

**GAO**

Report to the Chairman, Subcommittee  
on Surface Transportation and Merchant  
Marine Infrastructure, Safety, and  
Security, Committee on Commerce,  
Science, and Transportation, U.S. Senate

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March 2010

# DELAWARE RIVER DEEPENING PROJECT

Comprehensive  
Reanalysis Corrected  
Errors, but Several  
Issues Still Need to Be  
Addressed



**GAO**

Accountability \* Integrity \* Reliability

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Highlights of [GAO-10-420](#), a report to the Chairman, Subcommittee on Surface Transportation and Merchant Marine Infrastructure, Safety, and Security, Committee on Commerce, Science, and Transportation, U.S. Senate

## Why GAO Did This Study

In 1992 Congress authorized the U.S. Army Corps of Engineers (Corps) to implement the Delaware River deepening project, which would deepen the river's shipping channel from 40 to 45 feet. In 2002 GAO reviewed the Corps' economic analysis of the project, concluding that it contained significant limitations. GAO recommended that the Corps prepare a comprehensive economic reanalysis, which the Corps completed in 2004. GAO was asked to determine the extent to which (1) the reanalysis addressed the limitations GAO identified; (2) the reanalysis's benefit projections, as updated, reflect current and anticipated market and industry conditions; and (3) the Corps has accounted for other key issues that could affect the project. GAO reviewed Corps project documentation and interviewed federal officials along with representatives of affected states, firms, and environmental groups.

## What GAO Recommends

GAO recommends that the Department of Defense direct the Corps to (1) provide an assessment of relevant market and industry changes and the effect of any changes on the project's net benefit estimate, and (2) develop guidance for public notice and comment on environmental documents for projects that are controversial but have no applicable NEPA requirement. The Department of Defense generally agreed with these recommendations.

View [GAO-10-420](#) or [key components](#). For more information, contact Anu K. Mittal at (202) 512-3841 or [mittala@gao.gov](mailto:mittala@gao.gov).

# DELAWARE RIVER DEEPENING PROJECT

## Comprehensive Reanalysis Corrected Errors, but Several Issues Still Need to Be Addressed

### What GAO Found

The Corps' reanalysis addressed many of the limitations GAO had identified in 2002 in the Delaware River deepening project's original economic analysis by using updated information to correct invalid assumptions and outdated data, recalculating benefits and costs to correct miscalculations, and accounting for some of the economic uncertainty associated with the project. For example, the Corps revised its benefit estimates for transportation cost savings related to such commodities as crude oil, containerized cargo, and steel slabs. In addition, as GAO recommended, the Corps had independent experts review the reanalysis. Although the Corps' efforts were responsive overall to GAO's 2002 recommendations, GAO identified several additional limitations in the reanalysis. For example, in its analysis of economic uncertainty, the Corps considered the effects of negative-growth scenarios only for crude oil and refined petroleum, but not for the remaining commodities.

In the 6 years that have elapsed since the Corps completed its reanalysis, current and anticipated future market and industry conditions have changed significantly. Several of the assumptions that underlie the Corps' estimates of the project's benefits are inconsistent with these changes. For example, the Department of Energy has lowered its long-term forecasts for growth in East Coast refinery capacity and U.S. imports of crude oil. Also, in the fall of 2009, Delaware River refinery firms closed two major facilities. Further, steel imports have declined since 2006 according to the benefiting facility identified in the reanalysis, and were well below the reanalysis's growth projection for 2009. However, the Corps' 2008 and 2009 economic updates for the project did not analyze the potential effect of these changes on the project's benefit estimates. The updates also did not determine the current status of shipping services on two trade routes that provide all of the benefits related to containerized cargo. Because of these and other omissions, decision makers do not have sufficient updated information to judge the extent to which market and industry changes would affect the project's net benefits.

GAO identified three key outstanding issues that could affect the Delaware River deepening project. First, the Corps lowered its estimate of the volume of dredged material, which eliminated the need for new disposal sites in New Jersey, but its disposal plan continues to face resistance from that state. Second, Delaware, New Jersey, and several environmental groups filed separate lawsuits against the Corps in the fall of 2009, charging that the Corps lacks the environmental approvals needed to proceed with the project, among other concerns. Finally, New Jersey and several environmental groups have challenged in court the Corps' National Environmental Policy Act (NEPA) process for the project. Although the Corps completed an environmental assessment (EA) in April 2009, stakeholders believe that the process for soliciting public comment on its scope was unclear, did not allow enough time for comment, and that a new supplemental environmental impact statement is needed. Also, at the Army's direction, the Corps did not provide a public comment period for the draft EA as it had proposed to do.

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## Abbreviations

|       |   |
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| Corps | U.S. Army Corps of Engineers                |
| DMA   | David Miller & Associates, Inc.             |
| EIA   | U.S. Energy Information Administration      |
| EIS   | Environmental Impact Statement              |
| LRR   | Limited Reevaluation Report                 |
| NEPA  | National Environmental Policy Act           |
| OSG   | Overseas Shipholding Group, Inc.            |
| PRPA  | Philadelphia Regional Port Authority        |
| SEIS  | Supplemental Environmental Impact Statement |

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United States Government Accountability Office  
Washington, DC 20548

March 31, 2010

The Honorable Frank R. Lautenberg  
Chairman  
Subcommittee on Surface Transportation  
and Merchant Marine Infrastructure,  
Safety, and Security  
Committee on Commerce, Science,  
and Transportation  
United States Senate

Dear Mr. Chairman:

In 1992 Congress authorized the U.S. Army Corps of Engineers (Corps) to implement the Delaware River deepening project.<sup>1</sup> The project would increase the depth of the Delaware River's main shipping channel from 40 to 45 feet from the mouth of the Delaware Bay to the ports of Philadelphia, Pennsylvania, and Camden, New Jersey, about 100 miles upriver. The Corps expects this greater depth to facilitate the movement of certain commodities—liquid cargo (such as crude oil), containerized cargo (such as refrigerated meat), and bulk commodities (such as steel slabs and other construction materials)—to receiving refineries and other terminals along the river. The deeper channel is also expected to reduce the transportation costs for these commodities because ships carrying them could travel upriver more fully loaded. Specifically, the Corps expects cost savings to occur because oil tankers would need less lightering—the practice of unloading a portion of a tanker's liquid cargo onto smaller ships in deeper water before sailing upriver—and because container and bulk commodity vessels could carry the same cargo for lower shipping costs and potentially make fewer overall trips from their originating ports to their Delaware River destinations. Furthermore, ships that now experience delays as they wait for rising tides to allow safe passage up the channel could see these tidal delays reduced or eliminated.

According to project plans, the construction period for the Delaware River deepening project is 5 years, followed by annual maintenance over a 50-

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<sup>1</sup>Water Resources Development Act of 1992, Pub. L. No. 102-580, § 101(6) (1992). Congress modified the project in the Water Resources Development Act of 1999, Pub. L. No. 106-53, § 308 (1999) and the Water Resources Development Act of 2000, Pub. L. No. 106-541, § 306 (2000).

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year project operation period. Responsibility for managing the project rests with the Philadelphia district office of the Corps' North Atlantic division. Following the project's congressional authorization in 1992, the Philadelphia district issued a series of analyses supporting the deepening, including its 1998 *Limited Reevaluation Report* (LRR), which updated the project's benefits and costs. In June 2002<sup>2</sup> we reported on material weaknesses in the 1998 report's economic analysis of the project's benefits and costs. We concluded that the analysis undermined the reliability of the Corps' basis for determining whether the project was economically justified—that is, whether net benefits exist once project costs are subtracted from project benefits. We recommended, among other things, that the Corps comprehensively reanalyze the project's benefits and costs.

In response, the Corps reanalyzed the project from 2002 to 2004 (hereafter referred to as the reanalysis) and concluded that it would yield, on average, annual benefits of \$24.2 million with annual costs of \$21.0 million—resulting in annual net benefits totaling \$3.2 million, about \$8 million less than the 1998 estimate of annual net benefits.<sup>3</sup> As in the Corps' 1998 LRR, the reanalysis determined that benefits would result largely from transportation cost savings associated with importing specific commodities, such as crude oil. In addition to the reanalysis, the Corps updated aspects of its benefit and cost information in 2008 and 2009.

The Corps' project plans call for the mud, silt, sand, gravel, and rock that would be dredged from the river bottom (dredged material) to be stored at federal disposal sites in Delaware and New Jersey; blasted rock would be deposited at a federal disposal site in Pennsylvania. Through the years, these affected states and regional environmental groups have differed in their positions toward the deepening project. For example, Pennsylvania has been supportive of the deepening, while Delaware, New Jersey, and the environmental groups have raised concerns about the disposal of dredged material among other aspects of the project. At the time of its reanalysis, the Corps envisioned adding three new disposal sites in New Jersey, in addition to using existing disposal sites in all three states.

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<sup>2</sup>GAO, *Delaware River Deepening Project: Comprehensive Reanalysis Needed*, [GAO-02-604](#) (Washington, D.C.: June 7, 2002).

<sup>3</sup>Corps benefit and cost estimates cited in this report are based on the Corps' planned 5-year construction period. Estimates could change if project construction takes longer than 5 years.

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You asked us to determine (1) the extent to which the Corps' reanalysis addressed the economic analysis limitations we identified in 2002; (2) the extent to which the benefit projections the Corps included in its reanalysis of the project, as updated, are consistent with current and anticipated future market and industry conditions; and (3) what other key issues, if any, could affect the project, and the extent to which the Corps has accounted for these issues and their potential impacts.

To answer the first and third objectives, we developed a list of economic limitations and other key issues that we had identified in our 2002 report. These issues ranged from errors in benefit and cost estimation—such as the misapplication of commodity growth rates and the omission of disposal site construction costs—to concerns about the Corps' treatment of economic uncertainty, the lack of internal quality control in the Corps' report review process, and the Corps' analysis of selected environmental topics. We used the economic limitations and other key issues we had identified earlier, along with standard economic principles, as criteria for reviewing the 2002 and 2004 reports that form the basis of the Corps' reanalysis to assess whether and how each issue was addressed in those documents. In addition to the reanalysis, we reviewed later economic and environmental analyses the Corps had prepared to determine whether certain limitations and other key issues previously identified by GAO had been addressed in these subsequent documents. We discussed these issues with officials from the Corps' Philadelphia district, its North Atlantic division, and its headquarters in Washington, D.C. To answer the second objective, we reviewed historical crude oil imports from a number of sources, including the Department of Energy's Energy Information Administration (EIA). We also reviewed EIA's Annual Energy Outlook forecasts for U.S. crude oil imports and refinery capacity on the East Coast. We determined that EIA's crude import data and forecasts are sufficiently reliable for the purposes of this report. (We note that EIA may revise its forecasts over time as new information becomes available.) For other commodities, we interviewed representatives of importing firms and a U.S. Geological Survey official, as appropriate. We also reviewed U.S. government import data for additional background. For all three objectives, we consulted experts in the fields of economics and lightering, including consultants who helped the Philadelphia district prepare its reanalysis. We also spoke with representatives of the Delaware River refineries, other potential project beneficiaries, and the private lightering firm that serves the Delaware River market; representatives of the states of Delaware, New Jersey, and Pennsylvania; and environmental groups with an interest in the project. Appendix I contains more detailed information on our scope and methodology.

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We conducted this performance audit from March 2009 through March 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

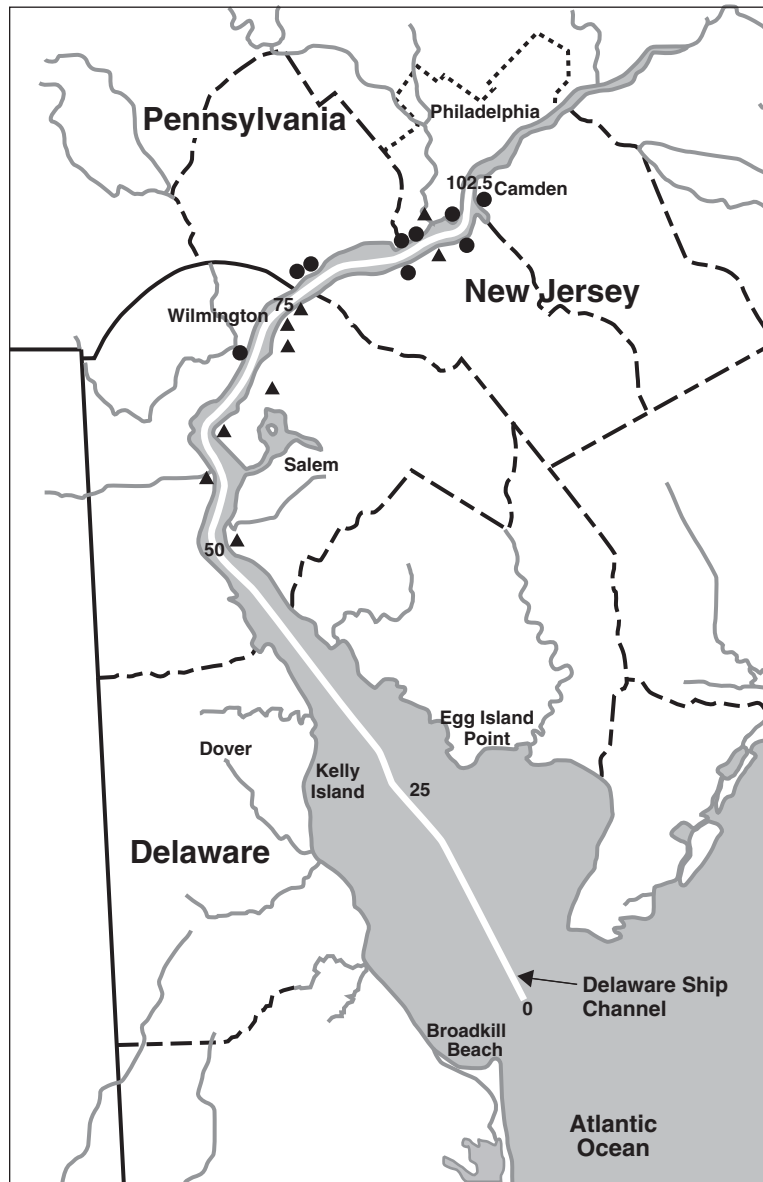
The Delaware River deepening project calls for dredging the river's main navigation ship channel to 45 feet, from a depth of 40 feet, beginning at the mouth of the Delaware Bay through Philadelphia Harbor, and to the Beckett Street Terminal in Camden, New Jersey—a distance of 102.5 miles. The Corps plans to use nine existing federal disposal sites in Delaware (one), New Jersey (seven), and Pennsylvania (one) to dispose of the material dredged from the bottom of the river.<sup>4</sup> The new dredged material is to be layered on top of the material already deposited at these sites during annual maintenance dredging in the channel to maintain its 40-foot depth. Additionally, a portion of the material to be dredged is sand from Delaware Bay, which would be used by the Corps to restore wetlands at Kelly Island, Delaware, and the shoreline at Broadkill Beach, Delaware. According to the Corps, dredged material has been used in a variety of beneficial projects over the years, including environmental restoration, landscaping, and airport runway fill material. Often, the material must be drained and dried for several months before it can be used in these ways. Figure 1 shows the area to be dredged, the nine federal disposal sites, the two Delaware restoration locations, and other features discussed in this report.

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<sup>4</sup>Project-related disposal at the Pennsylvania site is limited to rock that would be removed from the river after blasting in the vicinity of Marcus Hook, Pennsylvania.



**Figure 1: Map of Delaware River Deepening Project Area**



- ▲ Federal disposal site
- Deep-draft commodity terminal
- - - County boundary
- ..... Philadelphia boundary

Source: GAO analysis of U.S. Army Corp of Engineers documents.

Note: Numbers in the ship channel indicate river miles.

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In 1992, the year Congress authorized the deepening project, the Corps completed a *Final Interim Feasibility Study and Environmental Impact Statement* (EIS) for the project. This document was used to inform decision makers and the public of the Corps' recommended plan for the project, potential alternatives to it, its benefits and costs, and the likely environmental effects. The Corps then prepared a design memorandum in 1996, which provided details on the final design and engineering plans for the project, and published a *Supplemental Environmental Impact Statement* (SEIS) in 1997. In its 1998 LRR, the Corps updated its economic analysis of the project's benefits and costs.

In our June 2002 report,<sup>5</sup> we found that the Corps' 1998 analysis was based on miscalculations, invalid assumptions, and outdated information, and did not consider a number of uncertainties that could affect the project's benefits and costs. Consequently, we concluded that the Corps' analysis did not provide a reliable basis for determining whether the project was economically justified and recommended that the Corps (1) prepare a comprehensive, new economic analysis of the project; (2) obtain the information necessary to address uncertainties that could affect benefits and costs; (3) engage an external independent party to review the new analysis; and (4) submit the new analysis to Congress.

In response to our 2002 report, the Corps reanalyzed the economic benefits and costs of the deepening project and issued a *Comprehensive Economic Reanalysis Report* in 2002, followed by a *Supplement to Comprehensive Economic Reanalysis Report* in 2004. (In this report we use the term "reanalysis" to refer collectively to both the Corps' 2002 report and 2004 supplement.) The Corps' reanalysis concluded that the project would yield average annual benefits of \$24.2 million, about \$16 million less than the Corps' 1998 annual benefit estimate of \$40.1 million.<sup>6</sup> According to the Corps' reanalysis, annual benefits would result largely from transportation cost savings associated with the importation of specific commodities—crude oil; containerized cargo, such as refrigerated meat and produce; and dry bulk commodities, such as steel slabs and blast

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<sup>5</sup>[GAO-02-604](#).

<sup>6</sup>The Corps' 1998 LRR presented benefit and cost estimates at 1996 price levels and federal fiscal year 1997 discount rate (7.375 percent); the reanalysis's 2004 supplement presented benefit and cost estimates at 2002 price levels and federal fiscal year 2004 discount rate (5.625 percent). Some of the change observed in benefit and cost estimates between the LRR and the reanalysis was due to this change in price level and discount rate.

furnace slag (an additive used in the production of cement). Crude oil savings would account for about half of these benefits, with cost savings related to containerized cargo accounting for another quarter of them. See table 1 for details on the benefit estimates and share of total benefits for each benefit category in the reanalysis.

**Table 1: Corps' Average Annual Benefit Estimates and Share of Total Benefits by Benefit Category for the Delaware River Deepening Project, 2002-2004 Reanalysis**

Dollars in millions

| <b>Benefit category</b>              | <b>Average annual benefits<sup>a</sup><br/>(percentage of total benefits)</b> |
|--------------------------------------|---|
| <b>Transportation cost savings</b>   |   |
| Crude oil                            | \$11.8 (49)   |
| Containerized cargo                  | 6.1 (25)  |
| Steel slabs                          | 3.6 (15)  |
| Blast furnace slag                   | 1.8 (7)   |
| Refined petroleum                    | 0.4 (1)   |
| <b>Beneficial use cost savings</b>   |   |
| Beneficial use of dredged sand       | 0.6 (2)   |
| <b>Total average annual benefits</b> | <b>\$24.2</b>   |

Source: GAO analysis of 2004 *Supplement to Comprehensive Economic Reanalysis Report*.

Note: Due to rounding, individual estimates do not sum to total and percentages do not sum to 100.

<sup>a</sup>Estimates presented at 2002 price levels and federal fiscal year 2004 discount rate (5.625 percent).

The benefit estimates in the Corps' reanalysis depend on a number of factors, including (1) the extent to which future growth expands the total volume transported for each of the benefiting commodities; (2) the savings associated with using less of certain economic resources, such as the Delaware River lightering fleet; and (3) the economy's prevailing price level and discount rate.<sup>7</sup> For the reanalysis, the Philadelphia district contracted with a private consulting firm to analyze project benefits.

<sup>7</sup>Corps guidelines state that districts should discount future benefits and costs that accrue in different periods back to their present values for valid comparison and should revise this discount rate periodically. The Corps also directs districts to adjust price levels to account for changes that occur over time in the prices of various factors, such as commodities and wages.

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According to the Corps' reanalysis, the Delaware River deepening project would generate benefits relating to commodities imported by the following entities:

- Five crude oil refining facilities with six deep-draft terminals now owned by Sunoco (four), Valero (one), and ConocoPhillips (one), with four terminals located in Pennsylvania and two in New Jersey.<sup>8</sup>
- Other commodity terminals, including those at Beckett Street Terminal in Camden, New Jersey; Packer Avenue Marine Terminal in Philadelphia, Pennsylvania; and Delaware Terminal at the port of Wilmington, Delaware.<sup>9</sup>

(The nine commodity terminals appear in the figure 1 map.)

With regard to project costs, the Corps' reanalysis estimated average annual project costs of \$21.0 million, almost \$8 million less than the Corps' 1998 annual cost estimate of \$28.8 million. This revised cost estimate includes channel dredging, disposal site construction, and any related land costs, such as land for new disposal sites and rights of way. It also includes associated costs, which are those needed, in addition to project costs, to achieve the benefits claimed during the period of the Corps' analysis. These costs include, for example, berth deepening and dock modifications to accommodate deeper ships at refinery facilities and container terminals. Although associated costs are the responsibility of the potentially benefiting facilities, the Corps includes these costs in its total cost estimate, in accordance with its guidance. See appendix II for more information about the project's associated costs.

In addition to the 2002 and 2004 reanalysis documents, the Corps prepared the following documents that provide supplemental information on the benefits and costs of the Delaware River deepening project:

- an economic update to the project that reaffirmed the reanalysis's benefit and cost estimates for budgeting purposes (April 2008),

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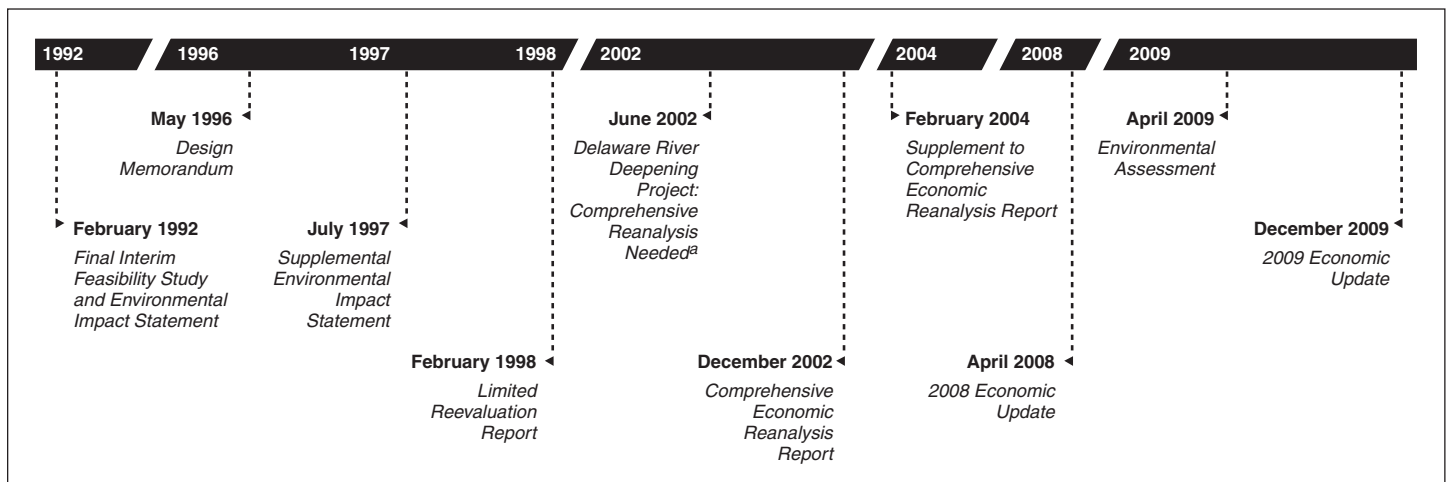
<sup>8</sup>At the time of the reanalysis, Coastal Eagle Point owned one of the current Sunoco facilities. In addition, Valero owns a second Delaware River refinery facility that was owned by Motiva Enterprises at the time of the reanalysis, but this facility was not considered to be a potential project beneficiary.

<sup>9</sup>The Delaware Terminal—a facility that imports refined petroleum—has since been renamed Magellan Terminal because of a change of ownership.

- an environmental assessment that included a section summarizing the project’s potential economic benefits (April 2009), and
- an economic update to support the Corps’ fiscal year 2011 budget request (December 2009).<sup>10</sup>

See figure 2 for a summary timeline of key documents related to the deepening project.

**Figure 2: Summary Timeline of Key Documents Related to the Delaware River Deepening Project**



Source: GAO analysis of U.S. Army Corps of Engineers and GAO documents.

<sup>a</sup>GAO-02-604.

As of December 2009, the Corps estimated average annual benefits of \$30.1 million and average annual costs of \$22.3 million for the project, yielding annual net benefits of \$7.8 million. Because estimated benefits exceeded estimated costs—resulting in positive net benefits and a benefit-cost ratio greater than one—the Corps determined that the project remained economically justified. See table 2 for a summary of the benefit and cost estimates and resulting benefit-cost ratios in the Corps’ reanalysis and in its most recent economic update. As noted in table 2, the benefit and cost estimates are based on different price levels and discount rates,

<sup>10</sup>We received this document from the Corps in January 2010 as our work neared its completion. We considered the document in our findings but due to reporting time frames we could not comprehensively review its economic analysis.

which accounts for some of the changes observed in the estimates between the 2002-2004 reanalysis and the 2009 economic update. This means that the estimates and resulting net benefits and benefit-cost ratios are not directly comparable between the two analyses.

**Table 2: Corps' Average Annual Benefit, Cost, and Net Benefit Estimates, and Benefit-Cost Ratio for the Delaware River Deepening Project, 2002-2004 Reanalysis and 2009 Economic Update**

Dollars in millions

|                                    | 2002-2004 reanalysis <sup>a</sup> | 2009 economic update <sup>b</sup> |
|------------------------------------|-----------------------------------|-----------------------------------|
| Total average annual benefits      | \$24.2                            | \$30.1                            |
| Total average annual costs         | \$21.0                            | \$22.3                            |
| <b>Average annual net benefits</b> | <b>\$3.2</b>                      | <b>\$7.8</b>                      |
| <b>Benefit-cost ratio</b>          | <b>1.15</b>                       | <b>1.35</b>                       |

Source: GAO analysis of 2004 *Supplement to Comprehensive Economic Reanalysis Report* and 2009 economic update.

<sup>a</sup>Estimates presented at 2002 price levels and federal fiscal year 2004 discount rate (5.625 percent).

<sup>b</sup>Estimates presented at 2009 price levels and federal fiscal year 2010 discount rate (4.375 percent). The change in price level and discount rate accounts for some of the change between estimates and resulting net benefits and benefit-cost ratios. This means that they are not directly comparable between the two analyses.

With regard to assessing the project's potential environmental impacts, the Corps is required to comply with the National Environmental Policy Act (NEPA).<sup>11</sup> In addition to summarizing the project's potential economic benefits, as noted earlier, the 2009 environmental assessment's primary purpose was to evaluate the impacts of changes to the project and in the project area since the 1992 EIS and 1997 SEIS, as well as to present the results of post-SEIS environmental monitoring and data collection.

Although the Corps has made efforts to conduct a reanalysis of the project and provide assessments of its potential environmental impacts, the project has remained controversial. For many years the project has been criticized by regional environmental groups, among others, who have raised concerns about the project's impact on water quality and various fish and wildlife species, as well as the accuracy of the Corps' estimates of the project's benefits and costs. Notwithstanding, because of the results of

<sup>11</sup>Under NEPA, federal agencies evaluate the likely environmental effects of projects they are proposing using an environmental assessment or, if projects are likely to significantly affect the environment, a more detailed environmental impact statement. See 42 U.S.C. § 4332(2)(C), (E).

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the reanalysis, congressional funding, and support for the project from its local sponsor and others, the Corps continued its efforts to begin construction. Specifically, in 2008 the Philadelphia Regional Port Authority (PRPA)—an independent agency of the state of Pennsylvania—replaced the Delaware River Port Authority as the project’s local sponsor. In that same year, PRPA and the Army signed a project partnership agreement for the construction of the deepening project. As the local sponsor, PRPA is to contribute 25 percent of the project’s total costs.<sup>12</sup>

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## The Corps’ Reanalysis Addressed Many of the Economic Analysis Limitations GAO Had Identified in 2002

The Corps’ reanalysis addressed many of the limitations that we had identified in 2002 in the project’s original economic analysis by using more recent information to correct invalid assumptions and outdated data, recalculating benefits and costs to correct miscalculations, and accounting for some of the economic uncertainty associated with the project. In addition, as we recommended, the Corps had independent experts review the reanalysis before submitting it to Congress. Although the Corps’ efforts were responsive overall to the recommendations we made in 2002, we found several additional limitations in the reanalysis. For example, in its analysis of the economic uncertainty associated with the project, the Corps considered the effects of negative-growth scenarios only for crude oil and refined petroleum but not for the remaining benefit categories.

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## Reanalysis Used Updated Information to Correct Invalid Assumptions and Addressed Other Errors

The Corps’ reanalysis was based in large part on the information that its contractor, David Miller & Associates (DMA), an economic consulting firm, developed between 2002 and 2004. Using the updated information that DMA developed, the Corps revised its list of potential benefit categories to exclude those that would no longer benefit from the project or those for which the agency had insufficient information to calculate benefits. For example, our 2002 report noted that the Corps had assumed benefits resulting from coal and iron ore imports, as well as scrap metal exports, even though trade in these commodities had greatly declined since the Corps had last studied them. In its reanalysis, the Corps dropped these commodities from its benefit calculations because of factors, such as reduced trade volumes, that indicated that benefits related to these commodities would not be realized. In addition to identifying outdated benefit categories, our 2002 report suggested that changing import

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<sup>12</sup>According to the agreement, PRPA would also pay an additional amount of 10 percent of the total cost of construction of the general navigation features.

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patterns could present new commodities for the Corps' consideration. The Corps' reanalysis subsequently identified additional benefiting commodities that were not previously considered, such as refined petroleum, steel slabs, and blast furnace slag.

The Corps' reanalysis also prepared new forecasts of growth rates for each of the benefiting commodities to correct the past overstatement of key benefit categories, using information from government and private trade databases to re-evaluate import growth rates. For example, in 2002 we found that the Corps' 1998 LRR had applied a 5.8 percent growth rate to oil imports from West Africa for 1992 through 2005, when that rate should have been applied only through 2000 and a lower rate—1.4 percent—applied for 2001 through 2005. This misapplication of growth rates was significant because crude oil benefits increase as import volume increases, generating savings from reduced transportation costs per barrel. For the reanalysis, the Corps assumed a lower annual growth rate of 0.2 percent by linking the forecast to the expected growth rate for the Delaware River refineries' relatively fixed overall capacity, which was expected to grow by 10 percent—or 0.2 percent per year—over the 50-year life of the project. For other commodities, the Corps assumed that growth would be limited to the period leading up to the base year, which is the first year that the project's full benefits can be realized.<sup>13</sup> One commodity that the Corps limited in this way was containerized cargo, which, like crude oil, was assigned growth rates in the 1998 LRR that we found in 2002 to be overstated. In addition to constraining containerized cargo growth to the period leading up to the base year, the Corps' reanalysis also assumed that project benefits for containerized cargo would be limited to two specific trade routes and the Corps forecasted growth for only one of these two routes. These routes included one extending from the East Coast of South America northbound to the U.S. East Coast and a second reaching from Australia and New Zealand eastbound through the Panama Canal and up the U.S. East Coast—both terminating at Philadelphia's Packer Avenue Marine Terminal.

In its reanalysis the Corps also corrected several additional invalid assumptions that we had identified in our prior report concerning the estimate of crude oil benefits. Specifically, in 2002 we reported that the Corps' 1998 LRR (1) assumed that many more crude oil ship type and trade route combinations would benefit from a deepened channel than could be

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<sup>13</sup>Typically, the base year occurs at or near the end of project construction.



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supported by its analysis, (2) relied on outdated specifications for lightering vessels in calculating benefits, and (3) incorrectly assumed that lightering reduction benefits would be realized at ports of origin. In the reanalysis these issues were addressed as follows:

- First, according to the Corps' original statistical model, in 23 percent of all possible cases, ships on specific crude oil trade routes would carry enough cargo to exceed 40 feet of draft if a 45-foot channel were available, leading to transportation cost savings for that cargo in a deeper channel. However, in its 1998 LRR the Corps applied these benefits for 100 percent of the possible ship type-trade route combinations, thereby overstating benefits. In the reanalysis, DMA replaced the Corps' statistical model with new projections based on the characteristics of the ships that actually called on Delaware River refineries in 2000, including information on each ship's origin and destination, operating cost, crude oil tonnage, actual draft, and maximum draft for which it was designed. DMA used this information, in conjunction with refinery interviews, to determine which ships would be likely to increase their tonnage—and thus their drafts—in a deepened channel, and what level of benefits would be associated with this change. DMA ultimately based its projections on 86 percent of the crude oil tonnage reported by the refineries for the year 2000 because the remaining data were incomplete or otherwise unsuitable for analysis.
- Second, for those crude oil tankers that would need to be lightered less in a deepened channel, the 1998 LRR relied on outdated specifications in assuming that tankers can discharge crude oil into refineries' dockside storage tanks twice as fast as they can transfer the oil to lightering vessels. The Corps' reanalysis revised this assumption to reflect that lightering rates exceed dockside discharge rates because of, for example, shorter pumping distances and the assistance of gravity when pumping from large tankers to smaller lightering vessels. As the Corps recognized in the reanalysis, some portion of the benefits of reduced lightering would be offset by the increased time and cost of discharging more cargo at refineries' docks.
- Third, the Corps' 1998 analysis assumed that cost savings from reduced lightering would be realized at both the port of origin and port of destination. In fact, these benefits would be realized only at the destination port because that is where lightering occurs. The reanalysis assigns these benefits only to destination ports.

In the reanalysis, the Corps used a lightering model based on a full year's worth of lightering operations data to help refine its estimate of crude oil benefits. DMA initially constructed this model using assumptions about

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the lightering firm's practices that were based on its review of Maritime Exchange data on tanker movements and sailing drafts for the year 2000. Following publication of the model's assumptions and results in the Corps' 2002 *Comprehensive Economic Reanalysis Report*, the lightering firm disagreed with DMA's methodology and claimed that DMA's assumptions resulted in an overstatement of lightering costs, which in turn would overstate crude oil benefits derived from avoiding these costs. For example, the lightering firm noted that DMA did not include the minority of its lightering activity that occurs not in the Delaware River but in the ocean offshore of Delaware Bay. Ignoring this portion of the firm's lightering overstates cost per barrel lightered by inaccurately dividing 100 percent of costs by less than 100 percent of barrels lightered. In response, DMA revised its lightering model in the 2004 supplement by collecting and combining actual lightering operations data for the year 2000 from the lightering firm, the Corps' Waterborne Commerce Statistics Center, and three of the five principal refinery firms operating in the Delaware River at that time. According to the Corps, this refinement allowed DMA to account for nearly 99 percent of all crude oil barrels lightered in the Delaware River and offshore during 2000, providing a more accurate estimate of crude oil benefits in the 2004 supplement.

The Corps further attempted to address the lightering firm's comments about its 2002 report by developing a more sophisticated model of lightering activities in the event of a 45-foot channel. Specifically, in its initial model, DMA had determined that the likely reduction in lightering volume in a deeper channel would be roughly equivalent to the capacity of one of the three vessels in the lightering firm's fleet. DMA estimated lightering reduction benefits by removing that vessel and its operating costs from the fleet, as it assumed the lightering firm would choose to do in the event of a deepened channel, then recalculating total lightering costs based on the remaining two vessels. In response to the lightering firm's criticism of this approach as unrealistic, DMA revised its approach by using updated data on operations from 2000 to simulate tanker-by-tanker lightering operations through 2058. The simulation results were matched with estimated vessel operating costs and hourly fuel consumption costs developed by the Corps' Institute for Water Resources specifically for each of the three vessels in the lightering firm's fleet.<sup>14</sup> According to the Corps, this approach allowed the agency to more directly

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<sup>14</sup>The Institute for Water Resources provides the Corps' Civil Works program with research and analysis to aid its long-range planning.

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calculate the reduction in total economic resources—such as those devoted to each ship’s crew, fuel, and maintenance—needed to provide lightering services as lightering volumes fall. The Corps assumed these freed resources would be put to productive use by the lightering firm elsewhere in the economy. The revised methodology in the 2004 supplement was associated with a roughly 20 percent drop in the Corps’ crude oil benefit estimate when compared to the 2002 report.

Finally, the Corps corrected miscalculations and important omissions we identified in 2002 that affected the project’s benefit and cost estimates. For example:

- When we attempted to replicate the Corps’ results in 2002, we identified a \$4.7 million gap between the Corps’ estimate of annual project benefits and the estimate that we developed. The Corps’ economist for the project told us in 2002 that the gap resulted from a computer error that could have occurred when files were transferred from one program to another; ultimately, the Corps acknowledged the error but was unable to definitively explain it. For the reanalysis, the Corps recalculated its total benefit estimate using DMA’s new analysis of each benefiting commodity. We reviewed this calculation and found no significant errors.
- The Corps’ 1998 LRR was marked by inconsistent discounting of project benefits and costs to determine their net present value. Moreover, the Corps presented benefit estimates at price levels for different years—for example, coal benefits were presented at 1991 price levels and containerized cargo benefits at 1995 price levels. Both of these practices made it difficult for decision makers to understand and compare the true benefits and costs of the project. In developing the reanalysis the Corps used DMA’s analysis, which standardized the price level and discounting adjustments for project benefit estimates by benefit category, presenting each at 2002 price levels and using the prevailing discount rate at the time the reanalysis was published (5.625 percent). The Corps adjusted the reanalysis’s cost estimates using the same approach.
- In 2002 we found that the Corps omitted construction costs for federal disposal sites from its summary calculations in the 1998 LRR cost estimate. These construction costs would be incurred as the Corps expands the sites to accommodate additional dredged material resulting from annual maintenance of the 45-foot channel over its 50-year project life. In its reanalysis, the Corps’ estimate of total costs included costs for these sites.

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- In 2002 we reported that the Corps' 1998 LRR failed to update its estimates for associated costs, such as deepening the access channels that connect the main channel to benefiting facilities' loading docks and increasing on-site storage capacity to handle larger deliveries. For the reanalysis, DMA hired a subcontractor to survey potentially benefiting firms and determine their likely associated costs, including berth deepening, dock modifications, and additional storage, and to estimate the cost of these modifications. This work was completed in 2002, and the Corps included the updated associated costs in the reanalysis's total cost estimate.
  - Our 2002 report noted that the Corps' cost estimate in the 1998 LRR assumed that annual maintenance dredging for the 45-foot channel would begin after the last year of construction and continue for 50 years. However, maintenance dredging in completed segments of the channel could be required before the end of project construction—a consideration that was not accurately incorporated into the Corps' previous maintenance cost estimate. The Corps' reanalysis recognized that maintaining a 45-foot channel segment is more costly than maintaining a 40-foot segment, and incorporated this higher cost into its total cost estimate.

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### Reanalysis Included Sensitivity Analysis to Assess Uncertainty in Benefit and Cost Assumptions

In our 2002 report, we observed that some of the errors we identified illustrated the uncertainty inherent in forecasting information, such as commodity shipments, technological changes, and industry's economic choices. We suggested that a reanalysis of the project consider a more careful treatment of the uncertainty associated with estimating benefits and costs, particularly since Corps guidance requires planners to identify areas of uncertainty in their analysis and to clearly describe them so that decision makers can understand the degree of reliability in a project's benefit and cost estimates.

One way to analyze the uncertainty associated with estimating benefits and costs is to include more information than simple point estimates, which can give the illusion of precision when a range of estimates may be more appropriate. Sensitivity analysis is one analytical tool for assessing the uncertainty associated with the estimates. In the context of benefit and cost estimation, sensitivity analysis can be used to assess the degree to which a benefit or cost estimate is affected by a change in a key assumption. For example, a sensitivity analysis for a labor-intensive construction project might examine the effect on overall project cost if the estimated hourly cost of labor were varied by plus or minus 10 percent.

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The 1998 LRR did not employ sensitivity analysis, but both of the reports that constitute the Corps' reanalysis used this tool to analyze some of the uncertainties associated with the project's benefit and cost estimates. Specifically, in the 2002 *Comprehensive Economic Reanalysis Report*, the Corps used sensitivity analysis to assess the extent to which the benefit and cost estimates, including the net benefit estimate, would change given alternative assumptions about factors such as commodity growth rates, lightering operation costs, and future ship sizes for slag and steel imports. For example, the Corps analyzed the effect on the net benefit estimate if future crude oil imports to Delaware River refineries grew by more, or less, than the assumed 0.2 percent per year. Scenarios included higher growth, lower growth, no growth, and negative growth.<sup>15</sup> Under the latter scenario, the Corps estimated that crude oil benefits would be reduced by about 16 percent. The Corps' rationale for the negative-growth scenario, in part, was the possibility that one or more of the refineries could go out of business. The Corps, however, stated that this was unlikely, citing the continued expansion of demand for products refined from crude oil and noting that its 0.2 percent growth rate was conservative relative to the Department of Energy's projection of future U.S. crude oil imports through 2020, which ranged from 0.6 percent to 1.6 percent annually. Similarly, the Corps examined the potential effect on benefits of a negative-growth scenario for refined petroleum, as well as higher-growth, lower-growth, and no-growth scenarios for refined petroleum, blast furnace slag, containerized cargo, and steel slabs.

To augment its sensitivity analysis, the Corps examined the vulnerability of various benefit categories to the actions of individual firms whose business decisions could affect the project. For example, the Corps' estimate of blast furnace slag benefits was based on slag imports by a single cement firm. Benefits related to importing blast furnace slag could be lower or could disappear if this facility were to operate at a lower production capacity than the Corps assumed, or if it were shut down and not replaced by another firm. Crude oil, on the other hand, was imported by five firms at the time of the reanalysis's 2002 report. Given the history of the continued operation of their respective refinery facilities in the recent past, including successful transfers of ownership to new firms, the Corps considered it unlikely that any refinery would be shut down for an extended period of time. However, the Corps did note that if one or more

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<sup>15</sup>The Corps analyzed a 0.2 percent annual decline in future crude oil imports.

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of the refineries went out of business, the benefits related to crude oil imports could drop significantly.

In addition to analyzing the uncertainty associated with some of its benefit estimates, the Corps conducted a sensitivity analysis of some cost assumptions in the 2002 *Comprehensive Economic Reanalysis Report*. These sensitivity analyses tested different assumptions about key cost factors, such as dredging efficiency and the composition of dredged material. The latter could vary from mud and silt, which is relatively more expensive to dredge, to loose sand, which is relatively cheaper. The Corps also examined associated costs—specifically, whether individual firms were likely to make the necessary infrastructure investments to benefit from a deepened channel given their expected benefits. The Corps' analysis showed that facility benefits would likely exceed facility costs for each of the project beneficiaries.

The 2004 *Supplement to Comprehensive Economic Reanalysis Report* also contained sensitivity analyses—four related to crude oil benefits and three related to containerized cargo benefits. The crude oil analyses examined the impact of altering certain assumptions about lightering operations. These assumptions informed the Corps' lightering simulation model, such as the vessel capacity assigned to each lightering trip in the model, and therefore any change in these assumptions could result in a significant change in the Corps' crude oil benefit estimate. The final three sensitivity analyses examined containerized cargo assumptions. For example, the Corps calculated the positive and negative effect on project benefits that would result from increasing and decreasing containerized imports by 20 percent, respectively, for the two trade routes that the reanalysis identified as benefiting from a deeper channel.

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## Independent Experts Reviewed the Corps' Reanalysis

As we recommended in our 2002 report, the Corps submitted its reanalysis to independent reviewers before delivering it to Congress. This process included separate reviews of project benefits and costs. Benefits were reviewed first by a university professor with expertise in transportation systems. In addition, at the request of Corps headquarters, the Corps' Institute for Water Resources arranged to have an external independent panel review the project's benefit analysis. The institute contracted with a private consulting firm to convene a panel of economics and navigation experts for this review, which consisted of an iterative process of issue resolution through panel comments and the Corps' responses. Similarly, the Corps selected an engineering firm with expertise in dredging cost analysis to review the project's costs, including those incurred in initial

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construction dredging, long-term maintenance dredging, and the construction of disposal sites for dredged material. After the independent reviewers issued their final reports, the Corps' Director of Civil Works approved the reanalysis.

In at least one instance, the Corps' external independent reviews resulted in a substantial change to the project's benefit estimate. Specifically, the benefits review panel disagreed with an aspect of the approach DMA used to calculate the cost of crude oil lightering operations. This calculation had a direct effect on project benefits because a significant portion of crude oil benefits are derived from avoiding the cost of some lightering due to a deepened river channel. DMA defended its methodology in a series of responses to review panel comments. However, the Corps ultimately accepted the review panel's revision of DMA's calculation and used the resulting lower benefit estimate in its 2004 supplement. This \$2.8 million adjustment represented a 19 percent reduction in annual crude oil benefits and a 10 percent reduction in the project's total benefit estimate.

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### Reanalysis Contained Several Additional Limitations

Overall, while the Corps' efforts have been responsive to the recommendations we made in 2002, we identified several limitations in the economic reanalysis that introduce additional uncertainty into the project's benefit estimates. First, the external independent panel convened to review the reanalysis's benefit estimates raised concerns about the benefit analysis for containerized cargo that may not have been fully resolved. Specifically, in its January 2004 final report, the independent panel concluded that the Corps had not eliminated significant uncertainties associated with the estimation of containerized cargo benefits. The review panel had been concerned that the Corps based its benefit estimate on transportation cost savings that would accrue to the project through more direct delivery of goods to Philadelphia-area destinations on just the two trade routes in the Corps' analysis—one originating from South America and the other from Australia/New Zealand—and a weekly shipping service operating on each. According to the Corps, savings would result because some containers on the South America route were being shipped to the deeper port of New York/New Jersey to bypass the 40-foot Delaware River channel, and then trucked south to Philadelphia-area destinations. With the deeper channel, the Corps projected that these containers—as well as others resulting from growth on the Australia/New Zealand route—would instead be shipped directly to the port of Philadelphia through the 45-foot channel, avoiding the costly trucking from New York/New Jersey to Philadelphia. The review panel noted that for one of the two trade routes—Australia/New Zealand

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to the U.S. East Coast, accounting for 85 percent of containerized cargo benefits—the Corps’ benefit estimate relies on trucking that (1) does not yet occur and (2) depends on future revisions to the existing shipping service prompted by growth. The panel also noted that the prospective benefits rely on the future business decisions of only a few shipping services. For these and other reasons, the review panel stated that significant uncertainties remained in the containerized cargo benefit estimate and that the estimation of benefits accruing to the Australia/New Zealand trade route was the greatest source of residual uncertainty for this benefit category. The Philadelphia district responded to the panel’s comments in a document defending its analysis and also revised its discussion of containerized cargo benefits in the final version of the February 2004 supplement. The district’s response was reviewed by Corps headquarters, which acknowledged that not all uncertainties had been resolved, but concluded that the findings as a whole were reasonable and defensible. However, the Corps did not provide the final version of the 2004 supplement to the external review panel for resolution as the contract for its services had expired.

Second, as noted earlier, the Corps’ 2002 *Comprehensive Economic Reanalysis Report* employed sensitivity analysis to examine the effect of negative-growth scenarios on the annual benefit estimates for crude oil and refined petroleum. However, negative-growth scenarios were not considered for the remaining benefiting commodities, which were analyzed under only higher-growth, lower-growth, and no-growth scenarios. The possibility of a contraction in the market for blast furnace slag, containerized cargo, and steel slabs was not insignificant, given the relatively few importers for certain commodities and the sensitivity of these markets to changes in world economic conditions. Indeed, as noted earlier, estimated benefits for slag rely on the future business decisions of a single firm. Considering that even a no-growth scenario for each benefit category would collectively result in the project’s total annual costs slightly exceeding its total annual benefits, as shown in the Corps’ reanalysis, the cumulative effect of negative growth for all commodities could have provided additional context to decision makers. In addition, the alternative-growth scenarios for crude oil from the 2002 report’s sensitivity analysis were not reanalyzed in the 2004 supplement, even though the methodology used to develop the estimate of crude oil benefits changed substantively from the 2002 report and the estimate itself declined by about 20 percent.

Finally, the lightering firm disagrees with the reanalysis’s assumption that significant savings will result from the firm reducing its service levels



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proportionally in response to reduced demand for lightering in a deepened channel. To the extent that lightering service levels in a 45-foot channel are higher than the Corps assumes, project benefits could be reduced. In practice, the Corps' assumption would mean that the lightering firm's three vessels would spend less time in operation, or perhaps that two vessels would maintain similar service levels but the third vessel would be put to other uses. This reduction in service would save crew, fuel, and other resource costs that are the basis for the Corps' estimate of lightering cost savings in its crude oil benefit model. However, the lightering firm contends that tanker arrivals into Delaware Bay can be unpredictable, with multiple arrivals possible on short notice, which requires the firm to retain three vessels in order to maintain the flexibility needed to provide prompt service. For the importing refineries that pay for tankers to ferry crude oil across the ocean to their facilities, lightering delays in the bay are costly. Moreover, refinery facilities typically do not maintain much on-site storage and instead rely on timely deliveries to continue operating. For these reasons, the lightering firm told us that the reanalysis's assumption of service levels falling in proportion to reduced lightering demand is unrealistic. Instead, the lightering firm believes service levels would likely remain higher than the Corps' modeling predicts because, for example, the firm would continue to provide service with three vessels instead of two. In fact, the lightering firm's position on the feasibility of reduced service levels resembles an observation that the Corps made in discussing the undesirability of delivery delays for containerized cargo in the reanalysis's 2002 report: "The issue is customer satisfaction and the potential loss of customers who are not receiving their desired service." In interviews with us, Corps officials characterized their assumption of reduced lightering service levels as consistent with an economically rational firm's most efficient allocation of its resources.

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## The Benefit Assumptions in the Corps' Reanalysis and Economic Updates Do Not Fully Reflect Current and Anticipated Future Market and Industry Conditions

In the 6 years that have elapsed since the Corps completed its reanalysis, current and anticipated future market and industry conditions have changed significantly. Several of the assumptions that underlie the Corps' estimates of the project's benefits are inconsistent with these changes. For example, the Department of Energy has lowered its long-term forecasts for growth in East Coast refinery capacity and U.S. imports of crude oil. These developments raise questions about the extent to which the reanalysis's findings could be affected by these changed conditions. The Corps' 2008 and 2009 economic updates did not analyze the potential effect of these changes on the project's benefit estimates. Consequently, decision makers do not have the updated information necessary to indicate whether the market and industry changes that have occurred would affect the project's net benefits.

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## Reanalysis's Benefit Assumptions Do Not Consistently Reflect Current Market and Industry Conditions and Future Outlook

Benefits related to crude oil, containerized cargo, and steel slabs make up 89 percent of the project's total annual benefits, accounting for 49 percent, 25 percent, and 15 percent respectively.<sup>16</sup> Current market and industry conditions and future outlook for these key benefit categories have changed since the reanalysis was completed in early 2004. These changes indicate that the assumptions underlying the Corps' benefit estimates may need to be revised, but their net effect is unclear without additional information and analysis. The following summarizes our findings related to these benefit categories, in descending order of importance to the project's overall benefit estimate.

### Crude Oil

The reanalysis's crude oil benefit assumptions are not consistent with current market and industry conditions and future outlook, which raises questions about the reliability of the reanalysis's crude oil benefit estimate. Relevant changes that could affect crude oil benefits include a projected decline in refinery capacity, a current and projected decline in crude oil imports, and changes in the Delaware River crude oil refining and lightering industries.

#### **Projected Decline in Refinery Capacity**

In the reanalysis, the Corps chose a 0.2 percent annual growth rate as the basis for its long-term forecast for crude oil imports into Delaware River

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<sup>16</sup>These percentages were the same in the reanalysis's 2004 supplement and in the 2009 economic update.

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ports. The Corps based its growth rate on the expected growth in long-term capacity for refineries in the East Coast region. This forecast came from the Department of Energy's Energy Information Administration (EIA) as part of its Annual Energy Outlook.<sup>17</sup> However EIA's long-term outlook for East Coast refinery capacity has declined from 0.2 percent annual growth in its 2002 outlook to a 0.1 percent annual decline in its 2009 outlook, and the early-release version of EIA's 2010 outlook has predicted a steeper decline of 2.0 percent annually.

### **Current and Projected Decline in Imports**

The Corps observed in its reanalysis that its 0.2 percent annual growth rate for crude oil imports was a conservative projection compared to a Department of Energy forecast of future U.S. crude oil imports through 2020, which ranged from 0.6 percent to 1.6 percent annual growth; in its 2002 annual energy outlook, EIA identified 1.1 percent annual growth in imports as the most likely rate for this period. By 2009, this outlook had changed considerably from the earlier part of the decade: instead of the 1.1 percent annual growth for crude oil imports forecasted in EIA's 2002 long-term outlook or the 0.2 percent annual growth assumed by the Corps, EIA's 2009 and 2010 long-term outlooks forecasted annual declines of 1.6 and 0.4 percent, respectively.

Moreover, to date, available data indicate that even the Corps' marginal growth rate of 0.2 percent overstated crude oil imports through at least 2008. According to EIA data, the volume of crude oil imports into Delaware River ports declined from about 415 million barrels in 2000 to about 381 million barrels in 2008, for an annual decline of 1.1 percent and an overall decline of 8.1 percent since 2000. Imports were about 332 million barrels in 2009.<sup>18</sup>

We identified several reasons for the decline in crude oil imports into the Delaware River and changes to their long-term outlook. First, EIA officials pointed to several factors that have reduced the demand for crude oil in the United States overall and thus contributed to changes in the long-term forecast. These include the requirements of new regulations and

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<sup>17</sup>The EIA is the Department of Energy's statistical and analytical agency. It is the primary federal government authority on energy statistics and analysis.

<sup>18</sup>An EIA official indicated that imports for 2009 are preliminary and subject to revision.

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legislation, such as the Energy Independence and Security Act of 2007<sup>19</sup>— which includes mandates to increase domestic use of nonpetroleum liquid fuels such as ethanol and more stringent fuel efficiency standards—and competition from gasoline produced in Europe. EIA officials explained that crude oil imports are sensitive to changes in the market for gasoline, a product that accounts for about half of the refined output from a typical barrel of crude oil. East Coast refineries are especially vulnerable to competition from refineries in Europe (as well as U.S. Gulf Coast states) because the East Coast refineries have relatively high production costs. On the other hand, the officials noted that by lowering lightering costs, a deeper channel could reduce the cost of production and could potentially improve the refineries' position in a highly competitive market.

Second, EIA officials explained that the nation's current economic recession has been associated with declines in demand for products refined from crude oil and shrinking profit margins for Delaware River refineries. These conditions are reflected in relatively low utilizations—that is, how much of a refinery's total productive capacity is being used—which EIA officials said had fallen below 80 percent by late 2009. The officials noted that the following two Delaware River refinery firms have recently reduced their respective refinery capacities by halting production at major facilities:

- In October 2009 Sunoco announced that it was indefinitely idling its Eagle Point refinery facility in Westville, New Jersey. Subsequently, the firm announced in February 2010 that the closure was permanent.
- In November 2009 Valero announced that it would permanently shut down one of its two Delaware River refinery facilities—the former Motiva facility in Delaware City, Delaware.<sup>20</sup>

According to EIA officials, the remaining Delaware River facilities are likely to continue to operate because most of the excess refinery capacity has already been squeezed out of the Delaware River region. Looking ahead, EIA officials said that according to many observers, demand is not

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<sup>19</sup>Pub. L. No. 110-140, §§ 102 (requiring increased average fuel economy standards for vehicles), 202 (requiring regulation to ensure that, of the transportation fuel sold each year, a certain amount is renewable fuels and certain biofuels, including most ethanols), 121 Stat. 1492.

<sup>20</sup>According to a Valero representative, as of March 2010 the firm was seeking a buyer for the facility.

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expected to return to its former levels even after the economy recovers because of the policy and structural changes noted earlier, resulting in less need for gasoline from crude oil. However, they said that the Northeast will remain a major consumer of home heating oil, which is made from crude oil, and that demand will likely grow for diesel fuel, a crude oil product that is used heavily in the trucking industry—especially in the Northeast.

Third, according to an independent economic expert with experience analyzing the Delaware River crude oil market, demand for crude oil imports has declined in the Northeast because of high oil prices, changing consumer preferences, and gasoline imports from Europe. He predicted that, in general, U.S. energy demand will rely less heavily on crude oil in the future. In his assessment, the Corps' crude oil forecasts are therefore likely outdated, and while the Corps' assumptions about projected crude oil growth may have been reasonable in the early 2000s, they do not reflect current and expected future conditions.

### **Changes in Delaware River Refining Industry**

Changes in the Delaware River crude oil refining industry affect the reanalysis's crude oil benefit assumptions in ways that raise questions about the Corps' crude oil benefit estimate. For example, the reanalysis's lightering simulation model predicted that in the first year of a 45-foot channel the recently closed Eagle Point facility's lightering requirement would be reduced by 41 percent. This amount represented 22 percent of the total expected decline in the need for Delaware River lightering in the model's initial year. This reduction in lightering represents resource cost savings that are a key part of the Corps' crude oil benefit estimate. If the facility is not reopened, it is unclear to what extent its share of crude oil benefits would instead be realized by Sunoco's remaining Delaware River facilities. In comparison with Sunoco's Eagle Point closure, Valero's closure of its Delaware City facility would likely affect the crude oil benefit estimate less because this facility was not considered a potential beneficiary in the Corps' reanalysis.<sup>21</sup> However, the Corps' lightering simulation model assumed that the facility would account for nearly a quarter of the lightering firm's volume in the first year of a 45-foot channel.

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<sup>21</sup>At the time of the reanalysis, Motiva maintained the facility's access channel at less than the main channel's 40-foot depth, a practice that Valero has continued since it acquired the facility. This is due to excessive sediment deposit in the facility's access channel.

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While this consideration does not affect the crude oil benefit estimate directly—because the volume of lightering for this facility was expected to remain the same in a 45-foot channel, thus precluding lightering reduction benefits—it does alter the assumptions about the lightering firm’s day-to-day operations that the Corps used to build the model, which could affect the benefit estimates for other facilities.<sup>22</sup> In addition, because the Corps’ crude oil benefit estimate includes time savings from fewer tidal delays as tankers proceed upriver, a reduction in future oil imports could decrease these savings in a 45-foot channel. Overall, the net effect of these and other industry changes on the Corps’ crude oil benefit estimate is unclear.

### **Changes in Delaware River Lightering Operations**

Changes experienced by the lightering firm whose operations were modeled in the Corps’ reanalysis also could influence the Corps’ estimate of crude oil benefits. According to Overseas Shipholding Group (OSG),<sup>23</sup> the firm lightered about 98 million barrels in 2000, the year that the Corps used to build the reanalysis’s crude oil benefit model and that served as the basis for its crude oil projections. As recently as 2007, OSG officials told us, the firm lightered about 95 million barrels; however, OSG lightered only about 88 million barrels in 2008 and 77 million barrels in 2009, down almost 22 percent from the 2000 total. Despite the drop in lightering demand, OSG officials said they have maintained three ships in their lightering fleet to keep service levels consistent for their customers.

As discussed earlier, the Corps’ Institute for Water Resources estimated the vessel operating costs, including factors such as hourly fuel consumption costs, for each of the three vessels in the lightering fleet at the time of the reanalysis—avoiding these costs through reduced lightering provided the basis for lightering resource cost savings in a

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<sup>22</sup>Moreover, Valero’s other Delaware River facility—in Paulsboro, New Jersey—was assumed to benefit primarily from the more efficient use of vessels rather than reduced lightering because the facility avoided lightering during the period of the Corps’ reanalysis. Instead, the Paulsboro facility was expected to account for most of the project’s annual benefits associated with increased tanker efficiency, such as the ability to load existing vessels more fully or switch to larger vessels. However, Valero representatives told us that their supply practices have changed since the Corps’ reanalysis, with the facility now relying more on lightering than before. For this reason, it is likely that benefits related to vessel efficiency should be reduced for this facility and benefits related to reduced lightering should be increased.

<sup>23</sup>In 2006 OSG acquired Maritrans, the lightering firm whose operations were modeled in the Corps’ reanalysis.

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deepened channel. However, according to OSG officials, two of the three ships in the firm's current Delaware River lightering fleet are different from those the Corps modeled in its reanalysis, which suggests that fleet operating costs and other characteristics, such as pumping efficiency, may now be different.<sup>24</sup> In 2010 the composition of OSG's lightering fleet is expected to change even more from the composition of the fleet used in the Corps' model, which could further influence the Corps' estimate of crude oil benefits. Fleet composition would change because of a 10-year contract with Sunoco—OSG's largest Delaware River customer—that led OSG to order two new tug-barges slated for delivery in 2010. An OSG official explained that these vessels were specially designed to take into account customer requirements, desired cargo volumes, increased operational efficiencies, and anticipated future environmental requirements. By adding these vessels to its fleet, OSG expects that greater lightering volumes will be realized. OSG officials said that by fall 2010, they expect to have the two new tug-barges operating as part of the firm's fleet, along with a third vessel that was not modeled in the Corps' reanalysis. OSG officials expect the new lightering fleet to have lower operating costs than the fleet that was modeled by the Corps, primarily because they will burn a less expensive fuel, coupled with increased operational efficiency. This would tend to reduce lightering resource costs and thus reduce the Corps' estimated crude oil benefits, all else the same.

Finally, the delivery of the first new tug-barge would activate the 10-year contract with Sunoco, which OSG officials said includes guaranteed minimum lightering volumes. If this contract causes lightering volumes to be higher than the Corps' model predicts for whatever portion of the 10 years overlaps with the deepened channel's 50-year operation period, then lightering reduction benefits could be lower as a result. It is possible that increased lightering under the contract, if any, for Sunoco's remaining facilities could mitigate the drop in potential lightering cost savings resulting from the closure of Sunoco's Eagle Point facility. Still, without an updated analysis of these changes, their net effect on the Corps' estimate of crude oil benefits remains unclear.

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<sup>24</sup>According to an OSG official, one of the vessels in the lightering fleet at the time of the reanalysis has been replaced by its sister ship, which loads more slowly but is otherwise similar to the original vessel.

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## Potential Effect of Crude Oil Changes

The Corps has acknowledged that changes since the reanalysis could affect its crude oil benefit model but has not analyzed this potential effect. In the reanalysis's 2002 sensitivity analysis, the Corps showed that benefits related to crude oil could drop significantly in a negative-growth scenario where, for example, refineries go out of business (though, as we mentioned earlier, this analysis was not revised in the 2004 supplement despite substantive changes in the crude oil analysis). Further, according to the Corps, future import growth is responsible for about 9 percent of annual crude oil benefits. The Corps' primary economic consultant for the reanalysis agreed that a decline in crude oil imports into the Delaware River would reduce crude oil benefits, although he noted that the percentage decline for benefits would be less than the decline for imports—that is, it would not be a one-for-one decline. The consultant also said that changes to vessel operating costs in the lightering firm's fleet could have a significant effect on the crude oil benefit model.

## Containerized Cargo

The reanalysis's containerized cargo benefit assumptions may not fully reflect current conditions and cannot be adequately assessed without additional information. In the reanalysis's 2004 supplement, the Corps revised its containerized cargo analysis to focus on specific growth assumptions for the two trade routes in its analysis—one from the East Coast of South America and a second from Australia/New Zealand passing through the Panama Canal. At the time of the Corps' reanalysis, the two routes were served by a primary shipping firm and several partners operating one weekly service on each route that called at Philadelphia. The reanalysis's containerized cargo benefits depended entirely on changes in shipping practices prompted by a 45-foot ship channel. Specifically, the reanalysis derived transportation cost savings from avoiding inefficient and costly trucking from the port of New York/New Jersey to Philadelphia—whether already occurring (on the South America service) or assumed to begin at some future time (on the Australia/New Zealand service). This trucking was an adaptation resulting from constraints on cargo capacity because of the need to maintain ship drafts that did not exceed the Delaware River's 40-foot depth, which meant that some ships and cargo destined for Philadelphia would offload first at the relatively deeper port of New York/New Jersey.

We were unable to verify the Corps' key assumptions underlying the reanalysis's expected containerized cargo benefits. Specifically, we could not confirm whether trucking is occurring at all, is occurring at a stable rate, or is growing on the South America service, and whether trucking has



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begun as a result of growth on the Australia/New Zealand service. According to the logistics provider for the firm that operates the Packer Avenue Marine Terminal, the South America weekly service still exists, is still operated by the same primary shipping firm, and still includes time-sensitive refrigerated cargo that could be trucked from New York/New Jersey to hasten its arrival in Philadelphia, thus preserving its retail value. The logistics provider's weekly delivery data from January through November 2009 indicate overall growth on this service. However, we cannot fully assess the reanalysis's benefit assumptions for this trade route without information about the number of containers still being offloaded in the port of New York/New Jersey and trucked to Philadelphia, which is the basis for containerized cargo benefits.

We also asked the logistics provider for information about the weekly Australia/New Zealand service, which represents 85 percent of containerized cargo benefits in the Corps' reanalysis. The provider said the weekly shipping service on that trade route is now handled in part by a firm that acquired the former primary shipper. In addition, a competing biweekly service that carries refrigerated cargo from the same countries began in early 2006. The logistics provider's weekly delivery data from January through November 2009 indicate that the reanalysis may have understated the number of containers that could be shipped directly into Philadelphia on the weekly service without being rerouted to New York/New Jersey with subsequent trucking back to Philadelphia. It is also possible that additional imports that otherwise would have arrived on the weekly service are instead being accommodated at current channel depth, without trucking, by the competing biweekly service that did not exist at the time of the reanalysis. Being able to avoid trucking only through a deeper channel was the basis for containerized cargo benefits in the reanalysis, and was a key source of uncertainty identified by the reanalysis's independent review panel. Ultimately, as in the case of the South America trade route, we cannot fully assess the reanalysis's benefit assumptions for this trade route without additional information about the extent to which trucking is occurring on the weekly service, if at all.

## Steel Slabs

The reanalysis's steel slabs benefit assumptions are not consistent with current market conditions. The Corps assumed that (1) transportation cost savings would be realized by a shift toward deeper-drafted vessels that can load more fully in a deepened channel and (2) these savings would grow as steel import volumes increased. From a 2001 base, the reanalysis forecasted a 1.1 percent annual growth rate for steel slab imports into the Packer Avenue Marine Terminal over the life of the project, which the Corps estimated would result in approximately 1 million tons imported in

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## Potential Effect of Recession and Other Observations

2009—the reanalysis’s project base year—and 1.6 million tons imported in 2059. According to the Packer Avenue logistics provider, 1 million tons was exceeded in 2002 (1.1 million tons) and again in 2006 (1.2 million tons). However, worsening economic conditions affecting construction and other steel-intensive industries were reflected in import volumes for steel products in 2008 (261,000 tons) and 2009 (63,000 tons). In the reanalysis’s 2004 supplement, the Corps notes that the domestic market for steel is cyclical and exhibits a certain level of expected volatility. Still, import volumes would need to recover to at least 1 million tons by 2015—the revised project base year—before steel slab benefits could reach the Corps’ forecasted levels.

For commodities such as steel slabs, the downturn in imports may be directly related to the recession and imports may recover as the economy recovers. It is possible that, over the length of the project, the growth rate for this benefit category may reach or exceed the Corps’ expected growth rate. For example, the current construction schedule means that benefits would not begin to be realized until at least 2015. Certain market and industry trends that have the potential to reduce project benefits—especially those tied to current economic conditions—could change over the next 5 years and have little or no negative effect on the benefit estimates or could even increase them. On the other hand, trends that result in part from policy and structural changes in the economy, such as legislation requiring increased fuel efficiency and the adoption of alternative fuels, are more likely to persist.

Despite policy changes, competition from other sources, the recent downturn in the crude oil market, and other changes in the industry, officials from Delaware River crude oil refineries continue to be strong supporters of the deepening project. They agree that as long as they are importing crude oil, they would have an incentive to maximize efficiency on large vessels with drafts that exceed 40 and often 45 feet. For example, according to an official from a refinery facility that receives crude oil from Canada, being able to more fully load its supply tankers would save one out of every seven tanker deliveries to the facility. The Corps’ benefit model correctly presumes that transportation cost savings could be generated from these efficiencies, but given the market and industry changes since the modeling was performed, the benefit estimates may not be reliable.

In addition, the Corps, the Philadelphia Regional Port Authority (PRPA), and others contend that the project has additional benefits that are not included in the Corps’ reanalysis. In its reanalysis, the Corps based its

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benefit estimate for the project on existing ships, commodities, and trade routes, with no commodity growth or new routes occurring as a direct result of the deepening. However, others have suggested that a 45-foot channel would actually increase the amount of trade in the Delaware River by making its ports more marketable globally. Moreover, a Corps Institute for Water Resources study expects the expansion and deepening of the Panama Canal that would accommodate 50-foot ship drafts by 2014 to significantly affect shipping routes, port development, and cargo distribution among ports.<sup>25</sup> According to the study, one of the expansion's greatest impacts will be seen in the containerized cargo trade. We heard from industry representatives that this trade is moving toward ever-larger container ships in order to realize greater economies of scale, including many ships that draft in excess of 40 feet. Furthermore, according to one of the economic experts we spoke with, significant growth in the chilled meat market could attract trade to Philadelphia and its extensive refrigerated warehouse infrastructure. To the extent that new cargoes and trade routes appear during the project's 50-year operation period, the Corps' analysis may understate project benefits for those commodities carried on vessels large enough to benefit from a 45-foot channel. However, these potential benefits would need to be analyzed by the Corps before they could be used to support the project's economic justification. This analysis would also need to assess the potential effect of an expansion of Delaware River trade in relation to other East Coast ports to ensure that any Delaware River benefits claimed are not merely transfers from those ports.

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### Corps' Recent Economic Updates Do Not Account for Changes in Conditions and Future Outlook That Could Affect Project Benefits

The Corps' 2008 and 2009 economic updates do not account for the market and industry changes that have occurred since the completion of the reanalysis or verify certain benefit categories that were expected to develop by 2009. The two economic updates affirmed the level of expected benefits for each commodity and adjusted these estimates to reflect the current price level and discount rate. However, neither update analyzed the extent to which changes in, for example, the market for crude oil might affect the net benefits of the project. Such information would be useful to establish whether the changes have affected the Corps' estimate of the project's economic justification.

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<sup>25</sup>U.S. Army Corps of Engineers Institute for Water Resources, *The Implications of Panama Canal Expansion to U.S. Ports and Coastal Navigation Economic Analysis* (Alexandria, VA: December 2008).

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Corps policy requires planners to report and maintain current estimates of project benefits and costs for all active funded projects in order to provide reasonable estimates of economic justification to Congress, federal decision makers, and local project sponsors. This policy requires economic updates for ongoing projects when more than 3 fiscal years have passed since the project's last economic analysis. According to Corps guidance, economic updates do not require any major new analysis. Instead, they are limited to reviewing and updating previous assumptions, as well as limited surveying, sampling, and other techniques to develop a reasonable estimate of project benefits.

The Corps' 2008 economic update did not account for changed conditions and uncertainties related to the Corps' commodity benefit estimates. According to Corps officials, the April 2008 economic update was developed internally for budgetary purposes and for establishing current project costs in preparation for the Army's June 2008 project partnership agreement with PRPA. The update recapped the discussion of major benefit categories from the two documents that constitute the reanalysis and presented an additional few years of data on the volume of commodity imports. We believe that some of these updates would be useful to decision makers seeking to understand how the reanalysis's forecasts had performed to date, but others would be less relevant. For example, the Corps validated its assumption of growth in blast furnace slag imports (and thus slag benefits) by using Waterborne Commerce Statistics Center data through 2005 to show that slag imports had exceeded the reanalysis's growth forecast. However, the Corps also used the center's data to show that crude oil imports had remained stable through 2005, but did not update the true constraint on long-term growth identified in the reanalysis—the Corps' assumption of 0.2 percent annual growth in the area's refinery capacity. For example, EIA's 2006 *Annual Energy Outlook* forecasted a 0.4 percent long-term annual decline in East Coast refinery capacity, and its 2007 outlook forecasted no long-term change, but the Corps did not discuss either of these forecasts in its 2008 economic update or assess their potential effect on its crude oil benefit estimate.<sup>26</sup> Neither did the Corps contact OSG to discuss the potential benefit-estimate implications of (1) the firm's long-term contract with Sunoco and the new lightering vessels it ordered (both of which were reported publicly in 2005), or (2) OSG's 2006 acquisition of the lightering firm whose

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<sup>26</sup>EIA's 2008 annual energy outlook was released in June 2008—too late to have been considered for the Corps' April 2008 economic update.

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operations were modeled by the Corps, which could have led to changes in the lightering operations that serve as the basis for the Corps' model.

The Corps' 2008 update also did not resolve uncertainties related to some other benefit categories. For example, the Corps noted the healthy growth rate of container volumes overall for the Packer Avenue Marine Terminal for 2005 and 2006 but did not update the status of the weekly shipping services on the two trade routes that account for all containerized cargo benefits. Specifically, the Corps did not confirm that (1) containers were still being trucked from New York/New Jersey to Philadelphia on the South America trade route and (2) the expected rate of growth was occurring on the Australia/New Zealand trade route, which was projected to cause trucking to begin by 2009—both of which are necessary to realize any containerized cargo benefits. This information is especially vital given that the future status of the Australia/New Zealand trade route was identified by the reanalysis's external independent review panel as the primary source of uncertainty in the Corps' estimate of containerized cargo benefits. Furthermore, the Corps' estimate of refined petroleum benefits depends in part on the benefiting petroleum firm's construction of a new ship berth on the Delaware River that was due to be completed in 2007. The 2008 economic update did not discuss the status of this berth; according to a firm official, these improvements have not been made.<sup>27</sup>

Like the 2008 update, the Corps' 2009 economic update reviewed commodity growth rates and adjusted benefit estimates to reflect new price levels and a lower discount rate. In addition, the update—completed by the Philadelphia district in December 2009, reviewed by the New England and New York districts, and approved by the North Atlantic division in January 2010—reduced the project's construction cost estimate to reflect the latest engineering surveys of the amount of material needing to be dredged from the river channel. However, the 2009 update did not present any revised modeling, sensitivity analysis, or related adjustments to the benefit estimates to reflect changes to market and industry conditions and outlook for the Delaware River region—for example, by incorporating the lost refinery capacity at the Delaware City and Eagle

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<sup>27</sup>In January 2010 we spoke with a representative of the petroleum firm—Magellan LP—located at the port of Wilmington, Delaware. He indicated that no new Delaware River berth had been constructed but that two alternative berths were now being evaluated. According to the representative, Magellan LP is in favor of the deepening project, which would create certain advantages for the firm. However, the firm's pursuit of a Delaware River ship berth is being evaluated independently of the deepening.

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Point facilities into its forecasts, or by revisiting the sensitivity analysis from the Corps' 2002 report that analyzed the effect of negative growth for crude oil, both of which could have provided additional context for decision makers. Like the 2008 update, the 2009 update provided no updated information about the current status of the weekly shipping services on the two trade routes that account for all containerized cargo benefits. Moreover, the 2009 update reprinted the same steel slab import volumes from 2005 and 2006 that appeared in the 2008 update, which captured the 2006 peak in steel slab imports but ignored the precipitous decline from 2007 through 2009. In addition, the 2009 update presented 2 additional years of blast furnace slag import data (2006 and 2007), but did not discuss the 38 percent decline in slag imports from 2005 to 2007. The 2007 import total (529,000 tons) was just more than half of the 1 million tons that the reanalysis forecasted would occur by 2009; according to a U.S. Geological Survey official who studies the slag industry, a private trade database indicates that the 2009 import total was about 125,000 tons. Finally, like the 2008 update, the 2009 update did not revisit the Corps' expectation that the benefiting petroleum firm's new ship berth would be in place by 2007.

The Corps' 2009 update did reduce the project's overall benefit estimate by 2.6 percent to remove benefits that were expected to be achieved prior to the completion of all segments of the deeper channel. In the reanalysis, the Corps stated that its construction schedule would allow benefits to be achieved at downriver facilities where deepening had already occurred before all upriver segments had been deepened. However, we observed—and Corps officials agreed—that the Corps' revised construction schedule makes it impossible to achieve these benefits.

After we shared our preliminary findings with the Corps in February 2010, the agency asked David Miller & Associates (DMA) to prepare a document that would provide us with additional information about the current status of Delaware River commerce to consider as we finalized our report. The resulting memorandum, reviewed by the Philadelphia district, discussed current trends in Delaware River commerce and identified changes in operations for relevant industries since the reanalysis was completed in 2004. DMA's memorandum generally agreed with our findings regarding declines in crude oil, steel slab, and blast furnace slag imports. However, the memorandum concluded that other than short-term impacts of the recession, Delaware River import trends and industry changes have the potential to increase project benefits. According to DMA, this is because changes that would likely have a negative impact on project benefits, such as the reduction in crude oil imports, would likely be offset by increases in

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containerized cargo, refined petroleum, and steel imports. However, although the memorandum asserts that additional benefits and beneficiaries may be present, it does not include sufficient quantitative analysis to show how the changed conditions and outlook would likely affect the reanalysis's commodity benefit estimates. For example, DMA's memorandum acknowledges that (1) crude oil imports have declined in part because of competition from imports of refined petroleum products, such as gasoline, to East Coast ports; and (2) refined petroleum vessels typically do not lighter their cargo and therefore tend to arrive at the Delaware River with shallower drafts than crude oil vessels, which often engage in lightering. DMA suggested that a deeper channel could result in a shift to larger refined petroleum vessels that could make fewer trips to deliver the same volume of cargo. If so, DMA states that partial replacement of crude oil imports by refined petroleum imports may increase project benefits if the transportation cost savings of avoided refined petroleum vessel trips are greater than the cost savings associated with reduced crude oil lightering over the life of the project. Nonetheless, this partial revision of the reanalysis's assumptions indicates that its crude oil and refined petroleum benefit estimates may no longer be reliable. Changed assumptions related to these benefit estimates—and those related to the estimates for containerized cargo, steel, and slag that also were presented in DMA's memorandum—could affect each benefit estimate as well as the project's overall net benefit estimate.

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## Several Key Issues That Could Affect the Project Remain Outstanding

We identified three key outstanding policy issues that could impact the construction of the Delaware River deepening project as it moves forward. Specifically, the Corps (1) lowered its estimate of the volume of dredged material, which eliminated the need for new disposal sites, but it continues to face resistance to its disposal plan; (2) was sued by Delaware and New Jersey in October and November 2009, respectively, which charged that the Corps lacks the environmental approvals needed to proceed with the project; and (3) has an ongoing dispute with New Jersey and several environmental groups over the project's National Environmental Policy Act (NEPA) process.

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## Disposal Plan Remains a Point of Contention

In the 2009 environmental assessment, the Corps lowered its 2002 estimate for the amount of material that would be dredged during the project's 5-year initial construction period by 38 percent, from 26 million cubic yards of material dredged during initial construction to 16 million cubic yards. The estimate was lower because improved hydrographic survey technology showed less need for dredging in some portions of the river

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channel, nonfederal interests had conducted dredging in some portions of the channel, and higher sea levels have naturally deepened some portions of the channel. Unlike the estimate of dredged material for initial construction, the estimate for additional annual dredging to maintain a 45-foot channel, over the amount of dredging that would be required to maintain the 40-foot channel, remained unchanged—860,000 cubic yards per year, or 43 million cubic yards over the 50-year life of the project. The Corps' lower estimate of dredged material for initial construction was independently validated in January 2009 by an engineering firm hired by PRPA, which, as the project's local sponsor, is responsible for 25 percent of the cost of dredging and other aspects of construction. We found the firm's approach to validating the dredged material estimate to be reasonable.

The lower estimate for dredged material allowed the Corps to eliminate the three additional disposal sites in New Jersey that it had planned to add according to the reanalysis. In its 2009 environmental assessment, the Corps stated that it can account for all project-related dredged material at its existing disposal sites. The disposal sites are to receive the material dredged during initial construction as well as the material dredged during annual maintenance of the 45-foot channel. As we mentioned earlier, the Corps already uses the existing sites in Delaware and New Jersey to dispose of dredged material during annual maintenance cycles for the current 40-foot channel. By using only its existing disposal sites, the Corps expects to reduce project costs by forgoing land expenditures and construction costs related to the new sites. The Corps has accounted for these plans in a revised disposal cost estimate in its 2009 economic update.

When it revised its dredged material estimate for the deepening project's initial construction in the 2009 environmental assessment, the Corps also reduced the beneficial uses of Delaware Bay dredged sand from three projects to two. A third beneficial use project included in the reanalysis would have restored wetlands at Egg Island Point, New Jersey. However, Corps officials told us that the agency decided to defer the project in part because the Corps no longer expects to dredge enough sand in the bay portion of the deepening project to supply all three sites.

Despite reductions in the dredged material estimate and the number of disposal sites needed, the Corps' disposal plan remains a point of contention. Specifically, New Jersey is opposed to receiving any dredged material from the deepening project because it believes that the Corps has not adequately sampled and analyzed the material. Furthermore, New



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Jersey officials believe that the material could contain polychlorinated biphenyls (PCBs) and other toxins that could contaminate the state's water supply, harm marine life, and pose a risk to disposal site employees.<sup>28</sup> The Corps disagrees with this assertion, maintaining that the incremental additional dredged material, from 40 feet to 45 feet, is similar to the material dredged during annual maintenance of the 40-foot channel, which is deposited each year at the same disposal sites in New Jersey. The Corps contends that based on its sediment testing, the dredged material contains no harmful levels of contamination and will have no impact on water quality. New Jersey officials question the sufficiency of this sediment testing, asserting that the Corps' testing is outdated and did not include sediment in the project's new work areas—channel bends, channel widenings, and the channel bottom below 40 feet—which are not dredged during the Corps' annual maintenance of the channel.<sup>29</sup>

A 2007 agreement between the governors of New Jersey and Pennsylvania has also added to the controversy over the placement of the project's dredged material. According to a letter from the governor of New Jersey to the Corps, the agreement specified that dredged material resulting from any deepening would be deposited entirely in Pennsylvania, not in New Jersey. Conversely, in separate letters from the governor of Pennsylvania to the Corps and to the governor of New Jersey, Pennsylvania interpreted the agreement to mean that Pennsylvania would be the final repository for all of the material unwanted by New Jersey or Delaware that could be used for beneficial purposes in Pennsylvania, but that the material could be initially deposited and drained in federal disposal sites in New Jersey and Delaware before being moved to Pennsylvania. Additionally, while both New Jersey and Pennsylvania agreed in 2007 to the formation of a committee to identify sites for the disposal of the material, they have not yet formed this committee.<sup>30</sup> Although the Corps and PRPA were not

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<sup>28</sup>PCBs are a family of chemicals that were used in hundreds of industrial and commercial applications, such as electric and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; and in pigments and dyes. PCBs were banned in 1979 and have been demonstrated to cause cancer and affect human immune, reproductive, and nervous systems.

<sup>29</sup>New Jersey officials further note that if dredged material is found after it is deposited in a federal disposal site to have higher levels of contaminants than currently expected by the Corps, changes to required treatment or disposal of this material could result in considerable federal expense. For more information about New Jersey's concerns, see the state's letter to GAO in appendix IV.

<sup>30</sup>For additional comments from Pennsylvania regarding the governors' agreement, see the state's letter to GAO in appendix V.

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involved in the governors' agreement, Corps officials told us that while they are open to an alternative disposal plan in general, any new disposal plan would have to be at least as safe as the current plan and result in no additional costs to the agency. Moreover, Corps officials stated that the project's benefits and costs would need to be reassessed to ensure economic justification if under an alternative disposal plan (1) the dredged material were first placed in New Jersey and later moved to Pennsylvania or (2) all the material went directly to Pennsylvania. They also noted that an alternative plan could result in another needed round of project approvals by Congress. However, Corps officials also told us that if Pennsylvania agreed with New Jersey to remove the dredged material from New Jersey sites at a later date, then the Corps would not consider this agreement to be part of the deepening project. Further, Corps officials said the later activity would have to be a "100 percent nonfederal expense" and would not affect the overall cost of the project.

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### States Contend That Additional Approvals Are Needed

The Corps and the states of Delaware and New Jersey disagree on the need for additional environmental approvals related to the deepening project, and this is currently the subject of litigation. In 1997 the Corps obtained letters from both states concurring that the project is consistent with each state's coastal resource management policies. Under the Coastal Zone Management Act, a federal agency must carry out its activities consistent to the maximum extent practicable with the enforceable policies of approved state management programs. In states with federally approved coastal zone management programs—such as Delaware and New Jersey—a federal agency that undertakes a project in the coastal zone must provide a certification to that state that the project is consistent with the state's program.<sup>31</sup> If a state deems the project consistent with the state's policies, the state issues a consistency "concurrence." However, in 2002, New Jersey informed the Corps that the state was revoking its consistency determination, citing substantial changes in the project's economic analyses and unresolved environmental issues. According to New Jersey officials, these issues include state requests for updated sediment sampling and analyses, as well as surface and groundwater monitoring reports, as described in a memorandum of understanding that

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<sup>31</sup>Coastal Zone Management Act of 1972, Pub. L. No. 92-583 (1972), as amended and codified at 16 U.S.C. §§ 1451-1466, § 1456(c) (2010). The act's purpose is to promote comprehensive and coordinated planning for coastal zone development and preservation between states and the federal government. *Conservation Law Foundation v. Watt*, 560 F.Supp. 561, 574 (D. Mass. 1983).

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accompanied the state's 1997 consistency concurrence.<sup>32</sup> Additionally, in a 2009 letter to the Corps, Delaware asked for additional coordination on its consistency concurrence issued in 1997, citing substantial project modifications over the previous 10 years.

The Corps disagrees with the states' positions on the consistency concurrences. First, Corps officials told us that they have the necessary concurrence letter on file from New Jersey. While New Jersey asserted that it "revoked" this concurrence, the National Oceanic and Atmospheric Administration, which administers the coastal zone management program, advised New Jersey that a state may not revoke a concurrence, noting an exception where the project has not begun and the effects are substantially different than previously reviewed.<sup>33</sup> Similarly, with respect to Delaware, the Corps' position is that the state already concurred with the Corps' consistency determination. In November 2009 the Corps determined that supplemental coordination was not required for either state's concurrence, because it found that the project changes were not substantial and that the changed circumstances were not significant.

In addition, in 2001 the Corps applied for a subaqueous lands and wetlands permit from the state of Delaware. Under that state's law, dredging in subaqueous lands or wetlands requires a permit. In comments on our 2002 report, the Under Secretary of the Army stated that the Corps "could not, and would not, proceed to construction without [Delaware's] Subaqueous Lands/Wetlands Permit," a position that the Under Secretary noted was a provision of the project cooperation agreement with the project's original local sponsor (Delaware River Port Authority). In 2003 a hearing officer for Delaware's Department of Natural Resources and Environmental Control recommended that the department deny the permit, citing the need for additional information. According to the Corps, it made several attempts to provide additional information to Delaware in the years following the hearing officer's recommendation. However, a senior Delaware official told us that this information could have been accepted

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<sup>32</sup>In commenting on a draft of this report, the Department of Defense stated that groundwater monitoring reports were provided to New Jersey in July 2009.

<sup>33</sup>David Kaiser, Office of Ocean and Coastal Resource Management, Letter to Bradley Campbell, Commissioner, New Jersey Department of Environmental Protection, December 19, 2002. The letter also noted the National Oceanic and Atmospheric Administration's understanding that the Corps had agreed to supplemental coordination and encouraged the state and the Corps to coordinate and consult with each other.

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only as part of a new application because the record on which the department's decision would be based had been closed.

When the Army entered into a new project partnership agreement with PRPA in 2008, it reserved the right to determine whether the Delaware state permit was required as a matter of federal law, and presumably to move forward with the project if it determined the permit not to be required. In July 2009 Delaware's Department of Natural Resources and Environmental Control denied the Corps' request for the permit—finding that the Corps failed in its 2001 application to demonstrate that adverse environmental effects resulting from the project had been minimized, and that the record was outdated given the significant changes to the project as well as additional information developed since 2001. Subsequently, the Corps has argued that, under a provision of the Clean Water Act, the agency can assert federal supremacy and avoid compliance with the relevant state law because the Assistant Secretary of the Army for Civil Works found that regulation under such law impaired the Corps' authority to maintain navigation.<sup>34</sup>

In summer 2009 the Corps solicited construction bids for dredging the first segment of the project.<sup>35</sup> In response to the Corps' statements and actions, in fall 2009, Delaware, New Jersey, and several environmental groups filed separate lawsuits against the Corps in U.S. district courts in Delaware and New Jersey. Among other things, the states and environmental groups are seeking a halt to the project until the Corps complies with all legal requirements, including obtaining relevant concurrences and permits.<sup>36</sup> However, a U.S. district court recently allowed the Corps to proceed with deepening of the first river segment, denying in part Delaware's motion for preliminary injunction. The judge also granted Delaware's motion in part, ruling that the Corps cannot proceed with the rest of the project pending resolution of the lawsuit or further order of the court. The judge stated her opinion that, notwithstanding the ruling, the project "should be completed,

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<sup>34</sup>In commenting on a draft of this report, the Department of Defense stated that a new subaqueous lands and wetlands permit application was submitted to Delaware on March 12, 2010.

<sup>35</sup>The solicitation was for a single contract for the segment to include both maintenance dredging and deepening. According to the Corps, the base contract is for maintenance, but there is also an option clause that would authorize dredging in the portions of the segment necessary to reach 45 feet of depth.

<sup>36</sup>The states' and environmental groups' lawsuits assert that the Corps has not complied with several other laws, such as the Clean Air Act, in addition to those discussed here.

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consistent with congressional intent.” In reaching the decision, the court did not make a final ruling on Delaware’s claims, but concluded that the state was unlikely to prevail on a majority of its claims, while finding the Corps’ record lacking with respect to one claim.<sup>37</sup> According to the court, its decision “gives the parties the opportunity to satisfy their respective obligations to govern responsibly.” The environmental groups who intervened in the case have appealed the ruling. On February 23, 2010, the Corps announced it had awarded a contract to deepen the first segment of the project, and on March 1 this work began. In the meantime, the district court case, as well as the pending New Jersey and environmental groups’ cases, is proceeding.

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## Outstanding Disputes over the Project’s NEPA Process

The Corps’ 2009 environmental assessment for the Delaware River deepening project was controversial and has been challenged in court on several grounds. Specifically, New Jersey officials and several environmental groups have separately claimed that the assessment is not the appropriate mechanism for updating the last major environmental analysis of the project—the 1997 Supplemental Environmental Impact Statement (SEIS)—because, in their view, applicable regulations require the Corps to prepare another SEIS to account for project and environmental conditions that they contend have changed significantly since 1997. Generally, an environmental assessment involves a less detailed analytical process than other NEPA documents, such as an Environmental Impact Statement (EIS) or SEIS. Instead, it is intended to be a concise document that provides sufficient evidence and analysis for determining whether to prepare an EIS or SEIS. In commenting on a draft of this report, the Department of Defense noted that it has followed the regulations concerning the NEPA documents. Specifically, the stated purpose of the environmental assessment included to evaluate the impacts of changes to the deepening project, as well as changes to the existing conditions in the project area from those described in the 1992 EIS and 1997 SEIS. On this basis, the Corps concluded that none of the changes to the proposed project were substantial and there were no new circumstances or information that

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<sup>37</sup>The court stated that Delaware had failed to prove its claim related to the state subaqueous lands and wetlands permit under the Clean Water Act, that the record supported the Corps’ determination that no supplemental consistency determination was required under the Coastal Zone Management Act, and that the record did not support that the Corps’ Clean Air Act conformity determination was rational. *Del. Dep’t of Natural Res. & Env’tl. Control v. United States Army Corps of Engineers*, — F.Supp.2d —, 2010 WL 322171 (D. Del., 2010).

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can be considered significant, and therefore determined that an SEIS was not required.

According to New Jersey and the environmental groups, the environmental assessment overlooked certain elements of the project, relied on outdated information, and did not sufficiently explore all of the potential adverse impacts from the project. For example, they believe additional and updated sediment sampling and analyses are needed to fully characterize the materials to be dredged in the deepening project. As a result of these concerns, New Jersey and the environmental groups are now asking a U.S. district court, as part of the lawsuits they filed in fall 2009, to order the Corps to issue a new SEIS before proceeding with the project.

In this regard, the Corps' process for public comments on the deepening project has also been criticized. On December 17, 2008, the Philadelphia district, via a public notice, solicited comments from stakeholders concerning environmental changes as well as project changes since the 1997 SEIS, such as changes to the amount of estimated dredged material and the elimination of new disposal sites. The Corps' notice indicated that all comments should be made by December 31, 2008. Among other things, environmental groups criticized the Corps for not giving stakeholders sufficient time for commenting on these changes and for scheduling the comment period over a major holiday period. Following these criticisms, the Corps extended the public comment period by 2 weeks.

The public notice also did not explicitly inform the public that their comments would be used to prepare an environmental assessment. Instead, the notice asked the public for comments related to a summary of project changes and to identify any applicable existing and new information generated subsequent to the 1997 SEIS, to be used to update the environmental record and to determine whether further environmental work and analyses would be needed. Owing to both the abbreviated response period and the confusion over the public notice's purpose, the environmental groups we spoke to stated that some potential respondents may not have commented, and comments the Corps did receive may not have been comprehensive.

The environmental groups also contend that the Corps should have circulated a draft of the environmental assessment for public comment. There was professional disagreement between the Corps and the Army concerning whether a comment period for the draft environmental assessment was necessary. Specifically, in March 2009 the Corps' Director of Civil Works asked permission from the Assistant Secretary of the Army

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for Civil Works to circulate the draft environmental assessment for public comment before it was issued in final form. In his request, the director identified several reasons why circulation of the draft assessment was advisable. The Assistant Secretary of the Army, however, denied his request, disagreeing with the rationale and focusing on its finding that circulation was not legally required—maintaining that the initial notice and comment period constituted a sufficient amount of public participation and that there was no legal requirement for additional public involvement.<sup>38</sup> While Corps officials in the Philadelphia district told us that Corps guidance does not direct the agency to provide a public comment period for draft environmental assessments, they could not identify other environmental assessments that the district had issued without first circulating the draft for public comment. The reason that NEPA regulations emphasize public involvement through mechanisms such as public comment is that the law’s purpose, in part, is “to require disclosure of relevant environmental considerations that were given a ‘hard look’ by the agency, and thereby to permit informed public comment on [the agency’s] proposed action and any choices or alternatives that might be pursued with less environmental harm.”<sup>39</sup>

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## Conclusions

The Corps has had the difficult task of developing benefit and cost estimates for the Delaware River deepening project that are based on what may occur over a 50-year period of analysis—a period that begins only after 5 years of channel dredging have been completed. For such a project, economic uncertainties associated with making projections about future conditions are important to consider because expectations about future market conditions and benefits often may not be realized. As the Corps’ policies recognize, analyzing uncertainties can help decision makers judge whether a project would be warranted under a range of economic conditions. The Corps’ reanalysis has provided a more solid foundation for estimating the project’s benefits and costs and has used sensitivity analysis to analyze the uncertainties associated with several key assumptions.

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<sup>38</sup>In commenting on a draft of this report, the Department of Defense observed that “predecisional disagreements are not uncommon during the deliberation process, and serve as a healthy basis for resolving differing opinions and reaching sound conclusions.”

<sup>39</sup>See, e.g., 40 C.F.R. §§ 1500.1(b), 1500.2(d), pt. 1503, § 1501.4(b) (2010); *Soda Mountain Wilderness Council v. Norton*, 424 F.Supp.2d 1241, 1262 (internal citations omitted) (E.D. Cal. 2006); *Sierra Nevada Forest Protection Campaign v. Weingardt*, 376 F. Supp. 2d 984, 990-91 (E.D. Cal. 2005); *Pogliani v. U.S. Army Corps of Engineers*, 306 F.3d 1235, 1237-38 (2nd Cir. 2002).

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However, since the reanalysis was completed, market and industry conditions have changed significantly in ways that raise questions about the Corps' project benefit estimates going forward. While some of these changes could be short-term trends, others could have longer-lasting impacts. Such changes create additional uncertainties about the deepening project. In some cases, such as blast furnace slag, the changes affect a small portion of the project's estimated benefits, but in other cases, such as crude oil, containerized cargo, and steel slabs, the changes are associated with commodities that make up most of the project's estimated benefits. A key purpose of the Corps' periodic economic updates is to analyze these uncertainties by collecting enough additional information to ensure that decision makers are presented with reasonable and timely estimates and that the project is warranted under a range of economic conditions. Because the Corps' economic updates have not accounted for the potentially significant impact that some market and industry trends could have on the project's estimated benefits, federal decision makers do not have the most current information about the project, including whether adjustments to the assumptions in the Corps' benefit models are necessary. Such information would help decision makers more fully assess the project's economic justification.

Noneconomic aspects of project implementation can also add to uncertainties about the project. A key area of such uncertainty is the outcome of the legal challenges to the project's environmental approvals and compliance. In particular, the Corps has made several decisions—such as soliciting information from the public over the winter holiday, and then, following Army direction, not seeking public comment on the draft environmental assessment—that have exacerbated public concerns over environmental issues, and as a result, its communications with the public regarding its actions have not been as open as might have been advisable for such a controversial project.

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## Recommendations for Executive Action

To better ensure that decision makers have the most current information about changes that could affect the benefits of the Delaware River deepening project, we recommend that the Secretary of Defense direct the Chief of Engineers and Commanding General of the U.S. Army Corps of Engineers to provide an updated assessment to the Assistant Secretary of the Army for Civil Works, and to Congress, of relevant market and industry trends and outlook that specifies the extent to which the data and assumptions underlying each benefit category have changed, and the effect of any changes on each benefit estimate and the project's net benefit



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estimate. This assessment should be issued as a public document and become part of the project's official record.

To improve consistency and transparency in how the Corps handles public participation in the development of environmental documents that are related to controversial projects and that the Corps believes have no applicable NEPA requirement, we recommend that the Chief of Engineers develop guidance on the appropriate timing and approaches for public notice and comment on such documents.

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## Agency Comments and Our Evaluation

We provided a draft of this report to the Department of Defense for review and comment. The department generally agreed with the recommendations in our report. Specifically, the department concurred with our recommendation that the Corps provide an updated assessment of relevant market and industry trends and outlook that specifies the extent to which data and assumptions underlying each benefit category have changed and the effect of these changes on project benefit estimates. The department agreed to have the Corps prepare an updated quantitative assessment that would incorporate the long-term trend in the economy over the project's 50-year planning period. In addition, the department partially concurred with our recommendation that the Corps develop guidance on the appropriate timing and approaches for public notice and comment on environmental documents that are related to controversial projects and that the Corps believes have no applicable National Environmental Policy Act requirement. The department agreed that the Army will review and evaluate the need for clarifying guidance regarding whether or when a draft Corps Civil Works environmental assessment (EA) and finding of no significant impact (FONSI) should be circulated for public comment before they are finalized.<sup>40</sup> The department notes that it has no reason to believe that its existing regulations and guidance regarding this subject are defective or in need of modification. While there are regulations addressing the typical scenario where an environmental assessment is the first NEPA document developed (e.g., there is no EIS previously prepared), we believe that no Corps guidance exists for the less common scenario where a relatively old EIS or supplemental EIS already exists for a project that has not yet been constructed, as was the situation

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<sup>40</sup>A FONSI is a document prepared by a federal agency briefly presenting the reasons why an action will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. It includes the environmental assessment or a summary of it.

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in 2009 when the Corps prepared its EA for the deepening project. The department acknowledges that it would be beneficial to issue clarifying guidance for conducting an EA in such a scenario.

The department's official comments are presented in appendix III. We also received technical comments from the department, which we have incorporated as appropriate throughout the report. In addition, we invited Delaware, New Jersey, and Pennsylvania to comment on draft report excerpts discussing issues relevant to each state. We received comment letters from New Jersey and Pennsylvania, which we present in appendixes IV and V, respectively. We also received technical comments from all three states, which we incorporated as appropriate throughout the report.

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As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees, the Secretary of Defense, the Chief of Engineers and Commanding General of the U.S. Army Corps of Engineers, and other interested parties. In addition, this report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions regarding this report, please contact me at (202) 512-3841 or [mittala@gao.gov](mailto:mittala@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix VI.

Sincerely yours,



Anu K. Mittal  
Director, Natural Resources and Environment

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# Appendix I: Objectives, Scope, and Methodology

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Our objectives were to determine (1) the extent to which the U.S. Army Corps of Engineers' (Corps) reanalysis addressed the economic analysis limitations we identified in 2002; (2) the extent to which the benefit projections the Corps included in its reanalysis of the project, as updated, are consistent with current and anticipated future market and industry conditions; and (3) what other key issues, if any, could affect the project, and the extent to which the Corps has accounted for these issues and their potential impacts.

To determine the extent to which the Corps' reanalysis addressed the economic analysis limitations we identified in 2002, we reviewed our 2002 report<sup>1</sup> to identify the key limitations we had found in the Corps' 1998 analysis. These limitations ranged from errors in benefit and cost estimation—such as the misapplication of commodity growth rates and the omission of disposal site construction costs for future channel maintenance dredging—to concerns about the Corps' treatment of economic uncertainty and the lack of internal quality control in the Corps' report review process. We then reviewed the Corps' reanalysis—the 2002 *Comprehensive Economic Reanalysis Report* and the 2004 *Supplement to Comprehensive Economic Reanalysis Report*—and supporting documents, and assessed the extent to which the reanalysis generally addressed the limitations we had identified earlier consistent with standard economic principles for conducting a benefit-cost analysis. The supporting documents we reviewed included detailed quantitative analyses for each of the five benefiting commodities included in the reanalysis—crude oil, containerized cargo, steel slabs, blast furnace slag, and refined petroleum—as well as the Corps' calculation of benefits for reuse of dredged sand at Broadkill Beach. We also reviewed documents that provided greater context for the Corps' reanalysis, such as the agency's official comments in response to the findings and recommendations in our 2002 report, and two subsequent internal documents that updated and further explained the reanalysis's benefit and cost assumptions—the Corps' 2008 and 2009 economic updates. We interviewed Corps officials at the Philadelphia district with primary responsibility for the reanalysis's benefit-cost analysis to gain further understanding of the steps taken by the Corps to address the limitations. We also discussed the reanalysis with officials from the Corps' North Atlantic division and its headquarters in Washington, D.C. For further

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<sup>1</sup>GAO, *Delaware River Deepening Project: Comprehensive Reanalysis Needed*, [GAO-02-604](#) (Washington, D.C.: June 7, 2002).

information about the reanalysis, we interviewed the primary economic consultant for the reanalysis from David Miller & Associates (DMA), the firm that the Corps hired to prepare key parts of the reanalysis, including an updated analysis of project benefits and associated costs. Finally, we presented our findings related to each limitation in a table for the Corps to review, at which time we requested additional information and documentation for certain items, as appropriate. In addition, we discussed the Corps' analyses with an academic expert who has analyzed the lightering and crude oil industries in the Delaware River.

To determine the extent to which the benefit projections the Corps included in its reanalysis of the project, as updated, are consistent with current and anticipated future market and industry conditions, we attempted to verify key data and assumptions underlying the key benefit categories in the reanalysis's 2002 report and 2004 supplement, as well as the Corps' 2008 and 2009 economic updates, using data on the general trends since the Corps conducted its reanalysis, current conditions, and the expected outlook for relevant Delaware River imports and industries. For crude oil, we used data on imports to Delaware River ports collected by the Department of Energy's Energy Information Administration (EIA). Importers of crude oil and petroleum products are required to report on a monthly basis to EIA. To assess the reliability of these data, we reviewed existing agency information about the data and the agency's data quality procedures, and we interviewed agency officials knowledgeable about the data. We used information from the Department of Commerce and industry sources to corroborate the general historical trend exhibited in the EIA import data. We note that EIA's import data for 2009 are preliminary and may be revised. We determined that the EIA data are sufficiently reliable for the purposes of this report. We also reviewed EIA's Annual Energy Outlook forecasts for U.S. crude oil imports and refinery capacity on the East Coast; EIA forecasts were a primary source for the Corps' in developing the reanalysis's crude oil benefit estimate. To assess the reasonableness of these forecasts, we reviewed supporting documentation on the approach and key assumptions and we interviewed knowledgeable EIA officials to discuss possible reasons for observed declines in historical imports and changes in the agency's forecast for crude oil refinery capacity and imports. We note that EIA may revise its forecasts over time as new information becomes available.

To further assess trends and outlook in the Delaware River crude oil industry, we interviewed officials from the three refinery firms that own the six Delaware River refinery facilities included in the Corps' reanalysis,<sup>2</sup> as well as representatives of Overseas Shipholding Group,<sup>3</sup> which conducts the lightering operations for those firms, to discuss their past and present crude oil-related operations. We also interviewed EIA officials and an academic expert knowledgeable about oil markets.

To assess current conditions and outlook for containerized cargo and steel slab imports, we reviewed Corps data in the reanalysis and subsequent economic updates and we interviewed the logistics provider for the Packer Avenue Marine Terminal. Although we obtained information on containerized cargo import trends, we were unable to obtain data with which to verify key assumptions that the Corps used to support its containerized cargo benefit estimate. Specifically, we could not confirm that (1) containers were still being trucked from the port of New York/New Jersey to Philadelphia for the weekly service on the South America trade route and (2) the expected rate of growth was occurring for the weekly service on the Australia/New Zealand trade route, which was supposed to cause trucking to begin by 2009—both of which are necessary to realize any containerized cargo benefits. For information on blast furnace slag imports, we reviewed annual reports by the U.S. Geological Survey on the slag industry in the United States and we interviewed a U.S. Geological Survey official who is knowledgeable about the slag industry. We believe that the information is sufficiently reliable for the purposes of this report.

For details about the operational status of the reanalysis's sole refined petroleum beneficiary, we interviewed a representative of Magellan LP, the firm that acquired the benefiting petroleum terminal identified in the reanalysis. For additional background on all commodities, we reviewed historical import data from several additional sources, including the

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<sup>2</sup>The reanalysis identified five of these refinery facilities importing crude oil at six deep-draft terminals as potential project beneficiaries. The sixth facility was included in DMA's modeling of Delaware River lightering operations but was not considered to be a project beneficiary.

<sup>3</sup>In 2006 Overseas Shipholding Group acquired Maritrans, the lightering firm whose operations were modeled in the Corps' reanalysis.

Corps' Waterborne Commerce Statistics Center,<sup>4</sup> the U.S. Department of Agriculture, and the U.S. Department of Commerce.

To determine what other key issues, if any, could affect the project, and the extent to which the Corps has accounted for these issues and their potential impacts, we reviewed the limitations that we had identified in our 2002 report to develop a list of key noneconomic concerns for further examination. This included the Corps' handling of environmental policy issues, such as its pursuit of a subaqueous lands permit from Delaware for dredging in that state's waters. Similar to the methodology described in our first objective, we used these previously identified concerns as criteria for reviewing the reanalysis and other key documents, as well as the Corps' 2009 environmental assessment, to determine whether and how each issue was addressed by the Corps. We also requested from the Corps all comment letters received in response to its public request for information in advance of its 2009 environmental assessment. These letters—from federal, state, and local agencies; environmental groups; and private citizens—detailed concerns about the project's potential impacts and changes in the project area since the Corps' 1997 supplemental environmental impact statement (SEIS). We reviewed these letters, and the content analysis that the Corps prepared to summarize them, in order to gain an understanding of prominent issues and controversies associated with the project. Throughout our review we also read local media accounts of these issues and controversies. Further, we reviewed correspondence and legal filings related to Delaware's, New Jersey's, and regional environmental groups' ongoing disputes with the Corps over environmental approvals for the deepening project. We discussed the project with several regional environmental groups, including some that were involved in lawsuits to stop the project. Finally, once we had determined key policy and legal issues affecting the project, we discussed these issues with the Corps and requested more information and documentation of the Corps' plans where necessary. We also asked representatives of the three states likely to be most affected by the project—Delaware, New Jersey, and Pennsylvania—to review our interpretation of these issues to the extent that it was relevant to each state.

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<sup>4</sup>The primary function of the Waterborne Commerce Statistics Center is to collect, process, distribute, and archive vessel trip and cargo data. These data are self-reported to the Corps by companies engaged in transporting goods on the navigable waters of the United States.

For all three objectives, we consulted experts in the fields of economics and lightering, environmental groups with an interest in the project, representatives of firms likely to be affected both positively and negatively by the project, and the Philadelphia Regional Port Authority (PRPA), the project's local sponsor. Where we obtained other analyses or external studies, we considered the contents of these studies but conducted our own independent review. For example, the Corps' reduced estimate of dredged material from initial construction was independently validated in January 2009 by an engineering firm hired by PRPA, which, as the project's local sponsor, is responsible for 25 percent of the cost of dredging and other aspects of construction. We reviewed the firm's approach to validating the revised dredged material estimate and found it to be reasonable.

We conducted this performance audit from March 2009 through March 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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# Appendix II: Additional Observations about the Project's Associated Costs

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It has now been more than 7 years since the Corps has asked the refineries about changes to their facilities. Since the reanalysis, some refinery facilities have undergone significant structural and operational changes that could affect the associated costs of the project, which are the private costs that would need to be incurred, in addition to project costs, to achieve the project's full benefits. Associated costs account for about 10 percent of the project's total economic first costs.<sup>1</sup> Specifically:

- *Associated costs could be lower.* According to one refinery, a tanker dock at one of its facilities was completely rebuilt in 2008 to address structural problems. In anticipation of a deepened channel, the new dock was constructed to accommodate tankers needing a depth of 45 feet. Since this work was undertaken after the Corps' reanalysis, the project's associated costs could be lower than the reanalysis initially predicted. In 2002 the Corps estimated that these modifications would cost \$3.6 million. In addition, the recent closure of Sunoco's Eagle Point facility, if permanent, could decrease associated costs because no modifications would need to be made at this facility. In 2002 the Corps estimated that it would cost \$362,000 to modify this facility.
- *Associated costs could be higher.* Refinery officials expressed concerns about the availability of private disposal space for dredged material, which could be costly. According to PRPA, private dredging and disposal costs have risen since the time of the reanalysis due to higher fuel costs, among other factors. If the disposal cost for dredged material is significantly more now than it was in 2002, the project's associated costs could increase.

Officials from all three refinery firms told us that they supported the deepening project. However, they also told us that they would need to analyze the project's benefits and costs for their firms to determine whether they would commit to making the improvements necessary to take advantage of the project. These improvements could be substantial: deepening their ship berths, retrofitting their docks, or expanding their storage capacity. As our discussions with refinery officials suggest, firms are not likely to commit to the modifications needed to realize project benefits until they have conducted their own financial analysis of the benefits they would gain. If the firms decided against making the

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<sup>1</sup>Total economic first costs include major items such as engineering and design, channel dredging, associated costs, and interest during construction, but do not include annual operations and maintenance of the deeper channel. The Corps' 2009 economic update estimated total economic first costs to be \$332.5 million. Associated costs, including interest, were estimated to account for \$34.4 million of this total.



necessary modifications, then the project's benefits could be lower than initially estimated.

These decisions are particularly important in light of the Army's project partnership agreement with PRPA. The agreement specifies that PRPA is responsible for ensuring that the local facilities undertake the modifications necessary to take advantage of the deepening project. However, this agreement does not require PRPA to produce third-party agreements with these potential beneficiaries as evidence of their commitment before project construction could proceed. In contrast, under the agreement with the project's original local sponsor (the Delaware River Port Authority), the local sponsor had to provide copies of third-party agreements as evidence of local facilities' commitment to make the modifications necessary to realize project benefits. Corps officials said that in the time between the signed agreements with the Delaware River Port Authority and PRPA, the model project partnership agreement, developed by Corps headquarters, changed so that provisions for third-party agreements are no longer included.

Nevertheless, according to Corps officials with whom we spoke, the agency expects benefiting firms will modify their facilities once project construction begins. The Corps assumes that the beneficiaries will make separate arrangements with the Corps' dredging contractor while the contractor is working in each beneficiary's section of the river. By using the Corps' contractor, the beneficiaries could save certain dredging costs, such as those related to the transfer of equipment to and from the site and the installation and removal of pipelines.

# Appendix III: Comments from the Department of Defense



DEPARTMENT OF THE ARMY  
OFFICE OF THE ASSISTANT SECRETARY  
CIVIL WORKS  
108 ARMY PENTAGON  
WASHINGTON DC 20310-0108

MAR 25 2010

Ms. Anu K. Mittal  
Director, Natural Resources and Environment  
U.S. Government Accountability Office (GAO)  
441 G Street, N.W.  
Washington, DC 20548

Dear Ms. Mittal:

This is the Department of Defense response to the GAO draft report, GAO-10-420, "DELAWARE RIVER DEEPENING PROJECT: Comprehensive Reanalysis Corrected Errors, but Several Issues Still Need to Be Addressed," dated March 2010 (GAO Code 36150). Thank you for the opportunity to comment on the draft report.

We concur with your first recommendation. The Corps will perform an updated quantitative assessment of the impact of relevant market and industry trends on the previously projected project benefits. The updated assessment will augment the qualitative port assessment previously provided by the Corps for consideration during the development of the GAO draft report.

We partially concur with your second recommendation that the Chief of Engineers develop guidance on the appropriate timing and approaches for public notice and comment on environmental documents that are related to controversial projects that the Corps believes to have no applicable National Environmental Policy Act requirement. We do not believe that our existing regulations, which are based on the Council on Environmental Quality regulations that are applicable to all Federal agencies, are either defective or in need of modification. However, we acknowledge that it would be beneficial to issue clarifying guidance for conducting the analysis contemplated by 40 C.F.R. § 1502.9(c), where a relatively old Environmental Impact Statement or Supplemental Environmental Impact Statement exists for a project that has not yet been constructed, as the situation was in the present case.

Responses to the GAO recommendations are enclosed.

Very truly yours,

A handwritten signature in cursive script that reads "jo-ellen darcy".

Jo-Ellen Darcy  
Assistant Secretary of the Army  
(Civil Works)

Enclosures

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GAO DRAFT REPORT – DATED MARCH 15, 2010  
GAO 10-420 (GAO CODE 36150)

DELAWARE RIVER DEEPENING PROJECT: Comprehensive Reanalysis Corrected  
Errors, but Several Issues Still Need To Be Addressed

DEPARTMENT OF DEFENSE COMMENTS TO THE RECOMMENDATIONS

**RECOMMENDATION 1:** To better ensure that decision makers have the most current information about changes that could affect the benefits of the Delaware River deepening project, we recommend that the Secretary of Defense direct the Commanding General and the Chief of Engineers of the U.S. Army Corps of Engineers to provide an updated assessment to the Assistant Secretary of the Army for Civil Works and to Congress of relevant market and industry trends and outlook that specifies the extent to which the data and assumptions underlying each benefit category have changed and the effect of any changes on each benefit estimate and the project's net benefit estimate. This assessment should be issued as a public document and become part of the project's official record.

**DOD RESPONSE:** CONCUR The Corps will perform an updated quantitative assessment of the impact on project benefits resulting from relevant market and industry trends and outlook. This work effort will augment the qualitative port assessment previously provided by the Corps to the GAO for consideration during the development of the agency's Draft Report, and will incorporate the long-term secular trend in the economy over the 50-year planning period of analysis. It should be noted that short-term business cycle fluctuations, such as the deep 2009 recession, are a consideration, but should not be the determining basis for defining a project's benefits.

**RECOMMENDATION 2:** To improve consistency and transparency in how the Corps handles public participation in the development of environmental documents that are related to controversial projects and that the Corps believes have no applicable NEPA requirement, we recommend the at the Chief of Engineers develop guidance on the appropriate timing and approaches for public notice and comment on such documents.

**DOD RESPONSE:** PARTIALLY CONCUR. The Department of the Army (DA) will review and evaluate our existing guidance regarding whether or when a draft Corps Civil Works EA/FONSI should be circulated for public comment before it is finalized.

Presently we have no reason to believe that our existing regulations and guidance regarding this subject are defective or in need of modification.

There are only three circumstances in which the Corps is required to circulate a draft EA/FONSI for public comment, none of which encompass the present situation. The first two circumstances are mandated by CEQ's legally binding NEPA regulations at 40 C.F.R. § 1501.4(e) (2):

1. where the proposed action is, or is closely similar to, one of a class of actions designated as normally requiring an EIS under that agency's NEPA regulations; or
2. where the nature of the proposed action is one without precedent.

The Corps' Civil Works NEPA regulation, 33 C.F.R. § 230.1, articulates the third circumstance in which the Corps is required to circulate a draft EA/FONSI:

"In the case of feasibility, continuing authority, or special planning reports and certain planning/engineering reports, the draft FONSI and EA should be included within the draft report and circulated for a minimum 30 days review to concerned agencies, organizations and the interested public (40 C.F.R. § 1501.4(e)(2))."

In all other circumstances, the decision to circulate a Corps Civil Works draft EA/FONSI before finalization is discretionary. The draft EA/FONSI may be circulated for public comment if the Army or Corps decision-maker determines that it would be advantageous or appropriate to do so.

In the case of the Delaware River Deepening Project's most recent EA, then-ASA(CW) Woodley determined that it was not necessary or appropriate to circulate that particular draft EA before it was finalized. We believe that decision was proper under the circumstances involved. The circumstances presented the issue whether the EA documenting that analysis contemplated by 40 C.F.R. § 1502.9(c), required additional public comment and participation where an environmental record exists in the form of a relatively old EIS or SEIS project, and the project has not yet been constructed. The Corps will undertake an additional review and consider whether internal guidance, in addition to 40 C.F.R. § 1502.9(c), would be useful to address these situations.

# Appendix IV: Letter from the State of New Jersey



## State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION  
P.O. BOX 402  
Trenton, NJ 08625-0402  
TEL: # (609) 292-2885  
FAX # (609) 292-7695

CHRIS CHRISTIE  
*Governor*

KIM GUADAGNO  
*Lt. Governor*

BOB MARTIN  
*Acting Commissioner*

March 16, 2010

Mr. David A. Brown  
United States Government Accountability Office  
441 G Street, NW  
Washington, DC 20548

Dear Mr. Brown:

Thank you and your staff for speaking to me and Suzanne Dietrick on March 4th about the Delaware River Deepening Project (Project) currently being undertaken by the Army Corps of Engineers, Philadelphia District (ACOE). We certainly appreciate that the Government Accountability Office (GAO) is reviewing the economic and environmental issues surrounding the Project, and will be issuing a new report on or around March 25, 2010.

As we discussed, the New Jersey Department of Environmental Protection (NJDEP) has serious concerns about this Project, and wants to ensure that New Jersey's air and water are not harmed should the Project continue to go forward. I am enclosing a mark-up of the draft report that we discussed, with NJDEP's comments incorporated, with the hope that the GAO will seriously consider the points that we raised. Please note that we have a correction on our mark up regarding the number of tons of NOx/year that are being offset in the New York Harbor Deepening Project.

NJDEP is particularly concerned that the ACOE will be deepening the Delaware River, and depositing the dredged materials in upland confined disposal facilities (CDFs) located primarily in New Jersey. Our concern is that large segments of the Delaware River that will be dredged have not been comprehensively sampled for at least seventeen years. In NJDEP's view, a significant amount of this dredged material will come from industrial parts of the River (between Philadelphia/Camden to the Port of Wilmington), where contamination with polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), and other highly toxic substances is likely to be high and in violation of NJDEP's regulatory standards. A massive oil spill occurred in this part of the River in 2004. NJDEP expects that runoff from the dredged material stored in the CDFs will impact the surface waters of the Delaware River and will also seep into and contaminate the groundwater. If the ACOE knows the levels of contamination in the dredged materials, then controls can be put in place to manage the contaminated material properly, and prevent further water pollution. For these reasons, NJDEP has been insisting on updated, comprehensive sampling of the new work areas of the River.

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Appendix IV: Letter from the State of New Jersey

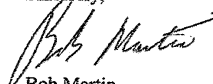
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NJDEP realizes that the sediment sampling it is demanding will add to the overall cost of the Project. In the New York Harbor Deepening Project, however, the New York District of ACOE performed comprehensive, state-of-the-art sediment sampling prior to the initiation of construction activities for each contract. We were able to use our experience with the New York Harbor Deepening Project to estimate the costs of performing sediment sampling in the Delaware River. We believe that the additional sampling will range from \$4.8 to \$5.4 million (or less than 2% of the total project costs). If the sediment sampling produces results that exceed New Jersey's regulatory standards such that the dredged materials could not be managed at the CDFs, then additional management of the materials will be required, which could add approximately \$400,000,000 to the total project costs. This figure is based on the projected volumes to be removed from areas of the Delaware River where we expect there to be the most contamination (e.g., between Philadelphia/Camden to the Port of Wilmington).

In addition, NJDEP has serious concerns that the ACOE is choosing to mitigate the air emissions caused by the construction of the Project (e.g., diesel emissions caused by the dredgers, tug boats, trucks and other heavy equipment) exclusively through the purchase of Emission Reduction Credits (ERCs). The ACOE is proposing to spend \$3.3 million to offset 607 tons/year of NOx emissions. In contrast, the New York District spent approximately \$20 million on new mitigation projects (e.g., engine upgrades and air pollution controls on the Staten Island Ferries, repowering tugboats, and ERCs) to offset the 1,265 tons/year of NOx emission increases caused by the deepening of New York Harbor. NJDEP believes that if the Philadelphia District approached air conformity in the same manner as the New York District, it would be spending much more on new mitigation projects that actually improved air quality.

Again, we appreciate the opportunity to review the draft report and to provide you with our comments. If you need any additional information, please feel free to contact us.

Sincerely,



Bob Martin  
Acting Commissioner

# Appendix V: Letter from the State of Pennsylvania

Philadelphia Regional Port Authority

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Chairman of the Board



March 26, 2010

Ms. Anu K. Mittal  
Director, Natural Resources and Environment  
U.S. General Accounting Office  
441 G Street, NW  
Washington, DC 20548

Subject: Delaware River Main Channel Deepening Project

Dear Ms. Mittal:

In my capacity as Chairman of the Philadelphia Regional Port Authority ("PRPA") -- an independent agency of the Commonwealth of Pennsylvania and the local sponsor for the Delaware River Main Channel Deepening Project (the "Project") -- I am writing to provide our views, generally, on the Project as well as clarification on the understanding between Governor Rendell and Governor Corzine regarding the disposal of dredged materials.

The Army Corps of Engineers ("ACOE") has been planning the Project in earnest since 1992 and, in accordance with applicable law, has followed a planning and implementation process that has been thorough, inclusive and protective of both public interest and the environment. The ACOE has been responsive to reasonable and justified concerns during the planning / implementation process and has worked diligently to resolve outstanding issues to the greatest extent possible. As a result of these efforts, the ACOE and PRPA executed a Project Partnership Agreement ("PPA") on June 23, 2008, federal and non-federal funds have been appropriated, and construction in Reach C of the Project began in February 2010.

Certain interest groups have opposed the Project on environmental grounds and certain state regulatory agencies from Delaware and New Jersey have expressed concerns in regard to the process that the ACOE followed in order for the Project to proceed. As noted above, the process followed was in accordance with applicable law and, since 1992, the environmental impacts of the Project have been studied leading to the preparation of numerous reports that incorporated input from regulatory agencies and the public. Furthermore, the ACOE and PRPA repeatedly met with stakeholders in the Project to address their concerns.

The concerns of the interest groups and state regulatory agencies have also been formally raised in court proceedings. To date, the United States District Court for the District of Delaware and the United States Third Circuit Court of Appeals have ruled in favor of the ACOE, validating the process followed by the ACOE and allowing the Project to proceed. I encourage you to carefully scrutinize for accuracy any issues that opponents of the Project contend are

“unresolved” in light of these court rulings. There may be parties who continue to be dissatisfied with aspects of the Project, but there are no unresolved issues.

Regarding the understanding between Governor Rendell of the Commonwealth of Pennsylvania and former Governor Corzine of the State of New Jersey regarding the disposal of dredged materials, I would like to point out the following:

1. The understanding is a non-binding agreement between Pennsylvania and New Jersey and is independent of the Project. As directed by Congress, ACOE is constructing the federally authorized project, including the use of the existing federal disposal sites as specified in the signed PPA and all of the accompanying economic and environmental reviews.

2. In order to use the dredged material beneficially, the following process -- the same process the ACOE currently uses for the beneficial use of maintenance material -- needs to be undertaken:

- The placed material needs to be de-watered.
- Specific uses for beneficial uses need to be identified.
- Appropriate environmental clearances need to be obtained.
- Removal needs to be funded by the beneficiary.

3. The identified disposal placement sites will be used for storage and dewatering of the dredged material until the respective states complete the process to use the material beneficially. Since the placement sites are federally owned and will be available for the life of the Project, the stored material will be available for beneficial use following the dewatering process.

4. Governor Rendell repeatedly assured the then Governor of New Jersey and the former and current Governors of Delaware that the Commonwealth of Pennsylvania will accept for beneficial re-use the dredged material from the Project that neither New Jersey nor Delaware desire. Until the final beneficial use of dredged material is defined and implemented, the dredged material will remain deposited in the federally owned disposal sites in New Jersey, Delaware and Pennsylvania.

During the current review of the Project’s benefits, you contacted the PRPA to obtain information on the Port’s current and anticipated commerce levels at various facilities. I would like to point out that during the current recession the volume and mix of cargoes coming to the Port have changed since the start of the recession. This is true of every major port complex in the United States. For example, in the last year the Port of New York/New Jersey experienced a decline in containers of almost 20%.

Certainly the economic analysis for any ACOE authorized deep draft commercial navigation project could be considered to have unresolved issues regarding the nature and extent of benefits previously estimated. However, the underlying strength of the regional economy has not changed and we fully expect the Port to recover and grow. Indeed, the economic outlook for Delaware River port facilities changes on a daily basis as demonstrated by the recent agreement



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**Appendix V: Letter from the State of  
Pennsylvania**

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of two shipping lines to call on PRPA facilities and bring an additional 76 ships per year to Philadelphia. The impending completion of improvements to the Panama Canal will only further enhance the Port and the region's economic strength.

Thank you for your attention and consideration with respect to these matters.

Respectfully,



**John H. Estey**  
Chairman  
Philadelphia Regional Port Authority

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# Appendix VI: GAO Contact and Staff Acknowledgments

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## GAO Contact

Anu K. Mittal, (202) 512-3841 or [mittala@gao.gov](mailto:mittala@gao.gov)

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## Staff Acknowledgments

In addition to the individual listed above, Vondalee R. Hunt (Assistant Director), Elizabeth Beardsley, David Brown, Laurie Ellington, and Timothy Guinane made significant contributions to this report. Michael Armes, Sara Daleski, Terrance Horner, Richard Johnson, Armetha Liles, Christopher Murray, Lauren Nunnally, Katherine Raheb, Carol Shulman, Vasiliki Theodoropoulos, and Eugene Wisnoski also made key contributions.

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