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## MIXING OIL AND WATER: THE EFFECT OF PREVAILING WATER LAW DOCTRINES ON OIL SHALE DEVELOPMENT\*

BY WILLIAM E. HOLLAND\*\*

### INTRODUCTION

The largest single deposit of fossil energy known to exist in the world is the oil shale formation underlying 16,000 square miles of several basin areas in Colorado, Utah, and Wyoming.<sup>1</sup> Known as the Green River Formation, this deposit was laid down in three lake beds in the Eocene Age.<sup>2</sup> It ranges in thickness from a few hundred feet to about 7 thousand feet. Even excluding beds which contain less than 10 gallons of oil per ton of shale, the formation is estimated to contain more than 2 trillion barrels of oil. Of this 2 trillion barrels, more than three-quarters of a trillion barrels are in beds containing more than 25 gallons per ton.<sup>3</sup> Eighty percent of the 25-gallon-per-ton shale is in the Piceance Creek Basin of Colorado, 15 percent in the Uinta Basin in Utah, and 5 percent in the Green River Basin in Wyoming. Some samples contain as much as 90 gallons of oil per ton of shale.<sup>4</sup> Significant parts of the formation, notably the Sand Wash Basin and the Washakie Basin, are still largely unappraised.<sup>5</sup>

The Green River Formation is by no means the only oil shale deposit in the United States. There are known deposits in 30 states totaling an estimated 72 trillion tons.<sup>6</sup> Only the Green

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<sup>1</sup> See map at Appendix A.

<sup>2</sup> Donnell, *Geology and Oil Shale Resources of the Green River Formation*, 59 COLO. SCHOOL OF MINES Q., July 1964, at 153.

<sup>3</sup> *Id.* at 162.

<sup>4</sup> *Id.*

<sup>5</sup> *Id.* See also map at Appendix A.

<sup>6</sup> University of Denver College of Law, *Legal Study of Oil Shale on Public Lands*,

River Formation has present commercial significance, as the other deposits are much lower in grade and quality, generally assaying below 15 gallons per ton.<sup>7</sup> However, there are Alaskan deposits of unknown extent but locally very rich, with up to 160 gallons per ton.<sup>8</sup>

Nor are oil shale deposits confined to the United States. In 1958 the Swedish Shale Oil Company, Svenska Skifferolje AB, estimated world shale deposits at 172 trillion metric tons, representing, by its estimate, 1.2 trillion barrels of oil.<sup>9</sup> But since that study listed U.S. reserves at only 90 billion metric tons or 618 billion barrels, it is clearly conservative. Estimates of world deposits have increased steadily since that time. An estimate in a study for the Colorado Water Conservation Board placed world reserves at nearer 500 billion metric tons, or 4 trillion barrels.<sup>10</sup> More recently, the U.S. government has published an estimate of known world reserves of 900 trillion tons.<sup>11</sup>

Even allowing for considerable error in the estimates, these figures dwarf proven petroleum reserves,<sup>12</sup> and they dwarf present rates of consumption. In 1972 the United States consumed approximately 6 billion barrels of petroleum and about 22.6 billion cubic feet of natural gas, which is the energy equivalent of approximately 4.4 billion barrels of petroleum.<sup>13</sup> Thus, if the oil in

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April 1969, at 11 (prepared for the Public Land Law Review Commission) [hereinafter cited as Legal Study].

<sup>7</sup> National Petroleum Council, Committee on U.S. Energy Outlook, Other Energy Resources Subcommittee, U.S. Energy Outlook, an Interim Report: An Initial Appraisal by the Oil Shale Task Group, 1972, at 15 [hereinafter cited as Task Group].

<sup>8</sup> Donnell, Tailleux & Tourtelot, *Alaskan Oil Shale*, 62 COLO. SCHOOL OF MINES Q., July 1967, at 39, 41.

<sup>9</sup> Cameron & Jones, Inc., Water Requirements for Oil Shale 1960-1975, July 1959, at 8-9 (prepared for the Colorado Water Conservation Board) [hereinafter cited as Cameron & Jones].

<sup>10</sup> Legal Study, *supra* note 6, at 11.

<sup>11</sup> *Id.*

<sup>12</sup> There is considerable variation in published estimates of petroleum reserves, however. The Office of Oil and Gas of the Department of the Interior estimated in 1971 that proven U.S. reserves were 39 billion barrels and reserves in the non-Communist world were 484 billion barrels. DEPARTMENT OF THE INTERIOR, OFFICE OF OIL & GAS, 1971 PETROLEUM SUPPLY AND DEMAND IN THE NON-COMMUNIST WORLD 28-29 (1973). Charles Issawi in a study for the Center for Strategic and International Studies estimates proven U.S. reserves at 200 billion barrels and world reserves at over 2 trillion barrels. C. ISSAWI, OIL, THE MIDDLE EAST, AND THE WORLD 8 (1971).

<sup>13</sup> *Hearings on the President's Energy Message and S. 1570 Before the Comm. on Interior and Insular Affairs of the United States Senate*, 93d Cong., 1st Sess., ser. 93-10, at 34-35 (1973).

that part of the Green River Formation which contains more than 10 gallons per ton were totally recoverable, it would replace both petroleum and natural gas for nearly 200 years at 1972 levels of consumption.

Nevertheless, except for a few pilot projects, almost no shale oil has been produced in the United States. Apparently the only commercial production was the operation from 1890 to 1924 of a small retort by the Catlin Shale Products Company from thin beds near Elko, Nevada. This firm never earned a profit but did market fuel oil, lubricating oil, and paraffin wax.<sup>14</sup> Shale oil has been produced commercially in various parts of the world since 1838, with an estimated world production from 1850 to 1961 of 400 million barrels.<sup>15</sup> The Russians were mining up to 18 million tons of shale per year by 1970 from Estonian deposits of about 50 gallons of gasoline per ton richness.<sup>16</sup> But, despite scattered assertions that the absence of American production can only have been due to foot-dragging by the major oil companies,<sup>17</sup> it appears that there have until recently existed real economic and technological barriers to production of oil from shale. One example is Russian production: despite the richness of the deposits, at least through 1965, oil shale was never competitive with crude petroleum.<sup>18</sup>

The technological and economic barriers to shale oil production stem from the fact that the organic minerals in shale are not fugacious, as are petroleum and natural gas, but are bound to the rock itself. The organic matter in oil shales is called kerogen. It can be converted into oil and gas by heating the shale to about 900 degrees Fahrenheit in a process called retorting.<sup>19</sup> This is accomplished by either of two basic methods: mining, either underground or open pit, followed by retorting of the mined shale; or in situ retorting by burning the shale beds in place and extracting and condensing the combustion products. The resulting shale oil is a black, highly viscous substance that is difficult to pour. To make it pipelineable, shale oil must be upgraded to remove wax-forming components; nitrogen and sulfur, in which it is rich,

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<sup>14</sup> C. WELLES, *THE ELUSIVE BONANZA* 29-30 (1970).

<sup>15</sup> Legal Study, *supra* note 6, at 10.

<sup>16</sup> Cieslewicz, *Selected Topics of Recent Estonian-Russian Oil-Shale Research and Development*, 66 *COLO. SCHOOL OF MINES Q.*, Jan. 1971, at 1, 1-5.

<sup>17</sup> For a compendium of these assertions, see WELLES, *supra* note 14.

<sup>18</sup> Cieslewicz, *supra* note 16, at 1-7.

<sup>19</sup> Task Group, *supra* note 7, at 9.

can be removed at the same time by conventional techniques.<sup>20</sup> The result is a high grade synthetic crude oil, "syncrude," suitable for refining into products equivalent to those produced from petroleum.<sup>21</sup>

The difficulty of separating the oil from the rock has held back oil shale production to the present time simply because known methods involved capital costs too great to allow competition with petroleum.<sup>22</sup> The recent rise in petroleum prices, if permanent, could remove that barrier. But there is another problem facing an oil shale industry: a problem that becomes more acute with time, rather than less—the acquisition of sufficient water. Both retorting and the upgrading process require considerable amounts of water. The Green River Formation is the only deposit in the United States of adequate size, richness, and availability to have present commercial value. It lies, however, in one of the more arid parts of the country.

The purpose of this paper is to consider the probable demand of an oil shale industry for water and the effect which existing water law doctrines will have on ability to meet that demand.

## I. WATER REQUIREMENTS FOR SHALE OIL PRODUCTION

### A. *Nature of Demand*

Water is required for three purposes in connection with the production of shale oil: (1) Processes directly required to produce shale oil from the rock—mining and retorting or in situ retorting; (2) upgrading the raw shale oil to pipelineable quality; and (3) municipal supply for domestic use by employees and for domestic and other use in necessary supporting economies. The third requirement does not involve water consumed in shale oil production per se, but without which production would be impossible.

There will also be a requirement for water for the further refinement of the upgraded syncrude. Since that process does not

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<sup>20</sup> *Id.* at 10.

<sup>21</sup> *Id.*

<sup>22</sup> The Oil Shale Task Group estimates the capital cost, at 1970 prices, of constructing the minimum plant which could take advantage of desirable economies of scale, at \$524 million exclusive of land costs (based on 100,000 barrels per day production). *Id.* A recent large-scale pilot project planned by a group of oil companies to develop oil shale on federal leases in Colorado was suspended in October 1974 after the estimated cost of a complex capable of producing 46,000 barrels per day rose from \$450 million in 1973 to \$800 million in 1974. Cowan, *Cost Makes Oil in Shale, Tar Sands Also Distant*, N.Y. Times, Jan. 26, 1975, § 4 at 4, col. 3.

differ significantly from the refinement of petroleum, there will be no *added* requirement, and no need for the water to be available in the oil shale region. The upgraded shale oil can be pipelined and refining can be done at any convenient location. And since at significant rates of production most oil would have to be exported ultimately in order to find a market, refining is likely to occur in areas where water is more readily available.

#### 1. Mining, Retorting, Upgrading

The production of crude shale oil by mining and *ex situ* retorting requires little water—about 10 gallons per barrel.<sup>23</sup> Mining consumption is chiefly for drilling blast-holes and as a dust palliative. Most retorting processes use water only for bearing coolant, and a small amount as steam for heating and cleaning. There is little return flow from these uses.<sup>24</sup>

The largest consumption of water in production of oil from shale occurs in the upgrading and refining processes. Consumption varies greatly, depending upon the process used.<sup>25</sup> Cameron and Jones estimated in 1959 that, including necessary electric power generation, the total water requirement for shale oil production and refining would be 50 to 100 gallons per barrel, depending upon the refining process, with 90 percent of this consumed.<sup>26</sup> Thus, if production were 1 million barrels per day, 100 gallons of water per barrel of oil would add up to 36.5 billion gallons per year, or about 110,000 acre-feet per year, to use the term by which water supply is normally measured. About 100,000 acre-feet per year would be consumed. Cameron and Jones in their estimate apparently use an (unstated) intermediate figure for refinery requirements and then multiply by a factor of 1.5 to cover errors in estimation. They arrive at a final estimate of 127,000 acre-feet per year diverted, 114,000 acre-feet per year consumed, on an estimated production of 1.25 million barrels of oil per day.<sup>27</sup> However, it is to be emphasized that this estimate is based upon the assumption that refining is done locally. It thus

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<sup>23</sup> Cameron & Jones, *supra* note 9, at 33.

<sup>24</sup> *Id.*

<sup>25</sup> *Id.* at 28.

<sup>26</sup> *Id.* Note however that refineries in the Salt Lake City area presently consume only about 30 gallons of water per barrel of crude petroleum. Gardner & LeBaron, *Some Neighborhood Effects of Oil-Shale Development*, 8 NATURAL RESOURCES J. 568, 576 (1968).

<sup>27</sup> Cameron & Jones, *supra* note 9, at 33.

represents a probable *maximum* requirement.<sup>28</sup> As noted above, there are sound reasons for refinery operations to be conducted outside the oil shale area where this is possible.

Cameron and Jones do not separately estimate the amount of water required for local upgrading only, but their estimate of total water demand including refining does correlate closely with another published estimate which gives separate upgrading and refining figures. Raymond D. Sloan, manager of the Humble Oil shale oil project, stated in addresses to the Colorado River Water Users Association in 1965 and to the Petroleum Accountants Society of Houston in 1966 that a 2 million-barrel-per-day industry would consume about 112,000 acre-feet of water per year without refining, or about 200,000 acre-feet per year if the refining operation is conducted in the oil shale area.<sup>29</sup> Thus, local refining could be expected to nearly double the local water requirement. Sloan also stated the figures another way: the water consumed in mining, retorting, and upgrading shale oil is about 1.2 times the volume of oil produced.<sup>30</sup>

The most recent estimates of water required for shale oil production are those of the National Petroleum Council's Oil Shale Task Group, which gives a figure of 16,000 acre-feet per year for each 100,000 barrels per day produced,<sup>31</sup> and those published (from unstated sources) by the U.S. Geological Survey, which gives a range of from 12,150 to 18,420 acre-feet per year for each 100,000 barrels per day produced.<sup>32</sup> On million barrels per day, The Oil Shale Task Group estimate would require 160,000 acre-feet per year, the Geological Survey estimates 121,500 to 184,200 acre-feet per year.

Although the Task Group is not specific on this point, the estimate appears to be based upon the quantity diverted, not consumed. It includes only mining, retorting and upgrading, not refining. The estimate is thus some 50 percent higher than Sloan's. The Final Environmental Statement for the Prototype Oil Shale Leasing Program in Colorado, however, gives an estimate of

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<sup>28</sup> *Id.* at 31.

<sup>29</sup> Cited in Ely, *The Oil Shale Industry's Water Problems*, 62 *COLO. SCHOOL OF MINES Q.*, July 1967, at 9, 10. See also Moses, *Where is the Water Coming From?*, 61 *COLO. SCHOOL OF MINES Q.*, July 1966, at 23.

<sup>30</sup> Ely, *supra* note 29, at 10.

<sup>31</sup> Task Group, *supra* note 7, at 92.

<sup>32</sup> G. DAVIS & L. WOOD, *GEOLOGICAL SURVEY CIRCULAR 703, WATER DEMANDS FOR EXPANDING ENERGY DEVELOPMENT 9* (1974).

consumption of 121,000 to 189,000 acre-feet per year for production of 1 million barrels per day.<sup>33</sup>

There has been no actual large-scale test of in situ retorting, so the water requirements are uncertain. Ely<sup>34</sup> states, without supporting data, that consumption for this process may be as much as twice that required for mining and retorting. But since the major consumption is in the upgrading process and not in retorting,<sup>35</sup> the added increment probably will not be significant, certainly no larger than differences between published estimates based upon mining and retorting.

## 2. Municipal

Per capita diversion of water for use in large western Colorado towns is up to 480 gallons per day, including lawn irrigation, but most towns divert about 300 gallons per capita day, of which approximately one-third is consumed.<sup>36</sup> It has been estimated that an industry producing 1¼ million barrels of shale oil per day will support directly or indirectly a population of about 340,000 people.<sup>37</sup> At 300 gallons per capita day, this population would require diversion of about 100 million gallons of water per day, or about 100,000 acre-feet per year, with consumption of about one-third.<sup>38</sup>

This estimate is reasonably close to other published figures. Sloan<sup>39</sup> states that a 2 million-barrel-per-day industry will divert 165 thousand acre-feet per year for municipal use and consume one-third of that diverted.

## 3. Totals

Summing the requirements for processing and for municipal use, it appears that for every increment of 1 million barrels per day of shale oil produced, there must be a diversion of not less than about 150,000 acre-feet of water per year<sup>40</sup> with about 85,000 acre-feet consumed. Diversion requirements could be as high as

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<sup>33</sup> *Id.*

<sup>34</sup> Ely, *supra* note 29, at 10.

<sup>35</sup> Cameron & Jones, *supra* note 9, at 34.

<sup>36</sup> *Id.* at 29.

<sup>37</sup> *Id.* at 34.

<sup>38</sup> Cameron & Jones' estimate is based on a slightly higher per capita use, and anticipates diversion of 115,000 acre-feet per year. *Id.* at 33.

<sup>39</sup> Moses, *supra* note 29.

<sup>40</sup> See note 29 *supra* & Cameron & Jones, *supra* note 9, at 33.



240,000 acre-feet per year, however, with consumption of about 180,000 acre-feet.<sup>41</sup> These two estimates bracket that made in 1953 for the Colorado Water Conservation Board.<sup>42</sup> The industry producing 2 million barrels per day would have required a diversion of 455,000 acre-feet per year and consumption of 290,000 acre-feet per year. (In this context it is difficult to fit the estimate of Ely,<sup>43</sup> which although based upon Sloan's figures comes out with a diversion of 750,000 acre-feet and consumption of 500,000 for an industry producing 2 million barrels per day.)

### B. *Probable Industry Size*

The rate of consumption of water can be expected to be approximately proportional to the rate of production of oil.<sup>44</sup> This is true both for direct processing uses and for support industries. The absolute requirements, then, depend upon the size of the shale oil industry, which in turn depends upon market factors not yet established. Past guesses about the future of the industry have not been notable for their accuracy. It was predicted in 1959 that production would reach 1¼ million barrels per day between 1970 and 1975.<sup>45</sup> A committee composed of representatives of oil companies, the Bureau of Mines, and the Bureau of Reclamation based their 1953 estimates of water use on an assumed industry of 2 million barrels per day.<sup>46</sup> The most recent guess, that of the Oil Shale Task Group,<sup>47</sup> is that commercial production at an assumed "optimum economic single-plant rate" of 100,000 barrels per day will begin in 1978, and that 400,000 barrels per day will be reached by 1985. Recent developments in the crude petroleum market could act as an incentive to even greater production. But increases in the cost of production appear to have negated the higher market price at least for the present.<sup>48</sup>

If it is not possible to assess the probable size of even a near-

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<sup>41</sup> Oil Shale Task Group figures at Task Group, *supra* note 7, at 92 for mining, retorting, and upgrading, combined with Cameron & Jones, *supra* note 9, at 33 for municipal use.

<sup>42</sup> Delaney, *The Necessity of Water Storage for the Oil Shale Industry*, 60 *COLO. SCHOOL OF MINES Q.*, July 1965, at 111, 113.

<sup>43</sup> Ely, *supra* note 29, at 16.

<sup>44</sup> Cameron & Jones, *supra* note 9, at 27 *et seq.* & Task Group, *supra* note 7, at 92.

<sup>45</sup> Cameron & Jones, *supra* note 9, at 34.

<sup>46</sup> Delaney, *supra* note 42, at 113.

<sup>47</sup> Task Group, *supra* note 7, at 114-15.

<sup>48</sup> Cowan, *supra* note 22.

future industry with any certainty, it is possible to demonstrate the more important point: an oil shale industry capable of supplying any significant fraction of national oil demand is going to require more water than is readily available. It has already been noted<sup>49</sup> that 1972 U.S. consumption of petroleum was 6 billion barrels, and natural gas supplied the energy equivalent of another 4.4 billion barrels. The oil shale industry would have to produce nearly 2 million barrels per day to supply only 10 percent of the demand for petroleum alone at this level. Energy consumption in the United States has nearly doubled every 15 years in recent decades, and it has been projected that it will continue to do so.<sup>50</sup> Even if the rate of increase slows significantly, total energy demand almost certainly will not decline in the near future. It is thus safe to predict that if shale oil can compete at all in cost with petroleum or other energy sources, and if production is not limited by non-economic factors, it will be produced at a rate running into the millions of barrels per day. Limitation on water supply will raise the cost of shale oil to the extent that there is a market in water; shale oil production will be absolutely limited, to the extent that water law doctrines inhibit transfer of scarce water resources.

## II. WATER SUPPLY AND WATER LAWS

### A. *Natural Supply*

The primary sources of surface water in the oil shale areas are the Green River in Wyoming, the Green and White Rivers in Utah, and the White and Colorado Rivers in Colorado.<sup>51</sup> The average yearly runoff from the White River basin over a period of 58 years (to 1968) was 458,000 acre-feet.<sup>52</sup> That from the Colorado River main stem to Glenwood Springs, Colorado, is 2 million acre-feet.<sup>53</sup> Runoff from the Green River basin is 3.92 million acre-feet at Green River, Utah.<sup>54</sup> There are also groundwater supplies, but these are more difficult to measure and are largely uncatalogued. However, in absolute terms it is clear that there is enough

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<sup>49</sup> See text accompanying note 13 *supra*.

<sup>50</sup> See, e.g., Task Group, *supra* note 7, at xiv, xxiii-xxv.

<sup>51</sup> See map at Appendix A.

<sup>52</sup> Cooley, *Physical Background—Oil Shale*, 59 COLO. SCHOOL OF MINES Q., July 1964, at 135, 136-38.

<sup>53</sup> *Id.* at 138.

<sup>54</sup> GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1875, CORRELATIVE ESTIMATES OF STREAM-FLOW IN THE UPPER COLORADO RIVER BASIN (1970).

water for almost unlimited oil shale development. Natural limits on water supply are not the problem.

B. *"The Law of the River"*

All of the streams in the oil shale region ultimately flow into the Colorado River above Glen Canyon Dam. They are thus subject to the Colorado River Compact,<sup>55</sup> which allocates the total flow of the Colorado River among seven western states and Mexico. The primary division is that between the Upper Basin states, Colorado, Utah, Wyoming, and New Mexico, and the Lower Basin states, Arizona, California, and Nevada. In 1922 the signers of the Compact assumed that a flow of 18 million acre-feet annually was available, and they allocated 7.5 million acre-feet to each of the Basins. The delivery of that amount to the Lower Basin at Lee Ferry was made a binding commitment on the Upper Basin states:

The states of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact.<sup>56</sup>

But over the past 30 years, the actual flow has been little over 13 million acre-feet per year, and about 14 million per year for the 50 years since the Compact was formed.<sup>57</sup> The Upper Basin states have recently agreed among themselves that they can depend upon a residual amount of about 6.2 million acre-feet.<sup>58</sup> This includes reservoir evaporation of 700,000 acre-feet, leaving a net supply available for consumptive use of 5.5 million acre-feet.

Also to be considered is the Mexican Water Treaty, ratified in 1945.<sup>59</sup> Article 10 of the Treaty requires the United States to deliver to Mexico 1.5 million acre-feet annually at the border (which represents about 1.8 million acre-feet at Lee Ferry because of evaporation losses).<sup>60</sup>

The Upper States claim, and the Lower States deny, that under the terms of the Colorado River Compact the Lower Basin tributaries

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<sup>55</sup> COLO. REV. STAT. ANN. § 37-61-101 *et seq.* (1973).

<sup>56</sup> *Id.* at art. III(d).

<sup>57</sup> *Hearings on H.R. 4671 Before a Subcomm. of the House Comm. on Interior and Insular Affairs*, 89th Cong., 1st Sess. 512 (1965).

<sup>58</sup> *Id.*

<sup>59</sup> 59 Stat. 1219; Treaty Series 994.

<sup>60</sup> Ely, *supra* note 29, at 14-15.

can and should contribute to this burden to an extent which relieves the Upper Basin of any obligation to deliver additional water at Lee's Ferry for Mexico. If the Lower Basin position were sustained, the 6.2 million acre-foot residue on which the Upper States are counting would shrink to about 5.5 million, but as 700,000 acre-feet of this must be lost in reservoir evaporation, the residue available for consumptive use would be about 4.8 million at site of use.<sup>61</sup>

The Upper Colorado River Basin Compact of 1948<sup>62</sup> gives Arizona 50,000 acre-feet annually from the Upper Basin water and divides the residue on a percentage basis: Colorado, 51.75 percent; New Mexico, 11.25 percent; Utah, 23 percent; Wyoming, 14 percent. There is thus a separate limit in each state on the consumption of water, irrespective of consumption in the other states. Actual amounts available for consumption are approximately 2.8 million acre-feet in Colorado, 1.25 million acre-feet in Utah, and 0.77 million acre-feet in Wyoming.

### C. Appropriation

The Colorado River Compacts are not the only limitations on supply in the oil shale areas. Prior users of both surface waters and groundwater are also protected by the laws. In all three oil shale states, water is the property, not of the land owner, but of the public.<sup>63</sup> The states allocate water rights by the prior appropriation system, under which the application of water to a beneficial use gives the user a vested right to that amount of water, subject only to conflicting rights which existed earlier. There are three areas which are especially important to oil shale development: priority of rights; "diligence"; and transfers of rights.

#### 1. Priority

Except as modified by statute, the elements necessary to establish an appropriation right in water are an intent to appropriate, actual diversion or capture of water, and application of the water to a beneficial use.<sup>64</sup> Assuming that the appropriation goes forward diligently to completion, the date of the right is the date of the first act evidencing an intent to take water for a beneficial

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<sup>61</sup> *Id.* at 13-14.

<sup>62</sup> 43 U.S.C. § 617 (1970).

<sup>63</sup> COLO. REV. STAT. ANN. § 37-82-101 (1973); UTAH CODE ANN. § 73-1-1 (1953); WYO. CONST. art. VIII, § 1.

<sup>64</sup> See, e.g., *City & County of Denver v. Northern Colo. Water Conservancy Dist.*, 130 Colo. 518, 276 P.2d 992 (1954); *Tanner v. Provo Reservoir Co.*, 99 Utah 139, 98 P.2d 695 (1940); *State v. Larafie Rivers Co.*, 59 Wyo. 9, 136 P.2d 487 (1943).

use.<sup>65</sup> These doctrines have been modified by statutory filing systems which make most rights a matter of public record. Under the filing statutes in Utah and Wyoming, the priority date is the date an application is filed with the state engineer,<sup>66</sup> and rights may be created only by filing.<sup>67</sup> In Colorado the date of priority for groundwater appropriations is the date of filing an application with the state engineer,<sup>68</sup> but no filing is required for appropriations of surface water, and the priority date is still that of the first act leading to beneficial use.<sup>69</sup>

The principle of prior appropriation is thus "First in time, first in right."<sup>70</sup> The obvious effect on any industry becoming established at this late date is that it will find water available only to the extent that it has not already been appropriated for another purpose.

According to the Colorado Water Conservation Board, "present, authorized, and committed" projects in 1967 were capable of consuming 2.4 million acre-feet, and projects pending in Congress would bring this to 2.7 million.<sup>71</sup> About 150,000 acre-feet of this amount was for oil shale projects. Another 100,000 acre-feet of consumption for oil shale was among 500,000 acre-feet in various states of planning. Since no oil shale plant has yet been built, even the water already committed to oil shale projects could be lost under the "due diligence" requirement.<sup>72</sup>

A more optimistic view of the Colorado situation is taken by the Oil Shale Task Group.<sup>73</sup> Based on a 1971 study, the Task Group assumes that 700,000 acre-feet per year is still uncommitted in Colorado "and possibly one-half of this can be diverted from the Colorado and/or White Rivers to the oil shale area."<sup>74</sup>

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<sup>65</sup> See, e.g., *Four Counties Water Users Ass'n v. Colorado River-Water Conservation Dist.*, 161 Colo. 416, 425 P.2d 259 (1967); *Salt Lake City v. Salt Lake City Water & Elec. Power Co.*, 24 Utah 249, 67 P. 672 (1902); *Moyer v. Preston*, 6 Wyo. 308, 44 P. 845 (1896).

<sup>66</sup> UTAH CODE ANN. § 73-3-1 (1953); WYO. STAT. ANN. § 41-212 (1957).

<sup>67</sup> UTAH CODE ANN. § 73-3-1 (1953); WYO. STAT. ANN. § 41-212 (1957).

<sup>68</sup> COLO. REV. STAT. ANN. § 37-90-109 (1973).

<sup>69</sup> *Id.* § 37-92-305.

<sup>70</sup> 1 W. HUTCHINS, *WATER RIGHTS LAWS IN THE NINETEEN WESTERN STATES* 396 (1971).

<sup>71</sup> Ely, *supra* note 29, at 14. Moses, *supra* note 29, at 31 shows the locations of 86,000 acre-feet of consumption committed to oil shale, and lists 64,000 other acre-feet committed to "potential oil shale uses."

<sup>72</sup> See text accompanying notes 91-94 *infra*.

<sup>73</sup> Task Group, *supra* note 7, at 92.

<sup>74</sup> *Id.*

However, the report notes that most of this could be taken by 1980 by projects now under investigation for the Department of the Interior. The report also notes that the uncommitted water supply in Utah is about 350,000 acre-feet per year at present, and that in Wyoming from the Green River about 250,000 acre-feet per year, but that in both states contemplated projects may have appropriated all of this by 1980. It has been reported that the Utah Water and Power Board has filed on water from the White River for the eventual purpose of oil shale development,<sup>75</sup> but the amount was not stated, and diligence requirements could affect the outcome.

It is possible that in some cases unappropriated water exists where the records indicate there is none, for in all three states it is "beneficial use" which is the measure of the right, not the amount stated in an application, or given by decree, in Colorado.<sup>76</sup> Thus, if application is made and a permit granted for diversion of 8 cfs, but only 4 cfs is ever put to use, the right is only to the use 4 cfs. Upon proof of these facts the "paperright" may be reduced to that amount, leaving 4 cfs available for use elsewhere, if it has not already been appropriated by a second user. The potential for finding water by this means is shown by a recent Wyoming study which found that acreage actually under irrigation was only 50 to 60 percent of that allowable under previously adjudicated rights.<sup>77</sup> However, the same study shows that paper rights are already so much larger than supply that actual use at only a fraction of the adjudicated rates uses all available water.

Conversely, there are some rights, dating from the days before filing was required, that may not be of record.<sup>78</sup> These unseen icebergs lurk in the path of any present-day appropriator who needs to know what supply he can count on.

One possible means of meeting the problems posed by inflated paper rights and unrecorded real rights is illustrated by a Colorado statute adopted as part of the Water Right Determina-

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<sup>75</sup> Gardner & LeBaron, *supra* note 26, at 579 n.33.

<sup>76</sup> *Green v. Chaffee Ditch Co.*, 150 Colo. 91, 371 P.2d 775 (1962); UTAH CODE ANN. § 73-1-3 (1953); WYO. STAT. ANN. § 41-2 (1957).

<sup>77</sup> McIntire, *The Disparity Between State Water Rights Records and Actual Water Use Patterns*, 5 LAND & WATER L. REV. 23, 27 (1970).

<sup>78</sup> Dewsnup, *Assembling Water Rights for a New Use*, 17 ROCKY MT. MINERAL L. INST. 613, 628 (1971).

tion and Administration Act of 1969.<sup>79</sup> The statute<sup>80</sup> provides that in every even-numbered year beginning with 1974 the division engineer of each of the state's seven water divisions shall prepare a tabulation of rights and priorities in his division. He may declare abandoned any right not fully applied to a beneficial use. The list is to be published and a copy mailed to every owner of a right. Protests may be made, and a revised list is then filed with the state district court. After a period for further protests, the "water judge" of the court conducts hearings on the filed list and enters judgment and decrees on the rights. Failure to use a right for a period of 10 years creates a rebuttable presumption that it has been abandoned.

This procedure will serve to rescind known rights which are not being used and to confirm known rights which *are* being used. The same purpose is served to some extent by statutes of the other two states which declare that water rights are voided through abandonment by non-use for a period of 5 years;<sup>81</sup> but the Colorado procedure has the advantage of requiring a continuing review of the status of all rights. The Colorado procedure could also void unfiled rights. However, that has not been held to be the effect of the statute, and it was probably not intended, since the other provisions of the Act do not require filing in order to acquire a right to appropriate.<sup>82</sup>

In all three states groundwater is subject to appropriation just as surface water is, although the terms may differ somewhat from those for surface water because of the different nature of the supply. Here all three states require permits from the state engineer before appropriation may begin.<sup>83</sup> Both Colorado and Wyoming have statutes allowing administrators to control groundwater use in certain circumstances. In Colorado a state groundwater commission has authority to determine "designated groundwater basins" in which immediate regulation of pumping is necessary.

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<sup>79</sup> COLO. REV. STAT. ANN. §§ 37-92-101 to -02 (1973).

<sup>80</sup> *Id.* § 37-92-402.

<sup>81</sup> UTAH CODE ANN. § 73-1-4 (1953); WYO. STAT. ANN. § 41-47 (1957).

<sup>82</sup> *See* COLO. REV. STAT. ANN. § 37-92-305 (1973). The question of whether such a voiding of unfiled rights would be a taking of property inconsistent with due process will not be discussed here.

<sup>83</sup> *Id.* § 37-90-107; UTAH CODE ANN. § 73-1-4 (1953); WYO. STAT. ANN. § 41-122 (Cum. Supp. 1973). *Bullock v. Tracy*, 4 Utah 2d 370, 294 P.2d 707 (1956), holds that underground waters are subject to appropriation on the same terms as surface waters.

Well permits will be granted only if the commission finds that there is "unappropriated water" and that there will be no unreasonable injury to vested rights.<sup>84</sup> Outside these basins, the application for a well permit is filed with the state engineer, who may issue a permit if he finds that the well will not injure vested rights.<sup>85</sup> The Wyoming provisions are similar. A state board of control has power to designate "control areas" in which use is equal to recharge, or the groundwater level is declining, or conflicts are foreseeable between users, or waste may occur, or in which any other condition requires protection of the public interest.<sup>86</sup> Within the control areas, a permit for appropriation of underground water may be granted after a public hearing and a finding by the state engineer that there are unappropriated waters and that the use will not be detrimental to the public interest.<sup>87</sup> Outside of the control areas, the state engineer must grant a permit for any beneficial use unless he finds it not in the public interest.<sup>88</sup>

"Unappropriated waters" in these statutes is not defined. The term of course cannot mean any water not already used, since any well that would not be a dry hole would then have to be allowed. In Wyoming it probably means waters which may be withdrawn without drawing down the water table, since any area in which use is equal to or greater than recharge is included among the control areas. However, other states have allowed appropriation from non-recharging basins, up to a set rate of draw-down per year.<sup>89</sup> Whatever the exact definition of the term, it seems safe to assume that the massive appropriations needed to support a large oil shale industry would not be permissible from an area in which groundwater withdrawal is already so closely regulated.

It should be noted that the doctrine of priority may apply to groundwater in a slightly different manner from its meaning with respect to surface waters. Where surface water is limited, junior appropriators' supplies are progressively shut off, beginning with the most recent, until only those more senior appropriators are

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<sup>84</sup> COLO. REV. STAT. ANN. § 37-90-107 (1973).

<sup>85</sup> *Id.* § 37-90-137.

<sup>86</sup> WYO. STAT. ANN. § 41-129 (Cum. Supp. 1971).

<sup>87</sup> *Id.* § 41-140.

<sup>88</sup> *Id.* § 41-142.

<sup>89</sup> *E.g.*, *Mathers v. Texaco, Inc.*, 77 N.M. 239, 421 P.2d 771 (1966).



left whose use equals the supply. In the situations described above where wells are drawing from a groundwater supply, new wells are allowed until use equals recharge or the allowable draw-down rate, and no new wells are subsequently allowed. Thus there are only "senior appropriators" and no juniors. Nevertheless, where over-appropriation has already occurred, the administrator may limit pumping by junior appropriators to protect senior rights.<sup>90</sup>

## 2. "Diligence"

The filing of applications for water will not necessarily secure a water supply even if water remains unappropriated. Applications which are not diligently pursued will not give rise to a right to water. In the absence of statute "due diligence" is an issue of fact, and the meaning of the term in any given case is therefore determined through the judicial process. Filing statutes have affected this procedure to some extent in all three states.

In Colorado, since there is no filing requirement for rights in surface water and all rights are decreed in special court adjudications,<sup>91</sup> diligence with respect to those rights is still a question for the courts. With respect to well permits within designated groundwater basins, the groundwater commission grants conditional permits to appropriate, which become final upon completion of construction if all conditions are complied with.<sup>92</sup> There is no express time limit placed upon construction, but it is apparently envisaged that such a limit will be one of the conditions set. Permits for wells outside the designated groundwater basins expire 1 year after issuance if beneficial use has not occurred, but the permit may be renewed for not more than 1 additional year.<sup>93</sup> Thus, for groundwater the court's finding is replaced by the administrator's discretion; and in most cases that discretion is strictly limited: most groundwater appropriations cannot date back more than 2 years before actual use.

Since the lead time needed to establish an oil shale production facility is at least 2 years,<sup>94</sup> and since most associated municipi-

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<sup>90</sup> COLO. REV. STAT. ANN. § 37-90-111 (1973); WYO. STAT. ANN. § 41-132 (Cum. Supp. 1973).

<sup>91</sup> COLO. REV. STAT. ANN. §§ 37-92-302 to -305 (1973).

<sup>92</sup> *Id.* §§ 37-90-107, 108.

<sup>93</sup> *Id.* § 37-90-137.

<sup>94</sup> The Oil Shale Task Group assumed engineering and construction would require 3 years. Task Group, *supra* note 7, at 121.

pal uses must develop over an even longer period, it is clear that groundwater supplies for oil shale cannot be reserved in advance in Colorado. Whether judicial definitions of diligence or administrative discretion offer any greater hope will be discussed below.

In both Utah and Wyoming an application must be filed with the state engineer before any right of appropriation will arise. Both states also set a limit on the time within which actual use must occur after application to the engineer, but the effect in both instances is to leave the real limit to the discretion of the engineer.

In Utah the initial time limit is set by the engineer, apparently in his discretion, as the statute offers no criteria for his guidance; and he may extend the time "on proper showing of diligence or reasonable cause for delay" for up to 50 years from the date of application!<sup>95</sup> In Wyoming, construction of works for surface appropriations must be completed within 5 years, or any shorter time set by the engineer,<sup>96</sup> and for appropriations for underground water use must begin within 3 years.<sup>97</sup> However, the engineer may grant unlimited extensions "for good cause shown."<sup>98</sup>

The statutory grants of discretion are not unlimited, and they should not be construed as granting power to extend time indefinitely as a means of reserving water, whether for oil shale development or any other use. The original purpose behind the prior appropriation doctrine was to *prevent* reservation of water which could not be put to immediate use.<sup>99</sup> The Utah statute's reference to "diligence" indicates an intent to maintain the court-developed standard, which in one much-quoted case was said to consist of

that constancy or steadiness of purpose or labor which is usual with men engaged in like enterprises, and who desire a speedy accomplishment of their designs,—such assiduity in the prosecution of the enterprise as will manifest to the world a *bona fide* intention to complete it within a reasonable time.<sup>100</sup>

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<sup>95</sup> UTAH CODE ANN. § 73-3-12 (1953).

<sup>96</sup> WYO. STAT. ANN. § 4-206 (Cum. Supp. 1973).

<sup>97</sup> *Id.* § 41-142.

<sup>98</sup> *Id.* § 41-206.

<sup>99</sup> See Dewsnup, *supra* note 78, at 616.

<sup>100</sup> Ophir Silver Mining Co. v. Carpenter, 4 Nev. 534, 546, 97 Am. Dec. 550, 555 (1869).

Whatever the exact limits of the engineer's discretion may be in either state, they probably could not be held to extend to cases in which an oil shale lessee had filed for water on a lease which he was maintaining by payments but by no labor which would actually advance production of shale oil. In the convincing Utah case of *Carbon Canal Co. v. Sanpete Water Users Association*,<sup>101</sup> the Utah Supreme Court held that the state engineer could not grant further extensions of time to an appropriator whose only showing was that his project was feasible, where nothing had been done to put it into effect for nearly 40 years after the initial filing, not because of construction difficulties but because of delay in financing. The court stated that such "procedural stagnation" should not be allowed to prevent others from using water. (The fact that extensions *had* been granted for nearly 40 years is not an indication that developers can or do actually reserve water for such periods. The existence of a permit in such circumstances might only give the holder a false sense of security: a large-scale appropriation for oil shale might go unchallenged for years if it existed only on paper, but it would almost certainly be challenged by holders of conflicting rights if attempts were made to put it into effect. The question then is whether it could survive court review. *Carbon Canal Co.* indicates that it could not.)

### 3. Transfer of Rights

Where unappropriated waters cannot be found, water may be acquired by acquisition of existing appropriation rights. All appropriation states consider water rights at least in theory to be property and therefore saleable and transferable by other means.<sup>102</sup> Rights may be transferred in all three of the oil shale states, at least in some circumstances.<sup>103</sup> Most transfers may be expected to be by purchase. Other means, such as loans and exchanges are possible, just as they would be with any other property right; but administrative approval may be required.<sup>104</sup>

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<sup>101</sup> 19 Utah 2d 6, 425 P.2d 405 (1967).

<sup>102</sup> Trelease, *Changes and Transfers of Water Rights*, 13 ROCKY MT. MINERAL L. INST. 507 (1967).

<sup>103</sup> See, e.g., *Arnett v. Linhart*, 21 Colo. 188, 40 P. 355 (1895); *Salt Lake City v. McFarland*, 1 Utah 2d 257, 265 P.2d 626 (1954); *Hunziker v. Knowlton*, 78 Wyo. 241, 322 P.2d 141 (1958).

<sup>104</sup> See COLO. REV. STAT. ANN. § 37-83-105 (1973) (authorizing loans for a limited time upon notice to water commissioner); WYO. STAT. ANN. § 41-5 (Cum. Supp. 1973) (authorizing state engineer to approve petitions for exchanges).

However, since oil shale needs are year-round and permanent, loans are not likely to be much used; and exchanges involve no problems fundamentally different from those raised by purchase. Therefore only purchases will be discussed in detail here.

The importance of water to the economy of arid states quickly led to its transfer being hedged about with legal and administrative precautions, so that under existing doctrines transfer is subject to a number of difficulties. The major barriers are those involving protection of junior appropriators, seasonal rights, appurtenance of water rights to land, and preferred uses.

a. *Protection of Junior Appropriators*

One hurdle which the states have erected in the path of a would-be purchaser in an attempt to protect other users is a requirement of administrative approval of certain transfers. Utah statutes require approval of the state engineer for any permanent change in the place of diversion or use, though not for a change in the use itself if the location remains unchanged.<sup>105</sup> Nearly all water rights purchased for oil shale use must involve a change of place of use, if not of diversion, since existing uses in the oil shale areas (except perhaps existing municipal uses, which are unlikely to be purchaseable) are unlikely to apply a large enough quantity of water in the desired area. Wyoming statutes require permission of the state board of control for any change in the use or place of use.<sup>106</sup>

Alongside the administrative protections there exists a judicial doctrine that vested water rights must be protected in any transfer. The problem arises in the following manner. Few uses of water consume all the water which is diverted. The unconsumed portion which returns to the stream is called "return flow." This flow is then subject to appropriation by other users. Thus, if an irrigator diverts 8 cfs, of which 4 cfs finds its way back to the stream, that 4 cfs will augment the flow downstream and can be diverted a second time. The downstream appropriator acquires a right to this 4 cfs, and his right must be protected. If the upstream irrigation right is sold to an industrial user, still with the same place of use, who diverts the same 8 cfs but consumes 7 cfs, the downstream user is damaged by the loss of 3 cfs

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<sup>105</sup> UTAH CODE ANN. § 73-3-3 (1953).

<sup>106</sup> WYO. STAT. ANN. §§ 41-4, 4.1 (Cum. Supp. 1973).

to which he has a vested right.

The same problem may arise with a change in place of use. If on the same stream there is a third appropriator, upstream from our irrigator and possessing a right junior to his, when the stream flow is only 8 cfs, the upstream junior cannot consume any water because the irrigator has a right to divert all 8 cfs. But if flow is above 8 cfs, the upstream junior may divert (within the extent of his right) whatever amount will return a flow of 8 cfs to the stream. If the upstream junior has a right to divert 16 cfs, of which he consumes half, and the stream flow is 16 cfs, he can divert his full amount without interfering with the senior right. But if the senior right is transferred upstream from this second junior, and the flow remains 16 cfs, diversion of 8 cfs under the senior right with a return flow of 4 cfs will leave only 12 cfs in the stream, and the second junior will be injured.<sup>107</sup>

In order to protect the junior appropriators in such situations, transfer of the senior right is prevented. Courts have ameliorated the limitation by allowing transfers of part of the right, to the extent that no other user would be harmed. The same result is directed by statute in Utah, where the state engineer is directed to approve changes in part, if that may be done without impairing vested rights.<sup>108</sup> Thus in *Green v. Chaffee Ditch Co.*<sup>109</sup> an irrigator owned an adjudicated right to divert 16 cfs during the irrigation season. He sold this right to the City of Fort Collins for municipal use, and the city converted the right to a storage right. Upon protest by other users, the court found that the irrigator had never diverted more than 8 cfs, and furthermore that he diverted a maximum of 360 acre-feet per year for a use which was 25 percent efficient (75 percent return flow), with a resulting consumption of 95 acre-feet per year. The city, however, returned only 50 percent of its diversions to the stream. The city's right was therefore reduced to a maximum of 8 cfs rate of flow, and a total yearly flow of 19 acre-feet, to achieve a consumption of 95 acre-feet. This flow could be diverted and stored only during the period April 15 to October 15, the period in which the irrigation right could be used. The seller, then, was found to have owned only

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<sup>107</sup> For a case discussing both of these changes (and disallowing them), see *Vogel v. Minnesota Canal & Reservoir Co.*, 47 Colo. 534, 107 P. 1108 (1910).

<sup>108</sup> UTAH CODE ANN. § 73-3-3 (1953).

<sup>109</sup> 150 Colo. 91, 371 P.2d 775 (1962).

one-half of his paper right, and the purchaser was able to divert only one-half of that.

Purchase of existing rights for oil shale development is likely to involve both of the problems which the City of Fort Collins faced in *Chaffee Ditch*. The major problem is that most existing rights in the oil shale areas are for irrigation, a low-efficiency use with return flows of 75 to 90 percent. Oil shale production is a much more efficient use. Most estimates are that over 60 percent of total diversions will be consumed; and direct processing and upgrading uses will consume 90 percent of the water diverted to them.<sup>110</sup> An oil shale processor with 90 percent efficiency buying rights from irrigators who had 10 percent efficiency would have to purchase rights to 90 cfs in order to divert only 10 cfs! (The irrigator would return 9 cfs and consume 1 out of every 10 diverted. But the oil shale processor will consume 9 and return only 1. Since he *must* return the full 9 cfs for every 1 he diverts, he must purchase 9 times the amount he actually requires and divert only 1 of the 9. The others he must send down the stream.) The only possible way to avert this difficulty is for the oil shale processor to purchase the right of every user who has appropriated any part of the return flow from the water rights he has purchased, except those uses which do not add up to more than his own direct return flow. This will probably significantly affect the price he must pay. The price of prior rights can be expected to be somewhere between their value for irrigation and that for oil shale processing. The latter is presumably higher, or there will be no sale. But if the processor need purchase only a few rights, the price can be expected to be nearer the value for irrigation, since the purchaser can always go elsewhere if one irrigator will not sell. If the processor must purchase a large fraction of the existing rights in order to acquire a sufficient supply, the price can be expected to approach the value of water in *his* use, *i.e.*, the price which would raise the total price of shale oil above the market level, since every seller knows that the buyer will probably be forced to deal with him eventually. The fact that the buyer need not purchase 100 percent of the rights keeps this from being a classic "holdout" problem; but if the buyer needs any significant proportion of the total flow of the stream, sufficient concerted action can easily arise to affect the price he must pay for rights.

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<sup>110</sup> See text accompanying notes 25-28 *supra*.

b. *Seasonal Rights and Storage*

Oil shale developers seeking to purchase existing rights will also face the other difficulty illustrated in *Chaffee Ditch*: many existing water rights are seasonal.<sup>111</sup> Purchase of these rights gives the purchaser a right to divert water only during the period allowed under the original use.

Oil shale is not a seasonal industry. The high capital investment required would make it uneconomical to shut down production during periods of low water availability. Thus it would be necessary to follow the procedure of the City of Fort Collins in *Chaffee Ditch* and smooth out the supply by storing water during the irrigation season and using it during the remainder of the year. In theory, this does not present any insuperable difficulties. In all three states a storage right is an appropriative right, to be acquired like any other; and conversion of existing rights to storage can be done while retaining the original priority dates.<sup>112</sup> However, acquisition of storage rights as well as other water rights has already been going forward for many years, with the result that the most economically-feasible storage sites have already been put to use, and also with the result that off-season flows in many cases have already been fully appropriated for storage for irrigation.<sup>113</sup>

Some storage rights have been acquired by oil companies for oil shale uses,<sup>114</sup> and the companies probably will be able to share storage in public works reservoirs in other instances,<sup>115</sup> especially since public works reservoirs typically include a large allocation for unspecified municipal and industrial uses.<sup>116</sup>

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<sup>111</sup> A basic part of the appropriation right is the period of use. *E.g.*, *Cache La Poudre Res. Co. v. Water Supply & Storage Co.*, 25 Colo. 161, 53 P. 331 (1898); *Hardy v. Beaver County Irrig. Co.*, 65 Utah 28, 234 P. 524 (1924).

<sup>112</sup> *Green v. Chaffee Ditch Co.*, 150 Colo. 91, 371 P.2d 775 (1962); UTAH CODE ANN. § 73-3-2 (Supp. 1973); WYO. STAT. ANN. §§ 41-26 to -46 (1957).

<sup>113</sup> This has occurred, for example, on the Sevier River in Utah, where year round storage rights take the entire flow of the stream for use during the irrigation season. *Dewsnup*, *supra* note 78, at 623.

<sup>114</sup> *Cooley*, *supra* note 52, at 138.

<sup>115</sup> *Balcomb, Availability of Water for Oil Shale Development*, 63 COLO. SCHOOL OF MINES Q., Oct. 1968, at 109; *Delaney*, *supra* note 42.

<sup>116</sup> See the projects listed by *Balcomb*, *supra* note 114; *Delaney*, *supra* note 42; *Moses*, *supra* note 29.

c. *Appurtenant to Land*

It was established early throughout most of the West that appropriative rights to water were appurtenant to the land upon which the water was used.<sup>117</sup> However, the general rule now is that, whether or not the right is "appurtenant" in theory, it may be transferred separately from the land. The rule has long been established in Colorado since the case of *Strickler v. City of Colorado Springs*.<sup>118</sup> In Utah water rights appurtenant to land have been made separately conveyable by statute.<sup>119</sup> In Wyoming the situation is somewhat more complicated. A Wyoming statute still declares that "water rights cannot be detached from the lands, place or purpose for which they are acquired, without loss of priority."<sup>120</sup> In unadulterated form such a statute would obviously make it impossible to develop oil shale production by means of purchased rights to water. Nonetheless, enough statutory exceptions have crept in over the years that separate conveyance of water rights for oil shale should be possible. Storage rights are now excepted from the appurtenance requirement,<sup>121</sup> as are rights which are changed to an "industrial" use or other preferred use.<sup>122</sup> Thus the transfer contemplated—purchase of irrigation rights for use in oil shale processing or allied municipal uses—should present no problem. One example of such a change was the purchase of four irrigation rights for use in a taconite mill in Wyoming:

The water supply for the mill was to be drawn from Rock Creek, and a small reservoir was constructed above the mill site. Water could be stored in this reservoir without too much interference with the rights of other appropriators on Rock Creek, but Rock Creek is a tributary of the Sweetwater, upon which a large number of ranchers depend, and the Sweetwater is itself a tributary of the North Platte, which is fully appropriated. The steel company purchased four irrigation water rights totaling approximately ten cubic feet per second from ranchers on the Sweetwater above the confluence with Rock Creek. The method of operation is to store Rock Creek water in the reservoir during the period when these water rights would have originally permitted the withdrawal from the Sweetwater. The ditches

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<sup>117</sup> 1 W. HUTCHINS, *supra* note 70, at 454-55.

<sup>118</sup> 16 Colo. 61, 26 P. 313 (1891).

<sup>119</sup> UTAH CODE ANN. § 73-1-10 (1953).

<sup>120</sup> WYO. STAT. ANN. § 41-2 (1957).

<sup>121</sup> *Id.* § 41-37.

<sup>122</sup> *Id.* §§ 41-2, -3.

<sup>123</sup> Trelease, *supra* note 102, at 517-18.



on the formerly irrigated land are closed so that the ten feet formerly diverted are left in the stream to replace the water being retained by the dam on Rock Creek. Analysis discloses that the nature of the use has changed from an agricultural to an industrial use; the place of use was changed from the land on the Sweetwater to the mill on Rock Creek, the point of diversion was changed from the Sweetwater to Rock Creek; the method of use was changed from direct use to storage, and the source was changed from the main stem of the stream to a tributary.<sup>123</sup>

d. *Referred Uses*

A final barrier to acquisition of water for oil shale development may be raised by state laws giving preference to certain uses. A "preferred use" in effect represents a legislative or, in some cases, a constitutional decision that such a use is more valuable than any other. Such decisions were typically made so long ago that there is no discernible relationship to present-day economic values, if indeed economic value was considered at all.

The Colorado state constitution contains a clause giving preference to domestic uses of water, followed in order by agricultural uses and then manufacturing.<sup>124</sup> However, the Colorado Supreme Court has held that in the event a junior appropriator with a preferred use exercises his "right" over a senior inferior use, he must pay "just compensation."<sup>125</sup> This requirement, which is not expressed in the constitution, effectively negates the preference, since an economically less valuable preferred use will not displace a more valuable but "inferior" use.

The situation is different in Utah. That state gives preference by statute to domestic uses first and second to agriculture.<sup>126</sup> This statute once required that just compensation be paid if an inferior right was taken for a preferred use, but that provision was deleted in 1903.<sup>127</sup> The statute has not been construed by the state supreme court, although that court has said that the legislature considered these two uses to be the most beneficial to which water could be applied.<sup>128</sup> Thus it could be possible for an oil shale producer in Utah to find its water supply appropriated out from under it for relatively valueless agricultural uses. It might be that

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<sup>124</sup> COLO. CONST. art. XVI, § 6.

<sup>125</sup> *Town of Sterling v. Pawnee Ditch Ext. Co.*, 42 Colo. 421, 94 P. 339 (1908).

<sup>126</sup> UTAH CODE ANN. § 73-3-21 (1953).

<sup>127</sup> Ch. 100, § 54 [1903] Utah Laws.

<sup>128</sup> *Tanner v. Bacon*, 103 Utah 494, 136 P.2d 957 (1943).

legislative action would swiftly follow any such appropriation; but legislative action beforehand would do much to ease the minds of potential investors in oil shale development.

Wyoming also has some statutory preferred uses which take priority over all others and for which others may be condemned; but "just compensation" must be paid.<sup>129</sup> The provision, like that of the Colorado constitution, is therefore innocuous. Furthermore, the order of preference in Wyoming is (1) Drinking water "for both man and beast;" (2) municipal; (3) railway use, laundry, bathing, refrigeration, and steam power plants; and (4) industrial uses.<sup>130</sup> The last could presumably be construed to include oil shale production, just as it included taconite ore processing in the Rock Creek-Sweetwater change described above; and much of the water requirement for shale oil production will be for expanded municipal uses and other of the preferred uses. Therefore the Wyoming preference system should if anything be beneficial to a shale oil industry.

#### D. *Water Delivery Rights*

One escape which has been suggested from the complications involved in the transfer of appropriative rights is the purchase of water *delivery* rights.<sup>131</sup> These are not appropriative rights, but simply contract rights, analogous to the right of a homeowner to receive domestic water from a municipal water company. Various forms of mutual, public, and privately-owned commercial water supply enterprises exist throughout the West.<sup>132</sup> They are alike in that the enterprise has a supply of water which it delivers to individual subscribers or stockholders. What the user has is a right to receive delivery of a share of the supply as long as he pays his water rent or owns a share of stock, while the "appropriative right" belongs to the enterprise as a whole. In the simplest case, the enterprise will own only one appropriation right, the water from which is divided among its users in proportion to their payments. The enterprise could conceivably hold a number of separate rights, in which case each user would receive a prorated share of each right.

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<sup>129</sup> WYO. STAT. ANN. § 41-4 (1957).

<sup>130</sup> *Id.* § 41-3.

<sup>131</sup> *E.g.*, Dewsnap, *supra* note 78, at 619-27.

<sup>132</sup> See 1 W. HURCHINS, *supra* note 70, at 550 *et seq.*

Transfers within such enterprises take place regularly, either by sale of an individual delivery right for a particular year or by sale of "shares" in the enterprise.<sup>133</sup> The main advantage of such transfers is that they avoid the need to consider junior rights, since transfers within the limits of the enterprise will ordinarily cancel one another out.

If, for example, a transfer of X's share to Y downstream, by changing the point of diversion, reduces the return flow in the area between X and Y but increases it below Y, the only consequence is that the intervening farmers will receive additional water to replace the missing return flow from X, while farmers below Y will receive their entitlement from the augmented return flow.<sup>134</sup>

This is not true where total return flow is diminished, such as when either percent consumption increases, or transfer is outside the normal return-flow limits of the enterprise.<sup>135</sup> It has already been noted that both of these conditions are likely to be present where irrigation rights are sold for oil shale uses. In such a case, appropriators outside the enterprise will be affected, and the transfer will raise all the problems involved in transfer of the appropriation right itself. The transfer may appear simplified in that consolidation of the numerous delivery rights under one enterprise-appropriation has already reduced the number of appropriators involved, and water taken from holders of delivery rights can be compensated by cash payments handled through the established management of the enterprise. But where the return flow from the enterprise as a whole has already been appropriated by a number of other users, the advantages may be more theoretical than real.

#### E. *Federal Reserved Rights*

In addition to appropriation rights, the other major class of water rights in the Western states is the federal reserved rights to water on lands which have been withdrawn from the public domain. The federal government owns 72 percent of the oil shale lands, containing an estimated 80 percent of the shale oil.<sup>136</sup> It has

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<sup>133</sup> Dewsnup, *supra* note 78, at 623 nn.16 & 17 described such transfers occurring in the operation of mutual water companies on the Sevier River in Utah, with prices for yearly water varying from \$2 to \$20 per acre-foot depending upon demand.

<sup>134</sup> C. Meyers & R. Posner, *Market Transfers of Water Rights*, 1971, at 35-36 (Review Draft of National Water Commission Legal Study No. 4, Final Report) [hereinafter cited as Meyers & Posner].

<sup>135</sup> *Id.* at 36.

<sup>136</sup> Legal Study, *supra* note 6, at 11.

been suggested that federal reserved rights will provide water for development of federal shale. If this does not occur, the other face of this Jekyll-and-Hyde doctrine could threaten the water supply of any oil shale development on either federal or private lands.

### 1. History and Extent of the Right

The extent of the federal reserved right to water has been stated as follows:

[W]hen the public lands of the United States were set aside as national forests, national parks, and the like, there was reserved for each enclave enough of the then unappropriated water appurtenant to the lands reserved to effectuate whatever purpose the reserved lands were set aside to serve, and this constitutes a water right with a priority of the date the lands were reserved.<sup>137</sup>

The doctrine originated with Indian water rights,<sup>138</sup> and to date almost the only applications of any importance have been for Indian reservations,<sup>139</sup> but it is widely hoped or feared that it will have an effect well beyond its beginnings. Such hopes and fears must be strengthened by the allusion of the U.S. Supreme Court to "naval petroleum and oil shale reserves which, if ever developed, would require water to accomplish the federal purpose for which the reservations were made."<sup>140</sup>

In the case which established the right, *Winters v. United States*,<sup>141</sup> the Supreme Court held that an Indian tribe whose reservation was established by treaty with the United States was the beneficiary of an implicit right to withdraw from streams upon the reservation sufficient water to sustain them in the way of life contemplated by the treaty. This water is exempt from appropriation under state laws and is subject only to the rights of appropriators whose use predated the treaty.

In *Arizona v. California*<sup>142</sup> the Court extended the reserved right to Indian reservations created by Executive Order and to other federal reservations. The Court upheld the Master's conclu-

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<sup>137</sup> Corker, *Federal-State Relations in Water Rights Adjudication and Administration*, 17 ROCKY MT. MINERAL L. INST. 579, 582 (1972).

<sup>138</sup> *Winters v. United States*, 207 U.S. 564 (1908).

<sup>139</sup> The major cases are discussed in Veeder, *Indian Prior and Paramount Rights to the Use of Water*, 16 ROCKY MT. MINERAL L. INST. 631 (1971).

<sup>140</sup> *United States v. District Court in and for Water Division No. 5*, 401 U.S. 527, 529 (1971).

<sup>141</sup> 207 U.S. 564 (1908).

<sup>142</sup> 373 U.S. 546 (1963).

sion as to quantity of water reserved for Indian use: "He found that the water was intended to satisfy the future as well as the present needs of the Indian Reservations and ruled that enough water was reserved to irrigate all the practicably irrigable acreage on the reservations."<sup>143</sup> And the Court upheld his finding that there was intended to be reserved "water sufficient for the future requirements of the Lake Mead National Recreation Area, the Havasu Lake Wildlife Refuge, the Imperial National Wildlife Refuge and the Gila National Forest."<sup>144</sup>

While it has been said that the "practicably irrigable acreage" standard of *Arizona v. California* settles once and for all the question of the scope of Indian water rights,<sup>145</sup> it of course cannot do so for other reservations where irrigation will never be carried on, such as game refuges and national forests. The Court did not bind itself to that standard, but merely upheld the Master's finding on intent at the time of the reservation. The holding is consistent with the dictum in *United States v. District Court in and for Water Division No.5*,<sup>146</sup> which looks to the original purpose of the reservation to determine the use for which water may be taken. We must thus fall back upon the "purpose of the reservation" as the only true guide. With respect to oil shale the relevant question becomes whether development of oil shale could be considered within the purposes of the reservation upon which the water is to be used.

## 2. Nature of Reservation

Federal reservations of land have been made for a number of purposes throughout the Western states. *Arizona v. California* considered not only Indian reservations, but also a national recreation area, two wildlife refuges, and a national forest. Another court<sup>147</sup> has considered reserved rights for a military reservation; and the Supreme Court has suggested that the doctrine applies

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<sup>143</sup> *Id.* at 600.

<sup>144</sup> *Id.* at 601.

<sup>145</sup> Bloom, *Indian "Paramount" Rights to Water Use*, 16 ROCKY MT. MINERAL L. INST. 669, 683 (1971).

<sup>146</sup> 401 U.S. 527 (1971).

<sup>147</sup> *Nevada ex rel. Shamburger v. United States*, 165 F. Supp. 600 (D. Nev. 1958). A naval ammunition depot was created by executive order. The order made no mention of water rights, but the court held that the United States need not secure a state permit to drill a well even though there would be interference with the water supply of a nearby town.

to naval oil and petroleum reserves. There are also important withdrawals of land for grazing districts, reclamation districts, public springs and waterholes, stock driveways, coal, and for classification of lands.<sup>148</sup>

Although there appears to be no reason why water could not be reserved in connection with any of the above, some of these withdrawals—grazing, stock driveways, wildlife refuges—appear to offer no reasonable argument that mining or oil shale development was envisaged as a purpose of their creation. The same may be said of public springs and waterholes, specifically withdrawn for the purpose of insuring public access to stock watering places. Use of the water for oil shale production would be contrary to that purpose.

Similarly, withdrawals of military reservations may give rise to a right to waters for use by military personnel or for service-related purposes,<sup>149</sup> but probably not for oil shale development. If, for example, a bombing range is created, it is difficult to infer an intent to develop minerals on that site.

Several kinds of withdrawals of land *do* offer an argument that water was reserved for mineral development.

a. *National Forests*

National forests are the most important federal land reservation in terms of area or of water availability. Forest service lands, including national parks, yield approximately 59 percent of total annual runoff from the 11 coterminous western states.<sup>150</sup> In Colorado they contribute 94 percent of the total natural runoff.<sup>151</sup> Oil shale lands occur within national forests in all three oil shale states.<sup>152</sup>

Creation of national forests was authorized by Congress in 1891,<sup>153</sup> and in 1897 an act was passed limiting their creation to the following purposes:

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<sup>148</sup> Legal Study, *supra* note 6, at 78-84.

<sup>149</sup> *Nevada ex rel. Shamburger v. United States*, 165 F. Supp. 600 (D. Nev. 1958). The only purpose stated in the withdrawal order in that case was "for the development of and use as an ammunition depot."

<sup>150</sup> PUBLIC LAND L. REV. COMM'N, ONE THIRD OF THE NATION'S LAND 141 (1970).

<sup>151</sup> C. Wheatley, Jr., Study of the Development, Management and Use of Water Resources on the Public Lands, 1969, at 405 (prepared for the U.S. Pub. Land L. Rev. Comm'n.).

<sup>152</sup> Legal Study, *supra* note 6, at 83.

<sup>153</sup> 16 U.S.C. § 471 (1970).

[T]o improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber . . . .<sup>154</sup>

It seems doubtful that “the purpose of securing favorable conditions of water flows” could by itself be construed to indicate an intent to reserve water. Some *use* for the water is surely necessary. If the only use for water, the only purpose in “securing favorable conditions of water flows,” is to raise timber, the phrase is redundant. Statutes are normally construed to avoid redundancy. And the structure of the language clearly makes “water flows” an alternative purpose to protection of the forests, not a subcomponent.

It may be that uses for the water which would give meaning to the phrase “securing favorable conditions of water flows” are those found in the further provisions of the 1897 Act:

All waters within the boundaries of national forests may be used for domestic, mining, milling, or irrigation purposes, under the laws of the State wherein such national forests are situated, or under the laws of the United States and the rules and regulations established thereunder.<sup>155</sup>

If this section does state uses for which “favorable conditions of water flows” are to be preserved, then mineral development is one of the purposes for which a forest may have been reserved, in the absence of any specific provision to the contrary in the Executive Order creating each forest. Traditionally, Forest Service policy has been to allow mining.

On the other hand the phrase “securing favorable conditions of water flows” could refer to water flows outside the forest as well as within. (For example, it could be argued that the purpose of having the forest is to preserve the watershed rather than reserving the water supply to preserve the forest.) In that case, one could not infer an intent to reserve water for mineral development.

There is no clear choice between these possible readings of the statute. But the fact that the Congress which enacted a statute delimiting the purposes for which national forests could be created also stated that water within them could be used for

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<sup>154</sup> *Id.* § 475.

<sup>155</sup> *Id.* § 481.

mineral development is at least some evidence that water was intended to be reserved for that use.

b. *Naval Oil Shale Reserves*

The lands withdrawn expressly as oil shale reserves are in a different category with respect to reserved water rights. Here there can be no doubt that the purpose of the reservation was to insure that oil from shale would be available in time of need. Even though the withdrawal order itself does not mention water, it is clear that water is necessary to fulfill the purpose of the reservation. The Secretary of the Navy is authorized to explore, prospect, conserve, develop, use, and operate naval petroleum reserves in his discretion, including

the production of . . . oil shale and products thereof whenever and to the extent that the Secretary . . . finds that it is needed for national defense and the production is authorized by a joint resolution of Congress.<sup>156</sup>

Oil Shale Reserves No. 1, in Colorado, and No. 2, in Utah, were created by Executive Order of December 6, 1916. Reserve No. 3, in Colorado, was established by Executive Order of September 27, 1924. These are traversed by the Colorado, Green and White Rivers. The dictum of Justice Douglas in the Supreme Court's opinion in *Water Division No. 5* strongly supports the conclusion that any appropriation from those rivers subsequent to December 6, 1916, is subject to being taken for development of the oil shale reserves under the federal government's reserved water right.

c. *Oil Shale Lands Withdrawn from Leasing*

One of the most interesting questions of reserved rights arises in connection with the withdrawal by Executive Order of all oil shale lands from leasing or other disposal. The Executive Order stated:

Under authority and pursuant to the provisions of the act of Congress approved June 25, 1910 . . . [the Pickett Act], as amended by the act of August 24, 1912, . . . it is hereby ordered that subject to valid existing rights the deposits of oil shale, and lands containing such deposits owned by the United States, be, and the same are hereby, temporarily withdrawn from lease or other disposal and reserved for the purposes of investigation, examination, and classification.

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<sup>156</sup> 10 U.S.C. § 7422 (1970).



This order shall continue until revoked by the President or by act of Congress.<sup>157</sup>

This "temporary" withdrawal has never been revoked. Its purposes are clearly stated: investigation, examination, and classification. There is no mention of water, and, more significantly, none of oil shale development. The language of the order cannot support a construction that development was intended, and it cannot be inferred from the mere act of withdrawal as is possible for the naval oil shale reserves. One does not withdraw lands from disposal in order to develop them unless one intends to do the developing oneself; and there is no evidence that federal development of oil shale has ever been seriously considered, except for the lands reserved for defense purposes.

The expressed purposes of the withdrawal are not such as to require large quantities of water. "Minerals classification involves core drilling, surface examination, and surface mapping."<sup>158</sup> Thus the argument that all federal oil shale lands carry with them their own protected water supply, intriguing though it may be, must fail.

#### d. *Indian Reservations*

Development of oil shale or indeed any industry on Indian lands could bring the reserved rights question back where it began. There is one Indian reservation on oil shale lands, the Uintah and Ouray Reservation in Utah,<sup>159</sup> created under an Act of Congress in 1864,<sup>160</sup> for "the permanent settlement and exclusive occupation" of the tribes, who were moved there from pre-existing reservations in other areas. The Act also appropriated \$30,000 "for the purpose of making agricultural improvements" on the reservation, "for the comfort of the Indians who may inhabit the same." In 1902 legislation was passed to allow specific amounts of land to be allotted to each tribe member. The remaining unallotted lands were restored to the public domain.<sup>161</sup> In 1934 Congress enacted legislation allowing the Secretary of the Interior to withdraw the unallotted lands once again and restore them to

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<sup>157</sup> Exec. Order No. 5327, 29 Fed. Reg. 6655 (1916).

<sup>158</sup> U.S. DEP'T OF INTERIOR BULL. NO. 537, THE CLASSIFICATION OF PUBLIC LANDS 50 (1913).

<sup>159</sup> Legal Study, *supra* note 6, at 84-85.

<sup>160</sup> Act of May 5, 1864, ch. 77, 13 Stat. 63.

<sup>161</sup> Act of May 27, 1902, Pub. L. No. 57-125, 32 Stat. 245, 263.

the reservation, subject to valid intervening private rights and claims.<sup>162</sup> Under this Act, the Secretary withdrew lands in Colorado and Utah which included much of the oil shale in those states. Ultimately restoration of all lands in Colorado was blocked by Congress, but 217,000 acres of land in Utah were restored to tribal ownership in 1945. This reservation now represents the largest single tract of oil shale lands outside the Bureau of Land Management, which controls the public domain lands.<sup>163</sup>

The erratic history of withdrawal leaves the date, if not the extent, of federal reserved rights on the reservation somewhat uncertain. Is the date of the right 1864, 1934, or 1945? The first, obviously, would predate most other water rights in existence. However, restoration was by the Act of 1934 made "subject to intervening rights." The reference may have been to intervening rights in *land*, but it cannot be limited to those, since the federal right to water dates only from the uninterrupted reservation of the land. At least, there has been no suggestion that a second reservation may relate back to the date of an earlier one; and the Supreme Court's decree in *Arizona v. California* suggested that where lands had been made part of an Indian reservation on different dates, the priority date of the reserved water right on each part was the date of that accession of land.<sup>164</sup>

Whatever the date of the federal reserved right on the reservation, it obviously will predate *some* other rights, and the question will therefore arise whether that right applies to water used for oil shale development.

The question must be answered by the same "purpose of the reservation" test that applies to other withdrawn lands and was applied to the Indian reservations in *Arizona v. California*.<sup>165</sup> It will be recalled that in that case the right was measured by "irrigable acreage," but that in applying that measure the Supreme

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<sup>162</sup> 25 U.S.C. §§ 461-79 (1970). The same act allowed the Secretary of the Interior to make regulations for forestry and livestock grazing but said nothing about mineral development except that it reopened the Papago Reservation in Arizona to mineral entry of all kinds, subject to lease payments to the Indians. No such provision was made with respect to the oil shale lands of the Uintah Reservation, which had been withdrawn as part of the general oil shale withdrawal. There is thus no affirmative showing that Congress considered mineral development likely on the Uintah Reservation, but there is some evidence that it had in mind the possibility of general mineral development on Indian reservations.

<sup>163</sup> Legal Study, *supra* note 6, at 84.

<sup>164</sup> 373 U.S. 546 (1963).

<sup>165</sup> *Id.*

Court merely upheld the finding of the Master that withdrawal of the lands was intended to reserve water only for irrigation. Arizona contended that the quantity reserved should be measured by the Indians' "reasonably foreseeable needs."<sup>166</sup> The Court rejected this argument, which it said,

in fact, means by the number of Indians. How many Indians there will be and what their future needs will be can only be guessed. We have concluded, as did the Master, that the only feasible and fair way by which reserved water for the reservations can be measured is irrigable acreage.<sup>167</sup>

Although the Court rejected a measure that was based upon the number of Indians, it did not say that some other measure based upon the originally contemplated use of the land would be rejected. A different measure than irrigable acreage thus could, and should, be used to measure Indian reserved water rights where it appears that the intent at the time of reservation was to have water for some purpose other than irrigation.

It probably will not be possible to conclude, as at least one writer has done,<sup>168</sup> that Indians may assert reserved rights to water for industrial purposes. There may be exceptional cases, but normally industrial development would not have been foreseen at the time of withdrawal of the reservation.

If there are exceptions, the Uintah and Ouray Reservation may be one of them. It cannot be seriously argued that oil shale development was foreseen and intended as a way of life on the reservation in 1864. The original act creating the reservation appears to have contemplated that the Indians would live by agriculture. But if part of the reservation dates to 1934 or 1945, the argument with respect to that part is less one-sided. The potential for development of oil shale was well known by 1934. The withdrawal of federal oil shale lands from leasing had occurred 4 years earlier. Development of oil on Indian lands had already occurred in Oklahoma.<sup>169</sup> A respectable argument could be made that lands reserved in 1934 or thereafter carried with them the rights to water for development by means other than irrigation, including the development of oil shale.

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<sup>166</sup> *Id.* at 600.

<sup>167</sup> *Id.*

<sup>168</sup> W. Veeder, *Winters Doctrine Rights in the Missouri River Basin*, 1965 (unpublished manuscript) cited in Bloom, *supra* note 145, at 691 & n.25.

<sup>169</sup> See, e.g., *Parker v. Riley*, 250 U.S. 66 (1919), concerning Indian homestead rights in oil and gas leases granted by Indians.

### CONCLUSION

Oil shale production at a rate which amounts to a significant part of national demand for oil will require more water than will remain in the unappropriated supply of the oil shale regions by the time large-scale production can begin. This means that transfers of existing rights will be necessary to allow production on that scale.

Existing water law doctrines of the oil shale states raise numerous barriers to the easy transfer of water rights. These could significantly lower oil shale production by raising the cost of water or barring transfer completely. Production could also be delayed by making it necessary to resort to court procedures in order to transfer water rights.

A few of the barriers can be easily lowered. For example, the Utah statute making agriculture a preferred right could be revoked, or a statute passed requiring compensation for the right taken if a preferred right is exercised. Other barriers will be more difficult to raze. The protection of junior rights under the appropriation system cannot be easily reversed once those rights have been granted. It has been suggested<sup>170</sup> that a purchaser should be granted rights in his own return flow, since there would then be no other appropriator who could object to further transfers of the right, and the cost of transfers would thus be lowered. This is quite correct. But the suggested change would do nothing to ease the first transfer where the return flow is already fully or partially appropriated.

It has also been suggested<sup>171</sup> that procedures should be established for forced mutualization of a water supply (similar to forced unitization of an oil field) and for auction rather than cost-free appropriation of unappropriated waters. These procedures could significantly ease the difficulty, and hence the cost, of transferring rights. Without some such radical overhaul of the water laws, water for oil shale may prove difficult to obtain.

The doctrine of federal reserved rights offers hope that a water supply sufficient for shale oil production can be obtained at least on certain lands—certainly on the naval oil shale reserves, and possibly on national forests and the Uintah and Ouray

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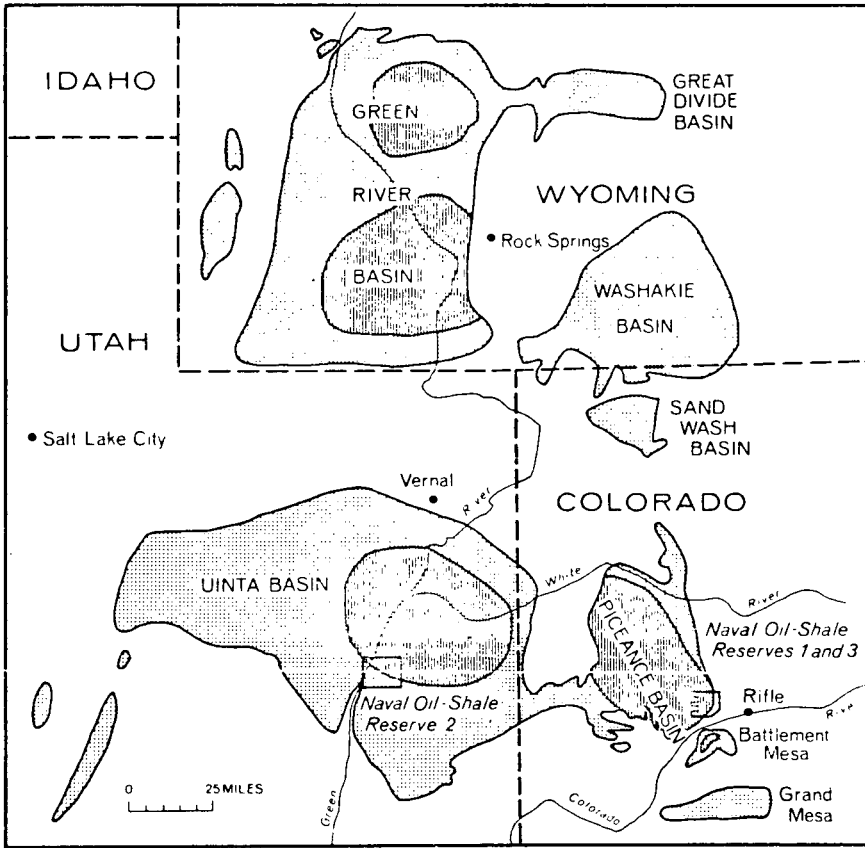
<sup>170</sup> Meyers & Posner, *supra* note 133, at 27-32.

<sup>171</sup> *Id.* at viii-ix, 37-38, 42-43.

Indian Reservation. But the doctrine is a two-edged sword. If it offers hope of development in those locations, it threatens development in others by cutting off private water rights which could be used for shale development on other lands.

At the very least, the federal reserved right should not be asserted without compensation for established rights, even where those rights are in theory subject to the federal right. Where water is already appropriated, there will be heavy political pressure not to take it from established users. An attempt to assert the right without compensation, especially for use by major oil companies, could lead to congressional reaction including abrogation of the right. Compensation might be money well invested. In effect it would amount to a means of achieving transfers of water at market value, without the additional costs imposed by the barriers to transfer in the appropriation system. That would not be the worst of results.

Appendix A



EXPLANATION



Area underlain by the Green River Formation in which the oil shale is unappraised or low grade



Area underlain by oil shale more than 10 feet thick, which yields 25 gallons or more oil per ton of shale

Source. Geological Survey Circular 523

Distribution of Oil Shale in the Green River Formation, Colorado, Utah and Wyoming.

EXPLANATION



Tertiary deposits Green River Formation in Colorado, Utah and Wyoming; Monterey Formation, California; middle Tertiary deposits in Montana. Black areas are known high-grade deposits.



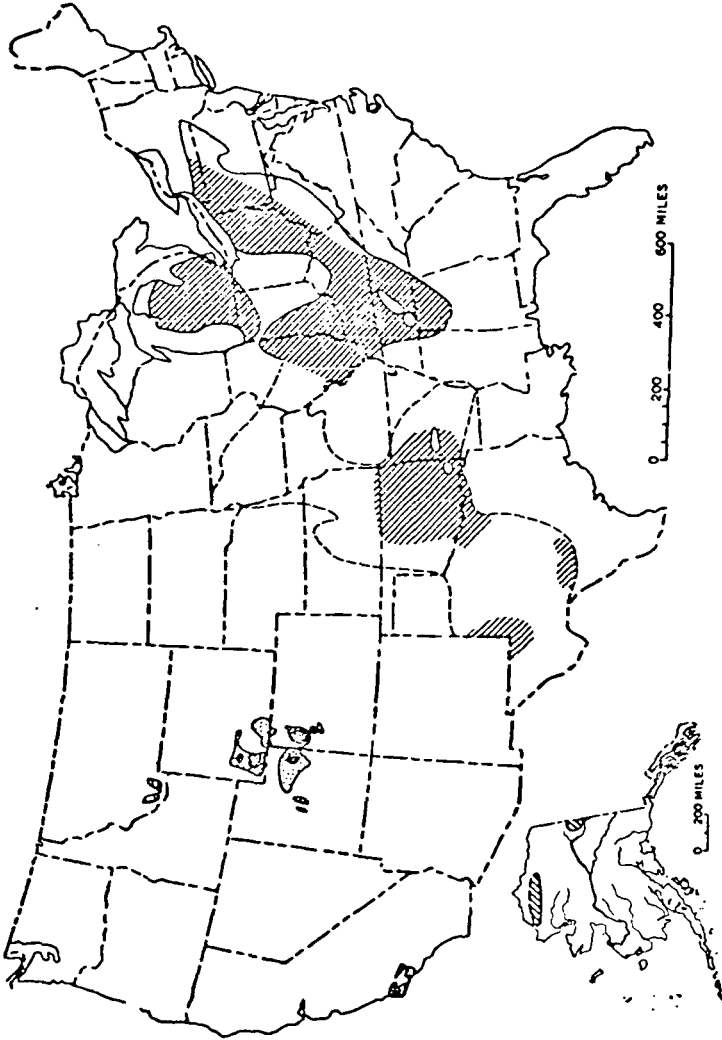
Mesozoic deposits Marine shale in Alaska



Permian deposits Phosphoria Formation, Montana



Devonian and Mississippian deposits (resource estimates included for hachured areas only in Geological Survey Circular 523). Boundary dashed where concealed or where location is uncertain



Source - Geological Survey Circular 523

Figure 3-1- Principal reported oil-shale deposits of the United States