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The European Directive on the Protection of Groundwater: A Model for the United States

RICHARD THOMAS*

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I. INTRODUCTION

Groundwater is a vital natural resource for the United States. Water extracted from underground aquifers across the country supplies both industry and agriculture. Perhaps more importantly, thirty-seven percent of the publicly supplied drinking water, serving 242 million Americans, comes from groundwater.[1] Another forty-three million Americans rely on groundwater as their primary source of drinking water in private supplies.[2] Once contaminants enter groundwater they are difficult and costly to remove, and pose a significant and lasting threat to public health.[3]

In December 2006, the European Parliament and Council enacted the Directive on the Protection of Groundwater Against Pollution and Deterioration.[4] The Groundwater Directive implements Article 17 of the European Water Policy Framework,[5] and provides criteria for assessing and restoring groundwater quality.[6] By providing a single comprehensive legislative framework for preventing groundwater pollution, the European directive stands in stark contrast to the United States' approach, where a patchwork of federal legislation fails to adequately tackle threats to this important resource.[7]

This comment will examine legislative protection of groundwater resources in the United States and the European Union. Part One of this comment will describe some of the main sources and consequences of groundwater pollution, the difficulties of

1. SUSAN S. HUTSON ET AL., U.S. GEOLOGICAL SURVEY, ESTIMATED USE OF WATER IN THE UNITED STATES IN 2000 13 (2005), *available at* http://pubs.usgs.gov/circ/2004/circ1268/pdf/circular1268.pdf.

2. *Id.* at 16.

3. *See*, *e.g.*, RUTH PATRICK ET AL., GROUNDWATER CONTAMINATION IN THE UNITED STATES 6, 10 (2d ed. 1987).

4. Council Directive 2006/118, Protection of Groundwater Against Pollution and Deterioration, 2006 O.J. (L 372) 19 (EC) [hereinafter Groundwater Directive].

5. Council Directive 2000/60, Framework for Community Action in the Field of Water Policy, 2000 O.J. (L 327) 1 (EC) [hereinafter Water Framework Directive].

6. Groundwater Directive, *supra* note 4, arts. 3-4.

7. *See, e.g.,* Todd A. Frampton, *Private Well Owners Pay Price as MTBE Contamination Exposes the Lack of Groundwater Protection in Federal and New York Law*, 18 PACE ENVTL. L. REV. 135, 141 (2000); Benjamin R. Vance, *Total Aquifer Management: A New Approach to Groundwater Protection*, 30 U.S.F. L. REV. 803, 811-17 (1996).

cleaning up contamination and the consequent need for a systematic legislative approach to solving this problem. Part Two will briefly outline the main federal statutes regulating groundwater pollution in the United States, and give an overview of criticisms of those statutes. Part Three will discuss and evaluate the provisions of the 2006 European Groundwater Directive. Finally, Part Four will consider whether the European framework could, or should, be imported to the United States.

II. GROUNDWATER, AND THE SOURCES AND CONSEQUENCES OF CONTAMINATION

Groundwater is subsurface water that fills open spaces in saturated rock formations, known as aquifers.[8] Constituting an estimated ninety-six percent of all fresh water in the United States, groundwater supplies far exceed more traditional surface water sources including lakes, rivers, and glaciers.[9] Aquifers have been described as "underground reservoirs" because of the sheer volume of water that may be extracted.[10]

While groundwater, as noted earlier, is a significant source of drinking water, it is also vital to industry and agriculture. Over eighty-four billion gallons of groundwater are extracted each day, supplying forty percent of the nation's irrigation requirements, and twenty percent of industrial needs.[11] In addition, groundwater does not exist in isolation from other bodies of water; it is an integral part of the hydrological cycle and discharges into lakes and streams.[12] Such "tributary" groundwater is vital for maintaining surface water supplies and sustaining surface ecosystems.[13]

By design, accident, or simple neglect, a bewildering array of chemical and biological contaminants threatens groundwater resources. The simplest way to classify the wide variety of pollutants is by their mode of entry into groundwater:[14]

8. JON WITTEN ET AL., A GUIDE TO WELLHEAD PROTECTION 5-7 (1995).

9. PATRICK, *supra* note 3, at 21.

10. DAVID H. GETCHES, WATER LAW IN A NUTSHELL 239 (3d ed. 1997).

11. *See* HUTSON, *supra* note 1, at 6-9.

12. William M. Alley, *Tracking U.S. Groundwater: Reserves for the Future*, ENVIRONMENT, Apr. 2006, at 10, 15; *See also* William M. Alley et al., *Flow and Storage in Groundwater Systems*, 296 SCI. 1985, 1990 (2002).

13. *See id.*; *See also* GETCHES, *supra* note 10, at 272-81 (briefly discussing the legal ramifications of tributary versus non-tributary groundwater).

14. *See* MICHAEL BARCELONA ET AL., U.S. EPA, HANDBOOK OF GROUNDWATER PROTECTION 4-5 (1988).

1) Intentional release – soil can be used to treat wastewater using subsurface percolation systems such as septic tanks. Land application of sewage sludge is also utilized in this way. Septic systems discharge large volumes of wastewater into the ground, adding significant quantities of nitrogen pollutants, and potentially disease-causing bacteria and viruses, to groundwater.[15]

2) Underground storage – underground injection of waste, landfills, underground storage tanks, and even graveyards, can be sources of groundwater pollution.[16] Many types of hazardous waste, as well as gasoline and other oil products are stored underground. When they leak, pollutants can enter groundwater and pose a serious threat to public health. The recent and widespread contamination of groundwater used for human consumption, caused by MTBE leaks from gasoline storage tanks, highlights the seriousness of this problem.[17]

3) Planned activities – agricultural activities causing runoff of pesticides and fertilizer; highway de-icing activities causing runoff of salt and other pollutants; and mine drainage causing heavy metal contamination, are just some of the many planned activities that have groundwater contamination as a significant, but almost unavoidable consequence.[18] This is perhaps the largest category of pollutant sources, and one of the least regulated. Most types of run-off pollution are characterized as "non-point sources," which are only minimally regulated by the Clean Water Act and other pollution control legislation.[19]

4) Unintentional discharge - excavation, including drilling oil, gas, and water wells, can lead to direct discharge of pollutants into groundwater. Contaminants of this kind are usually oil-based, and are the result of spills of either the resource being extracted, or lubricants and other products used in drilling.[20] Discharges at inland oil drilling sites can easily exceed the more familiar marine spills. At one Chevron plant in California, an esti-

15. *Id.*; *See also* Patrick, *supra* note 3, at 126-38.

16. BARCELONA, *supra* note 14.

17. *See* Frampton, *supra* note 7, at 136.

18. BARCELONA, *supra* note 14, at 5.

19. *See* Punam Parikh Prahalad et al., *Beyond Water Quality: Can the Clean Water Act be Used to Reduce the Quantity of Stormwater Runoff?*, 39 URB. LAW. 85, 98 (2007).

20. *Id.*

mated 252 million gallons of crude oil were floating on top of the groundwater.[21]

5) Pipeline leakages – with over 2 million miles of pipeline in the United States,[22] and over 120 reported significant discharges per year, pipeline leaks are a major source of groundwater contaminants.[23] Oil and gasoline pipeline leaks are a particular concern, given the often harmful or carcinogenic nature of the transported liquids.[24]

6) Naturally occurring sources – some types of groundwater contaminants are naturally occurring, but are exacerbated by human activities.[25] For example, removing large volumes of fresh groundwater can cause salt water inflow to contaminate an aquifer.[26]

Pollutants commonly found in groundwater can have serious public health effects. Waterborne diseases, caused by discharge from septic systems and some agricultural runoff, are a possibility, although disinfection of drinking water limits their incidence.[27] Chemicals found in groundwater, including pesticides, gasoline additives and other hazardous wastes, present a more insidious threat. For example, high levels of nitrates (a common groundwater pollutant) in drinking water can cause "blue baby syndrome" and lead to death in infants.[28] While acute chemical poisoning is only occasionally reported, the long-term health risks associated with the thousands of new chemicals that make their way into groundwater supplies each year are unknown.[29]

There are a number of techniques available to contain or treat groundwater contamination, ranging from physical removal of contaminated soil for treatment on the surface, to physical containment using trenches and concrete sheets.[30] The most common

21. CTR FOR ENERGY EFFICIENCY & RENEWABLE TECHS., CRUDE RECKONING: THE IMPACT OF PETROLEUM ON CALIFORNIA'S PUBLIC HEALTH AND ENVIRONMENT 27 (2002), *available at* http://www.ceert.org/ceert_reports/Crude_Reckoning.pdf.

22. Office of Pipeline Safety, Dep't of Transp., *Pipeline Basics*, http://primis.phmsa.dot.gov/comm/PipelineBasics.htm (last visited Dec. 6, 2008).

23. Office of Pipeline Safety, Dep't of Transp., *Significant Pipeline Incidents*, http://primis.phmsa.dot.gov/comm/reports/safety/SigPSI.html (last visited Dec. 6, 2008).

24. BARCELONA, *supra* note 14.

25. *Id.*

26. *Id.*

27. PATRICK, *supra* note 3, at 126-38.

28. *Id.* at 139.

29. *Id.* at 138.

30. *See* BARCELONA, *supra* note 14, at 35-48.

and least expensive form of remedial activity is the so-called "pump-and-treat" method, which involves removing contaminated groundwater, treating it at the surface and then returning it to the aquifer. The cost of these remedial efforts is often prohibitively high. Even using the cheaper "pump-and-treat" method, remediation at a single site can cost millions of dollars.[31] In addition, remedial measures may have adverse environmental consequences.[32] Physical removal of contaminated soil, for instance, may simply result in the transfer of contaminants to another site or another medium.[33]

Many of the sources of pollution discussed above are also a threat to surface water, such as rivers and lakes. The principal difference between surface and groundwater, and an area of particular cause for concern, is the speed of flow and mixing.[34] Depending on an area's geology, groundwater can take anything from one to several thousand years to flow just a few kilometers.[35] Rapid mixing, dilution, and dispersal of pollutants, which is a feature of surface water contamination, does not occur in groundwater, resulting in much lengthier persistence of pollutants and their deleterious effects. This problem, together with the costs, difficulties, and uncertain benefits of remediation, militates strongly in favor of taking preventative measures against groundwater pollution, rather than attempting to deal with the consequences of pollution after the fact.

Again, like rivers and other surface waters, many groundwater-bearing aquifers cross county, state or national boundaries.[36] For instance, the High Plains Aquifer stretches from New Mexico to Wyoming, covering 174,000 square miles and extending under parts of eight states.[37] Even where states rely on different

31. *See generally*, U.S. EPA, COST ANALYSES FOR SELECTED GROUNDWATER CLEANUP PROJECTS: PUMP AND TREAT SYSTEMS AND PERMEABLE REACTIVE BARRIERS (2001), *available at* http://www.cluin.org/download/remed/542R00013.pdf.

32. OFFICE OF TECH. ASSESSMENT, 1 PROTECTING THE NATION'S GROUNDWATER FROM CONTAMINATION 10 (1984), *available at* http://www.fas.org/ota/reports/8422.pdf.

33. *Id.*

34. PATRICK, *supra* note 3, at 36

35. William M. Alley et al., *Flow and Storage in Groundwater Systems*, 296 SCI. 1985, 1988 (2002).

36. William M. Alley, *Tracking U.S. Groundwater: Reserves for the Future*, ENVIRONMENT, Apr. 2006, at 10, 12 (2006); *See also* JAMES A. MILLER ET AL., U.S. Geological Survey, Groundwater Atlas of the United States (2000), *available at* http://capp.water.usgs.gov/gwa/gwa.html.

37. S.G. ROBSON AND E.R. BANTA, U.S. GEOLOGICAL SURVEY, GROUNDWATER ATLAS OF THE UNITED STATES: ARIZONA, COLORADO, NEW MEXICO, UTAH (1995), *reprinted in*

aquifers, contaminated groundwater can also cross between separate aquifers in a process known as "interaquifer exchange."[38] Thus, pollutants entering one state's groundwater supply can easily find their way into neighboring states. As a consequence, state-based efforts at protecting groundwater supplies, while valuable, cannot adequately solve the problem of groundwater contamination.[39]

The crucial role of groundwater in the nation's water supply, the cross-jurisdictional nature of groundwater resources, and the difficulties presented by remediation, all point to the necessity of a federal response to directly address groundwater contamination and pollution. Unfortunately, to date, Congress has treated the protection of groundwater as a peripheral issue, and federal regulation and protection of this key national resource has been uncoordinated and piecemeal.

III. FEDERAL REGULATION OF GROUNDWATER POLLUTION

A patchwork of federal and state legislation impacts efforts to protect groundwater resources within the United States. The four most significant federal statutes are: 1) the Clean Water Act (CWA);[40] 2) the Safe Drinking Water Act (SDWA);[41] 3) the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA);[42] and 4) the Resource Conservation Recovery Act (RCRA).[43] Despite this significant body of legislation addressing elements of groundwater pollution, federal protection for groundwater resources is neither adequate nor comprehensive.[44]

GROUNDWATER ATLAS OF THE UNITED STATES (2000), *supra* note 36, *available at* http://pubs.usgs.gov/ha/ha730/ch_c/index.html.

38. BARCELONA, *supra* note 14, at 3.

39. *See*, *e.g.*, John D. Leshy, *The Federal Role in Managing the Nation's Groundwater*, 11 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 1 (2004).

40. Clean Water Act (CWA), 33 U.S.C. §§ 1251–1387 (2006).

41. Safe Drinking Water Act (SDWA), 42 U.S.C. §§ 300f to -300j-26 (2006).

42. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601-9675 (2006).

43. Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901-6992k (2006). Many other pieces of federal legislation also touch on the protection of groundwater in some way. *See, e.g.*, Surface Mining Control and Reclamation Act (SMCRA), 30 U.S.C. §§ 1201-1328 (2006) (allowing for the designation of areas as unsuitable for mining where such operations may affect aquifers); Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. §§ 136-136y (2006) (mandating controls on the sale and use of pesticides, a common source of groundwater contamination).

44. *See* sources cited, *supra* note 7.

A. Clean Water Act

The goal of the CWA[45] is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[46] The CWA achieves this goal primarily by prohibiting discharges from point sources into the "waters of the United States" without a permit.[47] Regulations promulgated by the Environmental Protection Agency (EPA) define "waters of the United States," extending the CWA's protections to much of the nation's surface waters and wetlands, but not groundwater.[48] During early debates on water pollution, the authorizing committee for the CWA, the Senate Committee on Public Works, discussed proposals to extend the regulatory reach of the CWA to groundwater.[49] Unfortunately, the idea was ultimately rejected because "the jurisdiction regarding groundwaters is so complex and varied from State to State."[50] Limited support for the idea of protecting groundwater was maintained by the provision of grants for State programs aimed at reducing non-point source pollution.[51] A handful of States recognized the inadequacy of the CWA's limited jurisdiction and expressly included point source discharge to groundwater within their CWA-equivalent programs.[52]

Despite Congress's failure to address groundwater issues, environmental groups have sought to expand the CWA's jurisdiction to include groundwater, particularly where that groundwater feeds into "navigable waters." Until the Supreme Court's recent *Rapanos* decision,[53] they have had mixed success, with a majority of federal courts often preferring to await specific measures from Congress before placing groundwater under the protection of the CWA.[54]

45. 33 U.S.C. §§ 1251–1387 (2006).
46. *Id.* § 1251(a).
47. *Id.* §§ 1251(a), 1342.
48. *See* 40 C.F.R. § 122.2 (2008).
49. S. Rep. No. 92-414, at 3739 (1972).
50. *Id.*
51. 33 U.S.C. § 1329(i).
52. Connecticut, New York and Wisconsin have each adopted State Pollutant Discharge Elimination System (SPDES) programs which prohibit discharge of pollutants into "Waters of the State," and include underground water within the statutory definition of "Waters of the State." *See* CONN. GEN. STAT. §§ 22a-423, -427 (2008); N.Y. ENVTL. CONSERV. LAW §§ 17-0105, -0701 (2008); WIS. STAT. §§ 283.01, .31 (2008).
53. Rapanos v. United States, 547 U.S. 715 (2006) (plurality opinion).
54. *See, e.g.*, Vill. of Oconomowoc Lake v. Dayton Hudson Corp., 24 F.3d 962, 965 (7th Cir. 1994). The Seventh Circuit held that the lack of specific protections for groundwater in the Clean Water Act was "not an oversight" but an intentional exclu-

Prior to *Rapanos* a handful of courts did find that groundwater falls within the jurisdiction of the CWA. For example, a district court in Colorado held that a refinery's discharge that found its way into a nearby stream was prohibited by the CWA.[55] The refinery was not discharging directly into the stream itself, but into soil and groundwater.[56] The court chose to give the broadest interpretation to the policy goal of protecting the "integrity of the Nation's waters," when ruling that discharges that reached "navigable water" through groundwater were prohibited by the CWA.[57] A few other courts made similar rulings that prohibited discharges into groundwater that was tributary to navigable water, but did not extend protection to isolated groundwater bodies.[58]

In light of the *Rapanos* decision, courts may begin to look again at groundwater in relation to the CWA. The plurality opinion in *Rapanos* limited the jurisdiction of the CWA to waters that had a "continuous surface connection" with traditionally navigable water.[59] This requirement would seem to eliminate any protection for most groundwater bodies. By contrast, Justice Kennedy, in his concurring opinion, held that the CWA regulated waters that had a "significant nexus" with waters that are navigable in fact.[60] If a body of water "significantly affect[s] the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable,'" then it falls within the jurisdiction of the CWA.[61] Given the intimate relationship between groundwater and surface water, the "significant nexus" requirement holds out some hope that the CWA could protect many bodies of groundwater.

The Ninth Circuit Court of Appeals and a California district court have indeed used the language of *Rapanos* to regulate discharges of pollutants into groundwater, on the basis that such pollution significantly affects the integrity of navigable waters, creating the required nexus.[62] For example, in *Northern Califor-*

sion, therefore the CWA does not prohibit pollution of groundwater. *Id. See also* United States v. GAF Corp., 389 F. Supp. 1379 (S.D. Tex. 1975).

55. Sierra Club v. Colo. Refining Co., 838 F. Supp. 1428, 1434 (D. Colo. 1993).

56. *Id.*

57. *Id.*

58. *See, e.g.*, Quivira Min. Co. v. U.S. EPA, 765 F.2d 126 (10th Cir. 1985); McClellan Ecological Seepage Situation (MESS) v. Weinberger, 707 F. Supp. 1182 (E.D. Cal. 1988).

59. Rapanos v. United States, 547 U.S. 715, 742 (2006) (plurality opinion).

60. *Id.* at 779 (Kennedy, J., concurring).

61. *Id.* at 780.

62. N. Cal. River Watch v. City of Healdsburg, 496 F.3d 993, 1000 (9th Cir. 2007); Coldani v. Hamm, 2007 WL 2345016, at *7 (E.D. Cal. 2007).

nia River Watch, contaminants from a wastewater treatment pond were leaching into groundwater and then entering a nearby river.[63] This discharge was found to violate the CWA because there was a demonstrable "nexus" between the pond, groundwater, and river.[64] However, some circuits do not consider Justice Kennedy's concurring opinion in *Rapanos* to be controlling,[65] and the full implications of that complicated ruling have yet to be played out in most jurisdictions.

Without a clear jurisdictional reach, the CWA cannot provide effective regulation of groundwater pollution. In addition, it must also be remembered that the CWA focuses primarily on point sources.[66] Even where courts have sought to regulate pollution of groundwater using the CWA, non-point sources of pollution remain beyond the Act's jurisdiction. Thus, at least two significant barriers prevent the CWA regulating pollution of groundwater: the exclusion of groundwater from the regulatory definition of "waters of the United States" (i.e. the CWA's jurisdictional reach); and the CWA's almost exclusive focus on the regulation of point sources of pollution.

B. The Safe Drinking Water Act

Enacted in 1974 as a response to widespread media concern about water quality, the purpose of the Safe Drinking Water Act (SDWA) is to protect the public supply of drinking water.[67] EPA is charged, under the SDWA, with establishing limits (maximum contaminant levels, or 'MCL's) for chemicals that it believes pose a risk to public health.[68] Once a final MCL is in place, a public water supplier must notify its customers, and potentially face penalties, if the maximum level of a chemical is exceeded.[69] In addition, the SDWA provides explicit protection for groundwater in provisions prohibiting underground injection (a waste disposal technique). Permits for underground injection will only be granted

63. *N. Cal. River Watch*, 496 F.3d at 996-97.

64. *Id.* at 1002-03.

65. *See, e.g.*, United States v. Johnson, 467 F.3d 56, 63-64 (1st Cir. 2006) (ruling that the federal government can establish CWA jurisdiction if it can meet the standards set out in *either* the plurality opinion or Justice Kennedy's concurring opinion).

66. *See* 33 U.S.C. §§ 1251(a), 1342 (2006).

67. 42 U.S.C. §§ 300f to -300j-26 (2006); *See also* James L. Agee, *Protecting America's Drinking Water: Our Responsibilities Under the Safe Drinking Water Act*, EPA J., Mar. 1975, *available at* http://www.epa.gov/history/topics/sdwa/07.htm.

68. 42 U.S.C. § 300g-1.

69. *Id.* § 300g-3(b).

where the practice does not endanger public drinking water supplies either by creating a health hazard, or by threatening to violate an MCL.[70] The SDWA also makes federal financial aid available to states for the development of groundwater protection programs.[71]

The use of MCL's as a central method of implementation poses a particular problem for managing groundwater pollution. The number of chemicals that are introduced into the environment grows dramatically each year, many of which can find their way into groundwater.[72] This presents a significant, if not insurmountable, challenge to EPA regulators, compounded by uncertainty regarding potential adverse health effects of those new chemicals.[73] In the thirty years since the enactment of the SDWA, the EPA has established MCL's for just eighty-seven contaminants.[74] In addition, MCL's, and the SDWA generally, tend to focus attention on end-user safety and technological solutions to contamination.[75] While this approach does help protect human health, it relies heavily on continued advances in technology to keep up with an expanding range of chemical contaminants, and it ignores potential ecosystem impacts of pollution.

With the CWA lacking jurisdiction over groundwater, the SDWA has been acknowledged as the primary vehicle for the EPA's "Ground Water Protection Strategy."[76] However, while the SDWA does go some way towards establishing protections for groundwater, it only regulates the input of pollutants from a single activity – underground injection – and those minimal protections only apply to groundwater that is utilized by public water suppliers.[77] Private underground water supplies, and currently unutilized groundwater that may nevertheless affect the natural environment, are left without any protection under this Act.[78]

70. *See id.* §§ 300g-9(a), 300j-12(a)(1)(G)(i).

71. *Id.* § 300h-8.

72. PATRICK, *supra* note 3, at 140.

73. William E. Cox, *Evolution of the Safe Drinking Water Act: A Search for Effective Quality Assurance Strategies and Workable Concepts of Federalism*, 21 WM. & MARY ENVTL. L. & POL'Y REV. 69, 161 (1997).

74. *See* 40 CFR §§ 141.61-.66 (2008).

75. *See, e.g.*, 42 U.S.C. § 300g-1(b)(7)(C)(ii) (requiring the EPA to establish regulations for the disinfection of water coming from groundwater supplies, rather than taking steps to prevent contamination); *See also* Cox, *supra* note 73, at 153-54.

76. Cox, *supra* note 73, at 149.

77. *See* 42 U.S.C. § 300g (2006).

78. *See* Frampton, *supra* note 7, at 144.

C. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)[79] was enacted in 1980 to tackle an estimated 50,000 uncontrolled hazardous waste sites in the United States.[80] The twin goals of CERCLA were to encourage prompt cleanup of hazardous spills, and to place financial responsibility on the parties responsible for the spill.[81] Congress sought to achieve these goals by providing broad authority to the EPA to respond to and manage hazardous waste spills, leaks, or other releases.[82] CERCLA applies where hazardous wastes have been disposed and are now posing a threat to human health, which most often includes former industrial sites, landfills, and mines.[83]

The main role of CERCLA is remedial. The act makes almost no conduct unlawful.[84] Instead, it provides that when a spill occurs the EPA can take remedial action itself, or order a "potentially responsible party" (PRP) to do so.[85] The costs of remediation are then born either by the PRP, if one has been identified, or by a trust called the 'Superfund.'[86] CERCLA applies strict liability to PRP's, allowing for only a handful of statutory defenses.[87]

CERCLA has successfully stimulated the EPA and private parties to take remedial action at contaminated sites that pose a threat to groundwater.[88] However, CERCLA's implementation has been marked by delays. One study found that an average of eleven years was required for the completion of a cleanup operation.[89] The Act is also strictly backward looking, although future spills are managed to some degree by the Resource Conservation

79. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§ 9601-9675 (2006).

80. *See* H.R. Rep. No. 96-1016(I), at 18 (1980), *reprinted in* 1980 U.S.C.C.A.N. 6119, 6120.

81. *See* Aviall Servs., Inc. v. Cooper Indus., Inc., 312 F.3d 677, 681 (5th Cir. 2002) (en banc), *rev'd*, 543 U.S. 157 (2004).

82. *See* B.F. Goodrich Co. v. Murtha, 754 F. Supp. 960, 963 (D. Conn. 1991).

83. Susan R. Poulter, *Cleanup and Restoration: Who Should Pay?*, 18 J. LAND RESOURCES & ENVTL. L. 77, 84 (1998).

84. John C. Cruden, *CERCLA Overview, in* ALI-ABA COURSEBOOK ON ENVIRONMENTAL AND TOXIC TORT LITIGATION 557, 564 (2007).

85. 42 U.S.C. § 9604(a)(1) (2006).

86. *Id.* § 9607(a).

87. *Id.* § 9607(b).

88. Poulter, *supra* note 83, at 89.

89. *See* KATHERINE N. PROBST & PAUL R. PORTNEY, ASSIGNING LIABILITY FOR SUPERFUND CLEANUPS: AN ANALYSIS OF POLICY OPTIONS 20 (1992).

and Recovery Act, discussed below.[90] CERCLA works to clean-up sources of groundwater pollution, but does little to regulate hazardous waste sites that may pose threats to groundwater supplies in the future.[91] While hazardous waste spills do represent a threat to groundwater resources, CERCLA's provisions respond to pollution after the fact, and are completely inapplicable to other sources of groundwater contamination.

D. The Resource Conservation and Recovery Act

Congress enacted the Resource Conservation and Recovery Act (RCRA) in 1976 as an amendment to the Solid Waste Disposal Act.[92] The goal of the RCRA is to manage solid waste and to prevent hazardous spills.[93] The RCRA first came into effect in 1980, with a primarily forward-looking approach to preventing future hazardous waste problems.[94] Later amendments expanded the scope of the Act to include requirements for corrective action following spills at regulated hazardous waste facilities.[95] Although the RCRA regulates only "solid waste," the term is flexible enough to encompass almost any waste material.[96]

The basic mechanism used by RCRA is a comprehensive "cradle-to-grave" program, regulated and monitored by the EPA.[97] Generators and transporters of hazardous waste are required to handle the waste according to EPA regulations, and fulfill strict record keeping requirements.[98] In addition, those that treat, store or dispose of hazardous waste (TSD's) are required to obtain permits for their facilities.[99] When a permitted hazardous waste facility closes, the operator must go through a rigorous clean-up

90. *See, e.g.*, Stanley A. Millan, *Contemporary CERCLA: Reversals of Fortune and Black Holes*, 16 FORDHAM ENVTL. L. REV. 183, 187 (2005).

91. *Id.*

92. Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901-6992k (2007).

93. LYNN L. BERGESON ET AL., THE RCRA PRACTICE MANUAL 1 (Theodore L. Garrett ed., 2d ed. 2004).

94. *See* Am. Iron & Steel Inst. v. U.S. EPA, 886 F.2d 390, 393 (D.C. Cir. 1989); *See also* Timothy O. Schimpf, *Unleash RCRA! Letting Loose the Corrective Action Process of RCRA Can Change the World*, 29 WM. & MARY ENVTL. L. & POL'Y REV. 481, 483 (2005).

95. BERGESON, *supra* note 93.

96. "The term 'solid waste' means . . . discarded material, including solid, liquid, semisolid, or contained gaseous material." 42 U.S.C. § 6903(27) (2006).

97. *See* Joseph F. Guida, *Corrective Action Under the Resource Conservation and Recovery Act*, 44 SW. L.J. 1331, 1334 (1991).

98. 40 C.F.R. §§ 262-63 (2008).

99. 40 C.F.R. §§ 124, 264-265 (2008).

process to ensure no contamination of groundwater or soil at the site.[100]

Among RCRA requirements that are of particular concern to a discussion of groundwater contamination is the Act's management of "contaminants [of] drinking water from underground and surface supplies."[101] In particular, Subchapter IX provides regulations for the storage of hazardous waste in underground storage tanks (UST's).[102] Leaking UST's are a significant source of groundwater contamination, with the EPA registering over 7,000 new leaks in the past year alone.[103] The RCRA aims to tackle the problem by requiring that all new UST's must be constructed according to national regulations, and include leak detection and overflow devices.[104] The RCRA also provides for groundwater monitoring, and remedial action, for land-based hazardous waste units, such as landfills or surface impoundments.[105]

Described by one commentator as a "dynamic program" that forces hazardous waste facilities to act responsibly, the RCRA plays a vital role in environmental protection and regulation.[106] By regulating UST's, and other hazardous waste sites, the RCRA plays a major role in limiting contamination of groundwater supplies. However, and critically, hazardous waste leaks are just a small part of a much larger universe of groundwater pollution sources, many of which currently remain unregulated.

E. Summary

With regard to groundwater pollution, current federal legislation only addresses narrow areas of concern, such as underground storage tanks, or current public water supplies. Through the exclusion of groundwater from broad-based legislation like the Clean Water Act, and the provision of federal grants for State programs, Congress has both implicitly and explicitly left the protection of groundwater resources to the States. The extraction of groundwater and surface water has consistently increased over recent years, responding to growing demand from industry and the

100. 40 C.F.R. § 264 (2008).
101. 42 U.S.C. § 6901(b)(4) (2006).
102. *See id.* §§ 6991-6991m.
103. Memorandum from Cliff Rothenstein, Director, EPA Office of Underground Storage Tanks, to UST/ LUST Regional Division Directors (Dec. 5 2007), *available at* http://www.epa.gov/OUST/cat/ca_07_34.pdf.
104. 40 C.F.R §§ 280.20, 280.40-42 (2008).
105. 42 U.S.C. § 6925(j)(6)(B) (2006).
106. *See* Schimpf, *supra* note 94, at 509-10.

public.[107] Continuing economic and population expansion in low rainfall areas, particularly in the South-West, makes it likely that such a trend will continue, with a possible greater focus on groundwater extraction.[108] Currently un-, or under-, utilized groundwater resources will become ever more important, and the challenges posed by contamination of these resources stretch beyond state boundaries and jurisdiction, yet they remain relatively unprotected by federal legislation.

IV. A EUROPEAN MODEL: THE DIRECTIVE ON THE PROTECTION OF GROUNDWATER

Europe suffers many of the groundwater pollution problems experienced by the United States: fertilizer used in intensive agriculture has caused a third of Europe's groundwater bodies to have areas where nitrogen is in excess of safe levels year round;[109] twelve countries within the European Union (EU) have reported serious problems with heavy metal contamination of groundwater from heavy industry;[110] and there have been reports of widespread incidents of hydrocarbons (oil, gasoline, etc.)[111] and harmful bacteria[112] contaminating groundwater, particularly in Eastern Europe.

As in the United States, an often dense population relies heavily on groundwater resources. Groundwater extraction accounts for eighteen percent of all water used in the EU.[113] On a national level, groundwater may play an even more significant role. All of Denmark's public drinking water and over ninety-nine percent of Austria's public drinking water is supplied by groundwater extraction.[114] In the Mediterranean region, groundwater plays an equally significant role in supplying water for irriga-

107. *See* HUTSON, *supra* note 1, at 40 tbl.14.

108. Jon Unruh & Diana Liverman, U.S. Geological Survey, *Changing Water Use and Demand in the Southwest* (2003), http://geochange.er.usgs.gov/sw/impacts/society/water_demand.

109. *See* STEVE NIXON ET AL., EUROPEAN ENV'T AGENCY, EUROPE'S WATER: AN INDICATOR-BASED ASSESSMENT 30 (2003), *available at* http://reports.eea.europa.eu/topic_report_2003_1/en/Topic_1_2003_web.pdf.

110. *See* ANDREAS SCHEIDLEDER ET AL., EUROPEAN ENV'T AGENCY, GROUNDWATER QUALITY AND QUANTITY IN EUROPE 91 tbl.5.16, 92 (1999), http://reports.eea.europa.eu/groundwater07012000/en.

111. *See id.* at 91.

112. *See id.* at 92; *See also* NIXON, *supra* note 109, at 45.

113. SCHEIDLEDER, *supra* note 110, at 40.

114. *Id.* at 42 tbl.4.2.

tion.[115] Over-extraction is becoming a major problem, particularly in coastal areas where low groundwater levels allow salt water intrusion.[116] Malta, for example, can no longer use most of its groundwater because of salt contamination, and the island now relies on desalination plants for most of its water supply.[117]

Recognizing the importance of groundwater as a vital natural resource and the complex threats facing groundwater integrity across the EU, the European Council and Parliament, on December 12, 2006, enacted the Groundwater Directive on the Protection of Groundwater Against Pollution and Deterioration.[118] This new Groundwater Directive replaces and enhances an earlier directive[119] while addressing both the pollution and deterioration of groundwater resources.[120]

As a "daughter directive" of the Water Framework Directive,[121] the Groundwater Directive operates within the structure of an existing body of legislation governing water policy as a whole. The Water Framework Directive seeks, inter alia, "the objective of good groundwater chemical status."[122] This target is to be achieved by establishing criteria for assessing "good groundwater chemical status" and by monitoring and responding to "upward trends" in groundwater pollution.[123] The Groundwater Directive meets these objectives in part by setting specific European Union-wide limits on certain pollutants, in particular nitrates and pesticides, but also by delegating significant regulatory authority and responsibility to the EU Member States. As a comprehensive federal-style approach in response to a similar range of issues, the Groundwater Directive may be a useful model to assist in the development of a federal solution to the problem of groundwater pollution in the United States.

115. *See id.* at 44.

116. *See id.* at 96-98.

117. EUROPEAN ENV'T AGENCY, THE EUROPEAN ENVIRONMENT: STATE AND OUTLOOK 2005 117 (2005), *available at* http://reports.eea.europa.eu/state_of_environment_report_2005_1/en/SOER2005_all.pdf.

118. *See* Groundwater Directive, *supra* note 4.

119. *See* Council Directive 80/68, Protection of Groundwater Against Pollution Caused by Certain Dangerous Substances, 1980 O.J. (L 020) 43 (EEC) [hereinafter 1980 Groundwater Directive].

120. *See* Press Release, European Parliament, Cleaner Groundwater on the Way - Conciliation Approved (Dec. 12, 2006), *available at* http://www.europarl.europa.eu (follow "Press Service" hyperlink; then follow "Info" hyperlink).

121. *See* Georgina Crowhurst, *The Groundwater Daughter Directive: A UK Perspective*, 16(7) EUR. ENVTL. LAW REV. 203, 203 (2007).

122. Water Framework Directive, *supra* note 5, art. 17.

123. *Id.*

A. Groundwater as a Key Element of European Water Policy

The Groundwater Directive emerged as a so-called "daughter directive" of the 2000 Water Framework Directive.[124] The Water Framework Directive came into effect in 2003, and aims to protect all European Union waters, including groundwater.[125] Enacted to consolidate and enhance over thirty years of European legislation on water resources, an important premise of the Water Framework Directive is that it should at least achieve an equal level of protection as existing European regulations.[126] However, while the Water Framework Directive does reflect previous European Union directives, it has also introduced several novel approaches, and goes beyond the requirements of prior regulations.[127] Some commentators suggest that this unification and expansion of Europe-wide water regulations should allow for easier monitoring and enforcement.[128]

Groundwater protection, as noted above, is one of the central elements of the Water Framework Directive. Crucially, one of the Water Framework Directive's key goals is the progressive reduction of groundwater pollution.[129] The Water Framework Directive presumes that groundwater should be free from contaminants wherever possible, and sets as an environmental objective the reversal of groundwater pollution caused by human activity.[130] To achieve this objective, the Water Framework Directive prohibits, with limited exceptions, direct discharge into groundwater.[131] In addition, member States must, inter alia, delineate groundwater bodies, identify groundwater bodies at risk, and establish a groundwater monitoring program to track indirect discharges.[132] They must also develop and implement policies to actively reverse sustained increases in the presence of groundwater contami-

124. *See generally id.* art. 17; *See also* Crowhurst, *supra* note 121.
125. *Id.* art. 1.
126. *See id.* recital 51.
127. *See* William Howarth, *Water Quality and Land Use Regulation Under the Water Framework Directive*, 23 PACE ENVTL. L. REV. 351, 367 (2006).
128. *See* Danielle Urban, *European Union Framework Directive*, 2000 COLO. J. INT'L ENVTL. L. & POL'Y 193, 193-94 (2000).
129. Water Framework Directive, *supra* note 5, art. 4(b)(iii).
130. *Id.*; *See also* Urban, *supra* note 128, at 196.
131. *See* Water Framework Directive, *supra* note 5, art. 11(3)(j).
132. *Id.* art. 4(1)(b); *See also* Philippe Quevauviller, *EU Groundwater Legislative Framework*, *in* EUROPEAN GROUNDWATER CONFERENCE 2006 22, 24, *available at* http://www.umweltbundesamt.at/fileadmin/site/umweltthemen/wasser/Grundwasser/conference/Abstracts_Presentations/1_3_Quevauviller.pdf.

nants.[133] Recognizing the difficulty of fully meeting these requirements, the directive allows a lengthy timeline for compliance, of up to fifteen years after the directive's entry into force.[134] By that deadline, Member States are expected to have achieved "good groundwater status."[135]

Among the new policy ideas implemented by the Water Framework Directive is an innovative approach to managing groundwater bodies (and surface water bodies) to achieve the objectives noted above. Traditional administrative and political boundaries have been rejected; instead, the basis of water management is the river basin.[136] Although the concept of managing water in this way is not unique within the European Union, prior to the entry into force of the Water Framework Directive, it was not widespread.[137] To facilitate management, river basins are divided between "surface water" and "groundwater" each of which has particular environmental objectives that must be met.[138] Additional environmental objectives exist for areas that have been designated for the protection of endangered or economically important species, and for water that is intended for human consumption.[139] EU Member States are to develop management plans for each river basin, detailing exactly how those objectives will be met.[140]

Some environmental organizations have criticized the Water Framework Directive for what they view as its weak protec-

133. Water Framework Directive, *supra* note 5, art. 4(1)(b)(iii).

134. *Id.* art. 4(1)(b)(ii).

135. *Id.* "Good groundwater status" is both a quantitative and qualitative determination, as the Water Framework Directive is concerned with both the limiting or preventing groundwater pollution and maintaining a "sufficient supply" of groundwater for human consumption. *See id*. arts. 1(d)-(e), 2(20).

136. *See* Urban, *supra* note 128, at 195.

137. *Id.* The International Commission for the Protection of the Rhine and the International Commission for the Protection of the Danube River are the best-known European examples of river basin management that pre-date the Water Framework Directive. *See* Convention on Cooperation for the Protection and Sustainable use of the Danube River, art. 2, June 29, 1994, *reprinted in* 1997 O.J. (L 342) 19, *available at* http://www.icpdr.org/icpdr-pages/legal.htm (locate the "Legal Documents" heading; then follow the "Danube River Protection Convention" hyperlink); Convention on the Protection of the Rhine, art. 2-3, April 12, 1999, *reprinted in* 2000 O.J. (L 289) 31, *available at* http://www.iksr.org/index.php?id=327 (follow the "Rhine Convention" hyperlink on the left; then follow the "Convention on the Protection of the Rhine" pdf. hyperlink).

138. *See* Water Framework Directive, *supra* note 5, art. 4.

139. *Id.*; *See also id.* annex IV (defining those "Protected Areas" subject to more stringent environmental objectives).

140. *Id.* arts. 5, 11.

tions.[141] However, as the name suggests, the Water Framework Directive is only intended to provide a framework for future European and national legislation. More critically, the directive depends heavily on Member State implementation, monitoring, and reporting to achieve its goals.[142] Directives are legally binding on Member States, and there is a possibility of heavy penalties for those found in violation of a directive by the European Court of Justice.[143] However with particular reference to groundwater, the Water Framework Directive has yet to become fully operational, and it remains to be seen if Member States possess the necessary political will to fully implement this Directive.[144]

B. Development of the Groundwater Directive

Concern regarding the pollution of groundwater led to the adoption of a European Groundwater Directive in 1980.[145] This early directive contained provisions prohibiting the discharge of hazardous "List 1" chemicals, and limiting the discharge of less harmful "List 2" chemicals.[146] A variety of authorization procedures and derogation clauses minimized the directive's impact.[147] This early attempt to tackle groundwater issues, which has been criticized by some commentators as both needlessly complex and weak,[148] will be repealed under the Water Framework Directive by 2013.[149] At the same time as repealing the 1980 Directive, the Water Framework Directive also paved the way for the 2006 Groundwater Directive, by requiring the European Parliament and Council to adopt new measures to tackle groundwater pollution.[150]

The new Groundwater Directive was adopted by the European Parliament and Council in December 2006 after three years of debate and negotiations.[151] The new directive "considerably ex-

141. *See* Urban, *supra* note 128, at 200.
142. *See id.* at 195.
143. Treaty Establishing the European Community, Dec. 24, 2002, 2002 O.J. (C 325) 33, 125-126 (allowing for a lump sum penalty payment if the European Court of Justice finds a Member State has failed to comply with a judgment).
144. LUDWIG KRÄMER, EC ENVIRONMENTAL LAW 279, 417-24 (6th ed. 2007).
145. *See* Quevauviller, *supra* note 132, at 22.
146. *See* 1980 Groundwater Directive, *supra* note 119, art. 3.
147. *See* Quevauviller, *supra* note 132, at 22.
148. *See* PASCALE KROMAREK, FEDERAL REPUBLIC OF GERMANY: WATER AND WASTE: A STUDY OF THE IMPLEMENTATION OF THE EEC DIRECTIVES 80-81 (1986).
149. Water Framework Directive, *supra* note 5, art. 22(2).
150. *Id.* art. 17(1).
151. Crowhurst, *supra* note 121, at 203.

tends the scope of [existing law],"[152] and provides specific regulations and guidance to Member States on the implementing effective groundwater protection policies.[153] One key expansion, in response to the concerns of many members of the European Parliament, was to include the objective of protecting groundwater "from deterioration *and* chemical pollution," rather than chemical pollution alone.[154] In addition, unlike the protection of the CWA in the United States, which at best covers only groundwater tributary to navigable surface waters,[155] the Groundwater Directive expressly "aims to prevent the deterioration of the status of *all bodies of groundwater*."[156]

C. "Pillars" of the Groundwater Directive

The Groundwater Directive adopts three main elements (or "pillars") to achieve the European Parliaments objectives described above: 1) criteria for assessing groundwater chemical status; 2) criteria to identify upward trends in groundwater pollution; and 3) requirements to prevent or limit pollutant inputs to groundwater.[157] Member States should have domestic legislation in place incorporating these pillars by 2009.[158]

1. Assessing Groundwater Status

The Groundwater Directive establishes two separate pollutant limits to be used by Member States in assessing the status of a particular body of groundwater: "groundwater quality standards" and "threshold values."[159]

Groundwater quality standards are expressed as a "concentration of a particular pollutant, group of pollutants or indicator of

152. Quevauviller, *supra* note 132, at 23.

153. *See generally* Groundwater Directive, *supra* note 4.

154. Groundwater Directive, *supra* note 4, recital 1 (emphasis added). The Water Framework Directive separately addresses concerns regarding the quantity, rather than the quality, of groundwater bodies. *See* Water Framework Directive, *supra* note 5, art. 4(1)(b)(ii).

155. *See supra* Part III(a).

156. Groundwater Directive, *supra* note 4, art. 1(2) (emphasis added).

157. *See generally* Groundwater Directive, *supra* note 4; *See also* Crowhurst, *supra* note 121, at 204-05.

158. Groundwater Directive, *supra* note 4, art. 12. Between 2009 and 2013, when the 1980 Groundwater Directive will finally be repealed, new authorizations under the 1980 directive must take into consideration the main requirements of the 2006 directive. *Id.* art. 7.

159. Groundwater Directive, *supra* note 4, art. 3(1).

pollution in groundwater."[160] These standards limit chemicals that are harmful to human health, and are established by the directive itself.[161] Currently, groundwater quality standards limit only pesticides and nitrates, reflecting the prevalence of these pollutants in groundwater supplies.[162] Groundwater quality standards apply across the European Union; however, more rigorous standards are to be developed in locations where the quality standards are insufficient to meet the Water Framework Directive's environmental objectives.[163]

In contrast, most pollutants are required to be limited according to threshold values established by the Member States themselves.[164] These standards apply to any other pollutant that contributes to a situation in which one or more bodies of groundwater are at risk of "failing to achieve good groundwater chemical status."[165] The Groundwater Directive includes a minimum list of pollutants for which Member States must establish threshold values, but this list is not expected to be exhaustive.[166]

When a Member State begins the process of establishing threshold values, they must take into consideration a variety of factors stipulated by the directive as the basis for their decision-making.[167] These factors include qualities intrinsic to particular pollutants, such as pollutant toxicity, but also include local factors such as the hydro-geological characteristics of a groundwater body, the water's potential uses, interactions with surface ecosystems, and the presence of naturally occurring contaminants.[168] Thus, although threshold values may be established at the national level, the directive allows those values to vary between river basins.[169] Member States must adopt threshold values by December 2008,[170] and are required to amend threshold values to reflect any new information they later receive regarding a particular pollutant.[171]

160. *Id.* art. 2(1)
161. *Id.* arts. 2(1), 3(1)(a).
162. *Id.* annex I(1).
163. *Id.* annex I(3).
164. *Id.* art. 3(1)(b).
165. *Id.* annex II pt. A.
166. *Id.* annex II pt. B.
167. *See id.* art. 3(1)(b), annex II pt. A.
168. *Id.* annex II pt. A.
169. *Id.* art. 3(2). Member States may also establish threshold values for any part of an international river basin within their territory. *Id.*
170. *Id.* art. 3(5).
171. *Id.* art. 3(6).

If an aquifer is found to contain levels of a pollutant exceeding either groundwater quality standards or threshold values, it will be considered to be at risk of "failing to achieve good groundwater chemical status" (the main objective of the Groundwater Directive).[172] In addition, an aquifer may violate either limitation and still retain "good chemical status" if concentrations of pollutants do not threaten to cause a breach of the Water Framework Directive's environmental objectives.[173] Alternatively, the water body may still be classified as of "good chemical status" if an assessment demonstrates that there is no significant environmental risk.[174] However, at monitoring points where a quality standard or threshold value has been exceeded, Member States must take any measures necessary to protect both aquatic or terrestrial ecosystems, and human uses.[175]

2. Identifying and Reversing Upward Trends

Under the Water Framework Directive, Member States should have established programs to monitor the chemical status of groundwater bodies.[176] These monitoring programs should be utilized to identify any "significant and sustained upward trend in concentrations of pollutants" in groundwater identified as at risk.[177] Member States are required to take action to reverse any upward trends in groundwater pollution "which present a significant risk of harm to the quality of aquatic ecosystems or terrestrial ecosystems, to human health, or to actual or potential legitimate uses of the water environment."[178]

At a minimum, Member States must implement a program of measures outlined in the Water Framework Directive[179] whenever an upward trend passes a baseline of seventy-five percent of the quality standard or threshold value for a particular pollutant.[180] However, Member States may adopt an alternative starting point for trend reversal in a particular groundwater body when:

172. *See id.* art. 4(2).
173. *See id.*; *See also* Water Framework Directive, *supra* note 5, annex V tbl.2.3.2.
174. *Id.* art. 4(2)(c)(i).
175. *Id.* art. 4(5).
176. Water Framework Directive, *supra* note 5, art. 8(1).
177. Groundwater Directive, *supra* note 4, art. 5(1).
178. *Id.* art. 5(2).
179. *See* Water Framework Directive, *supra* note 5, art. 11.
180. Groundwater Directive, *supra* note 4, annex IV pt. B(1).

1) An earlier starting point is necessary to cost-effectively prevent or mitigate detrimental changes to groundwater quality;[181] or

2) Detection of an upward trend in a particular pollutant is impossible at seventy-five percent of the quality standard or threshold value;[182] or

3) The characteristics of an upward trend indicate that a later starting point for reversal would still allow the most cost-effective prevention or mitigation of harmful changes to groundwater quality.[183]

3. Preventing or Limiting Input of Pollutants

The central foundation of the Groundwater Directive is the adoption and integration of the precautionary principle of environmental law. This "pillar" of the Groundwater Directive instructs Member States to take the practical steps necessary to actually prevent groundwater pollution. The Groundwater Directive requires that pollution of groundwater should be avoided wherever possible, regardless of quality standards or threshold values.[184] Member States are to take "all measures necessary to prevent inputs into groundwater of *any* hazardous substances."[185] Similarly, policies must be established that prevent inputs of non-hazardous pollutants that might lead to a deterioration of groundwater chemical status.[186] Both traditional point sources and "diffuse" (i.e. non-point) sources of pollution are also to be restricted.[187] When developing these necessary measures, Member States are required to take into consideration "at least" best established environmental practices and techniques.[188]

The Groundwater Directive permits a number of exceptions to the rule of limiting or preventing pollution. Member States may exempt sources of pollution from measures taken to prevent pollution where:

1) They are of a quantity that is too small to pose a present or future danger to the groundwater body in question;[189]

181. *Id.* annex IV pt. B(1)(a).
182. *Id.* annex IV pt. B(1)(b).
183. *Id.* annex IV pt. B(1)(c).
184. *Id.* art. 6(1).
185. *Id.* art. 6(1)(a) (emphasis added).
186. *Id.* art. 6(1)(b).
187. *Id.* art. 6(2).
188. *Id.* art. 6(1)(b).
189. *Id.* art. 6(3)(b).

2) They are the result of accidents or natural causes that "could not reasonably have been foreseen, avoided or mitigated";[190]

3) They are the result of activities authorized by other European Union directives, particularly the Water Framework Directive;[191]

4) Prevention would require measures that would increase the risk of harm to humans or the environment;[192]

5) They are the result of surface activities designed to mitigate the effect of floods or drought.[193]

In all of these circumstances, the Member State may only permit the exemption if adequate monitoring of the groundwater body exists to help authorities control and mitigate any harmful effects.[194]

D. Summary

The Groundwater Directive lays out a practical approach to regulation of pollution, aiming to achieve the Water Framework Framework's policy objective of "good groundwater status" for all EU groundwater bodies.[195] With the exception of nitrates and pesticides, the Groundwater Directive does not reach this target by imposing uniform standards applicable throughout Europe. Instead, the Groundwater Directive coordinates methods for establishing standards based on local conditions, delegating to individual Member States the significant responsibility for regulating contaminants.[196] It is too early to measure the success of this approach as deadlines for implementation have yet to be reached.[197] Nevertheless, as a comprehensive approach to groundwater pollution applying a familiar federal-style of regulation, the Groundwater Directive provides an excellent starting point and model for the development of Federal groundwater legislation in the United States.

190. *Id.* art. 6(3)(c).
191. *Id.* art. 6(3)(a), (d).
192. *Id.* art. 6(3)(e)(i).
193. *Id.* art. 6(3)(f).
194. *Id.* art. 6(3).
195. *See* Water Framework Directive, *supra* note 5, art. 4(1)(b)(ii).
196. *See* Crowhurst, *supra* note 121, at 207.
197. *See, e.g.*, Groundwater Directive, *supra* note 4, art. 3(5).

V. POSSIBLE APPLICATION OF THE EU DIRECTIVE TO U.S. POLICY AND LEGISLATION

As the U.S. population expands, and changing rainfall patterns bring prolonged droughts to many areas, groundwater will become an increasingly vital, and threatened, natural resource.[198] Considering the importance of groundwater, the variety of contaminant sources threatening supplies, and the cross-jurisdictional nature of those threats, a comprehensive federal approach to protecting groundwater resources is essential. In contrast to current federal legislation in the United States, the European Groundwater Directive provides such a comprehensive and relatively simple framework for regulating, preventing, and reversing groundwater pollution. By adapting the Groundwater Directive to the legal context of U.S. federal legislation, Congress would fill an important gap in American environmental law.

A. Scope of Legislation

European Union directives are not bound by the same constitutional restraints as federal legislation in the United States. The Groundwater Directive has jurisdiction over every body of groundwater in the European Union.[199] However, even the most expansive Ninth Circuit interpretations of the Clean Water Act have excluded "isolated groundwater."[200] Most courts have interpreted the jurisdiction of federal environmental legislation using the Commerce Clause.[201] Although this grants environmental laws an expansive reach, it is not without its limits.[202] The scope of federal

198. *See* U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS ON THE UNITED STATES 421-26 (2000), *available at* http://www.usgcrp.gov/usgcrp/Library/nationalassessment/14Water.pdf.

199. *See* Groundwater Directive, *supra* note 4, art. 1(2) (stating that "This Directive . . . aims to prevent the deterioration of the status of *all bodies of groundwater*") (emphasis added).

200. *See, e.g.*, Wash. Wilderness Coal. v. Hecla Mining Co., 870 F. Supp. 983, 989-90 (E.D. Wash. 1994) (ruling that "Congress did not intend to include isolated groundwater as part of the 'navigable waters'" regulated by the CWA, but did intend the CWA to apply to discharges of pollutants that reach navigable waters through groundwater).

201. *See, e.g.*, Quivira Min. Co. v. U.S. EPA, 765 F.2d 126, 129-30 (10th Cir. 1985) (ruling that an arroyo with only intermittent flow, but continuous connection, through underground aquifers, with a navigable stream, had sufficient impact on interstate commerce to satisfy the commerce clause).

202. Solid Waste Agency of N. Cook County v. U.S. Army Corps of Eng'rs, 531 U.S. 159, 161 (2001) (ruling that an isolated gravel pit does not have sufficient impact on

groundwater legislation would therefore be limited to all interstate groundwater bodies and those bodies that are used in, or may affect, interstate commerce.[203] Assuming federal courts adopt Justice Kennedy's concurring opinion in *Rapanos*,[204] jurisdiction could also extend over groundwater bodies with a "nexus" to navigable water.

Ideally, new federal legislation would follow the Groundwater Directive by not limiting its scope to protect currently utilized groundwater resource as well as groundwater vital to "aquatic ecosystems [and] terrestrial ecosystems."[205] Under the existing Safe Drinking Water Act, for instance, only groundwater currently exploited for human consumption falls with the scope of legislative protections.[206] In contrast, the Groundwater Directive, by not limiting its scope in this manner, serves both to protect surface ecosystems reliant on tributary groundwater and to preserve potential future supplies for human use. This is an excellent example of the application of the precautionary principle, which is often applied in the development of European environmental legislation, and is particularly appropriate when considering such a fragile resource.[207]

B. A Federal Approach

The absence of comprehensive groundwater pollutant standards and central regulation is a significant aspect of the Groundwater Directive, and one that lends itself to application in the United States. Although some key groundwater pollutants — nitrates and pesticides — are directly limited by the directive, "Member States . . . draw up threshold values for [other] relevant groundwater pollutants" on the basis of criteria reflecting local conditions as well as the toxicity of the contaminants.[208] This "fed-

interstate commerce to satisfy the commerce clause and fall within the jurisdiction of the CWA, simply because it is a habitat for migratory birds).

203. The EPA's definition of "Waters of the United States" for jurisdictional purposes under the Clean Water Act, could serve as an adequate model for establishing the reach of new federal groundwater legislation. *See* 40 C.F.R. § 122.2 (2008).

204. Rapanos v. United States, 126 S.Ct. 2208, 2236-52 (2006) (Kennedy, J., concurring).

205. Groundwater Directive, *supra* note 4, art. 4(5).

206. *See* 42 U.S.C. § 300g (2006).

207. *See generally Communication from the Commission on the Precautionary Principle*, COM (2000) 1 final (Feb. 2, 2000), *available at* http://ec.europa.eu/environment/docum/20001_en.htm.

208. Opinion of the Committee of the Regions on the 'proposal for a directive of the European Parliament and of the Council on the protection of groundwater against

eral" approach mirrors, to a certain extent, the approach taken by many federal environmental statutes.

The Clean Water Act's water quality standards are a clear example of a federal framework that leaves key aspects of regulation and implementation to the states, and that could be adjusted to cover groundwater bodies. However, the Groundwater Directive and the Water Framework Directive take a somewhat different approach that may prove useful. Rather than aiming to regulate the mode of groundwater pollution, as in federal legislation like the Clean Water Act, the Groundwater Directive and the Water Framework Directive adopt an ecosystem-based approach.[209] The Groundwater Directive looks at groundwater bodies as a whole, and in relation to their impact on surface ecosystems, rather than attempting to tackle individual types of pollution sources.[210] By allowing Member States to manage water on an ecosystem or watershed basis, local conditions can be considered and all sources of pollution within that system can be managed.[211] Most importantly, non-point sources of pollution, which are often the most significant sources of groundwater pollution, may be best managed by regulating land-use practices.[212] In the United States, land-use and zoning are firmly within the jurisdiction of the states and municipalities.[213] A broad federal approach, with adequate funding, may be an ideal way of obtaining local cooperation in tackling non-point sources of pollution.

C. Preemptive Measures

The Groundwater Directive mandates that Member States respond not only to breaches of quality standards and threshold values, but also to upward trends in concentrations of groundwater

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pollution', 2004 O.J. (C 109) 29, 30. *See also* Groundwater Directive, *supra* note 4, art. 3(1)(b).

209. *See, e.g.*, Water Framework Directive, *supra* note 5, art. 3 (providing for regulation of water resources by river basin, as opposed to regulation by type of pollution source or within a traditional administrative boundary).

210. *See, e.g.*, Groundwater Directive, *supra* note 4, art. 3(1) ("good chemical status shall be based on the protection of the body of groundwater . . . having particular regard to its impact on, and interrelationship with, associated surface waters and directly dependent terrestrial ecosystems and wetlands").

211. *Id.*

212. *See, e.g.*, Dianne K. Conway & Daniel S. Evans, *The Imperative of Integrating Environmental Standards and Review on an Ecosystem Scale*, 23 SEATTLE U.L. REV. 977, 1009 (2000).

213. JOHN R. NOLON & PATRICIA E. SALKIN, LAND USE IN A NUTSHELL 5-8, 47-9 (5th ed. 2006).

contaminants that do not violate any limits.[214] By requiring action under these circumstances, rather than waiting for an actual breach, the Groundwater Directive recognizes and responds to the difficulties involved in remediation of contaminated groundwater. Also responding to this need for preemptive action regarding contamination of groundwater are both the monitoring requirements of the Water Framework Directive,[215] and the general requirement to limit or prevent the input of any hazardous pollutants.[216] Both of these forward-looking provisions would be appropriate to a U.S. approach to groundwater pollution.

D. Individual Liability and Enforcement

European Union directives, including the Groundwater Directive and the Water Framework Directive, require Member States to achieve a particular result. They do not themselves regulate private individuals, but instead mandate legislative action by the Member States, which in turn will regulate individuals. Member States may face fines for failure to implement the provisions of a directive, but there are no penalties or indicators of liability for individuals.[217] This feature of directives is blamed for the often slow and patchy implementation and enforcement within Member States.[218]

A variety of enforcement mechanisms would be required to comprehensively manage groundwater pollution. Although a full discussion of such mechanisms is beyond the scope of this comment, regulatory measures would likely include a permitting scheme, managed by the States or the federal government and similar to those adopted under the CWA[219] or the RCRA.[220] Although permits may be an effective method of regulating point sources, non-point sources play an important role in groundwater pollution and pose unique management problems because of their pervasiveness and difficulties with control.[221] A more imaginative

214. *See* Groundwater Directive, *supra* note 4, art. 5, annex IV pt. B.

215. *See* Water Framework Directive, *supra* note 5, art. 4(1)(b).

216. *See* Groundwater Directive, *supra* note 4, art. 6.

217. P.S.R.F. MATHIJSEN, A GUIDE TO EUROPEAN UNION LAW 27-28 (8th ed. 2004).

218. Clifford Rechtschaffen, *Shining the Spotlight on European Union Environmental Compliance*, 24 PACE ENVTL. L. REV. 161, 163 (2007).

219. *See* 33 U.S.C. § 1342 (2006).

220. *See* 42 U.S.C § 6925 (2006).

221. Daniel R. Mandelker, *Controlling Nonpoint Source Water Pollution: Can it be Done?*, 65 CHI.-KENT L. REV. 479, 481-83 (1989).

combination of permits and land-use regulations may be required, probably requiring enforcement on the State level.[222]

VI. CONCLUSION

Groundwater resources are vital for industry, agriculture and the public. They are also facing increasing risks from contamination and pollution, with only limited federal protection. The European Groundwater Directive provides a simple framework to achieve comprehensive protection of groundwater resources. While federal legislation could not be quite as comprehensive, because of constitutional limitations on Congressional powers, the Groundwater Directive's "federal" approach could easily be applied to the United States. Monitoring and mandating responses to upward trends in pollution levels would protect groundwater resources for future generations, and by aiming to manage and reduce pollution on an ecosystem level, the directive points a way towards tackling non-point source pollution.

In adopting a modified version of the Groundwater Directive, a significant role for state and local government is necessary and should be welcomed. However, it must be recognized that state implementation of existing water quality standards under the CWA has been slow, and they have been reluctant to extend regulations to non-point sources.[223] A mechanism to ensure state implementation must be found, whether it be through pro-active use of federal spending powers, citizen suits against recalcitrant states, or some other means.

Groundwater is a vital resource: agriculture, industry, the public and many surface ecosystems rely on the continued existence of a plentiful and pure supply of groundwater. However, under the existing patchwork of legislation, this crucial national resource is treated as a peripheral concern and is subject to only cursory legal protections. Adopting groundwater legislation modeled on the European Groundwater Directive would fill a substantial gap in the armory of environmental law and ensure the future of this key natural resource.

222. *Id.* at 482.
223. Conway, *supra* note 212, at 1006.