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In Hot Water: Can Idaho's Ground Water Laws Adequately Govern Low Temperature Geothermal Resources?

by

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IN HOT WATER: CAN IDAHO'S GROUND WATER LAWS ADEQUATELY GOVERN LOW TEMPERATURE GEOTHERMAL RESOURCES?

COMMENT

TABLE OF CONTENTS

I. INTRODUCTION

Idaho has an abundance of hot water resources and a long history of putting them to use in both residential and commercial applications. In the late 1800s, citizens of Boise, Idaho, harnessed this resource, establishing the Artesian Hot & Cold Water Company, a pri-

vate water system serving the Natatorium,[1] private homes along the new Warm Springs Avenue, and some commercial buildings in the business district.[2] Nearly one hundred years later, public systems[3] serving government buildings in Boise's downtown were developed. The first home and the only state capitol building in the United States to be heated by natural hot water are both in Boise. Other states and communities recognized the potential of this resource and set up similar direct use systems.[4] The country of Iceland, which currently heats 90 percent of the buildings in its capitol city by direct use of geothermal heat, sent representatives to Boise to study the municipal system and take recommendations back.[5]

Initially, this artesian hot water source was so plentiful that the city even used it to water the streets to keep them from getting too dusty.[6] Now, after the addition of public systems in the 1980s, the limits of the resource are being tested. Between 1983 and 1987, the diversion volume more than doubled the historic (pre-1983) levels.[7] A

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1. A public natural hot water swimming pool and entertainment pavilion in East Boise; the Natatorium operated from 1892–1934. Merle W. Wells, *Heat from the Earth's Surface: Early Development of Western Geothermal Resources*, 10(1) J. W. 53, 65, 69 (1971). The Natatorium Company survived two lawsuits in the early 1920s over its possible status as a public utility and its water right. *See* Natatorium Co. v. Erb, 34 Idaho 209, 200 P. 348 (1921); Pub. Utils. Comm'n v. Natatorium Co., 36 Idaho 287, 211 P. 533 (1922). Its successor in interest, the Boise Warm Springs Water District, still struggles to protect its right to the same hot waters (low temperature geothermal resources by today's definitions).

2. Boise's first district heating system, still in operation as the Boise Warm Springs Water District (BWSWD), is touted as the oldest of its kind in the United States. *See* Kevin Rafferty, P.E., *A Century of Service: The Boise Warm Springs Water District System*, 14(2) GEO-HEAT CENTER Q. BULL. 1 (August 1992).

3. There are currently four district heating systems in Boise, three of them public. The private Boise Warms Springs Water District is run by an elected board from among the members of the District and serves over 300 homes in the East End of Boise, on and around Warm Springs Avenue. Boise City established a system in 1982, which serves a number of public and private buildings in the downtown area. The State of Idaho maintains the Capitol Mall system (dedicated in 1982) serving the Capitol and other public buildings in the mall complex. Lastly, the Veterans Administration system heats buildings in its complex. Efforts to form an umbrella governing organization in the 1970s failed, and each water system is independently operated. The Boise Low Temperature Geothermal Aquifer, which serves all four Districts, is governed by the Idaho Department of Water Resources. *See* DEAN M. WORBOIS, GLAD TO BE IN HOT WATER: GEOTHERMAL DEVELOPMENT IN BOISE, IDAHO, 1890-1983 (1982).

4. *See infra* note 19.

5. *See* WORBOIS, *supra* note 3.

6. Wells, *supra* note 1, at 65. Today, this use would most certainly be found as not beneficial under Idaho law, and under Colorado law it would be waste. *See infra* at Part III. B. for more.

7. C.J. Waag & S.H. WOOD, ANALYSIS OF HISTORICAL AND CURRENT DRAWDOWN AND PRODUCTION DATA FROM THE BOISE GEOTHERMAL SYSTEM, 41-45 Idaho Water Resources Research Institute (1987) (available at the University of Idaho Library).

study prompted by noticeable changes in the aquifer following the first few years' use by the city and state heating districts in the 1980s revealed that water declines of up to thirty feet were documented at some of the geothermal wells in the Boise area.[8] In 1999, the city, in conjunction with the U.S. Department of Energy, put into service a reinjection well.[9]

These recent developments concern the historic heating district that wants to be sure that the pressure, volume, and thermal values of the aquifer are protected so that it can continue to deliver heat to over three hundred homes, many relying solely on geothermal heat.[10] The city continues to add customers to its system, adding to the historic user's concerns.[11] Improved technologies for more efficient heat delivery[12] coupled with reinjection may enable the resource to be stretched and accommodate more customers; however, the historic users need to have adequate legal recourse to protect their rights.

This issue is not unique to Idaho. Due to geologic and hydrologic features, a number of the western states enjoy an abundance of geothermal resources. A Department of Energy funded survey of low temperature geothermal resources in ten Western states catalogued

8. *Id.*

9. The city's stated goals for this project were to be responsive to concerns for aquifer depletion and to commit to new customer requests. IDAHO OPERATIONS OFFICE, U.S. DEP'T OF ENERGY & DEP'T OF PUB. WORKS, CITY OF BOISE, FINAL ENVIRONMENTAL ASSESSMENT BOISE GEOTHERMAL INJECTION WELL (1996) (available at the University of Idaho library). A rundown of the recent developments affecting the aquifer are available in the Idaho Department of Water Resource's report on the area. HELEN HARRINGTON & SHANE BENDIXSEN, IDAHO DEPT. OF WATER RES., GROUND WATER MANAGEMENT AREAS IN IDAHO: OVERVIEW AS OF 1998 *at* http://www.idwr.state.id.us/planpol/techserv/hydro/GW_Manage_Areas_Rept.htm.

10. Many of the historic homes in the district are also equipped with fireplaces and wood stoves; however, during the winter season Boise often imposes a burn ban so that an alternate heat source is not available when it is most needed.

11. *See* Liz Wyatt, *3 Boise Buildings Switch to Cheaper, Hot-Water Heating*, IDAHO STATESMAN, Dec. 25, 1998, at B1.

12. The city operates a closed loop system in which the customers use heat exchangers so the natural hot waters are used only to heat fluids that are circulated through the buildings for heat. This is more efficient than the old-fashioned delivery system operated by the BWSWD in which the actual natural hot water runs through radiator systems in each house and then is discharged by the owner either into the sewer or in many cases an irrigation canal that roughly parallels Warm Springs Avenue.

8,977 thermal wells and springs.[13] Two hundred seventy one communities have been identified as collocated with resources of greater than fifty degrees Celsius.[14]

Energy commentators have noted the benefits of utilizing this resource: "Geothermal energy is a domestic energy resource with economic, reliability, and environmental advantages over other energy sources."[15] This energy source provides a clean, low-cost alternative to traditional fossil fuel energy sources. Yet, the majority of the West's abundant geothermal resources remain untapped.[16] While many agree that development of alternative renewable energy sources is in the nation's best interest, the regulatory framework at times seems to be

13. The assessment covered Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Washington. Lineau, Paul J. & Howard Ross, *Low-Temperature Resource Assessment Program, in* PROCEEDINGS: "GEOTHERMAL ENERGY – THE ENVIRONMENTALLY RESPONSIBLE TECHNOLOGY FOR THE NINETIES," 11 GEOTHERMAL PROGRAM REVIEW 169 (April 27-28, 1993), *available at* http://id.inel.gov/geothermal/fy95/dir-use/use02.htm.

14. The assessment defined collocated resources as those which are greater than or equal to fifty (50) degrees Celsius that are within eight kilometers of a community. In total, one thousand four hundred ninety-six (1496) thermal wells were collocated with the two hundred seventy-one (271) communities with a total population of 7.4 million people in the ten western states (see *supra* note 13 for included states). Lineau & Ross, *supra* note 13.

In Idaho, fifty-one communities were collocated with resources. A table of the communities and properties and current uses of the well can be accessed as well. DANSART, W.J., ET AL., IDAHO WATER RES. RESEARCH INST., OVERVIEW OF GEOTHERMAL INVESTIGATIONS IN IDAHO, 1980 TO 1993, *at* http://geoheat.oit.edu/idaho.htm (last visited Oct. 14, 2002).

15. Ronald R. Kessler, *The Office of Energy Efficiency and Renewable Energy: A Policy Overview, in* PROCEEDINGS: "GEOTHERMAL ENERGY – THE ENVIRONMENTALLY RESPONSIBLE TECHNOLOGY FOR THE NINETIES," 11 GEOTHERMAL PROGRAM REVIEW 1 (April 27-28, 1993). One benefit of geothermal energy over other renewable energy sources is that it is "not hindered by a cyclical output as in the case of wind and solar." Lineau & Ross *supra* note 13, at 169.

16. The Department of Energy has catalogued collocated resources with potential for development *at* http://www.eren.doe.gov/GeopoweringtheWest. For information regarding current federal and private research and development initiatives in the geothermal field, see the websites of the Geothermal Energy Association at http://geotherm.org, the Geothermal Energy Program of the Department of Energy at http://www.eren.doe.gov/geothermal.html, and the Geoheat Center of the Oregon Institute of Technology *at* http://geoheat.oit.edu.

"more of an obstacle . . . than an aid" in geothermal development.[17] As we strive to reduce our reliance on foreign and domestic non-renewable resources such as fossil fuels and convert to more environmentally friendly energy sources, policy makers should focus not only on incentives in research and development, but making sure that solid regulatory frameworks will enable a smooth transition to a diversified energy base.

Interest in the exploitation of geothermal resources has waxed and waned in relation to general energy issues in the United States. During the late 1960s and 1970s, fears related to the energy crisis resulted in an increased interest in geothermal development. When Congress passed the Geothermal Steam Act of 1970, it was the first federal legislation relating to the resource.[18]

Once again in the past few years, possibly in reaction to recent brownouts, discussions of dam breaching in the Pacific Northwest, the general increase in concern for the environment, and tension in the Middle East, interest in utilizing the natural heat of the earth and

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17. R. Gordon Bloomquist, *A Review and Analysis of the Adequacy of the U.S. Legal, Institutional and Financial Framework for Geothermal Development*, 15(1) GEOTHERMICS 87 (1986). State and federal statements of policy and purpose tout geothermal and other renewable resources, while not necessarily enabling development. Many states have one section providing incentives (including tax credits and grant programs) for development, but the sections of their code regulating the resource thwart implementation of the efforts. *See, e.g.*, MONT. REV. CODE ANN. § 90-4-101 (Smith 2001) (stating that "purposes of this part are to stimulate research [and] development, . . . lessen that reliance on nonrenewable energy sources which conflicts with the goal of long-range ecological stability and . . . to stimulate the commercialization of alternative renewable energy.").

In addition to environmental and political concerns, direct-use geothermal heating can be far less expensive than traditional fuels, up to eighty percent. U.S. DEP'T OF ENERGY, DOE/GO-10098-536, DIRECT USE OF GEOTHERMAL ENERGY, (Mar. 1998), *at* http://www.eren.doe.gov/geothermal/geodirectuse.html. In 1982, the State Health Laboratory on Penitentiary Road in Boise, Idaho, measured geothermal heating versus gas heat on back-to-back days of similar ambient temperature; the geothermal price tag was $80.00 while the price of gas was $480.00. While rates are comparatively low, the cost of retrofitting buildings for geothermal can be prohibitively expensive. In this case, the retrofit was $120,000; however, much of that cost was related to the project being part of a pilot program. WORBOIS, *supra* note 3.

18. 23 U.S.C. §§1001-1025 (2001). Since then, both the federal and many state governments have established programs to promote development of geothermal resources in direct applications and for electrical generation. These programs are beyond the scope of this Comment. For a discussion of some of the federal and state incentive programs available to the geothermal developer, relating to both high and low temperature applications, including certain utility regulation exemptions, tax credits for alternative and renewable energy projects, and research and development grant programs, see Bloomquist *supra* note 17, at 112-129. *See also*, Donald N. Zillman & Steven Naumann *Geothermal Energy and National Energy Policy* 14 NAT. RES. LAW. 589 (1992).

other alternative energy sources has risen. In 2000, the Department of Energy launched its "GeoPowering the West Initiative" with the following ambitious goals: producing ten percent of the West's electricity through geothermal resources by 2020, heating seven million homes directly by 2010, and doubling the number of states with geothermal facilities by 2006.[19]

This Comment focuses on the second goal of the initiative: direct use heat applications. These applications generally use low temperature geothermal resources.[20] The Comment first examines the legal classification and definition of low temperature geothermal resources across the western states, examines the regulation of these resources, and identifies some of the potential issues that rights holders may encounter under Idaho's regime.

II. CLASSIFYING AND DEFINING THE RESOURCE

The western states can facilitate future development of low temperature geothermal resources in direct heating applications and avoid the problems experienced by Boise and other communities by making sure that a definite and adequate legal framework is in place. Such a framework needs to both provide security to rights holders and allow for the contingencies introduced by changing technology. The first step in establishing that framework is to clearly classify and define the resource. This is important because it affects both ownership and regulation of the resource. Low temperature geothermal resources are not consistently classified or defined across the western states. In fact, they are not even recognized as distinct in a number of states.[21] Because these resources are related to both geothermal re-

19. U.S. DEP'T OF ENERGY, GEOPOWERING THE WEST DRAFT ACTION PLAN *at* http://www.eren.doe.gov/geopoweringthewest (last visited Oct. 14, 2002).

Eighteen American communities currently operate geothermal district heating systems. U.S. DEP'T OF ENERGY, DOE/GO-10097-518 FS 188, GEOTHERMAL ENERGY... POWER FROM THE DEPTHS, (Dec. 1997), *at* http://www.eren.doe.gov.

Two hundred seventy-one communities in the West have been identified as having the potential for district heating or other direct use applications of low temperature geothermal resources. LINEAU & ROSS, *supra* note 13.

20. As explained in Part II.A., there is not a generally applicable definition of "low temperature geothermal resource" and some states do not even recognize it as a separate resource. For the purposes of this Comment, the author uses the term "low temperature geothermal resources" to refer to ground water between twenty (20) and one hundred fifty (150) degrees Celsius, a definition borrowed from the Department of Energy. *See* U.S. DEP'T OF ENERGY, DOE/GO-10098-536, DIRECT USES OF GEOTHERMAL ENERGY, (Mar. 1998), *at* http://www.eren.doe.gov/geothermal/geodirectuse.html (last visited Oct. 14, 2002).

21. In some states they are not considered distinct from geothermal resources and in other states they are not distinguished from water. See *infra* Part II.B. for a discussion of this topic.

sources, and water and often included in the definition of one or the other (or sometimes arguably both), it is necessary to first examine the classification of geothermal resources.

A. Classifying the Resource

Most broadly defined, geothermal energy is the heat energy of the earth.[22] The resources associated with that energy pose a unique classification problem: are they water, mineral, or energy? They are "related to water, gas and minerals, to both the surface and subsurface estates, and to both water rights and mineral titles."[23] This variety of characterization slows development of the resources because developers may be unsure as to whether to secure a mineral, water, or geothermal right (or all) before exploring the resource.[24]

The Geothermal Steam Act of 1970 failed to resolve this confusion because it avoided classifying the geothermal resources.[25] A subsequent Ninth Circuit decision determined that geothermal resources were included in the federal government's reservation of mineral rights under the Stock-Raising Homestead Act of 1916[26] when they have been severed from a granted surface estate.[27] While defined as a mineral for those purposes, the resource has been classified differently for regulation purposes across the western states.[28] Three basic

22. The term geothermal quite literally means earth and heat. For examples of the adaptation of this general definition to law, see MONT. REV. CODE ANN. § 77-4-102 (Smith 2001); WASH. REV. CODE ANN. § 79.76.030 (West 2000); CAL. PUB. RES. CODE § 6903 (West 2001).

23. Bloomquist, *supra* note 17, at 89.

24. For example, if a developer wants to enter into a geothermal lease on federal lands, they have to secure the lease to get the mineral rights to the geothermal resource, and depending on the jurisdiction, they may have to purchase a water right in order to appropriate the necessary water to do the development, or the water associated with it. *See* Bloomquist, *supra* note 17.

25. 30 U.S.C. §§ 1001-1025 (1995); *see also* Bloomquist, *supra* note 17, at 91.

26. 43 U.S.C. § 299 (1980).

27. United States v. Union Oil Co. of Cal., 549 F.2d 1271 (9th Cir. 1977), *cert. denied*, 434 U.S. 930 (1977).

28. While the *Union Oil* decision is only binding in the Ninth Circuit, the majority of the states implicated are in the Ninth Circuit as that is where the majority of the resource is located. In addition, there has been no subsequent litigation on the matter and the case was denied certiorari by the Supreme Court, leaving it fairly settled that all lands leased under the Stock-Raising Homestead Act contain a mineral reservation that includes geothermal resources. *Id.*

regimes for classifying geothermal resources developed: mineral, *sui generis*, and water.

1. Geothermal Resources as Minerals

After *United States v. Union Oil*,[29] geothermal resources are at least in part classified as minerals, even if governed in some other manner.[30] Some states followed suit, classifying and governing geothermal resources as minerals.

Hawaii's unique land tenure history lent itself to a mineral classification for geothermal resources.[31] Because the Hawaiian crown held all the lands until the 1840s and reserved all the minerals to the state when converting to a private ownership regime, the legislature's amendment of mineral definition in 1974 to include geothermal resources effectively reserved all geothermal resources to the state.[32]

Texas also applies a purely mineral classification, and governs geothermal resources much as it has oil and gas.[33] Similarly, Alaska's code treats geothermal resources much as it does oil and gas, recognizing the correlative rights doctrine and specifically dismissing any prior rights claims among geothermal owners in a geothermal system.[34] Arizona does not specifically designate the resource as water,

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Another issue that geothermal developers may encounter on federal lands is that water rights reserved to a given federal property do not include exploitation for geothermal electrical production under the Geothermal Steam Act. *See* United States v. City and County of Denver, 656 P.2d 1 (Colo. 1983) (holding that the water court had correctly denied geothermal development of federally reserved water rights in Rocky Mountain National Park because the reservation was not for the purpose of power production).

Part of the problem is that legislatures and courts focused on assigning geothermal resources to existing regulatory and property rights regimes. Doing so ignored unique aspects of the resource that prevent a ready application of either water or mineral regimes. Creating "a meaningless new classification," however, proved equally ineffective (referring to Idaho's *sui generis* classification). *See* Owen Olpin, A. Dan Tarlock and Carl F. Austin, *Geothermal Development and Western Water Law*, 1979 UTAH L. REV. 773, 797-807.

29. 549 F.2d 1271 (9th Cir. 1977).

30. *Id.*

31. *See* Robert M. Kamins, *Property Rights to Geothermal Resources in Hawaii*, 6 HAWAII ENERGY RESOURCE OVERVIEWS 2 (1979).

32. *Id.* at 1. Hawaii defines geothermal resources, in the "Reservation and Disposition of Government Mineral Rights" chapter of its code, as the "natural heat of the earth, the energy . . . below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from naturally heated fluids." HAW. REV. STAT. ANN. § 182-1 (Michie 2001).

33. Geothermal resources, including hot water, "shall be treated and produced as mineral resources." TEX. NAT. RES. CODE ANN. § 141.002(4) (Vernon 1997).

34. ALASKA STAT. § 41.06.050 (Michie 2000). Under this section of the code, geothermal owners must recognize any prior water rights; however, no priority is established among the geothermal owners.

mineral, or otherwise.[35] It does, however, treat geothermal resources much the same as Alaska, with most of its statute focusing on leases, well drilling, and unitization.[36] These examples illustrate a common occurrence, states adopting classifications that placed the resource in an already highly developed and well-understood section of the code.[37]

2. Geothermal Resources: *Sui generis*

Idaho, Washington, and Montana have classified geothermal resources as *sui generis*.[38] Idaho's statutory definition explains this classification: "[g]eothermal resources are found and hereby declared to be *sui generis*, being neither a mineral resource nor a water resource, but they are also found and hereby declared to be closely related to and possibly affecting and affected by water and mineral resources in many instances."[39] The *sui generis* classification, "although arguably the most accurate, is also the most impractical because it leaves unanswered the issue of which legal regime to use in allocating the resource."[40] Another problem with this classification is that it "serves only to cloud the ownership issue," which makes it "for all practical purposes, meaningless."[41] Consistent with these criticisms, though they share the *sui generis* classification, these three states treat geothermal resources differently.

Without specifically characterizing the resource as *sui generis*, Colorado treats it as such by placing it within a modified prior appropriation scheme applicable only to geothermal resources. The state recognizes that "[the prior appropriation] doctrine . . . should be modified to permit the full economic development of the resource."[42] The state deviates from the traditional appropriation doctrine somewhat

35. *See* ARIZ. REV. STAT. ANN. §§ 27-651-667 (West 1996).

36. *Id.*

37. Alaska and Texas have highly developed oil and gas regulations, whereas Montana, Wyoming, Utah, and other states with strong water laws have leaned towards regulating the resource as water. For a discussion of the water classification, see *infra* Part II.C.

38. WASH. REV. CODE ANN. § 79.76.040 (West 2001); IDAHO CODE, § 42-4002(c) (Michie 1996); MONT. REV. CODE ANN. § 77-4-104 (Smith 2001).

39. IDAHO CODE, § 42-4002(c) (Michie 1996) (emphasis added).

40. Thomas A. Starrs, *Solar, Wind, and Geothermal Energy, in* SUSTAINABLE ENVIRONMENTAL LAW, 735, 789 (Celia Campbell-Mohn et al. eds., West Publishing 1993).

41. Bloomquist, *supra* note 17, at 92.

42. COLO. REV. STAT. ANN. § 37-90.5-102 (West 1998).

to address the true value of geothermal resources – their heat energy.[43]

3. Geothermal Resources as Water

When most geothermal regulations were first set forth, the technology was not available to commercially exploit the normal thermal gradient resulting from geothermal energy, and a convective material medium was necessary.[44] Some states adopted a water classification for the resource, one which recognizes that water is often that medium and that physical connections between ground water and geothermal resources often exist. The benefit of the water classification is that it places the resource within a clearly defined, pre-existing regulatory scheme. It may, however, fail to recognize the energy facet of the resource.

Wyoming and Utah adopted a pure water classification of geothermal resources.[45] Wyoming, one of the few Western states without a separate statutory provision specifically addressing the regulation of geothermal resources, simply amended the ground water provision of their code to encompass the resource: "'[u]nderground water' means any water, *including hot water and geothermal steam.*"[46] Utah, in enacting its Geothermal Resource Conservation Act, specifically excluded geothermal fluids from the definition of geothermal resource,[47] and then deemed them water; "Geothermal fluids are deemed to be *a special kind of underground water resource*, related to and potentially affecting other water resources of the state."[48] Montana and Idaho, while purporting to classify the resource as *sui generis*, do in large part treat the resource as water.[49]

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43. First, Colorado recognizes the beneficial use of the energy as the basis, measure and limit of the right. Second, it includes a diminution in temperature in the definition of material injury. COLO. REV. STAT. ANN. § 37-91-101 (West Supp. 2001).

44. *See* Owen Olpin, A. Dan Tarlock, and Carl F. Austin, *Geothermal Development and Western Water Law*, 1979 UTAH L. REV. 773, 778. Since then, the development of geothermal heat pumps and cold water/hot rock injection pump systems has enabled a wider use of geothermal energy. *See* U.S. DEP'T OF ENERGY, DOE/GO-10097-518 FS 188, GEOTHERMAL ENERGY... POWER FROM THE DEPTHS, (Dec. 1997), *at* http://www.eren.doe.gov.

45. *See* WYO. STAT. ANN. § 41-3-901 (Lexis 2001); N.M. STAT. ANN. § 71-5-3 (Michie 1995); UTAH CODE ANN. §§ 73-22-3(5), 73-22-8(1) (1989).

46. WYO. STAT. ANN. § 41-3-901(a)(ii) (Lexis 2001) (emphasis added).

47. UTAH CODE ANN. § 73-22-3(5) (1989).

48. UTAH CODE ANN. § 73-22-8(1) (1989) (emphasis added). How "special" a resource the fluids are is not clear, that is to say that where the underground water regulations may be departed from with regards to this resource is not certain.

49. *See* MONT. REV. CODE ANN. §§ 77-4-104, 77-4-108 (Smith 2001); IDAHO CODE §§ 42-4001-4013 (Michie 1996). This is especially true of low temperature geothermal resources.

B. Defining Low Temperature Geothermal Resources

What this Comment refers to as a low temperature geothermal resource is not consistently defined by the western states. Early geothermal resource legislation defined geothermal resources in an ambiguous manner, leaving the inclusion or exclusion of hot waters uncertain. Some states, including Idaho after amending its geothermal act in 1987, specifically address these resources that occupy the fuzzy area between geothermal resources and water.

The federal government's "geothermal steam and associated geothermal resources" definition embraces hot water, as did many of the early geothermal resource definitions:[50]

> (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 byproduct derived from them.[51]

Similarly, Idaho's original geothermal resources definition was broad enough to include low temperature geothermal resources:

> the natural heat energy of the earth, the energy, in whatever form, which may be found in any position and at any depth below the surface of the earth present in, resulting from, or created by, or which may be extracted from such natural heat, and all minerals in solution or other products obtained from the material medium of any geothermal resource.[52]

Idaho's current definition further limits that with the following language: "Ground water having a temperature of two hundred twelve

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50. The first statutory definition of geothermal resources was set forth in the California Geothermal Resources Act of 1967, and remains in force there:

> '[G]eothermal resources' shall mean the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from *naturally heated fluids*, brines, associated gases, and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas, or other hydrocarbon substances.

CAL. PUB. RES. CODE § 6903 (West 2000) (emphasis added).

51. 30 U.S.C. § 1001(c) (West 2001) (emphasis added).

52. 1987 Idaho Sess. Laws 742.

(212) degrees Fahrenheit or more in the bottom of a well shall be classified as a geothermal resource."[53]

Like Idaho, many states have differentiated broadly two categories of geothermal resources: high temperature and low temperature. Apart from the obvious temperature distinction, this bifurcation loosely correlates with the potential use of the resource: electrical production and direct heat applications.[54]

This distinction has developed along three strands: first, some states (and the federal government)[55] do not distinguish between high and low temperature geothermal resources; second, some states simply define geothermal resources as those above a certain temperature; and third, some states specifically define a separate low temperature geothermal resource.

Arizona, Nevada, Montana, Colorado and Texas do not limit geothermal resources to those above a given temperature.[56] While not recognized in the statutory definitions, there is obviously some breaking point below which hot waters are just not hot enough to be geothermal resources and are, therefore, governed as water.

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53. IDAHO CODE § 42-4002 (Michie 1996). This portion of the definition was added in a 1987 amendment. 1987 Idaho Sess. Laws 347.

54. Initially it was only technologically practical to produce electricity from the very hot and/or highly pressurized resource. As early as 1980, however, electricity could be produced from resources with temperatures as low as one hundred degrees Celsius, which are commonly used in direct applications such as aquaculture (fish farms), greenhouses, recreational pools, and district or single building space heating. Bloomquist, *supra* note 17, at 90; U.S. DEP'T OF ENERGY, DOE/GO-10098-536, DIRECT USE OF GEOTHERMAL ENERGY, (Mar. 1998), *at* http://www.eren.doe.gov/geothermal/geodirectuse.html.

In addition, high temperature resources can be used in direct applications. For example, the Reykjavik District Heating service, the largest geothermal district heating service, gets 25 percent of its utilized resource from high temperature fields and 75 percent from low temperature fields. Ingvar B. Fridleifsson, *Direct Use of Geothermal Energy Around the World*, 19(2) GEO-HEAT CENTER Q. BULL. 4 (December 1998), *available at* http://geoheat.oit.edu. Examples of direct heat applications are aquaculture (fish farms), greenhouses, recreational pools, and district or single building space heating.

55. "'[G]eothermal resources' means . . . all products of geothermal processes, embracing indigenous steam, *hot water* and hot brines." 30 U.S.C. § 1001(c) (West 2001) (emphasis added).

56. ARIZ. REV. STAT. ANN. § 27-651 (West 1996); NEV. REV. STAT. ANN. 534A.010 (Michie 1999); MONT. REV. CODE ANN. § 77-4-102 (Smith 2001); TEX. NAT. RES. CODE ANN. § 141.003 (Vernon 1997); COLO. REV. STAT. ANN. § 37-90.5-103 (West 1998).

Colorado does not bifurcate geothermal resources by temperature in its definition; however, it does subject "all applications for a permit to construct a geothermal well which [the state engineer] expects to encounter geothermal fluids having a temperature in excess of 212 degrees Fahrenheit or will be in excess of two thousand five hundred feet in depth" to a second level of review. COLO. REV. STAT. ANN. § 37-90.5-106(4), 103 (West 1998). The state engineer must notify the oil and gas conservation commission and "consider" their comments before making a final determination on issuing a permit. *Id.*

Alaska, Hawaii, and Washington define a baseline below which heat resources are not considered geothermal resources. Presumably water law governs hot waters below the baseline. Alaska's definition is limited to "the natural heat of the earth at temperatures greater than 120 degrees Celsius."[57] Hawaii specifically excludes any water below 150 degrees Fahrenheit in its definition.[58] Washington attempted a more practical distinction by defining "geothermal resource" as "only that natural heat energy of the earth *from which it is technologically practical to produce electricity commercially* and the medium by which such heat energy is extracted from the earth, including liquids."[59] Because the statutory definition does not identify the temperature or pressure at which that boundary lies, that boundary has changed as electrical production technologies improve and most resources above 212 degrees Fahrenheit are now included in the high temperature definition.[60] The problem with this approach is that the actual use of the resource is not considered, so there could be unnecessary overlap in the types of activities governed by the two bodies if resources "from which it is technologically practical to produce electricity" are used in another application such as direct heating.[61]

Idaho, New Mexico and California recognize low temperature geothermal resources as distinct from geothermal resources. In Idaho, "[a]ll ground water having a temperature of greater than eighty-five (85) degrees Fahrenheit and less than two hundred twelve (212) degrees Fahrenheit in the bottom of a well shall be classified and administered as a low temperature geothermal resource."[62] Similarly, New Mexico includes "naturally heated fluids" in its definition of "geothermal resources," but then defines a "low-temperature thermal reservoir" as a "geothermal reservoir containing low-temperature thermal water . . . the temperature of which is less than boiling at the altitude of occurrence."[63] California bifurcates the resource at the boiling point, defining "[l]ow-temperature geothermal resources" as fluids

57. ALASKA STAT. § 41.06.060 (Michie 2000).

58. HAW. REV. STAT. ANN. § 182-1 (Michie 2001).

59. WASH. REV. CODE ANN. § 79.76.030 (West 2000) (emphasis added).

60. *See* Bloomquist, *supra* note 17, at 90.

61. WASH. REV. CODE ANN. § 79.76.030 (West 2000); *see supra* note 50.

62. IDAHO CODE § 42-230(a)(1) (Michie 1996). A 1987 amendment introduced this bifurcation of geothermal resources and low temperature geothermal resources. Previously the resource was not strictly subject to water regulations; however, the de facto policy of regulation by the Idaho Department of Water Resources meant that the resource was, in effect, water all along. *See* Owen Olpin & A. Dan Tarlock, *Water That is Not Water*, 13 LAND & WATER L. REV. 391, 401 (1978).

63. N.M. STAT. ANN. § 71-5-3(6) (Michie 1995).

that "have a temperature that is not more than the boiling point of water at the altitude of occurrence."[64]

Without bifurcating the resource in its definition, Oregon's approach reaches that end. Geothermal resources in Oregon specifically include hot water.[65] The state then excludes geothermal fluids of less than 250 degrees Fahrenheit from the well drilling and reinjection requirements of the Geothermal Act.[66]

Utah employs yet another approach. The state's geothermal code requires that geothermal resources be at least 120 degrees Celsius.[67] In addition, the code expressly excludes all geothermal fluids from that definition, relegating their regulation back to the water law of the state regardless of their temperature.[68]

The benefit of bifurcating the resource is that low temperature geothermal resources can escape regulations geared toward power production or other intensive developments of higher temperature geothermal resources. In addition, specifically defining low temperature geothermal resources separately from ground water recognizes their unique heat value. The problem with bifurcation is that it is somewhat artificial. Every ground water system is different; low temperature geothermal resources, geothermal resources and non-thermal ground water systems may be interconnected and that should be recognized by the law.[69] In recognizing the differences between low temperature geothermal resources and geothermal resources, states may facilitate a wider spectrum of development of geothermal resources. It is important that the states recognize not only that difference, but the critical differences between water and low temperature geothermal resources as well.

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64. CAL. PUB. RES. CODE § 3703.1 (West 2001).

65. Oregon's definition reads: "'Geothermal resources' means the natural heat of the earth, the energy, in whatever form, below the surface of the earth . . . including, specifically: (a) All products of geothermal processes, embracing indigenous steam, *hot water* and hot brines." OR. REV. STAT. § 522.005(11) (1988) (emphasis added).

66. Fluids already appropriated as water rights or that were producing geothermal resources prior to July 1, 1975, are also excluded. OR. REV. STAT. §§ 522.019, 522.025 (1988).

67. UTAH CODE ANN. § 73-22-3(5) (1989). "Geothermal resource does not include geothermal fluids." *Id.*

68. *Id.*

69. See Olpin, Tarlock & Austin, *supra* note 28, at 781-792 for a discussion of the formations that produce high and low temperature geothermal resources, and their relatedness to water from different sources. A number of states have addressed the interaction of water resources and geothermal resources. Arizona's code exempts geothermal resource development from the water laws of the state unless either "[s]uch resources are commingled with surface waters or groundwaters of this state" or "[s]uch development causes impairment of or damage to the groundwater supply." ARIZ. REV. STAT. ANN. § 27-667(A)(1), (2) (West 1996).

III. REGULATION OF LOW TEMPERATURE GEOTHERMAL RESOURCES

Following the passage of the Geothermal Steam Act in 1970 and the numerous western state geothermal statutes, a number of water law scholars tackled the subject of whether western water law was well suited to govern the emerging resource. Most found that it was not.[70] That criticism focused on the inadequacy of water doctrines to address the development of large-scale geothermal resources for power production.[71] Low temperature geothermal resources are often more closely related to ground water than higher temperature and pressure resources. Many states place low temperature geothermal resources under the rubric of ground water regulation. This arrangement, while common to many states, was arrived at using different frameworks.

In the states that do not differentiate between high and low temperature resources, high and low temperature resources alike are governed as geothermal resources. It is unclear, as mentioned above, where the dividing line between water and geothermal resources lies, but logic would suggest that any heat use might lead to a geothermal resource classification.

Where that division lies is not of much consequence in states that govern water and geothermal resources by the same basic set of rules. Colorado, for example, applies a modified appropriation scheme to geothermal resources[72] and recognizes prior appropriation in some designated ground water basins.[73] Montana recognizes priority rights among geothermal lessees and follows the doctrine of appropriation to

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70. "The principle thesis advanced here is that it is undesirable to regulate geothermal resources merely as groundwater resources." Olpin, Tarlock & Austin, *supra* note 28, at 775. "[C]ourts should be hesitant to extend water law doctrines unthinkingly to geothermal developments. . . . Water doctrines were not developed with geothermal development in mind and, therefore, are unsuited for resolving many of the issues surrounding geothermal development." Owen Olpin & Barton H. Thompson, *Water Law and the Development of Geothermal Resources*, 14 NAT. RESOURCES LAW. 635, 648 (1981).

71. While power production generally does not involve the use of geothermal systems interconnected with the general ground water supply that is put to beneficial use for irrigation and domestic purposes, exploration and later power production could affect that supply. In order to promote development of geothermal resources, some argued that there should be a rebuttable presumption of non-interference with ground water resources. *See* Olpin, Tarlock & Austin, *supra* note 28, at 811.

72. COLO. REV. STAT. ANN. § 37-90.5-102 (West 1998).

73. A. DAN TARLOCK, LAW OF WATER RIGHTS AND RESOURCES, § 6:4 (2001).

govern ground water.[74] In addition, Montana specifically recognizes that geothermal resources are closely related to and may interact with water.[75] Nevada recognizes the doctrine of appropriation with geothermal resources by referencing the purposes of its water code as a consideration of geothermal permits.[76] In these states, disputes between rights holders would be subject to similar rules under either classification, thereby reducing the chances of confusion or conflict in the regulation of low temperature geothermal resources.

Arizona exempts geothermal resources from the water laws of the state unless they are commingled with or may impair or damage the ground water.[77] If part of any system containing low temperature geothermal resources has been appropriated as water, then Arizona's water regulations would apply, obviating conflict.

Texas applies the correlative rights doctrine to geothermal resources and absolute ownership to water, so there are potential conflicts with low temperature geothermal resources that occupy that fuzzy area between water and geothermal resources.[78]

In the states that limit the definition of geothermal resources by temperature or another criterion and do not separately define low temperature geothermal resources, the resources this Comment addresses are simply defined as part of the water supply, and governed thereunder. Most commonly this means that they are governed under the appropriation doctrine. For example, in Washington the Department of Natural Resources governs high temperature and pressure resources, while low temperature resources used in direct applications are governed by the Department of Ecology, which normally regulates ground water.[79]

In states that have specifically defined a low temperature resource, that resource may be mostly governed as water, or mostly governed as geothermal resource. California governs low temperature geothermal resources as geothermal resources with exemptions from certain well drilling and reporting requirements if "used domestically or in a noncommercial manner."[80] California also authorizes waiver or reduction of rental or royalty for geothermal resources leased for use

74. MONT. REV. CODE ANN. §§ 77-4-109, 77-4-103, 85-2-501 to 520 (Smith 2001). In addition, Montana's statute provides that water rights must be secured for any geothermal development affecting water. Doing so should eliminate any conflict. MONT. REV. CODE ANN. § 77-4-108 (Smith 2001).

75. MONT. REV. CODE ANN. § 77-4-103 (Smith 2001).

76. NEV. REV. STAT. ANN. 534A.070 (Michie 1999).

77. ARIZ. REV. STAT. ANN. § 27-667 (West 1996).

78. TEX. NAT. RES. CODE ANN. § 141.012 (Vernon 1997); TARLOCK, *supra* note 73 § 6:4 (2001).

79. Bloomquist, *supra* note 17, at 90.

80. CAL. PUB. RES. CODE § 3757.2 (West 2001).

in direct heat applications.[81] New Mexico regulates low temperature geothermal resources similarly, defining them separately in the geothermal code while keeping them under the rubric of water regulation.[82] Under the corresponding administrative code, New Mexico exempts these resources from a number of drilling requirements applicable to geothermal resources.[83]

When Idaho amended the geothermal resource definition to exclude low temperature geothermal resources, their governance was placed under ground water appropriation law as examined below.[84]

Wyoming, in choosing to define geothermal resources as a type of water, similarly governs low temperature geothermal resources under the rubric of ground water. Utah also chose to govern low temperature geothermal resources as water by excluding all geothermal fluids from the geothermal resources definition.

While low temperature geothermal resources may be more closely related to water than highly pressurized or higher temperature geothermal resources, ground water law, and in particular the prior appropriation doctrine, may not adequately address the heat value of this resource.

IV. ANALYSIS: ARE IDAHO'S LOW TEMPERATURE GEOTHERMAL REGULATIONS ADEQUATE?

In 1987, the Idaho legislature amended the ground water and geothermal regulations as they related to the management and regulation of low temperature geothermal resources and geothermal resources. Prior to that time, low temperature geothermal resources were not a distinct entity and no dividing line had been drawn to distinguish how hot water had to be in order to be included in the geothermal resources definition. The following changes were made: (1) low temperature geothermal resources were specifically excluded from the general geothermal resources definition;[85] (2) thermal and artesian pressure values were added as considerations for the determina-

81. CAL. PUB. RES. CODE § 6916 (West 2001).

82. N.M. STAT. ANN. § 71-5-3 (Michie 1995).

83. *See* N.M. ADMIN. CODE tit. 19 §§ 14.5.8, 14.5.9, 14.5.12, 14.1.9.8, 14.36.8 (2001).

84. 1987 Idaho Sess. Laws 347.

85. "The right to the use of low temperature geothermal resources of this state shall be acquired by appropriation." IDAHO CODE § 42-233 (Michie 1996); 1987 Idaho Sess. Laws 744.

tion of reasonable ground water pumping levels;[86] and (3) low temperature geothermal resources were specifically included under the rubric of ground water regulation.[87]

Idaho, like the majority of western states, applies the prior appropriation doctrine to govern ground water rights.[88] In addition, the ground water statutes provide for management area designation,[89] which, while under the auspices of the appropriation scheme, serve as a valuable administrative tool that may allow IDWR to coordinate with resource users and reduce conflict. Each of these components of the ground water regulation scheme and its application to low temperature geothermal resources will be examined.

A. Prior Appropriation

One thing to keep in mind is that prior appropriation operates more by threat than actual application.[90] The key to successful regulation becomes allowing for various contingencies between users so that senior appropriators will have an avenue for redress of any harm to their rights, while promoting conservation and cooperation among all users.

While the 1987 amendments make it clear that low temperature geothermal resources are governed as ground water, what remains unclear is how issues unique to these resources will be addressed within the framework of statutes and precedents developed mostly with irrigation in mind. The following sections attempt to address issues that may arise under different elements of Idaho's prior appropriation scheme.

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86. "In determining a reasonable ground water pumping level or levels, the director of the department of water resources shall *consider and protect the thermal and/or artesian pressure values for low temperature geothermal resources* and for geothermal resources to the extent that he determines such protection is in the public interest." IDAHO CODE § 42-226 (Michie 1996) (emphasis added); 1987 Idaho Sess. Laws 743.

87. IDAHO CODE § 42-233 (Michie 1996); 1987 Idaho Sess. Laws 744.

88. In 1951, the Ground Water Act extended the doctrine of prior appropriation to the state's ground waters. Idaho's early ground water regulation vacillated between absolute ownership and appropriation. A 1922 case classified waters withdrawn by the Natatorium as "private waters." Pub. Utils. Comm'n v. Natatorium Co., 36 Idaho 287, 306, 211 P. 533, 537 (1922). That once absolute water right is now part of the Boise Front Low Temperature Geothermal Resource GWMA. See Part IV.B. *infra* for more. Other states that apply the prior appropriation doctrine to ground water regulation include Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming. TARLOCK, *supra* note 73, § 6:4 (2001).

89. IDAHO CODE §§ 42-233a, 42-233b (Michie Supp. 2001).

90. A. Dan Tarlock, *Prior Appropriation: Rule, Principle, or Rhetoric?* 76 N.D. L. REV. 881, 883 (2000).

1. Priority

A major benefit of prior appropriation in any context is that the determination of rights by priority provides security in the ownership of a right.[91] Without that security, rights holders may not be willing to invest their capital in the development of a resource. The problem in the context of direct heating applications of low temperature geothermal resources is that senior appropriators with secure rights are not typically interested in developing the right in the most efficient, economically valuable or utilitarian manner.[92] Historic users are often individuals or businesses with self-interested economic concerns, not advocates of developing alternative energy sources or more environmentally sound energy practices.[93] While this problem applies in other contexts as well, it could be more easily avoided in this context because unlike irrigation or other consumptive uses of water, in well regulated heating systems there is the potential for the use to be nonconsumptive and for more development to occur without injury to the prior rights holders.

Colorado has addressed that reality by recognizing that the prior appropriation doctrine should be modified in its application to geothermal resources to "permit the full economic development of the resource."[94] Idaho's courts similarly limited prior appropriation with regards to ground water (and after 1987 low temperature geothermal resources), deciding that "it may sometimes be necessary to modify private property rights in ground water in order to promote full economic development of the resource."[95] Modification of private property

91. *Id.* at 885-86.

92. Generally speaking, the public's interest is in maximizing the efficient application of the resource to benefit the most people and reduce environmental impacts associated with its development. Senior appropriators' interest lies in their own economic gain. These two interests are often at odds. The obstacles faced by the communities of Klamath Falls, Oregon, Pagosa Springs, Colorado, and Boise, Idaho, in their development and expansion of municipal district heating systems over the last twenty years, illustrate the conflict. *See* Bloomquist, *supra* note 17, at 90.

93. Consider for instance New Meadows, Idaho, one of the many collocated communities identified in the Department of Energy's Assessment of Low Temperature Geothermal Resources. Currently a private hot springs pool facility (actually one that is for sale) has the right to one of the seven appropriations from the low temperature geothermal resource in the area, a resource which has the potential to heat many of the new homes being built in the area, or some of the existing buildings in the town and its environs. The interest of the pool owners, and other private owners is in reaping the greatest personal economic benefit possible from the resource, not looking into ways that the entire community may benefit. *See* DANSART ET AL., *supra* note 14.

94. COLO. REV. STAT. ANN. § 37-90.5-102 (West 1998).

95. Baker v. Ore-Ida Foods, Inc., 95 Idaho 575, 584, 513 P.2d 627, 636 (1973).

rights in a priority system can defeat the very purpose of the doctrine, providing security to rights holders to promote investment, and should, therefore, be implemented with caution.

Critics have noted problems related to using a system that assigns rights by priority, but it may be there are "no superior alternatives."[96] That probably holds true in regards to governing low temperature geothermal resources as well as water.

2. Beneficial Use

Idaho's prior appropriation doctrine requires that water be diverted for a beneficial use.[97] Appropriation of low temperature geothermal resources requires that the primary use of the resource be for heat value.[98] Using the resource other than for its heat value is statutorily defined as "not a beneficial use" of the resource.[99] The director of the department of water resources may exempt a low temperature geothermal resource from this requirement so long as the proposed use meets certain criteria.[100] The requirement helps promote and conserve low temperature geothermal resources by ensuring that the heat value is not wasted.

Prior to the 1987 low temperature geothermal resource amendments to the ground water regulations, the Idaho Supreme Court applied a public interest standard to reject an application for the appropriation of low temperature geothermal resource that was not in the public interest.[101] In that case, a developer applied for a permit to appropriate the resource to heat one hundred ten homes.[102] He later changed those plans to include using the cooled resource for irrigation purposes.[103] The court found IDWR's determination that it was not in the public interest to use water from the geothermal aquifer to irrigate crops not clearly erroneous.[104] In essence, the new regulations

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96. Tarlock, *supra* note 90, at 883.

97. IDAHO CODE § 42-104 (Michie 1996).

98. IDAHO CODE § 42-233 (Michie 1996).

99. *Id.*

100. A non-heat use of low temperature geothermal resources must meet these criteria "(i) there is no feasible alternative use of the resource; (ii) there is no economically viable source of water having a bottom hole temperature of eighty-five (85) degrees or less in a well available; [and] (iii) the exemption is in the public interest." IDAHO CODE § 42-233 (Michie 1996).

101. Collins Bros. Corp. v. Dunn, 114 Idaho 600, 759 P.2d 891 (1988).

102. *Id.*

103. *Id.*

104. *Id.* Because this case was not decided under the amended ground water regulations, it referred to the geothermal aquifer, not low temperature geothermal resources. Under the amended ground water act, approval of use of the resource for irrigation would be subject to the criteria laid out *supra* in note 100.

codify this decision in that the developer's use for irrigation would not be beneficial.

Colorado achieved similar ends through a slightly different means. That state defines the beneficial use in the obverse, positively recognizing that "[t]he use of water as a material medium is recognized as a beneficial use of such water."[105] This beneficial use requirement is less exclusive than Idaho's because it does not preclude or limit other possible beneficial uses.

In addition, Colorado's statute makes clear that "beneficial use of such energy is the basis, measure, and limit of the right and requires that efficient application methods be utilized."[106] In appropriation schemes, the 'use it or lose it' corollary to 'first in time, first in right' can actually serve to minimize efficiency.[107] Colorado's statutory scheme reflects and curbs that possibility.

By eliminating competing uses of low temperature geothermal resources that do not exploit its heat value, the beneficial use doctrine plays a strong role in maximizing efficient utilization of the resource. However, it might not be enough. Colorado's requirement that efficient methods be used is a good model. Another avenue would be to use the public interest considerations to promote efficiency.

3. Reasonable pumping level

In Idaho, "[p]rior appropriators of underground water shall be protected in the maintenance of reasonable ground water pumping levels."[108] Junior appropriators must compensate senior appropriators for expenses incurred in changing the method or means of diversion necessary to maintain their appropriation at a reasonable pumping

105. COLO. REV. STAT. ANN. § 37-90.5-107(c)(1) (West 1998).

106. *Id.* at § 37-90.5-107(c)(5) (West 1998 & Supp. 2002). An interesting unanswered question, especially in light of the many historic uses of geothermal resources in applications like hot springs resorts, is: what makes a use efficient?

107. *See* Tarlock, *supra* note 90, at 901.

108. IDAHO CODE § 42-226 (Michie 1996).

level.[109] The director of IDWR determines reasonable pumping levels.[110]

The reasonable pumping level protection was modified to address the concerns of low temperature geothermal rights holders, specifically allowing the director to consider thermal and/or artesian pressure values "to the extent that he determines such protection is in the public interest."[111] While rights holders to some extent must be relieved to have a statutory recognition of the heat and pressure values of their right, the public interest qualifier tempers it with insecurity. Whether a prior appropriator's and the public's interests would be aligned is contingent upon the specific circumstances.

In addition, the remedy in reasonable pumping level cases is to compensate a senior appropriator for the cost of sinking his well.[112] Prior appropriators cannot be compensated for a drop in temperature like a ground water appropriator can be compensated for having to sink his well, so in a sense this protection is illusory. A more sensible approach might be along the lines of Colorado's inclusion of "diminution in temperature" in the definition of "materially injure."[113] That may better serve as an incentive to junior appropriators not to engage in practices that may negatively impact the pressure or temperature of an aquifer, however, the difficulty in calculating damages still looms large.

Another problem that prior appropriators may face is the burden of proving that the junior appropriator caused the change in temperature or artesian pressure. "[I]t is difficult and very costly to establish the causal relationships among pumpers . . . without extensive and costly hydrologic evidence."[114] Vagaries of temperature within low temperature geothermal systems, and a lack of understanding of the flow, extent, and interconnectivity of underground water sources add

109. Parker v. Wallentine, 103 Idaho 506, 650 P.2d 648 (1982). In this case, the Ground Water Act did not apply because domestic wells were specifically excluded. Even without that protection, the court found that the earlier precedent supported their holding that a vested right to ground water "includes the right to have the water available at the historic pumping level or to be compensated for expenses incurred if a subsequent appropriator is allowed to lower the water table and [the prior appropriator] is required to change his method or means of diversion in order to maintain his right to use the water." *Id.* at 512, 650 P.2d at 654.

110. IDAHO CODE § 42-226 (Michie 1996).

111. *Id.*

112. *Parker*, 103 Idaho at 512, 650 P.2d at 648. A court may, in addition to payment of these costs, enjoin the junior appropriator. *Id.*

113. COLO. REV. STAT. ANN. § 37-90.5-107(c)(8) (West 1998 & Supp. 2002).

114. TARLOCK, *supra* note 73, § 4:5 (2001).

to the uncertainty.[115] Another problem is determining how great a drop in temperature would be reasonable: two degrees, ten degrees, twenty? This also relates back to calculating damages. Should they be calculated on the basis of the loss of energy? Should that be calculated over time? Will the thermal values be regained?

Intense study of every low temperature geothermal system is probably cost prohibitive. The law must find a way to recognize heat value in an equitable manner. Inclusion of thermal values is not a logical extension of the reasonable pumping level protections. First, unlike a decrease in pumping level, a decrease in thermal value is not easily cured (if it can be cured at all). Second, causation and the indeterminacy of reasonableness provide obstacles to remedial action.

4. Public Interest

Idaho's ground water statutes contemplate that the public interest is a factor in regulating low temperature geothermal resources. Reasonable pumping level protections are subject to the director's determination of whether or not the protection is in the public interest.[116] Beneficial use exemptions for non-heat uses of the resource must be in the public interest as well.[117] In addition, the general ground water rules and case law governing appropriation stipulate that any changes in a water right are subject to a determination that the change is in the local public interest.[118] Whether the "public inter-

115. In the Boise Front Low Temperature Geothermal Resource GWMA, there can be a difference of up to twenty degrees Fahrenheit between different pumpers. A five degree decline in the maximum monthly supply temperature between 1983 and 1994 in the Capitol Mall System was noted. This decline coincided with the operation of a nearby reinjection well, however, as the study's author pointed out, inferring a causal connection between the two "is speculative." Kenneth W. Neely, *Production History for the State of Idaho Capital [sic] Mall Geothermal System 1983-1994*, 17(1) GEO-HEAT CENTER Q. BULL. 1, 4 *available at* http://geoheat.oit.edu/bulletin/bull17-1/art8.htm (last updated Jan. 5 2001).

116. IDAHO CODE § 42-226 (Michie Supp. 2001).

117. IDAHO CODE § 42-233 (Michie Supp. 2001).

118. IDAHO CODE §§ 42-203A(5)(e), 42-222 (Michie 1996); *see* Hardy v. Higginson, 123 Idaho 485, 849 P.2d 946 (1993).

In addition to the public interest provisions of the code, Idaho case law has applied the public trust doctrine in the water context. In the early 1980s, Idaho adopted the public trust doctrine in *Kootenai Envtl. Alliance v. Panhandle Yacht Club*. 105 Idaho 622, 624, 671 P.2d 1085, 1087 (1983). In that seminal public trust case Justice Huntley intimated that the doctrine could apply even to vested interests:

est" requirement in the specific low temperature geothermal resource provisions is different from the "local public interest" employed in the general water regulations is undetermined.[119]

In defining public interest, the court borrowed language from Alaska's code, including the following elements: benefit to the applicant, effect of the resulting economic activity, effect on fish and game and on public recreational opportunities, effect on public health, effect of loss of alternate uses of the water that might be made within a reasonable time if not precluded by the appropriation, the intent and ability of the applicant to complete the appropriation, and the effect upon access to navigable or public waters.[120]

While most of these elements are geared toward considerations of the public interest related to surface waters, the court recognizes that they "are not intended to be a comprehensive list,"[121] and that "the legislature intended to include any locally important factor impacted by proposed appropriations."[122] The court places the burden on the applicant to demonstrate which elements are impacted and to what de-

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> The public trust doctrine takes precedent even over vested water rights. Grants, even if purporting to be in fee simple, are given subject to the trust and to action by the state necessary to fulfill its trust responsibilities. Grants to individuals of public trust resources will be construed as given subject to the public trust doctrine unless the legislature explicitly provides otherwise.

Id. at 631, 671 P.2d at 1095. In 1995, the court affirmed that "[t]he proprietary rights to use water, which are the subject of the SRBA, are held subject to the public trust." *In re* SRBA – Case No. 39576, Idaho Conservation League v. State, 128 Idaho 155, 157, 911 P.2d 748, 750 (1995). The doctrine, however, is not implicated in the adjudication process because it "is not an element of a water right used to determine the priority of that right in relation to the competing claims of other water right claimants." *Id.* Thus, while the public trust doctrine could be employed in considering new applications for low temperature geothermal resources, it will probably not be extended to the typical conflict between senior and junior appropriator or in any routine adjudication of rights. *Id.*

The question of whether the public trust doctrine applied to vested water rights and potentially low temperature geothermal resources was answered in finality by the 1996 legislature in section 58-1203: "the public trust doctrine shall not apply to . . . [t]he appropriation or use of water, or the granting, transfer, administration, or adjudication of water or water rights[.]" IDAHO CODE § 58-1203 (Michie 2002).

119. "[L]ocal public interest is defined as the affairs of the people in the area directly affected by the proposed use . . ." IDAHO CODE § 42-203A(5)(e) (Michie 1996). Section 42-203A of the code states that if an appropriation "will conflict with the local public interest . . ." the director "may reject such application and refuse issuance of a permit therefor, or may partially approve and grant a permit for a smaller quantity of water than applied for, or may grant a permit upon conditions." IDAHO CODE § 42-203A(5)(e) (Michie 1996).

120. Shokal v. Dunn, 109 Idaho 330, 338, 707 P.2d 441, 449 (1985) (referring to ALASKA STAT. § 46.15.080 as drafted by Dean Frank J. Trelease).

121. *Id.*

122. *Id.* at 338-39, 707 P.2d at 449-50.

gree.[123] The court also recognizes that "[t]he determination of what elements of the public interest are impacted, and what the public interest requires, is committed to Water Resources' sound discretion."[124]

Applying the section 42-203 public interest standard to low temperature geothermal resources could enable the regulation of the resource to the greatest return. The language in the code that allows IDWR to issue permits upon conditions,[125] coupled with the broad discretion to determine public interest could enable IDWR to mandate reinjection or efficient means of delivery and heat transfer.

B. Ground Water Management and Critical Ground Water Areas

The institution of critical ground water areas (CGWA) and later ground water management areas (GWMA) provided IDWR with a powerful tool to monitor and protect Idaho's limited water resources. The CGWA designation was part of Idaho's ground water regulations early on. The addition of the GWMA designation in 1982 enabled IDWR to intervene earlier and manage resources to benefit more users.[126]

These management area designations maintain the security of prior rights holders by enforcing the statutory regime of prior appropriation, but allow IDWR some flexibility and the ability to coordinate with water users to realize the maximum benefit.[127] These management area designations and the agency power associated with them may be broad enough to accommodate low temperature geothermal resources even though they were developed with irrigation in mind (as evidenced by the reference to the "growing season" in the statutory language).[128] Essentially management designations allow agencies to participate in what many water users have been doing over time: cooperating under the threat of appropriation.[129] One problem with this arrangement is that, unlike irrigation applications, there is very little precedent on the application of appropriation and its various elements to low temperature geothermal resources so that "threat" may not be very well defined.

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123. *Id.* at 339, 707 P.2d at 450.

124. *Id.*

125. IDAHO CODE § 42-203A (Michie 1996).

126. 1982 Idaho Sess. Laws 165; IDAHO CODE § 42-233b (Michie Supp. 2001).

127. *See* Tarlock, *supra* note 90 at 883.

128. IDAHO CODE §§ 42-233a, 42-233b (Michie Supp. 2001).

129. As one commentator notes, "priorities are seldom enforced . . . [and] . . . most water users are 'repeat users' and thus they have the incentives to share rather than stand on their rights." Tarlock, *supra* note 90, at 883.

Because low temperature geothermal resources' value is in the heat and water serves only as the medium, it is possible to continue using the heat indefinitely if the water withdrawn is returned to the aquifer or removed at a rate lower than the annual rate of recharge.[130] Given proper management, the heat from a low temperature geothermal aquifer may be an inexhaustible resource.

There are two designated GWMAs protecting geothermal systems: Banbury Hot Springs GWMA and the Boise Front Low Temperature Resource GWMA.[131] IDWR set forth four specific goals and actions for the management of the Boise Front GWMA: "(1) Protect the existing users; (2) Allow full use of the geothermal resource; (3) Provide clear management policies; and, (4) Stabilize depletions."[132] Prior to 1978 there was almost no data on the aquifer serving the Boise Front GWMA.[133] Designation as a GWMA has resulted in much more study and deliberation over current and future use of the low temperature geothermal resources of this system.[134]

Management of the resource is promising, but given the expense of the research and administrative tasks necessary to actively manage a designated area, its impact on the regulation of low temperature geothermal resources throughout the state will undoubtedly be limited.

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130. In fact, one right holder in the Boise Front GWMA is hoping that through reinjection the aquifer will be recharged to the point that the moratorium on development can be lifted. *See* Neely, *supra* note 115.

131. Coincidentally, the designation of the Boise Low Temperature Geothermal GWMA coincided with the passage of the 1987 amendments to the ground water act. A study, prompted by noticeable changes in the aquifer following the first few years' use by the city and state heating districts in the 1980s, revealed that water declines of up to 30 feet were documented at some of the geothermal wells now included in the GWMA.

The study suggested that prior to the more than doubled diversion volumes beginning in 1983, the aquifer was at or near equilibrium, meaning the water level returned to the same recovery level after a seasonal drawdown each winter when the demand for the heating is the greatest. In fact, up until 1983, artesian flow at the BWSWD well in the summertime was not uncommon. After the first two public systems in Boise were put in operation, the aquifer suffered from an average annual drawdown of 3.5 feet per year.

The study recommended that a temporary moratorium be put in place so that further studies of the aquifer could be carried out. Directly following the designation of the resource as a GWMA, a moratorium on increased new development or increased use of the resource was imposed in 1988. That moratorium has been extended twice and is in effect until September 1, 2003. WAAG & WOOD, *supra* note 7, 41-45; HARRINGTON & BENDIXSEN, *supra* note 9.

132. HARRINGTON & BENDIXSEN, *supra* note 9.

133. WAAG & WOOD, *supra* note 7, pp. 14-20.

134. *See supra* notes 136-138.

C. Issues Surrounding Reinjection

One major difference between the direct use of low temperature geothermal resources and other beneficial applications of appropriated water is that, in an efficient system, heating does not have to be a consumptive use of geothermal resources. Closed loop systems that reinject the spent resource back into the same aquifer are a means to provide longer term viability of both high and low temperature geothermal resources.[135] Because the prior appropriation doctrine was developed to address the needs of miners and agricultural concerns making a consumptive use of water, it does not address this scenario very well.

Reinjection of low temperature geothermal resources raises this question: should reinjection correlate with increased withdrawals from an aquifer? Idaho's ground water regulations forbid "mining" of an aquifer.[136] Rechargeable ground water aquifers are classic flow resources that if properly managed can continue to be used year after year. This is more true with low temperature geothermal resources because the water or other fluids are merely a medium for heat transfer, mediums that do not need to be consumed to enjoy their value. The statute states that water shall not be deemed available to fill a water right if it would result in "withdrawing of the ground water supply at a rate beyond the reasonably anticipated average rate of future *natural* recharge."[137] Because this law was developed with irrigation in mind, it does not contemplate that water could be recycled, possibly increasing the available resource for withdrawal by *unnatural* recharge (reintroduction by reinjection).

Nevada modified the appropriation doctrine to remove nonconsumptive uses of water in geothermal applications from its appropriation scheme. Water brought to the surface in conjunction with any geothermal well is "subject to the appropriation procedures" of Nevada water law unless "the water is returned to or reinjected into the

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135. There are other reasons to require reinjection of low temperature geothermal resource and other geothermal fluids as well. If the resource is not reinjected, it usually finds its way into the surface water system. The thermal and mineral load of the geothermal resources may adversely effect the water quality of those systems. *See* IDAHO OPERATIONS OFFICE, U.S. DEP'T OF ENERGY & DEPARTMENT OF PUBLIC WORKS, CITY OF BOISE, FINAL ENVIRONMENTAL ASSESSMENT BOISE GEOTHERMAL INJECTION WELL (1996) (available at University of Idaho library).

136. Baker v. Ore-Ida Foods, Inc., 95 Idaho 575, 583, 513 P.2d 627, 635 (1973).

137. IDAHO CODE § 42-237a(g) (Michie 1996) (emphasis added).

same aquifer or reservoir."[138] That is in essence answering our question in the affirmative because it allows a water user to withdraw a potentially unlimited amount of water so long as it is reinjected. The problem with a blanket exemption is that it ignores the effects that reinjection may have on other appropriators' rights. While reinjection can help to recharge aquifers, one must recognize that reinjection may affect the aquifer in ways harmful to other appropriators, for instance by decreasing the overall temperature, altering the flow, or changing the mineral concentration or distribution.

Reinjection should be properly monitored to minimize the harm to senior appropriators.[139] Questions then arise: who will pay for the monitoring and who has the burden of proof to show interference or non-interference with prior rights? While Idaho's low temperature geothermal resource and ground water regulations do not address this squarely, it is somewhat analogous to the reasonable pumping level protections for thermal and artesian pressures. Problems with causation and meeting the burden of proof could preclude recovery for injured prior appropriators. This may be a scenario in which the active involvement of IDWR through a ground water management area designation and management would be a powerful tool to monitor and manage the resource so as to protect prior appropriators and maximize the benefit derived from the resource.

Another approach is to mandate reinjection. In Klamath Falls, Oregon, a number of homeowners and commercial establishments used geothermal energy from the early 1900s. The City of Klamath Falls, using demonstration funds from the Department of Energy to construct a municipal district heating system, sank two wells that became operative in 1982. The historic users, fearful that the City's system use would impinge on their use, organized and passed a citizen's initiative that prohibited withdrawal of geothermal resources unless returned, undiminished in volume, to the same well.[140] Oregon challenged the ordinance's validity on the grounds that state water law

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138. NEV. REV. STAT. ANN. 534A.040 (Michie Supp. 2001). In the statute there are allowances for reasonable loss of water during the test of a geothermal well or the temporary failure of the well. *Id.*

139. The author could not find any examples of harm caused by reinjection. Concerns include reduced temperatures, cross contamination of hot and cold aquifers, and reduced aquifer levels. IDAHO OPERATIONS OFFICE, U.S. DEP'T OF ENERGY & DEP'T OF PUB. WORKS, CITY OF BOISE, FINAL ENVIRONMENTAL ASSESSMENT BOISE GEOTHERMAL INJECTION WELL (1996) (available at the University of Idaho library). An additional concern is the cost of monitoring for these harms. Should that cost be borne by the driller, the individual pumpers, or the department of water resources? The Idaho statutes don't contemplate this question.

140. The citizen's initiative is codified as City of Klamath Falls' Ordinance No. 6343; *see* Water Res. Dep't v. City of Klamath Falls, 682 P.2d 779 (Or. Ct. App. 1984). *See also* Bloomquist, *supra* note 17, at 90.

had preempted the entire field of ground water regulation.[141] The Oregon Court of Appeals found that "[a]lthough the ordinance is more restrictive than the [state ground water] statute, we see no reason why the two cannot operate concurrently."[142] Klamath Falls' municipal district heating system, though slowed by the early opposition, has succeeded.[143] Klamath Falls' reinjection ordinance operates alongside Oregon's prior appropriation for water regulations and has proven successful in promoting greater exploitation of the low temperature geothermal resources in the community without injuring the rights of prior appropriators.

In Idaho, there is not currently a reinjection program or a specific provision for reinjection relating to low temperature geothermal resources. A combination of prior appropriation, IDWR's discretion to grant permits subject to conditions, and the public trust doctrine could effectuate a reinjection program. The public interest in reducing the use of other less economically efficient or environmentally friendly energy sources justifies offering junior appropriators more opportunity to develop low temperature geothermal resources in direct use applications. At the same time, the statutory protections of prior appropriators assure prior appropriators that their rights will be protected and they will be compensated for any loss in pressure or temperature. IDWR's discretion to grant conditional permits provides the avenue for mandating reinjection if it would best serve the interests of the public and other appropriators. Reinjection programs should be seriously considered and short of that, the implications of reinjection need to be addressed in the low temperature geothermal resource regulations.

V. CONCLUSION

Low temperature geothermal resources offer a clean, inexpensive alternative to conventional space heating options. In order to facilitate this development, the western states need to provide definite and adequate legal frameworks for the resource.

The legal relationships between and among geothermal resources, both high and low temperature, and water need to be clearly

141. *Water Res. Dep't*, 682 P.2d 779 (Or. Ct. App. 1984).

142. *Id.* at 786.

143. By 1999, Klamath Falls' district heating system was serving about three times as many buildings as it did when originally constructed. In addition, a snow melt system for the town's sidewalks was developed. Brian Brown, P.E., *Klamath Falls Geothermal District Heating Systems*, 19(3) GEOHEAT CENTER Q. BULL. 5, 5-9 (March 1999), *available at* http://geoheat.oit.edu.

defined and articulated so that local water resources departments or other responsible administrative bodies have coherent guidelines and policies to manage low temperature geothermal resources. Because the physical relationships are often uncertain in the first place, science and fact should drive the law in this area. Flexibility is important because as science advances in its understanding of the resource, the law needs to be able to accommodate those new understandings. Remedies and regulations need to reflect physical reality.

Provisions designed to resolve conflicts between irrigators do not inherently protect the heat value of low temperature geothermal resources. That heat value needs to be specifically and adequately provided for. Given a strong underlying regulatory framework, establishment of designated management areas should serve the public, the resource owners, and the subscribers by ensuring that resource management takes a long-term perspective to maximizing utility of the resources.

In governing low temperature geothermal resources, Idaho and most other western states have all the tools they need in their arsenals of water and geothermal regulations. They do not, however, adequately address that fuzzy resource in between, the low temperature geothermal resource. The road to achieving the Department of Energy's ambitious goal of heating seven million homes in the west will be much smoother if Idaho and other states clarify the regulations relating specifically to low temperature geothermal resources in these ways providing for their unique characteristics. In addition to the provisions of existing regulations, ground water statutes relating to low temperature geothermal resources should address: increasing protections for heat value, promoting efficient use, and establishing reinjection programs and regulations. Short of legislative reform, courts and administrative agencies should extend the flexible provisions like the public interest and utilize creative tools like designated management areas to protect the true value of this resource – its heat.

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