US Army Corps of Engineers

Addendum 1 of Appendix D, Economics

Inner Harbor Navigation Canal (IHNC) Lock – Lock Replacement, Orleans Parish, Louisiana

General Reevaluation Report

Planning Center of Expertise for Inland Navigation and Risk-Informed Economics Division (PCXIN-RED)
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Preface

This report constitutes Addendum 1 of the Appendix D: Economics for the Mississippi River, Baton Rouge to the Gulf of Mexico Mississippi River-Gulf Outlet, LA, New Industrial Canal Lock and Connecting Channels General Reevaluation Report (GRR). Addendum 1 presents the results of the economic analysis of the Recommended Plan (RP), while the original Appendix D: Economics presents the economic analysis of the final array of all alternative plans. The GRR economic evaluation in Appendix D considered the following alternatives, consisting of the No Action alternative and 4 lock replacement alternatives of different dimensions:

- Plan 1 – No Action
- Plan 2 - 75' x 900' x 22’
- Plan 3 - 110' x 900' x 22’
- Plan 4 - 75' x 1200' x 22’
- Plan 5 - 110' x 1200' x 22’

Upon completing the feasibility-level design, as detailed in the 2017 GRR, Plan 3, featuring a 110-foot-wide by 900-foot-long lock configuration, demonstrated the greatest net excess benefits (over $172.4 million) and achieved the highest net benefits-to-cost ratio of 4.78:1. This plan was identified as the National Economic Development (NED) plan, consistent with Engineer Regulation 1105-2-100. All other plans (excluding the "no action" plan) also yielded high benefit-cost ratios and substantial net excess benefits. However, based on the need for a modern and reliable lock capable of efficiently handling forecasted traffic conditions, and after approval by the Major Subordinate Command at the Agency Decision Milestone held on 07-June-2017, Plan 3 was recommended.

After a pause in finalizing the GRR as well as additional study efforts since 2021, the purpose of this document (Addendum 1 to Appendix D – Economics) is to confirm whether the RP remains economically justified based on changes in costs, economic conditions, engineering information and designs that have occurred since the 2017 GRR. To support this determination, updated NED metrics were developed based on a comparison of the No Action alternative (Plan 1) and the RP (Plan 3). No other alternatives were evaluated or updated as part of this assessment, since the RP was already selected at the 2017 ADM. As the 2025 draft of the GRR was being prepared, the costs used to calculate the Benefit-Cost Ratios (BCRs) were updated, resulting in an updated first-cost estimate for the RP at FY 2025 price levels (October 2024) of $4.74 billion. These cost increases were driven by rising material and labor costs, including but not limited to fabricated steel, precast piles, rebar, rolled steel, structural concrete, and stone/rock. In addition, an updated and more refined Cost and Schedule Risk Analysis indicated that the increased costs would apply to all plans. Based on this economic reevaluation, the RP remains economically justified with positive net NED benefits of $6.5 Million, and a benefit to cost ratio of 1.03.

A qualitative review of the total net benefits for the final array of alternatives, along with a presentation of other social effects, consistently supports Plan 3 as the NED and Recommended Plan. Other options, such as using the old lock as a pass-through feature, or considering the replacement of the St. Claude Bridge, were also examined. The optimal lock size, which impacts costs, capacity, and construction, reduces overbuilding, minimizes construction impacts, lowers emissions, and supports industry needs and system-wide standardization. The proposed new lock design also offers flood risk reduction, improved safety (with fewer collisions and quicker emergency response), and greater operational efficiency. These improvements will contribute to a more sustainable and environmentally friendly logistics system by reducing trips and congestion.

As noted in Section 3.6.1 of the main GRR, the aging lock has experienced increased outages and delays, exacerbated by the rising frequency of maintenance events. However, for the purposes of the lock analysis model, it was assumed that these risks would be managed through regular maintenance and would occur at a similar frequency in both the existing lock and the recommended plan. In practice, as evidenced by the unscheduled 7-day outage in Spring 2024 (caused by the failure and subsequent emergency repair of an upper hinge on one of the gates), such unplanned outages are likely to occur more frequently with aging infrastructure and could have a greater impact on the navigation industry.

Appendix D presents cost and benefit data from the 2017 GRR, which justifies the selection of Plan 3 as the Recommended Plan. This document, Addendum 1, contains the updated economic analysis for Plan 3 (the RP), and Plan 1 (No Action). The cost increases affect all plans, but only Plan 3 was reviewed for updated economics due to its status as the recommended plan. Plan 3 continues to reasonably maximize net benefits and remains the NED plan, as well as the RP.

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Executive Summary

The Inner Harbor Navigational Canal (IHNC) lock experiences greater transit times than anywhere else in the Nation. When comparing processing times, the IHNC lock ranks 74th, but a comparison of the transit times (delay time plus processing times) shows the IHNC Lock as having the longest average transit times in the Nation, averaging more than 20 hours per tow. Many times, these delays are between 24 and 36 hours during high Mississippi River stages. The IHNC Lock Replacement General Reevaluation Report (GRR) assesses the feasibility of improving navigation efficiencies for traffic on the GIWW and the Mississippi River via the IHNC lock in New Orleans, Louisiana.

In the 2017 GRR, Plan 3 – a new 110' wide x 900' long x 22' depth lock - was determined to be the plan that reasonably maximizes contributions to the National Economic Development (NED) account, consistent with Engineer Regulation 1105-2-100. The purpose of this document (Addendum 1 to Appendix D – Economics) is to confirm whether the RP remains economically justified based on changes in costs, economic conditions, engineering information and designs that have occurred since the 2017 GRR. To support this determination, updated NED metrics were developed based on a comparison of the No Action alternative (Plan 1) and the RP (Plan 3). No other alternatives were evaluated or updated as part of this Addendum, since the RP was already selected at the 2017 ADM for the GRR. Based on this economic reevaluation, the RP remains economically justified with positive net NED benefits of $6.5 Million, and a benefit to cost ratio of 1.03.

Table 1 displays the updated Benefit-to-Cost ratio and Net Benefits of the RP for the Reference Case, as well as two upper and lower bound traffic demand scenarios. The project first cost of the RP at FY 2025 (October 2024) price levels is $4.74 Billion. The project first cost includes sunk costs of $171 Million, including $138 million of sunk pre-construction engineering and design (PED) costs, and $33 Million of sunk construction costs. The project first cost excluding sunk PED is $4.6 Billion. The average annual cost, excluding sunk PED, is $222.5 Million (FY 2025 Price Levels and Discount Rate of 3%), including implementation costs, interest during construction, and OMRR&R costs.

To estimate average annual benefits and average annual net benefits, the USACE Planning Center of Expertise for Inland Navigation Risk-Informed Economics Division (PCXIN-RED) employed numerical lock capacity and partial equilibrium economic models (ARNOLT and NIM, respectively). The ARNOLT and NIM models work together to assess how the different plans will impact lock capacity, waterway demand, waterway costs, waterway benefits, and other variables. This analysis of the RP resulted in average annual benefits of $229.1 Million, based on the Reference Case Traffic Forecast, resulting in net benefits of $6.5 Million, and a benefit to cost ratio of 1.03. The Low Traffic Forecast scenario results in average annual benefits of $132.4 Million, net benefits of negative $90.2 Million, and a benefit to cost ratio of 0.6, while the High Traffic Forecast scenario results in average annual benefits of $415.7 Million, net benefits of $193.1 Million, and a benefit to cost ratio of 1.9.

Table 1 - 2025 Updated Economic Results of 110 x 900 New Lock by Forecast Scenario

COST BENEFIT ANALYSIS - IHNCLockStudy_2025 (FY 2025 dollars, planning period 2026-2096 with base year 2047 at 3%)			
	WPC - New110x900		
Metric	Low Traffic Forecast Scenario	Reference Traffic Forecast Scenario	High Traffic Forecast Scenario
Total Cost-Benefit Analysis			
Recommended Plan Benefits	$ 132,400,000	$ 229,100,000	$ 415,700,000
Recommended Plan Total Costs	$ 222,500,000	$ 222,500,000	$ 222,500,000
Net Benefits	$ (90,200,000)	$ 6,500,000	$ 193,100,000
BCR	0.59	1.03	1.9

1. Purpose and Scope of Economic Analysis

This addendum to the 2017 GRR focused on updating information for the No Action plan as well as the RP, a new 110 feet by 900 feet lock chamber within the Inner Harbor Navigation Canal. The other lock sizes and locations evaluated for the 2017 GRR were not re-analyzed or updated to 2025 costs and benefits.

The scope of this analysis is consistent with relevant USACE guidance, including ER 1105-2-103, Policy for Conducting Civil Works Planning Studies (7Nov2023), ER 1105-2-100 Planning Guidance Notebook Appendix E (22Apr2000), as well as EC 1105-2-412, Assuring Quality of Planning Models (31Mar2011).

2. Summary of Changes

Since the 2017 GRR, changes to the economic analysis include a new cost estimate and schedule for implementation of the RP, changes to economic conditions such as price levels and traffic volumes, as well as design refinements to the RP resulting from more detailed engineering studies. This economic reevaluation captures these changes, as well as new information gained from the navigation community. The analysis of each specific changes affecting major inputs to the model or economic benefits are described in the following sections:

Section 3 - Discount rate and planning period of analysis

Section 4 – Commodity Flows and Traffic Demand Forecasts

Section 5 – Transportation Costs

Section 6 – New implementation Schedule and Costs

Section 7 - Operations and Maintenance, Repair, Rehabilitation, and Replacement Costs (OMRR&R) and Tropical Cyclone Restoration Costs

Section 8 - Lock Capacity Analysis

Section 9 – Navigation Equilibrium Modeling

Section 10 - Advanced Bridge Replacement Benefits Credit

Section 11 - Benefits from Reduction in Required Tripping Vessels

Section 12 – National Economic Development Evaluation Results

3. Discount Rate and Planning Period of Analysis

Table 2 shows a comparison of the planning period of analysis and discount rate used in the 2017 GRR versus the current economic analysis. The 2017 GRR featured a 13-year implementation period before the RP was online and began realizing benefits for its operations. The first-year of implementation (design followed by construction) could have realistically begun at the time was assessed to be 2019. This resulted in a start year of 2019 and a Base Year of 2032. The federal water resources discount rate for FY2017 was 2.875%. The new implementation plan developed for the GRR update is 19-years with a projected implementation start date of 2029. The federal water resources discount rate for FY2025 is 3.0%.

Table 2 – Comparison of Update Factors for Economics

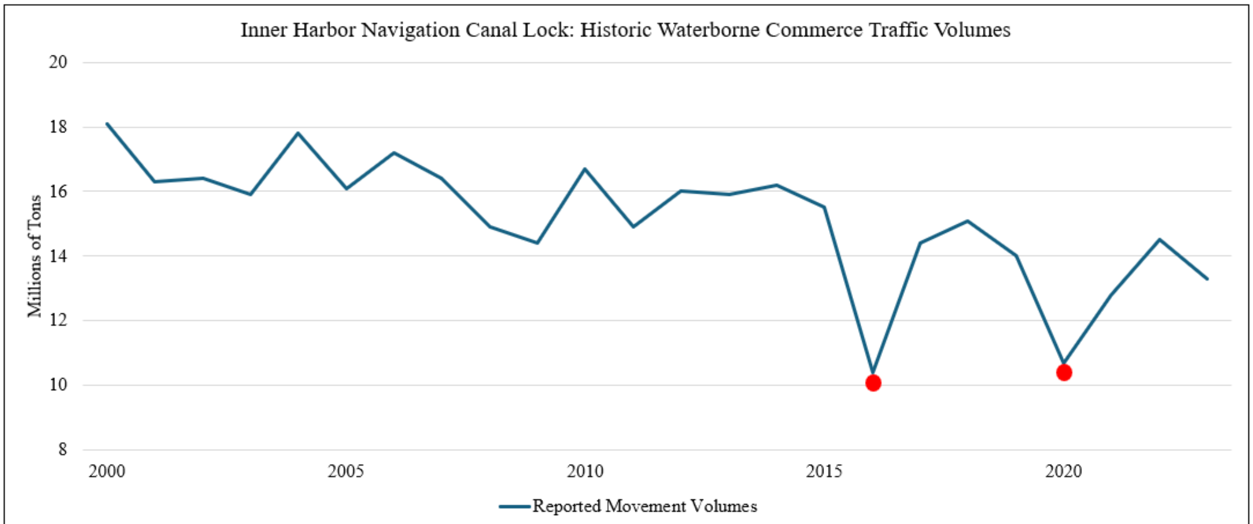
Update Comparison Economic Factors	2017	2025
Fed. Water Resources Discount Rate	2.875%	3.00%
Price Level	2017Q1	2025Q1
Base Year	2032	2047
Begin Year for Modeling	2019	2029
End of Analysis Period	2082	2096

4. Commodity Flows and Traffic Demand Forecasts

The forecasts of future waterway traffic demand follows the same methodology as the 2017 GRR, which is documented in Appendix D – Economics, Attachment 3. This reevaluation includes the same commodity-level forecast groupings from the 2017 study, which were re-applied to new basis years of traffic in this update.

Figure 3 displays reported Waterborne Commerce Statistics (WCS) tonnage through the IHNC Lock from 2000 – 2023 and denotes years of major scheduled closures which featured large-scale re-routing of waterborne traffic around the IHNC project. The basis years are 2018, 2019, 2021, and 2022, with tonnage volumes obtained from Waterborne Commerce Statistics (WCS) from these years. The average total tonnage on the IHNC during these basis years was 14.2 million tons. Data from year 2020 was excluded due to an extended scheduled closure of the project in that year which featured appreciable re-routing of waterborne traffic.

Figure 1 – Reported IHNC Lock Traffic Volumes



Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Tonnage (millions)	18.1	16.3	16.4	15.9	17.8	16.1	17.2	16.4	14.9	14.4	16.7	14.9	16	15.9	16.2	15.5	10.4	14.4	15.1	14	10.7	12.8	14.5	13.3

Source: U.S. Army Corps of Engineers Waterborne Commerce Statistics (WCS)	Base Year Utilized for Traffic Demand Forecasts in 2017 GRR
	Base Years Utilized for Traffic Demand Forecasts in 2025 Economic Update
	Significant Scheduled Lock Closures for Maintenance

The U.S. Energy Information Agency (EIA)'s Annual Energy Outlook (EIA-AEO) report was one of the primary data inputs in the development of the forecasts for the 2017 GRR. In this update, the 2023 EIA-AEO was applied to the average tonnage of the basis years for each commodity. Resulting project demand tonnages and a comparison to the 2017 demands are displayed in Figure 2. Figure 3 displays just the forecasted volumes for the Inner Harbor Navigation Canal Lock utilized for this update.

Figure 2 – Project Demand Tonnage Forecast Comparison: 2017 GRR & 2025 Economic Update

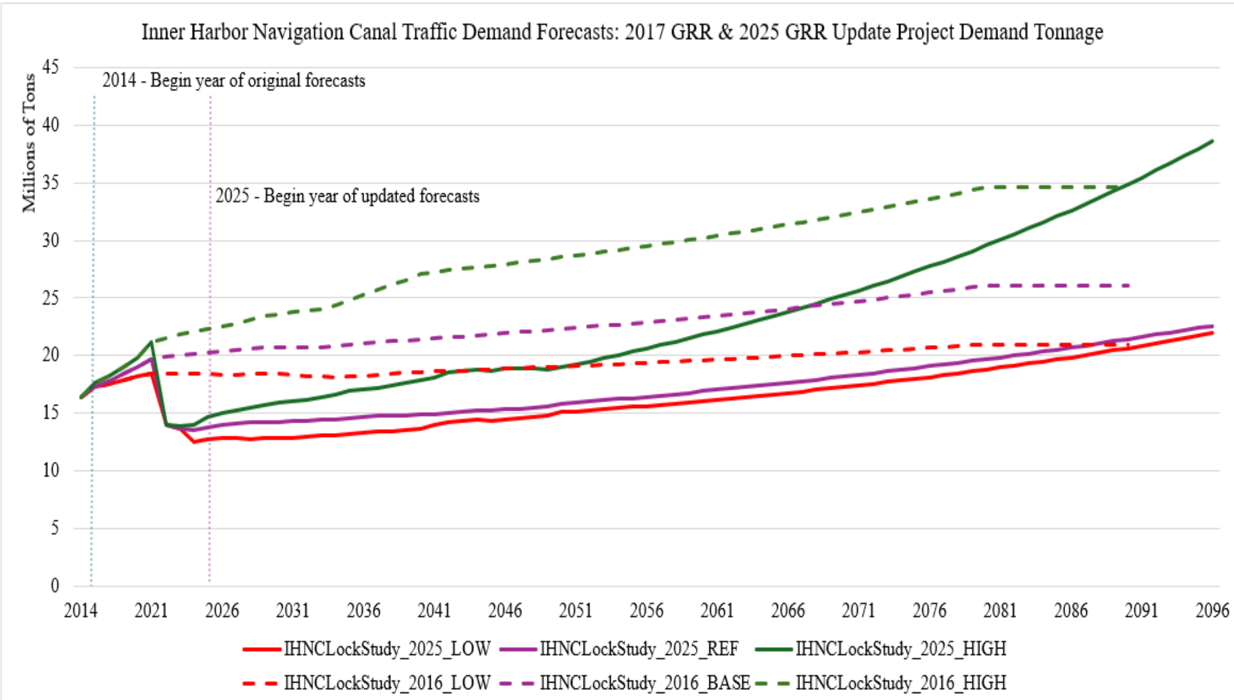
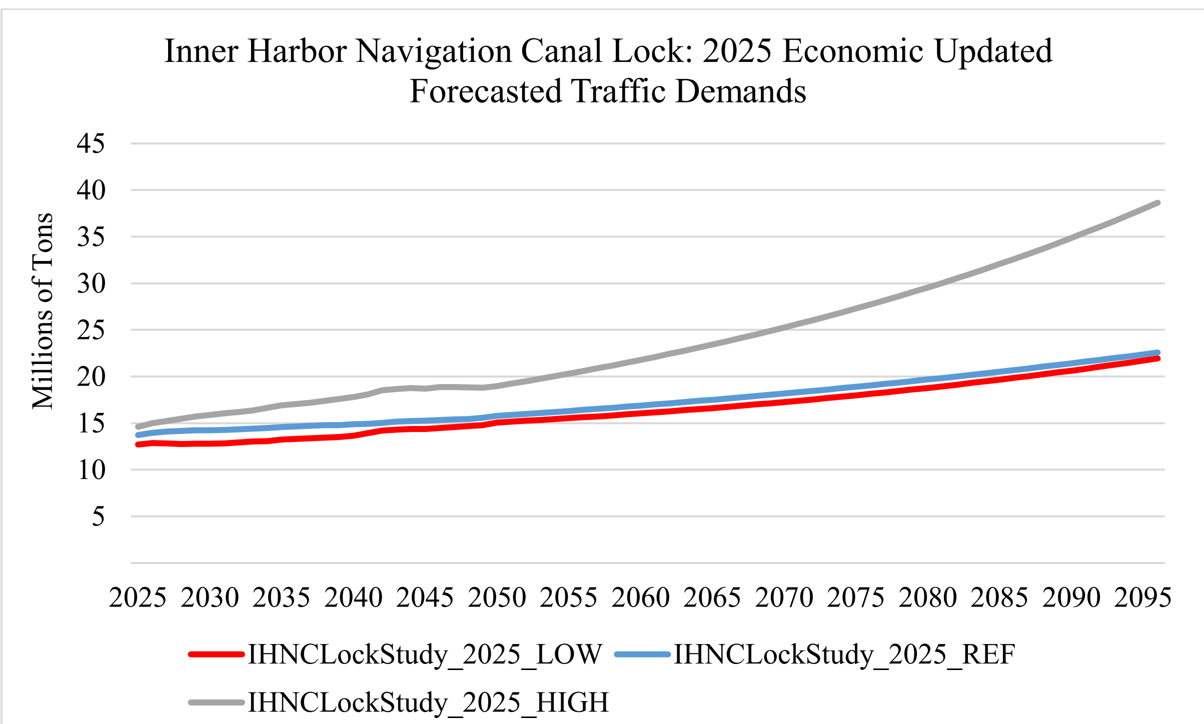


Figure 3 – IHNC Lock Forecasted Traffic Demands for 2025 Economic Update



5. Updates of Transportation Cost Characteristics

The 2017 GRR developed or otherwise relied on the calculations of several transportation cost categories to compute costs and benefits for the existing conditions and evaluated alternatives. For this economic update, current dollar (FY25) price levels were used. Where necessary, cost categories were indexed from their previous FY17 price levels to FY25 price levels utilizing relevant Producer Price Indices (PPI) for the various categories. All Produce Price Indices were based on the first month of the FY (e.g. October 2024 for FY25) for the relevant tables sourced from The U.S. Bureau of Labor Statistics via FRED (Federal Reserve Bank of St. Louis). The following information key to the economic evaluation was updated by indexing the underlying cost components:

5.1. Vessel Operating Costs

Vessel operating cost estimates characterize the costs of ownership and operations for the fleet of barges and towing vessels utilizing the inland waterways. These costs were escalated to current price levels utilizing the U.S. Bureau of Labor Statistics, Producer Price Index by Industry: Coastal and Great Lakes Freight Transportation: Coastal and Intercoastal Towing Transportation [PCU4831134831133].

5.2. Alternate Transportation Rates

Alternate transportation rates are the estimated rates charged for delivering the same commodities to the same origin and destination utilizing all-overland routing. The estimated values for these rates from the 2017 GRR were escalated to current price levels utilizing a composite of railroad and trucking cost indices giving 80% weight to U.S. Bureau of Labor Statistics, Producer Price Index by Industry: Rail Transportation [PCU48214821] and 20% weight to U.S. Bureau of Labor Statistics, Producer Price Index by Industry: General Freight Trucking, Long-Distance Truckload [PCU484121484121].

5.3. Waterway Routing Transportation Rates

Alternate transportation rates are compared to the estimated rates of accomplishing the movement utilizing the waterway for the line-haul segment of the intermodal transportation flows. The U.S. Army Corps of Engineers Planning Center of Expertise for Inland Navigation (PCXIN) has compiled a database of historically survey-sampled transportation rates for waterway and alternative routing for movements utilizing the inland navigation system. These rates were aggregated and utilized in the 2017 GRR. This addendum analysis utilized the same movement sets and aggregations from the 2017 GRR and index updated to current price levels using the U.S. Bureau of Labor Statistics, Producer Price Index by Industry: Coastal and Great Lakes Freight Transportation: Coastal and Intercoastal Towing Transportation [PCU4831134831133].

6. New Implementation Schedule and Costs

As part of the effort to update the 2017 GRR, the project delivery team furthered the project design and associated construction sequencing. Refer to Appendix B of the Integrated Draft GRR and SEIS for relevant details. The updated construction schedule and costs are summarized below in Table 3, along with the associated impacts to navigation anticipated with each year of the construction plan. The project first cost of the RP at FY 2025 (October 2024) price levels is

$4.74 Billion. The project first cost includes sunk costs of $171 Million, including $138 million of sunk pre-construction engineering and design (PED) costs, and $33 Million of sunk construction costs. The project first cost excluding sunk PED is $4.6 Billion. The implementation costs by year were provided by the New Orleans District engineering team and loaded into the Navigation Investment Model. Interest during construction was estimated to be $1.097 Billion based the 19-year implementation schedule. Average annual implementation costs were estimated to be $220.1 million.

Table 3 – Investment Plan Implementation Costs and Schedule

	Investment Plan: WPC - New110x900		
	Analysis Construction Costs		
	INVESTMENT PLAN		
Year	Project First Cost ** CG	Cost Used in a Econ Update ***	Analysis Present Worth
2029	$ 16,400,000	$ 16,400,000	$ 27,100,000
2030	$ 16,400,000	$ 16,400,000	$ 26,300,000
2031	$ 16,400,000	$ 16,400,000	$ 25,600,000
2032	$ 25,600,000	$ 25,600,000	$ 38,700,000
2033	$ 261,200,000	$ 261,200,000	$ 383,600,000
2034	$ 349,400,000	$ 349,400,000	$ 498,200,000
2035	$ 485,700,000	$ 485,700,000	$ 672,300,000
2036	$ 411,600,000	$ 411,600,000	$ 553,200,000
2037	$ 203,000,000	$ 203,000,000	$ 264,900,000
2038	$ 285,600,000	$ 285,600,000	$ 361,800,000
2039	$ 372,100,000	$ 372,100,000	$ 457,600,000
2040	$ 399,700,000	$ 399,700,000	$ 477,300,000
2041	$ 376,800,000	$ 376,800,000	$ 436,800,000
2042	$ 188,300,000	$ 188,300,000	$ 211,900,000
2043	$ 430,000,000	$ 430,000,000	$ 469,900,000
2044	$ 492,700,000	$ 492,700,000	$ 522,700,000
2045	$ 78,700,000	$ 78,700,000	$ 81,100,000
2046	$ 85,500,000	$ 85,500,000	$ 85,500,000
2047	$ 71,100,000	$ 71,100,000	$ 69,000,000
2048	-	-	-
2049	-	-	-
2050	-	-	-
TOTAL COST	$ 4,566,200,000	$ 4,566,200,000	$ 5,663,500,000
REMAINING COST	$ 4,566,200,000	$ 4,566,200,000	$ 5,663,500,000
	Interest During Construction (IDC) ****		$ 1,097,300,000
	Total AAE (costs amortized over 50 years at 3%)		$ 220,100,000
	Remaining AAE (costs amortized over 50 years at 3%)		$ 220,100,000

7. Operation, Maintenance, Repair, Replacement, Rehabilitation Costs and Tropical Cyclone Restoration Costs

Annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs were generated for the 2017 GRR by the PDT to capture expected future expenditures necessary for the project for both the No Action and the RP alternatives. These expenditures were escalated to current price levels utilizing the Civil Works Construction Cost Index System (CWCCIS) tables using the 05-Locks feature code. The summarized OMRR&R costs between the two plans is provided in Table 4. The No Action reflected expenditures necessary to continue operating the existing lock throughout the study's planning horizon. The RP also included necessary expenditures, including however a net reduction in OMRR&R costs of $2.5 Million annually (FY25 price levels) were realized due to avoidance of extensive repairs, replacements and rehabilitation of aging components of the existing lock. The benefits of the RP include $4.9 Million annually for avoided closures of the existing lock, and the costs of the RP include $2.4 Million annually for scheduled and unscheduled closures of the new lock. The No Action and the RP are estimated to have the same cost for day-to-day operations and maintenance, resulting in no net change for normal O&M.

The OMRR&R costs also reflect disruptions to lock service resulting from with tropical cyclones and restoring operations is an important consideration of operations in the Gulf. The analysis considers a probabilistic closure with an annual 20% chance of experiencing a tropical cyclone that closes and causes some damage and clean-up costs to restore operations.

Table 4 – Average Annual OMRR&R Cost Summary for 110 x 900 New Lock Investment Plan

AVERAGE ANNUAL OMRR&R Costs for IP: WPC - New110x900 (FY 2025 dollars, planning period 2029-2096 with base year 2047 at 3%)									
	Inner Harbor Lock			IHNC Lock - new location			Investment Plan WPC - New 110x900		
	WOPC	WPC	Incremental	WOPC	WPC	Incremental	WOPC	WPC	Incremental
Category									
Dewater	$ 1,100,000	$ 400,000	$ (800,000)	-	$ 600,000	$ 600,000	$ 1,100,000	$ 1,000,000	$ (100,000)
Maint.	$ 1,300,000	$ 500,000	$ (800,000)	-	$ 400,000	$ 400,000	$ 1,300,000	$ 900,000	$ (500,000)
Rehab.	$ 3,900,000	$ 1,300,000	$ (2,600,000)	-	$ 700,000	$ 700,000	$ 3,900,000	$ 2,000,000	$ (1,900,000)
OMRR&R TOTAL	$ 6,300,000	$ 2,200,000	$ (4,200,000)	-	$ 1,700,000	$ 1,700,000	$ 6,300,000	$ 3,900,000	$ (2,500,000)

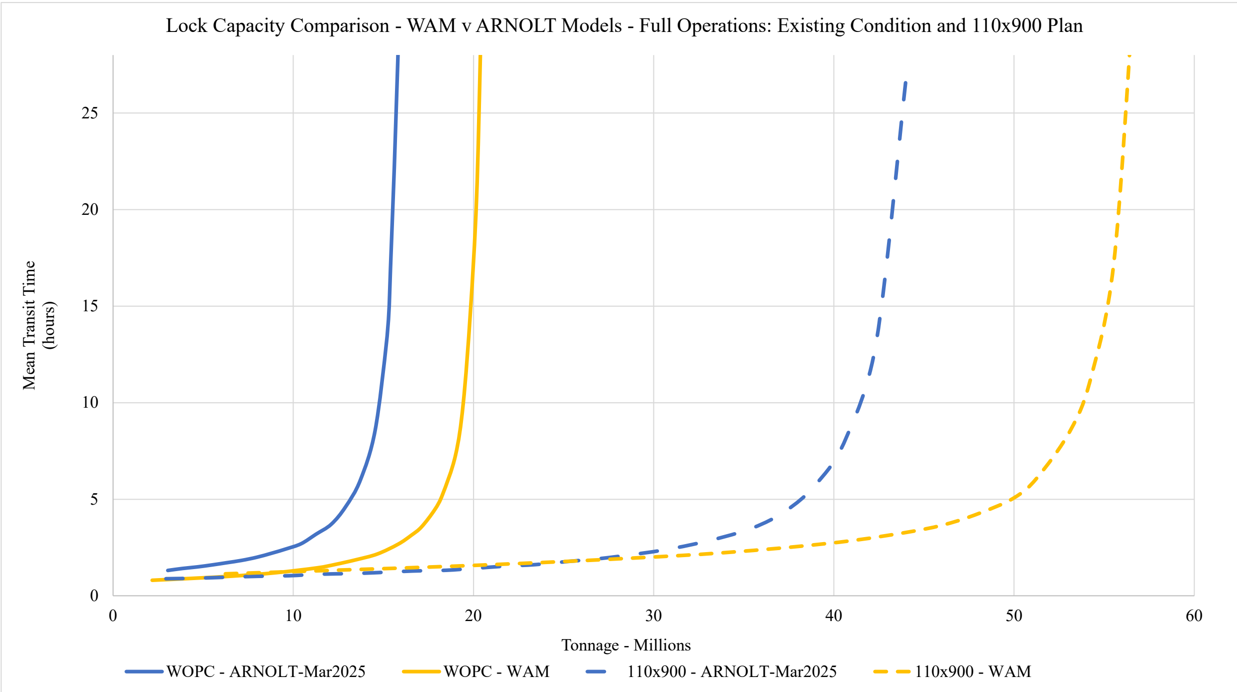
Average annual normal O&M costs are higher than the stated annual normal O&M cost since costs over the 68-year planning horizon are an amortization over 50 years.

8. Lock Capacity Analysis Summary

A major driver of navigation issues at the current IHNC lock is congestion and capacity constraints that are caused by the small lock chamber dimensions (relative to tow sizes), periodic outages in services, and high demand at the project. The Inner Harbor Navigational Canal (IHNC) lock experiences greater transit times than anywhere else in the Nation. When comparing processing times, the IHNC lock ranks 74th, but a comparison of the transit times (delay time plus processing times) shows the IHNC Lock as having the longest average transit times in the Nation, averaging more than 20 hours per tow. Many times, these delays are between 24 and 36 hours during high Mississippi River stages. The existing deep-draft IHNC navigation lock is obsolete, and no longer efficiently sized for the demands of modern transportation. Navigation through the canal is additionally impacted by the presence of three lift bridges for vehicular and rail traffic, most of which are required to raise for every vessel transit.

Congestion and capacity can be measured in the average delay time for each tow, and the maximum throughput of the lock. These indicators are measured through numerical modeling of lock capacity analysis. A major component of this economic reevaluation included the development of a new lock capacity analysis utilizing new traffic data, elicitation of information from industry, and state of the art modeling techniques.

Figure 4 - Comparison of Lock Capacity Modeling Outputs between WAM and ARNOLT



8.1. New Lock Capacity Numerical Model

A new lock capacity model has been developed to replace the Waterways Analysis Model (WAM) which was utilized in the 2017 GRR and preceding efforts. This new model, Analysis of River Navigation and Operational Lock Throughput (ARNOLT) builds upon its predecessor's discreet-event level vessel-lock modeling, removing some of the simplifying assumptions and allowing for more user input and control over how the model operates. ARNOLT has been reviewed and is undergoing the process for USACE corporate certification but will utilize a one-time use approval for this effort, supported by additional review charges for the review team.

The ARNOLT model represents a significant technological advancement over its predecessor, due to its ability to estimate the effects of empirical variability in the estimated delay time and capacity at waterway infrastructure. For the IHNC Lock, this advancement is particularly useful for reflecting tow configurations that exist in the real-world vessel fleet, compared to simplistic assumptions of homogenized tow configurations in WAM. Variability in fleet characteristics have been shown to impact throughput to a greater extent than the previous technology permitted. The new model, ARNOLT, was utilized to re-assess the No-Action Plan as well as the RP for both full operations and the array of potential closure scenarios evaluated in the 2017 GRR.
The 2017 GRR utilized WAM to conduct the capacity assessment for the existing Inner Harbor Navigation Canal Lock, the various proposed alternative sizes, and baseline capacity of the lock projects in the immediate vicinity to IHNC Lock. This economic update utilizes a new model, the

Analysis of River Transportation and Operational Lock Throughput (ARNOLT) model to update the assessment of the existing lock and the RP.

Differences in the models, inputs, and results are detailed in the Lock Capacity Attachment (Attachment 1) but are summarized below along with the impacts to the assessment.

8.2. Design Refinements of the Recommended Plan

In 2023, the US Army Corps of Engineers Engineer Research Development Center (ERDC) constructed a detailed ship-simulation of both the existing lock and the RP. The details of this simulation, the process, and its findings can be found in Appendix B of the Integrated Draft GRR and SEIS. The ship-simulation sessions with river pilots yielded new information which will be discussed in more detail below, but significantly for the economic analysis includes:

New construction requirements - Development and design of a temporary bypass channel to facilitate navigation around the construction site. This information is discussed in detail in Appendix B of the Integrated Draft GRR and SEIS. There are also newly anticipated impacts to commercial waterborne navigation during construction of the RP. These are displayed in Table 5 and section 8.4 below. The newly developed plans and specs have also shifted the implementation period from the previously anticipated 13 years to the newly assessed period of 19 years.

No multi-vessel lockages – As part of the ShipSimulation evaluation, pilots also attempted to navigate through the new 100’ wide by 900’ long structure with two vessels with barges transiting in a single lockage operation. The 2017 analysis assumed that vessels would attempt such lockages whenever practical and safe, consistent with U.S. Coast Guard regulations, to maximize the utilization and throughput of the new and larger lock. The pilots and companies who attempted such lockages during the 2023 ship simulation all stated that they would not perform such lockages when carrying jumbo tanker barges (54’ x 300’), or when carrying multiple standard sized (35’ x 195’) barges where there was less than 10’ to 15’ of clearance between tows. This left very few situations in which multi-vessel lockages could be expected to occur. This assumption was revised in the updated lock capacity modeling, the results of which are discussed below. This change impacted the estimated throughput (capacity) of the RP lock. The ARNOLT curves for the 110x900 lock in Figure 4 and the rest of this document reflect the removal of multi-vessel lockages from the simulation.

This assumption was revised in the updated lock capacity modeling, the results of which are discussed in the Lock Capacity Attachment (Attachment 1). This change has a significant impact on the potential future throughput (capacity) of the RP lock. All ARNOLT curves representing the 110 by 900 feet chamber presented in this document reflect the removal of this assumption.

8.3. LPMS Data Issues and Optimized Tows

A critical element in the assessment of new chamber dimensions is the ability and willingness of the users of the project to adapt their operations to be able to fully utilize the increased volume of the lock chamber. As part of the 2017 GRR and discussed in Appendix D, the vessel fleet and current tow configurations were not expected to change appreciably between the No-Action Plan and any of the alternatives with increased chamber size. The commercial fleet is already maximizing the available dimensions of the larger waterway system (especially the Mississippi River and the GIWW). However, most tows require temporary downsizing to process through the lock, which adds to the overall transit time for their voyage. This process is referred to as "tripping" – with each segment of the tow that transits the lock known as a "cut". A larger lock chamber would mean this inefficient tripping process would be eliminated, and navigators would be free to transit the lock in larger tow-sizes, with the limiting factor being the dimensions of the larger waterway system. This assumption remains valid for this update. Tow-sizes are observed at the lock in the Lock Performance Monitoring System (LPMS) which supplies data on historic lock usage patterns and levels as well as processing time data. LPMS data is recorded by U.S. Army Corps of Engineers personnel at the lock site based on their observations and communications with pilots. The nature of the IHNC Lock and its ready-to-serve policy pose additional challenges to the lock operations team in accurately and completely recording every element of a complex tow reconfiguration, lockage, and tripping process where many of these activities take place away from the immediate vicinity of the lock and line of sight for the operators. Analysts require the data to capture the original completed tow-configuration package, with the smaller tripping movements recorded as "cuts" related back to that original tow-configuration package. This allows analyst insight into the configuration, dimensions, and other key elements of the original tow-package as it arrived, which is critical to being able to model and account for the changes in navigation operations between the No-Action versus RP.

Discussions with and information provided by the navigation community throughout this update effort suggested that lock staff do not have access to information about the tow-configuration packages as they travel on either side of the project area. Rather, lock staff are informed of tow-configurations after they are prepared in smaller cuts that are prepared to pass through the lock at nearby re-fleeting areas. Discussion with, as well as data provided by industry partners confirmed that the reconfiguring of tows occurring far in advance of their canal transits was not adequately reflected in the LPMS data. This was especially the case for tows consisting of standard-sized barges (35 feet by 195 feet), where a wider distribution of larger tows is observed than was being captured by the LPMS data. Through discussions with district Operations staff and discussions with U.S. Coast Guard Sector New Orleans, the economics team also validated that the larger waterway system (including the GIWW) could handle larger tow-sizes than were being reported in LPMS.

Figure 5 displays the tow-sizes by barge class, as recorded by LPMS without any adjustments, and their associated limits between the existing lock and proposed 110 feet by 900 feet new lock. To correct for this discrepancy with the recorded LPMS data, a Genetic Algorithm (GA) was developed by the Planning Center of Expertise for Inland Navigation and deployed on the LPMS data through an add-on feature in the ARNOLT model. The GA and its integration within the ARNOLT model, as well as validation and testing are captured more completely in Attachment 3 to this addendum document. Figure 6 compares the tow-sizes as captured in LPMS against the outputs from the GA process. Notably, a much wider distribution of tow-configurations was observed, with larger tow configurations arriving more frequently, in line with the information provided by the navigation industry as part of the team's interactions.

Figure 5 – IHNC Lock LPMS Recorded (un-adjusted) Tow Sizes by Number of Barges by Barge Class 2017-2024

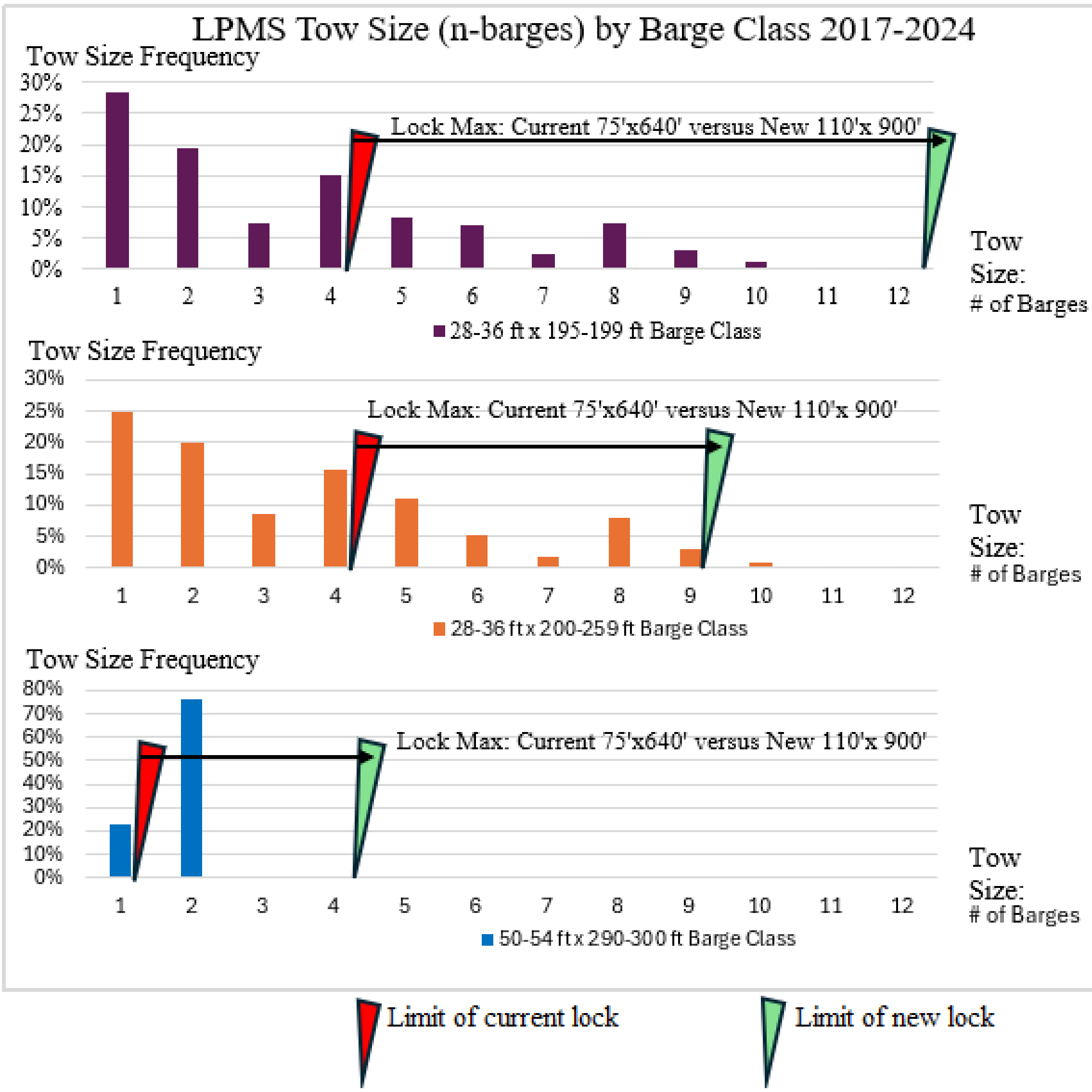
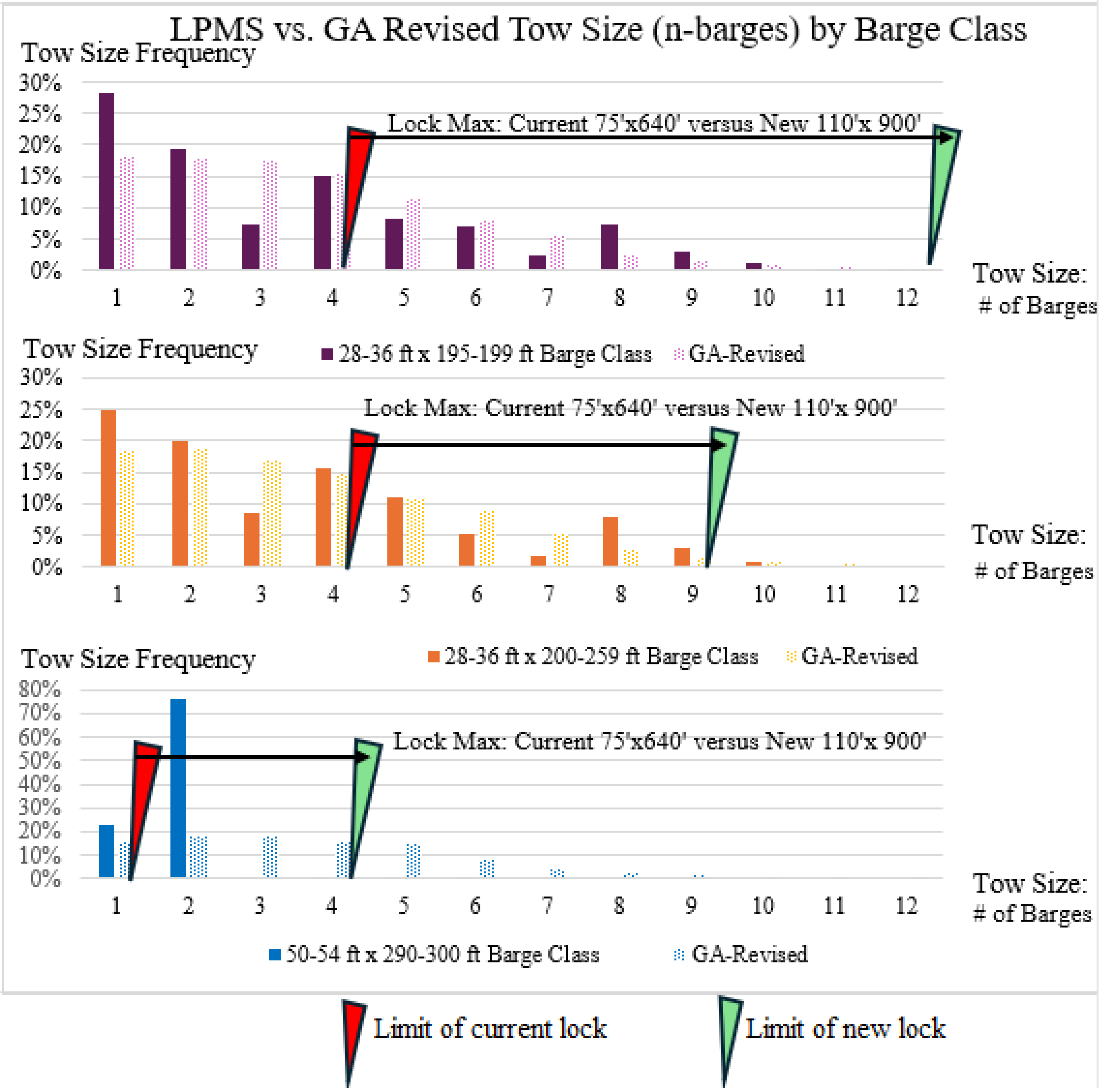


Figure 6 – IHNC Lock LPMS vs Genetic Algorithm Adjusted Tow Sizes by Number of Barges by Barge Class



8.4. Implementation Impact Modeling

New detailed engineering studies revealed there is no practical method to construct the new lock or demolish the old project while providing full-service throughout the canal for waterway transportation throughout the full period (refer to Appendix B of the Integrated Draft GRR and SEIS). The ARNOLT model was utilized to develop tonnage-transit time curves to capture the expected channel shutdowns and lock unavailability provided by the engineering team. The navigation impacts during construction are summarized in Table 5, while the results of the ANROLT capacity analysis are presented in Attachment 1.

Table 5 – 2025 Updated Implementation Schedule of Activities with Navigation Impact Estimates

Calendar Year	Cost	Activity	Nav impact closure type	Nav impact duration (days)
2029	$ 16,000,000	PED	None	0
2030	$ 16,000,000	PED	None	0
2031	$ 16,000,000	PED	None	0
2032	$ 26,000,000	PED	None	0
2033	$ 261,000,000	New lock construction	None	0
2034	$ 349,000,000	New lock construction	None	0
2035	$ 486,000,000	New lock construction	None	0
2036	$ 412,000,000	New lock construction	None	0
2037	$ 203,000,000	New lock construction	None	0
2038	$ 286,000,000	New lock construction	None	0
2039	$ 372,000,000	New lock construction	None	0
2040	$ 400,000,000	New lock construction	None	0
2041	$ 377,000,000	New lock construction	None	0
2042	$ 188,000,000	SCB piles, pier	None	0
2043	$ 430,000,000	New SCB Bascule Demo old SCB	24-hour full 12-hour shift	Two x 7-days One x 3-day
2044	$ 493,000,000	SCB bullnose, GW	None	0
2045	$ 79,000,000	Demo old lock E, SCB bullnose, GW	12-hour shift	200
2046	$ 85,000,000	Demo old lock W, SCB bullnose, GW	None	0
2047	$ 71,000,000	Site Demobilization, Final Site Clean Up	None	0
Abbreviation Key	*PED*	*Preconstruction, Engineering and Design*		
	SCB	*St. Claude Avenue Bridge*		
	GW	*Guide Walls*		

9. Navigation Equilibrium Modeling

Improvements to the existing waterway reduce costs to shippers, which can induce changes in shipping behavior. Specifically, lower costs of transiting the IHNC can provide an incentive for shippers to send future traffic through the IHNC throughout the period of analysis, to the extent that the cost is less than shipping by alternate routes or modes, or sourcing from alternate origins or destinations. These equilibrium effects on traffic demand are counted as Shift of Mode and Shift of Origin or Destination, or New Movement benefits. To account for these effects, the partial equilibrium economic model (NIM) relies on projections of system-level tonnage, lock capacity, alternate transportation modes available to shippers, the costs of using alternate modes, and the shippers' demand elasticities (a measure of how sensitive shippers are to waterway costs). NIM uses these factors to determine the least cost method of shipping commodities.

The alternate modes available to shippers as well as their costs are especially important in considering the potential for scheduled and unscheduled closures of the IHNC Lock, which is likely to experience greater problems with reliability as it ages in the future. NIM determines the shipping volumes through the lock considering all closures that occur throughout the period of analysis. Shifts of mode or shifts of origins and destinations due to lock closures are estimated in the partial equilibrium modeling using the updated transportation rates, the estimates of delay time derived from the lock capacity modeling, as well as the amount of traffic forecasted to seek service at the lock. The equilibrium traffic levels are determined based on the least cost option for shippers, after considering the availability of the lock and the associated congestion levels.

NIM also considers demand elasticities to determine when shippers are incentivized to rely more heavily on waterway transportation as a means of increasing the volumes of existing shipments or diverting shipments that would normally ship by an alternate mode of transportation (regardless of lock closures). Since elasticities measure demand based on relative prices (e.g. an x% waterway costs results in y% change in waterway shipping volumes), rather than an absolute measure prices, it was determined that the estimates used for the 2017 GRR remain appropriate for use today. Therefore, the same elasticities are applied to determine equilibrium shipping volumes.

The equilibrium waterway tonnage for the No Action as well as the RP was estimated throughout the period of analysis based on lock closures, as well as shippers' sensitivity to waterway costs (elasticities of demand). The resulting equilibrium waterway traffic is displayed in Figure 7 (total tonnage) and Figure 8 (total tows). Notably, more tonnage passes through the IHNC with the with-project conditions (RP) compared to the without project conditions (No Action), while fewer total tows transit the IHNC. This is because the larger lock size of the RP allows for more barges per tow than the existing lock size.

Figure 7 – IHNC Lock Estimated Equilibrium Tonnage

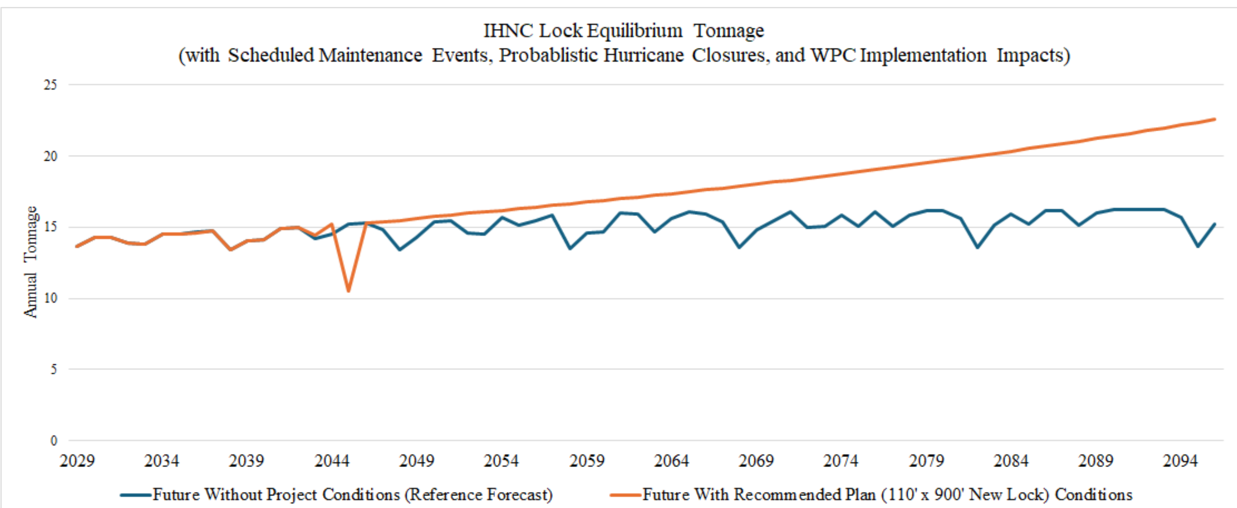
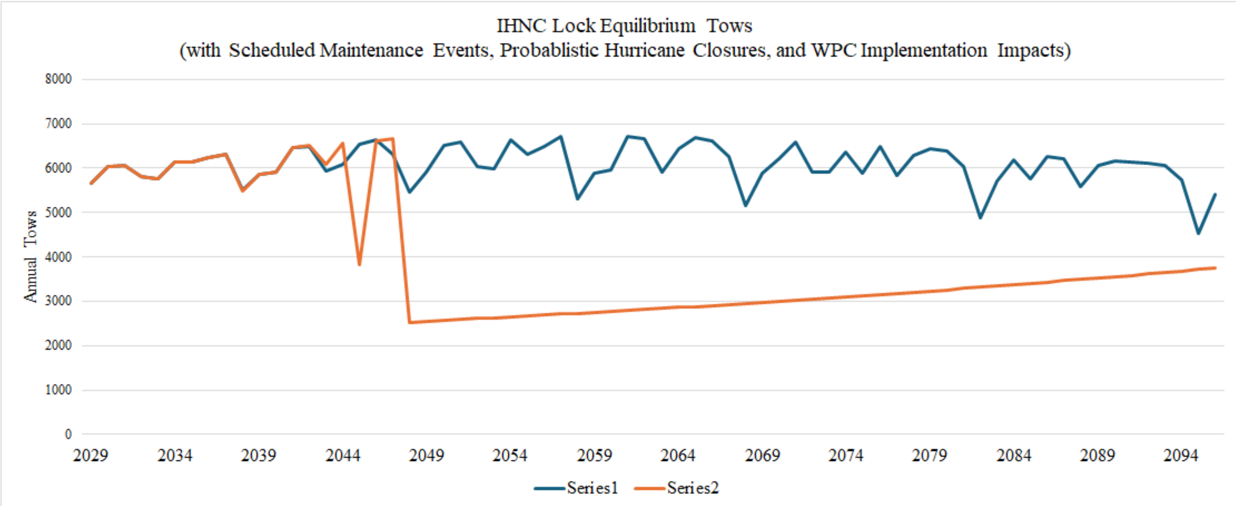


Figure 8 – IHNC Lock Estimated Equilibrium Tows



Appendix D of the 2017 GRR and its attachment detail the modeling procedures applied to the analysis of the without-project condition and various alternatives, including detailed descriptions of the application of the Navigation Investment Model (NIM). The 2025 updated analysis built upon the previous NIM network, with the model and majority of the analysis' structure remaining unchanged. Descriptions of major changes or deviations from the previous NIM analysis are detailed in this section of the addendum.

9.1. Modifications to the 2017 NIM Network

As a part of updating the 2017 NIM analysis, many adjustments were made to ensure the current analysis captured changing conditions, such as changes in transportation costs, changes to the cost, implementation, and impacts from constructing the new 110 by 900 chamber, and others. However, some adjustments were also made due to minor errors in the previous analysis.

This section highlights the refinements that were made due to these minor errors.

9.2. OMRR&R Adjustments

The previous plan of Operation, Maintenance, Rehabilitation, Repair, and Replacement (OMRR&R) includes scheduled closures and costs for the current lock at IHNC as well as the new 900x110' chamber. In NIM, these costs were assigned to individual lock nodes (i.e. an OMRR&R plan for the new lock, and a plan for the old lock). The costs at each lock node were subcategorized as "L" for Long, "S" for Short, and "D" for Dewater. Rules were constructed in NIM to turn off OMRR&R at the old lock node when the new lock came online. However, during recent modeling, it was discovered that the dewater costs and closures were not turned off at the old lock node, nor were they turned on at the new lock node. Since each lock had a unique dewater schedule, this error was fixed in the current analysis.

9.3. Tropical Cyclone Event

The previous analysis used the lock component features of the NIM Lock Risk Module (LRM) (i.e event trees, hazard functions, and a Monte Carlo Process) to model possible tropical cyclone events at IHNC. In reviewing the entries, unused component IDs were included in the Alternative

Component table, but these components had no underlying probabilistic data. Although the unused components are not suspected to have caused an error, the unused data was removed to avoid confusion.

9.4. Calibrating NIM for Optimized Tow Configurations

Calibration is an important step in NIM. It validates that the model is developing least-cost shipping plans that reasonably depict historical (or some other desired) condition before introducing other elements of risk to the calculations (such as changing lock services levels, changing traffic levels, etc.). Calibration in NIM consists of estimating the efficiency of towboats, movement dedication factors (i.e. percent empty backhaul), and the tow-size limits on each waterway sector.

This section describes how the tow-size limits were modified in the current analysis at IHNC Lock.

9.4.1. NIM Calibration Targets

As mentioned in section 8.3, previous analyses at IHNC Lock assumed that tows would continue to arrive at the project in the same configurations as they had arrived historically in both the With (WPC) and Without (WOPC) Project Conditions. This same assumption is maintained in the current analysis for the WOPC. However, in the WPC, tows are expected to reconfigure into more optimized tow packages to make better use of the new 900x110' chamber dimensions. As a result, NIM must be calibrated to new targets that do not match the historical targets. Specifically, NIM must be calibrated to align itself with the lock performance simulation (ARNOLT) to reasonably depict a similar number of tows, barges, and tow-sizes at IHNC Lock. To accomplish this, NIM was loaded with modified targets, derived from the outputs of the ARNOLT model. The outputs used were at a historical tonnage level (about 16 million tons), but using optimized tow configurations and the new chamber dimensions. The new targets are shown in Table 6 below.

Table 6 - Comparison of previous vs. current analysis targets at IHNC Lock

Analysis	Loaded Barges	Empty Barges	Avg Delay Time (mins)	Avg Processing Time (mins)	Tows	Avg Towboat Horsepower
Previous	7,395	5,800	884	52	5,645	1,604
Current	7,314	5,131	40	32	2,831	1,604

9.4.2. System considerations

Although processing tows that are "optimized" for the new chambers dimensions in ARNOLT will result in higher lock capacity and generally lower average transit time per tow at any given tonnage level, it does not necessarily mean that tows are "optimized" towards producing a least-cost shipping plan. This is largely due to the potential costs of reconfiguring a tow mid-transit (roughly 20 minutes per tow, 5 minutes per barge). For movements that are close to their waterway destination after traversing IHNC Lock, it might be more cost effective to simply remain in their current/historical configuration than reassembling into something more akin to a "unit tow." Additional waterway system constraints are also a consideration, such as the chamber dimensions (and thus maximum tow-sizes) at other locks from origin-to-destination.

For the current analysis, the calibrated parameters for the rest of the IHNC network were left unchanged. Only the IHNC Lock waterway sector was recalibrated.

9.4.3. Results

Overall, the current analysis calibration improved at IHNC Lock but worsened at other system locks. Comparative metrics can be seen in Table 7 and Table 8. This is likely due to the choice to only calibrate the IHNC Lock waterway sector compared to recalibrating the entire system.

The distribution of tow-sizes at IHNC Lock also improved, aligning much closer to the desired targets compared to the previous IHNC analysis.

Table 7 - Previous analysis comparison of select target vs. model calibration metrics

lock name	**tows**			**average horsepower**			**barges per tow**		
	target	model	percent difference	target	model	percent difference	target	model	percent difference
Bayou Sorrel Lock	4,588	4,679	2%	1,884	1,629	-14%	3.5	3.4	-2%
Port Allen Lock	5,517	5,515	0%	1,738	1,606	-8%	3.0	3.0	0%
Old River L&D	2,286	2,175	-5%	1,962	1,723	-12%	3.4	3.6	5%
Inner Harbor Lock	5,645	5,733	2%	1,604	1,650	3%	2.3	2.3	-2%
Calcasieu Lock	11,658	11,495	-1%	1,737	1,179	-32%	2.4	2.5	1%
Leland Bowman Lock	11,536	11,216	-3%	1,729	1,359	-21%	2.5	2.6	3%
Bayou Boeuf Lock	11,163	7,872	-29%	1,405	1,498	7%	2.0	2.8	42%
Harvey Lock	2,030	2,032	0%	1,279	1,540	20%	1.3	1.3	0%

Algiers Lock	6,820	7,071	4%	1,698	1,661	-2%	2.7	2.6	-4%

Table 8 - Current analysis comparison of select target vs. model calibration metrics

lock name	**tows**			**average horsepower**			**barges per tow**		
	target	model	percent difference	target	model	percent difference	target	model	percent difference
Bayou Sorrel Lock	4,588	4,151	-10%	1,884	1,371	-27%	3.5	3.8	11%
Port Allen Lock	5,517	4,751	-14%	1,738	1,710	-2%	3.0	3.5	16%
Old River L&D	2,286	2,073	-9%	1,962	1,657	-16%	3.4	3.8	10%
Inner Harbor Lock	2,831	2,831	0%	1,604	1,548	-3%	4.4	4.4	1%
Calcasieu Lock	11,658	7,728	-34%	1,737	1,333	-23%	2.4	3.7	51%
Leland Bowman Lock	11,536	9,874	-14%	1,729	1,299	-25%	2.5	2.9	17%
Bayou Boeuf Lock	11,163	7,729	-31%	1,405	1,304	-7%	2.0	2.9	44%
Harvey Lock	2,030	2,016	-1%	1,279	1,543	21%	1.3	1.3	1%
Algiers Lock	6,820	6,568	-4%	1,698	1,684	-1%	2.7	2.8	4%

Figure 9 - Previous analysis comparison of target vs. NIM tow sizes at IHNC Lock with a 900'x110' chamber

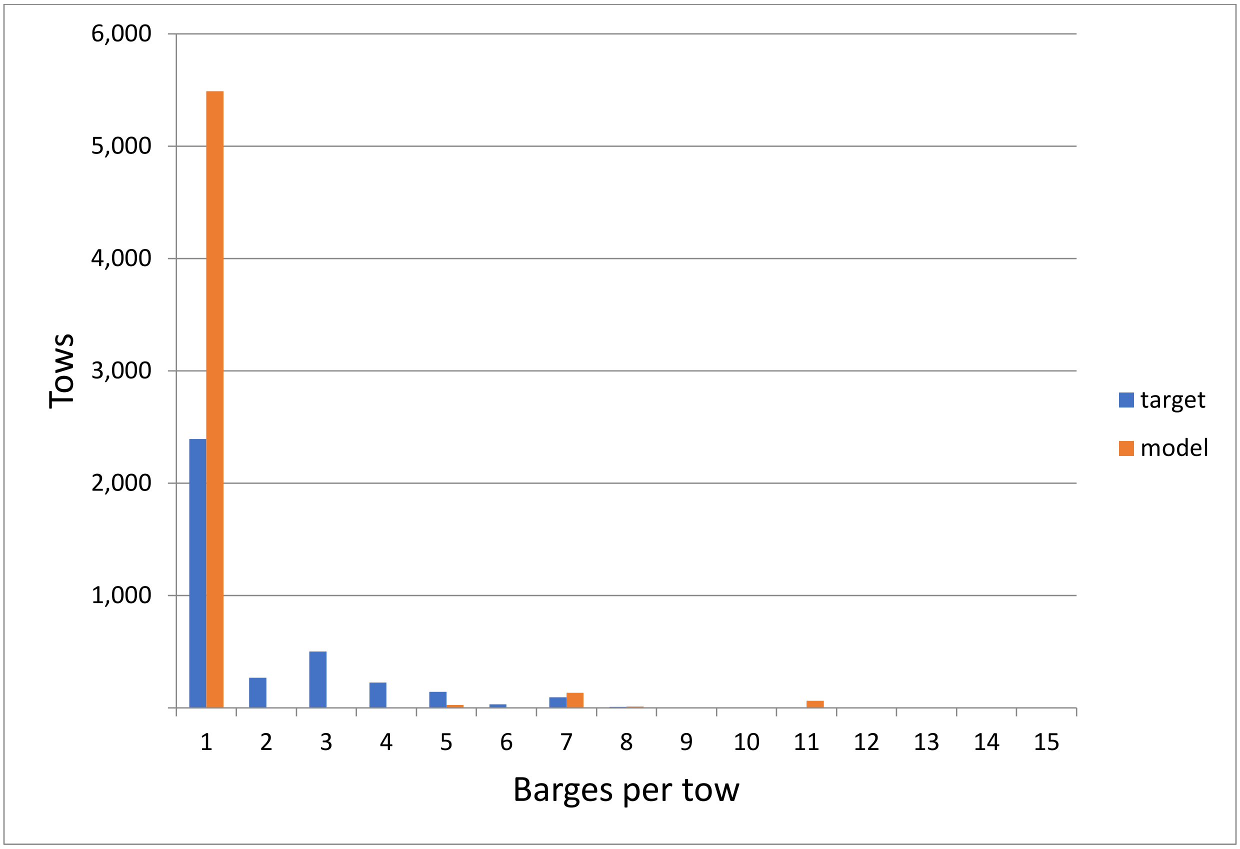
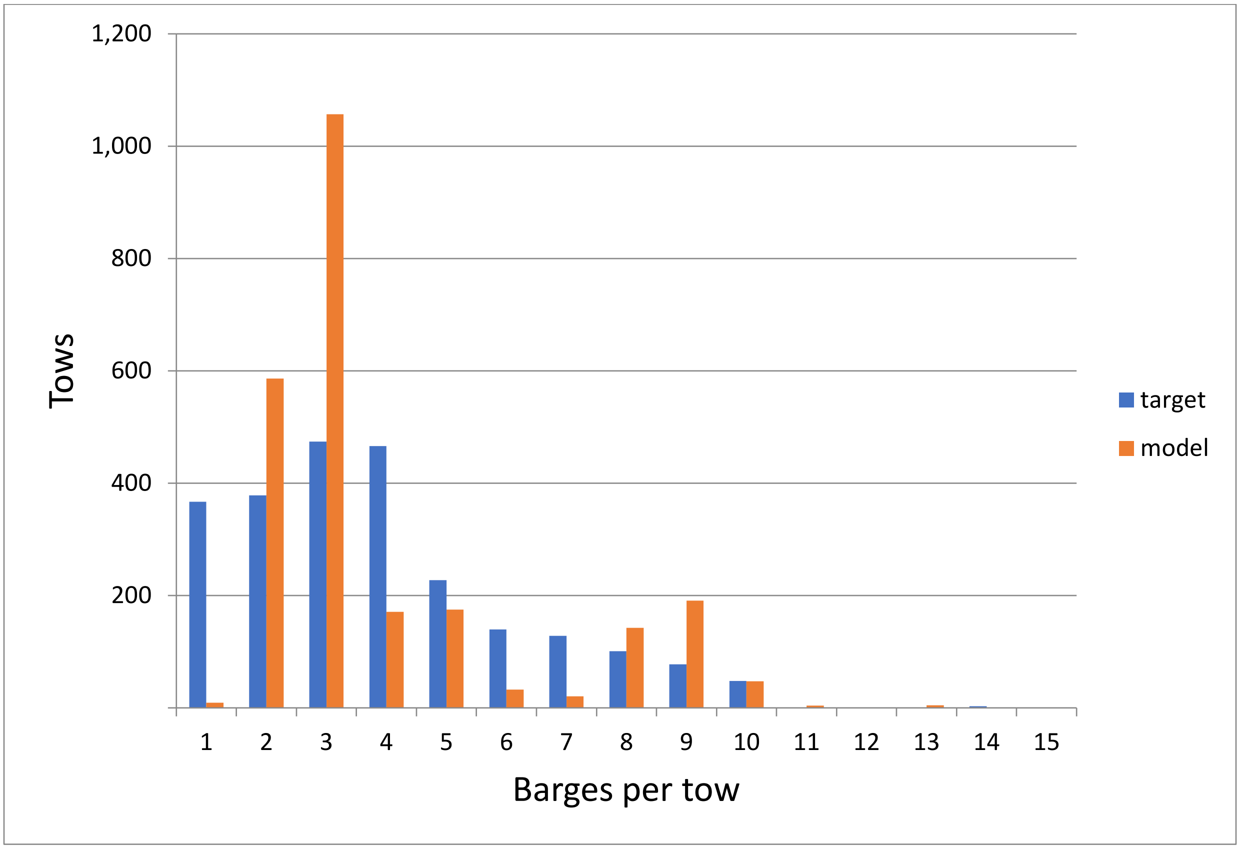


Figure 10 - Current analysis comparison of target vs. NIM tow sizes at IHNC Lock with a 900'x110' chamber



10. Advanced Bridge Replacement Credit

The existing St. Claude Avenue bridge, owned and operated by the Port of New Orleans, was completed in 1921 and is nearing the end of its useful life. The Port of New Orleans will spend a total of $55 million over the next five years to extend the bridge's life by 25 years from the present to the year 2050. Although the existing bridge would normally be replaced by the Port of New Orleans in that year, the bridge will need to be replaced sooner, estimated for 2047, as part of the implementation for the new IHNC Lock project. Because this new St. Claude Avenue bridge will extend the life of the bridge service as well as incur lower maintenance costs, these benefits (or credits) will be added to the total benefits of the IHNC Lock project to offset the cost of the new St. Claude Avenue bridge which is included in the project's first cost.

These benefits are calculated according to the **NED Procedures Manual—Urban Flood Damage, IWR Report 88-R-2 (March 1988)** which states, "For many projects, relocations will result in the replacement of existing bridge facilities. Often the expected life of the replacement bridge will be greater than that of the existing structure, thereby extending the life of the bridge service being provided. Since the total cost of the new bridge is included in the first cost of the project, a credit for this extension is needed on the benefit side. A credit is also needed if any reduction in O&M costs will occur during the remaining life of the existing facility."

Table 9 – Summary of Advanced Bridge Replacement Calculations and Results for St. Claude Avenue Bridge

Cost of new bridge:	$367,700,000
Life of new bridge (2047 – 2146):	100 years
Remaining useful life of existing bridge (2047 – 2050):	4 years
Extension of bridge life (2051 – 2146):	96 years
Annual OMRR&R of existing bridge:	$3,600,000
Annual OMRR&R of new bridge:	$1,000,000
Interest rate:	3.00%
Capital recovery factor (100 years):	0.031647
Annual cost of new bridge:	$11,600,000
Present worth of annuity factor for 96 years:	31.381
Benefits in year 4, credited to bridge life	
Extension Benefits	$365,200,000
Single payment present worth factor for 4 years:	0.8885
Present worth in year 1 of bridge	
extension	$324,500,000
Annual OMRR&R savings (years 1 - 4) =	
	$2,600,000
Present worth of annuity factor for 4 years:	3.717
Present worth in year 1 of OMRR&R	
Annual OMRR&R savings x Annuity Factor	$9,800,000
Present worth of total credit:	$334,200,000
Average annual credit (benefit):	$10,600,000

The basis for the credit for the extension of the useful life is that the replacement cost for the existing bridge will be deferred 96 years. The estimated first cost of replacing the St. Claude Avenue bridge is built into the project first costs for the new IHNC Lock project and this advanced bridge replacement credit was added to the overall average annual benefits estimated for the new lock.

11. Benefits from Reduction in Required Tripping Vessels

In the existing condition, the Inner Harbor Navigation Canal Lock operates under a "ready-to-serve" operating policy due to the dimensions and characteristics of the industrial canal and congested nature of the lock facility. Unlike most other USACE lock projects where tow packages are permitted to reconfigure at the lock facility itself, tow packages wishing to navigate the canal must resize into configurations small enough to transit the facility outside of the canal before they are formally placed into the lock's queue and given permission to transit. To accomplish their transits, these larger tows must employ additional motorized towing vessels, referred to as “trip boats,” either from their own companies or one of several independent companies that operate in the vicinity of the project. The larger towing packages will be broken down into smaller groupings of barges, each with their own trip boats, outside of the industrial canal, individually lock through the existing lock facility, and then reconfigure back into their larger configurations on the other side to continue the movements to their destinations.

This ready-to-serve operating policy minimizes the delay for other users in the system by minimizing the time the lock facility is committed to processing individual tow packages. Reconfiguring, known commonly as cutting, tow packages at a lock facility usually increases the processing time of individual tows by 150% or more, time that could otherwise be devoted to processing other tows.

However, this policy comes with an increased cost to shippers by requiring tow companies to employ and utilize extra powered vessels to facilitate their lockages. Local port captains that utilize IHNC Lock provided an estimate of 3.5 to 4.0 hours per trip boat needed to break down the tow packages, transit the lock facility, and reconfigure on the other side. Towing companies and their customers must pay for these extra trip boats to facilitate their lockages.

Utilizing LPMS data and the ARNOLT model for the existing condition, USACE estimates that 0.55 trip boats are required for each lockage operation. While many tow packages complete their entire movement in sizes small enough to transit the lock in a single process, it is not unusual for three or more trip boats to be required to complete a single lockage for larger towing packages. This appreciably increases the costs to transit the IHNC Lock project in the existing condition.

This extra expense could be anticipated to be completely removed in the With-Project Condition if the larger lock eliminates need for the ready-to-serve operating policy by sufficiently reducing congestion, but the With-Project capacity analysis assumed that ready-to-serve policy and associated lock processing times would remain. 0.07 trip boats per tow package was estimated in for the With-Project Condition based on ARNOLT simulation results. These two values, 0.55 in the existing and 0.07 in the with-project, were applied to the estimated equilibrium annual number of tow transits from NIM’s outputs to develop a net average annual savings between the existing and with-project conditions, reflective of the with-project’s optimized tow configurations and ability to serve a higher level of traffic demand. USACE’s average vessel operating costs for a power vessel was applied to the annual trip boat estimates in each condition to derive a conservative estimate of average savings. Many tow companies do not utilize their own vessels for this process but pay per transit for other companies who specialize in providing this tripping service and would be assumed to pay a higher average cost than a vessel employed by the towing companies.

Figure 11 - Existing vs WPC – 110x900 Lock - Estimated Trip Boats

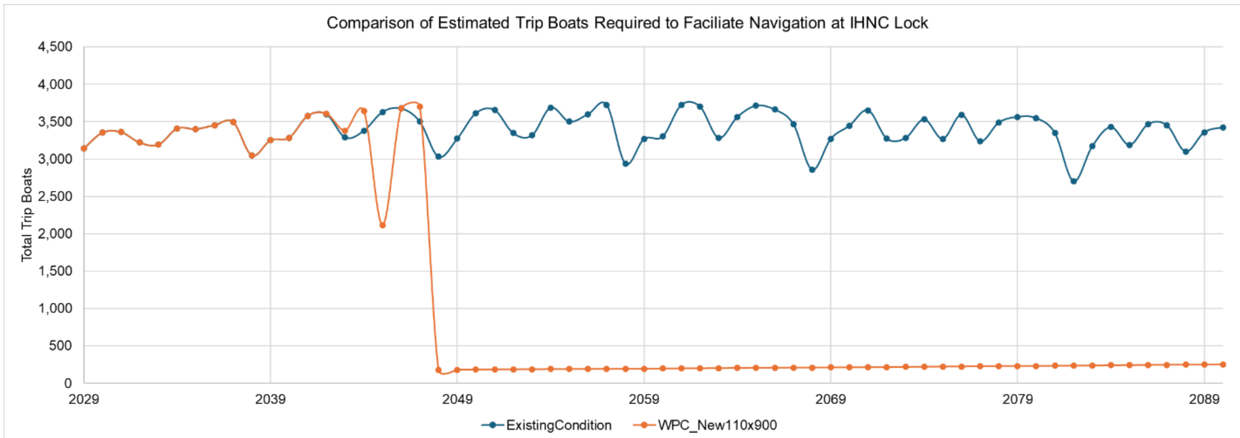


Table 10 – Summary of Average Annual Net Trip Boat Savings Estimate

	Existing Condition			WPC_New110x900		
Forecast Scenario	**Low**	**Ref**	**High**	**Low**	**Ref**	**High**
Average Estimated Trip Boats 2029 - 2048	3,286	3,365	3,197	3,082	3,175	3,089
Average Estimated Trip Boats 2049-2090	3,466	3,372	2,530	169	221	294
Average Trip Boat Costs per Year 2029-2090	$ 6,300,000	$ 6,300,000	$ 5,100,000	$ 1,900,000	$ 2,000,000	$ 2,100,000
Average Annualized Net Trip Boat Savings				$ 6,000,000	$ 5,800,000	$ 4,300,000

12. National Economic Development Evaluation Results

This economic addendum changed several elements associated with analysis and implementation of the recommended plan from the 2017 GRR. Only the RP, a new 110 feet wide by 900 feet long and 22 feet deep navigation lock, and the No Action were analyzed for this economic update. The first years of modeling (2029), construction (2032), and online date (2047) were revised based on the current best estimates provided by the PDT, and the construction period was increased from 13 years to 19 years. The expected annual benefits for 2047 through 2096 were converted to an annual average equivalent value using the FY25 federal water resources discount rate of 3.0% over the 50-year period of analysis. Total cost and estimated annual costs for the project plans includes the construction costs and operation and maintenance costs. Construction costs, along with a schedule of expenditures, were used to determine the interest during construction and total investment costs at the end of construction.

12.1. Economic Analysis Basis from 2017 GRR

The 2017 Inner Harbor Navigation Canal (IHNC) Lock Replacement General Reevaluation Report (GRR) assessed the feasibility of improving navigation efficiencies for traffic on the GIWW and the Mississippi River via the IHNC lock in New Orleans, Louisiana. The purpose of a new lock is to provide a more efficient locking process by increasing lock capacity, to increase the reliability of the lock, as well as to reduce operation and maintenance costs and related delays. The completed GRR evaluated six alternatives, one No-Action and 5 different structural replacements of different sizes. Refer to the previous GRR and its appendices for information on the full scope of the evaluation, methods, and findings. .

After completing the planning assessment associated with the 2017 GRR, the US Army Corps of Engineers selected a structural replacement alternative, replacing the existing Inner Harbor Navigation Canal Lock with a modern 900 feet long by 110 feet wide and 22 feet deep (NAVD88) navigation lock north of the Claiborne site. A benefit/cost analysis was conducted to evaluate the economic feasibility of each of the lock replacement plans. Expected annual benefits for 2032 through 2082 were converted to an equivalent annual value using the FY16 federal interest rate of 2.875%, and a 50-year period of analysis. Total cost and estimated annual costs for the project plans includes the construction costs and operation and maintenance costs. Construction costs, along with a schedule of expenditures, were used to determine the interest during construction and total investment costs at the end of construction. For the 2017 GRR, implementation (or construction period) was 13 years, from 2019 to 2032. The first year of the construction period was set at 2019 (first possible budget year), resulting in a base year of 2032, and a final analysis period year of 2084.

Figure 12 shows Cost Summary and Average Annual Benefits of the final array of plans as presented in the 2017 GRR. All plans were justified (value>1.0). Plan 3, the 900-feet-long by 110-feet-wide lock, had the highest benefit cost ratio at 4.78:1 and generated the greatest net excess benefits and was identified as the NED plan.

Figure 12 - 2016 Average Annual Benefit - Cost Summary

Inner Harbor Navigation Canal Lock Replacement GRR Average Annual Benefit - Cost Summary[1] Elastic Movement-Level Demand[2] (Dollars, Average annual 2.875% discount/amortization rate, 2019-2082 with 2032 base year)				
Lock Alternative	Plan 2: 75' x 900'	Plan 3: 110' x 900'	Plan 4: 75' x 1,200'	Plan 5: 110' x 1,200'
First Cost of Construction	$937,730,000	$952,110,000	$972,850,000	$1,002,530,000
Interest During Construction	$210,120,000	$213,910,000	$218,610,000	$225,850,000
Total Investment	$1,147,850,000	$1,166,020,000	$1,191,460,000	$1,228,380,000
Average Annual Const. Cost	$43,560,000	$44,250,000	$45,210,000	$46,610,000
Average Annual Increm. O&M	$1,370,000	$1,350,000	$1,440,000	$1,440,000
Total Average Annual Cost	$44,930,000	$45,600,000	$46,650,000	$48,050,000
Total Average Annual Benefits	$214,680,000	$217,920,000	$216,790,000	$218,270,000
Net Excess Benefits	$169,760,000	$172,310,000	$170,140,000	$170,220,000
B/C Ratio	4.78	4.78	4.65	4.54

[1]PCXIN-RED 20-AUG-2016 preliminary draft NIM results.

[2]GEC Reference Traffic Demand Forecasts and Wilson Calcasieu study commodity group elasticities.

12.2. Economic Analysis Results from 2025 Update

The figures and tables below provide summaries of the analysis results from the 2025 update of the economic analysis for the new 110 by 900 feet lock as evaluated using the Navigation Investment Model. The price level for this analysis is Q1 FY25, the applicable federal water resources discount rate is 3.0%. The first year of modeling is 2029, first year of construction is 2032, and online date for full operations of the new lock and navigation within the canal is 2047. The 50-year benefits stream is from 2047-2096. While construction of the new lock is estimated for completion in 2045, the navigation industry is unable to take advantage of the new lock dimensions and resulting operations until the current lock is deconstructed and construction of a new St. Claude Avenue bridge is completed.

The project first cost of the RP is $4.74 Billion. The project first cost includes sunk costs of $171 Million, including $138 million of sunk pre-construction engineering and design (PED) costs, and $33 Million of sunk construction costs. The project first cost excluding sunk PED is $4.6 Billion. The average annual cost, excluding sunk PED, is $222.5 Million, including implementation costs, interest during construction, and OMRR&R costs.

Results are displayed for the three primary traffic demand scenarios utilized for this analysis, Low Forecasted Demand, Reference Forecasted Demand, and High Forecasted Demand. The analysis of the RP resulted in average annual benefits of $229.1 Million, based on the Reference Case Traffic Forecast, resulting in net benefits of $6.5 Million, and a benefit to cost ratio of 1.03. The Low Traffic Forecast scenario results in average annual benefits of $132.4 Million, net benefits of negative $90.2 Million, and a benefit to cost ratio of 0.6, while the High Traffic Forecast scenario results in average annual benefits of $415.7 Million, net benefits of $193.1 Million, and a benefit to cost ratio of 1.9.

Figure 13 displays the estimated annual system transportation savings over the period of analysis for shippers utilizing the Inner Harbor Industrial Canal and Gulf Intracoastal Waterway within the study area. Table 11 summarizes the average annual benefits between key categories of the analysis along with the aggregated total.

Figure 13 – Estimated Annual System Transportation Savings for New 110x900 Lock, Low Forecast Demand Scenario

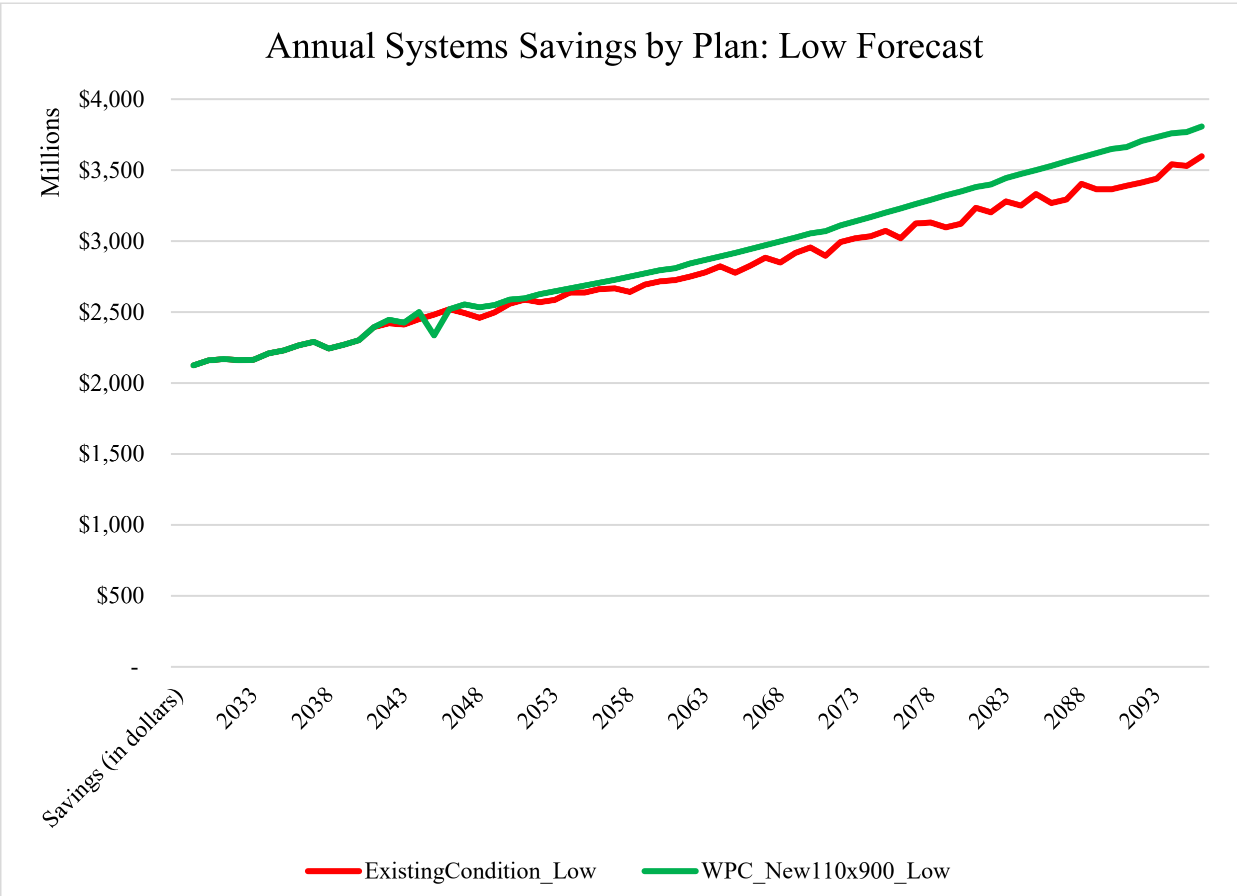


Table 11 – Benefits Summary: New 110 by 900 Lock - Low Forecast Scenario

Benefits Summary: WPC - New110x900, IHNCLockStudy_2025_01_LOW Forecast Scenario (FY 2025 dollars, planning period 2029-2096 with base year 2047 at 3%)			
Benefit Category	**Basis**	**WPCAlt01New110x900**	**Recommended Plan Benefits**
System Transportation Surplus			
Full Operations (no service disruption)	$5,017,500,000	$5,054,800,000	$37,300,000
Impacts from Scheduled Maintenance	($62,100,000)	($19,300,000)	$42,800,000
Impacts from River/Project Closure Shipper Response	$0	$0	$0
Impacts from Unscheduled Over Capacity Diversions to Land	$0	$0	$0
Impacts from Unscheduled Failure-Repair Service Disruptions	($32,600,000)	($1,700,000)	$30,900,000
Estimated AAE Transportation Surplus	$4,922,800,000	$5,033,800,000	$111,000,000
	$0	$0	
Other AAE Alternative Benefits (costs less than WOPC) *	$0	$0	
Scheduled Repair Cost	$0	$0	
Inner Harbor Lock	$6,400,000	$2,200,000	$4,200,000
IHNC Lock - new location	$0	$1,700,000	$0
Unscheduled Repair Cost	$0	$0	$0
Inner Harbor Lock	$1,200,000	$500,000	$800,000
IHNC Lock - new location	$0	$800,000	$0
Random Minor Cost	$0	$0	$0
Inner Harbor Lock	$0	$0	$0
IHNC Lock - new location	$0	$0	$0
Normal O&M Cost	$0	$0	$0
Inner Harbor Lock	$800,000	$800,000	$0
IHNC Lock - new location	$0	$0	$0
Normal O&D Cost	$0	$0	$0
Inner Harbor Lock	$0	$0	$0
IHNC Lock - new location	$0	$0	$0
Advanced Bridge Replacement	$0	$0	$0
Inner Harbor Lock	$0	$0	$10,400,000
IHNC Lock - new location	$0	$0	$0
Trip Boat Savings	$0	$0	$0
Inner Harbor Lock	$0	$0	$6,000,000
IHNC Lock - new location	$0	$0	$0
Estimated AAE Other Benefits (costs avoided)			$21,400,000
AVERAGE ANNUAL PROJECT BENEFITS			**$132,400,000**

** FWPC maintenance costs above the FWOPC costs are itemized on the cost side and lowered maintenance costs are itemized on the benefit side per the Budget EC. Normal and non-normal (cyclical) maintenance costs are tracked separately.*

Figure 14 - Estimated Annual System Transportation Savings for New 110x900 Lock, Reference Forecast Demand Scenario

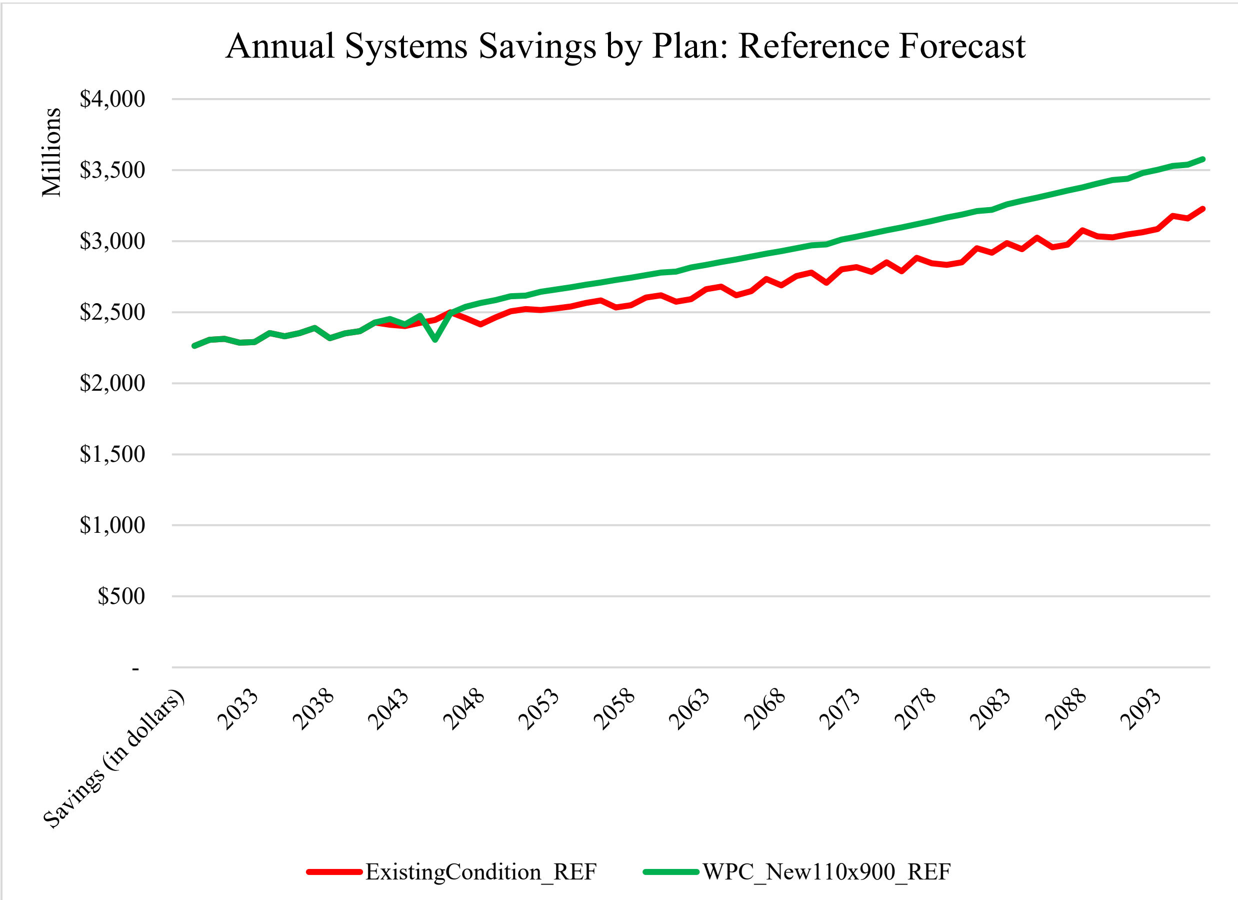


Table 12 – Benefits Summary: New 110 by 900 Lock - Reference Forecast Scenario

Benefits Summary: WPC - New110x900, IHNCLockStudy_2025_01_REF Forecast Scenario (FY 2025 dollars, planning period 2029-2096 with base year 2047 at 3%)			
Benefit Category	Basis	WPCAlt01New110x900	Recommended Plan Benefits
System Transportation Surplus			
Full Operations (no service disruption)	$4,949,800,000	$5,078,100,000	$128,300,000
Impacts from Scheduled Maintenance	($71,700,000)	($31,300,000)	$40,400,000
Impacts from River/Project Closure Shipper Response	$0	$0	$0
Impacts from Unscheduled Over Capacity Diversions to Land	$0	$0	$0
Impacts from Unscheduled Failure-Repair Service Disruptions	($43,300,000)	($3,900,000)	$39,400,000
Estimated AAE Transportation Surplus	$4,834,800,000	$5,042,900,000	$208,100,000
Other AAE Alternative Benefits (costs less than WOPC) *			
Scheduled Repair Cost			
Inner Harbor Lock	$6,400,000	$2,200,000	$4,200,000
IHNC Lock - new location	$0	$1,700,000	$0
Unscheduled Repair Cost	$0	$0	$0
Inner Harbor Lock	$1,200,000	$500,000	$800,000
IHNC Lock - new location	$0	$800,000	$0
Random Minor Cost	$0	$0	$0
Inner Harbor Lock	$0	$0	$0
IHNC Lock - new location	$0	$0	$0
Normal O&M Cost	$0	$0	$0
Inner Harbor Lock	$800,000	$800,000	$0
IHNC Lock - new location	$0	$0	$0
Normal O&D Cost	$0	$0	$0
Inner Harbor Lock	$0	$0	$0
IHNC Lock - new location	$0	$0	$0
Advanced Bridge Replacement	$0	$0	$0
Inner Harbor Lock	$0	$0	$10,400,000
IHNC Lock - new location	$0	$0	$0
Trip Boat Savings	$0	$0	$0
Inner Harbor Lock	$0	$0	$5,800,000
IHNC Lock - new location	$0	$0	$0
Estimated AAE Other Benefits (costs avoided)			$21,200,000
AVERAGE ANNUAL PROJECT BENEFITS			$229,300,000

* FWPC maintenance costs above the FWOPC costs are itemized on the cost side and lowered maintenance costs are itemized on the benefit side per the Budget EC. Normal and non-normal (cyclical) maintenance costs are tracked separately.

Figure 15 – Comparison of Average Vessel Transit Time Estimates, Reference Demand, Existing Condition and 110 x 900 New Lock

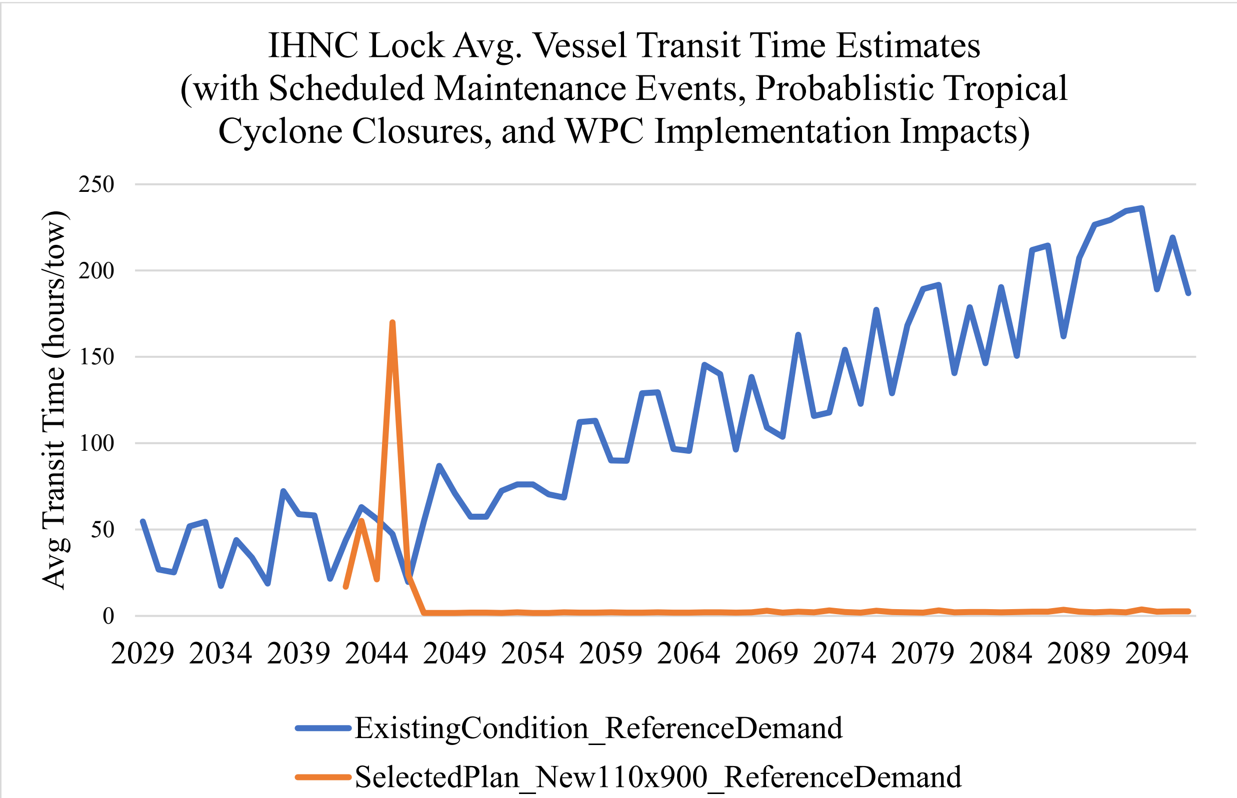


Figure 16 - Estimated Annual System Transportation Savings for New 110x900 Lock, High Forecast Demand Scenario

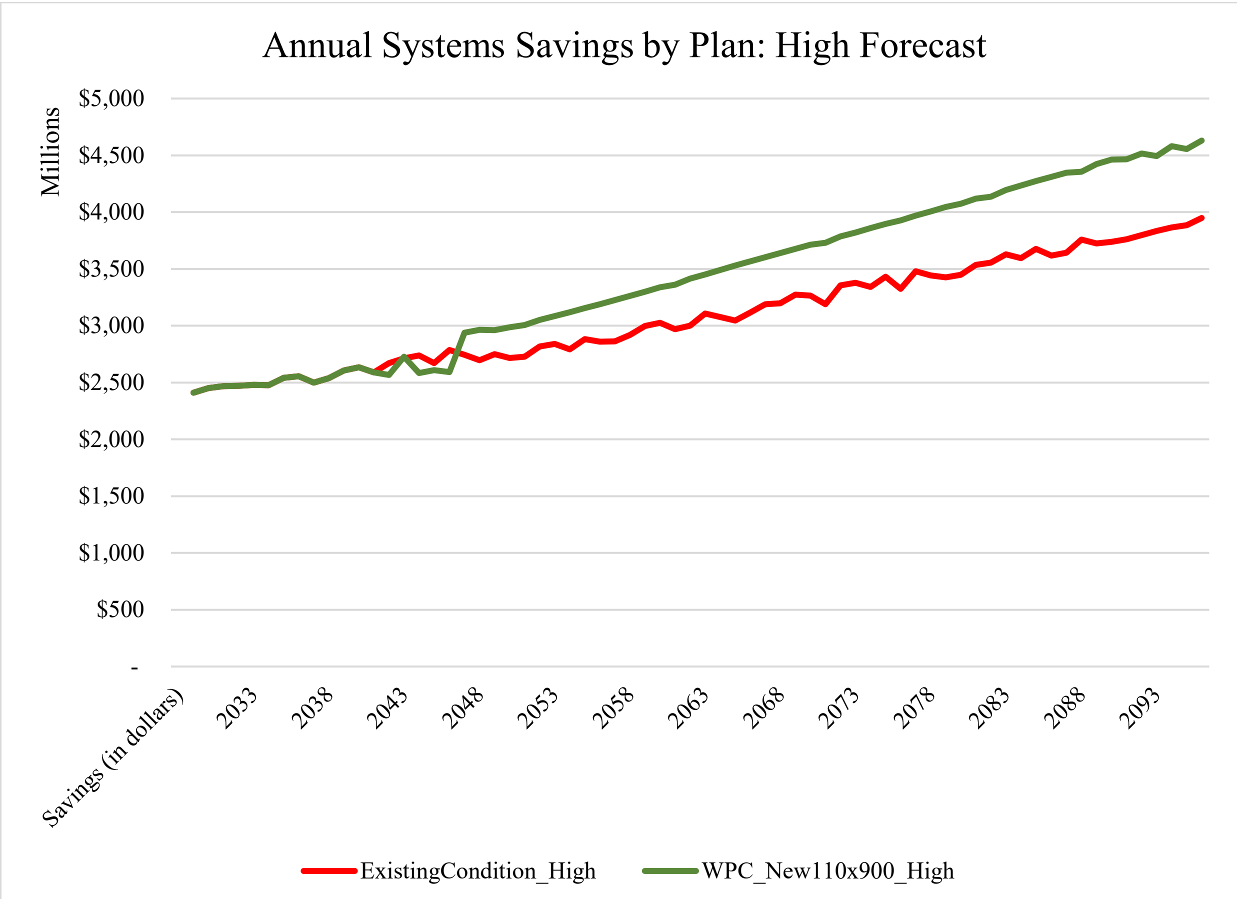


Table 13 - – Benefits Summary: New 110 by 900 Lock - High Forecast Scenario

Benefits Summary: WPC - New110x900, IHNCLockStudy_2025_01_HIGH Forecast Scenario (FY 2025 dollars, planning period 2029-2096 with base year 2047 at 3%)			
Benefit Category	Basis	WPCAlt01New110x900	Recommended Plan Benefits
System Transportation Surplus			
Full Operations (no service disruption)	$5,604,300,000	$5,928,000,000	$323,700,000
Impacts from Scheduled Maintenance	($56,500,000)	($28,000,000)	$28,500,000
Impacts from River/Project Closure Shipper Response	$0	$0	$0
Impacts from Unscheduled Over Capacity Diversions to Land	($100,000)	$0	$100,000
Impacts from Unscheduled Failure-Repair Service Disruptions	($86,800,000)	($43,000,000)	$43,800,000
Estimated AAE Transportation Surplus	$5,460,900,000	$5,857,000,000	$396,100,000
	$0	$0	
Other AAE Alternative Benefits (costs less than WOPC) *	$0	$0	
Scheduled Repair Cost	$0	$0	
Inner Harbor Lock	$6,400,000	$2,200,000	$4,200,000
IHNC Lock - new location	$0	$1,700,000	$0
Unscheduled Repair Cost	$0	$0	$0
Inner Harbor Lock	$1,200,000	$500,000	$800,000
IHNC Lock - new location	$0	$800,000	$0
Random Minor Cost	$0	$0	$0
Inner Harbor Lock	$0	$0	$0
IHNC Lock - new location	$0	$0	$0
Normal O&M Cost	$0	$0	$0
Inner Harbor Lock	$800,000	$800,000	$0
IHNC Lock - new location	$0	$0	$0
Normal O&D Cost	$0	$0	$0
Inner Harbor Lock	$0	$0	$0
IHNC Lock - new location	$0	$0	$0
Advanced Bridge Replacement	$0	$0	$0
Inner Harbor Lock	$0	$0	$10,400,000
IHNC Lock - new location	$0	$0	$0
Trip Boat Savings	$0	$0	$0
Inner Harbor Lock	$0	$0	$4,300,000
IHNC Lock - new location	$0	$0	$0
Estimated AAE Other Benefits (costs avoided)			$19,700,000
AVERAGE ANNUAL PROJECT BENEFITS			$415,800,000

* FWPC maintenance costs above the FWOPC costs are itemized on the cost side and lowered maintenance costs are itemized on the benefit side per the Budget EC. Normal and non-normal (cyclical) maintenance costs are tracked separately.

Table 14 – Benefit-Cost Analysis Summary Results – All Forecast Scenarios

COST BENEFIT ANALYSIS - IHNCLockStudy_2025 (FY 2025 dollars, planning period 2026-2096 with base year 2047 at 3%)			
	WPC - New110x900		
Metric	**Low Traffic Forecast Scenario**	**Reference Traffic Forecast Scenario**	**High Traffic Forecast Scenario**
Total Cost-Benefit Analysis			
Recommended Plan Benefits	$ 132,400,000	$ 229,100,000	$ 415,700,000
Recommended Plan Total Costs	$ 222,500,000	$ 222,500,000	$ 222,500,000
Net Benefits	$ (90,200,000)	$ 6,500,000	$ 193,100,000
BCR	0.59	1.03	1.9

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