WATER SCARCITY AND HYDRAULIC FRACTURING IN PENNSYLVANIA: EXAMINING PENNSYLVANIA WATER LAW AND WATER SHORTAGE ISSUES PRESENTED BY NATURAL GAS OPERATIONS IN THE MARCELLUS SHALE*

I. INTRODUCTION

In 2009, eighteen households in Dimock, Pennsylvania had their well water contaminated after a natural-gas-extraction accident in the Marcellus Shale.[1] In September 2010, the federal government found that Encana, a natural-gas operation making use of the same drilling techniques now being used in Pennsylvania to remove natural gas from the Marcellus Shale, contaminated the water supply of a Wyoming town so badly that residents were advised not to shower without proper ventilation.[2] Perhaps disasters like these influenced the American Rivers organization's[3] decision to put two of Pennsylvania's largest rivers on its 2010 annual list of the ten most endangered rivers in the United States.[4] On its list, American Rivers named the Upper Delaware River America's most endangered river, in addition to ranking the Monongahela River America's ninth most endangered river.[5] The stated basis for both of these dubious distinctions was each river's location within regions of Pennsylvania experiencing increased natural-gas activity on account of their position above the Marcellus Shale.[6]

The Marcellus Shale is an ancient geologic formation and the richest unconventional source of natural gas in the world, with the majority of it situated

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1. Andrew Maykuth, *Marcellus Shale Fight Takes New Turn with Pipeline Mandate*, PHILA. INQUIRER, Oct. 1, 2010, at A01.

2. Abrahm Lustgarten, *Feds Warn Residents Near Wyoming Gas Drilling Sites Not to Drink Their Water*, PROPUBLICA (Sept. 1, 2010, 5:42 PM), http://www.propublica.org/article/feds-warn-residents-near-wyoming-gas-drilling-sites-not-to-drink-their-wate (discussing EPA announcement linking fracking to contamination of town of Pavillion, Wyoming's water system).

3. In its own words, American Rivers is the nation's "leading conservation organization standing up for healthy rivers." *About American Rivers*, AM. RIVERS, http://www.americanrivers.org/about-us/ (last visited Nov. 14, 2011).

4. AM. RIVERS, AMERICA'S MOST ENDANGERED RIVERS (2010), *available at* http://www.americanrivers.org/assets/pdfs/mer-2010/americas-most-endangered-rivers-2010.pdf.

5. *Id.*

6. *Id.*

underneath Pennsylvania.[7] Given the great amount of natural gas in Pennsylvania, proponents of extraction have been touting the economic benefits of drilling in the Commonwealth for several years.[8] Though economic growth may accompany Pennsylvania's emerging natural gas industry, extracting natural gas is not without costs, as drilling in formations like the Marcellus Shale is a very resource-intensive and highly technical process with the potential to cause significant environmental harm.[9] An aspect of the drilling process that should be of central concern to Pennsylvania is the tremendous amount of freshwater that is necessary to carry out the drilling process.[10] To drill a single well in the Marcellus Shale, a natural gas company requires, on average, around seven million gallons of fresh water.[11] To get all of this freshwater, natural gas companies are making impermissible use of Pennsylvania's rivers and streams.[12] Some of Pennsylvania's streams have already gone dry on account of this activity.[13] Dry streams and reduced stream flow will likely be a recurring problem for Pennsylvania, given that currently the Commonwealth has only around 1,100 gas wells but may have up to 50,000 wells by the year 2030.[14]

Any harm resulting from the use of massive amounts of freshwater for natural gas extraction will likely be complicated by the Commonwealth's lack of authority to regulate the withdrawal of water. Some commentators have shown concern for potential contamination caused by natural gas extraction in the Marcellus Shale.[15] But none have examined the problems that may result from the excessive withdrawals from Pennsylvania's rivers and streams in particular. This Comment sets out to analyze water supply issues that may arise because of increased natural gas activity within

7. See *infra* notes 16–25 and accompanying text for a discussion of what the Marcellus Shale is and how much natural gas it contains.

8. *See, e.g.*, TIMOTHY CONSIDINE ET AL., PENN. STATE UNIV. COLL. OF EARTH & MINERAL SCIS., AN EMERGING GIANT: PROSPECTS AND ECONOMIC IMPACTS OF DEVELOPING THE MARCELLUS SHALE NATURAL GAS PLAY 24 (2009), *available at* http://www.alleghenyconference.org/PDFs/PELMisc/PSUStudyMarcellusShale072409.pdf (claiming that the "Marcellus gas industry in Pennsylvania directly added $1.1 billion to the economy of Pennsylvania, which then generated indirect and induced impacts that increased the total value added generated in the Commonwealth by $2.3 billion").

9. See *infra* Part II for an explanation of the technical process of extracting natural gas from shale formations and for a discussion of the potential harms associated with natural gas extraction.

10. See *infra* Part II for a discussion of the amount of water necessary to drill a well and the impact such a process may have throughout Pennsylvania.

11. SUSQUEHANNA RIVER BASIN COMMISSION, NATURAL GAS WELL DEVELOPMENT IN THE SUSQUEHANNA RIVER BASIN COMMISSION 1 (2010), *available at* http://www.srbc.net/programs/docs/ProjectReviewMarcellusShale(NEW)(1_2010).pdf.

12. *See* 4ABC Pittsburgh, *Team 4: Pa. Streams Drained Dry by Drillers*, WTAE.COM: PITTSBURGH (Nov. 17, 2008), http://www.thepittsburghchannel.com/news/17973811/detail.html (showing video footage of natural gas company employees making water withdrawals from Allegheny River to use for fracking, seemingly without permission or right).

13. *See id.* (showing video footage of streams in western Pennsylvania that have dried up due to natural gas extraction).

14. See *infra* notes 62–63 and accompanying text for sources predicting how many wells will be drilled in Pennsylvania in the coming decades.

15. *See, e.g.*, Hannah Wiseman, *Regulatory Adaptation in Fractured Appalachia*, 21 VILL. ENVTL. L.J. 229, 232 (2010) (noting concerns about clean water among affected communities).

Pennsylvania, and to explore ways in which potential problems may be caused or exacerbated by Pennsylvania's lack of comprehensive water withdrawal regulations.

In Part II, this Comment explains why natural gas activities have increased tremendously within Pennsylvania over the last three years and discusses some of the technical aspects of hydraulic fracturing and horizontal drilling—two techniques that are necessary to make drilling in the Marcellus Shale profitable. It then highlights various environmental concerns associated with the precipitous rise in drilling, focusing primarily on water supply issues triggered by increased natural-gas extraction activities within Pennsylvania.

In Part III, this Comment details the various sources of Pennsylvania water law and the rules regarding water withdrawal in the Commonwealth. The Part first discusses Pennsylvania's continued reliance on the common law for controlling water use and highlights the important elements of the Commonwealth's version of riparianism. It then discusses some statutory sources of water law within Pennsylvania, before explaining the roles of the Delaware River Basin Commission (DRBC) and the Susquehanna River Basin Commission (SRBC)—two federal compacts governing water withdrawals in two-thirds of Pennsylvania.

Part IV analyzes the effectiveness of the various sources of Pennsylvania water law for dealing with the environmental problems that may accompany expanding natural gas extraction. This Part criticizes Pennsylvania's water common law and points out various procedural and substantive problems with riparianism; most importantly, that it does not prevent environmental harm before it occurs and that it favors large-scale users on account of its vagueness. It goes on to discuss regulated riparianism, a popular alternative to the common law. It acknowledges that while regulated riparian regimes like the DRBC and the SRBC improve upon the common law, they are not ideal for guarding against environmental harm as they codify the vagueness and uncertainty at the heart of the common law's problems.

Part IV goes on to argue that an ideal water regime is one which requires permits for water use and makes permitting decisions based on predictable, scientific standards. Finally, Part V of this Comment proposes various policies that Pennsylvania should consider adopting in order to improve its water law and to better guard against environmental harm that may result from the excessive water consumption needed for natural gas extraction in the Marcellus Shale.

II. FACTUAL OVERVIEW: FRACKING IN THE MARCELLUS SHALE

A. The Rise of Natural Gas Activities in Pennsylvania

The Marcellus Shale is a subterraneous rock formation that begins in West Virginia and extends northward through most of Pennsylvania, parts of Ohio, and into New York.[16] It is situated 5,000 to 9,000 feet below the earth's surface.[17] More than

16. LISA SUMI, OIL & GAS ACCOUNTABILITY PROJECT, SHALE GAS: FOCUS ON THE MARCELLUS SHALE 2 (2008), *available at* http://www.earthworksaction.org/pubs/OGAPMarcellusShaleReport-6-12-08.pdf.

17. MICHELE RODGERS ET AL., PENN. STATE UNIV. COLL. OF AGRIC. SCIS., MARCELLUS SHALE: WHAT LOCAL GOVERNMENT OFFICIALS NEED TO KNOW 4 (2008), *available at* http://downloads.cas.psu.edu/naturalga

two-thirds of Pennsylvania sits atop the Marcellus Shale.[18] Geologists have recognized the Marcellus Shale as a potential source of natural gas for nearly eighty years,[19] but the consensus for much of the twentieth century was that the Marcellus Shale did not contain enough natural gas to make drilling profitable.[20] However, in the late 1970s, as geologists sought to find American sources of gas in the face of rising oil prices and the energy crisis of 1973, a clearer picture of the mineral wealth trapped inside the Marcellus Shale emerged.[21] Current estimates of the amount of recoverable natural gas inside the Marcellus Shale range from 50 trillion cubic feet to nearly 500 trillion cubic feet.[22] The entire United States produced only about 21 trillion cubic feet of natural gas in 2008.[23] Some believe there is enough gas inside the Marcellus Shale to supply the entire United States for up to fifteen years.[24] By the most conservative or the most extreme measure, "[the] Marcellus Shale is the largest unconventional natural gas reserve in the world."[25]

Before the end of the twentieth century, nearly all of America's natural gas production came from conventional sources, usually porous rock structures comprised primarily of limestone and sandstone.[26] Extracting natural gas from conventional sources is relatively easy and inexpensive because the gas they contain is not tightly packed and flows freely through the naturally occurring pores in the rock.[27] Traditional drilling techniques, like standard vertical drilling, work well in deriving natural gas from conventional sources, partly due to the permeability of the rock, and partly due to the relatively shallow depths of the formations.[28]

Extracting natural gas from the Marcellus Shale was not considered economically feasible until the last few years, primarily because it is an unconventional source from

s/pdf/MarcellusShaleWhatLocalGovernmentOfficialsneedtoknow.pdf.

18. *See Approximate Extent of Marcellus Formation in Pennsylvania*, PA. DEP'T OF CONSERV. & NATURAL RES. [hereinafter *Approximate Extent of Marcellus Formation*], *available at* http://www.dcnr.state.pa.us/topogeo/oilandgas/Occurrence_of_Marcellus_in_PA.pdf (depicting estimate that Marcellus Shale covers approximately two-thirds of Pennsylvania's land).

19. John A. Harper, *The Marcellus Shale—An Old "New" Gas Reservoir in Pennsylvania*, 38 PA. GEOLOGY, no. 1, 2008 at 2, 2.

20. *Id.* at 3.

21. *Id*. at 3–5.

22. *See* CONSIDINE ET AL., *supra* note 8, at 4 (claiming Marcellus Shale may contain 489 trillion cubic feet of natural gas); RODGERS ET AL., *supra* note 17, at 4 (stating that Marcellus Shale may contain around 50 trillion cubic feet of recoverable natural gas).

23. CONSIDINE ET AL., *supra* note 8, at 8.

24. Ian Urbina, *Regulation Lax as Gas Wells' Tainted Water Hits Rivers*, N.Y. TIMES, Feb. 27, 2011, at A1.

25. CONSIDINE ET AL., *supra* note 8, at ii.

26. FOOD AND WATER WATCH, NOT SO FAST, NATURAL GAS: WHY ACCELERATING RISKY DRILLING THREATENS AMERICA'S WATER 2 (2010), *available at* http://documents.foodandwaterwatch.org/fracingFINALweb.pdf.

27. *Id.*

28. *Id.* (discussing how gas is extracted from conventional sources using vertical drilling techniques that were not economically feasible in deep shales with low permeability).

which natural gas is not easily extracted using traditional vertical drilling.[29] A natural gas source is unconventional where "the permeability of the rock is so low that the gas cannot flow, or when the gas is tightly attached to organic matter in the formation."[30] The natural gas trapped in the Marcellus Shale is contained in relatively small natural fractures that are interspersed throughout the formation.[31] These fractures are extremely thin, unlike the large gas folds in conventional sources.[32] Additionally, most of the fractures within the Marcellus Shale are aligned vertically, which means that drilling a vertical well is not likely to penetrate a sizeable pocket of gas at one time.[33]

The Marcellus Shale has quickly turned from an infeasible source into one of the most attractive domestic deposits for natural gas production of all time.[34] The shift in thinking about the feasibility of drilling in the Marcellus Shale primarily has been caused by rising natural gas prices, coupled with advanced extraction technologies, each of which has made it more profitable to drill.[35] Natural gas prices have risen since the 1970s, when conventional sources reached their peak production.[36] Rising prices are also linked to increased demand for natural gas as a so-called "bridge fuel."[37] Many believe that natural gas will help America transition from traditional sources of fuel, like oil, to more sustainable energy sources, like solar and wind.[38] Though it is nonrenewable, many tout natural gas as a "cleaner burning" fuel and see it as a better option than oil and coal.[39] The environmental benefits of natural gas over coal and oil are, however, overstated, as the natural gas industry still produces significant amounts of greenhouse gases and has the potential to cause serious environmental damage because of the difficulty of extraction.[40]

Extracting natural gas from unconventional sources like the Marcellus Shale would not be profitable without the emergence of two technologies: horizontal drilling

29. SUMI, *supra* note 16, at 7–8; *see* CONSIDINE ET AL., *supra* note 8, at 6 (claiming that a great deal of gas needs to be produced in order to break even because drilling in the Marcellus Shale is very expensive due to the formation being situated at such deep depths).

30. COLUMBIA UNIV. URBAN DESIGN RESEARCH SEMINAR, HANCOCK & THE MARCELLUS SHALE: VISIONING THE IMPACTS OF NATURAL GAS EXTRACTION ALONG THE UPPER DELAWARE 4 (Emily Weidenhof et al. eds., 2009) [hereinafter URBAN DESIGN RESEARCH SEMINAR], *available at* http://www.urbandesignlab.columbia.edu/sitefiles/file/HancockAndTheMarcellusShale.pdf.

31. Harper, *supra* note 19, at 10.

32. Marianne Lavelle, *Forcing Gas Out of Rock with Water*, NAT'L GEOGRAPHIC DAILY NEWS (Oct. 17, 2010), http://news.nationalgeographic.com/news/2010/10/101022-energy-marcellus-shale-gas-science-technology-water.

33. *See* SUMI, *supra* note 16, at 7–8 (explaining impracticability of vertical drilling in Marcellus Shale).

34. *See* CONSIDINE ET AL., *supra* note 8, at 5 (stating that the Marcellus Shale has become a "prize" source for natural gas developers).

35. FOOD & WATER WATCH, *supra* note 26, at 1.

36. Wiseman, *supra* note 15, at 233. The percentage of American gas derived from conventional sources declined every year from 1998 to 2007. FOOD & WATER WATCH, *supra* note 26, at 3. Despite this, American natural gas production as a whole increased because gas derived from unconventional sources began to be extracted at much greater volume. *Id.* From 2000 to 2010, unconventionally sourced natural gas rose from one percent to twenty percent of the overall U.S. natural gas supply.

37. Wiseman, *supra* note 15, at 231.

38. *Id.* at 232.

39. *Id.*

40. FOOD & WATER WATCH, *supra* note 26, at 2.

and hydraulic fracturing.[41] Horizontal drilling is a technique that allows drillers to cross a series of fractures in which the gas is trapped, making a single well much more productive.[42] Horizontal wells are initially drilled vertically for several thousand feet before the drill bore is turned ninety degrees to drill horizontally for a few thousand more feet.[43] When complete, the drill bore will have crossed many more fractures than a vertical well and will have penetrated several thousand more feet of the gas reservoir.[44] Once drilling is finished, a gas company cements a steel casing atop the well to stabilize the surface and to protect groundwater.[45]

Hydraulic fracturing, commonly referred to as "fracking," is the process whereby a fluid (usually water or kerosene) is mixed with a granular material like sand and then pumped at an extremely high pressure into a rock until it cracks, creating fissures throughout the rock.[46] Fracking stimulates well production by increasing the rock formation's surface area.[47] In creating fractures, it makes the rock more permeable; also, the granular propant agent (typically sand, silicon, or ceramic beads) works to maintain permeability by holding open the newly created fractures.[48] Traditional fracking uses vertical drilling alone and was not considered economically feasible in formations like the Marcellus Shale because of their high impermeability and highly pressurized natural gas.[49] However, the development of the Barnett Shale in Texas during the 1990s demonstrated that fracking could be done economically in shale formations.[50]

The fracking technique first utilized in the Barnett Shale, and now used in the Marcellus Shale, is called "slick-water" fracking.[51] This technique requires the use of propants like sand or ceramics and uses "very large volumes of freshwater that has been treated with a friction reducer such as a gel."[52] The "gel" material necessary to carry out a slick-water frac is typically a petroleum distillate mixed with other chemicals.[53] The gel-like material reduces friction while the sand props open the "paper-thin" fractures.[54] Fracking in the Marcellus Shale requires huge volumes of

41. *See id.* at 2–3 (claiming that combination of hydraulic fracturing and horizontal drilling has made extracting natural gas from Marcellus Shale appear economical).

42. *See* RODGERS ET AL., *supra* note 17, at 4 (explaining that the virtue of drilling horizontal wells is that numerous vertical fractures can be accessed from one drill pad).

43. *Id.*

44. Harper, *supra* note 19, at 10–11.

45. RODGERS ET AL., *supra* note 17, at 4.

46. Harper, *supra* note 19, at 10.

47. *Id.*

48. *Id.*

49. *See id.* (explaining the difficulties of traditional fracking in shale formations).

50. Wiseman, *supra* note 15, at 233–34.

51. Harper, *supra* note 19, at 10.

52. *Id.*

53. DUSTY HORWITT, ENVTL. WORKING GRP., DRILLING AROUND THE LAW 7 (2010), *available at* http://www.ewg.org/files/EWG-2009drillingaroundthelaw.pdf.

54. Lavelle, *supra* note 33.

water because the natural gas contained within the rock is deeper and under higher pressure than gas in shallow wells.[55]

B. Environmental Concerns Associated with Increased Drilling Activities in Pennsylvania

Under the Pennsylvania Oil and Gas Act, anyone wishing to drill a natural gas well in Pennsylvania must apply to the Pennsylvania Department of Environmental Protection (PaDEP).[56] The number of permits granted by the PaDEP since 2007 indicates that natural gas extraction within the Marcellus Shale is rapidly expanding. In 2007, the PaDEP issued only seventy-one permits to drill in the Marcellus Shale.[57] Four hundred and seventy-six permits were issued in 2008.[58] Fracking permits spiked in 2009, as the PaDEP issued 1,984 Marcellus Shale permits.[59] The total number of permits issued for 2010 was 2,482, of which 2,235 permits were for horizontal wells.[60] A total of 1,106 wells have been fracked in the Marcellus Shale as of October 2010.[61] Disregarding Marcellus Shale activity, water use within the Susquehanna River Basin—located primarily in Pennsylvania and overlaying a significant portion of the Marcellus Shale—was expected to increase to more than 645 million gallons per day by 2010.[62] This number will likely surge given that Pennsylvania state officials and the natural gas industry believe that there will be between 35,000 to 50,000 natural gas wells in Pennsylvania by 2030.[63]

The natural gas industry has come under intense scrutiny since it started to make widespread use of slick-water fracking in the Marcellus Shale. There is widespread belief that slick-water fracking has the potential to cause serious environmental harm. One of the main concerns is that fracking may lead to contamination of ground and

55. RODGERS ET AL., *supra* note 17, at 5.

56. 25 PA. CODE § 78.11 (2011).

57. PA. DEP'T OF ENVTL. PROT. BUREAU OF OIL & GAS MGMT., YEAR END WORKLOAD REPORT (2010), *available at* http://www.dep.state.pa.us/dep/deputate/minres/oilgas/reports.htm (follow "2009 Year End PowerPoint Presentation" hyperlink).

58. *Id.*

59. PA. DEP'T OF ENVTL. PROT. BUREAU OF OIL & GAS MGMT., REGIONAL YEAR TO DATE WORKLOAD REPORT: JANUARY 1, 2009 TO DECEMBER 31, 2009 (2010), *available at* http://www.dep.state.pa.us/dep/deputate/minres/oilgas/2009%20Year%20End%20Report-WEBSITE.pdf.

60. PA. DEP'T OF ENVTL. PROT. BUREAU OF OIL & GAS MGMT., PERMITS ISSUED BY COUNTY (2010), *available at* http://www.dep.state.pa.us/dep/deputate/minres/oilgas/RIG10.htm (follow "Permits Issued by County with Location Information" hyperlink).

61. *2011 Permit & Rig Activity Report*, PA. DEP'T OF ENVTL. PROT. BUREAU OF OIL & GAS MGMT., http://www.dep.state.pa.us/dep/deputate/minres/oilgas/RIG11.htm (last visited Nov. 14, 2011) (follow "2011 YTD Total by County by Well Type" hyperlink); *2011 Wells Drilled by County as of Aug. 3, 2011*, PA. DEP'T OF ENVTL. PROT. BUREAU OF OIL & GAS MGMT., http://www.dep.state.pa.us/dep/deputate/minres/oilgas/2011%20Wells%20Drilled%20by%20County.htm (last visited Nov. 14 , 2011).

62. R. TIMOTHY WESTON, K&L GATES, DEVELOPMENT OF THE MARCELLUS SHALE – WATER RESOURCE CHALLENGES 1 (2008), *available at* http://www.wvsoro.org/resources/marcellus/Weston.pdf.

63. JOHN W. UBINGER ET AL., PA. ENVTL. COUNCIL, DEVELOPING THE MARCELLUS SHALE: ENVIRONMENTAL POLICY AND PLANNING RECOMMENDATIONS FOR THE DEVELOPMENT OF THE MARCELLUS SHALE PLAY IN PENNSYLVANIA 7 (2010); Don Hopey, *Do Gas Wells Pose Health Risk?: Expert Says More Research Needed*, PITT. POST-GAZETTE, Aug. 28, 2010, at A1.

surface water supplies.[64] Some fear that water may be contaminated by the drilling chemicals themselves.[65] The natural gas industry has been quick to point out that the injection of chemicals occurs well below the water table and that fracking poses no potential risk of contaminating water supplies when wells are properly drilled.[66] However, over 1,000 cases of contaminated water have been linked to natural gas drilling nationwide.[67]

The disposal of toxic wastewater resulting from the fracking process presents another water-related fracking hazard. In the weeks after a well is fracked, thirty to forty percent of the injected water returns to the surface.[68] The water that reemerges is extremely saline from having come in contact with minerals below the surface; at nine percent salt, it is more saline than ocean water.[69] Frack-water, as it is known, may also contain radioactive metals, detergents, fracking chemicals, and other highly toxic pollutants.[70] Contaminated frack-water has potential to pollute rivers, streams, lakes, and groundwater if not properly treated and disposed.

Most importantly, slick-water fracking requires huge amounts of water, and thus presents a potential threat to Pennsylvania water supplies and the ecosystems that depend upon them. The Susquehanna River Basin Commission, an authority that monitors water withdrawals by natural gas extractors, reports that the amount of water necessary for fracking in the Marcellus Shale ranges from four to seven million gallons of water per frack.[71] Other estimates range as high as nine million gallons of water per

64. The passage of the Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, significantly added to the economy of fracking in the Marcellus Shale. When written, the Safe Drinking Water Act was meant to protect the public from any water contamination resulting from injection-drilling, as the act initially required every state to ensure that "underground injection will not endanger drinking water sources" and to monitor, keep records, and report all findings relating to water quality. Safe Drinking Water Act, Pub. L. No. 93-523, § 1421(b)(1)(B)–(C), 88 Stat. 1660, 1675 (1974) (codified as amended at 42 U.S.C. § 300h(b)(1)(B)–(C) (2006)). However, as a result of the 2005 Energy Policy Act amendment, "underground injection" now "excludes . . . the underground injection of fluids or propping agents . . . pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities." Energy and Policy Act of 2005 § 322, 119 Stat. at 694. With the inclusion of this amendment, often referred to as the "Cheney Loophole," the potential liability for using slick-water fracking techniques was negated. *See* CONSIDINE ET AL., *supra* 9, at 33 (calling amendments to the Safe Drinking Water Act "ominous" to prospects of continued natural gas development within Marcellus Shale and arguing that efforts to close the Cheney Loophole should be abandoned as the industry should not have to face additional liabilities).

65. Pennsylvania requires drillers to disclose the chemical makeup of their fracking solutions to the PaDEP. Scott Detrow, *How Pennsylvania's Fracking Chemical Disclosure Rules Stack Up Against Other States*, STATEIMPACT (Aug. 12, 2011, 8:27 AM), http://stateimpact.npr.org/pennsylvania/2011/08/12/whats-in-the-frack-how-pennsylvanias-chemical-disclosure-rules-stack-up-against-other-states/. These chemical reports, however, are not readily available via a public database, though citizens may request individual reports from the PaDEP. *Id.* While the industry insists fracking solutions pose no threat, documented toxins include benzene, a petroleum derivative that is highly toxic to humans at very low exposure levels. HORWITT, *supra* note 53, at 7.

66. MARCELLUS SHALE COAL., IN THE SPIRIT OF FULL DISCLOSURE (2010), *available at* http://marcellus coalition.org/wp-content/uploads/2010/06/msc-spirit-of-full-disclosure.pdf.

67. FOOD & WATER WATCH, *supra* note 26, at 1.

68. URBAN DESIGN RESEARCH SEMINAR, *supra* note 30, at 10.

69. Lavelle, *supra* note 32.

70. URBAN DESIGN RESEARCH SEMINAR, *supra* note 30, at 10.

71. SUSQUEHANNA RIVER BASIN COMMISSION, *supra* note 11, at 1.

well fracked.[72] In Texas's Barnett Shale, attempts to use recycled frack-water have had very little success, with recycled water supplying a maximum of about ten percent of the water necessary for fracking.[73] To remain productive, a well will likely need to be fracked several more times after its initial fracking—the amount of water necessary to make these subsequent fracks will sometimes be greater by as much as twenty-five percent of the original volume.[74] Some wells will need to be fracked more than others, as the life of a well may range from five to thirty years.[75] Additionally, horizontal wells usually require between 63 to 112.5 times more water than vertical wells.[76] As the natural gas industry continues to expand within Pennsylvania, the horizontal drilling process will be the primary method used.[77]

Already, fleets of silver water tanker trucks have become a familiar sight in the parts of Pennsylvania where fracking predominates, mostly rural communities.[78] To supply the amount of water necessary for fracking, as many as 700 tanker-loads of water are often necessary.[79] In addition to stressing local water supplies, these full water tankers place a great deal of infrastructural strain on country roads.[80] A few hundred water tankers driving to a drill pad is the equivalent of several million cars passing over roads not built for heavy traffic.[81] Additionally, water-tanker traffic has a tendency to adulterate the air quality of rural areas.[82]

The amount of water necessary to frack so many new wells has the potential to alter ecosystems and to disrupt the activities of people, plants, and wildlife that depend on the high quantity and quality of Pennsylvania's waters.[83] In locations where slick-water fracking has a longer history than in Pennsylvania, water supplies have been overused due to the demands fracking has created.[84] Although the Appalachian Region is thought to be "water rich," the area faces its own water challenges.[85] Though many have discussed the precarious future of the eastern United States' water supplies, residents of the Northeast have rarely been forced to think about water supply issues

72. URBAN DESIGN RESEARCH SEMINAR, *supra* note 30, at 10.

73. SUMI, *supra* note 16, at 11.

74. *Id.*

75. RODGERS ET AL., *supra* note 17, at 5.

76. URBAN DESIGN RESEARCH SEMINAR, *supra* note 30, at 10.

77. CONSIDINE ET AL., *supra* note 8, at 6.

78. *See* RODGERS ET AL., *supra* note 17, at 11 (discussing impact that water tanker trucks may have on local Pennsylvania roads due to high volume of tankers necessary to provide adequate water supply for fracking).

79. SUMI, *supra* note 16, at 11.

80. RODGERS ET AL., *supra* note 17, at 11; *see also* MARY BETH ADAMS ET AL., U.S. DEP'T OF AGRIC., EFFECTS OF DEVELOPMENT OF A NATURAL GAS WELL AND ASSOCIATED PIPELINE ON THE NATURAL AND SCIENTIFIC RESOURCES OF THE FERNOW EXPERIMENTAL FOREST 18 (2011), *available at* http://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs76.pdf (studying the effects of Marcellus gas development in a West Virginia forest and finding unanticipated "substantial damage to roads" on account of water tanker traffic).

81. RODGERS ET AL., *supra* note 17, at 11.

82. URBAN DESIGN RESEARCH SEMINAR, *supra* note 30, at 10.

83. *See id.* at 20 (discussing threats that fracking presents specifically to people and biodiversity within the Delaware River Basin).

84. RODGERS ET AL., *supra* note 17, at 12.

85. WESTON, *supra* note 62, at 1 (internal quotation marks omitted).

aside from periodic drought warnings issued throughout particularly dry summers.[86] Despite the lack of public awareness concerning the water supply, states in the eastern United States are beginning to face water-shortage crises outside of droughts.[87] In fact, Pennsylvania, New York, and the other Marcellus Shale states,[88] despite their relatively high levels of rainfall, faced water supply problems decades prior to the rise of hydraulic fracturing operations.[89] With the rapid emergence of fracking, Pennsylvania's water supply—already strained by population growth, expansion of cities, the needs of industry, and other uses of water incident to modern life—is sure to experience much greater stresses as demand for the quickly–receding resource increases.[90] "[T]he likelihood of overexploitation of the Commonwealth's water resources is already upon us," evidenced by more droughts in the last twenty-five years than in the previous 300.[91] Strains on the water supply are even more likely, considering the natural gas industry's quickly increasing demand for huge volumes of water needed to frack wells in the Marcellus Shale.[92]

Water-related impacts of fracking inside Pennsylvania could include, among other things, decreased stream flows and degraded uses of streams, inadequate water supply during droughts, aquifer depletion, and harm to aquatic species.[93] A reduced water supply caused by fracking withdrawals threatens aquatic species and the public health, given that reduced stream flows can increase overall levels of pollution in a water body by decreasing its ability to dilute pollutants.[94] In the Monongahela River Basin, for instance, the river's assimilative capacity for pollution is already "showing signs of saturation" that will only be worsened by continued use of the Basin's waters for

86. *See* Lynda L. Butler, *Allocating Consumptive Water Rights in a Riparian Jurisdiction: Defining the Relationship Between Public and Private Interests*, 47 U. PITT. L. REV. 95, 97–98 (1985) (observing a lack of water supply problems in the Northeast until around the 1970s); Olivia S. Choe, Note, *Appurtenancy Reconceptualized: Managing Water in an Era of Scarcity*, 113 YALE L.J. 1909, 1910–11 (2004) (discussing the perceived abundance of water in northeastern United States and the likelihood that water shortages will begin to plague the eastern United States in coming years); Leslie M. MacRae, *Water, Water Everywhere But Much Less Than You Think*, 11 PENN ST. ENVTL. L. REV. 189, 189 (2003) (discussing the assumptions of northeasterners that water is plentiful).

87. Butler, *supra* note 86, at 98.

88. The other states overlaying the Marcellus Shale include West Virginia, Ohio, and Maryland. KERRY MOSS, U.S. DEP'T. OF INTERIOR, DEVELOPMENT OF THE NATURAL GAS RESOURCES IN THE MARCELLUS SHALE 1 (2009), *available at* http://www.marcellus.psu.edu/resources/PDFs/marcellusshalereport09.pdf. For a map displaying the Marcellus Shale's geographic reach, see *Depth to Marcellus Shale Base*, PENN STATE MARCELLUS CTR. FOR OUTREACH & RESEARCH, *available at* http://www.marcellus.psu.edu/images/Marcellus_Depth.gif.

89. Writing as early as 1985, Lynda Butler addressed persistent water supply problems in Pennsylvania and advocated for a reassessment of existing water law. Butler, *supra* note 86, at 97–100.

90. *See* Choe, *supra* note 86, at 1910 (discussing how demands for water have increased dramatically in the last few decades due to commercial expansion and "[r]apid population growth").

91. Joseph W. Dellapenna, *Developing a Suitable Water Allocation Law for Pennsylvania*, 17 VILL. ENVTL. L.J. 1, 20 (2006).

92. See *supra* Part II.A for a discussion of the fracking process and the rapid expansion of the oil and natural gas industry in the Marcellus Shale in Pennsylvania.

93. FOOD & WATER WATCH, *supra* note 26, at 1–3.

94. Kyle Ferrar, *Do the Natural Gas Industry's Surface Water Withdrawals Pose a Health Risk?*, FRACTRACKER.ORG (Sept. 22, 2010), http://www.fractracker.org/?p=228.

natural gas development.[95] Evidence in the Monongahela watershed suggests that fracking withdrawals have lessened the river's flow volume, which increases aggregate pollution "by increasing [the river's] pollutant concentrations."[96] The Monongahela River is a source of drinking water for several hundred thousand people.[97] Given current withdrawal rates for natural gas drilling, any new economic use of the Monongahela River would need to be curtailed "if public health is to be conserved."[98] Like the Monongahela, decreased flow of the Delaware River could lead to a higher concentration of pollutants, thus jeopardizing the water supply of fifteen million people.[99]

III. LEGAL OVERVIEW

This Part sets out to summarize and analyze Pennsylvania water law to see if it is capable of protecting environmental integrity and the equitable use of the Commonwealth's resources in the face of the natural gas industry's water demands. Pennsylvania water law is a patchwork of common law doctrine, federal and state compacts, and scattered state statutes. This Part first discusses riparian rights, the common law doctrine that traditionally governed water allocation in the eastern United States and continues to be the law in much of Pennsylvania. It then discusses the Commonwealth's continued reliance on common law doctrine in the context of water allocation and the right to use water in the western third of Pennsylvania. It moves on to discuss the national trend away from pure riparianism in favor of statewide water regulatory regimes. This discussion primarily focuses on regulated riparianism's codification of common law principles and its requirement that water users have permits. Next, this Part addresses the Delaware and Susquehanna River Basin Commissions, two federal-state commissions that regulate water allocation and the right to use water in two-thirds of Pennsylvania. Finally, it discusses Pennsylvania legislation that regulates some aspects of water use, but that does not control water use through a permitting scheme.

A. Riparian Rights

This Subsection discusses the historical development of the riparian rights doctrine as the dominant form of water control in the eastern United States. After generally explaining the historical trajectory of common law water rights, this Subsection details the riparian rights doctrine as it has come to be defined and applied in Pennsylvania.

95. *Id.*

96. *Id.*

97. AM. RIVERS, *supra* note 4.

98. Ferrar, *supra* note 94.

99. *See* AM. RIVERS, *supra* note 4 (noting that fracking presents a serious threat to the water supply of seventeen million Pennsylvanians and New Yorkers).

1. The Development of the Riparian Rights Doctrine

The riparian rights doctrine is premised upon the notion that the right to use water is an inherent characteristic of land, "dependent on the natural availability of water to the land."[100] Riparian rights attach to riparian land itself, which is any property abutting a watercourse, through which a watercourse runs, or which overlays a subterranean body of water.[101] Land is riparian in its entirety so long as a fraction of it abuts a watercourse, no matter how large the tract or how small the stream.[102] Only owners of property appurtenant to a watercourse have the right to use that water.[103] Thus, riparian owners, for no reason other than owning property appurtenant to a water source, possess "vested property rights."[104]

Riparian owners maintain their riparian rights for as long as they own their land; riparian rights do not expire.[105] As possessors of vested rights, riparian owners may resort to both legal and equitable means to protect their interests.[106] Riparian rights are "correlative"; that is, all riparian owners are entitled to the same rights of access and use as all other riparian owners.[107] Riparian proprietors, therefore, are like co-owners of the water body abutting their properties, and—unless they are willing to resort to litigation—are left to decide amongst themselves how to use the water.[108]

The riparian rights doctrine developed in a wet and sparsely populated England and was thus "predicated on relative abundance [of water] and infrequent conflict."[109] Given their moist climates and extensive water resources, all states east of the Mississippi River at one point adopted the riparian rights doctrine from English common law.[110] The English tradition of riparian rights gave a riparian owner absolute entitlement to the uninhibited flow of water running through or next to his riparian holding.[111] A riparian owner could not divert or obstruct the water's flow, but he could make use of the water for domestic needs or to benefit his land, so long as he did not take the water off of the riparian tract.[112] This original formulation of riparian rights is often referred to as the "natural flow doctrine" due to its insistence on unobstructed

100. Joseph W. Dellapenna, *Adapting Riparian Rights to the Twenty-First Century*, 106 W. VA. L. REV. 539, 555 (2004).

101. *Id.*

102. JOSEPH L. SAX ET AL., LEGAL CONTROL OF WATER RESOURCES 22 (3d ed. 2000).

103. Choe, *supra* note 86, at 1911.

104. Butler, *supra* note 86, at 105.

105. SAX ET AL., *supra* note 102, at 20.

106. Butler, *supra* note 86, at 105–06.

107. Robert E. Beck, *Current Water Issues in Oil and Gas Development and Production: Will Water Control What Energy We Have?*, 49 WASHBURN L.J. 423, 450 (2010).

108. Dellapenna, *supra* note 100, at 555–56.

109. George A. Gould, *A Westerner Looks at Eastern Water Law: Reconsideration of Prior Appropriation in the East*, 25 U. ARK. LITTLE ROCK L. REV. 89, 89 (2002).

110. *See* SAX ET AL., *supra* note 102, at 30 (claiming that American water law is an "outgrowth of English water law" and how colonies and newly formed states "continued the English common law of water rights as their own law").

111. *Id.*

112. *See id.* at 22 (discussing the inherent arbitrariness of assigning water rights based on ownership of properties abutting watercourse).

flow of water.[113] The natural flow doctrine was summarized by later Supreme Court Justice Story in *Tyler v. Wilkinson*.[114]

In *Tyler*, the court acknowledged that a riparian owner has "a right to the use of the water flowing over [riparian land] in its natural current, without diminution or obstruction."[115] At the same time, the court recognized that strict adherence to the natural flow doctrine was not well suited to the needs of an industrializing nation ready to harness water power.[116] In turn, the court famously adapted the riparian rights doctrine to an American context,[117] stating that,

> I do not mean to be understood . . . that there can be no diminution . . . and no obstruction or impediment whatsoever, by a riparian proprietor, in the use of the water as' [sic] it flows; for that would be to deny any valuable use of it. There may be, and there must be allowed of that, which is common to all, a reasonable use.[118]

This formulation of riparian rights was among the first pronouncements of the "reasonable use" doctrine and has largely defined American riparianism.[119] The reasonable use rule favored productive use of water and "allow[ed] some diminution of flow as to both quantity and quality, so long as the challenged use was reasonable under the totality of the circumstances."[120]

2. Riparian Rights in Pennsylvania and the Reasonable Use Rule

In the western third of the Commonwealth, the part of Pennsylvania not situated within the Susquehanna or Delaware River Basins,[121] the common law of riparian rights still governs surface and ground water allocation.[122] Pennsylvania common law has defined four distinct categories of water, including surface streams and lakes,

113. *See generally id.* at 31.

114. 24 F. Cas. 472 (C.C.D.R.I. 1827) (No. 14,312).

115. *Tyler*, 24 F. Cas. at 474.

116. *Id.*

117. *See* SAX ET AL., *supra* note 102, at 24 (referring to Justice Story's opinion as "one of the more important breaks with English common law").

118. *Tyler*, 24 F. Cas. at 474.

119. *See* SAX ET AL., *supra* note 102, at 24 (calling formulation of reasonable use riparianism ushered in by Justice Story's opinion the "American rule"); David N. Copas Jr., *The Southeastern Water Compact, Panacea or Pandora's Box? A Law and Economics Analysis of the Viability of Interstate Water Compacts*, 21 WM. & MARY ENVTL. L. & POL'Y REV. 697, 701 (1997) (claiming that Justice Story "laid the foundation" of reasonable use doctrine); R. Timothy Weston, *Harmonizing Management of Ground and Surface Water Use Under Eastern Water Law Regimes*, 11 U. DENV. WATER L. REV. 239, 246 (2008) (stating that "'riparian rights' doctrine governs right to withdraw and use waters in surface streams under common law of eastern states").

120. SAX ET AL., *supra* note 102, at 24.

121. Inside the Delaware River Basin and the Susquehanna River Basin, water allocation in Pennsylvania is regulated by two interstate commissions created by federal compact, the Delaware River Basin Commission and the Susquehanna River Basin Commission. Craig P. Wilson, *Water Resources*, *in* PENNSYLVANIA BAR INSTITUTE RESOURCE MANUAL 197, 201 (2008). The commissions have replaced common law riparianism within the basins. See *infra* Part III.C for a discussion of the two river basin commissions regulating water in two-thirds of Pennsylvania.

122. Wilson, *supra* note 121, at 201.

diffuse surface water, well-defined subsurface streams, and percolating groundwater.[123] Of those four water-types, allocation of surface streams and lakes and of well-defined subsurface streams is based on the reasonable use formulation of the riparian rights doctrine.[124] The use of percolating groundwater (e.g., aquifers) is also governed by reasonable use, though this rule did not evolve from the riparian rights doctrine.[125] Pennsylvania's water common law, like the water laws of all eastern states, developed from English riparian common law.[126] Pennsylvania requires that riparian tracts abut or overlay a watercourse, which the courts have defined as any "stream of water usually flowing in a definite channel having a bed and sides, or banks, and discharging itself into some other stream or body of water" that presents "unmistakable evidence of the frequent action of running water."[127]

Pennsylvania applies the reasonable use formulation of riparian rights, despite language in many opinions mentioning the natural flow doctrine.[128] The first Pennsylvania case to reject the pure natural flow theory in favor of the reasonable use rule was *Miller v. Miller*.[129] In *Miller*, the court summarized what was then contemporary scholarly opinion on riparian rights and prior Pennsylvania case law, noting the lack of consensus.[130] One precedent allowed for no diversion of the watercourse, even if the flow of the stream was sufficient to support the riparian owner's intended uses of irrigating his crops and providing water to his cattle.[131] Another court held that an upstream mill owner was allowed to hold water in a dam for a few days if this was necessary to operate his mill.[132] Evaluating these cases and the critical commentary on riparian rights, the court proclaimed that the natural flow doctrine "must not be construed literally, for that would be to deny all valuable use of the water to the riparian proprietors."[133] Rejecting the bright-line natural flow rule, the court held that "[t]he reasonableness of the detention of the water . . . must depend on the circumstances of each case, and is to be judged of by the jury."[134] Though it

123. R. Timothy Weston & Joel R. Burcat, *Legal Aspects of Pennsylvania Water Management*, *in* WATER RESOURCES IN PENNSYLVANIA: AVAILABILITY, QUALITY AND MANAGEMENT 219, 220 (Shyamal K. Majumdar et al. eds., 1990).

124. *Id.*

125. *See* Dellapenna, *supra* note 91, at 63–64 (claiming that the common law of percolating groundwater has evolved to apply the reasonable use rule). The reasonable use rule as applied to groundwater in Pennsylvania is, for the purposes of this Article, almost identical to the reasonable use rule as applied to surface and subsurface streams. *See id.* at 63–66 (explaining what reasonable use of groundwater in Pennsylvania means).

126. *See* Wilson, *supra* note 121, at 200 (discussing how early Pennsylvania cases followed English rule of riparian rights).

127. Kislinski v. Gilboy, 19 Pa. Super. 453, 454–55 (1902) (internal quotation marks omitted).

128. *See* Dellapenna, *supra* note 91, at 8–9 (explaining how Pennsylvania case law clearly establishes reasonable use rule, but that cases, perhaps due to their age, are filled with confusing dicta making many references to natural flow theory).

129. 9 Pa. 74 (1848).

130. *Miller*, 9 Pa. at 76.

131. *Id.* at 76.

132. *Id.*

133. *Id.* at 77.

134. *Id.*

denounced the English natural flow theory, the *Miller* court did not completely alter the state of riparian rights in Pennsylvania, for it held that a riparian owner would be entitled to relief against another proprietor whose actions "perceptibl[y]" diminished a stream, even if the proprietor bringing suit had no real need for the water.[135]

Not long after *Miller*, Pennsylvania courts crystallized the definition of reasonable use. In *Clark v. Pennsylvania Railroad Co.*,[136] the Supreme Court of Pennsylvania delivered the classic definition of Pennsylvania's reasonable use rule, declaring that riparian owners are entitled "to the natural flow of the water of a stream running through [riparian land], undiminished in quantity and unimpaired in quality, subject to the reasonable use of the water by those similarly entitled, for the ordinary purposes of life."[137] What constitutes a reasonable use of riparian waters is a highly fact-specific determination and depends upon the circumstances of each case.[138] Various considerations of reasonableness may include the purpose to which water is applied,[139] whether or not the diminution of flow prompted by a diversion away from a watershed is de minimus,[140] "the size and capacity of the stream,"[141] and "the condition and circumstances of other proprietors on the stream."[142] Shorthand for these various considerations is that reasonableness requires "a comparison of competing uses."[143]

An essential feature of the reasonable use rule is the preference shown for domestic use.[144] In Pennsylvania, domestic use takes precedence over all other types of use.[145] In fact, domestic use is so protected that an upper riparian owner may use the entirety of a stream so long as that use is reasonably necessary to support his domestic needs.[146] Domestic uses always trump industrial, manufacturing, or other types of uses.[147] The preeminence of domestic use of a watercourse was reiterated as recently as

135. *Id.*

136. 22 A. 989 (Pa. 1891).

137. *Clark*, 22 A. at 990.

138. *See* Brown v. Kistler, 42 A. 885, 886 (Pa. 1899) (affirming trial court's instruction to jury on various factors to consider in making reasonable use determination); Pa. R.R. Co. v. Miller, 3 A. 780, 781 (Pa. 1886) (discussing the considerations a jury must make when deciding if use is reasonable); Messinger's Appeal, 4 A. 162, 162–63 (Pa. 1885) (claiming that reasonableness depends on specific conditions and considerations); *Miller*, 9 Pa. at 77 (stating that reasonableness of use "must depend on the circumstances of each case, and is to be judged of by the jury").

139. *Brown*, 42 A. at 885.

140. *Id.*

141. *Pa. R.R. Co.*, 3 A. at 781.

142. *Messinger's Appeal*, 4 A. at 163.

143. T.E. Lauer, *Reflections on Riparianism*, 35 MO. L. REV. 1, 10 (1970).

144. *See* Weston, *supra* note 119, at 248 (stating that domestic uses generally prevail over others).

145. *See* Clark v. Pa. R.R. Co., 22 A. 989, 990 (Pa. 1891) (discussing the preeminence of domestic use of watercourse); Irving's Ex'rs v. Media, 10 Pa. Super. 132, 145 (1899) (holding that if use is for domestic purposes like watering cattle, riparian owner may "divert, detain and even consume the water"), *aff'd*, 42 A. 882, 886 (Pa. 1899).

146. *See* Palmer Water Co. v. Lehighton Water Supply Co., 124 A. 747, 749 (Pa. 1924) (reiterating that riparian owner can make use of as much of stream as is necessary to support his domestic needs); *Pa. R.R. Co.*, 3 A. at 781 (stating that riparian owner has the right to use as much of a stream as is reasonably necessary for "domestic purposes"); Filbert v. Dechert, 22 Pa. Super. 362, 366 (1903) (discussing the right of a riparian owner to use the entirety of a stream if it is reasonably necessary to support his domestic use).

147. Weston & Burcat, *supra* note 123, at 221.

1987 in *Alburger v. Philadelphia Electric Company*.[148] In *Alburger*, the court stated that "a riparian owner is entitled to use so much of the water that flows through his land as may be reasonably necessary for domestic needs or similar purposes."[149] Domestic use is so favored that the Pennsylvania Supreme Court once declared that "[e]very riparian owner has the right to use the water . . . for ordinary domestic purposes; and if the stream be so small that his cattle drink it all up, while it may be a loss to the lower riparian owner, it is *damnum absque injuria*."[150] In addition to cattle-watering, domestic needs include the "natural wants" of a person, including "drinking, washing, cooking" as well as anything else "necessary to the preservation of life and health."[151] Domestic use is not limited to the use of the riparian proprietor alone, but is rather extended to all those living on a riparian tract, including entire populations of hospitals, group homes, or military barracks situated on riparian land.[152]

Diverting a stream or river to different parts of a riparian tract is referred to as "extraordinary use" and is allowed if it is reasonable and does "not materially or sensibly diminish [a watercourse's] quantity."[153] Extraordinary use occurs typically in manufacturing, agriculture, or other uses that will benefit the riparian tract.[154] Although reasonable extraordinary use is permissible, Pennsylvania courts absolutely prohibit any diversion of water outside the riparian tract, even by a riparian owner himself.[155] Nonriparian diversions are "per se unreasonable," regardless of their impact on the quality or quantity of a stream.[156] This complete prohibition against diversion to nonriparian lands is maintained because the basis of riparianism is that a riparian owner "has no property in the water per se . . . only a right to use the water *on* the riparian land."[157] The correlative nature of riparian rights would break down if a riparian owner

148. 535 A.2d 729 (Pa. Commw. Ct. 1987). *Alburger* is the most recent case in Pennsylvania applying the riparian rights doctrine. Dellapenna, *supra* note 91, at 8.

149. *Alburger*, 535 A.2d at 731.

150. *Pa. R.R. Co.*, 3 A. at 781.

151. *Filbert*, 22 Pa. Super. at 368; *see also* MacRae, *supra* note 86, at 194 (discussing types of domestic uses).

152. *Filbert*, 22 Pa. Super. at 365. In *Filbert* the case dealt with a challenge to the rights of all those living in an insane asylum to use water for their domestic needs. *Id.* The court made a conscious decision to liberally construe the word domestic to not only mean familial, but personal, ordinary and natural needs. *Id*. at 368.

153. *Id*. at 366.

154. Scranton Gas & Water Co. v. Del., Lackawanna & W. R.R. Co., 88 A. 24, 25 (Pa. 1913).

155. *See Scranton Gas & Water, Co*., 88 A. at 24 (stating that it is "unlawful" to divert a stream "for purposes other than those incident to the proper enjoyment of the riparian land"); Clark v. Pa. R.R. Co., 22 A. 989, 990 (Pa. 1891) (discussing the unlawfulness of diverting a stream for non-riparian purposes even when said diversion does not cause injury).

156. Weston & Burcat, *supra* note 123, at 221. Much the same, reasonable use of groundwater is limited to the tract of land immediately overlaying an aquifer. An owner of land above an aquifer is free to use the ground water reasonably. However, use of an aquifer's water away from the land above the aquifer is per se unreasonable. Dellapenna, *supra* note 91, at 64.

157. Wilson, *supra* note 121, at 200.

were allowed to exercise total control over a water resource,[158] for an upper riparian owner's rights are "qualified by the rights of [other] riparian owners."[159]

Accordingly, riparian owners are prohibited from capturing and selling the water running through or next to their land.[160] Traditionally, no injury needed to be shown to halt the diversion of water to nonriparian land, but the rigidness of the common law on this point may have receded, at least somewhat.[161] In *Belin v. Department of Environmental Resources*,[162] the Commonwealth Court of Pennsylvania was faced with a challenge to the authority of the Department of Environmental Resources (DER) to authorize a diversion of "waters from one watershed to another in instances wherein the diversion causes no injury to neighboring landowners."[163] The *Belin* court held that if a diversion causes no injury, then there is "no basis in statute or in decisional law to inhibit the functioning of the Department."[164] This holding indicates that diversions authorized by the DER must cause actual injury to a riparian owner to be actionable. But it is not clear if *Belin's* "actual injury" requirement would apply to diversions made by riparian owners without DER's authorization, or to even more egregious diversions by nonriparian owners.[165]

Another modern case also required a showing of actual injury by a plaintiff seeking an injunction. In *Borough of Media v. Edgmont Golf Club, Inc.*,[166] an upstream riparian owner sold some of his riparian rights in the abutting Ridley Creek, save his domestic use, to Media Borough, a downstream riparian owner.[167] The upstream owner subsequently sold his parcel to the Edgmont Golf Club.[168] Edgmont then began making withdrawals from Ridley Creek to water its golf course.[169] The court acknowledged that Edgmont was bound by the covenant made between Media and the previous upstream owner.[170] It also stated that Edgmont violated the covenant because watering a golf course is not domestic use.[171] However, like the *Belin* court, the *Edgmont* court

158. *Cf.* Beck, *supra* note 107, at 450 (discussing the correlative quality of riparian rights and the demand that riparian owners work among themselves to preserve water supply).

159. Irving's Ex'rs v. Media, 10 Pa. Super. 132, 145 (1899) (quoting Rudolph v. Pa. R.R. Co., 40 A. 1083, 1086 (Pa. 1898)), *aff'd*, 45 A. 482 (Pa. 1900).

160. In *Irving's Executors*, the Pennsylvania Supreme Court stated that a "'riparian owner could not sell the water to a non-riparian owner, nor could he possess himself of the whole of it.'" 10 Pa. Super. at 145 (quoting *Rudolph*, 40 A. at 1086).

161. *See* Dellapenna, *supra* note 91, at 10 (stating that Pennsylvania courts have limited rights of riparian plaintiffs seeking relief for extraordinary use to situations where plaintiffs can demonstrate actual injury).

162. 291 A.2d 553 (Pa. Commw. Ct. 1972).

163. *Belin*, 291 A.2d at 555.

164. *Id.* at 555–56.

165. *Contra* Dellapenna, *supra* note 91, at 10 (stating that Pennsylvania does indeed require actual injury, not that it might require actual injury).

166. 288 A.2d 803 (Pa. 1972).

167. *Edgmont Golf Club*, 282 A.2d at 803.

168. *Id.*

169. *Id.*

170. *Id.* at 804.

171. *Id.*

denied Media's claim for equitable relief because Edgmont's use did not cause Media harm.[172]

In addition to requiring actual injury on the part of the downstream riparian, *Edgmont* seems to establish that riparian rights are conveyable. But because *Edgmont* did not reach the issue of transferability of riparian rights directly, it is unclear what and to whom a riparian owner may convey.[173] A gas company leasing property on riparian land may enjoy the same riparian rights as its lessor, but it may also have significantly fewer rights.[174]

3. Criticism of Reasonable Use Riparianism

Debate concerning the future of riparian rights is important to Pennsylvania because of the stress that will be placed upon the Commonwealth's water resources as Marcellus Shale fracking continues to expand.[175] In recent years, scholars have raised concerns about riparian water regimes, expressing pessimism about the suitability of riparianism in a modern context.[176] The conditions that initially gave rise to riparianism—plentiful water and minimal conflict—are no longer realities, which has sparked intense debate about the future of riparian rights.[177] George Gould sums up the critical disfavor with the common law by stating that "increasing competition for water, greater sensitivity to environmental needs, the desire for more active management of water resources, and other factors, have given rise to a widely held perception that the common law riparian doctrine is no longer adequate to meet the needs of the East."[178]

A primary concern among water scholars is that the reasonable use rule leaves a great deal of uncertainty as to the extent of a riparian owner's rights.[179] This uncertainty is compounded by the restricted nature of the judicial process, which

172. *Id.*

173. *See* Joseph W. Dellapenna, *Pa. Waters and Water Rights*, *in* 6 WATERS & WATER RIGHTS § PA-II (Robert E. Beck & Amy L. Kelley eds., 3d ed. 2009) (claiming that riparian rights are conveyable, but expressing uncertainty about what exactly that means).

174. WESTON, *supra* note 62, at 4; *see also* Dellapenna, *supra* note 91, at 14 ("Just what is acquired through conveyance or condemnation remains unsettled in Pennsylvania law, which probably explains the relative rarity of such transactions.").

175. See *supra* Part II.B for a discussion of the stresses fracking may place on Pennsylvania's water supply.

176. See generally *infra* note 179 for a list of scholars that have expressed concerns with the reasonable use rule.

177. Copas, *supra* note 119, at 702.

178. Gould, *supra* note 109, at 89.

179. Lauer, *supra* note 143, at 13; *see also* Robert H. Abrams, *Water Allocation by Comprehensive Permit Systems in the East: Considering a Move Away from Orthodoxy*, 9 VA. ENVTL. L.J. 255, 263 (1990) (discussing the "characteristic uncertainty" of riparianism and how it does not "promote the establishment of security of right"); Richard Ausness, *Water Rights Legislation in the East: A Program for Reform*, 24 WM. & MARY L. REV. 547, 552–53 (1983) (claiming that riparianism's vagueness leaves great uncertainty as to the extent of riparian rights); Butler, *supra* note 86, at 126 (stating that planning to ensure an optimal level of water use is almost impossible due to the uncertainty of the reasonable use rule); Choe, *supra* note 86, at 1911–12 (explaining that the uncertainty of riparianism is inefficient and inhibits investment); Copas, *supra* note 119, at 701 (claiming that the uncertainty of the reasonable use doctrine produces problems enforcing rights); Eric T. Freyfogle, *Water Justice*, 1986 U. ILL. L. REV. 481, 500 (1986) (discussing the "vagueness and uncertainty" of the reasonable use rule).

produces results that, even if successful, "are frustratingly narrow and limited in scope," as they only affect parties to the litigation, not other users in the water system.[180] Other critics have claimed that riparianism fails because litigation is the only way to protect water interests.[181]

Scholars have pointed to several problems with this litigation-as-enforcement model. One criticism is that riparian-rights regimes address water problems reactively, not proactively.[182] Because one cannot bring a lawsuit without a valid claim, problems are addressed only after they have become problems. In western Pennsylvania, where at least one stream has gone dry on account of unauthorized water withdrawals for fracking,[183] a gas company that makes a diversion from a watercourse "needs no approval of the Commonwealth for the use of the water" and is "limited only by the rights of other riparians and their willingness to challenge the diversion as an unreasonable use damaging their riparian rights."[184] Even if a riparian owner decides to bring a reasonable use case, a court's decision will only settle the dispute between the given parties.[185] This means that a gas company, even if it loses a case, will still be allowed to make withdrawals from other watercourses until another riparian owner decides to file suit.[186]

Another criticism of common law riparianism is "that there is no process for managing water in times of extreme shortage or for otherwise protecting public values."[187] In riparian rights jurisdictions, courts do not often consider the interests of all water users, which can lead to results that are not the best outcomes for the general public.[188] The lack of system-wide regulation in Pennsylvania leads to unfettered and unregulated use, which is "set[ting] the stage for extreme shortages."[189]

180. Lauer, *supra* note 143, at 13.

181. *See* Ausness, *supra* note 179, at 553 (expressing thought that litigation is an inefficient mechanism for dissolving water disputes); Gould, *supra* note 109, at 90 (discussing criticisms of riparian rights and pointing out the tendency to condemn litigative necessity of riparian right enforcement); Lauer, *supra* note 143, at 13 (explaining that requiring litigation to enforce rights is inefficient, uncertain, and extremely narrow).

182. *See* Abrams, *supra* note 179, at 263 (expressing concern that a claim cannot be brought under riparianism until it is "concrete"); Gould, *supra* note 109, at 90 (discussing the reactive nature of riparian rights); SAX ET AL., *supra* note 102, at 76 (discussing the critical disfavor over the reactive nature of riparian rights).

183. *See* 4ABC Pittsburgh, *supra* note 12 (showing footage of natural gas companies making unauthorized water withdrawals and streams that have gone dry on account of fracking withdrawals).

184. Wilson, *supra* note 121, at 201.

185. *See* Gould, *supra* note 109, at 90–91 (pointing out that riparianism fails to address water resource problems logically or efficiently because it leaves riparian's rights "vis-a-vis other riparians unresolved").

186. Under the principle of res judicata, a riparian owner on the same stream would likely be entitled to relief against a gas company if it continued to make withdrawals from that stream. Though this would likely mean significantly shorter litigation, it would still require a riparian to overcome the inertia of filing a law suit.

187. Dellapenna, *supra* note 100, at 559–60.

188. *See id.* (expressing concern over courts' lack of attention to public and other riparian interests when deciding riparian rights cases).

189. MacRae, *supra* note 86, at 195.

Lack of system-wide management gives rise to another criticism, that the reasonable use rule necessarily favors large-scale water users.[190] Riparianism could be manipulated to favor large-scale users because "[s]mall users will be less able to afford to litigate, or to organize collectively for litigation if the water they need is taken by another, more affluent riparian."[191] Aside from the expenses, administrative costs, and difficulties of overcoming the human inertia associated with bringing a riparian rights claim, "the balancing process" required under the reasonable use rule also tends to "strongly favor[] large users over smaller users because the economic value of the water to the large user usually will outweigh the economic loss of the small user."[192] Courts often prioritize a large-scale user's economic loss as opposed to a small-scale user's loss.[193]

B. Regulated Riparianism: The Trend Away from Pure Riparianism

Nearly every state east of the Mississippi River has statutorily modified its common law riparianism.[194] Nineteen states have "enacted administrative permit systems to replace traditional riparian rights."[195] These statutory changes are thought of generally as "regulated riparianism," as they codify many of the principles of riparianism while establishing a level of regulatory oversight that did not exist under the common law.[196] Of the nineteen states that have enacted regulated riparian statutes, fifteen of them apply regulated riparianism to both groundwater and defined surface water.[197] Five other states have enacted statewide regulations that apply only to ground water.[198] Pennsylvania is one of the few eastern states that has not adopted a statewide regulated riparian regime.[199]

No two regulated riparian regimes are exactly alike, but most draw on the core principles that are articulated in each state statute and in the *Model Water Code*, a model code promulgated by the American Society of Civil Engineers.[200] Although one cannot speak about each state's regulated riparianism in the exact same way, the

190. *See* Dellapenna, *supra* note 100, at 560 (explaining that reasonable use leads to "bias in favor of large users").

191. *Id.*; *see also* MacRae, *supra* note 86, at 194 (discussing that a major problem with Pennsylvania's riparian rights regime is that it lacks systematic permitting or prioritization schemes).

192. Dellapenna, *supra* note 100, at 560.

193. *Id.*

194. *See* Ausness, *supra* note 179, at 554 ("Dissatisfaction with common law water allocation doctrines led a number of eastern states to consider adopting a statutory system of water rights."); Wilson, *supra* note 121, at 201 (claiming that nearly all states east of the Mississippi have modified their common law riparian rights with statewide regulatory statutes).

195. Joseph W. Dellapenna, *Special Challenges to Water Markets in Riparian States*, 21 GA. ST. U. L. REV. 305, 327 (2004).

196. *See* SAX ET AL., *supra* note 102, at 76 (explaining the adoption of regulated riparianism and how it "sought to superimpose administrative management system on common law riparianism").

197. 2 WATERS & WATER RIGHTS § 9.03 (Robert E. Beck & Amy L. Kelley eds., 3d ed. 2009).

198. *Id.*

199. Wilson, *supra* note 121, at 201.

200. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.03. *The Model Water Code* was written by Joseph Dellapenna, a professor, water law expert, and prolific writer on regulated riparianism.

discussion that follows touches upon the commonalities between regulated riparian systems.

Regulated riparianism treats water as public property, as opposed to private or common property, which means that water use should benefit the entire public, not just riparian owners who have a land interest in water.[201] Given that water is a public commodity, anyone is free to use it—even use it away from riparian land—so long as she has a permit.[202] Requiring that water users obtain a permit from a state permitting agency is regulated riparianism's most significant modification of common law riparian rights.[203] The state permitting agency is supposed to design or reject permits in a way that benefits not only the party requesting a permit or other riparian owners, but in a way that "protect[s] other lawful [water] users and public values."[204] Water withdrawal permits may be granted to a user for a specific length of time.[205] Other permitting agencies do not issue temporal permits, but instead grant permits that are subject to termination by the regulating agency.[206]

Though permitting schemes are wholly different from the common law, they relate back to riparianism because they are based on "reasonable use."[207] Some states do not specifically use the word reasonable in their statutes, but have instead based the granting of permits on the closely related concepts of "equitable" or "beneficial use."[208] Reasonable use under regulated riparianism is different than under the common law because it is determined prospectively, not retrospectively.[209] Thus, the regulated riparian version of reasonable use is based on the idea that "an administering agency decides before a use begins whether it is reasonable, both in terms of general social policy and in terms of the effects of the proposed use on other permitted uses."[210] Permitting agencies that issue permits for specific lengths of time will reevaluate reasonableness whenever a user's permit has expired.[211] Permitting is therefore thought

201. *See* Dellapenna, *supra* note 195, at 329–31 (explaining that regulated riparian statutes have provisions meant to protect public values).

202. *Id.* at 330.

203. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.03.

204. Dellapenna, *supra* note 195, at 330.

205. *Id.* Depending on the given state, allocation permits may range from three to twenty years. *Id.*

206. *See* Ausness, *supra* note 179, at 555 (claiming that eastern water regulations differ from western water permitting schemes because permits are not perpetual, but instead are subject to temporal or regulatory control).

207. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.03; *see, e.g.*, MASS. GEN. LAWS ANN. ch. 21G, § 7(5) (West 2011) (basing water permitting decisions on "[r]easonable protection of water uses"); MICH. COMP. LAWS ANN. § 324.32723(5)(d) (West 2011) (considering whether a proposed use of water "is reasonable under common law principles of water law in Michigan"); MINN. STAT. ANN. § 103G.315.3 (West 2011) (permitting decisions to be based on ideas of reasonableness and "public welfare").

208. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.03; *see, e.g.*, ARK. CODE ANN. § 15-22-217(a) (West 2011) (requiring water allocation decisions during times of shortage to consider "equitable portion[s]" of available water); DEL. CODE ANN. tit. 7, § 6010(f)(1) (West 2011) (basing approval of water use on "equitable apportionment"); N.Y. ENVTL. CONSERV. LAW § 15-1503.2 (McKinney 2011) (making permit decisions based upon whether water use project is "just and equitable").

209. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.03.

210. Dellapenna, *supra* note 100, at 586.

211. *Id.* at 589–90.

to promote certainty, as permit holders know that their use is considered reasonable for the length of time set out in a permit.[212]

Most regulated riparian regimes tend to give a single agency the authority to manage both water quantity and quality issues.[213] This includes authority to grant permits, as well as promote a statewide water plan that protects public values and expectations.[214] Emphasis on planning is a central feature of regulated riparianism. Every regulated riparian statute requires a regulating agency to develop a long-term, comprehensive plan to properly manage the waters of the state.[215] In some states, planning and permitting are conducted by two separate administrative agencies.[216] Requiring statewide planning is typically the first step to enacting comprehensive regulated riparian legislation.[217]

Planning provisions are used to ensure that state regulating agencies make decisions to protect public values and "optimize" sustainable use of water resources.[218] In times of crisis, most agencies are permitted to modify or cut off a permitted use if that use violates the state's water plan or even "independently of such plans should the agency's plans be inadequate to handle an actual shortage, notwithstanding any inconsistency with a permit."[219] Regulating agencies use permit information to take measures that will help assure expected uses of certain sources.[220] Permitting information also provides regulating agencies with data necessary to determine how to cope with emergencies that threaten expected uses, like low availability of water.[221]

Weaknesses with many of the enacted regulated riparian statutes have been pointed out, including lack of planning provisions, lack of communication between planning agencies and permitting authorities, and exemptions for large-scale users.[222] The large-scale users typically exempted by riparian rights statutes were making their large-scale use before such statutes were enacted.[223] Often, the types of users that are exempted are those that conduct large-scale use for agricultural purposes.[224]

212. Dellapenna, *supra* note 195, at 330–31.

213. Dellapenna, *supra* note 100, at 591.

214. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.05.

215. *Id.*

216. *Id.*

217. *Id.*

218. *Id.*

219. Dellapenna, *supra* note 100, at 590.

220. 2 WATERS & WATER RIGHTS, *supra* note 197, § 9.05.

221. *Id.*

222. *See* Ausness, *supra* note 179, at 589–90 (praising regulated riparianism for correcting many limitations of the common law, but pointing out areas of regulated riparianism that could do more towards attaining optimal use of water resources).

223. Dellapenna, *supra* note 195, at 331–32.

224. *Id.*

C. Regulatory Riparianism in Pennsylvania?: Water Allocation in the Delaware and Susquehanna River Basins

Pennsylvania does not have a regulated riparian system like the type discussed above. The Commonwealth has, however, "achieved something like a regulated riparian system through the river basin commissions created by the Delaware and Susquehanna Compacts."[225] Common law riparianism governs water usage in the westernmost third of Pennsylvania, while the Delaware River and Susquehanna River Basin Commissions control water allocation in the Susquehanna and Delaware River Basins.[226] A statewide permitting scheme like those discussed above would supersede these Compacts, but Pennsylvania remains the only signatory to each that has not enacted a statewide water regulatory regime.[227] Even so, the Susquehanna River Basin Commission has full authority to regulate withdrawals from waters not regulated by signatory states if doing so is necessary to further its comprehensive water plan for the Basin.[228] The Marcellus Shale lies beneath more than seventy-two percent of the Susquehanna River Basin and more than thirty-six percent of the Delaware River Basin.[229]

1. The Delaware River Basin Commission

The Delaware River Basin Commission (DRBC) was established in 1961 with the adoption of the Delaware River Basin Compact.[230] The Compact is an interstate agreement between the four Basin States[231] and the Federal Government.[232] When signed, the Delaware River Basin Compact was the first compact of its kind; not only did it receive the requisite approval of Congress,[233] but the Federal Government also endorsed the Compact as a full signatory to the agreement.[234] The DRBC consists of

225. Dellapenna, *supra* note 91, at 70.

226. Weston & Burcat, *supra* note 123, at 228; Weston, *supra* note 119, at 273. Riparian rights also govern water use in areas covered by the Delaware and Susquehanna River Basin Commissions, but only when the Compacts do not cover a given dispute.

227. JOSEPH W. DELLAPENNA, *The Delaware River Basin Compact Today*, *in* 4-DE-RB WATERS & WATER RIGHTS § IV (Robert E. Beck & Amy L. Kelley eds., 3d ed. 2009) [hereinafter DELLAPENNA, *Delaware River*]; JOSEPH W. DELLAPENNA, *The Susquehanna River Basin Compact*, *in* 4-DE-RB WATERS & WATER RIGHTS § VI (Robert E. Beck & Amy L. Kelley eds., 3d ed. 2009) [hereinafter DELLAPENNA, *Susquehanna River*.

228. 18 C.F.R. § 801.6(b) (2010).

229. *Natural Gas Drilling in the Delaware River Basin*, DEL. RIVER BASIN COMM'N, http://www.state.nj.us/drbc/naturalgas.htm (last updated Sept. 7, 2011) [hereinafter *Natural Gas Drilling*]; SUSQUEHANNA RIVER BASIN COMM'N, ACCOMMODATING A NEW STRAW IN THE WATER: EXTRACTING NATURAL GAS FROM THE MARCELLUS SHALE IN THE SUSQUEHANNA RIVER BASIN 1, *available at* http://www.srbc.net/programs/docs/Marcellus%20Legal%20Overview%20Paper%20(Beauduy).pdf.PDF.

230. 32 PA. CONS. STAT. ANN. §§ 815.101–106 (West 2011) [hereinafter Del. River Basin Compact].

231. The four basin states include Pennsylvania, New Jersey, New York, and Delaware. *Id.* § 815.101.

232. Weston, *supra* note 119, at 280.

233. Under Article I, § 10 of the United States Constitution, Congress must approve all compacts entered into by the states. Morrisville v. Del. River Basin Comm'n, 399 F. Supp. 469, 470–71 (E.D. Pa. 1975).

234. *Id.* at 470; Weston, *supra* note 119, at 280. Because the Federal Government is a full participant, this was the first compact to be classified as a "federal-state" compact. DELLAPENNA, *Delaware River*, *supra* note 227, § IV.

each Basin state's governor, usually represented by a delegate, and one representative from the Federal Government appointed by the President to serve for the term of his presidency;[235] typically a member of the Army Corps of Engineers.[236] About fifteen million people rely on the Delaware River Basin for their drinking water.[237]

The DRBC has broad powers to develop policies and plans for the entire river Basin. Under the Compact, the DRBC may allocate the Basin's waters among the signatories, develop, implement, and operate projects related to the water supply; including the authority to construct dams and water supply facilities, to coordinate pollution control, to institute flood protection measures, to promote watershed management, to develop the Basin for recreational activities, and to develop and construct hydroelectric facilities within the Basin.[238]

In addition to the above powers, the DRBC possesses the power to "regulate and control withdrawals and diversions from surface waters and ground waters of the basin."[239] But before the DRBC can require water users to obtain withdrawal permits, the Commission must first designate a portion of the Basin as a "protected area."[240] A protected area is one "wherein the demands upon supply made by water users have developed or threaten to develop to such a degree as to create a water shortage or to impair or conflict with the requirements or effectuation of the comprehensive plan."[241] The DRBC also has authority to declare a "water supply emergency" when it determines there is an "actual and immediate shortage of available water supply within the [B]asin, or within any part thereof."[242]

If the DRBC deems that an area is "protected" or in an "emergency," no user may make withdrawals from the Basin except with a permit issued by the DRBC, or by one of the signatory states.[243] Thus, anyone undertaking a project that will have a "substantial effect on the water resources of the [B]asin" may not proceed with his plans without first submitting a proposal to the Commission.[244] All projects that will result in surface or ground water withdrawals in excess of 100,000 gallons per day over a thirty-day period must be submitted to the DRBC, as this is the level of water use deemed by the Commission to have "substantial effect" on the Basin's water resources.[245] After a potential water user submits its plan, the DRBC has authority to grant, deny or modify a permit "so as to avoid . . . depletion of the natural steam flows and ground waters in the protected area or in an emergency area as will adversely affect the comprehensive plan or the . . . equitable interests and rights of other lawful users of

235. Del. River Basin Compact, § 2.2.

236. DELLAPENNA, *Delaware River*, *supra* note 227, at § IV.

237. DEL. RIVER BASIN COMM'N, WATER RESOURCES PROGRAM: FY 2010–2015, at 4 (adopted July 14, 2010), *available at* http://www.state.nj.us/drbc/WRP2010-2015.pdf.

238. *See generally* Del. River Basin Compact, §§ 3.1–3.6, 4.1–4.2, 5.1–5.5, 6.1–6.4, 7.1–7.4, 8.1–8.4, 9.1–9.5.

239. *Id.* § 10.1.

240. *Id.* § 10.2.

241. *Id.*

242. *Id.* § 10.4.

243. *Id.* § 10.3–10.4.

244. *Id.* § 3.8.

245. Weston, *supra* note 119, at 281–82.

the same source."[246] The DRBC must approve the project if it "would not substantially impair or conflict with the comprehensive plan."[247] Substantial impairment or conflict with the comprehensive plan is not clearly defined, although it seems to leave complete discretion to the DRBC.[248]

In its most recent water resources program, the DRBC recognized that fracking in the Marcellus Shale could "adversely affect or stress water resources" within the Basin,[249] and stated that fracking "must be conducted in a way to minimize impacts to water resources."[250] Since May 19, 2009, the DRBC has required that all sponsors of natural gas projects located within an area of the Basin's "Special Protection Waters" first submit their projects to the Commission for approval, regardless of the amount of water the project proposes to withdraw.[251] The Special Protection Waters designation first applied to a 121 mile stretch between Hancock, New York and the Delaware Water Gap in Pennsylvania, but has since been applied to key stretches of the Lower Delaware River.[252] A significant portion of this stretch sits atop the Marcellus Shale.

2. The Susquehanna River Basin Commission

The Susquehanna River Basin Commission (SRBC) formed in 1970 upon passage of the federal-state Susquehanna River Basin Compact.[253] The signatories to the Compact[254] took the Delaware River Basin Compact as their model, and bestowed upon the SRBC similar powers as the DRBC. [255] Like the DRBC, the SRBC disallows any "project" that may have an effect on the water resources of the Basin prior to approval by the Commission.[256]

In terms of natural gas activities in the Basin, "project" means "the drilling pad upon which one or more exploratory or production wells are undertaken, *and all water-related appurtenant facilities and activities related thereto*."[257] All "natural gas well development project[s] in the [B]asin targeting" the Marcellus Shale are subject to SRBC approval "*regardless of the quantity*" of water to be used.[258] Non-Marcellus Shale projects are only subject to SRBC approval if they require a thirty-day average water withdrawal of 100,000 gallons per day.[259] Additionally, all "consumptive use"

246. Del. River Basin Compact, § 10.5.

247. *Id.* § 3.8.

248. *See id.* (providing no standard by which DRBC will make its determination as to whether a given project substantially impairs or conflicts with the Basin-wide water plan).

249. DEL. RIVER BASIN COMM'N, *supra* note 237, at 11.

250. *Id.*

251. *Natural Gas Drilling*, *supra* note 229.

252. *Special Protection Waters: "Keeping the Clean Water Clean,"* DEL. RIVER BASIN COMM'N, (Nov. 6, 2008), http://www.state.nj.us/drbc/SPWflyerNov2008.pdf.

253. DELLAPENNA, *Susquehanna River*, *supra* note 227, § II.

254. The signatories are Maryland, New York, Pennsylvania, and the federal government. *Id.* § VI.

255. *Id.*; Weston, *supra* note 119, at 284.

256. 18 C.F.R. § 806.23(b)(2) (2009).

257. *Id.* § 806.3 (emphasis added).

258. *Id.* § 806.4(a)(8) (emphasis added).

259. *Id.* § 806.4(a)(2)(i).

projects exceeding an average water use of 20,000 gallons per day over thirty days must first be approved by the SRBC.[260] The SRBC defines consumptive use as

> [t]he loss of water transferred through a manmade conveyance system . . . due to . . . incorporation into products during their manufacture, evaporation, injection of water or wastewater into a subsurface formation from which it would not reasonably be available for future use in the basin . . . or any other process by which the water is not returned to the waters of the basin undiminished in quantity.[261]

The SRBC will not approve projects that will have "significant adverse impacts" upon the Basin's water resources.[262]

The SRBC applies the same standard of review to Marcellus and non-Marcellus Shale applications, whether or not "a project would cause adverse impacts" to the Basin's water resources.[263] In conducting its adverse impact analysis, the SRBC considers the following assorted factors:

> [l]owering of groundwater or stream flow levels; rendering competing supplies unreliable; affecting other water uses; causing water quality degradation that may be injurious to any existing or potential water use; affecting fish, wildlife or other living resources or their habitat; causing permanent loss of aquifer storage capacity; or affecting low flow of perennial or intermittent streams.[264]

When reviewing projects, the SRBC claims to conduct an "environmental screening that examines the designated use of the stream, wild trout status, impairment, presence of rare, threatened or endangered species, surrounding wetlands and scenic waterways."[265] When the SRBC approves a water withdrawal—for fracking or otherwise—the Commission includes a measure to protect streams during low-flow periods called a "passby flow," a "prescribed quantity of stream flow that must be allowed to pass a specific point downstream from a water supply intake at any time a withdrawal is occurring."[266] During a low-flow period, the SRBC has authority to require a project sponsor to decrease or to cease its withdrawal operations.[267]

In 2008, the SRBC granted eighty-two permits for natural gas projects.[268] By 2009, the SRBC received 613 withdrawal applications for fracking activities in the Basin, granting 427 of those permits by December 2009; the other 186 permits were not rejected but remained pending.[269] The SRBC has not yet reported on 2010 applications, but given that fracking has increased in the Basin since 2009, it is likely

260. *Id.* § 806.4(a)(1)(iv).

261. *Id.* § 806.3.

262. *Id.* § 806.23(b)(2).

263. SUSQUEHANNA RIVER BASIN COMM'N, *supra* note 11, at 1.

264. 18 C.F.R. § 806.23(b)(2).

265. SUSQUEHANNA RIVER BASIN COMM'N, *supra* note 11, at 2.

266. *Id.*

267. *Id.*

268. SUSQUEHANNA RIVER BASIN COMM'N, ANNUAL REPORT 2009, at 5 (2009), *available at* http://www.srbc.net/pubinfo/docs/annualreport2009.pdf.

269. *Id.*

that the Commission has seen a rise in the number of permit applications for natural gas projects.[270]

The SRBC has recently approved many fracking projects through Approval by Rule (ABR), an expedited review procedure for projects making consumptive use of public water supplies.[271] A public water supply is a water system for human consumption that "[s]erves at least 15 service connections used by year-round residents of the area served by the system,"[272] or "at least 25 year-round residents."[273] Under ABR, the SRBC evaluates a project within thirty days, rather than at one of the Commission's quarterly project-approval meetings.[274] The SRBC's basis for expediting project review under ABR is that it has already analyzed the basin-wide impacts of withdrawals made from the public water supply, and thus, does not need to evaluate a consumptive use beyond its impact on the specific public water supply.[275] If a public water supply can support a proposed consumptive use, the project will be approved.[276] The SRBC did not initially intend Marcellus Shale projects to go through ABR, but it has allowed them to utilize the process so that "time sensitive" gas projects can "continue while requests for surface water approvals under[go] review and consideration."[277] The SRBC issues ABRs to individual drill pads for eighteen months for each public water supply they use.[278] As of August 2, 2010, the SRBC has used ABR to grant 838 permits to natural gas projects making consumptive use of public water supplies within Pennsylvania.[279]

D. Relevant Pennsylvania Water Statutes

Though Pennsylvania has not yet passed statewide water permitting requirements, it has enacted some legislation regarding water quantity and quality.[280] This Section highlights two Pennsylvania water statutes that attempt to provide some state-level

270. See *supra* notes 57–63 and accompanying text for a discussion of how fracking activities within Pennsylvania are expanding rapidly.

271. 18 C.F.R. § 806.22(e) (2009).

272. *Id.* § 806.3.

273. *Id.*

274. SUSQUEHANNA RIVER BASIN COMM'N, *supra* note 11, at 4.

275. *Id.*

276. *See id.* (indicating that the SRBC grants Approval by Rule if the public water supply is able to withstand the proposed consumptive use).

277. *Id.*

278. *Id.*

279. *Approval by Rule (ABR) for Natural Gas Pad Locations under 18 C.F.R. 806.22(f) in the Susquehanna River Basin*, SUSQUEHANNA RIVER BASIN COMM'N (Aug. 2, 2010), *available at* http://www.srbc.net/atlas/downloads/BasinwideAtlas/PDF/1404b_ABR.pdf.

280. Clean Streams Law, 1937 Pa. Laws 1987 (codified as amended at 35 PA. CONS. STAT. ANN. §§ 691.1–691.1001 (West 2011)); Pennsylvania Safe Drinking Water Act, 1984 Pa. Laws 206 (codified as amended at 35 PA. CONS. STAT. ANN. §§ 721.1–721.17 (West 2011)). These Pennsylvania water regulations are applicable to the entire state. Many of them deal primarily with water quality, not water quantity.

control over the waters of the Commonwealth: the Water Resources Planning Act,[281] and the Oil and Gas Act.[282]

1. Pennsylvania Water Resources Planning Act

The Pennsylvania Water Resources Planning Act requires Pennsylvania to formulate and adopt a statewide water plan.[283] The Act separates the state into six regions, each of which is assigned a regional planning committee responsible for creating its own region-wide water resource plan.[284] The regions are divided along the lines of the six different watersheds within Pennsylvania.[285] Committees for each of the six regions are responsible for developing their own regional water plans and for guiding the statewide committee on incorporation of those regional plans into the larger statewide plan.[286] Regional and state water plans must first be drafted and presented at a public hearing before the state and regional planning committees may adopt them.[287] The state planning committee is charged with "[e]nsuring public participation in the development or amendment of the State water plan."[288] Both regional and statewide plans must also be reevaluated and updated every five years.[289]

Statewide and regional plans must include fifteen different elements.[290] Some of the required elements consist of "an estimate of the safe yield of [surface water] sources for withdrawal and nonwithdrawal uses during periods of normal conditions and drought"; inventory of groundwater resources in the region and Commonwealth including "withdrawal limits and [the] relationship to stream base flows"; assessment of future and present withdrawal and nonwithdrawal water demands; "identification of potential problems with water availability or conflicts among water uses and users"; and an assessment of the demands of public water supply agencies.[291] The Act also calls for state and regional planning committees to designate "critical water planning areas," localities "where existing or future demands exceed or threaten to exceed the safe yield of available water resources."[292] Once designated a critical area, the specific regional and the statewide committees work together to formulate a "critical area resources plan" that must identify "existing and future reasonable and beneficial uses," the water available for such uses, and the amount of water available for use in new, existing, or future projects.[293]

281. 27 PA. CONS. STAT. ANN. §§ 3101–3136 (West 2011).
282. 25 PA. CODE §§ 78.1–78.906 (2010).
283. 27 PA. CONS. STAT. ANN. § 3111(a).
284. *Id.* §§ 3111(a), 3113(a)(1)–(6).
285. *Id.* § 3113(a)(1)–(6).
286. *Id.* §§ 3111(a), 3113(c)(1).
287. *Id.* § 3115(b)(1)(i), (b)(3).
288. *Id.* § 3115(a)(2)(ii).
289. *Id.* § 3115(a)(1).
290. *See generally id.* § 3112(a)(1)–(16).
291. *Id.* § 3112(a)(1)–(5), (7).
292. *Id.* § 3112(a)(6), (d)(1).
293. *Id.* § 3112(d)(5)(i)–(iii).

2. Pennsylvania Oil and Gas Act

Pennsylvania regulates oil and gas drilling through the Oil and Gas Act. Although the Oil and Gas Act is not a water statute, one provision of the act does relate to water and is especially relevant in the fracking context. Under section 78.51 of the Act, a gas company that "affects a public or private water supply by pollution or diminution shall restore or replace the affected supply with an alternate source of water adequate in quantity and quality for the purposes served by the supply."[294] If the Pennsylvania Department of Environmental Protection makes a finding that a well operator has affected a water supply through pollution or diminution, then the operator must show that "the quality of the restored or replaced water supply to be used for human consumption is at least equal to the quality of the water supply before it was affected by the operator."[295] If the affected water supply is not used for consumption but for a use dependent upon the quantity of the affected body—like generating hydro-electricity—then the well operator must demonstrate that the replacement or restoration of water will serve that purpose.[296]

IV. DISCUSSION

This Discussion begins by evaluating Pennsylvania's water law. It focuses on Pennsylvania's potential to adequately deal with the unprecedented demand for water that hydraulic fracturing and natural gas extraction present.[297] This Discussion analyzes current water law to determine whether it can guard against environmental degradation and protect Pennsylvania's citizens and aquatic ecosystems. This Discussion first finds that Pennsylvania's riparian rights regime does not properly protect the environment before considering whether regulated riparianism represents a more appropriate replacement. It proposes that a centralized water regulatory regime would be better able to guard against environmental degradation of the Commonwealth's water resources. It argues that a strong water regulatory regime requires a permitting standard based on precise terms before evaluating the Delaware and Susquehanna River Basin Commissions—two examples of centralized water regimes currently in control of about two-thirds of Pennsylvania—in light of this standard.

Finally, this Discussion offers several measures that Pennsylvania should take to ensure that its water regulatory regime is strong enough to protect the Commonwealth's aquatic resources and the ecosystems and people that depend upon them. It argues that Pennsylvania must adopt a statewide water regulatory regime that requires permits for all water withdrawals. This regulatory program should feature a single regulatory agency responsible for making permitting decisions and for limiting or cutting off use when necessary. It should also allow for citizen suits. And most importantly, it must base its permitting decisions on a clear, scientific standard in order to adequately

294. 25 PA. CODE § 78.51(a) (2010).

295. 40 Pa. Bull. 3845 (Jul. 10, 2010) (to be codified at 25 PA. CODE § 78.51(d)), *available at* http://www.pabulletin.com/secure/data/vol40/40-28/1248.html.

296. 25 PA. CODE § 78.51(e).

297. See *supra* notes 71–72 and accompanying text for estimates of the amount of water necessary to frack wells in the Marcellus Shale.

protect against harm to Pennsylvania's aquatic resources and to provide an easily applied basis of review for those who wish to challenge awarded permits.

A. Evaluating Pennsylvania Water Law

1. Analyzing Riparian Rights in Pennsylvania

In regards to protecting against environmental degradation of water resources, Pennsylvania's water common law suffers from both procedural and substantive defects. This Subsection discusses how the procedural limitations and substantive application of the reasonable use rule render it incapable of properly protecting against environmental degradation that may accompany the use of Pennsylvania's waters for the purpose of hydraulic fracturing.

a. Procedural Limitations of Riparian Rights and the Reasonable Use Rule

Pennsylvania's water common law has several procedural limitations. The first such limitation is that only riparian landowners have water rights, and that only those who possess such rights can challenge water withdrawals. Under riparianism, one may acquire the right to use water only by owning land that abuts or overlays a watercourse.[298] Riparian rights are "vested," in that they may be protected by bringing a claim in law or equity.[299] Much the same, the right to use an aquifer, and thus the privilege to protect that right in court, is gained only by owning property that sits atop an aquifer.[300] The only recourse for persons who believe their riparian rights have been violated is to bring a lawsuit. A person may not bring a case against a water withdrawer unless she owns riparian property or property overlying an aquifer.

Because nonriparians are not permitted to challenge a water withdrawal under the common law, the number of potential water-rights cases is automatically limited to a class of citizens who possess certain property.[301] Disallowing nonriparians from bringing suit severely limits the number of potential cases that could be initiated to protect Pennsylvania's water resources. Citizens of the Commonwealth who wish to protect its water resources from excessive withdrawals relating to fracking—at least those living in western Pennsylvania—are entirely subject to the willingness of riparian owners to challenge a natural gas company's withdrawals.[302] The riparian ownership requirement necessarily means that environmental groups dedicated to protecting water resources through litigation, or concerned citizens willing to litigate but for owning riparian property, have no standing to bring a claim against a natural gas company that makes water withdrawals for fracking. The best these groups could do is to try to

298. See *supra* Part III.A.1 for a discussion of the nature of the riparian rights doctrine.

299. See *supra* notes 101–04 and accompanying text for information on the vested nature of riparian rights.

300. See *supra* notes 121–24 and accompanying text for a discussion of how the Pennsylvania common law of ground water is functionally equivalent to its common law of surface water.

301. In this Section, "riparian" is used to mean traditional riparian property, as well as property overlying an aquifer and the owners of such land.

302. See *supra* Part III.A.2 for a discussion concerning the geographical scope of Pennsylvania's water common law.

persuade a riparian to file a claim. Allowing only riparian owners to bring suits leaves the Commonwealth's water resources in greater jeopardy of being overexploited.

Given the dearth of Pennsylvania riparian rights cases over the last century, it seems likely that many riparian owners will be unwilling to initiate riparian rights enforcement actions against gas companies.[303] The high costs of litigating a claim support the idea that many water problems precipitated by fracking withdrawals will never be addressed, as eligible riparian litigants might be unwilling or unable to support the costs of enforcing their rights.[304]

A second procedural problem with riparian rights is the doctrine's litigation-as-enforcement method.[305] The riparian rights doctrine is a water management system based on regulation through litigation.[306] Rather than proactively prevent a problem, riparians must wait for a water withdrawer to take an action that comes up against their own riparian rights.[307] Problems with the reactive character of riparian rights are illuminated in the fracking context. Natural gas companies have already demonstrated that they are willing to drain whole streams, even while possessing no riparian rights.[308] As discussed above, common law riparianism leaves nonriparians powerless to stop behavior like this. Although riparian owners enjoy the right to bring a water-rights claim, by the time a suit gets to trial, environmental damage may have already been done. Riparianism's post-harm approach is surely not encouraging for one who wishes to see all water withdrawals made in the most environmentally conscious way.

b. Substantive Limitations of the Reasonable Use Rule

A major substantive concern with Pennsylvania's riparian rights doctrine stems from its reliance on the reasonable use rule.[309] By its very nature, the reasonable use rule promotes uncertainty as to the extent of a given riparian's rights. The only certain outcome of a reasonable use case is where the nondomestic use of a riparian owner detrimentally affects another riparian's domestic use.[310] Pennsylvania case law shows that a riparian litigant making domestic use of a stream would likely triumph considering Pennsylvania's strong preference for domestic use. The preference for domestic use could, theoretically, present a strong device for riparian owners wishing to prevent large-scale water withdrawals relating to fracking. It seems unlikely, however, that most individual riparian owners still make domestic use of the

303. *See* Dellapenna, *supra* note 173, § PA-II (stating that cases establishing Pennsylvania's riparian rights rules are "notably old").

304. *See* Lauer, *supra* note 143, at 13 (claiming that litigation is expensive and time-consuming).

305. See *supra* notes 176–81 and accompanying text for a discussion of criticisms of the reactive nature of the riparian rights doctrine and the problems it may cause.

306. See *supra* Part III.A.3 for a discussion of how the reasonable use rule is enforced only through litigation.

307. See *supra* notes 181–86 and accompanying text for a discussion of the "reactive" character of the riparian rights doctrine.

308. See *supra* note 12 and its accompanying video footage for evidence that natural gas activity within the Pennsylvania has already led to drainage of whole streams.

309. See *supra* Part III.A.2 for a discussion of Pennsylvania's version of the reasonable use rule.

310. See *supra* notes 144–52 and accompanying text for an explanation of Pennsylvania's preference for domestic use of water and for cases applying the preference.

watercourses abutting their property. In an era where public water systems supply the majority of the population, there is little need to rely on water abutting one's property.[311]

If domestic use is not involved in a water dispute, a court will balance a range of factors to decide what constitutes reasonable use. Reasonable use forces courts to evaluate each case as it arises, and to take into consideration competing uses, physical characteristics of the water body, and the categories of uses by the feuding owners.[312] Courts are likely not well equipped to make such determinations concerning complicated water supply issues.[313] Another flaw with this balancing approach is that courts tend to evaluate a given dispute by looking only at the parties to the suit, rather than by considering the water system as a whole, which may lead to results that are not necessarily in line with "public values."[314] The uncertainty of the reasonable use rule also gives way to long and drawn out court cases. A Pennsylvania court that hears a reasonable use case is likely to be very slow in addressing the situation, for Pennsylvania case law shows that courts have tended to "settle[] disputes only after two to five years of trial and appeal, hardly a comfort to those requiring settlement of water rights in the midst of a drought."[315] The aim of environmental protection is not served when it takes several years simply to determine if a watercourse is being reasonably used.

Pennsylvania's reasonable use rule is further complicated by the rise of the natural gas industry. It is entirely possible that natural gas companies will attempt to purchase riparian property with the intention of legally acquiring a source of freshwater necessary for fracking. Although it is clear that a natural gas company would gain riparian rights via purchase of riparian property, it is less clear whether a gas company would acquire riparian rights by possessing a leasehold on riparian land.[316] One may question how many leases on riparian property gas companies will actually obtain. But, because a tract of land is riparian so long as any part of it touches a watercourse,[317] it is possible that a fair number of leases will be made within large swaths of property, some of which touch a watercourse.

Assuming a natural gas company is able to acquire riparian rights, it would be expected to make reasonable use of the watercourse abutting its riparian property. If it uses water inside a riparian holding, a traditional balancing test would be required to determine the reasonableness of that gas company's water use, should another riparian challenge it. The likelihood, however, that water will be used within riparian property is rather low. Thus far, most Marcellus Shale wells have not been located close to a

311. An exception to this, of course, is the use of an aquifer for the purposes of drinking water.

312. See *supra* notes 137–40 and accompanying text for a discussion of the various uncertainties produced by Pennsylvania's reasonable use rule and the various considerations made by courts.

313. *See* Dellapenna, *supra* note 100, at 559–60 (describing the limitations of courts in making reasonable use balancing determinations).

314. *See id.* (arguing that courts making reasonable use determinations are myopic for not considering the rights of all water users, which can lead to results that do not best serve the public).

315. Weston & Burcat, *supra* note 123, at 225.

316. *See supra* notes 173–74 and accompanying text for the notion that a natural gas company might gain riparian rights when it leases riparian property, or that it might gain less than full riparian rights.

317. See *supra* Part III.A.1 for a discussion of what makes a piece of property "riparian."

watercourse, and have required several hundred water tankers to transport water to each well site.[318] This pattern suggests that a gas company with riparian rights could use its right of water access to make extraordinary use of the water at extrariparian well sites.

The possibility that a natural gas company could make extraordinary use of water highlights another potential limitation of riparian rights in Pennsylvania. Pennsylvania courts now seem to require that a complaining riparian demonstrate actual injury when alleging extraordinary use.[319] Under a traditional conception of the extraordinary use rule, a withdrawal made by a riparian gas company for use on nonriparian land would be per se unreasonable.[320] Withdrawals made by nonriparian natural gas companies from streams and rivers would unquestionably be unreasonable per se, and halted by an injunction.[321] The burden upon the party asserting her riparian rights, however, seems to have gotten much higher in light of *Belin v. Department of Environmental Resources*[322] and *Media v. Edgmont Golf Club, Inc.*[323] These cases seem to indicate that riparian owners who bring suit against a water withdrawer need to demonstrate actual injury to forward a winning claim.[324]

The potential reach of both *Belin* and *Edgmont* is particularly important considering the continued expansion of the natural gas industry within the Marcellus Shale. Oil and gas companies have already shown they are willing to make nonriparian withdrawals, and the need for more freshwater necessary to meet the needs of fracking will only increase.[325] In *Belin*, the complainant objected to a diversion that was properly authorized by the Pennsylvania Department of Environmental Resources.[326] *Belin* is distinguishable from a scenario in which a natural gas company simply drives a water tanker next to a stream and starts withdrawing due to the fact that the *Belin* defendant was acting under state authority.[327] *Edgmont Golf Club*, on the other hand, is

318. See *supra* notes 76–80 and accompanying text for a discussion of how water tankers are necessary to transport the millions of gallons of necessary water to Marcellus Shale well sites.

319. See *supra* notes 165–72 and accompanying text for a discussion of the possibility that Pennsylvania courts may now require a complaining riparian to demonstrate actual injury in order to prevail on a reasonable use claim.

320. See *supra* notes 153–59 and accompanying text for a discussion of the extraordinary use rule and how it has traditionally been treated as use that is unreasonable per se.

321. See *supra* notes 153–59 and accompanying text for a discussion of extraordinary use and the per se unreasonableness of a nonriparian making a water withdrawal.

322. 291 A.2d 553 (Pa. Commw. Ct. 1972).

323. 288 A.2d 803 (Pa. 1972).

324. *See Edgmont Golf Club*, 288 A.2d at 804 (refusing to issue an injunction against an upstream owner that was bound by a covenant giving up its riparian rights because its water withdrawal did not cause injury to the complaining party); *Belin*, 291 A.2d at 555 (denying an injunction halting the diversion of waters from one watershed to another where the diversion caused no actual injury to the complaining party).

325. See *supra* note 12 and accompanying video for a demonstration of the withdrawal practices of oil and gas companies that are fracking the Marcellus Shale. See *supra* Part I.B for a discussion of how the natural gas industry within Pennsylvania is rapidly expanding and how it will require significant water resources in order to frack the thousands of new wells that will be drilled.

326. *See Belin*, 291 A.2d at 555 (stating that the diversion was authorized by the Department of Environmental Resources).

327. See *supra* note 12 and accompanying video for a demonstration of how natural gas companies have demonstrated a willingness to make withdrawals from streams and rivers without permission or riparian property.

more difficult to distinguish. Edgmont was bound by a covenant through which the previous landowner gave up all of his riparian rights, save his domestic use.[328] So even though Edgmont owned the land next to a creek, it was no longer riparian.[329] Edgmont's diversions violated the covenant, and were therefore nonriparian. In spite of this, the Pennsylvania Supreme Court still required a showing of actual injury on the part of the complaining party.[330] Read together, *Belin* and *Edgmont Golf Club* seem to stand for the premise that riparian owners are required to show that actual injury results from a nonriparian or extraordinary diversion before they are entitled to relief. Under these cases, natural gas companies may be free to continue their nonriparian or extraordinary withdrawals without repercussion in situations where it is difficult for a complaining party to show "actual injury."[331] This heightened standard could have terrible repercussions for aquatic ecosystems throughout western Pennsylvania because although a withdrawal might not "actually" injure a riparian, it could certainly have unseen impacts on the ecosystem of a watercourse that will go entirely unaddressed.

Another major substantive concern with the reasonable use rule is that it could favor large-scale users like natural gas drillers. Pennsylvania should be most concerned about this, as it faces an increase in fracking operations by oil and gas companies with international portfolios. In a situation not involving domestic use, balancing the competing large-scale uses of a gas company and that of a riparian making small-scale use of a watercourse is a situation likely to favor the natural gas company. The entire basis for adopting reasonable use was to assure the economic use of a watercourse.[332] It is not surprising then that when a court engages in a reasonable use analysis, "the balancing process generally strongly favors large users over smaller users because the economic value of the water to the large user usually will outweigh the economic loss of the small user."[333] Assuming that a judge hearing a reasonable use case will base her decision on economic factors, it will be hard for a small user to prevail over a large-scale user like a natural gas company that withdraws water for the purpose of engaging in a very profitable industry. A riparian owner motivated to bring litigation in the hopes of preserving aesthetic beauty or environmental integrity of a watercourse would have little chance of prevailing in a reasonable use balancing test, for it would be difficult for a court to place economic value on a stream's aesthetics or the ecosystem system it sustains. Failure to take account of such intangible factors will benefit a large-scale

328. *Edgmont Golf Club*, 288 A.2d at 803.

329. *Id.* at 803–04.

330. *Id.* at 805.

331. If Pennsylvania courts decide that nonriparian water withdrawals must cause "actual injury," it is not clear what exactly a riparian owner would need to show to demonstrate that requisite injury. The case law is completely lacking on this question. What is clear, however, is that the injury would actually need to be sustained by a riparian owner given that nonriparians are barred from bringing injunctive actions for violations of riparian rights.

332. *See* Tyler v. Wilkinson, 24 F. Cas. 472, 474 (C.C.D.R.I. 1827) (No. 14,312) (exemplifying the first American case to adopt the reasonable use rule on the basis that continued adherence to the natural flow theory "would be to deny any valuable use of [water]"); Miller v. Miller, 9 Pa. 74, 77 (Pa. 1848) (exemplifying the first Pennsylvania case to adopt the reasonable use rule on the premise that a strict interpretation of the natural flow theory "would be to deny all valuable use to the riparian proprietors").

333. Dellapenna, *supra* note 100, at 560.

user like a natural gas company, but continue to leave Pennsylvania's water resources vulnerable to excessive withdrawal.

2. Analyzing Pennsylvania Water Statutes

This Subsection briefly discusses the Pennsylvania Water Resources Planning Act[334] and section 78.51 of the Pennsylvania Oil and Gas Act,[335] relating directly to water quality and quantity. These statutes are not capable of protecting the Commonwealth's water supplies against environmental degradation.

a. The Water Resources Planning Act

The Water Resources Planning Act (WRPA) requires Pennsylvania to formulate a statewide water plan according to information regarding the amount of water used throughout the Commonwealth and the amount of water necessary to maintain the demand for water throughout the state.[336] It also requires those preparing the water plan to designate certain areas throughout the state as containing critically threatened water resources.[337] The WRPA is commendable for the emphasis it places on developing a long-range statewide water plan and for attempting to compile valuable information that water users may access when making decisions regarding water use. But though much of the WRPA deals expressly with water quantity and quality issues, it is a regulation wholly without teeth.

The WRPA does not require water users to apply for a permit before making use of water. Furthermore, it does not disturb Pennsylvania's water common law. By its own terms, the WRPA is not meant "to constitute or contain legally binding regulations, prohibitions or prescriptions."[338] And nothing in the Act "shall be construed to authorize, expand or diminish the existing authority of the [Pennsylvania Department of Environmental Protection] . . . to regulate, control or require permits for the withdrawal or use of water."[339]

Any water plan promulgated under the WRPA is not to serve as an authoritative regulation that water users must follow, but is instead to be used generally as a "policy and guidance document"[340] that private and public water users, developers, policymakers, and educators can use to help make decisions regarding Pennsylvania's water supply.[341] Though it is possible the WRPA is a precursor to the adoption of a full-scale water regulatory regime, it currently does not disturb Pennsylvania's riparian rights regime and grants the state no authority to curb the excessive use of water likely

334. 27 PA. CONS. STAT. ANN. §§ 3101–3136 (West 2011).

335. 25 PA. CODE §§ 78.1–78.906 (2010).

336. 27 PA. CONS. STAT. ANN. § 3111.

337. See *supra* Part III.D.1 for a discussion of the Pennsylvania Water Resources Planning Act and for a list of the requirements to be included in the statewide and regional water plans.

338. 27 PA. CONS. STAT. ANN. § 3116(a).

339. *Id.* § 3111(c).

340. *Id.* § 3116(a).

341. *Id. See generally id.* § 3116(b)(1)–(6).

to accompany the expansion of hydraulic fracturing operations within the Marcellus Shale.[342]

b. The Oil and Gas Act

Section 78.51 of the Pennsylvania Oil and Gas Act requires gas companies that have polluted or diminished a public or private water supply through gas or oil drilling to replace the quality or quantity of that water supply in conformity with its given use.[343] This provision is very important in that it protects those living in communities most directly exposed to the environmental impacts related to fracking. However, section 78.51 actually does nothing to prevent the water supply from being affected in the first place. Much like riparian rights, this provision deals with water problems retrospectively. Even though the statute calls for the replacement of the water supply, this does nothing to remedy the environmental harm that has already occurred. Proper protection of the Commonwealth's water supply from overexploitation due to fracking is not accomplished by requiring gas companies to pay for harm that they happen to cause. Even so, this provision is invaluable for protecting those harmed by oil and gas drilling.

B. Considering Regulated Riparianism

Despite the limitations of common law riparianism, many scholars believe that regulated riparianism is the best way to control water allocation in the East.[344] Regulated riparian regimes are usually statewide water regulatory systems that require water-use permits based on common law riparian principles.[345] Regulated riparianism seems like an appealing alternative to the common law because it requires that water users obtain permits before making water withdrawals, which has the potential to remedy the reactive nature of common law riparianism and allow for better resource control and planning.[346] It is also an improvement over the common law in that it considers nonriparian owners and their stake in the state's water resources.[347]

342. *See* 2 WATER & WATER RIGHTS, *supra* note 197, § 9.05 ("Comprehensive long-range planning often is the first step that a traditional riparian rights state takes in transforming itself into a regulated riparian state."); Dellapenna, *supra* note 92, at 83 (claiming that the Water Resources Planning Act could lead to changes in Pennsylvania's riparian rights regime).

343. 25 PA. CODE § 78.51 (2010). See *supra* Part III.D.2 for a brief discussion of the mandate that an oil or gas company replace the quantity or quality of a water supply if their drilling activities are responsible for polluting a water source or for causing its diminution.

344. *See, e.g.*, Dellapenna, *supra* note 91, at 57. *But see* Gould, *supra* note 109, at 89–90 (questioning the adequacy of regulated riparianism in the eastern United States and advocating for the adoption of a western-style permitting scheme based on prior appropriation principles established in western common law).

345. See *supra* Part III.B for a discussion of the central features of regulated riparianism and for the assertion that nearly all states in the eastern United States have adopted a regulated riparian system.

346. See *supra* notes 210–11 and accompanying text for a discussion of how regulatory riparianism differs from the common law because it requires approval of a use *before* it occurs, not after. See *supra* notes 216–19 and accompanying text for a discussion of the role of planning in regulated riparianism.

347. See *supra* note 202 and accompanying text for a discussion of how regulated riparianism treats water as a public commodity and takes steps to ensure and protect public values.

Regulated riparianism is different from common law riparian rights in that regulated riparianism treats water as public property (i.e., property controlled by a state body), as opposed to common or private property.[348] This change is important, for some say that treating water as common property is only tenable when the supply of water exceeds its demand. A "tragedy of the commons" situation is likely when water supplies are low, given that, without the intervention of courts, individual riparians decide for themselves how much water is necessary for their own use, regardless of other water users' needs.[349] An especially desirable element of regulated riparianism is the control that tends to be vested in a central regulating agency.[350] A regime with a centralized permitting authority is a better system than the common law for dealing with the environmental stresses of increased water demands because only a central agency has the authority to grant water-use permits and terminate water use when it determines that conditions do not warrant the withdrawal.

C. What Makes a Strong Environmental Water Regulatory Regime?

If water regulations are to serve the end of environmental protection, they must be crafted in a way that prioritizes the environment. Regulations that best protect environmental resources are ones that "articulate a standard that reflects purely environmental values."[351] Regulations written in broad language that seek to honor the needs of the whole water system and those who rely on it, though high-minded and well-intentioned, are not the best way to serve environmental management. Oliver Houck argues that laws aimed towards "managing the whole," however "laudable," are not specific enough to ward off environmental harm.[352] The more specifically an environmental standard is articulated in a statute, the more effectively that statute can guard against environmental degradation.[353] Water statutes that seek to protect against environmental harm should not be written in terms of what regulators and water users could do to protect aquatic ecosystems "with willing hearts,"[354] but rather in terms of what water users cannot do.[355] This is especially true in situations where there is great economic pressure to develop or exploit environmental resources.[356]

348. Dellapenna, *supra* note 91, at 20.

349. *Id.*

350. See *supra* Part III.C for a discussion of the role that central regulatory agencies play in a regulated riparian regime.

351. Susan F. Mandiberg & Michael G. Faure, *A Graduated Punishment Approach to Environmental Crimes: Beyond Vindication of Administrative Authority in the United States and Europe*, 34 COLUM. J. ENVTL. L. 447, 474 (2009).

352. Oliver A. Houck, *On the Law of Biodiversity and Ecosystem Management*, 81 MINN. L. REV. 869, 871–73 (1997).

353. *See id.* at 959–60 (arguing that efforts to condemn the Endangered Species Act on the ground that it does not look to prevent system-wide maintenance overlook that specific standards such as permanent harm to individual species, though seemingly short-sighted, are the only effective way to assure biodiversity and ecosystem management because species themselves serve as "law to apply").

354. *Id.* at 871.

355. *Cf. id.* (claiming that environmental laws are ineffective if they do not offer clear standards to apply).

356. *See id.* at 882 (arguing that when environmental laws confront economic forces, "aspiration[al]" laws are not enough to overcome economic pressures).

Regulations that grant deference to regulatory agencies to make decisions as they see fit will not be effective at combating the exploitive interests of natural gas companies wishing to frack the Marcellus Shale. Rather, the rush to drill in the Marcellus Shale must be met with "precise law," for Houck urges that "[w]hatever the statute, and however well-intentioned the implementing agency, what Justice Holmes once described as the '*hydraulic* pressure' of 'immediate interests' will wear it down."[357]

The rise of the natural gas industry in the Marcellus Shale represents a situation where an industry is literally exerting tremendous "hydraulic" pressure to exploit natural resources. Two brief anecdotes illustrate what those wishing to see prioritization of the environment are likely to face as natural gas activities in the Marcellus Shale accelerate. In September 2010, the PaDEP found that Cabot Lodge, a natural gas company that has fracked many wells in the Marcellus Shale, was responsible for the contamination of the town of Dimock, Pennsylvania's water supply.[358] When Cabot was fracking in Dimock, a well casing busted, leading to the methane-gas contamination of an aquifer supplying the town with water.[359] The PaDEP found that the only way to assure eighteen households in Dimock a permanent safe drinking water supply would be to build a new water pipeline into the town at the cost of around eleven million dollars.[360] Cabot Lodge denies all responsibility for the contamination and has called the decision to build the pipeline for which it must pay "unfounded, irrational, and capricious."[361] Cabot also denied that a January 2009 well explosion ever happened in Dimock, despite a great deal of media coverage surrounding the event.[362]

On Wednesday, November 3, 2010, the day after the 2010 midterm elections that brought a huge number of candidates supported by the natural gas industry into the House of Representatives, Karl Rove gave the keynote address at a Pittsburgh, Pennsylvania conference on Marcellus Shale drilling.[363] To open his address, Rove stated that "[c]limate is gone" before going on to say that the natural gas industry would no longer need to worry about federal legislation regulating hydraulic fracturing or natural gas extraction activities.[364] Presumably, Rove meant that the threat of Congress passing climate change or natural gas regulatory legislation is gone.

In order to compete against such economic pressures, strong regulation requires a standard that is not merely "aspiration[al]," but *enforceable*; for without a "bottom line," "objective" standard that is easily applied, environmental interests are easily

357. *Id.* at 883 (emphasis added) (quoting N. Sec. Co. v. United States, 193 U.S. 197, 400–01 (1904) (Holmes, J., dissenting)).

358. Maykuth, *supra* note 1, at A01. The Maykuth article provides a description of how eighteen households in Dimock had their water contaminated. *Id.*

359. *See id.* (noting that three wells are believed to be the source of natural gas leaking into Dimock residences).

360. *Id.*

361. *Id.*

362. *Id.*

363. Andrew Maykuth, *In Pa., Rove Tells Marcellus Shale Drillers: Expect 'Sensible Regulations'*, PHILA. INQUIRER, Nov. 4, 2010, at C01.

364. *Id.*

manipulated or worked around.[365] Regulated riparianism is a marked improvement over the common law in that it grants permitting authority and control over resources to a centralized body and can potentially remedy the reactive nature of common law riparianism. Regulated riparianism, however, suffers from a fundamental failing: its adherence to common law reasonable use principles in making permitting decisions. As this Comment discussed above,[366] reasonable use represents an extremely blurry standard for regulatory decision-making. It requires a judge to balance many factors before arriving at a determination of what she considers "reasonable use."[367] The reasonable use rule is uncertain in its outcomes and potentially arbitrary in its application. From a standpoint that prioritizes environmental protection, the reasonable use rule's imprecision is unacceptable.[368]

Regulated riparian regimes base permitting decisions on a conception of reasonable use, or on other closely related concepts like equitable or beneficial use.[369] Reasonable use in the regulated riparian context tends to be based on abstract principles like honoring social policy and whether a use will affect other users.[370] Regulated riparianism continues to adhere to abstract and uncertain common law principles as the standard for its permitting decisions. For this reason, it is not the best regulatory approach for protecting Pennsylvania's water resources from environmental degradation resulting from diminution of water flow.

D. Failures of the Basin Commissions

This Subsection evaluates the Delaware River Basin Commission (DRBC) and the Susquehanna River Basin Commission (SRBC) in light of the above-mentioned principle that a water regulatory regime must apply precise standards in order to adequately protect the environment.[371] This Subsection concludes that while the Basin Commissions are certainly improvements over the common law given their level of control over significant portions of Pennsylvania's water, their regulatory regimes are not ideal for assuring that Pennsylvania's water resources are used in the most environmentally advantageous way.

365. *See* Houck, *supra* note 352, at 882, 954, 959–60 (claiming that viable environmental laws provide a bottom line to apply objectively).

366. See *supra* Part IV.A.1.b for a discussion of how the reasonable use rule creates uncertainty with respect to riparian rights in Pennsylvania.

367. See *supra* notes 138–42 and accompanying text for a discussion of some factors considered when a court applies the reasonable use rule.

368. See *supra* Part IV.A.1 for a discussion of how the reasonable use rule is inadequate to best protect Pennsylvania's water resources against environmental harm.

369. See *supra* notes 208–12 and accompanying text for a discussion of how regulated riparianism bases permitting decisions on reasonable use or other closely related concepts.

370. *See* Dellapenna, *supra* note 101, at 586 (describing features common to most regulated riparian regimes and discussing how permitting decisions are often based on honoring "social policy").

371. See *supra* Part IV.C for a discussion of how to make a strong water regulatory regime.

1. Geographical Limitations

The first problem with the River Basin Commissions is not so much a failing as it is a geographical limitation. Collectively, the DRBC and the SRBC control about two-thirds of Pennsylvania's waters.[372] While this is a significant portion of the Commonwealth, the westernmost third of the state is still governed exclusively by common law principles.[373] Almost all of western Pennsylvania sits atop the Marcellus Shale.[374] Without passage of a statewide regulatory regime, much of the water used for fracking will continue to be governed by the common law.[375]

2. The Basin Commissions' Permitting Standards

The standards the DRBC and the SRBC follow for deciding whether to grant permit applications sound very similar to common law reasonable use. Both Commissions require withdrawal approval for any project that will substantially affect Basin-waters.[376] Both the DRBC and the SRBC require all natural gas projects to have prior approval, regardless of the amount of water they will use.[377] When evaluating a project application, the DRBC must grant, modify, or deny a permit, "so as to avoid such depletion of the natural stream flows and ground waters in the protected area or in an emergency area as will adversely affect the comprehensive plan or the just and equitable interests and rights of other lawful users of the same source."[378] Likewise, the SRBC reviews water use applications by a standard analogous to the common law reasonable use rule.[379] The SRBC makes all permit decisions based on a vague, multi-factor balancing test, considering such factors as

> [l]owering of groundwater or stream flow levels; rendering competing supplies unreliable; affecting other water uses; causing water quality degradation that may be injurious to any existing or potential water use; affecting fish, wildlife or other living resources or their habitat; causing permanent loss of aquifer storage capacity; or affecting low flow of perennial or intermittent streams.[380]

Both permitting standards are quite expansive and seem to suffer from the same imprecision as the common law and other regulated riparian regimes. Though the

372. *See* WESTON, *supra* note 62, at 11 (noting that the DRBC and SRBC "have displaced the courts as the arbiters of water rights issues in the eastern two-thirds of the Commonwealth").

373. See *supra* note 228 and accompanying text for a discussion of how water usage in Pennsylvania is governed throughout the state.

374. *See Approximate Extent of Marcellus Formation*, *supra* note 19 (providing an image of the Marcellus formation in Pennsylvania, with almost all of Western Pennsylvania covered).

375. See *supra* Part IV.A.1 for a discussion of the procedural and substantive problems with Pennsylvania's common law water regulatory regime.

376. See *supra* Part III.C.1–2 for a discussion of when the DRBC and the SRBC require water withdrawers to apply to for permits and for each Commission's definition of "project."

377. See *supra* Part III.C.1–2 for a discussion of ways the DRBC and the SRBC treat Marcellus Shale projects.

378. Del. River Basin Compact, § 10.5.

379. See *supra* Part III.C.2 for a comprehensive discussion of the Susquehanna River Basin Commission and its various regulations.

380. 18 C.F.R. § 806.23(b)(2) (2009).

DRBC allows citizens to challenge application decisions,[381] any successful review of a granted permit would still need to overcome the same muddy standard, an extremely difficult burden. DRBC's permitting standard provides no law to apply, as it focuses on grand concepts like "equitable use" and honoring the "comprehensive plan." Similarly, the SRBC's permitting standard is entirely discretionary, allowing the SRBC the choice to focus on a single element or many factors in making its permitting decision.[382] Leaving decisions to the discretion of a permitting agency is hardly different from leaving the determination of reasonable use to a judge. These discretionary considerations, though desirable goals, are not "law to apply," and could lead to exploitation of the Basin's resources in the face of the strong economic interest to develop the Marcellus Shale.[383]

Both the DRBC and the SRBC suffer from the same imprecision that characterizes regulated riparian statutes. They do not offer objective standards for application, but rather defer to the determinations of the given regulatory commission. Though the SRBC and the DRBC require project sponsors to apply for permits, they ultimately "serve to benefit major energy developments" in the Marcellus Shale because they allow permit holders to rest assured that they can make withdrawals to the full extent of their approved use.[384] Though both Commissions have the authority to retroactively modify or cut off a permitted water use, the absence of standards beyond "adverse impact" to the "comprehensive [basin] plan[s]" allows the SRBC or the DRBC to act however slowly they desire to prevent users from making environmentally unsound use of water.[385]

3. Treatment of Natural Gas Extraction Activities

This Comment also disapproves of the SRBC's Approval by Rule (ABR) process, as it seems to have made it easier to make large-scale water withdrawals for hydraulic fracturing.[386] The SRBC has explicitly acknowledged that its initial motivation in allowing ABR for natural gas projects was to prevent Marcellus Shale projects from slowing down due to a lack of a consistent source of water.[387] As evidenced by more than 800 fracking projects that have been approved through ABR, drillers are making widespread use of the expedited approval system that was originally only intended as a short-term solution to growing consumptive use by Marcellus Shale gas drillers.[388] The

381. Del. River Basin Compact, § 10.6.

382. *See* 18 C.F.R. § 806.23(b)(2) (stating that the SRBC "may" take into account various factors relating to a particular water use's impact on the Basin).

383. See *supra* Part IV.C for the argument that strong environmental laws require precise standards that can be objectively applied.

384. WESTON, *supra* note 62, at 18–19.

385. *See* 18 C.F.R. § 806.23(b)(2) (failing to provide specification as to when or how quickly the SRBC must act to avoid interference with water resources in the Basin); Del. River Basin Compact, § 10.5 (failing to provide specification as to when or how quickly the DRBC must act to avoid interference with the comprehensive plan).

386. See *supra* notes 271–79 and accompanying text for an explanation of the SRBC's Approval by Rule process.

387. SUSQUEHANNA RIVER BASIN COMM'N, *supra* note 229, at 4.

388. See *supra* note 279 and accompanying text for the number of ABR permits granted.

ABR scheme is questionable because the SRBC will approve an application so long as the public water supply can sustain the proposed use. Although a source may be able to "sustain" a use by providing enough water for other users reliant upon it, this does not mean that the withdrawal will not cause environmental harm.

V. POLICY PROPOSALS

This Part briefly proposes several measures that Pennsylvania should take in order to assure environmental protection of its water resources in the face of increased water use related to natural gas activities in the Marcellus Shale.

A. Adopt a Centralized State Water Permitting Program

With each drill pad constructed atop the Marcellus Shale, demand for Pennsylvania's water resources increases. Pennsylvania should implement an agency with the authority to cut off a gas company's water allocation and to issue permits based on precise standards. A centralized water regulatory regime would supplant the common law as a more effective way to deal with possible environmental harm that could result from the continued stress on Pennsylvania's water supply.[389] A centralized permitting scheme is also highly desirable because it would unite the Commonwealth under a single water law. Remembering that water withdrawers in western Pennsylvania are entirely free to withdraw water without commonwealth approval, a permitting agency would lead to better oversight of Pennsylvania's water resources.[390]

A strong Pennsylvania water regime should take account of the shortcomings of both the common law and regulated riparianism, for environmental regulations must "confront the status quo, or there [will] be little reason for them in the first place."[391] First, the permitting agency should have broad authority to restrict or cut off water usage during necessitous times like drought or water shortage. It should also have authority to cut off or modify use whenever water withdrawals threaten to cause environmental harm. Requiring all water users throughout the state to apply to a permitting authority before making any withdrawals would solve the common law's litigation-as-enforcement problem. Permits would prevent disputes before they occur, rather than once they have started. Requiring permits would also put all water users, large-scale and small-scale, on the same footing by removing the chance for subjective analysis of a given use.

B. Base Permitting Decisions on a Precise, Scientific Standard that Is Easily Applied

Under both the common law and regulated riparianism, decisions about water allocation are made on the basis of reasonability.[392] What constitutes "reasonable use"

389. See *supra* notes 85–92 and accompanying text for a discussion of how Pennsylvania's water supplies have been stressed even before the rise of hydraulic fracturing operations within the Marcellus Shale.

390. See *supra* note 227 and accompanying text, which states that common law riparianism governs water usage in western Pennsylvania.

391. Houck, *supra* note 352, at 880.

392. See *supra* Part IV.B for a discussion of how regulated riparianism is similar to the common law reasonable use rule.

of water or a "reasonable" extraction is left to the discretion of courts or permitting agencies.[393] To remedy the uncertainty of judge- or agency-subjectivity, Pennsylvania should require its water-permitting agency to apply a predictable, scientific standard when making decisions about granting or modifying permits. In addition to being predictable, the standard must be one that prioritizes the protection of Pennsylvania's public health and aquatic ecosystems. A predictable standard that prioritizes public health and ecosystems would require the permitting agency to make decisions that are best for Pennsylvania's environment. This would be a huge improvement over a common law rule that does not focus on environmental protection. And it would also be a positive development from regulated riparianism, which does not lead to the best results for the environment because it is rooted in common-law conceptions of reasonableness.

In choosing a predictable, scientific standard, Pennsylvania should consider looking to the federal Endangered Species Act (ESA) as a model for an effective standard that prioritizes ecosystem protection. The ESA prohibits any action that threatens the existence of an endangered species.[394] Pennsylvania might think about allowing water allocation only when it will not threaten the existence of an endangered aquatic species. Thus, the water regulatory regime would need to decide what levels of water flow are necessary to avoid impairment of an endangered aquatic species. To do this, the regulatory agency must first determine, through the best available scientific data, what levels of flow are necessary to maintain the species in a given water body. Once that has been calculated, the regulatory agency should only permit water extraction to the extent that it will not diminish flow below the level necessary for species maintenance. If Pennsylvania's water regulatory regime primarily bases its permitting decisions upon the impact to aquatic species, its permitting decisions will be predictable and the goal of prioritizing environmental protection will be accomplished.

Though the ESA is only written in terms of species protection, it has been instrumental in assuring full-scale ecosystem protection. This is because the standard it sets forth—"impairment to species' ability to maintain viable populations"—is "objective, science-based and enforceable."[395] Adopting "endangered aquatic species impairment" as the standard for deciding if water use is acceptable would add objectivity, as well as certainty, to Pennsylvania's water law, which has historically been rooted in "reasonable use." But, above all else, it would protect Pennsylvania's citizens and aquatic ecosystems from the degradation and contamination of water resources that natural gas drilling activities are likely to spur.[396]

An "endangered aquatic species impairment" standard is superior to the common law and to regulated riparianism because it provides for certain outcomes in every case. If water use will impair an endangered aquatic species' ability to maintain viable

393. See *supra* Part IV for a discussion of how the common law and regulated riparianism leave too much discretion to either courts or permitting agencies to adequately protect Pennsylvania's aquatic ecosystems.

394. *See generally* Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884 (codified as amended at 16 U.S.C. §§ 1531–1544 (2006)).

395. Houck, *supra* note 352, at 960.

396. See *supra* notes 93–99 and accompanying text for a discussion of the ways in which increased use of water for natural gas activities threatens both the public health and aquatic species.

populations, then that use is impermissible. The water use will either not be allowed to begin, or it will be modified or stopped if extraction begins to interfere with a species' ability to maintain viable populations. If the ESA is any example, setting a standard based on individual species' impairment is one way for large-scale environmental protection because it gives a "bottom line" to those who want to protect the environment that can be used as a tool to effect the change they want.[397]

C. Provide for Citizen Suit Provisions to Challenge Granted Permits or Water Use in Violation of Permits

One of the most difficult aspects of enacting a water permitting scheme is enforcing the standards that the water regulatory regime sets.[398] As a way to ensure that water users are complying with the terms of their permits and that regulators are issuing permits based on clearly defined, predictable terms, Pennsylvania would be wise to allow for "citizen suit" provisions like the kind authorized by several federal environmental statutes, including the Clean Air Act and the Clean Water Act.[399] Under a citizen suit provision, the legislature grants standing to a general class of plaintiffs.[400] In doing so, it makes the citizenry a group of "private attorney[s] general" that can assist the executive in enforcing environmental regulations for the common good.[401]

Riparian rights common law and regulated riparianism only allow for a limited range of plaintiffs, namely riparian owners in the case of the common law and those granted permits in the case of regulated riparianism. By allowing citizen suits, Pennsylvania would give its citizens, for the first time, a chance to have an active role in the protection of their water resources. This is likely to be a boon to environmental protection, as study of citizen suits demonstrates that lawsuits initiated by citizen plaintiffs help regulatory agencies enforce environmental statutes and persuade would-be "violators to achieve statute compliance."[402]

Evidence suggests that "citizens' suits act as a necessary supplement to and check on administrative enforcement power."[403] A clear standard, like "impairment of endangered species," is essential for possible citizen-plaintiffs to be able to challenge the regulatory agency's permitting decisions and to serve as a "check" on regulatory enforcement power. A clearly defined, scientific standard would allow possible citizen-plaintiffs to know exactly when they could bring a successful suit. If permits were granted based on vague notions of "reasonableness," citizen suits would have little

397. Houck, *supra* note 352, at 959–60.

398. See *supra* note 269 and accompanying text for an example of the difficulty regulated riparian regimes have in responding to demands for water.

399. *See generally* Clear Air Act, Pub. L. No. 88-206, 77 Stat. 391 (1963) (codified as amended at 42 U.S.C. §§ 7401–7449 (2006)); Clean Water Act, Pub. L. No. 92-500, 86 Stat. 816 (1972) (codified as amended at 33 U.S.C. §§ 1251–1274 (2006)).

400. Harold Feld, *Saving the Citizen Suit: The Effect of* Lujan v. Defenders of Wildlife *and the Role of Citizen Suits in Environmental Enforcement*, 19 COLUM. J. ENVTL. L. 141, 143 (1994).

401. *Id.* at 144.

402. Kristi M. Smith, *Who's Suing Whom?: A Comparison of Government and Citizen Suit Environmental Actions Brought Under EPA-Administered Statutes, 1995–2000*, 29 COLUM. J. ENVTL. L. 359, 395–96 (2004).

403. *Id.* at 396.

effect because there would be no law to apply. Because conceptions of reasonableness vary, a citizen suit could be defended by a mere showing of "reasonable use." With a clear, objective standard, citizen suits could ensure water users are following the terms of the permits and that regulators are issuing permits properly.

VI. CONCLUSION

Natural gas extraction activities have increased tremendously within Pennsylvania since 2007.[404] This phenomenon is linked primarily to two factors: (1) Pennsylvania's position atop the Marcellus Shale, the richest unconventional natural gas resource in the world, and (2) the viability of hydraulic fracturing ("fracking"), paired with horizontal drilling as an economic means of natural gas extraction.[405] Pennsylvania is expected to have tens of thousands of more natural gas wells in the coming decades as demand for natural gas increases and conventional sources of natural gas are depleted.[406] The rise of fracking presents a host of wide-ranging environmental problems and has potential to disrupt Pennsylvania's water system because of the huge volumes of water necessary to frack a single well.[407] Pennsylvania's existing water law is not well-equipped to handle the increased use of water precipitated by the dramatic increase of natural gas extraction.

In the westernmost third of Pennsylvania, water use is governed exclusively by common law riparianism in the form of the reasonable use doctrine.[408] The reasonable use rule suffers from both procedural and substantive defects and is thus not well-suited to protect Pennsylvania's aquatic ecosystems and the public health.[409] Most notably, the reasonable use rule is reactive, not proactive, and gives rise to great uncertainty regarding the scope of water rights and what exactly constitutes "reasonable use," which tends to favor large-scale water users.[410] The uncertainty of the reasonable use rule might be exacerbated by gas companies leasing land on riparian property.[411]

The rest of Pennsylvania is governed by two federal compacts, enforced by the Susquehanna River Basin Commission and the Delaware River Basin Commission.[412]

404. See *supra* notes 56–63 and accompanying text for numbers evidencing the rise in natural gas drilling activities in Pennsylvania since 2007.

405. See *supra* Part II.A for a discussion of factors leading to increased natural gas activities in the Marcellus Shale.

406. See *supra* note 63 and accompanying text stating that Pennsylvania can expect between 35,000 and 50,000 natural gas wells by 2030.

407. See *supra* Part II.B for a discussion of the environmental hazards associated with fracking and fracking's potential to cause serious disruptions to Pennsylvania's water system.

408. See *supra* Part III.A–B for a discussion of riparian rights common law and Pennsylvania's continued use of the reasonable use rule in the western one-third of the Commonwealth.

409. See *supra* Part IV.A.1 for a discussion of the procedural and substantive failings of the reasonable use rule.

410. See *supra* Part IV.A.1, which criticizes the balancing approach taken by courts applying the reasonable use rule, the reactive nature of the common law's litigation-as-enforcement model, and for a discussion of why this favors large-scale water users.

411. See *supra* notes 316–18 and accompanying text for a discussion of whether gas companies that lease land on riparian tracts will be given the rights of a riparian owner or something less.

412. See *supra* Part III.C for an explanation of the jurisdiction and powers of the SRBC and the DRBC.

Both commissions represent an improvement over the common law in that they require significant planning and that all water users obtain permits *before* a given use.[413] However, they are not capable of protecting Pennsylvania's aquatic ecosystems because they have jurisdiction over only two-thirds of Pennsylvania, their water permitting decisions are based on vague standards that are rooted in common law conceptions of reasonable use, and they have possibly made things easier for companies wishing to extract natural gas from the Marcellus Shale.[414] The Pennsylvania Water Resources Planning Act and the Pennsylvania Oil and Gas Act also do not address the shortcomings of Pennsylvania water law because the Planning Act is merely a policy regulation, and the Oil and Gas Act only offers remedies for harm that has already occurred.[415]

This Comment concludes that to adequately protect against the environmental degradation of Pennsylvania's water resources that may accompany the increased use of water for fracking, the Commonwealth should enact a statewide water regulatory regime that prioritizes environmental protection and is based on precise standards.[416] This regulatory regime should allow water use by permit only and must base its decisions to grant or deny permits on scientific standards that are easily applied and predictable.[417] Furthermore, the Commonwealth should authorize citizen suit provisions, as they will allow the citizenry to take an active role in ensuring compliance with permitting decisions, as well as serve as a check against arbitrary administrative decisions not based on precise, scientific standards.[418]

413. See *supra* Part IV.D for the idea that the control of both the DRBC and SRBC over the waters in their respective jurisdictions is an improvement over common law riparianism.

414. See *supra* Part IV.D for criticisms concerning the effectiveness of the DRBC and SRBC in protecting Pennsylvania's waters.

415. See *supra* Part IV.A.2, which explains why the Water Resources Planning Act and the Oil and Gas Act are not proper substitutes for statewide, *enforceable* regulation.

416. See *supra* Part IV.C, which argues that a strong environmental water regulatory regime is one based on precise standards and *supra* Part V.A, which advocates that Pennsylvania should enact statewide water regulation.

417. See *supra* Part V.A–B, which argue that Pennsylvania should set up a centralized agency responsible for granting water use permits and that those permitting decisions must be based on measurable, predictable, scientific standards.

418. See *supra* Part V.C for a brief discussion of the virtues of citizen suit provisions and the argument that Pennsylvania should allow citizen actions to assure compliance with water use permits.