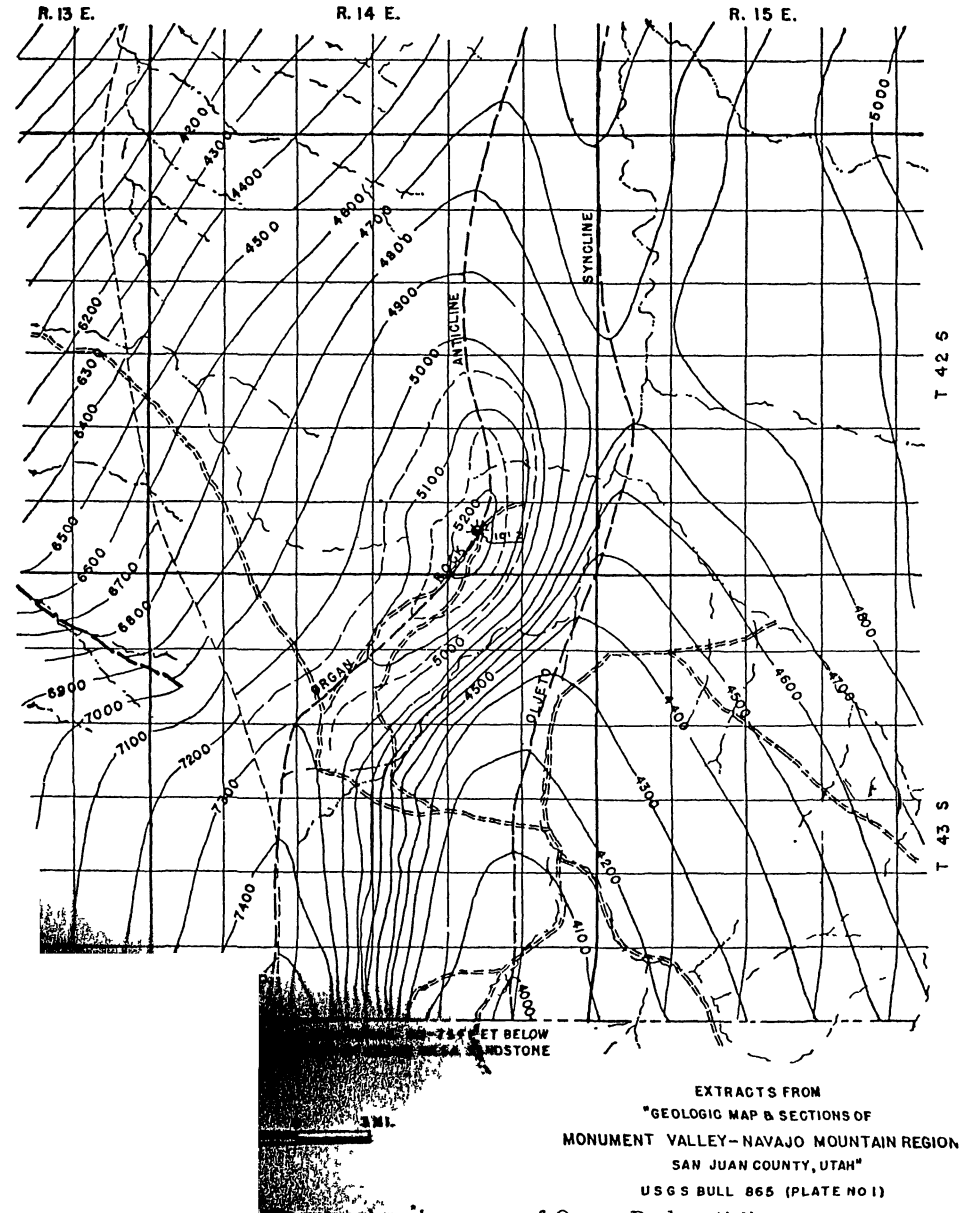
This structure is an asymmetric fold with a steep ea
ank and a gently dipping west flank. The east flank dip
bout 2° near the State line, but gradually steepens towar
ie north and dips 30° or more near the San Juan River. Th
ructural relief between the axis of the anticline and the ax
the Nokai syncline, which adjoins it on the east, increase
orrespondingly from about 50 feet at the State line to abou
100 feet at the river. The maximum observed dip on th
est flank is about 5°. The crest of the anticline plunges t
ie north about 900 feet in a distance of 12 miles from th
tate line, to a low saddle in the southern part of T. 41 S
. 12 E., beyond which it rises to the north or northeas
bout 200 feet in a distance of 4 miles. There are no close
omes on the crest of the anticline between the San Jua
iver and the Utah-Arizona State line.

The upper part of the Cedar Mesa sandstone member o
ie Cutler formation in the canyon of the San Juan River
t the crest of the anticline, is the oldest exposed formation
he Chinle formation is the surface rock at the crest of th
nticline throughout most of its length.

Organ Rock Anticline—The Organ Rock anticline trend
few degrees east of north from the Utah-Arizona State lin
t the south boundary of T. 43 S., R. 14 E., to the San Jua
iver in the eastern part of T. 40 S., R. 14 E., and north fo
bout 3 miles. It extends an unknown distance to the sout
eyond the limit mentioned. The anticline plunges to th
orth and gradually flattens in that direction. A closed dom
which centers in sec. 35, T. 42 S., R. 14 E., has a closure
about 150 feet. The Organ Rock anticline is asymmetric wi
a steep east flank and a more gently dipping west flank (s
Figure 4).

There are minor undulations on the west
anticline. The Cedar Mesa sandstone member
formation floors dip slopes on the Organ Rock
the upper part of this member includes the
rocks. Near the State line the Shinarump conglom
Moenkopi formation, and the upper part of the Cutler
tion crop out on the crest and flanks of the anticline.

Wilson Crammer and Company, in 1923, drilled
on the Organ Rock anticline, in sec. 35, T. 42 S., R.
deepest well penetrated the Cedar Mesa sandstone
Halgaito tongue of the Cutler formation, the Rico



...ural contour map of Organ Rock anticline area.

...upper Hermosa at 2,323 feet. One small show-
...was logged in the Rico formation at 950 feet.
...*Dome*—Navajo Mountain is a nearly
...center lies about 2½ miles north of the
...line, in sec. 23, T. 43 S., R. 10 E. The
...dent, and the regional dip is not disturbed
...about 5 miles from the center of the dome.

ps on the flanks range from 4 to 21°, with the steeper dips the west and northwest flanks. The exact closure on the me is unknown because of incomplete mapping.

No igneous rocks crop out in the Navajo Mountain, but is the consensus of opinion that the Navajo Mountain is one the group formed by laccolithic intrusion, like the LaSal, ɔajo, and Henry Mountains.

Beaver Anticline—The Beaver anticline is a northward-ınging anticlinal nose that lies northeast of Navajo Moun-in. Its axis crosses the San Juan River about a mile east the mouth of Cha Canyon, trending a few degrees west of rth, and plunges to the north about 700 feet in 6 miles. ıe anticline is an asymmetric fold. The east flank has a aximum dip of 8 to 10°, and the west flank has an average ɔ of about 4°. The Kayenta formation is the principle sur-ce formation on the anticline.

SAN JUAN OIL FIELD

The San Juan Oil Field is located about 25 miles west Bluff, Utah and includes an oval-shaped area lying between e Mitten Butte anticline on the west and the Comb Ridge ɔnocline on the east. Approximately 115 wells have been illed in the field, mainly in the area north and adjacent the San Juan River. The various horizons producing shows oil and some small production are indicated in the tabula-ɔn of wells drilled in the State of Utah. (See Fig. 5). The occurrences in this field are evidently associated with a ructural syncline, and the meager production of oil is prob-ly due to the lack of hydrostatic pressure and varying rosities in lenticular reservoir beds. The Utah Southern l Company, in 1927, completed drilling a well located in sec. , T. 40 S., R. 18 E., located on the northwest periphery of e San Juan Oil Field. The well encountered mica-schist at depth of 3,610 feet, as indicated in the accompanying well g.

SAN JUAN COUNTY

ɔTURE:	Cedar Mesa	WELL NO.:	S. J. 18
ıNY:	Utah Southern Oil Co.	LOCATION:	SE NE Sec. 28, T. 40 S., R. 18 E.
ENCED:	Sept. 16, 1926		
ıTION:	5,500	COMPLETED:	Sept. 3, 1927
		TOTAL DEPTH:	3,633

BOTTOMED: Mica Schist REF.: Files, USGS, Artesia, N. M.

MATION	Thickness (feet)	Depth (feet)	FORMATION	Thickness (feet)	Depth (feet)
ɔ wash	50	50	Red to brown shale and limestone	25	12(
h brown sandy shale	25	75			
ark gray limestone..	20	95	Light gray sandstone.	15.	13(

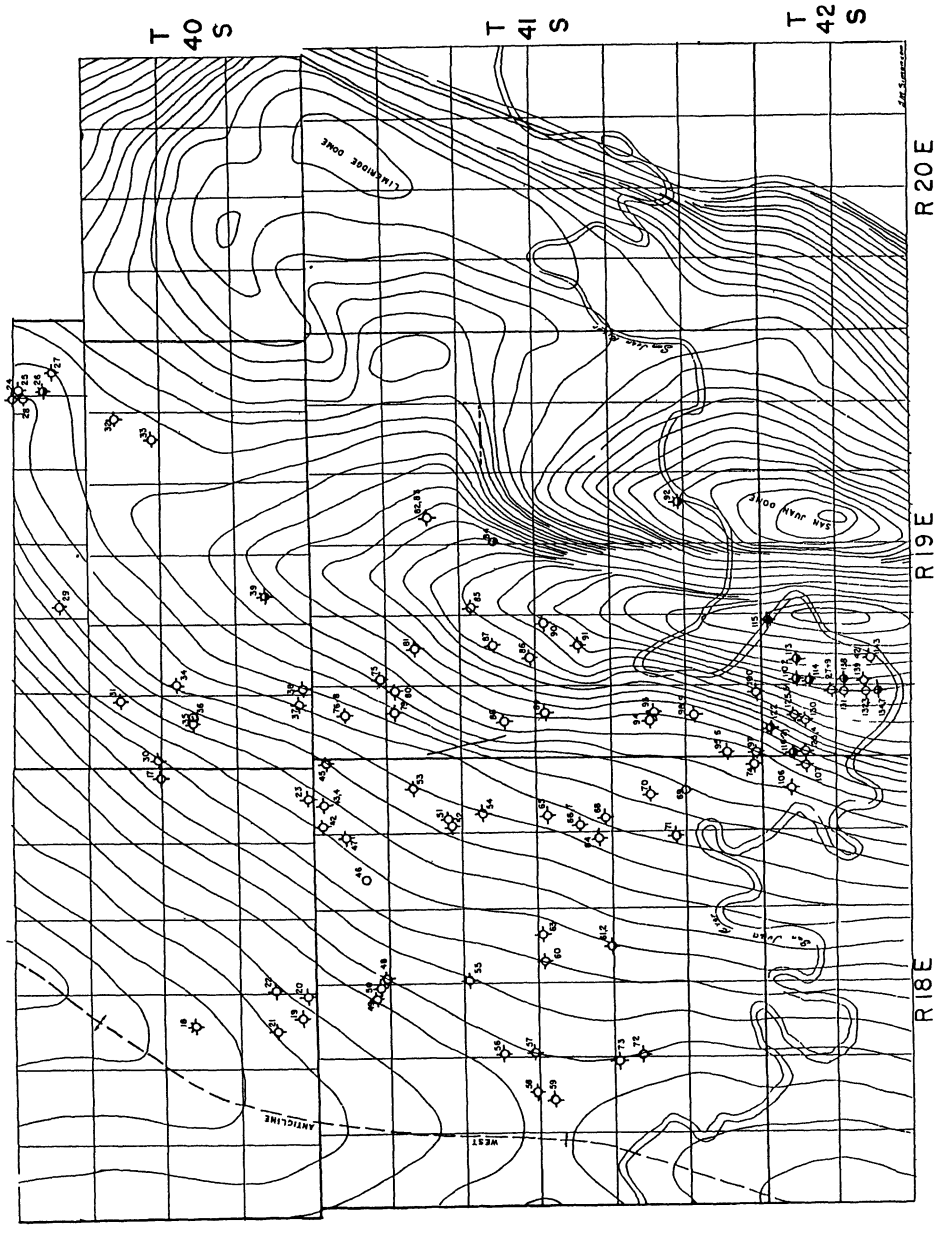


Figure 5

ORMATION	Thickness (feet)	Depth (feet)
gray limestone	10	145
gray limestone	13	158
ish lime and shale	12	170
e lime	33	203
lime, hard	67	270
e lime	7	277
red sand	7	284
rock, hard	10	294
shells and shale	10	304
e lime	7	311
hard sand	24	335
red lime	39	374
lime and shale	21	395
e lime	5	400
e lime	15	415
shale and gray lime	20	435
lime	38	473
e and shells, dark	22	495
e and shells, dark gray	20	515
lime	70	585
lime	15	600
and gray lime	22	622
lime, shelly	38	660
lime, hard shells	40	700
lime	25	725
n shale and lime	20	745
e lime	10	755
lime shale breaks	20	775
lime	15	790
lime	75	865
lime	25	890
lime	15	905
lime and shale breaks	10	915
sandy lime	20	935
lime	15	950
lime	20	970
shale	10	980
lime	20	1,000
lime	75	1,075
wn sand	20	1,095
own lime shale	70	1,165
rown lime shale	25	1,190
lack shale	10	1,200
Black lime	15	1,215
Gray shale	20	1,235
Gray lime	15	1,250
Black lime	15	1,265
Gray lime	40	1,305
ray shale	10	1,315
ray lime broken	25	1,340
lack lime	13	1,353
Gray lime	24	1,377
Gray lime, broken	46	1,423
Gray lime, broken, some shale	12	1,435
Gray lime, hard	28	1,463
Lime, shale gray	7	1,470
Gray lime	30	1,500
Gray lime	30	1,530
Gray lime	20	1,550
Blue shale	5	1,555
Sandy shale	6	1,561
Gray sand, slight showing of gas	9	1,570
Gray lime	55	1,625
Gray lime, broken	5	1,630
Gray lime, hard	20	1,650
Gray lime	15	1,665
White sand	5	1,670
Gray lime	30	1,700
Gray lime	60	1,760
Gray lime, shells	14	1,774
Gray lime	24	1,798
Gray lime, broken	22	1,820
Blue lime shale	20	1,840
Blue shale	20	1,860
Blue shale	30	1,890
Hard pink lime	10	1,900
Gray lime	5	1,905
Blue and lavender shale	20	1,925
Gray lime	10	1,935
Brown shale	10	1,945
Gray lime	15	1,960
Brown shale	15	1,975
Red shale	40	2,015
Red lime shale	5	2,020
Gray lime	25	2,045
White lime	110	2,155
Gray lime	45	2,200
White lime	100	2,300
Gray sandy lime	70	2,370
Brown sand, limey (carrying salt water)	20	2,390
Sandy lime	60	2,450
Hard gray lime	135	2,585
Gray lime	175	[illegible]
Gray lime	[illegible]	[illegible]
Gray sandy lime	[illegible]	[illegible]
Gray lime	[illegible]	[illegible]
Sandy lime	[illegible]	[illegible]
Black shale	[illegible]	[illegible]
Gray lime	[illegible]	[illegible]
Gray sandy lime	[illegible]	[illegible]
Gray lime	[illegible]	[illegible]
Brown shale, sandy	[illegible]	[illegible]
Gray sand, dry	[illegible]	[illegible]
Blue shale	[illegible]	[illegible]
Gray lime	[illegible]	[illegible]
Green shale, sandy	[illegible]	[illegible]

FORMATION	Thickness (feet)	Depth (feet)
Gray lime	15	3,230
Gray lime	60	3,290
Sandy lime	50	3,340
White sand or granite wash (carrying little water)	270	3,610
Gray to green mica schist	23	3,633

BOUNDARY BUTTE ANTICLINE

This anticline is located in T. 43 S., Rs. 22 and 23 east. Reconnaissance mapping, as shown by Fig. 6, indicates a structural closure of about 600 feet. Surface rock is Jurassic in age. Ten wells have been drilled on this structure, of which three have logged gas production and some oil production, as is indicated in the tabulation of wells drilled in the State of Utah.

COLORADO RIVER SALT BASIN

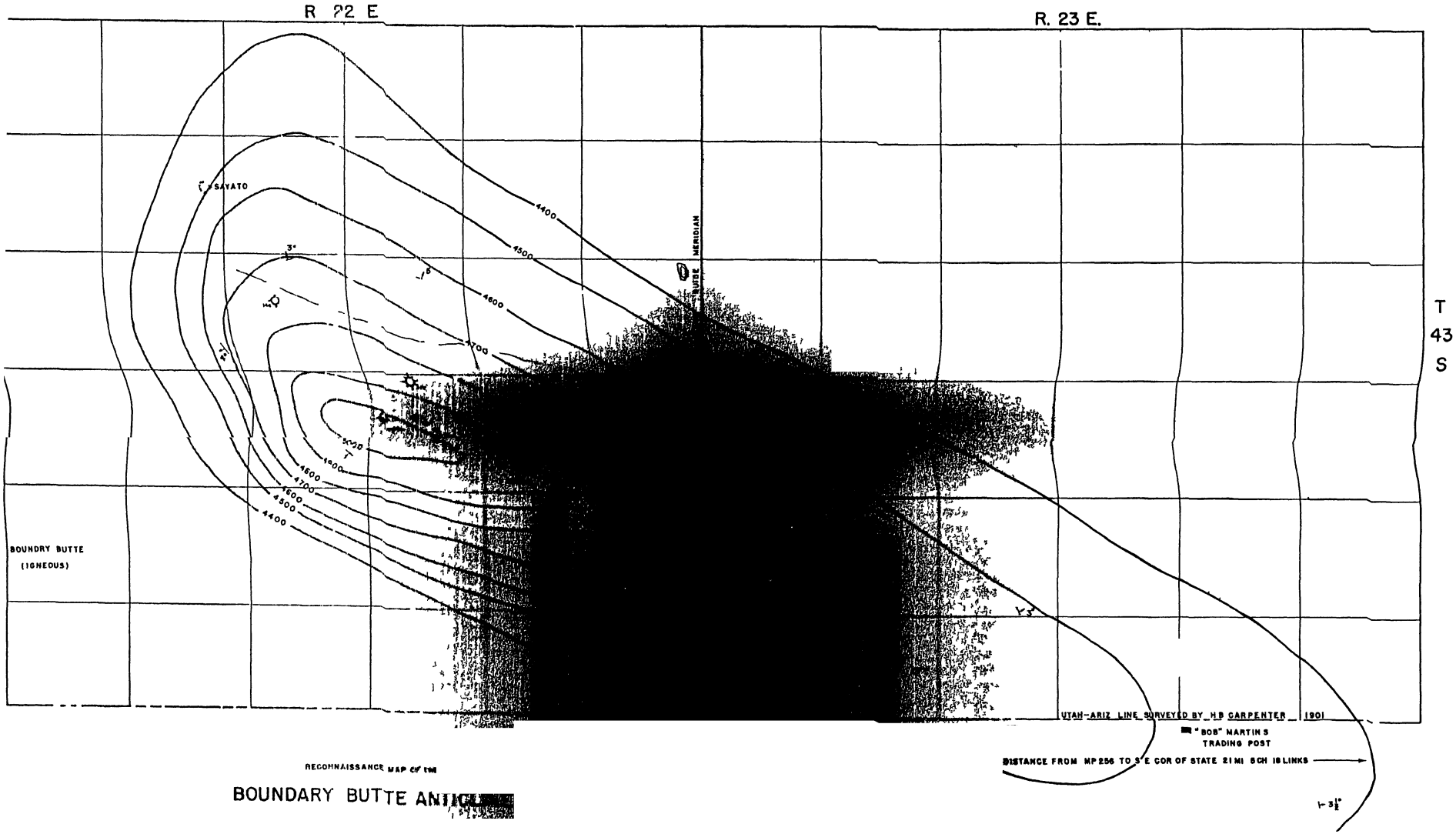
The Colorado River Salt Basin embraces 19,000 square miles of southeast Utah and southwest Colorado and was named from the thick evaporite deposits found in Pennsylvanian strata. The basin is elongate with a northwest trend and lies southwest and parallel to the Uncompahgre uplift; it is at least 150 miles long and about 80 miles wide. Exact outlining boundaries have not been established, particularly for the limits to the northwestward and southwestward.

Stratigraphic or facies changes present on the true periphery boundaries of the salt basin should provide interesting possibilities for petroleum accumulation.

Utah Salt-Dome Region—Within the Colorado River Salt Basin the evaporites of the Pennsylvanian strata have, in part, expressed a plastic characteristic and various surface forms have been developed which are directly allied to the movement or presence of the chemical sediments. The area in Utah and Colorado thus affected by the evaporites has been termed "The Utah-Colorado Salt-Dome Region."

A recognized portion of the region in Utah has been mapped, *in part, by the U. S. Geological Survey and is included* [illegible] *(in folder): "Preliminary Map Showing Geologic* [illegible] *Parts of Grand and San Juan Counties, Utah."* [illegible] in Colorado has recently been mapped [illegible] Survey and is included as Plate VI [illegible] Oil and Gas Map No. 93."

[illegible] of these maps indicates the salt cored [illegible] Colorado have been exposed by erosion to a [illegible] than similar structures in Utah. Geologic in- [illegible] based upon examination of the Colorado region, [illegible] applicable in defining similar structures in the [illegible] of Utah. Pertinent excerpts and diagram- [illegible] prepared by Stokes (1948) in discussion [illegible] area follow:



RECONNAISSANCE MAP OF THE

BOUNDARY BUTTE ANTIC[redacted]

The Utah-Colorado salt-dome region is characterized by a series of elongate earth flexures that are fundamentally anticlinal in nature but which have been variously modified by collapse folds and normal faults. Ignoring the LaSal Mountain intrusives there are eight major units: Gypsum Valley, Paradox Valley, Sinbad Valley, Spanish Valley, Onion Creek, Castle Creek Valley, Salt Valley, and Lisbon Valley. Among the minor features deserving notice are Upheaval Dome, Cache Valley, Meander Anticline, and Shafer Dome. Alternating with these anticlinal folds and domes are corresponding synclinal features but these are all relatively simple and need not be named here.

The most conspicuous regional characteristic is the common orientation of the faults and fold axes in a northwest direction. The individual faults and fold axes mostly lie parallel to the long axis of the Uncompahgre Plateau to the north and east. This regional uniformity of trend is evidently a reflection of important deep-seated breaks in the basement rocks that are part of a system of earth structures initiated in the late Paleozoic at the time of the creation of the Ancestral Rockies. A few faults and folds have a northeast trend and seem to belong to another, perhaps even more ancient, system of crust fractures.

The various anticlinal structures appear to occur in linear series along more or less well-defined northwest-trending zones. Along the individual zones deformation has taken various forms and has not been uniform or continuous. In one section the dominant structure may be a normal fault, in another section a collapse anticline, and in still another a graben zone. In the midst of this system of faults and folds rise the LaSal Mountains. These appear superficially to bear little or no relationship to the other structures but it has been noted that certain of the intrusions occupy structures that have the same trend and shape as adjacent ones that are associated with salt and gypsum.

That most of the structures are closely connected with salt flowage and solution is abundantly clear but the controlling influence of folds and breaks in the basement rocks below the salt must also be taken into account. At certain times and places the salt and gypsum have acted as ordinary rock and have suffered the same deformations as contiguous units in the section. At other times and places the saline beds have behaved independently and through plastic flow and solution have produced large-scale structures that have no expression in the deep-seated rocks. The connection between near-surface and deep-seated structures is obscure, and geophysical methods will probably have to be employed to gain an understanding of this phase of the structure.

As shown by the field relations the salt and gypsum had been forced into many elongate and localized structures by the end of the Paleozoic. Along these structures the Pennsylvanian and Permian rocks stand at high angles exhibiting unconformable relations with the overlying beds As a general rule the older beds have steeper dips and show more intense deformation than the younger beds. Rocks above the salt and only a short distance away may show little or no effects. Many of the salt structures continued to grow and reassert themselves in the Mesozoic periods but it is entirely possible that others did not move after the Paleozoic and had no surface expressions for long periods of time. The highest stratigraphic horizon reached by the salt so far observed is the base of the Morrison formation but it is evident that not all masses reached this position. (See Figure 7).

The arrangement of practically all the salt structures along well-defined northwest-trending zones strongly suggests a genetic relationship to fault systems in the basement rocks. Faults that are known to involve only thin non-saline strata and crystalline rocks near the salt dome area have the same trend as those involving the saline sediments

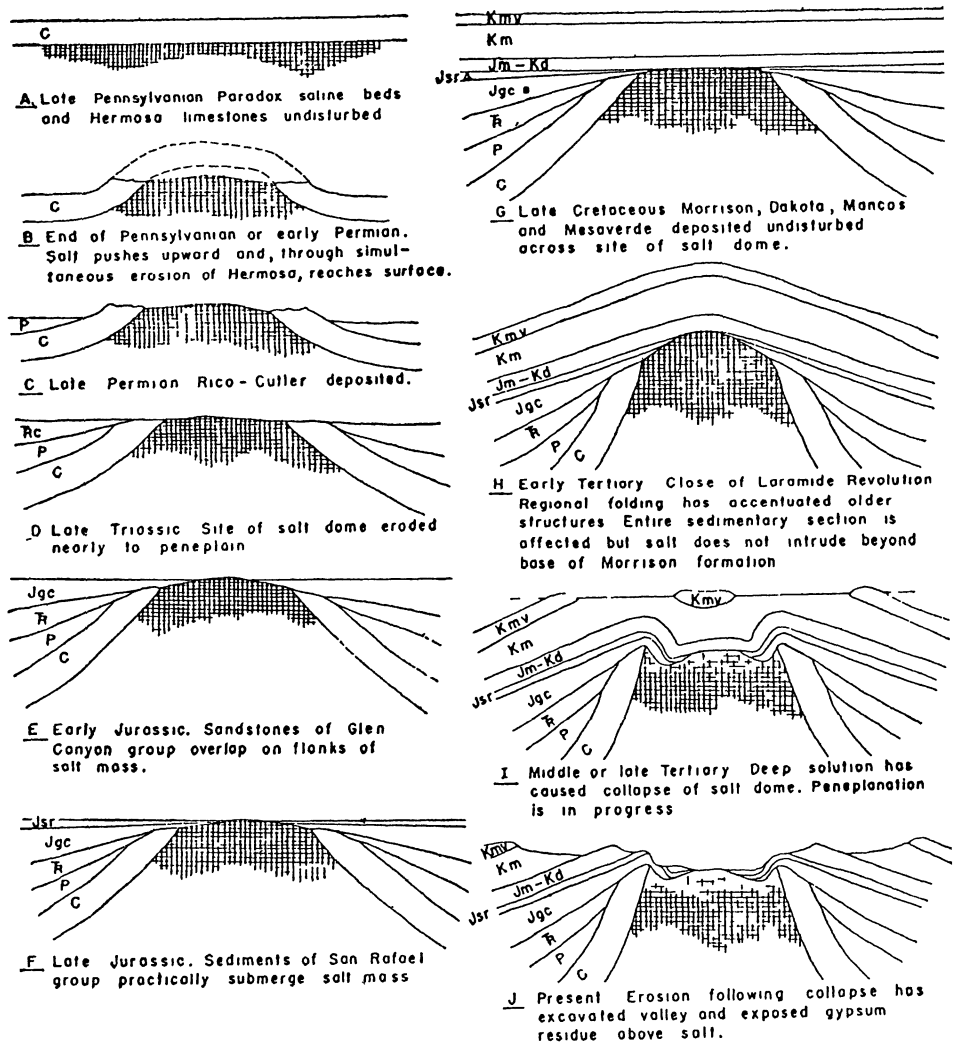


Fig 7 EVOLUTION OF GYPSUM VALLEY TYPE SALT STRUCTURE

Vertical scale greatly exaggerated, width of salt mass at highest point about 3 miles (Cross-lined symbol indicates Paradox formation, C, Hermosa fm, P, Permian fms, R, Triassic fms., Jgc, Glen Canyon group, Jsr, San Rafael group, Jm-Kd, Morrison to Dakota fms, Km, Mancos shale; Kmv, Mesaverde group)

Boulder Knoll-Dove Creek Structures—To the east of the town of Monticello are located two large structures similar in general outline to the so-called typical salt dome structures to the north, but lacking the graben valley-like topography. The Western Natural Gas Company has recently completed the drilling of a deep test on the Boulder Knoll structure. It commenced in Dakota and bottomed in Cambrian, at a total depth of 8,680 feet. This well, although furnishing showings at various depths, as indicated by the accompanying log, was abandoned temporarily; but it is under prospects of being reopened because of recent oil and gas showings in an adjacent structure just to the southeast, in Colorado, known as the Dove Creek.

SAN JUAN COUNTY

JCTURE: Boulder Knoll
PANY: Western Natural
MENCED:
VATION: 6,850
WELL NO.: S. J. 12
LOCATION: Sec. 23, T. 34 S., R. 25 E.
COMPLETED: April, 1948
TOTAL DEPTH: 8,680
BOTTOMED: Cambrian
REF.: Re-copy Fitts 2-48 - Sinclair Wyoming Oil Co.

ORMATION	Thickness (feet)	Depth (feet)
.OTA		
white med. gr. friable, porous sd. gray ale streaks	18	18
mes coarser, poorly rted & bentonite	32	50
se white round posted	5	55
ite; brown waxy derclay	8	63
gr. poorly sorted nt. sd.	27	90
Orthoclase grains coarse poorly sorted . sd.	16	116
:RISON green waxy & sdy. ale	8	124
e med. gr. qutz. & nt. bond sd	16	140
coarse arkose & ert congl.	10	150
sdy. bentonite	20	170
brown argill. band	20	190
brown finely mic. shale	10	200
hard poorly sorted kosic sd.	10	210
Hard qtzitic arkosic sd. & benton.	10	510
Shales	35	545
Blocky brown & red brown shale	5	550
Cream med. coarse arkosic sd.	20	570
Green & brown sandy shale	30	600
Cream porous sand	10	610
Green sandy shale	10	620
Gray med. gr. sd.—finely glauconitic	10	630
Smooth gray green sh. red. sd. purple sh.	20	650
White med. coarse sd	40	690
Brown med. crystallized ls. —cream dense limestone	32	722
SUMMERVILLE (?)*		722
Blocky red brown clay shale	43	765
(Much malachite & azurite)	(760)	
ENTRADA (?)*		765
Red brown shale and red sand	15	780
Red. med. gr. friable sand	25	805
Med. coarse poorly sorted sand	10	815
Smooth red brown & gray green sh.	25	840
Pink sand	40	880
Red orange med. coarse sand	30	910
Pink & white med. gr. poorly sorted sd.	30	940
CARMEL (?)*		940
Purple & green mottled shale	30	970
Red brown fine shaly sand	10	980
Cream white dense sand	10	990
Red brown shale & fine sand	10	1,000
Purple sh.-Bright red orange sd.	30	1,030
Bright red shaly sand	130	1,160
NAVAJO		1,160
Coarse pink round frosted sand	20	1,180
Bright red sandy shale	40	1,220
White sand	140	1,360
Cream to orange med. gr. sand	40	1,400
Red & green shales	10	220
Cream med. coarse hard sd.	20	240
Blocky red brown shale	10	250
Pale green argill. dense ls.	20	270
Hard bright green shale	15	285
Bentonite & green limy shale	38	323
Meta-bentonite silts—variicolored (Bright red accessory minerals at 355)	47	370
Purple shale	10	380
Highly indurated meta bentonite	10	390
Sand and shales	10	400
Med. gr. very hard arkosic sand	40	440
Tan dense limestone	10	450
Brown, tan & greenish finely arkos.	10	460
Sdy. sh.; cream, tan & greenish	10	470
Fresh water dense ls. bentonite	10	480
Pale green qtzitic sd.	10	490
Cream coarse arkosic sand	10	500

*Added by authors.

(No returns)	55	1,455
(Skipped)	15	1,470
Porous white sand	60	1,530
KAYENTA		1,530
Bright red orange sand	20	1,550
Purplish red med. gr. sand	20	1,570
Purplish white med. coarse sand pale amethyst color & biotite	70	1,640
Coarse purple impure sand & purple fine crystallized limestone	30	1,670
Coarse salmon-purple porous sand & plastic purplish red shale	30	1,700
WINGATE		1,700
Bright red brown sh. mic. thin hematite-red sh. streaks & red medium gr. evenly sort. sd.	265	1,965
Dark red brown fine silty shale and fine argill. & silty sd.	160	2,125
CHINLE (Unconformity)		2,125
Reddish purple gritty shale with green polka-dots	15	2,140
Pale green fine ls. & calc. sh. & smooth vivid purple-red shale with calc. nodules	90	2,230
Purple & greenish very fine crystaline ls.	190	2,420
Dark blocky purple shale	110	2,530
Conglomerate limestone	15	2,545
SHINARUMP (Unconformity)		2,545
Dark red brown mic. sandy sh. & pink por. impure mic. sand	55	2,600
Light-colored med. coarse arkosic sd. & green shales	45	2,645
MOENKOPI		2,645
Coarse calc. congl. & gray ls. & dark red brown highly mic. gritty shale	65	2,710
Dark purplish red brown shale	20	2,730
Med. gr. impure mic. sd. & calc. argill. sd.	30	2,760
Mottled red & white impure ls.	30	2,790

RMATION	Thickness (feet)	Depth (feet)
t red-range fine ar-		
. sd.	40	2,830
red impure mic. sd.		
h acc. large sd. gr.	30	2,860
e shale banded gran-		
wash.	40	2,900
arkosic sd.-green &		
Sh.	170	3,070
hale & argill. sand	30	3,100
ish gray calc. sand,		
& nodular limestone	40	3,140
nish purple arkosic		
large mica flakes	20	3,160
and orange sand	30	3,190
t red, orange &		
ly sand	28	3,218
rown gritty mic.		
le	5	3,223
coarse poorly sorted		
d	27	3,250
LE CUTLER		3,250
, finely crystallized		
ydr.	100	3,350
brown mic. & gritty		
le	10	3,360
se granite wash	130	3,490
um grained sand	30	3,520
e, pink, purple &		
nge sd.	80	3,600
coarse arkosic sand	30	3,630
calated anhydrite shales		
t orange med. gr. sd.		
c. bond	40	3,790
se granite wash (por-		
s)	30	3,820
& red finely crystal-		
ed ls.	90	3,910
e medium finely mic.		
	40	3,950
nish gray dolomitic		
ale	20	3,970
se porous granite wash	50	4,020
brown micaceous shale	5	4,025
brown finely crystal-		
ed ls.	30	4,055
se purple granite		
sh	30	4,085
crystalline limestone		
micaceous sand	50	4,135
ite wash and shale	195	4,330
ht red brown highly		
c. sh.	10	4,340
es, clastic ls. & dolo-		
tic, oolitic ls.	50	4,390
Coarse granite wash	10	4,400
Calcitic grit & finely calc. sd.	20	4,420
Red, brown, & gray mica- ceous ls.	20	4,440
Finely crystallized dolo- mite & semi-dense lime- stone	40	4,480
Dolomitic sand, micaceous shale & white fine calc. grit	40	4,520
Green gray dolomitic ls.	30	4,550
Gray argill. ls., shale & sand	90	4,640
Arkosic sand & dark brown sand	40	4,680
Green limestone, gray sand, & micaceous shale	20	4,700
Hard dark brown mic. sh. & ls.	20	4,720
Black sh., Gray sand, & sandy ls.	30	4,750
Dove gray finely crystal- line dolomitic lenses	10	4,760
Gray ls., black sh., mic. sd.	70	4,830
Arkosic sand	20	4,850
VIRGIL (Unconformity)		4,850
Gray gritty ls. & mic. shales	50	4,900
Brown, finely crystalline dolomitic ls. (oolitic)	40	4,940
Light gray dolomitic, oolitic, fossiliferous ls.	20	4,960
Massive dolomitic ls. gray sh.	30	4,990
Oolitic marl and calcitic & silty sandstone	40	5,030
Gray shales, argill. sd., massive gray ls.,-brown chert	100	5,130
Light gray medium grain- ed sandst.	20	5,150
Light gray to dark gray ls. & sh.	70	5,220
Cream, tan, medium cry- stalline, dolomitic ls.	40	5,260
TOP OF PARADOX TYPE SEDIMENTS		5,260
Dark calc. sh., thin cri. ls., vuggy dolomite with salt anhydrite crystals included	40	5,300
Mic. sand & black shale	30	5,330
Hard brown compact ls.	20	5,350

FORMATION	Thickness (feet)	Depth (feet)
Massive dark gray to black ls. with interbedded black shale	90	5,440
Fine grade dolomite oolites, intercalated anhydrite	50	5,490
Black argill. ls. & sooty black sh.	30	5,520
Light colored dolomites	50	5,570
Black ls. & shales	70	5,640
Gray to tan dolomites	65	5,705
Gritty dark gray to black shale	70	5,775
EVAPORITE SECTION		5,775
Dolomite, sand, white med- ium crystallized anhydrite & shales	105	5,880
Hematite, red mic. sh., gray sh., and anhydrite	34	5,914
TOP OF SALT		5,914
Halite, shales, silts, and interspersed anhydrite, selenite, & some thin bedded dolomitic lime- stone members	1,966	7,880
Dark gray ls. with inter- calated anhydrite	30	7,910
Hard brown finely crystal- line siliceous limestone	25	7,935
MOLAS		7,935
Gray brown fine crystal- line dolomitic ls. & some brown vitreous chert	25	7,960
Green and purple finely crystalline limestone & shales	40	8,000
Mottled green, purple & red shales with vari-col- ored ls. (jasper)	40	8,040
MISSISSIPPIAN (Un- conformity)		8,040
Limestone, shales & ooli- tic ls.	50	8,090
(Endothyra bailey)	5	8,095
Buff gray oolitic dolomite limestone	5	8,100
DEVONIAN		8,100
Gray medium crystalline sucrose dolomite	15	8,115
Gray med. crystalline vug- gy dolomite	20	8,135
Brown gray med. crystalline sucrose dolomite	25	8,160
Green, tan & gray med. crystalline porous & vuggy dolomite	50	8,210
White med. crystalline highly dolomitic lime- stone	30	8,240
Brown siliceous dolomite ls.	10	8,250
Granular white chert	10	8,260
Gray brown siliceous dolo- mite ls. (Favocites)	10	8,270
Gray compact dolomite & white chert	50	8,320
Brown siliceous dolomite & dolomitic ls.	40	8,360
ELBERT FORMATION (Unconformity)		8,360
Buff gray dense ls. - oolitic dolomite	30	8,390
Black dolomitic limestone	10	8,400
Gray & brown dolomite	30	8,430
Tan med. coarse magnes- ium ls.	20	8,450
Brown & gray ls. & dolo- mite	20	8,470
Tan dolomite & blue-gray meta-bentonite	10	8,480
Gray & tan med. crystal- line sucrose dolomite	30	8,510
Green shale & brown siliceous dolomitic ls.	10	8,520
Splintery green shale & tan lithographic lime- stone	30	8,550
Tan & gray dolomite with coarse sand grains	45	8,595
Tan sandy oolitic ls. & coarse limy sand	5	8,600
White coarse quartzite	10	8,610
Green sandy dolomite & ls.	30	8,640
Green sh. & red & green ls.	10	8,650
White quartzite, sandy dolo- mite & dense ls.	10	8,660
White coarse qtzitic sd., possible light oil stain dark gray sh.	15	8,675
CAMBRIAN		8,675
Gray impure argill. sand	5	8,680

POSSIBLE OIL STRUCTURES AND DRILLING HISTORY

As indicated previously by Stokes, many named geological structures occur in the Utah salt dome region (See Plates III and IV) Anticlines such as Salt Valley, Moab, Spanish Valley, and Onion Creek are recognized salt-generated structures. Other structures not mentioned here, but indicated on Plate III, likely have a similar origin—each structure, however, has its own peculiar characteristics which must be taken into account in evaluating its potential possibilities.

Nearly all of the anticlinal forms in the region have experienced sample drillings. With the exception of one or two structures, most of the drillings have penetrated only into the Pennsylvanian formations. A great many wells were so located as to explore only the crests of the structures and, in general, those wells located on the flanks were either so poorly located in reference to the major geological structure as to constitute an inconclusive test, or they failed to penetrate deeply enough to fully test the flank structural possibilities The Caine Creek anticline, located in T. 27 S , R. 21 E., has furnished the most interesting show of oil of any of the structures yet tested in the region Paraffin based green oil, with a specific gravity of 38 6, was produced for a very short period from the Frank Shafer Well No 1 The Utah Southern Oil Company's well, located in sec 32, T 23 S , R 21 E., on the Salt Valley anticline, also produced a paraffin based green oil of 38 6 Both favorable showings in this instance were developed from the Paradox formation of Pennsylvanian age. (See accompanying log.)

GRAND COUNTY

STRUCTURE Salt Valley
COMPANY· Utah Southern Oil Co
COMMENCED. December 18, 1930
ELEVATION 4,870 Feet

WELL NO
LOCATION;
COMPLETED
TOTAL

BOTTOMED Paradox

FORMATION	From	To
Cellar	1	12
Sand and gypsum	12	20
Shale and gypsum	20	50
Gypsum, set 15½" casing at 76'—cemented	50	95
Black shale	95	120
Blue shale and gypsum	120	200
Gray shale and gypsum	200	225
Blue shale	225	370
Blue shale with streaks of black shale and anhydrite	370	420

FORMATION	From	To
Gray shale		
Blue shale		
Blue shale very sticky		
Blue shale		
Muddy blue		
Blue shale		
Black shale with water		
Shale—hole		

FORMATION	From	To
Hard shale and shell at 869 10' casing set at 869' and 250' heavy mud dumped in hole and displaced behind casing (Later cemented with 50 sacks of cement)	865	883
Salt	883	884
Salt and shale	884	907
Gray shale and salt	907	920
Salt, coring	920	1,124
Salt with small amount of black shale	1,124	1,193
Salt	1,193	1,580
Salt and anhydrite and shale	1,180	1,584
Anhydrite	1,584	1,608
Shale and anhydrite	1,608	1,650
Black shale	1,650	1,684
Gray sandy shale and lime	1,684	1,720
Gray sandy limy shale	1,720	1,735
Black shale	1,735	1,748
Gray sandy shale	1,748	1,754
Black shale	1,754	1,758
Gray sandy, limy shale	1,758	1,763
Gray sandy shale	1,763	1,768
Soft gray shale	1,768	1,801
Sandy shale, core	1,801	1,806
Gray sandy shale	1,806	1,821
Gray shale and salt	1,821	1,829
Salt	1,829	2,408
Anhydrite	2,408	2,412
Black shale	2,412	2,435
Salt	2,435	2,695
Black shale	2,695	2,703
Salt	2,703	2,968
[illegible] and hard gray	2,968	2,984
[illegible]	2,984	3,020
[illegible] shale and	3,020	3,025
[illegible]	3,025	3,075
[illegible]	3,075	3,100
[illegible]	3,100	3,129
[illegible]	3,129	3,321
[illegible] shale	3,321	3,329
[illegible]	3,329	3,349
[illegible]	3,349	3,358
[illegible] gray shale, caving	3,358	3,367
[illegible] shale, with	3,367	3,387
[illegible] and black	3,387	3,390
[illegible] core barrel	3,390	3,399
Conglomerate and black shale	3,399	3,410
Black sandy lime and shale, oil and gas showing	3,410	3,432
Black sandy lime and shale, oil and gas showing	3,432	3,436
Sandy lime, hard	3,436	3,445
Lime and calcite, 8¼ casing set at 3,452 feet	3,445	3,500
Salt	3,500	3,818
Shale and anhydrite	3,818	3,930
Salt	3,930	3,937
Shale and anhydrite	3,937	3,952
Salt	3,952	4,563
Gray shale	4,563	4,590
Salt	4,590	4,596
Salt and shale	4,596	4,672
Black shale	4,672	4,703
Salt, took core, formation is lying flat	4,703	4,706
Salt and shale	4,706	4,735
Salt	4,735	4,785
Salt with a little shale	4,785	4,916
Gray and black shale	4,916	4,930
Shale with a little salt	4,930	4,950
Gray shale	4,950	4,960
Talc	4,960	4,972
Black shale	4,972	4,996
Salt and shale	4,996	5,056
Salt	5,065	5,320
Salt and shale	5,320	5,367
Gray sandy salt	5,367	5,380
Anhydrite	5,380	5,400
Shale and anhydrite	5,400	5,450
Black limy shale	*5,450*	*5,489*
Lime, hard	*5,489*	*5,503*
Lime with small showing of salt	*5,503*	*5,507*
Lime, very hard and black	5,507	5,530
Black shale	5,530	5,534
Lime, hard and black	5,534	5,542
Black shale	5,542	5,547
Black lime	5,547	5,567
Gray sandy shale	5,567	5,604
Mixed black and gray sandy shale	5,604	5,625
Light gray lime and shale	5,625	5,630
Dark gray lime and shale	5,630	5,636
Gray limy shale	5,636	5,646
Black limy shale	5,646	5,654
Gray limy shale	5,654	5,659
Salt with gray shale	5,659	5,670
Salt	5,670	5,794

FORMATION	From	To	FORMATION	From	To
lt with a little shale	5,794	5,841	Salt	6,058	6,059
lt, caving badly, had to cement	5,841	5,890	Salt and black muddy shale or bentonite	6,059	6,065
lt, caving, cemented at 5940'	5,890	5,940	Black muddy shale and salt. Formation has squeezing tendency	6,065	6,091
lt with a little black ale	5,940	6,023	Salt with some black shale	6,091	6,120
lt, black muck or shale	6,023	6,058			

Big Flat Structure—The Big Flat structure is a wide upwarp centered to the west of the Moab anticline between the Colorado and the Green Rivers and extending from the Caine Creek structure on the south, northwestward to the town of Green River, Emery County. The structure is now attracting considerable attention. The Tidewater Associated Oil Company is at present drilling a well in sec. 11, T. 26 S., R. 19 E. This well is considered by many geologists to be strategically located in reference to proving or disproving the possibilities of this major upwarp. The attending map and the following excerpts were taken from a paper recently published by Glen M. Ruby (1948), a consultant geologist who has reinterpreted the structure in the light of recognized regional tilting:

The accompanying map (Figure 8) of "The Big Flat-Salt Wash Anticline" is contoured on the base of the Wingate, as is the USGS map of the same area. However, it is "reconstructed" to show the writer's theory of the effects of very recent tilting, and is presented as an example of the type of study which should precede every location made in this part of Utah. Only information which has been published by the USGS is presented, although the writer in some instances gives his own interpretation of it, based on his own field studies.

The difference in contouring of the two maps of the same area is this: The USGS map shows the structure as it now is (See Plate V), while that by the writer shows it as it was until very recent time. T means that any oil field which might exist there would have a slig inclined oil-water contact, of about one degree, toward the

An adequate test is assured for the Big Flat [illegible] by a well to be drilled by the Tide Water Associated [illegible] block centering in the northeast quarter of [illegible] (unsurveyed). It should encounter the top of the [illegible] about 3,500 ft. and be through that formation at a total depth of 10,000 ft. should also make an adequate [illegible] lying Mississippian limestones and dolomites.

Green River Structure—The Green River structure is defined by the Little Grand fault cutting transverse to the north-plunging nose of the Big Flat upwarp. [illegible] clinal dip to the north of the Little Grand fault [illegible] interest since 1891 when Bamberger and Mills drilled in the SW¼SE¼ sec. 15, T. 21 S., R. 16 E. This commenced in the Mancos formation and bottomed in the [illegible] of Jurassic age at a depth of 1,000 feet. Evidences of commercial shows of oil and gas were encountered. Of

this first well on the Green River structure is located very near the recently drilled Amerada Petroleum Corporation Unit No. 1, located in sec. 2, T. 22 S., R. 16 E. This well attained a total depth of 5,645 feet and is reported to have encountered a strong flow of gas in the Paradox formation near the bottom of the hole. The well has now been abandoned and an offset well is being drilled 554 feet to the south. In 1913, two additional wells were drilled on this structure, one in sec. 21, T. 21 S., R. 17 E., and the other in sec. 20 T. 21 S., R. 17 E. They both commenced in the Mancos and the latter bottomed in the Entrada. No showings of gas or oil were recorded.

In 1919, the Morland Oil Company drilled a well in sec. 35, T. 21 S., R. 16 E. to a total depth of 3,820 feet. According to the well record, this well bottomed supposedly in the Rico formation.

Glen M. Ruby and associates, in 1919, drilled a well located immediately north of the Little Grand fault in sec. 34, T. 21 S., R. 16 E. The well was abandoned after penetrating 5 feet into the Kaibab formation of Permian age, at a total depth of 2,627 feet.

To the north and east of the Big Flat upwarp are a number of structures. In order, from north to south, they are: Moab, Salt Valley, Yellow Cat, Thompson, Crescent, Cisco, Harley Dome, Bitter Creek, Bar X, and several others located to the south of the Uintah-Grand County line and west of the Colorado border. All of these structures have attracted considerable interest and more than 60 wells have been drilled in an attempt to prove or disprove their possibilities. All of *them have approximately a N. 45° W. axial trend. This trend, in all probability, is influenced by the presence of the adjoining* [illegible] *uplift. A number of these structures have been* [illegible] *their crests and have furnished encouraging shows* [illegible] *but none of them, up to the present time, have* [illegible] *commercial producers.*

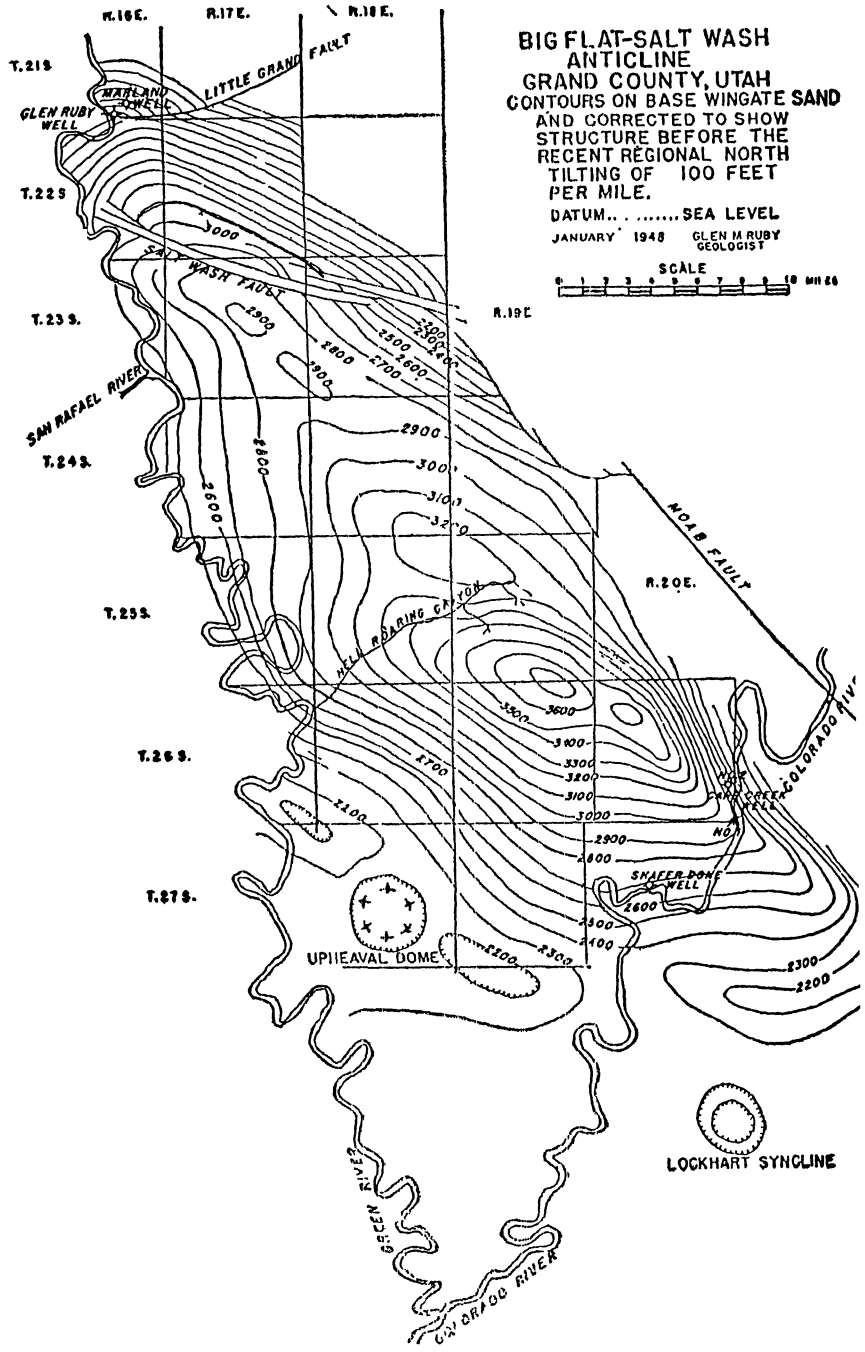


Figure 8.

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ARTHUR L CRAWFORD, Director
UTAH GEOLOGICAL AND MINERALOGICAL SURVEY
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Tab 12

UTAH GEOLOGICAL AND MINERALOGICAL SURVEY
AFFILIATED WITH
THE COLLEGE OF MINES AND MINERAL INDUSTRIES
UNIVERSITY OF UTAH
SALT LAKE CITY, UTAH

DRILLING RECORDS

FOR OIL AND GAS IN UTAH

COMPILED UNDER THE DIRECTION OF

GEORGE H. HANSEN, H. C. SCOVILLE,
AND THE
UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

From the Records of the Oil and Gas Leasing Branch of the Conservation Division of the U.S. Geological Survey

Bulletin 50 February 1955

Price $5.00

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FOREWORD

It was originally planned to include the subject matter of this bulletin in a symposium volume as was done in the first edition of the OIL AND GAS POSSIBILITIES OF UTAH, published by the Utah Geological and Mineralogical Survey in 1949. This revised edition was to have been known as the OIL AND GAS POSSIBILITIES OF UTAH RE-EVALUATED 1954. Two considerations have caused a departure from this procedure:

1. It is now evident that the OIL AND GAS POSSIBILITIES OF UTAH RE-EVALUATED 1954 would be inconveniently voluminous if the DRILLING RECORDS were included as a chapter.

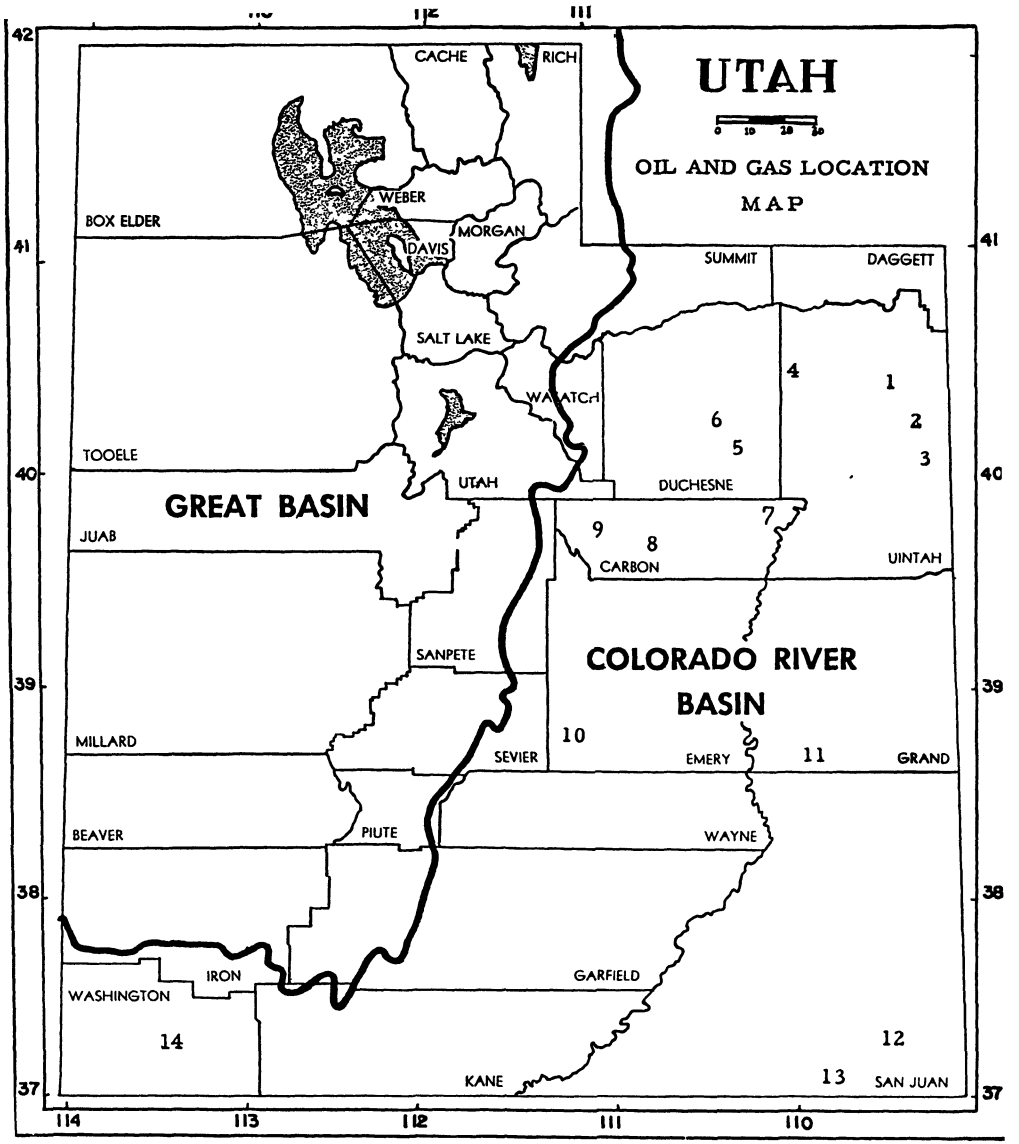
2. There has been increasingly urgent demand for the DRILLING RECORDS, so that it now seems advisable to make them available at once without waiting for the remainder of the material.

Because of these considerations, the present format has been adopted. The number (#50) originally reserved for the symposium volume has been allocated to this bulletin containing the DRILLING RECORDS, and the symposium will be given a later number in conformity with the sequence in which it appears.

One of the unsatisfactory features of the 1949 symposium volume was the great number of large maps appended to it. So bulky were these maps that a separate container had to be provided for them. Furthermore, "tip-ins" were numerous with excessive wear and tear resulting. In the present bulletin and in the larger symposium volume to follow, both "tip-ins" and separate maps have been avoided. Yet, no sacrifice has been made of illustrative material. Instead of one large map of the state showing a plot of all wells, as was attempted in 1949, the present bulletin has 29 maps--one for each county--allowing the extra detail necessitated by the large number of wells drilled since the previous publication. As will be noted, each map was prepared on such a scale that it could be printed on one page, bound into the bulletin, and made an integral part of it. A by-product of this design was the opportunity thus afforded to intersperse the maps with the tabular data so as to bring each county map as nearly adjacent as possible to the recorded data of wells within that county.

We hope and believe that the format adopted will prove pleasing, convenient, and durable.

Arthur L. Crawford, Director
Utah Geological and Mineralogical Survey



FIELDS

1.	Ashley Valley -	Oil	8.	Farnham -	CO_2
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D R I L L I N G R E C O R D S
FOR OIL AND GAS
IN UTAH

Compiled Under the Direction of

Dr. George H. Hansen,[1] H. C. Scoville,[2]
and the
Utah Geological and Mineralogical Survey

ABSTRACT

A well drilled to a depth of 1,000 feet near the to of Green River in Grand County in 1891 was the first e ploratory drilling for oil or gas in the state of Uta

A well-drilling record from 1891 to the present sho that peak years of activity were as follows:

Year	No. of Wells Drilled	Total Footage
1895	20	10,000
1909	22	11,000
1927	34	70,000
1949	55	267,000
1952	84	515,000

Utah's first commercial producer was completed September, 1948, in the Ashley field near Vernal, Uta It is known as Equity #1.

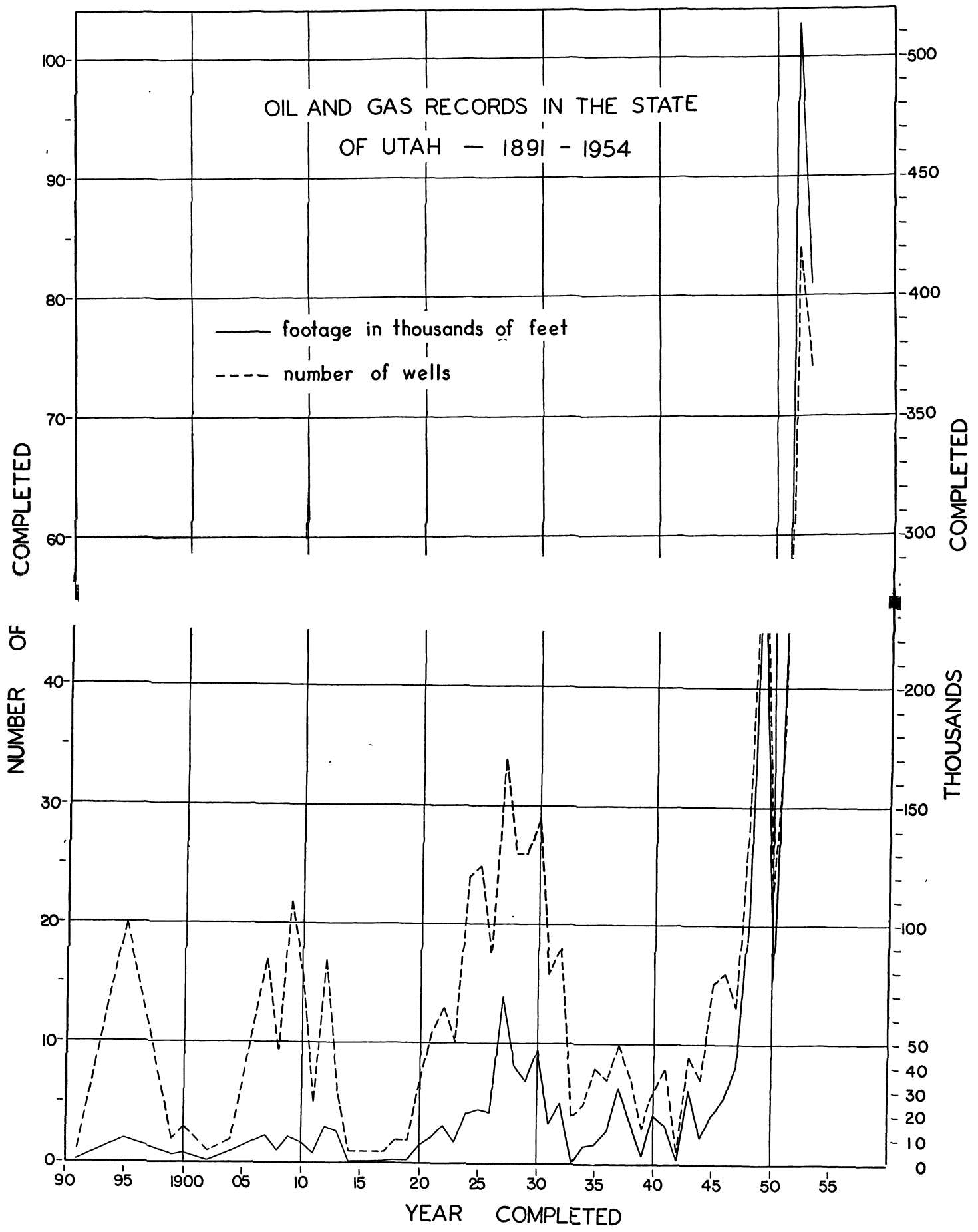
Commercial production in oil or gas, or both, has be developed in the Red Wash, Roosevelt, and Duchesne fields the Uinta Basin, the Clear Creek field on the Wasatch Pl teau in central Utah, and the Bluff and Big Flat fields the southeastern part of the state.

Formational tops for many of the earlier wells are n available, but tops have been identified (and recorded) f most of the later wells.

---

[1]Dean of Graduate School (formerly Head of the Depart ment of Geology), Brigham Young University, Provo, Utah

[2]Formerly District Engineer, Salt Lake City Office the Oil and Gas Leasing Branch, Conservation Division of th U. S. Geological Survey.


OIL AND GAS RECORDS IN THE STATE OF UTAH — 1891 - 1954
footage in thousands of feet
number of wells
NUMBER OF COMPLETED
THOUSANDS COMPLETED
YEAR COMPLETED
100
90
80
70
60
40
30
20
10
0
500
450
400
350
300
200
150
100
50
40
30
20
10
0
90
95
1900
05
10
15
20
25
30
35
40
45
50
55

ACKNOWLEDGMENTS

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The art of digging wells or shafts for water is very old. Lo before the time of Christ, the Egyptians were in possession of t art. Two thousand years before Christ, the oases--Thebian, Shar and Dachel--were watered by numerous artesian shafts, some to 3 feet in depth. Five centuries before Christ, wells to 500 feet de had been dug. By the 12th century, the art of digging wells had be quite well developed in Europe. The first artesian well was brough in, it is said, in the province Artois in southern France in 112 and has been flowing ever since. By the 17th century, artesian wel had been drilled in Italy and Austria as well.

In 1841, the first great well by cable tools was drilled Grenelle, near Paris, France. The history of seven years' incessa labor expended in this well's construction has been equaled in i terest by that of few other engineering enterprises. The story oil is closely connected with the search for artesian water. G and oil seeps were curiosities to early man. Because gas and o would burn, they became useful. Kettles of burning pitch beca the flame throwers of that day. Pitch was also used in times peace to waterproof baskets, as a building stone mortar, and to ma boats seaworthy. Egyptians, Chinese, and American Indians used o as medicine. They rubbed it on their bodies to relieve aches a pains. They swallowed it in spite of the bad taste.

Petroleum geology had its beginning as a science long befo the commercial production of petroleum was started in 1859 by t completion of the Drake well. Observations on the origin of petr leum were made as early as 1788 when Haquett suggested that petr leum came directly from organic material such as mussels. In 184 Sir William Logan, Director of the Geological Survey of Canad noted that the oil seeps on the hills of Gaspe near the mouth of t St. Lawrence River were located on anticlines. This observation w published in 1844 as a progress report on stratigraphic studies The Drake well, drilled to a depth of 693 feet in Titusville western Pennsylvania, was the first discovery oil well in the Unite States. It produced 15 barrels of oil a day.

While Drake was drilling his well in Pennsylvania, the Mormo pioneers were trudging their way by handcart and ox team into t valleys of Utah. In 1891, the Bamberger and Mills Company drill Utah's first oil prospect well in Grand County, in section 15, Town ship 21 S, Range 16 E. It commenced in the Mancos shale and, at depth of a thousand feet, bottomed in basal Morrison or Summerville In 1895, a now unknown company drilled a lake bed wildcat 915 fe deep in Salt Lake County, in section 36, Township 3 N, Range 1 W and obtained a show of gas. In 1900, a well was drilled into lak beds to a depth of 800 feet in Boxelder County, in Township 6 N Range 10 W, with a showing of gas. In 1900, John Pope drilled t first well in Uintah County, in section 35, Township 15 S, Rang 23 E. This well was a thousand feet deep and had no showing of o or gas. In 1908, a well was drilled by the San Francisco and Sa Juan Oil Company in section 13, Township 40 S, Range 19 E, to a dept of 225 feet, with a showing of gas and oil. The well was late deepened to 595 feet. A large number of additional wells we drilled in the general area, but the oil boom was short lived. T first use of natural petroleum in the state of Utah was evidentl in San Juan County. Certain oil seeps were discovered and used f

various purposes. The first well actually drilled for oil was, however, as noted in the foregoing, in 1891, just south of the town of Green River, Utah.

The first commercial producer was the Equity No. 1 well in the Ashley Valley field near Vernal, Utah, in 1948. This was a hundred years after the Mormon pioneers made their first request for statehood under the name of Deseret. Utah's oil and gas history prior to 1954 indicates a large number of wells drilled at the expense of many millions of dollars. At the end of 1948, there had been drilled in the state of Utah more than 550 wells, with a total combined footage of approximately eight hundred thousand feet. More than 360 of these wells were less than 1,000 feet deep, and only 31 were more than 5,000' in depth. A high percentage of the wells drilled prior to 1948 were too shallow either to prove or disprove horizons that represent the drilling objectives of today. It is only within the last few years that deeper tests have been applied that were capable of actually proving or disproving some of Utah's many structures.

Prior to 1948, drilling operations in Utah were spasmodic. In 1895, 20 wells were drilled, but only one in 1902. Twenty-three wells were drilled in 1909. Seventeen wells were drilled in 1913, only one in 1915. A real drilling boom occurred between 1925 and 1930, with thirty-four wells being drilled in 1927. Only four wells were drilled in 1933. From 1933 to 1945, wells were few in number. In 1948, however, fifty-five wells were drilled with a total footage of around 270,000 feet. In 1950, the number of wells dropped to 23, with a total footage of about 80,000 feet. The year 1952 had the all-time drilling high in the state of Utah; 84 wells were drilled, with a total footage of around 515,000 feet. In 1953, 73 wells were drilled with a total footage of about 410,000 feet. As of this writing, there are 23 wells now being drilled in the state, and it looks as if the number of wells for 1954 will be somewhat less than the record number of 1952 or the near-record number of 1953.

It is significant that early drilling operations were mostly shallow wells in terms of present day drilling capabilities. Drilling techniques now make it possible to drill to greater depths, and the possibilities for commercial production are, of course, mathematically greater. Since the discovery well in Ashley Valley in 1948, a number of other fields have come into commercial production, among which are the Red Wash field, the Roosevelt field, the South Duchesne structure, and the Duchesne County area. All are important, but their true significance will not be completely understood until additional drilling operations cover larger areas. The driller's bit has still to test many oil structures in the state of Utah, and the next few years will probably shed much additional light on our true potentialities.

The past drilling records are not always accurately recorded; however, the compilers of this bulletin have listed in tabular form the available and essential information pertaining to all wells drilled in the state of Utah prior to January 1, 1954. It is believed that data so gathered and so arranged will greatly increase the usefulness of available information on the individual wells throughout the state.

Since January 1, 1954, which was the cutoff date for gathering statistics for this publication, several significant discoveries have been made that alter slightly the current picture for exploratory operations in the state. They are briefly listed as follows:

1. Extensions in the Red Wash field in Uintah County have been substantially increased in 1954.

2. Revised well pressure readings in the Clear Creek area of the Wasatch Plateau indicate the probable need for a downward revision of estimates of the ultimate gas reserves for this field.

3. The King Oil Company on the Big Flat area to the northwest of Moab, Grand County, is now in the process of attempting a Mississippian test. If successful, it will represent the first Mississippian production in the state and may have a profound influence on the deeper exploratory efforts in southeastern Utah.

4. The Shell Oil Company's discovery well, Desert Creek #2 (see page 14), near Bluff in San Juan County in the basal Hermosa (Pennsylvanian) formation, may become as important to the Paradox Basin in 1954 as the Equity Oil #1 well was to the Uinta Basin in 1948.

Sample tops for the Desert Creek well are listed as follows:

Navajo	550 feet
Chinle	1,460 feet
Shinarump	2,280 feet
Moenkopi	2,290 feet
Coconino	2,450 feet
Cutler	2,500 feet
Organ Rock	2,820 feet
Hermosa	4,280 feet
Paradox	5,200 feet
Leadville	6,215 feet
Ouray	6,380 feet
Elbert	6,585 feet

OIL FLOWS IN DESERT CREEK,
NAVAJO INDIAN RESERVATION,
SAN JUAN COUNTY, UTAH

Aerial view of discovery well (Desert Creek #2) of Shell Oil Company, drilled in 1954, C SE SE, sec. 35, T. 41 S., R. 23 E., Salt Lake base and meridian. Initial production, 1,128 barrels oil per day.

STATE AND FIELD	DRILLING		PRODUCING					
			ACTIVE		SHUT IN			
	Act.	Susp.	Oil	Gas	Oil	Gas	Abd.	Total
UTAH								
Ashley Creek	1	0	30	1	0	1	8	41
Bar-X	0	0	0	0	0	1	0	1
Brennan Bottom	0	0	0	0	1	0	0	1
Chapita Wells	0	0	0	0	1	0	0	1
Cisco Dome	0	0	0	1	0	0	17	18
Clay Basin	0	0	0	9	0	1	5	15
Clear Creek	2	2	0	10	0	1	3	18
Duchesne	0	0	2	0	0	0	1	3
Duchesne County	0	0	2	0	0	0	0	2
East Farnham (CO_2)	0	0	0	0	0	1	0	1
Farnham (CO_2)	0	0	0	3	0	0	1	4
Flat Canyon	2	0	0	0	0	1	0	3
Flat Mesa	0	0	1	0	0	0	0	1
Gordon Creek	0	1	0	0	0	2	1	4
Gusher	0	0	0	0	2	0	1	3
Last Chance, South	0	0	0	0	0	2	5	7
Peters Point	1	0	0	0	0	2	1	4
Red Wash	1	1	14	2	13	0	0	31
Roosevelt	0	0	8	0	0	0	4	12
San Juan	0	0	0	0	7	0	118	125
Virgin	0	0	0	0	22	0	117	139
Walker Hollow	0	0	3	0	0	1	2	6
West Pleasant Valley	0	0	0	0	2	0	1	3
Other Areas	13	14	0	0	0	0	395	422
Total Utah*	20	18	60	26	48	13	680	865

**Does not include Navajo Indian Reservation.*

KEY TO METHOD AND SEQUENCE OF TREATMENT OF MAPPED LOCATION, REPORTED GEOLOGY, AND OTHER DATA FOR EACH WELL DRILLED IN UTAH FROM 1891 THROUGH 1953

On the following pages have been plotted all oil wells in Uta for which information was available December 31, 1953. Maps hav been prepared for each county and have been integrated with the tabu lated oil well statistics for that county. Wells have been numbere separately and consecutively, starting with number 1, within eac county in the following manner:

1. The county number is given in bold print and circled the corner of each map.

2. Each county well number is printed opposite the dot the map indicating the approximate location within the county.

tabulated data detailed for each well. Thus, 2-5 is the index number for the "Northern Oil Company well number 1" in White Valley, Box Elder County. Alphabetically, Box Elder is the second county in Utah, and this White Valley well is the fifth well in Box Elder County, according to the system here used for numbering the wells reported between 1891 and 1954.

4. In each county, commencing with the most northerly township line and the most westerly range, the townships are considered from west to east along each township line.

5. In Uintah, Duchesne, and Wasatch Counties the townships numbered in reference to the Uintah Special base and meridian are listed first.

6. Within each township, the sections are considered individually in numerical sequence according to the standard method of numbering sections.

7. Where possible, wells are recorded to the nearest sixteenth of a section (1/4 of 1/4 section) following sequentially counterclockwise from northeast to northwest, southwest, and southeast within the quarter section.

8. The old system of recording data for public land surveys prior to October, 1952, divided the quarter sections into a theoretical grid having nine, rather than four, equal parts. For indexing purposes, data for the center 1/9 was first recorded. Then the data for the east 1/9 (immediately east of the center 1/9) was recorded. This was followed by the data for the northeast 1/9, the north 1/9, and so on, counterclockwise around the grid, finishing the southeast 1/9 as the last subdivision of the quarter section to be recorded and indexed. The data for the wells reported prior to October, 1952, are plotted according to this system.

9. Wells within lots within fractional sections, where lot numbers have been reported, are listed sequentially according to lot numbers after which the wells within the remainder of the section are now listed numerically counterclockwise for each minor and then for each major subdivision of the section, beginning with the northeast corner of the section.

10. Wells recorded only to the quarter of a section are in the identical order--northeast, northwest, southwest, southeast--within the section.

ABBREVIATIONS USED FOR LAND AND WELL STATUS

G	Government	Abd	Abandoned	DSI	Drilling suspended indefinitely
In	Indian	Drg	Drilling	IP	Initial production
P	Patented	DST	Drill stem test	MCFG	Thousand cubic feet of gas
Pu	Public	GSI	Gas well shut in	OSD	Oil well shut down
S	State	OSD	Oil well shut down	OSI	Oil well shut in according to regulations
		PB	Plugged back	P&A	Plugged and abandoned according to regulations
		PGW	Producing gas well	Psi	Pounds per sq. inch of pressure
		SIP	Shut in pressure		

For convenience the formations with their abbreviations as here used are listed in the approximate order of their sequence. When formations are bracketed together, they are believed to be approximate time equivalents. However, where formations occur in widely separated areas, it is often impossible to determine their age relationships. Where "upper," "middle," and "lower" are used, they are listed before detailing named subdivisions.

QUATERNARY.....Q
- Recent.....Qr
  - Alluvium.....Qra
  - Lake beds.....Qrlb
- Pleistocene.....Qp
  - Lake beds.....Qplb

TERTIARY.....T
- Pliocene.....Tp
  - Humboldt (Plio & Miocene)...Tpmh
  - Salt Lake formation (")....Tpmsl
- Miocene.....Tm
  - Bishop conglomerate.....Tmb
- Oligocene.....To
  - Norwood.....Ton
- Eocene.....Te
  - Duchesne River.....Tedr
  - Uinta.....Teu
  - Bridger.....Teb
  - Green River.....Tegr
    - Upper Green River.....Tegru
    - Middle Green River.....Tegrm
    - Lower Green River.....Tegrl
  - Wasatch.....Tew
  - Colton.....Tec
  - Flagstaff.....Tef
  - Almy.....Tea
- Paleocene.....Tpa
  - Current Creek.....Tpacc
  - North Horn.....TKpanh

CRETACEOUS.....K
- Montana.....Kmo
  - Mesaverde.....Kmv
    - Price River.....Kpr
    - Blackhawk.....Kbh
      - Star Point.....Ksp
    - Wahweap.....Kw
    - Masuk.....Kmk
- Colorado.....Kc
  - Mancos.....Km
    - Upper Mancos.....Kmu
    - Middle Mancos.....Kmm
    - Lower Mancos.....Kml
    - Emery.....Kme
    - Blue Gate.....Kmb
    - {Ferron.....Kmf
      {Frontier.....Kfr
- Dakota.....Kd
  - Burro Canyon.....Kbc
  - Cedar Mountain.....Kcm
    - Buckhorn.....Kcmb

JURASSIC.....J
- Morrison.....Jm
  - Salt Wash.....Jmsw
- San Rafael Group.....Jsrg
  - Summerville.....Js
    - Bluff sandstone.....Jsb
  - Curtis.....Jc
  - Entrada.....Je
    - Moab tongue.....Jemt
  - Carmel.....Jca
- Glen Canyon Group.....Jgcg
  - Navajo (and Nugget).....Jn
  - Kayenta.....Jk
  - Wingate.....Jw

TRIASSIC.....R
- Chinle.....Rc
- Shinarump.....Rsh
- Moenkopi.....Rm
- Sinbad.....Rsi

PERMIAN.....P
- Kaibab.....Pk
- Coconino.....Pco
- Cutler.....Pcu
  - Hoskinnini.....Pho
  - DeChelly.....Pd
  - White Rim.....Pw
  - Organ Rock.....Por
- Cedar Mesa.....Pcm
- Halgaito tongue.....Pht
- Phosphoria.....Pp
- Park City.....Ppc
- Rico (Goodridge).....Pr
- Supai.....PCs
- Bird Springs.....PCbs

CARBONIFEROUS.....C
- Pennsylvanian.....Cp
  - Oquirrh.....Cpo
  - Weber.....Cpw
  - Morgan.....Cpm
  - Hermosa.....Cph
  - Molas.....Cpmo
  - Paradox.....Cpp
  - Manning Canyon.....Cpmm
- Mississippian.....Cm
  - Chainman shale.....Cmc
  - Humbug.....Cmh
  - Joana limestone.....Cmj
  - Brazer.....Cmb
    - Pilot shale.....Cmp
  - Madison.....Cmm
    - {Leadville.....Cml
      {Redwall.....Cmr

DEVONIAN.....D
- Upper Devonian.....Du
- Middle Devonian.....Dm
- Lower Devonian.....Dl
- Ouray.....Do
- Elbert.....De
- Guilmette.....Dg
- Simonson dolomite.....Ds
- Sevy dolomite.....Dse
- North Point.....Dnp

SILURIAN.....S
- Laketown dolomite.....Sl

ORDOVICIAN.....O
- Eureka quartzite.....Oe
- Pogonip limestone.....Op

CAMBRIAN.....Ꞓ
- Lynch.....Ꞓl
- Bowman.....Ꞓb
- Tapeats.....Ꞓt
- Ophir.....Ꞓo
- Tintic.....Ꞓti

PRE-CAMBRIAN.....pꞒ

BEAVER COUNTY

BOX ELDER COUNTY

2-1	NWNWNW 26-14N8W	P	Utah Duchess Oil Co. #1	Snowville	6-?-40	4819	Quaternary	?	———	———	400	Abd
2-2	C SENE 25-13N11W	P	Stanford Petroleum Co. #1	Warm Springs Dome	10-?-46	?	Pennsylvanian	?	———	———	679	Abd
2-3	C SESE 7-13N4W	P	Promontory Oil Co. #1	White Valley	9-2-50	5100?	Lake Beds	Cs	———	———	7,321	DSI
2-4	NENW 17-13N4W	P	Utah Pennsylvanian Oil Co. #2	White Valley	1927	?	?	?	———	———	10	Abd
2-5	NENESW 17-13N4W	P	Northern Oil Co. #1	White Valley	12-?-47	5140	Permian	Ms	———	———	2,013	Abd
2-6	NWSWSE 31-12N8W	S	Mohawk Petroleum Co. #2	Promontory	2-10-48	?	?	?	———	———	514	P&A
2-7	SWSWNE 17-10N7W	P	Utah Southern Oil Co. Bar-B #1	Rozel	9-1-52	4253	Quaternary	De	Cmb 3580', Cmm 6530', Dm 7500'	———	7,918	Abd
2-8	NWNW 3-10N4W	P	Utah Pennsylvanian Oil Co. #2	Penrose	7-?-31	4300	Lake Beds	Cs fe	———	———	4,100	Abd
2-9	Center 14-9N8W	Pu	Leonora Mining & Milling Co. #2	Rozel	7-?-34	4300	Lake Beds	?	———	———	2,280	Abd
2-10	SWSE 31-9N7W	P	Lakeside Oil Co. #1	Rozel	11-?-27	4250	Lake Beds	?	———	———	2,710	Abd
2-11	NENE 4-8N7W	Pu	LaSalle Mineral Co. #2	Rozel	1908	4250	Lake Beds	?	———	———	2,012	Abd
2-12	NENW 4-8N7W	Pu	LaSalle Mineral Co. #1	Rozel	1907	4250	Lake Beds	?	———	———	1,400	Abd
2-13	NWNE 8-8N7W	P	Nebeker #1	Rozel	1907	?	?	?	———	———	?	Abd
2-14	NWSW 9-8N7W	P	A.B. Coreoy #1	Rozel	1910	4250	Lake Beds	?	———	———	930	Abd
2-15	SWNW? 9-8N7W State Lease #19	S	Leonora Mining & Milling Co. #1	Rozel	4-?-30	4250	Lake Beds	?	———	———	1,705	Abd
2-16	NWNWNW 16-8N7W	S	Liquid Asphalt #1	Rozel	12-?-52	4195	Lake Beds	?	———	———	300	Abd
2-17	-7N15W	?	Unknown	Lemay	1904	4300	Lake Beds	?	———	———	2,480	Abd
2-18	-6N10W	?	Unknown	Strong Knob	1900	4300?	Lake Beds	?	———	———	800	Abd
2-19	-5N9W	?	Lakeshore Oil Co. #1	Lakeside	7-?-26	4250	Lake Beds	?	———	———	1,200	Abd

CACHE COUNTY

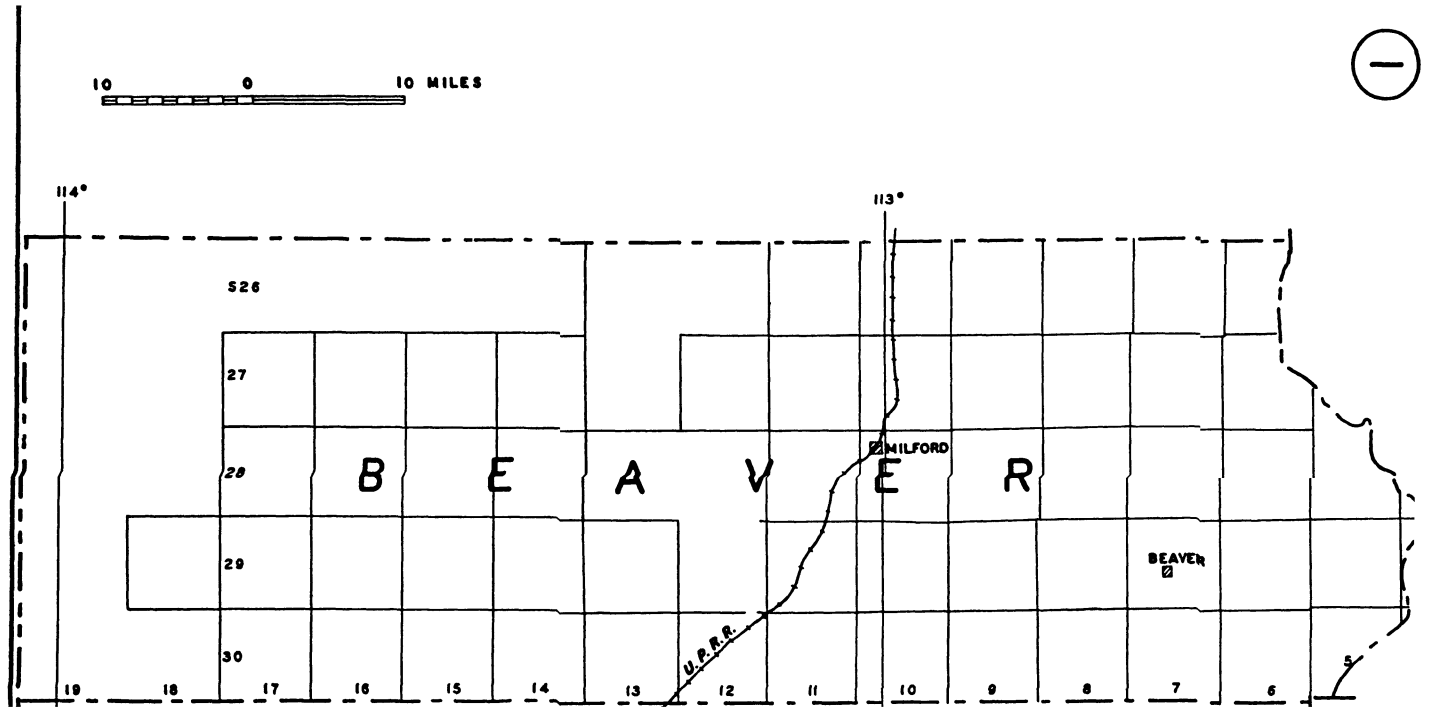
3-1	NWNW 9-14N1W	P	Eureka Oil Co. #1	Cornish	7-?-52	4380	Alluvium	?	———	———	729	DSI
3-2	NWNW 25-13N1W	P	Cache Valley Oil Assoc. #1	Cache Valley	1925	4425	Lake Beds	Ms	———	———	1,650	Abd

CARBON COUNTY

4-1	NWNESE 22-12S7E	P	Three States Nat. Gas Co. #1	Scofield	4-11-53	8468	Mesaverde	Mc	Kme 2894', Kmf 5992', Kd 6785', Jm 6899', lower ss. (Jmsw?) 7820'.	7 DSTs; 1,000 MCFG at 6005-6109' SIP 1638#.	7,917	Abd
4-2	C SWNE 13-12S14E	Pu	Carter Oil Co. #1	Jack Canyon	9-28-52	7562	Green River	Ma	Tegr surface, Tew 2828', Tpa 4787', Kmv 6814', Km 9446'.	25 DSTs; greatest = 44 MCFG PD with SIP 3170#.	9,802	Abd
4-3	SWNESW 36-12S16E	Pu	El Paso Natural Gas Co. #2	Peters Point	6-30-53	6728	Green River	Wa	Tew 2780'.	5 DSTs. 2160 MCFG at 2847-2900', SIP 575#.	4,984	GSI
4-4	NWSESW 13-13S6E (Lot 8)	Pu	Three States Nat. Gas Co. #1, T. F. Kearns	Clear Creek	6-14-53	8622	Blackhawk	Fe	Kme 1853'?, Kmf 5362'.	3 DSTs with gas shows.	5,825	Abd
4-5	C NE 23-13S6E	Pu	Superior Oil Co. #1-23	Clear Creek	5-?-53	9059	Blackhawk	?	———	———	362	DSI
4-6	SWSESW 17-13S7E	P	Three States Nat. Gas Co. #7, Utah Fuel Co.	Clear Creek	8-?-53	8053	Star Pt.	Fe	Kme 335', Kmb 2400', Kmf 3835'.	IP 31,000 MCFG Pb, initial RP 1132 Psi. Kmf 3865-4250'.	4,250	PGW
4-7	NWNENW 19-13S7E	P	Three States Nat. Gas Co. #8, Utah Fuel Co.	Clear Creek	1-15-53	8300	Mesaverde	Fe	Kme 930'?, Kmf 4204'.	IP 58,000 MCFG PD, Sp.G. 0.575 RP 1126 Psi at surface, Kmf 4227-4390'.	4,390	GSI
4-8	NESWSW 30-13S7E	P	Three States Nat. Gas Co. #4, Utah Fuel Co.	Clear Creek	11-29-52	9305	Mancos	L.	Kme 2062'?, Kmf 5338'.	IP 10,050 MCFG PD, Kmf 5366-5800'.	5,820	GSI

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.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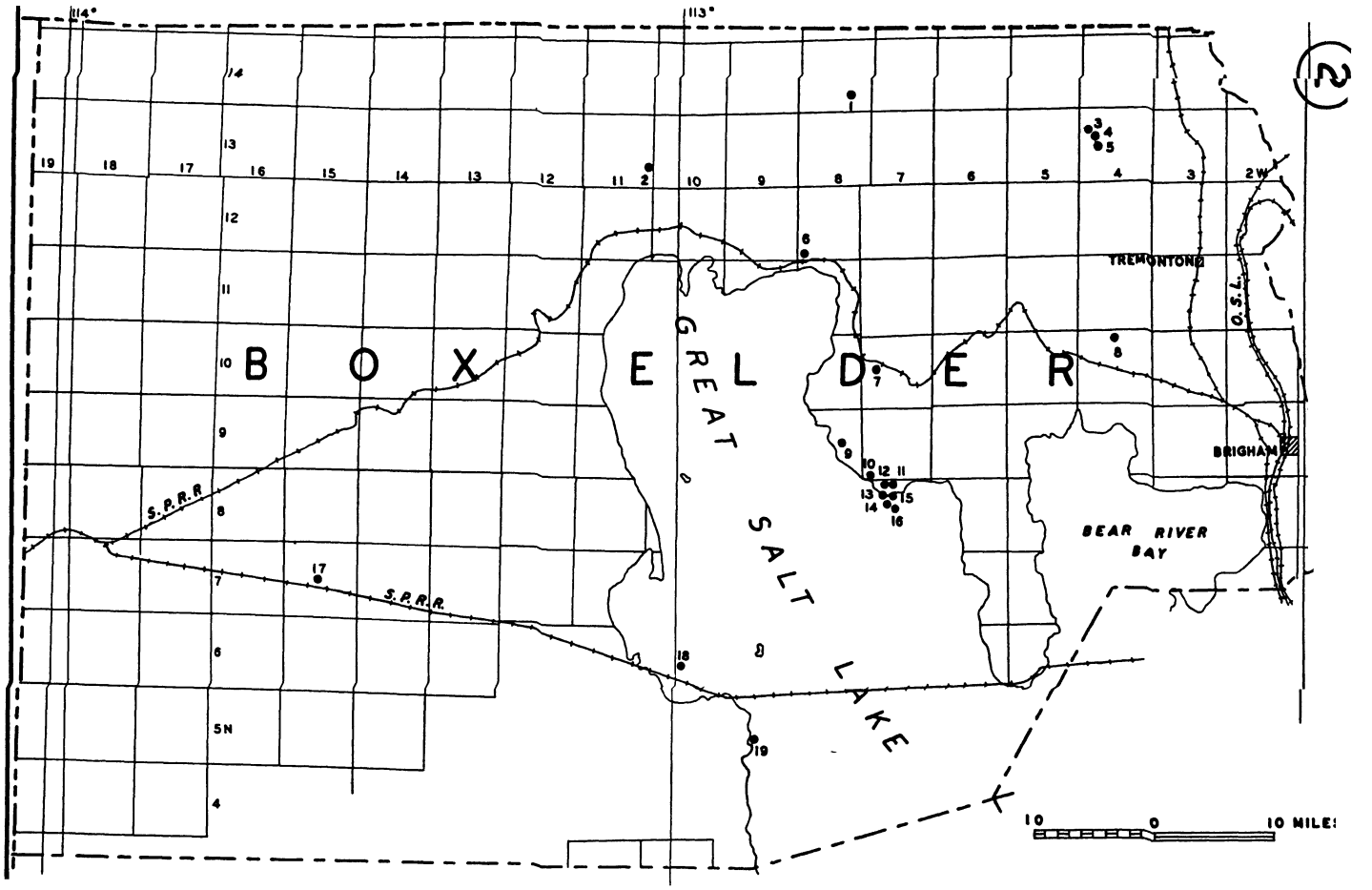
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4-9	NWSWSW	31-13S7E	P	Three States Nat. Gas Co. #5, Utah Fuel	Clear Creek	9-2-53	9734	Blackhawk	Ferron	Ksp 500', Kme 2298', Kmb 4220', Kmf 5749'.	IP 27,500,000 cu.ft. Tubing shut-in pressure: 1089 Psig. Kmf 5980-6153'.	6,225
4-10	NWSWSW	32-13S7E	P	Three States Nat. Gas Co., Utah Fuel #2	Clear Creek	8-?-52	8771	Mancos	Ferron	Kme 1080', Kmf 4483'.	IP 28,000,000 cu.ft. Kmf 4608-4760'.	4,760
4-11	SENWSE	32-13S7E	P	Three States Nat. Gas Co., Utah Fuel #3	Clear Creek	8-?-52	8459	Mancos	Ferron	Kme 810', Kmf 4050'.	IP 48,000,000 cu.ft., open flow, Initial RP 880# surface shut-in, Kmf 4067-4399'.	4,399
4-12	NWSESE	7-13S16E	Pu	ElPaso Nat. Gas Co. #2	Jack Canyon	12-1-53	6937	Green River	Paleoc	Tew 2945', Tpa 5910'?	DST 5038-90', 3 hrs., 60' mud. DST 5994-6024', 3 hrs., 10' mud.	6,201
4-13	N½NWNW	24-13S16E	Pu	ElPaso Nat. Gas Co. #4	Peters Point	?	7005	Green River	?			1,395
4-14	C SWNW	6-13S17E	Pu	Cities Service Oil Co. #1	Peters Point	11-19-52	6715	Green River	Mesave	Tew 2790', Kmv 6212'	15 DSTs run. Perf. 86 holes 4622-37', hydrafracked and acidized.	8,310
4-15	SWSWSE	8-13S17E	Pu	ElPaso Nat. Gas Co. #3	Peters Point	11-20-53	6673	Green River	Wasato	Tegr 0-2890', Tew 2890-4833'.	6 DSTs; 1140 MCFG PD at 2700-50'. Initial RP 1548 Psi surface, Tew 4710-4795'. Casing: 10-3/4" cc 265' w/190 sx.	4,833 7,010
4-16	SWNWNE	5-14S7E	P	Three States Nat. Gas Co., #10 Utah Fuel Co.	Clear Creek	?	9113	Blackhawk	?	Kme 1400', Kmf 4622', Kd 5545', Jm 5592'.	IP 7,500 MCFG PD, Kmf 4688-4761'.	5,219
4-17	E SESW	5-14S7E	Pu	Three States Nat. Gas Co. #1, Utah Fuel Co.	Clear Creek	11-?-51	8770	Mancos	Ferron	Kme 850', Kmm2480', Kmf 4335'.		80
4-18	E SWSE	8-14S7E	Pu	Three States Nat. Gas Co. Deck #1	Clear Creek	3-8-52	9200±	Mancos	?	Kme 1480', Kmf 5041'.	IP 35,000 MCFG PD, RP 1102 Psi, Kmf 5260-5434'. Commenced producing 10-17-53.	5,434
4-19	W SWSE	8-14S7E	Pu	Three States Nat. Gas Co. Deck #1-A	Clear Creek	9-30-52	9415	Mancos	Ferron	Kme 1420', Kmf 4975'.	SIP 100#. IP 13,000 MCFG PD, 3 DSTs, Initial RP 1096 Psi surface, Kmf 5035-5396'. Commenced producing 10-3-53.	5,421
4-20	SWNWNE	17-14S7E	Pu	Three States Nat. Gas Co. #1 Walton	Clear Creek	10-9-52	9350	Mancos	Ferron			1,460
4-21	SENENW	17-14S7E	Pu	Superior Oil Co. #1-17	Clear Creek	7-?-53	9684	Mancos	?	Kme surface, Kmm 1710', Kmf 3760' Kml 4020', Kd 4444', Jm 4600', Js 6038', Jc 6490', Je 6730', Jca 7805', Jn 9035', Jk 9365', Jw 9500', Rc 9840', Rm 10135', Rsi 10877', Pk 11325', Pco 11568'. Km surface, Kmf 3475', Kd 4260', Jm 4303'. Kmf 3734', Kd 4562'.	IP 8,535,000 cu.ft. CO_2 gas 10,000,000 cu.ft. CO_2 gas, Rsi 10,890-10,980'. Pco 11,650-12,066'. Slumberger 4 runs 4566, 8251, 11009, 11470.	12,146
4-22	C SENE (Lot 2)	24-14S7E	Pu	Pacific Western Oil Corp #1	Gordon Creek	5-10-48	7587	Emery	Coconi			
4-23	E½NWNE	8-14S8E	Pu	Pacific Western Oil Corp. #4.	Gordon Creek	7-?-53	7493	Mancos	Morris		Casing: 13-3/8" qc 423' w/350 sx.	4,312
4-24	C SWNE	18-14S8E	S	Pacific Western Oil Corp. #2	Gordon Creek	8-?-52	7543	Mancos	Morris		2 DSTs with gas shows.	4,738
4-25	C NENW	19-14S8E	S	Pacific Western Oil Corp. #3	Gordon Creek	11-19-52	7439	Mancos	Morris	Kmf 3416', Kml 3835', Kd 4220', Jm 4323'.	IP 664 MCFG PD on 1/2", Sp. G. 0.630, RP 950 Psi from DST, Kmf 3456-74'.	4,358
4-26	NWSE	1-14S9E	P	St. Thomas Oil Co. #1	Garley Canyon	1930	5650	Mancos	Colors			2,250
4-27	SWNE	16-14S10E	P	Price Petroleum Co. #1	Price	1930?	5560	Mancos	Morris			3,335
4-28	NESE	20-14S10E	P	Kelley Young #1	Price	9-?-37	5520	Mancos	Mancos			1,080
4-29	NWNE	14-15S10E	Pu	Holmes & McGee #1	So. Wellington	9-10-27	5530	Mancos	Morris			2,462
4-30	NWNWNE	12-15S11E	G	Carbon Dioxice & Chem. Co. #1	So. Wellington	12-25-45	?	?	?			3,246
4-31	SESW	12-15S11E	Pu	Carbon Dioxice & Chem. Co. #1	Farnham Dome	6-15-30	5960	Morrison	Coconi	Pco 3093.	2,780 MCFG (CO_2) at 3093-3114'.	3,114
4-32	NWNWSE	12-15S11E	Pu	Carbon Dioxice & Chem. Co. #3	Farnham Dome	11-16-45	5863	Morrison	Coconi	Pco 3215.	5,000 MCFG (CO_2) at 3215-26'.	3,250
4-33	SWNWSE	12-15S11E	Pu	Mt. Fuel Supply Co. #1	Farnham Dome	6-5-46	5850	Morrison	Pennsy vania	Jm surface, Js 865', Jc 1160', Je 1320', Jca 1617', Jn 2038, Jk 2200', Jw 2354', Rc 2590', Rm 2710', Rsi 3035', Pco 3133', Pr 3894', Cp 4430'. Pco 3093'.	3,250 MCFG (CO_2) at 3133-55'. Schlumberger 1 run, 5722'. Log with tops.	5,722
4-34	SWNWSE	12-15S11E	Pu	Carbon Dioxice & Chem. Co. #2	Farnham Dome	1-8-24	5935	Morrison	Cocon		12,000 MCFG (CO_2) at 3093-3105'.	3,235
4-35	C SWNE	18-15S12E	Pu	Equity Oil Co. #3 Mounds	East Farnham	7-10-53	5783	Mancos	Cocon	Kmf surface, Kd 420', Kcm 448', Kcmb 953', Jm 984', Jmsw 1338', Jc 1829', Je 2220', Jca 2480', Jn 2806', Jk 3108', Jw 3168', Ro 3605', Rsh 3780', Rm 3830', Marine Rm 4256', Rsi 4413', Pk 4762', Pco 4930'.	IP 18,000 MCFG, CO_2, Jn 2880-2920', 2830-70'.	5,254

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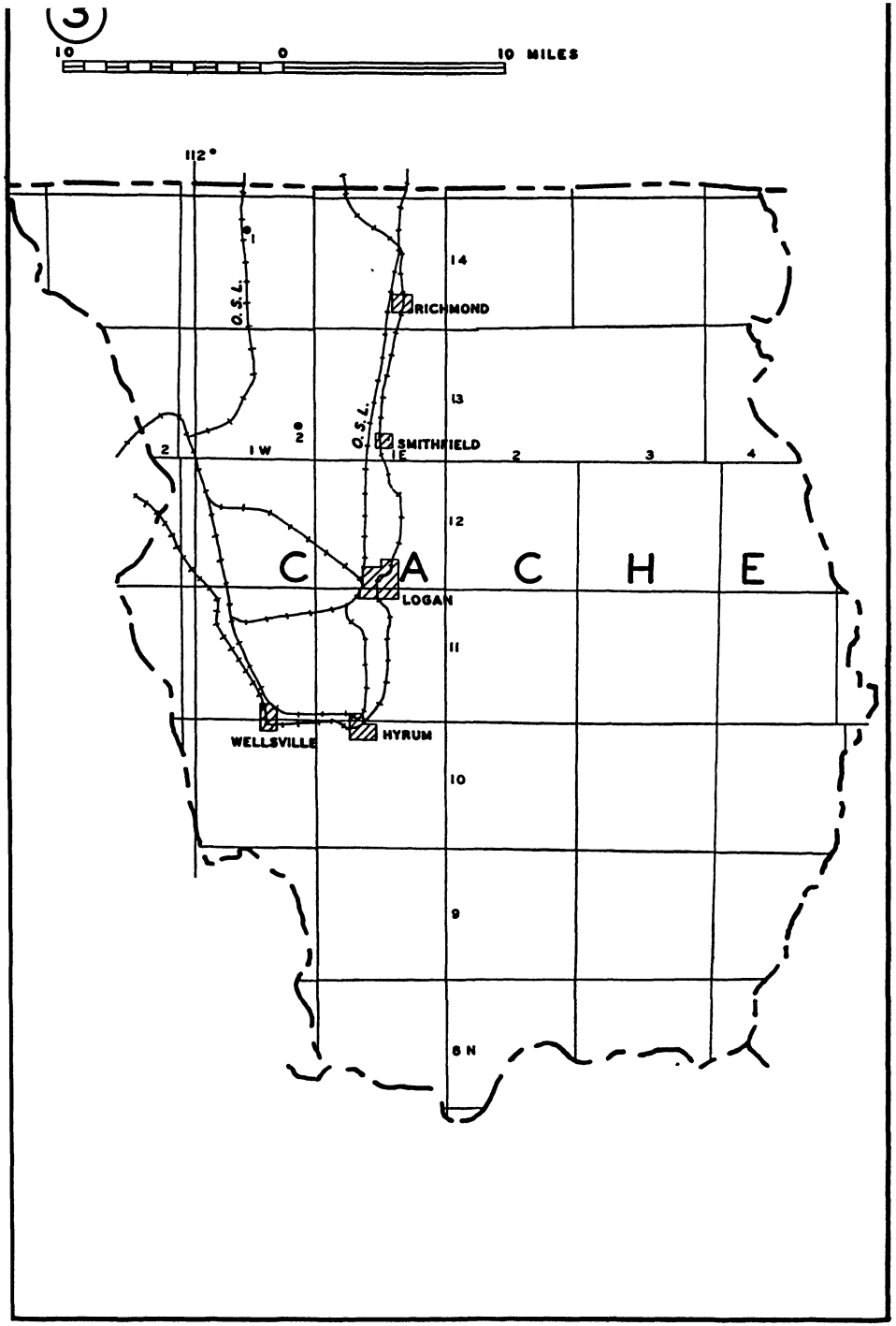
Note: For abbreviated legend data see explanation before tables.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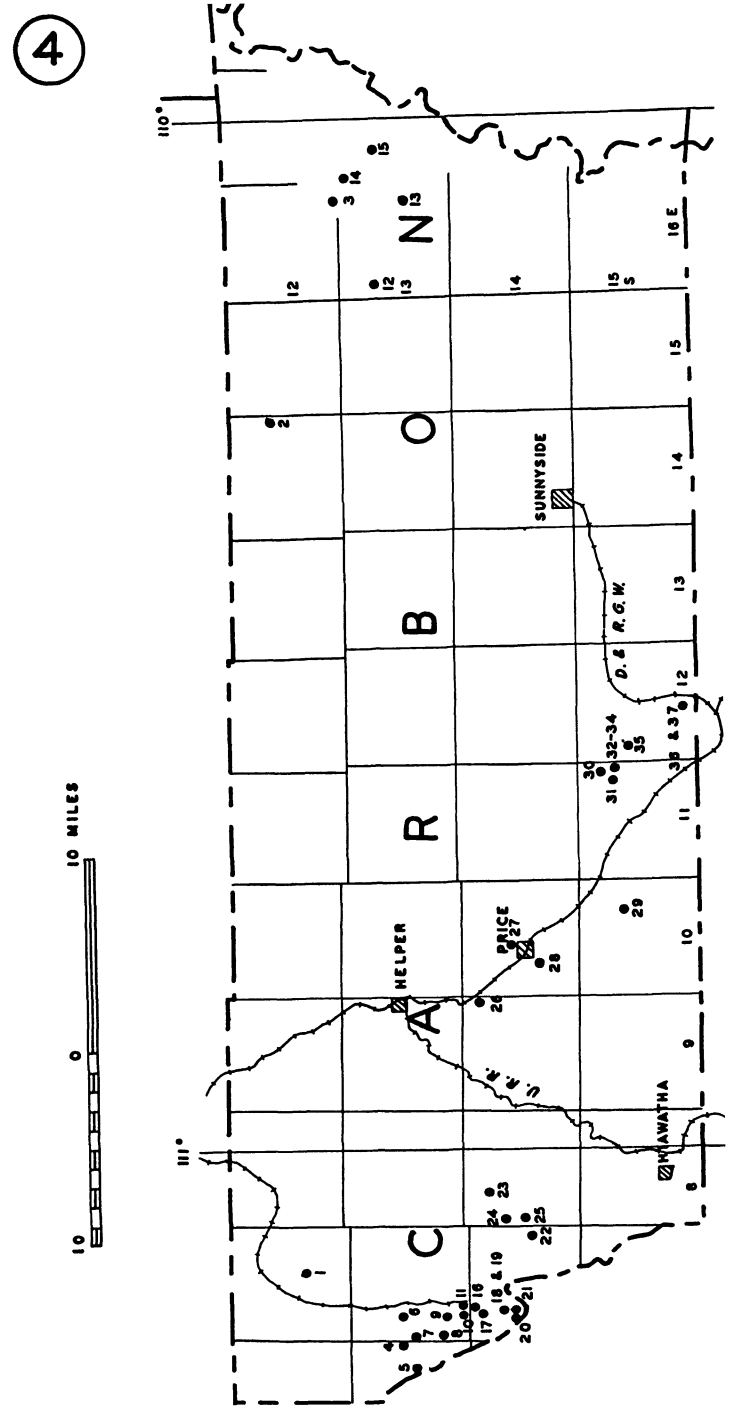
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KENILWORTH
WELLINGTON
KYUNA
HIAWATHA
C A R B O N

4-36	NESWNE 33-15S12E	Pu	Equity Oil Co. #1	Mounds	11-?-53	5438	Mancos		Kmf surface, Kd 434', Kcm 471', Kcmb 798', Jm 829', Jmsw 1168', Jc 1651', Je 1815', Jca 2181', Jn 2487', Jk 2853', Jw 2912', Tc 3354', Tsh 3563', Tm 3601', Marine Tm 4082', Tsi 4257', Pk 4626', Pco 4873', Pr 5473', Cp 5521', Cmu 6454', Cmm 8674', @ 9211'.	Casing: 10-3/4" cc 449' w/230 sx., 7" cc 4164' w/146 sx.	9,360

DAGGETT COUNTY

5-1	NESW 15-3N24E	Pu	Mt. Fuel Supply Co. #5	Clay Basin	9-14-40	6639	Mancos	Morr	Kfr 5575, Kd 5928'.	Show gas.	6,064
5-2	NWSESW 16-3N24E	S	Mt. Fuel Supply Co. #1	Clay Basin	8-4-37	6492	Mancos	Morr	Kd 5739'.	16,375 MCFG at 5739-79'.	6,151
5-3	SENENE 19-3N24E	Pu	Mt. Fuel Supply Co. #1	Clay Basin	7-1-40	6342	Mancos	Morr	Kd 5941'.	15,214 MCFG at Kd 5941-66'.	6,006
5-4	C SWNE 20-3N24E	P	Mt. Fuel Supply Co. #1	Clay Basin	12-8-37	6280	Mancos	Dako			5,674
5-5	NWNW 20-3N24E	Pu	P. C. Spencer #1	Clay Basin	9-13-24	6500	Mancos	Manc			500
5-6	NENE 21-3N24E	Pu	Mt. Fuel Supply Co. #2	Clay Basin	8-17-36	6485	Mancos	Entr			6,799
5-7	SESW 21-3N24E	Pu	Mt. Fuel Supply Co. #4	Clay Basin	4-18-40	6298	Mancos	Dako			5,713
5-8	SWNW 22-3N24E	Pu	Mt. Fuel Supply Co. #1	Clay Basin	4-6-27	6487	Mancos	Fron			5,445
5-9	SENW 22-3N24E	Pu	Mt. Fuel Supply Co. #6-W	Clay Basin	7-23-47	6507	Mancos	Webe			9,355
5-10	NWSW 23-3N24E	Pu	Mt. Fuel Supply Co., Producers & Refiners Corp., R. D. Murphy #1, Well #3.	Clay Basin	6-22-38	6660	Mancos	Morr			6,037
5-11	SWSE 23-3N24E	Pu	Mt. Fuel Supply Co., Carter Oil Co. #1	Clay Basin	7-1-41	6659	Mancos	Morr			6,045
5-12	NWNW 27-3N24E	Pu	Mt. Fuel Supply Co., Prairie Oil & Gas Co. #1	Clay Basin	8-4-37	6389	Wasatch	Morr			5,951

DAVIS COUNTY

6-1	13-3N1W	P	Guffey & Galey #1	Farmington	1904	4250	Lake Beds	Lake			2,000
6-2	C SWSW 26-3N1W	P	Gerald H. Anderson #1	Farmington	7-22-50	4250	Lake Bonneville	?			1,390
6-3	SWSWSW 26-3N1W	P	Gerald H. Anderson #2	Farmington	10-?-50	4250	Lake Bonneville	Tert		Productive horizons: 2700-2800'. Show gas.	3,52
6-4	36-3N1W	?	About 20 wells, no records kept.	Farmington	1896	4250	?	?	Entirely in Lake Beds or interbedded valley fill.	Gas in Lake Beds 400' & 700', also Aver recorded gas in one well 502', 542', 602'. Average pressure 200 Psi; max. 250 Psi.	50

DUCHESNE COUNTY

7-1	C SWNE 6-1S2W (Uintah Meridian)	In	Carter Oil Co. #1	Bluebell	5-5-51	6559	Duchesne River	Wasa	Teu 3995', Tegr 7000', Tew 12,082'.	Casing: 23" cc w/65 sx. at 53', 972' 16" cc w/1200 sx. at 962', 11,211' 7" cc w/350 sx. at 11,138'. Recovered 3062'.	12,51
7-2	NWNESW 9-2S5W (Uintah Meridian)	P	Union Oil Co. #1	Talmadge	5-21-53	7077	Duchesne River	Gree River	Tegr 5705'?	DST 6406-6502', 350' salt water. DST 6490-6618', 825' gas and water-cut mud. DST 9740-96', 472' gas and water-cut mud.	10,01
7-3	C SESE 16-3S5W (Uintah Meridian)	P	Carter Oil Co. #1 Joseph Smith	Flat Mesa	12-4-52	5694	Uinta	L. G River	Tegru 1734', Tegrm 4250', Tegrl 6800'.	IP 273 bbls., 41.8° API, Tegrl 8820-60' and 9032-9103'.	9,10
7-4	C SENW 25-3S5W (Uintah Meridian)	P	Carter Oil Co. #1 County	Duchesne County	5-18-53	5695	Uinta	Gree River	Tegr 1425'.	8 DSTs. IP 239 bbls. oil 23.5 API and 122 bbls. water.	5,25
7-5	NESENW 36-3S5W (Uintah Meridian)	P	Carter Oil Co. #1 Eyner Nielson	Duchesne County	11-12-53	5650	Uinta	Gree River	Tegr 4520'.	IP 27 BOPD, Tegru 4520-4623'.	4,80
7-6	SWSWNW 7-3S1W (Uintah Meridian)	P	Sinclair Oil & Gas Co. #1	Ioka	2-16-53	5281	Uinta	Wasa	Tegr 5200', Tew 9620'.	3 DSTs 3840-4406', rec. mud. DST 6122-6222', 400 MCFG and gas-cut mud. DST 6390-6489', 150 MCFG and gas-cut salt water. DSTs 9410-9500', oil and gas-cut mud. 3 DSTs 9688-9833', oil and gas-cut mud.	10,00

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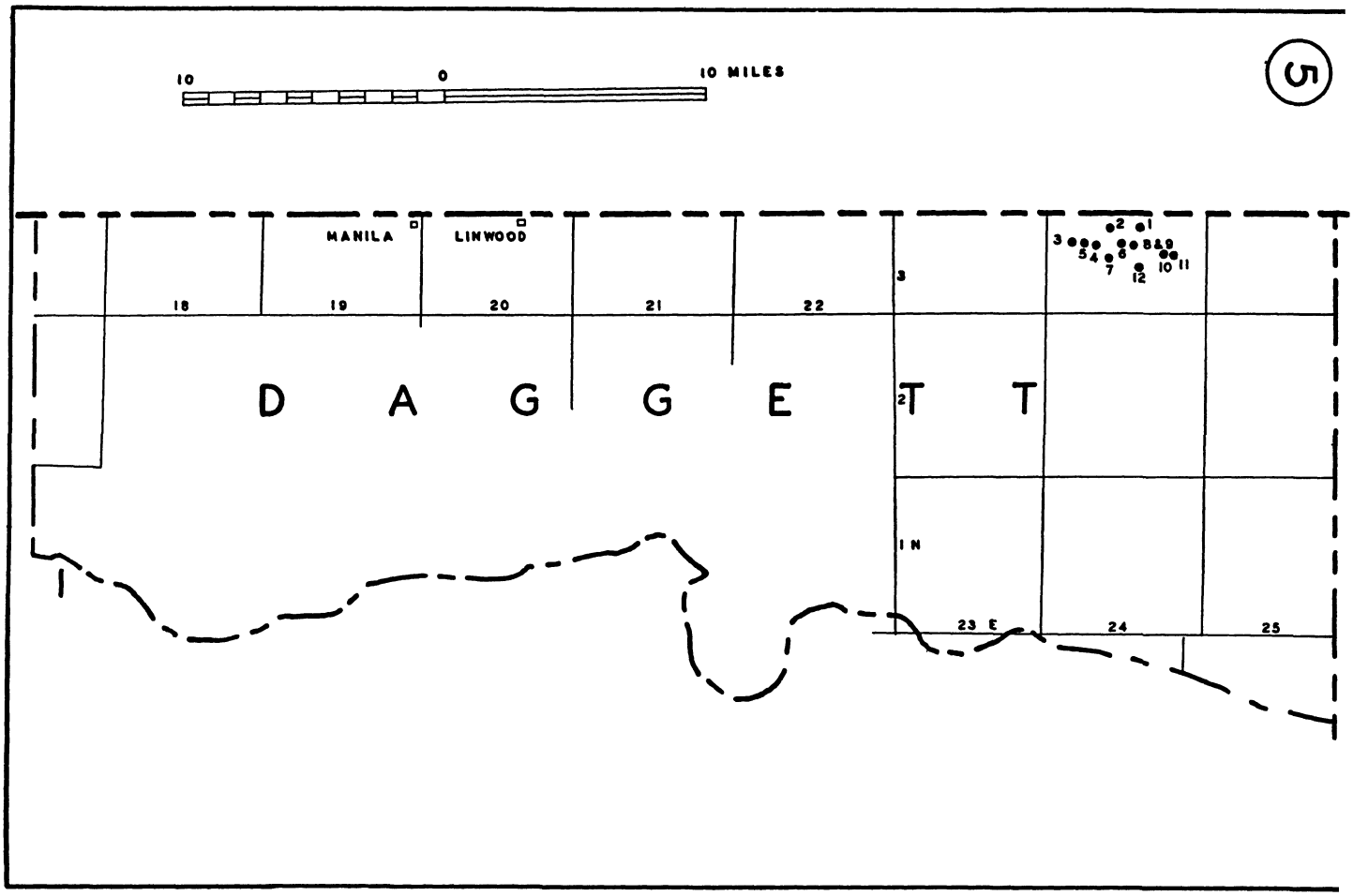
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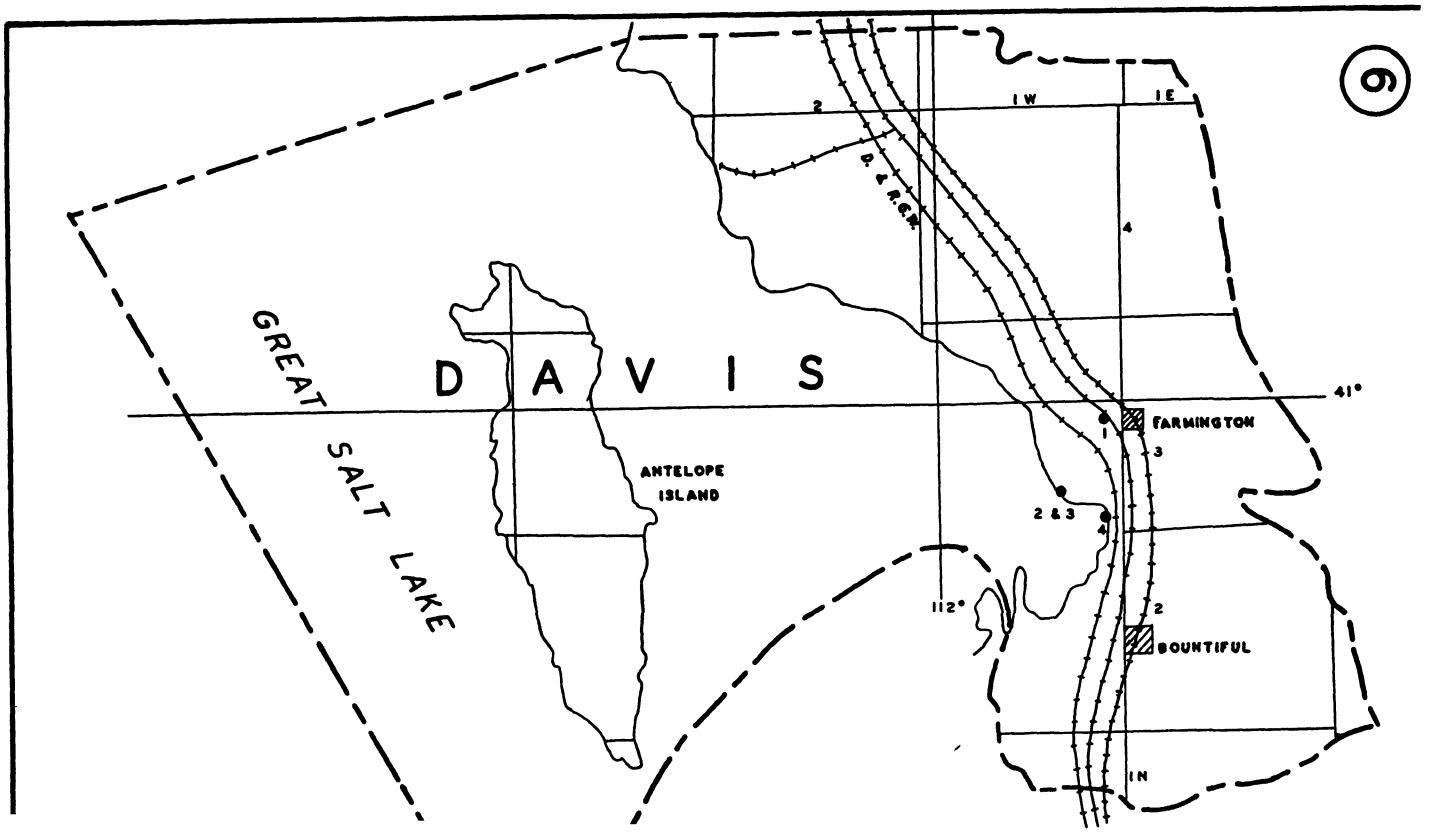
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								River	Riv		
7-8	C SESE (Uintah Meridian)	13-4S4W	P	Carter Oil Co. Willis Moon #1	Duchesne	6-27-52	5658	Uinta	Was	Tegr 3075', Tew 7130'.	20 DSTs, several shows oil and gas. Acidized, no results. 7,
7-9	C SENW (Uintah Meridian)	16-4S4W	In	Carter Oil Co. #2	Duchesne	6-4-52	5903	Green River	Was		IP 790 bbls. 41.7° API. Tegr-Tew Trans. Zone 7518-7661'. 11,
7-10	C SENE (Uintah Meridian)	17-4S4W	In	Carter Oil Co. #1	Duchesne	8-10-51	5932	Uinta	Was		IP 538 bbls. 42.9° API. Tegr-Tew trans. zone 7494-7550'. 7,
7-11	C SWSE (Uintah Meridian)	8-4S3W	P	Carter Oil Co. #1 Elmer Moon	Antelope Canyon	2-11-53	5539	Uinta	Was	Tegr 880', Tew 7722'.	Acidized strata-ffacked, re-acidized and squeezed with kerosene. Pumped dry. 8,
7-12	C NESW (Uintah Meridian)	26-4S3W	In	Ohio Oil Co. #1	Bridge-land	11-6-52	5648	Uinta-Green River	Was	Tegr 790', Tew 6680'.	DSTs from 1900-7067'. 7,
7-13	C NENE (Lot 1) (U. M.)	24-6S4W	Pu	California Co. #1	Antelope Creek	8-8-52	7292	Green River	Was	Tew tongue 5143', Tew 5737'.	6,
7-14	C W½NE (Lot 2)	21-8S16E	Pu	M. M. Travis #1 Jensen	W. Pleas-ant Valley	8-22-52	5449	Uinta	Was	Tegr 1830', Tew 6800±'.	IP 360 bbls., 39° API. Tegr 5238-6886', 5024-6780'? 7,
7-15	½ SWSW	22-8S16E	Pu	M. M. Travis #1	W. Pleas-ant Valley	5-28-52	5500	Uinta	Was	Tegr 750', Tew 6700'.	IP 150 bbls., 40° API. Tegr 6062-6436'. 7,
7-16	C SENW	23-8S16E	Pu	Stanolind Oil & Gas Co. #1	W. Pleas-ant Valley	1-17-53	5379	Uinta	Was	Tegr 2009', Tew 6959'.	Tegr 2009', 10 DSTs, Tegr-Tew Trans. Zone 6705', 1 DST, Tew 6959', 2 DSTs. 7,
7-17	NENE	26-8S16E	S	Pleasant Valley Oil Corp. #?	Myton	9-9-47	?	Uinta	?		2,
7-18	C	36-8S16E	S	E. S. Rich, et al #2	Myton	12-?-49	?	Uinta	?	Tegr 2267'.	2,
7-19	C NE	30-10S15E	Pu	California Co. #2	Antelope Creek	1-12-53	7080	Green River	Was	Tegr surface, Tew tongue 4374', Tew 5022'.	12 DSTs 1400-4348', 2 DSTs 4824-4956'. 5,
7-20	SWNWNE	28-10S17E	Pu	Sinclair Oil & Gas Co. #1	Juniper	7-10-52	6037	Uinta	Was	Tegr 903', Tew 4489'.	Casing: 302' 13-3/8" cc w/285 sx. 5,
7-21	N NENW	14-11S12E	Pu	McCarthy Oil Co. #1	Argyle	10-?-50	?	Green River	?		2,
EMERY COUNTY											
8-1	S½SESW	18-14S7E	Pu	Superior Oil Co. #1-18	Clear Creek	?	?	Blackhawk	?		
8-2	NWSESW	19-14S7E	Pu	Three States Nat. Gas Co. #1 P. T. Walton	Clear Creek	7-17-53	8535	Mesaverde Group	Manc		Lost bottom casing joint. Skid rig 16' west for well #1-X.
8-3	NWSESW	19-14S7E	Pu	Three States Nat. Gas Co. #1-X P. T. Walton	Clear Creek	9-15-53	8535	Masuk	Ferr	Kme 593', Kmb 2450', Kmf 4068'.	IP 108,000,000 Kmf 4165-4439'. 4,
8-4	SENESW	30-14S7E	Pu	Three States Nat. Gas Co. #A-3 H. E. Walton	Clear Creek	11-?-53	8201	Mancos	Ferr	Kme 585-2286', Kmf 3706'.	IP 112,000 MCFG PD. Initial RP 1235 Psi. Kmf 3719-4049' 121' net. 4,
8-5	NWNESW	5-15S7E	Pu	Three States Nat. Gas Co. #A-1 Steiner	Clear Creek	?	8091	Blackhawk	?	Kme 855', Kmf 4385'.	Casing: 10-3/4" cc 292' w/290 sx. 4,
8-6	SWSESW	23-16S6E	Pu	Three States Nat. Gas Co. #3 M. D. Kearns	Flat Canyon	?	9860?	Price River	?		Casing: 13-3/8" cc 281' w/317 & 50 sx. 4,
8-7	SENWNE	27-16S6E	Pu	Three States Nat. Gas Co. #1 M. D. Kearns	Flat Canyon	6-23-53	9159	Mesaverde	Dako	Kme 2773'?, Kmf 6056', Kd 7007'.	IP 3250 MCFG PD. Initial RP 1525 Psi. 7,
8-8	NESESE	27-16S6E	Pu	Three States Nat. Gas Co. #2 M. D. Kearns	Flat Canyon	?	8967	Price River	?	Kbh 395', Kme 2568', Kmm 4016'.	Casing: 16" cc 71' w/126 sx. & 40 sx. 8-5/8" cc w/125 sx. & 100 sx. at 4212'. 5,
8-9	C NENW	1-16S12E	Pu	Cities Service Oil Co. #1	Grassy Trail Creek	5-9-53	5425	Mancos	Humb	Kd 435', Jm 458', Js 1263', Jc 1512', Je 1650', Jca 1983', Jn 2360', Jk 2693', Jw 2750', Tc 3169', Tsh 3370', Tm 3410', Tsi 4017', Pk 4396', Pco 4550', Pcu 5177', Cph 5232', Cpmmc 6372', Cmh 7350'.	DST 3880-3951', 720' gas-cut muc and 900' oil-cut mud. DST 3958-4007', 5' mud. DST 4014-83', 80' sulphur-gas-cut mud, 90' water-cut mud & 450' water. DST 7831-7930', 270' CO_2 & salt water-cut mud & 1910' CO_2-cut salt water. 7,

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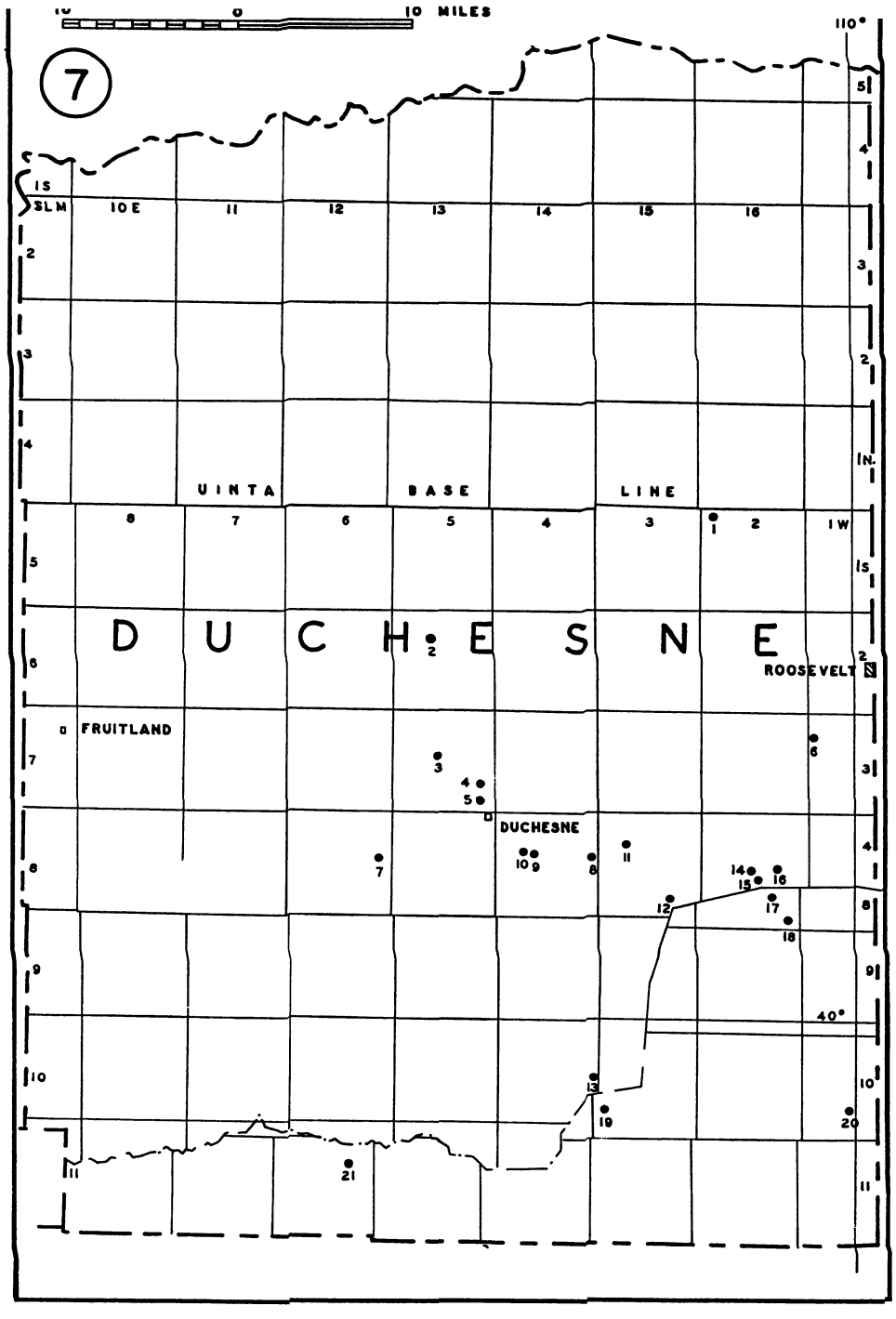
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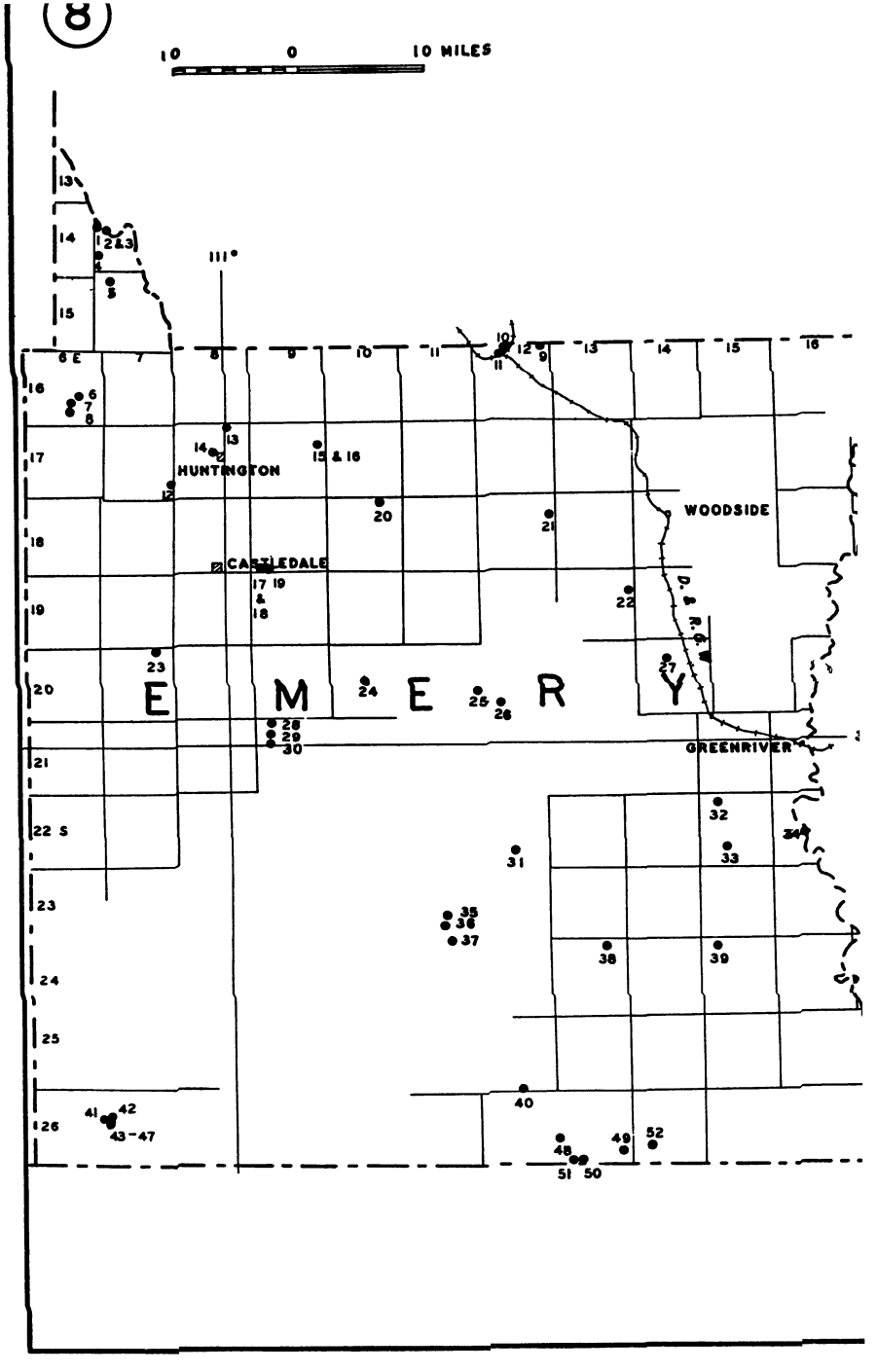
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D. & R. G. W.
EMERY
GREENRIVER

10	C	NENW	4-16S12E	Pu	Equity Oil Co. #2	Mounds	11-?-53	5420	Mancos	?	Kmf surface, Kd 246', Kcm 282', Kcmb 658', Jm 687', Jmsw 1014', Jc 1503', Je 1668', Jca 2029', Jn 2339', Jk 2794', Jw 2800', Rc 3228', Rsh, 3448', Rm 3490', Marine Rm 3955', Rsi 4141', Pk 4611'.	Casing: 10-3/4" cc 126', & 7" cc 4536' w/385 sx.	4,675
11	C	SESW	4-16S12E	Pu	Equity Oil Co. #4	Mounds	9-?-53	?	Mancos	Coconino			4,671
12		SWSESE	25-17S7E	Pu	Utah Southern Oil Co. #1	Orange-ville	?	7069	Mancos	?			3,425
13		NW	2-17S8E	P	Ohio Oil Co. #1	Hunting-ton	11-4-21	6000?	Mancos	Morrison	Km ? surface, Kmf 2215', Kd 2995'.		3,100
14		S½SENW	15-17S8E	Pu	Mt. Fuel Supply Co. & Phillips Pet. Co. #1	Hunting-ton Anticline	?	6127	Mancos	?	Kmf 1890', Kd 2690', Jm 2870', Kcm 2790', Kcmb 2860', Jmsw 3485', Js 3638', Jc 4260', Je 4720', Jca 5560', Jn 6768', Jw 7300', Rc 7710', Rsh 7900', Rm 8025', Rsi 8650', Pk 9088', Pco 9229', Cp 9640', Cm 10,095'.	Casing: 13-3/8" cc 605' w/500 sx.	10,511
15		SENWSW	12-17S9E	P	Anderson & Brockbank #1-X	East Huntington	7-?-53	?	Mancos	?		Casing: 10-3/4" cc 300' w/50 sx.	1,212
16	C	SW	12-17S9E	P	Anderson & Brockbank #1	East Huntington	2-28-53	5302	Mancos	Ferron?		Lost hole. Rig skidded northwest for Well 1-X.	1,700
17		NESE	31-18S9E	Pu	Castledale Oil Co. (Pacific Western Oil Co.) #1	Castle Dale	12-8-21	5306	Mancos	Morrison		A few feet north of P. W. #2.	833
18		NESE	31-18S9E	Pu	G. H. Mulvey (Pacific Western Oil Co.) #2	Castle Dale	8-5-29	5300	Mancos	Morrison			825
19		NWSWSW	32-18S9E	S	Kralik Oil Co. #1	Castle Dale	1-?-48	?	Mancos	Navajo	Km surface, Kmf 75', Kd 850', Jm 900', Jn 3540'.	Some dead oil shows 2300-2400'.	3,600
20	C	SWNW	2-18S10E	P	Equity Oil Co. #1	Bull Canyon	?	?	Morrison	?			4,825
21		N½SENE	12-18S12E	Pu	ElPaso Natural Gas Co. #1	Pack Saddle	5-11-53	5291	San Rafael Group	Pre-Cambrian	Jn 100', Jk 400', Jw 524', Rc 970', Rsh 1194', Rm 1265', Rsi 1945', Pk 2280', Pco 2330' Cp 2859', Cm 4566', Quartzite 6580', Metamorphics 6720', Granite 6796'.	10 DSTs; gas-cut mud at 2278-2312'.	6,806
22		SWSE	12-19S13E	Pu	Utah Oil Refining Co. #1	Woodside	2-7-24	5200	Curtis	Coconino	Jc surface, Je 215', Jca 680', Jn 835', Jk 1215', Jw 1475', Rc 1770', Rsh 2130', Rm 2215', Pk 2820', Pco 2900'.	10,000 MCFG containing CO_2 & He. Show at 1940-45', 2155-65', 2845', 2970'.	3,270'
23		NWNE	2-20S7E	P	Anderson & Brockbank (Intermtn. Nat. Gas Co.) Sorenson #1	Clawson	2-?-54	5950	Mancos	?		Gas show of 47-50 MCFG.	1,457
24			20S10E	Pu	J. A. Carrol #1	San Rafael	1921	?	Jurassic	Jurassic			300
25		SWSE	24-20S11E	?	Old Emery Oil Co. #1	San Rafael	10-?-22	?	Moenkopi	Moenkopi			480
26		SW	29-20S12E	P	San Rafael Oil Co. #1	San Rafael	1921	?	?	?			190
27			9-20S14E	Pu	Burns #1	Desert	1899	4500	Morrison	Navajo?			1,490
28		SENW	5-21S9E	Pu	Leonard Petroleum Co. #1	Salt Wash	7-?-21	?	Carmel	Carmel			480
29		SENW	8-21S9E	Pu	Leonard Petroleum Co. #1	Salt Wash	5-?-22	5500?	Carmel	Moenkopi	Jca surface, Jn 690', Rc 1915', Rsh 2105', Rm 2230'.		2,790
30		NWSW	8-21S9E	Pu	Utah Oil Refining Co. #2	Salt Wash	2-?-22	?	Carmel	Coconino			20
31			27-22S12E	Pu	H. A. Schweikhart #1	San Rafael	9-12-21	?	Moenkopi	?			150
32		SESE	5-22S15E	Pu	California-Utah Oil Co. #1	Green River	1899	4500?	Mancos	L. Entrada or U. Carmel		Show oil 1600'. Show gas and oil Jc ? 1100'.	1,600
33	C	SENW	28-22S15E	Pu	Equity Oil Co. #1	Horse Bench	1-12-52	4400	Morrison	Mississippian	Jca 1385', Jn 1565', Rc 2530', Rsh 2730', Rsi 3255', Pco 3559', Cph 4280', Cpp 6040', Cm 7860'.	Several DSTs. 6-10 bbls. oil 45° API 5916-32'.	8,134
34		SWNE	21-22S16E	P	W. P. Whisnant #1	Green River	9-20-43	4012	Jurassic	Jurassic			435
35		SWSW	22-23S11E	Pu	Standard Oil Co. of Calif. #1	San Rafael	10-28-36	6500?	Kaibab	Mississippian			2,285

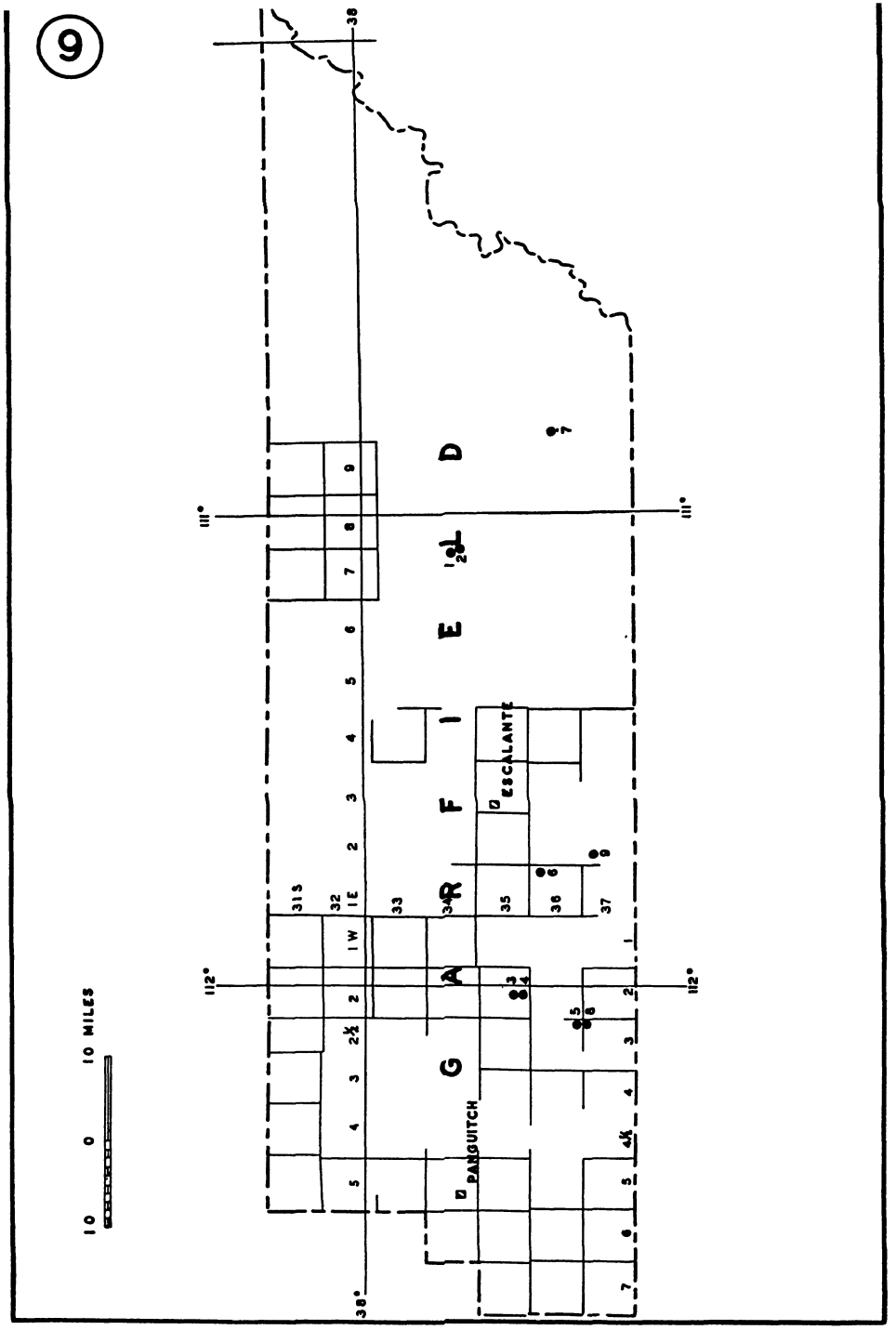
Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

36	NWNW 27-23S11E Pu	Standard Oil Co. of Calif. #2	San Rafael	6-12-37	6480	Coconino	Schist	Cph 770', Cm 1270', D 4020', P-6 4360'.	Log without tops available on photostat. No shows of oil or gas.	4,900
37	NESE 34-23S11E Pu	Carter Oil Co. #1	San Rafael	2-1-22	?	Coconino	Mississ pian	———	Log available on photostats. No oil or gas shows.	3,035
38	SESWSW 2-24S13E S	Iron Wash Oil & Gas Co. #1	Iron Wash	8-?-52	4700	Entrada	?	Jn 333', Jk 860', Jw 1060', Rc 1370', Rsh 1670'?. Rm 1751', Rsi 1967', Pco 2370'.	Oil shows at top of Rsh and several in Rsi; free oil and heavy oil in Pco. Water at 2355-65'. No water below 2365'.	2,426
-39	NENESW 5-24S15E Pu	General Petroleum Corp. #45-5-6	San Rafael River	4-6-51	4314	Entrada	Leadvil	Jn 360', Jk 880', Jw 1090', Rc 1410', Rsh 1720', Pk 2110', Pco 2470', Pr 3030', Cph 3220', Cpp 3981', Cml 6832'.	———	7,161
-40	C SWSW 34-25S12E Pu	Delhi Oil Corp. Russell #1	North Hanksville	6-7-53	5157	Entrada	Devonia	Jca 298', Jn 694', Jw 1420', Rc 1745', Rsh 2010', Rm 2090', Pk 2615', Pco 2680', Pr 3350', Cph 3695', Cpp 4155', Cpmo 5450', Cm 5590', D 5790'.	9 DSTs. Shows of CO_2.	6,008
-41	C NENE 13-26S6E Pu	Byrd-Frost, Inc. #1	South Last Chance	9-7-53	6064	Carmel	Moenkop	Jn 230', Jk 1309', Jw 1416', Rc 1734', Rsh 1851', Rm 1922'?, Rsi member 2780'.	IP 750 MCFG PD, Rm 2580-2600' & 2688-2706'. Sand-fracked.	2,875
-42	W SENW 18-26S7E Pu	Mountain Fuel Supply Co. #1-A	South Last Chance	4-11-48	6108	Carmel	Undiff. Paleozoc	Jca surface, Jn 204', Jk 1250', Jw 1387', Rc 1730', Rsh 1818', Rm 1950', Rsi 2768', Rm 2870', Pk 3000', Pco 3705', Cp 4035', Cm 4630', Undiff. Paleozoic 5575'.	Schlumberger 2 runs, 3401', 8516'. Log with top. DSTs to 2710'.	8,518
8-43	W NESW 18-26S7E Pu	American Oil Co. #1	South Last Chance	?	4400	Carmel	Navajo	———	———	320
8-44	E NWSW 18-26S7E Pu	Ramsey Petroleum Corp. #1-X	South Last Chance	12-16-34	6122±	Carmel	Coconino	Rm 2530'.	Gas Rm 2530-2771, 21,000 M. Gas Rm 2698-4000 M. Good oil show 2800' & 3071'.	3,168
8-45	NESESW 18-26S7E Pu	Byrd-Frost, Inc. #1-X English	South Last Chance	7-27-53	6118	Carmel	?	Jn 220', Jk 1260', Jw 1310', Rc 1710', Rm 1880', Rsi 2738'.	Information not yet available.	2,753
8-46	E SESW 18-26S7E Pu	Byrd-Frost, Inc #1 English	South Last Chance	11-2-52	6118	Carmel	Navajo?	———	Lost shoe joint; junked hole, skidded rig 20' south for well #1-X.	1,063
8-47	SESW 18-26S7E Pu	Mt. Fuel Supply Co. #1	South Last Chance	4-21-47	6130	Carmel	Coconinc	———	Gas Rm 2720'.	3,485
8-48	SESW 19-26S13E Pu	Des Moines Oil Co. #1	Flat Tops	1913	5500?	Entrada	Coconinc	Pco 2750'.	Water well; show of oil & gas 2160' Rsh ?; at 2400' Rm ? and Pcou.	2,910
8-49	SWNWSW 25-26S13E Pu	Tide Water Assoc. Oil Co. #6-25	Flattop Sweetwater	6-24-49	5320	Entrada	Elbert	Jca 300±, Jn 540'±, Jk 1000'±, Jw 1350', Rc 1630', Rsh 1943', Rm 2005', Pco 2565', Pr 3225', Cph 3575', Cpp 4037', De 5365'.	Sampled to Jk; electric log for tops below.	5,472
8-50	NENENE 32-26S13E S	George Callahan #1	Nequoia Arch	10-?-46	5000±	Entrada	Coconinc	Rsh 2030', Rm 2115', Pk 2502', Pco 2605'.	———	2,638
8-51	NENESW 32-26S13E S	R. D. Robinson #1	Nequoia Arch	4-8-47	?	San Rafael	?	———	———	2,642
8-52	C 29-26S14E Pu	Des Moines Oil Co. #?	Nequoia Arch	1912	?	Navajo	Chinle	———	———	2,140
GARFIELD COUNTY										
9-1	NENESW 24-34S7E Pu	N. B. Hunt #1	Circle Cliffs	?	6822	Kaibab	?	———	———	2,356
9-2	SWNE 25-34S7E Pu	Ohio Oil Co. #1	Circle Cliffs	11-9-21	?	Kaibab	Hermosa Mississi pian	Pk surface, Pco 745', Cph 1630'.	No shows of oil or gas.	3,212
9-3	NWSWNE 22-35S2W Pu	California Co. #2	Johns Valley	5-31-52	7783	Wahweap (Mancos)	Kaibab	Kd 1750', Jm 1950', Jn 3910' Rc 5700', Rsh 6260', Rm 6340', Pk 7320'.	———	7,700
9-4	C NWSE 22-35S2W Pu	California Co. #1	Johns Valley	1-7-52	7802	Wahweap (Mancos)	Redwall	Kd 1808' (S), 1808' (EL); Jm 2010' (S), 2010' (EL); Jn 3650' (S) 3650' (EL); Rc 5735' (S), 5735' (EL); Rsh 6305' (S), 6295' (EL); Pk 7370' (S) 7365' (EL); Pco 8288' (S), 8288'? (EL); Pr-Cph 9430' (S), 9410'? (EL); Cmr 10,189' (S)	To test 15 miles NW of Upper Valley discovery. Spudded in 12-8-48.	10,335

Note: Wells for each county are "spotted" on the accompanying map.

Note. For abbreviated legend data see explanation before tables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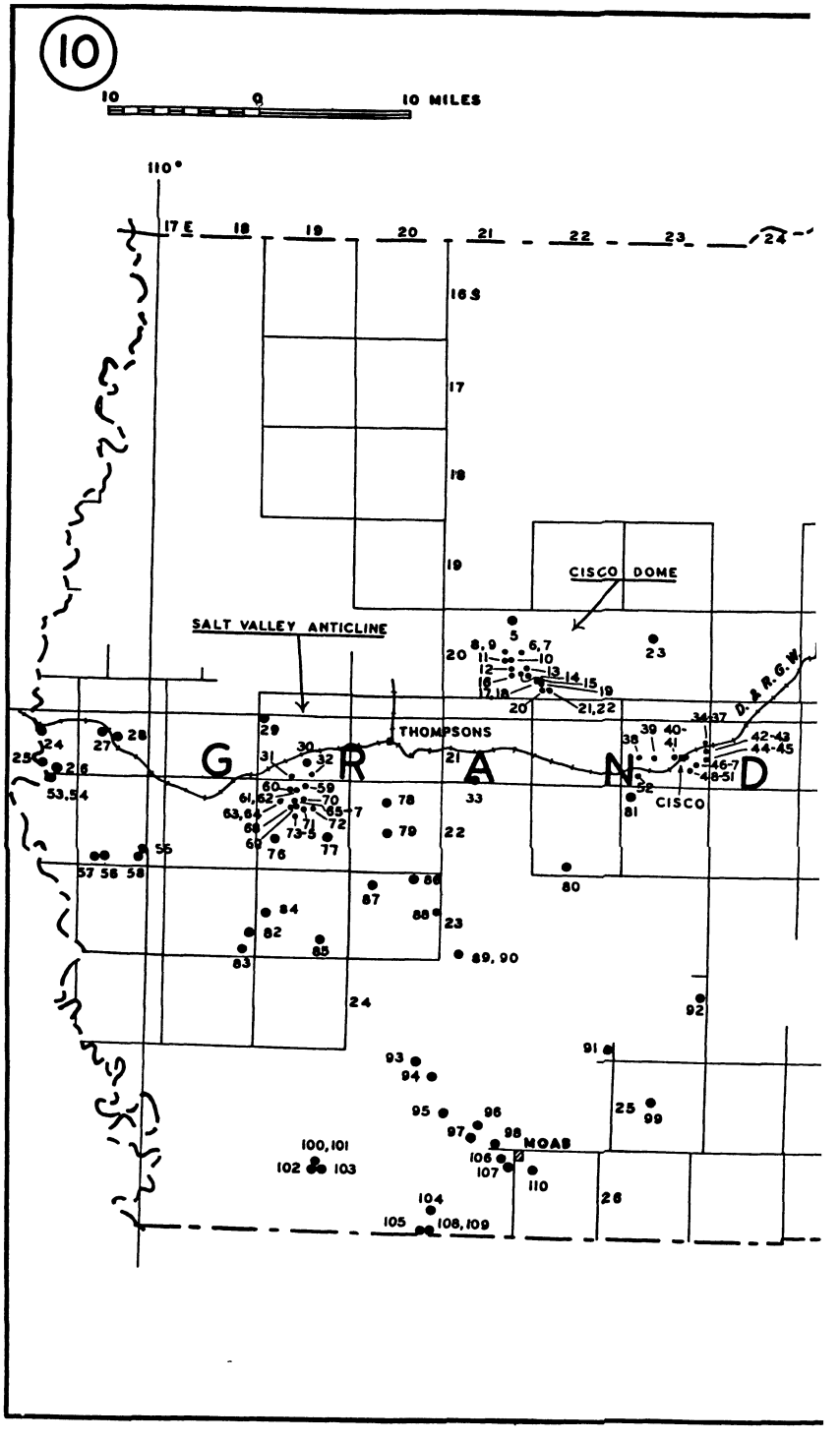
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CISCO DOME
SALT VALLEY ANTICLINE
D. & R. G. W.
THOMPSONS
GRAND
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110

9-5		36-36S3W	P	Bryce Canyon Oil Co. #1	Tropic	1928	6000?	Morrison	?		400
9-6	NWSWNW	12-36S1E	Pu	California Co. #1	Upper Valley	9-?-51	7185	Mesaverde	Cambri	Kd 715' (S), 715' (EL); Jm 930' (S), 930' (EL); Jn 2630' (S), 2630' (EL); Rc 4720' (S), 4710' (EL); Rsh 5158' (S), 5153' (EL); Rm 5251' (S), 5251' (EL); Pk 6040' (S), 6040' (EL); Pco 6945' (S); Pr-Cph (PCsm & PCsl) 8035' (S), 8041' (EL); Cmr 8750' (S), 8750' (EL); D 9530' (S), ? (EL); @ 10,023'.	IP 150 bbls., 17° (14° @ 60° F.), Cmr 8777-8857'.	10,120
9-7	E SESE	18-36S10E	Pu	California Co. #1	Muley Creek	3-28-52	5009	Morrison	Cambr	Jn 1460', Jk 2435', Jw 2698', Rc 2950', Rsh 3598', Rm 3640', Pw 3930', Por 4245', Pcm 4710', Pr 6088', Cph 6262', Cpmo 7014', Cmr 7201', D 7805', @ 8316'.		8,362
9-8		1-37S3W	P	Bryce Canyon Oil Co. #2	Tropic	1928	?	Morrison	?			15
9-9	NWNWNW	8-37S2E	Pu	California Co. #2	Upper Valley	10-26-52	7095	Wahweap	Timpo Kaiba	Kd 1478', Jm 1610', Js 2400', Je 2570', Jca 2830', Jn 3297', Rc 5316', Rsh 5920', Rm 6063', Pk 6782'.	DSTs 6809-7114' rec. gas-cut mud and water with sulphur odor. Gas would not burn.	7,114
GRAND COUNTY												
10-1	C SESE	12-17S25E	Pu	Frontier Refining Co. #1	Bar X	8-23-48	5008	Mancos	Grani	Kd 2820', Jm 2990', Js 3500', Je 3555', Jk 3780', Jw 3972', Rc 4348', Granite Wash 4455', Granite 4485'.	IP 4,700,000 cu.ft. Initial RP flowing 800# shut-in 1300#.	4,497
10-2	NENENW	21-17S25E	Pu	Burton W. Hancock #1	West Bar X	?	5170	Mancos	?	Kd 3350'.		3,935
10-3	NENE	4-19S25E	Pu	Fallgren & Weightman, Home Oil Co. #1	Harley Dome	9-12-25	4942	Dakota	Morr	Jm 488'.	Helium reserve #2, 250 M cu.ft. of gas; Jm 488-584', 4,000 M.	802
10-4	SENE	4-19S25E	Pu	Fallgren & Weightman #1	Harley Dome	5-3-26	4946	Dakota	Wing		Helium reserve #2, 250 M cu.ft. of gas from 564-81' and 5,000 M gas reported from 860-945' (Je).	1,675
10-5	SWSE	2-20S21E	S	Navajo Petroleum Corp. #1	Cisco Dome	6-1-29	5487	Mancos	Morr			2,965
10-6	SWSW	13-20S21E	Pu	Utah Oil Refining Co. #4	Cisco Dome	8-?-25	?	Mancos	Manc			500
10-7	NESW	13-20S21E	Pu	F. Engstrom #1	Cisco Dome	8-12-28	5145	Mancos	Morr			2,945
10-8	NESW	14-20S21E	Pu	W. A. Cunningham #1	Cisco Dome	4-3-28	5162	Mancos	Dako	Kd 2215'.	Gas, Kd 2215-44', 2104 M.	2,246
10-9	SESW	14-20S21E	Pu	Utah Oil Refining Co. #3	Cisco Dome	1-6-25	?	Mancos	Manc			501
10-10	SENE	23-20S21E	Pu	Continental Oil Co. #1	Cisco Dome	8-17-44	5105	Mancos	Gran	Kd 2025', Jm 2093', Jmsw 2504', Je 2741', Jn 3193', Jk 3262', Jw 3478', Rc 3781', Rm 3944', Arkose 4044', Granite 4395'.		4,744
10-11	NENW	23-20S21E	Pu	Crystal Carbon Co. #6	Cisco Dome	11-13-28	5127	Mancos	Dak	Kd 2080'.	3,500 MCFG at 2028-2108'.	2,108
10-12	NESE	23-20S21E	Pu	Crystal Carbon Co. #4	Cisco Dome	8-21-27	5107	Mancos	Dak	Kd 2022'.	9293 MCFG at 2022-2032'.	2,032
10-13	SESE	24-20S21E	Pu	Crystal Carbon Co. #2	Cisco Dome	11-14-26	5077	Mancos	Mor	Jm 2228'.	7194 MCFG at 2228-72'.	2,423
10-14	SENE	25-20S21E	Pu	Perfection Oil & Gas Co., Crystal Carbon Co., (Utah Oil Co.) #1	Cisco Dome	8-?-26	5051	Mancos	Mor	Kd 1915', Jm 2318'.	6,000 MCFG at 1930'; 90,000 MCFG at 1954'; also gas at 2318-25'.	2,414
10-15	SWNW	25-20S21E	Pu	Crystal Carbon Co. #3	Cisco Dome	5-4-27	5064	Mancos	Mor	Jm 2044'.	1042 MCFG at 2044-54'.	2,057
10-16	NWNE	26-20S21E	Pu	Crystal Carbon Co. #5	Cisco Dome	6-11-28	5099	Mancos	Mor	Jm 2250'.	1042 MCFG at 2250-71'.	2,271
10-17	E NWSW	30-20S22E	Pu	Perfection Oil & Gas Co. #1	Cisco Dome	8-25-26	4987	Mancos	Mor	Kd 1917', Jm 1978'.	4126 MCFG at 1917-1925'.	1,940
10-18	NWNWSW	30-20S22E	Pu	Utah Oil Refining Co. (Perfection Oil & Gas Co.) #2	Cisco Dome	4-13-25	4880	Mancos	Kay	Kd 1949'.	2,000 MCFG at 1949-50'. Closed in pressure 150# Psi and gas carried .0025 gallons gasoline to the 1000 cu.ft.	3,045

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Note: For abbreviated legend data see explanation before tables.

10-19		NESE 30-20S22E Pu	Perfection Oil & Gas Co. #3	Cisco Dome	9-22-28	4982	Mancos	Morri			2,
10-20		SENE 31-20S22E Pu	Perfection Oil & Gas Co. #2	Cisco Dome	10-26-27	4927	Mancos	Morri	Kd 1920'.	5252 MCFG at 1920-26'.	2,
10-21		NENW 32-20S22E Pu	C. A. Urban #1	Cisco Dome	8-9-28	4919	Mancos	Dakot	Kd 1950'.	5500 MCFG at 1950-60'.	1,
10-22		NWNW 32-20S22E Pu	Utah Oil Refining Co. #5	Cisco Dome	8-6-25	?	Mancos	Manco			
10-23		SESW 9-20S23E Pu	W. H. H. Cranmer Syndicate Moss #1	Cisco Springs	9-6-30	4720	Mancos	Dakot		Show gas top of Kd at 2015'.	2,
10-24		SWSE 15-21S16E P	Bamberger & Millis #1	Green River	1891	4100	Mancos	Morri			1,
10-25		SESE 34-21S16E S	Glen Ruby, et al #1-X	Little Grand Fault	6-?-36	4055	Morrison	Kaiba			2,
10-26		NWSE 35-21S16E Pu	Marland Oil Co. #1	Green River	9-14-26	4410	Morrison	Lower Cutle or Ri	Jk 1500'?, Rsh 2396'?, Rm 2630', Pco 3060'.	Oil shows at 400'; gas 1500-30'; oil at 2396'; gas at 2630'; oil at 2630-45'; oil at 3060-70'; gas at 3170-80'.	3,
10-27		NWNE 20-21S17E Pu	Crescent Drilling Co. #1	Green River	3-?-13	4200?	Mancos	Entra			2,3
10-28		NENE 21-21S17E Pu	Crescent Drilling Co. #2	Green River	1913	4200?	Mancos	?			1,6
10-29		NESW 7-21S19E Pu	Sandburg Petroleum Co. #1	Salt Valley Anticline	1925	5103	Mancos	Manco		Very small shows of gas.	2,4
10-30		SWSW 27-21S19E Pu	Crescent Oil Syndicate #1	Salt Valley Anticline	6-17-30	4916	Mancos	Dakot			2,1
10-31		SESW 33-21S19E Pu	Potash Company of America #2	Crescent	12-24-43	4865	Mancos	Parad	Jn 1736', Cph 3780', Cpp 4357'.	Show of light oil 1896-1901'. 2 MCFG at 4865'.	5,0
10-32		NW 34-21S19E ?	Western States Development Co. (McCarthy #1)	Crescent	1930?	4900	Mancos	Manco			2,2
10-33	C	NWSW 33-21S21E Pu	Pacific Western Oil Corp. #1	Thompson	7-22-49	4798	Mancos	Parad	Kmf 860', Kd 1147', Jm 1200', Jmsw 1699', Js 1936', Je 1969', Jca 2201', Jn 2225', Jk 2469', Rc 3386', Rm 3616', Pcu 3943', Cph 9525'?, Cpp 12,206'.	Show of gas at 830' and 1360'.	13,7
10-34	C	SWSE 13-21S23E P	Arizona-Utah Gas & Oil Co. #2	South Cisco	1925?	?	Mancos	Morri		Show of oil.	6
10-35	C	SWSE 13-21S23E P	Cisco Oil Development Co. #1	South Cisco	1927	4375?	Mancos	Entra		Show oil 640' and 1237'.	1,2
10-36	E	SWSE 13-21S23E P	Cisco Oil Refining Co. #1	Cisco Town	1927	?	Mancos	?		Show oil and gas	57
10-37	S	SWSE 13-21S23E P	Cisco Oil Development Co. #2	South Cisco	8-?-23	?	Mancos	?		Show gas.	53
10-38	N	NWSW 20-21S23E Pu	Equity Oil Co. #1	Nash Wash	9-20-50	4514	Mancos	Grani	Kd 1490', Jm 1544', Jmsw 1950', Je 2150', Jca 2515', Jn 2542', Jw 2790, Rc 3115, Granite Wash 3315', Granite 3798'.		3,81
0-39		NWNWSW 21-21S23E Pu	Utah Southern Oil Co. #1-A	Cisco	?	4477	Mancos	?			92
0-40		NWSE 22-21S23E S	Utah Southern Oil Co. #1	Cisco Wash	12-11-44	4398	Mancos	Morri			73
0-41		SWSW 23-21S23E S	Utah Southern Oil Co. #2	Cisco Wash	1-24-45	?	Mancos	Morri			93
0-42		NWNE 24-21S23E P (Block 6)	C. North & W. D. Owen #1	Cisco Townsite	?	?	Mancos	?	Kd 410', Jm 477'.	Casing: 5-1/2" cc at 500'.	56
0-43		SENE 24-21S23E P	Cisco Oil Refining Co. #1	Cisco Town	1927	?	Mancos	?		Oil show 552-556', 1-10 bbls. per day, water interference.	57
0-44		NWNESE 24-21S23E P	Cisco Oil Refining Co. #2	Cisco Town	1927	?	Mancos	?			55
0-45		SWNESE 24-21S23E P	Cisco Oil Refining Co. #3	Cisco Town	1927	?	Mancos	?		Oil show at 360'.	55
0-46		NWNW 25-21S23E P	Peerless Oil Co. #1	Cisco Town	1923?	?	Mancos	Morri		Shows oil and gas from Kd 390'.	631
0-47		SWNW 25-21S23E S	Western Crude Oil Co. #3	South Cisco	10-?-45	?	Mancos	Dakot			1,180
0-48	E	NWSE 26-21S23E S	Entrada Petroleum Corp. #1	South Cisco	9-?-49	?	Mancos	Entra			1,245
0-49		NWNESE 26-21S23E S	Western Crude Oil Co. #1	South Cisco	5-14-45	?	Mancos	Dakot	Kd 375'.	Show of gas 375-377'.	385

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

10-50	W NESE	26-21S23E	S	Western Crude Oil Co. #2	Cisco Wash	6-5-45	?	Mancos	Dako	———	———	44
10-51	S NWSE	26-21S23E	S	Utah Southern Oil Co. #1	South Cisco	6-1-30	4387	Mancos	Gran	Tc 2295' est.	Show of black oil 1200' (Je), drilled 34 feet into Granite.	2,43
10-52	C NW	32-21S23E	S	Taylor Brothers Oil Co. #1	Cisco	5-?-48	?	Mancos	Dako	Kmf 1120'.	15 bbls. of oil in 2-hour testing.	1,73
10-53	E NWNW (Lot 5)	2-22S16E	S	Amerada Petroleum Corp. #1	Green River	8-19-48	4080	Morrison	Para	Jm 1393', Jn 1495', Pco 2665', Cph 3155', Cpp 4820', Cpp Salt 5100'.	Reported to have hit high gas in Cpp at present depth. Oil show at 5640-45'.	5,64
10-54	SENWNW (Lot 5)	2-22S16E	S	Amerada Petroleum Corp. #2	Green River	7-17-49	4067	Morrison	Para	———	550' south of Amerada #1.	5,89
10-55	SESE	26-22S17E	Pu	British-American Petroleum Co. #3	Salt Wash	1912	4519	Morrison	Morr	———	———	42
10-56	C NENE	32-22S17E	S	Pacific Western Oil Corp. #1	Salt Wash	9-15-49	4245	Moab	Para	Je 19', Jca 360', Jn 485', Jk 700', Jw 905', Tc 1385', Rsh 1637', Rm 1687', Pk 1943', Pco 2323', Pcu-Pco 2725', Pr 2843', Cph 2928', Cpp 4761'.	Salt 5026'.	5,04
10-57	SWNENW	32-22S17E	S	Delaney Petroleum Corp. #1	Salt Wash	1-?-49	?	Mancos	?	———	———	98
10-58	NENW	35-22S17E	Pu	British-American Petroleum Co. #2	Salt Wash	1912	4415	Morrison	Entr	———	———	1,50
10-59	SWNW	3-22S19E	Pu	Utah Oil Refining Co. #1	Salt Valley Anticline	9-25-24	4920?	Mancos	Manc	———	———	8
10-60	SWSW	4-22S19E	Pu	Potash Co. of America #1	Salt Valley Anticline	6-3-43	4780	Mancos	Para	Benton 1285', Kd 1300', Jm 1310', Js 2065', Jemt 2128', Je 2180' Jca 2258', Jn 2290', Jk 2470', Cpp 2737'.	2051-2053' oil saturation, 2565-2578' show oil.	5,0
10-61	C SWSE	4-22S19E	P	Defense Plant Corp. #1 (Gus Pongratz)	Crescent	9-26-49	4787	Mancos	Para	———	Taken over by Gus Pongratz and drilled to 10,350'. Completed September 1949. No show of oil or gas below 3150'	10,3
10-62	SESWSE	4-22S19E	P	Crescent Eagle Oil Co. #1	Crescent	9-?-41	4900?	Mancos	Para	Kd 1811', Jm 1843', Cpp 1981'.	Shows of oil and gas in Km and Kd at 1981'; strong flow salt water and high-gravity oil 2060-2130' rock salt, moist gas flow with high gasoline content 5,000 MCFG below rock salt (2,132), gas, oil, and water blew out at 3,205'. Blow out 3911', 960 bbls. salt water, 60 bbls. oil on 6 hours test.	4,0
10-63	C SWNE	8-22S19E	Pu	Grand County Oil Co. #1	Crescent	9-25-48	4745	Mancos	Entr	Km surface, Kmf 682', Km 700', Kd 1105', Jm 1130', Js 2142', Je 2200'.	Slight shows of oil at 1121-24', oil and gas at 1610-20' and 1760-96'.	2,3
10-64	SESWNE	8-22S19E	G	Walker Production Co. #1	Crescent	1-27-48	?	Mancos	?	———	———	1,2
10-65	NWNENE	9-22S19E	?	Brendell Oil & Gas Co. #1	Salt Valley Anticline	1932	?	?	?	———	Gas show 3400'.	4,1
10-66	NENE	9-22S19E	Pu	W.S.L. Main #1	Crescent	9-14-32	4785	Mancos	Para	———	———	4,1
10-67	NWNE	9-22S19E	P	Crescent Eagle Oil Co. #0	Crescent	1920	?	Mancos	Manc	———	———	6
10-68	SESESW	9-22S19E	Pu	Robert L. Maddox #1	Crescent	3-11-51	4724	Mancos	Kaye	Kd 680', Jm 1224'?, Jem 1415', Jn 1610', Jk 1821'.	———	1,8
10-69	SESE	9-22S19E	Pu	Armstrong Co. #1	Crescent	1-7-27	4760	Mancos	Summ ville	Kd 660', Jm 710', Js 1190'.	Show heavy oil base Kd at 710'. Show oil 1212-1220', saturated oil sand 1210-1217'. No production.	1,2
10-70	NWNW	10-22S19E	Pu	Potash Co. of America #1	Crescent	10-26-43	4766	Mancos	Para	———	———	5,0
10-71	NWSW	10-22S19E	Pu	Utah Oil Refining Co. #1	Crescent	7-7-24	?	Mancos	Manc	———	———	
10-72	SENESE	10-22S19E	Pu	Big Six Oil Co. #1	Salt Valley Anticline	1928	?	Mancos	Nava	———	Gas show 460'; show oil 795'.	1,'
10-73	NWNWNE	16-22S19E	S	Potash Co. of America #1	Crescent	6-22-43	4731	Mancos	Para	———	130 bbls. 33.6° API oil 1603'.	5,2

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

-74	W NWNE	16-22S19E	S	Utah Drilling & Development Co: #1	Crescent	10-?-45	4729	Mancos	Morris	———	Oil show Jm 1055-80'.	1,215
-75	NENENE	16-22S19E	S	Reeder Corp. #1	Salt Valley	12?-?-41	4750?	Mancos	?	———	———	1,426
-76	SESESW	20-22S19E	Pu	Grand Pyramid Oil Inc. #1	Crescent	7-?-53	4630	Mancos	?	Kd 1430'.	———	1,430
-77	NWSE	23-22S19E	Pu	Big Six Oil Co #1	Salt Valley	12-?-41	4670	Mancos	Morris	———	———	1,130
-78	SESE	9-22S20E	Pu	Raddatz-Vogel-Travis #1	Thompson	10-3-25	4830	Mancos	Morris	———	———	1,450
-79	NWNE	21-22S20E	Pu	Hope Syndicate #1	Thompson	10-22-25	5250	Mancos	Morris	———	———	1,400
-80	NWNW	33-22S22E	Pu	Utah Southern Oil Co. #1	Cisco	4-?-37	4785	Morrison	Hermos	———	Water well temperatures at following depths: 60° F, 100'; 66.6°, 1000'; 76.1°, 2000'; 86.8°, 3000'; 96.5°, 4000'; 106.9°, 4800'.	6,715
-81	SESE	6-22S23E	Pu	P. D. Jones #1	Saleratus Creek	1900	4600	Mancos	Morris	———	No shows of oil or gas.	1,800
-82	NWNWNE	25-23S18E	Pu	British-American Petroleum Co. #1	Ten Mile Wash	1912	4800?	Morrison	Entrad	———	Water at 350'.	530
-83	NWNW	36-23S18E	S	W. P. Whisnant, et al #1	Ten Mile Wash	12-23-43	?	Mancos	Wingat	———	———	1,136
-84	SESE	18-23S19E	Pu	Hagen #1	Ten Mile Wash	1913	4800?	Mancos	Morris	———	Fresh water at 425', salt water 600' and 870', showing of oil 910'.	920
-85	NWSW	26-23S19E	Pu	Moab Oil Co. #1	Ten Mile Wash	1912	4800?	Mancos	Mancos	———	———	700
-86	SWSENW	2-23S20E	S	Pure Oil Co. #1	Northeast Salt Valley	2-4-49	5242	San Rafael Group	Parad	Jw 1275', Rc 1565', Rsh 1980', Rm 2060', Cpp 2480', Salt 2780'.	Schlumberger run at 1385'.	3,036
-87	SESE	5-23S20E	Pu	Western Allies #1	Salt Valley	1919	?	Jurassic	Parad	———	Show of oil and gas, salt and epsomite at 775-825', small show of gas and oil at 825'.	825
-88	SENESE	13-23S20E	Pu	Utah Southern Oil Co. #1	Salt Valley	10-23-29	5100?	Kayenta	Parado	Salt sequence 1570' to total depth.	Salt water 1478-1480' Cph.	3,829
-89	NENWNW	32-23S21E	S	King Oil Co. #1	Salt Valley	11-26-53	4870	Paradox	Parado	———	Show oil 3294-3358'. Shot with 308 quarts nitroglycerin, but no oil or gas by bailing.	3,550
-90	C NWNW	32-23S21E	G	Utah Southern Oil Co. #1	Salt Valley	10-27-32	4870	Paradox	Parado	Cpp 6120'.	Log is available on photostats. Oil showings from 3387-3436'. Water sands 840-850'.	6,120
-91	SWNWNE	36-24S22E	S	Grand River Oil & Gas Co. #1	Castle Creek	1-5-50	3999	Moenkopi	Granit Wash-H	Pr 1930'.	Hole left open above 350'. May be used for water.	3,711
-92	SWNESE	12-24S23E	Pu	Harry P. Hubbard #1	Onion Creek	5-15-51	4481	Cutler	Parado Member Hermos	———	Entire column was Arkosic in character.	7,955
-93	SESE	2-25S20E	S	Great Lakes Carbon Corp. #1	Seven Mile	8-15-46	?	Rico	Parado	———	———	3,655
-94	SWSE	12-25S20E	Pu	Columbia Crude Corp. #1	Seven Mile	10-26-38	4700	Rico	Parado	Salt 2440'.	Only creditable showing of oil was in three feet of sand from 2130-2133'.	4,243
-95	NESW	20-25S21E	Pu	Empire Petroleum Co. #1	Moab	7-?-26	4400	San Rafael	?	———	———	235
-96	NENE	27-25S21E	Pu	Embar Oil Co. #1	Moab	1926	4030	Jurassic	?	———	———	300
-97	SENW	34-25S21E	Pu	Embar-Big Six Oil Cos. #1	Moab	3-2-28	4000	Hermosa	Parado	———	Oil and gas showing at 2380-2420', 2870', 3000', 4303', and 4880'.	5,345
-98	SESESE	35-25S21E	P	Great Lakes Carbon Corp. #1	Moab	1-?-43	?	Hermosa	Parado	———	———	3,367
-99	NESE	16-25S23E	S	Grand River Oil & Gas Co. Sid Pace #1	Castle Creek	11-?-50	?	Alluvium	?	———	———	1,725
-100	SENWNW	11-26S19E	Pu	Glen M. Ruby #1	Big Flat	8-22-51	6040	Kayenta	Moenko	Rm 928'.	Unable to recover tools due to caving.	1,008
-101	SENWNW	11-26S19E	Pu	Glen M. Ruby #1-A	Big Flat	5-26-53	6033	Kayenta	Devoni	Jw 230', Rc 550', Rsh absent, Rm 925', Pcu-Pr 1395', Cphu 2085', Cph-Cpp 4100', Salt 4158-7520', Cpmo 7821' -4" only - Cml 7821', D 8105'.	———	8,213

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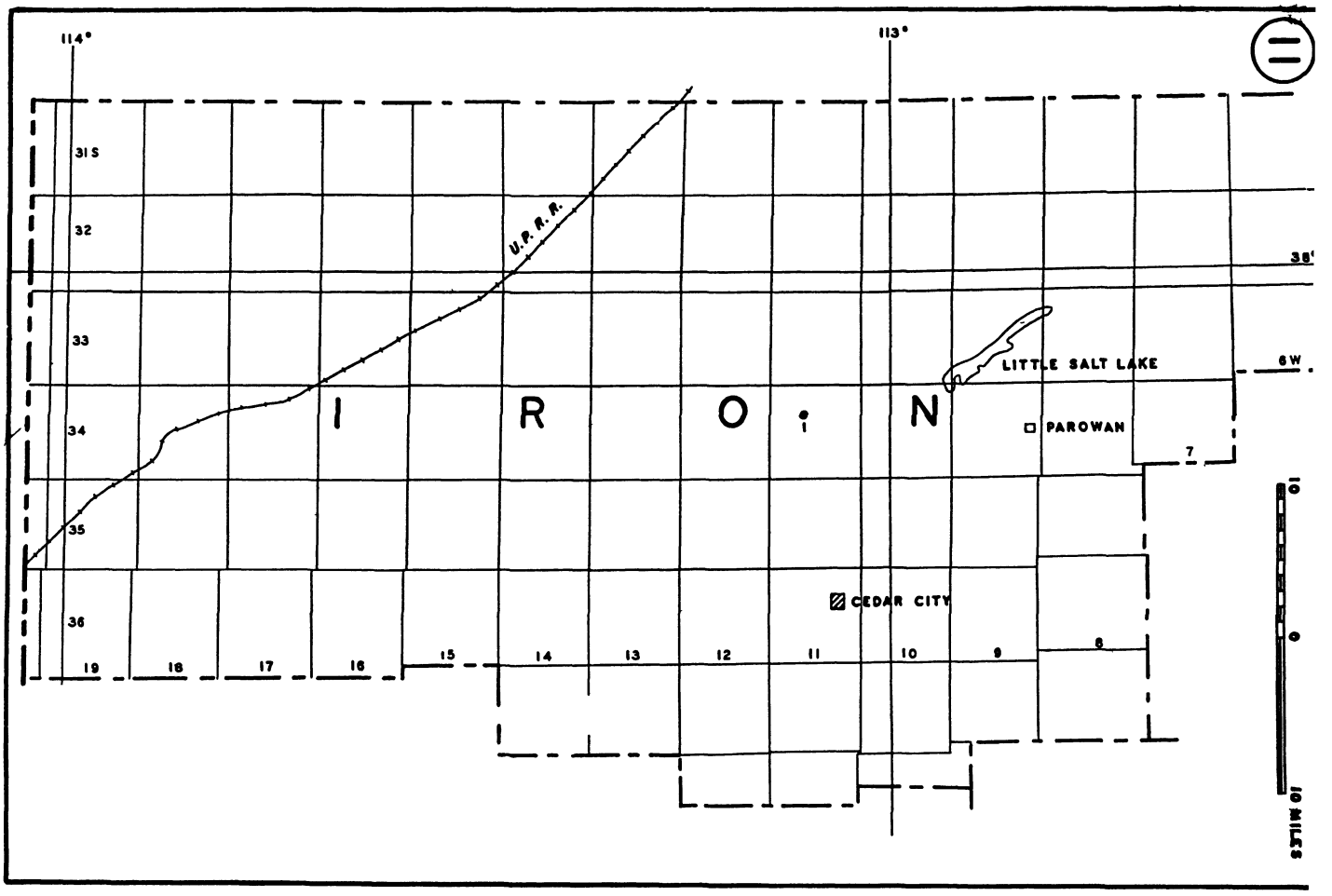
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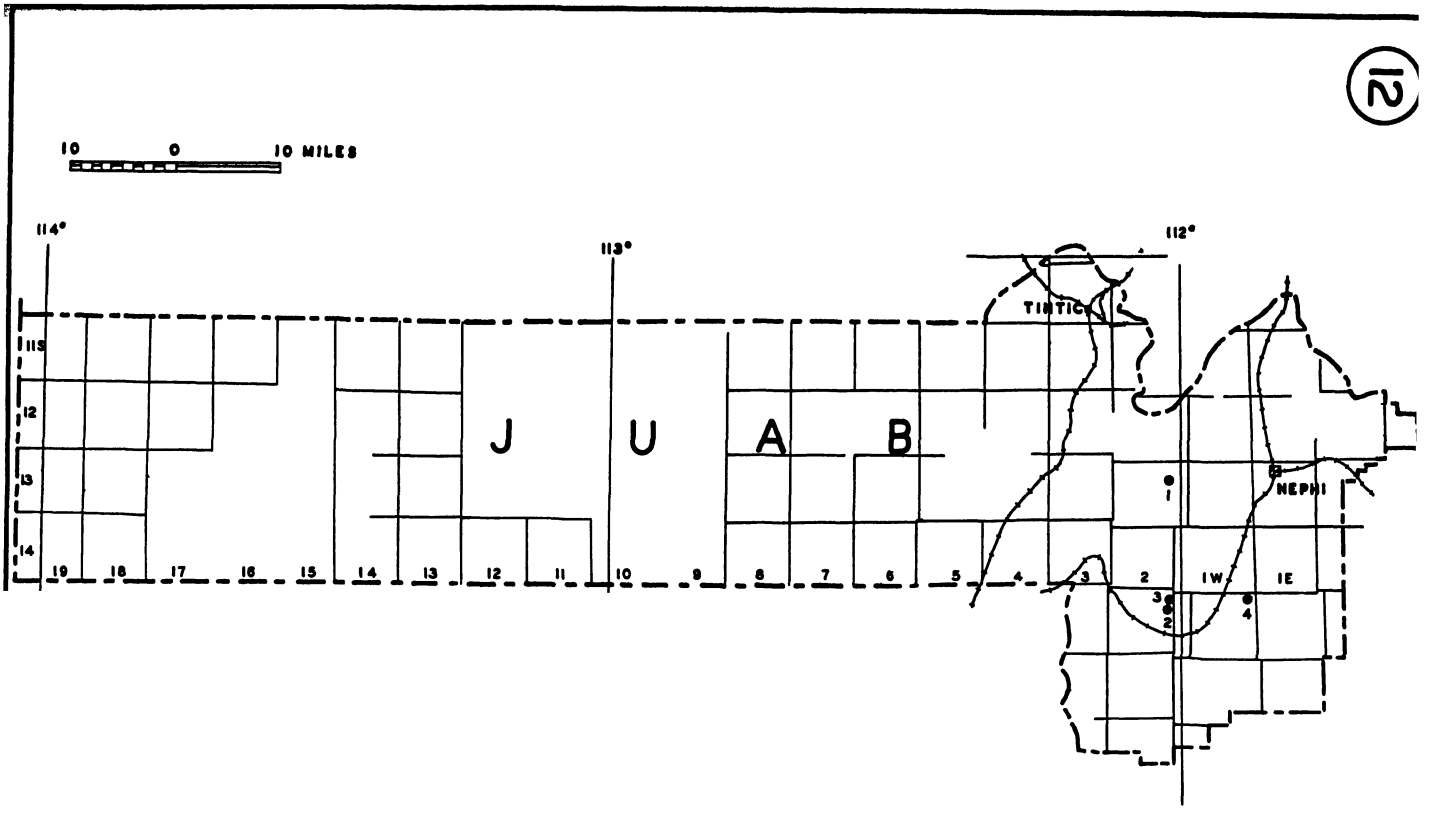
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10-102	S SENW	11-26S19E	Pu	Tide Water Assoc. Oil Co. #74-11	Big Flat	8-6-49	6141	Kayenta	Elbert	Jk surface, Jw 310, Rc 680', Rsh 991', Rm 1021', Pcu 1490', Pr 1564', Cph 2040', Cpp 3851', Salt 4261', Cml 7830', De 8362'.	8,
10-103	SWSESE	11-26S19E	Pu	King Oil Co. #1 Ruby	Big Flat	?	6139	Kayenta	?		
10-104	SWNE	25-26S20E	Pu	Utah Southern Oil Co. #1-A	Cane Creek	6-18-29	4000?	Rico	Paradc	Salt sequence from 2048'.	Show of gas 2055'. 4,
10-105	SENWSE	36-26S20E	Pu	MGM Petroleum Inc. #1	Cane Creek	?	4415	Hermosa	?		7,
10-106	C SWSW	1-26S21E	P	Dougan & Voohries #1	Moab	1-?-43	4000?	Paradox	Paradc		1,
10-107	NENWNE	12-26S21E	P	Western Allied Oil Co. #1	Moab	1920	4000?	Hermosa	Paradc		Show oil in Cpp, 1500' salt sequence. 2,
10-108	N SWSW	31-26S21E	Pu	Americol Petroleum Inc. Mason #1	Cane Creek	1-?-53	3965	Hermosa	?	Salt, 1530'.	5,
10-109	SWSW	31-26S21E	Pu	Midwest Exploration Co. (Utah Southern-Utah Oil Refining Co.) #1	Cane Creek	3-21-27	3944	Hermosa	Paradc	Cpp (salt) 1500'.	Good oil show 2024', oil and gas gushed to surface-burned rig. Oil show 3628', gas show 4980'. 5,
10-110	SWNW	8-26S22E	Pu	Utah Oil Development Co. #1	Moab	7-?-27	4000	Hermosa	Paradc		Shows of oil reported. 1,
IRON COUNTY											
11-1	NENESW	9-34S11W	P	Southern Utah Oil Co. #1	Rush Lake	10-?-49	?	Valley Fill	?		3,
JUAB COUNTY											
12-1	SENW	12-13S2W	S	Sage Valley Oil Co. Brough #1	Juab	12-?-46	?	Tertiary	?		1,
12-2	SENW	12-15S2W	S	Sage Valley Oil Co. #1	Sage Valley	1947	?	Tertiary	?		1,
12-3	SE	12-15S2W	?	Central Utah Gas & Oil Co. Clawson #1	Wildcat	Drilling	?	Quaternary	?		200' east of Sage Valley Oil Co. ab. well.
12-4		1-15S1W	S	Mt. Nebo Oil Co. #1	Juab	1912	5100	Tertiary	?		2,
KANE COUNTY											
13-1	SWSE	14-39S1W	Pu	Midwest Exploration Co. #1	Butler Valley	1930	6403	Navajo	Supai	Jk 840', Jw 947', Rc 1787', Rsh 2600', Pk 3370', PCs 4353'.	4
13-2	C SWSW	5-40S5E	Pu	Byrd Oil Corp. #1 Unit	Rees Canyon		6000	Mesaverde	?	Kd 1083', Jm 1340', Jca 2465', Jn 2655', Rc 4730', Rsh 5280', Rm 5461', Pk 5840', Pco 6532', Pr 8010', Cp 8150', Cph 8205'.	8
MILLARD COUNTY											
14-1	E NENW	8-15S17W	Pu	Standard Oil Co. of Calif. #1	Desolation	5-18-52	5530	Supai Permian	Devoni	PCbs 1170'?, Cmc 2514', Cmj 4583', Cmp 4620', Dg 5440'.	6
14-2	NWSW	8-16S17W	Pu	Gulf Oil Corp. #1	Bishop Springs	6-10-52	5768	Pilot Shale (Mississippian)	Chert	Dg 940', Cmp Fault 2000'±, Dg 2300', Fault 3675', Ds 5268', Dse 6000', Sl 6770', Fault ?, Ds Fault 7440', Dse 8110', Sl 8953', Chert 9042'.	9
14-3	12 or 13	20S5W	P	Tom Kearns #1	Fillmore	1910?	?	?	?		1
14-4	NWSW	36-20S5W	S	Westwood Oil Co. #1	Fillmore	1902	?	?	?		
14-5	NWSW	36-20S5W	P	Westwood Oil Co. #2, Well # 14-5	Fillmore	1908	?	?	?		
14-6	NWSW	36-20S5W	S	Westwood Oil Co. #3	Fillmore	1914	?	?	?		1
14-7	C NESE	3-22S19W	Pu	Standard Oil Co. of Calif. #1	Burbank	3-21-52	6243	Pilot	Pogoni	Dg 916', Ds 3026', Dse 3610', Sl 4742', Oe 6128', Op 6444'.	6
14-8	C NENW	29-24S18W	Pu	Elmer C. von Glahn #1	Desert Range	1-?-51	?	Undiff. Paleozoic	?		
14-9	E NESE	33-24S13W	Pu	Elmer C. von Glahn #1	Wah Wah Structure	6-?-51	4750	Quaternary	?		Casing: 40' 12" cc top to bottom. 1

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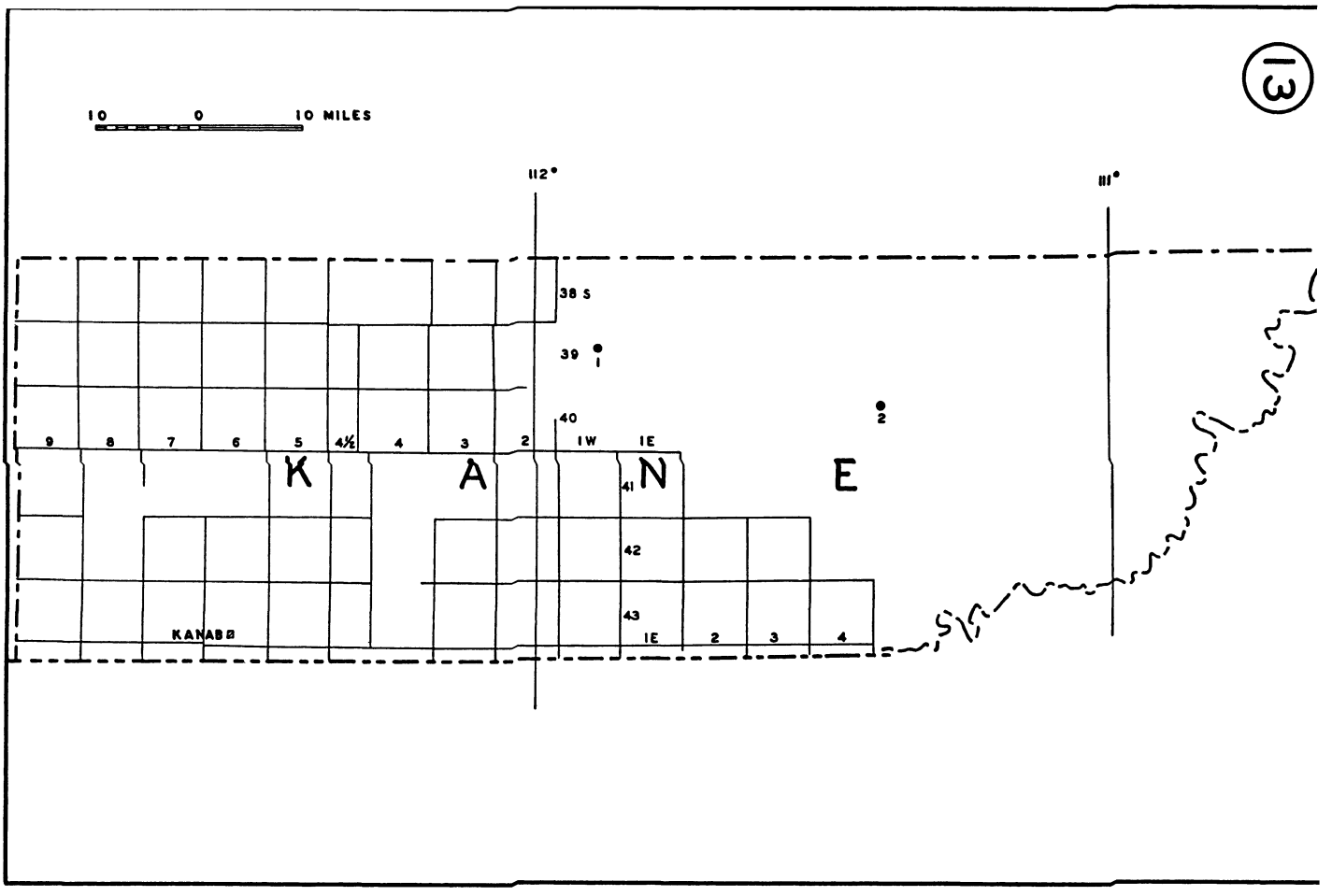
Note: For abbreviated legend data see explanation before tabl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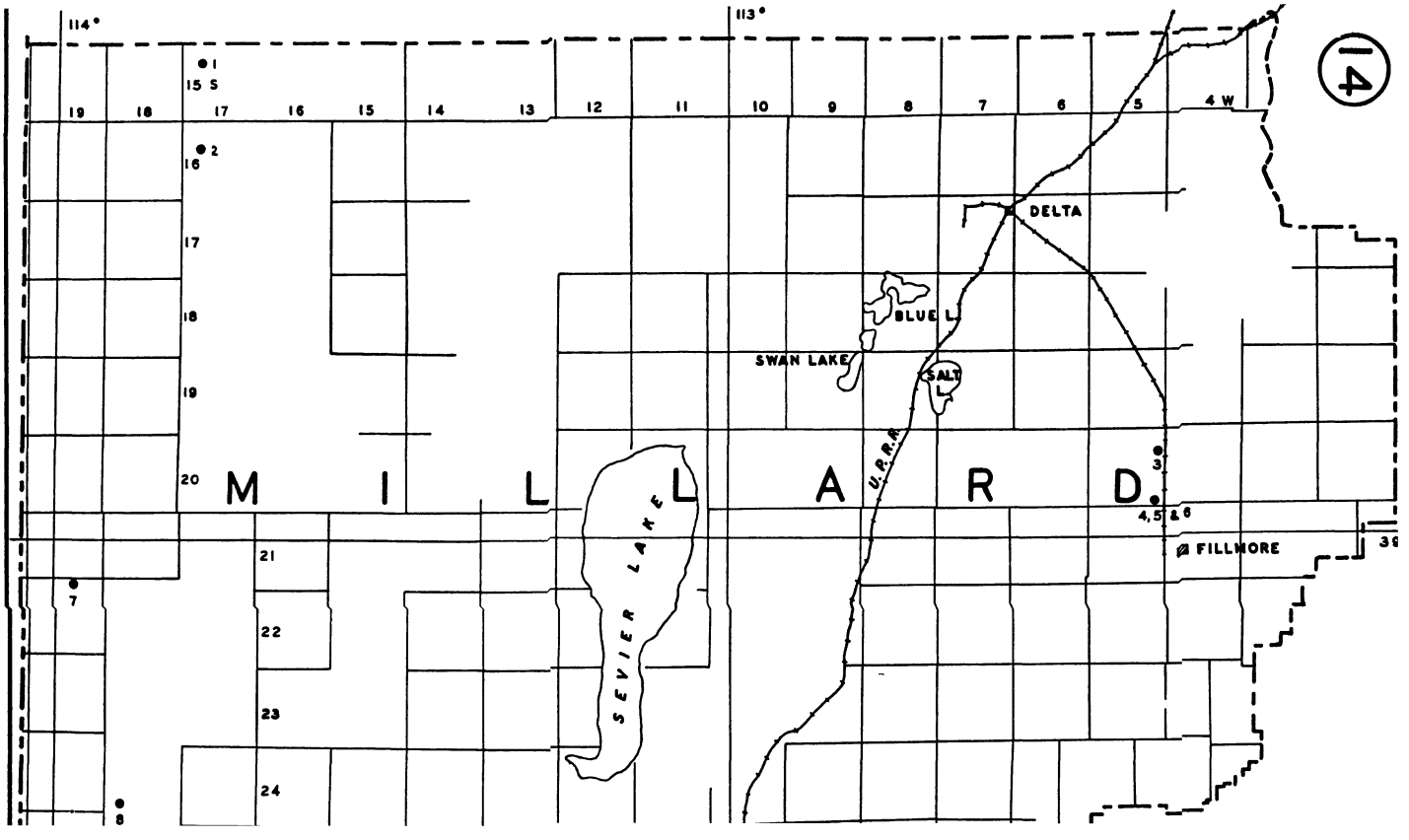
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M I L L A R D
DELTA
BLUE L.
SWAN LAKE
SALT L.
SEVIER LAKE
U.P.R.R.
FILLMORE
4,5 & 6

										REMARKS CONCERNING PRODUCING HORIZONS OR SHOWS
14-10		32-25S13W	S	Premium Oil Co. #1	Preuss Valley	11-?-48	?	Quaternary	?	
14-11	C	NENE 29-25S10W	P	El Capitan Drilling Co. Paxton #1	Black Rock	9-?-50	?	Quaternary	Lake Bed Fill (Quaternary)	
14-12	C	SESW 17-25S9W	P	El Capitan Drilling Co. James #1	Black Rock	8-4-50	?	Quaternary	?	
14-13		SWSE 19-25S9W	P	Beaver Valley Oil Co. #2	Black Rock	1930	4850	Quaternary	Quaternar	Arkosic sand at 3141'.
14-14		NWNE 20-25S9W	P	Beaver Valley Oil Co. #1	Black Rock	1930	4850?	Quaternary	Quaternar	
14-15		NENE 31-25S9W	P	H. T. Kaminska #1	Black Rock	1922	4850?	Quaternary	Quaternar	
MORGAN										
PIUTE										
RICH										
SALT LAKE COUNTY										
18-1	C	SENW 3-1N2W	P	Byrd-Frost, Inc. #1	Salt Lake	2-6-51	4220	Lake Bonneville	Lake Bonnevill	Casing: 540' 10-3/4".
18-2		NESE 21-1N1W	P	Western Petroleum Drilling Co. #1	Salt Lake	7-?-31	4250	Lake Beds	Lake Beds	
18-3		NESW 28-1S1E	P	Tower Petroleum Co. #1	Salt Lake	1927	4600?	Lake Beds	?	
SAN JUAN COUNTY										
19-1		SWNE 16-27S20E	Pu	Midwest Exploration Co. #1	Shafer Dome	6-13-27	4000	Hermosa	Mississippian	Cpp 1620'.
19-2		NWNE 5-27S21E	Pu	Midwest Exploration Co. #1	Cane Creek	6-27-27	4000?	Rico	Paradox	Salt beds 2045-3520'.
19-3		SWSW 16-28S20E	S	Utah Southern Oil Co. #1	Lockhart	11-24-26	4100	Rico	Hermosa	Show oil at 764'.
19-4		SWSW 34-29S20E	Pu	Western States Development Co. #1	Gibson	10-5-20	4600?	Rico	Rico	No shows recorded.
19-5		SENE 3-29½S20E	Pu	Deseret Petroleum Co. #1	Gibson	3-12-27	4825	Cutler	Hermosa	
19-6		NWNE 1-30S20E	Pu	Utah Petroleum Corp. #1	Gibson Dome	4-26-27	4800?	Cutler	Hermosa	
19-7	Lot	20 6-30S21E	Pu	Empire Gas & Fuel Co. #1	Gibson Dome	6-23-27	4800?	Cutler	Paradox	Pr 60', Cph 550', Cpp 2100' (Salt to bottom).
19-8		NENW 16-30S25E	S	Union Oil Co. #1	Lisbon Dome	10-15-27	?	Rico	Paradox	Salt beds below 1,620'.
19-9	C	SENW 23-33S24E	P	Byrd-Frost, Inc. Randall #1	Monticello	10-3-51	6838	Mancos	Paradox	No important show of oil or gas. One show oil at 2575' in salt; gas at 2693', 3250', 3510', 4110' and 4340 to 4345'.
19-10	C	NESE 17-33S25E	P	Byrd-Frost, Inc. #1	Boulder Knoll	8-8-51	6814	Dakota	Pennsylvanian	Kd 197', Js 750', Je 1034', Jca 1230', Jn 1268', Jk 1605', Jw 1670', Rc 2135', Rsh 2665', Rm 2745', Pcu 2860', Pr 3920', Cph 4465', Cpp 5659'. Jm 198', Js 750', Jc 940', Je 1015', Jca 1245', Jn 1285', Jk 1535', Jw 1595', Rc 1955', Rsh 2535', Rm 2629', Pcu 2705', Pr 3785', Cph 4335', Cpp 5561'. Cph 3977', Cm 5117', D 5567', θ 5857', θb 6217', θo 6397', θti 6697'.
19-11		NWSW 30-34S19E	Pu	Midwest Exploration Co. #1	Elk Ridge	11-5-27	7139	Rico	Schist	Cased, perf. and acidized 986 MCFG SIP 1920#.
19-12		NWNW 17-34S25E	P	Boulder Knoll Oil & Gas Co. #1	Boulder Knoll	6-12-30	7000	Dakota	Shinaru	
19-13	C	SENE 23-34S25E	P	Western Natural Gas Co. et al#1	Boulder Knoll	2-4-48	6850	Dakota	Ordovic	Reported gas. Jm 210', Js 950', Je 1028', Jca 1260', Jn 1360', Jk 1550', Jw 1670', Rc 2148', Rsh 2560', Pr 3817', Cph 4346', Cpp 5695', Gypsum Anhydrite 5765', Cpmo 7965', Cml 8110', Do 8295', De 8340', Detrital zone 8500', O 8550', Quartzite 8677'.

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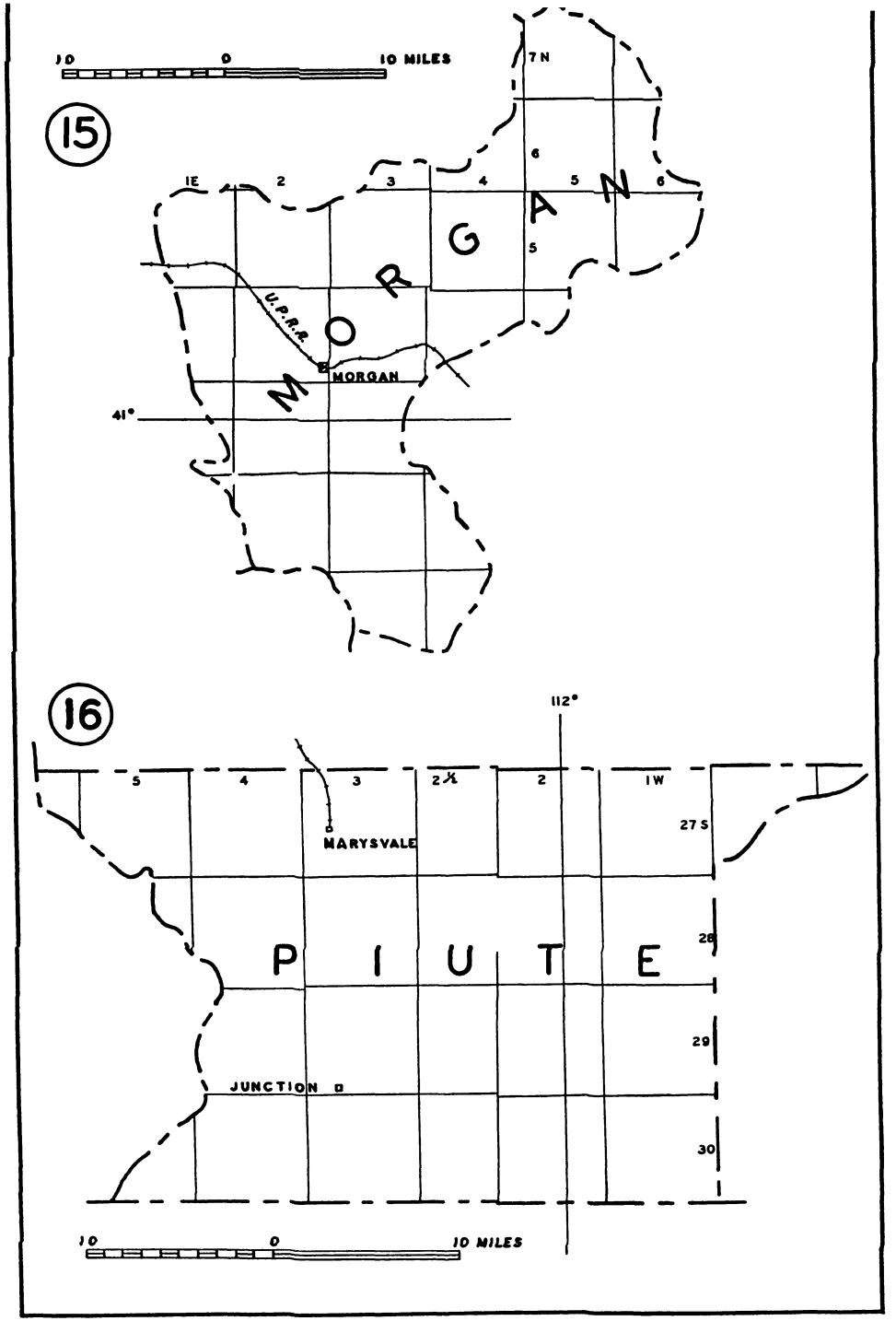
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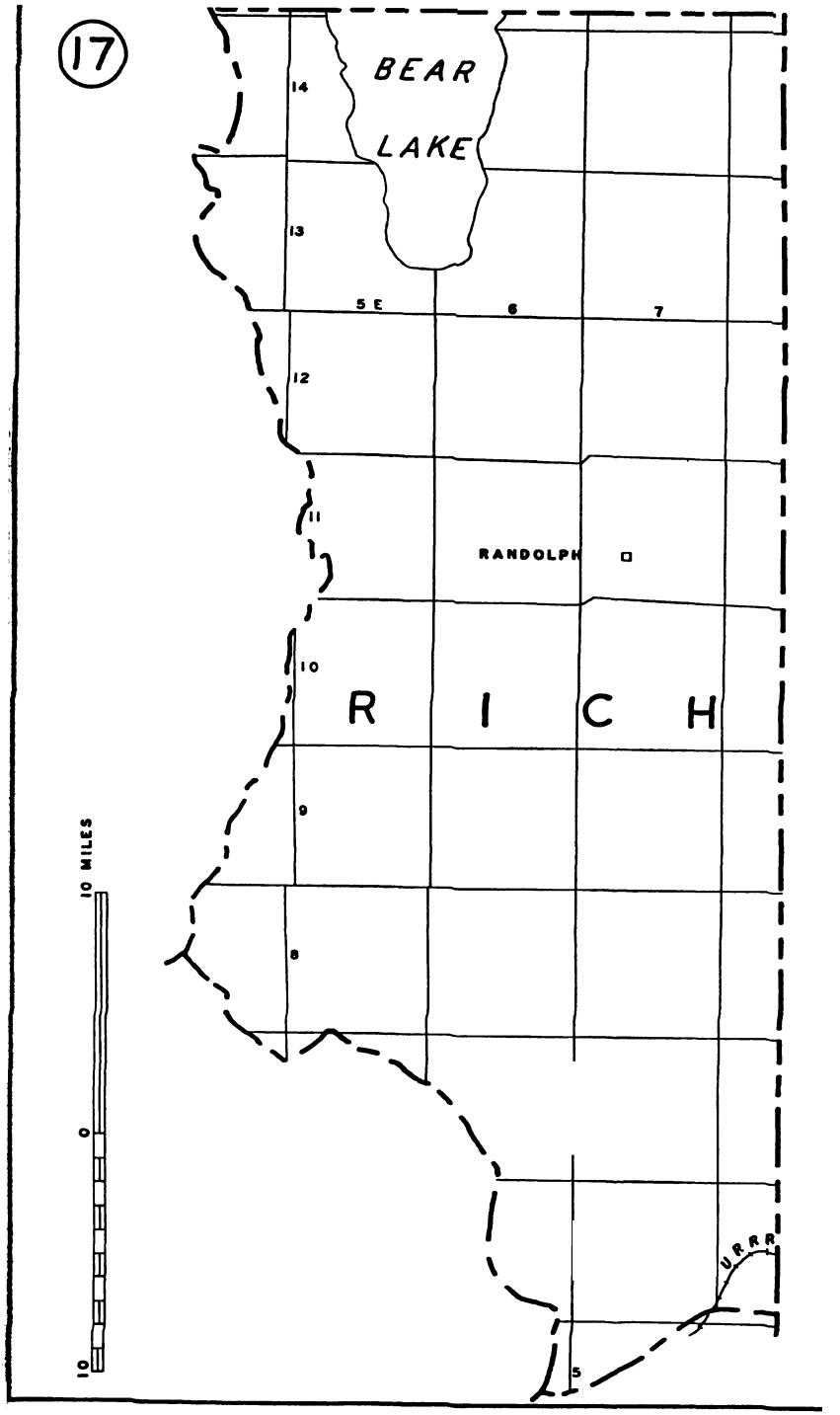
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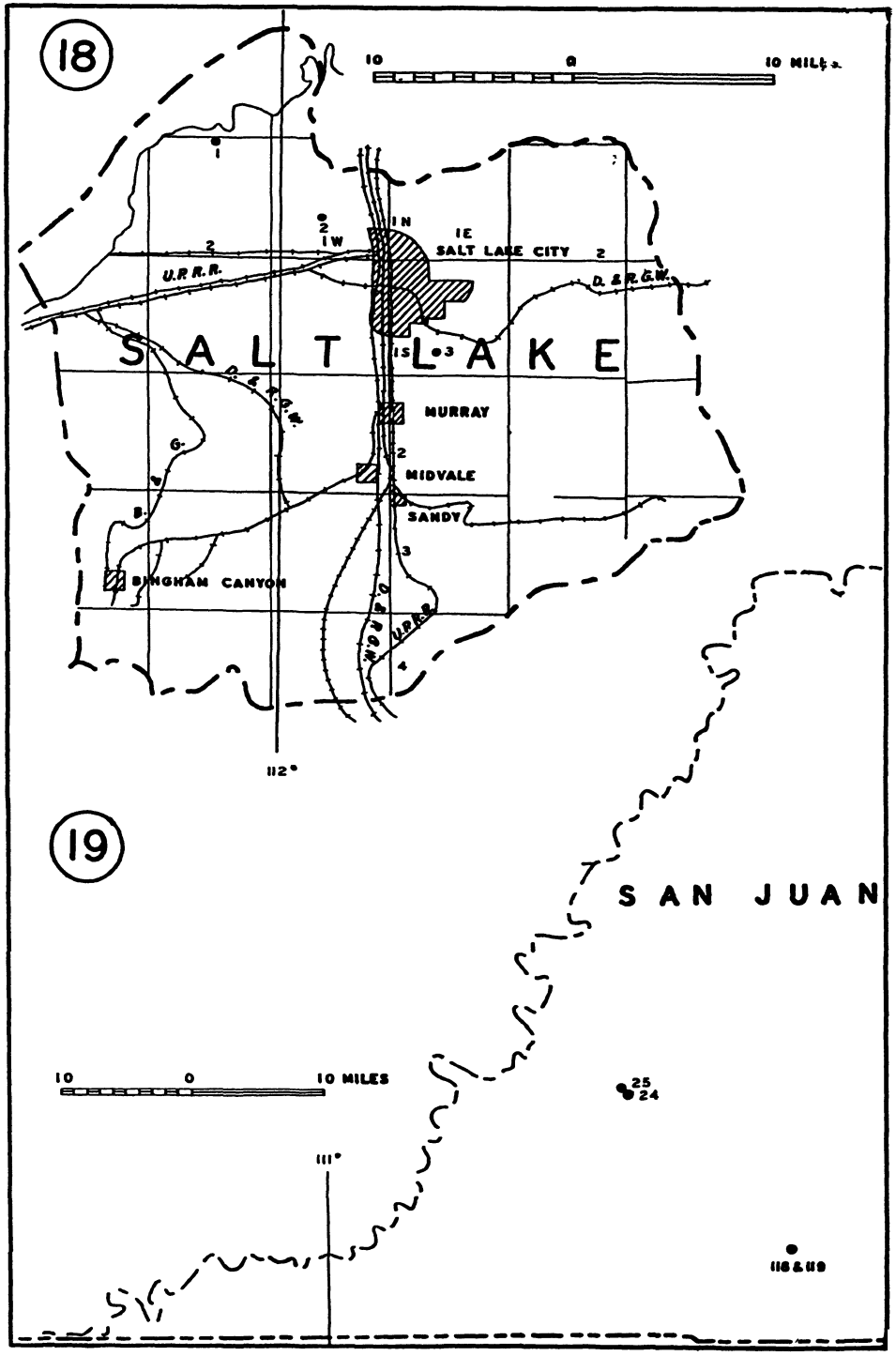
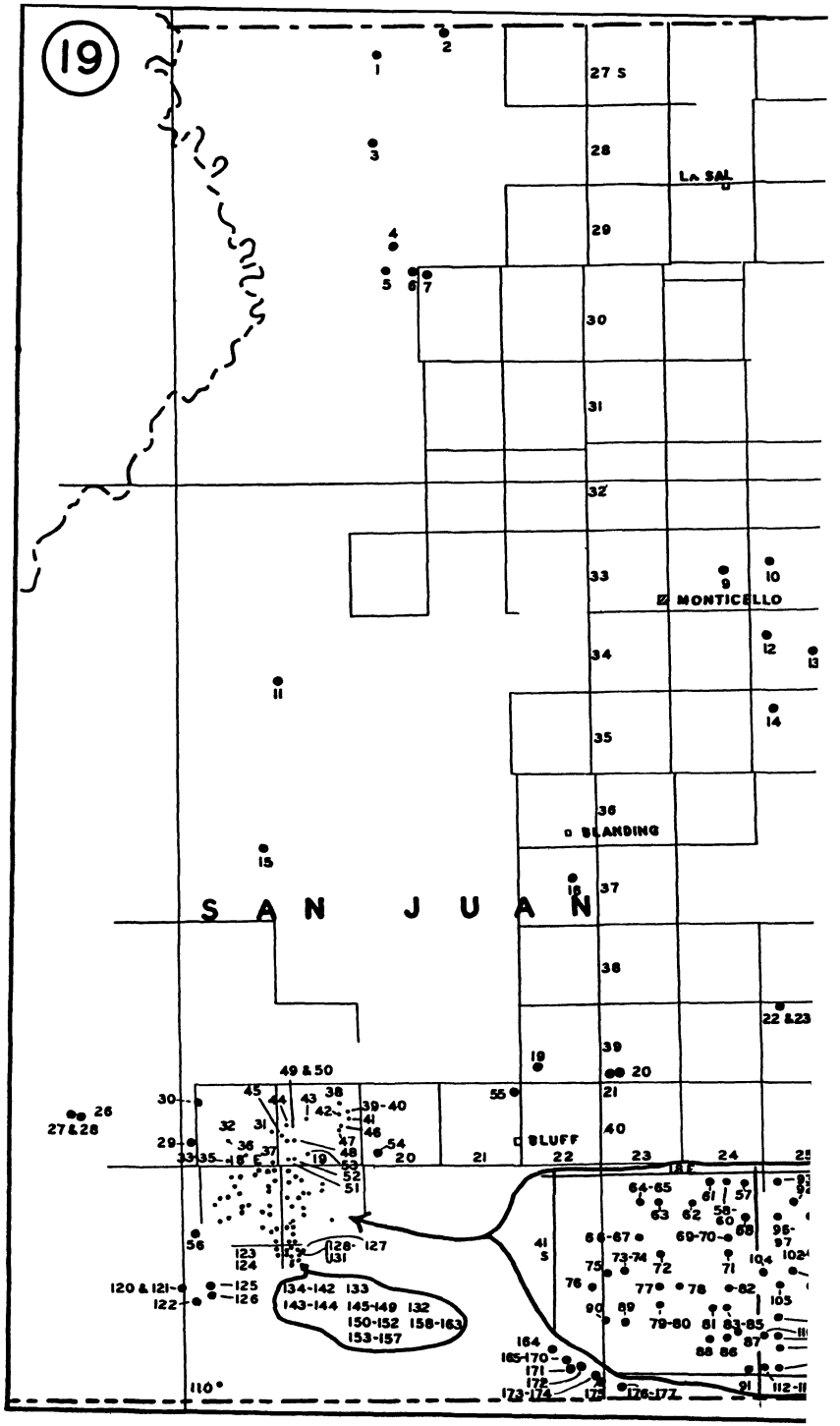
19-14	NENENE	8-35S25E	P	Southern Union Prod. Co. #1	Boulder Knoll	9-?-48?	?	?	?	Jn 1030', Jw 1205', Rsh 2535'?	2,
19-15	C SWSW	1-37S18E	Pu	Don Danvers #1	Bears Ears	?	6940	Permian	?	Pcm 120', Pht 870', Pr 1124', Cph 1485'; Cpp 2590', Salt 2774', Cphl 3240'?, Lime Anhydrite 3253', Cm ? 3830'.	3,
19-16	NWSW	14-37S22E	P	F. A. Sitton #1	Blanding	?	5700+	Dakota	?		
19-17	C SENW	35-38S25E	Pu	L. M. Glasco #1	Cross Canyon	?	4852	Morrison	?	Je 160', Jca 470', Jn 500', Jk 640', Jw 683', Rc 975', Rsh 2227', Rm 2325', Pcu 2530'?, Pr 4035', Cph 4275'?, Cpp 5305', 1st Anhydrite 5340', Main Evaporite 5640'.	6,:
19-18	C SWNE	28-38S26E	Pu	Hathaway Co. #1	Hovenweep	1-17-53	5214	Morrison	?		5,6
19-19	C NWSW	29-39S22E	Pu	Carter Oil Co. #1	Bluff Bench	?	4851	Bluff	?		5
19-20	W NWNE	32-39S23E	S	Shell Oil Co. #1	Bluff	11-7-51	5385	Burro Canyon	Baseme comple	Jm 130', Jsb 865', Js 1065', Je 1240', Jca 1425', Jn 1575', Jk 1835', Jw 1880', Rc 2220', Rsh 2918', Rm 3025', Pco-Pcu 3125', Pr 4445', Cph 5118', Cpp 5960', Cpmo 7087', Cml 7337', Do 7520', De 7715', 8 8045', Basement complex 8664'.	In the Cpp formations from 6045-6057', on swabbing tests through perforations well made 12 bbls., 40° API, 28% cut, and 16 MCF/D combustible gas. In the Do, well made 49 bbls., 53.8°API, 3.6% cut, and 6830 MCF/D non-combustible gas. Detailed core samples on file at U. of U. sample library.	8,7
19-21	C SENW	32-39S23E	S	Three States Natural Gas Co. #1	Bluff	?	5392	Burro Canyon	?	Jsb 870', Js 1082', Je 1260', Jca 1428', Jn 1625', Jk 1875', Jw 1925', Rc 2242', Rsh 2928', Rm 3027', Pcu 3235', Pr 4460', Cph 5147', Cpp 6062', Cpmo 7187', Cml 7435'.		7,09
19-22	N SWNE	5-39S25E	Pu	Hathaway & Glasco #1-A	Hatch	8-?-51	4766	Morrison	?		Casing: 309' 11-3/4" cc w/154 sx. Completed as water well with plate welded on top with 4" collar and 2" valve.	37
19-23	N SWNE	5-39S25E	Pu	Hathaway & Glasco #1-B	Hatch	1-14-52	4766	Morrison	Leadv	Je 252' (S), 252' (EL); Jca No Pick (S), 530' (EL); Jn No Pick (S), 555' (EL); Jk No Pick (S), 690' (EL); Jw 740'? (S), 738' (EL); Rc 1090'? (S), 1120' (EL); Rsh 2350' (S), 2370' (EL); Rm 2510' (S), 2485' (EL); Pcu No Pick (S), No Pick (EL); Pr 4550'? (S), 4538' (EL); Cph 4625' (S), 4610' (EL); Cpp 5340' (S), 5332' (EL); Cpmo 7354' (S), 7354 (EL); Cml 7464' (S), 7455' (EL).	Anhydrite 5420' (S), 5405 (EL); Top Salt 5770' (S), 5765' (EL); Bottom Salt 6925' (S), 6925' (EL).	7,62
19-24	C SWSE	27-40S12E	Pu	Skelly Oil Co. #1	Nokai Dome	11-12-51	5910	Kayenta	Cedar Mesa	Jw 82', Rc 430', Rsh 1268', Rm 1383, Pho? 1640', Pd 1690', Por 1780', Pcm 2225'.	Casing: 298' 13-3/8" cc 316 w/290 sx.	2,582
19-25	C NWNW	27-40S12E	Pu	Skelly Oil Co. #1-A	Nokai Dome	9-12-52	5640	Wingate	Tapes	Rc 405', Rsh 1172', Rm 1274', Pho 1469', Pd 1593', Por 1683', Pcm 2175', Pht 2680', Pr 3406', Cph 3899', Cpmo 4637', Cml 4786', De 5376', Mavue 6233', 8t 6395'.	Several DSTs; no shows reported.	6,726
19-26	NE	15-40S16E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico			267
19-27	NWNWNW	15-40S16E	Pu	Don Danvers Co. #1 Jack Harris	Slickhorn Gulch	10-29-52	3940	Permian	Permi	First rice sand 227-240'; second rice sand 260-268'.	Casing set at 425'. Crooked hole. Skidded rig 50' south for well #1-X.	696
19-28	NWNWNW	15-40S16E	Pu	Don Danvers Co. #1-X Jack Harris	Slickhorn Gulch	10-?-53	4199	Permian	?			1,810
19-29	SENE	25-40S17E	Pu	Norwood Oil Co. #1	Johns Canyon	5-26-11	?	Rico	Penns vanis		Shows oil and gas 85', 600', and 1170'.	1,938
19-30	NENW	7-40S18E	Pu	Mutual Oil Co. #2	Johns Canyon	1912	?	Rico	Ri			210

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.


18
10 0 10 MILES
SALT LAKE
SALT LAKE CITY
1N
1E
1W
2
U.P.R.R.
D. & R.G.W.
O.S.L. & O.W.
MURRAY
MIDVALE
SANDY
BINGHAM CANYON
OPEN
U.P.R.R.
112°
19
SAN JUAN
10 0 10 MILES
111°
25
24
118 & 119


19
27 S
28
29
30
31
32
La Sal
MONTICELLO
34
35
36
BLANDING
37
SAN JUAN
38
39
40
41 S
22 & 23
49 & 50
27 & 28
BLUFF
18 E
120 & 121
122
123
124
125
126
127
128
131
134-142
143-144
145-149
150-152
153-157
158-163
164
165-170
171
172
173-174
175
176-177
110°

19-31		SESE	24-40S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
19-32		SENE	28-40S18E	Pu	Utah Southern Oil Co. #1	Cedar Mesa	9-3-27	5500	Cutler	Mica Schist
19-33		SWSE	33-40S18E	Pu	Finley #2	San Juan	Before 1920	?	Rico	Rico
19-34	E	SESE	33-40S18E	Pu	Finley #3	San Juan	Before 1920	?	Rico	Rico
19-35		SESESE	33-40S18E	Pu	Barney Cockburn #1	San Juan	6-8-46	?	Rico	Pennsy vanian
19-36		SWNW	34-40S18E	Pu	Finley #1	San Juan	1920	?	Rico	Rico
19-37		SWSE	36-40S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
19-38		SESE	11-40S19E	Pu	San Francisco-San Juan Co. #1	San Juan	1910	4870	Rico	Rico
19-39		NWNW	13-40S19E	Pu	San Francisco-San Juan Co. #6	San Juan	1910?	4840	Rico	Rico
19-40		SWNW	13-40S19E	Pu	San Francisco-San Juan Co. #8	San Juan	7-?-08	4820	Rico	Rico
19-41		NWSW	13-40S19E	Pu	San Francisco-San Juan Co. #7	San Juan	1910?	4795	Rico	Rico
19-42		NENE	14-40S19E	Pu	San Francisco-San Juan Co. #9	San Juan	1908?	?	Rico	Rico
19-43		NWSW	16-40S19E	Pu	Unknown #1	San Juan	1909?	?	Rico	Rico
19-44		SENE	19-40S19E	Pu	Unknown #1	San Juan	1908?	?	Supai	Pennsy vanian
19-45		SWSW	19-40S19E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
19-46		SENE	23-40S19E	Pu	San Francisco-San Juan Co. #9	San Juan	1920	4720	Rico	Rico
19-47		SWSE	23-40S19E	Pu	Unknown #1	San Juan	1910?	4700?	Rico	Rico
19-48		NWNW	29-40S19E	Pu	Gibraltar Oil Co. #1	San Juan	1910?	?	Rico	Rico
19-49		SWNE	30-40S19E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
19-50		SWNE	30-40S19E	Pu	Unknown #?	San Juan	1908?	?	Rico	Rico
19-51		SESE	31-40S19E	Pu	Unknown #1	San Juan	1909?	?	Rico	Rico
19-52		SWSW	32-40S19E	Pu	Unknown #1	San Juan	1909?	?	Rico	Rico
19-53		SENW	33-40S19E	Pu	Navajo Oil Co. #1	San Juan	1909?	4720	Rico	Rico
19-54	C	NW	32-40S20E	S	A. G. Hill et al #1	Lime Ridge	1-8-50	?	Rico	Missis pian
19-55		SESE	1-40S21E	Pu	Unknown #1	Bluff	1910?	?	Jurassic	Jurass
19-56		SWNE	36-41S17E	Pu	Utah Petroleum Corp. #1	Halgaito	7-21-27	5473	Rico	Hermos
19-57		NENE	1-41S18E	Pu	Unknown #2	San Juan	Before 1920	?	Rico	Rico
19-58		NENW	1-41S18E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
19-59		NENW	1-41S18E	Pu	Unknown #2	San Juan	Before 1920	?	Rico	Rico
19-60		NWNW	1-41S18E	Pu	Unknown #1	San Juan	1910?	?	Rico	Rico
19-61		SENE	2-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
19-62		NESW	2-41S18E	S	Pinnacle Oil #1	San Juan	1909	?	Rico	Penns vania
19-63		SWSW	3-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
19-64		SESE	4-41S18E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
19-65		SESE	4-41S18E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
19-66		NWSESE	9-41S18E	Pu	Harry McKim et al #1	San Juan	4-?-50	5200±	Cutler	Cutle

Note: Wells for each county are "spotted" on the accompanying map.

Cm 2090', D 2480', θ 2810', PB bottom.	Small showing of gas in Cph.
	Shows oil and gas.
	Water well.
Cpp 1402', Cm 2300'.	Shows of oil and gas. Casing: 9-5/16" at 2272'. IP 5,000,000 cu. ft. Abandoned, no market for CO_2 gas. Cpp 2100-50'.
	All but the lower 280' is in rocks that outcrop in canyon of San Juan River 1-1/4 miles to north.
	Water well.
	Crooked Hole, rig skidded 10 feet west and well #1-A drilled.

Note: For abbreviated legend data see explanation before tables.

9-67	NWSESE	9-41S18E	Pu	Harry McKim et al #1-A	San Juan	12-5-50	>163	Cutler	Lo-- Herm
9-68	SWNE	12-41S18E	Pu	Pacific San Juan Co. #1	San Juan	Before 1911	?	Rico	Rico
9-69	SWSW	12-41S18E	P	London-San Juan Oil Co. #1	San Juan	12-?-09	?	Rico	Penn vani
9-70	SWSW	12-41S18E	Pu	London-San Juan Oil Co. #2	San Juan	1909	?	Rico	Rico
9-71	NW	13-41S18E	Pu	London-San Juan Oil Co. #4	San Juan	1923?	?	Rico	Rico
9-72	NWNW	15-41S18E	Pu	Aztec Oil Co. #1	San Juan	1912	?	Rico	Penn vani
9-73	NWSW	16-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-74	SWSW	16-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-75	SWSE	17-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-76	NENW	20-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-77	NENW	22-41S18E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
9-78	NWNE	22-41S18E	Pu	Humbolt #?	San Juan	Before 1920	?	Rico	Rico
9-79	SESW	22-41S18E	Pu	Palo Pinto Oil Co. #1	San Juan	1910	?	Rico	Penn vani
9-80	SESW	22-41S18E	Pu	Palo Pinto Oil Co. #2	San Juan	1910	?	Rico	Penn vani
9-81	SESE	23-41S18E	Pu	San Juan Oil Co. #1	San Juan	1912	4595	Rico	Rico
9-82	NWNW	24-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-83	N NWSW	24-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-84	NWNWSW	24-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-85	SWSW	24-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-86	SWSWSE	25-41S18E	Pu	London-San Juan Oil Co. #3	San Juan	1909?	4390	Rico	Rico
9-87	S SESE	25-41S18E	P	MacFulton Drilling Co. #1	San Juan	8-6-47	?	Supai	Penn vani
9-88	SESE	26-41S18E	Pu	Unknown #1	San Juan	Before 1920	4545	Rico	Rico
9-89	SWNW	28-41S18E	Pu	Unknown #?	San Juan	Before 1920	?	Rico	Rico
9-90	NENE	29-41S18E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico
9-91	SESE	36-41S18E	Pu	Yates & McLane #1	San Juan	1910?	4310	Rico	Rico
9-92	SWSW	5-41S19E	Pu	Unknown #1	San Juan	1909?	?	Rico	Rico
9-93	C SWNE	6-41S19E	Pu	Unknown Bitter Springs #2	San Juan	1909?	?	Hermosa	Herm
9-94	W SWNE	6-41S19E	Pu	Unknown Bitter Springs #1	San Juan	1909?	?	Supai	Herm
9-95	W SWNE	6-41S19E	Pu	Unknown Bitter Springs #3	San Juan	1912	?	Hermosa	Herm
9-96	NENENE	7-41S19E	Pu	F. H. King et al #1	San Juan	1909?	?	Supai	Herm
9-97	C NWNE	7-41S19E	Pu	Unknown #?	San Juan	Before 1910?	?	Hermosa	Herm
9-98	SENE	8-41S19E	Pu	San Francisco-San Juan Co. #1	San Juan	1908?	4545	?	Rico
9-99	NENESW	10-41S19E	Pu	Jackson & McGee #?	San Juan	1909?	4380	Supai	Herm
9-100	SWNW	15-41S19E	Pu	Oil Co. of San Juan #1	San Juan	1909?	?	Rico	Penn vani
9-101	NWNW	16-41S19E	Pu	Barney Cockburn #1	San Juan	3-8-46	?	?	Rico
9-102	SWNE	17-41S19E	Pu	Pioneer Development Co. #1	San Juan	1908	4360	Rico	Rico
9-103	SESW	17-41S19E	Pu	Spokane Oil Co. #1	San Juan	1908?	4280	Rico	Rico
9-104	NESW	18-41S19E	Pu	Unknown #1	San Juan	1909?	?	Rico	Rico

Note: Wells for each county are "spotted" on the accompanying map.

Cph 350 Cpp 1071', Cphl 1325'.		1,64(
		10(
		52(
		45(
		1,35(
		3(
		15(
		15(
		15(
		8(
		3(
		90(
		50(
		213
		5(
		1(
		1(
		1(
		356
		1,025
		?
		150
		150
		260
		50
		160
		200
		10
		50
		25'
		450
	Artesian water.	100'
	Water well. Show oil 105 feet.	500'
		354
		215
		200
		20

Note: For abbreviated legend data see explanation before tables.

19-105		NWNE	19-41S19E	Pu	San Francisco-San Juan Co. #1	San Juan	Before 1920	4430	Rico	Rico	
19-106		NENE	20-41S19E	Pu	Unknown #1	San Juan	Before 1920	?	Rico	Rico	
19-107		NWSE	20-41S19E	Pu	San Francisco-San Juan Co. #1	San Juan	1910	4220	Rico	Penn vani	
19-108		NENE (Lot 1)	27-41S19E	Pu	Utah Southern Oil Co. #1	San Juan	3-19-28	4090	Hermosa	Pre-Camb Mica Schi	
19-109	SWSWNE		30-41S19E	Pu	Barney Cockburn #1	San Juan	1-4-46	?	Hermosa	Penn vani	
19-110	NENESW		30-41S19E	Pu	Unknown #?	San Juan	Before 1920	?	Hermosa	?	
19-111	N NWSE		30-41S19E	?	Unknown #?	San Juan	Before 1920	?	Hermosa	?	
19-112		NWSW	31-41S19E	Pu	Unknown #1	San Juan	Before 1920	4290	Rico	Rico	
19-113		NWSW	31-41S19E	Pu	Unknown #2	San Juan	Before 1920	4295	Rico	Rico	
19-114		SWSW	31-41S19E	Pu	Unknown #?	San Juan	Before 1920	4280	Rico	Rico	
19-115		NWNE	31-41S19E	Pu	A. C. Ellis #1	San Juan	1925	4365	Rico	Rico	
19-116		NWNE	31-41S19E	Pu	A. C. Ellis #2	San Juan	1925	4365	Rico	Penn vani	
19-117		SESE	31-41S19E	P	Unknown #1	San Juan	1912?	4220	Rico	Rico	
19-118		SENW	35-42S14E	In	Wilson-Cranmer #1	Organ Rock	1923	4300	Coconino	Herm	
19-119		SENW	35-42S14E	In	Wilson-Cranmer #1-A	Organ Rock	1923	4300	Cedar Mesa	Herm	
19-120		SENE	23-42S17E	Pu	Monumental Oil Co. #1	Halgaito	12-?-24	?	Hermosa	Uppe Herm	
19-121		SENE	23-42S17E	Pu	Monumental Oil Co. #1-A	Halgaito	12-31-24	?	Rico	Herm	
19-122		SENE	35-42S17E	Pu	Monumental Oil Co. #1	Halgaito	1920	4970	Cutler	Herm	
19-123		SWNE	1-42S18E	Pu	Unknown #1	San Juan	1911	?	Rico	Rico	
19-124		NESE	1-42S18E	Pu	Unknown #1	San Juan	1912	?	Rico	Rico	
19-125		SENE	19-42S18E	Pu	Monumental Oil Co. #2	Halgaito	12-31-23	5155	Hermosa	Penn vani	
19-126		NWSE	19-42S18E	Pu	Monumental Oil Co. #3	Halgaito	1926	?	Hermosa	Herm	
19-127		NENE	5-42S19E	Pu	R. L. Raplee #1	San Juan	1912?	4120	Rico	Penn vani	
19-128	NESWNW		5-42S19E	P	Western Investment Co. #1	San Juan	1909	4160	Supai	Rico	
19-129	S SWNW		5-42S19E	P	Southside Oil Co. #1	San Juan	1910	4175	Supai	Herm	
19-130	SESWNW		5-42S19E	P	Mexican Hat Oil Co. #2	San Juan	11-?-44	4170?	Permian	Rico	
19-131		SENW	5-42S19E	P	Monumental Oil Co. #1	San Juan	1909?	4145	Rico	Penn vani	
19-132		NWSW	5-42S19E	P	Anderson Oil & Development Co. #1	San Juan	1909?	4160	Rico	Penn vani	
19-133	NESWNE		6-42S19E	P	Arcola Oil Co. #3	San Juan	1910?	?	Supai	Rico	
19-134	S NENW		6-42S19E	P	Unknown Producers #1	San Juan	1910?	4220	Hermosa	Penn vani	
19-135	E SWNW		6-42S19E	P	Western Investment Co. #2	San Juan	1909	?	Hermosa	Penn vani	
19-136	E SWNW		6-42S19E	P	Allen & Woolley #2	San Juan	7-21-47	?	Rico	Penn vani	
19-137	N SWNW		6-42S19E	P	Allen & Woolley #5	San Juan	9-1-48	4205	Hermosa	Litt Loop	
19-138	W SWNW		6-42S19E	P	Arcola Oil Co. #4	San Juan	1909?	4175	Hermosa	Herm	
19-139	SWSWNW		6-42S19E	P	Allen & Woolley #1	San Juan	4-23-44	4175	Hermosa	Herm	
19-140	SESWNW		6-42S19E	P	Arcola Oil Co. #1	San Juan	6-?-30	4170	Hermosa	Penn vani	

Note: Wells for each county are "spotted" on the accompanying map.

			400?
			10
			500?
		Oil show at 172', 30,000 MCFG (CO_2) 812-921'.	1,870
			1,580
			26
			70
			?
			?
			?
			100?
			1,130
		Townsite well.	?
			1,122
Pr 797', Cph 1300'.		Small show of oil and gas 950'.	2,323
		No showings.	756
		Reached strata only 180' deeper than the lowest rocks exposed in the canyon at San Juan at the crest of the anticline.	1,622
			1,300+
			25
			400?
			1,622
		Oil and gas shows at 800-812', 890-900'.	1,140
		Show oil Cph 900?	900?
		Oil Cph 165', 10 bbls. estimated.	500
		Show oil Cph 600' approximately.	600+
			300
		Show oil Cph 292', 525-50'.	635
		Show oil Cph 273-301', 1172-1222'.	1,222
		Show oil at 210'.	210
		Probable oil and gas Cph 800'.	800+
		Oil Cph 220'.	517
		IP about 25 bbls. oil and 75 bbls. water. Cp 300-305'.	335
		Oil Cph 263', 60 bbls. estimated.	1,130
			?
			740
		Show oil Cph 330-335'.	713

Note: For abbreviated legend data see explanation before tables.

N SENW	6-42S19E	P	Allen & Woolley #3	San Juan	5-10-48	?	Hermosa	Hermosa		IP P/10 bbls. oil and 25 bbls. water PD.	440
NENWSW	6-42S19E	Pu	Bluff Oil Co. #1	San Juan	1922	4165	Hermosa	Rico		Oil estimated 200 bbls. 47° gravity.	360
SENWSW	6-42S19E	Pu	Bluff Oil Co. #2	San Juan	1925	4175	Hermosa	Hermosa			630
S SWSE	6-42S19E	P	Urado Development Co. #4	San Juan	6-11-45	?	Supai	Rico?			269
SESWSE	*6-42S19E*	*P*	Urado Development Co. #3	San Juan	5-29-45	?	Supai	Pennsylvanian			645
SWSESE	6-42S19E	P	Urado Development Co. #2	San Juan	4-30-45	?	Supai	Rico?			257
S SESE	6-42S19E	P	Urado Development Co. #1	San Juan	4-17-45	?	Supai	Rico			271
SESESE	6-42S19E	P	Oil Co. of San Juan #1	San Juan	11-?-09	4185	Supai	Rico			284
NENENE	7-42S19E	P	Urado Development Co. #1	San Juan	5-20-45	?	Supai	Rico		Show of oil 233-253'.	273
NESENE	7-42S19E	P	Barney Cockburn #2	San Juan	5-3-46	?	Supai	Rico		Show of oil 210-241'.	241
S SENE	7-42S19E	P	Unknown #1	San Juan	Before 1920	4160	Supai	Rico			100
C NESE	7-42S19E	P	Mexican Hat Oil Co. #1	San Juan	3-1-44	4155±	Supai	Goodridg		5" casing set 170', IP pumped 48 bbls. first 24 hrs. 40 API, Goodridge 203-05'.	205
E NESE	7-42S19E	P	W. E. Nevills #7	San Juan	3-?-34	4125?	Supai	Rico		Show of oil 215-225'.	225
NENESE	7-42S19E	P	San Juan Oil & Refining Co. #1	San Juan	3-5-44	4155?	Supai	Rico		Show of oil 202-215'.	215
NENESE	7-42S19E	P	W. E. Nevills #6	San Juan	2-17-33	4150?	Supai	Rico		Oil at 189-194', gravity 40°. IP 4 bbls. oil PD.	194
W NESE	7-42S19E	P	Oil Co. of San Juan #1	San Juan	3-4-08	4145	Supai	Rico		Show of oil at bottom.	226
NWNWNW	8-42S19E	P	Barney Cockburn #1	San Juan	12-30-45	?	Supai	Goodridg		IP pump 35 bbls. after shot, Goodridge 270-96'.	296
N SWNW	8-42S19E	P	Barney Cockburn #4	San Juan	5-16-46	?	Supai	Rico		Oil at 66-96', 40° gravity, estimated 5 bbls. per day.	306
NWSWNW	8-42S19E	P	Barney Cockburn #3	San Juan	5-13-46	?	Supai	Rico		Show of oil 256-280'. 40° API 2 bbls. per day.	296
W SWNW	*8-42S19E*	*P*	*Barney Cockburn #5*	*San Juan*	*5-28-46*	?	Supai	Rico			21
W SWNW	8-42S19E	P	Barney Cockburn #6	San Juan	11-27-46	?	Supai	Pennsylvanian		Show of oil 270-276'.	633
SWSWNW	8-42S19E	Pu	Monticello Oil Co. #4	San Juan	1909?	4120	Supai	Rico		Show of oil at 210-263' 38° API.	263
SENW	16-43S22E	In	Wyoming Assoc. Oil Corp. #1	Boundary Butte	7-16-24	?	Navajo	Navajo			505
SWNENW	22-43S22E	In	Western Natural Gas Co. #1	Boundary Butte	6-20-48	5526	Navajo	Ignacio Quartzit (Cambria	Jw 185', Rc 750', Rsh 1335', Rm 1440', Pco 1652', Pr 3625', Cph 3890', Cpmo 5370', Cml 5490', Do 5695', De 5875', Ignacio 6980'.	IP F/25,000 MCFG PD after acid. Initial RP 1124 Psi. Cp 4620-70'.	6,090
E SWNW	22-43S22E	In	P. B. English #4	Boundary Butte Pool	6-12-49	5515	Navajo	Permian	Pco 1597'.	IP P/88 bbls., 42 API Pco 1608-15'.	1,615
SWNW	22-43S22E	In	Southwest Oil Co. #1	Boundary Butte	10-?-23	?	Navajo	Navajo			1,565
SWNW	22-43S22E	In	Continental Oil Co. #1	Boundary Butte	2-4-30?	?	Navajo	Mississi pian	Rsh 1560'.	Show oil Rsh 1560-9'. About 30 bbls. per day. Gas 4890-5256', gas volume estimated 15,000 M cu. ft.	5,612
SENW	22-43S22E	?	Western Natural Gas et al, English 2-S	Boundary Butte	11-30-48	?	Navajo	?		Completed 52-1/2 bbls. in 13-1/4 hr.	1,510
C SENW	22-43S22E	In	Western Natural Gas Co. #5	Boundary Butte Pool	8-29-49	5470	Navajo	Permian		IP P/11 bbls. oil and 46 bbls. water PD 42 API, Pco 1575-77'.	1,57'

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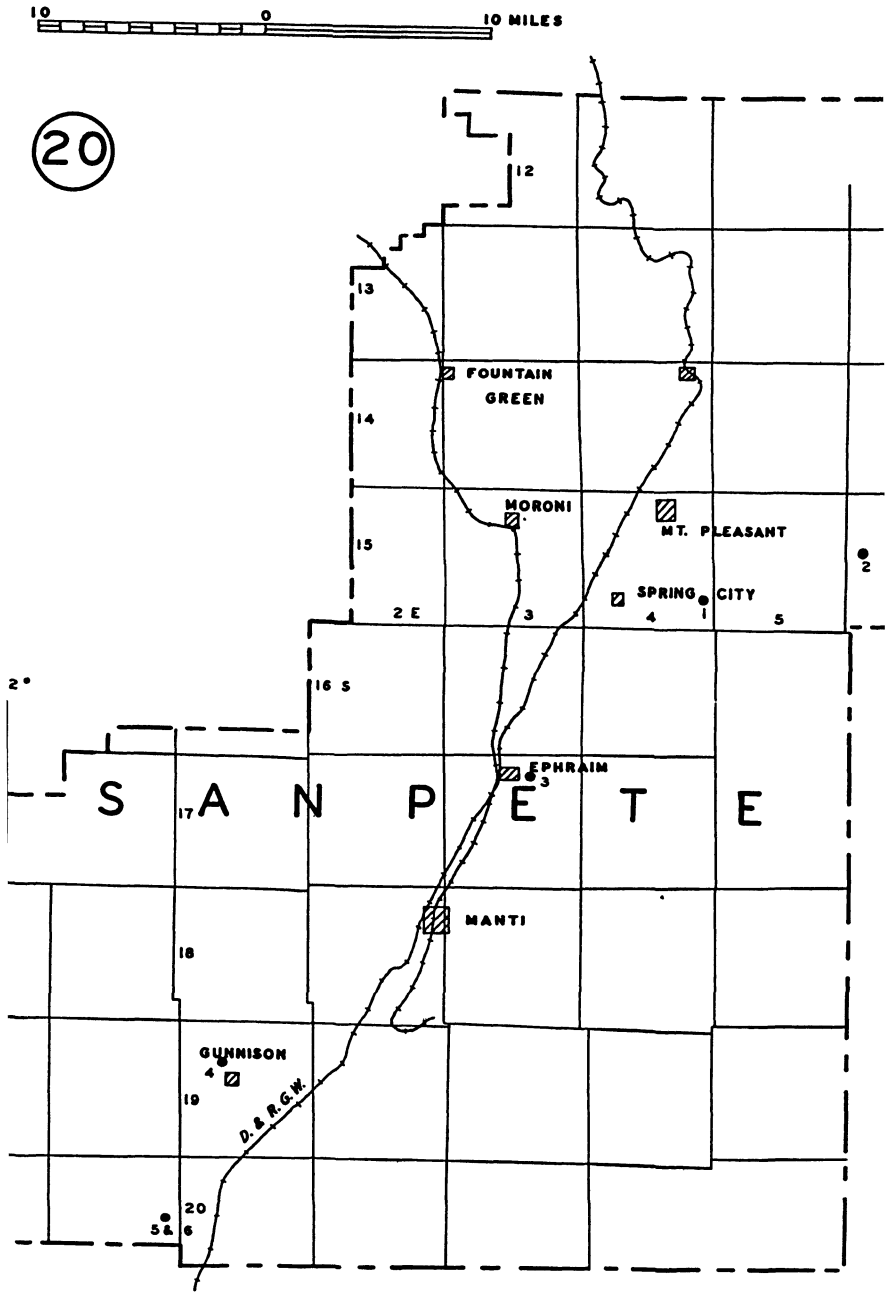
10 0 10 MILES
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14
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16 S
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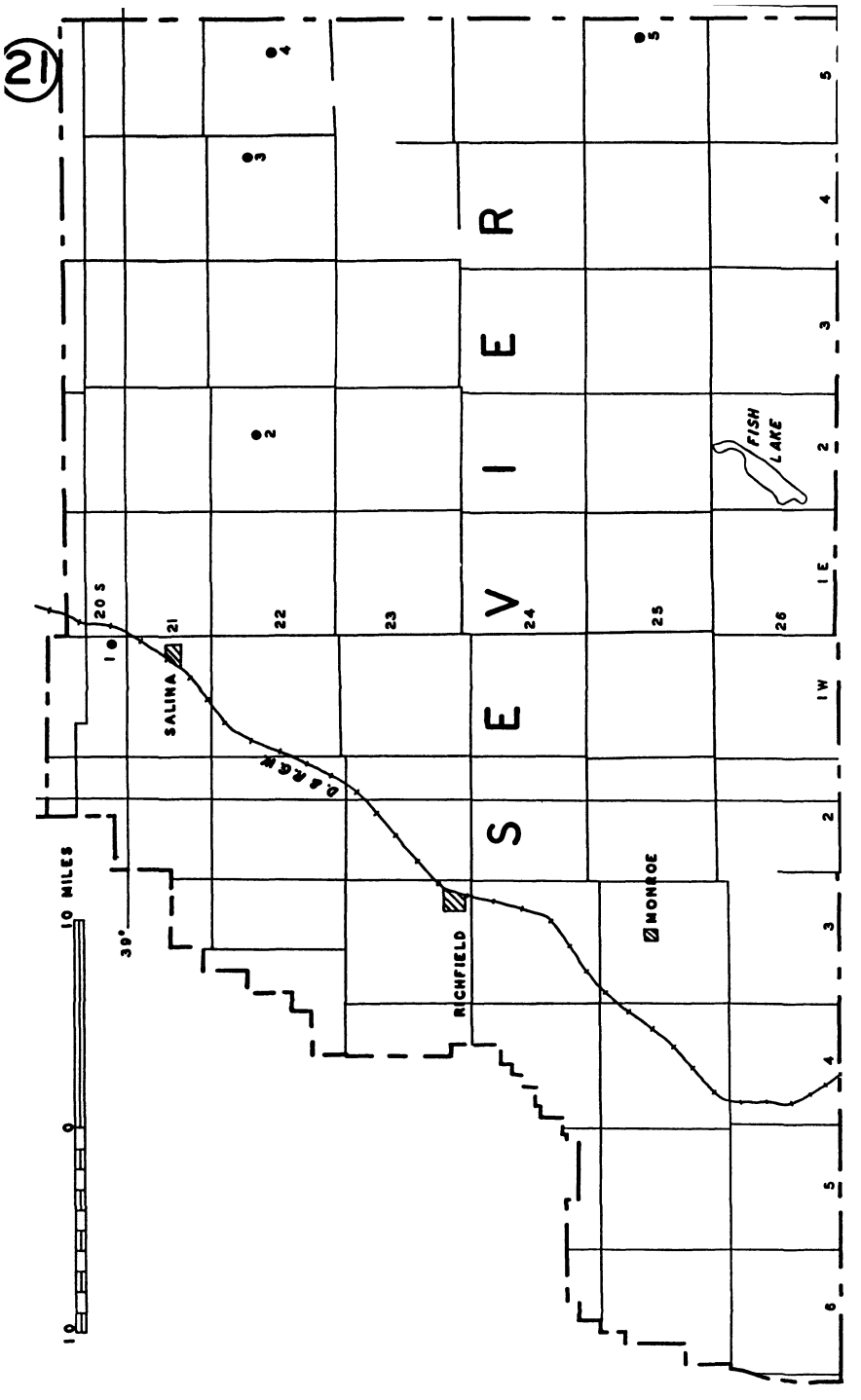
5
17
18
19
20
5&6
FOUNTAIN GREEN
MORONI
MT. PLEASANT
SPRING CITY
EPHRAIM
MANTI
GUNNISON
D. & R.G.W.
SANPETE


21
SEVIER
20 S
1 E
1 W
SALINA
MAPLE
RICHFIELD
MONROE
FISH LAKE
10 MILES
0
10

171	NWNWSE	22-43S22E	In	Western Natural Gas Co. #3	Boundary Butte Pool	3-18-49	5423	Navajo	Permian		No show oil or gas. Fresh water at TD, filled 1000'. Water well.	1,557
172	NWSW	23-43S22E	In	Mutual Oil Co. #1	Boundary Butte	8-9-24	?	Navajo	Navajo			502
173	C SWNE	25-43S22E	In	Western Natural Gas Co., Byrd-Frost Inc., Paul English Tribal #2	Boundary Butte	?	5121	Navajo	Hermosa	Rc 410', Rsh 1060', Rm 1150', Pco 1380', Pr 3380', Cph 3530'.	PB 4506 shut down acidized 7000g, tested 9000 MCFG, 1173# RP.	5,308
174	SWSWNE	25-43S22E	In	Western Natural Gas Co. #1	Boundary Butte	11-30-48	5104	Navajo	Pennsylvanian	Rc 410', Rsh 1060', Rm 1150', Pco 1365', Pr 3380', Cph 3530'.	IP 9,000 MCFG PD, initial RP 1140 Psi, Cp 4365-4450'.	5,306
175	NWSE	25-43S22E	In	Utah Oil & Refining Co. #1	Boundary Butte	6-12-24	?	Navajo	Navajo			510
176	NENW	32-43S23E	In	Union Oil Co. #1	Boundary Butte	7-23-24	?	Navajo	Navajo			550
177	C SENW	32-43S23E	In	Western Natural Gas Co. #2	Boundary Butte Pool	4-22-49	5400	Navajo	Pennsylvanian			4,882
IPETE COUNTY												
1	NESE	27-15S4E	P	S. Jenson #?	Mt. Pleasant	1918?	6000?	Quaternary	?			1,408
2	NWNESE	18-15S6E	Pu	Three States Nat. Gas Co. #1 C. K. Steiner	Joes Valley	?	10283	North Horn	Star Po			3,450
3	NESE	3-17S3E	P	Producers Oil Co. #1	Ephraim	12-?-20	5500?	Quaternary	?			921
4	W NWNE	8-19S1E	Pu	Gunnison Oil Co. #1	Gunnison	?	5200	Green River	?			1,800
5	NESW	24-20S1W	P	Sanpete Oil Co. #1	Redmond	?	?	Quaternary	?			1,462
6	SESW	24-20S1W	P	Ben H. Bullock, et al #1	Redmond	12-?-41	?	Quaternary	Cretace			85
VIER COUNTY												
1	SWNE	36-20S1W	S	Sanpete Oil Co. #2	Redmond Anticline	5-?-48	?	Quaternary	?			250
2	SWNENE	15-22S2E	Pu	El Paso Natural Gas Co. #1	Salina Canyon	9-3-53	6136	Price River	Morrisc	Ksp 950', Km shale 1300', Kme 2040', Middle Shale 2520', Kmf 4210', Sanpete 5650', Jm 6015'.		6,117
3	SWSWSW	12-22S4E	Pu	Gordon Gray #1	Emery	1-1-53	7200	Star Point Sandstone	Lower Mancos Shale	Kme 860', Kmm 2030', Kmf 3413'.	Several DSTs, no shows reported.	3,973
4	NESWNE	23-22S5E	Pu	K. D. Owen #1	Sevier	3-5-53	6222	Mancos	Curtis	Kd 2560', Jm 2686', Js 3140', Jc 3560'.	Kmf 1245-1775'; kelly bushing flowed water.	3,710
5	C SWSW	13-25S5E	Pu	American Liberty Oil Co. #1	North Last Chance	9-13-48	5900	Entrada	Coconir	Jca 326', Jn 610', Jk 2217', Jw 2355', Rc 2723', Rsh 2825', Rm 2950', Rsi 3918', Pk 4195', Pco 4315'.		4,493
MMIT COUNTY												
1	W SENW	28-6N8E	P	Utah Southern Oil Co. Hatch #1	Evanston Dome	3-28-52	6890	Almy	Nugget	Evanston 2050', Beckwith 3450', Basal Beckwith 5978', Twin Creek 6683', Nugget 8570'.	Casing: 10-3/4" cc at 380'. Dry hole.	8,630
2	SWSE	35-3N5E	P	Longwall Petroleum Co. #1	Coalville	5-20-44	6400?	Frontier	Frontie		Log available on photostats.	4,423
3	NWSE	9-2N5E	P	Mountain Fuel Supply Co. #1	Coalville	9-2-38	5635	Frontier	Morrisc		Log available on photostats.	5,538
4		16-2N5E	P	Western Empire Petroleum Co. #1	Coalville	1-?-27	5800	Frontier	Frontie		Log available on photostats.	3,870
5	NWSE	6-2N6E	Pu	Ohio Oil Co. #1	Coalville	11-6-24	6500	Frontier	Frontie			3,197
OELE COUNTY												
1	NW	31-1S5W	P	National Oil and Gas Co. #1	Burmaster	1917	4300	Lake Beds	?			1,127
2	SENE	14-2S6W	P	Bonneville Oil & Gas Exploration C. Worthington #1	Flux	7-?-48	?	Quaternary	?			3,115

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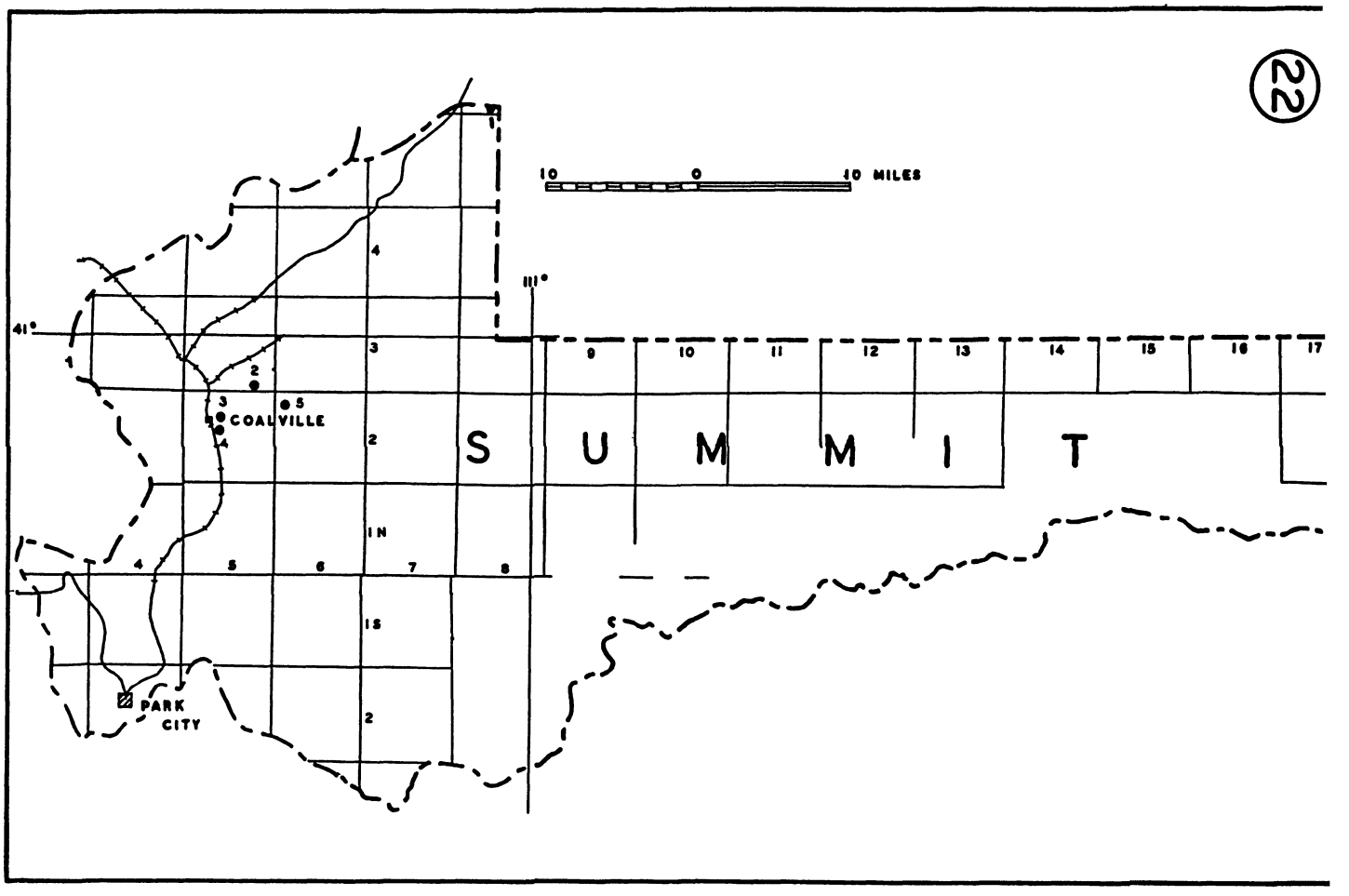
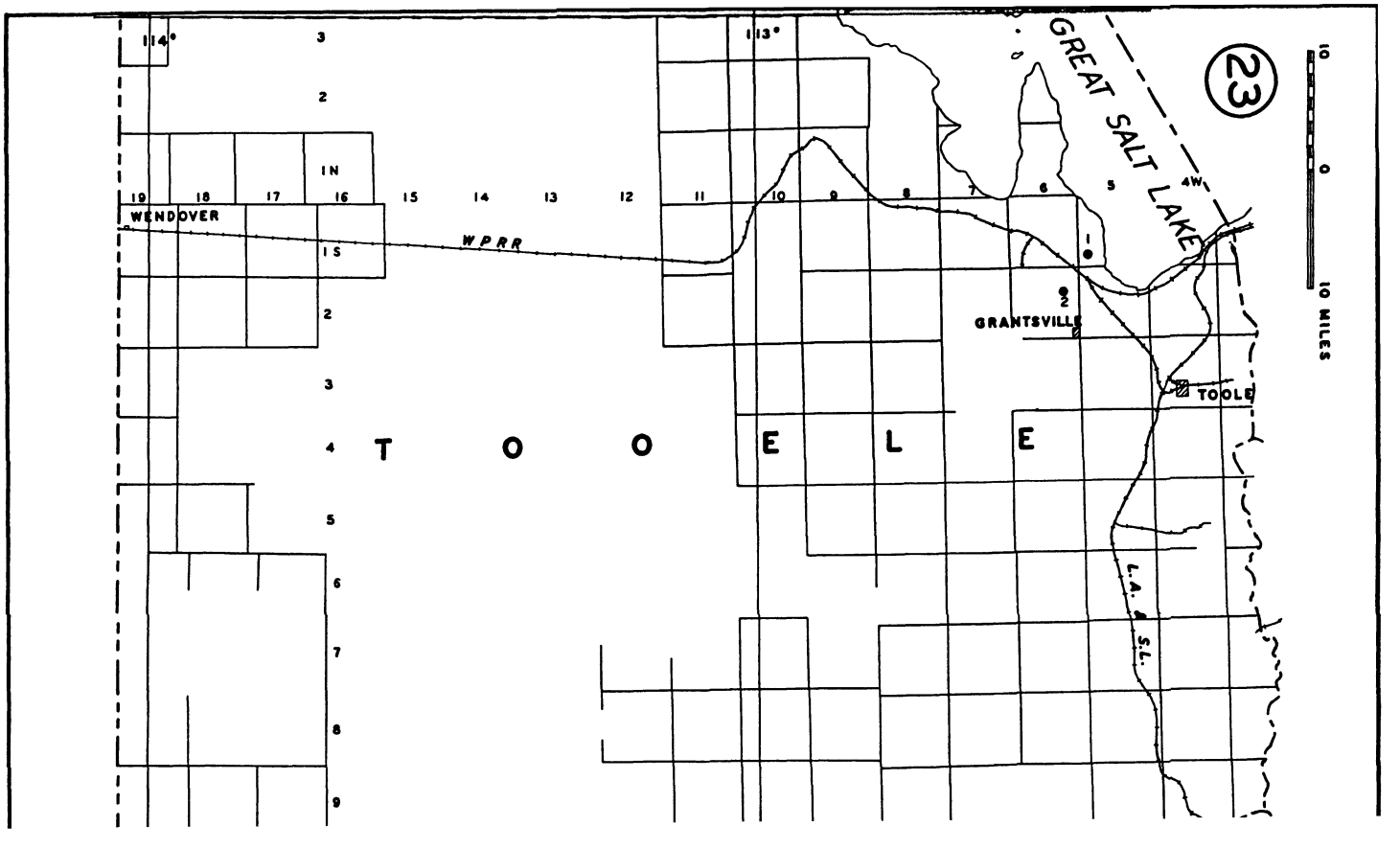

22
10 0 10 MILES
111°
41°
SUMMIT
COALVILLE
PARK CITY


23
114°
113°
GREAT SALT LAKE
WENDOVER
WPRR
GRANTSVILLE
TOOELE
10 0 10 MILES

NESE (Uintah Meridian)	18-2N1E	P	J. F. Walker et al #1	White Rocks	11-25-28	6300?	Nugget	Nugget			410 A
C SWSW (Uintah Meridian)	13-1S1W	P	Carter Oil Co. H. A. Peterson #_	Roosevelt	12-16-52	5549	Duchesne River	Wasatc	Teu 3220', Tegr 6040', Tew 10,187'.	IP 274 bbls., 32.8° API, Tegr 9825-9935' & 10,070-10,190'.	10,276 P
C NENE (Uintah Meridian)	24-1S1W	P	Phillips Petroleum Co. Leeton #1	Roosevelt	1-1-52	5520	Duchesne River	Wasatc	Teu 1790', Tegr 6237', Tew 10,064'.	IP 295 bbls., 34.7° API, Tegr zones 9610-10,064'.	10,140 P
C NWSW (Uintah Meridian)	24-1S1W	P	Carter Oil Co. #1	Roosevelt	4-26-53	5487	Duchesne River	Wasatc	Teu 2912', Tegr 5815', Tew 10,024'.	IP 90 bbls., pumped, 36.4° API, Tegr 9691-10,060'.	10,060 P
C SESW (Uintah Meridian)	10-1S1E	P	Gulf Oil Corp. Whitlock #1	Roosevelt	4-30-52	5464	Duchesne River	Green River	Teu 1415', Tegr 5963'.	IP 960 bbls., 30° API, Tegr 9269-9280'.	9,660 P
C SWSW (Uintah Meridian)	16-1S1E	In	Carter Oil Co. Ute Tribal C-1	Roosevelt	7-30-52	5460	Duchesne River	Wasatc	Teu 1840', Tegr 6005', Tew 9946'.	_____	9,995 P
C SESW (Uintah Meridian)	18-1S1E	P	Carter Oil Co. G. E. Houston #1	Roosevelt	3-13-53	5520	Duchesne River	Wasatc	Teu 3125', Tegr 5995', Tew 10,102'.	IP 144 bbls. pumped, 34.1° API, Tegr-Tew 9768-10,142'.	10,142 P
C NESW (Uintah Meridian)	20-1S1E	In	Carter Oil Co. Ute Tribal B-1	Roosevelt	3-31-52	5444	Duchesne River	Wasatc	Teu 1280', Tegr 5510', Tew 9850'.	IP 218 bbls., 33° API, Tegr 8926-9232'.	9,942 P
C NWSW (Uintah Meridian)	21-1S1E	In	Carter Oil Co. Roosevelt #1	Roosevelt	6-25-49	5410	Duchesne River	Green River	Teu 1220', Tegr 5785'.	IP 1633 bbls., 32.6° API, Tegr 9360-9390'.	9,391 P
C NWSE (Uintah Meridian)	21-1S1E	In	Carter Oil Co. Roosevelt #2	Roosevelt	9-28-50	5393	Duchesne River	Green River	Teu 1320', Tegr 5785'.	IP 439 bbls., 32.4° API, Tegr 9080-9393'.	9,393 P
C NWSW (Uintah Meridian)	24-1S1E	P	Carter Oil Co. Rosemary Lloyd #1	Roosevelt	10-26-52	5471	Duchesne River	Paleoc	Teu 2075', Tegr 5785', Tew 9668', Tpa 11,867'.	19 DSTs run.	11,888 P
C SENE (Uintah Meridian)	28-1S1E	In	Carter Oil Co. Roosevelt #3	Roosevelt	9-12-52	5313	Duchesne River	Wasatc	Teu 1811', Tegr 5514', Tew 9524'.	15 DSTs. IP 228 bbls., API 32.3° Tegr-Tew 9056-9592'.	9,592 I
SESENE (Uintah Meridian)	29-1S1E	P	J. W. Weightman et al #1	Roosevelt	2-14-51	?	Duchesne River	?	_____	Shut down 2-14-51 at 330'. Operating rights in conflict. Water well for farm.	330 A
$N\frac{1}{2}S\frac{1}{2}$ (Uintah Meridian)	36-1S1E	P	Syndicate Oil & Mining Co. #1	La Point	10-23-46	?	Duchesne	?	_____	Show gas, Tew 1840-1856'.	2,207 A
SWNW (Uintah Meridian)	8-2S2E	P	Uintah Oil & Exploration Co. #1	Moffat	1919	5100?	Duchesne	?	_____	_____	1,100 A
SWSWNW (Uintah Meridian)	19-2S2E	P	Syndicate Oil & Mining Co. #1	Moffat	12-?-52	?	Green River	?	_____	_____	832 A
N SESE (Uintah Meridian)	29-4S1E	Pu	Utah Southern Oil Co. #1	Myton	2-24-29	5000	Uinta	Green River?	_____	At 1800' in Tegr sticky substance resembling Vernal asphalt beds.	3,000 A
SWSWSE	7-3S20E	Pu	Tide Water Assoc. Oil Co. 58-7	Pine Ridge	9-17-49	7504	Shinarump	Missis pian Limest	Rm 65', Ppc 730', Cpw 876', Cpm 1630', Cm 2588'.	_____	3,508 I
NWSE	28-3S21E	Pu	Maude Ellen Oil Co. #1	Neal Dome	11-2-32	5750	Nugget	Weber	_____	Water well.	2,552 A
SESE (Lot 10)	30-3S21E	P	Vernal Oil & Gas Co. #1	Vernal Dome	11-?-48	?	Chinle	?	Rsh 96', Rm 150', Ppc 1046', Cpm 2264'.	_____	2,660 A
SWSESE	30-3S22E	Pu	Cities Service Oil Co. #1	Brush Creek	?	?	Mancos	?	Kfr 1580', Kd 1910', Jm 2045', Jca 3206', Jn 3343', Rc 4155', Rsh 4268', Rm 4375', Pp 5270'.	_____	? I
NENWNE	12-4S20E	Pu	George F. Martin #1	Coal Basin	7-4-50	5883	Carmel	Navaj	Jn 84'.	Artesian water at Jn 84-590', 2000 bbls. per day. Completed as water well.	590 P
NWNWNE	12-4S20E	Pu	George F. Martin #1-A	Coal Basin	9-25-50	5869	Carmel	Weber	Jn 95', Rc 1220', Rsh 1317', Rm 1430', Ppc 2255', Cpw 2300'.	Water sands Jn 115-125', 355-400', 630-650'. Completed as water well.	2,314 P
NESE	21-4S20E	Pu	Union Oil Co. #1	Cottonwood Springs	6-11-42	6275	Duchesne River	Mes-	_____	Tar sand 1630-1730'.	2,222 A

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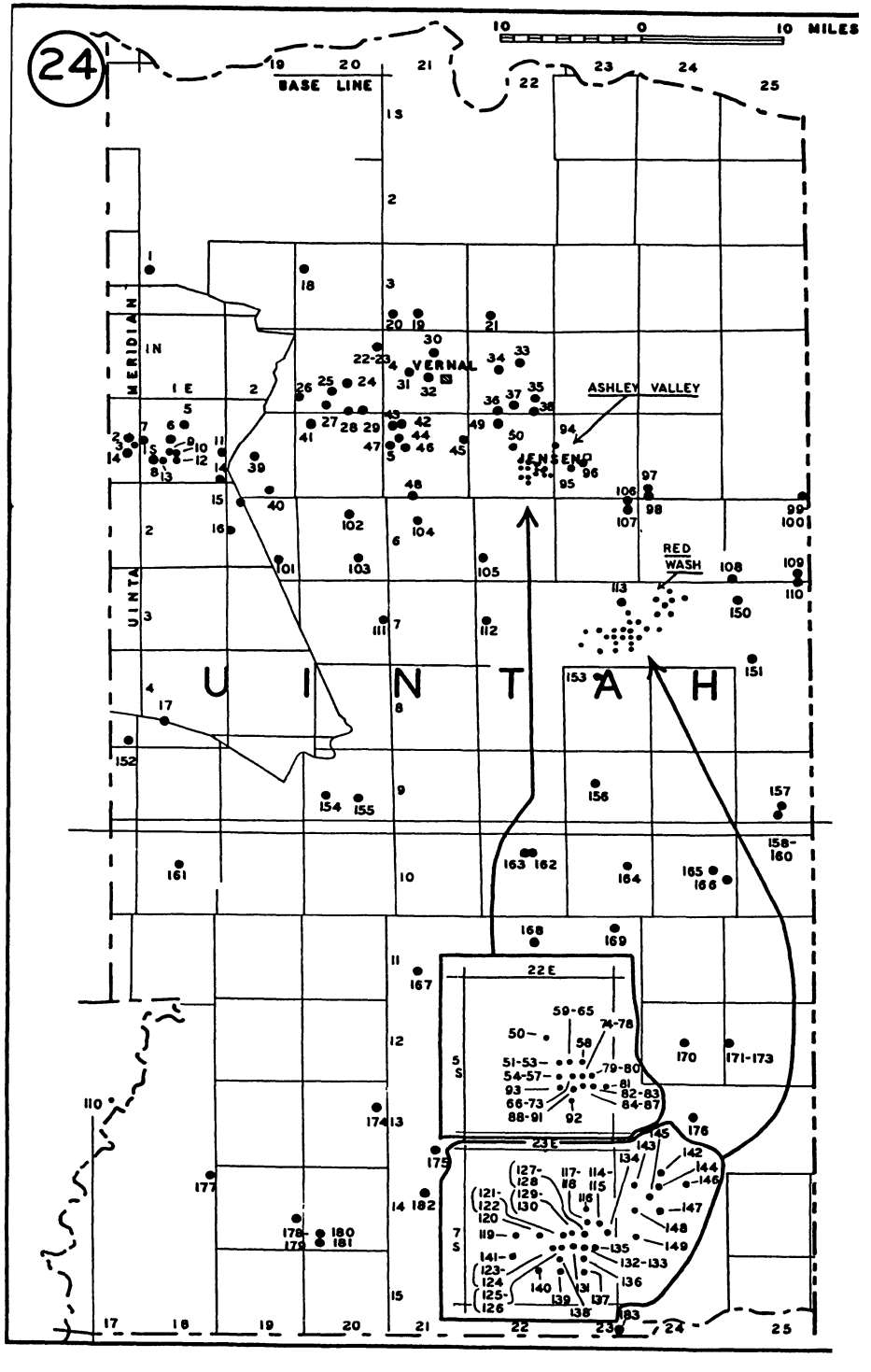
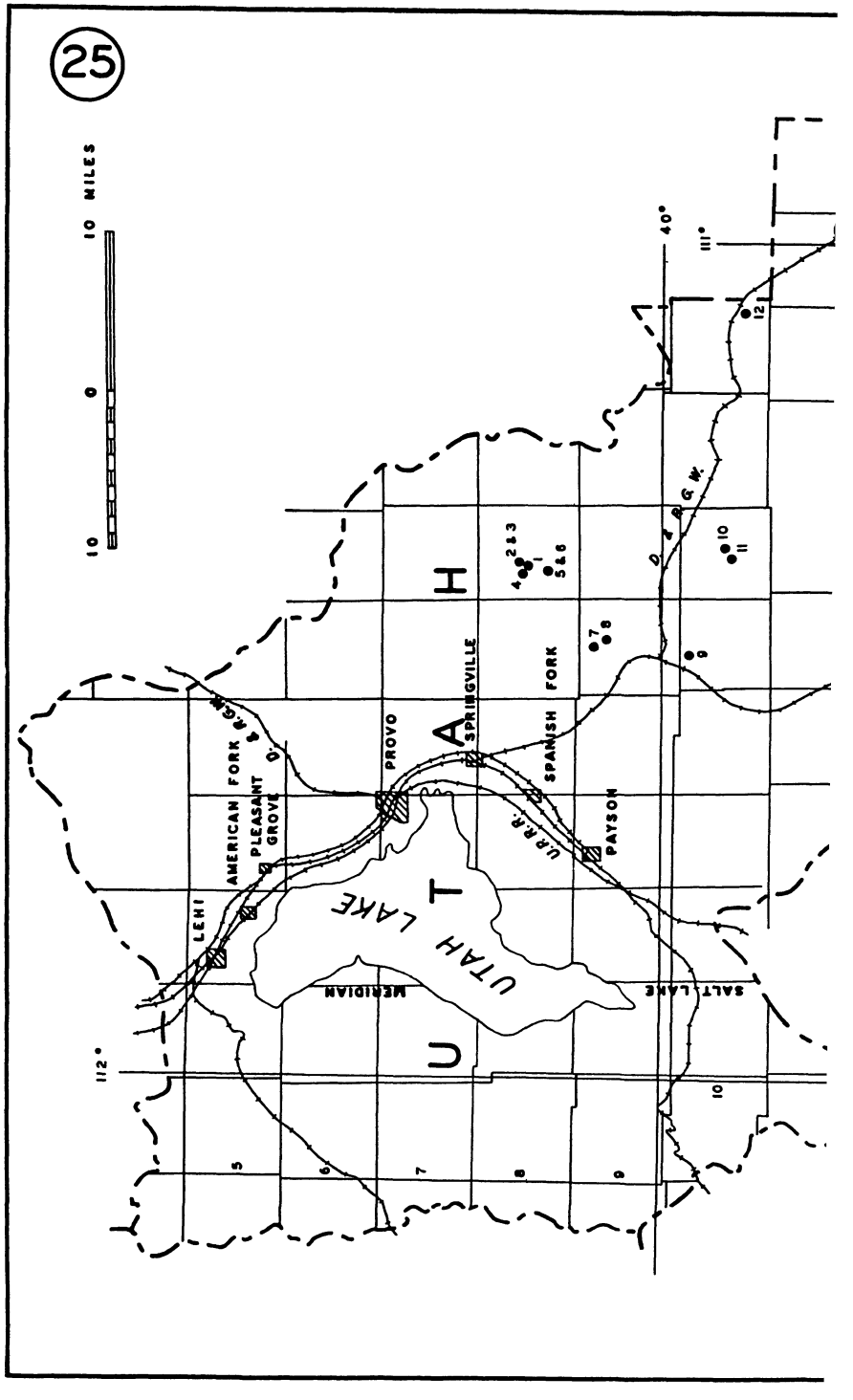

24
10 0 10 MILES
BASE LINE
UINTA MERIDIAN
1 N
1 E
VERNAL
ASHLEY VALLEY
JENSEN
RED WASH
U I N T A H
22 E
23 E
5 S
7 S


25
10 MILES
10 0 10
U T A H
UTAH LAKE
PROVO
SPRINGVILLE
SPANISH FORK
PAYSON
PLEASANT GROVE
AMERICAN FORK
LEHI
SALT LAKE MERIDIAN
D. & R.G.W.
U.P.R.R.
40°
112°
111°

[illegible]	C	SESE	28-4S20E	Pu	Carter Oil Co. #3 Schmidt #1	Vernal	3-25-48	6086	Duchesne River	Mancos Shal	Teu 1860', Kmv 4030', Km shale 6130'.	Gas shows at 1800' and 5197-5734'. Schlumberger 5 runs 2967', 3874', 4770'. 5505', 6132'.	6,370	P&A
24-26		SW	30-4S20E	Pu	Uintah Development Co. #?	Vernal	1912	5800	Tertiary	Tert	———	———	900	Abd
24-27		NWNW	33-4S20E	Pu	Carter Oil Co. Davis #1	Vernal	1947	5840	Duchesne River	Upper Cret	———	Gas 5845-70', 2800 MCFG.	8,001	Abd
24-28		SESE	34-4S20E	Pu	Uintah Development Co. #?	Vernal	1912	5800	Tertiary	Tert	———	———	1,500	Abd
24-29		SWSE	35-4S20E	Pu	Curtis & Dixon #1	Vernal	1912	5800	Tertiary	Tert	———	———	500	Abd
24-30			9-4S21E	?	Vernal Oil & Gas Co. #1	?	9-9-47	?	Morrison	?	———	———	509	?
24-31		S½SWSW	16-4S21E	P	Continental Oil Co. #1	Maeser	3-1-53	5523	Mancos	Webe	Kfr 3954', Mowry 4160', Kd 4301', Jm 4401', Jc 5300'?, Jn 5804', Rc 6616', Rsh 6826', Rm 6915', Cpw 7866'.	3 DSTs. No shows.	7,960	Abd
24-32		SWNW	22-4S21E	P	Mayo-Utah Oil Co. #1	Vernal	2-?-46	5230?	Mancos Shale	Nava	Kfr 4230', Mowry 4355', Kd 4520', Jm 5300', Jn 6500'.	———	6,773	Abd
24-33		NENENE	15-4S22E	Pu	Service Drilling Co. #1	Brush Creek	10-4-52	5413	Mancos Shale	Webe	Kfr 943', Kd 1340', Jm 1410', Jc 2266', Je 2403', Jca 2642', Jn 2784', Rc 3564', Rsh 3772', Rm 3873', Pp 4560', Cpw 4742-1/2'.	2 DSTs. No shows reported.	4,759	Abd
24-34		NENESW	16-4S22E	S	Herman Flader et al #1	Brush Creek	11-24-52	5284	Mancos Shale	Webe	Kd 1760', Jm 1833', Jc 2540', Je 2819', Jca 3068', Jn 3184', Rc 3939', Rsh 4139', Rm 4197', Pp 5130', Cpw 5276'?	———	5,323	Abd
24-35		NESWSE	26-4S22E	Pu	Sun Oil Co. #1	Brush Creek	12-10-49	5284	Mancos Shale	Webe	Kfr 576', Mowry 796', Kd 926', Jm 1000', Jc 1870', Je 1990', Jca 2249', Jn 2348', Rc 3140', Rsh 3305', Rm 3421', Pp 4107', Cpw 4280'.	———	4,302	P&A
24-36		SWNESW	33-4S22E	P	Equity Oil Co. Kendall #1	Naples	8-?-49	4976	Mancos Shale	Webe	Kfr 1225', Kd 1665', Je 2730', Jca 2930', Jn 3050', Rc 3808', Pp 4746', Cpw 4907'.	———	4,922	P&A
24-37		SWNWNW	34-4S22E	P	Equity Oil Co. Powell #1	Vernal	1-?-46	?	Mancos Shale	Morri	Kfr 835', Kd 1234', Jm 1295'.	———	1,763	Abd
24-38		SWNWSE	35-4S22E	Pu	Roy M. Johnson #2	Brush Creek	4-13-51	5243	Mancos Shale	Webe	Kfr 1070', Kd 1450', Jm 1520', Jc 2375', Je 2520', Jca 2760', Jn 2865', Rc 3660', Ppc 4591', Pp 4597', Cpw 4765'.	———	4,778	P&A
24-39	C	SESW	21-5S19E	P	California Co. #2	Gusher	6-22-51	5344	Duchesne River	Wasat	Teu 1210', Tegr 5636', Tew 9448'.	Non-commercial oil, Tegr 8504-8568'.	10,500	Abd
24-40	S	NWNW	35-5S19E	Pu	California Co. #1	Gusher	8-27-50	5358	Duchesne River	Wasat	Teu 1000', Tegr 5452', Tew 9157'.	18 DSTs. IP 24 bbls. 32.8° API. Tegr 8699-8950'.	9,757	OSI
24-41	C	NESW	5-5S20E	Pu	Carter Oil Co. Rockwood Brown #1	Vernal	7-13-51	5732	Duchesne River	Wasat	Teu 3605', Tegr 4480', Tew 10,110'.	———	10,714	P&A
24-42		NWSW	5-5S21E	P	Reed #1	Vernal	8-16-11	5800	Uinta	?	———	———	1,430	Abd
24-43		NWSE	6-5S21E	Pu	Western Venture Corp. #1	Vernal	10-?-30	5750	Uinta	Uinta	———	Gas 1296-1300'.	1,515	Abd
24-44		NESW	8-5S21E	Pu	Home Oil Co, #1	Vernal	8-?-29	5500	Uinta	Uinta	———	———	1,165	Abd
24-45	S	NESE	12-5S21E	P	California-Utah Oil Co. Slaugh #1	Naples	11-19-49	?	Mancos Shale	Navaj	Kfr 4280', Kd 4620', Jm 4730', Jc 5630', Je 5720', Jca 5960', Jn 6115'.	———	6,133	P&A
24-46		NENE	17-5S21E	Pu	Uintah Development Co. #?	Vernal	1912	5400	Uinta	?	———	———	1,200	Abd
24-47	C	SWNE	18-5S21E	Pu	Carter Oil Co. #2	Vernal	9-27-47	5393	Duchesne River	Upper Cret	Teu 1950', Tew 4320', Kmv 5150'.	DSTs irregular intervals through the Tew, oil and gas cuts and muddy water. Slumberger run 6013'. Log without tops.	6,013	Abd
24-48	C	SESW	33-5S21E	Pu	Carter Oil Co. #4 (Nelson #1)	Vernal	3-6-49	5330	Duchesne River	Wasat	Teu 1870', Tegr 2850', Tew 6555'.	Oil and gas shows 6737', 6807', 6827-54', 7068-7079', 7077-7089'; 29.6° green oil; 2-5 MCFG.	7,884	P&A

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

24-49	C SESW 4-5S22E	P	Baird & Robbins B. D. Slaugh #1	Naples	8-?-49	?	Mancos Shale	Weber	Kfr 2100', Kd 2470', Jm 2530', Jc 3400', Je 3500', Jn 3796', Rc 4586', Rsh 4785', Cpw 5710'?	———	5,9
24-50	SESWNW 15-5S22E	P	Crain & Griffith Drilling Co. Hillman #1	Ashley Creek	9-?-49	4995	Mancos Shale	Chinle	Kfr 1848', Kd 2205', Jm 2278', Rc 4358'.	———	4,3
24-51	SESWNE 22-5S22E	P	California Co. Gentry #1	Ashley Creek	11-15-49	4941	Mancos Shale	Weber	Kfr 916', Kd 1270', Jc 2215', Je 2305', Jca 2475', Jn 2605', Rc 3263', Anhydrite 3795', Pp 4162', Cpw 4277'.	IP 137 bbls. 32° API, Cpw 4277-4301'.	4,3
24-52	SESENE 22-5S22E	P	Equity Oil Co. #6	Ashley Creek	7-16-49	4923	Mancos Shale	Weber	Kfr 770', Kd 1088', Jm 1131', Je 2102', Jca 2350', Jn 2451', Rc 3175', Pp 4040', Cpw 4185'.	IP 432 bbls. 32° API, Cpw 4185-4293'.	4,2
24-53	SENE 22-5S22E	P	Utah Oil Refining Co. #4	Ashley Valley	12-20-28	4923	Mancos	Nugget	———	Show gas Jm 1730-35'; oil 1842-47'.	2,1
24-54	SENESE 22-5S22E	P	Equity Oil Co. #5	Ashley Creek	6-16-49	4922	Mancos Shale	Weber	Kfr 804', Kd 1162', Jm 1222', Je 2155', Jca 2310', Jn 2430', Rc 3130', Pp 3993', Cpw 4147'.	IP 265 bbls. 31.9° API, Cpw 4147-4290'.	4,2
24-55	NENWSE 22-5S22E	Pu	Stanolind Oil & Gas Co. #8	Ashley Creek	9-25-49	4946	Mancos Shale	Weber	Kfr 920', Mowry 1150', Kd 1261', Jm 1326', Jc 2021', Je 2227', Jca 2460', Jn 2585', Rc 3295', Rsh 3387', Rm 3511', Pp 4120', Cpw 4280'.	IP 257 bbls. 32° API, Cpw 4280-4306'.	4,2
24-56	NESWSE 22-5S22E	Pu	Stanolind Oil & Gas Co. #10	Ashley Creek	2-19-50	4962	Mancos Shale	Weber	Kfr 995', Mowry 1080', Kd 1352', Jm 1408', Jc 2110', Je 2290', Jca 2520', Jn 2642', Rc 3338', Rsh & Rm 3442', Pp 4212', Cpw 4328'.	IP 100 bbls. allowable. 31° API. Pp-Cpw 4323-4330'	4,2
24-57	NESESE 22-5S22E	Pu	Stanolind Oil & Gas Co. #4	Ashley Creek	6-20-49	4933	Mancos Shale	Weber	Kfr 774', Kd 1200', Jm 1270', Jc 2117', Je 2170', Jca 2358', Jn 2458', Rc 3180', Rm 3670', Pp 4038', Cpw 4188'.	IP 175 bbls. 31° API. Cpw 4188-4308'.	4,2
24-58	SWSWNE 23-5S22E	P	Equity Oil Co. #8	Ashley Creek	4-16-50	4875	Mancos Shale	Weber	Kfr 786', Kd 1132', Jm 1211', Je 2240', Jn 2440', Rc 3212', Rm 3370', Pp 4050', Cpw 4220'.	IP 100 bbls. allowable. 32° API. Pp-Cpw 4135-4239'.	4,2
24-59	SWNENW 23-5S22E	P	Equity Oil Co. #2	Ashley Creek	3-13-49	4895	Mancos Shale	Weber	Kfr 625', Kd 977', Jm 1042', Je 1920', Rc 2000', Jca 2245', Jn 2340', Rc 3060', Rm 3247', Pp 3920', Cpw 4065'.	IP 430 bbls. 32° API. Cpw 4065-4218'.	4,2
24-60	SWNENW 23-5S22E	P	Stewart-Six, et al Hullinger #1	Ashley Creek	1-?-50	4887	Mancos Shale	Weber	Kfr 1000', Kd 1350', Jm 1430', Jc 2235', Je 2368', Jca 2590', Jn 2705', Rc 3435', Rsh 3532', Rm 3714', Pp 4373', Cpw 4526'.	———	4,2
24-61	SWNW 23-5S22E	P	Utah Oil Refining Co. #1	Ashley Valley	4-13-25	4847	Mancos	Morris	———	Gas, Jm 1673-80', 15,000 MCFG.	1,6
24-62	SWNW 23-5S22E	P	Utah Oil Refining Co. #3	Ashley Valley	3-23-28	4844	Mancos	Nugget	———	Gas, Jm 1663-71', 15,000 MCFG. 2720-20,000 bbls fresh water daily.	2,7
24-63	C SWNW 23-5S22E	?	Equity Oil Co. et al Meagher #1	Ashley Valley	10-19-48	?	Mancos	Weber?	Kfr 676', Kd 1020', Rc 3125', Pp 4060', Cpw 4136'.	October 19, 1948, flow 260 bbls. in 24 hrs. through 2" tubing, Cpw.	4,
24-64	C SWNW 23-5S22E	P	Equity Oil Co. #9	Ashley Creek	5-22-50	4891	Mancos Shale	Weber	Kfr 729', Kd 1060', Jm 1140', Jca 2350', Jn 2460', Rc 3180', Pp 4065', Cpw 4214'.	IP 99 bbls. allowable. 32° API, Pp-Cpw 4065-4260'.	4,2
24-65	SWSENW 23-5S22E	P	Equity Oil Co. #7	Ashley Creek	10-1-49	4897	Mancos Shale	Weber	Kfr 701', Kd 1068', Jm 1150', Je 2127', Jca 2310', Jn 2414', Rc 3147', Pp 4007', Cpw 4152'.	IP 960 bbls. 32° API, Cpw 4152-4230'.	4,2
24-66	NESW 23-5S22E	P	Utah Oil Refining Co. #2	Ashley Valley	9-17-27	4901	Mancos	Mancos	———	———	

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

24-67	NESW 23-5S22E	P	Uintah Gas Co. #5	Ashley Valley	12-4-34	4836	Mancos	Morr			1,730
24-68	N NWSW 23-5S22E	P	Equity Oil Co. #1	Ashley Creek	9-23-48	4904	Mancos Shale	Webe	Kfr 690', Kd 1020', Jm 1073', Jc 1970', Je 2046', Jca 2280', Jn 2408', Rc 3120', Rsh 3240', Rm 3306', Pp 3990', Cpw 4138'.	IP 300 bbls. 33° API. Pp-Cpw 4136-4152'.	4,152
24-69	SENWSW 23-5S22E	P	Equity Oil Co. #4	Ashley Creek	5-15-49	4904	Mancos Shale	Webe	Kfr 605', Kd 970', Jm 1047', Jc 1930', Je 2004', Jca 2230', Jn 2339', Rc 3070', Rsh 3200', Rm 3260', Pp 3915', Cpw 4076'.	IP 295 bbls. 34° API. Cpw 4076-4271'.	4,271
24-70	SENWSW 23-5S22E	P	Equity Oil Co. #2-A	Ashley Creek	7-28-50	4898	Mancos Shale	Entr	Kfr 636', Kd 969', Jm 1054', Je 2002'.	IP 5,000,000 cu. ft., Jm 1612-1624'.	2,027
24-71	NESWSW 23-5S22E	Pu	Stanolind Oil & Gas Co. #1	Ashley Creek	4-13-49	4902	Mancos Shale	Webe	Kfr 610', Kd 958', Jc 1920', Je 2020', Jca 2250', Jn 2375', Rc 3090', Rsh 3260', Rm 3295', Pp 3945', Cpw 4088'.	IP 288 bbls. allowable. 31.5° API, Cpw 4097-4278'.	4,327
24-72	NWSESW 23-5S22E	P	Crain & Griffith Drilling Co. Hall #1	Ashley Creek	12-11-48	4890	Mancos Shale	Webe	Kfr 628', Kd 978', Jm 1048', Jc 1933', Je 2014', Jca 2245', Jn 2350', Rc 3060', Rm 3253', Pp 3975', Cpw 4080'.	IP 502 bbls. 32° API, Cpw 4088-4122'.	4,122
24-73	SESESW 23-5S22E	?	Crain & Griffith Drilling Co. Hall #2	Ashley Valley	?	?	?	?	———	Offset to #1.	
24-74	SWNWSE 23-5S22E	P	Equity Oil Co. #3	Ashley Creek	4-18-49	4894	Mancos Shale	Wel	Kfr 700', Kd 1055', Jm 1135', Jc 1980', Je 2087', Jca 2314', Jn 2425', Rc 3106', Rsh 3240', Pp 3964', Cpw 4105'.	IP 480 bbls., 32° API, Cpw 4105-4268'.	4,268
24-75	NWSWSE 23-5S22E	P	Hollandsworth Drilling Co. Hall #1	Ashley Creek	3-8-49	4890	Mancos Shale	Webe	Kfr 693', Kd 1037', Jm 1123', Jc 1971', Je 2045', Jca 2274', Jn 2366', Rc 3056', Rm 3266', Pp 3923', Cpw 4076'.	IP 624 bbls. 32° API, Cpw 4076-4124'.	4,124
24-76	SWNESE 23-5S22E	P	California Co. Wyman #1	Ashley Creek	6-23-49	4844	Mancos Shale	Webe	Kfr 752', Kd 1100', Jm 1184', Jc 2070', Je 2128', Jca 2346', Jn 2448', Rc 3174', Pp 4050', Cpw 4204'.	IP 132 bbls. 30.1° API, Cpw 4207-4235'.	4,235
24-77	NWSESE 23-5S22E	P	Crain & Griffith Drilling Co. Hall #3	Ashley Creek	4-26-49	4858	Mancos Shale	Wel	Kfr 713', Kd 1064', Jm 1133', Jc 2008', Je 2085', Jca 2326', Jn 2427', Rc 3125', Rsh 3237', Rm 3307', Pp 3992', Cpw 4135'.	IP 600 bbls. 32° API, Cpw 4135-4208'.	4,208
24-78	SESESE 23-5S22E	P	Crain & Griffith Drilling Co. Hall #4	Ashley Creek	10-21-49	4860	Mancos Shale	Webe	Kfr 738', Kd 1077', Jm 1136', Jc 2020'; Je 2097', Jca 2315', Jn 2424', Rc 3134', Pp 3988', Cpw 4132'.	IP 480 bbls. 32° API, Cpw 4132-4200'.	4,200
24-79	SWSWSW 24-5S22E	P	Stewart-Six et al Nelson #1	Ashley Creek	9-?-49	4856	Mancos Shale	Webe	Kfr 774', Kd 1118', Jm 1186', Je 2124', Jca 2350', Jn 2463', Rc 3157', Pp 4015', Cpw 4163'.	IP 800 bbls. 32° API, Cpw 4163-4190'.	4,190
24-80	SWSESW 24-5S22E	P	Stewart-Six et al Massey #1	Ashley Creek	11-28-49	4776	Mancos Shale	Webe	Kfr 788', Kd 1128', Jm 1203', Jc 2042', Je 2177', Jca 2403', Jn 2509', Rc 3206', Rsh 3298', Rm 3453', Pp 4093', Cpw 4249'.	———	4,255
24-81	C SENE 25-5S22E	P	Roy M. Johnson #1	Brush Creek	2-?-51	?	Mancos Shale	Fron	Kfr 1400'.	Well abandoned because of steep dips.	1,412
24-82	NWNWNW 25-5S22E	Pu	Stanolind Oil & Gas Co. #7	Ashley Creek	9-9-49	4856	Mancos Shale	Webe	Kfr 757', Mowry 1014', Kd 1125', Jm 1195', Jc 1993', Je 2135', Jca 2361', Jn 2478', Rc 3165', Rsh 3258', Rm 3430', Pp 4023', Cpw 4168'.	IP 792 bbls. 32° API, Cpw 4168-4216'.	4,216
24-83	NWSWNW 25-5S22E	Pu	R. Lacy Production Co. #3	Ashley Creek	7-23-49	4823	Mancos Shale	Webe	Kfr 810', Kd 1146', Jm 1210', Je 2184', Jca 2410', Jn 2475', Rc 3192', Pp 4070', Cpw 4193'.	IP 142 bbls. allowable. 31.6° API, Cpw 4193-4205'.	4,205

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

NWNENE 26-5S22E	Pu	Stanolind Oil & Gas Co. #5	Ashley Creek	7-3-49	4868	Mancos Shale	Weber	Kfr 720', Mowry 925', Kd 1042', Jm 1098', Jc 1967', Je 2068', Jca 2295', Jn 2408', Rc 3118', Rsh 3200', Rm 3325', Pp 3950', Cpw 4089'.	IP 174 bbls. allowable. 32° API Cpw 4089-4243'.	4,243	POW
NWNWNE 26-5S22E	Pu	Stanolind Oil & Gas Co. #2	Ashley Creek	5-25-49	4889	Mancos Shale	Weber	Mowry 720', Kfr 786', Kd 1050', Jm 1118', Jc 1960', Je 2027', Jca 2282', Jn 2382', Rc 3104', Rm 3592', Pp 3958', Cpw 4046'.	IP 375 bbls. 31° API, Cpw 4096-4251'.	4,310	POW
NESWNE 26-5S22E	Pu	R. Lacy Production Co. #1	Ashley Creek	3-8-49	4878	Mancos Shale	Weber	Kfr 812', Kd 1152', Jm 1224', Jc 2084', Je 2150', Jca 2398', Jn 2510', Rc 3219', Rsh 3308', Rm 3404', (Anhydrite 3720'), Pp 4078', Cpw 4227'.	IP 734 bbls. 31.6° API, Cpw 4227-4255'.	4,255	POW
NWSENE 26-5S22E	Pu	Hollandsworth & Travis #1-A	Ashley Creek	4-24-49	4881	Mancos Shale	Weber	Kfr 796', Kd 1110', Jm 1200', Je 2150', Jca 2397', Jn 2486', Rc 3212', Rsh 3295', Rm 3390', Pp 4052'. Cpw 4184'.	IP 864 bbls. 32° API, Cpw 4207-4235'.	4,235	POW
NWNENW 26-5S22E	Pu	Stanolind Oil & Gas Co. #3	Ashley Creek	5-23-49	4912	Mancos Shale	Weber	Kfr 700', Mowry 775', Kd 1058', Jm 1130', Jc 1996', Je 2070', Jca 2321', Jn 2424', Rc 3150', Rm 3643', Pp 4005', Cpw 4142'	IP 1008 bbls. 31° API, Cpw 4148-4287'.	4,287	POW
E NWNW 26-5S22E	Pu	Stanolind Oil & Gas Co. #6	Ashley Creek	7-27-49	4926	Mancos Shale	Weber	Kfr 769', Mowry 979', Kd 1085', Jm 1165', Jc 1990', Je 2135', Jca 2360', Jn 2473', Rc 3204', Rsh 3283', Rm 3396', Pp 4060', Cpw 4205'.	IP 240 bbls. allowable. 31.5° API, Cpw 4205-4301'.	4,301	POW
NESWNW 26-5S22E	Pu	Hollandsworth & Travis #1-B	Ashley Creek	5-23-49	4954	Mancos Shale	Phospho:	Kfr 1079', Kd 1398', Jm 1474', Jc 2260', Je 2342', Jca 2565', Jn 2677', Rc 3390', Rsh 3480', Rm 3595', Anhydrite 3902', Pp 4270'.	Casing: 260' 10-3/4" cc w/165 sx.	4,393	P&A
NESENW 26-5S22E	Pu	Crain & Griffith Drilling Co. #1	Ashley Creek	6-2-49	4926	Mancos Shale	Weber	Kfr 878', Kd 1213', Jm 1287', Jc 2173', Je 2249', Jca 2458', Jn 2523', Rc 3285', Rm 3790', Pp 4152', Cpw 4294'.	IP 101 bbls. allowable. 32° API, Cpw 4296-4303'.	4,307	POW
NESESW 26-5S22E	P	Ute Royalty Corp. & Signal Uintah Basin Oil Co. Herriott #1	Ashley Creek Ext.	?	4930	Mancos	?	Jensen 970', Kfr 1503', Mowry 1594', Kd 1807', Jm 1870', Jc 2630', Je 2748', Jca 2990', Jn 3090', Rc 3807', Rsh 3984', Rm 4016', Pp 4635'?, Cpw 4770'.	Casing: 12-3/4" cc100' w/50 sx.	2,630	Drg
NENENE 27-5S22E	Pu	Stanolind Oil & Gas Co. #9	Ashley Creek	12-12-49	4922	Mancos Shale	Weber	Kfr 918', Kd 1273', Jm 1344', Jc 2210', Je 2298', Jca 2481', Jn 2630', Rc 3250', Rm 3437', Pp 4125', Cpw 4268'.	IP 55 bbls. allowable. 32° API, Cpw 4268-4290'.	4,290	POW
SWSENW 18-5S23E	Pu	H. D. Moore, et al #1	Ashley Valley	7-16-49	4898	Mancos Shale	Weber	Kfr 926', Mowry 1130', Kml 1172', Kd 1272', Jm 1340', Jc 2400', Je 2490', Jca 2588', Jn 2615', Rc 3275', Rsh 3575', Rm 3615', Pp 4272', Cpw 4408'.	Casing: 263' 10-3/4" cc w/150 sx.	4,439	P&A
SWSWSW 20-5S23E	P	Utah-Vernal Oil Co. #1	Jensen	7-?-49	?	Mancos	Weber	Kfr 382', Kd 719', Jm 807!, Jc 1697', Je 1767', Jca 1979', Jn 2085', Rc 2776', Pp 3624', Cpw 3757'.	Casing: 250' 10" cc.	4,447	Abd
C NENW 21-5S23E	P	Equity Oil Co. #1	Jensen	11-12-51	4770	Mancos Shale	Weber	Kd 376', Jm 410', Jc 1300', Je 1408', Jca 1622', Rc 2400', Rsh 2604'?, Rm 2656', Pp 3267', Cpw 3420'.	DSTs with oil shows in Rsh ? and Pp; water in Cpw.	3,421	Abd
NENWNE 31-5S24E	P	Utah Southern Oil Co. #1	Section Ridge Anticline	11-19-53	5069	Alluvium	Weber	Rm 91', Pp 160', Cpw 254'.	Water Cpw 47 bbls. per hour, flowing, not potable but suitable for irrigation.	265	Abd

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

98	SWNWSE	31-5S24E	P	Utah Southern Oil Co. #1-CS	Section Ridge Anticline	11-4-53	5025	Triassic	Weber	Rm 153', Pp 435', Cpw 535'.	Water Cpw.	550
99	C S½S½ (Lot 4)	36-5S25E	S	Richfield Oil Co. of Montana, State #1	Trail Creek	10-?-47	?	Shinarump	Shinar	———	———	1,450
100		36-5S25E (Lot 4)	S	Richfield Oil Co. of Montana #1-X	Trail Creek	12-?-47	?	Shinarump	?	———	———	628
101	NWNE	26-6S19E	Pu	Uintah Oil & Exploration Co. #1	Moffat	9-?-25	5000	Uinta	Green River	———	———	1,500
102	E NWNE	10-6S20E	Pu	California Co. #3	Gusher	11-6-52	5063	Duchesne River	Wasatch	Teu 705', Tegr 4728', Tegr-Tew 8161', Tew 8370'.	IP 23 bbls. oil and 4 bbls water PD, 35.4° API, Tegr 7736-7989'.	8,633
103	C NWNW	26-6S20E	Pu	Stanolind Oil & Gas Co. Klein #1	South Gusher	2-16-52	4984	Duchesne River	Wasatch	Teu 700', Tegr 4105', Tew 7865'.	Casing: 1175' 10-3/4" cc w/505 sx.	8,169
104	C SWSW	9-6S21E	Pu	Carter Oil Co. #1	Vernal	6-27-52	5022	Duchesne River	Wasatch	Teu 2000', Tegr 4580', Tew 7650'.	Casing: 570' 10-3/4" cc at 579' w/275 sx.	9,002
105	SESWNE	30-6S22E	Pu	California Co. #1	Horseshoe Bend	5-29-52	4859	Duchesne River	Wasatch	Tegr 3633', Tew 6730'.	———	8,944
106	NE (Lot 3)	1-6S23E	Pu	Russell D. Garner #1 Boesche	Cliff Creek	2-25-53	5164	San Rafael Group	Weber	Je 190', Jn 298', Rc 1000', Rsh 1182', Rm 1210', Pp 1840', Cpw 1990-2012', fault zone and back into Rm, Pp 2265', Cpw 2447'.	Flowed fresh water. Temporarily completed as water well.	2,650
107	NESENW	1-6S23E	Pu	Russell D. Garner #1 Garner	Cliff Creek	5-2-53	5158	Curtis	Weber	Je 150', Jca 375', Jn 470', Rc 1155', Rsh 1320'?, Rm 1350'?, Pp 1850' fault?, Cpw 2015'.	Dead oil zones 1850-2100', and water in Cpw.	2,336
108		31-6S25E (Lot 4)	P	George Brown #?	Powder Springs	1911	5500	Tertiary	?	———	———	700
109	SENW	36-6S25E	S	E. R. McElroy #1	Powder Springs	?	?	Mesaverde	?	———	———	1,640
110	C NESW	36-6S25E	?	Regan et al #1	Powder Springs	1-27-48	?	?	?	———	Completed as water well at 1640'.	2,056
111	C NESE	13-7S20E	Pu	Gulf Oil Corp. #1	Brennan Bottom	11-?-53	4820	Duchesne River	Wasatch	Teu 480', Tegr 3765', Tew 7095'.	Detailed DST records show gas at 4079-4284', asphaltic oil at 5589-5680', IP 168 bbls. oil PD, API 31°, pour point 100° F. at 6870-7328'.	8,000
112	C SESE	18-7S22E	Pu	California Co. #1	South Horseshoe Bend	10-25-52	5107	Duchesne River	Wasatch	Tegr 2915', Tew 6332'.	Various DSTs in both formations recovered mud and gas-cut water.	6,878
113	S½SWNW	11-7S23E	Pu	Carter Oil Co. #1-BU	Walker Hollow	10-22-53	5208	Uinta	Wasatch	Tegr 2790', Tew 5730'.	Detailed DSTs with production at 4327-5282', SIP 1540#. IP 109 bbls. oil PD, API 29.8°.	5,754
114	SWNESW	13-7S23E	Pu	California Co. #30	Red Wash	12-2-53	5785	Duchesne River	Green River	Tegr 3026'.	Casing: 7" cc 5850' w/425 sx. Tegr 5695-5797'.	5,848
115	C SWSW	13-7S23E	Pu	California Co. #14	Red Wash	4-9-52	5752	Duchesne River	Wasatch	Tegr 3002'.	IP 186 bbls. pumping, Tegr zones 5593-5777'.	5,813
116	S½SWNE	14-7S23E	Pu	California Co. #21	Red Wash	3-26-53	5508	Duchesne River	Wasatch	Tegr 2888', Tew 5730'.	PB 5566'. Perforated 4 bullets and 4 jets per foot 5535-42', 5546-54'. IP 110 bbls., 29° API, Tegr 5535-5554'.	5,783
117	SWSWSE	14-7S23E	Pu	California Co. #24	Red Wash	8-21-53	5746	Duchesne River	Green River	Tegr 3017'.	IP 204 bbls oil PD, API 30°, Tegr 5709-5823'.	5,844
118	C NESE	14-7S23E	Pu	California Co. #27	Red Wash	11-3-53	5525	Duchesne River	Green River	Tegr 2820'.	IP 226 bbls. oil PD, 6% cut, API 27.2°, Tegr 5443-5606'.	5,63
119	C NENE	20-7S23E	Pu	California Co. #17	Red Wash	9-9-52	5618	Duchesne River	Wasatch	Tegr 3154' (Schl.), Tew 6024' (Schl.), Tew 6030' (Spl.).	IP 107 bbls., 29° API, Tegr 5086-5125'.	6,07
120	C NENE	21-7S23E	Pu	California Co. #6	Red Wash	1-6-52	5636	Duchesne River	Wasatch	Tegr 3050', Tew 5945'.	IP 52 bbls., 29° API, Tegr 5116-5180'.	5,95

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

4-121	C NENE 22-7S23E	Pu	California Co. #4	Red Wash	8-31-51	5714	Duchesne River	Green River	Tegr 3004'.	IP 138 bbls., 28.9° API, Tegr 5550-5830'.	5,83
4-122	C SWNE 22-7S23E	Pu	California Co. #8	Red Wash	11-18-51	5716	Duchesne River	Green River	Tegr 3027'.	IP 205 bbls., 29° API, Tegr 5568-5732'.	5,82
4-123	C NESW 22-7S23E	Pu	California Co. #26	Red Wash	10-13-53	5703	Duchesne River	Green River	Tegr 3010'.	IP 251 bbls. oil and 9 bbls. water PD, API 26.2°, Tegr 5632-5858'.	5,86
4-124	C SWSW 22-7S23E	Pu	California Co. #13	Red Wash	2-23-52	5650	Duchesne River	Green River	Tegr 2980'.	IP 134 bbls., 29° API, Tegr 5618-5657'.	5,84
4-125	C SWSE 22-7S23E	Pu	California Co. #31	Red Wash	?	5590	Duchesne River	?	Tegr 2880'.	———	3,22
4-126	C NESE 22-7S23E	Pu	California Co. #28	Red Wash	12-3-53	5635	Duchesne River	Green River	Tegr 2889'.	IP 318 bbls oil PD flowing, API 29.4°, Tegr 5528-5680'.	5,74
4-127	C NENE 23-7S23E	Pu	California Co. #5	Red Wash	11-24-51	5711	Duchesne River	Wasatc	Tegr 2884', Tew 5794'.	IP 216 bbls., 28° API, Tegr 5544-5714'.	5,7(
4-128	C SWNE 23-7S23E	Pu	California Co. #29	Red Wash	12-2-53	5675	Duchesne River	Green River	Tegr 2854'.	IP 10 bbls. oil PD, cut 3% water, API 28.8°, Tegr 5544-5663'.	5,7(
4-129	SENENW 23-7S23E	Pu	California Co. #23	Red Wash	6-19-53	5756	Duchesne River	Green River	Tegr 2990'.	IP 230 bbls. pumped, 29° API, Tegr 5639-5814'.	5,8
4-130	C SWNW 23-7S23E	Pu	California Co. #10	Red Wash	2-3-52	5662	Duchesne River	Green River	Tegr 2893'.	IP 251 bbls., pumping, 29° API, Tegr 5428-5696'.	5,7
4-131	C NESW 23-7S23E	Pu	California Co. #25	Red Wash	10-17-53	5650	Duchesne River	Green River	Tegr 2838'.	IP 289 bbls. oil PD, API 29.4°, Tegr 5474-5667'.	5,6
4-132	C NESE 23-7S23E	Pu	California Co. #9	Red Wash	12-18-51	5638	Duchesne River	Green River	Teu 400', Tegr 2776'.	IP 130 bbls., 29° API, Tegr 5301-5358'.	5,6
4-133	C SWSE 23-7S23E	Pu	California Co. #3	Red Wash	9-5-51	5575	Duchesne River	Green River	Tegr 2758'.	IP 95 bbls., 28.9° API, Tegr 5265-5565'.	5,5
4-134	C NENE 24-7S23E	Pu	California Co. #12	Red Wash	4-3-52	5689	Duchesne River	Wasat	Tegr 2812'.	IP 27 bbls. pumping, Tegr zones 5456-5568'.	5,6
4-135	C SWSW 24-7S23E	Pu	California Co. #2	Red Wash	6-13-51	5604	Duchosne River	Wasat	Teu 400', Tegr 2684', Tew 5540'.	IP 62 bbls. oil 10,500 MCFG PD 29.4° API, Tegr sands 5194-5409'.	5,6
4-136	NENENE 26-7S23E	Pu	California Co. #1	Red Wash	2-2-51	5568	Duchesne River	Green River	Teu 400', Tegr 2666'.	IP 513 bbls., 30.4° API, Tegr 5172-5270'. Discovery of gas was also made in this well at depths of 4166-4252', 4268-4278', 4356-4364'. On DSTs the well produced 4,090 MCFG and 8,130 MCFG. Oil production has leveled off at 174 bbls. PD through 1/4" choke with gas-oil ratio of 2275 cu. ft. per bbl. Gravity 29.8° API.	5,2
4-137	C SWSE 26-7S23E	Pu	California Co. #19	Red Wash	11-22-52	5563	Duchesne River	Wasatc	Tegr 2664', Tew 5489'.	DST 4845-82', 1 hr., 7000 MCFG PD SIP 1845#, DST 5184-5244', 1 hr., small amount gas, 540' high pour point oil. SIP 1795#. IP 63 bbls. 29° API, Tegr 5190-5245'.	5,5
4-138	C NENE 27-7S23E	Pu	California Co. #7	Red Wash	11-12-51	5592	Duchesne River	Wasat	Tegr 2808', Tew 5653'.	IP 129 bbls., 28° API, Tegr 5276'-5540'.	5,(
4-139	C SWSE 27-7S23E	Pu	California Co. #11	Red Wash	3-19-52	5505	Duchesne River	Green River	Tegr 2736'.	IP 120 bbls., Tegr 5286-5524'.	5,(
4-140	C NESE 28-7S23E	Pu	California Co. #16	Red Wash	7-14-52	5596	Duchesne River	Wasat	Tegr 2923', Tew 5752'.	IP 73 bbls., 27° API, Tegr 5464-5594'.	5,
4-141	C NENE 29-7S23E	Pu	California Co. #20	Red Wash	2-?-53	5536	Duchesne River	?	Tegr 3020', Tew 5913'.	13 DSTs with 7120 MCFG at 5546-78'. Several shows of oil.	5,
4-142	SESWSE 5-7S24E	Pu	Carter Oil Co. R. E. Sutton #1	Walker Hollow	3-13-53	5509	Uinta	Wasat	Tegr 2818', Tew 5530'.	5 DSTs.	5,

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Note: For abbreviated legend data see explanation before tables

143	NWSWNE	7-7S24E	Pu	Carter Oil Co. Gloria Bamberger #1	Walker Hollow	3-1-53	5566	Uinta	Wasa	Tegr 2893', Tew 5688'.	IP 3,400 MCFG PD, 2105 PSI, Tegr 5318-5323'.	5,730
144	N½SWNE	8-7S24E	Pu	Carter Oil Co. Gloria Bamberger #2	Walker Hollow	3-1-53	5629	Uinta	Wasa	Tegr 2860', Tew 5607'.	Detailed DSTs available. IP 89 bbls. pumped, 27° API, Tegr 5454-60', 5462-65', 5468-84'.	5,640
145	C SWSW	8-7S24E	Pu	Carter Oil Co. O. L. Johnson #1	Walker Hollow	12-4-52	5704	Duchesne River	Wasa	Tegru 2852', Tegrm 3800', Tegrl 4750', Tew 5695'.	IP 159 bbls., 30.9° API, Basal Tegr 5520-5626-1/2'.	5,716
146	N½SWNE	9-7S24E	Pu	Carter Oil Co. O. L. Johnson #2	Walker Hollow	3-19-53	5726	Uinta	Wasa	Tegr 2830', Tew 5574'.	5 DSTs.	6,111
147	C SWNE	17-7S24E	Pu	California Co. #15	Red Wash	6-20-52	5709	Duchesne River	Wasa	Tegr 2775', Tew 5535'.	IP 102 bbls., 29° API, Tegr 5367-5413'.	5,802
148	SWNENE	18-7S24E	Pu	California Co. #22	Red Wash	4-6-53	5720	Duchesne River	Wasa	Tegr 2873', Tew 5708'.	IP 160 bbls., 29° API, Tegr 5528-5638'.	5,726
149	C NENE	19-7S24E	Pu	California Co. #18	Red Wash	9-12-52	5572	Duchesne River	Wasa	Tegr 2609' (Schl.) Tew 5360' (Schl.) Tew 5373' (Spl.)	IP 1,188 MCFG PD RP 1020# Tegr 4978-4986'.	5,435
150	SENE	7-7S25E	Pu	California Oil & Refining Co. #1	Powder Springs	1924?	5500	Uinta	Gree River	———	———	1,000
151	C NENE	32-7S25E	S	Mid-Continent Petroleum Corp. #1	Powder Springs	2-12-52	5655	Duchesne River	Mesa	Tegr 2160', Tew 4800', Kmv 6020'.	———	6,222
152	N NWSW	36-8S17E	S	Sun Oil Co. #1	Castle Peak	2-8-52	5014	Uinta	Wasa	Tegr 1633', Tew 6500'.	———	7,794
153	C NWSE	4-8S23E	Pu	Shell Oil Co. #33-4	South Red Wash	8-7-52	5382	Duchesne River	Wasa	Tegr 2600', Tew 5635'.	———	6,140
154	C SWNE	20-9S20E	Pu	Sun Oil Co. #2	South Ouray	3-14-53	4770	Uinta	Manc Shal	Tegr 1717', Tew 5210', Kmv 8100', Km 10,495'.	15 DSTs.	10,498
155	C NENE	22-9S20E	Pu	Sun Oil Co. #1	South Ouray	10-26-51	4830	Uinta	Mesa	Tegr (Transition) 1010', Tegr 1744', Tew 5204', Kmv 8120'.	———	8,457
156	SESENW	16-9S23E	S	Continental Oil Co. #1	Chapita Wells	1-2-53	5000	Uintah	Manc	Tegr 1610', Tew 4680', Kmv 6910', Km 9278'.	PB 9243-9082', 8850-8770', 8457-8301'. IP 30 bbls., 48° API, Kmv 8275-8301'.	9,517
157	SWSWSW	27-9S25E	P	Roy M. Johnson #1	Bonanza	2-?-51	?	Green River	Gree River	———	Bailer lost in hole. Unable to recover.	2,080
158	SWNWNW	34-9S25E	P	Roy M. Johnson #2	Bonanza	11-?-51	5035	Green River	Entr	Tew 1100', Kmv 1975', Km shale 4400', Kfr 8410', Kd 8750', Jm 8800', Jc 9420'?	3 DSTs.	9,605
159	NWNW	34-9S25E	P	Roy M. Johnson #3	Bonanza	6-17-52	5026	Green River	Wasa	Tew 1200'.	Pumped 1 bbl. oil, 21° API gravity with water at 919-25'.	1,252
160	SWSWNW	34-9S25E	P	Johnson & Bunn #4	Bonanza	5-7-53	?	Green River	Wasa	———	———	1,212
161	C NWNW	15-10S18E	Pu	Sinclair Oil & Gas Co. #1	Badlands Cliff	2-11-52	5103	Uinta	Mesa	Tegr 655', Tew 4240', Kmv 7790'.	4 DSTs.	9,500
162	C SWNW	10-10S22E	Pu	Seaboard Oil Co. of Delaware #1	Bitter Creek	3-31-49	5036	Uinta	Wasa	Tegr 1260', Tew 3970'.	DSTs with several gas shows.	8,520
163	This number was originally given to a duplication of Well No. 162 under an erroneous description. The error was discovered too late to renumber the following wells in the text and on the map for Uintah County.											
164	NENENW	14-10S23E	Pu	Gulf Oil Corp. #1	Southman Canyon	2-28-53	5577	Uinta	Manc	Tegr 810', Tew 3995', Kmv 5730', Km 8255'.	Several DSTs with slight gas shows.	8,502
165	S SWSW	14-10S24E	Pu	Continental Oil Co. #2	Watson	10-10-51	5247	Uinta	Wasa	Tegr 1610'?, Tew 2800'.	———	3,315
166	S SWNW	24-10S24E	Pu	Continental Oil Co. #1	Watson	8-30-51	5417	Uinta	Mesa	Tegr 280', Tew 2690', Kmv 3520'.	Tegr-Tew transition zone at 1680'.	4,249

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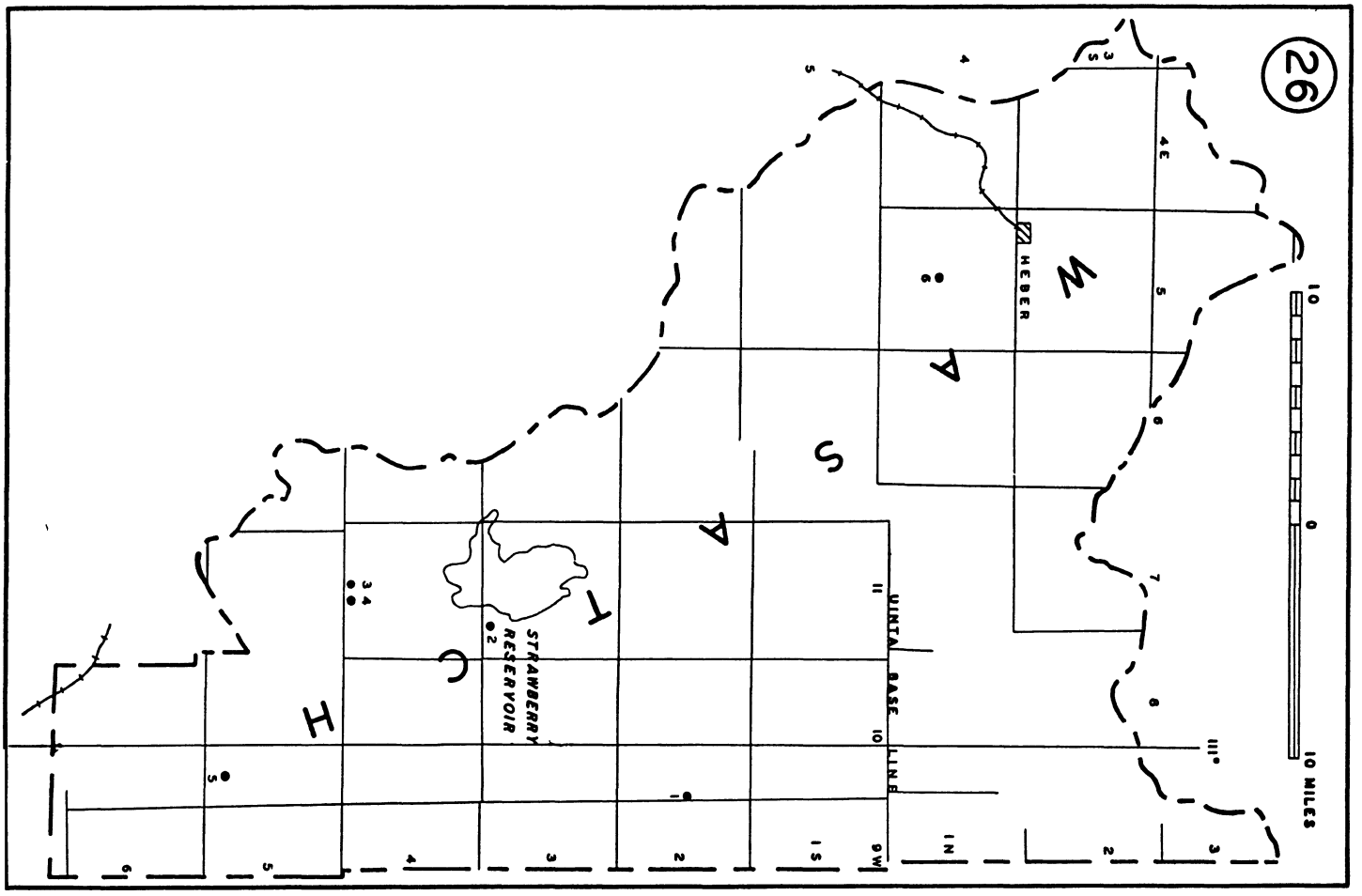
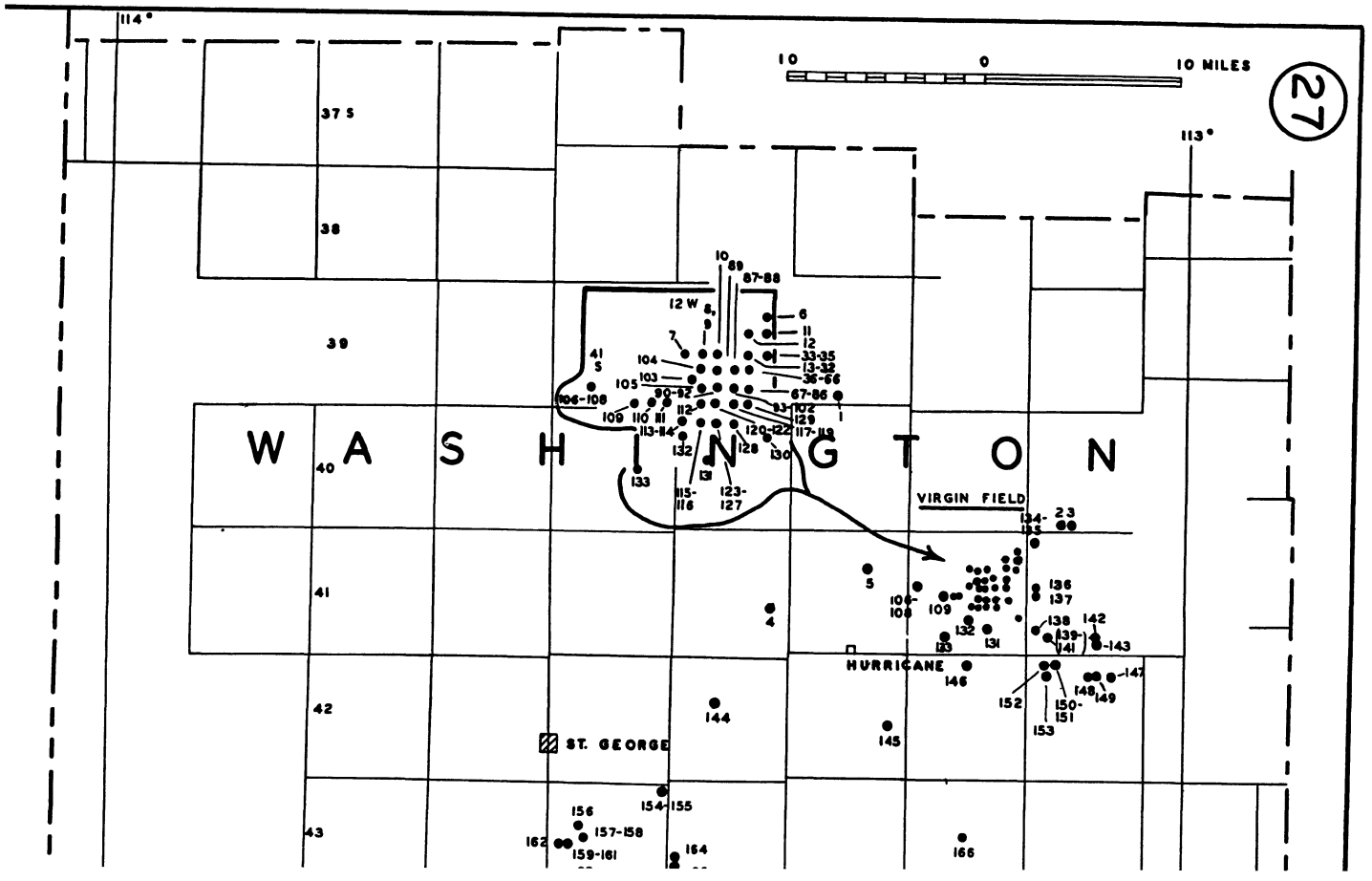
,-167	C	NESW	21-11S21E	Pu	Carter Oil Co. #1	Willow Creek	2-6-52	5743	Uinta	Manc Shal	Tegr 605', Tew 3790', Tpa 5640', Kmv 6390', Km shale 8712'.		9,538
,-168		NWNWSE	10-11S22E	Pu	Stanolind Oil & Gas Co. #1	Asphalt Creek	10-1-52	5300	Uinta	Wasa	Tegr 250', Tew 3358', Tuscher 4950', Kmv 5240'.	Several DSTs, slight gas shows.	5,500
,-169		NWNWSW	2-11S23E	S	Stanolind Oil & Gas Co. to 5505', General Petroleum Corp. 5505' to T.D. #1	Rainbow	3-10-53	5550	Uinta	Manc	Tegr 96', Tew 3243', Kmv 4884', Km 7435'.	7 DSTs.	8,037
,-170		SESWSE	15-12S24E	Pu	Continental Oil Co. #1	Oil Springs	12-21-51	6395	Green River	Mesa	Tew 2270', Kmv 3120'.		4,350
,-171	W	NWSW	18-12S25E	Pu	Continental Oil Co. #2	Oil Springs	2-4-52	6278	Green River	Wasa	Tew 2030'.	Lost casing.	2,667
,-172	W	NWSW	18-12S25E	Pu	Continental Oil Co. #2-A	Oil Springs	3-21-52	6278	Green River	Mesa	Tew 1710', Kmv 2695'.		4,170
,-173	S	NWSW	18-12S25E	Pu	Continental Oil Co. #4	Oil Springs	10-19-52	6184	Green River	Mesa	Tew 1649', Kmv 2603'.	DSTs gave several good gas shows.	3,498
,-174		NESW	12-13S20E	P	Sunray Oil Co. Utah Corp. #1	Agency Draw	11-24-53	5767	Green River	Manc	Tew 2380', Kmv 4690', Km 7222'.	Some gas shows.	7,316
,-175		SWSESW	27-13S21E	Pu	Continental Oil Co. #1	Bull Canyon	8-3-52	5672	Green River	Mesa	Tew 2220', Kmv 3420'.		4,215
,-176		NWNWNE	15-13S24E	Pu	Continental Oil Co. #3	Oil Springs	6-7-52	6661	Green River	Mesa	Tew 1800'±, Kmv 2700'.		4,177
,-177	C	SESE	1-14S18E	Pu	El Paso Natural Gas Co. #1	Firewater Canyon	8-29-53	7050	Green River	Mesa	Tew 2760' (Spl.), 2740' (Schl.), Kmv 5460' (Spl.), 5455' (Schl.).	Oil and gas-cut mud in hole.	5,513
,-178			24-14S19E	P	Castle Dale Oil Co. #1	Hill Creek	1921	?	Green River	Gree Rive			900
,-179			24-14S19E	P	Castle Dale Oil Co. #2	Hill Creek	1922	7000?	Green River	Gree Rive			1,170
,-180		SWSW	29-14S20E	Pu	Midwest Refining Co. #1	Hill Creek	2-2-22	7000?	Green River	?			26
,-181		SWNW	32-14S20E	P	Utah Oil Refining Co. #1	Hill Creek	6-25-22	7000	Green River	Gree Rive			2,150
,-182	S	SESE	9-14S21E	Pu	Continental Oil Co. #2	Bull Canyon	9-14-52	5885	Green River	Mesa	Tew 2116', Kmv 3160'?		4,205
,-183			35-15S23E	P	John Pope #1	?	1900	?	Wasatch?	?			1,000
TAH COUNTY													
5-1	C	SWSW	16-8S5E	Pu	Sun Oil Co. #2	Diamond Fork	11-13-52	6937	Price River	Park City	Thaynes 100', Woodside 1505', Ppc 2384'.	Abnormally thick Ppc.	5,632
5-2		SENW	16-8S5E	P	Diamond Oil Co. #1	Diamond Fork	3-?-45	6200?	Triassic	Penn vani		Log available on photostats.	3,980
5-3	S	SENW	16-8S5E	P	Utah Drilling & Development Co. Buskirk #1	Diamond Fork	3-?-45	6800?	Quaternary	Park City		Lost hole in 1940 at 3990' and drilled out through window in 3-1/2" casing at 3890'. Formerly known as Diamond Oil Co. Well #2.	3,990
5-4		SWSENE	17-8S5E	Pu	Sun Oil Co. #1	Diamond Fork	7-5-52	7424	Price River	Park City	Thaynes 580', Woodside 1740', Ppc 3700'.		3,821
5-5		NENE	29-8S5E	P	Diamond Oil Co. #3	Diamond Fork	12-22-26	6000?	Ankareh	Penn			1,691
5-6		NENE	29-8S5E	Pu	Diamond Oil Co. #1	Diamond Fork	12-31-28	6500	Ankareh	?			10

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.


26
UTAH
WASATCH
STRAWBERRY RESERVOIR
HEBER
UINTA BASE LINE
10 0 10 MILES


27
WASHINGTON
114°
113°
10 0 10 MILES
37 S
38
39
40
41
42
43
12 W
VIRGIN FIELD
HURRICANE
ST. GEORGE

5-7	NWSW	3-9S4E	P	Diamond Oil Co. #2	Diamond Fork	7-?-27	5500	Price River				2,151
5-8	SWNE	10-9S4E	P	Diamond Oil Co #1	Diamond Fork	1921	5500	Price River				941
5-9		4?-10S4E	P	Unknown #?	Thistle	1920	5000?	Wasatch				2,000.
5-10		10S5E	?	Spanish Fork Oil Co. #1	Thistle	1922	5000?	?		Dairy Fork area.		875
5-11	SESENE	21-10S5E	P	Walter Nelson et al, Finlayson #1	South Diamond Fork	1-28-52	?	Green River				1,000 Approx.
5-12	SENWSW	25-10S7E	P	Walter Nelson et al, Gustaveson #1	Soldier Summit	8-8-52	?	Green River				1,000?
5-13	SWSWNW (Lot 5)	35-11S6E	Pu	Southern Production Co. #1	Pondtown Creek	?	9074	Price River				4,942
ASATCH COUNTY												
6-1	NENESE (Uintah Meridian)	13-2S10W	P	Sinclair Oil & Gas Co. #1	Fruitland	5-7-53	8430	Tertiary	Curran Creek	Tpacc 5545'.	Fresh water at 6800'.	10,000
6-2	W SWSW (Uintah Meridian)	35-3S11W	Pu	Union Oil Co. of California #1	Strawberry Reservoir	10-4-52	7613	Uinta	Wasatc	Tegr 215', Tew 5730'.	4 DSTs.	7,015
6-3	N NWSE (Uintah Meridian)	33-4S11W	Pu	Carter Oil Co. Duhrkop #1	Strawberry Reservoir	12-24-49	8258	Green River	Green River			2,758
6-4	C SWSW (Uintah Meridian)	34-4S11W	Pu	Carter Oil Co. Burnett #1	Strawberry Reservoir	10-29-51	8788	Green River	North (Lower Wasatc	Tec 6120', Tef 7860', TKpanh 8390'.		10,017
6-5	E NWSE (Uintah Meridian)	26-5S10W	Pu	California Co. #1	Slab Canyon	9-16-52	8634	Green River	North	Tew 4005', Tef 4575', TKpanh 4958'.	Several DSTs. Some dead oil and gas shows.	5,600
6-6	SWNENE	21-4S5E	P	Syndicate Oil & Mineral Mining #1	Heber	8-4-50	?	Alluvium	?			515
ASHINGTON COUNTY												
7-1	S SWSW	33-39S13W	Pu	Sun Oil Co. #1	Pintura	9-19-51	5250	Navajo	Coconin	Rc 905', Rsh 2550', Rm 2727', Pk 4498', Pco 5294'.		,496
7-2	SESE	32-40S11W	P	R. E. Newman et al #1	Virgin	4-?-38	4050	Moenkopi	Moenkop			1,260
7-3	NESW	33-40S11W	Pu	Anna V. Toney #1	Virgin	9-5-35	4100	Moenkopi	Moenkop		Show oil Rm 180-206'.	517
7-4	SWSW	24-41S14W	Pu	W. W. Toney #1	Harrisburg	1938	?	Moenkopi	Moenkop			47
7-5	SESW	11-41S13W	P	W. W. Toney #1	La Verkin	1937	?	Moenkopi	?			80
7-6	NESE	1-41S12W	Pu	Diamond Oil #1	Virgin	9-25-24	3773	Moenkopi	Moenkop			830
7-7	SESW	10-41S12W	Pu	John Walther #1	Virgin	12-12-25	?	Moenkopi	Moenkop			650
7-8	SWSE	10-41S12W	Pu	Star Crescent Oil Co. #2, Well A	Virgin	1907	3816	Moenkopi	Kaibab			1,142
7-9	SESE	10-41S12W	Pu	Star Crescent Oil Co. #1, Well B	Virgin	1907	3775	Moenkopi	Moenkop			650
7-10	SWSW	11-41S12W	Pu	Edwin A. Peay, Jr. #1	Virgin	1-?-39	3600?	Moenkopi	Moenkop			513
7-11	NWSENE	12-41S12W	Pu	Emma F. Dunn #1	Virgin	5-5-31	3722	Moenkopi	Moenkop		Show oil Rm 739-49'.	778
7-12	SESENW	12-41S12W	Pu	Utacal Oil Co. #3	Virgin	8-9-28	3815	Moenkopi	Moenkop			940
7-13	C NESW	12-41S12W	Pu	Utacal Oil Co. #4	Virgin	10-20-28	3742	Moenkopi	Moenkop		Oil Rm 706-718', 12 bbls.	759
7-14	C NESW	12-41S12W	Pu	Utacal Oil Co. #6	Virgin	3-26-29	3706	Moenkopi	Moenkop		Oil Rm 663-669', 1 bbl.	700
7-15	C NESW	12-41S12W	Pu	Burley M. Jones #14	Virgin	11-11-31	3740	Moenkopi	Moenkop			714
7-16	E NESW	12-41S12W	Pu	Burley M. Jones #20	Virgin	1-8-40	?	Moenkopi	Kaibab		Show oil 638-49'.	660
7-17	N NESW	12-41S12W	Pu	Utacal Oil Co. #0	Virgin	1907	3777	Moenkopi	Kaibab		Probably produced oil in 1907.	1,200
7-18	N NESW	12-41S12W	Pu	Utacal Oil Co. #2	Virgin	6-30-27	3720	Moenkopi	Moenkop		Oil Rm 795-98'. 819-25', 8 bbls.	890

Note: Wells for each county are "spotted" on the accompanying map.

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-19	NWNESW	12-41S12W	Pu	Utacal Oil Co. (Miller, Hickey & Lambert) #5	Virgin	12-12-28	3788	Moenkopi	Moenk	
-20	S NESW	12-41S12W	Pu	Utacal Oil Co. #1	Virgin	12-15-26	3700	Moenkopi	Moenk	Oil Rm 636-649', 2 bbls.
-21	SENWSW	12-41S12W	Pu	Utacal Oil Co. #1	Virgin	3-30-31	3842	Moenkopi	Moenk	
-22	C SWSW	12-41S12W	Pu	Utacal Oil Co. #16	Virgin	5-9-32	3712	Moenkopi	Moenk	
-23	E SWSW	12-41S12W	Pu	Utacal Oil Co. #15	Virgin	3-11-32	3670	Moenkopi	Moenk	
-24	SESWSW	12-41S12W	Pu	Utacal Oil Co. #9	Virgin	2-21-31	3708	Moenkopi	Moenk	Oil Rm 648-651', 30 bbls.
-25	SESWSW	12-41S12W	Pu	Utacal Oil Co. #11	Virgin	7-8-31	3752	Moenkopi	Moenk	Oil Rm 690-694', 1-1/2 bbls.
-26	SESWSW	12-41S12W	Pu	Escalante Explorations Inc. #12	Virgin	8-4-31	3746	Moenkopi	Moenk	Oil Rm 688-704', 5 bbls.
-27	C SESW	12-41S12W	Pu	Utacal Oil Co. (Burley M. Jones) #19	Virgin	4-18-35	3675	Moenkopi	Moenk	Oil Rm 588-598', 1/2 bbl.
-28	W SESW	12-41S12W	Pu	Utacal Oil Co. #8	Virgin	9-15-30	3658	Moenkopi	Moenk	Show oil Rm 601-616'.
-29	SWSESW	12-41S12W	Pu	Utacal Oil Co. #10	Virgin	4-13-31	3705	Moenkopi	Moenko	
-30	S SESW	12-41S12W	Pu	Utacal Oil Co. #7	Virgin	7-12-30	3647	Moenkopi	Moenko	Oil Rm 587-592', 2 bbls.
-31	S SESW	12-41S12W	Pu	Utacal Oil Co. #17	Virgin	7-27-32	3648	Moenkopi	Moenko	Oil Rm 599-604', 3 bbls.
-32	SESESW	12-41S12W	Pu	Utacal Oil Co. (Burley M. Jones) #18	Virgin	12-15-32?	3652	Moenkopi	Moenko	Oil Rm 628-630', 1-1/2 bbls.
-33	NWSWSE	12-41S12W	Pu	S. Fox Co. #1	Virgin	5-5-29	3757	Moenkopi	Moenko	Show oil Rm 728-764'.
-34	NWNWSE	12-41S12W	P	Hobson & Lowe #1	Virgin	1-?-31	3696	Moenkopi	?	
-35	SWSWSE	12-41S12W	Pu	S. Fox Co. #2	Virgin	1907	3784	Moenkopi	Kaibab	
-36	C NENW	13-41S12W	S	Utah Parks Petroleum Co. #1	Virgin	11-28-28	3644	Moenkopi	Moenko	Oil Rm 566-570'.
-37	C NENW	13-41S12W	S	Utah Parks Petroleum Co. #8	Virgin	8-5-30	3676	Moenkopi	Moenko	Oil Rm 615-624'.
-38	C NENW	13-41S12W	S	Utah Parks Petroleum Co. #10	Virgin	12-?-35	3681	Moenkopi	Moenko	
-39	N NENW	13-41S12W	S	Utah Parks Petroleum Co. #9	Virgin	7-26-32	3652	Moenkopi	Moenko	Oil Rm 603-612', 1 bbl.
-40	NWNENW	13-41S12W	S	Utah Parks Petroleum Co. #6	Virgin	3-14-30	3636	Moenkopi	Moenko	Oil Rm 571-577'.
-41	NWNENW	13-41S12W	S	Utah Parks Petroleum Co. #7	Virgin	7-11-30	3640	Moenkopi	Moenko	Oil Rm 570-580'.
-42	W NENW	13-41S12W	S	Utah Parks Petroleum Co. #4	Virgin	2-?-30	3638	Moenkopi	Moenko	Oil Rm 579-589'.
-43	W NENW	13-41S12W	S	Utah Parks Petroleum Co. #5	Virgin	3-15-30	3635	Moenkopi	Moenko	Oil Rm 570-578'.
-44	W NENW	13-41S12W	S	Utah Parks Petroleum Co. #11	Virgin	11-25-36	3632	Moenkopi	Moenko	Oil Rm 600-608', 15 bbls.
-45	SWNENW	13-41S12W	S	Utah Parks Petroleum Co. #2	Virgin	12-22-29	3628	Moenkopi	Moenko	Oil Rm 566-574'.
-46	S NENW	13-41S12W	S	Utah Parks Petroleum Co. #3	Virgin	2-14-30	3640	Moenkopi	Moenko	Oil Rm 581-585'.
-47	E NWNW	13-41S12W	Pu	Walklin Petroleum Co. #2	Virgin	8-28-30	3653	Moenkopi	Moenko	Oil Rm 590-600', 14 bbls.
-48	E NWNW	13-41S12W	Pu	Walklin Petroleum Co. #3	Virgin	9-23-30	3661	Moenkopi	Moenko	Oil Rm 600-606', 4 bbls.
-49	E NWNW	13-41S12W	Pu	Walklin Petroleum Co. #8	Virgin	8-17-37	3627?	Moenkopi	Moenko	Show oil, Rm 601-605', 617-30'.
-50	NENWNW	13-41S12W	Pu	Walklin Petroleum Co. #1	Virgin	4-27-29	3652	Moenkopi	Moenko	Oil Rm 585-589', 12 bbls.
-51	NENWNW	13-41S12W	Pu	Walklin Petroleum Co. #5	Virgin	10-25-32	3664	Moenkopi	Moenko	Show oil Rm 540'.
-52	S NWNW	13-41S12W	Pu	Walklin Petroleum Co. #6	Virgin	12-1-32	3678	Moenkopi	Moenko	Show oil Rm 604-607', 620'.
-53	SENWNW	13-41S12W	Pu	Walklin Petroleum Co. #4	Virgin	3-19-32	3627	Moenkopi	Moenko	Oil Rm 563-576', 35 bbls.

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

SENWNW 13-41S12W Pu	Walklin Petroleum Co. #7	Virgin	1-1-39	3631	Moenkopi	Moenko	Show oil Rm 576-591'.
SENWNW 13-41S12W Pu	Donald R. Thompson #9	Virgin	7-17-53	3639	Moenkopi	Moenko	IP 82 bbls. water, 14 bbls. oil approx., API 35.7° Rm 578-589'.
NESWNW 13-41S12W P	Burnham Oil Co. #0	Virgin	9-14-29	3625	Moenkopi	Moenko	Show oil Rm 565-574'.
NESWNW 13-41S12W P	Burnham Oil Co. #6	Virgin	10-18-30	3625	Moenkopi	Moenko	Oil Rm 570-575', 7? bbls.
NESWNW 13-41S12W P	Burnham Oil Co. #7	Virgin	3-10-31	3615	Moenkopi	Moenko	Oil Rm 545-550', 10? bbls.
NESWNW 13-41S12W P	Burnham Oil Co. #8	Virgin	11-?-36	3626	Moenkopi	Moenko	Oil Rm 529-540', 1-2 bbls.
N SWNW 13-41S12W P	Champion Oil Co. #1	Virgin	3-?-32	3654	Moenkopi	?	
N SWNW 13-41S12W P	B. M. Jones et al #1	Virgin	7-24-37	3660	Moenkopi	Moenko	Show oil Rm 586-592'.
SESWNW 13-41S12W P	Burnham Oil Co. #1	Virgin	9-30-28	3615	Moenkopi	Moenko	Oil Rm 519-528', 12? bbls.
SENW 13-41S12W P	Burnham Oil Co. #5	Virgin	5-25-30	3624	Moenkopi	Moenko	Oil Rm 540-548', 6? bbls.
NWSENW 13-41S12W P	Burnham Oil Co. #2	Virgin	11-9-28	3625	Moenkopi	Moenko	Oil Rm 566-568', 12? bbls.
NWSENW 13-41S12W P	Burnham Oil Co. #3	Virgin	1-1-29	3655	Moenkopi	Moenko	Oil Rm 590-594', 12? bbls.
NWSENW 13-41S12W P	Burnham Oil Co. #4	Virgin	2-1-29	3625	Moenkopi	Moenko	Oil Rm 561-566', 5? bbls.
SWNESW 13-41S12W Pu	Crystal Oil Co. #2	Virgin	7-7-27	3793	Moenkopi	Moenko	Oil Rm 691-697', 15 bbls.
SWNESW 13-41S12W Pu	Crystal Oil Co. #3	Virgin	12-1-27	3801	Moenkopi	Moenko	Oil Rm 699-701'.
NWSW 13-41S12W P	Flickinger & Echelman #2	Virgin	8-?-32	3591	Moenkopi	Moenko	
C NWSW 13-41S12W P	Diamond Oil Co. #5	Virgin	1907	3603	Moenkopi	Moenko	
C NWSW 13-41S12W P	Diamond Oil Co. #4	Virgin	3-?-24	3602	Moenkopi	Moenko	Oil Rm 538-553', 30? bbls.
NENWSW 13-41S12W P	Flickinger & Echelman #1	Virgin	8-?-32	3599	Moenkopi	Moenko	
N NWSW 13-41S12W P	Diamond Oil Co. #9	Virgin	1925?	3602	Moenkopi	Moenko	Oil Rm 550'.
NWNWSW 13-41S12W P	Diamond Oil Co. #10	Virgin	1925?	3608	Moenkopi	Moenko	
W NWSW 13-41S12W P	Diamond Oil Co. #1	Virgin	1918?	3601	Moenkopi	Moenko	Oil probably.
W NWSW 13-41S12W P	Diamond Oil Co. #6	Virgin	6-21-24	3604	Moenkopi	Moenko	Oil Rm 539-545', 30? bbls.
W NWSW 13-41S12W P	Diamond Oil Co. #B-2	Virgin	6-18-29	?	Moenkopi	Moenko	Oil Rm 495-498'.
SWNWSW 13-41S12W P	Diamond Oil Co. #3	Virgin	2-?-24	3601	Moenkopi	Moenko	Oil Rm 550-552', 30? bbls.
SWNWSW 13-41S12W P	Diamond Oil Co. #7	Virgin	1925	3605	Moenkopi	Moenko	
S NWSW 13-41S12W P	Diamond Oil Co. #2	Virgin	1907	3600	Moenkopi	Moenko	
S NWSW 13-41S12W P	Diamond Oil Co. #8	Virgin	1925	3600	Moenkopi	Moenko	Oil Rm 535'.
SENWSW 13-41S12W P	Diamond Oil Co. #B-1	Virgin	3-10-29	3600	Moenkopi	Moenko	Oil Rm 513-514'.
W SWSW 13-41S12W P	Utacal Oil Co. #5	Virgin	1924?	3593	Moenkopi	Moenko	
W SWSW 13-41S12W P	Utacal Oil Co. #8	Virgin	1924?	3585	Moenkopi	Moenko	
W SWSW 13-41S12W P	Utacal Oil Co. #9	Virgin	1924?	3587	Moenkopi	Moenko	
NWSESW 13-41S12W Pu	Crystal Oil Co. #1	Virgin	9-24-25	3850	Moenkopi	Moenko	Oil Rm 705-728', 2 bbls.
SESENE 14-41S12W Pu	D. C. McKensey #1	Virgin	1909	3658	Moenkopi	Kaibab	
SESENE 14-41S12W Pu	Utacal Oil Co. #1	Virgin	7-15-32	3686	Moenkopi	Kaibab	Show oil 565-574'.
SESWNW 14-41S12W Pu	Utah Parks Petroleum Co. #3	Virgin	9-8-31	3753	Moenkopi	Moenko	Oil Rm 594-610'.
SESWSW 14-41S12W P	Mohawk Petroleum Corp. #4	Virgin	3-18-29	3700	Moenkopi	Moenko	Oil Rm 513-520', 5? bbls.

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

'-91	NESWSW	14-41S12W	P	Mohawk Petroleum Corp. #5	Virgin	10-1-29	3695	Moenkopi	Moenkoj		Oil Tm 513-520'.
'-92	SWSESW	14-41S12W	P	Diamond Oil Co. #2	Virgin	?	3670	Moenkopi	Moenkoj		
'-93	C NESE	14-41S12W	P	White Throne Oil Co. #12	Virgin	1934	?	Moenkopi	Moenkoj		
'-94	SWNESE	14-41S12W	P	White Throne Oil Co. #11	Virgin	1933	?	Moenkopi	Moenkoj		
-95	SENESE	14-41S12W	P	Baker Petroleum Co. Baker #1	Virgin	11-?-40	3610?	Moenkopi	?	Pk 558'.	
-96	C SESE	14-41S12W	P	Utacal Oil Co. #3	Virgin	1923?	3613	Moenkopi	Moenkoj		Oil Tm?, 5? bbls.
-97	NESESE	14-41S12W	P	Utacal Oil Co. #10	Virgin	1924?	3592	?	?		
-98	NESESE	14-41S12W	P	Utacal Oil Co. #6	Virgin	1925?	3596	Moenkopi	Moenkoj		Oil Tm 536-541'.
-99	N SESE	14-41S12W	P	Utacal Oil Co. Alsop #1	Virgin	1923?	3604	Moenkopi	Moenkoj		Oil Tm 536-546', 1? bbl.
-100	N SESE	14-41S12W	P	Utacal Oil Co. Alsop #2	Virgin	1923?	3630	Moenkopi	Moenkoj		
-101	NWSESE	14-41S12W	P	F. D. Goody McMullen #1	Virgin	5-?-4	?	Moenkopi	?		
-102	W SESE	14-21S12W	P	Utacal Oil Co. #4	Virgin	1924?	3605	Moenkopi	Moenkoj		Oil Tm 534-545'.
-103	C	15-41S12W	Pu	R. E. Parsons #D	Virgin	1907	?	Moenkopi	Moenkoj		
-104	SWSWNE	15-41S12W	Pu	R. E. Parsons #C	Virgin	1922	3728	Moenkopi	Moenkoj		
-105	NWSWSE	15-41S12W	Pu	G. S. McMullen #E	Virgin	10-26-26	3659	Moenkopi	Moenkoj		Shows oil.
-106	NENWSW	18-41S12W	Pu	W. W. Toney #2	Virgin	10-?-35	3733	Moenkopi	Moenkoj		
-107	NENWSW	18-41S12W	Pu	W. W. Toney #3	Virgin	1935	3666	Moenkopi	Moenkoj		
-108	N SESW	18-41S12W	Pu	W. W. Toney #1	Virgin	5-?-36	3702	Moenkopi	Kaibab		
-109	SESENE	20-41S12W	Pu	Smith #1	Virgin	1921	3754	Moenkopi	Moenkoj		
-110	SESENW	21-41S12W	Pu	W. W. Toney #5	Virgin	7-2-38	3600	Moenkopi	Kaibab		Show oil 170-172'.
111	NESWNE	21-41S12W	Pu	W. W. Toney #4	Virgin	7-7-36	3605	Moenkopi	Kaibab		
112	C SENE	22-41S12W	Pu	H. E. Kuphal #2	Virgin	1921	3631	Moenkopi	Moenkoj		
113	NWNWSW	22-41S12W	Pu	Southern Utah #F	Virgin	1907	3606	Moenkopi	Moenkoj		
114	NWNWSW	22-41S12W	Pu	Al Gray #G	Virgin	1922	3606	Moenkopi	Moenkoj		
115	SWNESE	22-41S12W	Pu	Frank Boneau #1	Virgin	1907	3543	Moenkopi	Moenkoj		
116	NWSWSE	22-41S12W	P	Ben H. Bullock #1	Virgin	3-25-38	3540	Moenkopi	Moenkoj		Show oil.
117	N NENE	23-41S12W	P	Utacal Oil Co. #7	Virgin	1925?	3568	Moenkopi	Moenkoj		
118	C NWNE	23-41S12W	Pu	Virgin Petroleum Corp. #1	Virgin	8-1-26	3628	Moenkopi	Kaibab		
119	C NWNE	23-41S12W	Pu	Virgin Petroleum Corp. #2	Virgin	5-1-29	3628	Moenkopi	Supai		
120	NWNENW	23-41S12W	P	Mohawk Petroleum Corp. #3	Virgin	1-1-29	3663	Moenkopi	Moenkop		Oil Tm 518-521'.
121	NENWNW	23-41S12W	P	Mohawk Petroleum Corp. #1	Virgin	1907	3667	Moenkopi	Moenkop		Oil Tm.
122	NENWNW	23-41S12W	P	Mohawk Petroleum Corp. #6	Virgin	1930	3667	Moenkopi	Moenkop		Oil Tm 447-63', 533-38'.
123	N NESW	23-41S12W	Pu	E. D. Dunn #3	Virgin	4-27-28	3605	Moenkopi	Moenkop		
124	SENESW	23-41S12W	Pu	Utah Parks Petroleum Co. #5	Virgin	4-4-37	3526	Moenkopi	Kaibab		
125	NWNWSW	23-41S12W	Pu	Howard Smith #4	Virgin	7-27-29	3656	Moenkopi	Moenkopi		
126	NESWSW	23-41S12W	P	Lloyd James #1	Virgin	1907	3505	Moenkopi	Moenkopi		
127	E SESW	23-41S12W	P	Zion Oil & Refining Corp. #1	Virgin	1926	3541	Moenkopi	Moenkopi		

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

28	NWSWSE	23-41S12W	P	C. W. Townsen & R. J. Larsen #1	Virgin	6-12-41	?	Moenkopi	Kaibab			306
29	NWNWNW	24-41S12W	Pu	Miller, Hickey, & Lambert #0	Virgin	1907	3583	Moenkopi	Moenko			527
30	W SENE	25-41S12W	Pu	Alta-Devilspeak Mining Co. #1	Virgin	6-29-25	3534	Moenkopi	Moenko			165
31	N SWSW	26-41S12W	Pu	E. D. Dunn #1	Virgin	1907	?	Moenkopi	Kaibab			1,380
32	S SENW	27-41S12W	Pu	C. E. Cline #2	Virgin	7-31-28	?	Moenkopi	Moenko			240
33	NWNE	32-41S12W	P	C. W. Townsen et al #1	Virgin	5-22-41	?	Moenkopi	Kaibab			64
34	E SENW	6-41S11W	Pu	Diamond Oil Co. #2	Virgin	1-26-35	3897	Moenkopi	Kaibab			1,225
35	SESENW	6-41S11W	Pu	Virgin River Oil & Development Co. #0	Virgin	1907	?	Moenkopi	Moenko		Oil?	914
36	SENESW	18-41S11W	Pu	J. P. Thomas #1	Virgin	9-7-29	3800	Moenkopi	Moenko			1,227
37	C NENW	19-41S11W	Pu	J. P. Thomas #0	Virgin	7-19-29	?	Moenkopi	Moenko			82
38	N SWSW	30-41S11W	Pu	W. C. Dunn #1	Virgin	2-1-27	3550	Moenkopi	Kaibab			560
39	E SENE	31-41S11W	P	Arneal & Muir Duncan #1	Grafton	10-19-31	3100	Moenkopi	Moenko			45
40	E SENE	31-41S11W	P	Polly Ann Development Co. #1	Grafton	10-?-32	?	Moenkopi	?			531
41	SESENE	31-41S11W	P	A. A. Slaback #1	Grafton	12-?-30	?	Moenkopi	Moenko			20
42	SWSWNE	34-41S11W	Pu	Grafton Oil Co #1	Grafton	1907	?	Moenkopi	Kaibab			1,010
43	SWSWSE	34-41S11W	Pu	Royal Oil Development Co. #1	Grafton	10-17-29	?	Moenkopi	Kaibab			907
44	NWNWNW	16-42S14W	P	Harry T. Cypher Co. #1	Harrisburg Dome	8-?-41	3000	Kaibab	?		Formerly Virgin Dome Oil Co. Drilled to 3400' before 1923.	3,508
45		24?-42S13W	P	Glen Colusa Oil Co. #1	Gould Ranch	1909	?	Moenkopi	Supai			1,715?
46	N NWNW	3-42S12W	Pu	J. S. Standlee #1	Virgin	1-21-24	?	Moenkopi	Moenko		Show oil Rm 543-555'.	571
47	NWSE	2-42S11W	P	C. M. Schroth & Assoc. #1	Rockville	7-11-33	?	Moenkopi	Moenko			1,040
48	SWNESW (Lot 7)	3-42S11W	Pu	Swartsbaugh & McMillian #1	Grafton	6-8-31	?	Moenkopi	Moenko			793
49	NWSE	3-42S11W	P	Swartzbaugh #1	Grafton	1933	?	Moenkopi	Moenko			100?
50	C NWNW	5-42S11W	Pu	E. R. White #2	Grafton	9-?-26	?	Moenkopi	Moenko			400
51	C NWNW (Lot 4)	5-42S11W	Pu	E. R. White #3	Grafton	10-?-26	?	Moenkopi	Moenko			810
52	E NWNE	6-42S11W	Pu	E. R. White #1	Grafton	8-22-25	?	Moenkopi	Moenko			109
53	SWSESE	6-42S11W	Pu	C. H. Mangels #4	Grafton	9-18-31	3650	Moenkopi	Moenko			780
54	SESWNE	1-43S15W	Pu	Arrowhead Petroleum Corp. #1	Punchbowl	12-2-32	2780?	Moenkopi	Kaibab			1,185
55	SESWNE	1-43S15W	Pu	Arrowhead Petroleum Corp. #1-A	Punchbowl	9-?-39	2780	Moenkopi	Permia			2,590
56	N SENW	17-43S15W	Pu	Mid-American Oil Co. #1	Bloomington	6-?-31	2950?	Kaibab	Supai			2,532
57	NWSWSE	17-43S15W	Pu	Usona Oil Co. #1	Bloomington	3-15-27	?	Kaibab	Kaibab			382
58	NWSWSE	17-43S15W	Pu	Utah Parks Petroleum Co. H. E. Ritchey #2	Bloomington	?	?	Kaibab	Kaibab			50
59	C NWNE	19-43S15W	Pu	Usona Oil Co. #1-A	Virgin	2-28-28	?	Kaibab	Kaibab			43
60	NWNWNE	19-43S15W	Pu	Escalante Explorations Inc. #2	Bloomington	6-30-35	2800	Kaibab	?			4,114
61	NWNWNE	19-43S15W	Pu	California Co. #1	St. George	9-19-51	2929	Kaibab	Devoni		Pco 1050', Pakoon 2950', Upper Callville 3730', Lower Callville 4600', Bluepoint 5350', Cmr 5560', D 6119'.	6,347

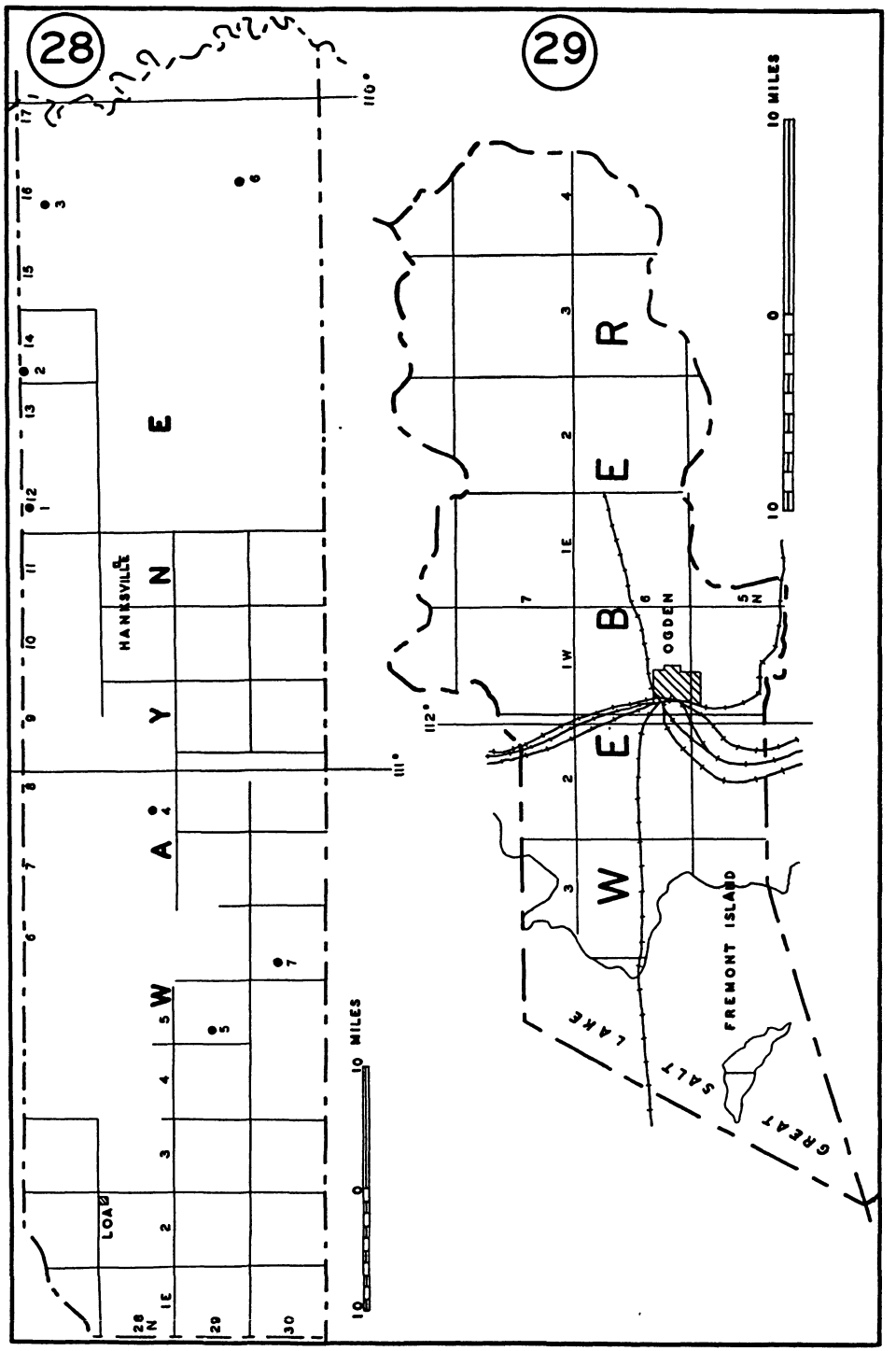
Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.

162	NENW	19-43S15W	Pu	Usona Oil Co. #1	Blooming-ton	8-1-27	2740	Kaibab	Kaibab			265	A1
163		32-43S15W	S	Escalante Explora-tions Inc. #1	White Dome	3-6-35	?	Moenkopi	?			969	A1
164	SWSESW	19-43S14W	Pu	St. George Oil Co. #1	Beehive	6-13-29	2800	Moenkopi	Moenkopi			93	A1
165	S NENW	30-43S14W	Pu	St. George Oil Co. #1	Beehive	10-?-29	2800	Moenkopi	?			970	A1
166		43S12W	P	Montgomery & Jeffries #1	Little Creek	?	?	?	?			800?	A1
NE COUNTY													
1	C SWSW	4-27S12E	Pu	Mt. Vernon Oil Co. #1	Flat Tops	1913	5500	Entrada	Coconino		Shows of oil 2175', 2530', 2655', below surface (probably Rsh-Rm).	2,950	A1
2	C NW	5-27S14E	Pu	Texas Production Co. #1	Sweetwater Dome	7-3-28	5500	Entrada	Coconino	Rsh 2195', Rm 2730'.	Water well 650'; oil shows at 2195' and 2730'.	2,875	A1
3	C NE	16-27S16E	Pu	Phillips Petro-leum Co. #1	Barrier Creek	8-3-29	5600	Navajo	Mississi pian ?	Jk 475', Jw 600', Rc 910', Pco 1930', Cph 2450'.	No oil or gas showings logged.	5,191	A
4	NWNENE	29-28S8E	Pu	Ohio Oil Co. #1	Caineville	5-17-22	?	Entrada	Coconino	Jca 500', Jn 710', Jk 1520', Jw 1750', Rc 2360', Rsh 2730', Rm 2755'.	No oil or gas showings logged. Log available on photostats.	3,650	A
5	C NENW	20-29S5E	P	Parry Oil Co. #1	Teasdale	9-20-50	6800	Moenkopi (Est.)	?			523	A
6	SESW	34-29S16E	Pu	Texas Production Co. #1	French Seep	4-4-24	6750?	Navajo	Organ Rock			2,200	A
7	NWNWNE	17-30S6E	Pu	Pacific Western Oil Corp. #1	Teasdale	8-7-49	7838	Sinbab	Leadville	Rml 95', Pk 154', Pco 292', Cph 1542', Cml 3316', D 4910'?	Show of free oil in sample cutting at 660-785'.	4,930	P
ER COUNTY													

Note: Wells for each county are "spotted" on the accompanying map.

Note: For abbreviated legend data see explanation before tables.



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Fifth Annual Field Conference of the Intermountain Association of Petroleum Geologists

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ARTHUR L. CRAWFORD, Director

UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

200 Mines Building, University of Utah Salt Lake City, Utah

Tab 13

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The Oil and Gas Possibilities of Utah

A SYMPOSIUM VOLUME

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UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

College of Mines and Mineral Industries

UNIVERSITY OF UTAH

♦

LOCATION PLOT OF WELLS DRILLED IN UTAH

Compiled in cooperation with

C A HAUPTMAN U S Geol Survey

CHAPTER III

Part I

LOCATION PLOT OF WELLS DRILLED IN UTAH

Plate II (in folder) indicates the location of wells drilled in Utah by a red-dot symbol. The scale of the base map in this instance necessitated plotting of the well locations only to the section. Numbers accompanying the red-dot symbols refer to the county number assigned the well (or wells) in the "Table of Wells Drilled in Utah 1891-1948."

TABLE OF WELLS DRILLED IN UTAH 1891-1948

Prepared in cooperation with C A. Hauptman,
District Engineer, Oil and Gas Leasing Branch, U S G S

The following tabulation of oil and gas test wells drilled in Utah is arranged alphabetically according to counties. Wells are numbered separately and consecutively, starting with number 1, within each county, in the following manner:

1. In each county, commencing with the most northerly township line and the most westerly range, each "township and range" is considered from west to east along each township line.

2. In Uintah and Duchesne Counties the "township and range" blocks numbered in reference to the Uintah Special Base and Meridian are listed first.

3. Within each "township and range" block the sections are considered individually in numerical sequence according to the standard method of numbering sections.

4. Where possible, wells are recorded to the nearest sixteenth of the section (¼ of ¼ section) in the order; northwest, southwest, northeast, southeast—within the quarter of section.

5. Wells recorded only to the quarter of a section are in the identical order, i.e., northwest, southwest, northeast, southeast—within the section.

LAND STATUS LEGEND

P	Patented
Pu	Public
S	State
G	Government
In	Indian

Note Information as of December 31, 1948.

No	Location	Land Status	Operator and Well No	Field or Area	Comp
	BOX ELDER COUNTY				
1	NWNW 26-14N8W	P	Utah Duchess Oil Co #1	Snowville	
2	NENE 25-13N11W	P	Stanford Pet Co #1	Warm Spgs Dome	
3	SENE 25 13N11W		Stanford Pet Fee #1	Warm Spgs Dome	10 8-46
4	NENW 17-13N4W	P	Utah Penn Oil Co #1	White Valley	1927
5	NENESW 17 13N4W	P	Northern Oil Co #1	White Valley	11 18 47
6	NWSWSE 31 12N8W	S	Mohawk Pet Co #1	Promontory	2 10-48
7	NWNW 3-10N4W	P	Utah Penn Oil Co #1	Penrose	7-?-31
8	Center 14-9N8W	Pu	Leonora Mng & Mill Co #1	Rozel	7-?-34
9	SWSE 31-9N7W	P	Lakeside Oil Co #1	Rozel	11-?-27
10	NENE 4-8N7W	Pu	LaSalle Mineral Co #1	Rozel	1907
11	NENE 4-8N7W	Pu	LaSalle Mineral Co #2	Rozel	1908
12	NWNE 8-8N7W	P	Nebeker #1	Rozel	1907
13	SWNW ? 9 8N7W	S	Leonora Mng & Mill Co #1	Rozel	4 ? 30
14	NWSW 9 8N7W	P	A B Coreoy #1	Rozel	1910
15	NWNW 16-8N7W	P	Liquid Asphalt Co #1	Rozel	1938
16	7N15W		Unknown	Lemay	1904
17	6N10W		Unknown	Strong Knob	1900
18	5N9W		Lakeshore Oil Co #1	Lakeside	7-? 26

WELL RECORD LEGEND

Drg	Drilling
DST	Drilling suspended temporarily
DSI	Drilling suspended indefinitely
PGW	Producing gas well
GSI	Gas well shut in
OSI	Oil well shut in according to regulations
OSD	Oil well shut down
Abd	Abandoned
P&A	Plugged and abandoned according to regulations
PB	Plugged back

The blank spaces appearing in the list indicate the information is not available

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
4819 ?	Lake Beds			400	DSI
	Penn		*Shows Marsh gas, 640 feet*	679	DSI
				730	Drg
				10	Abd
5140 ?	Permian			2013	DSI
				514	Abd
4300	Lake Beds	**Carboniferous**		4100	Abd
4300	Lake Beds			2280	Abd
4250	Lake Beds			2710	Abd
4250	Lake Beds			1400	Abd
4250	Lake Beds			2012	Abd
					Abd
4250	Lake Beds			1705	Abd
4250	Lake Beds			930	Abd
4195	Lake Beds			252	Abd
4300	Lake Beds			2480	Abd
4300 ?	Lake Beds			800	Abd
4250	Lake Beds			1200	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Geologic Formations Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
CACHE COUNTY											
1	NWNW 25 13N1W	P	Cache Valley Oil Assn #1	Cache Valley	1925	4425	Lake Beds	Madison		1650	Abd
CARBON COUNTY											
1	Lot 2 24 14S7E	Pu	Pacific Western Oil Co #1	Gordon Creek	1948	7500	Mancos	Coconino	*CO_2 Gas Coconino* 11 650 12 146 12 066 8 880 *M Tops Chinle* 9 840 *Moenkopi* 10 135 *Sinbad* 11 335 *Kaibab* 11 580		DSI
2	NWSE 1 14S9E	P	St Thomas Oil Co #1	Garley Canyon	1930	5650	Mancos	Colorado		2250	Abd
3	SWNE 16 14S10E	P	Price Petroleum Co #1	Price	1930 ?	5560	Mancos	Morrison ?		3335	Abd
4	NESE 20 14S10E	P	Kelley Young #1	Price	9 ? 37	5520	Mancos	Mancos		1080	Abd
5	NWNE 14 15S10E	Pu	Holmes & McGee #1	So Wellington	9 10 27	5530	Mancos	Morrison ?		2462	Abd
6	SESW 12 15S11E	Pu	Carbon Dioxide & Chem #1	Farnham Dome	6 15 30	5960	Morrison	Coconino	*CO_2 Gas Coconino* 3093 3114 2780 *M*	3114	PGW
7	NWNWNE 12 15S11E	Pu	Carbon Dioxide & Chem #1	Farnham Dome	12 25 45					3246	Abd
8	NWSE 12 15S11E	Pu	Carbon Dioxide & Chem Co #3	Farnham Dome	11 16 45	5863	Morrison	Coconino	*CO_2 Gas Coconino* 3215 26 5000 *M*	3250	PGW
9	NWSE 12 15S11E	Pu	Carbon Dioxide & Chem Co #2	Farnham Dome	1 8 24	5935	Morrison	Coconino	*CO_2 Gas Coconino* 3093 3105 12 000 *M*	3235	Abd
10	SWNWSE 12 15S11E	Pu	Mountain Fuel Supply Co #1	Farnham Dome	6 5 46	5850	Morrison	*Penn*	*CO_2 Gas Coconino* 3133 55 3250 M	5722	(PB GSI
DAGGETT COUNTY											
1	*NESW 15 3N24E*	Pu	Mountain Fuel Supply Co #5	Clay Basin	9 14 40	6639	Mancos	Morrison	*Show gas Frontier* 5575 91 *Dakota* 5928 63	6064	Abd
2	NWSLSW 16 3N24E	S	Mountain Fuel Supply Co #1	Clay Basin	8 4 37	6492	Mancos	Morrison	*Gas Dakota* 5739 79 16 375 *M*	6151	PGW
3	SENENE 19 3N24E	Pu	Mountain Fuel Supply Co #1	Clay Basin	7 1 40	6342	Mancos	Morrison	*Gas Dakota* 5941 66 15 214 *M*	6006	(I B PGW
4	NWNW 20 3N24E	Pu	P C Spencer #1	Clay Basin	9 13 24	6500	Mancos	Mancos		500	P&A
5	CSWNE 20 3N24E	P	Mountain Fuel Supply Co #1	Clay Basin	12 8 37	6280	Mancos	Dakota	*Gas Dakota* 5606 59 21 774 *M*	5674	PGW
6	SLSW 21 3N24E	Pu	Mountain Fuel Supply Co #4	Clay Basin	4 18 40	6298	Mancos	Dakota	*Gas Dakota* 5643 5710 *6 286 M*	5713	PGW PGW
7	NENE 21 3N24E	Pu	Mountain Fuel Supply Co #2	Clay Basin	8 17 36	6485	Mancos	Entrada	*Recompleted Frontier* 5400 *Gas Dakota* 5623 92 32 000 *M*	6799	(PB PGW
8	SWNW 22 3N24E	Pu	Mountain Fuel Supply Co #1	Clay Basin	4 6 27	6487	Mancos	Frontier	*Gas Dakota* 5395 5412, 3250 *M*	5445	PGW
9	SENW 22 3N24E	Pu	Mountain Fuel Supply Co #6 W (Prod & Ref Corp R D Murphy #1)	Clay Basin	7 23 47	6507	Mancos	Weber	*Gas Dakota* 5603 5720 5210 *M* (*Gas Frontier* 3000 *M Weber gas* CO_2)	9355	(PB PGW
10	NWSW 23 3N24E	Pu	Mountain Fuel Supply Co #3	Clay Basin	6 22 38	6660	Mancos	Morrison	*Gas Dakota,* 5847-5901, 15 214 *M*	6037	PGW

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
11	SWSE 23-3N24E	Pu	Mountain Fuel Supply Co #1 (Carter Oil #1)	Clay Basin	7-1-41	6659	Mancos	Morrison	*Gas, Dakota,* 5892-5985, 19,153 *M*	6045	PGW
12	NWNW 27-3N24E	Pu	Mountain Fuel Supply Co #1 (Prairie Oil & Gas Co #1)	Clay Basin	8-4 37	6389	Wasatch	Morrison	*Gas, Dakota,* 5741-5805; 14,035 *M*	5955	PGW
DAVIS COUNTY											
1	13-3N1W	P	Guffey & Galey #1	Farmington	1904	4250	Lake Beds	Lake Beds		2000	Abd
2 20	Sec 36 3N1W		Unknown # 1-20	Farmington	1895 App	4250	Lake Beds	Lake Beds	*About 20 wells drilled in this area Gas in Lake Beds* 400 *and* 700 *feet, also recorded gas in one well* 502, 542, 602 *feet Average pressure* 200 *psi max* 250 *psi Average depth* 500 *feet, max* 1400 *feet*		Abd
DUCHESNE COUNTY											
1	SESW 13-4S6WUBM	Pu	Midwest Explor Co #1	Duchesne	5-26-28	6519	Green River	Green River	*Deepened by Midwest Refining Co from 2867 to present depth Oil shows reported at close intervals from* 50 *to* 2430, *gas shows* 1500, 2600, 2866	4760	Abd
2	NENE 26-8S16E	S	Pleasant Valley Oil Corp	Myton	9 9 47		Uintah			2952	Drg
EMERY COUNTY						6000?	Mancos	Morrison	*Dakota,* 3015	3100	Abd
1	NW 2-17S8E	P	Ohio Oil Co. #1	Huntington	11-4-21	5306	Mancos	Morrison		833	Abd
2	NESE 31-18S9E	Pu	Castledale Oil Co. #1 (Pacific Western Oil Co.)	Castle Dale	12-8-21	5300	Mancos	Morrison		825	Abd
3	NESE 31-18S9E	Pu	G H Mulvey #2 (Pacific Westren Oil Co)	Castle Dale	8-5-29		Mancos	Navajo	*Tops Ferron* 75, *Dakota* 850, *Morrison* 900, *Navajo* 3500, 2300-2400 *some dead oil shows*	3600	Abd
4	NWSWSW 32-18S9E	S	Kralik Oil Co #1	Castle Dale	1-27-48	5200	Curtis	Coconino	CO_2 *and helium gas, Coconino,* 3120 65, 10,000 *M, gas show* 1940-45, 2155-65, 2845, 2970	3270?	Abd
5	SWSE 12 10S13E	Pu	Utah Oil Ref. Co #1	Woodside	2-7-24		Jurassic	Jurassic		300	Abd
6	20S-10E	Pu	J A Carol #1	San Rafael	1921		Moenkopi	Moenkopi		480	Abd
7	SWSE 24-20S11E		Old Emery Oil Co #1	San Rafael	10-?-22		Jurassic	Jurassic		190	Abd
8	SW 29-20S12E	P	San Rafael Oil Co #1	San Rafael	1921	4500	Morrison	Navajo?	*Show oil* 1100 (*Curtis or Entrada*), *strong flow water* 1200 *and* 1340 (*basal Carmel?*)	1490	Abd
9	9-20S14E	Pu	Burns #1	Desert	1899		Carmel	Carmel		480	Abd
10	SENW 5-21S9E	Pu	Leonard Petroleum Co #1	Salt Wash	7-?-21	5500?	Carmel	Moenkopi		2790	Abd
11	SENW 8 21S9E	Pu	Leonard Petroleum Co #1	Salt Wash	5-?-22		Carmel	Coconino		20	Abd
12	NWSW 8 21S9E	Pu	Utah Oil Ref Co #2	Salt Wash	2-?-22		Moenkopi	?		150	Abd
13	27-22S12E	Pu	H A Schwelhkart #1	San Rafael	9-12-21						

No	Location	Land Status	Operator and Well No	Field or Area	Comp
14	SESL 5 22 >15E	Pu	California Utah Oil Co #1	Green River	1899
15	SWNE 21 22S16E	P	W P Whisnant #1	Green River	9 20 43
16	SWSW 22 23S11E	Pu	Std Oil Co of Calif #1	San Rafael	10 28 36
17	NWNW 27 23S11]	Pu	Std Oil Co of Calif #2	San Rafael	6 12 37
18	NLSL 34 23S11E	Pu	Carter Oil Co #1	San Rafael	2 1 22
19	WSENW 18 26S7E	Pu	Mountain Fuel Supply Co #1 a	So Last Chance	4 11 48
20	NESW 18 >6S7E	Pu	American Oil Co #1	So Last Chance	
21	WNESW 18 26S7E	Pu	Ramsey Petroleum Corp #1 X	So Last Chance	12 16 34
22	SESW 18 26S7E	Pu	Mountain Fuel Suppl Co #1	So Last Chance	4 21-47
23	SESW 19 26S13E	Pu	Des Moines Oil Co #1	Flat Tops	1913
24	NENESW 32 26S13E	S	R D Robinson #1	Nequoia Arch	4 8 47
25	NENE 32 26S13E	S	George Callihan #1	Nequoia Arch	
26	C 29 26S14E	P	Des Moines Oil Co	Nequoia Arch	1912
GARFIELD COUNTY					
1	SWNE 25 34S7E	Pu	Ohio Oil Co #1	Circle Cliffs	11 9 21
2	NENWSE 22 35S2W		California Co #1	John's Valley	
3	36 36S3W	P	Bryce Canyon Oil Co #1	Tropic	1928
4	CSWNW 12 36S1E	Pu	California Co #1	Upper Valley	

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
4500?	Mancos	Probably base of Entrada or top of Carmel	*Show oil* 1600—*show gas* 1100 *Curtis? Show oil* 1100 *Curtis?*	1600	Abd
4012	Jurassic	Jurassic		435	Abd
6500?	Kaibab	Miss	*Completed as water well after encountering large cavern*	2285	Abd
6480	Coconino	Schists	*No shows gas or oil logged Schists* 4360 70	4900	Abd
	Coconino	Miss	*No shows oil or gas reported*	3035	Abd
6108	Carmel	Undif Paleozoic	*Coconino* 6302 *Drill stem tests to* 2710 *Tops Navajo* 204 *Kayenta* 1250 *Wingate* 1387 *Chinle* 1730 *Shinarump* 1818 *Moenkopi* 1950 *Kaibab* 3000 *Coconino* 3075 *Penn* 4035 *Miss* 4630 *Undif Paleozoic* 5575	8515	P&A
4400	Carmel	Navajo		320	Abd
5500	Carmel	Coconino	*Gas Moenkopi* 2530 2771 21 000 *M Gas Moenkopi* 2698 4000 *M Good oil show* 2800 *and* 3071	3168	Abd
6130	Carmel	Coconino	*Gas Moenkopi* 2720	3485	Abd
5500?	Entrada	Coconino	*Water well show of oil and gas* 2160 *Shinarump? Show of oil and gas* 2400 *Moenkopi? Show of oil about* 2750 *top of Coconino?*	2910	Abd
	San Rafael			2642	Abd
	Entrada	Kaibab		2640	DST
	Navajo	Chinle		2140	P&A
	Kaibab	Hermosa (or Miss)	*No showing of oil or gas reported*	3212	Abd
	Cretaceous			1762	Drg
6000?	Morrison			400	Abd
7185	Mesa Verde	Hermosa	*Pumped* 460 *bbls in* 23 *hrs* 10 15% *oil swabbed* 130 *bbls oil* 16 *hrs* 17° *API cor grav Fluid level* 3700 *ft Sample tops Dakota* 715 *Morrison* 837? *Carmel* 2020 *Navajo* 2461 *Todilto* 3889 *Wingate* 4034 *Chinle* 4328 *Shinarump* 5143 *Moenkopi* 5253 *Kaibab* 6041 *Coconino* 6195 *Rico Supai* 8033? *Hermosa* 8396 *Lime pay* 8777	8857	Drg

No	Location	Land Status	Operator and Well No	Field or Area	Comp.
5	1-37S3W	P	Bryce Canyon Oil Co #2	Tropic	
GRAND COUNTY					
1	C-SESE 12-17S25E		Frontier Ref Co Crittenden #1	Bar X	1948
2	NENE 4-19S25E	Pu	Home Oil Co or H H Bashor #1	Harley Dome	9-15 25
3	SENE 4-19S25E	Pu	Weightman & Fallgren #1 (Home Oil Company #2)	Harley Dome	5-3-26
4	SWSE 2-20S21E	S	Navajo Petroleum Corp #1	Cisco Dome	6-1-29
5	SWSW 13-20S21E	Pu	Utah Oil Ref Co #4	Cisco Dome	8-?-25
6	NESW 13-20S21E	Pu	F Engstrom #1	Cisco Dome	8-12-28
7	NESW 14-20S21E	Pu	W A Cunningham #1	Cisco Dome	4-3-28
8	SESW 14 20S21E	Pu	Utah Oil Ref Co #3	Cisco Dome	1-6-25
9	NENW 23 20S21E	Pu	Crystal Carbon Co #6	Cisco Dome	11-13-28
10	SENE 23-20S21E	Pu	Continental Oil Co #1	Cisco Dome	8-17-44
11	NESE 23 20S21E	Pu	Crystal Carbon Co #4	Cisco Dome	8-21-27
12	SESE 24-20S21E	Pu	Crystal Carbon Co #2	Cisco Dome	11-14-26
13	SWNW 25 20S21E	Pu	Crystal Carbon Co #3	Cisco Dome	5-4-27
14	SENE 25 20S21E	Pu	Perfection Oil & Gas Co #1 (Utah Oil Co #1)	Cisco Dome	8-?-26
15	NWNE 26 20S21E	Pu	Crystal Carbon Co #5	Cisco Dome	6 11-28

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
	Morrison			15	Abd
	Mancos	Granite?	386,000 *cu ft gas top Frontier, est* 4,000,000 *cu ft gas in Morrison at* 2996 *Tops of formations Dakota* 2810, *Lakota* 2960, *Morrison* 2996, *First Frontier* 3215, *Second Frontier* 3330, *Salt Wash* 3533, *Entrada* 3605, *Navajo* 3832	4497	GSI
4942	Dakota	Morrison	*Helium reserve #2, 250 M cu ft gas, Morrison,* 488-518, 4000 *M from* 538-584 (*top Morrison* 211)	802	Abd
4946	Dakota	Wingate	*Helium reserve #2, 250 M cu ft gas from* 564-81 *and* 5000 *M of gas reported from* 860 *to* 945 (*Entrada*) *Tops Morrison* 105, *Summerville* 795, *Entrada* 860, *Kayenta* 1148, *Wingate* 1350	1675	P&A
5487	Mancos	Morrison	*Show of oil*	2965	Abd
	Mancos	Mancos		500	Abd
5145	Mancos	Morrison		2945	Abd
5162	Mancos	Dakota	*Gas, Dakota,* 2215-44; 2104 *M*	2246	PGW
	Mancos	Mancos		501	Abd
5127	Mancos	Dakota	*Gas, Dakota,* 2080-2108, 3500 *M*	2108	Abd
5105	Mancos	Granite		4744	Abd
5107	Mancos	Dakota	*Gas, Dakota,* 2022-2032, 9293 *M*	2032	Abd
5077	Mancos	Morrison	*Gas Morrison,* 2228-2272; 7194 *M*	2423	Abd
5064	Mancos	Morrison	*Gas, Morrison,* 2044-2054, 1042 *M*	2057	Abd
5051	Mancos	Morrison	6 000,000 *cu ft per day dry gas in Dakota at* 1930 90,000,000 *cu ft per day dry gas in Dakota at* 1954 *Making* 1,000,000 *cu ft gas per day in* 1927	2414	Abd
5099	Mancos	Morrison	*Gas, Morrison,* 2250 2271, 1042 *M*	2271	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Com
16	NWSW 30-20S22E	Pu	Utah Oil Ref Co #2	Cisco Dome	4-13-25
17	NWSW 30-20S22E	Pu	Perfection Oil & Gas Co #1	Cisco Dome	8-25-26
18	NESE 30-20S22E	Pu	Perfection Oil & Gas Co #3	Cisco Dome	9-22-28
19	SENE 31-20S22E	Pu	Perfection Oil & Gas Co #2	Cisco Dome	10-26-2
20	NWNW 32-20S22E	Pu	Utah Oil Ref Co #5	Cisco Dome	8-6-25
21	NENW 32-20S22E	Pu	C A Urban #1	Cisco Dome	8-9-28
22	SESW 9-20S23E	Pu	W H H Cranmer #1 (Syndicate Moss #1)	Cisco Spgs	9-6-30
23	SWSE 15-21S16E	P	Bamberger & Millis #1	Green River	1891
24	SESE 34-21S16E	S	Glen Ruby, et al #1 X	Little Grand Fault	6-?-36
25	NWSE 35-21S16E	Pu	Marland Oil Co #1	Little Grand Fault	9-14-26
26	NWNE 20-21S17E	Pu	Crescent Drilling Co #1	Green River	3-?-13
27	NENE 21-21S17E	Pu	Crescent Drilling Co #2	Green River	1913
28	NESW 7-21S19E	Pu	Sandburg Petroleum Co #1	Salt Valley Anticline	1925
29	SWSW 27-21S19E	Pu	Crescent Oil Syndicate #1	Salt Valley Anticline	6-17-30
30	SESW 33 21S19E	Pu	Potash Co of American #2	Crescent	12-24 4
31	NW 34-21S19E		Western Sts Devel Co McCarthy #1	Crescent	1930?
32	CNWSW 33-21S21E		Pacific West Oil Corp #1	Thompson	
33	SWSE 13-21S23E	P	Cisco Oil & Ref. Co—Booth #2 (Ariz-Utah Oil and Gas Co #3)	Cisco	8-?-23

Elev	Surface Geologic Formations	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
4880	Mancos	Kayenta?	*Gas, Dakota,* 1949-1950, 2000 *M Gas at top of Dakota at* 1950—5 *to* 6 *million cu ft per day Made steady flow of* 2,000,000 *cu ft per day—closed in pressure* 150 *lbs psi, and gas carried* 0 0025 *gallons gasoline to the* 1000 *cu ft*	3045	Abd
4987	Mancos	Morrison	*Gas in Dakota* 1917 1925 4,126,000 *cu ft per day—pressure* 525 *psi, gasoline content* 0 164 *gallons to the* 1000 *cu ft*	1940	Abd
4982	Mancos	Morrison		2200	Abd
4927	Mancos	Morrison	*Gas, Dakota,* 1920 1926, 5252 *M*	2207	Abd
	Mancos	Mancos		500	Abd
4919	Mancos	Dakota	*Gas, Dakota,* 1950-1960, 5500 *M*	1960	Abd
4720	Mancos	Dakota	*Show of gas at top of Dakota at* 2015	2030	Abd
4100	Mancos	Morrison		1000	Abd
4055	Morrison	Kaibab?	*Numerous oil and gas shows to* 536	2627	Abd
4410	Morrison	Lower Cutler or Rico	*Oil, Morrison?,* 400, *gas* 1500 30, *Kayenta, oil, Shinarump,* 2396, *gas, Moenkopi* 2630, *oil,* 2630-2645, *oil, Coconino,* 3060-70, *gas,* 3170-80	3820	Abd
4200?	Mancos	Entrada		2100	Abd
4200?	Mancos			1600	Abd
5103	Mancos	Mancos	*Very small shows of gas*	2470	Abd
4916	Mancos	Dakota?		2171	Abd
4865	Mancos	Paradox	*Show gas, Paradox,* 4865-4867, *Navajo* 1736 1758, 1896-1901 *light oil* 3780—*top of Hermosa?* 4357—*top of Salt Paradox,* 4865—*gas* 2000 *cu ft*	5012	P&A
4900	Mancos	Mancos?		2200?	Abd
	Mancos	Cutler	*Top formations Ferron* 865, *Dakota* 1147, *Morrison* 1200, *Salt Wash* 1699, *Summerville* 1936, *Entrada* 1969, *Navajo* 2225, *Kayenta* 2469 *Chinle* 3386, *Moenkopi* 3616, *Cutler* 3943	8327	Drg
	Mancos		*Show gas* (500 *M gas*)	535	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
34	SWSE 13 21S23E	P	Cisco Oil & Ref Co —Bevel #1	Cisco	1927		Mancos		*Show oil and gas*	575	Abd
35	SWSE 13 21S23E	P	Ariz Utah Oil & Gas Co #2	Cisco	1925 ?		Mancos	Morrison	*Show of oil* 464 741?	643	Abd
36	SWSE 13 21S23E	P	Cisco Oil & Ref Co —Booth #1 (Ariz Utah Oil & Gas Co #1)	Cisco	1927	4375 ?	Mancos	Entrada	*Show oil* 640	1242	Abd
37	NWSE 22 21S23E	S	Utah Southern Oil Co #1	Cisco	12 11 44	4398	Mancos	Morrison		735	Abd
38	SWSW 23 21S23E	S	Utah Southern Oil Co #2	Cisco	1 24 45		Mancos	Morrison		930	Abd
39	SENE 24 21S23E	P	Cisco Oil & Ref Co #1 (Ariz — Utah Oil & Gas Co #4)	Cisco	1927		Mancos		*Oil show* 552 556 *ft* 1 *to* 10 *bbls per day, water interference*	573	Abd
40	NESE 24 21S23E	P	Cisco Oil & Ref Co #2 (Ariz — Utah Oil & Gas Co #5)	Cisco	1927		Mancos			550	Abd
41	SESE 24 21S23E	P	Cisco Oil & Ref Co #3 (Ariz — Utah Oil & Gas Co #6)	Cisco	1927		Mancos		*Oil show at* 360 *ft*	550	Abd
42	SWNW 25 21S23E	S	Western Crude Oil Co #3	Cisco	10 ? 45		Mancos	Dakota		1180	Abd
43	NENW 25 21S23E	P	Peerless Oil Co #1	Cisco	1924		Mancos	Morrison	*Shows oil and gas from Dakota* 390 *ft*	631	Abd
44	CSE 26 21S23E	S	Utah Southern Oil Co #1	Cisco	6 1 30	4387	Mancos	Granite	*Showing of black oil* 1200 *ft* (*Entrada*) 34 *ft into granite Tops Dakota* 380 *Morrison* 450 *Summerville* 1132 *Entrada* 1162 *Navajo* 1457 *Kayenta* 1503 *Wingate* 1729 *Chinle* 2085 *Granite* 2397	2431	Abd
45	NESE 26 21S23E	S	Western Crude Oil Co #2	Cisco	6 5 45		Mancos	Dakota		445	Abd
46	NESE 26 21S23E	S	Western Crude Oil Co #1	Cisco	5 14 45		Mancos	Dakota	*Show of gas Dakota* 375 377	385	GSI
47	CNW 32 21S23E	S	Taylor Bros Oil Co #1	Cisco	1 3 48		Mancos		15 *bbls of oil in* 2 *hour testing* 1300—2500 *bbls oil pumped*	1300	Drg
48	NWNW 2 22S16E	S	Amerada Pet Corp #1	Green River		4090	Mancos		*Tops Navajo* 1495 *Coconinno* 2665 *Hermosa* 3155 *Paradox* 4820 *Paradox Salt* 5100 *Reported heavy gas pressures*	5645	Drg
49	SWNW 2 22S16E	S	Amerada Pet Corp #2	Green River					*Location* — 1948 550 *ft south Amerada* #1		Drg
50	SESE 26 22S17E	Pu	British American Pet Co #3	Salt Wash	1912	4519	Morrison	Morrison		425	Abd
51	NENW 35 22S17E	Pu	British American Pet Co #2	Salt Wash	1912	4415	Morrison	Entrada		1500	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp.
52	SWNW 3-22S19E	Pu	Utah Oil Refining Co. #1	Crescent	9-25-24
53	SWSW 4-22S19E	Pu	Potash Co. of America #1	Crescent	6-3-43
54	SWSE 4-22S19E		Ponegrantz Oil Co. (DPC) #1	Crescent Jct.	
55	SESWSE 4-22S19E	P	Crescent Eagle Oil Co. #1	Salt Valley Anticline	9-?-25
56	SWSE 4-22S19E	P	Defense Plant Corp #1	Salt Valley Anticline	2-?-43
57	CSWNE 8 22S19E	Pu	Grand County Oil Co #1	Crescent	1948
58	SESWNE 8-22S19E	G	Walker Production Co #1	Crescent	1-27-48
59	NWNE 9-22S19E	P	Crescent Eagle Oil Co. #0	Crescent	1920
60	NWNENE 9-22S19E		Brendell Oil & Gas Co #1	Salt Valley Anticline	1932
61	NENE 9 22S19E	Pu	W. S L Main #1	Crescent	9-14-32
62	SESE 9-22S19E		Armstrong Co. #1	Crescent	1927
63	NWNW 10-22S19E	Pu	Potash Co of America #1	Crescent	10-26-43
64	NWSW 10-22S19E	Pu	Utah Oil Re. Co #1	Crescent	7-7-24
65	SENESE 10-22S19E	Pu	Big Six Oil Co. Randall #1	Crescent	10-?-28
66	NWNWNE 16 22S19E	S	Potash Co of America #1	Crescent	6-22-43
67	NENWNE 16-22S19E	S	Utah Drill & Devel Co #1	Crescent	10-?-45
68	NENE 16-22S19E	S	Reeder Corp. #1	Crescent	12-?-41
69	NWSE 23-22S19E	Pu	Big Six Oil Co #1	Crescent	12-?-41
70	SESE 9-22S20E	Pu	Raddatz-Vogel-Travis #1	Thompson	1-?-26

Elev.	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
4920?	Mancos	Mancos		80	Abd
4780	Mancos	Paradox	*Oil saturation* 2050-2053; *oil show* 2565-2578	5005	P&A
	Mancos	Paradox?	*No show of oil or gas below* 3150—*show at this depth.*	6150	Drg
4900?	Mancos	Paradox?	*Showings of oil and gas in Mancos and Dakota at* 1981, *strong flow salt water and high-gravity oil* 2060-2130 *rock salt, moist gas flow with high gasoline content* 5000 *M below rock salt* (2132) *gas, oil and water blew out at* 3205 *ft Blow out* 3911 *ft*, 960 *bbls. salt water,* 60 *bbls oil* on 6 *hour test In* 1924 *well produced* 10 *gal. light-gravity oil daily*	4009	Abd
4787	Mancos	Paradox?		4420	DSI
	Mancos	Summerville?	*Slight show of oil* 1121-1124, *Sand Dakota, show of oil and gas* 1760-1796; *slight show of gas and oil* 1610-20	1820	DSI
				1200	OSI
	Mancos	Mancos		600	Abd
			Gas *show* 3400	3400+	P&A
4785	Mancos	Paradox		4125	DSI
4760	Mancos	Summerville	*Show heavy oil base Dakota at* 710, *Tops Dakota* 660, *Morrison* 710, *Summerville* 1190, *show oil* 1212-1220, *saturated oil sand* 1210-1217, *no production*	1223	P&A
4766	Mancos	Paradox		5013	Abd
	Mancos	**Mancos**		80	Abd
	Mancos	Navajo	Gas, some *oil at* 460; *oil show* 795; *Tops: Dakota* 240, *Morrison* 280, *Entrada* 1000, *Navajo* 1425	1710	Abd
4731	Mancos	Paradox	*Show of oil;* 1 *bbl.* 1170; 150 *bbls.* 33 6° *API oil* 1603	5250	P&A
4729	Mancos	Morrison	*Oil show Morrison,* 1055-80	1215	Abd
4750?	Mancos	Morrison		1426	DSI
4670	Mancos	Morrison?		1127	DSI
4830	Mancos	Morrison		1450	P&A

No	Location	Land Status	Operator and Well No	Field or Area	Comp
71	NW NE 21 22S20E	Pu	Hope Syndicate #1 (Raddatz Syndicate)	Thompson	12 ? 25
72	NWNW 33 22S22E	Pu	Utah Southern Oil Co #1	Cisco	4 ? 37
73	SESE 6 22S23E	Pu	P D Jones #1	Saleratus Ck	1900
74	NWNWNE 25 23S18E	Pu	British American Pet Co #1	Ten Mile Wash	1912
75	NW NW 36 23S18E	S	W P Whisnant, et al #1	Ten Mile Wash	12 23 43
76	SESE 18 23S19E	Pu	Hagen #1	Ten Mile Wash	1913
77	NWSW 26 23S19E	Pu	Moab Oil Co #1	Ten Mile Wash	1912
78	SWSE NW 2 23S20E	Pu	Pure Oil Co #1	Salt Valley	
79	SESE 5 23S20E	Pu	Western Allies #1	Salt Valley	1919
80	SENESE 13 23S20E	Pu	Utah Southern Oil Co King #1	Salt Valley	10 23 29
81	NWNW 32 23S21E	G	Utah Southern Oil Co #1	Salt Valley	10 27 32
82	SESE 2 25S20E	S	Great Lakes Carbon Corp #1	Seven Mile	8 15 46
83	SWSE 12 25S20E	Pu	Columbia Crude Corp #1	Seven Mile	10 26 38
84	NESW 20 25S21E	Pu	Empire Petroleum Co #1	Moab	7 ? 26
85	NENE 27 25S21E	Pu	Embar Oil Co #1	Moab	1926
86	SENW 34 25S21E	Pu	Embar Oil—(Big Six Oil Co) #1	Moab	3 2 28
87	SESE 35 25S21E	P	Great Lakes Carbon Corp #1	Moab	1 ? 43
88	NWNWSW 11 26S19E	Pu	Tide Water Association #74 11	Big Flat	
89	SWNE 25 26S20E	Pu	Utah Southern Oil Co #1 A	Cane Creek	6 18 29
90	SWSW 1 26S21E	P	Dougan & Voohries #1	Moab	1 ? 43
91	NENW NE 12 26S21E	P	Western Allied Oil Co #1	Moab	1920

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
5250	Mancos	Morrison		1400	Abd
4785	Morrison	Hermosa	*Water well*	6715	P&A
4600	Mancos	Morrison	*No shows of oil or gas*	1800	P&A
4800 ?	Morrison	Entrada	*Water at* 350 *feet*	530	P&A
	Mancos	Wingate		1136	P&A
4800 ?	Mancos	Morrison	*Fresh water at* 425 *ft salt water* 600 *and* 870 *showing of oil* 910	920	P&A
4800 ?	Mancos	Mancos		700	Abd
	Jurassic			1385	Drg
	Jurassic	Paradox	*Show of oil and gas salt and epsomite at* 775 *to* 825 *small show of gas and oil at* 825	825	Abd
5100 ?	Kayenta	Paradox	*Salt water* 1478 1480 *Hermosa Salt sequence* 1570 *to total depth*	3829	P&A
4870	Paradox	Paradox	*Show oil* 3397 3415 3432 300 *bbls light green oil Oil arose* 2300 *ft in hole* 37° *baume recovered in* 2 *day bailing test est* 15 *bbls daily with apparently no decrease in rate of production* 7 18 35 *Deepened later to final depth Tops Chinle* 510 *Hermosa* 1020	6120	P&A
	Rico	Paradox		3655	P&A
4700	Rico	Paradox	*Top Salt* 2440	4243	P&A
4400	San Rafael			235	Abd
4030	Jurassic			306	Abd
4000	Hermosa	Paradox	*Showings of gas and oil at* 17 *horizons*	5345	Abd
	Hermosa	Paradox		3367	DSI
	Jurassic		*Scheduled* 7000 *foot Mississippian test*	1468	Drg
4000 ?	Rico	Paradox	*Show of gas* 2055 *salt sequence from* 2048 *to total depth*	4107	Abd
4000 ?	Paradox	Paradox		1150	DSI
4000 ?	Hermosa	Paradox	*Show of oil in Paradox* 1500 *feet of salt sequence*	2450	Abd

N	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
92	SWSW 31 26S21E	Pu	Midwest Expl Co Frank Shafer #1 (Utah So—Utah Oil Ref Co)	Cane Creek	3 21 27	3944	Hermosa	Paradox	*Good oil show Paradox 2024 oil and gas gushed to surface burned rig Oil show at 3628 gas show at 4980 salt bed sequence from 1500 to total depth*	5000	P&A
93	NWNW 8 26S22E	Pu	Utah Oil Devel Co #1	Moab	7 ? 27	4000	Hermosa	Paradox	*Shows of oil reported*	1525	Abd
JUAB COUNTY											
1	SE 1/ 15S2W		Central Utah Gas & Oil #1 (Clawson)	Wildcat			Quaternary		*200 feet east of Sage Valley Oil Co abd well*	450	Drg
2	SENW 12 15S2W	S	Sage Valley Oil Co #1	Sage Valley	1947		Tertiary			1200	DSI
3	1 15S1W	S	Mt Nebo Oil Co #1	Juab	1912	5100				2900	Abd
KANE COUNTY											
1	SWSE 14 39S1W	Pu	Midwest Exploration Co #1	Butler Vly	1930	6403	Navajo	Supai		4436	Abd
MILLARD COUNTY											
1	12 or 13 20S5W	P	Tom Kearns #1	Fillmore	1910 ?		Quaternary	Quaternary		1920	Abd
2	NWSW 36 20S5W	S	Westwood Oil Co #1	Fillmore	1902		Quaternary	Quaternary		920	Abd
3	NWSW 36 20S5W	S	Westwood Oil Co #3	Fillmore	1914		Quaternary	Quaternary		1200	Abd
4	32 25S13W		Premium Oil Co #1	Preuss Vly			Quaternary	Quaternary		600	Drg
5	SWSE 19 25S9W	P	Beaver Valley Oil Co #2	Black Rock	1930	4850	Quaternary	Quaternary		1545	Abd
6	NWNE 20 25S9W	P	Beaver Valley Oil Co #1	Black Rock	1930	4850 ?	Quaternary	Quaternary		3500	Abd
7	NE NE 31 25S9W	P	H T Kaminska #1	Black Rock	1922	4850 ?	Quaternary	Quaternary		800	Abd
SALT LAKE COUNTY											
1	NESE 21 1N1W	P	Western Pet Drlg Co #1	Salt Lake	7 ? 31	4250	Lake Beds	Lake Beds		1985 ?	Abd
2	NESW 28 1S1E	P	Tower Pet Co #1	Salt Lake	1927	4600 ?	Lake Beds			930	Abd
SAN JUAN COUNTY											
1	SWNE 16 27S20E	Pu	Midwest Exploration Co #1	Shafer Dome	6 13 27	4000	Hermosa	Miss	*Show oil at 764*	5863	Abd
2	NWNE 5 27S21E	Pu	Midwest Exploration Co #1	Cane Creek	6 27 27	4000 ?	Rico	Paradox	*Salt beds 2045 to 3520 no shows recorded*	3520	Abd
3	SWSW 16 28S20E	S	Utah Southern Oil Co #1	Lockhart	11 24 26	4100	Rico	Hermosa		527	Abd
4	SWSW 34 29S20E	Pu	Western Sts De	Gibson	10 5 20	4600 ?	Rico	Rico		323	Abd

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5	SENE 31 29½S20E	Pu	Deseret Petroleum Co #1	Gibson	3 12 27	4825	Cutler	Hermosa		510	P&A
6	NWNE 1 30S20E	Pu	Utah Petroleum Corp #1	Gibson Dome	4 26 27	4800?	Cutler	Hermosa	*Small show of oil and gas*	1643	P&A
7	Lot 20 6 30S21E	Pu	Empire Gas & Fuel Co #1	Gibson Dome	6 23 27	4800?	Cutler	Paradox	*Salt series at 2005 to bottom of hole no important show of oil or gas*	4136	P&A
8	NW NW 16 30S25E	S	Union Oil Co #1	Lisbon Dome	10 15-27		Rico	Paradox	*Salt beds below 1620 to bottom of hole several gas shows one show oil in salt sequence* 2575 *gas* 2693 3250 3516 4110 (4340 *to* 4345)	5010	Abd
9	NW SW 30 34S19E	Pu	Midwest Exploration Co #1	Elk Ridge	11 5 27	7139	Rico	Schist		4422	Abd
10	NW NW 17 34S25S	P	Boulder Knoll Oil & Gas Co #1	Boulder Knoll	6 12 30	7000	Dakota	Shinarump	*Gas well?*	2763	Abd
11	SW NE 23 34S25E	P	Western Natural Gas Co #1	Boulder Knoll	4 ? 48	6850	Dakota	Cambrian	*Madison limestone* 8110	8680	DSI
12	NENE 8 35S25E		Southern Union Colgram #1	Boulder Knoll	1948		Mancos		*Tops Navajo* 1030 *Wingate* 1205 *Shinarump* 2535? *Hole full of water*	2670	P&A
13	NW SW 14 27S22E	P	F A Sitton #1	Blanding		5700+	Dakota			731	DSI
14	NE 15 40S16E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		267	Abd
15	SW NE 25 40S17E	Pu	Norwood Oil Co #1	Johns Can	5 26 11		Rico	Penn	*Shows of oil and gas 85 feet 600 feet 1170 feet*	1938	P&A
16	NENW 7 40S18E	Pu	Mutual Oil Co #2	Johns Can	1912		Rico	Rico		210	Abd
17	SESE 24 40S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		150	Abd
18	SW NE 28 40S18E	Pu	Utah Southern Oil Co #1	Cedar Mesa	9 3 27	5500	Cutler	Mica Schist	*Small showing of gas in the Hermosa*	3633	Abd
19	SWSE 33 40S18E	Pu	Unknown (Finley) #2	San Juan	Before 1920		Rico	Rico		40	Abd
20	SESE 33 40S18E	Pu	Unknown #3	San Juan	Before 1920		Rico	Rico		50	Abd
21	33 40S18E	Pu	Barney Cockburn #1	San Juan	6 8 46		Rico	Penn		560	Abd
22	SWNW 34-40S18E	Pu	Unknown (Finley) #1	San Juan	1920		Rico	Rico		50	Abd
23	SWSE 36 40S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		300	Abd
24	SESE 11 40S19E	Pu	San Francisco San Juan Co #1	San Juan	1910	4870	Rico	Rico		50+	Abd
25	NW NW 13 40S19E	Pu	San Francisco San Juan Co #6	San Juan	1910?	4840	Rico	Rico		165	Abd
26	SWNW 13 40S19E	Pu	San Francisco San Juan Co #8	San Juan	7 ? 08	4820	Rico	Rico	***Shows of oil and gas***	595	Abd
27	NWSW 13 40S19E	Pu	San Francisco San Juan Co #7	San Juan	1910?	4795	Rico	Rico		140	Abd

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28	NE NE 14 40S19E	Pu	San Francisco San Juan Co #9	San Juan	1908 ?		Rico	Rico		145	Abd
29	NWSW 16 40S19E	Pu	Unknown #1	San Juan	1909 ?		Rico	Rico		12 ?	Abd
30	SWSW 19 40S19E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		20	Abd
31	SE NE 19 40S19E	Pu	Unknown #1	San Juan	1908 ?		Rico	Penn.		600	Abd
32	SE NE 23 40S19E	Pu	San Francisco San Juan Co #9	San Juan	1920	4720	Rico	Rico		50	Abd
33	SW SE 23 40S19E	Pu	Unknown #1	San Juan	1910 ?	4700 ?	Rico	Rico		150 ?	Abd
34	NWNW 29 40S19E	Pu	Gibralter Oil Co #1	San Juan	1910 ?		Rico	Rico		500	Abd
35	SW NE 30 40S19E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		80	Abd
36	SWNE 30 40S19E	Pu	Unknown	San Juan	1908 ?		Rico	Rico	*Water well*	515	Abd
37	SE SE 31 40S19E	Pu	Unknown #1	San Juan	1909 ?		Rico	Rico		100	Abd
38	SW SW 32 40S19E	Pu	Unknown #1	San Juan	1909 ?		Rico	Rico		50	Abd
39	SE NW 33 40S19E	Pu	Navajo Oil Co #1	San Juan		4720	Rico	Rico	*Shows oil and gas*	1200	Abd
40	SE SE 1 40S21E	Pu	Unknown #1	Bluff	1910 ?		Jurassic	Jurassic		200 ?	Abd
41	SWNE 36 41S17E	Pu	Utah Petroleum Corp #1	Halgaito	7 21 27	5473	Rico	Hermosa	*All but the lower 280 feet of this well is in rock that outcrops in canyon of San Juan River 1¼ miles to north*	1707	Abd
42	NWNW 1 41S18E	Pu	Unknown #1	San Juan	1910 ?		Rico	Rico		50	Abd
43	NENW 1 41S18E	Pu	Unknown #2	San Juan	Before 1920		Rico	Rico			Abd
44	NENW 1 41S18E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		300	Abd
45	NE NE 1 41S18E	Pu	Unknown #2	San Juan	Before 1920		Rico	Rico		20	Abd
46	NE SW 2 41S18E	S	Pinnacle Oil Co #1	San Juan	1909		Rico	Penn	***Water well***	600	P&A
47	SENE 2 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		20	Abd
48	SWSW 3 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		10	Abd
49	SE SE 4 41S18E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		150	Abd
50	SE SE 4 41S18E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		10	Abd
51	SWSW 12 41S18E	P	London-San Juan Oil Co #1	San Juan	12 ? 09		Rico	Penn		520	Abd
52	SWSW 12 41S18E	Pu	London San Juan Oil Co #2	San Juan	1909		Rico	Rico		450	Abd
53	SWNE 12 41S18E	Pu	Pacific San Juan Co #1	San Juan	Before 1911		Rico	Rico		100	Abd

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54	NW 13 41S18E	Pu	London San Juan Oil Co #4	San Juan	1923?		Rico	Rico		213	Abd
55	NWNW 15 41S18E	Pu	Astec Oil Co #1	San Juan	1912		Rico	Penn		1350	Abd
56	NWSW 16 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		30	Abd
57	SWSW 16 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		150	Abd
58	SWSE 17 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		150	Abd
59	NENW 20 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico?		150	Abd
60	NENW 22 41S18E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		80	Abd
61	SESW 22 41S18E	Pu	Palo Pinto Oil Co #2	San Juan	1910		Rico	Penn		500?	Abd
62	SESW 22 41S18E	Pu	Palo Pinto Oil Co #1	San Juan	1910		Rico	Penn		900?	Abd
63	NWNE 22 41S18E	Pu	Humbolt	San Juan	Before 1920		Rico	Rico		30	Abd
64	SESE 23 41S18E	Pu	San Juan Oil Co #1	San Juan	1912	4595	Rico	Rico	*(Chicago well)*	213	Abd
65	NWNW 24 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		50	Abd
66	NWSW 24 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		10	Abd
67	NWSW 24 41S18E		Unknown	San Juan	Before 1920		Rico	Rico		10	Abd
68	SWSW 24 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		10	Abd
69	SWSE 25 41S18E	Pu	London San Juan Oil Co #3	San Juan	1909?	4390	Rico	Rico		356	Abd
70	25 41S18E	P	MacFulton Drlg Co #1	San Juan			Rico			1025	DSI
71	SE SE 26 41S18E	Pu	Unknown #1	San Juan	Before 1920	4545	Rico	Rico			Abd
72	SWNW 28 41S18E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		150	Abd
73	NENE 29 41S18E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		150	Abd
74	SESE 36-41S18E	Pu	Yates & McLane #1	San Juan	1910?	4310	Rico	Rico		260	Abd
75	SWSW 5 41S19E	Pu	Unknown #1	San Juan	1909?		Rico	Rico		50	Abd
76	SWNE 6 41S19E	Pu	Unknown #1	San Juan			Rico	Rico		200	Abd
77	SWNE 6 41S19E	Pu	Unknown #2	San Juan			Rico	Rico		160	Abd
78	SWNE 6 41S19E	Pu	Unknown #3	San Juan	1912						Abd
79	NWNE 7 41S19E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		25?	Abd
80	NENE 7-41S19E	Pu	F H King, et al #1	San Juan	1909?		Rico	Rico		50	Abd

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81	SENE 8 41S19E	Pu	San Francisco San Juan Co #1	San Juan	1908 ?	4545		Rico		450	Abd
82	NESW 10 41S19E	Pu	Unknown	San Juan	Before 1920		Rico	Rico		26	Abd
83	NESW 10 41S19E	Pu	Jackson & Mc Gee	San Juan	1909 ?	4380		Rico		100 ?	Abd
84	SWNW 15 41S19E	Pu	Oil Co of San Juan #1	San Juan	1909 ?		Rico	Penn	*Water well Show oil 105 feet*	500 ?	Abd
85	NWNW 16 41S19E	Pu	Barney Cock burn #1	San Juan	3 8 46			Rico		354	Abd
86	SESW 17 41S19E	Pu	Spokane Oil Co #1	San Juan	1908 ?	4280	Rico	Rico		200	Abd
87	SWNE 17 41S19E	Pu	Pioneer Devel Co #1	San Juan	1908	4360	Rico	Rico		215	Abd
88	NESW 18 41S19E	Pu	Unknown #1	San Juan	1909 ?		Rico	Rico		20	Abd
89	NWNE 19 41S19E	Pu	San Francisco San Juan Oil Co #1	San Juan	Before 1920	4430	Rico	Rico		400 ?	Abd
90	NENE 20 41S19E	Pu	Unknown #1	San Juan	Before 1920		Rico	Rico		10	Abd
91	NWSE 20 41S19E	Pu	San Francisco San Juan Oil Co #1	San Juan	1910	4220	Rico	Penn		500 ?	Abd
92	Lot 1 27 41S19E	Pu	Utah Southern Oil Co #1	San Juan	3 19 28	4090	Hermosa	Pre Cambrian mica schist	*Gas Ch 812 971 (at 935 gas (CO_2) vol 30 000 M cu ft) Small show of oil at 172 feet*	1870	P&A
93	NWSE 30 41S19E		Unknown	San Juan	Before 1920		Rico	Rico		70	Abd
94	30 41S19E	Pu	Barney Cock burn #1	San Juan	1 4 46		Rico	Penn		1580	Abd
95	NW SW 31 41S19E	Pu	Unknown #1	San Juan	Before 1920	4290	Rico	Rico			Abd
96	NWSW 31 41S19E	Pu	Unknown #2	San Juan	Before 1920	4295	Rico	Rico			Abd
97	SWSW 31 41S19E	Pu	Unknown	San Juan	Before 1920	4280	Rico	Rico			Abd
98	NWNE 31 41S19E	Pu	A C Ellis #1	San Juan	1925	4365	Rico	Rico		100 ?	Abd
99	NWNE 31 41S19E	Pu	A C Ellis #2	San Juan	1925	4365	Rico	Penn		1130	Abd
100	SESE 31 41S19E	P	Unknown #1	San Juan	1912 ?	4220	Rico	Rico	*Townsite well*		Abd
101	SENW 35-42S14E	In	Wilson Cranmer #1 A	Organ Rock	1923	4300	Cutler (Cedar Mesa)	Hermosa	*Small show of oil and gas 950 feet in Rico*	2323	Abd
102	SENW 35-42S14E	In	Wilson Cranmer #1	Organ Rock	1923	4300	Coconino	Hermosa		1122	Abd
103	SENE 23 42S17E	Pu	Monumental Oil Co #1	Halgaito	12 ? 24		Rico	Upper Hermosa	*No showings*	756	Abd
104	SENE 23 42S17E	Pu	Monumental Oil Co #1 A	Halgaito	12 31 24		Rico	Hermosa	*Penetrated 1200 feet of Hermosa Reached strata only 180 feet deeper than the lowest rocks exposed in the canyon at San Juan at the crest of the anticline*	1622	Abd

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105	SENE 35 42S17E	Pu	Monumental Oil Co #1	Halgaito	1920	4970	Cutler	Hermosa		1300+	Abd
106	SWNE 1 42S18E	Pu	Unknown #1	San Juan	1911		Rico	Rico		25	Abd
107	NESE 1-42S18E	Pu	Unknown #1	San Juan	1912		Rico	Rico		400?	Abd
108	SENE 19 42S18E	Pu	Monumental Oil Co #2	Halgaito	12 31-23	5155	Rico	Penn		1622	Abd
109	NWSE19 42 18E	Pu	Monumental Oil Co #1	Halgaito	1926	5145	Rico	Hermosa	*Small showing of oil and gas, 800-812 and 890 900 Upper Hermosa — cannot be precisely correlated with oil bearing beds in San Juan Field*	1140	Abd
110	SWNW 5 42S19E	P	Southside Oil Co #1	San Juan	1910	4175	Rico	Penn	*Show of oil Hermosa, ap prox 600 feet*	600+	Abd
111	SWNW 5-42S19E	P	Mexican Hat Oil Co #2	San Juan	11-?-44	4170?	Rico	Rico		300	Abd
112	SWNW 5-42S19E	P	Western Investment Co #1	San Juan	1909	4160	Rico	Penn	*Oil Hermosa, 165 feet, 10 bbls est*	500	Abd
113	SENW 5 42S19E	P	Monumental Oil Co #1	San Juan	1909?	4145	Rico	Penn	*Show oil, Hermosa 292 feet, 525-50 feet*	635	Abd
114	NWSW 5-42S19E	P	Anderson Oil & Devel Co #1	San Juan	1909?	4160	Rico	Penn	*Shows oil, Hermosa, 273-301 feet and 1172-1222 feet*	1222	Abd
115	NENE 5 42S19E	Pu	R L Raplee #1	San Juan	1912?	4120	Rico	Penn.	*Show oil, Hermosa 900?*	900?	Abd
116	SWNW 6 42S19E	P	Arcola Oil Co #4	San Juan	1909?	4175	Rico	Rico			Abd
117	SWNW 6 42S19E	P	Western Investment Co #2	San Juan	1909		Rico	Penn	*Oil Hermosa, 220 feet*	517	Abd
118	SWNW 6-42S19E	P	Allen & Woolley #1	San Juan	4 23-44	4175	Rico	Rico		292	Abd
119	SWNW 6-42S19E	P	Allen & Woolley #2	San Juan	7 19-47	4175?	Rico			335	PGW
120	SWNW 6 42S19E	P	Arcola Oil Co #2	San Juan	6 ?-30	4170	Rico	Penn	*Show oil, Hermosa, 230 335 feet*	713	Abd
121	SWNW 6 42S19E	P	W E Nevills #5	San Juan	6-?-31	4205	Rico	Penn	*Oil, Hermosa, 263 feet, 60 bbls est*	512	Abd
122	NENW 6 42S19E	P	Unknown (Producers No 2?) #1	San Juan	1910?	4220	Rico	Penn	*Probable oil and gas, Hermosa, 800 feet*	800+	Abd
123	NWSW 6-42S19E	Pu	Bluff Oil Co #2	San Juan	1925	4175	Rico	Penn		630	Abd
124	NWSW 6-42S19E	Pu	Bluff Oil Co #1	San Juan	1922	4156	Rico	Rico		300	Abd
125	SWNE 6-42S19E	P	Arcola Oil Co #3	San Juan	1910?		Rico	Rico		210	Abd
126	SWSE 6-42S19E	P	Urado Development Co #4	San Juan	6-11-45		Rico	Rico?		269	Abd
127	SESE 6-42S19E	P	Urado Development Co #2	San Juan	4-30 45		Rico	Rico		257	Abd
128	SESE 6-42S19E	P	Oil Company of San Juan #1	San Juan	11-?-09	4185	Rico	Rico		284	Abd
129	SESE 6-42S19E	P	Urado Development Co #1	San Juan	4-17-45		Rico	Rico		271	Abd
130	6-42S19E	P	Urado Development Co #3	San Juan	5-29-45		Rico	Penn.		645	Abd

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131	NENE 7 42S 19E	P	Urado Development Co #1	San Juan	5 20 45	Rico	Rico		273	Abd
132	SENE 7 42S 19E	P	Barney Cockburn #2	San Juan	5 3 46	Rico	Rico		241	Abd
133	SENE 7 42S 19E	P	Unknown #1	San Juan	Before 1920	Rico	Rico		100	Abd
134	NESE 7 42S 19E	P	W E Nevills #7	San Juan	3 ? 34	Rico	Rico		225	Abd
135	NESE 7 42S 19E	P	W E Nevills #6	San Juan	2 17 33	Rico	Rico	*Produced oil*	194	Abd
136	NESE 7 42S 19E	P	Oil Co of San Juan #1	San Juan	3 4 08	Rico	Rico		226	Abd
13	NESE 7 42S 19E	P	San Juan Oil & Ref Co #1	San Juan	3 5 44	Rico	Rico		215	OSI
138	NWNW 8 42S 19E	P	Barney Cockburn #1	San Juan	12 27 45	Rico	Rico	*Produced oil*	296	
139	SWNW 8 42S 19E	P	Barney Cockburn #5	San Juan	5 28 46	Rico	Rico		21	Abd
140	SWNW 8 42S 19E	P	Barney Cockburn #4	San Juan	5 16 46	Rico	Rico		306	Abd
141	SWNW 8 42S 19E	P	Barney Cockburn #3	San Juan	5 13 46	Rico	Rico		296	Abd
142	SWNW 8 42S 19E	Pu	Monticello Oil Co #4	San Juan	1909 ?	Rico	Rico		263	Abd
143	8 42S 19E	P	Barney Cockburn #6	San Juan	11 27 46	Rico	Penn		633	Abd
144	SENW 16 43S 22E	In	Wyo Assoc Oil Corp #1	Boundary Butte	7 16 24	Navajo	Navajo		505	Abd
145	SWNW 22 43S 22E	In	Southwest Oil Co #1	Boundary Butte	10 ? 23	Navajo	Navajo		1565	Abd
146	SWNW 22 43S 22E	In	Continental Oil Co #1	Boundary Butte	2 4 30 ?	Navajo	Miss	*Show oil Shinarump 1560 9 about 30 bbls per day gas 4890 5256 Total gas vol est 15 000 M cu ft*	5612	Abd
147	CNENW 22 43S 22E	In	Western Nat Gas Co et al #1	Boundary Butte	1 27 48	Navajo	Lynch dol ?	*Flow—28 M cu ft daily of sweet wet gas rated at 980 B T U s per ft Wet gas blowing from Hermosa between 4610 4660 Aug 10 1948 shut in Tops Wingate 185 Chinle 750 Shinarump 1335 Moenkop 1440 Coconino 1652 Rico 3625 Hermosa 3790 Molas 5395 Devonian 5735 Ordovician 5890 Lynch 5985*	6090	GSI
148	SENW 22 43S 22E	In	Western Nat Gas Co et al #2 S	Boundary Butte	11 30 48	Navajo		*So theast of the discovery well where operator hopes to find oil Pumped 140 bbls 42 7 grav oil in 24 hrs*	1510	OSI
149	NWNWSE 22 43S 22E	In	Western Nat Gas Co et al #3	Boundary Butte		Navajo		*To test Coconino*	1000	Drg
150	NWSW 23 43S 22E	In	Mutual Oil Co #1	Boundary Butte	8 9 24	Navajo	Navajo		502	Abd
151	CSWNE 25 43S 22E	In	Western Nat Gas Co et al #2	Boundary Butte		Navajo	Hermosa	*Tested 9000 MCF per day Tops Chinle 410 Shinarump 1060 Moenkopi 1150 Coconino 1380 Rico 3380 Hermosa 3530*	5308	Drg

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152	NWSE 25 43S22E	In	Utah Oil & Ref Co #1	Boundary Butte	6 12 24
153	NENW 32 43S23E	In	Union Oil Co #1	Boundary Butte	7 23 24
SANPETE COUNTY					
1	NESE 27 15S4E	P	S Jenson	Mt Pleasant	1918?
2	NESW 3 17S3E	I	Producers Oil Co #1	Ephraim	12 ? 20
3	NESW 24 20S1W	P	Sanpete Oil Co #1	Redmond	
4	LSW 24 20S1W	P	Ben H Bullock et al #1	Redmond	12 ? 41
SEVIER COUNTY					
1	SWNE 36 20S1W		Sanpete Oil Co #2	Redmond Anticline	
2	SWSW 13 25S5E	Pu	American Liberty Oil Co #1	No Last Chance	10 5 48
SUMMIT COUNTY					
1	SWSE 35 3N5E	P	Longwall Pet Co #1	Coalville	5 20 44
2	NWSE 9 2N5E	P	Mt Fuel Supply Co #1	Coalville	9 2 38
3	16 2N5E	I	Western Empire Pet Co #1	Coalville	1 ? 27
4	NWSE 6 2N6E	Pu	Ohio Oil Co #1	Coalville	11 6 24
TOOELE COUNTY					
1	NW 31 1S5W	P	National Oil & Gas Co #1	Burmaster	1917
2	SENE 14 2S6W	P	Bonneville Oil & Gas Expl Co #1	Flux Area	1 27 48
UINTAH COUNTY					
1	NE SE 18 2N1E UBM	P	J F Walker et al #1	White Rocks	11 25 28
2	NW SW 21 1S1E UBM	In	Carter Oil Co Ute Tribal #1	White Rocks	
3	N½S½ 36 1S1E UBM	P	Syndicate Oil & Mng Co #1	LaPoint	10 23 46
4	SWNW 8 2S2E UBM	P	Uintah Oil & Explor Co #1	Moffat	1919
5	SWNW 19 2S2E UBM	P	Syndicate Oil & Mng Co #1	Moffat	

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
	Navajo	Navajo		510	Abd
	Navajo	Navajo		550	Abd
6000?	Quaternary			1408	Abd
5500?	Quaternary			921	Abd
	Quaternary			1462	Abd
	Quaternary	Cretaceous		85	Abd
	Quaternary			250	DSI
	Cretaceous			4493	P&A
6400?	Frontier	Frontier		4423	Abd
5635	Frontier	Morrison		5538	P&A
5800	Frontier	Frontier?	*Water well*	3870	Abd
6500	Frontier	Frontier?		3197	Abd
4300	Lake Beds			1127	Abd
	Lake Beds	Limestone?		2200	DSI
6300?	Nugget	Nugget		410	Abd
	Duchesne		*Cored at 3652 63 rec 9 2 Sandstone with thin carbonaceous shale streaks Spud 10 23 48 (9000) Tertiary test Tops Uinta 1220 Green River 5820*	4744	Drg
	Duchesne	Duchesne	*Show gas Wasatch 1840 1856*	2207	Abd
5100?	Duchesne			1100	Abd
	Duchesne			832	DSI

No	Location	Land Status	Operator and Well No	Field or Area	Comp.
6	NSESE 29-4S1E UBM	Pu	Utah Southern Oil Co #1	Myton	2-24-29
7	NWSE 28-3S21E	Pu	Maude Ellen Oil Co #1	Neal Dome	11-2-32
8	SESE 30-3S21E	P	Vernal Oil & Gas Co #1	Neal Dome	
9	NESE 21-4S20E	Pu	Union Oil Co of Calif #1	Cottonwood Springs	6-11-42
10	CSENE 28-4S20E		Carter Schmidt #1	Vernal	2-10-48
11	SW 30-4S20E	Pu	Uintah Develop Co	Vernal	1912
12	NWNW 33-4S20E	Pu	Carter Oil Co Davis #1	Vernal	1947
13	SESE 34-4S20E	Pu	Uintah Develop Co	Vernal	1912
14	SWSE 35 4S20E	Pu	Curtis and Dixon #1	Vernal	1912
15	9-4S21E		Vernal Oil & Gas Co #1	Vernal	9-9-47
16	SWNW 22-4S21E	P	Mayo-Utah Oil Co #1	Vernal	1945
17	NWNW 34-4S22E	P	Equity Oil Co #1	Vernal	
18	NWSW 5-5S21E	P	Reed #1	Vernal	8-16-11
19	NWSE 6-5S21E	Pu	Western Venture Corp #1	Vernal	10-?-30
20	NESW 8-5S21E	Pu	Home Oil Co #1	Vernal	8-?-29
21	NENE 17-5S21E	Pu	Uintah Develop Co	Vernal	1912
22	CSWNE 18-5S21E		Carter Knudson #1	Vernal	9-27-47
23	SESW 33 5S21E		Carter (Nelson-Ruth) #1	Vernal	
24	SENE 22-5S22E	P	Utah Oil Refining Co #4	Ashley Valley	12-20-28
25	CSWNW 23-5S22E		Equity Oil Co, et al, #1	Ashley Valley	10-19-48
26	SWNW 23-5S22E	P	Utah Oil Refining Co #3	Ashley Valley	3-23-28

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
5000	Uinta	Green River?		3000	Abd
5750	Nugget	Weber	*Water well*	2552	Abd
	Chinle		*Oil and gas shows top Morgan* 2264	2660	DSI
6275	Duchesne	Mesaverde	*Tar sand* 1630 1730	2222	Abd
6086	Duchesne	Mancos	*Tops Uinta* 1800, *Mesaverde* 4035 *Mancos* 6130 *Dead oil stains* 5850 6100	6367	P&A
5800	Tertiary	Tertiary		900	Abd
5840	Duchesne	Upper Cretaceous	*Producing gas* 5832-70, 3000 *M Dead oil sands below Green River Tops Uinta* 1390, *Green River* 2715, *Wasatch* 5313, *Mesaverde* 6855, *Mancos* 8002	8002	Abd
5800	Tertiary	Tertiary		1500	Abd
5800	Tertiary	Tertiary		500	Abd
	Morrison?			509	
	Mancos	Navajo		6787	DSI
	Mancos			1763	DSI
5800	Uinta			1430	Abd
5750	Uinta	Uinta	***Gas show, 1296-1300***	1711	Abd
5500	Uinta	Uinta		1165	Abd
5400	Uinta			1200	Abd
5395	Duchesne	Upper Cretaceous	*Tops Uinta* 1950, *Wasatch* 4320 *Mesaverde* 5150	6013	P&A
5330?	Duchesne	Wasatch	*Oil and gas shows* 6807, 6827-54, 6737, 7068-7089, 29.6° *green oil*, 2-5000 *M CFG Tops Uinta* 1715, *Green River* 2850, *Wasatch* 6500 *Persistent sand* 7020 *Dead oil Sai sands from* 7156 7200	7880	DSI
4923	Mancos	Nugget	*Slow gas Morrison*, 1730-35, *oil* 1842 47	2165	Abd
	Mancos	Weber	*Tops Frontier* 676, *Dakota* 1020, *Chinle* 3125, *Phosphoria* 4060, *Weber* 4136 *Flow* 260 *bbls in 24 hours through 2" tubing from Weber*, 31° *API oil*	4152	POW
4844	Mancos	Nugget	*Gas, Morrison*, 1663-71, 15,000 *M* 1790—8 *bbls oil per day*, 2720—20,000 *bbls. fresh water per day*	2720	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
27	SWNW 23 5S22E	P	Utah Oil Refining Co #1	Ashley Valley	4-13-25	4847	Mancos	Morrison	*Gas, Morrison,* 1673-80, 15,000 *M*	1685	PGW
28	NESW 23 5S22E	P	Utah Oil Refining Co #2	Ashley Valley	9 17-27	4901	Mancos	Mancos		709	Abd
29	NESW 23 5S22E	P	Uintah Gas Co #1	Ashley Valley	12-4-34	4836	Mancos	Morrison		1730	Abd
30	SESESW 23-5S22E		Cane Griffith Oil Co, Hall #2	Ashley Valley					*Location*		
31	SESW 23 5S22E		Cane Griffith Oil Co Hall #1	Ashley Valley			Mancos	Weber	*Shut in for storage, flowed* 487 *bbls* 32 *grav oil in* 24 *hours, Weber* 4088	4122	POW
32	Lot 4 36-5S25E	S	Richfield Oil Co of Montana #1	Trail Creek	10-?-47		Shinarump			1450	DSI
33	NWNE 26-6S19E	Pu	Uintah Oil & Explor Co #1	Moffat	9-?-25	5000	Uinta	Green River		1500	Abd
34	Lot 4 31-6S25E	P	George Brown	Powder Spgs	1911	5500	Tertiary			700	Abd
35	SENW 36-6S25E	S	E R McElroy #1	Powder Spgs			Mesaverde			1640	Abd
36	CNESW 36-6S25E		Rogan, et al #1	Powder Spgs	2-24-48				*Completed as water well*	2056	Drg
37	SENE 7-7S25E	Pu	Calif Oil & Ref Co #1	Powder Spgs	1924?	5500	Uinta	Green River		1000	Abd
38	SWNE 10 10S22E		Seaboard Oil Co #1	Bitter Creek	1948	5063	Uinta		100 *M CF sweet gas* 2320-2435	6620	Drg
39	24 14S19E	P	Castle Dale Oil Co #2	Hill Creek	1922	7000?	Green River	Green River		1170	Abd
40	24-14S19E	P	Castle Dale Oil Co #1	Hill Creek	1921		Green River	Green River		900	Abd
41	SWSW 29-14S20E	Pu	Midwest Refining Co #1	Hill Creek	2-2-22	7000?	Green River			26	Abd
42	SWNW 32 14S20E	P	Utah Oil Refining Co #1	Hill Creek	6-25-22	7000	Green River	Green River		2150	Abd
43	35 15S23E	P	John Pope #1		1900		Wasatch?			1000	Abd
UTAH COUNTY											
1	SENW 16-8S5E	P	Diamond Oil Co #1		3-?-45	6200?	Triassic	Penn.?		3980	DSI
2	NENE 29-8S5E	Pu	Diamond Oil Co #1	Diamond Fk	12-31-28	6500	Ankareh			10	Abd
3	NENE 29 8S5E	P	Diamond Oil Co #3	Diamond Fk	12-22-26	6000?	Ankareh	Permian?		1691	Abd
4	NWSW 3-9S4E	P	Diamond Oil Co #2	Diamond Fk	7-?-27	5500	Price River			2151	Abd
5	SWNE 10-9S4E	P	Diamond Oil Co. #1	Diamond Fk	1921	5500	Price River			941	Abd
6	4?10S4E	P	Unknown	Thistle	1920	5000?	Wasatch			2000	Abd
7	10S5E		Spanish Fork Oil Co #1	Thistle	1922	5000?				875	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Geologic Formations Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
WASHINGTON COUNTY											
1	SESE 32-40S11W	P	R E Newman, et al #1	Virgin	4-?-38	4050	Moenkopi	Moenkopi		1260	Abd
2	NESW 33 40S11W	Pu	Anna V Toney #1	Virgin	9 5-35	4100	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 180-206	517	Abd
3	SWSW 24 41S13W	P	W W Toney #1	Stewart Cannon	1938		Moenkopi	Moenkopi		47	Abd
4	SESW 11-41S13W	P	W W Toney #1	La Verkin	1937		Moenkopi			80	Abd
5	NESE 1-41S12W	Pu	Diamond Oil Co #1	Virgin	9-25-24	3773	Moenkopi	Moenkopi		830	Abd
6	SESW 10 41S12W	Pu	John Walther #1	Virgin	12-12-25		Moenkopi	Moenkopi		650	Abd
7	SWSE 10-41S12W	Pu	Star Crescent Oil Co #2-A	Virgin	1907	3816	Moenkopi	Kaibab		1142	Abd
8	SESE 10-41S12W	Pu	Star Crescent Oil Co #1-B	Virgin	1907	3775	Moenkopi	Moenkopi		650	Abd
9	SWSW 11-41S12W	Pu	Edwin A Peay, Jr #1	Virgin	1-?-39	3600?	Moenkopi	Moenkopi		513	Abd
10	SENW 12-14S12N	Pu	Utacal Oil Co #3	Virgin	8 9-28	3815	Moenkopi	Moenkopi		940	Abd
11	NWSW 12 41S12W	Pu	Utacal Oil Co #1	Virgin	3 30-31	3842	Moenkopi	Moenkopi		827	Abd
12	SWSW 12-41S12W	Pu	Utacal Oil Co #15	Virgin	3-11 32	3670	Moenkopi	Moenkopi		710	Abd
13	SWSW 12 41S12W	Pu	Utacal Oil Co #9	Virgin	2 21-31	3708	Moenkopi	Moenkopi	*Oil, Moenkopi,* 648-651, 30 *bbls*	651	OSI
14	SWSW 12 41S12W	Pu	Utacal Oil Co #11	Virgin	7-8-31	3752	Moenkopi	Moenkopi	*Oil, Moenkopi,* 690-694, 1½ *bbls*	708	OSI
15	SWSW 12-41S12W	Pu	Escalante, Explor, Inc #12	Virgin	8-4-31	3746	Moenkopi	Moenkopi	*Oil, Moenkopi,* 688-704, 5 *bbls*	704	OSI
16	SWSW 12-41S12W	Pu	Escalante, Explor, Inc #16		5-9-32	3712	Moenkopi	Moenkopi		666	Abd
17	NESW 12-41S12W	Pu	Utacal Oil Co #0	Virgin	1907	3777	Moenkopi	Kaibab	*Probably produced oil in* 1907	1200	Abd
18	NESW 12 41S12W	Pu	Utacal Oil Co #2	Virgin	6-30-27	3720	Moenkopi	Moenkopi	*Oil, Moenkopi,* 795-8, 819-25, 8 *bbls*	890	Abd
19	NESW 12-41S12W	Pu	Burley M Jones #20	Virgin	1-8-40		Moenkopi	Kaibab	*Show oil,* 638-49	660	Abd
20	NESW 12-41S12W	Pu	Utacal Oil Co #1	Virgin	12-15-26	3700	Moenkopi	Moenkopi	*Oil, Moenkopi,* 636-649, 2 *bbls*	675	Abd
21	NESW 12-41S12W	Pu	Utacal Oil Co #5 (Miller, Hickey & Lambert)	Virgin	12-12 28	3788	Moenkopi	Moenkopi		815	P&A
22	NESW 12-41S12W	Pu	Utacal Oil Co #4	Virgin	10-20-28	3742	Moenkopi	Moenkopi	*Oil, Moenkopi,* 706-718, 12 *bbls*	759	Abd
23	NESW 12-41S12W	Pu	Utacal Oil Co #6	Virgin	3-26-29	3706	Moenkopi	Moenkopi	*Oil, Moenkopi,* 663-669, 1 *bbl.*	700	Abd
24	NESW 12-41S12W	Pu	Burley M Jones #14	Virgin	11-11-31	3740	Moenkopi	Moenkopi		714	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp
25	SESW 12-41S12W	Pu	Utacal Oil Co #10	Virgin	4 13-31
26	SESW 12 41S12W	Pu	Utacal Oil Co #8	Virgin	9 15-30
27	SESW 12-41S12W	Pu	Utacal Oil Co #18 (Burley M Jones)	Virgin	12 15 32
28	SESW 12-41S12W	Pu	Utacal Oil Co #19 (Burley M Jones)	Virgin	4 18-35
29	SESW 12-41S12W	Pu	Utacal Oil Co #7	Virgin	7 12 30
30	SESW 12-41S12W	Pu	Utacal Oil Co #17	Virgin	7-1-32
31	SENE 12 41S12W	Pu	Emma F Dunn #1	Virgin	5-5-31
32	NWSE 12-41S12W	P	Hobson & Lowe #1	Virgin	1-?-31
33	SWSE 12-41S12W	Pu	S Fox Co #2	Virgin	1907
34	SWSE 12 41S12W	Pu	S Fox Co #1	Virgin	5 5-29
35	NWNW 13-41S12W	Pu	Walklin Pet Co #8	Virgin	8-17-37
36	NWNW 13-41S12W	Pu	Walklin Pet Co #7	Virgin	1-1-39
37	NWNW 13-41S12W	Pu	Walklin Pet Co #6	Virgin	12-1-39
38	NWNW 13-41S12W	Pu	Walklin Pet Co #5	Virgin	10 25 32
39	NWNW 13-41S12W	Pu	Walklin Pet Co #4	Virgin	3-19-32
40	NWNW 13-41S12W	Pu	Walklin Pet Co #3	Virgin	9-23-30
41	NWNW 13 41S12W	Pu	Walklin Pet Co #2	Virgin	8-28-30
42	NWNW 13-41S12W	Pu	Walklin Pet Co #1	Virgin	4 27-29
43	SWNW 13-41S12W	P	Champion Oil Co #1	Virgin	3-?-32
44	SWNW 13 41S12W	P	Burnham Oil Co #8	Virgin	11-?-36
45	SWNW 13 41S12W	P	Burnham Oil Co #7	Virgin	3-10-31
46	SWNW 13 41S12W	P	Burnham Oil Co #6	Virgin	10-18-30
47	SWNW 13 41S12W	P	Burnham Oil Co #0	Virgin	9-14-29
48	SWNW 13 41S12W	P	Burnham Oil Co #1	Virgin	9-30-28
49	SWNW 13-41S12W	P	B M Jones, et al #1	Virgin	7-24-37

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
3705	Moenkopi	Moenkopi		675	Abd
3658	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 601 616	641	Abd
3652	Moenkopi	Moenkopi	*Oil Moenkopi,* 628 630 1½ *bbls*	636	OSI
3675	Moenkopi	Moenkopi	*Oil Moenkopi,* 588 598, ½ *bbl*	613	OSI
3674	Moenkopi	Moenkopi	*Oil, Moenkopi,* 587-592, 2 *bbls*	600	Abd
3648	Moenkopi	Moenkopi	*Oil, Moenkopi,* 599, 604, 3 *bbls*	615	OSI
3722	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 739-49	778	Abd
3696	Moenkopi			704	Abd
3784	Moenkopi	Kaibab		1298	Abd
3757	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 728-764	765	Abd
3627	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 601 5 617 30	630	Abd
3631	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 576 591	610	Abd
3678	Moenkopi	Moenkopi	*Show oil Moenkopi,* 604-7 620	620	Abd
3664	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 540	638	Abd
3627	Moenkopi	Moenkopi	*Oil, Moenkopi,* 563-576, 35 *bbls*	576	Abd
3661	Moenkopi	Moenkopi	*Oil Moenkopi,* 600-606, 4 *bbls*	617	Abd
3653	Moenkopi	Moenkopi	*Oil Moenkopi,* 590-600, 14 *bbls*	608	Abd
3652	Moenkopi	Moenkopi	*Oil Moenkopi,* 585-589, 12 *bbls*	640	Abd
3654	Moenkopi			586	Abd
3626	Moenkopi	Moenkopi	*Oil Moenkopi,* 529-540, 1-2 *bbls*	540?	OSI
3615	Moenkopi	Moenkopi	*Oil Moenkopi,* 545 550, 10? *bbls*	560	Abd
3625	Moenkopi	Moenkopi	*Oil, Moenkopi,* 570-575, 7? *bbls*	580	Abd
3625	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 565-574	590	Abd
3615	Moenkopi	Moenkopi	*Oil Moenkopi,* 519-528, 12? *bbls*	544	Abd
3660	Moenkopi	Moenkopi	*Show oil, Moenkopi,* 586-592	630	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Geologic Formations Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
50	NENW 13-41S12W	S	Utah Parks Pet Co #11	Virgin	11-25-36	3632	Moenkopi	Moenkopi	*Oil, Moenkopi,* 600 608 15 *bbls*	608	OSI
51	NENW 13-41S12W	S	Utah Parks Pet Co #10	Virgin	12-?-35	3681	Moenkopi	Moenkopi		620	Abd
52	NENW 13-41S12W	S	Utah Parks Pet Co #9	Virgin	7-26-32	3652	Moenkopi	Moenkopi	*Oil Moenkopi,* 603 612, *bbl*	624	OSD
53	NENW 13 41S12W	S	Utah Parks Pet Co #8	Virgin	8-5-30	3676	Moenkopi	Moenkopi	*Oil Moenkopi,* 615 624	642	OSD
54	NENW 13-41S12W	S	Utah Parks Pet Co #7	Virgin	7-11-30	3640	Moenkopi	Moenkopi	*Oil Moenkopi,* 570 580	600	Abd
55	NENW 13-41S12W	S	Utah Parks Pet Co #6	Virgin	3-14-30	3636	Moenkopi	Moenkopi	*Oil Moenkopi,* 571 577	587	Abd
56	NENW 13 41S12W	S	Utah Parks Pet Co #5	Virgin	3-15-30	3635	Moenkopi	Moenkopi	*Oil Moenkopi,* 570-578	589	Abd
57	NENW 13-41S12W	S	Utah Parks Pet Co #4	Virgin	2-?-30	3638	Moenkopi	Moenkopi	*Oil, Moenkopi,* 579 589	591	Abd
58	NENW 13-41S12W	S	Utah Parks Pet Co #3	Virgin	2-14-30	3640	Moenkopi	Moenkopi	*Oil, Moenkopi,* 581-585	656	Abd
59	NENW 13-41S12W	S	Utah Parks Pet Co #2	Virgin	12-22-29	3628	Moenkopi	Moenkopi	*Oil, Moenkopi,* 566-574	574	Abd
60	NENW 13-41S12W	S	Utah Parks Pet Co #1	Virgin	11-28-28	3644	Moenkopi	Moenkopi	*Oil, Moenkopi,* 566-570	580	OSI
61	SENW 13-41S12W	P	Burnham Oil Co #5	Virgin	5-25-30	3624	Moenkopi	Moenkopi	*Oil Moenkopi,* 540-548, 6? *bbls*	562	Abd
62	SENW 13-41S12W	P	Burnham Oil Co #4	Virgin	2-1-29	3625	Moenkopi	Moenkopi	*Oil Moenkopi,* 561-566, 5? *bbls*	581	Abd
63	SENW 13-41S12W	P	Burnham Oil Co #3	Virgin	1-1 29	3655	Moenkopi	Moenkopi	*Oil, Moenkopi,* 590-594, 12? *bbls*	608	OSI
64	SENW 13-41S12W	P	Burnham Oil Co #2	Virgin	11-9-28	3625	Moenkopi	Moenkopi	*Oil, Moenkopi,* 566-568, 12? *bbls*	574	Abd
65	NWSW 13-41S12W	P	Diamond Oil Co #10	Virgin	1925?	3608	Moenkopi	Moenkopi		671	Abd
66	NWSW 13 41S12W	P	Diamond Oil Co #9	Virgin	1925?	3602	Moenkopi	Moenkopi	*Oil Moenkopi,* 550	572	Abd
67	NWSW 13-41S12W	P	Diamond Oil Co #8	Virgin	1925	3600	Moenkopi	Moenkopi	*Oil Moenkopi,* 535	550	OSI
68	NWSW 13-41S12W	P	Diamond Oil Co #7	Virgin	1925	3605	Moenkopi	Moenkopi		570	Abd
69	NWSW 13 41S12W	P	Diamond Oil Co #6	Virgin	6-21-24	3604	Moenkopi	Moenkopi	*Oil Moenkopi,* 539-545, 30? *bbls*	545	Abd
70	NWSW 13-41S12W	P	Diamond Oil Co #5	Virgin	1907	3603	Moenkopi	Moenkopi		565	Abd
71	NWSW 13-41S12W	P	Diamond Oil Co #4	Virgin	3-?-24	3602	Moenkopi	Moenkopi	*Oil Moenkopi,* 538-553, 30? *bbls*	553	Abd
72	NWSW 13 41S12W	P	Diamond Oil Co #3	Virgin	2-?-24	3601	Moenkopi	Moenkopi	*Oil Moenkopi,* 550-552, 30? *bbls*	558	OSI
73	NWSW 13-41S12W	P	Diamond Oil Co #2	Virgin	1907	3600	Moenkopi	Moenkopi		550	OSI
74	NWSW 13 41S12W	P	Diamond Oil Co #1	Virgin	1918?	3601	Moenkopi	Moenkopi	*Oil probably*	535	OSI

No	Location	Land Status	Operator and Well No	Field or Area	Comp
75	NWSW 13 41S12W	P	Diamond Oil Co #B 2	Virgin	6 18 29
76	NWSW 13 41S12W	P	Diamond Oil Co #B 1	Virgin	3 10 29
77	NWSW 13 41S12W	P	Flickinger & Echelman #2	Virgin	8 ? 32
78	NWSW 13 41S12W	P	Flickinger & Echelman #1	Virgin	8 ? 32
79	SWSW 13 41S12W	P	Utacal Oil Co #9	Virgin	1924?
80	SWSW 13 41S12W	P	Utacal Oil Co #8	Virgin	1924?
81	SWSW 13 41S12W	P	Utacal Oil Co #5	Virgin	1924?
82	NESW 13 41S12W	Pu	Crystal Oil Co #3	Virgin	12 1 27
83	NESW 13 41S12W	Pu	Crystal Oil Co #2	Virgin	7 7 27
84	SESW 13 41S12W	Pu	Crystal Oil Co #1	Virgin	9 24 25
85	SWNW 14 41S12W	Pu	Utah Parks Pet Co #3	Virgin	9 8 31
86	SWSW 14 41S12W	P	Mohawk Pet Corp #4	Virgin	3 18 29
87	SWSW 14 41S12W	P	Mohaw Pet Corp #5	Virgin	10 1 29
88	SESW 14 41S12W	P	Diamond Oil Co #2	Virgin	
89	SENE 14 41S12W	Pu	D C McKensey #1	Virgin	1909
90	SENE 14 41S12W	Pu	Utacal Oil Co #1	Virgin	7 15 32
91	NESE 14 41S12W	P	White Throne Oil Co #11	Virgin	1933
92	NESE 14 41S12W	P	White Throne Oil Co #12	Virgin	1934
93	NESE 14 41S12W	P	Baker Petroleum Co #1	Virgin	11 ? 40
94	NWSESE 14 41S12W		F D Goody McMullen #1	Virgin	
95	SESE 14 41S12W	P	Utacal Oil Co #10	Virgin	1924
96	SESE 14 41S12W	P	Utacal Oil Co #6	Virgin	1925?
9	SESE 14 41S12W	P	Utacal Oil Co #4	Virgin	1924?
98	SESE 14 41S12W	P	Utacal Oil Co #3	Virgin	1923?
99	SESE 14 41S12W	P	Utacal Oil Co #2	Virgin	1923?

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
	Moenkopi	Moenkopi	*Oil Moenkopi* 495 498	508	OSI
3600	Moenkopi	Moenkopi	*Oil Moenkopi* 513 514	594	Abd
3591	Moenkopi	Moenkopi		595	Abd
3599	Moenkopi	Moenkopi		600	Abd
3587	Moenkopi	Moenkopi			Abd
3585	Moenkopi	Moenkopi			Abd
3593	Moenkopi	Moenkopi			Abd
3801	Moenkopi	Moenkopi	*Oil Moenkopi* 699 701	756	Abd
3793	Moenkopi	Moenkopi	*Oil Moenkopi* 691 697 15 bbls	697	Abd
3850	Moenkopi	Moenkopi	*Oil Moenkopi* 705 728 2 bbls	812	Abd
3753	Moenkopi	Moenkopi	*Oil Moenkopi* 594 610	727	Abd
3700	Moenkopi	Moenkopi	*Oil Moenkopi* 513 520 5? bbls	550	OSI
3695	Moenkopi	Moenkopi	*Oil Moenkopi* 513 520	530	OSI
3670	Moenkopi	Kaibab		500?	Abd
3658	Moenkopi	Kaibab		1382	Abd
3686	Moenkopi	Moenkopi	*Show oil* 565 574	592	Abd
	Moenkopi	Moenkopi		20	Abd
	Moenkopi	Moenkopi		158	Abd
3610?	Moenkopi			1700	DSI
	Moenkopi			544	DSI
3592					Abd
3596	Moenkopi	Moenkopi	*Oil Moenkopi* 536 541	546	Abd
3605	Moenkopi	Moenkopi	*Oil Moenkopi* 534 545	545	Abd
3613	Moenkopi	Moenkopi	*Oil Moenkopi? 5? bbls*		Abd
3630	Moenkopi	Moenkopi			Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
100	SESE 14 41S 12W	P	Utacal Oil Co #1	Virgin	1923?	3604	Moenkopi	Moenkopi	Oil Moenkopi 536 546 17 bbl	579	Abd
101	SWNE 15 41S 12W	Pu	R E Parsons #C	Virgin	1922	3728	Moenkopi	Moenkopi		300	Abd
102	Center 15 41S 12W	Pu	R E Parsons #D	Virgin	1907		Moenkopi	Moenkopi			Abd
103	SWSE 15 41S 12W	Pu	G S McMullen #E	Virgin	10 26 26	3659	Moenkopi	Moenkopi	Shows oil	584	Abd
104	NWSW 18 41S 12W	Pu	W W Toney #3	Virgin	1935	3666	Moenkopi	Moenkopi		61	Abd
105	NWSW 18 41S 12W	Pu	W W Toney #2	Virgin	10 ? 35	3733	Moenkopi	Moenkopi		80	Abd
106	SESW 18 41S 12W	Pu	W W Toney #1	Virgin	5 ? 36	3702	Moenkopi	Kaibab		360	Abd
107	SENE 20 41S 12W	Pu	Smith #1	Virgin	1921	3754	Moenkopi	Moenkopi		240	Abd
108	SENW 21 41S 12W	Pu	W W Toney #5	Virgin	7 2 38	3600	Moenkopi	Kaibab	Show oil 170 172	240	Abd
109	SWNE 21 41S 12W	Pu	W W Toney #4	Virgin	7 7 36	3605	Moenkopi	Kaibab		308	Abd
110	NWSW 22 41S 12W	Pu	Al Gray #G	Virgin	1922	3606	Moenkopi	Moenkopi		518	Abd
111	NWSW 22 41S 12W	Pu	Southern Utah #F	Virgin	1907	3606	Moenkopi	Moenkopi		170	Abd
112	SENE 22 41S 12W	Pu	H D Kuphal #2	Virgin	1921	3631	Moenkopi	Moenkopi		440	Abd
113	SWSE 22 41S 12W	P	Ben H Bullock #1	Virgin	3 25 38	3540	Moenkopi	Moenkopi	Show oil	185	DSI
114	NESE 22 41S 12W	Pu	Frank Boneau #1	Virgin	1907	3543	Moenkopi	Moenkopi		300	Abd
115	NWNW 23 41S 12W	P	Mohaw Pet Corp #1	Virgin	1907	3667	Moenkopi	Moenkopi	Oil Moenkopi	525	Abd
116	NWNW 23 41S 12W	P	Mohaw Pet Corp #6	Virgin	1930	3667	Moenkopi	Moenkopi	Oil Moenkopi 447-63, 533-38	650	OSI
117	NENW 23 41S 12W	P	Mohawk Pet Corp #3	Virgin	1 1 29	3663	Moenkopi	Moenkopi	Oil Moenkopi 518-521	576	OSI
118	NWSW 23 41S 12W	Pu	Howard Smith #4	Virgin	7 27 29	3656	Moenkopi	Moenkopi		460	Abd
119	SWSW 23 41S 12W	P	Lloyd James #1	Virgin	1907	3505	Moenkopi	Moenkopi		225	Abd
120	NESW 23 41S 12W	Pu	Utah Parks Pet Co #5	Virgin	4 4 37	3526	Moenkopi	Kaibab		360	Abd
121	NESW 23 41S 12W	Pu	F D Dunn #3	Virgin	4 27 28	3605	Moenkopi	Moenkopi		558	Abd
122	SESW 23 41S 12W	P	Zion Oil & Ref Corp #1	Virgin	1926	3541	Moenkopi	Moenkopi		395	Abd
123	NWNE 23 41S 12W	Pu	Virgin Pet Corp #2	Virgin	5 1 29	3628	Moenkopi	Supai		2195	Abd
124	NWNE 23 41S 12W	Pu	Virgin Pet Corp #1	Virgin	8 1 26	3628	Moenkopi	Kaibab		1414	Abd
125	NENE 23 41S 12W	P	Utacal Oil Co #7	Virgin	1925?	3568	Moenkopi	Moenkopi			Abd
126	SWSE 23 41S 12W	P	Townsen and Larsen #1	Virgin	6 12-41		Moenkopi	Kaibab		306	Abd
127	NWNW 24 41S 12W	Pu	Miller Hickey & Lambert #0	Virgin	1907	3583	Moenkopi	Moenkopi		527	Abd
128	SENE 25 41S 12W	Pu	Alta Devilspeak Mng Co #1	Virgin	6 29 25	3534	Moenkopi	Moenkopi		165	Abd
129	SWSW 26 41S 12W	Pu	E D Dunn #1	Virgin	1907		Moenkopi	Kaibab		1380	Abd
130	SENW 27 41S 12W	Pu	C E Cline #2	Virgin	7 31 28		Moenkopi	Moenkopi		240	Abd
131	NWNE 32 41S 12W	P	C W Townsen et al #1	Virgin	5 22 41		Moenkopi	Kaibab		64	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp	Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
132	SENW 6 41S11W	Pu	Diamond Oil Co #2	Virgin	1-26 35	3897	Moenkopi	Kaibab		1225	Abd
133	SENW 6 41S11W	Pu	Virgin River Oil & Dev Co #0	Virgin	1907		Moenkopi	Moenkopi	*Oil?*	914	Abd
134	NESW 18 41S11W	Pu	J P Thomas #1	Virgin	9-7-29	3800	Moenkopi	Moenkopi		1227	Abd
135	NENW 19 41S11W	Pu	J P Thomas #0	Virgin	7 19-29		Moenkopi	Moenkopi		82	Abd
136	SWSW 30-41S11W	Pu	W C Dunn #1	Virgin	2-1-27	3550	Moenkopi	Kaibab		560	Abd
137	SENE 31 41S11W	P	A A Slaback #1	Grafton	12 ?-30		Moenkopi	Moenkopi		20	Abd
138	SENE 31-41S11W	P	Polly Ann Devel Co #1	Grafton	10 ?-32		Moenkopi			531	Abd
139	SENE 31 41S11W	P	Arneal and Muir #1	Grafton	10-19-31	3100	Moenkopi	Moenkopi		45	Abd
140	SWNE 34-41S11W	Pu	Grafton Oil Co #1	Grafton	1907		Moenkopi	Kaibab		1010	Abd
141	SWSE 34-41S11W	Pu	Royal Oil Devel Co #1	Grafton	10 17 29		Moenkopi	Kaibab		907	Abd
142	NWNW 16-42S14W	P	Harry T Cypher Co #1	Harrisburg Dome	8-?-41	3000	Kaibab	Redwall		3508	DSI
143	24 42S13W	P	Glen Colusa Oil Co #1	Gould Ranch	1909		Moenkopi	Supai		1715?	Abd
144	NWNW 3 42S12W	Pu	J S Standlee #1	Virgin	1-21-24		Moenkopi	Moenkopi	***Show oil, Moenkopi, 543-555***	571	Abd
145	NWSE 2-42S11W	P	C M Schroth & Assoc #1	Rockville	7-11 33		Moenkopi	Moenkopi		1040	Abd
146	NESW 3 42S11W	Pu	Swartsbaugh & McMillian #1	Grafton	6-8 31		Moenkopi	Moenkopi		793	Abd
147	NWSE 3 42S11W	P	Swartsbaugh #1	Grafton	1933		Moenkopi	Moenkopi		100	Abd
148	NWNW 5-42S11W	Pu	E R White #2	Grafton	9 ? 26		Moenkopi	Moenkopi		400	Abd
149	NWNW 5 42S11W	Pu	E R White #3	Grafton	10 ?-26		Moenkopi	Moenkopi		810	Abd
150	NWNE 6 42S11W	Pu	E R White #1	Grafton	8-22-25		Moenkopi	Moenkopi		109	Abd
151	SESE 6 42S11W	Pu	C H Mangels #4	Grafton	9 18-31	3650	Moenkopi	Moenkopi		780	Abd
152	SWNE 1 43S15W	Pu	Arrowhead Pet Corp #1	Punchbowl	12-2-32	2780?	Moenkopi	Kaibab	(*Crooked hole*)	1185	Abd
153	SWNE 1 43S15W	Pu	Arrowhead Pet Corp #1 A	Punchbowl	9 ?-39	2780	Moenkopi	Permian	***Base at Kaibab 1260; show oil*** 2190	2590	Abd
154	SENW 17 43S15W	Pu	Mid American Oil Co #1	Bloomington	6-? 31	2950	Kaibab	Supai		2532	Abd
155	SWSE 17 43S15W	Pu	Utah Parks Pet Co #2	Bloomington			Kaibab	Kaibab		50	Abd
156	SWSE 17 43S15W	Pu	Usona Oil Co #1	Bloomington	3-15-27		Kaibab	Kaibab		382	Abd
157	NENW 19 43S15W	Pu	Usona Oil Co #1	Bloomington	8 1 27	2740	Kaibab	Kaibab		265	Abd
158	NWNE 19 43S15W	Pu	Escalante Explor, Inc #2	Bloomington	6 30 35	2800	Kaibab	Callville		4114	Abd
159	NWNE 19 43S15W	Pu	Usona Oil Co #1 A	Virgin	2 28 28		Kaibab	Kaibab		43	Abd

No	Location	Land Status	Operator and Well No	Field or Area	Comp
160	NE 32 43S15W	S	Escalante Explor, Inc #1	White Dome	3 6 35
161	SESW 19 43S14W	Pu	St George Oil Co #1	Beehive	6 13 29
162	NENW 30 43S14W	Pu	St George Oil Co #1	Beehive	10 ? 29
WAYNE COUNTY					
1	SWSW 4 27S 12E	Pu	Mt Vernon Oil Co #1	Flat Tops	1913
2	NE 9 27S 12E		Mt Vernon Oil Co	Flat Tops	1913
3	CNW 5 27S14E	Pu	Texas Production Co #1	Sweetwater Dome	7 3 28
4	CNE 16 27S16E	Pu	Phillips Petroleum Co #1	Barrier Ck	8 3 29
5	NENE 29 28S8E	Pu	Ohio Oil Co #1	Caineville	5 17-22
6	SESW 34 29S16E	Pu	Texas Production Co #1	French Seep	4 4 24
7	NWNWNE 17 30S6E		Pac Western Oil Corp #1	Teasdale	1948

Elev	Geologic Formations Surface	Bottom	Remarks Concerning Producing Horizons or Shows	Total Depth	Status
	Moenkopi	Kaibab		969	Abd
2800	Moenkopi	Moenkopi		93	Abd
2800	Moenkopi	Kaibab		970	Abd
5500	Entrada	Coconino	*Showing of oil 2175 2530 2655 below the surface (probably in Shinarump Moenkopi)*	2950	Abd
	Navajo		*Oil shows at 2175 2530 and 2655*	2715	P&A
5500	Entrada	Coconino	*Oil show Shinarump 2195 water well 650 ft oil show Moenkopi 2730*	2875	Abd
5600	Navajo	Miss ?	*No oil or gas showings logged*	5191	Abd
	Entrada	Coconino	*No oil or gas showings logged*	3650	Abd
6750 ?	Navajo	Coconino		2200	Abd
5589	Moenkopi			3330	Drg

Other Publications available through

UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

Mines Building University of Utah
Salt Lake City Utah

★

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BULLETIN 36—Directory of **Utah Mineral Resources and Consumers Guide** by Alfred M Buranek and C F Needham

For the convenience of those needing the Directory we have prepared and conveniently folded in a pocket inside the back cover a Mineral Resource Map of Utah All important producers and consumers of Utah minerals metals and non metallics are classified and listed in the bulletin under each respective product Price $1 00

SYMPOSIUM VOLUME—**The Oil and Gas Possibilities of Utah** Compiled by Dr George H Hansen and Mendell M Bell Bound volume sold out Ask for prices on reprinted separates

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This bulletin covers the geography topography and geology of Eastern Iron County as well as much historical data of interest Because of its importance to Cedar Breaks and the National Parks of Southern Utah this publication is much in demand by the tourists of this area Price $1 50

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A stratigraphic section of interest to geologists concerned with the petroleum possibilities of the Great Basin Price $1 00

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REPRINTS AND CIRCULARS OF THE SURVEY available Free Upon Request

Cir 35—**A Reconnaissance of the Geology and Mineral Deposits of the Lake Mountains Utah County Utah** by Arthur L Crawford and Alfred M Buranek

Cir 36—**Flourite in Utah** by Alfred M Buranek

Cir 37—**Metal Mining in Utah (1935 to 1950)** by Dr C E Needham and Alfred M Buranek

Reprint—Article by Arthur L Crawford published in Chemical and Engineering News (Vol 27 pp 3017 3019 1949) on Utah Raw Materials of Interest to the Chemical Engineer

Tab 14

UTAH!

100 YEARS OF EXPLORATION

and still the place to find oil and gas

Contact Information

For information about oil and gas programs, geophysical well logs, publications, geological samples, regulations and permitting, production, and leasing of state lands, contact the following:

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Cover Photos: *Top – Cane Creek anticline exposing the Permian Cutler and Pennsylvanian Honaker Trail Formations; view east from Dead Horse Point State Park. Middle – Midwest Exploration and Utah Southern No. 1 Shafer wildcat well drilled in 1924 targeting the Pennsylvanian Cane Creek shale of the Paradox Formation on the Cane Creek anticline; view southwest down the Colorado River. The well blew out and was abandoned. Used by permission, Utah State Historical Society, all rights reserved.*

Message from the Governor

Utah is enjoying a period of exciting economic expansion and energy is a critical component to both maintaining and enhancing our growth opportunities. We are endowed with abundant natural resources that place Utah in a unique position to meet the energy needs of our Nation. Through the application of innovation and technology, we are poised to be a leader in America's sustainable energy future, fostering even greater economic vitality within our state and our country.

Jon M. Huntsman, Jr.

Utah's resources are not only abundant but diverse. Presently, more than 95% of the electricity produced in our state is coal-fired, largely fueled from local coal deposits. Our oil and gas production has ranked among the top 10-15 states in the nation for the past 40 years, with natural gas production rising spectacularly during the 1990s as coal bed methane gas has supplemented our conventional sources of production. Utah's rich oil shale and tar sands reserves are attracting the global attention of investors, innovators, and the general public. Moreover, Utah is attracting renewable resource development as investors seek to tap the benefits of the states' wind potential.

In addition to being energy-rich, Utah has managed to balance the preservation of its outstanding natural environment and quality of life. Our challenge will be to maintain this balance between promoting new resource developments and minimizing the environmental impacts. New technologies enable us to tap natural resources with reduced impact to the environment. For continued economic growth it is essential that we pursue both sustainable and efficient new energy developments, as well as conservation and prudent use of our energy supplies.

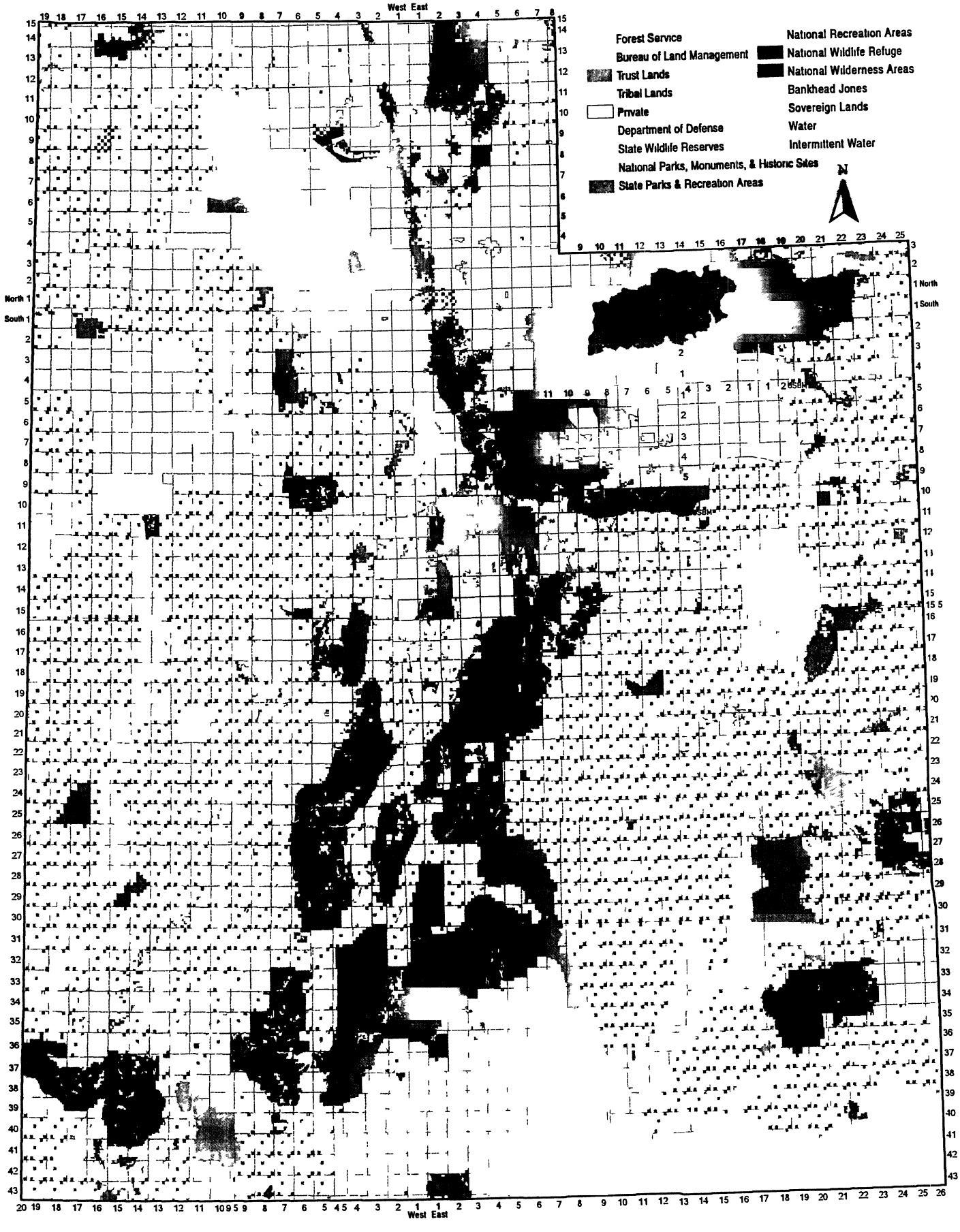
As Governor of this great state, I encourage exploration and development companies to consider including Utah in their portfolios. In addition to opportunities for applying new technologies to more efficiently extract oil from our known fields, Utah has many unexplored areas and the geological potential for concealed targets that contain oil and gas. There is also potential for significant expansion of our coalbed methane resources and development of our vast oil shale and tar sands reserves.

Several state agencies such as the Utah Geological Survey, the Division of Oil, Gas and Mining, the School and Institutional Trust Lands Administration and the Office of the Governor are ready to help with your queries regarding exploration and development opportunities. We have a supportive regulatory environment and a streamlined well-permitting process. I hope this brochure encourages you to invest in Utah's energy development during the coming years.

Welcome to Utah!

Governor

Map of Land Ownership



SITLA: Leasing Environment

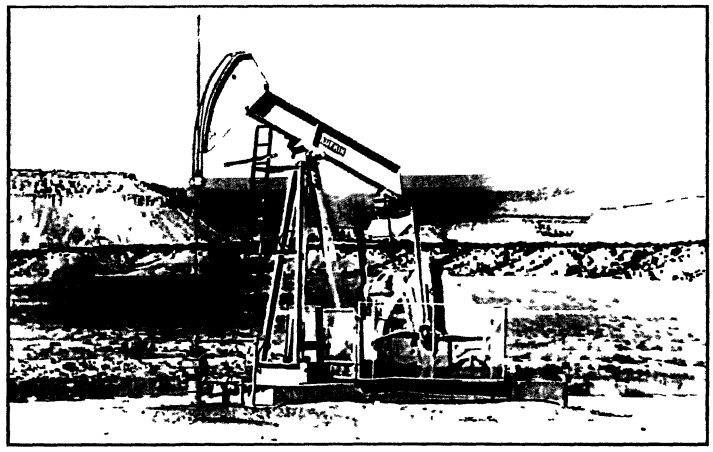
What is SITLA?

SITLA (School and Institutional Trust Lands Administration) is an independent state agency that manages 3.4 million acres of surface and 4.5 million acres of Utah mineral trust lands exclusively for the benefit of Utah's schools and other public institutions.

Out of the total oil and gas rights available on state trust land, there are currently about 1.5 million acres leased for oil and gas exploration and development. This means that there are approximately 3 million acres of trust land yet to be leased and evaluated for oil and gas potential.

Advantages of leasing from the Trust Lands Administration

- Fast and easy to commit lands to a lease or other business arrangement.
- Sealed-bid oil and gas lease offerings – January, April, July and October
  Contact us to have your name placed on the bid mailing list, or visit our Internet site at www.trustlands.com and follow these links: Homepage>Minerals>Current Competitive Leasing, then select the offering or results of your choice.
- Over-the-counter leasing is available for some parcels. These parcels are leased on a first-come, first-serve basis, after being offered competitively.
  Contact us or visit our Internet site at www.trustlands.com and follow these links: Homepage>Minerals>Over-the-Counter Leasing, to view current offerings.



Pump jack – Ferron field

- Not ONLY leasing options, but flexible business arrangement terms are also available for some parcels, such as
  - Exploration and development agreements
  - Drill to earn and farmouts
  - Seismic options
  - Other business arrangements

  Contact us for more information on these options.
- Timely state permitting process through the Division of Oil, Gas and Mining.

Give us a call, and let's consider the possibilities.

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You can download the ownership map on the preceding page or select other Utah maps from SITLA's Web site at www.trustlands.com. Follow these links: Homepage>Maps & GIS, then select a category from the left-hand navigation bar.

OGM: Utah's Regulatory Environment

The Oil and Gas Regulatory Program within the Division of Oil, Gas and Mining (OGM) regulates exploration for, and development of, oil and gas resources in Utah.

The Oil and Gas Regulatory Program incorporates important conservation principles derived from the historical exploitation of petroleum resources in the United States. It is our obligation to promote the wise development of oil and gas, preventing waste and maximizing ultimate recovery, while protecting the environment so that the public might realize the greatest possible good from these natural resources.

It is also our duty to protect correlative rights of all owners of oil and gas resources, controlling the proper participation and sharing of the various owners within an oil and gas pool.

OGM issues permits for all wells whether they are on private land, SITLA lands or the vast expanse of Federal (Bureau of Land Management, Tribal, or Forest Service) lands in Utah.

Through roughly 50 years of existence, the oil and gas conservation program has evolved into a user-friendly system for effective regulation of the state's oil and gas industry.

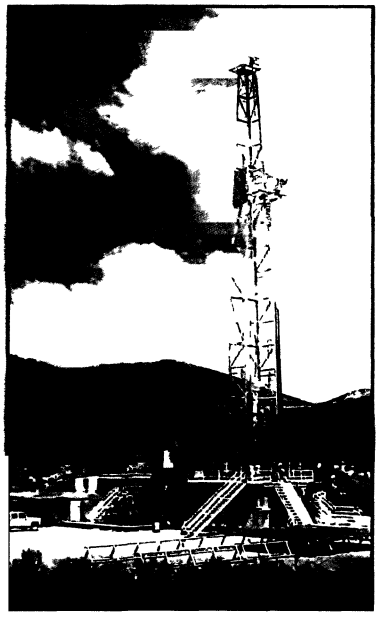
Elk Petroleum "Nielsen 3-22," True rig 24, Pelican Lake in the background

- **Permits** - The Division provides timely processing and approval of various permits involving drilling, workover and recompletion operations, underground injection, well plugging, and waste management.
- **Monitoring** - An experienced field staff monitors operations with regular inspections, enforcement, and database tracking of field operations.
- **Record Keeping and Public Information** - Basic well data, well histories, injection data, production reporting, operator statuses, and bonding are electronically stored and easily retrieved in our public information room or on our Web site.
- **Reporting Compliance** - An audit staff conducts reviews of industry compliance reports to ensure accurate and timely documentation.
- **Other Services** - Technicians provide expertise relating to tax credit qualification, royalty payment disputes, mapping, and abandoned well plugging.

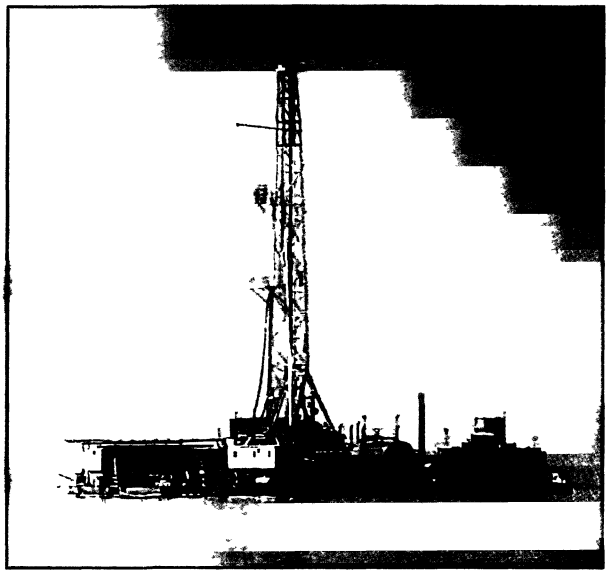
Providing technically current, timely, and quality regulatory services –
The Utah Division of Oil, Gas and Mining.

Exploration History

Utah's oil and gas exploration history extends back over 100 years. In 1891, natural gas was accidentally discovered at a depth of 1,000 feet in Farmington Bay on the eastern shore of Great Salt Lake during the drilling of a water well. Between 1895 and 1896, gas from several wells near this location was transported to Salt Lake City in a wooden pipe, marking Utah's first use of local oil or gas. The first oil shows were encountered in wells drilled during the early 1900s at Rozel Point (northern Great Salt Lake), Mexican Hat (near Monument Valley, southeastern Utah), and near the town of Virgin (near Zion National Park). Although oil shows were also found at several other eastern Utah locations in later decades, it was not until 1948 that Utah's first large-scale commercial oil well, Ashley Valley No. 1, was drilled near Vernal. By 1960, Utah was the 10th largest oil-producing state in the country, and it has remained in the top 15 since then. Today there are over 6,000 producing oil and gas wells.

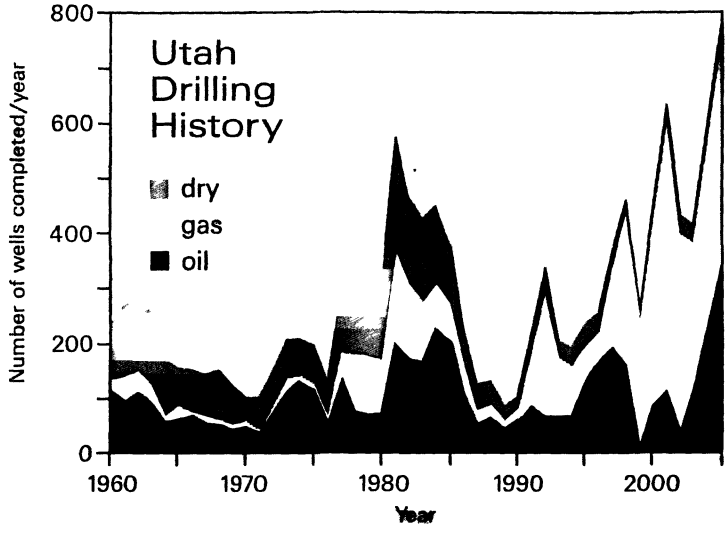


First thrust belt discovery, Pineview field, Summit County, in 1975

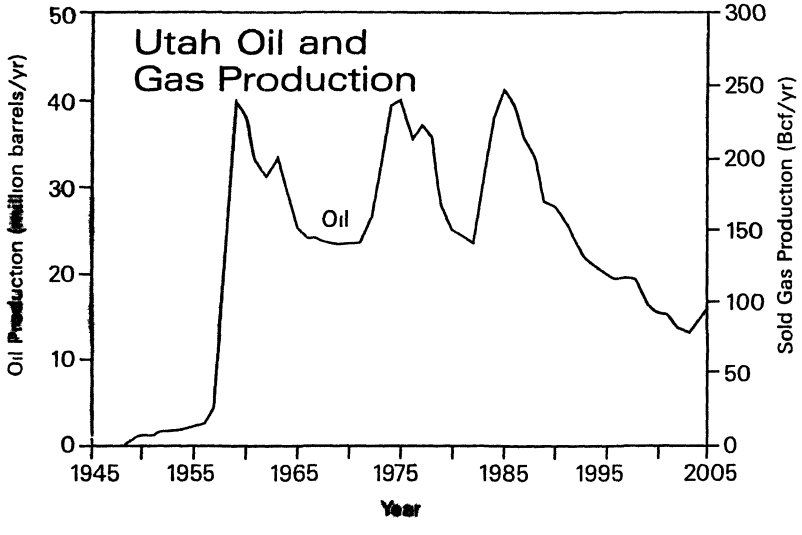


Exploring beneath Great Salt Lake in 1978

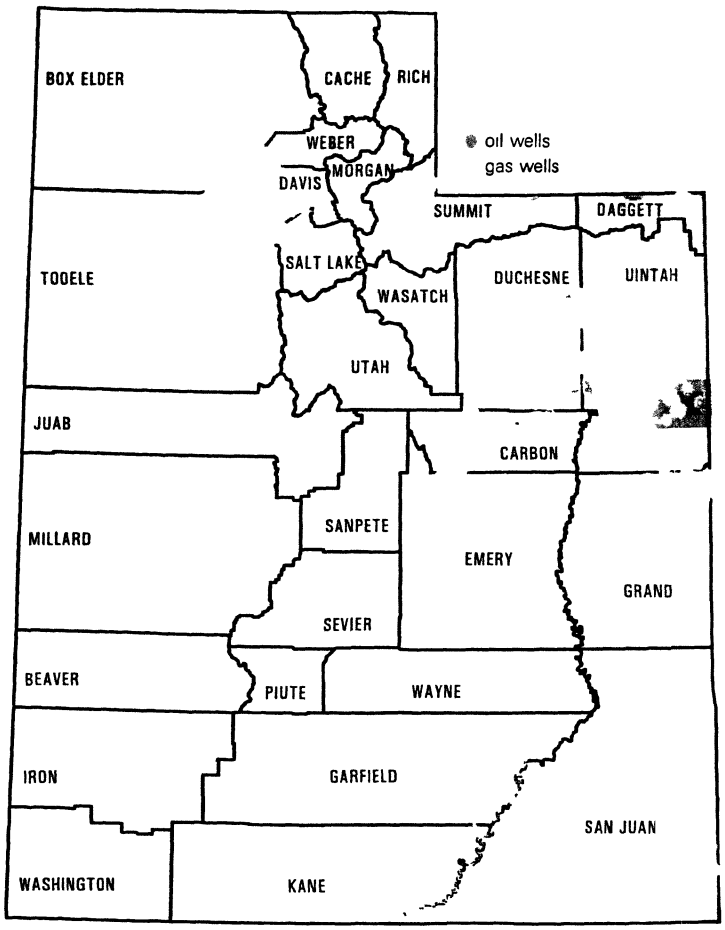
Utah's drilling history has fluctuated greatly due to discoveries, oil and gas price trends, and changing exploration targets. During the boom period of the early 1980s, activity peaked at over 500 wells per year. After slowing in the 1990s, drilling activity has again increased, reaching an all-time peak of 882 wells spudded in 2005. This increase in activity has been spurred by high prices for both oil and natural gas, and perceptions that Utah is highly prospective and under-explored. In recent years, the proportion of new wells exploring for gas has increased greatly. The success rate of exploration drilling for both oil and gas has also improved, with very few dry holes being reported compared to the 1980s drilling boom. Sustained high prices are likely to entice less risk-averse exploration investment (more wildcats), resulting in new discoveries.



Utah oil fields have produced a total of 1.3 billion barrels (bbl). Although annual production decreased from a peak of 41 million bbl in 1985 to 13 million bbl in 2003, the trend has reversed and 2005 production reached 16 million bbl. A component of this turn-around has been the discovery of Covenant field in a new play known as the "Hingeline" or central Utah thrust belt. This new oil play is the focus of renewed exploration activity, and additional increases in production are expected. Despite over 40 years of production at rates that have varied by a factor of three, proven oil reserves during this time have remained between 200 and 250 million bbl, indicating significant oil remains to be produced. Higher oil prices, horizontal drilling technology, more elaborate completion techniques, and secondary and tertiary recovery techniques should collectively result in a continued boost in production rates and ultimate recovery from both known fields and new discoveries. There is also resurgence in interest in Utah's substantial oil shale and tar sand resources, which received brief attention during the 1970s oil supply crisis.



Total natural gas production from Utah fields now exceeds 8 trillion cubic feet (Tcf), with sold production close to 6 Tcf. The difference in these two volumes is mainly due to reinjection of produced gas and nitrogen at Anschutz Ranch East field as part of a pressure maintenance program to prevent retrograde condensate loss. Total proven reserves of gas are close to 4 Tcf, and annual sold production is close to 0.3 Tcf. Recent successful drilling has been expanding reserves by about 10% per year, one of the highest rates of gas reserve increase in the country. Although gas production from some fields declined during the late 1990s, two factors caused overall gas production to increase. The development of coalbed methane accumulations in the Ferron play, in particular Drunkards Wash field, has added between 20 and 30% to the total annual gas production. Also, deeper exploration drilling in the eastern and southern Uinta Basin during the past five years has led to discoveries of substantial gas accumulations in Mesaverde, Entrada, and Wingate reservoirs. Significant potential exists for other coal fields around the Uinta Basin to yield coalbed methane, and the extent of deeper conventional and tight gas plays remains to be explored.



Producing oil and gas wells

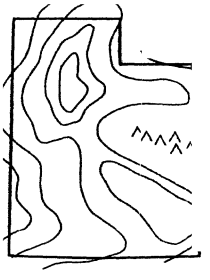
Virgin oil field - Utah's first oil production (only minor production realized)

General Geologic Setting

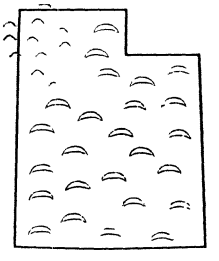
The ages of the rocks exposed in Utah include every geologic eon, era, period, and epoch. Many of these rocks have the qualities necessary to create the oil and gas reservoirs, sources, and seals that make Utah a petroleum-producing state with large, relatively unexplored areas of hydrocarbon potential. Because of Utah's world-class rock exposures, every producing formation and type of trap in the state can be examined in outcrop analogs. Many of these serve as outcrop analogs for oil and gas fields outside of Utah as well as providing a natural laboratory for study.

A combination of depositional and structural events created the major petroleum-producing provinces in Utah: Paradox Basin, Ferron coalbed methane fairway, thrust belt, Uncompahgre uplift, and Uinta Basin.

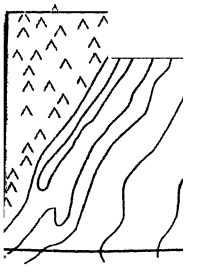
During the Pennsylvanian, the Paradox Basin developed in southeastern Utah where cyclic organic-rich shales, carbonates, and evaporites accumulated under restricted marine conditions in the rapidly subsiding basin. The Paradox Basin contains Utah's largest oil field, Greater Aneth. Renewed movement on deep, older basement faults in the basin formed structures productive in Mississippian-age carbonates.



Permian - Pennsylvanian
(240 - 330 mya)



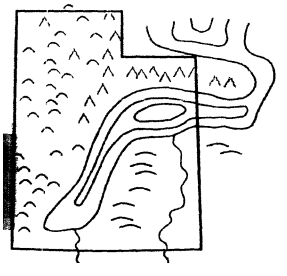
Early Jurassic
(187 - 205 mya)



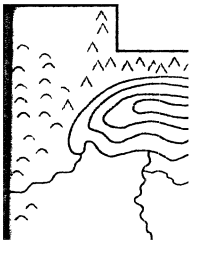
Cretaceous
(66 - 138 mya)

In Early Jurassic time, Utah had an arid climate and lay 15 degrees north of the equator. It was then that the most prolific reservoir in the thrust belt, the Nugget/Navajo Sandstone, was deposited in an extensive dune field comparable to the present Sahara. Correlative rocks form many of the spectacular canyons in the parks of southern Utah.

During the Cretaceous, compressional forces of the Sevier orogeny produced highlands in western Utah and the Western Interior Seaway covered most of eastern Utah. Extensive coal-forming swamps and marshes near the coastline (Emery, Book Cliffs, and Sego coal fields) and fluvial and wave-dominated deltas migrated eastward



Paleocene
(55 - 66 mya)

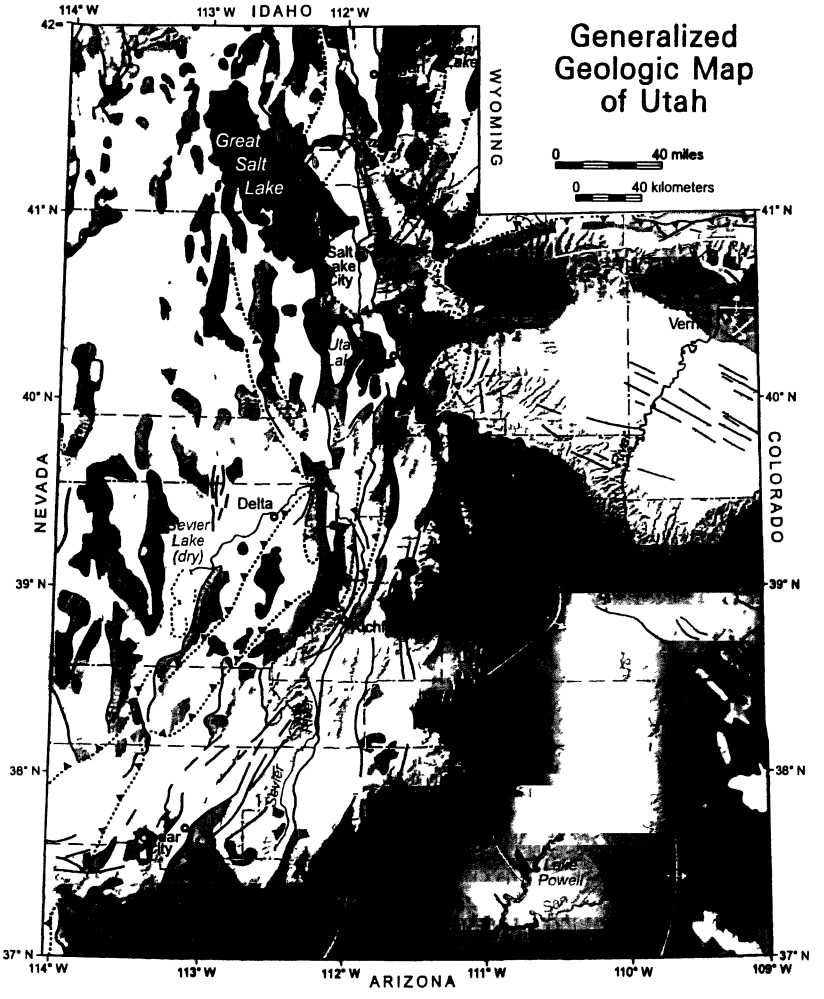


Eocene
(38 - 55 mya)

across the state as the sea eventually retreated. The resulting deposits are now the targets for gas production aggressively being pursued in eastern Utah and in the Ferron coalbed methane (CBM) fairway of central Utah. The Sevier orogeny continued into the Paleocene producing the "thin-skinned" folds and faults of the thrust belt that have been such prolific producers in northern Utah. Concealed, deep exploration targets beneath the Sevier thrusts offer frontier drilling opportunities in the poorly explored western half of Utah.

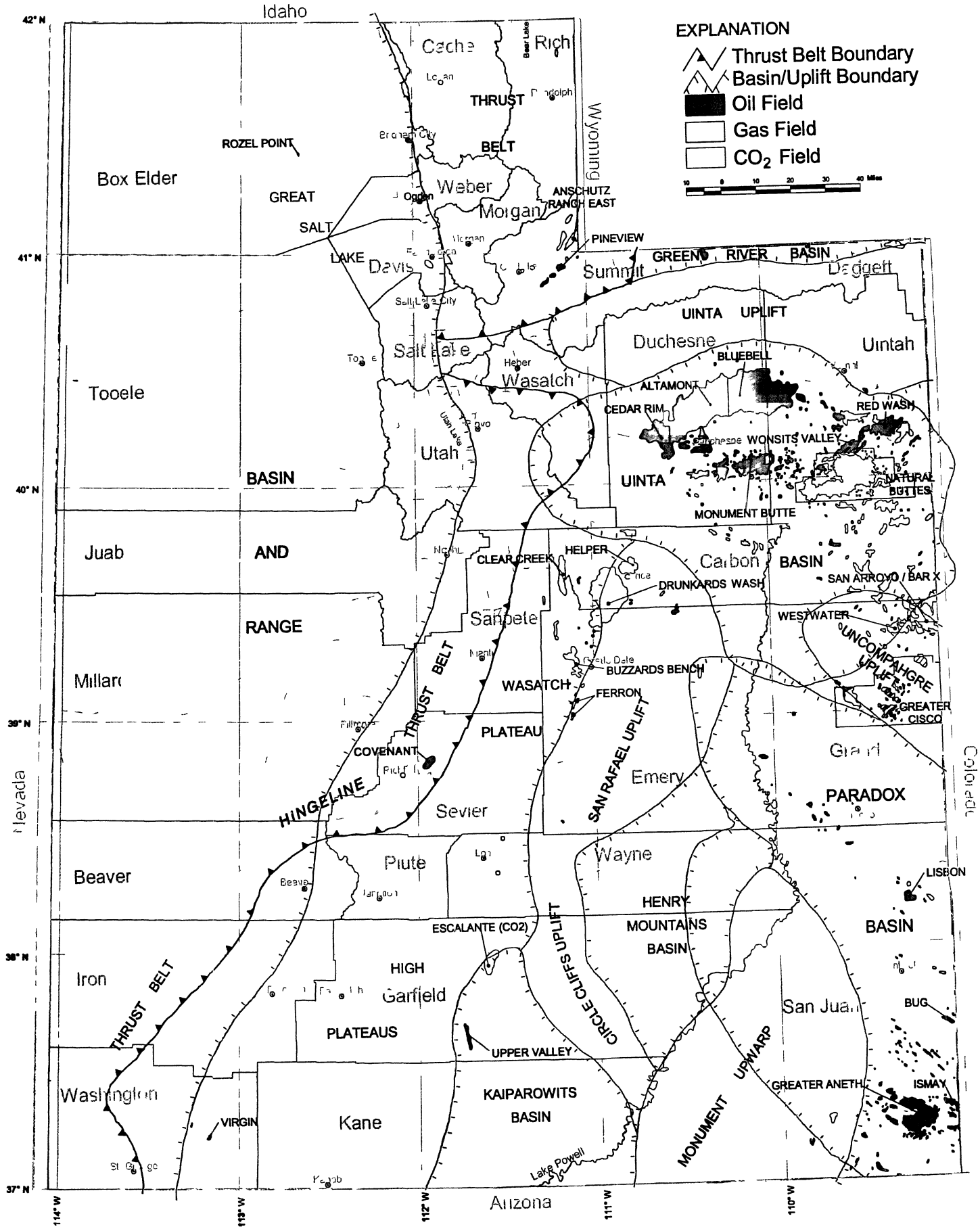
The Laramide orogeny, between latest Cretaceous and Eocene time, produced numerous basins and basement-cored uplifts in the Rocky Mountain states. In Utah, the Uinta Basin and Uncompahgre uplift are the major petroleum contributors. The northwest-trending Uncompahgre uplift represents a reactivation of ancient highlands of the Pennsylvanian-Permian Ancestral Rockies. Numerous subsidiary structures formed along the uplift and produce mainly gas. During the Paleocene and Eocene, lakes Flagstaff and Uinta formed in the Uinta Basin where over 11,000 feet of alluvial, marginal lacustrine (fluvial, deltaic, beach, etc.), and open lacustrine sediments accumulated in an intertonguing relationship. The eastern Uinta Basin is Utah's most prolific producer of non-associated (dry) gas; recent waterflood projects have been very successful in increasing oil production in the southern part of the basin.

The principal source rocks for these provinces were deposited during the Pennsylvanian, Permian, Cretaceous, and Tertiary as marine and lacustrine shale, and coal. The reservoir rocks were deposited in a variety of environments including deltas, shallow-shelf marine, eolian dunes, coastal-plain, and river-flood plain settings.



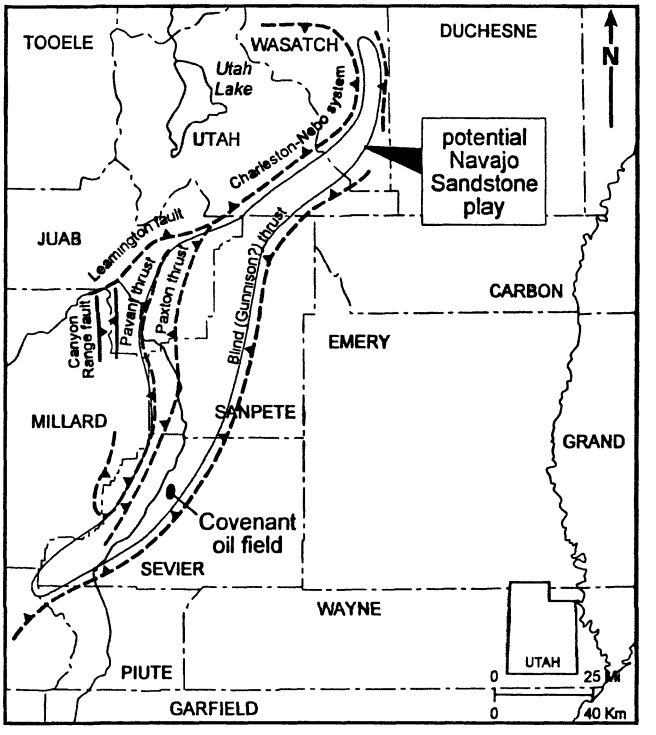
Public Information Series 81 by Grant Willis

Utah's Oil and Gas Fields



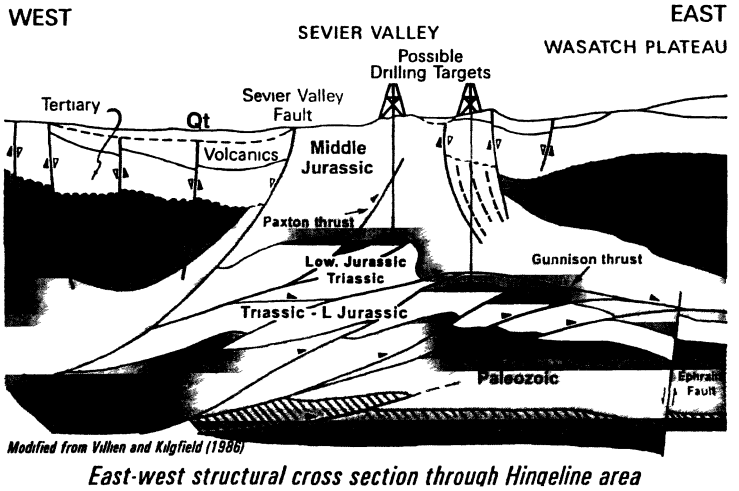
Hingeline

- Major reservoirs: Jurassic Navajo Sandstone, eolian dune sandstone.
- Trapping mechanisms: anticlines in the hanging walls of detached (not involving basement rocks) thrust systems created by thrust imbricates, or imbricate fans above, and antiformal stacks of horses forming duplexes below the major thrusts.
- Source rocks: organic-rich marine shale within the Mississippian Manning Canyon Shale, Delle Phosphatic Member of the Deseret Limestone, Doughnut Formation, or Chainman Shale; possibly Permian Park City/Phosphoria Formation.
- First commercial discovery: Covenant field, 2004.
- Number of active fields/wells: one field/seven wells.
- Average monthly production: 133,000 bbl of oil.
- Cumulative Production: 781,000 bbl of oil.
- Types of enhanced oil recovery projects: possible future carbon dioxide/nitrogen injection.
- Major pipelines: Questar Pipeline Co. (18", 24" gas), Questar Gas Co. (8" and 10" gas), Kern River Gas Transmission Co. (36" gas).
- Land ownership: 47% Private, 25% National Forest, 17% BLM, 11% School and Institutional Trust Lands Administration.
- Outcrop analogs in Utah: San Rafael Swell, Pavant Range, southern Wasatch Range, and throughout the Colorado Plateau of southern Utah.
- Utah Geological Survey contact: Thomas C. Chidsey, Jr., ph.: (801) 537-3364; e-mail: tomchidsey@utah.gov



Hingeline oil play area, central Utah (Covenant field shown in green)

Eolian dune sandstone, Jurassic Navajo Sandstone, southern Wasatch Range



East-west structural cross section through Hingeline area

Uinta Basin

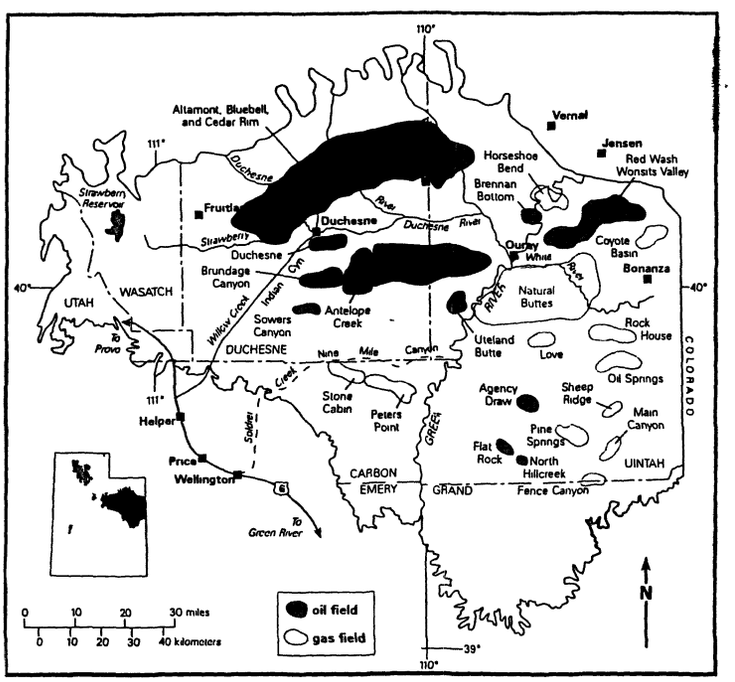
- Major reservoirs: Eocene Uinta, Green River, and Colton Formations, lacustrine to alluvial channel and bar sandstone; Cretaceous Mesaverde Group, fluvial and littoral sandstone; Jurassic Entrada and Wingate eolian sandstone; Permian Park City Formation, shallow marine limestone and dolomite; and Pennsylvanian Weber Sandstone, coastal eolian and littoral sandstone.

- Trapping mechanisms: anticlinal at Ashley and Peters Point fields, stratigraphic conventional and basin centered.

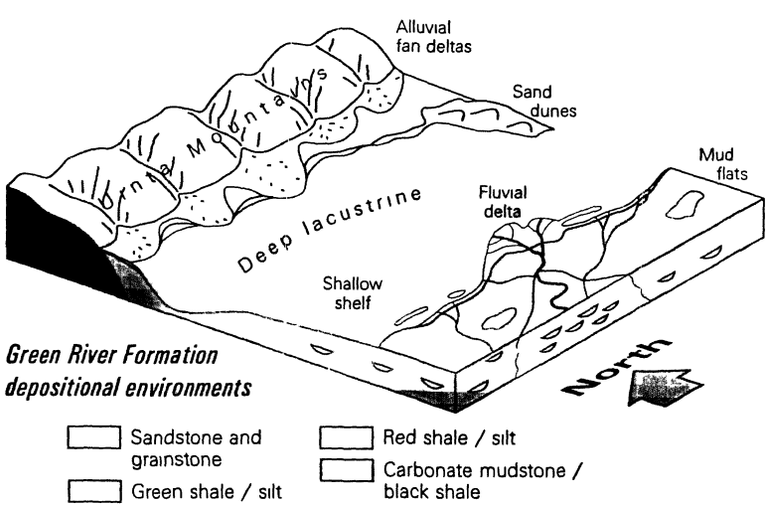
- Source rocks: Cretaceous coals and shale, Eocene lacustrine shale.

- First commercial discovery: gas at the Ashley Valley field, 1925, and oil at Roosevelt field, 1949.

Red Wash field, Uintah County



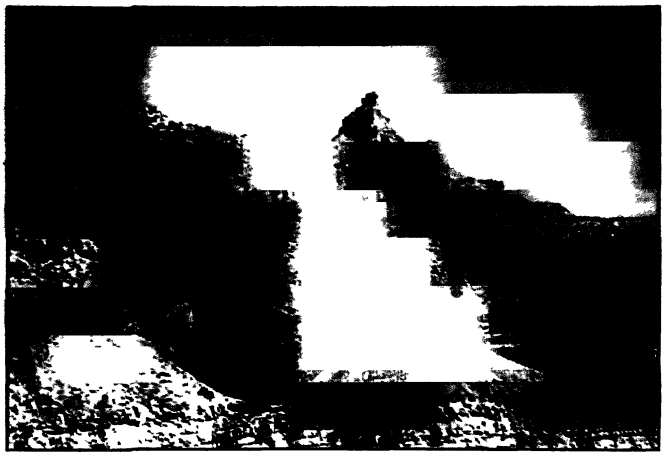
Uinta Basin fields



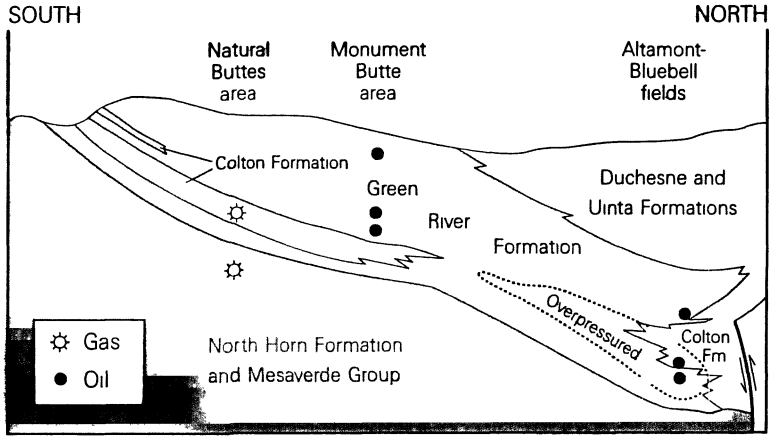
Green River Formation depositional environments

Sandstone and grainstone
Green shale / silt
Red shale / silt
Carbonate mudstone / black shale

- Number of active fields/wells: 51 fields/ 5,279 wells.
- Recent monthly production: 926,869 bbl of oil, 16 billion cubic feet (Bcf) of gas.
- Cumulative production: 528 million bbl of oil, 2.6 Tcf of gas.
- Types of enhanced oil recovery projects: waterflood in the Green River Formation.
- Major pipelines: Chevron Pipeline Co. (10" oil [2 lines]), Colorado Interstate Gas Co. (20" gas), Enterprise Products Partners (10" and 16" products), Questar Pipeline Co. (16" and 20" gas) Williams Gas Pipeline - Northwest (26" gas).
- Land ownership: 80% BLM, 7% National Forest, 6% Native American, 5% Private, 1% SITLA.
- Outcrop analogs in Utah: Book, Roan, and Badlands Cliffs, and Raven Ridge.
- Utah Geological Survey contact: Craig D. Morgan, ph.: (801) 537-3370; e-mail: craigmorgan@utah.gov



Cretaceous Mesaverde Group in the Book Cliffs north of Floy, Grand County, Utah

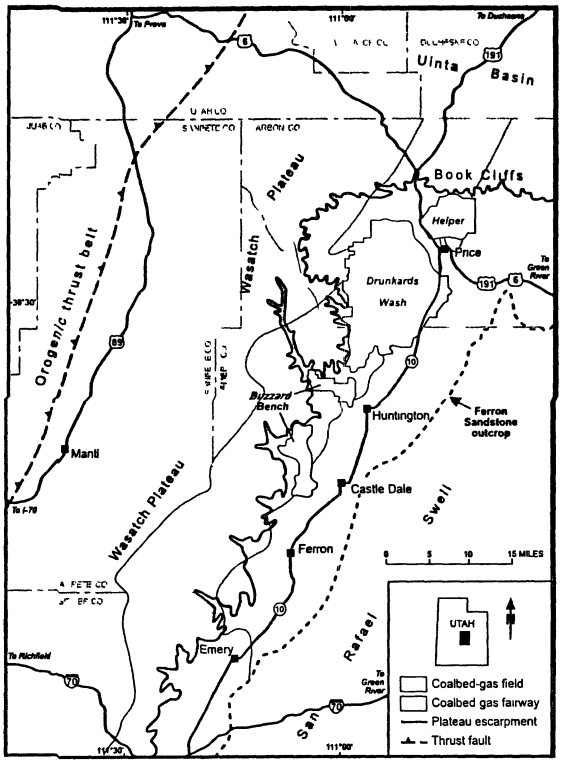


South-north cross section through Uinta Basin

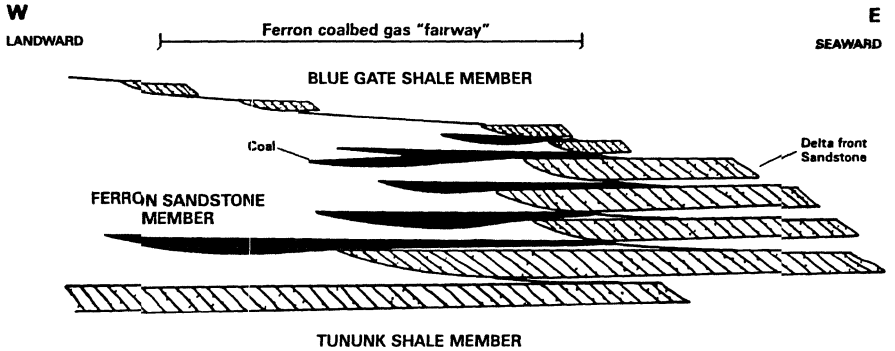
Coalbed Methane (CBM) Plays

- Major reservoirs: primarily coal, with some organic shale and sandstone beds in the Ferron Sandstone Member of the Mancos Shale, and the Blackhawk Formation.
- Trapping mechanisms: self-sourcing reservoir beds with some secondary biogenic gas and some migrated gas trapped by updip stratigraphic pinchout of reservoir beds.
- Source rocks: coal and organic shale beds in the Ferron Sandstone Member of the Mancos Shale, and the Blackhawk Formation.
- First commercial discovery: Drunkards Wash field, 1992 (Ferron); Castlegate field, 1993 (Blackhawk).
- Number of active fields/wells: 5 fields/ 841 wells.
- Recent monthly production: 0 bbl of oil, 7.0 Bcf of gas.
- Cumulative production: 0 million bbl of oil, 0.7 Tcf of gas.

The thick basal marine sandstone and the overlying shales, sandstones, and coals of the Ferron Sandstone as exposed near Emery, Utah

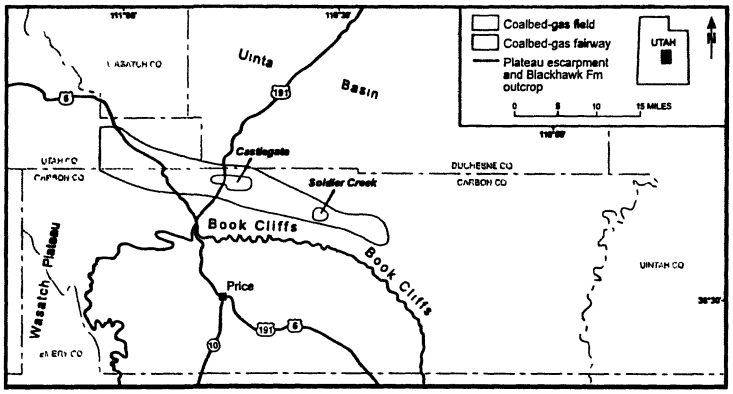


Trend of thick net coal and fields in the Ferron Sandstone CBM play



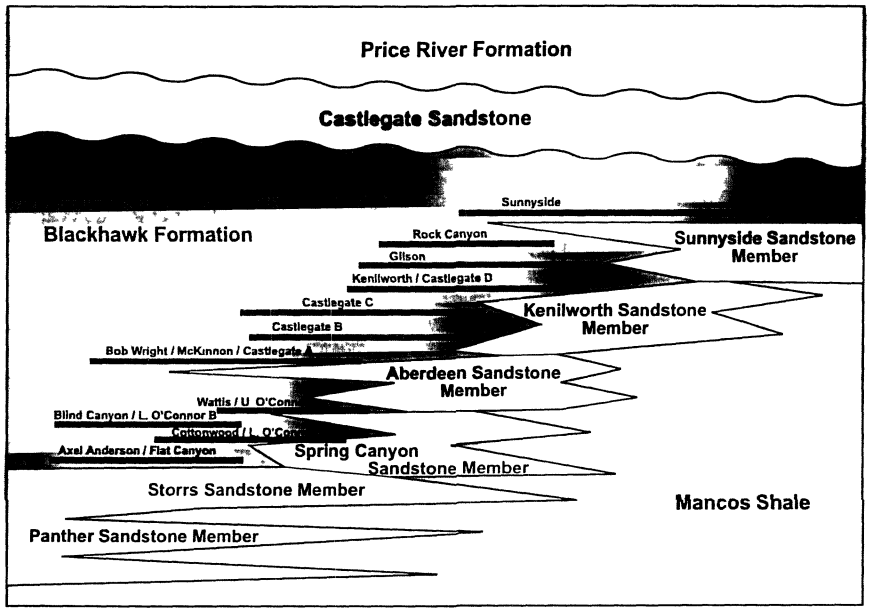
West-east cross section across the Ferron Sandstone CBM play

- Types of enhanced oil recovery: none at present.
- Major pipelines: Questar Pipeline Co. (6" and 20" gas), Conoco Phillips Co. (10" gas).
- Ferron land ownership: 48% National Forest, 26% Private, 16% BLM, 8% SITLA, 1.2% State Wildlife Resources, <0.1% State Park.
- Blackhawk land ownership: 78% Private, 13% BLM, 9% SITLA.
- Outcrop analogs in Utah: exposures of the Ferron Sandstone Member of the Mancos Shale along the western flank of the San Rafael Swell to the south-east of Emery, Utah, exposures of the Blackhawk Formation along the Book Cliffs.



Trend of thick net coal and fields in the Blackhawk Formation CBM play

- Utah Geological Survey contact: David E. Tabet, ph.: (801) 537-3373; e-mail: davidtabet@utah.gov



West-east cross section across the Blackhawk Formation CBM play

Paradox Basin

- Major reservoirs: Devonian McCracken Sandstone Member of the Elbert Formation, subtidal to supratidal dolomite to delta-front sandstone; Mississippian Leadville Limestone, shallow-shelf marine limestone and dolomite; Pennsylvanian Paradox Formation, shallow-shelf marine limestone and dolomite in the Desert Creek and Ismay zones, and fractured units in the Cane Creek shale; Pennsylvanian Honaker Trail Formation, beach and deltaic sandstone; Permian Coconino Sandstone, eolian sandstone.

- Trapping mechanisms: stratigraphic – carbonate buildups (algal mounds, shoals, islands) sealed by anhydrite, salt, or organic-rich shale; structural – fracture zones faulted and asymmetrical anticlines; diagenetic – dolomitization and dissolution.

- Source rocks: black, organic-rich marine shale within the Pennsylvanian Paradox Formation.

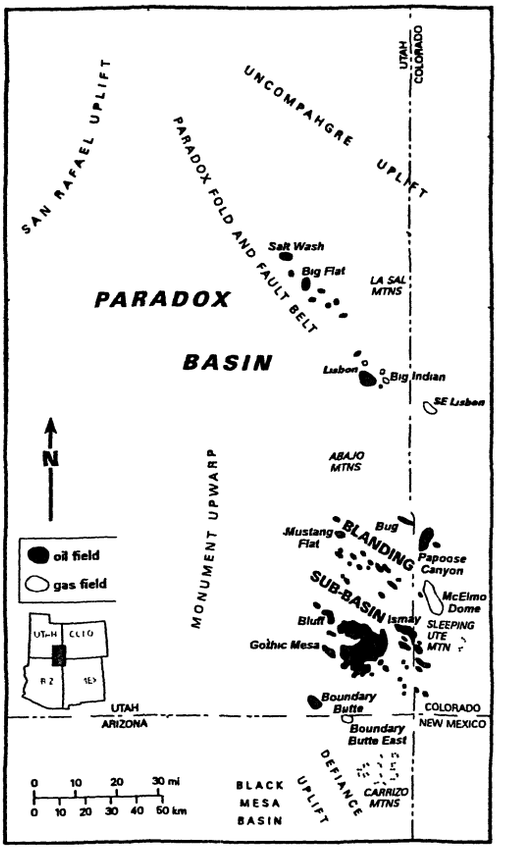
- First commercial discovery: Boundary Butte field, 1947.

- Number of active fields/wells: 78 fields/779 wells.

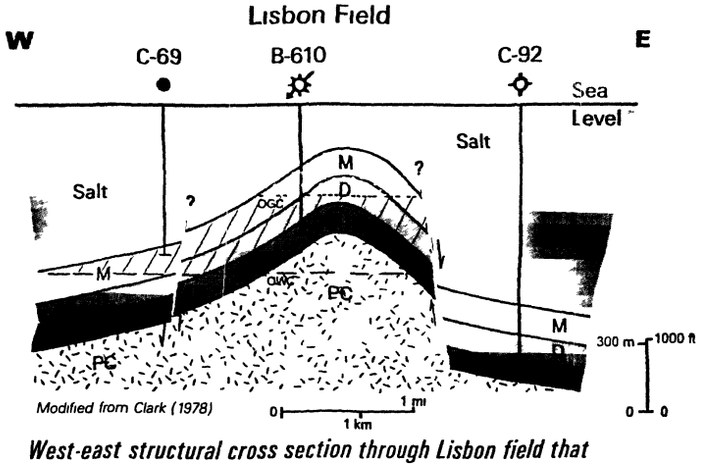
- Average monthly production: 344,000 bbl of oil, 1.1 Bcf of gas.

- Cumulative production: 548 million bbl of oil, 1.4 Tcf of gas.

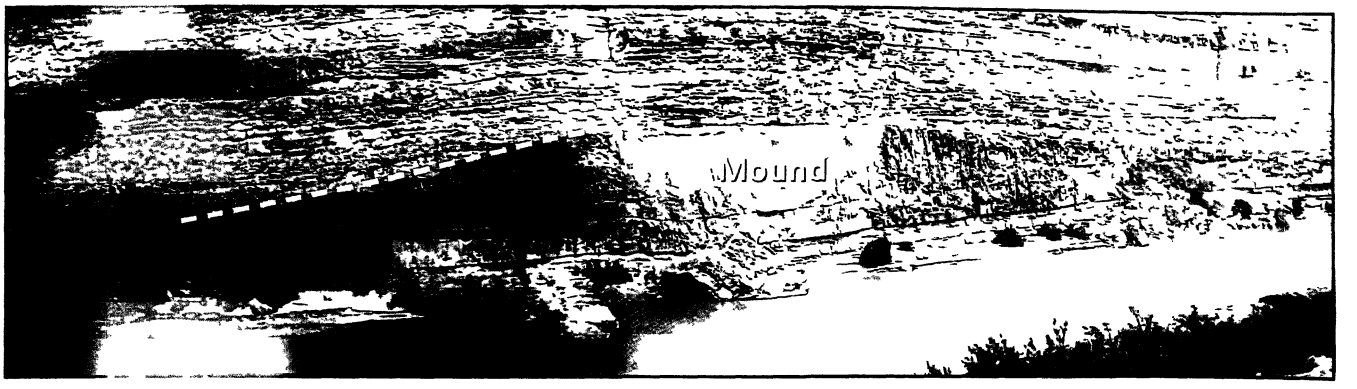
- Types of enhanced oil recovery projects: waterflood, CO_2 flood (CO_2 provided by pipeline from McElmo Dome in Colorado or locally from the Mississippian Leadville Limestone within the Utah part of the Paradox Basin), gas injection, horizontal drilling.



Paradox Basin fields



West-east structural cross section through Lisbon field that produces from the Leadville Limestone



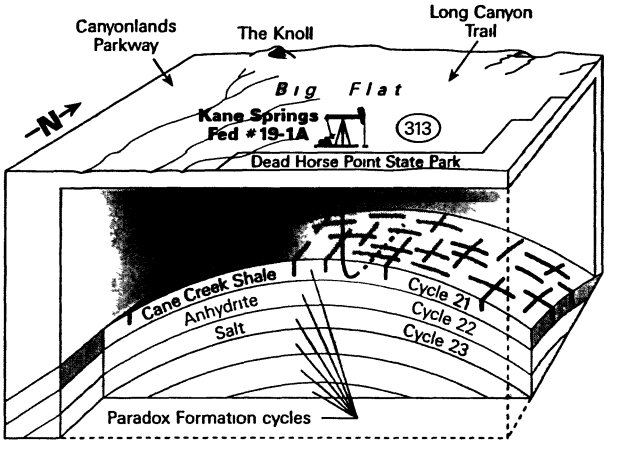
Paradox Formation algal mound, San Juan River Canyon

- Major pipelines: Four Corners Pipeline Co. (12" oil), Navajo Nation Oil and Gas Co. (16" oil), Encana (10" oil), TransColorado Pipeline Gathering Co. (4" gas), Utah Gas Services Co. (4" gas), Western Gas Resources, Inc. (16" gas), Williams Gas Pipeline - Northwest (26" gas), ExxonMobil/Resolute Natural Resources/Navajo Nation Oil and Gas Co. (8" carbon dioxide), Enterprise Products Partners LP (10" products).

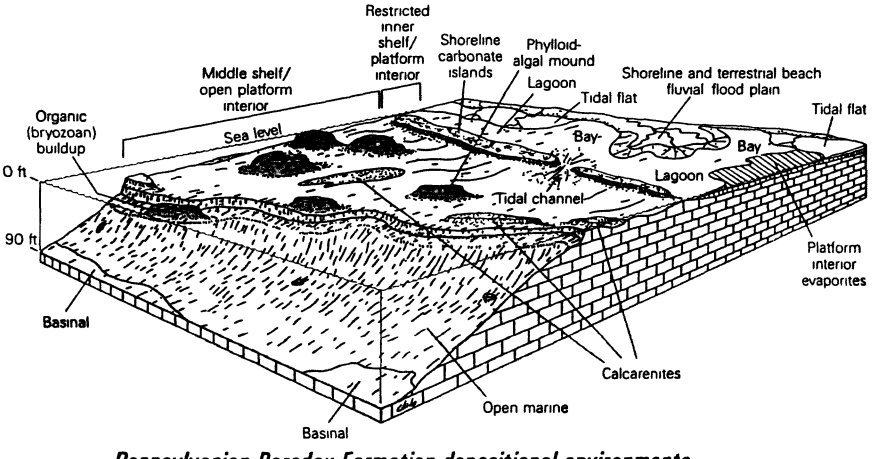
- Land ownership: 56% BLM, 11% National Park, 9% Native American, 8% School and Institutional Trust Lands Administration, 8% Private, 7% National Forest, 1% Wilderness.

- Outcrop analogs in Utah: shallow-shelf carbonates and karst features, Mississippian Madison and Deseret Limestones, south flank of the Uinta Mountains; Ismay and Desert Creek algal mounds, Pennsylvanian Paradox Formation, exposed along the San Juan River in southeastern Utah; deltaic and eolian sandstone, Pennsylvanian Honaker Trail Formation and Permian White Rim Sandstone, respectively, Canyonlands area.

- Utah Geological Survey contact: Thomas C. Chidsey, Jr., ph.: (801) 537-3364; e-mail: tomchidsey@utah.gov



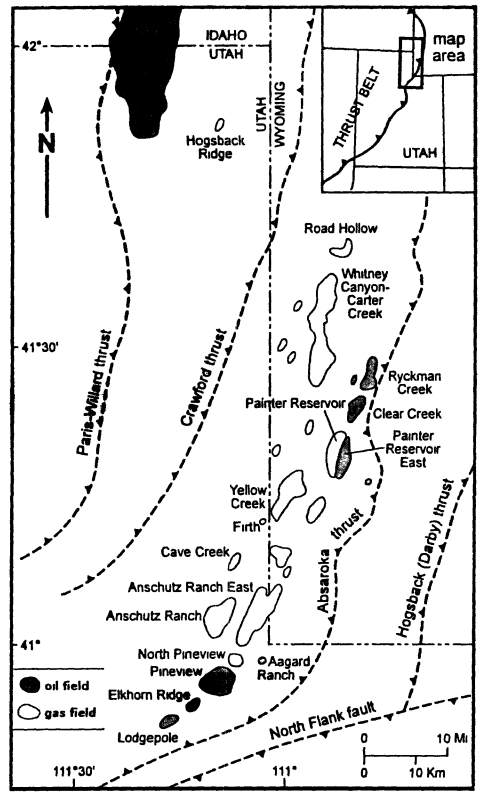
Schematic of horizontal drilling targets, Cane Creek shale, Park Road field



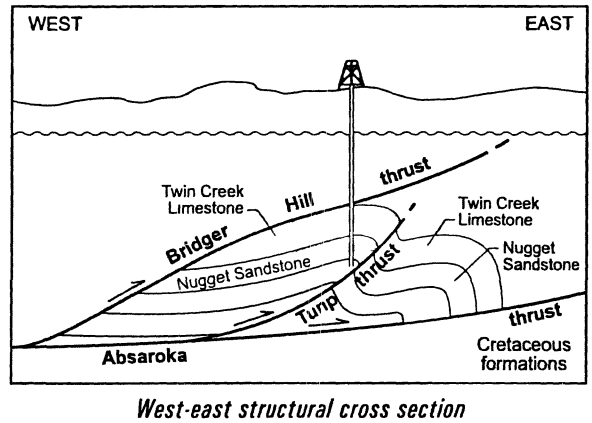
Pennsylvanian Paradox Formation depositional environments

Thrust Belt

- Major reservoirs: Mississippian Madison Group, open-marine to supratidal limestone and dolomite; Pennsylvanian Weber Sandstone, coastal eolian and littoral sandstone; Permian Phosphoria Formation, shallow marine limestone, dolomite, phosphatic shale, and chert; Triassic Dinwoody Formation, tidal-flat dolomite; Jurassic Nugget Sandstone, eolian dune sandstone; Jurassic Twin Creek Limestone, shallow marine limestone.
- Trapping mechanisms: anticlines in the hanging walls of detached (not involving basement rocks) thrust systems, and untested subthrust structures (beneath detached and basement-cored faults).
- Source rocks: Cretaceous Mowry Shale; possibly Permian Phosphoria Formation.
- First commercial discovery: Pineview field, 1975.
- Number of active fields/wells: 10 fields/79 wells.
- Average monthly production: 34,300 bbl of oil, 1.3 Bcf of gas.
- Cumulative production: 166 million bbl of oil, 3.1 Tcf of gas.
- Types of enhanced oil recovery projects: gas re-injection to maintain pressure, horizontal drilling.
- Major pipelines: Pacific Energy Partners LP (8" oil), Rocky Mountain Pipeline Systems LLC (10", 16" oil), Chevron Pipeline Co. (10" oil), Pioneer Pipeline Co. (8" products), Enterprise Products Partners LP (6" products), Questar Pipeline Co. (10", 12", 16", 18", 20", 24", gas), Kern River Gas Transmission Co. (36" gas), Williams Gas Pipeline - Northwest (22" gas), Anadarko Rocky Mountain Energy (10" hydrogen sulfide).
- Land ownership: 71% Private, 16% National Forest, 6% BLM, 3% School and Institutional Trust Lands Administration, 3% Wilderness, 2% Utah Division of Wildlife Resources.
- Outcrop analogs in Utah: northern Wasatch Range, Crawford Mountains.
- Utah Geological Survey contact: Thomas C. Chidsey, Jr., ph.: (801) 537-3364; e-mail: tomchidsey@utah.gov



Thrust belt fields

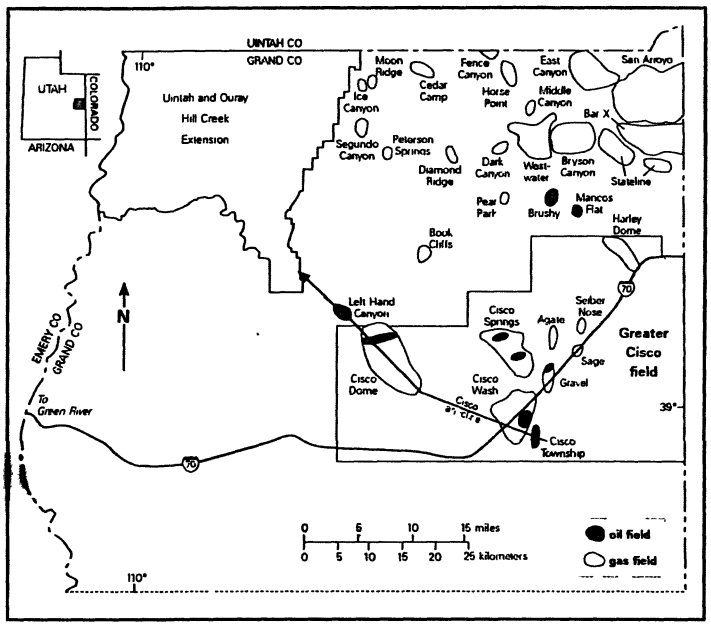


West-east structural cross section

East-dipping Ogden thrust,

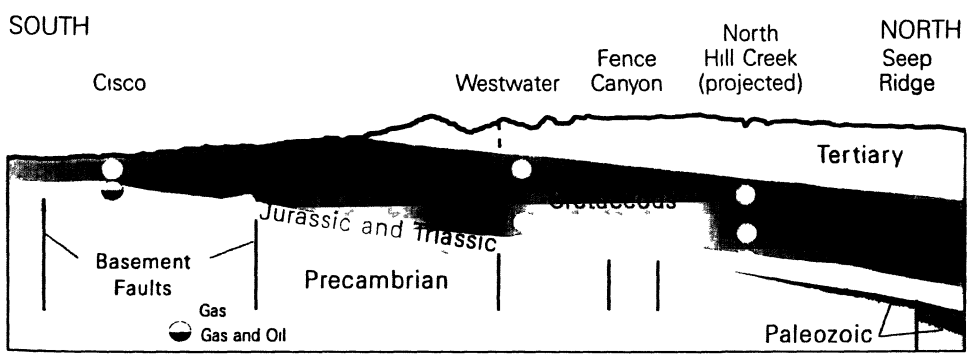
Uncompahgre Uplift

- Major reservoirs: Cretaceous Dakota and Cedar Mountain Formations, fluvial and littoral sandstone; Jurassic Morrison Formation, fluvial sandstone; and Jurassic Entrada and Wingate, eolian sandstone.
- Trapping mechanisms: combination structural and stratigraphic.
- Source rocks: Cretaceous shale and possibly Permian and Pennsylvanian shale.
- First commercial discovery: Cisco Dome field, 1925.
- Number of active fields/wells: 21 fields/ 541 wells.
- Recent monthly production: 1,799 bbl of oil, 0.5 Bcf of gas.
- Cumulative production: 2.9 million bbl of oil, 0.3 Tcf of gas.
- Types of enhanced oil recovery projects: one waterflood unit (Calf Canyon) in the Cedar Mountain Formation.
- Major pipelines: Williams Gas Pipeline - Northwest (26" gas), Enterprise Products Partners (10" products).
- Land ownership: 98% BLM, 1.6% Native American, 0.6% SITLA.
- Outcrop analogs in Utah: Cretaceous and Jurassic outcrops south of the production area.
- Utah Geological Survey contact:
  Craig D. Morgan, ph.: (801) 537- 3370;
  e-mail: craigmorgan@utah.gov



Uncompahgre uplift fields

Wingate Sandstone, Seven Mile Canyon in Grand County



South-north cross section across the Uncompaghre Uplift

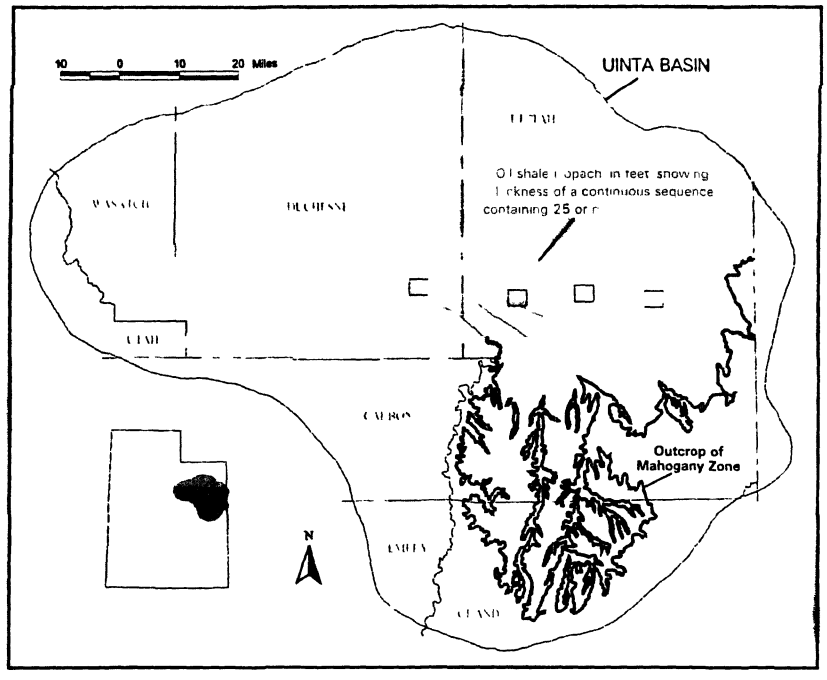
Oil Shale

- The largest oil shale deposits in the world are in the Eocene Green River Formation, which covers parts of Utah, Colorado, and Wyoming. Utah's oil shale deposits are found in the northeast corner of the state within the Uinta Basin.

- Organic and lime-rich mud *deposited in a large lake about* 50 million years ago forms the present-day oil shale.

- The organic material preserved in the oil shale is not oil, but a substance called kerogen that can be heated either at the surface or underground to produce crude oil and natural gas.

- The stratigraphic section with the richest oil shale is the Mahogany zone, which in Utah can contain more than 40 bbl of oil per ton of shale and can be up to 130 feet thick.



Location of oil shale deposits in Utah

- Estimates of the in-ground oil resource contained within Utah oil shale are over 300 billion bbl, based on oil shale at a grade of greater than 15 gallons per ton. Potential reserves based on 30 gallons per ton and a thickness of 15 feet are almost 20 billion bbl of oil.

- The Utah Geological Survey is compiling an oil shale information database for the UGS Web site. This database will contain copies of previously published and unpublished reports and digital resource information.

- Utah Geological Survey contact:
  Michael D. Vanden Berg, ph.: (801) 538-5419;
  email: michaelvandenberg@utah.gov

Oil shale sample showing bands of kerogen

Tar Sand Resources of Utah

- Utah's tar sand resources are the largest in the United States. Other states having tar sand resources include Alabama, Alaska, California, Kentucky, New Mexico, Oklahoma, Texas, and Wyoming.

- The Uinta Basin hosts the majority of Utah's tar sands, both in terms of the number of deposits and resources-in-place (measured and estimated). Other deposits are present in the Tar Sand Triangle, Circle Cliffs, and the San Rafael Swell areas.

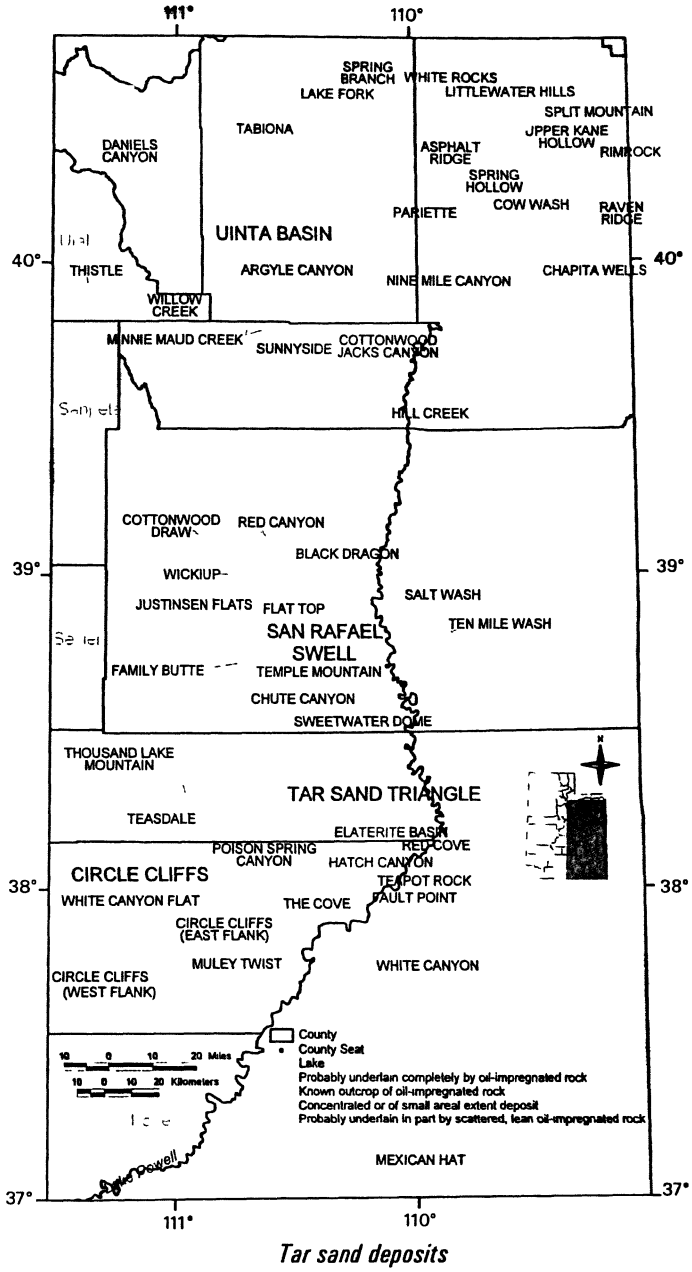
- Utah's measured tar sand resource is at least 12 billion bbl oil-in-place. The total estimated resource includes an additional 7 billion bbl.

- The average bitumen content of Utah's tar sands ranges from 4.5% to 14.1%, average API gravity from -3 to 12, sulfur content (wt%) from 0.3 to 3.8, carbon content from 13% to 24%, and atomic hydrogen/carbon ratio from 1.31 to 1.65.

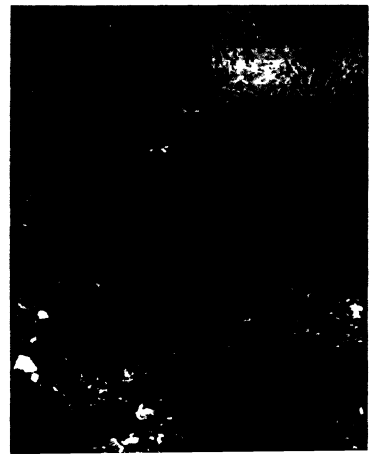
- Despite the failure of numerous past efforts to develop this heavy-oil resource, the current period of sustained high oil prices is stimulating a resurgence in interest.

- Advances in oil extraction from tar sands in other countries such as Canada make the vast Utah deposits an attractive target. The results and strategies used in bitumen extraction and oil upgrading, developed by industry and academia, are readily available and will provide a solid foundation for the development of Utah's tar sand resources in the future.

- Utah Geological Survey contact: Wally Gwynn, ph.: (801) 537-3366; e-mail: wallygwynn@utah.gov



Tar sand deposits



Utah Core Research Center

- The Utah Core Research Center (UCRC) occupies a 12,000-square-foot warehouse managed by the Utah Geological Survey, and contains the region's only publicly available and most complete collection of geologic cuttings and core from Utah.

- Holdings include cuttings from >3500 wells, cores from >700 wells, samples from major tar sands and oil shale deposits, and type oils from all producing formations in the state. The holdings catalogue is Web-accessible.
- The UCRC is available for industry and academic research, workshops, and short courses.
- Samples may be examined on-site, or borrowed for up to six months; destructive testing may be allowed with advance permission.
- Highlights of the core collection include the fluvial-dominated deltaic rocks of the Ferron Sandstone of east-central Utah, and the shallow-shelf carbonates of the Pennsylvanian Paradox Formation of southeastern Utah.
- Utah Geological Survey contact: Michael Laine, ph.: (801) 537-3359; e-mail: michaellaine@utah gov

Sources of Utah Oil and Gas Information

- Production, consumption, reserves and price trends for all energy commodities: http://geology.utah.gov/sep/newdata/statpage.htm
- Oil and gas resources, Utah oil and gas map, research reports: http://geology.utah.gov/utahgeo/energy/oilgas/index.htm
- Oil and gas well locator map: http://atlas.utah.gov/oilgaswells2/viewer.htm
- Oil and gas well logs: http://www.ogm.utah.gov/oilgas/DATA_SEARCH/well_data_search.htm
- Catalogue of oil and gas well cores and cuttings: http://geology.utah.gov/emp/ucrc/index.html
- Production data: http://ogm.utah.gov/oilgas/PUBLICATIONS/Reports/report_list.htm
- Data on permits, drilling starts, completion reports: http://ogm.utah.gov/oilgas/STATISTICS/statindx.htm

UTAH GEOLOGICAL SURVEY
Utah Geological Survey

Utah!
School and Institutional Trust Lands Administration

Utah Oil Gas and Mining
Division of Oil, Gas and Mining

Public Information Series 71
Utah Geological Survey
a division of
Department of Natural Resources

Updated 2006

Although this product represents the work of professional scientists, the Utah Department of Natural Resources, Utah Geological Survey,

ISBN 1-55791-665-1

Tab 15

LIST OF CONDEMNATION CASES

1. ***Mountain Fuel Supply Co. v. Smith,*** Civil No. 4645, Memorandum Decision and Order granting immediate occupancy (4th Dist. Ct. Duchesne County, June 7, 1972); Judge Maurice Harding. (Counsel unknown).

2. ***The Anschutz Corp. v. Cunningham Ranches, Inc.,*** Case No. 3793, Memorandum Decision and order denying motion for immediate occupancy or dismissing case on grounds oil and gas not covered by statute (7th Dist. Ct. Grand County, July 22, 1977). (Robert G. Pruitt, Jr./Robert S. Campbell, Jr.).

3. ***Amerada Hess Corp. v. Thousand Peaks Ranches, Inc.,*** Civil No. 7482, Order dismissing (3rd Dist. Ct. Summit County, Sept. 7, 1983); settled after hearing on motion for order of immediate occupancy and before entry of judgment. VCBC (Yeates, Lear, Gaufin).

4. ***ANR Production Co. v. Burkley,*** Case No. 950800003CV, Order dismissing (8th Dist. Ct. Duchesne County, Feb. 15, 1995); settled after service and prior to hearing. S&W Client No. 24941.0011 (Lear/Snow).

5. ***Richardson Operating Co. v. Thousand Peaks Ranches, Inc.,*** Case No. 950300082CD, Minute Entry granting immediate occupancy (3rd Dist. Ct. Summit County, Aug. 22, 1995). Ultimately dismissed 1999. S&W Client No. 27912.0001 (Lear/Sivertsen).

6. ***El Paso Production Oil & Gas Co. v. Stricklen,*** Case No. 010800547, Findings of Fact, Conclusions of Law, and Order granting immediate occupancy (8th Dist. Ct. Uintah County, October 26, 2001); settled. L&L Client/Matter No. 1003.065, 1003.070 (companion cases). (Lear/Snow).

7. ***FIML Natural Resources, LLC, v. The Estate of Robert C. Pyles, Deceased,*** Case No. 060800183, Order granting immediate occupancy (8th Dist. Ct. Duchesne County, January 10, 2007); settled. L&L Client/Matter No. 1137.001 (Lear/Williams).

8. ***Marion Energy, Inc. v. KFJ Ranch Properties,*** Case No. 090700027, Judgment and Order Granting Defendant's Motion to Dismiss and Denying Plaintiff's Motion for Summary Judgment (7th Dist. Ct. Carbon County, September 7, 2009).

DISTRICT COURT OF DUCHESNE COUNTY,

STATE OF UTAH

- - -

MOUNTAIN FUEL SUPPLY COMPANY, A Utah corporation; CHEVRON OIL COMPANY, a California corporation; and PHILLIPS PETROLEUM COMPANY, A Delaware corporation,

Plaintiffs,

vs.

EMORY C. SMITH and VERLAND E. SMITH,

Defendants.

Civil No. 4645

MEMORANDUM DECISION

The Court has carefully considered the law and the evidence, and now holds that the motion for immediate occupancy should be granted.

Dated May 16, 1972.

J. Rulon Harding

JUDGE

FILED
IN THE DISTRICT COURT
DUCHESNE COUNTY, STATE OF UTAH
JAN 8 1973
CLERK
DEPUTY

Book 6 Misc. Page 12

State of Utah } ss
County of Duchesne }

I do hereby certify that the above and foregoing is a full, true and correct copy of the original document which is on file in the District Court, Duchesne County, Utah.

In Witness Whereof I have hereunto set my hand and seal of said Court above mentioned, this 12th day of January A.D. 19 73

Clerk

By Merlene Holmes Deputy

IN THE DISTRICT COURT

OF THE FOURTH JUDICIAL DISTRICT

IN AND FOR DUCHESNE COUNTY,

STATE OF UTAH

MOUNTAIN FUEL SUPPLY COMPANY, a Utah corporation; CHEVRON OIL COMPANY, a California corporation; and PHILLIPS PETROLEUM COMPANY, a Delaware corporation, Plaintiffs, -vs- EMORY C. SMITH and VERLAND E. SMITH, Defendants.	ORDER OF IMMEDIATE OCCUPANCY Civil No. 4645

The motion of the plaintiffs for an order of immediate occupancy having come on regularly for hearing before the Honorable Maurice Harding, Judge of the above entitled Court, at the courtroom thereof in Provo, Utah, on the 24th day of February, 1972, the time and place of hearing having been stipulated to between the parties, and it appearing from the file that the defendants above named were duly served with notice of said motion, and the Court having considered the testimony of the parties and having examined the file, the affidavits thereto attached and the exhibits in the record, and the Court being fully advised in the premises; NOW, THEREFORE,

IT IS HEREBY ORDERED that the plaintiffs have immediate occupancy of the rights of way, described in the Complaint on file herein, for the purposes of exploring for and developing and extracting oil and gas from the subject lands, comprising the oil and gas field as identified in Exhibit "A" of the Complaint.

3564½

FILED
In the District Court Duchesne
County - State of Utah
JUN 7 1972
JANET COWAN, Clerk
By Deputy

IT IS FURTHER ORDERED that further hearing be had herein at a date and location agreeable to the parties for the purpose of determining the amount of the deposit to be paid into the Court, pursuant to the provisions of Section 78-34-9, U.C.A. 1953, 1971 Pocket Supplement.

Dated this 16th Day of May, 1972.

Maurice Harding
JUDGE

State of Utah } SS
County of Duchesne
I do hereby certify that the above and foregoing is a full, true and correct copy of the original document which is on file in the District Court, Duchesne County, Utah.
In Witness Whereof I have hereunto set my hand and seal on the said Court above mentioned, this 13th day of January A.D. 19 95
Clerk
By Marjorie B. Lamas Deputy

CERTIFICATE:

STATE OF UTAH } ss
COUNTY OF GRAND }

I, the undersigned Clerk of the Seventh District Court in and for Grand County, State of Utah, do hereby certify that the annexed and foregoing is a true, full and correct copy of an original document on file in my office as such clerk.

WITNESS my hand the seal of said Court this 13th day of January 19, 95.

Clerk

By Sue Batchelder
Deputy

Book No. 222 Page 22
Filed 12-15-77
Entered [illegible]
L. O.
Deputy Clerk

IN THE SEVENTH JUDICIAL DISTRICT COURT IN AND FOR GRAND COUNTY, STATE OF UTAH

THE ANSCHUTZ CORPORATION, a Colorado corporation, Plaintiff,	:	ORDER OF DISMISSAL
vs.	:	Civil No. 3793
CUNNINGHAM RANCHES, INC. a Colorado corporation, Defendant.	:	

Pursuant to the Stipulation of the parties entered into on the 22 day of November, 1977, predicated upon the Memorandum Decision and Order of the Honorable EDWARD SHEYA, District Judge under date of September 1, 1977, and based upon the Motion to Dismiss of the Defendant, CUNNINGHAM RANCHES, INC.,

IT IS ORDERED, ADJUDGED AND DECREED that the Complaint of Plaintiff be and the same is hereby dismissed on the merits and with prejudice, each party to bear their respective costs in the matter.

DATED this 12 day of ~~November~~ December, 1977.

BY ORDER OF THE COURT

District Judge

CERTIFICATION

STATE OF UTAH } ss
COUNTY OF GRAND }

I, the undersigned Clerk of the Seventh District Court in and for Grand County, State of Utah, do hereby certify that the annexed and foregoing is a true, full and correct copy of an original document on file in my office as such clerk.

WITNESS my hand the seal of said Court this 13th day of January 19 95.

Clerk

By Ann Bitteldeer
Deputy

Entry No. 221210
Filed 9-7-77
Book
Barbara Carpenter
Clerk of Second District

IN THE DISTRICT COURT IN AND FOR GRAND COUNTY, STATE OF UTAH

THE ANSCHUTZ CORPORATION, a Colorado corporation,

Plaintiff,

vs.

CUNNINGHAM RANCHES, INC., a Colorado corporation,

Defendant.

Civil No. 3793

MEMORANDUM DECISION

The hearing on Plaintiff's Motion For An Order for Immediate Occupancy came before the Court on July 22, 1977, at 10 o'clock a.m., the Court sitting in chambers for Grand County at Price, Utah.

The Plaintiff was represented by Attorney Robert G Pruitt, Jr., and the Defendant was represented by Attorney Robert S. Campbell, Jr. The Court heard the testimony offered by the respective parties and examined the exhibits which were introduced and received in evidence and took the matter under advisement, permitting counsel to submit written memoranda to the Court in this matter in addition to the memoranda which had been submitted. The Court having now read the written memoranda submitted by the parties at the time of the hearing and thereafter and now being fully advised in the premises finds and orders as follows:

1. Section 78-34-1, Utah Code Annotated 1953, does not permit the condemnation of an easement over private property for an access road for exploratory drilling of oil or gas, and this right cannot be implied.

MINUTE BOOK

THIRD JUDICIAL DISTRICT

C inty of ~~Salt Lake~~ Summit - State of ' ah

9-1-83

FILE NO. # 7482

TLE: (✓ PARTIES PRESENT)	COUNSEL: (✓ COUNSEL PRESENT)
Amerada Hess Corp.,	: Patrick O'Hara, Kenneth Yeates
vs	: Phillip Lear
Howard Peak Ranches, Inc.,	: Edward Clyde, Rodney Olsen

SEP 7 1983

Clerk of Summit County

By _____ Deputy Clerk

Evelyn Thompson CLERK

Bunny Neumeister REPORTER

Ken Jensen BAILIFF

HON. Dorothy P. Hanson JUDGE

DATE: August 31, 1983

The above entitled case comes on regularly before the Court for Evidentiary Hearing on Various Motions. Respective Counsel agree to having the Hearing in Salt Lake County.

The following persons are sworn & examined on behalf of the plaintiff, Raymond G. Straw, Arnold W. Conn, William L. Christensen (No testimony), Phillip Ireydon, & Dennis C. Alstead. The plf rest. Sworn and examined on behalf of the defendants are, Lorin L. Mooney, Russell Dean Gary, & Howard R. Ridgway. Lorin L. Mooney & Phillip Ireydon are recalled by the defense. The defense rest. Both sides rest. Respective Counsel make closing arguments to the Court. The case is continued to Sept 1, 1983 @ 2:00pm for Courts ruling.

Counsel will submit to the Court the agreement Mr. Mooney has with the Oil Companies.

MINUTE BOOK FORM 1101

THIRD JUDICIAL DISTRICT
County of Salt Lake - State of Utah

FILE NO. Civil # 24823

FILE: (✓ PARTIES PRESENT) | COUNSEL: (✓ COUNSEL PRESENT)

Amerada Hess Corp., : Kenneth Yeates, Patrick O'Hara
VS : Philip Lear
Thousand Peaks Ranches Inc. Edward Clyde, Rodney Snow

SEP 7 1983
Clerk of Summit County
By ✓ Deputy Clerk

Evelyn Thompson — CLERK
REPORTER
BAILIFF

HON. Dennis L. Hanson — JUDGE
DATE: Sept. 1, 1983

This being the time and place set for the Courts ruling on the issues in the above entitled case, all necessary persons are present.

Respective Counsel represent to the Court they have entered into an oral agreement settling the issues, to wit:

The defendant consents that plaintiffs may immediately commence work, further stipulations will be reduced to writing. The Court reserves any ruling (pending) receipt of the Stipulation and Order.

All exhibits have been withdrawn by respective counsel.

EIGHTH DISTRICT COURT-DUCHESNE
DUCHESNE COUNTY, STATE OF UTAH

ANR PRODUCTION COMPANY vs. CAROL W. BURKLEY

CASE NUMBER 950800003 {Civil}

CURRENT ASSIGNED JUDGE
A. LYNN PAYNE

PARTIES

Plaintiff - ANR PRODUCTION COMPANY
Represented by: PHILLIP WM LEAR.

Defendant - CAROL W. BURKLEY

Defendant - GAREL LARSON

Defendant - MARILYN C. LARSON

Defendant - ROCKY PASS INVESTMENTS

Defendant - HAL A. LAFLEUR

ACCOUNT SUMMARY

TOTAL REVENUE	Amount Due:	118.82
	Amount Paid:	118.82
	Credit:	0.00
	Balance:	0.00

REVENUE DETAIL - TYPE: COMPLAINT		NO AMT S
	Amount Paid:	100.00
	Amount Credit:	0.00
	Balance:	0.00

REVENUE DETAIL - TYPE: MISCELLANEOUS FEE		
	Amount Paid:	15.50
	Amount Credit:	0.00
	Balance:	0.00

REVENUE DETAIL - TYPE: MISCELLANEOUS FEE		
	Amount Paid:	3.32
	Amount Credit:	0.00
	Balance:	0.00

PROCEEDINGS

Printed: 09/22/09 17:21:00 Page 1

CASE NUMBER 950800003 {Civil}

01-12-95 Filed: Complaint
01-12-95 Judge A. LYNN PAYNE assigned.
01-12-95 Fee Account created Total Due: 100.00
01-12-95 COMPLAINT - NO AMT S Payment Received: 100.00
01-12-95 Note: Other Agency control stay began 01/12/95
01-12-95 Note: Other Agency control stay ended 01/12/96
01-12-95 Note: Began tracking Return Date Review on 05/12/95
01-12-95 Note: FILED: COMPLAI8NT
01-12-95 Note: FILED: SUMMONS
01-12-95 Note: FILED: MOTION AND MEMORANDUM IN SUPPORT OF PLAINTIFF'S REQUEST
01-12-95 Note: FOR EXPEDITED HEARING ON PLAINTIFF'S MOTION FOR IMMEDIATE
01-12-95 Note: OCCUPANCY.
01-12-95 Note: FILED: MOTION FOR IMMEDIATE OCCUPANCY.
01-12-95 Note: FILED: MEMORANDUM OF POINTS AND AUTHORITIES IN SUPPORT OF
01-12-95 Note: PLAINTIFF'S MOTION FOR IMMEDIATE OCCUPANCY.
01-12-95 Note: FILED: AFFIDAVIT OF M. FRANK PECK.
01-12-95 Note: FILED: AFFIDAVIT OF GARY D. OLSOBROOK.
01-12-95 Note: FILED: ANSWER
01-13-95 HEARING scheduled on January 26, 1995 at 09:30 AM in Duchesne with Judge PAYNE.
01-13-95 Note: FILED: REQUEST FOR HEARING.
01-18-95 Note: FILED: AMENDED COMPLAINT
01-18-95 Note: FILED: REQUEST FOR HEARING
01-18-95 Note: FILED: NOTICE OF HEARING (9:30 A.M.)
01-18-95 Note: FILED: CERTIFICATE OF SERVICE.
01-20-95 Note: FILED: MOTION FOR AUTHORITY TO SERVE SUMMONS AND
01-20-95 Note: COMPLAINT BY CERTIFIED MAIL AND BY POSTING
01-20-95 Note: AFFIDAVIT OF CHIEF DEPUTY CONSTABLE ORSON MADSEN
01-20-95 Note: MEMO
01-20-95 Note: ORDER AUTHORIZING SERVICE OF PROCESS BY CERTIFIED MAIL
01-20-95 Note: AND BY POSTING
01-23-95 Note: FILED: SUMMONS AND RETURN OF SERVICE - CAROL W. BURKLEY
01-23-95 Note: FILED: SUMMONS AND RETURN OF SERVICE - GAREL R. LARSON
01-23-95 Note: FILED: SUMMONS AND RETURN OF SERVICE - MARILYN C. LARSON
01-23-95 Note: FILED: MOTION FOR AUTHORITY TO SERVE SUMMONS AND COMPLAINT BY
01-23-95 Note: CERTIFIED MAIL AND BY POSTING.
01-23-95 Note: FILED: AFFIDVIT OF CHIEF DEPUTY CONSTABLE ORSON MADSEN.
01-23-95 Note: FILED: ORDER AUTHORIZING SERVICE OF PROCESS BY CERTIFIED MAIL
01-23-95 Note: AND BY POSTING
01-24-95 Note: FILED: LETTER RE GAREL LARSON
01-25-95 Note: FILED: CERTIFICATE OF SERVICE
01-25-95 Note: CERTIFICATE OF SERVICE
01-25-95 Note: SUMMONS/RETURN OF SERVICE (HAL A LAFLEUR)

Printed: 09/22/09 17:21:00

CASE NUMBER 950800003 {Civil}

01-25-95 Note: SUMMONS/RETURN OF SERVICE (ROCKY PASS INVESTMENTS)
01-25-95 Note: ORDER AUTHORIZING SERVICE OF PROCESS BY CERTIFIED
01-25-95 Note: MAIL AND BY POSTING (HAL A. LAFLEUR SR. AND ROCKY
01-25-95 Note: PASS INVESTMENTS)
01-26-95 Note: HEARING - Event No. 001
01-26-95 Note: Judge: ALP Reporter: TAPE
01-26-95 Note: This matter was stricken per: ATTORNEY FOR PLAINTIFF
01-26-95 Note: Atty for plaintiff not present Atty for defendant not present
01-26-95 Note: THIS MATTER WAS STRICKEN PER THE PLAINTIFF'S ATTORNEY
02-02-95 Fee Account created Total Due: 15.50
02-02-95 MISCELLANEOUS FEE Payment Received: 15.50
Note: MAIL
02-08-95 Note: FILED: STIPULATION FOR DISMISSAL WITHOUT PREJUDICE
02-08-95 Note: FILED: NOTICE OF DISMISSAL WITHOUT PREJUDICE.
02-15-95 Judgment #1 Entered $ 0.00
02-15-95 Note: FILED: ORDER DISMISSING WITHOUT PREJUDICE
02-15-95 Note: Case judgment is Dismissed
02-15-95 Note: Case disposition is Dismissed
02-15-95 Note: Ended tracking of Return Date
02-22-95 MISCELLANEOUS FEE Payment Received: 3.32
Note: MAIL
02-22-95 Fee Account created Total Due: 3.32
08-03-09 Filed: Case File Destroyed

Printed: 09/22/09 17:21:00 Page 3 (last)

IN THE THIRD JUDICIAL DISTRICT COURT

SUMMIT COUNTY, STATE OF UTAH

Richardson Operating Company, a Colorado corporation; Richardson Production Company, a Colorado corporation; and Forcenergy Gas Exploration, Inc., a Delaware corporation, Plaintiff,	MINUTE ENTRY
vs.	Civil No. 950300082 CD
Thousand Peaks Ranches, Inc., a Utah corporation; Lorin L. Moench, an individual, d/b/a Moench Investment Company, Ltd.; Anschutz Land & Livestock Company, Inc., a Kansas corporation; John Does 1 through 10; and All Other Persons Unknown Claiming Any Right, Title, Estate, Lien or Interest in the Real Property Described in the Complaint; Defendants.	JUDGE FRANK G. NOEL

The court heard testimony and took evidence on plaintiffs' Motion for Immediate Occupancy, on Thursday, August 17, 1995 and after hearing oral argument and having taken the matter under advisement now rules as follows:

As to the approximately six and one half miles of road which has been referred to throughout these proceedings as the *"access road"* the court finds that plaintiffs have failed to establish the element of *"necessity"* for immediate occupancy. The plaintiffs are not denied occupancy of the road but rather must pay what they deem to be an unreasonable fee to the

defendant Thousand Peaks Ranch, Inc. Plaintiffs' evidence is that if they are required to pay this fee then, based on their experts projections, the well becomes economically unfeasible to operate within twelve years, whereas the payment of a more reasonable fee, presumably the amount testified to by their expert, would result in a well life of seventeen years. This difference in well life means that approximately 17,000 barrels of oil will be left in the ground and, argues the plaintiff, this situation would not be in the public interest. The plaintiff asks this court to assume much and to look far ahead in analyzing the *"necessity"* issue. Plaintiffs, according to the testimony, now have access to the road and even considering the payment to defendant which plaintiff feels to be unreasonable, plaintiff will be able to economically operate the well for twelve years. Even if this court were to deem the $55,000.00 a year payment to be unreasonable, it would not necessarily follow that the court should find a *"necessity"* for condemnation. (This is not to say that there would never be a situation where the fee asked by the defendant would be so unreasonable that the court could base thereon a finding of necessity.)

The court is concerned about a ruling that would permit a private oil company to condemn private property against the will of the landowner simply because they cannot agree to the landowner's terms. The court is of the opinion that the legislature did not intend that the condemnation statute be used in this fashion. Plaintiffs must show, in the opinion of the court, true necessity.

As to the Champlain road, Mr. Moench testified that he has reached an agreement allowing plaintiffs to use that road for which he has received a $7,500.00 payment. The court therefore is of the opinion that plaintiffs again have failed to establish the element of necessity. If it subsequently turns out that defendant bars plaintiff's access to the Champlain well then the matter may be brought back before the court.

As to the plaintiffs' request to condemn grazing rights the court grants the motion to the extent that it is necessary to have access to and to operate the wells in question.

With regard to the approximately 1800 foot road referred to throughout these proceedings as the *"ATV"* road the testimony before the court was that the inability to use this road creates an extra burden on the project which may indeed make the project economically unfeasible and moreover would make it difficult for plaintiffs to find employees willing to drive the more circuitous route year round to make daily checks of the well. Based on theses facts the court finds a *"necessity"* and will condemn an easement in the *"ATV"* road for daily access by ATVs and snowmobiles.

Counsel for plaintiff is to prepare a more detailed set of findings of fact, conclusions of law to support the court's ruling herein, together with an order consistent with the court's ruling, submit it to opposing Counsel for approval as to form and then to the court for review and signature.

Dated this 22nd day of August, 1995.

Frank G. Noel
District Court Judge

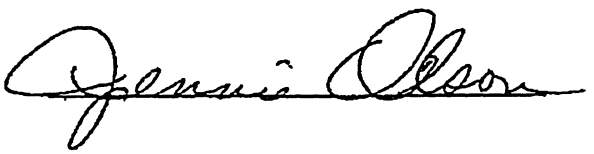
STATE OF UTAH
THIRD DISTRICT COURT
SALT LAKE

MAILING CERTIFICATE

I hereby certify that I mailed a true and correct copy of the foregoing Minute Entry, postage prepaid, to the following on this 22 day of August, 1995.

Phillip Wm. Lear
Jeffrey T. Siversten
SNELL & WILMER
Attorney for Plaintiffs
Broadway Centre
111 East Broadway, Suite 900
Salt Lake City, UT 84111

Mark C. Moench
Attorney for Defendants
1133 South 1400 East
Salt Lake City, UT 84105



FILED
DISTRICT COURT
UINTAH COUNTY, UTAH
OCT 26 2001
JOANNE McKEE, CLERK
BY _____ DEPUTY

Phillip Wm. Lear (1914)
Bradley R. Cahoon (5925)
J. Matthew Snow (8269)
SNELL & WILMER L.L.P.
15 West South Temple, Suite 1200
Gateway Tower West
Salt Lake City, Utah 84101
Telephone (801) 257-1900
Facsimile (801) 257-1800

Attorneys for El Paso Production Oil & Gas Company

IN THE EIGHTH JUDICIAL DISTRICT COURT OF UINTAH COUNTY

STATE OF UTAH

EL PASO PRODUCTION OIL & GAS COMPANY, a Delaware corporation, Plaintiff, vs. **BARNEY W. STRICKLEN**, an individual; **KEVIN CARL BLAKER**, an individual; **PAUL F. TAYLOR and HORTENSIA M. TAYLOR**, husband and wife; **BAR F. PARTNERSHIP**, a Family Partnership; **DEEP CREEK INVESTMENTS**, a Utah Limited Partnership; **JOHN DOES 1 THROUGH 10**; and **ALL OTHER PERSONS UNKNOWN** Claiming any Right, Title, Estate, Lien, or Interest in the Surface Estates to the Real Property Described in the Complaint; Defendants.	**FINDINGS OF FACT, CONCLUSIONS OF LAW & ORDER OF IMMEDIATE OCCUPANCY** Case No. 010800547 Judge John R. Anderson

The Court has reviewed the Complaint, Motion for Order of Immediate Occupancy, and Memorandum of Points and Authorities in Support of Motion for Immediate Occupancy, together with the evidence in support thereof, filed by Plaintiff El Paso Production Oil & Gas Company ("**El Paso**"). Based upon the Complaint, Motion for Order of Immediate Occupancy, and Memorandum of Points and Authorities in Support of Motion for Immediate Occupancy, together with the evidence in support thereof, the Court enters the following Findings of Facts and Conclusions of Law and Order of Immediate Occupancy.

FINDINGS OF FACT

1. El Paso is an oil and gas exploration and production company and has extensive operations in the State of Utah. El Paso's current operations respond to the increased demand for expanding domestic oil and gas production for consumption within the United States.

2. El Paso is the operator of the Leland Bench #35-22 Well to be drilled in the SE¼NW¼ of Section 35, Township 4 South, Range 2 East, U.S.M. (the "**Well**").

3. Time is of the essence because El Paso's right to drill the Well expires on November 1, 2001.

4. El Paso owns rights to all of the Section 35 lands which it acquired pursuant to a Farmout Agreement (entitled Drilling Agreement) dated August 21, 2000, between Petroglyph Energy Inc., successor to Petroglyph Gas Partners, L.P. ("**Petroglyph**") and Armstrong Resources, LLC ("**Farmout Agreement**"). The Farmout Agreement entitles El Paso to earn oil and gas leasehold and exploration rights in all of Section 35 by drilling a well in that Section.

5. Petrolglyph's (and now El Paso's) rights in the S½ stem from that certain Exploration and Development Agreement No. 14-20-H62-4750 between the Ute Indian Tribe

and Petroglyph (the "**Exploration Agreement**"). The Bureau of Indian Affairs, Uintah and Ouray Agency ("**BIA**"), approved the Exploration Agreement on December 11, 1996. The BIA holds both the surface and mineral estates in the S½ of Section 35 (less mining claims) in trust for the Ute Indian Tribe (the "**Tribal Lands**").

6. El Paso acquired its rights to the N½ of the Section 35 lands pursuant to the provisions of the Farmout Agreement, certain Oil and Gas Leases taken from the mineral owners, and that certain forced pooling order dated September 7, 2001, issued by the Utah Board of Oil, Gas and Mining (the "**Order**"). The N½ comprises private lands pursuant to patents from the United States. The mineral estate in the N½ has been severed from the surface estate. Separate parties own the estates.

7. The mineral estates in the N½ and S½ have been pooled for common development under the Order.

8. Defendant Deep Creek Investments ("**Defendant Deep Creek**") is owner of the surface estate in the N½ of Section 35.

9. El Paso desires to construct, maintain, and operate a 3.764-acre rectangular well-site for the Well in the SE¼NW¼ of Section 35 affecting the surface estate owned by Defendant Deep Creek (the "**Well-Site**"). The Well-Site is depicted in **Plaintiff's Exhibit One** attached as **Exhibit A** to this Order.

10. The Well-Site is the only reasonable location given topographic, environmental, geological, and logistical considerations.

11. In addition, El Paso desires to construct, operate, and maintain a 2.2 mile-long easement and right-of-way over the surface estates owned by Barney W. Stricklen ("**Defendant**

Stricklen"), Kevin Carl Blaker ("**Defendant Blaker**"), Paul F. Taylor and Hortensia M. Taylor (collectively, "**Defendants Taylor**"), Bar F. Partnership, a Family Partnership; Helen Wymer, Dixie Lee Kosec, David Feltier and Bonnie Pierce (collectively "**Defendant Bar F**"), and Defendant Deep Creek for the access road, a powerline, and a natural gas (gathering system) pipeline to the Well-Site. The courses and distances of the easement and right-of-way are depicted in **Plaintiff's Exhibit Two** attached as **Exhibit B** to this Order. The Defendants own all lands for which access is sought in fee simple.

12. During August and September 2001, El Paso through its consultant attempted to contact Defendants Stricklen, Blaker, Taylor, and Bar F to negotiate surface access for an easement for the access road, natural gas pipeline, and a powerline across the surface estate owned by Defendants in Sections 1 and 6.

13. During June 18, 2001 through September 15, 2001, El Paso through its consultant attempted to negotiate surface access and use and the easement to construct the Well-Site, access road, natural gas pipeline, and a powerline across the surface estate owned by Defendant Deep Creek in Section 35.

14. El Paso must use another party's drilling rig. Due to the scarcity of drilling rigs in the Leland Bench Field, El Paso is required to schedule rigs well in advance of the commencement of drilling operations. The rig scheduled for the Well will be available to El Paso on either October 18, 2001 or November 1, 2001. At that time, El Paso must reserve the rig at a rate of approximately $10,000 per day or pay approximately $60,000 to move the rig to another well-site. The Defendants' refusal to grant El Paso a reasonable access route to the Well-Site will cause El Paso substantial economic hardship.

15. El Paso requires immediate occupancy of the Well-Site and an access road, natural gas pipeline, and powerline easement to and from the Well-Site to alleviate the economic hardship that will result from Defendants' failure to grant El Paso access to its lawfully held mineral rights.

CONCLUSIONS OF LAW

1. El Paso has authority to condemn easements for the public use of oil and gas extraction operations. Oil and gas extraction operations are a public use authorized by law.

2. El Paso's taking of Defendants' property is necessary for the public use of oil and gas extraction operations.

3. El Paso's construction and use of Defendants' property sought to be condemned will commence within a reasonable time.

4. El Paso is entitled to immediate occupancy of Defendants' lands pursuant to *Utah Code Ann.* § 78-34-9 (Supp. 2001).

5. El Paso is entitled to occupy the premises sought to be condemned pending this action, including appeal, and do whatever work on the premises that is required for its operations.

6. Section 78-34-9 authorizes this Court to enter an order allowing El Paso to take immediate occupancy of Defendants' lands for the Well-Site and for an easement for the natural gas pipeline, powerline and access road to the Well-Site.

1. Granting El Paso immediate occupancy will not prejudice the legitimate and constitutional right of Defendants to receive just compensation.

8. El Paso immediately needs a reasonable access route because of the substantial economic hardship imposed on El Paso. Any delay in granting El Paso access to the Well-Site will cause El Paso substantial economic harm with no real prospect of recovering damages from Defendants.

9. The equities favor El Paso as the holder of both a legal and equitable right to occupy the Well-Site and that portion of the access easement in Defendant Deep Creek's land in the N½ of Section 35 and because El Paso owns the mineral leases—the dominant estate.

10. The Defendants have no legal or equitable right to prevent El Paso's use of the surface because El Paso's use is necessary and reasonable.

11. Defendants will suffer no significant hardship from El Paso's immediate occupancy and will be paid just compensation.

12. The benefits of developing and accessing the Well-Site and Well far outweigh perceived harm, if any, to Defendants.

13. The easements for the Well-Site, access road, powerline and natural gas pipeline are in the only reasonable location given the topographic, environmental, geological, and logistical considerations.

14. The proposed access route was selected by El Paso to minimize the surface disturbance to Defendants' land.

ORDER OF IMMEDIATE OCCUPANCY

Based upon the foregoing Findings of Fact and Conclusions of Law, and good cause appearing therefor,

THE COURT HEREBY ORDERS AS FOLLOWS:

1. El Paso's Motion for Immediate Occupancy is GRANTED.

2. Pursuant to Utah Code Ann. § 78-34-9(3), (6), El Paso must deposit immediately with the Clerk of the Court the total amount of El Paso's appraised valuation of Defendants' property to be taken as an advance toward the just compensation to be awarded the Defendants in this proceeding.

3. Upon the deposit of El Paso's advance payment, the Defendants are ordered, pursuant to Utah Code Ann. § 78-34-9(4)(a), to surrender immediately possession to El Paso of their respective property to be taken for the Well-Site, access road, powerline and natural gas (gathering system) pipeline to the Well-Site.

DATED this 26 day of Oct 2001.

Honorable Judge John R. Anderson

Approved as to form:

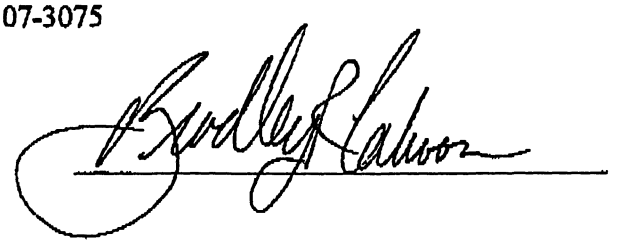
Melvin E. Leslie, Esq.
Attorney for Defendant
Deep Creek Investments

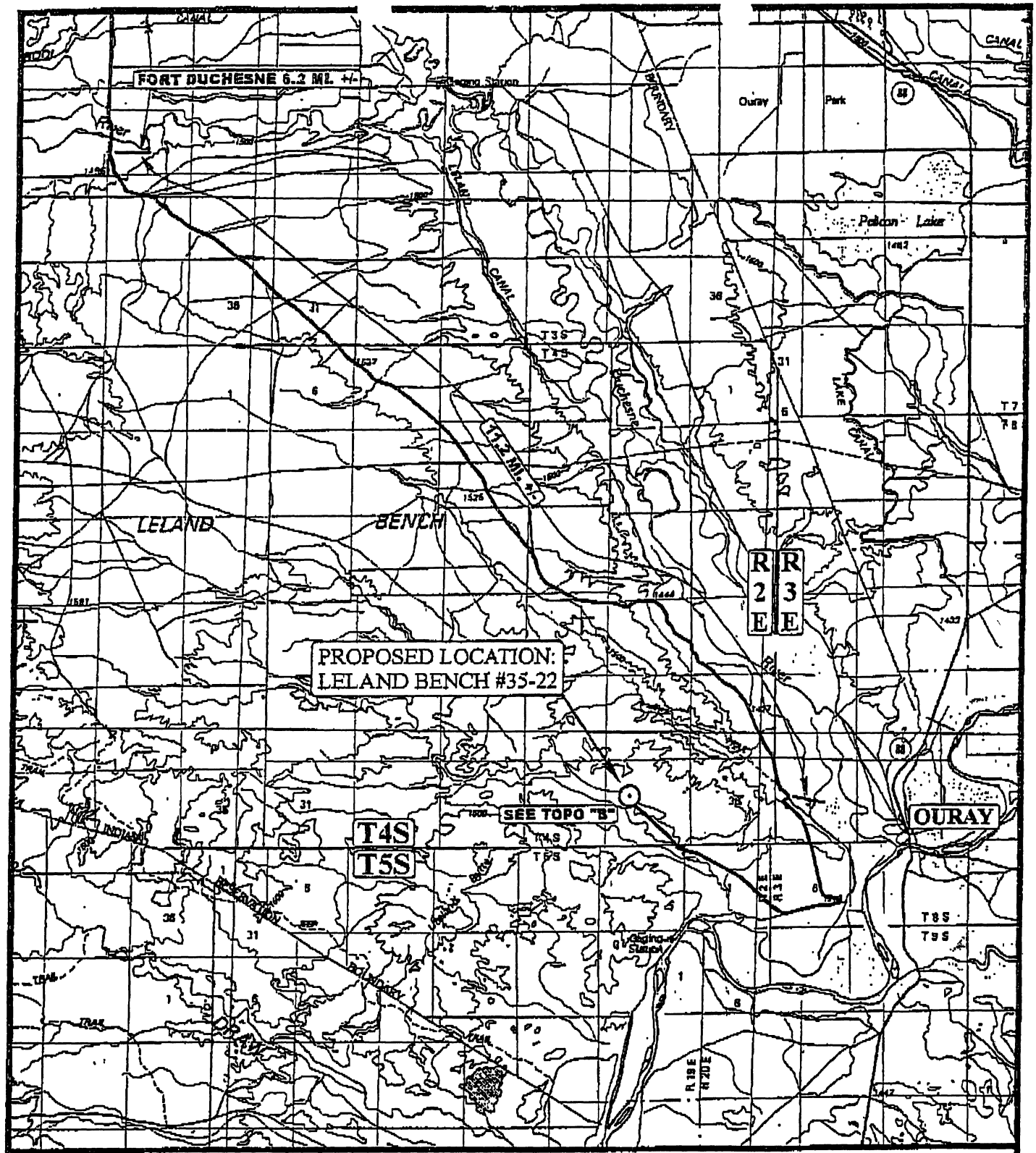
Date: October 24, 2001

CERTIFICATE OF SERVICE

I hereby certify that I caused a true and correct copy of the within and foregoing **ORDER GRANTING IMMEDIATE OCCUPANCY** to be mailed, postage prepaid, this 24th day of October, 2001, to the following counsel of record:

Melvin E. Leslie, Esq.
4444 South 700 East #203
Salt Lake City, Utah 84107-3075





LEGEND:

⊙ PROPOSED LOCATION

N

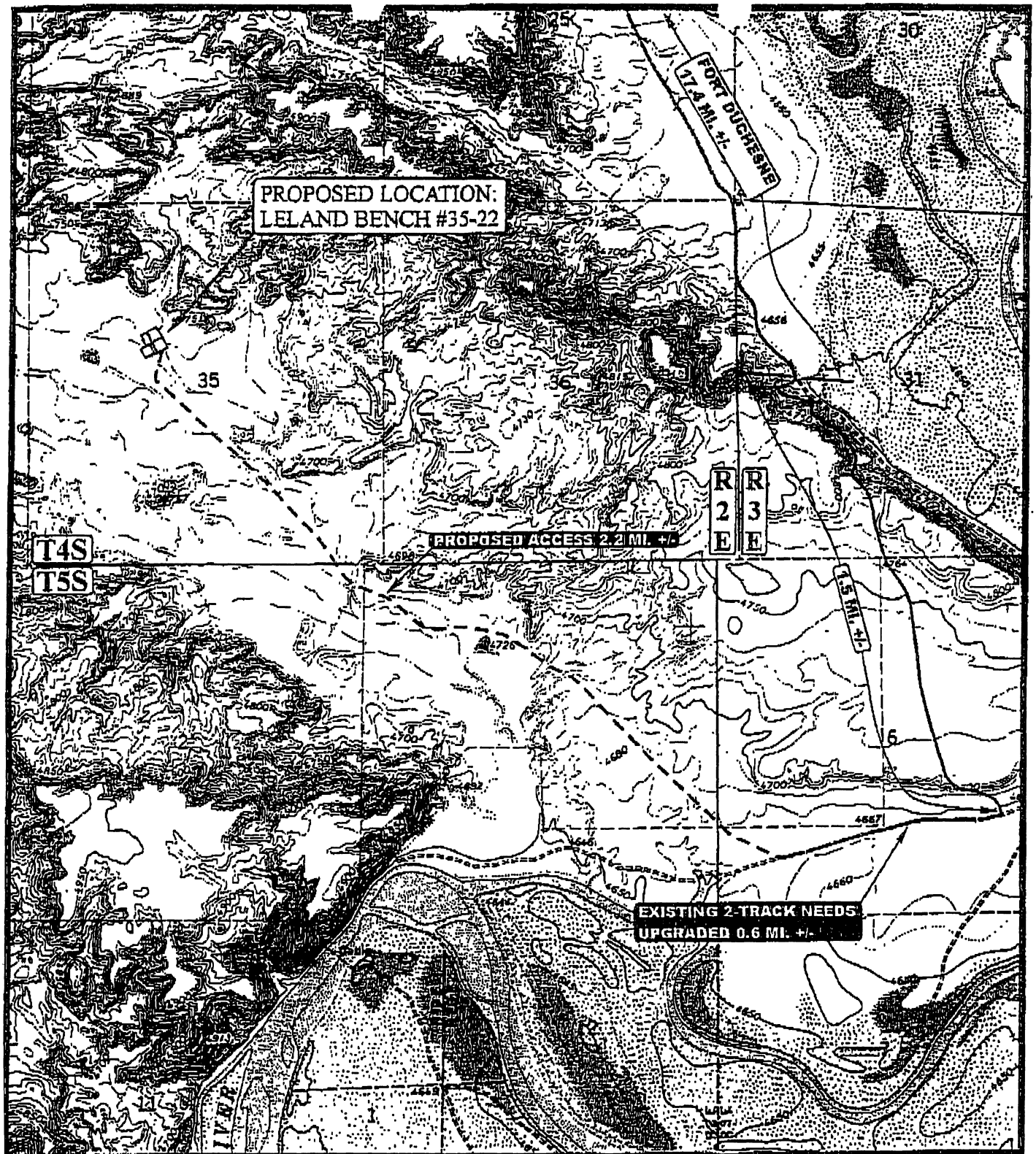
EL PASO PRODUCTION OIL & GAS COMPANY

LELAND BENCH #35-22
SECTION 35, T4S, R2E, U.S.B.&M.
2053' FNL 1845' FWL

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	8 MONTH	8 DAY	01 YEAR	A TOPO
SCALE: 1:100,000	DRAWN BY: J.L.G.	REVISED: 00-00-00		

Exhibit A



LEGEND:

PROPOSED ACCESS ROAD

EXISTING ROAD

EXISTING 2-TRACK NEEDS UPGRADED

N

EL PASO PRODUCTION OIL & GAS COMPANY

LELAND BENCH #35-22

SECTION 35, T4S, R2E, U.S.B.&M.

2053' FNL 1845' FWL

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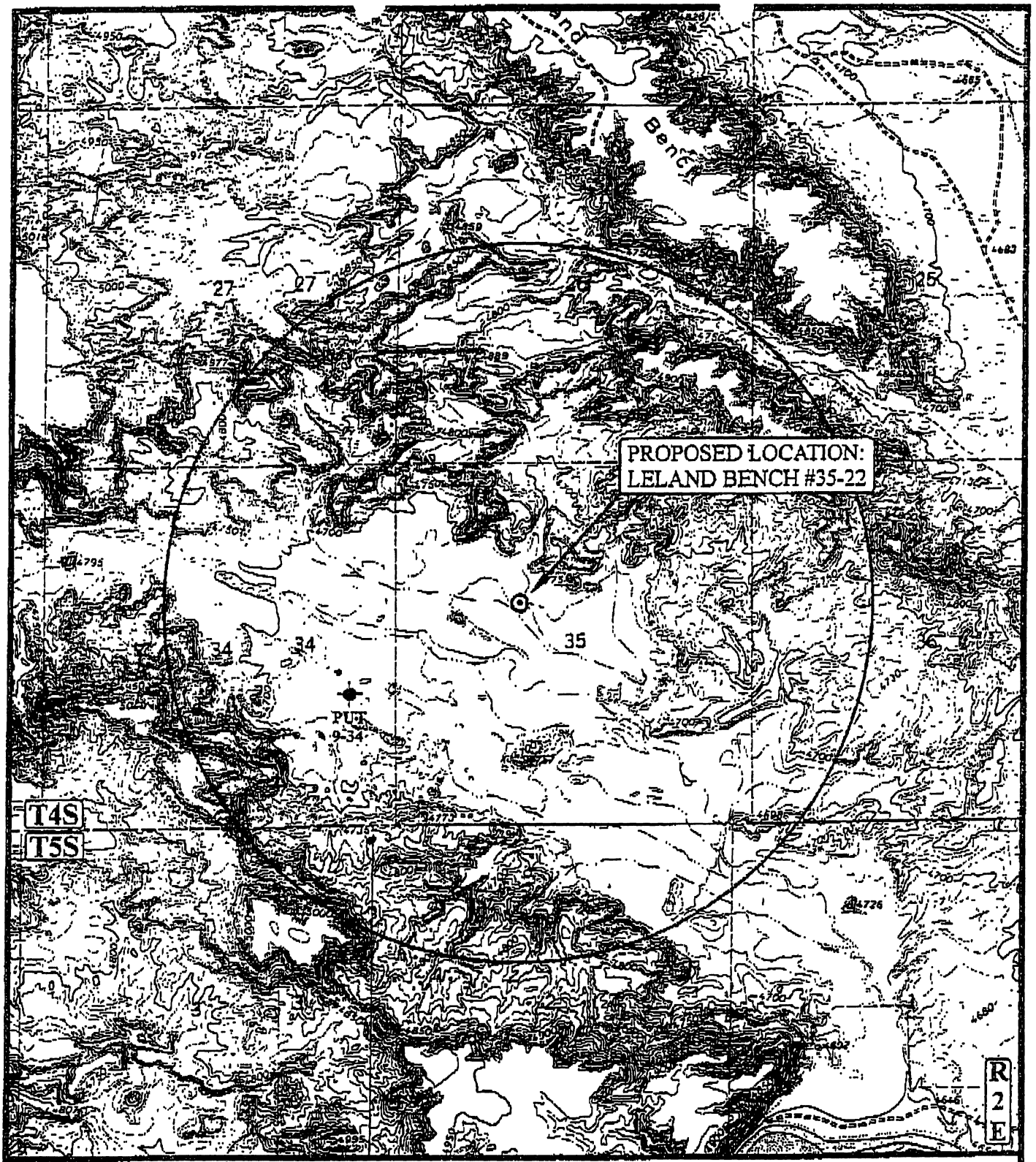
TOPOGRAPHIC MAP	8 MONTH	8 DAY	01 YEAR	B TOPO
SCALE: 1" = 2000'	DRAWN BY: J.L.G.	REVISED: 00-00-00		

EXHIBIT A



LEGEND:

- DISPOSAL WELLS
- PRODUCING WELLS
- SHUT IN WELLS
- WATER WELLS
- ABANDONED WELLS
- TEMPORARILY ABANDONED

N

EL PASO PRODUCTION OIL & GAS COMPANY

LELAND BENCH #35-22
SECTION 35, T4S, R2E, U.S.B.&M.
2053' FNL 1845' FWL

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

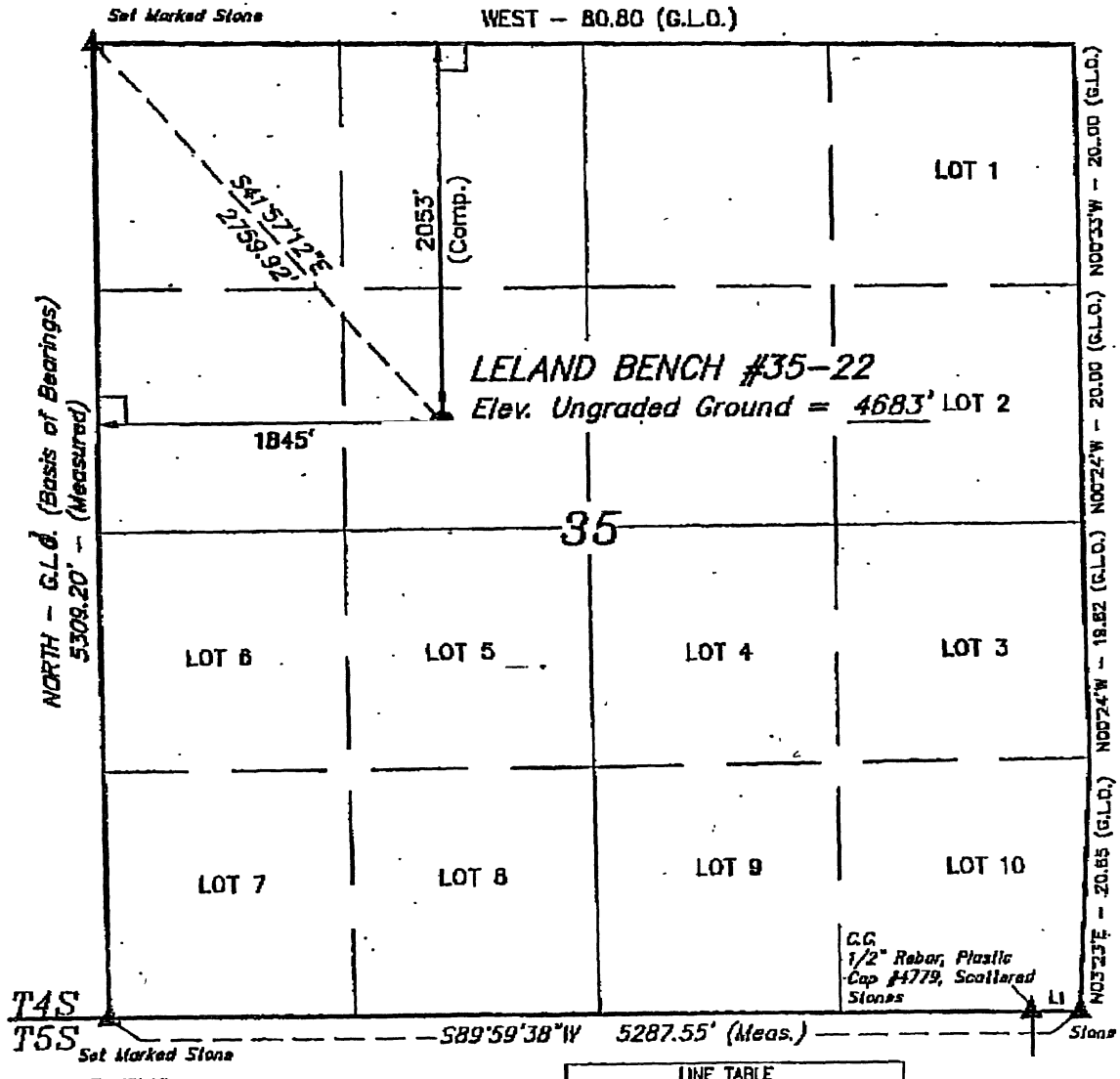
TOPOGRAPHIC MAP	8 MONTH	8 DAY	01 YEAR
SCALE: 1" = 2000'	DRAWN BY: J.L.G.	REVISED: 00-00-00	

TOPO

EL PASO PRODUCTION OIL & GAS COMPANY

T4S, R2E, U.S.B.&M.

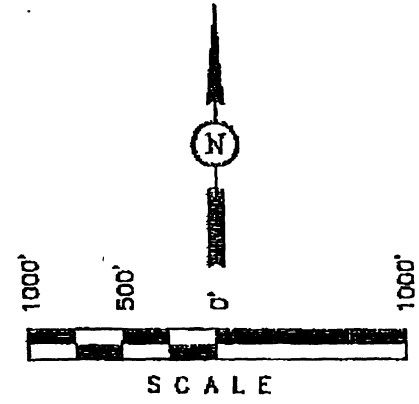
Well location, LELAND BENCH #35-22, located as shown in the SE 1/4 NW 1/4 of Section 35, T4S, R2E, U.S.B.&M. Uintah County, Utah.



LINE TABLE		
LINE	BEARING	LENGTH
L1	N86°05'59"W	267.24'

BASIS OF ELEVATION

BENCH MARK 31EAM LOCATED IN THE SW 1/4 OF SECTION 29, T4S, R3E, U.S.B.&M. TAKEN FROM THE OURAY QUADRANGLE, UTAH, UINTAH COUNTY, 7.5 MINUTE SERIES (TOPOGRAPHICAL MAP) PUBLISHED BY THE UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY. SAID ELEVATION IS MARKED AS BEING 4697 FEET.



CERTIFICATE

...S IS TO CERTIFY THAT THE ABOVE PLAT WAS PREPARED FROM FIELD NOTES OF ACTUAL SURVEYS MADE BY ME OR UNDER MY SUPERVISION AND THAT THE SAME ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

No. 161319
ROBERT L.
REGISTERED LAND SURVEYOR
REGISTRATION NO. 161319
STATE OF UTAH
STATE OF UTAH

LEGEND:

. = 90° SYMBOL

= PROPOSED WELL HEAD.

LATITUDE = 40°05'41"

UINTAH ENGINEERING & LAND SURVEYING
85 SOUTH 200 EAST - VERNAL, UTAH 84078
(435) 789-1017

SCALE	DATE SURVEYED:	DATE DRAWN:
1" = 1000'	08-07-01	08-09-01
PARTY: B.B. W.L. D.R.B.	REFERENCES: G.L.O. PLAT	
WEATHER:	FILE:	

Exhibit A

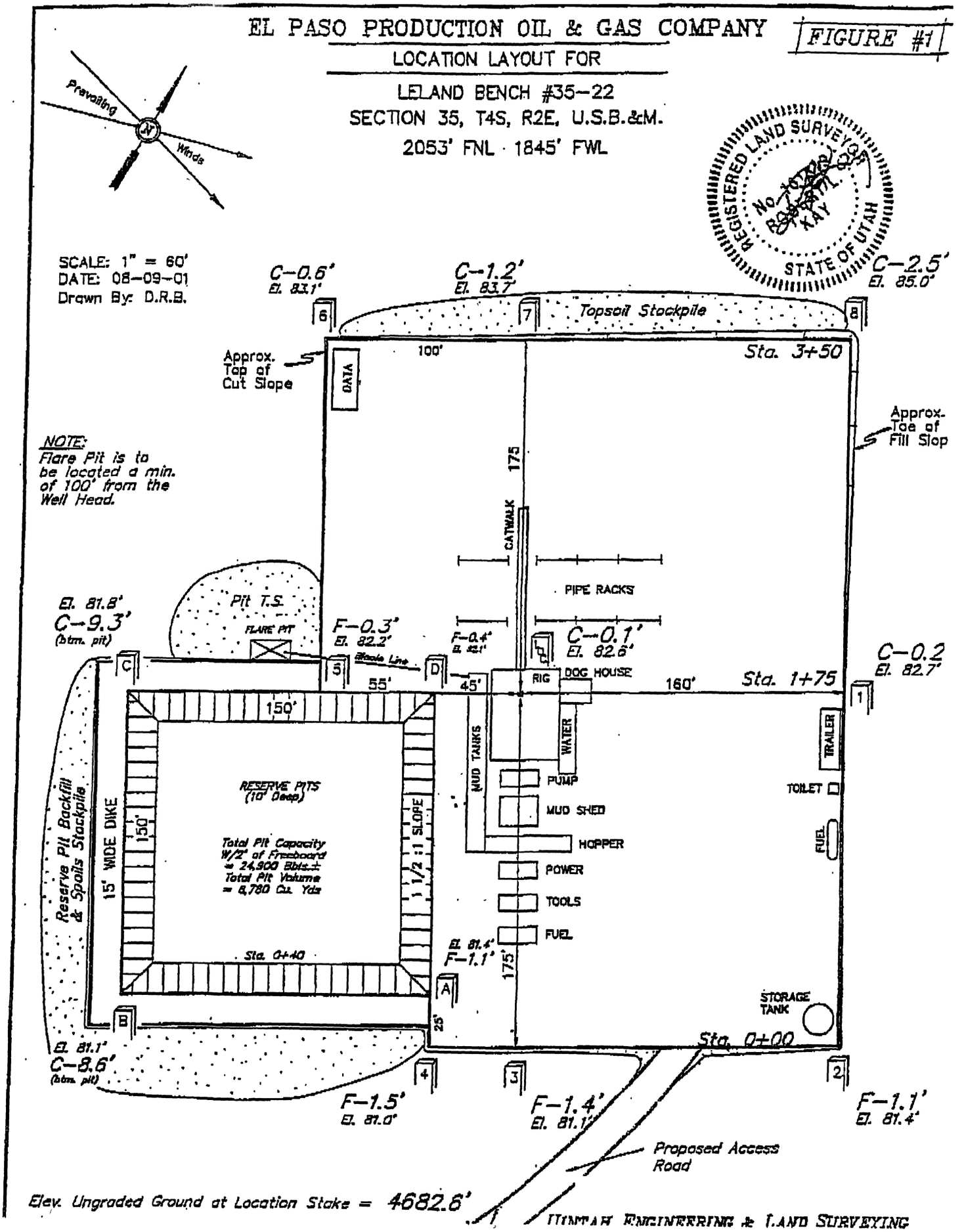

EL PASO PRODUCTION OIL & GAS COMPANY
FIGURE #1
LOCATION LAYOUT FOR
LELAND BENCH #35-22
SECTION 35, T4S, R2E, U.S.B.&M.
2053' FNL 1845' FWL
Prevailing Winds
REGISTERED LAND SURVEYOR
No. 161319
STATE OF UTAH
SCALE: 1" = 60'
DATE: 08-09-01
Drawn By: D.R.B.
C-0.6'
El. 83.1'
C-1.2'
El. 83.7'
C-2.5'
El. 85.0'
Topsoil Stockpile
Approx. Top of Cut Slope
DATA
100'
Sta. 3+50
Approx. Toe of Fill Slop
NOTE:
Flare Pit is to be located a min. of 100' from the Well Head.
175'
CATWALK
PIPE RACKS
El. 81.8'
C-9.3'
(btm. pit)
Pit T.S.
FLARE PIT
F-0.3'
El. 82.2'
F-0.4'
El. 82.1'
C-0.1'
El. 82.6'
C-0.2
El. 82.7'
Blooie Line
55'
45'
RIG
DOG HOUSE
160'
Sta. 1+75
150'
RESERVE PITS
(10' Deep)
Total Pit Capacity
W/2' of Freeboard
= 24,900 Bbls.±
Total Pit Volume
= 8,780 Cu. Yds
MUD TANKS
WATER
PUMP
MUD SHED
HOPPER
POWER
TOOLS
FUEL
TRAILER
TOILET
FUEL
Reserve Pit Backfill & Spoils Stockpile
15' WIDE DIKE
150'
1 1/2 : 1 SLOPE
Sta. 0+40
El. 81.4'
F-1.1'
175'
25'
STORAGE TANK
Sta. 0+00
El. 81.1'
C-8.6'
(btm. pit)
F-1.5'
El. 81.0'
F-1.4'
El. 81.1'
F-1.1'
El. 81.4'
Proposed Access Road
Elev. Ungraded Ground at Location Stake = 4682.6'
TRI STATE ENGINEERING & LAND SURVEYING

Exhibit A

EL PASO PRODUCTION OIL & GAS COMPANY

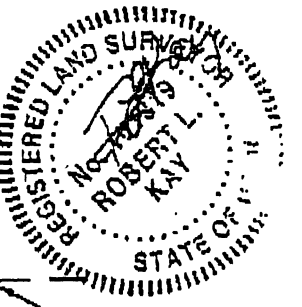
FIGURE #2

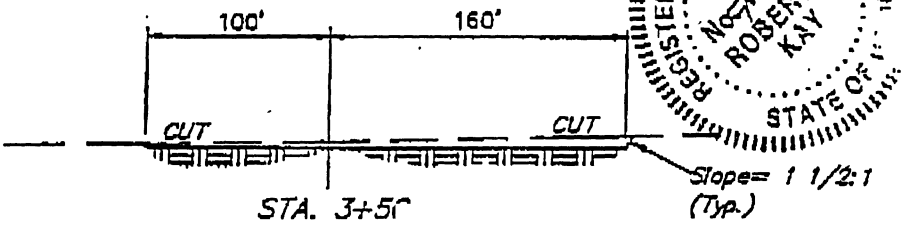
TYPICAL CROSS SECTIONS FOR

LELAND BENCH #35-22
SECTION 35, T4S, R2E, U.S.B.&M.
2053' FNL 1845' FWL

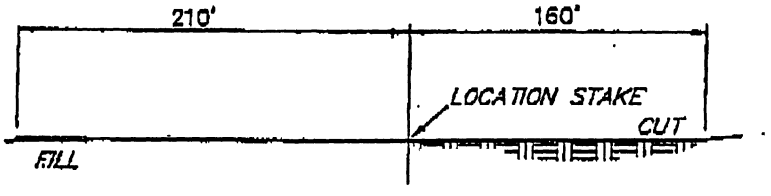
1" = 40'
X-Section Scale
1" = 100'

DATE: 08-09-01
Drawn By: D.R.B.

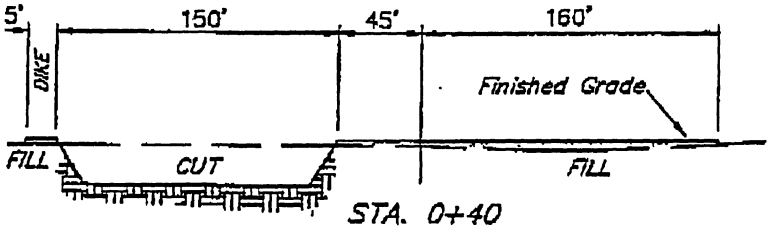




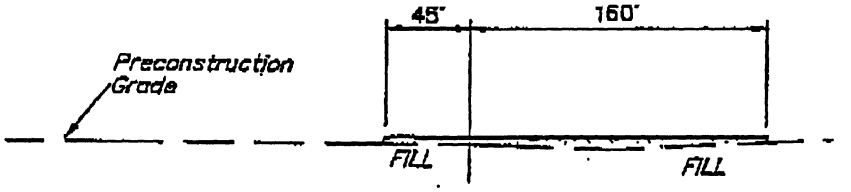
STA. 3+50



STA. 1+75



STA. 0+40



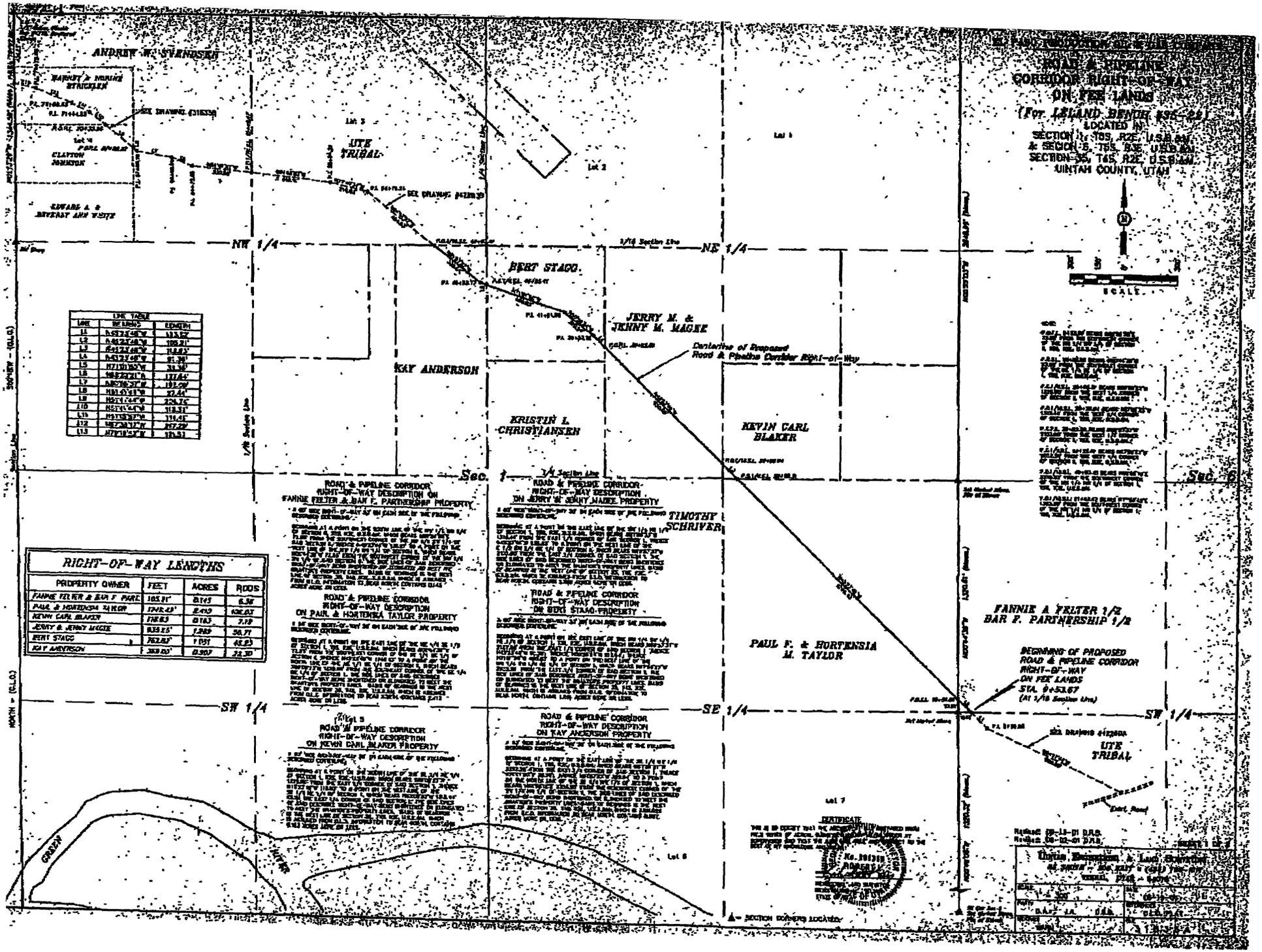
STA. 0+00

NOTE:
Topsoil should not be Stripped Below Finished Grade on Substructure Area.

APPROXIMATE YARDAGES

(6") Topsoil Stripping	= 2,040 Cu. Yds.	EXCESS MATERIAL AFTER 5% COMPACTION	= 5,800 Cu. Yds.
Remaining Location	= 6,520 Cu. Yds.	Topsoil & Pit Backfill (1/2 Pit Vol.)	= 5,430 Cu. Yds.
TOTAL CUT	= 8,560 CU.YDS.	EXCESS UNBALANCE (After Rehabilitation)	= 370 Cu. Yds.
FILL	= 7,620 CU.YDS.		

UINTAH ENGINEERING & LAND SURVEYING


ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY ON FEE LANDS
(For LELAND BENCH #35-22)
LOCATED IN:
SECTION 1, T6S, R2E, U.S.B.&M.
& SECTION 6, T6S, R3E, U.S.B.&M.
SECTION 36, T5S, R2E, U.S.B.&M.
UINTAH COUNTY, UTAH
SCALE
ANDREW W. STENDSEN
LYLE & BEVERLY ANN WHITE
CLAYTON JOHNSTON
UTE TRIBAL
BERT STAGG
JERRY M. & JENNY M. MAGEE
KAY ANDERSON
KRISTIN L. CHRISTIANSEN
KEVIN CARL BLAKER
TIMOTHY SCHRIVER
PAUL F. & HORTENSIA M. TAYLOR
FANNIE A. FELTER 1/2
BAR F. PARTNERSHIP 1/2
Centerline of Proposed Road & Pipeline Corridor Right-of-Way
BEGINNING OF PROPOSED ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY ON FEE LANDS STA. 0+53.67 (At 1/16 Section Line)
NW 1/4
NE 1/4
SW 1/4
SE 1/4
Sec. 1
Sec. 6
Lot 5
Lot 6
Lot 7
Lot 8
Dirt Road
GORGE
WASH
SECTION 15
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON FANNIE FELTER & BAR F. PARTNERSHIP PROPERTY
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON JERRY M. & JENNY MAGEE PROPERTY
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON PAUL & HORTENSIA TAYLOR PROPERTY
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON BERT STAGG PROPERTY
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON KEVIN CARL BLAKER PROPERTY
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON KAY ANDERSON PROPERTY
CERTIFICATE
Uintah Engineering & Land Surveying
LINE TABLE
L1 N 43°23'48" W 133.52'
L2 N 46°36'12" E 100.31'
L3 N 43°23'48" W 14.68'
L4 N 43°23'48" W 91.36'
L5 N 71°10'52" W 39.58'
L6 N 68°36'12" E 137.64'
L7 N 90°00'00" E 189.00'
L8 N 81°01'48" W 37.44'
L9 N 21°14'48" W 224.76'
L10 N 57°14'48" W 118.31'
L11 N 13°15'52" W 111.45'
L12 N 87°28'12" E 217.00'
L13 N 76°18'52" W 170.51'
RIGHT-OF-WAY LENGTHS
PROPERTY OWNER | FEET | ACRES | RODS
FANNIE FELTER & BAR F PART. | 165.31' | 0.145 | 8.98
PAUL & HORTENSIA TAYLOR | 1741.43' | 2.419 | 105.63
KEVIN CARL BLAKER | 116.83 | 0.163 | 7.19
JERRY & JENNY MAGEE | 1139.25' | 1.369 | 58.71
BERT STAGG | 763.82' | 1.091 | 46.83
KAY ANDERSON | 388.00' | 0.557 | 23.91
▲= SECTION CORNERS LOCATED

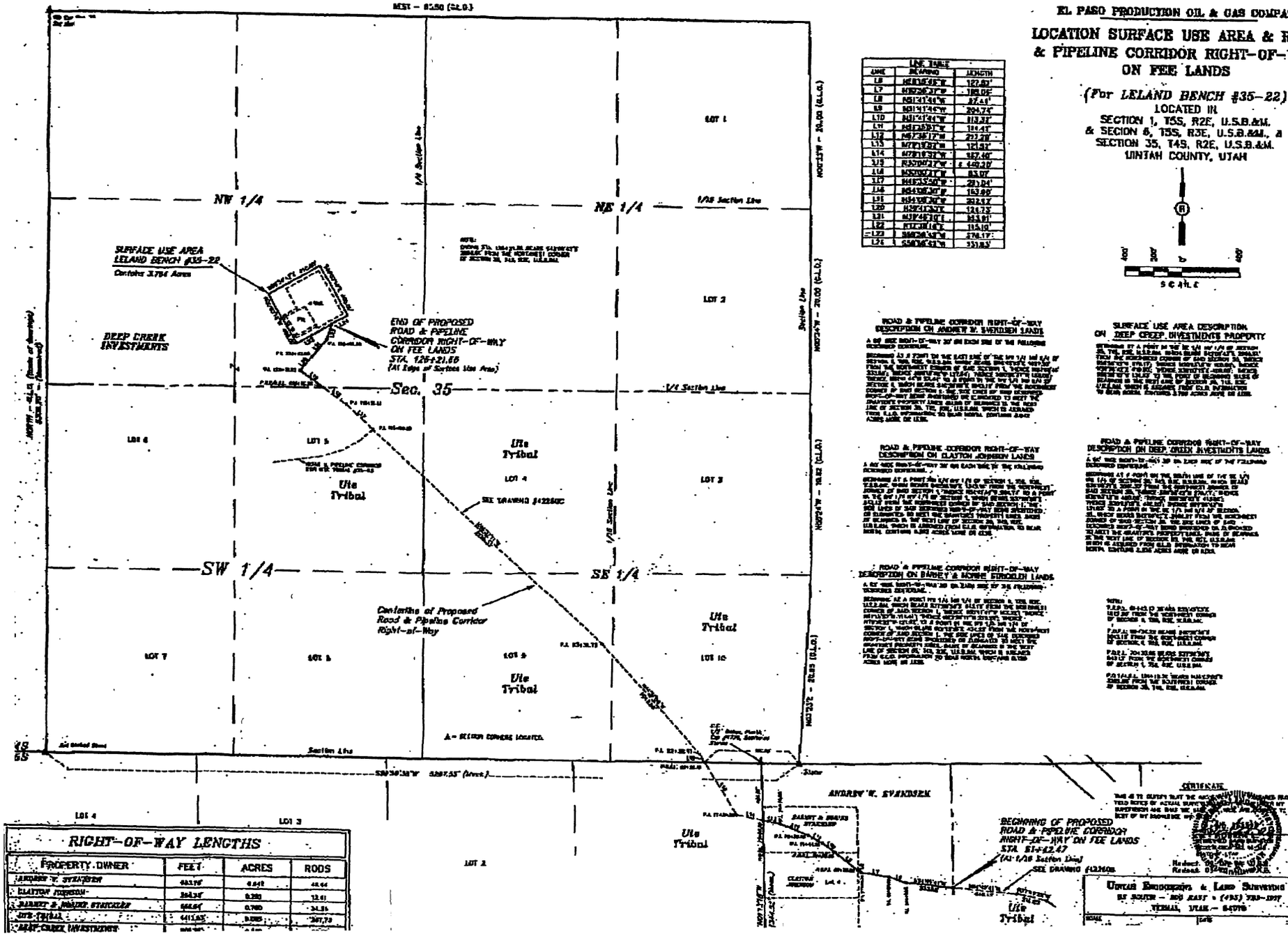

EL PASO PRODUCTION OIL & GAS COMPANY
LOCATION SURFACE USE AREA & RO
& PIPELINE CORRIDOR RIGHT-OF-W
ON FEE LANDS
(For LELAND BENCH #35-22)
LOCATED IN
SECTION 1, T5S, R2E, U.S.B.&M.
& SECTION 6, T5S, R3E, U.S.B.&M., a
SECTION 35, T4S, R2E, U.S.B.&M.
UINTAH COUNTY, UTAH
SCALE
LINE TABLE
LINE BEARING LENGTH
L8 N81°15'46"W 122.80'
L7 N80°26'37"W 186.05'
L8 N81°41'46"W 87.41'
L9 N81°41'46"W 204.75'
L10 N81°41'46"W 813.32'
L11 N81°53'57"W 194.45'
L12 N67°36'17"W 293.28'
L13 N77°13'07"W 121.52'
L14 N77°13'07"W 187.40'
L15 N53°00'27"W ± 440.28'
L16 N53°00'27"W 83.07'
L17 N46°53'30"W 283.04'
L18 N46°53'30"W 163.66'
L19 N34°58'06"E 303.17'
L20 N39°41'06"E 124.73'
L21 N39°46'30"E 343.91'
L22 N77°38'16"E 115.19'
L23 S88°36'43"W 276.17'
L24 S58°36'43"W 331.83'
SURFACE USE AREA
LELAND BENCH #35-22
Contains 3.794 Acres
DEEP CREEK INVESTMENTS
END OF PROPOSED ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY ON FEE LANDS STA. 126+21.66 (At Edge of Section Use Area)
Sec. 35
NW 1/4
NE 1/4
SW 1/4
SE 1/4
Ute Tribal
Centerline of Proposed Road & Pipeline Corridor Right-of-Way
ANDREW W. SVENDSEN
BARRETT & BRAUER STRICKLER
BEGINNING OF PROPOSED ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY ON FEE LANDS STA. 51+42.47 (At 1/16 Section Line)
SEE DRAWING #123605
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON ANDREW W. SVENDSEN LANDS
SURFACE USE AREA DESCRIPTION ON DEEP CREEK INVESTMENTS PROPERTY
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON CLAYTON JOHNSON LANDS
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON DEEP CREEK INVESTMENTS LANDS
ROAD & PIPELINE CORRIDOR RIGHT-OF-WAY DESCRIPTION ON BARNEY & MONIE STRICKLER LANDS
CERTIFICATE
UINTAH ENGINEERING & LAND SURVEYING
85 SOUTH - 200 EAST - (435) 789-1017
VERNAL, UTAH - 84078
RIGHT-OF-WAY LENGTHS
PROPERTY OWNER FEET ACRES RODS
ANDREW W. SVENDSEN 443.76' 0.643 26.94
CLAYTON JOHNSON 844.24' 0.290 13.61
BARNEY & MONIE STRICKLER 666.64' 0.765 34.35
UTE TRIBAL 6411.62' 8.980 387.73
DEEP CREEK INVESTMENTS

Exhibit B

FILED
DISTRICT COURT
DUCHESNE COUNTY, UTAH

JAN 10 2007

JOANNE McKEE, CLERK
BY _____ DEPUTY

Phillip Wm. Lear, Esq., (1914)
Kelly A. Williams, Esq., (8669)
LEAR & LEAR L.L.P.
299 South Main Street, Suite 2200
Wells Fargo Building
Salt Lake City, Utah 84111
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Facsimile (801) 538-5001
Attorneys for Plaintiffs

IN THE EIGHTH JUDICIAL DISTRICT COURT OF DUCHESNE COUNTY

STATE OF UTAH

FIML NATURAL RESOURCES, LLC, a Delaware limited liability company; and **UTE/FNR LLC**, a Delaware limited liability company, Plaintiffs, v. **THE ESTATE OF ROBERT C. PYLES, DECEASED; BETTY PYLES**, an individual; **RANDOLPH PYLES**, an individual; **ARTHUR TAYLOR, RACHEL K. PYLES**, an individual, **ROBERT K. PYLES**, an individual; **JOHN DOES 1 THROUGH 10**; and **ALL OTHER PERSONS UNKNOWN** Claiming any Right, Title, Estate, Lien, or Interest in the Surface Estates to the Real Property Described in the Complaint, Defendants.	**ORDER GRANTING IMMEDIATE OCCUPANCY** Case No. 060800183 Honorable A.L. Payne

This matter having come before the Court on November 29, 2006 on Plaintiffs' motion for an order granting immediate occupancy of the property sought to be condemned in the

above-entitled action and upon Plaintiffs' motions for expedited disposition; and the court having examined the appraisal prepared by Free and Associates, Inc. and the Affidavits of Carol Mellinger and Kelly A. Williams, the responses of Defendants, and good cause appearing;

NOW, THEREFORE, IT IS HEREBY ORDERED that:

1. Plaintiffs have established a prima facie case for condemnation in this matter and are entitled to immediate occupancy pursuant to Utah Code Ann. § 78-34-9 (2002).

2. Plaintiffs are authorized to occupy the property sought to be condemned in this action, namely, a portion of the southeast quarter of Section 26, Township 5 South, Range 6 West, U.S.M., and to construct the Access Road Easement and Access Road and the natural gas Pipeline Easement and Pipeline as defined in the Amended Complaint and to do such other work as may be required for the purposes for which the property is sought to be condemned.

3. As a condition precedent to occupying the property, Plaintiffs shall post with the Duchesne County Clerk a bond to Defendants in the sum of ~~$900.00~~ 35,000 AMP conditioned to pay the adjudged value of the property on Plaintiffs' failure to pay the adjudged value in case the property is condemned, and to pay all damages arising from occupation of the property, in case the property is not condemned, plus all costs adjudged to Defendants in the action.

4. Pending the action, Defendants, their respective agents, servants, and employees be, and they hereby are, restrained from hindering or interfering with the occupation of the property by Plaintiffs and the doing of the work required for the purposes for which it is sought to condemn the land.

DATED this 10 day of January, 2007.

BY THE COURT:

Honorable A. L. Payne
District Judge

CERTIFICATE OF NOTIFICATION

I certify that a copy of the attached document was sent to the following people for case 060800183 by the method and on the date specified.

METHOD	NAME
Mail	BETTY PYLES DEFENDANT 1423 South Sunrise Way Palm Springs, CA 92265
Mail	RANDOLPH PYLES DEFENDANT 1423 South Sunrise Way Palm Springs CA 92265
Mail	ROBERT ESTATE OF PYLES DEFENDANT 1423 South Sunrise Way Palm Springs CA 92265
Mail	ARTHUR TAYLOR DEFENDANT 246 E 400 N Duchesne UT 84021
Mail	PHILLIP WM. LEAR ATTORNEY PLA 299 S MAIN ST STE 2200 SALT LAKE CITY UT 84111
Fax	KELLY A WILLIAMS (801)538-5001

Dated this 11th day of Jan, 2007.

BM

Deputy Court Clerk

Susan Parker

From: Marlene Lewis
Sent: Wednesday, September 23, 2009 10:47 AM
To: Susan Parker
Subject: FW: From " 4357382754"(Fax Message NO.1502)

2009092310383045
0.tif (97 KB)

-----Original Message-----
From: c4545@learlaw.com [mailto:c4545@learlaw.com]
Sent: Wednesday, September 23, 2009 8:39 AM
To: Fax
Subject: From " 4357382754"(Fax Message NO.1502)

This E-mail was sent from "RNPCAE514" (C4540).

Queries to: c4545@learlaw.com

No virus found in this incoming message.
Checked by AVG - www.avg.com
Version: 8.5.409 / Virus Database: 270.13.112/2388 - Release Date: 09/23/09 05:52:00

Susan Parker

From: Marlene Lewis
Sent: Wednesday, September 23, 2009 10:47 AM
To: Susan Parker
Subject: FW: From " 4357382754"(Fax Message NO.1502)

20090923103830450.tif (97 KB)

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No virus found in this incoming message.
Checked by AVG - www.avg.com
Version: 8.5.409 / Virus Database: 270.13.112/2388 - Release Date: 09/23/09 05:52:00

COL

ANDERSON & KARRENBERG
Thomas R. Karrenberg (#3726)
Samantha J. Slark (#10774)
50 West Broadway, Suite 700
Salt Lake City, Utah 84101-2035
Telephone: (801) 534-1700
Facsimile: (801) 364-7697

Attorneys for Defendant

FILED
SEP - 8 2009
SEVENTH DISTRICT COURTS

IN THE SEVENTH JUDICIAL DISTRICT COURT

IN AND FOR CARBON COUNTY, STATE OF UTAH

MARION ENERGY, INC., a Texas corporation; and **STATE OF UTAH SCHOOL AND INSTITUTIONAL TRUST LANDS ADMINISTRATION,** Plaintiffs, vs. **KFJ RANCH PARTNERSHIP**, a business association of unknown type, Defendant.	**JUDGMENT AND ORDER GRANTING DEFENDANT'S MOTION TO DISMISS AND DENYING PLAINTIFFS' MOTION FOR SUMMARY JUDGMENT** Case No. 090700027 Judge George M. Harmond

Defendant KFJ Ranch Partnership's Motion to Dismiss and Plaintiffs' Motion for Summary Judgment came on for hearing before the Court on August 5, 2009. Defendant KFJ Ranch Partnership was represented by Thomas R. Karrenberg and Samantha J. Slark of Anderson & Karrenberg. Plaintiff Marion Energy, Inc. ("Marion") was represented by Jack R. Luellen and Matthew L. Crockett of Beatty & Wozniak, P.C. and the State of Utah School and Institutional Trust Lands Administration ("SITLA") was represented by Thomas A. Mitchell.

The Court, having carefully reviewed and considered the various pleadings and papers submitted by the parties with respect to Defendant's Motion to Dismiss and Plaintiffs' Motion for Summary Judgment, hereby enters the following order:

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED:

Defendant's Motion to Dismiss is granted and Plaintiffs' Motion for Summary Judgment is denied. Plaintiffs' condemnation action is hereby dismissed with prejudice. The operative facts of this case are not in dispute. Plaintiffs brought this condemnation action to take two permanent easements over Defendant's private property for the purpose of building roads to access and develop their SITLA oil and gas leases.

Utah Code Ann. § 78B-6-501(6)(a) does not provide authority to take land for roads to access oil and gas deposits. In interpreting the intent of the legislature, the Court is required to consider the plain language of the statute, to consider that each word has been used advisedly, and to presume any omissions are purposeful. Utah Code Ann. § 78B-6-501(6)(a) lists the substances for which land can be condemned for roads, and oil and gas are not included. Furthermore, oil and gas are specifically mentioned in Utah Code Ann. § 78B-6-501(6)(d), which shows the legislature purposefully intended to exclude oil and gas from Utah Code Ann. § 78B-6-501(6)(a). Accordingly, Defendant's Motion to Dismiss is granted, Plaintiffs' Motion for Summary Judgment is denied, and the condemnation action is dismissed with prejudice.

DATED this 8 day of September, 2009.

BY THE COURT:

/S/ GMH

Honorable George M. Harmond
District Court Judge

Approved as to form:

Jack R. Luellen
Matthew L. Crockett
Attorneys for Plaintiff Marion

Approved as to form

Thomas A. Mitchell
Attorneys for Plaintiff SITLA

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on the _____ day of August, 2009, I did cause a true and correct copy of the foregoing **JUDGMENT AND ORDER GRANTING DEFENDANT'S MOTION TO DISMISS AND DENYING PLAINTIFFS' MOTION FOR SUMMARY JUDGMENT** to be served via first-class mail, postage prepaid, upon the following:

Jack R. Luellen
Matthew L. Crockett
Beatty & Wozniak, PC
216 16th Street, Suite 100
Denver, CO 80202
Attorneys for Plaintiff Marion Energy, Inc.

Thomas A. Mitchell
675 East 500 South, Suite 500
Salt Lake City, UT 84102
Attorneys for Plaintiff State of Utah School and Institutional Trust Lands Administration

Tab 16

Public Land Statistics

2008

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

PUBLIC LAND

STATISTICS

2008

Volume 193

BLM/OC/ST-09/001+1165

May 2009

Table 1-3. MINERAL AND SURFACE ACRES ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT, FISCAL YEAR 2008

State	Land Total	Federal Minerals /a/	Federal Surface Lands /b/	Split-Estate Federal Minerals /c/	BLM Public Lands /d/	Indian Trust Minerals /e/
	Million Acres	*Million Acres*	*Million Acres*	*Million Acres*	*Million Acres*	*Million Acres*
Alaska	365.48	237.0	237.0	0.0	78.5	1.2
Arizona	72.69	35.8	33.0	3.0	12.2	20.7 /f/
California	100.21	47.5	45.0	2.5	15.3	0.6
Colorado	66.49	29.0	24.1	5.2	8.3	0.8 /g/
Eastern States	/h/	40.0	40.0	0.3	0.1	2.3
Hawaii	4.11	0.6	0.6	0.0	0.0	0.0
Idaho	52.93	36.5	33.1	3.4	11.6	0.6
Kansas	52.51	0.8	0.7	0.1	0.0	0.0
Montana	93.27	37.8	26.1	11.7	7.9	5.5
Nebraska	49.03	0.7	0.7	0.0	0.1	0.1
Nevada	70.26	58.7	58.4	0.3	47.8	1.2
New Mexico	77.77	36.0	26.5	9.5	13.4	8.4 /g/
North Dakota	44.45	5.6	1.1	4.5	0.1	0.9
Oklahoma	44.09	2.3	1.7	0.5	0.1	1.1
Oregon	61.60	33.9	32.4	1.5	16.1	0.8
South Dakota	48.88	3.7	2.1	1.6	0.2	5.0
Texas	168.22	4.5	4.5	0.0	0.1	0.0
Utah	52.70	35.2	34.0	1.2	22.8	2.3 /f/
Washington	42.69	12.5	12.2	0.3	0.4	2.6
Wyoming	62.34	41.6	30.0	11.6	18.3	1.9
Total	**1,529.72**	**699.7**	**643.2**	**57.2**	**253.3**	**56.0**

Table 1-3. MINERAL AND SURFACE ACRES ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT, FISCAL YEAR 2008–concluded

Note: This table and the accompanying maps represent 2 years of effort involved in researching, collecting, analyzing, and verifying data from numerous sources, and then coordinating and consulting with BLM State staff and other agencies. It presents a "snapshot" of data as of 1999. Because of the scope and complexity involved in creating and updating this table, and the fact that it is intended to present an approximation of the surface and mineral acreages managed by the BLM, yearly updates are not planned.

Estimated acreages were based on various sources of published and unpublished data. The rationale used to develop these data is presented in "Public Lands, On-Shore Federal and Indian Minerals in Lands of the U.S.," prepared by Sie Ling Chiang of BLM's Washington Office in 2000. The first column, Land Total, is taken from Table 1-3, *Public Land Statistics*, 1999, whereas the fifth column, BLM Public Lands, comes from Table 1-4, *Public Land Statistics*, 2007.

/a/ The term Federal Minerals refers to on-shore Federal minerals that are part of the BLM's responsibilities. The on-shore Federal mineral acreage approximates the sum of Federal Surface Lands acres and Split-Estate Federal Minerals acres shown in the next two columns. As of 1999, the total was *approximately* 700 million acres.

/b/ Federal Surface Lands include both the public domain and acquired lands of all Federal agencies. With the exception of an estimated 4 million acres of the acquired lands, Federal mineral rights exist in all Federal lands.

/c/ The term Split-Estate Federal Minerals refers to Federal mineral rights under private surface lands. These are patented lands with minerals reserved to the U.S. Reservations may be for single, multiple, or all minerals. The 58 million acres is the mid-point of estimates ranging from 55 to 60 million acres (provided by the BLM's Colorado State Office). This results in a significantly lower acreage than that shown in Table 3-2; we hope that any future updates will address this inconsistency.

/d/ On these public lands, the BLM manages both surface resources and subsurface minerals. The surface acreage is part of the Federal Surface Lands shown in the third column. The subsurface mineral acreage is part of the Federal Mineral estate included in the second column. As of 2008, the BLM's public lands comprise 253.3 million surface acres; refer to Table 1-4 of *Public Land Statistics*.

/e/ As part of its trust management responsibility, the BLM provides technical supervision of mineral development on 56 million acres of American Indian trust lands except for Osage lands. All minerals in Indian trust lands are "leasable." Acreage information was obtained in 1999 from the Real Estate Services staff of the Bureau of Indian Affairs.

/f/ Navajo and Hopi oil and gas in Arizona and Utah are managed by New Mexico BLM.

/g/ Ute Mountain Ute oil and gas in New Mexico are managed by Colorado BLM.

/h/ The BLM's Eastern States Office is responsible for Federal minerals in the 31 states east of, or bordering, the Mississippi River.

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008

	Leases as of September 30, 2008 /a/		Leases Issued During Fiscal Year		
	Number	*Acres*	*Number*	*Acres*	*Accepted Bonus Bid*
Oil and Gas Pre-Reform Act Leases					
Public Domain					
Alabama	4	203			
Alaska	0	0			
Arkansas	20	3,207			
California	24	2,349			
Colorado	243	74,944			
Kansas	52	10,795			
Louisiana	26	2,149			
Michigan	2	200			
Mississippi	2	53			
Montana	171	42,227			
Nevada	2	120			
New Mexico	786	204,114			
North Dakota	35	6,631			
Oklahoma	205	14,514			
South Dakota	11	1,197			
Utah	159	56,301			
Wyoming	620	137,099			
Total	**2,362**	**556,103**	**None**	**None**	
Acquired Lands					
Alabama	2	91			
Arkansas	75	29,103			
Colorado	4	897			
Illinois	2	210			
Kansas	10	1,755			
Kentucky	4	1,372			
Louisiana	7	8,411			
Michigan	4	337			
Mississippi	30	9,725			
Montana	5	1,323			
New York	2	751			
North Dakota	28	4,448			
Ohio	14	2,466			
Oklahoma	44	9,715			
Pennsylvania	1	315			
Texas	11	4,070			
Utah	1	40			
Virginia	2	693			
West Virginia	1	570			
Wyoming	13	1,880			
Total	**260**	**78,172**	**None**	**None**	**None**

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Leases as of September 30, 2008 /a/		Leases Issued During Fiscal Year		
	Number	*Acres*	*Number*	*Acres*	*Accepted Bonus Bid*
Summary: Pre-Reform Act Leases					
Public Domain and Acquired Lands					
Alabama	6	294			
Alaska	0	0			
Arkansas	95	32,310			
California	24	2,349			
Colorado	247	75,841			
Illinois	2	210			
Kansas	62	12,550			
Kentucky	4	1,372			
Louisiana	33	10,560			
Michigan	6	537			
Mississippi	32	9,778			
Montana	176	43,550			
Nevada	2	120			
New Mexico	786	204,114			
New York	2	751			
North Dakota	63	11,079			
Ohio	14	2,466			
Oklahoma	249	24,229			
Pennsylvania	1	315			
South Dakota	11	1,197			
Texas	11	4,070			
Utah	160	56,341			
Virginia	2	693			
West Virginia	1	570			
Wyoming	633	138,979			
Total	**2,622**	**634,275**	**None**	**None**	
Pre-Reform Act Future Interest Leases					
Public Domain and Acquired Lands					
Arkansas	1	151			
Colorado	1	320			
Kansas	206	43,029			
Louisiana	1	40			
Michigan	1	200			
Ohio	1	68			
Oklahoma	4	561			
Texas	1	106			
Wyoming	5	1,195			
Total	**221**	**45,670**	**None**	**None**	
Total Pre-Reform Act Oil and Gas Leases /b/ /c/	**2,843**	**679,945**	**None**	**None**	

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Leases as of September 30, 2008 /a/		Leases Issued During Fiscal Year		
	Number	*Acres*	*Number*	*Acres*	*Accepted Bonus Bid*
Reform Act Leases					
Public Domain					
Alabama	16	2,437	3	396	$794
Arizona	16	16,560	0	0	0
Arkansas	326	230,643	48	21,251	13,906,848
California	368	307,548	52	61,220	1,631,642
Colorado	3,472	3,246,821	285	256,138	136,394,779
Idaho	13	23,339	9	15,982	39,870
Kansas	23	3,860	2	154	852
Louisiana	72	7,177	31	3,540	1,699,897
Michigan	5	596	1	108	216
Mississippi	17	1,950	0	0	0
Montana	1,371	1,209,720	161	169,901	881,744
Nebraska	2	342	0	0	0
Nevada	992	1,485,270	119	170,059	1,730,160
New Mexico	2,826	1,845,089	159	138,772	33,212,227
North Dakota	401	141,411	17	3,210	870,105
Oklahoma	292	29,968	14	1,083	1,642,464
Oregon	156	224,590	0	0	0
South Dakota	83	87,055	0	0	0
Utah	2,291	2,895,094	64	90,728	10,475,166
Washington	179	193,849	0	0	0
Wyoming	11,012	9,257,296	722	747,625	48,480,471
Total	**23,933**	**21,210,615**	**1,687**	**1,680,167**	**$250,967,235**
Acquired Lands					
Alabama	134	120,690	17	22,400	$125,188
Arkansas	787	518,054	39	14,115	1,995,803
California	8	1,102	0	0	0
Colorado	144	62,135	24	10,661	220,636
Florida	2	3,368	0	0	0
Illinois	9	6,382	0	0	0
Kansas	45	14,484	2	2,609	18,544
Kentucky	29	12,801	0	0	0
Louisiana	271	116,004	59	36,866	2,742,346
Michigan	59	34,072	17	17,532	281,176
Mississippi	743	337,889	13	922	204,288
Montana	319	222,601	35	28,059	381,825
Nebraska	1	161	0	0	0
New Mexico	26	14,128	0	0	0
New York	2	274	0	0	0
North Dakota	612	361,562	35	17,025	11,828,393
Ohio	48	7,260	0	0	0
Oklahoma	254	171,768	49	47,621	2,655,274

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Leases as of September 30, 2008 /a/		Leases Issued During Fiscal Year		
	Number	*Acres*	*Number*	*Acres*	*Accepted Bonus Bid*
Reform Act Leases—continued					
Acquired Lands—continued					
Oregon	3	1,703	0	0	$0
Pennsylvania	2	108	0	0	0
South Dakota	2	471	0	0	0
Texas	424	252,076	23	18,802	7,749,030
Utah	5	770	1	320	17,600
Virginia	35	19,722	20	10,098	136,015
Washington	184	296,802	0	0	0
West Virginia	44	63,286	5	5,185	789,403
Wyoming	71	33,519	0	0	0
Total	**4,263**	**2,673,192**	**339**	**232,215**	**$29,145,521**
Summary: Reform Act Leases					
Public Domain and Acquired Lands					
Alabama	150	123,127	20	22,796	$125,982
Arizona	16	16,560	0	0	0
Arkansas	1,113	748,697	87	35,366	15,902,651
California	376	308,650	52	61,220	1,631,642
Colorado	3,616	3,308,956	309	266,799	136,615,415
Florida	2	3,368	0	0	0
Idaho	13	23,339	9	15,982	39,870
Illinois	9	6,382	0	0	0
Kansas	68	18,344	4	2,763	19,396
Kentucky	29	12,801	0	0	0
Louisiana	343	123,181	90	40,406	4,442,243
Michigan	64	34,668	18	17,640	281,392
Mississippi	760	339,839	13	922	204,288
Montana	1,690	1,432,321	196	197,960	1,263,569
Nebraska	3	503	0	0	0
Nevada	992	1,485,270	119	170,059	1,730,160
New Mexico	2,852	1,859,217	159	138,772	33,212,227
New York	2	274	0	0	0
North Dakota	1,013	502,973	52	20,235	12,698,498
Ohio	48	7,260	0	0	0
Oklahoma	546	201,736	63	48,704	4,297,738
Oregon	159	226,293	0	0	0
Pennsylvania	2	108	0	0	0
South Dakota	85	87,526	0	0	0
Texas	424	252,076	23	18,802	7,749,030
Utah	2,296	2,895,864	65	91,048	10,492,766
Virginia	35	19,722	20	10,098	136,015
Washington	363	490,651	0	0	0
West Virginia	44	63,286	5	5,185	789,403
Wyoming	11,083	9,290,815	722	747,625	48,480,471
Total	**28,196**	**23,883,807**	**2,026**	**1,912,382**	**$280,112,756**

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Leases as of September 30, 2008 /a/		Leases Issued During Fiscal Year		
	Number	*Acres*	*Number*	*Acres*	*Accepted Bonus Bid*
Reform Act Future Interest Leases					
Public Domain and Acquired Lands					
Arkansas	5	511	3	218	$72,780
Colorado	1	160			
Kansas	39	9,672			
Louisiana	1	73			
North Dakota	2	363			
Oklahoma	17	2,274			
Texas	38	7,263			
Total	**103**	**20,316**	**3**	**218**	**$72,780**
Total Reform Act Competitive Oil and Gas Leases /d/ /e/	**28,299**	**23,904,123**	**2,029**	**1,912,600**	**$280,185,536**
Competitive General Services Administration (GSA) Oil and Gas Leases /f/					
Public Domain					
California	2	712			
Nebraska	10	8,641			
Total	**12**	**9,353**	**None**	**None**	**None**
Competitive Protective Leases /g/					
Public Domain and Acquired Lands					
Alaska	1	400			
Arkansas	2	690			
California	2	72			
Colorado	1	320			
Louisiana	2	4,588			
Nebraska	2	950			
New Mexico	1	27			
North Dakota	2	353			
Ohio	1	113			
Oklahoma	2	2,768			
Texas	6	2,259			
Utah	3	143			
Wyoming	1	80			
Total	**26**	**12,763**	**None**	**None**	**None**

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Leases as of September 30, 2008 /a/		Leases Issued During Fiscal Year		
	Number	*Acres*	*Number*	*Acres*	*Accepted Bonus Bid*
Competitive National Petroleum Reserve—Alaska Leases /h/					
Public Domain					
Alaska	334	3,081,375	0	0	$0
Total	**334**	**3,081,375**	**0**	**0**	**$0**
Competitive Naval Oil Shale Reserve Leases /i/					
Public Domain					
Colorado	4	8,388			
Total	**4**	**8,388**	**None**	**None**	**None**
Total Competitive Oil and Gas Leases /j/	**31,518**	**27,695,947**	**2,029**	**1,912,600**	**$280,185,536**
Pre-EPAct Competitive Geothermal Leases /k/					
Public Domain and Acquired Lands					
California	64	86,296			
Nevada	51	70,267			
New Mexico	4	4,581			
Oregon	10	6,464			
Utah	7	6,058			
Total	**136**	**173,666**	**None**	**None**	**None**
EPAct Competitive Geothermal Leases /l/					
Public Domain and Acquired Lands					
California	6	2,711	6	2,711	$8,006,800
Idaho	5	8,902	0	0	0
Nevada	77	223,525	34	100,677	11,418,509
Utah	3	6,022	3	6,022	3,673,560
Total	**91**	**241,160**	**43**	**109,410**	**$23,098,869**
Total Competitive Geothermal Leases	**227**	**414,826**	**43**	**109,410**	**$23,098,869**
Grand Total of All Competitive Oil, Gas and Geothermal Leases	**31,745**	**28,110,773**	**2,072**	**2,022,010**	**$303,284,405**

Table 3-13. COMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–concluded

Note: The three right-hand columns of this table do not apply to Pre-Reform Act Leases, except for those leases that had been pending issuance due to litigation or appeal.

The data for this table come from the Automated LR2000 System. The Automated LR2000 System is a dynamic system that is frequently corrected as data entry errors are found.

/a/ Leases which are authorized as of the last day of the fiscal year. Includes leasing actions during the fiscal year as shown in the three right-hand columns of this table.

Note: Because of an error in a program which automatically counts oil and gas leases in effect for *Public Land Statistics*, the number of oil and gas leases in effect at the end of each fiscal year between 2004 and 2007 for Tables 3-13, 3-14, and 3-15 were underreported by approximately 6,000 leases, combined. This error was corrected before collecting the data reported for Fiscal Year 2008.

/b/ Leases issued prior to the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

/c/ This is the total of all Pre-Reform Act and Pre-Reform Act Future Interest leases.

/d/ Leases issued under the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

/e/ This is the total of all Reform Act and Reform Act Future Interest leases.

/f/ Leases issued under the Mineral Leasing Act of 1920 for lands previously withdrawn or reserved from the public domain that are no longer needed by the agency for which the lands were withdrawn, and that have been declared excess or surplus by the General Services Administration.

/g/ Leases issued in accordance with the provisions of the Attorney General's Opinion of April 2, 1941; i.e., these leases must have the consent of the jurisdictional agency, must have drainage of oil and gas wells located on adjacent lands, and must not be subject to leasing under any leasing act.

/h/ Leases issued under the Interior Appropriations Act, Fiscal Year 1981, for lands within the National Petroleum Reserve—Alaska.

/i/ Leases issued under the Defense Appropriations Act, Fiscal Year 1998, for lands within Oil Shale Reserve Numbers 1 and 3.

/j/ This is the grand total of all Pre-Reform Act, Reform Act, and all other competitive oil and gas leases; however, it does not include competitive geothermal leases.

/k/ Leases issued under the Geothermal Steam Act.

/l/ Leases issued under the Geothermal Steam Act, as amended by the Energy Policy Act of 2005.

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Oil and Gas Pre-Reform Act Over-the-Counter Leases				
Public Domain				
Alabama	10	3,452		
Alaska	35	60,291		
Arkansas	19	25,268		
California	78	20,039		
Colorado	762	607,539	4	5,894
Kansas	27	7,967		
Louisiana	39	7,953		
Michigan	2	222		
Mississippi	10	1,346		
Montana	920	1,341,727		
Nebraska	3	159		
Nevada	20	12,942		
New Mexico	3,043	2,055,022		
North Dakota	28	7,257		
Oklahoma	180	28,564		
South Dakota	11	5,745		
Utah	721	572,957		
Wyoming	1,985	975,600		
Total	**7,893**	**5,734,050**	**4**	**5,894**
Acquired Lands				
Alabama	8	2,056		
Arkansas	43	32,627		
California	5	143		
Colorado	11	3,958		
Kansas	2	996		
Kentucky	9	10,197		
Louisiana	25	29,091		
Maryland	4	2,637		
Michigan	16	4,302		
Mississippi	74	34,685		
Montana	42	17,533		
Nebraska	3	136		
New Mexico	3	1,566		
North Dakota	47	27,637		
Ohio	11	9,844		
Oklahoma	36	10,505		
Pennsylvania	1	1,679		
Texas	39	80,771		

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Oil and Gas Pre-Reform Act Over-the-Counter Leases—continued				
Acquired Lands—continued				
Utah	8	1,493		
Virginia	6	10,202		
West Virginia	34	47,024		
Wyoming	17	3,994		
Total	**444**	**333,076**	**None**	**None**
Summary: Oil and Gas Pre-Reform Act Over-the-Counter Leases				
Public Domain and Acquired Lands				
Alabama	18	5,508		
Alaska	35	60,291		
Arkansas	62	57,895		
California	83	20,182		
Colorado	773	611,497	4	5,894
Kansas	29	8,963		
Kentucky	9	10,197		
Louisiana	64	37,044		
Maryland	4	2,637		
Michigan	18	4,524		
Mississippi	84	36,031		
Montana	962	1,359,260		
Nebraska	6	295		
Nevada	20	12,942		
New Mexico	3,046	2,056,588		
North Dakota	75	34,894		
Ohio	11	9,844		
Oklahoma	216	39,069		
Pennsylvania	1	1,679		
South Dakota	11	5,745		
Texas	39	80,771		
Utah	729	574,450		
Virginia	6	10,202		
West Virginia	34	47,024		
Wyoming	2,002	979,594		
Total	**8,337**	**6,067,126**	**4**	**5,894**

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Pre-Reform Act Simultaneous Leases				
Public Domain				
Alabama	4	1,604		
Arkansas	4	901		
California	29	7,773		
Colorado	789	462,749		
Florida	1	120		
Kansas	2	880		
Louisiana	12	633		
Michigan	11	13,915		
Mississippi	5	380		
Montana	330	262,367		
Nevada	21	8,620		
New Mexico	1,403	879,588		
North Dakota	102	60,229		
Oklahoma	125	17,422		
South Dakota	37	17,675		
Utah	449	374,572		
Wyoming	3,182	1,588,970		
Total	**6,506**	**3,698,398**	**None**	**None**
Acquired Lands				
Alabama	4	3,589		
Arkansas	17	10,879		
California	1	43		
Colorado	31	18,374		
Kentucky	3	7,045		
Louisiana	22	12,449		
Michigan	19	8,356		
Mississippi	106	60,393		
Montana	49	45,196		
Nebraska	1	9		
New Mexico	4	834		
North Dakota	152	144,651		
Ohio	1	1,670		
Oklahoma	39	12,958		
South Dakota	2	841		
Texas	21	20,139		
Utah	3	324		
Virginia	2	4,066		

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Pre-Reform Act Simultaneous Leases—continued				
Acquired Lands—continued				
West Virginia	2	4,156		
Wyoming	41	15,981		
Total	**520**	**371,953**	**None**	**None**
Summary: Pre-Reform Act Simultaneous Leases				
Public Domain and Acquired Lands				
Alabama	8	5,193		
Arkansas	21	11,780		
California	30	7,816		
Colorado	820	481,123		
Florida	1	120		
Kansas	2	880		
Kentucky	3	7,045		
Louisiana	34	13,082		
Michigan	30	22,271		
Mississippi	111	60,773		
Montana	379	307,563		
Nebraska	1	9		
Nevada	21	8,620		
New Mexico	1,407	880,422		
North Dakota	254	204,880		
Ohio	1	1,670		
Oklahoma	164	30,380		
South Dakota	39	18,516		
Texas	21	20,139		
Utah	452	374,89(		
Virginia	2	4,06(		
West Virginia	2	4,15(		
Wyoming	3,223	1,604,95]		
Total	**7,026**	**4,070,351**	**None**	**None**
Pre-Reform Act Future Interest Leases				
Public Domain and Acquired Lands				
Arkansas	5	843		
Colorado	7	1,060		
Kansas	2	400		

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Pre-Reform Act Future Interest Leases—continued				
Public Domain and Acquired Lands—continued				
Louisiana	4	14,029		
Michigan	3	1,241		
Mississippi	1	395		
North Dakota	5	1,110		
Texas	2	4,615		
Wyoming	3	511		
Total	**32**	**24,204**	**None**	**None**
Total Pre-Reform Act Noncompetitive Leases /b/	**15,395**	**10,161,681**	**4**	**5,894**
Reform Act Leases				
Public Domain				
Alabama	1	281	0	0
Arizona	70	342,113	0	0
Arkansas	108	175,722	2	8,220
California	56	49,482	1	760
Colorado	484	617,655	6	3,779
Idaho	3	3,321	1	1,527
Kansas	3	2,574	0	0
Louisiana	1	52	0	0
Michigan	9	5,705	0	0
Mississippi	3	1,230	0	0
Montana	547	840,634	11	30,171
Nebraska	3	320	0	0
Nevada	1,141	2,838,487	280	551,782
New Mexico	128	206,583	0	0
North Dakota	46	14,169	0	0
Oklahoma	9	1,915	0	0
Oregon	21	40,818	0	0
South Dakota	20	22,179	0	0
Utah	645	1,079,205	2	3,521
Washington	40	64,188	2	3,804
West Virginia	1	929	0	0
Wyoming	1,490	1,552,037	57	59,385
Total	**4,829**	**7,859,599**	**362**	**662,949**

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Reform Act Leases—continued				
Acquired Lands				
Alabama	20	14,430	0	0
Arkansas	108	173,840	2	5,577
California	1	21	0	0
Colorado	19	10,979	0	0
Kentucky	1	881	0	0
Louisiana	45	18,319	0	0
Michigan	16	10,915	0	0
Mississippi	162	104,920	0	0
Montana	223	270,991	4	7,223
North Dakota	68	44,413	1	3
Ohio	26	9,832	0	0
Oklahoma	19	18,782	0	0
Oregon	11	21,982	5	14,358
South Dakota	1	320	0	0
Texas	58	54,189	0	0
Utah	1	400	0	0
Virginia	1	1,038	0	0
Washington	13	24,324	0	0
West Virginia	6	5,856	0	0
Wyoming	15	10,801	0	0
Total	**814**	**797,233**	**12**	**27,161**
Summary: Reform Act Leases				
Public Domain and Acquired Lands				
Alabama	21	14,711	0	0
Arizona	70	342,113	0	0
Arkansas	216	349,562	4	13,797
California	57	49,503	1	760
Colorado	503	628,634	6	3,779
Idaho	3	3,321	1	1,527
Kansas	3	2,574	0	0
Kentucky	1	881	0	0
Louisiana	46	18,371	0	0
Michigan	25	16,620	0	0
Mississippi	165	106,150	0	0
Montana	770	1,111,625	15	37,394
Nebraska	3	320	0	0
Nevada	1,141	2,838,487	280	551,782

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–continued

	Total as of September 30, 2008 /a/		Leases Issued During Fiscal Year	
	Number	*Acres*	*Number*	*Acres*
Summary: Reform Act Leases—continued				
Public Domain and Acquired Lands—continued				
New Mexico	128	206,583	0	0
North Dakota	114	58,582	1	3
Ohio	26	9,832	0	0
Oklahoma	28	20,697	0	0
Oregon	32	62,800	5	14,358
South Dakota	21	22,499	0	0
Texas	58	54,189	0	0
Utah	646	1,079,605	2	3,521
Virginia	1	1,038	0	0
Washington	53	88,512	2	3,804
West Virginia	7	6,785	0	0
Wyoming	1,505	1,562,838	57	59,385
Total	**5,643**	**8,656,832**	**374**	**690,110**
Reform Act Future Interest Leases				
Acquired Lands				
Texas	1	547		
Total	**1**	**547**	**None**	**None**
Total Reform Act Noncompetitive Leases /c/	**5,644**	**8,657,379**	**374**	**690,110**
Total Oil and Gas Noncompetitive Leases /d/	**21,039**	**18,819,060**	**378**	**696,004**
Geothermal Leases				
Public Domain and Acquired Lands				
Arizona	1	2,084		
California	15	12,640		
Idaho	2	726		
Nevada	230	341,465	4	7,777
Oregon	55	49,638		
Total	**303**	**406,553**	**4**	**7,777**
Grand Total of All Noncompetitive Oil, Gas, and Geothermal Leases	**21,342**	**19,225,613**	**382**	**703,781**

Table 3-14. NONCOMPETITIVE OIL, GAS, AND GEOTHERMAL LEASING, FISCAL YEAR 2008–concluded

Note: The two right-hand columns of this table do not apply to Pre-Reform Act Leases, except for those leases that had been pending issuance due to litigation or appeal.

/a/ Leases which are authorized as of the last day of the fiscal year. Includes leasing actions during the fiscal year as shown in the two right-hand columns of this table.

Note: Because of an error in a program which automatically counts oil and gas leases in effect for *Public Land Statistics*, the number of oil and gas leases in effect at the end of each fiscal year between 2004 and 2007 for Tables 3-13, 3-14, and 3-15 were underreported by approximately 6,000 leases, combined. This error was corrected before collecting the data reported for Fiscal Year 2008.

/b/ Leases issued prior to the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

/c/ Leases issued under the Federal Onshore Oil and Gas Reform Act of 1987.

/d/ This is the total of all Pre-Reform Act and Reform Act noncompetitive oil and gas leases; it does not include noncompetitive geothermal leases.