Limited Reevaluation Report
Appendix C:
Economics Appendix

U.S. Army Corps of Engineers
New York District

January 2004

CURRENT ECONOMICS OF THE RECOMMENDED PLAN

1. In the *Chief's Report* of May 2, 2000, the NED benefits of the Recommended Plan were reported as $3,522,410,000, NED costs were reported as $2,272,244,000, and the resulting BCR was reported as 1.6. More than three years have passed since that report was approved. That fact, combined with the fact that this document will be used to support the proposed PCA with respect to the HDP means that an economic reevaluation is required per ER 1105-2-100, para. D-4.b(1)(d). A summary, in annualized terms, of the changes reported in this economic reevaluation is in Table 1, below.

Table 1: Tabulation of Annual Average Current Costs and Benefits

	Latest Approved[1]	Current Estimates[2]	Difference	Reason for Difference
Benefit Category				
Transportation Cost Reduction	$238,500,000	$270,929,000	$32,429,000	adjustment for change in discount rate, vessel operating costs, commodity forecast, *et al*.
Cost Category				
Construction of GNF	$113,021,000	$77,219,000	($35,802,000)	reduction of quantities reflecting actual results of predecessor project dredging and consolidation
LERR	$1,495,000	$1,853,000	$358,000	refined cost of Real Estate for mitigation
Local Service Facilities	$6,625,000	$2,444,000	($4,181,000)	Sponsor review revealed that the latest approved cost was total, and not incremental.
Federal Aids to Navigation	$9,666	$8,421	($1,245)	
Owner Cost for Utility Relocations	$1,378,000	$1,318,000	($60,000)	additional utility crossing identified
Owner Cost for Facility Removals	$473,000	$434,000	($39,000)	Revised channel alignment and more detailed structural has significantly changed this line item. Please see the report for details.
Incremental O&M	$73,000	$26,000	($47,000)	improved estimating of O&M cycle period and adjustment for change in discount rate
Interest During Construction	$32,841,000	$17,623,000	($15,218,000)	reduction in above line items and adjustment for change in discount rate
Net Benefits	$86,316,000	$161,525,000	$75,209,000	
Benefit / Cost Ratio	1.6	2.5	0.9	

1. *Report of the Chief of Engineers on the New York and New Jersey Harbor Navigation Study*, 2 May 2000. The figures reported reflect a discount rate of $6^{5}/_{8}$% and are in terms of the price level of October 1999.
2. The figures reported reflect a discount rate of $5^{5}/_{8}$% and are in terms of the price level of FY 2004.

2. The scope of the required economic reevaluation is described in ER 1105-2-100, para. D-4.(b)(3). Note that adjustment of the project benefits estimate in Table 1 is based upon the following updates to conditions identified in the *Chief's Report*:

a. Modify the future container-handling capacity at the Port, based upon updated acreage and productivity estimates;
b. Modify the future container-handling capacity at the Port, based upon updated acreage and productivity estimates;
c. Apply an updated commodity forecast to the analysis;
d. Apply updated vessel operating costs to the analysis;
e. Rediscount using the FY '04 discount rate for water resources projects of $5^{5}/_{8}$%;
f. Calculate the resulting current estimates of project benefits and project costs; and
g. Calculate the revised benefit-cost ratio for the Recommended Plan.

3. Each component of the adjustment process is described below. As presented in Table 1, the results of this adjustment procedure indicate that the Recommended Plan remains economically justified.

4. The estimate of project benefits in the *Chief's Report* was based entirely on transportation costs avoided in the with-project condition. Furthermore, that benefits estimate was restricted to costs avoided in the marine transportation of containerized cargo. This is so because the Recommended Plan entails improved access for vessels bound for or departing from the various container-handling facilities in the Port.

CONTAINER TERMINAL ACREAGE

5. Container terminals at the Port are typically operated under long term lease arrangements between the terminal operator and the land owning city or agency. At Port Newark and Howland Hook, the PANYNJ holds the lease on the land and sub-leases the facility to the terminal operator. Global Marine is the land owner and operator of that container facility. All of the lease arrangements extend well into the study period with the exception of the container terminal at Red Hook, which is not expected to be in operation during the study period and is not included in the benefits analysis.

Table 2 Terminal Operators and Lease Arrangements				
Terminal Complex	**Land Owner**	**Lease Holder (lease expiration)**	**Marine Terminal**	**Terminal Operator (lease expiration)**
New Jersey				
Port Elizabeth	PANYNJ		Maher	Maher (2029)
			APM (Maersk)	APM (2028)
Port Newark	City of Newark	PANYNJ (2031)	Port Newark Container Terminal (PNCT)	PNCT (2029)
Jersey City	Global Marine	Global Marine	Global Marine	Global Marine
New York				
Red Hook	PANYNJ & NYC		Red Hook	American Stevedore (2004)
Howland Hook	New York City	PANYNJ (2033)	Howland Hook	Howland Hook Container Services (2019)

6. Table 3, below, presents the Port's expected container terminal acreage for both the without- and with-project conditions. Acreage reductions at Howland Hook and Port Newark-Elizabeth are due to planning adjustments made by PANYNJ. The acreage allocation for the South Brooklyn terminal is based on the condition of a cross-harbor freight operation. The current acreage estimate for the Port Jersey peninsula assumes continued use of the existing 100 acre Global Marine Terminal and conversion of the smaller of the two North East Auto Terminal (NEAT) properties into a container-handling facility, as planned by the PANYNJ. Note, however, that benefit estimates conducted for this LRR are based on existing container terminal acreage at the Global Marine terminal.

7. The acreage reduction for container terminals at the Port Jersey peninsula is due to the uncertainty of future container terminal development at the former Military Ocean Terminal – Bayonne (MOTBY) site. The Bayonne Local Redevelopment Authority (BLRA) has received expressions of interest (closed November 2003) from container terminal developers. To those who submitted conforming expressions of interest, BLRA will issue requests for proposals (January 2004), to which responses are due in April 2004. Selection of a proposal and a construction contractor is scheduled for June 2004; however, the exact size, configuration, and capacity of a potential container terminal remains unknown at this

time. Therefore the MOTBY site is not included in the estimate of Port-wide container-handling capacity.[1]

Table 3
Container Terminal Acreage (Without- and With-Project Conditions)
***Chief's Report* (1999) to LRR Comparison (2003)**

	Port Newark/Elizabeth	Howland Hook	Port Jersey	South Brooklyn	Total
Chief's Report	1050	147	310	100	1607
LRR	1000	197	170*	100	1467
Difference	(50)	50	(140)	(0)	(140)

Note: * Port Jersey benefits are based on existing 100 acres at Global Marine Terminal only

CONTAINER TERMINAL CAPACITIES

8. PANYNJ and the various terminal operators have provided current data and updated investment plans for facilities with respect to cranes, berths, terminal acreage, and container lifts per acre per year at the Port's container terminals. These investment plans include reductions of gate constraints and development of the Port Intermodal Distribution Network (PIDN). The container-handling capacity for each container terminal is estimated as the product of terminal acreage and the projected average lifts per acre per year. In addition, container-handling capacities for vessels requiring channel depths greater than 45 ft are based upon the expected number of berths at each terminal to be deepened to depths greater than 45 ft MLW.

9. Table 4, below, presents a comparison between the container terminal capacities estimated for the Chief's Report and the updated container terminal capacities estimated for this LRR. Although there has been a reduction in expected container terminal acreage, as explained above, the LRR container-handling capacity projections are larger than those in the

[1] The Office of Management and Budget (OMB) established a condition precedent to Federal government cost sharing of the Port Jersey Channel portion of the Recommended Plan. The condition precedent stems from a letter from the Acting Deputy Associate Director for Energy and Science at OMB to the then Assistant Secretary of the Army (Civil Works) Joseph W. Westphal. The letter specifies that a container facility must be operational at the MOTBY site prior to the construction of the 50-foot deepening of the Port Jersey Channel. This mandate was slightly adjusted in the Energy and Water Appropriations Act of 2004, which requires commitments for construction of container-handling facilities. The Chief of Engineers incorporated the suggested item of local cooperation into the *Chief's Report*. Note that the condition precedent applies only to the Port Jersey Channel portion of the Recommended Plan; it is not a bar to Federal participation in cost sharing the PJ-41 project. As of this writing, the condition precedent to Federal participation in cost sharing the Port Jersey Channel portion of the Recommended Plan has not been satisfied. The eventual satisfaction of the condition precedent will be accomplished with the selection of a proposal and a construction contractor, scheduled for June 2004.

Chief's Report because of projected increases in productivity (lifts per acre) and increases in the number of berths to be deepened to 50 ft MLW.

Table 4
Container-Handling Capacity (Without and With-Project Conditions)
***Chief's Report* (1999) to LRR Comparison (2003)**

	2010	2020	2030	2040	2050	2060
	Lifts per Acre					
Chief's Report	1,660	2,410	3,170	3,500	3,500	3,500
LRR	3,400	3,600	4,500	4,500	4,500	4,500
Difference	1,740	1,190	1,330	1,000	1,000	1,000
	Overall Container-Handling Capacity (TEUs)					
Chief's Report	4,684,520	6,801,020	8,945,740	9,877,000	9,877,000	9,877,000
LRR	7,901,260	8,366,040	10,457,550	10,457,550	10,457,550	10,457,550
Difference	3,216,740	1,565,020	1,511,810	580,550	580,550	580,550
	Container-Handling Capacity for Vessels Requiring More Than 45 ft MLW					
Chief's Report	2,804,000	4,074,000	5,354,000	5,912,000	5,912,000	5,912,000
LRR	6,456,260	6,836,040	8,545,050	8,545,050	8,545,050	8,545,050
Difference	3,652,260	2,762,040	3,191,050	2,633,050	2,633,050	2,633,050
Note: All handling capacity calculated using 1.7 TEUs per lift						

COMMODITY FORECAST

10. The volume of containers handled at the Port since the publication of the *Chief's Report* has grown more rapidly than anticipated by the commodity forecast used in the *Chief's Report*. Table 5, below, compares the forecasted total volume of TEUs used in the *Chief's Report* and the observed volume. The commodity forecast used in this LRR has been updated in the sense that observations from 1999 through 2002 have been added to the data set and the model has been re-estimated incorporating revised trends observed since the development of the *Chief's Report* forecast.

Table 5 Comparison Between *Chief's Report* Forecast and Observed Total TEU Volume 1998 - 2002				
Year	*Chief's Report* Forecasted Total (TEUs)	*Chief's Report* Forecasted Annual Growth Rate	Observed Total (TEUs)*	Annual Rate Of Growth Of Observed Total
1998	2,546,514	4.95%	2,465,993	0.37%
1999	2,663,380	4.59%	2,828,878	14.72%
2000	2,798,032	5.06%	3,050,036	7.82%
2001	2,934,170	4.87%	3,313,275	8.63%
2002	3,080,803	5.00%	3,749,014	13.15%
*Source: PANYNJ				

11. The commodity forecast generated for this LRR is based upon a new run of the same forecasting model used to generate the commodity forecast for the *Chief's Report*. Differences between the *Chief's Report* forecast and the current forecast, including differences in total TEU volume and differences in relative import and export TEU volumes, are largely due to three long-term developments in international trade that have become increasingly important since the forecast conducted for the *Chief's Report*. These developments include the rate of increase in imports from China, the slower growth of US export trade relative to import trade, and growth in trade along the "all-water" route between the Port and Asia. The overall effect of these developments has been to increase the projected volume of containerized imports for the Port and decrease the projected growth of full export containers. Table 6 presents the long term average annual growth gates for the *Chief's Report* and LRR commodity forecasts. Overall, the long term growth rates for both forecasts are similar and are significantly less than the explosive growth rates observed since 1998.

Table 6 Forecasted Long-Term Annual TEU Volume Growth Rates (Without and With-Project Conditions) *Chief's Report* (1999) to LRR Comparison (2003)	
Chief's Report	
Total TEU Volume	3.06%
TEU Volume on Vessels Requiring More Than 45 ft MLW	3.32%
LRR	
Total TEU Volume	3.10%
TEU Volume on Vessels Requiring More Than 45 ft MLW	3.32%

12. Container vessels already dominate vessel traffic at the Port in terms of port calls, and as container traffic grows more rapidly than other cargo types, the number of containership calls will continue to increase relative to total calls at the Port. Currently liquid bulk cargo is the largest commodity group by tonnage transiting the Port; however, by 2020, combined container import and export tonnage will exceed combined liquid bulk import and export tonnage. By about 2030, container import tonnage is projected to be greater than liquid bulk import tonnage, making container imports the leading import category in tonnage terms by vessel service type and direction. Towards the end of the forecast period, containership tonnage will exceed the combined tonnage of all other vessel types.

13. More than three million full and empty TEUs moved through the port in 2001. Total TEU volume is projected to grow to nearly 12 million TEUs in 2030, and to over 27 million TEUs in 2065, a more than nine-fold increase. The pattern of full containers inbound and many empties outbound is expected to continue due to expected higher growth in containerized import volume versus containerized export volume. The number of empty TEUs outbound will grow from nearly one million TEUs in 2010 to nearly 8 million TEUs in 2065, an eight-fold increase. Figure 1 and Table 7, below, present comparisons between the *Chief's Report* and LRR commodity forecasts.

Figure 1: Current Commerce Forecast v. *Chief's Report* Commerce Forecast

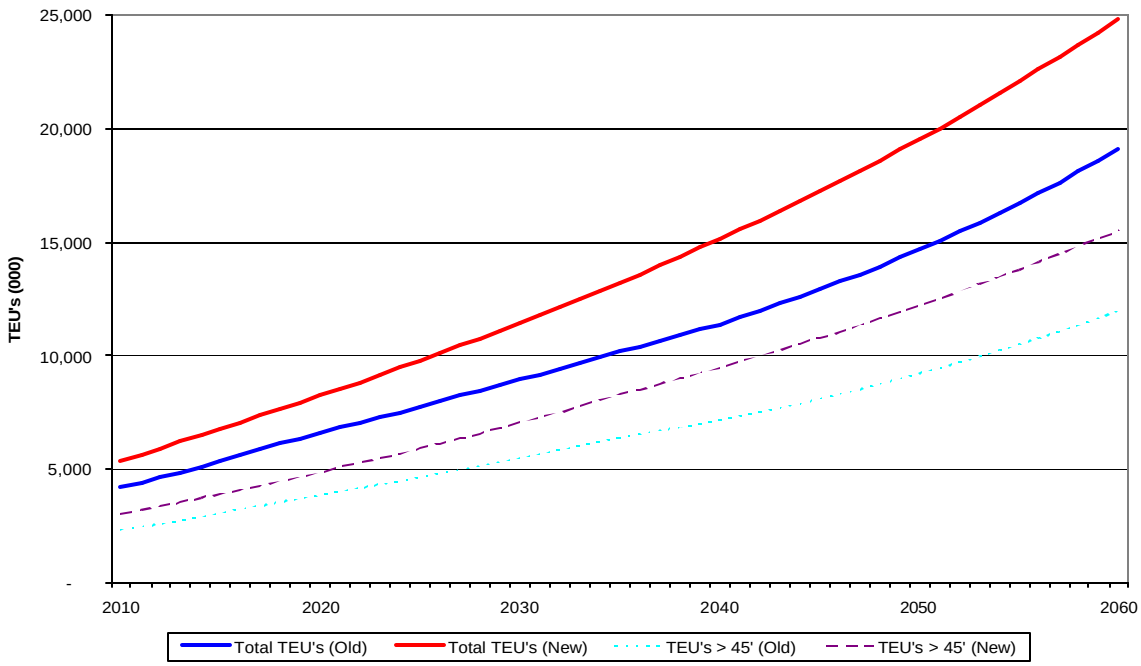


Table 7 Containerized Commodity Forecasts (Without- and With-Project Conditions) *Chief's Report* (1999) to LRR Comparison (2003)						
	2010	2020	2030	2040	2050	2060
	Imports (TEUs)					
Chief's Report	2,300,117	3,422,140	4,474,074	5,493,824	7,069,000	9,183,086
LRR	2,760,262	4,209,472	5,852,453	7,747,237	9,997,546	12,701,698
Difference	460,145	787,332	1,378,379	2,253,413	2,928,546	3,518,612
	Exports (TEUs)					
Chief's Report	1,942,875	3,179,733	4,463,720	5,898,153	7,611,832	9,937,258
LRR	2,653,420	4,039,097	5,607,587	7,417,347	9,569,184	12,161,390
Difference	710,545	859,364	1,143,867	1,519,194	1,957,352	2,224,132
	Total (TEUs)					
Chief's Report	4,242,993	6,601,873	8,937,793	11,391,977	14,680,832	19,120,344
LRR	5,413,682	8,248,570	11,460,041	15,164,584	19,566,730	24,863,089
Difference	1,170,689	1,646,697	2,522,248	3,772,607	4,885,898	5,742,745
Note: Includes loaded and empty containers						

Capacity Constraint Impacts on the Commodity Forecast

14. The estimate of containerized cargo transportation cost savings, as calculated for the *Chief's Report* and this LRR, is based on four major elements:

- The commerce forecast;
- The fleet forecast;
- The loading pattern; and
- Vessel operating costs.

The Commerce Forecast

15. The first element listed, the commerce forecast, is subject to a capacity constraint. If, in any given year, the Port's container-handling capacity is insufficient to accommodate all of the containers that the commerce forecast indicates that marine carriers would like to pass through those facilities, the benefits estimate for that year must be reduced. Benefits can only be claimed on that number of containers that can be passed through the Port's container-

handling facilities, given their capacity. The *Chief's Report* projected that container-handling capacity, both overall and for vessels requiring berths deeper than 45 ft MLW, constrained project benefits. This LRR presents similar findings below.

16. Table 8 presents the updated overall container-handling capacity of the harbor in terms of annual TEUs. This table also presents the updated projected total quantity of container-handling services (measured in TEUs) demanded and the percentage of that quantity that can be satisfied, given the port's container-handling capacity. Although the updated container-handling capacity estimate has increased over the estimate generated for the *Chief's Report*, beginning in the mid-2020's the projected total Port container-handling capacity will fall short of total quantity of container-handling services (measured in TEUs) demanded. A similar capacity constraint was identified in the *Chief's Report*. Therefore, in this LRR as in the *Chief's Report*, transportation cost savings related to navigation improvements in the Port are constrained by overall container-handling capacity.

Table 8
Overall Container-Handling Capacity Constraint (TEUs)

	2010	2020	2030	2040	2050	2060
Total TEU Demand	5,413,682	8,248,570	11,460,041	15,164,584	19,566,730	24,863,089
Total TEU Capacity	7,901,260	8,366,040	10,457,550	10,457,550	10,457,550	10,457,550
Serviceable Demand	100%	100%	91%	69%	53%	42%

17. In addition to the benefits constraint posed by the overall container-handling capacity of the Port, benefits are further constrained by the Port's capacity to handle containers arriving on vessels requiring berths deeper than 45 ft. Table 9 presents the projected quantity of container-handling services (measured in TEUs) demanded by vessels arriving with drafts that require berths greater than 45 ft. This table also presents the projected capacity of the Port in terms of handling the volume of TEUs carried on vessels with depth requirements greater than 45 ft. This capacity is limited by the number of berths that would be able to service vessels with depth requirements greater than 45 ft. Again, the LRR forecasts a similar constraint on benefits as was forecast in the *Chief's Report.*

Table 9 Container-Handling Capacity Constraint for Vessels Requiring Berths Deeper Than 45ft MLW (TEUs)						
	2010	2020	2030	2040	2050	2060
>45ft TEU Demand	3,577,791	5,591,294	7,877,871	10,470,734	13,483,004	17,134,989
>45ft TEU Capacity	6,456,260	6,836,040	8,545,050	8,545,050	8,545,050	8,545,050
Serviceable Demand	100%	100%	100%	82%	63%	50%

The Fleet Forecast and Vessel Loading Pattern

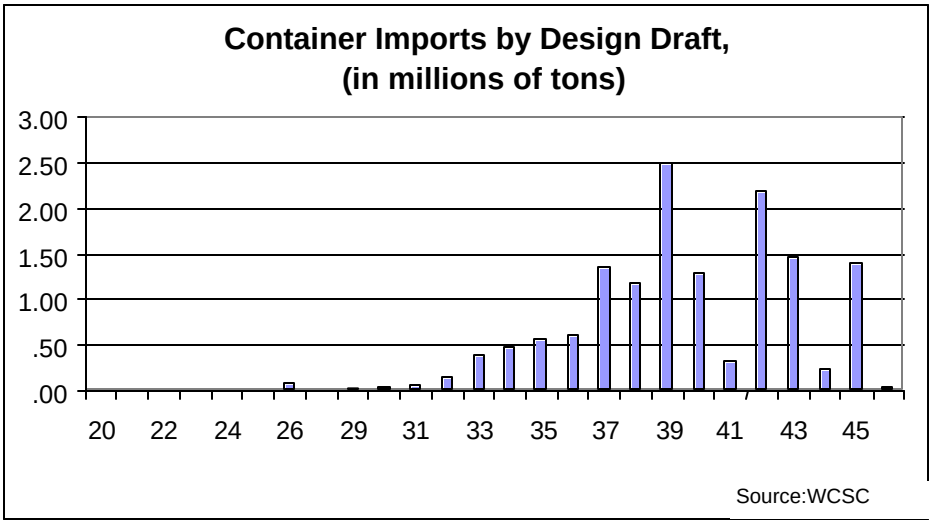
18. The fleet forecast and vessel loading pattern developed for the *Chief's Report* have not been modified for this analysis. Observations on the current containership fleet calling at the Port and on current containership loading patterns support continued use of the *Chief's Report* fleet forecast and vessel loading pattern in this LRR. Benefits can only be realized with respect to vessels that would have been depth limited in the without-project condition. The design vessel in the *Chief's Report* was a Post-Panamax container ship whose design draft is 47.6 feet. Underkeel clearance would, of course, have to be added to prevent the design vessel from grounding when fully loaded. The without-project channel depths ranged from 40 to 45 feet.

19. As of this writing, none of the channels have a controlling depth in excess of 40 feet. Nevertheless, as Figure 3, below, indicates, the Port is already receiving calls by post-Panamax container ships. This is an indication that these vessels have already entered the fleet, are already calling on the Port even though they must do so in a light-loaded condition, and that they are carrying a significant proportion of the tonnage of containerized cargo coming into the Port. The *Chief's Report* fleet forecast anticipated that these vessels soon would be entering the fleet even in the without-project condition, but observations since the *Chief's Report* indicate that their arrival is happening sooner than anticipated. The benefits calculated in this LRR are based upon the same fleet forecast used in the *Chief's Report.* The implication of larger vessels arriving sooner than anticipated is that the benefits estimated in this LRR may be conservative in this respect.

20. Similarly, current loading pattern data indicate that project benefits estimated in this LRR may be conservative in this respect. The loading pattern used to estimate the project benefits described in the *Chief's Report* was derived from data supplied by the former U.S. Customs Service (now the Bureau of Customs and Border Protection of the U.S. Department of Homeland Security) regarding the fore and aft draft on entrance and clearance of all non-U.S. flag vessels using the Port. Thus, the loading pattern was based on observations of actual containership operations in the Port, and not on engineering calculations. Those observations indicated that it was quite common for container ships to be operated in a

condition that brought the keel very close to the channel bottom, and that some container ships were loaded in such a way that they could only be safely operated in the Port by taking advantage of high tide conditions. Figure 4, below, summarizes recent observations of the actual draft at which container ships are operated in the Port. It indicates that the practices of operating with the keel quite close to the channel bottom and tide riding continue in the Port. The implication of these observations is that the loading pattern used to estimate the project benefits described in the *Chief's Report* remains valid.

Figures 2 & 3: Containerized Imports and Exports by Vessel Design Draft (2001)



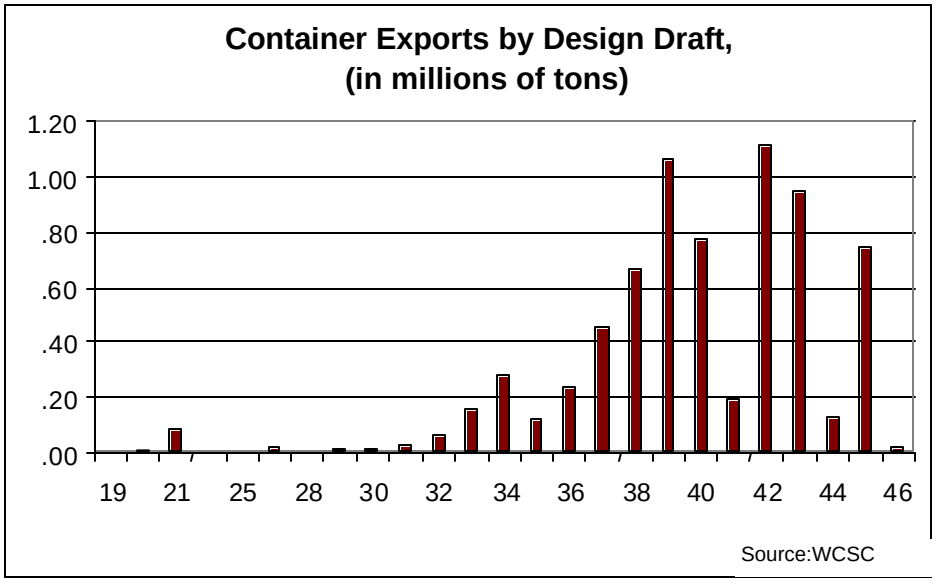
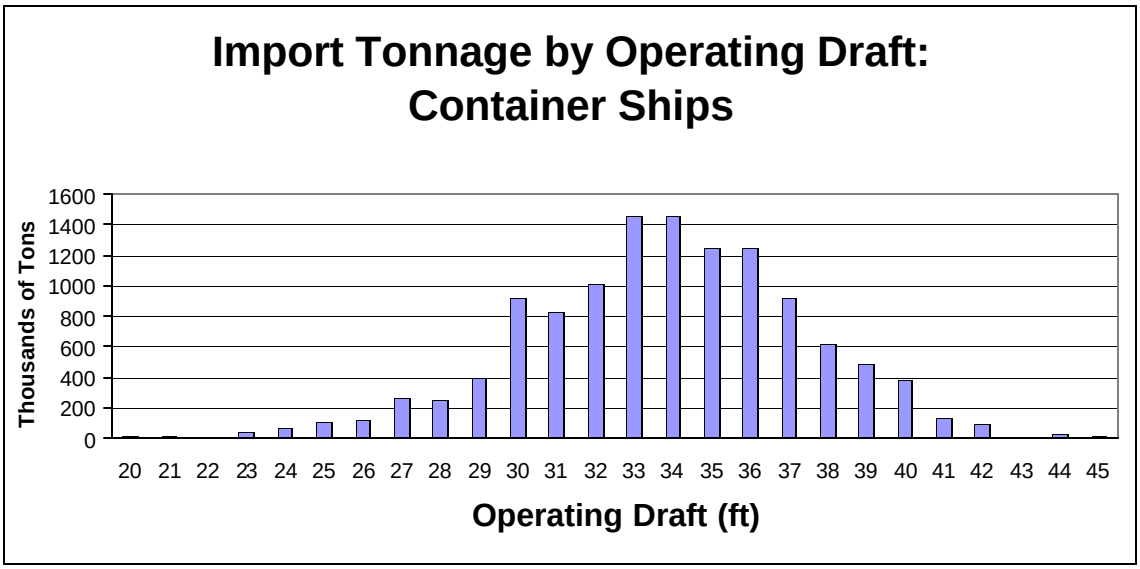


Figure 4 – Import Tonnage by Containership Operating Draft (2001)



Vessel Operating Costs

21. The Institute for Water Resources (IWR) provides data on vessel operating costs on a regularly updated basis. The FY 1999 IWR vessel operating cost data were used to estimate the project benefits described in the *Chief's Report*. This LRR uses the most recent set of IWR vessel operating costs, which are pre-publication estimates expected to be issued in FY 2004. Comparing the FY 1999 edition of the Deep Draft Vessel Cost Memorandum (Economic Guidance Memorandum 99-05) with the most recent IWR vessel operating cost estimates reveals that overall vessel operating costs have fallen, but they have fallen by different percentages for different container ship sizes.

Table 10
Vessel Operating Costs (EGM 99-05 and Pre-Publication IWR FY04 Estimates)
***Chief's Report* (1999) to LRR Comparison (2003)**

Vessel Size	**1,000 TEU**	**2,000 TEU**	**3,000 TEU**	**4,000 TEU**	**4,800 TEU**	**6,000 TEU**
	Chief's Report					
Daily at-sea	$15,844	$25,175	$35,917	$42,908	$48,574	$63,157
Daily at-port	$12,443	$18,117	$25,341	$29,142	$30,067	$41,637
	LRR					
Daily at-sea	$14,944	$23,697	$33,201	$39,791	$46,015	$58,098
Daily at-port	$10,909	$15,377	$20,846	$23,654	$24,330	$32,883
	Difference					
Daily at-sea	($900)	($1,478)	($2,716)	($3,117)	($2,559)	($5,059)
% change	-6%	-6%	-8%	-7%	-5%	-8%
Daily at-port	(1,534)	(2,740)	(4,495)	(5,488)	(5,737)	(8,754)
% change	-12%	-15%	-18%	-19%	-19%	-21%

QUANTIFIED PROJECT BENEFITS

22. This analysis quantifies the same category of benefits, containerized cargo transportation cost savings, that were quantified in the *Chief's Report*. These benefits are due to the increased channel dimensions afforded by the Recommended Plan because they will allow Post-Panamax container ships to utilize the Port in a more heavily loaded, economically efficient manner. In both the without- and with-project conditions, Post-Panamax vessels will be supplanting smaller vessels on some routes, while on other routes they will be supplementing the smaller vessels.[2] The reduction in transportation cost between the with- and without-project conditions derives from the difference, on a per TEU basis, between the costs of operating Post-Panamax and smaller container ships loaded as they would be without-project, and the cost of operating those post-Panamax and smaller container ships loaded as they would be loaded under with-project conditions.

23. Other benefits of the Recommended Plan that had been identified but not quantified in the *Chief's Report*, such as improved vessel safety due to less congestion under the with-project condition, reduced tide and queuing delays, and reduced need for lightering and bulk vessel "topping-off" are also not quantified in this analysis. Although each of the benefit types identified above are reasonable and anticipated benefits of navigation improvements to the Port, they are not included in the benefits calculations because either these benefit types cannot currently be quantified to a reasonable level of certainty or they were not quantified in the *Chief's Report* as a separate category of benefits.

24. The benefit estimation method used in both the *Chief's Report* and this LRR is an assessment of the difference in transportation costs between the without-project condition and alternative with-project conditions. A layer of complexity is added by the two capacity constraints based on 1) the overall container-handling capacity of the Port, and 2) container-handling capacity related to vessels with drafts deeper than 45 ft. These constraints were applied to both the *Chief's Report* and this LRR. The geographic layout of the Port causes additional complexity because navigation improvements to the harbor can be seen as a collection of individual project segments. Following the procedures laid out in the *NED Procedures Manual – Deep Draft Navigation*, IWR–91–R-13, benefits (and net benefits in the plan formulation process) are estimated incrementally for individual segments.

25. The two capacity constraints, overall container-handling capacity and berth availability for vessels with drafts deeper than 45 ft, are assumed to interact in a cumulative manner. For example, in 2040 the overall capacity constraint limits the overall container-handling potential to 69% of quantity demanded. In addition, limited berth availability for vessels that require channel depths greater than 45 ft means that the Port will only be able to accommodate 82% of the cargo projected to arrive on these vessels (in the all project

[2] It is also useful to keep in mind that container ships are used on routes of differing lengths, and that, consequently, some ships are at sea a higher proportion of their voyage time than others

segments scenario). Given the observation that the Port cannot discriminate by optimally allocating overall container-handling capacity to the deepest vessels, the effect of the combined capacity constraints limits benefits to 57% (.69 * .82 = .57) of the potential transportation cost savings implied by total quantity of container-handling services (measured in TEUs) demanded.

26. Annual transportation cost savings for each route are calculated as the difference between weighted costs per TEU in the without- and with-project conditions. Costs per TEU are weighted by the allocation of TEUs among vessel sizes in the projected fleet distribution for each route. The weighted costs calculated for the *Chief's Report* are based upon the FY99 Vessel Operating Costs. The weighted costs calculated for this LRR are based upon the unpublished FY04 Vessel Operating Costs. Differences in fleet distributions and differences in sailing distances are the reasons for variation in weighted TEU costs among routes in any given year. Weighted TEU costs for a single route in any given year vary according to the fleet distributions that can be accommodated under alternative project depths. As an example, Table 11 compares the weighted TEU costs for the without-project condition and the Recommended Plan with-project depth (50 ft MLW) for the Northern European route for selected years between 2011 and 2040. The table is truncated at 2040 merely for presentation purposes. The pattern identified in the table continues throughout the period of analysis.

Table 11
Weighted Transportation Cost per TEU (North Europe Trade Route)

	2011		**2020**		**2030**		**2040**	
	Channel Depth (MLW)		**Channel Depth (MLW)**		**Channel Depth (MLW)**		**Channel Depth (MLW)**	
	45ft	50 ft	45ft	50 Ft	45 ft	50 ft	45 ft	50 ft
Chief's Report	$68.18	$54.38	$66.80	$53.44	$65.27	$52.40	$64.51	$51.87
LRR	$65.37	$52.10	$64.21	$51.20	$62.92	$50.21	$62.27	$49.71
Difference	($2.81)	($2.28)	($2.59)	($2.24)	($2.35)	($2.19)	($2.24)	($2.16)

27. Table 12 illustrates the calculations used to estimate the transportation cost savings for alternative channel depths for TEUs on the Northern Europe route in 2010 – 2040. The weighted costs per TEU are taken from Table 11, above. The total TEUs for the Northern Europe route are estimated in the commodity forecast. The process presented in Table 12 is repeated for each of the four routes contributing to transportation cost savings (Northern Europe, Far East, Southeast Asia, Middle East) and for each year of the study period (2011 – 2062). The results of the calculations illustrated in Table 12 below are then discounted at the federal discount rate for water resources projects (6.625% for the *Chief's Report*, 5.625% for the LRR) and summed. Average annual equivalent cost savings are calculated to determine whether the Recommended Plan remains economically justified.

Table 12 Transportation Cost Savings (North Europe Trade Route)								
	2011		2020		2030		2040	
	Channel Depth (MLW)		Channel Depth (MLW)		Channel Depth (MLW)		Channel Depth (MLW)	
Chief's Report	45ft	50 ft	45ft	50 Ft	45 ft	50 ft	45 ft	50 ft
Total TEUS	798,469		1,025,936		1,243,233		1,368,011	
Cost per TEU	$ 68.18	$ 54.38	$ 66.80	$ 53.44	$ 65.27	$ 52.40	$ 64.51	$ 51.87
Total Cost (000's)	$54,437	$43,420	$68,534	$54,826	$81,149	$65,140	$88,249	$70,965
Cost Savings (000's)	$11,017		$13,708		$16,009		$17,284	
LRR	45ft	50 ft	45ft	50 Ft	45 ft	50 ft	45 ft	50 ft
Total TEUS	1,199,233		1,719,753		2,438,054		3,325,145	
Cost per TEU	$65.37	$52.10	$64.21	$51.20	$62.92	$50.21	$62.27	$49.71
Total Cost (000's)	$78,391	$62,479	$110,419	$88,059	$153,394	$122,416	$207,062	$165,305
Cost Savings (000's)	$15,912		$22,360		$30,978		$41,758	
Difference	$4,895		$8,652		$14,969		$24,474	

Total Project Benefit Comparisons

28. Navigation improvements to the Port are allocated to project segments that are pathways to individual terminal facilities. The alternative plans assessed in the *Chief's Report* were formulated as combinations of pathways. Benefits (and net benefits in the plan formulation process) were estimated for individual segments both independently and collectively. The configurations of the individual segments have not changed since the analysis conducted for the *Chief's Report*.

Multiple Segment Benefits

29. Benefit assessments are calculated under the assumption that terminal capacities are cumulative. The combined throughput capacity of all of the project segments equals the total TEU capacity of the Port, which may be greater or less than the projected quantity of container-handling services (measured in TEUs) demanded. However, all terminals may not be used at full capacity during some years, especially early in the planning period. No additional transportation cost savings were calculated for any excess capacity, once total quantity demanded was satisfied.

30. The effects of cumulative terminal capacities are illustrated in the following example. At channel depths of 50 ft MLW, the total average annual equivalent benefits of combining the Port Newark – Port Elizabeth (PNE) and Port Jersey (PJ) segments would be $188.2 ($143.7 + $44.5 = $188.2) if one simply added the benefits estimated for the individual segments. However, by taking into account the excess TEU capacity that this combination provides in the early years of the project life, the more accurate benefit estimate becomes $185.9, which is a reduction of $2.3 ($188.2 - $185.9 = $2.3). The average annual equivalent benefits of multiple project segments (formulated as the Recommended Plan) as calculated in the *Chiefs Report* and this LRR are presented in Table 13.

Table 13
Multiple Segment Benefits ($millions)
***Chief's Report* (1999) to LRR Comparison (2003)**

	Chief's Report		**LRR**	
	Segment	Cumulative	Segment	Cumulative
Port Jersey	$82.7	$82.7	$44.5	$44.5
Port Newark/Eliz	$95.0	$177.7	$141.4	$185.9
Howland Hook	$34.7	$212.4	$61.3	$247.2
South Brooklyn	$26.1	$238.5	$23.7	$270.9
Total	$238.5		$270.9	

31. Table 14 presents the effects of individual factors on project benefits as identified in the *Chief's Report.* Factors that have changed significantly since the writing of the *Chief's Report* include reductions in the Federal discount rate and reductions in vessel operating cost estimates. Since the writing of the *Chief's Report*, there have also been increases in estimates of future container-handling capacities and in the volume of TEUs that will be serviced at the Port. Increases in these two factors have caused an increase in the amount of "benefiting" TEUs estimated in the LRR as compared to the *Chief's Report*.

Table 14
Generalized Impacts on Average Annual Benefits as Estimated in the 1999 *Chief's Report* ($millions)

Factor	Type of Change	Effect on Benefits
Federal Discount Rate	Increase by 100 basis points	$5.99
Vessel Operating Costs (a)	Decrease by 19%	($45.32)
Commodity and Capacity Forecasts (b)	Increase in Benefiting TEUs	$71.76
Cumulative Effect		$32.43

Notes: (a) VOC change based on 19% decrease in at-sea operating costs for a 4000 TEU vessel, the predominant benefiting vessel.

(b) Calculated as residual change in benefits after accounting for discount rate and operating costs.

BENEFITS AND COST COMPARISON

32. The construction cost for navigation improvements (GNF) to the Port, as identified in the *Chief's Report* have been reduced to $1,284 million. Average annual costs are reduced by the decrease in total project costs and by the decrease in the Federal discount rate (from 6.625% at the time of the *Chief's Report* to 5.625% currently). Total project average annual costs, as calculated in this LRR (see Appendix H Cost Engineering), are $109.4 million and total average annual project benefits are $270.9 million. The resulting Benefit-Cost Ratio for the Recommended Plan is 2.5 ($270.9 / $109.4 = 2.5).

Table 15 Recommended Plan: Incremental Segment Updated Benefit-Cost Analysis ($mil)							
Pathway 4 (Port Jersey Channel) as First Pathway from Container Terminal to Sea							
		Plan Segment			**Cumulative**		
		Benefits	Costs	BCR	Benefits	Costs	BCR
Port Jersey	**Pathway 4**	$44.5	$26.2	1.7	$44.5	$26.2	1.7
Port Newark/Eliz	**Pathway 1**	$141.4	$58.1	2.4	$185.9	$84.3	2.2
Howland Hook	**Pathway 2**	$61.3	$10.7	5.7	$247.2	$95.0	2.6
South Brooklyn	**Pathway 5**	$23.7	$13.2	1.8	$270.9	$106.3	2.5
Pathway 1 (Port Newark/Eliz) as First Pathway from Container Terminal to Sea							
		Plan Segment			**Cumulative**		
		Benefits	Costs	BCR	Benefits	Costs	BCR
Port Newark/Eliz	**Pathway 1**	$141.4	$71.4	2.0	$141.4	$71.4	2.0
Port Jersey	**Pathway 4**	$44.5	$10.9	4.1	$185.9	$82.4	2.3
Howland Hook	**Pathway 2**	$61.3	$10.7	5.7	$247.2	$93.1	2.7
South Brooklyn	**Pathway 5**	$23.7	$13.2	1.8	$270.9	$106.3	2.5

Note: As the first segment, Port Jersey costs include all Ambrose Channel, Anchorage Channel, and Port Jersey Channel costs. As the second added segment, Port Jersey costs include 31% of the Anchorage Channel costs and all of the Port Jersey Channel costs. Port Jersey benefits are based upon existing acreage (100 acres) only.

33. The fact that the overall Recommended Plan remains economically justified does not, by itself, mean that each of its elements remains incrementally economically justified. The conclusion of this update of the economic analysis of the Recommended Plan is that:

- The Recommended Plan remains economically justified on the basis of the *Chief's Report* assumptions.
- On the basis of the current estimates of project benefits and costs, the Recommended Plan is also economically justified with Pathway 1 as its first added element. To put this conclusion in other words, on the basis of the current estimates, each of the elements of the Recommended Plan remains incrementally economically justified, but in an order that is different from the order in which they were incrementally justified in the economic analysis summarized in the *Chief's Report*.

34. In the economic analysis summarized in the *Chief's Report*, the Recommended Plan was formulated as follows:

- Pathway 4 (Port Jersey Channel to the sea) was the only pathway that was independently economically justified. Consequently, it became the first added element.

- Construction of Pathway 4 would involve the deepening of Ambrose Channel and Anchorage Channel. Pathways 1 and 5 (KVK/NB and South Brooklyn, respectively) were incrementally economically justified as second and third added elements because part of their implementation costs as independent pathways to the sea (*i.e.*, Ambrose Channel and Anchorage Channel) would be absorbed by Pathway 4.
- Pathway 2 (Arthur Kill to Howland Hook) was economically justified as an element added to Pathway 1.

35. This formulation assumed that the planned conversion of the former MOTBY to a 130-acre container-handling facility and the planned conversion of the Northeast Auto Terminal (NEAT) to an 80-acre container-handling facility, both of which are on Port Jersey Channel (*i.e.* Pathway 4), would take place as scheduled. Although the City of Bayonne has issued a request for proposals with respect to the MOTBY conversion, to date, neither conversion has taken place.[3] This update of the economic analysis of the Recommended Plan has, therefore, assumed that those conversions will not take place prior to execution of a PCA with respect to the HDP. The effect of this assumption is to reduce the proportion of project benefits whose realization can be attributed to the provision of 50-foot channel access at Port Jersey Channel.

36. Increases in the container-handling capacity of Global Marine Terminal, the only terminal on Port Jersey Channel that is currently engaged in container-handling operations, have partially, but not fully counterbalanced the fact that the MOTBY and NEAT conversions have not yet taken place. As a result of this reduction in the proportion of total project benefits attributable to Port Jersey Channel, the current estimate of the Benefit to Cost Ratio (BCR) of Pathway 4 has been reduced to 1.7. Pathway 4, therefore, remains economically justified as a first added element (*i.e.*, as an independent pathway to the sea).

37. The increase in the current estimate of total project benefits and the decrease in the current estimate of total project costs for those channels that make up Pathway 1 have had the effect of increasing the net benefits of Pathway 1 so as to render it also economically justified as a first added element, with a BCR of 1.9.

38. In the formulation presented in the *Chief's Report*, only Pathway 4 was economically justified as an independent pathway from container terminal to the sea, but the current economic analysis indicates that both Pathway 4 and Pathway 1 are economically justified as an independent pathway from container terminal to the sea in the most likely with-project future condition.

[3] As of this writing, the plans of the Bayonne Local Redevelopment Authority call for:
1. close of the period for expressions of interest in November of '03, to be followed by issuance of a request for proposals
2. close of the period for submission of proposals in April of '04, to be followed by
3. selection of a construction contractor in June of '04, contemplating construction completion in late 2006 or early 2007.

39. Because Pathway 1 is carrying the costs of Ambrose Channel and those parts of the Kill Van Kull and Anchorage Channels that Pathways 1 and 2 have in common, Pathway 2 is incrementally economically justified as an element added to Pathway 1 (incremental BCR = 5.7).

40. By the same reasoning, Pathway 5 is incrementally economically justified as an element added to either Pathway 1 or Pathway 4, with an incremental BCR of 1.8.

41. Therefore, each of the elements of the Recommended Plan remains incrementally economically justified.