UNITED STATES DISTRICT COURT
DISTRICT OF COLUMBIA

KARST ENVIRONMENTAL EDUCATION AND PROTECTION, INC., WARREN COUNTY CITIZENS FOR MANAGED GROWTH, GAYLA CISSELL, JIM DUFFER and ROGER BRUCKER	)	
Plaintiffs	)	No. 1:05-cv-01190-RMU
v.	)	
U.S. ENVIRONMENTAL PROTECTION AGENCY, U.S. HOUSING AND URBAN DEVELOPMENT, and TENNESSEE VALLEY AUTHORITY	)	
Defendants.	)	

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DECLARATION OF ROGER W. BRUCKER

I, Roger W. Brucker, make the following declaration based on personal knowledge, information, and belief:

1. **Qualifications.** I have been an adjunct professor at Western Kentucky University, Bowling Green, KY, Institute for Cave & Karst Studies, Dept. of Geography & Geology, at Mammoth Cave, 1980-2002. I am an Honorary Life Fellow of the National Speleological Society and winner of the 2004 Peter Hauer Spelean History Prize. I have been a Fellow of the Cave Research Foundation since 1957 and was President from 1978-1979. I am a Board Member of Karst Environmental Education and Protection, Inc. ("KarstEEP").

I have explored the Mammoth Cave system for almost 50 years and have co-authored five books about this cave system and 22 articles or papers about caves, including articles and presentations on the threat to Mammoth Cave from the Kentucky Trimodal Transpark and the geologic unsuitability of the Transpark site:

Books (not all presented).

Brucker, Roger W. and Richard A. Watson, The Longest Cave, Alfred A. Knopf, New York, 1979, 316 pp, (Reprinted 1987 by Southern Illinois University Press, Carbondale, IL).

Borden, James D. and Roger W. Brucker, Beyond Mammoth Cave, SIU Press, Carbondale, IL, 2000, 353 pp.

Murray, Robert K. and Roger W. Brucker, Trapped! The Story of Floyd Collins, G.P.Putnam's Sons, New York, 1979, 335 pp, (Reprinted 1982 by University Press of Kentucky, Lexington, KY). Option taken for major motion picture.

Lawrence, Joe, Jr. and Roger W. Brucker, The Caves Beyond, Funk & Wagnalls, New York, 1955, 290 pp, (Reprinted 1975 by Cave Books, Nashville, TN).

Articles (most relevant presented).

Kambesis, Patricia and Brucker, Roger. "Case Study #2, Collapse sinkhole at Dishman Lane, Kentucky, in Waltham, Tony, Fred Bell, and Martin Culshaw, Sinkholes and Subsidence: Karst and cavernous rocks in engineering and Construction, Springer (2005), pp 277-282.

Brucker, Roger W., "Mammoth Cave System" in White, William B and D. Culver, *Encyclopedia of Caves,* Elsevier, (2004), pp 351-355.

Brucker, Roger W. "Can the Transpark contaminate Mammoth Cave?" *Proceedings*, Sinkhole Conference, Huntsville, AL, (Sept. 2003), 12 pp.

Meiman, Joe, Dr. Hilary Lambert, and Roger W. Brucker. "Management Issues and Threats to the Longest Cave," National Cave Management Symposium, Tucson, AZ, Oct. 2001.

Brucker, Roger W., "Mammoth Cave: a world heritage" and "The joy of connecting Mammoth and Roppel caves", NSS News, (Feb. 1984), pp 105-109.

Brucker, Roger W. Keynote banquet address, Cave Management Symposium, Bowling Green, KY, proceedings, 1982.

Brucker, Roger W., "New Kentucky junction; Proctor-Mammoth link puts system over 200 miles", NSS News, Vol. 37, No. 10, (Oct. 1979), pp 231-236.

Brucker, Roger W., Five papers on cave management delivered at the National Cave Management Symposiums between 1978 and 1984 and published in proceedings.

Brucker, Roger W., John W. Hess, and William B. White, 1972, "Role of vertical shafts in the movement of groundwater in carbonate aquifers", Ground Water, Vol. 10, No. 6, pp 5-13.

White, William B., Richard A. Watson, E. Robert Pohl, and Roger W. Brucker, "The Central Kentucky Karst", Geographical Review, Vol. 60, 1970, pp 80-115.

Brucker, Roger W. and Denver P. Burns, The Flint Ridge Cave System, (map folio), Washington, DC, Cave Research Foundation, 1966, 34 pp.

Brucker, Roger W., "Truncated cave passages and terminal breakdowns in the Central Kentucky Karst", National Speleological Society Bulletin, Vol. 28, 1966, pp 171-178.

Brucker, Roger W.,"The death of Floyd Collins" in Celebrated American Caves, edited by Charles E. Mohr and Howard N. Sloane, pp 151-171. New Brunswick, NJ., Rutgers University Press, 1957.

Brucker, Roger W., "Recent explorations in Floyd Collins Crystal Cave", National Speleological Society Bulletin, Vol. 17, 1955, pp 42-45.

Brucker, Roger W., Philip M. Smith, Joe Lawrence, Jr., and David B. Jones, "Some new approaches to speleology", paper presented at the National Speleological Society Annual Meeting, Louisville, KY, April 1955, 11 pp.

Brucker, Roger W., David B. Jones, William T. Austin, and Bro. G. Nicholas, "New discovery yields world's longest cave," paper presented at the American Association for the Advancement of Science Meeting, Atlanta, GA, Dec. 27, 1955, 5 pp.

I am providing this declaration as a volunteer and without compensation. I have read the Second Declaration of Nicholas Crawford, PH.D., P.G., dated August 18, 2005.

2. **Hydrogeologic Unsuitability of the Transpark Site.**

Dr. Crawford published Site Evaluation and Design Assistance for the Proposed Trimodal Transpark, Final Report, February 22, 2003 (Final Report) and also a Preliminary Report Based on Existing Data (Preliminary Report) based on most of the same data. Neither the Preliminary Report nor Final Report accurately describes the dynamic character of the regional karst underground drainage of ground water with respect to its migration, circulation, and known proclivity to overflow its basin boundaries. Neither the Preliminary Report nor Final Report accurately describes the brittleness of the bedrock members of the geologic column with respect to its structural proclivity to collapse into unsupported karst

cavities nor the location of brittle discontinuous chert members and cavities with respect to the site. Thus, the Final Report based its conclusions on preventing groundwater flow, contamination, flooding, and collapse on false premises with respect to construction on karst.

Dr. Crawford further states that binding elements imposed as a part of local rezoning actions (including the TVA-funded Bowling Green Metalforming site) require protocols for preventing sinkhole collapse. While protocols for preventing sinkhole collapses were called for, such were not effective as evidenced by the inadvertent digging into a cave described in Dr. Crawford's para. 11. The single microgravity protocol cited by Dr. Crawford is inadequate to detect subsurface cavities that weaken support and allow collapse of overburden.

3. Potential for Contamination of Mammoth Cave National Park and the Green River by Spillover or Reverse Flow from the Barren River and Graham Springs Basin.

Dr. Crawford cites studies made by Dr. Quinlan and Mr. Joe Ray, conducted in the 1960s and 1970s (published in 1981, the "Quinlan Study") that show low groundwater stage water circulation and drainage patterns in a limited way for the Central Kentucky Karst in the Mammoth Cave Region of Kentucky. The Quinlan study has been critiqued and put in the context of the times in which the underlying work was conducted by Dr. Ralph Ewers, Ph.D. and others as follows:

a) The Quinlan study is inaccurate with respect to fixing the low stage boundaries of the karst drainage basins due to the subsequent scientific finding that rhodamine red water tracing dye biodegrades into green that is indistinguishable from fluorescein water tracing dye. The only means used by the investigators for differentiating the flow direction is inadequate and unreliable with respect to rhodamine traces. Modern quantitative dye tracing has replaced the earliest tracing methods of Quinlan.

b) The Quinlan study covers a region of approximately 150 square miles. Crawford interpolated the findings to cover the Transpark area of 2,000-4,000 acres, and by implication the 900-acre Phase I development. As pointed

out by Dr. Ewers, the entire conjectural fifteen-mile northern boundary of the Graham Springs drainage basin is based on only two low water injection points. The Quinlan/Ray investigation is inadequate by today's groundwater investigation technology.

c) Dye injection points for the low stage groundwater flow determination at its highest conjectured elevation are not wells drilled into the base groundwater aquifer. Such traces yield data that misrepresent the elevation of the low stage drainage divides, which could be much lower. Crawford's Final Report uses this wrong conclusion to bolster his guess that water cannot migrate between the Turnhole Spring basin (Mammoth Cave karst basin) and the Graham Springs basin.

d) No groundwater flow tracing was performed by Quinlan or Crawford at intermediate and high stage groundwater flows. The risk of cross-basin contamination might be revealed by such studies, a point made by the eighteen karst scientists who were concerned about the possible adverse effects of the Transpark on groundwater quality. They sent a letter to the ITA explaining the need for such investigation, but the ITA ignored the letter on the basis of consultant Crawford's advice.

e) Crawford states that some karst hydrogeologists "agreed completely" with his report conclusions. The area of agreement was confined to low stage groundwater flows as indicated in the Quinlan study and fully endorsed by Crawford. It is false to conclude, as Crawford does, that karst hydrogeologists unreservedly endorse his report with respect to intermediate and high stage groundwater flows. Many scientists have many disagreements with procedure, fact, and conclusions stated in his Preliminary Report and Final Report.

f) Crawford states, "There are no reports based on scientific research that refute the conclusions within my report." This statement is misleading. I presented a peer reviewed paper at the 2003 Sinkhole Conference that specifically cites evidence, some of it from Crawford's published studies, that refutes Crawford's conclusions. That paper concludes that Crawford mischaracterized this karst drainage by using the metaphor of a mountain range drainage divide when in fact the surface is underlain by a three-dimensional network of cavities, openings, and

caves that routinely form flow migration conduits across basin low water boundaries. Crawford admits the probability of flow across the Graham Springs basin boundary with Poorhouse Spring Boundary where the conjectured low water divide is only slightly lower than the divide between the Graham Springs basin and Turnhole Spring (Mammoth Cave) basin. Groundwater contamination potential is a fundamental risk in karst.

4. **Natural Wetlands on the Transpark Site.**

Flood danger warning signs on some roads adjacent to the Transpark attest to the proclivity of sinkholes to flood during heavy rains. Contrary to Crawford's statement (para. 9) that no natural wetlands occur, flooding in karst creates a natural wetland. This is a widely misunderstood problem in karst areas, as when the Corps of Engineers concluded that since the intended site of the Transpark is 150 to 200 feet above the regional base level Barren River, there was no floodplain risk. Crawford cites the rubber-lined lake as a beneficial wetland resulting from construction. The large lake at Bowling Green's Hartland Golf Course, cited as a model for Transpark lakes, disappeared in a few days down a sinkhole. The rubber lining apparently failed, sending the lake contents directly into the aquifer. It may be true that Crawford is making "every effort" to treat storm water runoff, but the inherent characteristics of karst that produce flooding also make it risky and expensive ground for development. It is precisely these issues of high construction cost and maintenance expense and high environmental risk that make the Transpark a risky economic proposition in which federal funds should not have and ought not to be invested without the analysis and public participation afforded by an Environmental Impact Statement.

5. **Reputation of Karst Environmental Education and Protection, Inc.**

Dr. Crawford's pejorative statement (para. 6) that Karst Environmental Education and Protection, Inc. ("KarstEEP") has made unsubstantiated and false claims is not fact. KarstEEP, a Kentucky non-profit corporation, was incorporated to educate and advocate towards the goal of protecting, conserving, and defending karst, karst systems,

and karst landscapes. Its Board includes myself, a Ph.D. geographer, an environmental attorney, and two Ph.D. professors emeritus in biological sciences, with academic backgrounds at the University of Kentucky, Harvard, Columbia University, and Vanderbilt University and the University of Chicago-Illinois, respectively.

KarstEEP's activities are conducted year-round in Kentucky by volunteers and include:

- Presentations to elementary school, high school, public, and university-level students on cave and karst education.

- Advice and assistance to the Living Arts & Science Center, Lexington KY for its "Caves in Your Backyard" display and teaching curriculum.

- Assistance to the Western Kentucky Speleological Survey. Collaboration with other scientific and educational groups, such as Kentucky Waterways Alliance and Citizens' Agenda for Rivers. Assistance to Kentucky's Watershed Watch in the development and support of Subterranean Watershed Watch, now in its third year of training cavers to conduct water quality sampling of cave streams and springs in KY.

- Advice and support for efforts to preserve the Turnhole Spring Basin Watershed and to protect and clean up Crystal Cave and Preston's Spring Cave in Lexington, KY.

- Submittal of detailed comments on Mammoth Cave National Park's cell tower proposal and proposed revisions to the 1-hr. ozone maintenance plan for Edmonson County (home of Mammoth Cave National Park).
  Tabling at Mammoth Cave National Park to educate visitors about development threats to the park.

In the past, Crawford has characterized me as the best Speleology teacher in the world. Crawford's pejorative opinion is an attempt to discredit the messenger rather than deal with the substance of karst education with respect to scientific processes and facts that cast doubt on the adequacy of his developer-sponsored research.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 14th day of September 2005.

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Roger W. Brucker