

MISSOURI

COALITION FOR THE ENVIRONMENT FOUNDATION

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April 1, 2005

Dr. Linton Wells
Chief Information Officer
Department of Defense
6000 Defense Pentagon
Room E3194
Washington, DC 20301

**Re: Data Quality Act Petition
Upper Mississippi River System Flow Frequency Study**

Dear Dr. Wells:

Please find enclosed a "Petition for Correction of Information" filed pursuant to the Data Quality Act of 2000. The Missouri Coalition for the Environment Foundation is challenging the findings and conclusions of the U.S. Army Corps of Engineers' "Upper Mississippi River System Flow Frequency Study", which was released to the public in February 2004. This Study had the goal of recalculating flood risks on the entire Upper Mississippi, Lower Missouri and Illinois rivers – roughly 1,900 miles of river channel.

We do not lightly challenge the results of this study that consumed approximately six years and millions of taxpayer dollars. However, after a comprehensive review, and consultation with independent experts, it is our conclusion that the Study's results are seriously flawed. The Corps' conclusion that flood heights have decreased on many reaches of the Midwest's large rivers is not supported by the historical record and should raise suspicions about the accuracy of the complex models that were used. Moreover, the anticipated use of the Study's flawed results in future floodplain management decisions could have dire consequences for individuals and businesses in the Midwest's broad floodplains.

The Petition seeks a withdrawal of the Study's results, a statement that the Study should not be relied on for public or private decision-making, and the undertaking of a new effort to establish more accurate flood profiles for the Midwest's large rivers. Thank you for giving this your serious consideration. We look forward to your response.

Very truly yours,

A handwritten signature in black ink, appearing to read "Ed Heisel".

Edward J. Heisel
Executive Director

Encls.

Effective Citizen Action Since 1969

OFFICE

cc:

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Before the U.S. Department of Defense
WASHINGTON, D.C.

Missouri Coalition for the)
Environment Foundation,)
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Petitioner,)
)
)

Petition for Correction of Information

INTRODUCTION

In early 2004, the U.S. Army Corps of Engineers ("Corps") released its "Upper Mississippi River System Flow Frequency Study: Final Report" ("Flow Frequency Study"). This document contains predictions of future flood profiles for the entire Upper Mississippi River, the Lower Missouri River, and the Illinois River. As such, the Flow Frequency Study will have huge implications for the management of floodplains along the Midwest's largest rivers. Of primary importance is the anticipated use of these new profiles by the Federal Emergency Management Agency ("FEMA") to redraw flood insurance rate maps, which largely dictate how and where development can occur in floodplains. Because of these implications, it is imperative that the flood predictions arrived at in the Flow Frequency Study be as accurate as possible.

Unfortunately, there are many indications that the predictions in the Flow Frequency Study seriously underestimate actual flood risk and, if adopted by FEMA, will lead to increased flood damages in the future. Academic literature and government reports have long documented increasing flood heights on the Midwest's large rivers and even casual observation of the historic flood record suggests that flooding is much worse today than a century ago. And yet, despite the clear evidence of increased flooding, the Corps' Flow Frequency Study concludes that flood heights have decreased on many reaches of the Mississippi River as compared to earlier

estimates prepared in the 1970s. This conclusion runs counter to common sense and reams of articles by independent, academic researchers and other government scientists.

Pursuant to the federal Data Quality Act, the Missouri Coalition for the Environment Foundation ("Coalition") challenges the data, analysis, and conclusions disseminated by the Corps in its Flow Frequency Study released in February 2004. The Coalition requests that the findings of the Flow Frequency Study be disavowed and removed from circulation, and replaced with findings that more accurately predict flood profiles on the Mississippi, Missouri and Illinois rivers. The Coalition additionally requests that all work based on the Flow Frequency Study be halted until a thorough peer review of the Study has been conducted and the data corrected. In particular, the Coalition is concerned about FEMA redrawing flood insurance rate maps based on the flawed data presented in the Flow Frequency Study, thereby subjecting billions of dollars of public and private infrastructure to unknown and unacceptable risks. A copy of the Flow Frequency Study is on the enclosed CD and can also be found on the internet at <http://www.mvr.usace.army.mil/pdw/pdf/FlowFrequency/flowfreq.htm>.

STANDING

The Coalition is a non-profit, non-partisan, public interest organization with the mission of preserving, protecting and enhancing a healthful and sustainable environment through education, citizen action and legal defense. The Coalition has members who stand to be impacted by decisions made by government agencies in reliance on the flawed conclusions of the Flow Frequency Study. For example, many of the Coalition's members use highways and other infrastructure located in areas that could be subject to induced flooding if additional floodplain development is allowed based on the Flow Frequency Study's conclusions. These areas include the vast expanses of the Mississippi and Missouri river floodplains in and around the St. Louis

region. In addition, the Flow Frequency Study's conclusions of reduced flooding along some river segments will logically lead to further development in those areas, which will negatively impact wetlands and other riparian habitats that are used by Coalition members for birdwatching and other outdoor activities.

FACTS

In February 2004, the Corps published the results of its Flow Frequency Study. The purpose of the Flow Frequency Study was to update flood profiles for over 1,900 miles of the Upper Mississippi, Lower Missouri and the Illinois rivers. The Corps' conclusions in the Study include a prediction that flooding is less severe today on many segments of the Midwest's large rivers than it was when earlier flood profiles were prepared. That is, the Study concluded that flood levels along many segments of the subject rivers has decreased subsequent to earlier studies, which were performed in 1962 on the Missouri River, 1979 on the Mississippi River and 1980 on the Illinois River.

The Corps' findings in the Flow Frequency Study run counter to a large and growing body of scientific evidence demonstrating that flooding has actually increased substantially on these large Midwestern rivers over the past century. This body of evidence is summarized in an attached report prepared by Dr. Nicholas Pinter of Southern Illinois University at Carbondale. Dr. Pinter's report also highlights numerous flaws and oversights contained in the Flow Frequency Study. He concludes that "the [Flow Frequency Study] is built upon fundamental assumptions that run contrary to a large body of mainstream scientific research and cannot be justified." Pinter Report, p.1.¹ Even the Corps admits, as set forth at length below, that there are

¹ A CD is enclosed with this petition that contains an electronic copy of all referenced material.

statistically significant trends of increased flooding over many of the studied reaches of these rivers, but it ignores these trends when rendering its prediction about future flood frequency.

The consequences of relying on erroneously calculated flood profiles would be huge. Local governments have already expressed their intentions of using the Flow Frequency Study findings to redraw floodplain maps up and down these large river systems, which in many areas will increase the amount of floodplain land that can be developed and will reduce the requirement that landowners employ flood reduction measures. Thus, it is essential that flood profiles be as accurate as possible, or else billions of dollars worth of private and public infrastructure will be put at risk.

REQUIREMENTS OF THE DATA QUALITY ACT

The Data Quality Act of 2000 ("Act") was passed by Congress with the objective of "ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by Federal agencies." 44 U.S.C. § 3516(a)(2004)(historic and statutory note). The Act requires federal agencies to issue guidelines designed to maximize the quality of the information they disseminate. *Id.* § 3516(b)(2)(A).

The Department of Defense's ("DOD") guidelines for implementing the Data Quality Act require that information disseminated by DOD components meet quality criteria in three areas: utility, objectivity, and integrity.² The DOD guidelines explain that in terms of "utility," the government component disseminating the information "must consider the usefulness of the information for its reasonable and expected application." DOD Guidelines § 3.2.2. Objectivity means that the information should be "presented in an accurate, clear, complete, and unbiased manner and as a matter of substance, is accurate, reliable and unbiased." *Id.* "Sometimes, in

² In the absence of data quality guidelines promulgated by the Corps, this petition is made to the Department of Defense pursuant to the guidelines entitled, "Ensuring the Quality of Information Disseminated to the Public by the Department of Defense" of February 10, 2003.

disseminating certain types of information to the public, other information must also be disseminated in order to ensure an accurate, clear, complete, and unbiased presentation." DOD Guidelines § 8.1.

The DOD has created an additional requirement that applies to cases involving the dissemination of "influential scientific . . . or statistical information." *Id.* at §§ 3.1.1.2 and 3.2.3.1. For such "influential" information "a high degree of transparency of data and methods must be ensured to facilitate the reproducibility of such information by qualified third parties." *Id.* at 8.2.2.

REQUEST FOR CORRECTED INFORMATION

The Coalition requests that the Department of Defense withdraw and suspend from further use the data presented in the Flow Frequency Study because it fails to meet the Data Quality Act's standards for "utility" and "objectivity." Use of this flawed information would lead to floodplain management decisions with potentially catastrophic consequences. The reasons in support of the Coalition's request are set forth below.

I. The Flow Frequency Study Relies On A Key Assumption That Flooding Has Been "Stationary" Over The Period of Record, An Assumption That Lacks Factual Support.

The single most important assumption used by the Corps in preparing the Flow Frequency Study was that flooding on the three rivers has not increased over time. That is, it was assumed that the flood record is "stationary", meaning that floods have been randomly distributed over time (the so-called "independent and identically distributed" assumption or "iid"). This fundamental assumption allowed the Corps to overlook the obvious trend of increasing flood heights over the past century, and to hide that trend by

averaging out recent floods with earlier years of lesser flooding. The problem is that the Corps' assumption of flood stationarity lacks any foundation in the historical record.

The Corps even acknowledged repeatedly in the Flow Frequency Study that there were trends apparent in the historical flood record "that are significant at the 90% confidence level or higher". In fact, it is astounding how often the Corps acknowledges trends in flooding in a report that is otherwise devoted to arguing that the presumption of stationarity is valid. Some examples of the Corps' admissions about the trend of increased flooding are reproduced below (keep in mind that the Corps ultimately chose to ignore the existence of this trend):

A majority of gages analyzed throughout the study area show worsening flood trends that are significant at the 90% confidence level or higher, including the entire Upper Mississippi River from St. Paul, [MN] down to Thebes [IL] with the single exception of Clinton, Iowa. [App. G1, Fig. 4.³]

Although flood risk may have changed over time for some of the stations in the Upper Mississippi basin, there is currently no viable alternative in flood frequency analysis to using the assumption that flood flows are independent and identically distributed random variables. [App. G1, p.42.]

Some evidence of non-randomness was found both in statistical analyses performed in this investigation and by Olsen and Stakhiv (1999). However, the recommendation is to use the standard techniques applied in flood frequency analysis despite evidence for non-randomness at the gages in the study area. [App. A1, p.4.]

However the data provide very strong evidence that flood risk has increased in recent decades in the lower part of the Missouri basin, on the Mississippi near Hannibal, on the Illinois River, and at St. Louis below the junction of the two rivers. Analysis of flows on tributaries of the Missouri and Meremac [sic] River add to the evidence of a significant change in flood risk with time over the last century. [App. G2, p.90.]

³ The Flow Frequency Study consisted of a main report and numerous appendices. The portions of the Study referred to in this petition are reproduced in electronic format on the enclosed CD.

Our interpretation of the data is that flood risk has increased in recent decades in the lower part of the Missouri basin, on the Mississippi near Hannibal, on the Illinois River, and at St. Louis below the junction of the two rivers (Olsen et al., 1999). [App. G1, p.18.]

This paper considers flood risk assessment in the upper Mississippi River Basin where statistically significant trends in the magnitude of flood peaks have been documented. These results demonstrate that the traditional time-independent flood risk model is incorrect and a more sophisticated model may be appropriate. [App. G5, p.2.]

There is evidence that flood risk has changed over time for sites where the 1993 flood was the flood of record, particularly at and below Hannibal, Missouri. This increased flood risk challenges the traditional assumption that flood series are independent and identically distributed random variables. This raises concerns that flood risk during the planning period will be underestimated if the entire flood record is used as the basis of projections of future flood risk. [App. G2, p.130.]

The final sentence in the last quote above is worth repeating: "*This raises concerns that flood risk during the planning period will be underestimated if the entire flood record is used as the basis of projections of future flood risk.*" (emphasis supplied)

It appears that the Corps simply concluded that it was too hard to account for the clear evidence of non-random distribution of flooding over time, and therefore decided to ignore the trend of worsening floods. See, e.g., Flow Frequency Study, pp.9-10. In arriving at its conclusions about future flood frequency, the Corps relied on "Bulletin 17B", which is the manual traditionally applied to flood probability estimation. *Id.* The methodology set forth in Bulletin 17B relies on the assumption that floods are neither getting more or less frequent over time, an assumption that makes it far easier to develop predictions of future flood probabilities. The problem is that such a situation does not

exist on the Midwest's large river systems, where there is clear evidence that flooding has gotten worse over time.

The consequences of the Flow Frequency Study were apparently not lost on members of the Study's "Technical Advisory Group", which was not unanimously "comfortable with the final recommendations." App. A1, p.141. In particular, members of the Technical Advisory Group apparently disagreed with the Corps' selected statistical method, which governed how trends in the flood record were interpreted. "The members [of the Group] did feel the selection of the log-Pearson III distribution was pragmatic, but not necessarily the best approach." *Id.* Minutes of one of the Group's meetings indicate that "[t]he TAG was very concerned about these issues and believed they needed to be resolved. . . . There was no time to discuss how frequency analysis should be conducted if records exhibited real trends." App. A1, p.148.⁴

Unfortunately, the Corps failed to heed the warning of the Technical Advisory Group and proceeded with its assumption that flooding has remained static over the past century. This has caused a substantial underestimation of flood profiles, which, if utilized in redrawing floodplain maps, will subject billions of dollars of infrastructure and many human lives to unknown and unacceptable risks. The results of the Flow

⁴ It is hard to ascribe a particular rationale to why the Corps chose to ignore the obvious trend of increased flooding. One possible explanation is that it becomes more difficult to arrive at flood probability estimates if a trend is acknowledged. Another possible explanation is that estimates of increased flooding would create controversy. This latter complication is alluded to in the Study: "Deviations from its use [assumption of stationarity] may cause litigation if communities face a larger Special Flood Hazard Area or the loss of levee certification." App. G1, p.45.

Frequency Study must therefore be withdrawn until more accurate flood estimates are developed.⁵

II. The Existence of a Trend of Increasing Flooding on the Midwest's Large Rivers is Also Supported by a Growing Body of Scientific Literature, But the Corps Almost Completely Ignored Such Literature When Conducting the Flow Frequency Study.

The academic literature suggesting that floods have been increasing over time on the Missouri, Mississippi and Illinois rivers is growing larger by the year. And yet the Corps almost completely ignored this mountain of evidence that demonstrates an upward trend of flooding. The Corps did not even give a mention in the Flow Frequency Study to the work of the two most prominent researchers who have pointed out this trend in flooding over the past several years, Drs. Nicholas Pinter and Robert Criss. The failure to even mention the peer-reviewed articles of these two distinguished professors hints at a bias that may have pervaded the Corps' work on the Flow Frequency Study.

For example, it is worth noting that the appendix to the Flow Frequency Study that addresses the impact of land use change and channel constrictions on flooding cites a reference such as Merritt, *Creativity, Conflict & Controversy: A History of the St. Paul District U.S. Army Corps of Engineers*, but does not cite a reference such as Pinter, *Regional impacts of levee construction and channelization, Middle Mississippi River*. How could a report with such huge significance for floodplain management completely

⁵ The causes of the observed increase in flooding are complex. The enclosed report of Dr. Pinter identifies several possible causes and explains how the Corps manipulated various inputs to its Flow Frequency Study to downplay such causal mechanisms. For example, the Corps considered land use and climate – both possible mechanisms of increased flooding – to be stable over the 100-year period of record. However, there is scientific literature supporting the proposition that these mechanisms are leading to larger floods. While overlooking such flood worsening mechanisms, the Corps did choose to attribute reductions in flooding to dams on the Missouri River and various tributaries.

ignore published, peer-reviewed articles that are directly on point? The absence of such references indicates that the Corps has not met the "objectivity" requirements of the Data Quality Act.

As noted, examples of literature that reveal increased trends in flooding abound.

Excerpts from some of these works are reproduced below:

The [1973 flood] stage topped the 189-year record by 0.3 m. The flood peak was 0.61 m higher in 1973 than in 1844 but the discharge was about 35 percent less than the estimated flow for 1844. The 1908 flood had the same flow as the 1973 flood but the peak was 2.51 m lower.

Belt, C.B., *The 1973 Flood and Man's Constriction of the Mississippi River*, Science, vol. 189, p.681 (Aug. 29, 1975).

Our graphs, together with many other sets of available data, indicate that flood stages at constant discharge have increased steadily on the Missouri and upper Mississippi Rivers since continuous records have been kept. These increases correlate with continuing efforts to manage the rivers and suggest that certain management practices should be reconsidered. Specifically, the evidence given here indicates that levee construction and channelization of the lower Missouri River and the middle Mississippi have greatly magnified flood stages.

Criss, R. and E. Shock, *Flood enhancement through flood control*, Geology, vol. 29, p.878 (2001).

[S]even of nine gauges on the Missouri River have slowly and consistently produced higher water levels for the same high flow rates since about 1927.

U.S. General Accounting Office, *Midwest Flood: Information on the Performance, Effects, and Control of Levees*, pp. 47, 48 (1995).

Studies of the problem have repeatedly demonstrated that, although low flows within the channel are being conveyed at progressively lower stages, flood flows are now significantly higher than prior to regulation of the river (Harrison, 1983; MRRRCC, 1998). [p.75.]

In other words, equal quantities of flood water resulted in systematically increasing stages over the duration of record at all of the gages analyzed on the Lower Missouri River. [p.78.]

Flows that were fully contained within the Missouri channel in the early 20th century now create floods, and extreme high flows today are associated with stages as much as 3.7 m higher than at the start of the record. [p.84.]

These results document significant loss of channel conveyance capacity for flood conditions, and the associated magnification of flood stages—as much as about 4 m above baseline conditions. [p.89.]

Pinter, N. and R. Heine, *Hydrodynamic and morphodynamic response to river engineering documented by fixed-discharge analysis, Lower Missouri River, USA*, J. Hydrology, vol. 302, pp.70-91 (2005).

Present-day floods on the Mississippi River at St. Louis tend to be 9 feet (3 m) higher than historic floods at 780,000 cfs. A plot of the 10 greatest floods at St. Louis (as measured by water-surface elevations) shows they were all recorded after 1942.

Wlosinski, J., *Hydrology, in Ecological Status and Trends of the Upper Mississippi River System*, p.6-6 (USGS 1998).

The combination of these scholarly works with the Corps' own admission of a trend of increased flooding should leave little doubt about the inaccuracy of the Flow Frequency Study's estimates of future flood probabilities. The Corps' assumption in the Flow Frequency Study that there is not a trend in flood profiles is not supportable. Therefore, the conclusions set forth in the Flow Frequency Study should be withdrawn, and more accurate estimates of flood probability should be computed.

CONCLUSION

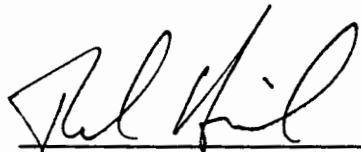
The results of the Flow Frequency Study are demonstrably flawed in that they fail to account for a clear trend of increased flooding on the Mississippi, Missouri and Illinois rivers. Allowing the Study results to be used in future decision-making by public and private entities would subject billions of dollars of investments to unknown and

unacceptable risks. The Coalition therefore respectfully requests that the Department of Defense withdraw the results of the Flow Frequency Study, make clear that such results should not be used in government and private decision-making, and undertake a revised study that more accurately estimates flood profiles on the Mississippi, Missouri and Illinois rivers.

Respectfully submitted,

Missouri Coalition for the Environment Foundation

By:



Edward J. Heisel
Executive Director