Penn State Marcellus Shale Law and Policy Symposium
Water and Wastewater Issues

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I. THE WATER SUPPLY CHALLENGE OF OIL AND GAS DEVELOPMENT[1]

A. Water Supply Requirements for Marcellus and Other Shale Development

1. 1-5+ million gallons for each well; 500,000 to 1,000,000 gallons of fluid in each of five to seven stages.

2. Some opportunities for recycling, ***but s***ignificant freshwater sources are needed.

3. Primary focus of concern is impacts on small local streams, and cumulative impacts of many withdrawals in a watershed.

B. Water Supply Requirements for Conventional Oil and Gas Development

1. Relatively modest amounts required for drilling (mud preparation).

2. Hydraulic fracing is practiced, but to date amounts of water required have not been a significant issue.

C. The Water Supply Issue in Perspective

1. From a statewide or basin perspective, water requirements for Marcellus Shale development might appear comparatively modest.

2. The Susquehanna River Basin Commission, for example, estimates that annual consumptive water use for all gas well development, once full-scale development has been reached, will equate to approximately 28

[1] *This outline is for informational purposes only and does not contain or convey legal advice. The information herein should not be used or relied upon in regard to any particular facts or circumstances without first consulting with a lawyer.*

million gallons per day ("mgd"),[2] representing approximately three percent of total basin consumptive water use.[3] Total Marcellus Shale gas well water demand equates to about one-half the basin-wide water use by the recreational sector (golf courses and ski resorts), and less than one nuclear power plant.[4]

3. In some basins, cumulative consumptive water use (from all uses) poses concerns during drought and low flow events.

4. Portion of oil and gas development occurs in areas with smaller headwater streams, many with high quality and cold-water fisheries, where concerns are raised as to the impact of large withdrawals leading to significant streamflow reductions or even depletion. Location, amount, timing, and conditions of withdrawals, and whether multiple withdrawals are occurring in the same watershed, are a matter of considerable focus.

5. The Marcellus Shale spans the upper Appalachian Basin, cutting across several important watersheds, including the Delaware, Susquehanna, Ohio, and Great Lakes-St. Lawrence systems.

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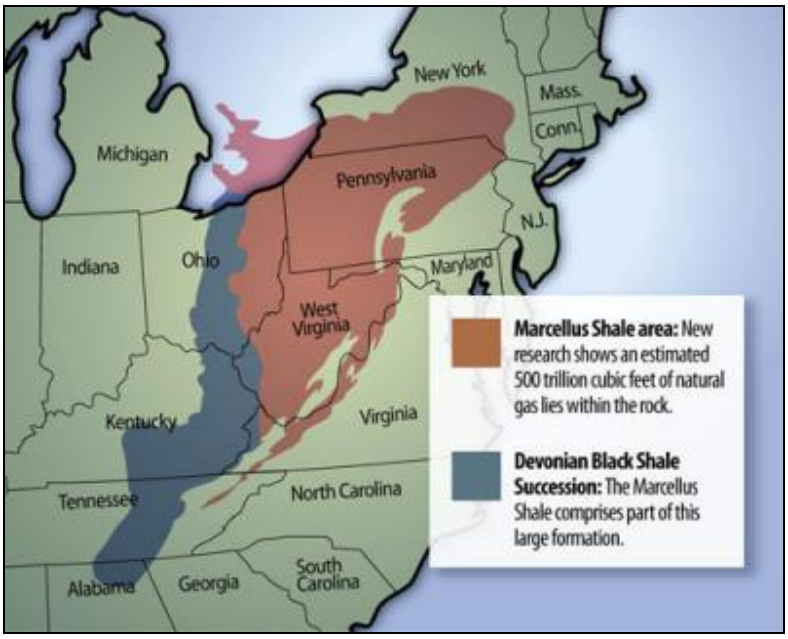
[2] Thomas R. Beauduy, *Accommodating a New Straw in the Water: Extracting Natural Gas from the Marcellus Shale in the Susquehanna River Basin*, SRBC White Paper available at http://www.srbc.net/programs/projreviewmarcellus.htm.

[3] SRBC reports that current "approved" consumptive use totals approximately 563 mgd (*id*.), but the total current maximum consumptive use in the basin (including both grandfathered uses and those approved by SRBC) has been estimated 882.5 mgd. SRBC, CONSUMPTIVE USE MITIGATION PLAN, SRBC Pub. No. 253 (March 2008) at 5 (available at http://www.srbc.net/planning/CUMP.htm).

[4] T. R. Beauduy, *supra*.



6. Delaware River Basin

   a. Northeastern Pennsylvania and southern New York.

   b. Major water source for some 15 million residents of the Northeast Metropolitan Corridor from New York City to Wilmington, Delaware, roughly five percent of the nation's population.

   c. Relatively small watershed, 13,539 square miles, draining one percent of the United States.

   d. Basin encompasses four states, 42 counties, and some 838 municipalities, while its service area extends to encompass the entire New York City and northern New Jersey region.

   e. Substantial portions of the upper Basin, including much of the area underlain by the Marcellus Shale, provide the headwaters of high quality streams valued for their trout fisheries, which flow into sections of the River mainstem designated as part of the National Wild and Scenic Rivers System.

7. Susquehanna River Basin

   a. Drains 27,500 square miles (including one-half of the land area of Pennsylvania, plus portions of New York and Maryland) – 43 percent of the Chesapeake Bay's drainage area, supplying a normal flow of about 18 million gallons per minute at Havre de Grace, Maryland.

   b. Population of some 4.1 million; basin supports a service area that extends to the City of Baltimore and many northern Maryland counties outside the basin.

   c. Basin is experiencing growing volumes of consumptive use. The basin is a major center of electric energy production, from a combination of hydroelectric facilities in the lower basin, and both nuclear and fossil fuel fired steam electric stations throughout the drainage area.

8. Ohio River Basin

a. The Ohio River Basin and its major tributary components (including the Monongahela and Allegheny Rivers) which traverse much of the Marcellus Shale area.

b. Recent decades have not witnessed droughts across the region anywhere near the intensity of either seen in the basins to the east or encountered in the earlier part of the 20th Century.

c. A number of streams and aquifers affected by acid mine drainage, supplies of potable water are limited. In many areas, tight hard rock formations provide limited groundwater storage and transmissive capabilities, further limiting the ability to successfully develop large volume wells or providing highly variable yields between normal and dry years.

d. During the late summer and fall of 2008, these factors were highlighted when extreme low flow in the Monongahela River was accompanied by rising total dissolved solids ("TDS") concentrations, to the point that instream TDS values exceeded State water quality criteria and secondary drinking water standards.

While the major source of the high TDS concentrations derived from acid mine drainage, particularly from abandoned mines in West Virginia and Pennsylvania,[5] some media and public agencies mentioned Marcellus Shale gas development as a potentially contributing factor.[6]

9. Great Lakes – St. Lawrence Basin

   a. Western New York, northwestern Pennsylvania, and northern Ohio all lie within the Great Lakes-St. Lawrence Basin.

   b. Represents largest single fresh water resource in the world.

   c. Serious water resource controversies have arisen concerning the impacts of interbasin and interlake diversions and large consumptive uses, leading to the recent proposal of a regionwide compact to enact much more stringent water withdrawal regulation.

II. DEFINING AND OBTAINING WATER RIGHTS

A. Key Questions:

1. What "water rights" may oil and gas developers acquire, either in conjunction with mineral leases or otherwise, to procure the necessary water supplies to support well development? What do those "water

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[5] Tetra Tech NUS, Inc., *Evaluation of High TDS Concentrations in the Monongahela River* (January 2009) (available at http://www.pamarcellus.com/Mon%20River%20High%20TDS%20Study%20Report%20(Final).pdf)

[6] PaDEP News Release, *DEP Investigates Source of Elevated Total Dissolved Solids in Monongahela River*, October 22, 2008, *available at* http://www.ahs2.dep.state.pa.us/newsreleases; Don Hopey, *DEP hopes a flush cleans Mon water*, PITTSBURGH POST-GAZETTE, October 24, 2008, *available at* http://ww.post-gazette.com/pg/08298/922462-113.stm; Don Hopey, *Drillers, sewer authority want state to lift waste limits,* PITTSBURGH POST-GAZETTE, November 22, 2008, *available at* http://www.post-gazette.com/pg/08327/929978-113.stm; Don Hopey, *Drill press: Environmental, sportsmen's groups want stricter regulation of natural gas projects,* PITTSBURGH POST-GAZETTE, November 28, 2008, *available at* http://www.post-gazette.com/pg/08333/931286-113.stm; Don Hopey, *Area gas deposits reported to be nation's largest,* PITTSBURGH POST-GAZETTE, December 14, 2008, *available at* http://www.post-gazette.com/pg/08349/935140-113.stm; Don PITTSBURGH POST-GAZETTE, December 21, 2008, *available at* http://www.post-gazette.com/pg/08356/936646-113.stm.

rights" mean in practical terms of what you can withdraw, how much you can withdraw, and where the water can be used?

2. What regulatory and permitting programs affect the procurement and development of water supplies to serve gas well drilling and operations?

B. What is a "Water Right" – A Useful Perspective

1. What can I do? (When, where, and how much can I withdraw?)

2. What can someone else do to me? (To what extent is my withdrawal and source of supply protected from interference? To what extent is my instream use of water for fishing, recreation, etc. protected from interference?)

3. What is the scope of public rights to the resource? What happens when private and public rights collide?

C. "Water Rights" Granted Under Mineral Leases

1. Regarding extraction of surface or ground water from the mineral lease premises to support drilling operations, the specific lease terms will govern the relationship between the surface fee owner and mineral rights holder.

2. A "typical" lease may have only general language on the topic, such as a clause granting the Lessee "the privilege of using sufficient … water for operating on the premises …."

3. "Typical" lease language refers to the right to use water "for operating on the premises." Such a "right," by its terms, may not authorize extraction of water from one leased parcel for use on another leased parcel.

4. What if lease is silent concerning issue of water use?

a. When a surface owner does not own the oil and gas below or has leased the oil or gas rights, the surface owner's interest in the surface estate is ***subject to*** the oil and gas estate and the rights and incidents that go with it. *See, e.g., Brady v. Yodanza*, 493 Pa. 186, 193, 425 A.2d 726, 729 (1981) ("One who purchases land expressly subject to an easement or with notice that it is burdened with an existing easement … takes the land subject to the easement irrespective of whether the deeds to the dominant landowners expressly grant the easement appurtenant."); *Wettengel v. Gormley*, 184 Pa. 354, 361, 39 A. 57, 58 (1898) (right to cultivate surface of land subject to the easement created in favor of lessee of mineral estate); *Babcock Lumber Co. v. Faust*, 39 A.2d 298, 303 (Pa. Super. 1944) (the surface estate is subject to mineral estate).

b. Owner or leaseholder of an oil and gas estate has, by operation of law, an implied easement or servitude appurtenant to the dominant oil and gas estate. *Westmoreland & Cambria Natural Gas Co. v DeWitt*, 130 Pa. 235, 18 A. 724 (1889) (nature of lessee's interest in surface is that of easement with right of ingress and egress for the duration of the oil and gas operations).

c. As the holder of the dominant estate, an owner or lessee of the oil and gas interests has the implied right to use the surface as reasonably necessary to explore for and develop oil and gas. *Chartiers Block Coal Co. v. Mellon*, 25 A. 597, 598 (Pa. 1893); *Belden & Blake Corp. v. Dept. of Conservation and Natural Resources*, 969 A.2d 528, 532 (Pa. 2009).

d. Holder of oil and gas interest holds an interest and separate estate in the land, as does the surface owner.

e. Although cases in Pennsylvania are scant, logic suggests that oil and gas interest owner, along with surface owner, enjoys riparian rights.

f. Cases in other states support the view that oil and gas interest owner has implied right to use as much water as is reasonably necessary for drilling operations. *See* William B. Browder, *The Dominant Oil and Gas Estate—Master or Servant of the Servient Estate*, 17 Sw. L.J. 25, 36-39 (1963) (citing *Wyckoff v. Brown*, 135 Kan. 460, 11 P.2d 718 (1932); *Holt v. Southwest Antioch Sand Unit, Fifth Enlarged*, 292 P.2d 998 (Okla. 1956); *Natural Light & Thorium Co. v. Alexander*, 85 S.C. 306, 67 S. E. 310 (1910); *Stradley v. Magnolia Petroleum Co.*, 155 S.W.2d 649, 652 (Tex. Civ. App. 1941); *Wiser Oil Co. v. Conley*, 346 S.W.2d 718 (Ky. 1960)).

5. Whatever "water rights" may be granted via a lease, those rights will be no greater than the "water rights" of the landowner or mineral rights owner granting the lease. Whether operating as a fee owner or a tenant, the scope and nature of rights to withdraw and utilize water will depend on the nature and scope of "water rights" as defined under applicable state law.

D. Bases of Water Rights.

1. Water rights may be founded on either or both of two fundamental bases: common law and statutory arrangements.

2. For the most part, allocation of surface and groundwaters in most eastern States is governed by common law, comprising the doctrines and precedents enunciated by courts in cases decided over the past two

centuries, supplemented by statutory or administrative systems for regulating water withdrawals.

E. Classification of Waters and Water Rights.

1. Although water resource scientists generally consider all water as part of a unitary hydrologic cycle, for the purpose of water rights and allocation, common law has attempted to distinguish four general categories of water: (1) surface waters in defined streams and lakes; (2) diffused surface waters, (3) groundwaters in well-defined subterranean streams, and (4) percolating groundwaters. 1 WATERS AND WATER RIGHTS §§4.05, 19.05 (R. W. Beck & A.E. Kelly, ed., 2007); R.T. Weston and J.R. Burcat, *Legal Aspects of Pennsylvania Water Management*, WATER RESOURCES IN PENNSYLVANIA: AVAILABILITY, QUALITY AND MANAGEMENT (1990).

2. Different rules have been developed for each of these classifications in governing diversion, use, and disposal of such waters. In addition, special rules have evolved to govern withdrawals from artificial canals and "developed waters" stored in reservoirs or imported through interbasin transfers.

F. Common Law Water Rights

1. Riparian Rights in Streams

a. The riparian doctrine governs allocation and use of waters flowing in a natural watercourse. Rights arise from the ownership of real property underlying or bordering streams and rivers.

b. Riparian rights are a type of property right – an incorporeal hereditament. Riparian rights are rights of use, not ownership of the water *per se*.

c. A riparian right is, in essence, a right to make use of water flowing in a stream upon riparian land.

d. A riparian right to divert and use surface water is generally confined to riparian land, that is, land along the stream.

i. Under the "unity of title" test, riparian rights may be exercised on contiguous lands which form a parcel adjoining a stream, so long as all the lands are owned by the same person and located in the same watershed.

ii. Waters may not be diverted to non-contiguous plots located some distance from the watercourse, or to contiguous lands which lie in another watershed (where diverted flow would

not return to the stream of origin above the next downstream riparian's lands).

iii. Under strict riparian doctrine, diversion of water to points away from riparian land is totally prohibited and per se unreasonable, irrespective of relative effect on stream flows or lack of substantial damage to lower riparians. In states applying this rule, generally rights to use water off riparian lands may only be acquired by municipalities, utilities, and other users through prescription, eminent domain, or contract with all affected riparians.

e. Measure of the riparian right to divert and consume water.

i. Under the common law of eastern States, two main doctrines have developed for dealing with riparian water rights: (i) the English common-law rule, also known as the natural flow doctrine and (2) the reasonable use doctrine. 1 WATER AND WATER RIGHTS § 7.02; STOEBUCK & WHITMAN, THE LAW OF PROPERTY (3d ed), §7.4, pp. 422-425.

ii. Natural flow doctrine: each riparian proprietor of a watercourse has a right "to have the body of water flow as it was wont to flow in nature," qualified only by the right of other riparian proprietors to make limited use of the water. RESTATEMENT (SECOND) OF TORTS, introductory note to §§ 850 to 857, p. 210; 1 WATERS AND WATER RIGHTS § 7.02(c), and cases cited therein at footnote 180.

iii. Reasonable use doctrine: "a riparian owner may make any and all reasonable uses of the water, as long [as] they do not unreasonably interfere with the other riparian owners' opportunity for reasonable use." STOEBUCK & WHITMAN at 423; 1 WATERS AND WATER RIGHTS § 7.02(d). Whether and to what extent a given use shall be allowed under the reasonable use doctrine depends upon the weighing of factors on the side of the prospective user, and balancing those considerations against similar factors on the side of other riparian owners.

iv. What constitutes a reasonable use is determined on a case-by-case basis, weighing a myriad of factors. The RESTATEMENT (SECOND) OF TORTS §850A attempts to lay out those factors to be weighed in determining a reasonable use, including (1) its purpose; (2) its suitability to the water body; (3) its economic value; (4) its social value; (5) the

harm it causes; (6) the potential for coordination with competing uses; (7) its temporal priority relative to competing uses; and (8) the justice of imposing a loss on the use. It should be noted that considerable debate has occurred among legal scholars as to whether the "reasonableness" test is to be determined in the abstract, based upon some form of "objective" standard (as advocated by Frank Trelease, Associate Reporter for the RESTATEMENT (SECOND) OF TORTS), or is fundamentally grounded upon determination of reasonableness as a relative relationship between disputing parties. *See* 1 WATERS AND WATER RIGHTS § 7.02(d)(1)-(2).

f. Under common law principles, no preference appears to be accorded to uses based on priority of time. All uses, old and new, are essentially treated as equals sharing a common resource (although some commentators have suggested protection of existing investments should be a factor in determining reasonableness).

g. Under certain circumstances, the public interest may create exceptions to the general riparian priorities.

i. For example, paramount public necessity in a water shortage emergency may justify a municipality taking water for domestic use of its citizens without regard to existing riparian rights, and a municipal water supplier may force riparian owners engaged in non-domestic uses to temporarily forego their diversions. *Philadelphia v. Collins*, 68 Pa. 106 (1871) (dicta); *North Mountain Water Supply Co. v. Troxell*, 14 Luz. L. Reg. 161 (C.P. Pa. 1908), *aff'd*, 223 Pa. 315, 72 A. 621 (1909).

ii. Public (through federal and state government) exercises a paramount servitude in navigable waters for purposes of navigation. *Yoffee v. Pa. Power & Light Co.*, 385 Pa. 520, 534, 123 A.2d 636, 644 (1956); *Flanagan v. Philadelphia*, 42 Pa. 219 (1862); *Philadelphia v. Phila. Suburban Water Co.*, 309 Pa. 130, 163 A. 297 (1932); *Gallagher v. Philadelphia*, 4 Pa. Super. 60 (1896).

2. Common Law Rights in Groundwater

a. Distinction has been created between subterranean streams and percolating groundwater. Rare subterranean streams are governed by riparian doctrine, while percolating groundwater is subject to different common law rules.

b. Three main common-law rights have developed with respect to ground water withdrawal disputes: (i) the English rule of absolute ownership; (ii) the American doctrine of "reasonable use"; and (iii) the so-called doctrine of correlative rights. 3 WATERS AND WATER RIGHTS Ch. 20-22; STOEBUCK & WHITMAN, § 7.5, p. 427.

c. English rule or the absolute ownership rule, was first stated in *Acton v Blundell,* 12 Mees & Wels. 324; 152 Eng. Rep. 1223 (Exch, 1843). Possessor of land may withdraw as much underground water as he or she wishes, for whatever purposes desired, without liability to neighboring property owners. This absolute ownership rule ostensibly remains the law in a very small minority of states. *See Sipriano v Great Spring Waters of America, Inc.,* 42 Tex. Sup. Ct. 629; 1 SW 3d 75 (Tex, 1999); *Maddocks v Giles,* 1999 ME 63, 728 A.2d 150, 153 (Me. 1999).

d. In the eastern U.S., including all States overlying the Marcellus Shale, the prevalent rule applicable to groundwater disputes is the doctrine of reasonable use, also sometimes called the American Rule. *Wheatley v. Baugh*, 25 Pa. 528, 531 (1855); *Williams v. Ladew*, 161 A. 283 (Pa. 1894); *Pence v. Carney*, 52 S.E, 702, 706 (W.Va. 1905); *Cline v. American Aggregates Corp.*, 474 N.E.2d 324 (Ohio 1984) (overturning the common law theory of absolute ownership in Frazier v. Brown, 12 Ohio St. 294 (1861) and adopting § 858 of the RESTATEMENT (SECOND) OF TORTS).

   i. Doctrine of reasonable use in the groundwater context is not actually dependent on the reasonableness of the use. Doctrine holds that virtually all uses of water made upon the land from which it is extracted are "reasonable," even if they more or less deplete the supply to the harm of neighbors, unless the purpose is malicious or the water simply wasted. *See, e.g., Wheatley v. Baugh*, 25 Pa. 528, 531 (1855); *Williams v. Ladew*, 161 A. 283 (1894); *DiGiacinto v. New Jersey Zinc Co.*, 27 Lehigh L.J. 307 (C.P. Pa. 1957).

e. Depending on the State, uses off of the land where percolating groundwater is extracted may be severely restricted or "unreasonable per se." *Rothrauff v. Sinking Spring Water Co.*, 339 Pa. 129, 14 A.2d 87 (1940); *Hatfield Twp. v. Lansdale Municipal Authority*, 19 Pa. D.&C. 2d 281 (C.P. Mont. 1959), *aff'd*, 403 Pa. 113, 168 A.2d 333 (1961); *Flowers v. Northampton Bucks Cty. Municipal Authority*, 57 Pa. D.&C. 2d 274 (C.P. Bucks 1972).

3. Can Water Be Transferred Off Riparian or Overlying Land?

a. Some older Pennsylvania cases treat off-land transfers of water withdrawn from a stream to be *per se* unreasonable, *See Scranton Gas & Water Co. v. Delaware L. & W. R.R.*, 240 Pa. 604, 88 A. 24 (1913); *Irving's Ex'rs. v. Borough of Media*, 10 Pa. Super. 132 (1899), *aff'd*, 194 Pa. 648, 45 A. 482 (1900).

b. More recent cases in other states view such uses as merely disfavored or less favored than on land uses. *Michigan Citizens for Water Conservation v. Nestlé Waters North America Inc.*, 269 Mich. App. 25, 57-58, 709 N.W.2d 174, 196 (2005).

c. Under a common law approach where off-land uses are considered "unreasonable" and "unlawful," liability for damages will be imposed if the withdrawal interferes with other users, and the water transfer may be enjoined by court order. The continued validity of this common law doctrine, however, is very much in question, particularly where basin commission permitting programs have been implemented that appear to largely displace the common law. As a result of *State College Borough Water Authority v. Board of Supervisors of Benner Township, 645 A.2d 394* (Pa. Cmwlth. 1994) ("*Benner I*"), and *Levin v. Board of Supervisors of Benner Township, Centre County*, 669 A.2d 1063 (Pa. Cmwlth. 1995), *aff'd per curium*, 689 A.2d 224 (Pa. 1997) ("*Benner II*"), the continuing viability of the *Rothrauff* and *Hatfield* approach is in doubt. After *Benner II*, although not yet stated by the Pennsylvania courts, the better view may be that approval of a water allocation by the Pennsylvania Department of Environmental Protection, SRBC, or DRBC under their respective statutory powers is an action that accords an exception to the common law rule.

4. Administration of Common Law Rights

a. Common law rights to use surface and groundwaters are adjudicated and administered through traditional litigation processes. Water rights are largely defined and protected by means of individual lawsuits in state courts. Where riparian water rights are legally injured, the usual remedies are available, including damages and, under certain circumstances, injunctive relief.

b. Court administration of common law water rights is a time-consuming and expensive process. Many of the reported decisions finally settled 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.

III. WATER WITHDRAWAL AND USE REGULATION IN PENNSYLVANIA

A. Continued Reliance on Common Law

1. In large part, the right to withdraw water from both surface and groundwaters in Pennsylvania is governed by common law. R.T. Weston and J.R. Burcat, *Legal Aspects of Pennsylvania Water Management*, WATER RESOURCES IN PENNSYLVANIA: AVAILABILITY, QUALITY AND MANAGEMENT (1990).

2. With the exception of state laws regulating the withdrawal of surface water by public water supply agencies, Pennsylvania has no statewide regulatory program mandating the acquisition of permits for withdrawing surface or ground waters. Basin level regulatory programs of the Susquehanna and Delaware River Basin Commissions have displaced the courts as the arbiters of water rights issues in the eastern two-thirds of the Commonwealth. However, common law doctrines and traditions remain strong.

B. Limited Statutory Programs Addressing Water Withdrawals

1. 1939 Water Rights Act, Pa. Stat. Ann. tit. 32, §§631-641, only regulates public water supply agencies withdrawing water from surface sources. Does not regulate industrial, commercial or agricultural water users, and the Act does not cover groundwater withdrawals.

2. Safe Drinking Water Act, Pa. Stat. Ann. tit. 35, § 721.1 *et seq.*, only regulates drinking water systems, although it has been interpreted to include consideration of the impacts of water withdrawals by public water supply systems. In terms of withdrawals by oil and gas well operators, however, the SDWA is not applicable. *Oley Township v. DEP and Wissahickon Spring Water, Inc.*, 1996 EHB 1098.

3. Water Resources Planning Act, 27 Pa.C.S. §3101 *et seq.* ("WRPA" or "Act 220").

   a. Focused on the preparation and updating of the State Water Plan.

   b. Requires registration and annual reporting of withdrawals and water use by any person who withdraws more than 10,000 gallons per day averaged over any 30-day period from any surface water or groundwater source, and by any person who obtains more than 100,000 gpd from another person (*e.g.*, via a purchase from or connection to a public water system). 27 Pa.C.S. §3118; 25 Pa. Code Ch. 110. The trigger withdrawal amounts are determined on the basis of the total amount withdrawn by a person from one or more points of withdrawal operated as a system.

4. Clean Streams Law, Pa. Stat. Ann. tit. 35, §691.1 *et seq.*, does not provide directly for regulation of withdrawals, but focuses on discharges or activities that cause or may cause pollution.

    a. Pennsylvania Department of Environmental Protection ("PaDEP") has more recently claimed authority under §691.401 (prohibition of other pollution) and 691.402 (potential pollution) to regulate withdrawals from Marcellus Shale wells to avoid depletion of stream flows that may cause "pollution."

    b. "Pollution" is broadly defined to include "contamination of any waters of the Commonwealth such as will create or is likely to create a nuisance or to render such waters harmful, detrimental or injurious to public health, safety or welfare, or to domestic, municipal, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life, including but not limited to such contamination by alteration of the physical, chemical or biological properties of such waters …." *Id.* §691.1.

C. Regulation of Marcellus Shale Withdrawals via the Pennsylvania Oil & Gas Act

1. Pa. Oil & Gas Act, Pa. Stat. Ann. tit. 58, §601.101 *et seq.*, requires permits for the drilling or alteration of any natural gas well. The Act requires PaDEP, in reviewing permit applications, to consider whether the proposed well would violate any environmental statutes administered by PaDEP (*e.g.*, the Pa. Clean Streams Law).

2. During 2008 and early 2009, PaDEP required operators to file an "Addendum" with well permit applications providing plans for water withdrawals.

3. Effective April 2009, PaDEP has created a separate "Water Management Plan" process.

    a. Marcellus Shale well permits contain a standard condition requiring that any water withdrawn or obtained for fracing purposes be conducted pursuant to a Water Management Plan approved by PaDEP.

    b. Water Management Plans must (i) list the proposed sources (surface water, groundwater, wastewater, public water supplies); (ii) provide information about impacts of withdrawals from those various types of sources; and (iii) provide a monitoring and reporting plan. (See model format and instructions at: http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm.)

D. Susquehanna River Basin Commission ("SRBC")

1. Federal / interstate commission created by Susquehanna River Basin Compact, Pub. L. No. 91-575, 84 Stat. 1509 (1970).

2. SRBC Project Review – Compact §3.10

a. All surface and groundwater withdrawals in excess of 100,000 gpd in any 30-day period. 18 C.F.R. §806.4(a)(2)(i).

b. Any new or increased consumptive water use in excess of 20,000 gpd requires SRBC approval, irrespective of its source of supply. 18 C.F.R. §806.4(a)(3).

c. All projects (***irrespective of water quantity***) involving the withdrawal and consumptive use of water for development of natural gas wells targeting the Marcellus and Utica formations. 18 C.F.R. §806.22 *et seq.*, 73 Fed. Reg. 78618 (Dec. 23, 2008).

d. Prior project approvals may be transferred with notice to and approval by SRBC, but transfers may trigger new review under current standards.

e. Approval required prior to commencement of construction.

f. "Project" definition: the drilling pad upon which one or more wells are undertaken, and all water-related appurtenant facilities and activities.

g. "Construction" is defined as the commencement of drilling (spudding) of the well.

h. Project review triggered for "re-completion" of wells formerly drilled into other formations.

i. For Marcellus Shale projects, project approvals associated with stream or groundwater withdrawals require "dockets" approved by the full Commission following public hearing. Because the Commission meets only 4-5 times per year, this process can be time-consuming and requires a good deal of advance planning.

j. For consumptive water use associated with well projects, SRBC has adopted an "approval-by-rule" ("ABR") procedure which allows Commission staff to issue administrative approvals without the need for action by the full Commission. 18 C.F.R. §806.22(f). Consumptive use ABRs are required for each well pad, irrespective of whether the water source involves a stream, groundwater well, water purchased from a public water supply system, or use of

wastewater, mine water, or another type of water source. Such an ABR may be sought by submission of a notice of intent, coupled with issuance of a prescribed notice to the public, after which SRBC staff will issue an approval usually within 10-14 days.

3. Standards and criteria for SRBC project approval.

   a. SRBC will (i) limit withdrawals to the amount (quantity and rate) needed to meet the reasonably foreseeable needs of the project sponsor; and (ii) limit or condition an approval to ensure that the withdrawal will not cause significant adverse impacts to the water resources of the basin. 18 C.F.R. §806.23.

   b. SRBC may consider, among other factors, potential lowering of groundwater or stream flow levels; impacts rendering competing supplies unreliable; effects on other water uses; water quality degradation; impacts on 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. *Id.* §806.23(b)(2).

   c. SRBC requirements for passby flows: *Guidelines for Using and Determining Passby Flows and Conservation Releases for Surface-Water and Ground-Water Withdrawal Approvals*, Policy No. 2003-001 (November 8, 2002).

      i. The method of determining passby flow for streams that support trout populations is based upon the SRBC's *Instream Flow Studies Pennsylvania and Maryland* (May 1998) publication. That publication reflects studies which applied Instream Flow Incremental Methodology ("IFIM") to evaluate cold water fish habitat impacts in a sampling of streams in several hydrologic regions of Pennsylvania and Maryland, arriving at a surrogate model to be applied to other streams in assessment predicted "habitat loss." The SRBC policy pegs the acceptable amount of habitat loss depending upon the classification of the stream. Less than 5% habitat loss is allowed for exceptional value streams. Generally, less than 5% loss (or at most 7.5% habitat loss) is allowed for high quality waters. Passby flows to prevent more than 10 or 15% habitat loss would be imposed on streams with lower classifications supporting trout populations. For areas of the basin that do not support trout populations, the SRBC passby flow policy sets levels generally ranging from 15 to 25% of average daily flow. In no case is the passby flow less than the $Q_{7\text{-}10}$ flow.

ii. There are several narrowly tailored exceptions to the SRBC passby flow requirements.

(a) First, an exception is provided in cases where the surface-water or groundwater withdrawal, has only a minimal impact in comparison to the natural or continuously augmented flows of a stream or river. The SRBC defines minimal impact as 10% or less of the natural or continuously augmented $Q_{7\text{-}10}$ low flow of the stream or river.

(b) Second, an exception may be provided where the project in question requires Commission approval and a passby flow would be required under the guidelines, "but where a passby flow has historically not been maintained." In these cases, withdrawals exceeding 10% of the $Q_{7\text{-}10}$ low flow will be permitted whenever flows naturally exceed the passby flow requirement plus the taking.

d. Consumptive use compensation requirements:

i. Applies to all consumptive uses that involve more than 20,000 gpd over any 30-day period and that were initiated or increased after January 23, 1971 and all consumptive use associated with Marcellus and Utica shale natural gas projects.

ii. A "consumptive use" is defined to mean the "loss of water transferred through a manmade conveyance system or any integral part thereof (including such water that is purveyed through a public water supply or wastewater system), due to transpiration by vegetation, 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, diversion from the basin, or any other process by which the water is not returned to the waters of the basin undiminished in quantity." 18 C.F.R. §806.3.

iii. Regulated consumptive users (all Marcellus Shale operators) must either curtail their consumptive use during "low flow" periods (as may be designated by the Commission), or must provide compensation for that use. 18 C.F.R. § 806.22(b). Compensation may be provided by one of several methods, including providing payments to SRBC under a set fee schedule. SRBC utilizes such funds

for the operation of storage capacity in certain reservoirs acquired by the Commission to provide for streamflow augmentation during low-flow periods.

E. Delaware River Basin Commission ("DRBC")

1. Federal / interstate commission created by Delaware River Basin Compact, Pub. L. No. 87-328, 75 Stat. 688 (1961).

2. DRBC Project Review – Compact §3.8

a. DRBC may regulate and approve any "project" having a substantial effect on the water resources of the Basin, to assure consistency with the Commission-adopted comprehensive plan, and "the proper conservation, development, management or control of the water resources of the basin."

b. The term "project" is very broadly defined to include "any work, service or activity which is separately planned, financed, or identified by the commission, or any separate facility undertaken or to be undertaken within a specified area, for the conservation, utilization, control, development or management of water resources which can be established and utilized independently or as an addition to an existing facility, and can be considered as a separate entity for purposes of evaluation." Delaware River Basin Compact § 1.2(g).

c. Traditional project review by DRBC was limited to surface and groundwater withdrawals exceeding 100,000 gallons per day (gpd) in any 30-day period; construction or alteration of industrial wastewater treatment facilities or domestic sewage treatment facilities involving a design capacity ≥ 50,000 gpd; the diversion (exportation or importation) of water from or to the Delaware River Basin whenever the design capacity is greater than 100,000 gpd; and impoundment of water. 18 C.F.R. §401.35(b).

d. In May 2009, DRBC Executive Director issued a "jurisdictional determination" under 18 C.F.R. §401.35(a) extending the Commission's project review authority to all natural gas extraction projects located in shale formations within the drainage area of special protection waters designated by DRBC (that is, most of the upper and middle Delaware Basin). DRBC, Determination of the Executive Director Concerning Natural Gas Extraction Activities in Shale Formations within the Drainage Area of Special Protection Waters (May 19, 2009) (available at http://www.state.nj.us/drbc/naturalgas.htm).

i. The determination defines the "project" to encompass "the drilling pad upon which a well intended for eventual production is located, all appurtenant facilities and activities related thereto and all locations of water withdrawals used or to be used to supply water to the project."[7] Thus, irrespective of the amount of water to be utilized, all Marcellus and other shale gas projects will trigger project review and approval requirements, and DRBC approvals are required prior to commencement of any development activities.

ii. More recently, DRBC extended this definition of project to include exploration wells, and announced a moratorium on process gas well drilling projects until regulations are finally adopted setting forth the standards for well project approvals. *See* notices posted at http://www.state.nj.us/drbc/naturalgas.htm.

3. Standards and criteria for project approval under existing DRBC regulations (applicable to withdrawals in general).

a. Central criterion governing approval of projects is whether the project proposal is consistent with the Delaware River Basin Comprehensive Plan, which encompasses a wide range of regulations and policies, most of which are now compiled as part of the DRBC Water Code. The Delaware River Basin Water Code is currently available on line at: www.state.nj.us/drbc/regula.htm.

b. Project review with respect to withdrawals includes consideration of such factors as the need for the proposed withdrawal, alternative sources available, impacts on other uses in the area and on instream uses downstream of the point of extraction, proposed mitigation measures, implementation of conservation measures, and other issues.

c. DRBC allocates water based upon the doctrine of equitable apportionment. During drought emergencies, DRBC has established a series of water use priorities, with first priority being given to uses which sustain human life, health, and safety, and second priority to uses needed to sustain livestock.

d. Water conservation policies applied to both new and existing uses.

e. DRBC policy "discourages" the exportation of water from the basin. At the same time, because of limited assimilative capacity,

[7] *Id.* at 2.

DRBC policy discourages the importation of wastewater into the basin that would significantly reduce the assimilative capacity of receiving streams, particularly with respect to conservative substances. DRBC Water Code § 2.30.2.

f. Much of the Delaware Basin containing Marcellus Shale has been designed as "special protection" waters for water quality purposes, and is subject to stringent restrictions on both point source discharges and non-point pollution controls (*e.g.*, erosion and sedimentation, and stormwater controls).

4. DRBC emergency powers: DRBC may declare emergencies and impose restrictions on water withdrawals and diversions (including suspension of State-issued water rights) during such periods. Delaware River Basin Compact §§ 10.4, 10.8.

5. Proposed DRBC regulations for natural gas well development. http://www.state.nj.us/drbc/notice_naturalgas-draftregs.htm

a. Proposed rules released for public comment December 9, 2010; comments due March 15, 2011 (unless comment period extended).

b. Water sources for uses related to natural gas well development (§7.4).

i. Requires approval of sources for uses related to natural gas well development, including (1) previously approved sources (such as surface and groundwater sources, non-contact cooling water); (2) new withdrawals; (3) use of treated wastewater and non-contact cooling water; (4) imported water; (5) mine drainage water; (6) recovered flowback and production water.

ii. Approval required irrespective of volume of water.

iii. Streamlined approval-by-rule process available for use of surface and groundwater withdrawals previously approved by DRBC for other uses (but only within previously-approved quantities), and use of water from treated wastewater and non-contact cooling water whose discharge was previously approved by DRBC, subject to conditions:

(a) Review of consumptive use impacts to assure water purchased for natural gas use will not adversely affect streamflow.

(b) Bulk water agreements must preserve priority for originally approved use.

(c) Metering, recording and reporting of withdrawals and transfers.

(d) Invasive species control plan.

(e) Pass-by flow requirement – $Q_{7\text{-}10}$ or any more stringent value recommended by appropriate host state agency.

iv. New water sources require full DRBC docket.

(a) Non-point source pollution control plan.

(b) Natural diversity inventory assessment.

(c) Metering, recording and reporting of withdrawals.

(d) Water withdrawal site plan covering planned facilities; no site clearing pending DRBC Executive Director approval of constructions plans and specifications.

(e) Water withdrawal site operations plan.

(f) Three year limit on approvals unless operation commenced within 3 years.

(g) Drought emergency plan.

(h) Hydrogeologic report for groundwater withdrawals.

v. Use of recovered flowback and production water.

(a) Recovered water may be used for well stimulation activities at the project sponsor's DRBC-approved well pads in accordance with well pad dockets or ABRs.

c. Natural gas development plan ("NGDP") and well pad siting requirements (§7.5).

i. DRBC would require NGDP submission by sponsors of natural gas well pad projects who have total lease holdings over 3,200 acres or intend to construct more than 5 pads designed for any type of natural gas well. Must be submitted within 3 months of filing of first well pad application.

ii. Content: identify foreseeable natural gas development in defined geographic area, including (1) lease area maps; (2) landscape maps (lease areas, local features, hydrology, geology, soils, slopes); (3) constraints maps identifying development restrictions (setbacks, flood hazard areas, steep slopes, critical habitat for protected species); (4) vehicular circulation maps; and (5) monitoring program for surface and groundwater monitoring locations.

iii. DRBC would issue project approval dockets for NGDPs, which may allow for phased development.

iv. Approval of individual well pads:

(a) Full DRBC dockets required for well pads that are not eligible for ABR process.

(b) ABR provided for certain well pads that conform to an approved NGDP and are not in a "forested site" and are outside management areas of the National Park Services and watershed of the NYC reservoirs.

(c) Requirements:

(1) Planning requirements – lease area map.

(2) Public notification

(3) Water source requirements, including identification of proposed sources, recording and quarterly reporting mandates.

(4) Water supply charge imposed assuming water use is 100% consumptive.

(5) Continuous water conservation requirements.

(6) Non-point source pollution control plan.

(7) Mitigation, remediation and restoration mandates for any release to environment.

(8) For high-volume hydraulically fractured wells, pre- and post- development ground and surface water monitoring.

(9) Wastewater treatment and disposal plans.

d. Wastewater generated by natural gas development (§7.6) (see discussion below).

i. Project approval dockets required for facilities (including POTWs) proposing to accept wastewaters from natural gas development.

ii. Treatability studies required.

iii. Analysis to show discharge will not result in exceedance of primary and secondary drinking water standards for identified parameters.

iv. Effluent limits to meet stream quality objectives in Zones 2-6 of Delaware Estuary, plus basewide effluent limits and stream quality objectives.

v. DRBC basinwide TDS objective: 133% of background, not to exceed 500 mg/l (except in lower Estuary).

e. Financial assurance requirements (§7.3(k)).

i. DRBC would require financial assurance (via surety bond, letter of credit, trust fund or other approved method) covering plugging, abandonment and restoration of natural gas wells in amount of $125,000 per well.

ii. After installation and fracing complete, Executive Director would reduce amount of assurances if no evidence of harm to water resources of the Basins and project sponsor obtains an excess insurance policy or other financial assurance instrument.

IV. PROTECTION OF WATER SUPPLIES – LIABILITY OF GAS WELL OPERATORS FOR IMPACTS ON OTHER WATER USERS

A. Liability for Impacts Caused by Water Supply Development

1. Question of liability for impacts caused by water supply development and withdrawals rests largely on the applicable state law governing "water rights" and water allocation, and substantially is affected by the location and nature of the withdrawal involved.

B. Liability for Impacts Caused by Gas Well Development and Operation

1. Common Law Liabilities

a. Absent special statutory arrangements, liability for water supply quantity and quality impacts occasioned by gas well development will rest substantially on common law tort doctrines – principally trespass, nuisance and, where applicable, strict liability rules.

2. Special Statutory and Regulatory Requirements

a. Some jurisdictions, such as Pennsylvania, have adopted special statutory and regulatory provisions that act as an overlay to, or displacement of, common law rules in regard to impacts from oil and gas well development.

b. The Pennsylvania Oil & Gas Act – Water Supply Protection Provisions

i. Section 208 of the Pennsylvania Oil and Gas Act, 58 P.S. §601.208, imposes an affirmative obligation on well operators to restore or replace affected water supplies:

(a) Any well operator who 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 or quality for the purposes served by the supply.

ii. Section 208(b) describes procedures by which any "landowner or water purveyor suffering pollution or diminution of a water supply ***as a result of the drilling, alteration or operation*** of an oil or ***gas well***" may notify the PaDEP and request an investigation be conducted.

iii. The Pennsylvania Act sets up a specific process. After receipt of a complaint, PaDEP must undertake an investigation within 10 days. The agency must render a determination within 45 days. If the agency fines or "presumes" that the pollution or diminution of the water supply was caused by drilling, alteration or operation activities, then PaDEP will issue an order to the gas well operator to restore or replace the affected supply, and if necessary provide a temporary replacement.

iv. Pennsylvania's law creates a presumption that the gas well operator is responsible for *pollution* of a water supply within 1000 feet of the gas well, where the pollution occurs *within six months* after completing drilling or alteration of the well. 58 P.S. §601.208(c). This presumption can be overcome if the well operator affirmatively proves one of five defenses:

(1) The pollution existed prior to the drilling or alteration activity as determined by a predrilling or prealteration survey.

(2) The landowner or water purveyor refused to allow the operator access to conduct a predrilling or prealteration survey.

(3) The water supply is not within 1,000 feet of the well.

(4) The pollution occurred more than six months after completion of drilling or alteration activities.

(5) The pollution occurred as the result of some cause other than the drilling or alteration activity.

58 P.S. §601.208(d).

v. To utilize either of the first two defenses, the well operator must retain the services of an independent laboratory to conduct a predrilling or prealteration survey of water supplies in the area, and results of that survey must be provided to PaDEP and each water supply owner in a manner prescribed by PaDEP. 58 P.S. §601.208(e).

vi. The statute does not create a presumption about impacts on the ***quantity*** of neighboring supplies or call for a predrilling or prealteration survey of the ***quantity*** aspects of neighboring wells. Nevertheless, a predevelopment survey of water supplies for both water quantity and quality may be prudent as a prophylactic defensive measure.

V. THE FLOWBACK / WASTEWATER CHALLENGE

A. Scope of the Challenge

1. About 3-5 million gallons of water are required to perform a successful frac job.

2. A portion (25-50%) of this water emerges from the well as flowback water, with significant volume in a relatively short period of time.

3. Efforts to obtain representative characterization of Marcellus Shale flowback and produced waters still underway (not complete).

4. Flowback water contains 4-25% salts (including constituents from underground formation), plus oil and gas, plus chemicals added during the frac.

   a. Typical TDS may exceed 100,000 mg/l.

   b. Other constituents of concern: barium, strontium, NORM (naturally occurring radioactive material).

   c. Typical flowback water vs. freshwater constituent values:

Parameter	***Typical Surface Water Analysis*** ***(mg/l or ppm)***	***Flowback Analysis*** ***(mg/l or ppm)***
TDS	< 500	20,000 to 300,000
Iron	< 2	0 to 25
Oil & Grease	< 15	0 to 1,000
Barium	< 2	0 to 1,000
Strontium	< 4	0 to 5,000
pH	6 to 9	5 to 7.5

5. Reuse of flowback water requires treatment and/or dilution with fresh water to lower TDS and some other specific constituent concentrations (*e.g.*, sulfates) that could inhibit successful fracture stimulation programs.

6. Millions of gallons of water from each frac job require handling, treatment and disposal.

7. Existing treatment facilities have limited capacity and capability to handle these volumes, constituents and concentrations/loadings.

8. Some eastern streams have limited capacity to assimilate these constituents.

9. Other streams may have high quality / special protection status.

10. Water management methods, facilities and disposal options need to be developed.

B. Overview of Wastewater Management Issues

1. Characterizing flowback wastewaters

2. Assuring wastewaters are sent to (and reach) appropriate treatment facilities – generator and treatment facility operator obligations

3. Treatment technology issues – determining what will meet current and future regulatory mandates

4. Treatment facility design and permitting issues

    a. Siting issues – zoning and land development regulation

    b. NPDES discharge technology-based limitations

    c. Water quality-based effluent limitations

    d. Stream assimilative capacity issues

    e. Air emissions issues – "facility" definition, State BAT, PSD, and NSR

5. Underground injection regulation (flowback or treatment residuals)

6. Residuals characterization – potential RCRA issues

7. Rules governing beneficial use of treatment residuals

C. Requirements for Characterizing Flowback Wastewater

1. Flowback water is exempted from RCRA Subtitle C hazardous waste regulation (42 U.S.C. §6921(b)(2)(A)), but subject to state regulatory regimes governing characterization of "solid wastes" and wastewaters

2. Pennsylvania requirements:

    a. Model permit conditions require wastewaters to be characterized "in accordance with 25 Pa. Code §287.54" (residual waste rules)

    b. Generator must use generator knowledge and representative sampling to determine physical and chemical composition of material

    c. May rely on detailed analysis that characterizes waste (company or industry data) within past five years, if generator can certify that it is representative

    d. Receiving facilities must have waste acceptance plan; and wastes must have approval for receipt

    e. POTWs must obtain DEP approval for receipt of new types of industrial wastewater not reflected in original NPDES permit application

f. Characterization required to avoid interference, pass-through, or impact on sludge quality/classification

D. Assuring Delivery to Appropriate Facilities

1. POTWs to provide notice and obtain NPDES permit modification if necessary for new types of influent sources.

2. Pennsylvania oil & gas and waste rules impose responsibilities on generators to send waste to appropriate permitted facilities.

a. 25 Pa. Code §287.55 – prepare and implement plan for control and disposal of fluids and wastes.

b. 25 Pa. Code §287.6 – generator may not consign or transfer residual waste "which is at any time subsequently" stored, treated, processed or disposed of or discharged at an unpermitted facility.

c. 25 Pa. Code §287.55 – required generator records: types and amounts of waste generated, date waste generated, information regarding processing or disposal facility (minimum 5 year retention).

d. Biennial and other reporting of waste disposition.

e. Manifests *per se* not required, ***but*** consider need to track waste shipments to meet above requirements.

f. Potential exposure to significant penalties for failure to deliver to permitted facilities, and potential cleanup liabilities if materials are mishandled.

E. Treatment and Reuse Technology Choices

1. Treatment and reuse choices

a. Natural pond evaporation – not practical in eastern U.S.

b. Direct reuse for drilling and fracing

i. Depends on desired water quality (varies)

ii. Need to address oil/condensate separation; solids and bacteria removal; sulfides control.

iii. Usually requires some treatment be applied.

iv. Potential for mixing with fresh water to attain desired TDS / chlorides values allowing reuse.

c. Underground injection of brines

i. Significant regulatory and permitting issues.

ii. Very small number of UIC wells currently permitted in Appalachian Basin States.

d. Conventional treatment technologies

i. pH adjustment, metals precipitation.

ii. Membrane filtration.

iii. Oil / water separation.

iv. Do not address TDS / chlorides challenge.

e. TDS reduction via reverse osmosis

i. Effective for TDS < 40,000 ppm

ii. Can be centralized or mobile

iii. Moderately energy intensive and operator intensive

iv. Products / Residuals:

(a) <500 ppm TDS Water (30-60% Recovery)

(b) Concentrated Brine (40-70%)

f. TDS reduction via evaporation

i. Centralized or mobile

ii. Energy intensive

iii. Products / Residuals:

(a) Distilled water (60% Recovery)

(b) Saturated brine (40%)

g. TDS reduction via crystallization

i. Centralized

ii. Energy intensive

iii. Products / Residuals:

(a) Distilled water (99% Recovery)

(b) Salt cake

2. Key regulatory questions affecting selection

a. What are the allowable discharge levels (loadings and concentrations)?

b. Are there differences in regulatory treatment between on-site treatment vs. centralized facilities?

c. What rules govern the management, disposition or beneficial use of residuals?

d. What are today's requirements?

e. What will be the likely future requirements - the regulatory trends?

F. PA Permitting Strategy for High-TDS Wastewaters (4/11/09)
http://www.depweb.state.pa.us/watersupply/cwp/view.asp?a=1260&Q=545730&watersupplyNav=|30160

1. Goal: by January 1, 2011, new sources of high-TDS wastewaters will be prohibited from discharging to Pennsylvania waters.

2. Regulatory amendments as initially proposed in strategy:

a. 25 Pa. Code Ch. 95 – new effluent standards for new or expanded sources of "High TDS Wastewater", defined as 2000 mg/l or 100,000 lbs/day. Initially proposed limits 500 mg/l TDS; 250 mg/l Chlorides) plus special standards for Marcellus Shale wastewaters (10 mg/l Barium; 10 mg/l Strontium). 39 Pa. Bulletin 6467 (November 7, 2009).

b. Pa Code Ch. 93 – new numeric water quality criteria for constituents of Osmotic Pressure, including Sulfates & Chlorides

c. The proposed Ch. 95 regulations met with a broad concern and opposition from various regulated sectors well beyond the oil and gas industry, including power generation, refineries, coal mining, pharmaceuticals, and food processing establishments. Responding to the concern that a "one-size-fits-all" approach was unjustified, DEP convened a TDS Stakeholders Subcommittee to its standing Water Resources Advisory Committee composed of representatives of various sectors and public interest organizations to examine various options.

3. Final 25 Pa. Code Ch. 95 Rule re TDS

   a. Adopted by the Environmental Quality Board in May 2010 and published finally on August 21, 2010 (40 Pa. Bulletin 4835) – varied substantially from the original proposal.

   b. Within one year of the effective date, each natural gas well operator must adopt and implement a source reduction strategy identifying the methods and procedures to maximum recycling and reuse of flowback or production fluid either to fracture other natural gas wells or for other beneficial uses. The strategy must be updated annually. 25 Pa. Code §95.10(b)(2).

   c. New or expanding treated discharges of wastewater resulting from the fracturing, production, field exploration, drilling or well completion of natural gas wells may be authorized under NPDES permits only if: (1) the discharges are from centralized waste treatment ("CWT") facilities; (2) the discharge meets monthly average effluent standards of 500 mg/l TDS, 250 mg/l Chlorides, 10 mg/l Barium, and 10 mg/l of Strontium; and (3) any CWT discharging to a POTW must meet the same treatment standards for TDS, chlorides, barium and strontium prior to the water reaching the POTW. 25 Pa. Code §95.10(b)(3).

   d. Other industries are subject to an effluent limitation of 2000 mg/l of TDS as a monthly average applied to any new or expanding mass loading of TDS, with certain exclusions and allowances for variances if certain criteria are met.

   e. If particular watersheds approach 75% of their TDS assimilative capacity as measured at the nearest downstream water supply intake, DEP may undertake a wasteload allocation process and impose more stringent loadings on all TDS discharges to that watershed.

4. Potential Instream Criteria (Ch. 93)

   a. Under the 2009 PA TDS Strategy, DEP proposed to develop new instream water quality criteria for the components of TDS that contribute to osmotic pressure.

   b. In May 2010, DEP proposed a new instream criteria for Chlorides of 230 mg/l as a 4-day average and 860 mg/l as a 1-hour average. 40 Pa. Bulletin 2264 (May 1, 2010). Both are stated as being aimed at aquatic life protection.

      i. If adopted, these criteria would affect the permitting of both new and existing discharges.

ii. Such instream criteria are applied in calculating whether new or existing discharges at each particular point of a stream, when combined with existing instream background concentrations of Chlorides at low flow (Q_{7-10}) conditions, would cause an instream exceedance of the standard. If so, a water quality based effluent limit ("WQBEL") will be developed to limit Chlorides in the discharge. Such WQBELs, by definition, may be more stringent than technology-based effluent limitations.

c. Significant issues raised concerning the science behind the proposed Chlorides limits, including the derivation of acute values from chronic impact studies.

d. DEP appears inclined to further review the studies and derivation, while EPA has indicated that it may develop new guidance on Chlorides.

VI. LEGAL AND REGULATORY ISSUES IN IMPLEMENTING TREATMENT AND DISPOSAL FACILITIES

A. Treatment Facility Siting

1. Zoning and land development regulations

a. Requirements vary by State and locality

b. In some instances (example: Pennsylvania), local zoning regulations may be partially preempted.

c. *See Range Resources-Appalachia, LLC v. Salem Twp.*, 964 A.2d 869 (Pa. 2009); *Huntley & Huntley, Inc. v. Borough Council of the Borough of Oakmont*, 964 A.2d 855 (Pa. 2009): PA municipalities may not regulate the same features of oil and gas operations as regulated under the Oil & Gas Act, but can apply traditional zoning defining districts where gas wells can be located).

i. On-site treatment – arguably part of operations regulated by DEP under the Oil & Gas Act and statutes referenced therein.

ii. Off-site central treatment facilities – regulated under various state laws, but not the Oil & Gas Act.

2. Zoning and land development plan approval process can be lengthy and complex (especially for conditional use and special exception zoning approvals).

3. State siting restrictions for certain treatment facilities.

a. Example: Pennsylvania residual waste processing facilities siting criteria (25 Pa. Code §297.202).

i. Does not apply to captive processing facilities subject to 287.102(b) permit-by-rule.

ii. Does not apply to wastewater treatment facility that discharges under an NPDES or discharges to a POTW under pretreatment standards (287.102(c)).

iii. *May apply to zero liquid discharge facilities unless DEP issues a general permit.*

iv. Exclusion from:

(a) 100-year floodplain absent DEP approved floodproofing

(b) 100 feet from exceptional value wetland

(c) 100 feet from other wetlands

(d) 300 feet from occupied dwelling, absent owner waiver

(e) 100 feet from perennial stream

(f) 50 feet from property line

(g) 300 yards from school building, park or playground

B. NPDES Permit Issues

1. Required under Federal Clean Water Act for any point source discharge of any pollutants to surface waters of the United States. 33 U.S.C. §1342.

2. Effluent limits are based on more stringent of applicable technology-based limitations or water-quality based effluent limits.

3. Technology-based effluent limits:

a. Treatment facilities and discharges at gas well site subject to effluent guidelines ("ELG") for onshore oil & gas extraction subcategory (40 C.F.R. §435.30-.32) – no discharge of wastewater pollutants allowed absent "fundamentally different factors" variance.

b. Central wastewater treatment facilities effluent limit guidelines (40 C.F.R. Part 437).

c. Best conventional control technology (BCT), available technology currently available (BAT) for toxics and non-conventional pollutants – determined by best professional judgment if no ELGs.

d. State effluent limits (*e.g.*, Pennsylvania 25 Pa. Code Ch. 95 standards).

4. Water quality based effluent limits:

a. Based on instream water quality criteria and protected uses.

b. Limits calculated based on assimilative capacity at design flow of 7-day, 10-year low flow ($Q_{7\text{-}10}$).

5. Special protection waters

a. Each State required to adopt standards to protect quality of streams that exceed levels necessary to support fish and recreation (i.e., are better than fishable/swimmable quality).

b. Pennsylvania special protection water regulations (25 Pa. Code §§93.4a – 93.4d)

i. Requires evaluation of non-discharge alternatives.

ii. Must use non-discharge alternative that is "environmentally sound and cost effective when compared with the cost of the proposed discharge."

iii. If non-discharge alternative is not environmentally sound or cost effective, must use "best available combination of cost-effective treatment, land disposal, pollution prevention and wastewater reuse technologies" (ABACT).

iv. Demonstrate discharge will not cause reduction in water quality or other degradation of receiving water.

v. Demonstrate (for HQ waters) that any degradation is justified by social or economic justification (SEJ) = important economic or social development in area where waters are located.

6. Degraded Waters

a. States must identify waters for which technology-based effluent limits fail to achieve water quality necessary to protect designated and existing uses. These waters are identified in "Section 303(d)" lists under the Federal Clean Water Act. 33 U.S.C. §1313(d).

b. States and/or EPA are required to establish Total Maximum Daily Loads ("TMDLs") under Clean Water Act §303(d)1)(A) for waters which effluent limits are not stringent enough to implement any quality standard applicable to such waters.

c. §303(d)(1)(C) provides that TMDLs must be established to implement water quality standards with seasonal variations and a margin of safety taking into account any lack of knowledge concerning the relationship between effluent limitations and water quality.

d. What TMDLs mean:

i. Loadings are allocated among point and non-point discharges.

ii. State must develop implementation plan, including imposition of stringent limits (beyond technology-based limits) on all point sources.

iii. More stringent effluent limitations, BMPs, and other measures to conform to wasteload allocation.

iv. State may allow some trading between regulated entities (example – nutrient trading program).

v. By definition, it goes beyond "technology."

C. Proposed DRBC Regulations re: Discharge of Wastewater Associated with Natural Gas Wells

1. Part of recently proposed DRBC rules.
http://www.state.nj.us/drbc/notice_naturalgas-draftregs.htm

2. Proposed requirements (Proposed DRBC Rules §7.6)

a. Project approval dockets required for facilities (including POTWs) proposing to accept wastewaters from natural gas development.

b. Treatability studies required.

c. Analysis to show discharge will not result in exceedance of primary and secondary drinking water standards for identified parameters.

d. Effluent limits to meet stream quality objectives in Zones 2-6 of Delaware Estuary, plus basewide effluent limits and stream quality objectives.

e. DRBC basinwide TDS objective: 133% of background, not to exceed 500 mg/l (except in lower Estuary).

D. Underground injection of flowback or treatment residuals

1. Federal Safe Drinking Water Act – Underground Injection Control ("UIC") program.

a. Federal Energy Policy Act amendment excludes from definition of "underground injection" the "underground injection of fluids or propping agents … pursuant to hydraulic fracturing operations related to oil, gas or geothermal production activities." 42 U.S.C. §300h(d).

b. But wells used for disposal of brine or waste require UIC permits

c. Permit program administered by EPA or by authorized state (holding "primacy")

2. Federal standards (40 C.F.R. Part 146)

a. Class II UIC wells: all wells used for disposal of fluid brought to surface from conventional oil and gas production

b. Requires evaluation of potential impacts within area of endangering influence (§146.6)

c. Plan for corrective action to prevent fluid movement into drinking water sources (§144.55, 146.7)

i. Identification of all wells within area of review penetrating formations affected by pressure increase

d. Demonstration of mechanical integrity

e. Specific construction standards (casing, cementing, logging, testing) (§146.22)

f. Detailed monitoring requirements (§146.23)

3. Pennsylvania

a. Injection wells regulated under 25 Pa. Code §78.18; provides for permitting of disposal or enhanced recovery wells via Oil & Gas Act well permit.

b. Must submit to DEP a copy of UIC permit and application submitted to EPA under 40 C.F.R. Part 146.

c. Requires control and disposal plan meeting requirements of 25 Pa. Code §91.34.

4. DRBC

a. DRBC invokes project review jurisdiction over UIC wells in the Delaware Basin

VII. KEY CHALLENGES

A. Developing and implementing methods for reuse of flowback and produced water.

1. Water storage methods

2. Water transportation

3. Sharing of water between entities in an area

B. For flowback / produced water that cannot be practically reused:

1. Choosing the right technology = flexibility to handle range of constituents, robustness, durability and resulting residuals

2. Regulatory uncertainty and flux

3. Permitting time frames