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**June 26, 2012**

**TO: Ann Beier, Director, Office of Healthy Working Rivers, City of Portland**  
**CC: Dave Livesay, GSI Water Solutions, Inc.**  
**FROM: Sarah Reich and Ed MacMullan, ECONorthwest**  
**SUBJECT: ECONOMIC IMPACTS OF THE PORTLAND HARBOR  
SUPERFUND SITE CLEANUP**

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## **INTRODUCTION**

Plans to cleanup the Portland Harbor Superfund Site (PHSS) currently include a broad range of remedial alternatives. The Portland Harbor Draft Feasibility Study (FS), which was submitted in March 2012 to the U.S. Environmental Protection Agency (EPA) by the Lower Willamette Group (LWG), contains a description of the remedial alternatives and includes cost estimates of implementing each alternative. The Draft FS, however, does not consider the near-term economic impacts (jobs, tax revenues, and opportunity costs) or the longer-term economic effects of the cleanup (economic-development benefits).

To provide a partial understanding of the near-term economic impacts of the PHSS cleanup, the City of Portland has asked us to evaluate likely changes in income, employment, and tax revenue that could result from spending on cleanup activities. This memo and the attached graphical presentation describe the methodology and assumptions we used to conduct our analysis, the results of the analysis, and some important considerations in interpreting the results and their implications for the Portland metropolitan economy.

## **METHODOLOGY**

To complete this analysis, we worked closely with staff of GSI Water Solutions, Inc. (GSI) to understand the relevant components of the Draft FS and develop an appropriate framework and set of assumptions to conduct the economic modeling. As necessary, GSI staff consulted Anchor QEA staff who prepared the Draft FS to clarify details about the assumptions underlying the cost estimates in the Draft FS.

Economists have developed several approaches for measuring economic impacts, including the technique used for this analysis, called input-output modeling.<sup>1</sup> Input-output models are mathematical representations of the economy and how different parts (or sectors) are linked to

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<sup>1</sup> Input-output analysis was first put to practical use by Wassily Leontief in the late 1930's. While at Harvard, Leontief used his input-output system to construct an empirical model of the United States economy. This research gave rise to his 1941 classic, "Structure of American Industry, 1919-1929." For his research, Leontief was awarded the Nobel Prize in Economics in 1973.

one another. We conducted the analysis using an economic model known as IMPLAN,<sup>2</sup> which is built on estimates of empirical and technological relationships that trace how spending circulates through an economy. Initial changes in spending propagate through the economy via supply- and demand-chain linkages, altering the equilibrium quantities of inputs and outputs and associated jobs and income. Analysts refer to these changes as the “multiplier effect” of initial changes in spending in an economy.

The IMPLAN model reports the following measures of economic impacts:

- **Output** represents the value of goods and services produced and is the broadest measure of economic activity.
- **Personal income** (or labor income) consists of employee compensation and proprietary income.
- **State and local taxes and fees** include production business taxes; personal income taxes; social insurance (employer and employee contributions) taxes; and various other taxes, fines, licenses, and fees paid by businesses and households.
- **Jobs** include both full- and part-time employment. Jobs are measured in terms of job-years, or one position (either full or part time) for one year.

The goal of this research is to assess how cleanup of the PHSS will contribute to the Portland metropolitan economy. To do this, our analysis relies on cost estimates from the Draft FS, and uses economic impact modeling techniques to measure the effect the cleanup spending has as it circulates through the economy *as it currently functions* (i.e., the model provides a snapshot of the economy as it exists today, and shows how spending today would circulate through; it does not account for changes in the economy that inevitably occur over time that may change the way spending circulates in the economy). This analysis does not measure potential scenarios that consider how scarce resources would have been allocated if not used for the activities described in the Draft FS. It also does not measure the long-term economic effects of cleaning up the Portland Harbor Superfund Site, including the potential economic development impacts of the cleanup. We describe these caveats in greater detail below, in “interpreting the results of this analysis.”

We based our analysis in part on the cost data in the Cost Tools Spreadsheet, an attachment to Appendix K of the Draft FS. The Cost Tools Spreadsheet was developed to help decision makers conduct sensitivity assessments of the underlying cost assumptions. It contains required details on costs by cleanup task (i.e. engineering design, construction, capping, dredging and transport, etc.) that are not available in the main body of the Draft FS. We discovered, however, that because the costs in the Cost Tools Spreadsheet do not include “modifications for long term monitoring and maintenance activities” and are not discounted, they do not add up exactly to the costs reported in the body of the Draft FS (Appendix K, pg. 11). For the purposes of our analysis, however, the Cost Tools Spreadsheet provides a reasonable approximation of the costs by task to gain a general understanding of the economic impacts of the cleanup activities.

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<sup>2</sup> IMPLAN was initially developed as part of a joint effort by the USDA Forest Service, the Federal Emergency Management Agency, and the USDI Bureau of Land Management.

We limited our scope to an analysis of two of the five alternatives, B and E. Within alternatives B and E, we focused on the integrated (i) rather than the removal-focused (r) activities, to capture the range of potential activities – and economic impacts – that may occur during the cleanup. Both B-i and E-i have a low and a high cost estimate.

## ASSUMPTIONS

**Geography.** Our analysis models the economic impacts that accrue within the Portland metropolitan area. Our economic model is built on data from the Portland-Vancouver-Hillsboro, OR-WA Metropolitan Statistical Area (MSA), which includes these counties: Clackamas, OR; Columbia, OR; Multnomah, OR; Washington, OR; Yamhill, OR; Clark, WA; and Skamania, WA.

**Time Period.** Our model is time-insensitive, meaning all cleanup spending is modeled as if it occurs as a lump sum. In reality, cleanup spending would occur over the period of cleanup, which differs by alternative. For Alternative B-I, cleanup activities would occur over two years. For Alternative E-i, cleanup activities would occur over seven years. Impacts associated with spending on long term monitoring and maintenance would occur over 30 years for both alternatives. In each case, spending and the resulting impacts on income, employment, and taxes, would be distributed over the period of activity, though not necessarily uniformly from year to year. To illustrate the yearly economic impact on employment, we divide the total employment impact by the number of years of cleanup and long term monitoring and maintenance for each alternative. This provides a rough approximation of the annual impact, and is especially relevant for understanding the employment impact because the economic model calculates employment in *job years* (e.g., one worker for one year), not jobs (e.g., permanent positions).

## RESULTS

The PHSS cleanup would involve inputs of labor and materials across a range of sectors of the economy. The economic impacts calculated in this analysis related to cleanup and long-term monitoring and maintenance (LTMM) activities are temporary and occur as spending unfolds – over a 32-year period for Alternative B-i and a 37-year period for Alternative E-i.<sup>3</sup>

The economic impacts occur through effects of cleanup spending in three categories: direct, indirect, and induced.

- **direct effects** consist of the income and jobs for companies, contractors, and employees working on or providing materials for the cleanup (e.g., PRP firm hires dredging contractor).
- **indirect effects** arise as contractors, service providers, and manufacturers engaged in the cleanup purchase goods and services produced by other sectors of the economy (e.g., dredging contractor buys a new support boat).

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<sup>3</sup> We assume LTMM activities begin after cleanup ends. If LTMM runs concurrently with cleanup, the total duration of activity could be less than these timeframes.

- **induced impacts** arise from changes in local spending that occur as households spend income generated from the cleanup (e.g., dredge worker remodels house and boat salesperson celebrates by taking family out for dinner).

Tables 1 and 2 summarize the direct effects, the indirect and induced effects, and the total impact of the PHSS cleanup and LTMM activities for the low and high cost estimates of Alternatives B-i and E-i. The overall economic impacts for both cleanup and LTMM would be the sum of Tables 1 and 2.

**Table 1. Economic Impacts of PHSS Cleanup Activities Within the Portland MSA**

	Alternative B-i (2 years)		Alternative E-i (7 years)	
	Low	High	Low	High
Cleanup Spending (From the Draft FS)	\$93,000,000	\$167,000,000	\$325,000,000	\$573,000,000
<b>Direct Effects in the Portland MSA</b>				
Output <sup>1</sup>	\$94,000,000	\$143,000,000	\$317,000,000	\$480,000,000
Personal Income	\$42,000,000	\$64,000,000	\$138,000,000	\$213,000,000
Business Taxes	\$1,000,000	\$2,000,000	\$4,000,000	\$5,000,000
Employment Years	685	1,080	2,249	3,587
Employment Years per Year of Cleanup <sup>2</sup>	343	540	321	512
<b>Indirect and Induced Effects in the Portland MSA</b>				
Output	\$98,000,000	\$149,000,000	\$329,000,000	\$500,000,000
Personal Income	\$34,000,000	\$52,000,000	\$114,000,000	\$173,000,000
Business Taxes	\$5,000,000	\$7,000,000	\$16,000,000	\$25,000,000
Employment Years	761	1,159	2,561	3,887
Employment Years per Year of Cleanup <sup>2</sup>	380	579	366	555
<b>Total Effects in the Portland MSA</b>				
Output	\$192,000,000	\$292,000,000	\$646,000,000	\$981,000,000
Personal Income	\$75,000,000	\$116,000,000	\$252,000,000	\$386,000,000
Business Taxes	\$6,000,000	\$9,000,000	\$20,000,000	\$30,000,000
Employment Years	1,446	2,239	4,810	7,473
Employment Years per Year of Cleanup <sup>2</sup>	723	1,119	687	1,068

<sup>1/</sup> Direct output is roughly equal to the proportion of spending on cleanup activities within the Portland MSA. In general, output is smaller than cleanup spending because some spending occurs outside the Portland MSA. Output in B-i appears larger than cleanup spending from the Draft FS because the underlying data in the Cost Tools Spreadsheet provided slightly larger estimates than presented in the Draft FS (up to 7 percent different in Alternative B-i).

<sup>2/</sup> Employment years per year of cleanup or LTMM assumes spending is distributed evenly over the period of cleanup or maintenance and monitoring. Actual employment in any given year would depend on the actual levels of spending in that year.

Totals may not sum due to rounding.

**Table 2. Economic Impacts of Long Term Monitoring and Maintenance Activities Within the Portland MSA**

	Alternative B-i (30 years)		Alternative E-i (30 years)	
	Low	High	Low	High <sup>3</sup>
LTMM Spending (From the Draft FS)	\$76,600,000	\$82,900,000	\$137,800,000	\$135,900,000
<b>Direct Effects in the Portland MSA</b>				
Output <sup>1</sup>	\$74,000,000	\$80,000,000	\$133,000,000	\$132,000,000
Personal Income	\$43,000,000	\$47,000,000	\$78,000,000	\$77,000,000
Business Taxes	\$1,000,000	\$1,000,000	\$1,000,000	\$1,000,000
Employment Years	740	800	1,330	1,312
Employment Years per Year of Cleanup <sup>2</sup>	25	27	44	44
<b>Indirect and Induced Effects in the Portland MSA</b>				
Output	\$85,000,000	\$90,000,000	\$150,000,000	\$148,000,000
Personal Income	\$29,000,000	\$32,000,000	\$53,000,000	\$52,000,000
Business Taxes	\$4,000,000	\$5,000,000	\$8,000,000	\$8,000,000
Employment Years	697	755	1,254	1,237
Employment Years per Year of Cleanup <sup>2</sup>	23	25	42	41
<b>Total Effects in the Portland MSA</b>				
Output	\$158,000,000	\$171,000,000	\$284,000,000	\$280,000,000
Personal Income	\$73,000,000	\$79,000,000	\$131,000,000	\$129,000,000
Business Taxes	\$5,000,000	\$5,000,000	\$9,000,000	\$9,000,000
Employment Years	1,437	1,555	2,585	2,549
Employment Years per Year of Cleanup <sup>2</sup>	48	52	86	85

<sup>1/</sup> Direct output is roughly equal to the proportion of spending on cleanup activities within the Portland MSA. In general, output is smaller than cleanup spending because some spending occurs outside the Portland MSA.

<sup>2/</sup> Employment years per year of cleanup or LTMM assumes spending is distributed evenly over the period of cleanup or maintenance and monitoring. Actual employment in any given year would depend on the actual levels of spending in that year.

<sup>3/</sup> Long-term monitoring and maintenance costs are slightly lower for the “high” cost scenario because this scenario utilizes different cleanup technologies (i.e., more capping and less in-situ treatment) that require less monitoring and maintenance.

Totals may not sum due to rounding.

## INTERPRETATION OF THE RESULTS

**What this analysis does and does not measure.** To assess the value of cleaning up the PHSS, economists typically would compare the total costs of the cleanup to the benefits society would derive from the cleanup. The economic impacts (e.g., the jobs, incomes, and tax revenues) assessed in this analysis do not factor into this equation. That is not to say, however, that they are not important in their own right – especially those that would not have occurred in the Portland economy but for the cleanup (we address this issue in the next section).

To understand what this analysis tells us (and what it doesn't), it helps to distinguish between two distinct but related concepts: *capacity* and *utilization*. Capacity represents what the economy could produce – which depends on its stocks of capital (e.g., people, natural resources, buildings, and institutions). Utilization represents how well the economy employs its capacity – the actual production. Economies grow in the short run by increasing the utilization of the existing stocks of capital. For example, growth reduces the unemployment rate by increasing the utilization of human capital, or people employed in an economy. Economies grow over the long run by increasing the capacity or amounts of capital. Continuing the employment example, long run growth happens when the supply of educated or trained people increases over time, thus increasing the capacity of the economy's human capital.

In the short-run, the cleanup would increase the utilization of the Portland region's economic capacity – boosting incomes, employment, and tax revenues. Economists refer to these types of changes as the cleanup's *economic impacts*. As Tables 1 and 2 show, cleanup spending would employ workers, equipment, and other resources in Portland's economy. These workers, equipment owners, and resource owners would, in turn, spend their compensation in the regional economy. This spending, in turn, supports jobs and generates incomes for others in the regional economy, which becomes jobs and incomes for still others.

The cleanup also could affect the capacity of the Portland region's economy by increasing the stock of natural capital, e.g., a cleaner river and increased supply of related ecosystem services, and physical capital, e.g., developable riverfront property. This process often evolves over time as the investments in the cleanup increase natural capital by generating cleaner water and cleaner sediment. These changes, in turn, could increase human-built capital by reducing the risk of investment and development in and adjacent to the PHSS. Taking the long-run view, cleanup spending is an investment in the growth of the region's economy. By protecting and increasing the supply of the region's natural and physical capital, cleanup spending also complements other investments that Portland has made in its long run growth and development. These investments include CSO controls and sustainable stormwater management, the Clean River Rewards program, and the Tabor to the River project. Our analysis does not address these economic development effects.

**Understanding and estimating the net impacts of spending.** Our analysis measures the gross, short term economic impacts (changes in employment, income, and tax revenues) of spending money cleaning up the PHSS. The *net* impacts of spending would differ from the *gross* impacts. If all of the money spent on cleaning up the PHSS would have instead been spent in similar ways in the Portland economy, the *net impacts* of cleaning up the PHSS would essentially be



zero – society would be no better or worse off (ignoring the longer-term effects that arise from the cleanup or from alternate investments of resources). This is true even though the gross impacts of spending show positive employment, income and tax revenue changes. To understand the *net* impact of the spending on the region’s economy it helps to keep these questions in mind:

*Where will cleanup money come from?*

From firms local to the region or from firms outside the region? Geography matters.

*How would the cleanup money have been spent without the cleanup?*

Would this have been new spending in the region’s economy? Or transfers of spending from one sector to another in the region’s economy?

When companies, governments, and citizens spend money on one thing, they are no longer able to spend it on something else – economists refer to this concept as *opportunity cost*. In general, spending that would not occur in the Portland-metropolitan economy without the cleanup has no opportunity cost to the region.<sup>4</sup> This type of spending would generate jobs, incomes, and tax revenues that wouldn’t occur in the region if the cleanup didn’t happen, and the net impact would be equal to the gross impact. Spending on cleanup and monitoring would provide new spending in the Portland-area economy under the following conditions:

*Spending by Potentially Responsible Parties<sup>5</sup> (PRP) that have left the Portland-area economy.*

- For PRP firms that no longer maintain operations in the Portland-metropolitan region, funds they provide for cleanup and monitoring (from insurance payments or company revenues) would be new money spent in the regional economy.<sup>6</sup>

*Spending by PRP firms that continue operating in the Portland-area economy but:*

- Use money from insurance payouts. In this case the PRPs would not have otherwise received the insurance payments but for their Superfund liability, and so the insurance payments represent new money rather than a transfer of funds from other services to cleanup and monitoring.
- Transfer spending that would have otherwise happened outside the Portland area to pay their portion of cleanup and monitoring, without changing the level of spending on day-to-day operations in the Portland area.
- Reduce returns to owners to pay for their portion of cleanup and monitoring. For owners *outside* the Portland-area economy, doing so transfers spending into the Portland-area economy that would have otherwise happened outside. Again, this

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<sup>4</sup> It may have opportunity costs in other regions and at the national level, but we are not concerned with those effects in this analysis.

<sup>5</sup> Potentially Responsible Parties are firms, individuals or other parties that are potentially liable for payment of Superfund cleanup and monitoring costs.

<sup>6</sup> This result also applies to some extent to other Superfund spending by these PRPs, e.g., spending on legal and consulting fees that would be additive to the cleanup and monitoring spending.

assumes the level of spending on day-to-day operations in the Portland area does not change.

Spending that would have occurred in the Portland-metropolitan economy without the cleanup, but with the cleanup is spent in different ways, may have opportunity costs. With the cleanup, this spending is essentially transferred from one sector to another within the Portland area economy, and may ultimately result in different levels of indirect and induced impacts. Spending on cleanup and monitoring represents a transfer from one sector to another within the Portland-area economy under the following conditions:

*Spending by PRP firms that continue operating in the Portland-area economy but:*

- Reduce returns to owners to pay for their portion of cleanup and monitoring. For owners *inside* the Portland-area economy, doing so may transfer spending from one part of the Portland-area economy to another.
- Transfer spending from other operations to pay their portion of cleanup and monitoring. Doing so transfers spending from one part of the Portland-area economy to another.
- Reduce wages to workers to pay for their portion of cleanup and monitoring. Doing so transfers spending from PRP workers to other workers in the Portland-area economy.

**Potential Impact to Public Services.** To the extent that PRPs provide public services, e.g., City of Portland, Port of Portland, or utility companies, their spending on cleanup and monitoring could possibly impact the services they provide. If spending on the cleanup and monitoring reduces the amount of money that these PRPs would have otherwise spent on public services, the amount, type or quality of services they provide could decline. Factors that could influence potential impacts to public services include:

- *If the public PRPs have insurance that would pay their cleanup and monitoring costs.* In this case the PRPs would not have otherwise received the insurance payments but for their Superfund liability, and so the insurance payments represent new money rather than a transfer of funds from other services to cleanup and monitoring.
- *If the public PRPs have already paid amounts equal to a portion or all of their cleanup and monitoring liability.* Some PRPs have already paid funds toward their Superfund liability (e.g. contribution share toward RI/FS costs). This spending is “sunk costs” and likely would not affect future spending on services by these PRPs.

Other factors relevant to public PRPs and their cleanup spending include:

- *Cleanup spending can complement other long run investments.* Cleaning up the Portland Superfund site would complement other investments in Portland’s long-run growth and development including a clean and healthy river, CSO controls and sustainable stormwater management, the Clean River Rewards program, and the Tabor to the River project
- *The extent to which the cleanup and monitoring increases the economic development opportunities in the Portland-area economy.* The Superfund designation creates uncertainty regarding land uses and liabilities for affected and adjacent properties. As a result, firms



may delay investing in the local economy, or may invest elsewhere. This represents lost spending to the Portland-area economy and lost demand for public services. Over the long run, cleanup and monitoring activities would reduce this uncertainty and may increase investments and resulting tax revenues, fees and demands for public services.