The Effect of Geothermal Classification on the Use and Development of Water: Conflicts Between State and Federal Laws

Energy development and use are among the top priorities of the federal and state governments. As geothermal power is a significant potential source of energy, its development and use has been furthered by state and federal aid. Several problems must be solved, however,


2. It has been estimated that geothermal resources could provide 40% of the national demand for space heat and domestic hot water, Fassbender, Bloomster & Price, The Economics of Geothermal, Solar and Conventional Space Heating, in GEOTHERMAL RESOURCES COUNCIL, GEOTHERMAL: ENERGY FOR THE EIGHTIES 707, 707 (Transactions Vol. 4, 1980) [hereinafter cited as GEOTHERMAL], and provide 3300 megawatts of electricity annually. Kruger & Roberts, Utility Industry Estimates of Geothermal Electricity, in GEOTHERMAL, supra at 511, 511; see also Bjorge, The Development of Geothermal Resources and the 1970 Geothermal Steam Act—Law in Search of Definition, 46 U. COLO. L. REV. 1, 3 n.15 (1974) (75% of total energy requirements of the U.S. from geothermal power) [hereinafter cited as Bjorge]; See also San Francisco Chronicle, March 2, 1981, at 23, col. 1. (Department of Energy estimates that geothermal power will provide 10% of nation's energy needs). In several cases, however, the failure to list geothermal power alternatives has been held not to invalidate Environmental Impact Statements because it was not a presently viable alternative. See Carolina Environmental Study Group v. United States, 510 F.2d 796, 800-01 (D.C. Cir. 1975); Sierra Club v. Morton, 431 F. Supp. 11, 17 (S.D. Tex. 1975); Warm Springs Dam Task Force v. Gribble, 378 F. Supp. 240, 246 (N.D. Cal. 1974); cf. Babcock & Wilcox Co. v. United Technologies Corp., 435 F. Supp. 1249, 1257 (N.D. Ohio 1977) (geothermal energy systems not relevant to analysis of competition in sales of electric generation equipment to utilities).


4. An Overview, supra note 3, at 33 (citing University of California, Ranking Research Problems in Geothermal Development (1971)). The largest deterrent to the development of geothermal power is the brine chemistry problem. Id. "Geothermal water tends to be more mineralized than is nongeothermal ground water, probably because at high temperatures it more readily dissolves salts (and minerals) from the rocks that surround it." Id. at 4. The brine chemistry problem entails eliminating, reinjecting, or neutralizing the corrosive or toxic minerals and salts in solution in geothermal fluids, developing heat-exchange technology for geothermal brines, and separating marketable mineral and chemicals from the rest of the geothermal fluid. Castrantas, Hydrogen Sulfide Abatement with Hydrogen Peroxide in Geothermal Operations, in Geothermal, supra note 2, at 637-40; Fritzler & Coury, Preliminary Process and Cost Analysis of a Multipurpose Geothermal Power and Desalination Plant, in Geothermal, supra note 2, at 507-10; McCright, Frey, & Tardiff, Localized Corrosion of Steels in Geothermal Steam/Brine Mixtures, in Geothermal, supra note 2, at 645-48; see also An Overview, supra note 3, at 12; Nichols, Orlander, & Lobach, Test Results from the 500 KW Direct Pilot Plant at East Mesa, in Geothermal, supra note 2, at 519.

There are several other significant deterrents. Development of resources has been slow due to federal land identification and classification requirements. McNamara, Federal Land Management Policy and the Drive to Develop an Alternate Energy Source, Geothermal Energy: Shall the Twain Ever Meet?, 19 Nat. Resources J. 261 (1979); see 43 C.F.R. § 2710.0-8(b) (Supp. 1980). Many technology-purchasing utility representatives believe that geothermal energy is only in the technological development stage and is therefore not economically viable. Prestwood, Duffy, Stone & Vanston, Alternate Energy Investment Decision Modelling: The Case of Geopressured-Geothermal Investment Decisions, in Geothermal, supra note 2, at 755, 757. Large utilities do not see a potential for geothermal operations on a scale large enough to be financially attractive as a new business enterprise or to improve the efficiency of existing systems. King, The Role of Gas and Electric Utilities in Direct Applications of Geothermal Resources, in Geothermal, supra note 2, at 799; see Guidebook, supra note 1, at 28. Although geothermal power is generally considered a clean energy source, Guidebook, supra note 1, at 1, "[a]lthough pollution, thermal pollution, soil erosion, land subsidence, increased seismicity, and disruption of existing land uses are all potential hazards associated with the development of a geothermal field." Bond, Environmental Impact of Geothermal Power Development and Utilization, in Geothermal, supra note 2, at 665. The impact on
classification of geothermal power within the existing framework of water law. This classification is particularly crucial in the arid western states, because these states have the majority of geothermal sites.

Geothermal energy is a naturally occurring phenomenon with its source in the heat of the earth's interior. Molten rock, or magma, can pour from the earth's surface as volcanic activity or lava flows, or it can remain in the earth's crust near the surface. The heat in these magmatic intrusions is a source of potential energy.


8. An OVERVIEW, supra note 3, at 4; Legal Problems, supra note 5, at 514-15; See Pariani v. State, 105 Cal. App. 3d 923, 926-27, 164 Cal. Rptr. 683, 684-85 (1980). There are four specific types of geothermal anomalies: (1) Steam-dominated systems are commonly known as geysers or fumaroles. The largest of these steam-dominated systems are in Larderello, Italy and The Big Geysers, California. Olpin, supra note 5, at 779. See generally Reich v. Commissioner, 52 T.C. 700 (1969), aff'd, 454 F. 2d 1157 (9th Cir. 1972); P.G. and E. Progress, Nov. 1980, 1. “[A]ll the systems involve generally similar types of operations (e.g., drilling wells, bringing the energy to the surface via a liquid medium, and producing electricity from . . . generators).” Bjorge, supra note 2, at 22. The steam anomalies are the cheapest because the energy can be directly harnessed to a turbine at the well-head. They are also the rarest. Sato & Crocker, Property Rights to Geothermal Resources (pt. 1), 6 ECOLOGY L.Q. 250, 260 (1977) [hereinafter cited as Sato I]. (2) The hot-water dominated systems are also known as wet rock systems. These dominated systems can be further divided by temperature. Those under 90°C (194°F) offer potential for small-scale users in space heat-
The raw geothermal resource is a hot fluid or vapor with four distinct elements: heat, water, minerals, and gases. This composition has created difficulties in classifying geothermal resources. Different classifications entail different systems of ownership of geothermal power and impose different limitations on its use. The classification of the resource also determines whether, through the exercise of their water laws, the states will control the development and use of the resource, including the water byproduct of a geothermal resource.

This Note explains the classifications of water produced at a geothermal resource, and discusses the conflicts in the ownership and use of the water element of the geothermal resource that arise from these classifications. The Note also examines the consumption of the water contained in a geothermal resource when water is used by a geothermal facility as the heat-transfer medium for producing electricity or direct heat. The Note begins by examining the interrelationship of water laws and geothermal power regulations. Next, it sets forth the conflicts that arise between the state and federal governments because of their different water rights laws and policies and their different definitions of geothermal resources. Finally, the Note proposes a possible solution to these conflicts: the geothermal byproduct water should be subject to

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10. Id.
11. See Olpin, supra note 5, at 874-75. Less water is used in non-electric geothermal development. Hansen, supra note 7, at 154-55.
state groundwater appropriation laws. This solution is designed both to further the development of geothermal power and to protect the water policies and needs of the states.

Water Rights Systems in the United States

The classification of geothermal power is affected by a vast body of state law that has been developed to protect water and water rights. The traditional common law water rights system, the riparian system, recognized a right in the owner of land bordering a watercourse to the flow of streamwater adjacent to his or her land. The owner of riparian land has a property right that is transient and usufructuary. Rather than a property right in the water itself, the owner has a right to the use of the water. A riparian’s right to the flow of streamwater is limited by the “reasonable use” of the stream by other riparian and non-riparian landowners.

The riparian system differentiates between rights to percolating water and rights to stream water. The owner of land over percolating water had, at common law, a right to sink wells on the land and to

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13. “Since water is a renewable resource producing a flow of benefits, what is allocated is its use, the right to take and use it over a period of time.” F. Trelease, Federal-State Relations in Water Law 5 (1971) [hereinafter cited as Relations].
14. F. Trelease, Cases and Materials on Water Law 263-64 (2d ed. 1974) [hereinafter cited as Water Law]. Determination of “reasonable use” is a question of fact. Mason v. Hoyle, 56 Conn. 255, 14 A. 786 (1888). The court in Red River Roller Mills v. Wright, 30 Minn. 249, 15 N.W. 167 (1883), set forth the classic criteria used to determine whether a use is reasonable: “In determining what is a reasonable use, regard must be had to the subject-matter of the use; the occasion and manner of its application; the object, extent, necessity, and duration of the use; the nature and size of the stream; the kind of business to which it is subservient; the importance and necessity of the use claimed by one party, and the extent of the injury to the other party; the state of improvement of the country in regard to mills and machinery, and the use of water as a propelling power; the general and established usages of the country in similar cases; and all the other and ever-varying circumstances of each particular case, bearing upon the question of the fitness and propriety of the use of the water under consideration.” Id. at 253, 15 N.W. at 169. The two basic variations on the riparian system are the American “reasonable use” doctrine and the English rule of “natural flow,” in which each riparian landowner has a right to have the water flow by his or her land undiminished in quantity or quality, subject to the use of the stream for domestic purposes. 3 J. Kent, Commentaries 439 (2d ed. 1832). Some American state jurisdictions retain the older English “natural flow” rule. See, e.g., Dimmock v. City of New London, 157 Conn. 9, 14, 245 A.2d 569, 572 (1968).
15. Percolating waters are found in an underground reservoir of uncertain quantity and location, “which pass through the ground beneath the surface of the earth without any definite channel, and do not form a part of the body or flow, surface or subterranean, of any water-course.” Black’s Law Dictionary 1427 (5th ed. 1979) [hereinafter cited as Black’s].
16. A stream is a “watercourse having a source and terminus, banks, and channel,
make unlimited use of the water from the wells.17 In contrast to an owner of land over water that formed an underground stream with a known course or channel,18 the owner of land over percolating water could maliciously allow the water to flow away, even if this diminished the water supply of an adjacent landowner.19

The riparian system prevails in those states in the East, Midwest, and Southeast20 whose water laws developed out of the common law. These states have plentiful water supplies and have developed similar rules regarding water possession and use.21 Most land in the western states, however, is arid or semi-arid,22 and most western states have only enough water to supply their most urgent needs.23 Consequently, the western states have developed different systems to conserve and regulate water.

The scarcity of water in the West was obvious to early miners,24 whose attempts to resolve disputes arising from this scarcity led to the now-dominant water law system of the West—the appropriation system.25 The miners formed vigilante groups to protect the interests of
those who had already appropriated stream water from those who arrived later, thus setting the precedent for the appropriation principle of first in time, first in right. Under this doctrine, one who takes possession of a piece of land must take it as found, subject to the prior appropriation of water rights by those who have come before.

Limitations on this rule have developed since its creation. One who takes a “first step” towards appropriating a supply of water is protected against one who begins later in time but who completes the appropriation first, as long as the one who took the “first step” exercises due diligence in completing the act of appropriation. In California, a permit system has been developed for water appropriations to allow water control boards to regulate the amount of water appropriated.

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30. CAL. WATER CODE § 1396 (West 1971). Diligence is the “steady application to business of any kind, constant effort to accomplish any undertaking.” Ophir Silver Mining Co. v. Carpenter, 4 Nev. 534, 546 (1869). Personal difficulties not incidental to an enterprise will result in a finding of an absence of due diligence. Id. at 547. Absent due diligence, the priority of the appropriation dates to the time when the appropriation is completed. Id. at 544.

31. See, e.g., CAL. WATER CODE §§ 1200-1801 (West 1971 & Supp. 1981); MONT.
The act of appropriation must be for a beneficial use, such as an agricultural, domestic, industrial, or recreational purpose. The appropriation system differentiates disputes involving groundwater from those involving surface water. While some states subject all groundwater to the state’s appropriation law, other states distinguish tributary groundwater from other groundwater, and allocate only tributary groundwater by prior appropriation. In these states, one who develops nontributary water owns exclusively the nontributary water that is on the developer’s land until the water reaches a natural water course. The developer does not own nontributary water that is not on his or her land, or water that is in a natural water course on his or her land. These states assign ownership of nontributary water, whether it is percolating groundwater or developed groundwater, to overlying landowners. This water becomes subject to prior appropriation laws.

Some beneficial uses are recognized by state constitutions. E.g., COLO. CONST. art. XVI, § 6; IDAHO CONST. art. 15, § 5; see also MONT. CONST. art. IX, § 3; N.M. CONST. art. 16, §§ 1-3; UTAH CONST. art. XVII, § 1. The uses enumerated in such constitutions are usually the primary uses of water, but the enumerations are not normally exhaustive. See Kaiser Steel Corp. v. W.S. Ranch Co., 81 N.M. 414, 467 P.2d 986 (1970); Young & Norton v. Hinderlinder, 15 N.M. 666, 110 P. 1045 (1910).

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32. See Phillips v. Gardner, 2 Or. App. 423, 469 P.2d 42 (1970) (discussion of statutory priorities); NEV. REV. STAT. § 534.120 (1979) (preferred uses in critical groundwater areas); N.M. STAT. ANN. § 72-12-2 (1978) (beneficial use is basis of right to use water); S.D. COMP. LAWS ANN. § 46-1-5 (Supp. 1981) (preference given to domestic users); UTAH CODE ANN. § 73-3-21 (1980).

33. See I S. WIEL, WATER RIGHTS IN THE WESTERN STATES § 37 (3rd ed. 1911).

36. See note 15 supra.


38. Howard v. Perrin, 8 Ariz. 347, 349, 76 P. 460, 462 (1904); Maricopa County Mun.
when it reaches a natural water course, passes beyond the owner's land, or is located in critical groundwater areas.

In most states that follow the prior appropriation system, water on all types of land, whether federal, state, or private, is subject to prior appropriation. Under the "mixed" scheme adopted by California and Arizona, however, riparian rights are recognized on private lands, but the prior appropriation rules determine water rights on public land.

**Federal Water Rights Law**

Federal water law differs in character and purpose from state water law. State water laws regulate the use of water and define the rights of water consumers and producers. No federal common law, however, governs water rights. These rights are governed by state law except when superseded by the United States Constitution or federal statute. Federal water law recognizes state water laws, authorizes federal projects that include the use of water systems, and appropriates...
water for use on federal lands. Although federal water laws have recognized the western water law system of appropriation, the federal government frequently undertakes projects and programs that use water in a manner inconsistent with state law.

The first major United States Supreme Court case to hold that the federal government has the power to appropriate water without regard to the laws of the state or territory where the water exists was *Winters v. United States.* In *Winters,* the Court held that the United States could lawfully enjoin the construction of a dam on a river that flowed through the Fort Belknap Indian Reservation in Montana. Approving the doctrine of prior appropriation and the general power of the states to regulate water, the Court ruled that in reserving land for the Indians, the United States also reserved enough water to irrigate the reservation.

This "reservation doctrine" was considered limited to Indian reservations until *Federal Power Commission v. Oregon.* In that case, the Supreme Court upheld, based on the property clause, the issuance of a license for a power project using water on lands reserved to the United States for power purposes. The Court noted that, while water rights on public lands might be governed by state law, water rights on "reservations" of the United States were not. Thus, the "reservation doctrine" may be interpreted to mean that if the federal government reserves a portion of the public domain for a federal purpose which will ultimately require water, and if at the same time the government

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46. Relations, supra note 13, at 56.
48. 207 U.S. 564 (1908).
49. Id. at 576. The rights were reserved as of the time of the creation of the Indian reservations. See Arizona v. California, 373 U.S. 546, 600 (1963).
51. 349 U.S. at 441-46. "The Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States . . . ." U.S. Const. art IV, § 3. For a discussion of congressional power over nonfederal lands under the property clause, see Gaetke, Congressional Discretion Under the Property Clause, 33 Hastings L.J. 381 (1981).
52. 349 U.S. at 438-39.
53. "'[R]eservations' means national forests, tribal lands embraced within Indian reservations, military reservations, and other lands and interests in lands owned by the United States, and withdrawn, reserved, or withheld from private appropriation and disposal under the public land laws; also lands and interests in lands acquired and held for any public purposes; but shall not include national monuments or national parks . . . ." 16 U.S.C. § 796(2) (1976).
54. 349 U.S. at 445.
intends to reserve unappropriated water for that purpose, then suffi-
cient water to fulfill that purpose is reserved to the federal govern-
ment from appropriation by private users.\textsuperscript{55}

The reservation doctrine thus allows the federal government to control
water on lands reserved by it for federal purposes,\textsuperscript{56} and may lead to
federal use of reserved waters without state control and in a manner
inconsistent with state plans and needs. Moreover, the ability of the
federal government to control water on reserved public lands may lead
to federal allocation of water previously reserved to private individuals
and federal destruction of state-created private water rights without
compensation.\textsuperscript{57}

The Supreme Court also has relied on the commerce clause,\textsuperscript{58} the

\textsuperscript{55} RELATIONS, supra note 13, at 109. The reservation doctrine applies to more than
surface water. State \textit{ex rel.} Bliss v. Dority, 55 N.M. 12, 225 P.2d 1007 (1950), appeal dis-
missed, 341 U.S. 924 (1951) (artesian waters are subject to New Mexico water law and are
therefore also subject to the Desert Land Act); \textit{see also} Cappaert v. United States, 426 U.S.

\textsuperscript{56} \textit{See generally} RELATIONS, supra note 13, at 197-234.

\textsuperscript{57} \textit{Id.} at 104; \textit{see also} Arizona v. California, 373 U.S. 546 (1963) (federal administra-
tive control of water allocation); Federal Power Comm’n v. Oregon, 349 U.S. 435 (1955)
/license to build dam granted despite policies of Oregon Fish and Game Commission); Sil-
ver Lake Power & Irrig. Co. v. City of Los Angeles, 176 Cal. 96, 167 P. 697 (1917) (muni-
cipal corporation’s congressionally granted right of appropriation supersedes inchoate vested
right of former appropriators); \textit{cf.} United States v. Gerlach Live Stock Co., 339 U.S. 725
(1950) (Congress did not intend to exercise navigation power in constructing Central Valley
Project).

\textsuperscript{58} “The Congress shall have Power . . . To regulate Commerce . . . among the sev-
eral States . . . .” U.S. CoNsT. art. 1, § 8, cl. 3. \textit{See generally} United States v. Darby, 312
U.S. 100 (1941). The commerce clause has been held to create a “navigable servitude” on all
navigable waterways in the United States, United States v. Rands, 389 U.S. 121 (1967);
Union Bridge Co. v. United States, 204 U.S. 364 (1907), and on once navigable waterways in
Appalachian Electric Power Co., 311 U.S. 377, 408-10 (1940); Arizona v. California, 238
U.S. 423 (1917). Thus, the United States, or its licensees, Federal Power Comm’n v. Oregon,
349 U.S. 435 (1955); First Iowa Hydro-Electric Coop. v. Federal Power Comm’n, 328 U.S.
152 (1946); United States v. Appalachian Electric Power Co., 311 U.S. 377 (1940); United
States v. Rio Grande Dam & Irrig. Co., 174 U.S. 690 (1899), may appropriate and use the
water on any navigable waterway without adequate compensation to those whose rights are
affected. United States v. Rands, 389 U.S. 121 (1967); City of Fresno v. California, 372 U.S.
627 (1963); United States v. Appalachian Electric Power Co., 311 U.S. 377 (1940); \textit{see Rela-
tions, supra note 13, at 175-96; Morreale, Federal Power in Western Waters: The Navigation
Power and the Rule of No Compensation, 3 NAT. RESOURCES J. 1 (1963); \textit{cf.} Henry Ford &
Son v. Little Falls Fibre Co., 280 U.S. 369 (1930) (power dam licensee to compensate owner
of upstream dam for destruction of that dam because of statute). The “reservation doctrine”
and the “navigation servitude” are creations of the Supreme Court. \textit{See Note, Colorado
River Water Conservation District v. United States: An Increased Role for State Courts in the
states are best able to protect themselves and to induce federal self-restraint when the
problems confronting them are handled through regular political channels and are least able
do so when the problems are not, constitutional guarantees notwithstanding. Thus the
supremacy clause, and the general welfare clause of the Constitution to uphold federal regulations of water that disregard state water law. One commentator has noted that these three constitutional provisions are so blended that, based on these provisions, the federal government could develop natural resources without regard to the desires of the states.

The federal government's disregard of state water laws and policies is evidenced by the token compliance of many federal agencies with state water licensing requirements. Thus, many state water departments may be unable to make an accurate appraisal of the state's federal institution that has done most to limit the states' powers is the United States Supreme Court, which, because of the American commitment to an independent judiciary, benefits extraordinarily from its position as the final arbiter of the Constitution. American Federalism, supra note 6, at 155-56. Congressional attempts to overturn the reservation and navigable servitude doctrines have been numerous, but have failed. Relations, supra note 13, at 130-31. "[I]t should be very plain, both logically and from the broad holdings of First Iowa, Ivanhoe, Pelton and many other cases, that the United States Supreme Court will brook no interference by the states with federal water functions. If Congress were to abjure the reservation doctrine in the strongest possible language the federal powers would remain unchanged." Id. at 144. See generally Goldberg, supra note 41; Meyers, The Colorado River, 19 Stan. L. Rev. 1 (1966).


60. "The Congress shall have Power To lay and collect Taxes, Duties, Imposts, and Excises, to pay the Debts and provide for the common Defense and general Welfare of the United States . . . ." U.S. Const. art. I, § 8, cl. 1. The grant of power to Congress under the general welfare clause is expansive. The Supreme Court has held that under the general welfare clause, Congress may "appropriate for the general welfare, limited only by the requirement that it shall be exercised for the common benefit as distinguished from some mere local purpose. . . . Thus the power of Congress to promote the general welfare through large-scale projects for reclamation, irrigation, or other internal improvement, is now as clear and ample as its power to accomplish the same results indirectly through resort to strained interpretation of the power over navigation." United States v. Gerlach Live Stock Co., 339 U.S. 725, 738 (1950).

In Arizona v. California, 373 U.S. 546 (1963), the court relied on the general welfare clause to hold that the Secretary of the Interior may distribute water in areas and times of scarcity according to that department's own standards of efficiency or preference. Id. at 592-94.


62. Goldberg, supra note 41, at 35.

available water resources. Although many states need all the water within their boundaries, the federal government has constitutional authority to determine the production and use of water on public lands and thus can control the water in ways inconsistent with a state's need.

Conflicts Between Federal and State Laws Affecting Geothermal Development

Conflicts between the state and federal governments concerning the use of water at a geothermal resource arise from conflicts between state and federal water laws. The conflicts affect geothermal development in two ways.

First, most of the lands reserved to the federal government are found in the western states, which contain the vast majority of geothermal power sites. An executive order issued by President Hoover in 1930 withdrew from sale and reserved for public use all public lands containing a hot spring. Hot springs are sometimes associated with geysers or other steam-dominated systems and are a potential source of significant geothermal energy. Today steam-dominated systems provide energy for the largest geothermal power plants in the world.

Thus, many geothermal sites are located on reserved federal land. Under the reservation doctrine, water on reserved federal lands may be reserved for any purpose that may have been contemplated when the reservation was made. Therefore, the federal government may ap-

64. See note 31 & accompanying text supra.
65. RELATIONS, supra note 13, at 88-90. Some states attempt to allocate among each other scarce water resources. See TEX. NAT. RES. CODE ANN. tit. 5, § 142.005 (Vernon Supp. 1980). The federal water rights doctrine and the potential of jeopardy to water rights has adversely affected investment in water-based projects by private users, local governmental agencies, and even federal agencies. RELATIONS, supra note 13, at 120-30.
66. See note 7 & accompanying text supra.
67. Exec. Order No. 5389 (July 7, 1930). The order was issued under the authority of the Pickett Act, ch. 421, 36 Stat. 847 (1910) (repealed 1976). A further withdrawal of public lands that are valuable for geothermal steam was made by the Secretary of the Interior in 1967. 32 Fed. Reg. 2588 (1967); id. at 4506-08. The power of the executive branch to withdraw lands from public acquisition was recognized in United States v. Midwest Oil Co., 236 U.S. 459 (1915). See generally PUBLIC LAND LAW REVIEW COMMISSION, STUDY OF WITHDRAWALS AND RESERVATIONS OF PUBLIC DOMAIN LANDS 176-87 (1969).
68. See note 8 supra.
appropriate water on geothermal sites located on reserved lands. As geothermal resources may use regular ground and surface water in large amounts for reinjection and cooling at the geothermal site, they may consume water that would be better used elsewhere to satisfy various state needs.

A second state-federal conflict may arise if a geothermal site produces a surplus of water. A geothermal resource ordinarily contains water, so some geothermal power sites could potentially provide a significant water source. Traditionally, a landowner owned the water or stream beneath the surface of his or her land. As landowner, the federal government is exempt from state water-use permit requirements.


71. See notes 8, 11 & accompanying text supra.

72. However, it may be difficult to make this water potable, because of the brine chemistry problem. See note 4 supra.

73. See notes 17-18, 33-40 & accompanying text supra.

The Geothermal Steam Act of 1970,\(^75\) allowing federal geothermal leases, exemplifies this conflict. If federal geothermal leases are exempt from state water laws under the reservation doctrine, then any by-product water from a geothermal resource on federal land would be exempt and could be used in a manner inconsistent with state needs. The Act provides that it neither claims nor denies this exemption.\(^76\)

Section 9 of the Act may limit any exemption from state water laws. Section 9 provides in part:

If the production, use, or conversion of geothermal steam is susceptible of producing a valuable byproduct or byproducts, including commercially demineralized water for beneficial uses in accordance with applicable State water laws, the Secretary shall require substantial beneficial production or use thereof unless, in individual circumstances he modifies or waives this requirement in the interest of conservation of natural resources or for other reasons satisfactory to him.\(^77\)

The legislative history of the Act shows that Congress intended section 9 to apply to water distillation whenever economically feasible and to apply to a broad range of geothermal resources.\(^78\)

State water boards direct the beneficial use of water.\(^79\) When a water source is part of a federal geothermal lease, section 9 substitutes the decision of the Secretary of the Interior for decisions of the state water board. The Secretary, however, must make such a decision in accordance with state water laws. It is unclear to what extent this requirement forces the Secretary to consider state policies. A state might disallow development of a water resource, including geothermal re-


\(^78\) Commercially demineralized water was not specified as a valuable byproduct in the original Senate Bill. S. 368, 91st Cong., 2d Sess., 116 Cong. Rec. 32,175 (1970). The specific inclusion of commercially demineralized water was made by the House Committee on Interior and Insular Affairs. Representative Hosmer, a member of the House Committee, was a prime proponent of the Act. See 116 Cong. Rec. 34,857 (1970) (remarks of Rep. Saylor). A Californian, Representative Hosmer was interested in the distillation of water from geothermal brine. Id. at 40,757 (remarks of Rep. Hosmer). Representative Hosmer suggested that water distillation would be economically feasible in many instances and that water could be distilled whether the geothermal resource had a naturally replenishable water supply or not. Id. Senator Bible noted that geothermal resources that were not naturally replenished could be artificially reinjected with water from external sources in a way that would improve and increase usable water in nearby water sources. Id. at 40,000.

\(^79\) See notes 31-32 & accompanying text supra.
sources that contain water, because the proposed withdrawal of the resource's water would "impair existing water rights from the source."80 In addition, a state might place limiting conditions on an appropriation permit.81 Similar problems have arisen under the Mineral Leasing Act of 1920,82 on which the Geothermal Steam Act was patterned. Decisions under the Mineral Leasing Act suggest that the Secretary of the Interior probably need not act in accordance with these state policies.83


81. See 5 WATERS AND WATER RIGHTS § 442.2 (R. Clark ed. 1972).


83. The Mineral Leasing Act recognized the validity of some exercises of state police powers. Section 32 of the Act provides in part: "Nothing in this chapter shall be construed or held to affect the rights of the States or other local authority to exercise any rights which they may have . . . ." 30 U.S.C. § 189 (1976).

Cases under the Mineral Leasing Act have allowed state regulation of conservation, e.g., Texas Oil and Gas Corp. v. Phillips Petroleum Co., 277 F. Supp. 366 (W.D. Okla. 1967) (state-imposed well-spacing and pooling of mineral interests, when approved by the Secretary of the Interior, applicable to oil and gas lessees on federal land), aff'd per curiam, 406 F.2d 1303 (10th Cir.), cert. denied, 396 U.S. 829 (1969), and property matters, e.g., Wallis v. Pan American Petroleum Corp., 384 U.S. 63 (1968) (Louisiana regulation of assignment of interests in federally granted mineral leases are not significant threat to any identifiable federal policy or interest), if such regulation does not conflict with federal policy. If the exercise of state police power impermissibly conflicts with the achievement of congressionally approved federal goals, however, the state's attempted regulation of federal land use is invalid. County of Ventura v. Gulf Oil Corp., 601 F.2d 1080 (9th Cir. 1979), aff'd mem., 445 U.S. 947 (1980) (land use controls that forbid oil exploration without permit impermissibly conflict with federally approved use).

Similarly, if a state-federal conflict arose with respect to geothermal development, a court might allow the state to regulate the geothermal resource absent a conflict with federal policy, but invalidate any state regulation that conflicts with federal policy. The Geothermal Steam Act of 1970 was enacted “to encourage private enterprise to invest in and develop” geothermal resources. H.R. REP. No. 91-1544, 91st Cong., 2d Sess. (1970), reprinted in 1970 U.S. CODE CONG. & AD. NEWS 5113, 5116. A state law that would disallow development of the resource because of adverse effects on existing water rights would directly conflict with the federal policy. In such a case, the state law must yield. The Secretary of the Interior would not be required to act in accordance with this state law. A state law that requires purification of water from a geothermal resource would pose a different problem. The legislative history of the Geothermal Steam Act of 1970 indicates a concern with developers' ability to operate a geothermal power site at a profit. 116 CONG. REC. 40,757 (remarks of Rep. Hosmer). A state law that requires purification when it could be done profitably would not impermissibly conflict with the congressionally approved development of geothermal
States will not be able to regulate production of water from federal geothermal power sites.

Classification of Geothermal Resources

Conflicts between the state and federal regulation of water at a geothermal site may arise from the different schemes by which geothermal resources are classified. If the water produced at a geothermal resource is classified as a mineral, then this byproduct water will be subject to the mineral laws regulating the geothermal resource. Minerals can be owned in fee, without any beneficial use limitations. If, however, the byproduct water is treated as water, and not as a mineral, it cannot be owned in fee because property rights in water, under both riparian and appropriation systems, are subject to beneficial use limitations. If the byproduct water is classified as a mineral, it may be used for whatever purposes the owner of the geothermal resource chooses, without regard to state water policy.

The Ninth Circuit considered the classification of geothermal resources in United States v. Union Oil Company, and ruled that geothermal resources should be classified as a mineral for federal land law resources on federal land. The Secretary of the Interior could adopt regulations not in conflict with such a law.

84. The earliest attempt by a court to classify geothermal resources occurred in a tax case, Reich v. Commissioner, 52 T.C. 700 (1969), aff'd, 454 F.2d 1157 (9th Cir. 1972). The Tax Court and the Ninth Circuit both held that the natural steam produced at a geothermal power site was a gas that qualified for the percentage depletion allowance under § 613 of the Internal Revenue Code, 454 F.2d at 1158-59; 52 T.C. at 708-15. The Tax Court ruled that the geothermal steam at The Geysers is an exhaustible resource, because it is locked within a closed reservoir and has no significant water influx. 52 T.C. at 708. The court emphasized that the geothermal wells at The Geysers had experienced a loss of pressure. Id. at 707.


86. See notes 12-43 & accompanying text supra.

87. Case law indicates that Congress may impose conditions and terms on transferred public domain property. United States v. City and County of San Francisco, 310 U.S. 16 (1940); Utah Power & Light Co. v. United States, 243 U.S. 389 (1917); Light v. United States, 220 U.S. 523 (1911).

88. 549 F.2d 1271 (9th Cir.), cert. denied, 434 U.S. 930 (1977).
The Court held that a mineral reservation in patents issued under the Stock-Raising Homestead Act of 1916 reserved to the United States the geothermal resources underlying the patented land, and overturned the district court ruling that geothermal steam is water and not a mineral.

In reversing the district court, the Ninth Circuit determined that Congress' intent in passing the Stock-Raising Homestead Act was to reserve mineral fuel resources, and that Congress' purpose would be furthered by including geothermal resources in the reservation of mineral rights, although Congress was not aware of geothermal power when it passed the Act. The Ninth Circuit noted in Union Oil that "[a]ll of the elements of a geothermal system—magma, porous rock strata, even water itself—may be classified as 'minerals.'" The Geothermal Steam Act of 1970, which allows leasing of geothermal resources on federal land, includes byproduct water as part of the geothermal resources to which the Act applies. The Act, however,

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89. Id. at 1279.
91. United States v. Union Oil Co., 369 F. Supp. 1289 (N.D. Cal. 1973), rev'd, 549 F.2d 1271 (9th Cir.), cert. denied, 434 U.S. 930 (1977). In finding that geothermal steam is water, the district court emphasized letters by officials of the Department of the Interior that stated that, "[g]eothermal steam is essentially just subterranean water heated to a high temperature." Id. at 1300-01, Appendix A. The district court stated that, although water may be termed a mineral by the mining industry or a dictionary, id. at 1297-98, it has never been considered a mineral for federal land law purposes. Id. at 1298-99.
92. 549 F.2d at 1273-74. The court refused to consider the Department of the Interior's interpretation of the Stock-Raising Homestead Act because it did not "reflect an agency view contemporaneous with the passage of the Act." Id. at 1280 n.19. During negotiations in the case, the United States refused an offer by the developing companies to extract minerals and give them to the United States. Interview with Joseph Munster, Jr., Professor Emeritus, Hastings College of the Law, Counsel to landowners in Union Oil (March 13, 1981). Union Oil was the first case to test the federal title to geothermal resources on patented federal lands that contained a mineral reservation. It was brought by the United States pursuant to § 21(b) of the Geothermal Steam Act of 1970, 30 U.S.C. § 1020(b) (1976). Questions regarding title to federal land have always been determined according to federal law. E.g., Wilcox v. Jackson, 38 U.S. (13 Pet.) 498, 517 (1839). The finding in Union Oil of a reservation of rights to geothermal resources as a mineral for federal land law purposes generated similar results in later state court actions dealing with state mineral reservations. See Pariani v. State, 105, Cal. App. 3d 923, 164 Cal. Rptr. 683 (1980) (state land grant); Geothermal Kinetics, Inc. v. Union Oil Co., 75 Cal. App. 3d 56, 141 Cal. Rptr. 879 (1977) (private grant).
93. 549 F.2d at 1273-74 (footnote omitted).
94. 30 U.S.C. § 1001 (1976) provides in part: "(c) 'geothermal steam and associated geothermal resources' means (i) all products of geothermal processes, embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any by-product derived from them; (d) 'byproduct' means any mineral or minerals (exclusive of oil, hydrocarbon gas, and helium) which are found in solution or in association with geothermal
does not expressly classify this byproduct water as a mineral.

Cases have classified geothermal resources as minerals, as water, and as gases. Various state schemes for classifying geothermal resources and by-product water have categorized geothermal resources as minerals, as resources subject to water laws, and as sui generis. Some states use the federal definition, thus including by-product water as an element of a geothermal resource, but other

steam and which have a value of less than 75 per centum of the value of the geothermal steam or are not, because of technical difficulties in extraction and production, of sufficient value to warrant extraction and production by themselves . . ." Cf. id. § 1008 (commercially demineralized water), discussed in notes 75-83 & accompanying text supra.


98. See generally Olpin, supra note 5, at 824-74.


100. Wyoming specifically subjects geothermal steam and hot water to the state's water laws. Wyo. Stat. Ann. § 41-3-901(a)(ii) (1979); see id. §§ 41-3-903, -904. Idaho and Montana define geothermal resources to be "sui generis . . . closely related to and possibly affecting and affected by water resources in many instances." Idaho Code §§ 42-4002(c), 47-1602 (1977); Mont. Code Ann. § 77-4-104 (1979). Montana subjects water required for geothermal development on state land to the state's water laws. Mont. Code Ann. § 77-4-108 (1979). The Montana statute does not define what is included in water required for development. This could mean water used as a transfer medium, or for re-injection or cooling purposes, see note 11 & accompanying text supra, and could include water brought in from a source other than the geothermal reservoir and water present in the reservoir.

Nevada defines the geothermal resource as heat. Nev. Rev. Stat. § 534A.010 (1979). Water or steam "encountered during geothermal exploration" is subject to the state's water laws. Id. § 534A.040. The Nevada statute does not say what is included in water or steam "encountered during geothermal exploration." As water or steam is encountered in all geothermal anomalies except the hot dry rock type, see note 8 supra, it may be argued that the Nevada statute subjects all of these geothermal anomalies to the state's water laws.


states specifically exclude byproduct water in definitions of geothermal

ANN. § 8-8A-01(e) (Supp. 1980); OR. REV. STAT. § 522.005(7) (1979); TEX. NAT. RES. CODE ANN. tit. 5, § 141.003(4) (Vernon 1978). Under the Louisiana, Maryland, and Texas schemes, the lessee of the raw geothermal resource owns the water that is a byproduct of the energy production, and the lessee's ownership of the water is not limited by the appropriation, permit, or beneficial use limitations of water law. See notes 72-76, 85-87 & accompanying text supra. However, such is not the case in Alaska, Arizona, Colorado, Hawaii, or Oregon.

Alaska generally requires a beneficial use of commercially demineralized water. ALASKA STAT. § 38.05.181(e)(2) (1978). The Commissioner of the Department of Natural Resources, however, may waive the requirement. Id. The Alaska statute subjects geothermal leases to prior leases and claims or permits that cover the same land or minerals. Id. The statute, however, does not mention prior claims to water.

Arizona subjects geothermal resource owners to water laws if outside groundwater is used for the geothermal resource. ARIZ. REV. STAT. ANN. § 27-667(B) (West Supp. 1980-81). The statute, however, does not clarify the status of outside groundwater used in reinjection after it has returned to the surface as byproduct water. Cf. 30 U.S.C. § 1001(c)(ii) (1976) (includes artificially-introduced heat-transfer medium in definition of geothermal resources); MD. NAT. RES. CODE ANN. § 8-8A-01(e) (Supp. 1980) (same); OR. REV. STAT. § 522.005(7) (1979) (same). Otherwise, the geothermal resource is exempt from the state's water laws unless the geothermal resource commingles with surface or groundwater, or impairs or damages groundwater. ARIZ. REV. STAT. ANN. § 27-667(A) (West Supp. 1980-81). Thus, geothermal reservoirs that are interconnected with other aquifers are subject to the state's water laws. The statute leaves unresolved whether or not damage to surface water will subject the geothermal resource to the state's water laws.

The Colorado Oil and Gas Conservation Commission will issue a permit for exploration or development of a geothermal resource if there will be no appropriation or consumptive use of groundwater or if the water to be appropriated is nontributary. Colo. Rules of Practice and Procedure for the Development and Production of Geothermal Resources § G6209(d) (1975); see also Colo. Rev. Stat. §§ 37-90-137 (1973).

Geothermal wells in Hawaii may neither deplete nor waste usable groundwater resources. HAWAII ADMIN. RULES §§ 13-183-7(1)(1981). A geothermal developer who violates this provision is subject to fines, HAWAII REV. STAT. §§ 178-7(1976), id. § 182-17 (Supp. 1981); id. § 13-183-4, is required to plug and abandon the violating well, HAWAII ADMIN. RULES §§ 13-183-82(a)(1981), and, if the developer is a state lessee, is liable to owners of a damaged water development. HAWAII REV. STAT. §§ 182-3(Supp. 1981); HAWAII ADMIN. RULES §§ 13-183-59(h)(1981). Other sections of Hawaii's Rules on Leasing and Drilling of Geothermal Resources impose liability only when operation of a geothermal well “unreasonably” degrades water resources, id. § 13-183-59(e), or does not “minimize” disturbance of water and natural drainage. Id. § 13-183-87(e)(1981). These regulations apply to geothermal resources in all areas of Hawaii, HAWAII ADMIN. RULES §§ 13-183-1(c), while normal groundwater use is regulated only in areas where groundwater is scarce or is threatened with salt water intrusion or chloride contamination. HAWAII REV. STAT. §§ 177-3, -4, -5(5), -19(1976).

Lower-temperature geothermal reservoirs are not governed by the Maryland and Oregon geothermal statutes and are subject to state water laws. MD. NAT. RES. CODE ANN. § 8-8A-01(e) (Supp. 1980) (less than 120° F.); OR. REV. STAT. § 522.025 (1979) (wells less than 2,000 feet deep with bottom hole temperature less than 250° F.). Oregon further removes from the coverage of its geothermal statute waters already appropriated as groundwater. OR. REV. STAT. §§ 522.025, 537.515, 537.535 (1979). Oregon's definition of groundwater is extensive, including any water underground, “whatever may be the geological formation or structure in which such water stands, flows, percolates or otherwise moves.” Id.
A Suggested Classification of Geothermal Resources

The classification of the geothermal resource determines how the water produced at a geothermal site is regulated. The geothermal resource may be classified separately from its byproduct water. If this approach is taken, the classification of the resource as a mineral would not disturb the traditional state regulation of the water.105

Several commentators, however, have suggested that all elements

§ 537.515(3). Therefore, geothermal reservoirs that are interconnected with groundwater aquifers that are subject to prior appropriation claims and permits are subject to Oregon water laws.

104. Utah has recently enacted new geothermal laws. Utah Geothermal Resource Conservation Act, 1981 Utah Laws, ch. 188, UTAH CODE ANN. §§ 73-22-1 to -10 (Supp. 1981). For a discussion of prior Utah geothermal law, see Olpin, supra note 5, at 864-67. The new Utah scheme defines geothermal resources to be heat and energy and specifically excludes geothermal fluids from the definition. UTAH CODE ANN. § 73-22-3(5) (Supp. 1981). Furthermore, ownership of a geothermal resource is derived from an interest in land, and not from appropriation. Id. § 73-22-4(1). This would appear to remove geothermal resources from the coverage of state water laws. The new Utah scheme, however, protects and gives priority to owners of prior rights to water other than geothermal fluids, id. § 73-22-8(3); cf. id. § 73-22-6(1)(d)(v) (Division of Water Rights may make regulations that prevent "unreasonable disturbance or injury to . . . prior water rights"), and subjects geothermal fluids to beneficial use limitations. Id. § 73-22-8(1). The Utah scheme attempts to prevent dissipation of reservoir pressure by reducing the number of wells drilled and by equitably allocating the geothermal resource produced. See id. §§ 73-22-3(1), -3(11), -7, -8(3). See notes 127-39 & accompanying text infra. Excessive production of geothermal resources is prevented by the exclusion of geothermal resources from water allocation laws.

California and New Mexico include in their definitions of geothermal resource the byproducts brine and heat, but do not specifically classify the byproduct water as an element of the geothermal resource. CAL. PUB. RES. CODE § 6903 (West 1977); N.M. STAT. ANN. § 71-5-2, -3 (1978). These schemes subject the geothermal resource to rules regarding waste and use, similar to regulations regarding waste of oil and gas. CAL. PUB. RES. CODE, §§ 3714-76 (West 1972 & Supp. 1981); N.M. STAT. ANN. §§ 71-5-4, -5, -7, -15, -21 (1978). Once the water has been obtained from the resource, however, the water's use and regulation are unclear.

105. A California Department of Water Resources study has concluded that, absent further legislation by Congress, "state laws will govern the development of any naturally potable water that may be developed. State laws will also probably govern the uses to which commercially demineralized water may be put." AN OVERVIEW, supra note 3, at 37. The same study determined that production of usable water would proceed in accordance with state water laws. Id.; accord, C. Stone, GEOTHERMAL ENERGY AND THE LAW, I THE FEDERAL LANDS MANAGEMENT PROGRAM 255 (1975) (citing U.S. Dept. of Interior position); Sato I, supra note 8, at 305-09; Sato II, supra note 4, at 495 n.362a. This is compatible with the California definition of geothermal resources, which does not specifically include water as part of the geothermal resource. CAL. PUB. RES. CODE § 6903 (West 1977). The result is that the heat and marketable minerals in the geothermal brine are treated as minerals that the developer owns in fee by right of capture. See note 85 & accompanying text supra and notes 130-35 & accompanying text infra. However, the water processed from the brine would be subject to state water laws.
of geothermal resources, including byproduct water, be subject only to mineral laws. Commentators have advanced several arguments to support this suggestion. The potable water associated with domestic, agricultural, industrial, and recreational uses controlled by state water laws is qualitatively and functionally different from geothermal byproduct water. The byproduct water may be needed for reinjection into the geothermal reservoir. Commentators maintain that if the byproduct water can be purified, the decision to purify or to reinject the water should be left to the developer. The development of geothermal resources could be impaired if geothermal developers fear that state water boards may force them to purify the byproduct water for consumption elsewhere.

A further argument made by those who recommend mineral clas-


107. Sato I, supra note 8, at 287-88; Rule of Presumption, supra note 106, at 606, 614-15. While the geothermal fluid is functionally different from ordinary water in most instances, see note 4 supra, some geothermal systems produce water that is naturally potable. See Kitchen, supra note 7, at 29-30, 34; Rule of Presumption, supra note 106, at 602. Some states have declared that there is no absolute title in byproduct water that is capable of being used for domestic or irrigation purposes. E.g., Cal. Pub. Res. Code § 3742.2 (West 1972).

In addition, many sites produce water that is not naturally potable but that can be purified economically. When the federal definition of geothermal resources, see note 94 supra, was first formulated, only low enthalpy water-dominated geothermal systems for use in space heating—Klamath Falls, Oregon—and steam-dominated geothermal systems for indirect use in generating electricity—The Big Geysers, California—were in operation. This is still true. In the Klamath Falls system, no economical extraction of minerals can be made and there is no excess water. In The Big Geysers system, no minerals are extracted from geothermal brine because of technological and economic problems and because water must be reinjected to avoid seismicity and pollution problems. It has been estimated that in the liquid and steam-dominated systems that will be operating in the desert area near the Nevada, Arizona, and California borders only 20-40% of the brine need be reinjected. See Bjorge, supra note 2, at 2; Cole Interview, supra note 8; San Francisco Chronicle, March 25, 1981, at 6, col. 1.

If, however, the byproduct brine must be reinjected to prevent surface pollution, seismicity, or land subsidence, see Kitchen, supra note 7, at 33; Vranesh, supra note 70, at 117, then state water boards should allow the developer to retain the water for reinjection into the geothermal system. See Vranesh, supra note 70, at 117-18. For example, if reinjection of the water is necessary to restore lost reservoir pressure, reinjection may qualify as a beneficial use of the water, thereby entitling the developer to use the water. See Utah Code Ann. § 73-22-8(1) (Supp. 1981). See generally Tarlock & Waller, An Environmental Overview of Geothermal Resource Development, 13 Land & Water L. Rev. 289, 320 (1977) [hereinafter cited as Tarlock & Waller]; Vranesh, supra note 70, at 122. If, however, the water can be used for domestic, agricultural, industrial, or recreational purposes, and is not needed for reinjection, then the state water boards should decide how the water is to be used.

108. Tarlock & Waller, supra note 107, at 315; Vranesh, supra note 70, at 121-15.

109. Olpin, supra note 5, at 822-23.

110. Sato II, supra note 4, at 520-23; Tarlock & Waller, supra note 107, at 319-20, 324; Note, Geothermal Energy: Problems and Shortcomings of a Unique Resource—A Look at
sification for geothermal byproduct water is that geothermal resources usually are separated from other water-bearing earth, gravel, or porous stone beds or strata. If a geothermal resource is not hydrologically connected with a freshwater aquifer, then development of the resource will not divest others of water rights in the aquifer. Commentators argue that rapid geothermal development should not be impeded by hypothetical problems. Geothermal resources should be presumed to be separate from freshwater aquifers, but groundwater pumpers should be allowed to rebut this presumption whether or not water rights are actually threatened. Recent findings, however, indicate that geothermal fluids are connected with general groundwater discharge. If geothermal waters are hydrologically connected with freshwater aquifers, then unregulated withdrawals of geothermal waters may have an adverse effect on the supply of groundwater that would arise gradually and unnoticed and last for many years after withdrawals of the water cease for geothermal purposes. Only a unified administration of water rights avoids the premature depletion of stored supplies of water.

The principal difficulty in classifying geothermal water as a min-


111. See Olpin, supra note 5, at 882. This view is consistent with the possible physical separation of many geothermal reservoirs from freshwater aquifers because of differences in the origins of the different water. Brooks, supra note 5, at 526 n.73. Some of the legal commentators believe that many geothermal waters are magmatic, that is, they are precipitate from igneous melt or water that is trapped in the interstices of sedimentary rock at the time the rock was deposited. See, e.g., Olpin, supra note 5, at 783-85.

112. Aquifers are the saturated, permeable earth materials from which significant quantities of water can be produced. See WATER LAW, supra note 14, at 459.


114. See Hansen, supra note 7, at 152; Not Water, supra note 42, at 394-95; Sato I, supra note 8, at 266; Vranesh, supra note 70, at 123-24.


116. See Bagley, supra note 80, at 153 (1961). Litigation is often an inadequate method of adjudicating groundwater rights. See id. at 158-59.
eral not subject to state water laws is that this classification ignores the need of arid states to increase their water supply.117 If the water produced at a geothermal site were not classified as a mineral, it would be subject to state groundwater laws, and a state could then direct the development and use of its water in the most efficient manner. To hold that geothermal waters are exempt from state water regulation would be to reverse the trend in these states to encourage the development of water supplies.118 A system that subjects the geothermal byproduct water to state regulation would allow a state to protect its water resources, because state agencies would be better informed about the amount of water available for beneficial use.119

The classification of byproduct water as water will not deprive a geothermal developer of financial gains associated with the purification of the water. State water laws contain provisions allowing a geothermal developer a right to water, yet limit the right by requiring beneficial use and prohibiting waste of the resource. The Wyoming and Nevada schemes classify the geothermal liquid byproduct as water.120 The byproduct water is a product of the developer’s efforts to increase or save a water supply. As its continuance depends upon human acts, the byproduct water is “developed water.”121 The developer has a right to the water as long as the water does not pass beyond the developer’s domain.122 The developer may also sell the purified water.123 How-

117. See notes 22-23 & accompanying text supra.
118. Western states have expanded the coverage of their water laws in an effort to encourage the development of water. For example, some states have abolished the distinction between tributary and nontributary waters and have regulated groundwater stored in subsurface strata in the same manner as surface water. E.g., N.M. STAT. ANN. § 72-12-18 (1978); Wyo. Stat. Ann. § 41-3-916 (1977) (priorities to aquifers are correlated when underground aquifers are interconnected); see also Knight v. Grimes, 80 S.D. 517, 127 N.W.2d 708 (1964) (police power of state extends to imposing groundwater appropriation statute upon older rule of absolute ownership of percolating water); City of Albuquerque v. Reynolds, 71 N.M. 428, 379 P.2d 73 (1962); Baumann v. Smrha, 145 F. Supp. 617 (D.C. Kan. 1956), aff’d per curiam, 352 U.S. 863 (1956) (Kansas water statute, which subjected all waters in state to appropriation permit system, is constitutional); Hanson v. Salt Lake City, 115 Utah 404, 205 P.2d 255 (1949); Idaho Code § 42-4201 (Supp. 1980) (project to recharge groundwater basins). See notes 33-34 & accompanying text supra. For a discussion of the extent of untapped groundwater, see WATER LAW, supra note 14, at 461. For a discussion of the physical and ecological importance of water stored in underground strata, see Miller v. Bay Cities Water Co., 157 Cal. 256, 276-80, 107 P. 115, 123-26 (1910).
119. See notes 31, 64 & accompanying text supra.
121. See Kitchen, supra note 7, at 44. See note 37 & accompanying text supra.
122. See note 35-40 & accompanying text supra.
123. One who acquires a right to use of water may resell and assign it to another, limited to the beneficial use of the water. Calkins v. Sorosis Fruit Co., 150 Cal. 426, 433-34, 88 P. 1094, 1096-97 (1907). This right also applies to developed water. See Pomona Land & Water Co. v. San Antonio Water Co., 152 Cal. 618, 620, 623, 93 P. 881, 882, 884 (1908); Mayberry v. Alhambra Addition Water Co., 125 Cal. 444, 450, 54 P. 530, 532, 58 P. 68, 68
ever, the developer must apply the water to a beneficial use and prevent waste of the water.

Allocation of the Resource to Multiple Users of the Geothermal Reservoir

Differences in the classification of the geothermal resource affect not only the ownership and use limitations on the resource and its byproducts, but also the allocation of the resource to multiple users of the same geothermal reservoir. Geothermal reservoirs are irregularly shaped masses of steam, hot water, gas and water, or magma. When different classes of land—federal, state, and private—overlie the same reservoir, different legal systems affect the allocation of the resource.

The need for prior developers to protect themselves is more acute in geothermal development than in oil and gas development. The continued use of a geothermal resource requires the maintenance of certain minimum pressure and temperature levels. If a geothermal


Developers are also concerned with the classifications' effects on pre-existing leases. Because of legal uncertainties surrounding ownership, lease grants should encompass all things the resource might be, see Kitchen, supra note 7, at 53; because the developer may lose his or her investment and profits if the lease is not all inclusive. See United States v. Union Oil Co., 549 F.2d 1271, 1273 (9th Cir.), cert. denied, 434 U.S. 930 (1977); Pariani v. State, 105 Cal. App. 3d 923, 164 Cal. Rptr. 683 (1980); Geothermal Kinetics, Inc. v. Union Oil Co., 75 Cal. App. 3d 56, 141 Cal. Rptr. 879 (1977); Trower, An Overview of California Permitting Process, Land & Water L. Rev. 325, 333 (1977). Developers desire clear statutory rules to avoid ownership uncertainties. See Rule of Presumption, supra note 106, at 597, 614.


Rules similar to those used for developed water will apply if the byproduct water is classified as reclaimed or artificial water, that is, escape or seepage from constructed works captured or recaptured by a developer. See City of Los Angeles v. City of San Fernando, 14 Cal. 3d 199, 256-58, 537 P.2d 1250, 1292-93, 123 Cal. Rptr. 1, 43-44 (1975); Stevens v. Oakdale Irrig. Dist., 13 Cal. 2d 343, 352, 90 P.2d 58, 62 (1939); Elgin v. Weatherstone, 123 Wash. 429, 212 P. 562 (1923); cf., Vanderwork v. Hewes, 15 N.M. 439, 110 P. 567 (1910) (seepage from an artesian well may not be artificial water).

126. See notes 8-9 & accompanying text supra.
127. See Complaint appendix, contract between Pacific Gas and Electric Co. and Pacific
area produced no more steam or hot water than [was] supplied by recharge, and at a rate that allowed it to heat to the required temperature, a geothermal field could have a life measured in millenia.”

If, however, several developers tap into the same reservoir, pressure and temperature levels could drop, thus terminating the usefulness of the geothermal reservoir.

The rule of capture, a feature of oil and gas law, may apply to geothermal resources. This rule allows a developer to withdraw unlimited amounts of oil or gas from a reservoir overlaid by land owned by other developers, as long as he or she does not cross the plane of that land with wells or waste the source of supply. Thus, a single user may deplete the reservoir that underlies the land of several potential users. If, however, subsequent developers drill for oil in a reservoir in which a neighboring prior developer has already made substantial investments, the rule of capture can lead to an inequitable situation. Irregularities in geologic structure may cause the shifting of oil otherwise obtainable by the prior developer so that it can be pumped up only by the subsequent developer.

Application of the rule of capture to geothermal resources could also lead to inequitable situations. Therefore, the federal government and some states have developed special rules to allocate geothermal resources from a single reservoir that is underneath the land of many potential users. Pursuant to section 18 of the Geothermal Steam Act...
of 1970,137 the United States Geological Survey formulated geothermal resource utilization regulations, including terms of suggested agreements between multiple users of the same geothermal resource.138 If the reservoir lies under both state and federal lands, however, the federal unitization plan might interfere with state allocation of the resource, or of the water in the resource.139

If geothermal byproduct water is classified as water, then state water laws may be used to allocate geothermal resources between competing geothermal developers, and between geothermal developers and fresh groundwater users. The jurisdictions that classify the geothermal resource or its byproduct as nontributary, percolating, or developed water can apply one of four approaches to allocate water to competing developers. The first approach, under which groundwaters are not allocated,140 does not adequately protect a prior developer's need for continued reservoir pressure.

The remaining approaches protect a prior developer. The second approach limits groundwater use to that which is reasonable in light of adjoining landowners' similar rights.141 The "reasonable use" approach has been used to enjoin groundwater pumping that "invades the natural movement, placement, and percolation" of a neighboring landowner's water.142 The reasonable use approach would enjoin a later geothermal developer from destroying the flow of a geothermal resource to a prior developer.

The third approach allows equitable apportionment of groundwater in times and areas of shortage.143 This "correlative rights" approach requires a sharing of groundwater based on land ownership and

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139. The federal regulations governing allocation state that, when state-owned land is included in an agreement, "provisions may be made in the agreement accepting State law, to the extent that they are applicable to non-Federal unitized land." 30 C.F.R. § 271.5 (1980).
The correlative rights approach has been used to obtain damages for diversion of water flow. A later geothermal developer would be protected under the correlative rights approach in the same manner as under the reasonable use approach.

The fourth approach is to require appropriation permits for all groundwater. This approach can prohibit withdrawal of groundwater in excess of “safe yield,” which is related to, but is not the same as, average recharge. Some states that apply this approach have statutes that grant groundwater users a right to pressure. Similar measures may be followed in the geothermal field to assure that a geothermal reservoir is developed in the most efficient manner and to assure prior developers a constant minimum pressure.

**Conclusion**

Water is a scarce and valuable resource in the western states. Federal intervention in water rights has resulted in uses of water that are inconsistent with state water needs. As water is an integral part of the geothermal resource, the federal regulation of such resources has the potential to allow a use of water that is inconsistent with state water policies. Congress should take steps to separate the mineral rights in the raw geothermal resource from the right to the use of the water obtained as a byproduct of the production of geothermal energy. As a result, the byproduct water would be subject to state water laws regulating the ownership and the use of such water. In addition, the states should classify the water produced at a geothermal site as groundwater to increase the amount of water that is available to the states. Legislation should give developers of geothermal resources the right to a constant minimum pressure to protect their investments. Thus, the federal and state governments could create a system of legislation that would assure developers that the exploitation of a geothermal resource would be adequately regulated to protect geothermal investments. Such regulation may lead to the increased development of geothermal resources.

146. See generally 5 Waters and Water Rights § 442.1 (R. Clark ed. 1967).
In taking such steps, Congress and the state legislatures can ensure the beneficial use of water developed as a byproduct of geothermal energy production while encouraging maximum use of the geothermal resource.

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