June 4, 2012

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Dear Anne,

The Buckeye Forest Council (BFC), the Sierra Club Ohio Chapter, Environment Ohio, the Natural Resources Defense Council (NRDC), the Center for Health, Environment, and Justice (CHEJ), Heartwood, the Ohio Environmental Council, and Earthjustice thank you again for recognizing that the emergence of high volume horizontal hydraulic fracturing (HVHHF) in Ohio deserves analysis by Wayne National Forest staff.

While we appreciate that the Wayne is examining issues relating to HVHHF as part of a Review of New Information (RONI) process, we write to share with you our concern that HVHHF brings with it highly significant new circumstances and information; circumstances and information that demand the supplementation of the Wayne's 2006 LRMP FEIS.

We believe, and legal precedent indicates, that the required time to give HVHHF formal NEPA analysis is now, prior to the sale of future leases and prior to the consideration of

applications for permits to drill (APDs). The following information details our perspective on the significance of HVHHF, as well as on the proper timeframe for NEPA analysis of the same.

I. NEPA Requires Supplementation of the 2006 FEIS Before Future HVHHF Lease Sales May Proceed.

High Volume Horizontal Hydraulic Fracturing (HVHHF) of deep shale formations was not considered as part of the 2006 Wayne LRMP planning process. See 2006 LRMP FEIS, page G-5 (stating directional drilling was "not yet economically feasible within the WNF."). As a result, the 2006 EIS did not analyze the impacts of this type of drilling activity, including potentially significant impacts on surface- and ground-water quality, aquatic habitat, air quality, wildlife habitat, listed species, recreation, and scenic values.

As the Forest Service is aware, *where significant new circumstances or information arise after the completion of an EIS, NEPA requires the preparation of a supplemental EIS*. *See* 40 C.F.R. § 1502.9(c)(1). An agency must prepare a supplemental EIS ("SEIS") when "[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." *Id.* § 1502.9(c)(1)(ii). As more fully explained in Part II of this letter, the emergence of commercially economical horizontal deep shale drilling is exactly the sort of new circumstance that requires supplementation under NEPA.

Moreover, EIS Supplementation Must Occur Prior to Lease Issuance. Instructive precedent is found in Pennaco Energy, Inc. v. United States Dept. of Interior. In that case, the "hotly contested issue […] [was] whether the environmental impacts of CBM development [were] significantly different than the environmental impacts of non-CBM oil and gas development."[1] In Pennaco, BLM issued leases for coal bed methane ("CBM") extraction on public lands in Wyoming.[2] A plan-level EIS for the area failed to address the possibility of CBM development, and a later EIS was prepared only after the leasing stage, and thus "did not consider whether leases should have been issued in the first place."[3] Because the issuance of leases gave lessees a right to surface use, the failure to analyze CBM development impacts before the leasing stage foreclosed NEPA analysis from affecting the agency's decision.[4] Accordingly, the 10th Circuit held that a supplemental EIS assessing the specific effects of coal bed methane was required before the leasing stage.[5] See also, New Mexico ex rel. Richardson v. Bureau of Land Management, 565 F.3d 683, 718-719 (10th Cir. 2009) (holding BLM was required to conduct NEPA analysis prior to lease issuance).

The situation presently facing the Wayne, i.e., the emerging and rapidly expanding practice of high volume horizontal hydraulic shale development in Ohio, coupled with the lack of NEPA analysis on the potential impacts, is closely analogous to the Pennaco case. Supplementing the 2006 FEIS now, before future HVHHF leases are sold, would be in the best

1 377 F.3d 1147, 1152 (10th Cir. 2004).
2 Id.
3 Id.
4 Id. at 1160.
5 Id.

interests of public participation, of administrative efficiency and compliance, and of the Wayne itself.

II. The Recent Emergence and Rapid Growth of HVHHF in Ohio Is a Significant New Circumstance Entailing Significant New Information.

A. HVHHF is New.

The High Volume Horizontal Hydraulic Fracturing of shale formations (HVHHF), which was not widely used in the United States until around 2005, involves the extraction of oil and natural gas from shale formations deep below the surface, and is one of the fastest growing trends in American on-shore domestic oil and gas production.[6] Large scale production of shale oil and gas has become widespread in the past several years due to these advances in horizontal drilling and hydraulic fracturing, which have significantly improved the industry's ability to produce oil and natural gas in shale basins around the country, including the Barnett, Hayesville, Fayetteville, Woodford, Utica, and Marcellus shale formations.[7] In 2009, 63 billion cubic meters of gas were produced from deep shale formations. In 2012, this production doubled to 137.8 billion cubic meters, and the U.S. Energy Information Administration projects that by 2035, production will increase to 340 billion cubic meters per year.[8]

B. The Increased Impacts Associated with HVHHF Are Clearly Significant.

1. Greatly Increased Surface Disturbance

a. Increased Wellpad and Road Disturbance

HVHHF surface disturbance should be considered *in addition* to any existing and potential surface disturbance associated with conventional development. Because HVHHF involves different formations or productive zones than conventional development, the potential for both forms of development in the same areas or drilling units is very real. This basic principle of overlapping development is discussed in Appendix G to the 2006 FEIS, at G-4:

> In areas of the WNF where there are multiple potentially productive zones at varying depths, the potential exists for a higher density of wells due to

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[6] Ground Water Protection Council and ALL Consulting, Modern Shale Gas Development in the United States: A Primer. Prepared for U.S. Dep't of Energy, Office of Fossil Energy and National Energy Technology Laboratory (Apr. 2009), available at http://www.rrc.state.tx.us/doeshale/Shale_Gas_Primer_2009.pdf. See also Energy Information Administration, Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays (July 2011), available at http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf; Secretary of Energy Advisory Board Shale Gas Production Subcommittee, 90-Day Report (Aug. 18, 2011), available at http://www.shalegas.energy.gov/resources/081811_90_day_report_final.pdf (noting that "it was only around 2008 that the significance of shale gas began to be widely recognized").

[7] Robert B. Jackson et al., Duke University, Research and Policy Recommendations for Hydraulic Fracturing and Shale-Gas Extraction, Center on Global Change (2011), available at http://www.nicholas.duke.edu/cgc/HydraulicFracturingWhitepaper2011.pdf.

[8] U.S. Energy Information Administration. Annual Energy Outlook 2011 with Projections to 2035 (Dec. 2010), available at http://www.eia.doe.gov/oiaf/aeo/electricity.html.

> overlapping spacing units. Two wells could be located side by side and still satisfy spacing requirements because they are completed at different depths.

In other words, potential HVHHF surface disturbance in a particular area of the Wayne does not displace the potential for additional conventional surface disturbance in the same area, and vice versa. Thus, any conventional disturbance considered in the 2006 FEIS has little to no bearing on any potential HVHHF disturbance that may occur on the Wayne.

As noted on page 3-256 of the 2006 FEIS, "[m]ost wells within the WNF are all classified as 'stripper' wells, which produce small volumes of oil, gas, or both, with equally small volumes of brine as a waste product." Appendix G of the 2006 FEIS, page G-6, estimates the average surface disturbance acreage for new conventional wellpads in the Wayne to range from .69 to 1.1 acres per pad. However, the surface disturbance associated with HVHHF is significantly greater. Estimates provided by the Pennsylvania Nature Conservancy (TNC) found that:

> [HVHHF] [w]ell pads occupy 3.1 acres on average while the associated infrastructure (roads, water impoundments, pipelines) takes up an additional 5.7 acres, or a total of nearly 9 acres per well pad (8.8 acres). […] Edge effects amount to 21.2 acres on average, for a total average of 30 acres of disturbance per well pad.[9]

The direct and indirect surface disturbance associated with HVHHF wellpads and associated infrastructure both clearly dwarf the .69 to 1.1 acre disturbance size contemplated in the 2006 FEIS.

b. Increased Gathering Line Disturbance

Moreover, the 2006 FEIS gave no consideration to future gathering line ROW surface disturbance associated with conventional development, let alone that associated with HVHHF. This oversight is highly significant because, as TNC notes, HVHHF natural gas pipeline construction will disturb "an area larger than the cumulative area affected by all other Marcellus gas infrastructure (e.g., wellpads, roads, water containment, and staging/storage areas)."[10]

Page G-8 of FEIS Appendix G appears to provide a rationale for why gathering line disturbance was not examined in the 2006 FEIS: "Given the long history of gas production in the WNF, there is already a well developed pipeline infrastructure in place which should minimize the need for lengthy gathering lines to service new wells." However, HVHHF development will require the construction of new gathering line infrastructure because HVHHF gathering lines

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[9] Johnson, Nels, "Pennsylvania Energy Impacts Assessment: Report 1: Marcellus Shale Natural Gas and Wind," The Nature Conservancy (Nov. 15, 2010), page 10, available at http://www.nature.org/media/pa/tnc_energy_analysis.pdf.

[10] Johnson, Nels, et al., "Natural Gas Pipelines: Excerpt from Report 2 of the Pennsylvania Energy Impacts Assessment," The Nature Conservancy – Pennsylvania Chapter (Dec. 16, 2011), page 8, available at: http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/ng-pipelines.pdf.

range from 6 to 24 inches in diameter and "are much larger than gathering lines used in shallow gas fields, which generally range from 2 to 6 inches in diameter."[11]

According to TNC's estimates, cleared HVHHF ROWs range between 30 to 150 feet, but average 100 feet in width.[12] In addition, an average of 1.65 miles of gathering pipeline is required for each HVHHF wellpad.[13] According to TNC, "[e]ach mile of a 100-foot-right-of-way directly disturbs 528,000 square feet or approximately 12 acres and creates an additional 72 acres of new forest edges."[14]

In short, gathering pipeline construction is perhaps the single largest source of surface disturbance associated with HVHHF development. Nonetheless, the 2006 FEIS fails to give any consideration to either conventional or HVHHF gathering line disturbance.

2. Greatly Increased Water Withdrawal Volumes

HVHHF entails the use of much larger quantities of water than those associated with conventional drilling. In conventional drilling, typically 20,000 to 80,000 gallons of fresh water were used each time a well was hydrofractured,[15] but HVHF uses 2 to 7.8 million gallons of water[16] (on average 5.6 million[17]) each time. In addition, wells are often "fracked" multiple times in order to maximize the resources extracted. The vast amount of water needed to drill these wells must come from somewhere, likely either from the streams and rivers of the National Forest or from local groundwater resources. Water withdrawals in other parts of the country for hydrofracking have had significant effects on lakes, streams, rivers and reservoirs, impacting aquatic life and local residents.[18] The lowering of water levels can also impact water quality, depleting aquifers and causing chemical changes in the water, affecting solubility and mobility; stimulating bacterial growth; and lowering surface water resources, causing changes in flow depth, velocity, and temperature and reducing the dilution effect on contaminants.[19] The 2006 FEIS fails to analyze the local, area-specific impacts of such water withdrawals on the Wayne or on the nearby communities that rely on the Wayne as drinking water sources, making it unclear how large volume water withdrawals may impact this region.

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[11] Id. at page 1.
[12] Id. at page 4.
[13] Id. at page 3.
[14] Id. at page 5.
[15] Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (GEIS), 1992, New York State Department of Environmental Conservation, Chapter 9, Part F, p. 9–26.
[16] Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (SGEIS), September 2009, New York State Department of Environmental Conservation, Section 5.62, p. 5–73.
[17] Water Use in Marcellus Deep Shale Gas Exploration: Fact Sheet, March 2010. Chesapeake Energy Corporation. http://www.chk.com/Media/MarcellusMediaKits/Marcellus_Water_Use_Fact_Sheet.pdf
[18] Donald Gilliland, The Patriot-News, SRBC suspends water withdrawal permits for drilling due to low stream flows (July 19, 2011), available at http://www.pennlive.com/midstate/index.ssf/2011/07/srbc_suspends_water_withdrawal.html.
[19] Id. at 21.

3. Greatly Increased Chemical Usage Volumes

Per each individual fracturing, old hydrofracking used 700 to 2,800 lbs. of chemical additives,[20] but HVHF will use 205,000 to 935,000 lbs.,[21] many of which are toxic to humans and wildlife. A typical 7-well site could receive 4 million lbs. of chemicals.[22]

4. Greatly Increased Wastewater Generation

Assuming HVHF wells use on average 150 times more fluid than traditional wells,[23] *the drilling of 7 HVHF wells (assuming one 7-well pad per 640 acres [square mile]) creates an amount of toxic waste fluid equivalent to that from 1,000 traditional wells per square mile*.[24]

Additionally, many horizontal hydrofracking operations use open storage pits to hold brine and flowback. These pits can have impacts on bird and bat species, which can mistake the pits for bodies of water.[25] Waste storage pits can also impact the environment from leaks and spills. For example, in Ohio, a fracturing flowback storage pit was cut with a track hoe in 2010, causing more than 1.5 million gallons of fluid to spill into the environment.[26] The volume of HVHHF wastes temporarily stored in pits is likely to greatly exceed past volumes associated with conventional development, thus increasing surface disturbance, contamination risk, and wildlife impacts.

5. Greatly Increased Waste Solids Generation

The 2006 FEIS also failed to address the potential impacts of HVHHF solids disposal. The total volume of drill cuttings from drilling a horizontal well may be one-third greater than for the conventional drilling well.[27] This may necessitate the use of a larger reserve pit, and increases the amount of heavy metals and naturally occurring radioactive metals on the site.

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[20] Chemical additives used in water gel hydraulic fracturing are gels (20 lbs. per 1,000 gallons), surfactants (1 gallon per 1,000 gallons), and small amounts of bactericides, iron controllers, and clay stabilizers (GEIS, Chapter 9, Section F, pp. 9–26 and 9–27). Assuming the surfactant density is around 10 lbs./gallon (just slightly more dense than water) and taking bactericide, iron control, and clay stabilizer concentrations as given in the SGEIS (Chapter 5, Section 5.4.3, p. 5–44), the weight of chemicals in a water gel hydraulic fracture is roughly 35 lbs./1,000 gallons. Water gel hydraulic fracturing uses 20,000 to 80,000 gallons of water (GEIS, Chapter 9, Section F, p. 9–26), so 700 to 2,800 lbs. of chemicals are used.

[21] The typical percentage of chemicals in hydraulic fracturing solutions for the Fayetteville Shale is reported as 0.44% by weight (SGEIS, Section 5.4.3, p. 5–44). 0.44% by weight of 5.6 million gallons is 205,000 lbs. (water weighs 8.34 lb./gallon). The SGEIS also states that chemical additives typically comprise 2% or less of the fracturing fluid (Section 5.4, p. 5–33). 2% by weight of 5.6 million gallons is 935,000 lbs. Averaging these two weights yields 570,000 lbs. per well, or 4 million pounds for 7 wells.

[22] Id.

[23] See Notes 15, 16, and 17, supra.

[24] Since each HVHF well uses about 150 times more fluid than a traditional well (the rough average of 70 and 300), there is also about 150 times more waste fluid for each HVHF well, assuming HVHF and traditional wells have similar fractions of returned fluid. 7 wells x 150 = 1,050 times the waste fluid.

[25] See U.S. Fish and Wildlife Service, Region 6, Envtl. Contaminants Program, Reserve Pit Management: Risks to Migratory Birds, at i (2009), available at http://westernenergyalliance.org/wp-content/uploads/2009/09/Reserve-Pits.pdf.

[26] Ohio Dep't of Natural Resources, Notice of Violation No. 1278508985 (June 21, 2010).

[27] See N.Y. D.E.C. Draft Supplemental GEIS, supra at note 10, at 6-63.

6. Greatly Increased Air Impacts

As part of its 2006 NEPA analysis, the Forest Service also did not consider the air quality impacts of high volume hydrofracking, which are more severe than those related to conventional drilling. Fugitive methane emissions from shale operations have been shown to be at least 30 percent more than those from conventional gas operations.[28]

A recent study by Colorado School of Public Health researchers found increased air emission-related cancer and non-cancer health risks for residents living within one half mile of HVHHF development versus residents living further than one half mile from HVHHF well sites. Non-cancer risks were "driven principally by exposure to trimethylbenzenes, aliphatic hydrocarbons, and xylenes, all of which have neurological and/or respiratory effects," while ambient benzene was the "major contributor" to higher cancer risks.[29]

The EPA has reported that hydraulic fracturing of one well leads to emissions of 23 tons of volatile organic compounds (VOCs) – roughly 200 times more emissions than if the well was not hydraulically fractured.[30] VOCs are known to be highly toxic and also to contribute to ozone, which damages both lung tissue and vegetation. The greatly increased truck traffic associated with shale sites is also a significant source of air pollution and ozone formation: "at each stage of production and delivery, tons of toxic volatile compounds (VOCs) […] can escape and mix with nitrogen oxides (NOx) from the exhaust of diesel-fueled, mobile, and stationary equipment, to produce ground-level ozone."[31]

7. Greatly Increased Truck Traffic

Truck traffic associated with horizontal natural gas wells is significantly heavier than traffic associated with conventional drilling operations. For example, the National Park Service estimates that in Marcellus Shale production areas, between 300 and 1,300 truck trips would occur per well.[32] Other documents have estimated that between 2,920 and 4,445 truck trips are

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[28] Robert W. Howarth, et al., Climactic Change, Methane and the greenhouse has footprint of natural gas from shale formations: A letter, at Abstract (2011), available at http://www.eeb.cornell.edu/howarth/Howarth%20et%20al%20%202011.pdf; see also Robert W. Howarth, et al., Climactic Change, Venting and leaking of methane from shale gas development: Response to Cathles et al. (Feb 2012), available at http://www.eeb.cornell.edu/howarth/Howarthetal2012_Final.pdf.

[29] McKenzie, Lisa M.; Witter, Roxana Z.; Newman, Lee S.; Adgate, John L., "Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources," Colorado School of Public Health, University of Colorado, SCIENCE OF THE TOTAL ENVIRONMENT, Volume 424, issue (May 1, 2012), p. 79-87.

[30] U.S. Envtl. Prot. Agency, Proposed Rule, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 76 Fed. Reg. 52,757 (Aug. 23, 2011).

[31] Colborn, T; Kwiatkowski, C; Schultz, K; Bachran M (2011). Natural gas operations from a public health perspective. Human and Ecological Risk Assessment. 17(5): 1039-1056. http://cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/fracking%20chemicals%20from%20a%20public%20health%20perspective.pdf.

[32] See U.S. Envtl. Prot. Agency, Office of Research and Development, Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, pp. 55 (Feb. 7, 2011), available at http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711-08.pdf.

necessary for a three well multi-well pad.[33] Narrow dirt roads may need to be widened or paved to accommodate this high volume of traffic and road integrity may become compromised, increasing surface impacts and stormwater runoff. Additionally, the increase in the number of truck trips required for each well also increases the risk of chemical transportation accidents.[34]

8. Greater Cumulative Impacts

Under NEPA, there must be an analysis of cumulative impacts on the environment in an Environmental Impact Statement. This cumulative impacts analysis must assess "past, present, and reasonably foreseeable future actions" and the incremental impact of the proposed activities when added to that baseline, whether those actions and activities are private or governmental. 40 C.F.R. § 1508.7. This requires "some quantified or detailed information." Neighbors of Cuddy Mountain v. U.S. Forest Service, 137 F.3d 1372, 1379 (9th Cir. 1998). Despite this, the 2006 FEIS did not – and could not – estimate the increased potential impacts of HVHHF on private mineral rights, nearby private lands, and human and environmental health in assessing the regional cumulative impacts of oil and gas operations. Forest Service and BLM need to supplement the 2006 FEIS to consider the potential impacts of private mineral development on the Wayne, on adjacent and nearby private lands, and on residents in light of the new HVHHF circumstance and information confronting the region.

III. Conclusion.

The recent and sudden rise of HVHHF in Ohio is clearly a new circumstance bringing with it new information relevant to the Wayne and the surrounding region. The Wayne has not undertaken any NEPA analysis of the host of potential impacts surrounding HVHHF, let alone taken the sort of "hard look" that NEPA requires.

It is also abundantly clear that this new circumstance is *highly significant*, as the footprint and potential impacts associated with HVHHF dwarf those associated with conventional oil and gas development. Greatly increased surface disturbance, water withdrawals, chemical usage volumes, wastewater volumes, waste solids generation, air impacts, truck traffic, and cumulative impact potential are only a few examples.

In short, the emergence of HVHHF is one of the most significant socioeconomic, environmental, and land use-related developments the region has seen over the past 100 years. This circumstance and related information demand the supplementation of the Wayne's 2006 FEIS. The legally sound and best option is for the Wayne to pursue EIS supplementation *now*, prior to any future oil and gas lease sales. EIS supplementation must occur before lease sale and issuance decisions are made and not after-the-fact as part of the APD process. As Pennaco and

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[33] See 2011 Draft Environmental Impact Statement for the Revised Land and Resource Management Plan, George Washington National Forest (Apr. 2011) at 3-338, available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5297825.pdf.

[34] See U.S. Envtl. Prot. Agency, Office of Research and Development, Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, pp. 14 (Feb. 7, 2011), available at http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/HFStudyPlanDraft_SAB_020711-08.pdf.

other authorities have held, prior NEPA analysis must be given to "whether leases should [be] issued in the first place."[35]

The undersigned organizations respectfully request that the Wayne take the above information and concerns into consideration during its present Review of New Information. We and our members share your love for the Wayne, for its rich natural fabric, and for its great beauty. We hope that you will offer the undersigned organizations, our members, and the general public the opportunity to work with the Forest Service to assess the future of the Wayne relating to HVHHF via a formal NEPA process.

Thank you,

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[35] Pennaco Energy, Inc. v. United States Dept. of Interior, 377 F.3d 1147, 1152 (10th Cir. 2004).