

A Critique of “Final Re-Evaluation of the Recommended Plan: UMR-IWW System Navigation Study: Interim Study”

Prepared for
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Donald C. Sweeney II, Ph.D.

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Executive Summary

This report provides a critical examination of the U.S. Army Corps of Engineers' "Final Re-Evaluation of the Recommended Plan: UMR-IWW System Navigation Study: Interim Study". This examination reveals that the re-evaluation completed by the Corps of the National Economic Development (NED) benefits of the navigation related components of the recommended plan originally identified in their 2004 feasibility report entitled "UMR-IWW System Navigation Feasibility Study Integrated Feasibility Report and PEIS" does not support funding the costly construction of new lock chambers in the near future. The reasons for this conclusion are:

- The forecasts of future traffic growth that predict significant congestion of the UMR-IWW navigation system without implementation of the recommended plan are based on arbitrary economic assumptions which are inconsistent with historic trends in UMR-IWW system traffic. The reduction in future congestion represents by far the largest source of estimated NED benefits of the recommended plan. Actual system traffic has already fallen below the lowest forecast level of traffic growth presented in the Re-Evaluation Report for which the Corps report estimated a NED benefit to cost ratio of 0.44.
- The Corps' estimates of NED transportation benefits likely overstate the real NED transportation benefits of the recommended plan. The NED model employed by the Corps integrates empirical estimates of shippers' responses to changes in transportation prices that were derived from surveys of shippers. However, the NED model does not incorporate shippers' responses to either increased shipping times or decreases in system reliability. While incorporating shippers' responses to changes in water transportation costs represents a significant improvement over older Corps of Engineers' methodologies, omitting shippers' responses to changes in transit times and system reliability will likely overestimate the real NED benefits of the recommended plan under any future traffic growth outcome.
- Given the large escalation in costs of recent Corps of Engineers inland navigation construction projects, the real NED costs required to implement the recommended plan are likely to be significantly greater than the estimates reported by the Corps. Any significant cost escalation will render an already unfavorable net NED benefit outcome even worse.
- Under existing law and regulations, the Inland Waterways Trust Fund (IWTF) does not have sufficient funds available to meet its required 50 percent share of the cost of construction of the navigation related components of the recommended plan.
- There are lower cost alternatives available for improving UMR-IWW navigation as needed, such as revising traffic management policies at UMR-IWW locks or quickening relatively slow tow lockages with assist vessels, which better, adaptively mitigate NED risks than do the large, unrecoverable, immediate construction expenditures associated with the recommended plan.

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1. The Re-Evaluation Report and the Recommended Plan

In their March 2008 Report entitled “Final Re-Evaluation of the Recommended Plan: UMR-IWW System Navigation Study: Interim Study” the Corps of Engineers completed a re-evaluation of the recommended plan identified in their 2004 feasibility report entitled “UMR-IWW System Navigation Feasibility Study Integrated Feasibility Report and PEIS”. In general, four accounts are used to evaluate a project’s estimated impacts. The accounts are: (1) the National Economic Development (NED) account; (2) the Environmental Quality (EQ) account; (3) the Regional Economic Development (RED) account; and (4) the Other Social Effects (OSE) account. The Re-Evaluation Report was limited in scope to a re-evaluation of only the NED benefits of the navigation components of the recommended plan.

The recommended plan identified in the feasibility study is summarized below with the navigation related components emphasized in italics.

The Recommended Plan is a 50-year framework for modification and operational changes to the Upper Mississippi River and Illinois Waterway System to provide for navigation efficiency and environmental sustainability, and to add ecosystem restoration as an authorized project purpose. The integrated, dual-purpose plan will provide flexibility in managing operation and maintenance of the system for both navigation and the environment. The integrated, dual-purpose plan will be implemented through an adaptive approach that will include an incremental implementation strategy paired with periodic checkpoints requiring future reporting to the Administration and Congress. The Corps of Engineers will administer the plan in full collaboration with the other Federal and State agencies involved in management of the UMRS.

The recommended navigation improvement framework includes small-scale structural and non-structural measures, new 1200-foot locks and lock extensions, and appropriate measures to avoid, minimize, and compensate for environmental impacts at a first cost of \$2.59 billion at October 2004 price levels plus annual switch boat operation costs of \$19.4 million. The first increment proposed for immediate implementation at a first cost of \$2.03 billion includes:

- *Small-scale measures (\$218 million, including site specific mitigation)*
- *Mooring Facilities at 7 lock and dam sites (\$11 million)*
- *Switchboats at Locks & Dams 20 through 25 in phased approach (\$207 million for first increment)*

- *7 new 1200-foot locks at Locks & Dams 20, 21, 22, 24, 25 on the UMR and LaGrange and Peoria on the IWW (\$1.66 billion, including \$200 million for site-specific and system mitigation) with decision points for adaptive implementation.*

- *In accordance with Section 102 of the Water Resources Development Act of 1986, one-half of the cost of navigation improvement construction shall be paid from the amounts appropriated from the general fund of the U.S. Treasury and one-half from amounts appropriated from the Inland Waterway Trust Fund. Other features of the Recommended Plan (extensions of Locks 14, 15, 16, 17, and 18 and switch boats at locks 11, 12, and 13), will be revisited through an update of the feasibility study, which will be done a few years prior to completing the first increment.*

The recommended ecosystem restoration framework consists of an estimated 1009 individual projects with a combined first cost of about \$5.72 billion at October 2004 price levels. The first increment proposed for immediate authorization includes:

- An estimated 225 projects with a combined first cost of \$1.58 billion. The cost of projects proposed for implementation at full Federal expense is estimated at about \$1.28 billion. The first cost of the cost shared floodplain restoration projects is estimated at about \$299 million with a Federal cost of about \$194 million and a non-Federal cost of about \$ 105 million.

- Total operation, maintenance, replacement, repair, and rehabilitation (OMRR&R) costs for these projects, over a 50-year project life are estimated at \$82 million. OMRR&R costs will be the responsibility of the agency with management responsibility for the land on which the project is located or with operation and maintenance responsibility for the existing structure being modified.

- Ecosystem restoration will be accomplished through an adaptive management process.

There are two major narratives interwoven throughout the Re-Evaluation Report. The first describes the analytical methodology employed and reports the findings of the Corps of Engineers' NED re-evaluation of the recommended plan. The second attempts to interpret these results in the context of national transportation policy using qualitative based analyses and risk assessments. A great deal of ancillary material is included.

2. Estimation of the NED Benefits of the Recommended Plan

The estimation of the NED benefits of the recommended plan was accomplished by means of a complex analysis involving many subordinate analyses. The Re-evaluation Report refers to the quantification of the NED benefits as the “traditional analysis”. It should be noted that the analysis described in the report is traditional only in the sense that it focuses on estimating the NED benefits directly attributable to waterway improvements under the tacit assumption that the relative alternative transportation cost of movements via other modes will remain constant. The analysis, beginning with the economic model and spatial equilibrium concepts first introduced by the Corps in their original UMR-IWW feasibility study, and extended in this re-evaluation analysis are, in fact, quite innovative in comparison to previous Corps’ efforts to evaluate inland navigation projects.

As with any complex analysis, the estimation of NED benefits requires the use of simplifying assumptions to render the problem computationally tractable and to ensure that the solution can be obtained with the available data and study resources. Further, the long-lived nature of the proposed system improvements necessitates an analysis that projects far into the future. This, as correctly noted in the Re-Evaluation Report, introduces considerable uncertainty into the estimation. Some of the uncertainty was accommodated by estimating the NED benefits under two different “reasonably plausible” future traffic scenarios.

This review focuses on the appropriateness of the methodology used, as well as the likely implications of the execution of that methodology to the NED evaluation. This review also provides a comparison of then forecasted outcomes with actual observed values from recent history. Finally, it highlights results that seem unusual or counter-intuitive. For the most part, this review assumes that the analysis was conducted as described, and that the modeling and calculations were performed correctly.

2.1 Summary of the Estimated NED Benefits and Costs

The Re-Evaluation Report estimated the net NED effects of implementing the navigation components of the recommended plan using two alternative forecasts of future traffic levels. The two forecasts were designed to bracket the “reasonably plausible” extremes of the uncertain future demand for barge transportation in the UMR-IWW. The first traffic forecast employed for the re-evaluation was termed the “Low Traffic Forecast” (LTF) and the second traffic forecast was termed the “High Traffic Forecast” (HTF). Each traffic forecast attempted to estimate annual “unconstrained” traffic levels for the UMR-IWW beginning in 2005 and extending through 2069. The term unconstrained in this context means water and alternative transportation costs were held constant at real 2006 levels. The LTF was designed to represent external economic conditions unfavorable to growth of the demand for UMR-IWW barge

transportation and the HTF represented external economic conditions favorable to demand growth for UMR-IWW barge transportation.

The Re-Evaluation Report also identified two other possible future traffic scenarios but did not explicitly quantify the NED effects under either scenario. The first of these other scenarios is called the multimodal transportation scenario (MTS) which the report states “would result in more traffic and higher benefits”. The final traffic scenario is called the MIN scenario and is meant to represent a situation of flat traffic continuing indefinitely into the future.

The summary of the Corps re-evaluation findings is presented in their Table 3.24 (page 42) and reproduced as Figure 1 below. The average annual NED benefits of the recommended plan are estimated at \$77 million per year with the LTF and \$230 million with the HTF measured at 2006 price levels over a 50 year period beginning in the base year 2019 and ending in 2069. These estimated average annual NED benefits are the result of transportation cost savings to system users (\$56 million with the LTF and \$210 million with the HTF) and rehabilitation cost savings (\$21 million) created by decreased rehabilitation expenditures for the existing locks associated with the recommended plan relative to the without project condition.

The average annual costs of implementing the navigation components of the recommended plan are estimated to be \$175 million per year (again at 2006 price levels) over the 50 year period. The estimated average annual net (NED) benefits are therefore a loss of \$98 million per year with the LTF and a gain of \$55 million with the HTF yielding benefit to cost ratios of 0.44 and 1.31 respectively. Not displayed in Table 3.24 but mentioned in the report is a third benefit to cost ratio of 0.20 for the MIN case of no future growth in traffic.

**Table 3.24. Average Annual Benefit Cost Summary
(2006 Prices, \$millions, 4.875 Percent)**

	Low Traffic Forecast	High Traffic Forecast
Avg Ann Trans Savings	\$56.214	\$209.062
Avg Ann Rehab Savings	\$20.827	\$20.827
Avg Ann Total Benefits	\$77.041	\$229.890
First Costs	\$3,665.256	\$3,665.256
Present Value of First Cost	\$3,156.642	\$3,156.642
Interest During Construction	-\$508.614	-\$508.614
Avg Ann I&A	\$169.582	\$169.582
Avg Ann O&M	\$5.509	\$5.509
Avg Ann Total Costs	\$175.091	\$175.091
BCR	0.44	1.31
Net Benefits	-\$98.050	\$54.799
Base Year	2019	2019

Figure 1

2.2 The Survey Model

A “Survey Model” was developed by the Corps to estimate the transportation related NED benefits afforded by decreasing future congestion levels at the UMR-IWW locks. The Survey Model was designed to model the future interaction of the supply of and demand for water transportation on the UMR-IWW in a manner consistent with the generally accepted analytical framework of a more complex spatial equilibrium model. Spatial equilibrium models view transportation as an important factor in determining the location and levels of general economic activity. The Survey Model may be characterized as a periodic, comparative static system equilibrium model, where the UMR-IWW system equilibrium at any point in time is characterized by a matrix of estimated transportation prices and commodity flows. The model focuses on the impact of lock performance in determining the system equilibrium that balances the supply of and demand for water transportation on the UMR-IWW

The performance of the locks impacts the estimated system equilibrium through the effect of lock performance on system congestion. Congestion at the locks affects both the supply of and demand for inland waterway transportation. Congestion decreases the productivity of carrier owned equipment thereby increasing transportation costs and prices. Forecast commodity flows are then adjusted as shippers alter their demands in response to the increased prices charged by carriers. The system equilibrium at a point in time is characterized as the level of system delays where, at the resulting transportation prices, the quantity supplied is equal to the quantity demanded for all river origins, destinations, and commodities. In other words, carriers’ supplies interact with the forecast demands of shippers to yield an estimate of the UMR-IW navigation system equilibrium commodity flows and transportation prices. These estimated commodity flows and transportation costs form the basis of the measure of net NED benefits created by the system.

The Survey Model is not a spatial equilibrium model, but attempts to be consistent with the principles of spatial equilibrium. By changing the levels of unconstrained traffic demand to those forecast at selected points in the future and estimating the performance of system locks at those points in time, a sequence of system equilibria can be estimated. For any given future year, the system traffic, delays, and NED benefits attributable to the waterway movements are estimated by finding the equilibrium of the system users’ willingness-to-pay for transportation services and the additional costs imposed by congestion at the systems locks. Then by comparing with-project and without-project equilibria, the net NED transportation benefits created by the recommended plan can be estimated at the selected points in the future. The NED benefits of the recommended plan are estimated as the difference in NED transportation benefits in the with-recommended plan and the without-recommended plan system equilibria at those points in time.

In this particular case, with-project and without-project conditions were modeled under both the HTF and LTF scenarios. Each model run represented a single (calendar) year of operation.

The model was run for the base year (2004) and then in five-year increments for the years 2010 through 2040 and in 10-year increments for the years 2040 through 2060. Estimates for the intermediate years were made by interpolation. For years evaluated after 2060, the assumption was made that traffic, delays, and benefits remained at the 2060 levels of the modeled scenario.

The next two sections describe the general strengths and weaknesses of the Survey Model.

2.2.1 Strengths of the Survey Model

- The model structure is internally consistent, consistent with Corps of Engineers' Planning Guidance, and consistent with the overall perspective that the economic value and NED benefits of the navigation system are derived from the movement of goods embedded in the larger national economy. The Survey Model provides a more credible theoretical framework than traditional Corps of Engineers models used in the past to estimate the NED benefits likely to be generated by the existing navigation system and the alternative investments under consideration for the navigation system.
- The model is implemented using widely available software (Microsoft Excel) to estimate a systemic equilibrium for the various system operating conditions and traffic demands. Programming the model in Microsoft Excel has the virtue of making all the data and functional forms employed in the model readily observable in the model.
- The model acknowledges and incorporates the individual marginal equilibrium conditions of system shippers and carriers. Specifically these conditions are that in equilibrium the incremental ton of every origin, destination, and commodity movement has an estimated marginal willingness to pay equal to the estimated private carrier cost of producing that movement.
- The model may be programmed with a wide variety of functional forms to represent the willingness to pay of potential system users. The model may be programmed with a wide variety of functional forms to represent the response of carriers to changed operating conditions. Finally, the model may be readily programmed to identify and evaluate congestion tolls and other demand management measures.

2.2.2 Weaknesses of the Survey Model

- The model as currently implemented does not permit substitution between competing water origins and destinations as water transportation prices vary. This lack of substitution between competing origins and destinations tends to overestimate the NED transportation costs associated with the future without project condition relative to the transportation costs associated with "with project" conditions. Consequently, the current Survey Model will bias upward the estimates of the NED benefits of potential projects designed to alleviate congestion.

- The Survey Model is not dynamic. It is a periodic equilibrium model. The system equilibrium estimated for a set of traffic demands and operating conditions for any analytical time period is independent of the equilibrium conditions of any other time period.
- The Survey Model uses steady state, large sample, and infinite population approximations for independent servers to represent the expected average delay for some system locks and independently derived transit curves to estimate expected average delay at other locks. These approximations may not accurately reflect the real dynamics of the system as arrivals at locks are related, there is a finite tow population at any point in time, and seasonality is evident in lockage demand patterns.
- The Survey Model is a partial equilibrium implementation of a more general spatial equilibrium analysis. To focus on the direct NED impacts to potential system users the Survey Model invokes some rather restrictive assumptions regarding the responses of some economic agents to changes in water transportation prices and costs. This was originally done to limit the scope of the analyses, to avoid computations of changes in consumer and producers surpluses for other economic activities, and to minimize the need for gathering new data not originally anticipated by the original study scope.
- The Survey Model only incorporates the estimated response of shippers to changes in water transportation costs. The survey of shippers referenced in the Re-Evaluation Report clearly indicates that shipper responses to changes in barge transit times and the reliability of delivery times are also significant determinants of shipper decisions to use or not use the waterway. Omitting the responses of shippers to the changes in these variables in the Survey Model will overstate the NED estimates associated with system improvements. Incorporating shipper responses to changes in barge transit times and the reliability of delivery times in the Survey Model is critical to accurately estimating the national economic development benefits of the recommended plan.

The Survey Model requires and is sensitive to many detailed inputs. Each of these inputs requires considerable analytical efforts to derive. Following is a discussion of the key inputs along with the likely NED implications of how they were estimated or derived.

2.3 Unconstrained Traffic Forecasts

An unconstrained traffic forecast attempts to forecast the future traffic that would utilize the subject waterway in the absence of any constraints imposed by capacity or congestion at the system's locks. As previously noted, this is the single largest component of uncertainty in the analysis. The report acknowledges this uncertainty by providing both a low traffic forecast (LTF) and a high traffic forecast (HTF) to bracket the "reasonable" range of possible traffic futures. It should be noted that the analysis deliberately does not attempt to assign a probability of occurrence to either the LTF or HTF nor does it attempt to estimate the probability that future traffic will fall within the range defined by these bounds. Forecasting the future unconstrained

traffic growth was accomplished using two different methodologies for non-agricultural commodities and agricultural commodities (primarily corn and soybeans), respectively.

For each of the non-agricultural commodities (coal, iron & steel, industrial chemicals, agricultural chemicals, etc.) a regression model was developed to predict future traffic using a vector of explanatory variables. This model was used to produce a baseline forecast for each of the underlying commodity groups. In most cases the LTF and HTF were produced by varying the explanatory variables of the regression model downwards or upwards by 10%. In some cases, where this variation did not produce a significant variation in the forecast, the explanatory variables were changed by larger amounts. This technique was somewhat arbitrary as it relied on the qualitative assessment of the modeler to deem that the LTF and HTF encompassed a “reasonable” range of future traffic possibilities

There are some characteristics of the non-agricultural commodity forecasts that should be noted. The forecast for ethanol movements was derived to be consistent with the forecast for corn movements. This created a situation where the low traffic forecast for ethanol is actually part of the HTF scenario whereas the ethanol high traffic forecast is part of the LTF scenario (note that this is misstated in the report). In any case, the forecasted waterway movements of ethanol are relatively small in either scenario. The commodity group coal was portioned to provide separate forecasts for coal that uses the systems locks (north) and that which does not (south). While this was a good idea, it is unclear why the forecast for north coal was significantly larger than that for south coal. As part of the forecast of non-agricultural commodities, the forecasters investigated the potential for container-on-barge (COB) movements in the study area. They concluded that there was little likelihood of these movements contributing significant traffic to the system over the planning horizon. This conclusion was based on the lack of infrastructure in the study area to handle COB as well as the difficulty of moving COB through the system locks.

The forecasting of the future unconstrained demand for agricultural commodities was accomplished using a “Global Grain Model”. This model divides the world into domestic and international regions of supply and demand of various agricultural products. The model incorporates user defined parameters to forecast the growth in domestic and international production and consumption. The model then employs non-linear programming techniques to find the lowest cost flows (including production, tariff, subsidies and transportation costs) between regions with residual supply (production less domestic consumption) and regions with unmet demands over all available modes of transportation that connect exporting and importing regions. As some transportation modes involve water transportation through the UMR-IWW, forecasts of future flows of agricultural products through the UMR-IWW are produced. It is important to note that the production and consumption forecasts in the model were made independently of the delivered commodity price. This is a serious limitation of the model.

The different assumptions that produced the LTF and HTF for the agricultural commodities were well explained in the Re-Evaluation Report, however, a few deserve special note. The HTF scenario does include the expansion of the Panama Canal by the year 2020. The anticipated reduction in ocean shipping rates in this scenario was offset, in part, by the expected increase in tolls associated with this expansion. The LTF does not include the anticipated canal expansion, and presumably does not incorporate the recent toll increases. Both the LTF and HTF account for the concern of limited future domestic railroad capacity by constraining the amount of additional traffic that can be accommodated via this mode. The LTF assumes only a 10% increase over 2004 Max car loadings, while the HTF assumes a 20% increase is possible. The predicted UMR-IWW flows are most sensitive to the assumptions made regarding the demand and timing for corn used in the domestic production of ethanol.

While the Global Grain Model was of sufficient detail to forecast the UMR and IWW flows independently, a decision was made to aggregate the separately forecast UMR and IWW flows and derive a single growth rate for each scenario that was then applied to movements on both waterway segments. It is unclear why this decision to aggregate flows was made.

The results of the forecasting for the entire UMR-IWW system are displayed in Figures 2 through 4 below.

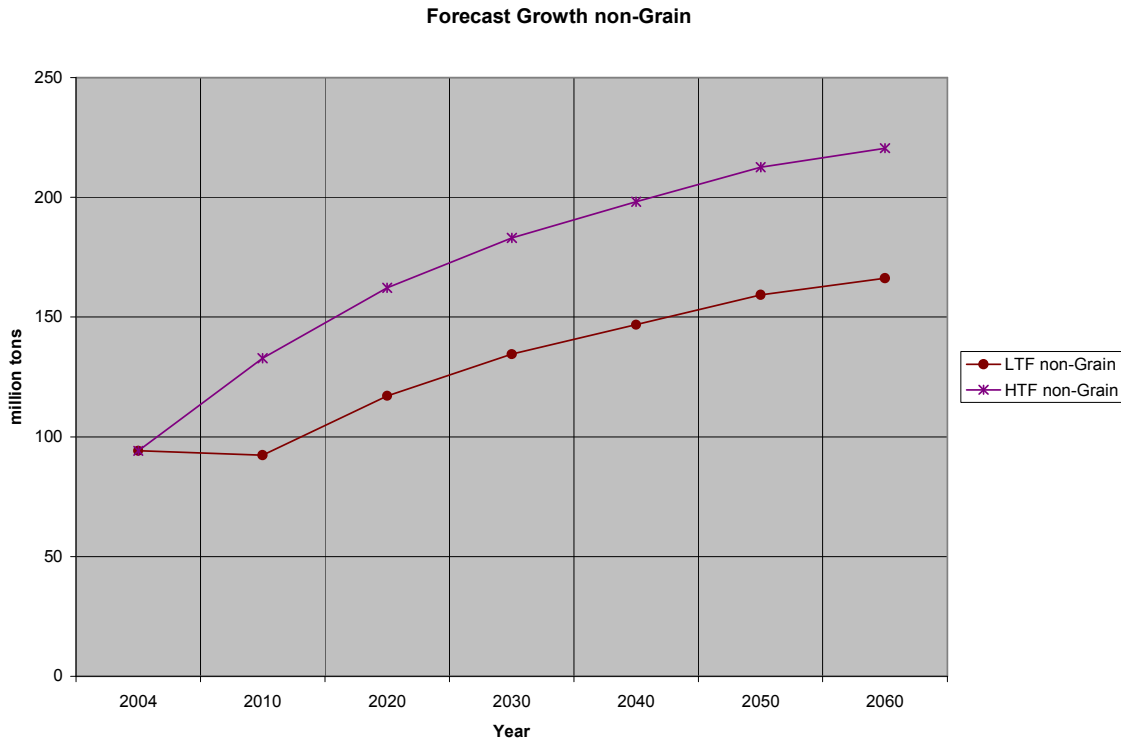


Figure 2

Grain Forecast

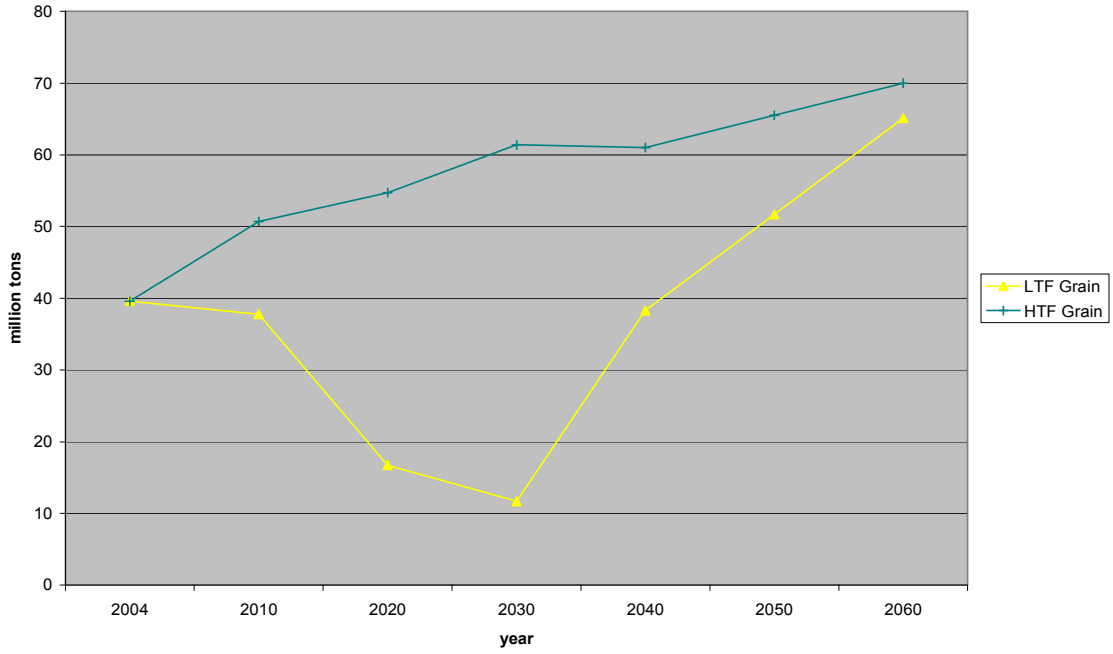


Figure 3

Total Forecast

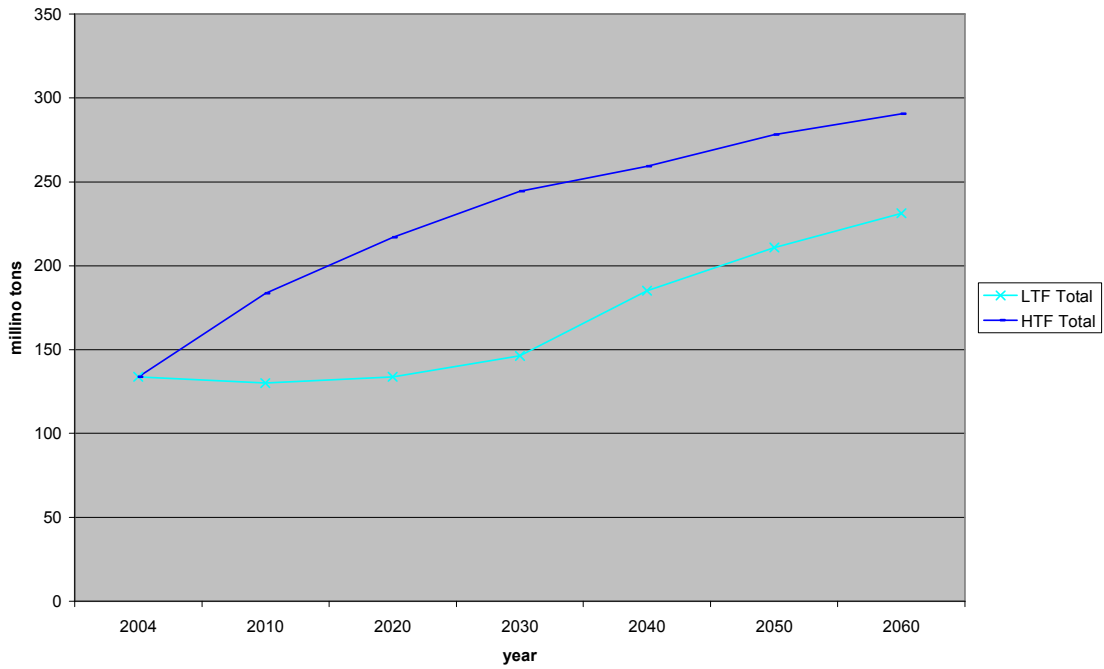


Figure 4

There are several interesting and unusual results evidenced by the figures. First, in Figure 2, the difference between the HTF and LTF (40.5 million tons) for the non-grain commodities is quite substantial in the first forecast year (2010). However, the difference between the HTF and the LTF in the subsequent years increases only slightly and at a diminishing rate. Under the HTF scenario the non-grain traffic is forecast to grow at an average annual rate of 2.59% between the years 2004 and 2030, while the average annual growth rate drops to 0.62% for the years 2030-2060. Alternatively, under the LTF scenario non-grain traffic is forecasted to grow at an average annual rate of 1.38% in the years 2004-2030, while dropping to 0.71% in the years 2030-2060. It is interesting to note that the forecasted out-year growth (as a percentage) is actually greater (although slightly) in the LTF than in the HTF.

The difference between the HTF and LTF is even more striking for the grain forecast displayed in Figure 3. The difference in the tonnage between these scenarios grows to a peak of 49.7 million tons in the year 2020 before narrowing to a difference of only 4.9 million tons in the year 2060. This unusual outcome is largely the result of how domestic demand, especially the ethanol demand, was treated in the Global Grain Model. Under the HTF scenario, grain tonnage is forecast to increase at an average annual rate of 1.70% between the years 2004-2030, while dropping to an annual average growth rate of 0.44% over the years 2030-2060. Alternatively, under the LTF scenario, the forecast calls for the grain forecast to decrease at an average annual rate of 4.58% (-4.58% growth), while increasing at an average annual rate of 5.89% in the years 2030-2060. Note that, once again, in the out-years the average annual growth rate expected in the LTF scenario exceeds that of the HTF scenario, in this case by an unusually large amount.

Looking at the combined traffic forecast displayed in Figure 4, the HTF predicts an average annual growth rate of 2.35% over the years 2004-2030, while an average annual growth rate of 0.58% is expected in the years 2030-2060. Alternatively, the LTF predicts an average annual growth rate of 0.34% in the years 2004-2030, while the average annual growth rate of 1.54% is expected in the out-years.

Several issues are raised by these results. First, the “reasonable” forecast uncertainty (measured as the difference between the HTF and LTF) in the year 2010 of 53.4 million tons is nearly as great as the “reasonable” forecast uncertainty of 59.3 million tons in the year 2060. This belies the concept that it is the long planning horizon that necessitates the need for a scenario based approach. Further, to my knowledge, it is unprecedented to have uncertainty in traffic forecasts of any kind decrease over time such as evidenced in Figure 4 for the period 2030 through 2060.

The Re-evaluation Report describes the scenario approach as intending to “define a range of reasonable alternative future scenarios that ultimately describe a reasonable range of demand for inland waterway transportation for the waterway system.” As described in the Re-Evaluation Report and described below, traffic has been relatively flat on the UMR-IWW system for the past 20 years. The LTF scenario essentially extends that trend through the year 2030. In total that would be over 40 years of flat traffic on the system. Yet, extending this trend through the entire planning horizon, under the formulation of the LTF, is not considered a “reasonable”

outcome. Similarly, the HTF predicts average annual growth of 2.35% through the year 2030. If this rate of growth is considered reasonable through 2030, then it seems it should be reasonable throughout the planning horizon. In short, the forecasts imply knowledge of out-year traffic that contradicts the assertions made to justify adopting the scenario approach.

An analysis more closely meeting the goals of the scenario approach could have been accomplished by simply extending the HTF and LTF forecasts for the years 2004-2030 to the end of the planning horizon. It is useful to consider what the consequences to the estimation of NED benefits might have been if the analysis had been done in that way.

It is fairly easy to estimate the NED consequences of a lower LTF since the report provides an NED estimate of the benefit-to-cost ratio of 0.2 in the "MIN" or flat traffic scenario. All other things being equal, the benefit-cost-ratio of a lower LTF would lie between 0.2 and 0.4.

It is much more difficult to estimate the benefits of a higher HTF scenario. Extending the HTF scenario 2030 traffic through to 2060 at a 2.35% rate of growth would yield a traffic forecast of 490.6 million tons in the year 2060. This far exceeds the 290.6 million tons forecast for 2060 in the existing HTF. This, at first glance, may not seem reasonable, but if 2.35% growth is reasonable for the 2004-2030 time-frame, then it should also be reasonable in the 2030-2060 time-frame, especially when all agree that there is considerable uncertainty with regard to these out-years. Although it is tempting to conclude that higher traffic growth rates would lead to higher NED project benefits, this is not necessarily the case. Projects of this type generally produce higher NED benefits with higher traffic levels up until the point where the costs of growing congestion associated with the greater traffic overcome the NED benefits associated with adding the additional traffic. It is very likely that under this proposed higher traffic growth scenario the project benefits would be eroded by increasing congestion at the unimproved lock sites. The analysis could have been greatly improved by at least providing some out-year runs with higher traffic forecasts to estimate how much traffic the recommended project could accommodate prior to the point where NED benefits decline.

Another issue worthy of note is the differing traffic mixes implied by the forecasted scenarios. The forecasts at various points in the future imply a significantly different mix of commodities than is currently observed on the waterway. The new mix of commodities will require different fleet characteristics (barge types and tow configurations) and necessitate a different mix of empty barge movements through the system. The differing traffic mixes and empty barge movements create some inconsistency with the development of the lock transit curves. This is discussed in detail later in this review.

Total Barges Processed at Selected UMR and IWW Locks

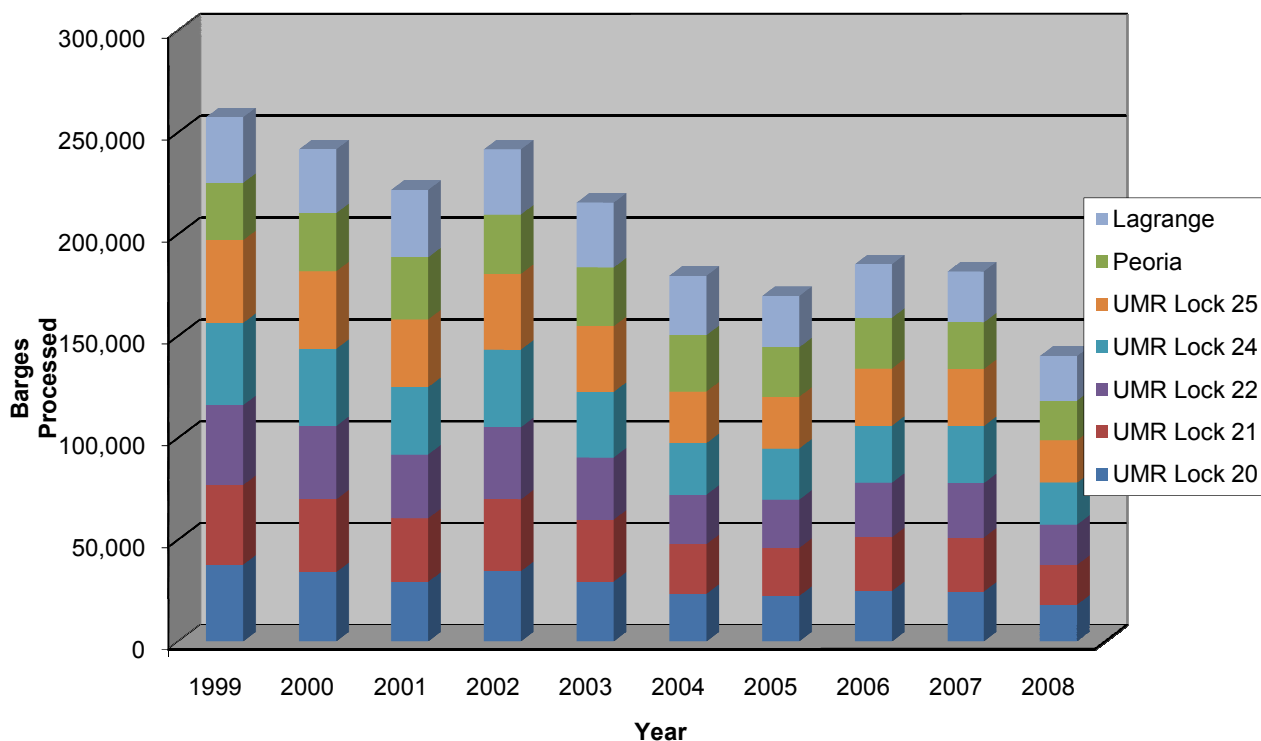


Figure 5

2.4 Realized UMR-IWW Lock Traffic Levels 2004-2008

Actual UMR-IWW lock traffic levels have recently fallen below the LTF levels (and even the 2004 traffic levels that served as the baseline for the forecasts) at the seven locks. Figure 5 above displays the total number of barges processed annually for the last ten years at the seven locks included in the recommended plan. The total number of barges processed in 2008 is 22 percent below the number of barges processed in 2004 and nearly 46 percent less than the number processed ten years ago in 1999.

Figures 6 and 7 display the observed annual tonnages locked at Lagrange Lock and UMR Lock 25 over the same period. These are the two most heavily utilized locks included in the first increment of the recommended plan and are among the first scheduled for completion of an additional 1200 foot chamber. Also displayed are the LTF and HTF without project tonnages forecast by the Corps for these locks through 2008. The LTF and HTF forecasts are interpolations of the data presented in the Re-Evaluation report in Tables 3-15a and 3-15b. Note that the ten year trend in traffic for both these locks is clearly downward with 2008 traffic levels below both the 2004 actual traffic levels and the estimated LTF traffic levels.

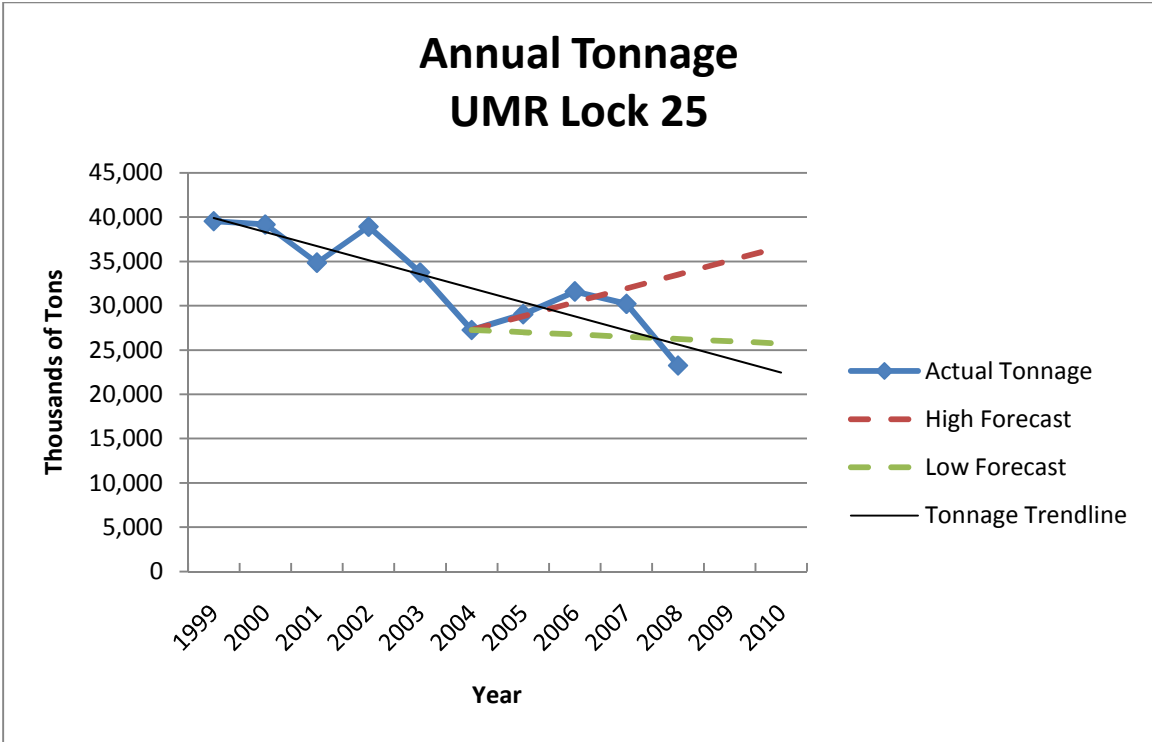


Figure 6

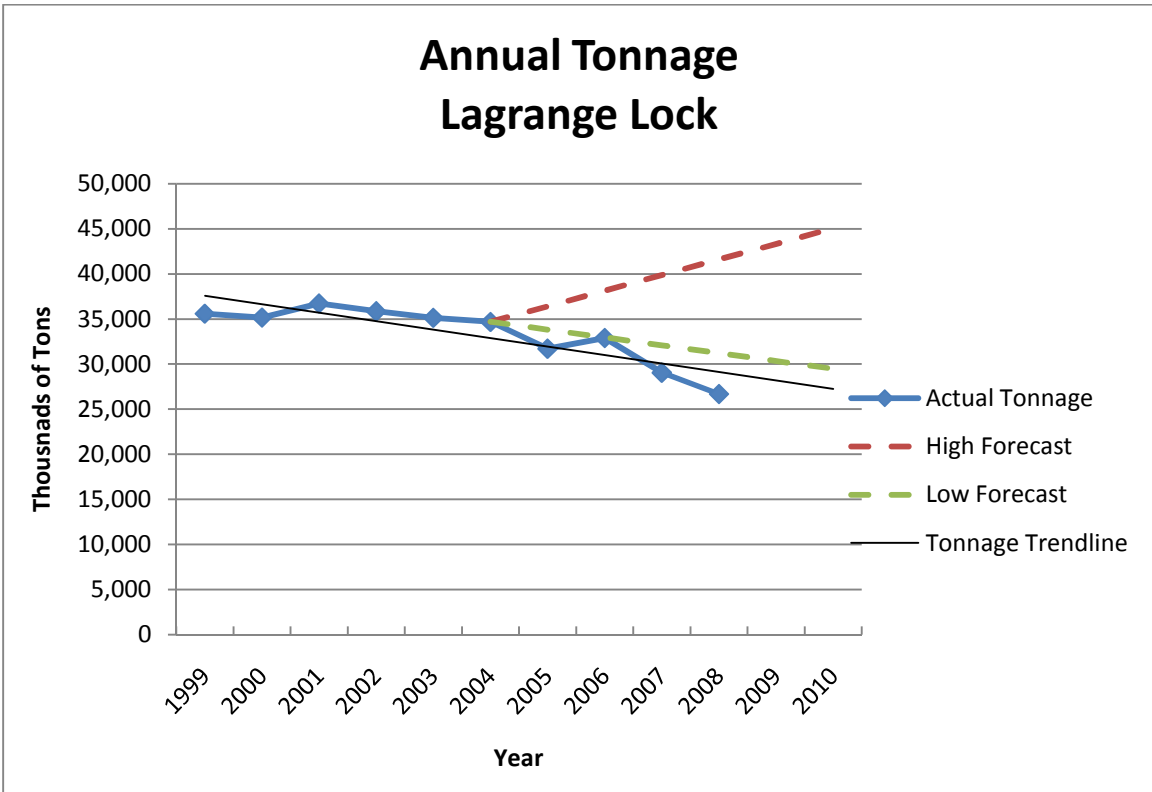


Figure 7

Even if one believes the Corps transportation savings NED benefit estimates presented in the Re-Evaluation Report are accurate as a function of forecasted traffic, the real NED benefits of the recommended plan are likely to be below the reported benefits associated with the LTF (and maybe even below the levels of the MIN traffic) reported in Table 3.24 of the Re-Evaluation Report described above.

2.5 Lock Transit Curves That Relate Lock Traffic to Congestion

Another important group of inputs to the Survey Model are lock transit curves which relate the expected average transit time (delay time + processing time) at system locks to the tonnages passing through the locks. The transit curves used in the Re-Evaluation Report are unchanged from those employed in the original UMR-IWW feasibility study. It should be noted that the lock transit time is not directly related to tonnage itself but rather to the frequency and type of lockage services demanded by tows, as well as periods of time when the lock may be unavailable to service tows.

The demand for lockage services depends not only on the tonnage, but, as noted previously, the commodity mix as different commodities are transported with different tow configurations. The commodity mix in turn influences the number of empty barges moved as well as the type of lockage (i.e. single, double, setover) required to process tows. Because the transit curves were developed for use with the feasibility study scenarios, they are very likely inconsistent with the HTF and LTF scenarios posited for this analysis. Without an extensive analysis, it is not possible to conclude what impact this might have on the estimation of the NED benefits.

It should be noted that, for the locks scheduled for improvement in the recommended plan, two different transit curves were developed to simulate the without-project and the with-project future, respectively. The transit curves representing the improved condition were substituted into the Survey Model for model runs in the projected years that the improvements were expected to be in place.

Of some concern is the fact that different methodologies were employed for estimating the transit curves at different sites. For the “critical locks” (11-25, Peoria and Lagrange) the Waterway Analysis Model (WAM) was used. WAM is a discrete event simulation model. For the other locks in the system mathematical formulations based on queuing theory approximations were adopted, but not simulated. Because estimating the transit curve using the WAM is an involved and time consuming process, it is understandable that the Corps would not want to employ this technique at locks unlikely to become congested in the without-project future. Because of the two different methodologies it is possible that the transit curves for critical and non-critical locks may be inconsistently specified. The report does not provide enough information to ascertain if this is the case or not. Further two non-critical locks, Mel Price and UMR Lock 27, may, under the with recommended plan HTF scenario, become critical

system locks in the sense that traffic levels will be great enough to cause significant congestion at these sites.

Regardless of whether WAM or the queuing theory formulation is used, the transit curves developed for the Survey Model will generally tend to overstate delay under very congested conditions. This is because both formulations use steady state, large sample, and infinite population approximations for independent servers to represent the expected delay at the system locks. These approximations do not accurately reflect the real dynamics of the system as arrivals at locks are related, there is a finite tow population at any point in time, and seasonality is evident in UMR-IWW lockage demand patterns. This overestimation of delay will in turn lead to an overestimation of NED benefits relative to the without project (which are largely due to delay reductions to without project traffic) especially in the HTF scenario.

It should also be noted that provisions were made to modify the transit curves in the out-years to account for possible degradation of service or improved service due to completion of major rehabilitation. Similarly, in the with-project modeling, the transit curves are modified during certain time periods in the attempt to capture the interference of construction on locking operations.

On average, open pass conditions, where lockage is not required, exist at Peoria and Lagrange Locks a substantial portion of the time. The report specifies that the average percentage of time that open pass conditions are observed at Peoria and Lagrange are 38% and 42%, respectively. The Re-evaluation Report stated that this was accounted for in the formulation of the transit curves at these two sites.

Table 1 below presents some noteworthy results selected from both the Re-evaluation Report and the original Feasibility Study. The following observations are offered regarding some unusual data revealed in Table 1:

- 1) Similar levels of tonnage correspond to significantly different estimated delay outcomes at given lock sites;
- 2) The without project estimated delays at Peoria and Lagrange locks seem inconsistent with the significant duration of existing open pass conditions at these sites;
- 3) The estimated with-project delays (HTF) at Peoria lock in the years 2050 and 2060 are incongruous. This may be a transcription error, or may indicate a modeling problem; and
- 4) In the with-project future (HTF) the estimated out-year delays at L/D 25 and Lagrange exceed those at L/D 26 and L/D 27. This occurs despite the fact that the estimated tonnage at both L/D 26 and L/D 27 is close to double the tonnage estimated for either L/D 25 or Lagrange. This may be due to the specification of the transit curves, or due to some simplifications made to the model. In either event, it is very likely that, under the

assumptions of the HTF, significant out-year congestion will occur at these sites, which, if incorporated in the NED analysis, would have reduced the estimated NED benefits in the with-project future. This in turn would have reduced the estimated NED benefits attributable to the recommended project.

Selected Results for Lock Transit Times					
LOCK	With or w/o PROJECT	SCENARIO	YEAR	TONNAGE (KTONS)	DELAY (HOURS)
Peoria	w/o	LTF	2060	45,848	13.1
Peoria	w/o	HTF	2030	45,890	56.7
Peoria	w/o	FEAS. L.B. scen. 3	2050	45,263	12.3
Lagrange	w/o	LTF	2060	53,072	14.1
Lagrange	w/o	HTF	2030	52,737	23.9
Lagrange	w/o	HTF	2040	54,339	41.4
Lagrange	w/o	HTF	2050	60,501	28.9
Lagrange	w/o	Feas. L.B. scen 3	2050	54,123	15.4
Lagrange	w/o	Feas. L.B. scen 3	2040	49,706	29.9
L/D 25	w/o	LTF	2060	41,061	37.4
L/D 25	w/o	HTF	2025	42,488	17.5
L/D 25	w/o	HTF	2030	44,103	22.2
L/D 25	w/o	HTF	2035	42,925	28.7
L/D 25	w/o	HTF	2040	43,016	32.9
L/D 25	w/o	Feas L.B. scen 3	2015	41,606	12.6
Peoria	with	HTF	2030	53,024	3.9
Peoria	with	HTF	2035	54,529	5.0
Peoria	with	HTF	2040	55,875	6.5
Peoria	with	HTF	2050	58,019	29.2
Peoria	with	HTF	2060	58,408	56.7
L/D 25	With	HTF	2050	53,169	1.8
Lagrange	With	HTF	2050	65,508	4.0
L/D 26	With	HTF	2050	122,722	0.9
L/D 27	With	HTF	2050	131,727	1.1
L/D 25	With	HTF	2060	55,289	1.9
Lagrange	With	HTF	2060	66,384	4.5
L/D 26	With	HTF	2060	126,543	0.9
L/D 27	With	HTF	2060	135,621	1.1

Table 1

2.6 Estimation of Transportation Costs for Waterway and Alternative Modes

This input to the Survey Model estimated the “full cost”, including landside movement and handling, of a large sample of 2004 observed waterway movements. It should be noted that, for waterway movements, the waterway “full cost” estimate does not include the cost of the

operation, maintenance and improvement of the waterway infrastructure except in-so-far as the \$.20 per gallon fuel tax contributes to these costs. A second “total cost”, by the next least costly alternate mode for the same movement, using the same landside origin and landside destination (to the extent these could be determined), was also estimated for each sampled water movement. Rail is generally the next least costly alternative mode to waterborne transportation.

The results from this sample of costs were then extrapolated to the full population of potential waterway movements via an iterative matching technique. These cost estimates are computed at 2006 price levels and used in the Survey Model to establish a baseline for the NED benefit estimations of the with and without project futures. This work appears very detailed and well done; however, the absolute levels of these costs have very little influence of the estimation of NED benefits provided by the recommended plan. This is the result of the fact that the net transportation related NED benefit estimates of the recommended plan are measured as the difference between the with and without project conditions at periods in the future. Existing and alternative mode transportation costs just serve to position the starting point for the differential comparisons and play little role themselves in actually estimating future cost differentials.

Finally, I note that, as a consequence of rising real energy prices, the real costs of transportation for all modes have been increasing since the completion of this cost study in 2006. Rising transportation costs have the detrimental effect of decreasing overall levels of economic activity. They can also affect modal choice decisions if transportation costs increase differentially for different modes of transportation. The net effect of changes in real transportation costs on the real NED benefits of the recommended plan is unclear as water transportation is a relatively low-energy-intensive mode of transportation; however, real increases in transportation costs are another source of uncertainty that should be evaluated in a robust risk analysis of the decision to implement the first increment of the recommended plan.

2.7 Integration of Shipper Survey Results into the Survey Model

The Survey Model attempts to integrate into the NED analysis empirical estimates of the willingness of users to pay for differing levels of barge transportation that were derived from recent surveys of shippers. The surveys of shippers indicated that barge shippers do vary their desired level of system use in response to changes in transportation prices, transit times and the reliability of delivery times. However, due to a lack of required data, the Survey Model did not incorporate the shipper response to either increased shipping times or decreases in system reliability. While incorporating shippers’ responses to changes in water transportation costs represents a significant improvement over older Corps of Engineers methodologies, omitting their responses to changes in transit times and system reliability will overstate shippers desired traffic levels for these conditions. Periodic lock congestion affects both system transit times and system reliability. Further, over periods of prolonged congestion, the shipper response to

changes in transportation rates, transit times and reliability of performance is likely to be even more pronounced than the responses identified in the surveys as shippers have more time to adjust their production and shipping plans. These two issues, taken together, suggest that future system traffic is likely more responsive to increased congestion levels than the modeling would indicate. This in turn leads to a less congested without-project future than estimated by the model, which in turn tends to decrease the actual NED benefits of the recommended plan.

2.8 Rehabilitation Cost Reductions NED Benefits

One source of NED benefits identified in the Re-Evaluation Report is future lock rehabilitation costs avoided because of the implementation of the recommended plan. The report identifies some \$21 million in average annual rehabilitation cost savings. It is not possible to verify the estimates of savings in future lock rehabilitation costs associated with the recommended plan from the information provided in the Re-Evaluation Report. The report presents a schedule of estimated savings by year but does not specify at which project and for what items rehabilitation costs are saved.

2.9 Additional Observations Regarding the Economic Modeling

It is worth discussing the source of the transportation NED benefits derived from waterway improvement projects. In very simple terms the transportation benefits for waterway improvement projects originate from two sources; the first is the benefit contribution from “new movements”, these are movements that would not have used the waterway in the absence of the improvement. The second source of benefits is the improved efficiency (delay reduction) enjoyed by movements that are expected to use the waterway system regardless of whether the proposed project is implemented. On a mature system, such as the UMR-IWW the increased efficiency (delay reduction) usually accounts for the larger share of the project benefits. This is why, when evaluated, demand management measures such as licensing or congestion tolls are generally shown to be very economically advantageous.

It is also useful to consider to whom the project (NED) benefits accrue. It is logical to assume that they are shared by the commodity producers, shippers, landside carriers (to and from the waterway), waterway carriers, buyers of the commodity, and finally by the consumers of finished goods produced from input commodities transported on the waterway. It is not possible to determine from the analysis what share of benefits each of the aforementioned entities might receive, but it is worth noting that in the case of export (or import) movements benefits may not be accrued domestically.

As previously mentioned, the analysis conducted in the Re-evaluation Report was not a spatial equilibrium analysis, but attempted to be consistent with the concepts of spatial equilibrium. It is not a modal-choice model. That is to say, it is not assumed that every ton of commodity

which cannot be economically accommodated via the waterway is necessarily shipped via some other mode. To illustrate this point consider the example of a ton of corn grown in Iowa 20 miles from the river. It is very likely it would be economically advantageous to truck this corn to a river terminal for export via the UMR. If future conditions increase the cost of movement via the UMR that corn may instead be trucked to an ethanol plant, sent to a feed lot, used by the grower to feed his own livestock, trucked to a rail-terminal for shipment either to the Pacific Northwest or a Gulf port, or perhaps, in the long run, not be produced at all. The main point is that even though congestion on the waterway will tend to increase rail traffic, it is not a one-for-one substitution.

There are a couple of other, rather subtle, reasons why this analysis will tend to overestimate delay in the without project future, and hence tend to overestimate real project NED benefits. First, the modeling assumes traffic growth (HTF or LTF), which in turn leads to congestion at the locks, which in turn leads to increased costs for waterway movements. In order to accommodate the increased traffic along with the increased delay, additional equipment (barges and tows) is required. To attract this new equipment, either new investments must be made, or equipment must be attracted from other waterway segments. In either case, a premium rate, over and above the additional cost imposed by delay, must be charged. This escalation in rate will in turn cause a shipper response greater than that predicted by the Survey Model. Therefore, the system equilibrium traffic will occur at a lower level of traffic and delay.

The second issue is generally referred to as “path dependence”. That is, the system demands were forecast under the simplifying assumption that the system was unconstrained. The fact is, the system is not unconstrained, and the economic entities making decisions on where to locate facilities such as power plants and refineries know that the system is not unconstrained. Therefore, the demand forecasted to occur in an unconstrained environment, even if the unconstrained forecasts are absolutely accurate, may never actually materialize in the real world.

2.10 NED Implementation Costs of the Recommended Plan

In 2008 the Corps reported to the Inland Waterways Users Board their recent experience regarding actual navigation related project implementation costs and the original cost estimates reported in their feasibility reports for three selected Ohio River basin projects (Corps, 2008c). The report was delivered in response to the Board’s request for information related to navigation project construction cost escalation. Table 2 below summarizes the information reported by the Corps for the three projects to the Users Board in millions of 2008 dollars. Though this is a very small sample of recently authorized inland navigation construction projects it is interesting to note that all three projects experienced significant real cost escalation over their authorized costs with the percentage increase averaging some 47 percent. Note also that the percentage cost escalation appears to be greater the greater the original authorized project cost estimate.

Selected Case Studies –Findings				
Project	Authorized Costs	Current Costs	Difference	% Increase
Marmet	\$360	\$426	\$67	18%
Lower Mon	\$844	\$1,206	\$361	43%
Olmsted	\$1,255	\$1,991	\$736	59%
Total	\$2,459	\$3,623	\$1,164	47%

Table 2

These cost escalations are common across large numbers of publicly provided infrastructure projects. Flyvbjerg *et.al.* (2002) surveyed 258 transportation infrastructure projects costing a total of worth \$90 billion and representing different project types, geographical regions, and historical periods and found with overwhelming statistical significance that the cost estimates used to authorize such projects are greatly and systematically understated. They found significant cost escalation in over 84 percent of all the projects they surveyed.

Like other providers of transportation infrastructure projects the Corps has experienced significant real cost escalation in constructing inland navigation projects. There is a significant risk that the estimated project implementation costs employed in the Corps net NED benefit evaluation understate the true costs of construction.

2.11 Age and Reliability Issues of the Existing Lock Chambers

One discussion thread running throughout the Re-Evaluation Report involves the age and performance reliability of the existing system infrastructure. The Re-Evaluation Report provides a graph (Figure 2.4) illustrating the recent history of lock unavailability caused by hardware malfunctions or scheduled maintenance outages at the locks for the entire UMR-IWW system. It does not identify at which lock sites these malfunctions occurred or the mechanisms which caused the malfunctions. Therefore, from the information given, it is not possible to determine what measures, if any, might be taken to effectively improve lock reliability.

It should be noted that the majority of the infrastructure in the with-project future is exactly the same infrastructure in the without-project future as the recommended plan only adds new locks at seven locations in the system of 37 lock and dam sites. Therefore, if one accepts the notion that the UMR-IWW infrastructure is generally “sinking in disrepair”, then that is likely the case regardless of whether or not the recommended project is implemented.

What is notably absent from the discussion of lock and dam performance are other mechanisms that impact system reliability. Over the long run, natural phenomena such as floods and droughts likely have a much greater impact on system reliability than do infrequent lock malfunctions. Further, adverse tow operating conditions such as the presence of fog, ice, and even high winds, impact waterway navigation. Towboat accidents also can impair navigation. A more evenhanded analysis would likely find very little real difference between the with and the without project futures in terms of overall system reliability.

Figure 8 below depicts the recent temporal distribution of the operational status of the seven locks authorized for construction of new lock chambers in the first increment of the navigation plan. Figure 8 indicates that the existing locks currently sit idle over 60 percent of the time and that there is no systematic observable decrease in lock availability at these locks evidenced over the ten year period. Clearly, there is no compelling need for immediate construction of new locks at these locations justified by the degrading performance of the existing locks.

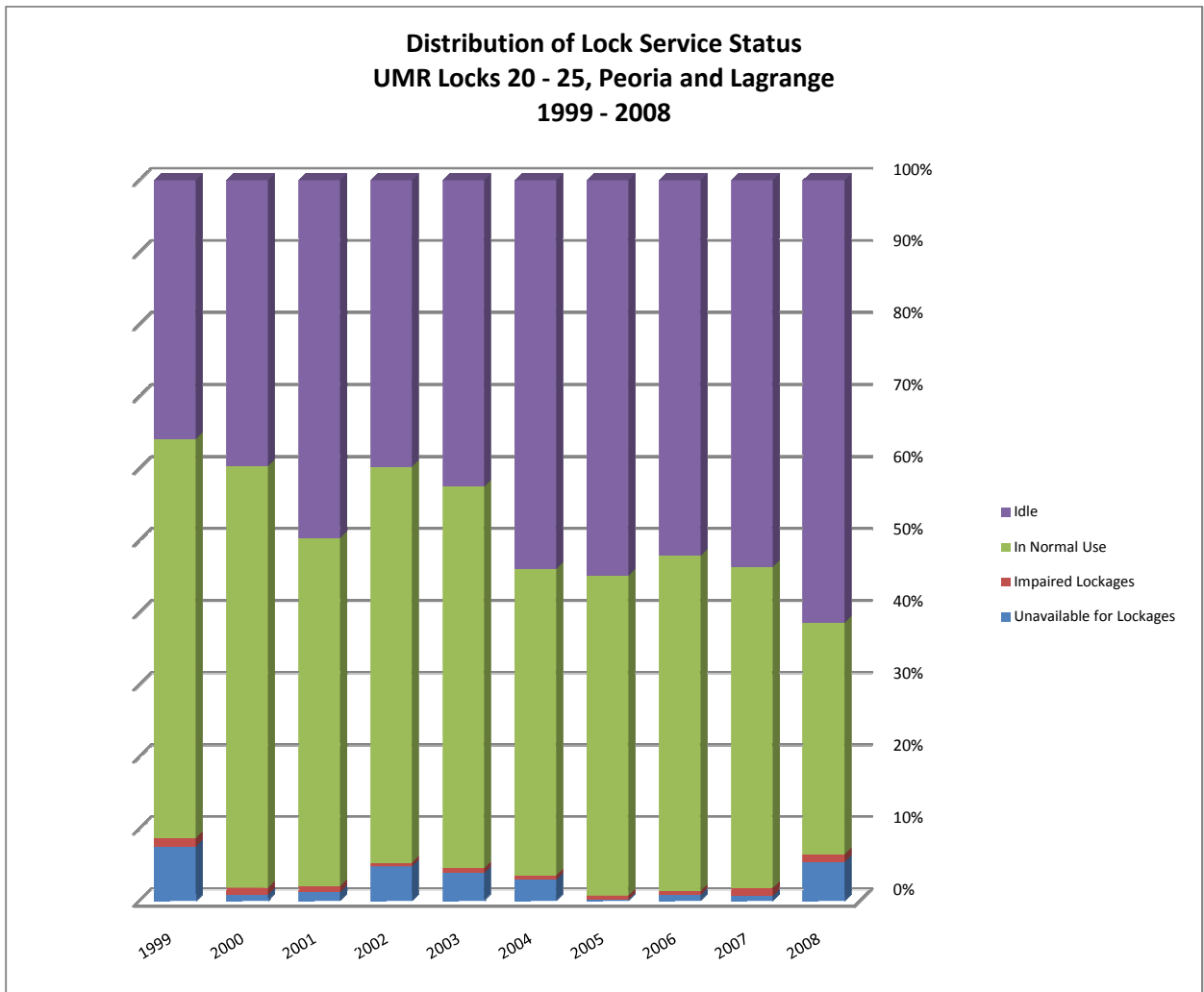


Figure 8

2.12 The Discount Rate

The discount rate is another important factor in the NED benefit evaluation of the recommended plan. It's important because the NED costs and benefits of the recommended plan occur over a very long period of time (some 60 plus years) with the majority of costs incurred in the near term and the majority of benefits received in the more distant future. A discount rate is employed to make meaningful comparisons of values over time and to estimate the net present value of the estimated benefit and cost streams associated with the recommended plan. The Corps typically reports the average annual benefits and costs associated with the net present values which represent constant annual benefits and costs over the life of the project that yield the same net present values as the variable benefit and cost streams. The discount rate used in the Re-Evaluation Report is 4.875%, but this is not reported consistently throughout the report.

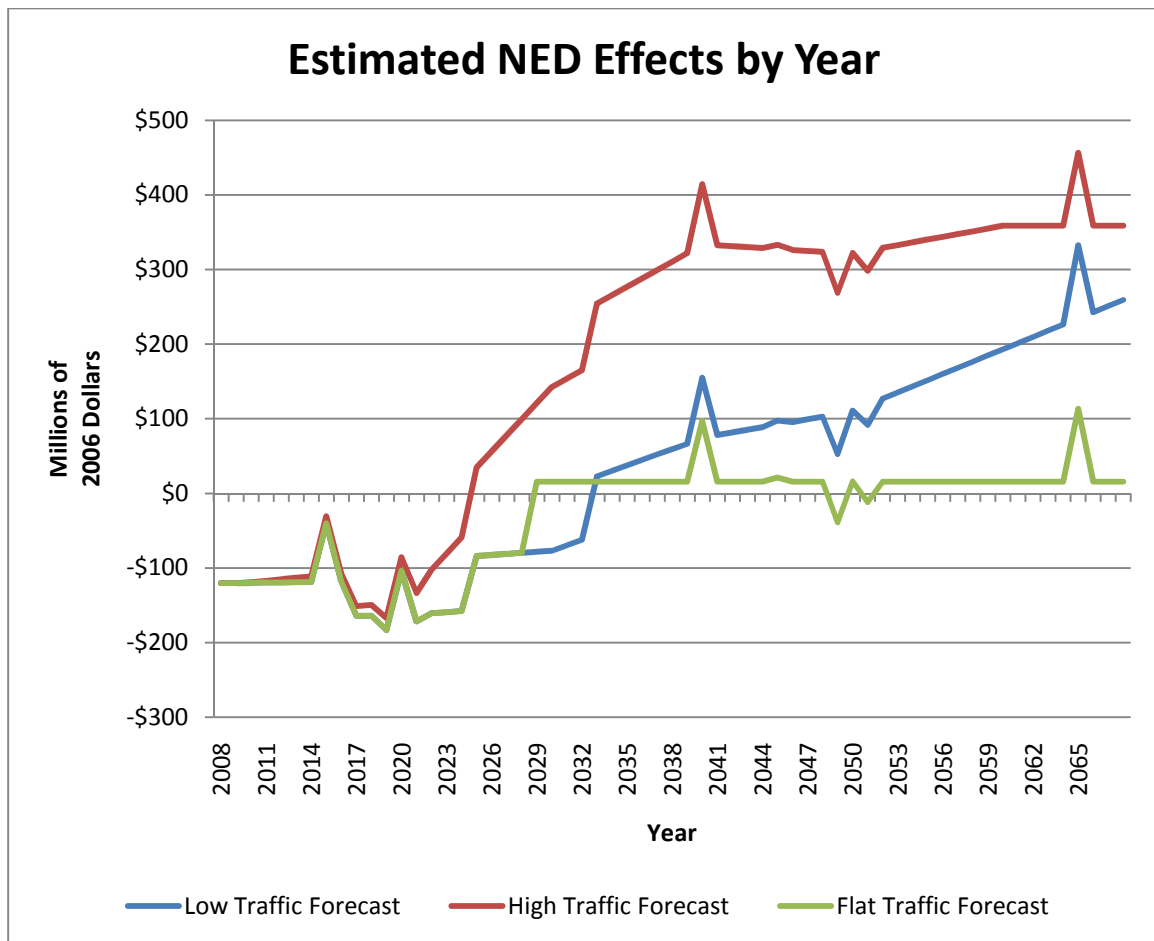


Figure 9

Figure 9 above presents the estimated net NED effects by year of the recommended plan associated with the LTF and HTF traffic forecasts as reported in the Re-Evaluation Report. Also included in Figure 9 for reference are the yearly net NED effects associated with implementing only the first increment of the recommended plan under the MIN forecast of no traffic growth. Note that the periods of net NED loss under all traffic outcomes are primarily front loaded and the periods of net NED gains are back loaded over the life of the project. Also note the “peaks” and “valleys” in the net benefit streams associated with rehabilitation costs avoided or created by the implementation of the recommended plan, respectively. This is typical in long lived project evaluations. Figure 9 highlights the fact that the net NED benefit estimates of the project are closely related to traffic growth rates and without significant traffic growth the large up front construction costs are not “recovered” by later NED transportation related benefits.

The estimated real internal rate of return generated by the recommended plan is approximately -3.7% for the MIN forecast, 1.4% for the LTF, and 6.4% for the HTF. Only the HTF has a real rate of return greater than 4.875%. In fact the IRR of -3.7% associated with the flat traffic MIN scenario indicates that the first increment of the recommended plan should not be implemented without traffic growth at any positive interest rate. It is unlikely that the real net project NED benefits will be positive even with very low real discount rates.

2.13 NED Benefits and Costs Conclusion

This review of the Corps Re-Evaluation Report indicates that using the Corps own NED benefit estimations, the probability of significant construction cost escalation, and the continuing declining trends in traffic using the UMR-IWW navigation system that it is highly unlikely that the implementation of the navigation related features of the recommended plan as scheduled in the report will produce real NED benefits greater than real NED costs.

3. Interpretation of the NED Estimation Results in the Re-Evaluation Report

A self-serving “interpretation” of the NED analysis in the context of broad national transportation policy is woven throughout the document. It is interwoven with the conclusions and recommendations of the report. It is also found in the so called “qualitative MTS analysis” and in the qualitative risk assessment of the recommended plan. Finally it serves as the basis for the inclusion of much of the report’s ancillary materials.

Unlike the NED analysis itself, this “interpretation” of the NED evaluation of the recommended plan is fundamentally flawed. It contains conclusions and assertions not supported by the NED analysis and in many cases contradicted by the NED analysis. It seems to have been prepared

with a lack of familiarity with the methodology, assumptions, context, and, in some cases, even the results of the NED analysis.

As previously noted, the NED analysis is informed by the concept of spatial equilibrium. The interpretation of the results of the NED analysis, however, is offered almost entirely from a narrow modal-choice perspective. Much of the interpretation relies on speculation or assertions that cannot withstand critical evaluation. The material presented is often one-sided, or is of such a general nature that it does not inform the decision at hand.

The report refers to the qualitative assessment of the MTS as the “second phase of NED economic analysis”. In fact, the qualitative assessment of the MTS is based purely on speculation and offers no real assessment of the recommended plan’s impact on the NED economic analysis. Statements such as “Although not quantified, MTS would result in more traffic and higher benefits” are not supported by the application of any qualitative analyses.

It is further asserted in the qualitative assessment that the improvement of the waterways will provide the added benefit of decreasing congestion on other modes. While the supporting statements in the Re-evaluation Report such as: “generally accepted projections of increasing freight demand and international trade”, “growing congestion on highways” and “expanding rail capacity become more difficult and costly” are fair statements of the consensus of transportation planners, the speculated impact of the recommended plan on those congestion forecasts is completely unsupported and most likely contrary to the facts presented by the Corps in their report.

For example, it is almost certain that expanding the navigation carrying capacity of the UMR-IWW will increase total highway truck traffic rather than decrease total highway truck traffic as claimed by the Corps. This is because truck and barge transportation are not substitutes for each other, but rather are complementary modes of transportation. Products such as corn and soybeans likely to be shipped on the UMR-IWW are not grown in the bottom of barges, but rather are transported by truck relatively longer distances in greater volumes to the river for export with the recommended plan than they otherwise would be if shipped to domestic consumption locations or local grain elevators without the Corps’ recommended plan. The Corps could have quantified the impacts to highway congestion of implementing these projects, but elected not to do so.

Similarly, the Corps noted in the Re-evaluation report that the capabilities to perform detailed rail capacity analyses exist and further acknowledged that it could not say whether or not there will be adequate rail capacity in the future regardless of actions taken on the UMR-IWW system. Yet, they claim that these navigation projects will have qualitatively “higher benefits” than those estimated by their “traditional” NED analysis. This statement is not supported by any rigorous quantification of project impacts on any other mode of transportation.

With regard to railroad movements, rail may either be a complementary or competitive mode to waterway transportation. It is true that (assuming system traffic growth) the without-project

future will result in additional demand for rail transportation. It is also a fair assessment that, if false, the assumption that rail traffic will accommodate this increased traffic at the existing rates would lead to some level of underestimation of project NED benefits. It should be noted that this is the one identified instance where a simplifying assumption (if false) would lead to the underestimation of project NED benefits. As noted previously in this review, all the other modeling assumptions lead either to an overestimation of benefits, or to an indeterminate outcome.

Although the congestion on the waterway system will create additional demand for railroad transportation it is not, as noted earlier in this review, a ton-for-ton substitution. The additional tonnage demand for rail transportation will be something less, and very likely significantly less, than the unconstrained demand not accommodated by the waterway. Unfortunately, because a true spatial equilibrium analysis was not completed, it was not possible to provide an estimate of this additional rail demand. It is also important to note that, despite the assertions to the contrary, the forecasts of unconstrained grain traffic did incorporate a limit on rail capacity in both the HTF and LTF scenarios.

4. Risk Assessment and Mitigation

Twice, in The Executive Summary of the subject report it states; “The greatest possible economic loss is limited by the first cost of the first increment of Navigation improvements”. This is an especially egregious characterization for several reasons. First, it implies that the first costs of the first increment of the improvements are a known quantity. As already discussed in this review, a significant likelihood of substantial real cost escalation exists. Secondly, even if the estimated first costs are accurate, this is a cavalier dismissal of an investment risk of over \$2,000,000,000. Finally, the statement is inaccurate, although the investment risk is substantial; there are considerably more risks, economic and otherwise, than simply the first costs of the first project increment.

The more detailed risk assessment portion of the report offers only slight improvement over the statements in the executive summary. The risk assessment claims a “lock redundancy benefit”. According to the logic offered by the risk assessment, this benefit is limited to only severe events that were not modeled due to their absence in the historical record. It needs to be noted that, even assuming full implementation of the recommended plan, 25 of the 38 lock sites on the system will still be single chamber sites. This compares to the 32 of 38 of the sites that are currently single chamber sites. The improved condition represents a 22% reduction in the number of single chamber sites. Therefore, at best, the lock redundancy reduces a diminutive probability by an additional 22%. But, when considering the higher traffic level expected in the improved condition, the consequences of a severe event are also greater. Therefore, there is little, if any real lock redundancy benefit attributable to this particular plan. It should be noted

that redundant lock chambers will provide a benefit in terms of the short-term closures for repair and maintenance, but these benefits were fully accounted for in the NED modeling effort.

The risk assessment states; “Considering the anticipated stress on the national transportation network over time, however, it is reasonable to conclude that traffic on waterways—provided they are maintained as efficient and reliable—will be greater than estimated through the Corps’ traditional analysis”. This statement is directly contradictory to the rationale justifying the scenario approach to define a range of possible future traffics, rather than a single traffic forecast. Furthermore, the grain traffic forecast did employ the assumption of limited additional rail capacity in both the HTF and LTF scenarios. Finally, as previously discussed, it is not a certainty that higher project traffic necessarily will lead to higher project benefits.

The risk assessment gives only cursory mention or omits entirely many issues which, in a true risk assessment, would deserve a fuller exposition. Among these issues are:

- 1) The potential for cost overruns.
- 2) Construction delays resulting in delayed project implementation.
- 3) Interference with existing traffic during construction may have greater than anticipated impacts.
- 4) By any measure, the recommended project involves massive construction in a difficult environment. This construction will, of course, involve the intensive use of heavy equipment and machinery. There is substantial risk that accidents or spills during construction may result in injury, death, structural damage, interference with system traffic with resulting economic loss, or environmental degradation.
- 5) Because of the long duration of the construction period, there is a significant risk that partially completed projects may be vulnerable to damage due to flood.
- 6) There is a risk that the projects may not perform as designed. There is also the further possibility that, as is very common with these types of projects, one or more of the projects may experience an initial period of unreliability while design and/or construction deficiencies are corrected.
- 7) There is a possibility that advancing or delaying the implementation schedule may result in greater project benefits. No analysis was conducted to determine if this might be the case.
- 8) It may be the case that greater project benefits might be obtained by only improving a single river reach (IWW or UMR). No analysis of this possibility was conducted.

- 9) Finally, there is the risk that additional public monies may be used to compensate for the lack of Waterway Trust Fund resources. This issue is discussed in a later section of this review.
- 10) The Re-evaluation report emphasizes the risks of “under-investing”, however investments can always be made if the situation warrants. It has been said that; “It is easier to turn money into concrete than it is to turn concrete into money.” A key strategy to mitigate risk is to delay investment until a clear need for investment is demonstrated.
- 11) A second approach to mitigating investment risk would be to make better forecasts. This is problematic, however, since we observed in the traffic forecasting portion of the NED analysis that even the short-term forecasts showed a great deal of uncertainty.

An obvious and straightforward strategy to mitigate risk is to shorten the construction schedule. The long construction schedules presented in the Re-Evaluation Report are entirely budget driven. From an engineering and construction viewpoint, it is feasible to reduce the construction schedule to less than half the allotted time. A shorter construction schedule would be advantageous from an engineering perspective, a construction perspective, an economic perspective, and an environmental perspective. A shorter construction schedule would afford more time to observe traffic trends and their associated impacts on navigation without delaying, if ultimately warranted, the implementation of the project.

There has been a significant amount of academic research regarding the performance of the UMR-IWW navigation system completed since the publication of the Re-Evaluation Report. Campbell, Smith and Sweeney (2009) describe a robust optimal sequence for implementing three methods of reducing periodic congestion at UMR Locks 20 through 25: (1) lock queue re-sequencing of vessels, (2) providing helper boats to assist slow lockages and (3) constructing new lock chambers. They state:

The results from our modeling suggest that at current (2008) traffic levels, the savings from re-sequencing queues of vessels on the UMR would be rather small, relative to the size of this market, and these benefits would be distributed quite unevenly, with some users disadvantaged by new policies. Furthermore, vessels will likely adapt to traffic and locking operations, which will reduce the actual benefits below the levels that we have found. Considering these issues and the small amount of time that vessels actually spend transiting these five locks (relative to their total operating time), we conclude that there is insufficient justification to introduce re-sequencing rules at current traffic levels. With higher traffic levels, queue re-sequencing will not alleviate congestion and more intrusive congestion relief measures are needed to eliminate seasonal bottlenecks. The preferred sequence of navigation system improvements is: “re-

sequence queues, then implement helper boats, then build new locks” and this is very robust to reasonable sets of economic drivers.

The time at which to transition from one option to the next depends on the level of traffic and the relative values of the relevant cost components. The best policy for the present time is to monitor traffic levels and prepare for implementing re-sequencing at lock queues only if traffic increases. Only after a substantial increase in traffic would helper boats or improvements such as new locks become attractive. If lock performance dramatically degrades or traffic levels dramatically increase in the future, then only significant capacity expansion, such as new locks, would keep waiting times to reasonable levels. At high traffic levels new locks could yield significant economic benefits that potentially outweigh the costs of disruptions on the UMR. However, a number of recent trends create concerns about the future of shipping on the UMR and infrastructure investments.

The completion of a fully formalized risk based analysis regarding the outcomes is critical to evaluating the national economic development benefits of such an expensive infrastructure investment. For example, there is no way to determine in the report if postponing these costly investments for one year, two years, or some other period of time increases or decreases the chances of a positive national economic development outcome. Postponing the investments decreases the present value of their real implementation costs but may or may not decrease the present value of the transportation related benefit stream. The Re-Evaluation Report would benefit greatly from an extensive sensitivity analysis of project national economic development outcomes to plausible changes in critical economic and systemic performance variables. The relationship between outcomes and parameters would be clarified by such a sensitivity analysis

5. Inland Waterway Trust Fund

The barge and towing industry was cautioned on Feb. 24, 2009 that this is the first year that the Inland Waterways Trust Fund (IWTF) does not have sufficient funding to meet its 50 percent share of federal funding in support of navigation infrastructure construction and rehabilitation projects. That cautionary statement was made by Rep. Peter J. Visclosky (D-Ind.), chairman of the Energy and Water Development Appropriations Subcommittee, in his keynote address to the 2009 Spring Seminar of the Waterways Council Inc. in Washington, D.C. Also reporting on the dwindling fund at that same event was Maj. Gen. Merdith W. B. Temple, deputy commanding general for the U.S. Army Corps of Engineers’ Civil and Emergency Operations, who stated that the fund “has been essentially drawn down to zero, and we are limited to spending annually only as much as its annual income of about \$85 million allows.” Figure 10 below reproduces a graphic presented by the Corps to the Inland Waterways Users Board at their July 31, 2008 meeting that illustrates the precarious status of the trust fund finances.

Figure 10 indicates that at least through 2013 the net total assets of the IWTF are forecast to remain essentially zero with the fund scheduled to expend all its forecast revenues on already ongoing construction and rehabilitation projects which do not include the recommended UMR-IWW plan activities. For the period 2010-2013, the IWTF share of the implementation costs of the first increment of the recommended plan can be estimated from the Re-Evaluation Report to total some \$180 million if the proposed implementation schedule is adhered to by the Corps. Given the financial status of the IWTF, fully funding the first increment of the recommended plan would then require the Corps to stop ongoing construction of other navigation projects, seek greater annual funding levels from the navigation industry by increasing the fuel tax that currently funds the IWTF, seek greater funding levels from the navigation industry by replacing or augmenting the fuel tax with a new, greater revenue source, or require greater funding levels than currently provided by all federal taxpayers in an environment of massive federal deficits forecast far into the future. None of these financing options are attractive in the face of the risk mitigation analysis presented above and the best adaptive management strategy is to postpone implementation of the costly navigation related features of the recommend plan until real traffic levels in the UMR-IWW increase substantially enough over current levels to warrant implementation of the navigation related features of the recommended plan.

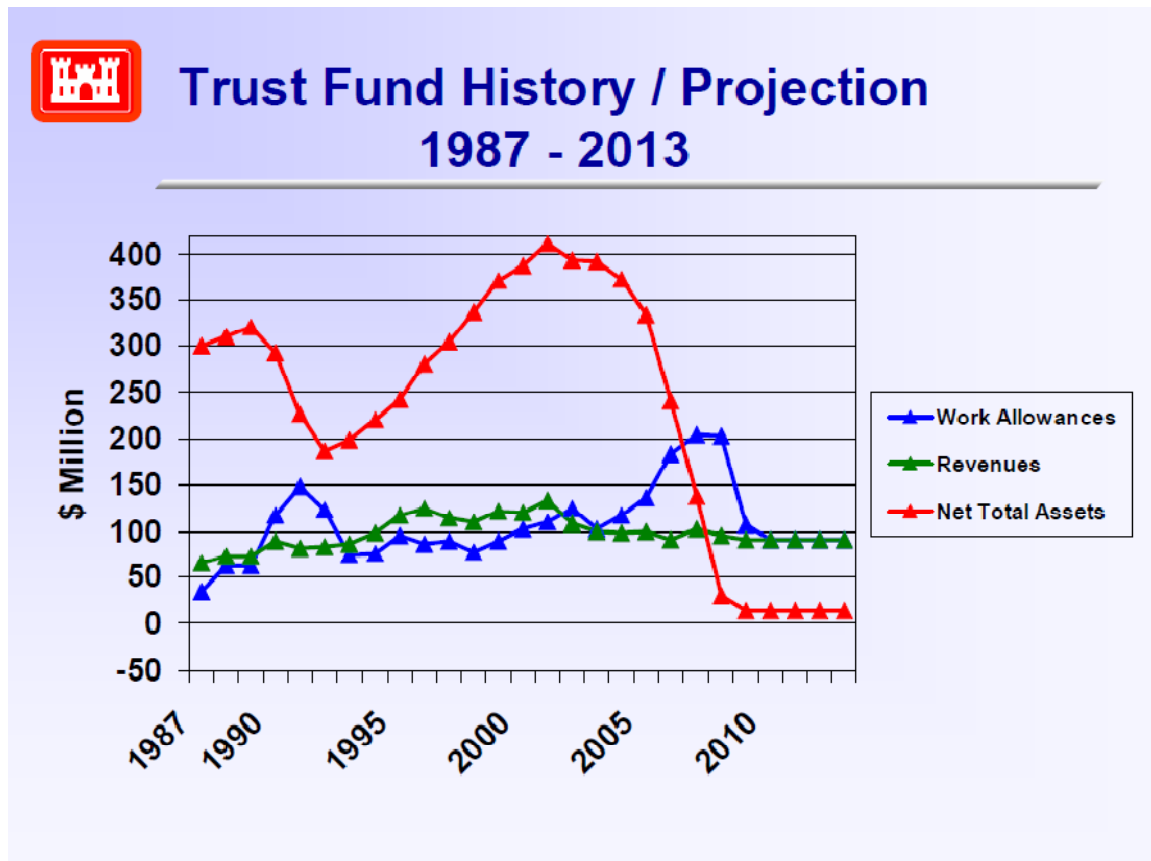


Figure 10

6. References

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