SCHOOL OF PUBLIC HEALTH
UNIVERSITY of WASHINGTON

JustHealthAction

DUWAMISH RIVER CLEANUP COALITION
Technical Advisory Group

Health Impact Assessment

Proposed Cleanup Plan for the
Lower Duwamish Waterway Superfund Site

Technical Report

September, 2013

(Final version)

Assessment and Recommendations

Effects of the proposed cleanup plan on health of workers and employment in Lower Duwamish area industries

Part A

(Report)

Note: Part B includes the evidence base and references for Part A, and is published separately

Technical report

This technical report supports our HIA *Final Report,* published in September, 2013. An earlier version of this report supported our *Public Comment HIA Report*, which was submitted to EPA on June 13, 2013. Part A of this technical report was included within the *Public Comment Report*, and Part B was submitted as an accompanying appendix.

There were some changes in the technical report between June 13 and the *Final Report.* Most of the interim changes involved addition of material to the "context" section of the Assessment [section 5.A] and supporting sections in Part B of the report. There were no substantial changes to the assessment of potential health impacts or recommendations.[sections 5.C and 5.D] A track-changes version is available upon request.

Acknowledgment and disclaimer

We are indebted to the many agencies, organizations, and individuals who have contributed their time, information, and expertise to this project.

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The views expressed are those of the authors and do not necessarily reflect the views of the Health Impact Project, The Pew Charitable Trusts, the Robert Wood Johnson Foundation, or the Rohm & Haas Company.

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Readers are encouraged to focus on "Part A" of this report.

Part A is the actual "report, with text written by the report authors. Part B includes the evidence base for Part A, and consist of annotated references organized according to the research questions that guided this assessment. In many instances the annotations are substantial but consist almost exclusively of text, tables, and figures copied verbatim from the cited source, with nominal or no report-author comment. Substantial text by the report authors is generally confined to Part A. Reference citations in Part A [shown in square brackets] refer to chapter and section numbers in Part B.

PART A

Part A is the actual "report," with text written by the report authors. Part B is the evidence base for Part A, and consists of annotated references organized according to the research questions that guided this assessment. Reference citations in Part A [in square brackets] refer to chapter and section numbers in Part B.

1. Overview

This portion of the HIA examined possible effects of the proposed cleanup plan on the health of workers and employment in Lower Duwamish area industries. This assessment was prompted by concerns expressed by people in business and labor communities that the costs of cleanup, or cleanup-associated uncertainties, could have a negative effect on business performance, resulting in loss of jobs and employment options. Many types of uncertainty are mentioned, but common concerns are uncertainty about the ultimate dollar cost of liability, fears of legal actions or litigation, and seeming endlessness of the situation and liability.

From a health perspective, the major concern is job loss or under-employment. Employment is one of the strongest favorable determinants of health and well-being.[1] Employment and skill development generate personal income and increase the likelihood of future employment and income stability. Steady employment with a decent wage allows individuals and families to live in safe home and safe neighborhood with access to basic services, purchase healthful food, ensure education for their children, and afford child-care services. Steady employment and a decent wage can provide disposable income and time to enjoy pleasures of life, exercise, and ensure adaptive capacity to deal with unanticipated life challenges. Good jobs with benefits may provide health insurance which, along with a decent wage, ensures regular and timely access to health care, preventive, and health promotion resources. Together, these factors can reduce the risk of major preventable health problems such as obesity, diabetes, high blood pressure, heart attack, and stroke. Employment and higher income are associated with longer lifespan.[2]

Traditional manufacturing, wholesale trade, transportation and warehousing businesses in the Lower Duwamish area face a variety of pressures that could influence their productivity and economic viability, and that could stimulate changes in land use analogous to ongoing residential gentrification in local neighborhoods. It is plausible that the proposed cleanup of the Lower Duwamish River and related decisions could add to existing unfavorable pressures on local industries, with net loss of jobs or reduction in hours of employment. Lower skilled and lower income workers might face disproportionate risk of being laid off. Alternatively, it is plausible that existing businesses and employment could benefit substantially if the cleanup reversed the constraints and stigma of a blighted river, and if this stimulated industry revitalization and economic robustness.

This assessment considered four major categories of possible cleanup-related effects: cleanup job creation, cleanup costs and business liability, business uncertainty, and industry revitalization. Any potential effects of the proposed cleanup plan on workers and employment in the Lower Duwamish area industries would not occur in a vacuum. Therefore, the assessment considered the context within which any cleanup-related effects would occur, recognizing that: cleanup-related effects could combine or interact with existing challenges faced by local industries; the priority of a problem or opportunity might appear more or less important, when viewed relative to other problems or opportunities; and possible future options or strategies may be more appealing to stakeholders if they can be tailored to address more than one problem or serve multiple needs.

1. Robert Wood Johnson Foundation. How Does Employment—or Unemployment—Affect Health? *Health Policy Snapshot: Public Health and Prevention*. March 2013.
2. Waldron H. Trends in Mortality Differentials and Life Expectancy for Male Social Security–Covered Workers, by Average Relative Earnings. *ORES Working Paper*, No. 108. US Social Security Administration. Oct. 2007.

2. Methods

A. Disclosure

This "workers and employment" assessment for the Duwamish Superfund HIA is a *desk-based* health impact assessment. The original HIA plan (and funding) was to focus only on three populations of concern: South Park and Georgetown residents, local Tribes with cultural ties to the Duwamish River, and non-tribal subsistence fishers. However, our Resident and Tribal Advisory Committees and Liaison Committee expressed additional concern about possible effects of the proposed cleanup on local industries and worker employment. In response, we added this fourth population assessment but had limited funding, staffing, and resources to do so. Therefore, this assessment was based almost entirely on review of existing literature and data.

In contrast to our three other population assessments, this assessment was *not* guided by a population-specific advisory committee or community advisors. We drafted plans to conduct key-informant interviews (and obtained UW Human Subjects exempt-status approval), but did not have enough time or staff to conduct them. We identified several existing reports that included interviews with local industry representatives about challenges that they face,[9.B; 9.C; 9.E] although none of those interviews focused specifically on possible effects of the proposed cleanup. Also in contrast to our three other assessments, we did not complete this assessment in time to share draft recommendations with our Liaison Committee (before the end of the EPA public comment period, June 13, 2013), for Committee member suggestions on how to word recommendations to be optimally understandable and potentially implementable by decision-makers. Consequently, we have erred on the side of making our recommendations more general than specific.

After releasing the June 13 "Public Comment" version of this report, we extended invitations to six key informants for one-on-one meetings with Daniell to discuss the report findings and recommendations. Two public. One union representative (International Longshore and Warehouse Union) and two public representatives met individually with Daniell and offered comments. Three business community representatives did not respond..

B. Materials

This assessment relied entirely on existing data and printed (pdf) or web-based materials that were available in the public domain. Data were obtained by download of existing datasets or by query at an online agency portal. Data sources included: U.S. Census, Washington Employment Security Department, and Puget Sound Regional Council. The assessment focused on workers and employment in major Duwamish Valley industries, particularly manufacturing (NAICS 31-33), wholesale trade (NAICS 42), transportation and warehousing (NAICS 48-49), and utilities (NAICS 22). Location-specific data were often not available specifically for utilities, because of agency policies preventing disclosure of data for an individual employer.

C. Procedures

Very few data analyses were conducted for this assessment but, when conducted, used MS-Excel.™ More than 250 printed or web-based resource materials were reviewed for this assessment. Copies of most materials were retained on a local computer, stored in a cloud-based Mendeley™ reference manager, and/or bookmarked. All materials were reviewed by William Daniell with assistance from Jonathan Childers. In order to facilitate review and re-review over the drawn-out period of assessment, relevant sections of text from *selected* materials were copied verbatim and pasted into Part B of this assessment document, organized according to the major HIA

research questions that we identified during scoping (and formatively modified during the assessment). Selection of source material was based on relevance to a research question, source credibility, and contribution of new or more recent information without substantial redundancy relative to other selected source material. Copied text was generally distinguished from author-generated text by indentation and bullet marks, without quote marks. The original resource citation was documented at the start of each respective copy/paste section. Materials viewed relatively late during the period of assessment were often only documented by placing the reference citation under the appropriate reference question, without additional annotation.

Characterization of health effects (impacts) used the criteria described in our "Methods" technical report. All of our technical reports, including the present report, are included as appendices to our *Final HIA Report*.

D. Definitions

Many terms are used or defined differently in different source materials, particularly "industry" and the geographic bounds of industry in the Lower Duwamish area.

This assessment generally defined local "industry" as including manufacturing (NAICS 31-33), wholesale trade (NAICS 42), transportation and warehousing (NAICS 48-49), and utilities (NAICS 22). The term, WTU, is used in many sources to encompass wholesale trade, transportation and warehousing, and utilities (NAICS 42, 48-49, 22). At least one cited source studied "basic industry" in Seattle and additionally included construction (NAICS 23). Another source used the term "principal industry" sectors to denote manufacturing, wholesale trade, and transportation and warehousing.

The geographic scope of "Lower Duwamish River area" industries is variably defined by others as: the Duwamish Manufacturing Industrial Center (MIC), confined to Seattle or extending beyond the Seattle city limit; the natural watershed of the Lower Duwamish River (often called the Duwamish Valley or Lower Duwamish Valley); or the "constructed" watershed,[6.A.1] which includes portions of Seattle that are outside the natural watershed but contribute stormwater or combined sewer overflows (CSOs) to the Lower Duwamish River. The boundaries of geographical units in various data sources (e.g., ZIP codes, census tracts, forecast analysis zones) do not align perfectly with any of the "Duwamish" geographic categories, and therefore, summary statistics are generally only (reasonably close) approximations of the underlying reality.

This report attempts to specify or clarify at the point of use, what industry sectors and geographic scope are discussed. In general, when we refer to the Lower Duwamish area, we refer to the valley and natural watershed associated with the Lower Duwamish River, with particular attention to industries in the Duwamish MIC. Note, the section of river demarcated as the Lower Duwamish Waterway (LDW) Superfund site is just one 5.5 mile stretch of the Lower Duwamish River. There is additional waterway to the north (downstream), along Harbor Island and opening into Elliott Bay, and additional river to the south (upstream).[3] The LDW and Harbor Island stretches of the Duwamish River are part of the larger Duwamish-Green River system, which flows 93 miles from the crest of the Cascade Mountains to Elliott Bay

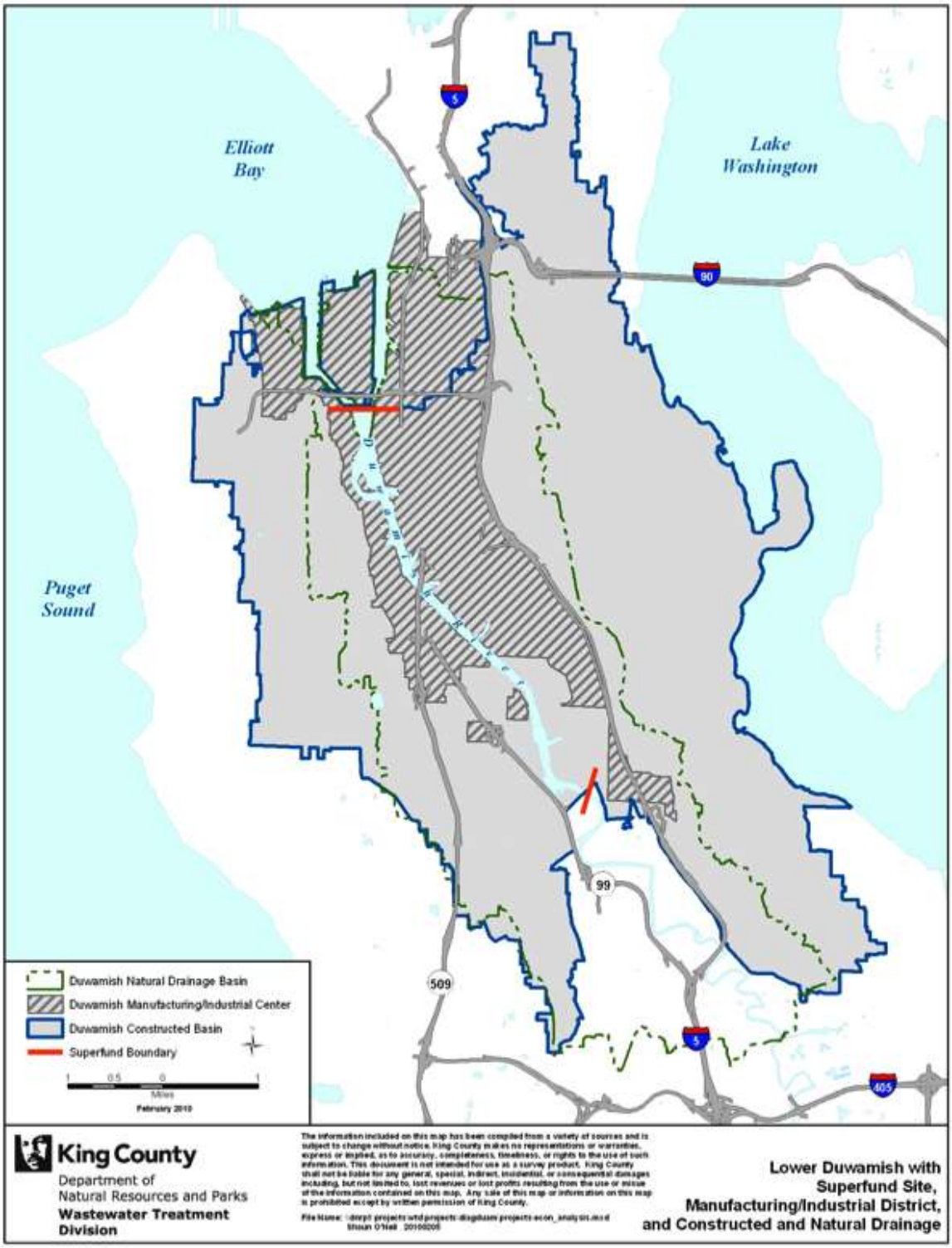
Maps in Figures 1 through 3 (next pages) illustrate these geographic relationships.

3. Note, Harbor Island and the East Waterway are part of the separate Harbor Island Area Superfund Site.

Figure 1: Map of Seattle's Manufacturing and Industrial Centers (MICs), including the Duwamish MIC and the *separate* Ballard-Interbay North-end MIC.[4]

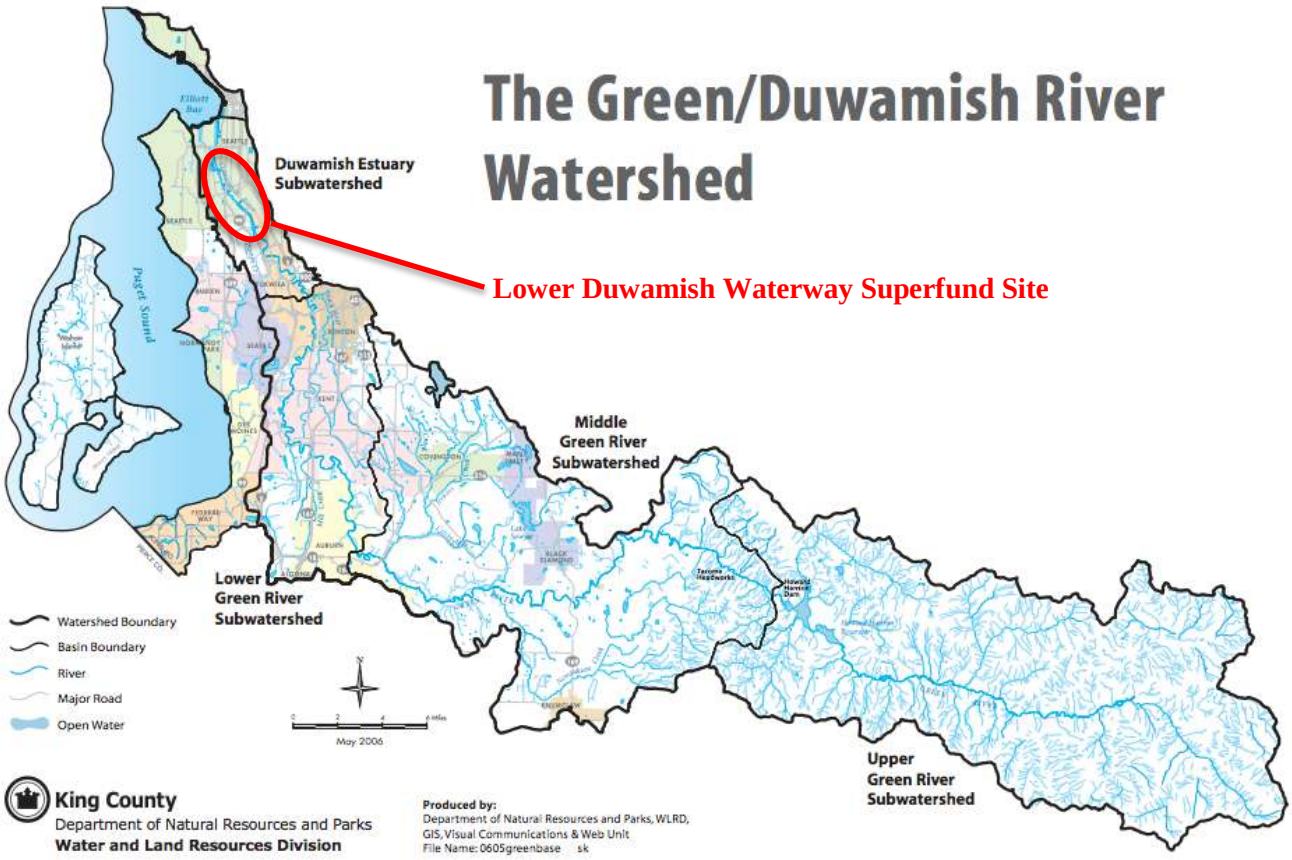
4. Source of map: Exhibit 1 in *Basic Industries Economic Analysis* by Medford C, Forsyth M, Babb M, Couch D, Schrag T, Schwed R. (Community Attributes; produced for Seattle Office of Economic Development). July 2009. Original source: City of Seattle, 2008.

Figure 2: Map of Lower Duwamish River showing Lower Duwamish Waterway Superfund Site, Duwamish Manufacturing and Industrial District (MIC), and constructed and natural drainage.[5]



5. Source of map: Figure 1 in *Lower Duwamish Economic Analysis* by by Voight T, Josephson A, Goodman B, Warren E. (ECONorthwest; produced for King County Dept. of Natural Resources and Parks). March 2010. Original source: King County, 2010.

Figure 3 : Duwamish-Green River Watershed [6]



6. Source of map: King County. Green-Duwamish Watershed (web page; accessed July 17, 2013). http://www.kingcounty.gov/environment/watersheds/green-river.aspx

3. Baseline community profile

A. Employment

The Lower Duwamish River area is home to Seattle's and King County's largest concentration of industry, including the Duwamish Manufacturing Industrial Center (MIC) and Port of Seattle. The Puget Sound Regional Council (PSRC) estimated Duwamish MIC total covered employment in 2008 to be 65,333, representing about 38% of employment across the eight MICs in the Central Puget Sound Region.[7.A.3] Duwamish MIC employment included 15,445 employees in manufacturing and 15,696 employees in wholesale trade, transportation and warehousing, and utilities (WTU).

Another estimate by ECONorthwest, using data derived for an area larger than but encompassing the Duwamish MIC (ECONorthwest "Tier 2"), estimated 2010 employment to be about 25,000 people working in manufacturing and another 30,000 working in WTU industries (see ECONorthwest "Table 1" below).[7] [6.A.1]

Table 1: Geographic, Demographic, and Economic Characteristics of Tier 1 and Tier 2 Areas

Characterization*	Tier 1: Broader Area, Contributing Stormwater & Combined Sewer Overflows Reaching the Superfund Site	Tier 2: Narrower Zone, More immediately adjacent to the Area; Focused on Manufacturing/Industrial Zoning
Geography		
Characterization	Mixed uses; Mostly within Seattle; Many residential communities	Concentrated area of manufacturing & industrial activity; Mostly within Seattle
Size / Percent of County**	33.5 square miles / 1.5%	8 square miles
Population & Demographics		
2010 Population / Percent of County	135,000 / 7%	60,000 / 3%
Percent of King County's Low Income HHs	9%	4%
Forecast Population Growth 2010-20	Moderate; slower than rest of County	Moderate; slower than rest of County
2010 Households / Percent of County	51,000 / 6%	24,000 / 3%
2010 Person Per Household***	2.6; Higher than County average	2.5; Higher than County average
Employment & Economic Output		
2010 Employment / Percent of County	129,000 (10% of County)	106,000 (8% of County)
Percent in Manufacturing	21% (County = 10%)	24% (County = 10%)
Percent in Wholesale Trade, Transportation, Warehousing	24% (County = 14%)	29% (County = 14%)
Jobs/Resident Ratio	0.96 - higher than rest of City and County	1.75 much higher than rest of City and County
Average Annual Wage (2008)	$53,000 (County average = $57,000)	$56,000 (County average = $57,000)
Total Wages / Percent of County (2008)	$9 billion / 10%	$4.4 billion / 5%
Total Economic Output / Percent of County (2008)	$27.3 billion / 9%	$13.5 billion / 4.3%
Total Value Added (2008)	$15.6 billion / 9%	$7.3 billion / 4.3%
Forecast Job Growth 2010-20	Slightly slower than rest of County; share of manufacturing/industrial forecast to increase	Slightly slower than rest of County; share of manufacturing/industrial forecast to increase

Source: ECONorthwest analysis of data from PSRC, IMPLAN, and other sources.

*All 2010 population, demographic, and economic information based on PSRC Population, Household, and Employment Forecast, 2006

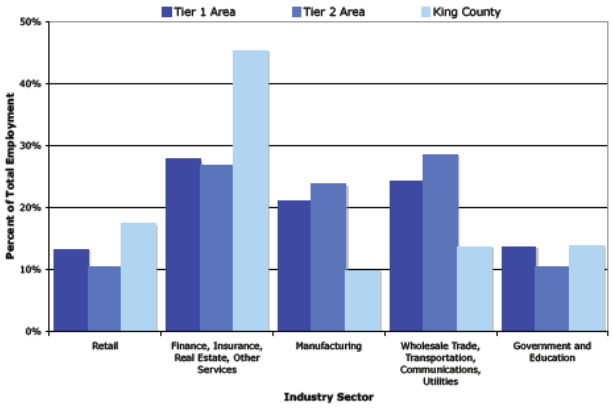
**Due to overlap of the zip codes and FAZs used to represent the Tier 1 and Tier 2 areas, the size of the area analyzed is greater than the areas shown in Table 1. For Tier 1, the area analyzed is 45 square miles based on zip code data and 39 square miles based on FAZ data; For Tier 2 area, the size of the area analyzed is 16 square miles based on zip code data and 24.6 square miles based on FAZ data. .

***Household population (not total population) used in denominator.

7. Source of Table 1: *Lower Duwamish Economic Analysis* by by Voight T, Josephson A, Goodman B, Warren E. (ECONorthwest; produced for King County Dept. of Natural Resources and Parks). March 2010.

The MIC represents less than 1% of King County land area but employment represents about 19% and 17% of manufacturing and WTU employment in the county, respectively (See ECONorthwest "Figure 2," right).[8] [6.A.1] Although sizable numbers of people are employed in retail (11,000) and services (28,000) in these areas, their percentages are much lower than King County averages.

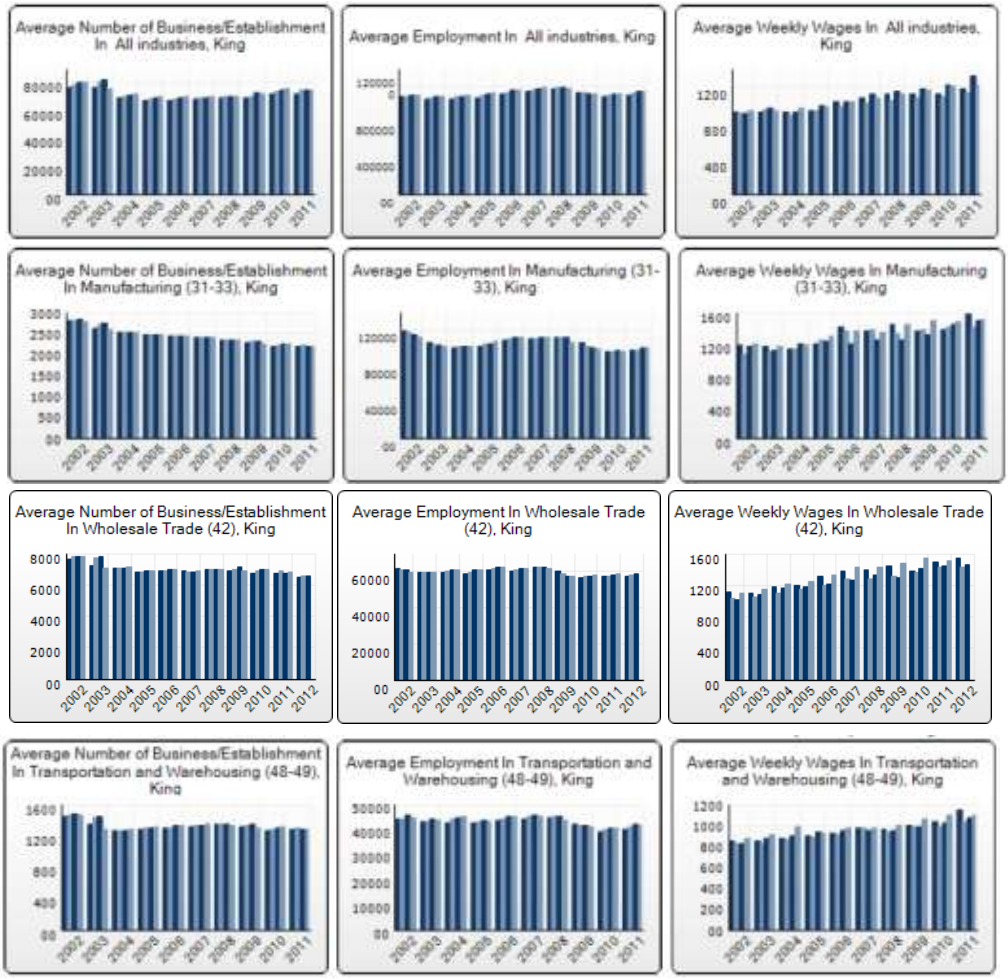
Figure 2: Distribution of Employment by Industry Sector, Tier 1 and Tier 2 Areas, and King County (2010)*



Source: ECONorthwest analysis of data from PSRC.
*Based on PSRC Population, Household, and Employment Forecast, 2006.

If one extends the geographic boundary to the larger, "constructed" watershed (ECONorthwest "Tier 1")—which includes businesses and employees that might be affected by the proposed cleanup—total employment is larger by an additional 23,000 (total 129,000), including 2,200 manufacturing and 900 WTU workers.[6.A.1]

Employment has been relatively stable in these industries, with signs of recovery since the 2008 economic recession. Overall, U.S. manufacturing has shown substantial growth since 2008,[7.A.6] and the Seattle area has led this trend, primarily due to aerospace jobs.[6.A.6] In the past decade, there has been cyclical variation in manufacturing employment in King County, with a steady decline in the number of businesses, but a relatively steady increase in average wages (see figures to right, compared to all industries; WA Employment Security Dept.). [7.A.2.a)] Wholesale trade, transportation and warehousing showed less variation in employment but also showed steady increase in wages.



8. Source of Figure 2: *Lower Duwamish Economic Analysis* by by Voight T, Josephson A, Goodman B, Warren E. (ECONorthwest; produced for King County Dept. of Natural Resources and Parks). March 2010

B. Wages

The Duwamish MIC is widely known for providing, "the largest concentration of family wage jobs in the Puget Sound region." [Puget Sound Regional Council; 6.A.1] However, as a study of "basic industry"[9] in Seattle noted, "While Basic Industry jobs do provide higher than average wages in Seattle, not all jobs are created equal."[6.A.5] This statement referred to the substantial differences between average wages for managers and professionals, compared to production workers, but can also be applied to differences between manufacturing industries. The Duwamish MIC does, without doubt, provide a large concentration of good-paying jobs that do not require higher education and that offer opportunities for people with entry-level skills. However, the average-wage statistics do not necessarily reflect wages of workers in production occupations.

The average annual wage in King County in 2011 was about $63,300.[7.A.2.c)] The average wage for relevant industries was about:

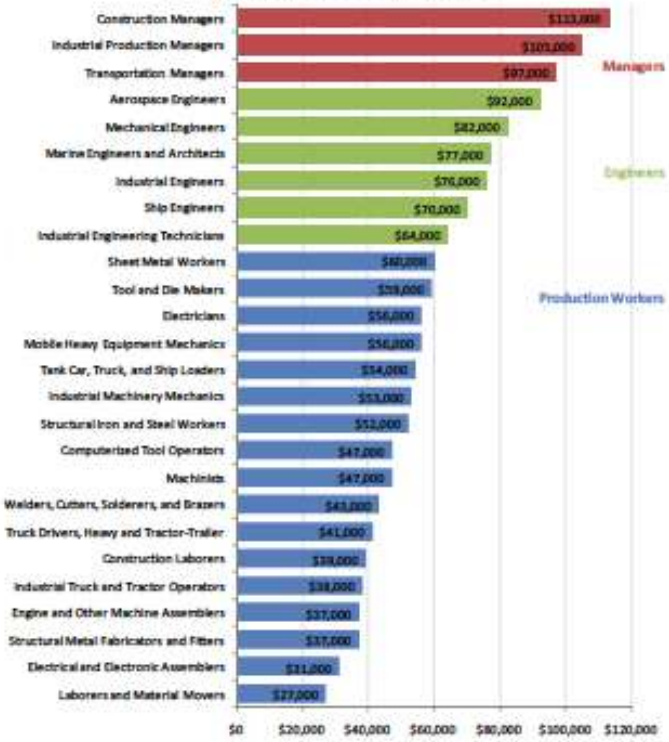
- $78,300 in manufacturing,
- $76,700 in wholesale trade, and
- $56,700 in transportation and warehousing.

However, manufacturing wages were highest for some industries that tend to require higher entry skills and/or have higher concentrations of employment outside the Duwamish area:

- $99,700 in transportation equipment mfg. (which includes aerospace mfg.),
- $92,200 in chemical mfg., and
- $86,000 in computer and electronic equipment mfg.

In fact, manufacturing wages are lower on average in the Duwamish area than for manufacturing elsewhere in King County. The ECONorthwest study found that the MIC ("Tier 2") region accounted for 19% of manufacturing employment in King County, but only 7% of wages in that sector.[6.A.2] In contrast, this region accounted for 17% of WTU employment, but 12-14% of wages in those sectors.

Exhibit 19
Average Basic Industry Occupational Wage Rates for the Seattle-Bellevue-Everett-Tacoma MSA, Selected Occupations, 2008



Source: Washington State Employment Security Department, 2008.

Wages differ substantially between occupations, as illustrated for "basic industry" in the Seattle-Bellevue-Everett metropolitan region (see "Exhibit 19" figure, above).[10] [6.A.5] In 2010, "production" occupations accounted for one-third (34%) of metropolitan regional manufacturing employment, and "transportation and material moving" occupations accounted for 6%.[7.A.2.d)] Nearly one-quarter (23%) of production occupations and half (50%) of transportation and material moving occupations had average annual wages under $30,000. For comparison, the U.S. Census poverty threshold for a four-person household in 2010 was $22,113,[11] and the average annual wage in King County was $63,600 in 2011.[7.A.2.c)] However, on average, wages for lower-

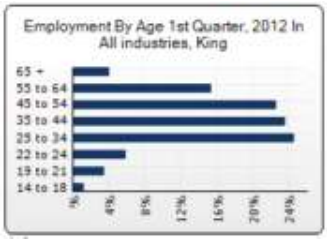
9. The "basic industry" category includes construction, in addition to manufacturing and WTU.
10. Source of Exhibit 19: *Basic Industries Economic Analysis* by Medford C, Forsyth M, Babb M, Couch D, Schrag T, Schwed R. (Community Attributes; produced for Seattle Office of Economic Development). July 2009. Original source: City of Seattle, 2008.
11. http://www.census.gov/hhes/www/poverty/data/threshld/

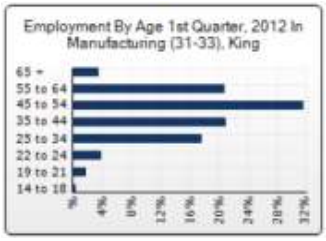
income manufacturing occupations were generally higher than for common occupations in retail sales, food service, and other services.[7.A.2.e)]

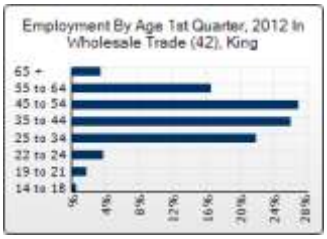
C. Demographics

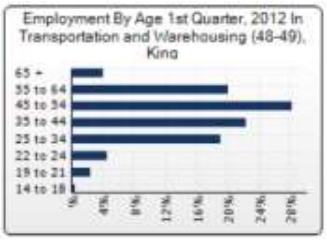
There is limited demographic information that is readily available for Duwamish area manufacturing and WTU workers. A 2009 study by the Port of Seattle found that about half (53%) of its 12,428 direct jobs were held by King County residents, and about one-quarter (28%) were held by Seattle residents.[6.B.2]

On average, workers in manufacturing and WTU industries tend to be older, based on Employment Security data for King County (see figures, below; compared to all industries).[7.A.2.b)] This is noteworthy because some employers are concerned about aging of their workforce and the seemingly limited interest among younger people in manufacturing or WTU employment.[9.B.3]









D. Economic connections

Lower Duwamish area industries have widespread economic connections throughout the local region and Washington state. This is relevant because any change or reduction in Duwamish industry employment could have economic and employment repercussions beyond the Duwamish industries. We did not identify estimates of economic connections for all Duwamish industries. However, Port of Seattle estimates are illustrative: a 2009 economic impact study of marine cargo and vessel operations identified: [6.B.2]

12,428	"direct" jobs (maritime services, 8,410; trucking, 1,931; railroad, 1,621; and administration),
4,224	"indirect" jobs, through local purchases by firms that directly depend on the seaport,
16,639	"induced" jobs, supported by purchases of directly employed workers, and
135,084	"related" jobs in Washington state, in firms connected to cargo moving through the seaport.

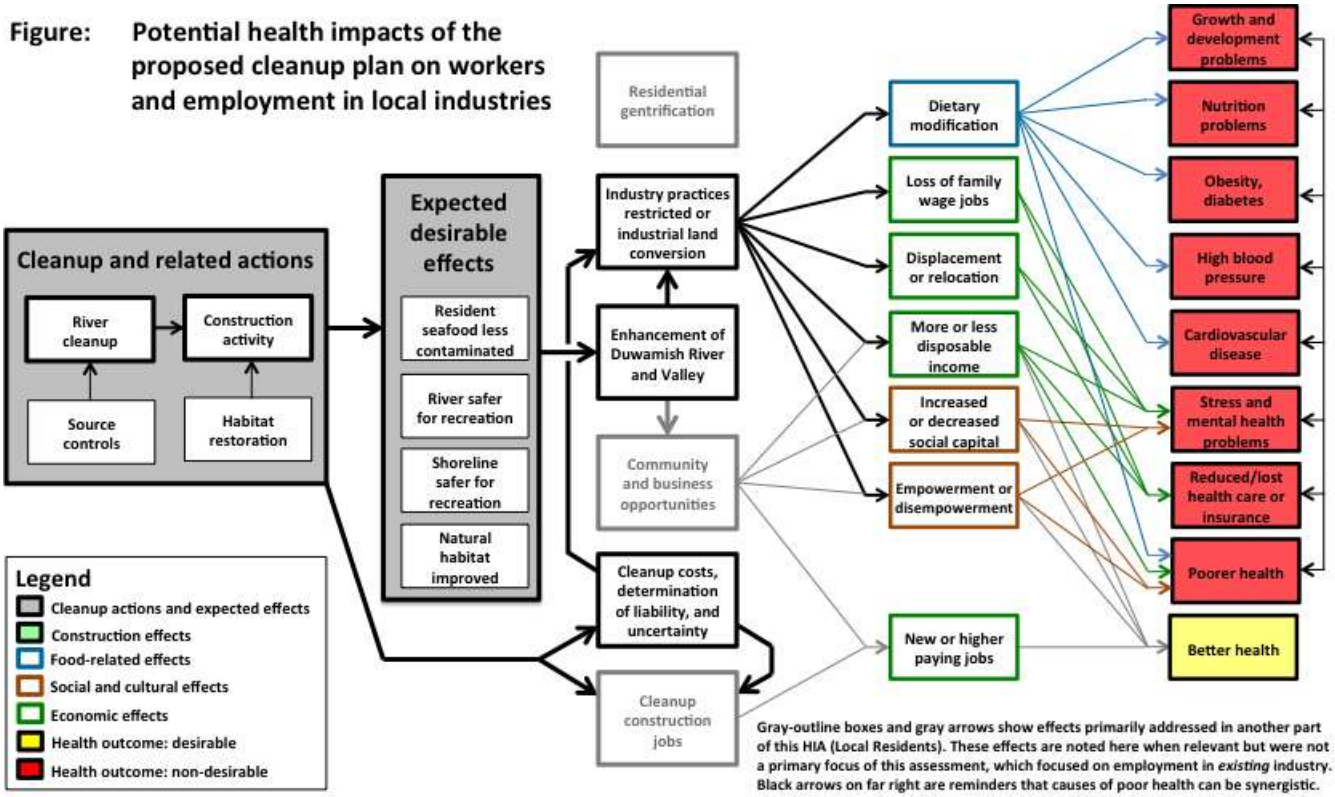
4. What are the major health outcomes of concern?

The potential health impacts of greatest concern for this assessment are related to employment in local industries—for current workers and local owners and for employment opportunities in the future.

Traditional manufacturing, wholesale trade, transportation and warehousing businesses in the Lower Duwamish area already face a variety of pressures that could influence their productivity and economic viability and that could stimulate changes in land use analogous to ongoing residential gentrification in local neighborhoods. It is plausible that the cleanup and related decisions could add to existing unfavorable pressures on local industries, with net loss of jobs or reduction in hours of employment. Alternatively, it is also plausible that existing businesses and employment could benefit substantially if the cleanup reversed the constraints and stigma of a blighted river and if this stimulated industry revitalization and economic robustness.

The following logic model (see figure, below) illustrates potential health impacts of the proposed cleanup plan on workers and employment in Duwamish area industries.

Figure: Potential health impacts of the proposed cleanup plan on workers and employment in local industries



1. Health outcomes associated with employment

Employment is one of the strongest favorable determinants of health and well-being.[12] Employment and skill development generate personal income and increase the likelihood of future employment and income stability. Steady employment with a decent wage allows individuals and families to live in safe home and safe neighborhood with access to basic services, purchase healthful food, ensure education for their children, and afford child-care services. Steady employment and a decent wage can provide disposable income and time to

12. Robert Wood Johnson Foundation. How Does Employment—or Unemployment—Affect Health? *Health Policy Snapshot: Public Health and Prevention*. March 2013.

enjoy pleasures of life, exercise, and ensure adaptive capacity to deal with unanticipated life challenges. Good jobs with benefits may provide health insurance which, along with a decent wage, ensures regular and timely access to health care, preventive, and health promotion resources. Together, these factors can reduce the risk of major preventable health problems such as obesity, diabetes, high blood pressure, heart attack, and stroke. Employment and higher income are associated with longer lifespan.[13]

2. Health outcomes associated with unemployment or under-employment

Unemployment or under-employment means that an individual or family may compromise or sacrifice any of the health-promoting aspects of employment. Unemployment is also associated with stress and depression, which can substantially impair health and well-being.[14] Unemployment, particularly during business downturns, is associated increased risk of suicide.[15] Under-employment or unemployment might prompt individuals to seek alternative employment or second or multiple jobs. For individuals who have limited or no transferrable job skills, alternatives might include expending additional time and cost to travel to a geographically distant area where similar work exists or taking a job in a closer area that requires fewer skills and may pay less. Both alternatives yield lower net income and less free time and could disproportionately harm lower-income households.

3. Importance or "severity"

Importance (or severity) is one of the categories used by this HIA to characterize possible health effects (impacts) of the proposed cleanup. The effects-characterization categories and definitions are described in the "Methods" technical report for this HIA. We use the terms, severity and importance, interchangeably. "Severity" is more intuitively understandable when applied to a potential adverse effect, but seems illogical when applied to a potential beneficial effect. Therefore, we use "importance" when considering a potential beneficial effect. We defined severity/importance with the question, "How important is the effect with regards to human function, well-being, or longevity, considering the affected community's current ability to manage the health effects?" [16] We rated severity/importance on a three-category scale: mild, medium, or high (or insufficient evidence).

In general, we rated the health outcomes associated with employment—and with unemployment or under-employment—as "medium." Although the associated health outcomes can truly range from mild to high, we concluded that medium was the best single, representative rating for the present situation. The potential health benefits of employment can vary substantially, depending on the individual's salary and employment benefits, total hours of employment (and hours of free time), household size, and other sources of household income. Conversely, the potential adverse health outcomes of unemployment and under-employment depend on the duration of that status, options for re-employment, and social safety net. At this particular point in time, economic conditions in Seattle and King County have substantially improved since the 2008 recession, with a recent reported unemployment rate of 4.4%, among the lowest in major U.S. cities.[7.A.1; 7.A.2] Unemployment benefits and other social safety nets (e.g., food stamps) have generally proven to be relatively secure and long-lasting during the recession. Consequently, we concluded that "medium" ("Acute, chronic, or permanent effects that substantially affect function, well-being, or livelihood but are largely manageable within the capacity of the community health system") was the optimal single rating for employment-associated beneficial and adverse health outcomes.

13. Waldron H. Trends in Mortality Differentials and Life Expectancy for Male Social Security–Covered Workers, by Average Relative Earnings. *ORES Working Paper*, No. 108. US Social Security Administration. Oct. 2007.
14. Zukin C, et al. Out of Work and Losing Hope: The Misery and Bleak Expectations of American Workers. *Work Trends*. Sept. 2011. John J. Heldrich Center for Workforce Development at Rutgers, State University of New Jersey.
15. Luo F. Impact of business cycles on US suicide rates, 1928-2007. *Am J Public Health*. 2011; 101(6):1139-46
16. Bhatia R. *Health Impact Assessment: A Guide for Practice* (2011).

5. Assessment

This chapter describes our assessment of potential effects of the proposed cleanup plan on workers and employment in Duwamish area industries. The chapters in Part B of this report provide the evidence base for the assessment, and consist of annotated references or simple reference citations organized according to the research questions that guided the assessment.

A. Context

Any potential effects of the proposed cleanup plan on workers and employment in the Lower Duwamish area industries would not occur in a vacuum. Potential cleanup-related effects are best appreciated by considering the context in which they would occur. It is conceivable that cleanup-related effects could combine or interact with existing challenges faced by local industries. The priority of any one problem or opportunity might appear more or less important, when viewed relative to other problems or opportunities. Most importantly, possible future options or strategies may be more appealing to stakeholders if they can be tailored to address more than one problem, serve multiple needs, or aim for broader goals.

Manufacturing, wholesale trade, transportation and warehousing businesses in the Duwamish Valley already face a variety of pressures that could or already do influence their productivity and economic viability. Some of these are longstanding, but others are newly manifesting or looming on the horizon.

1. Economic conditions and business environment

The existing surveys of local industry representatives about the influence of general economic conditions are colored by whether the survey was conducted before or since the onset of the 2008 recession. However, the U.S. economy and particularly the local economy show clear signs of recovery.[8.B] Unemployment in Seattle and King County had dropped to 4.4% as of April 2013, almost half of rates still seen in other major U.S. cities.[7.A.1; 7.A.2]

As mentioned earlier, U.S. manufacturing has shown substantial growth since 2008,[7.A.6] and the Seattle area has led this trend, primarily due to growth in aerospace employment.[6.A.6] The Puget Sound Regional Council projects that regional manufacturing employment will decline slightly between now and 2040, although employment is expected to grow in the Lower Duwamish area.[6.A.2; 8.A; 8.C] Higher growth rates are projected for other regional industries, such as information technology, life sciences, and clean technology.[8.C]

A 2011 survey of 400 manufacturing executives in Washington state found that "while manufacturers think the state's business environment is on the wrong track, they are optimistic about their own prospects for the future." [9.K] Of note, their top concerns for prospects of business success were: costs of health care (72%; rated 8-10 on scale of 1-10), state policies and regulations (60%), taxes (58%), and federal policies and regulations (54%). In contrast, concern was much lower for business pressures such as foreign competition (25%), competitor pricing (27%), and attracting and retaining qualified workers (30%).

2. International trade

To quote the Puget Sound Regional Council's *Vision 2040*, "More than any other state in the nation, Washington's economy depends on foreign trade — and the central Puget Sound region is vital to the majority of the state's trade activity." [8.C] The Seattle area is a leader among U.S. export markets: 6th largest in 2011, with $41 billion in exports, up 16% compared to 2010,[6.B] although shipping volume declined between 2011 and 2012 [9.I.7] and

have otherwise been down in the past seven years.[9.I.1,9.I.4] Other leading metropolitan areas, notably New York, are reported to have made larger overall recoveries than Seattle since the 2008 recession.[9.I.7]

The Port of Seattle is geographically and strategically well positioned for future trends in Pacific shipping but faces serious competition. The global trend in cargo shipping is toward larger and more fuel-efficient ships (per ton of cargo), which are too large to traverse the Panama Canal even after canal expansion.[9.I.3] For Asian cargo ships bound for the U.S., including east coast markets, it is cost competitive to transload cargo at west coast ports and then ship overland by rail. The ports of Los Angeles and Long Beach are larger than Seattle but already operate at or near full capacity. They are also farther from east and northeast Asian ports than Seattle. Ports in British Columbia offer major competition to the Port of Seattle for these markets, particularly given existing resources and plans for port expansion in Vancouver and Prince Rupert.[9.I.3; 9.I.7; 9.I.8] Of note, the rail route from Prince Rupert has less elevation gain than the route from Seattle.[9.I.3]

The Port of Tacoma is an important source of competition with Port of Seattle.[9.I.6.a)] The two ports have a longstanding rivalry marked by switches of major shipping lines from one port to the other. For example, Maersk Lines moved from Seattle to Tacoma in 2009, and Grand Alliance moved to Tacoma in 2012. The Port of Tacoma does not have as much large-crane capacity as Seattle. However, Tacoma has capacity for expansion, other local strategic advantages including the ability to load from ships to rail without relying on intermodal trucking, greater physical separation from the urban center, and exclusive focus on its seaport activity (whereas Port of Seattle also includes SeaTac International Airport).

The Port of Seattle has made important steps toward expanding port capacity. In its recently adopted *Century Agenda* strategic plan, the Port of Seattle ambitiously aspires, "Over the next 25 years, we will add 100,000 jobs through economic growth led by the Port of Seattle, for a total of 300,000 Port-related jobs in the region, while reducing our environmental footprint." [9.I.2] The Port has made substantial infrastructure improvements toward this goal. The 2013 *North American Port Analysis* by Collier's International reported, "Norfolk, Seattle, and Miami have already spent in excess of $100 million in [capital expenditure] from 2010–2012, or have appropriated project funding after 2013 that will likely place them among [the] top five in 2014." [9.I.7] As of July 2012, the Port had installed 13 "super post Panamax" cranes, capable of handling the largest container ships.[6.B.1; 9.I.1]

Traffic congestion and limited access to major highways and freeways are longstanding local problems for the Port of Seattle.[9.G] Although most imported cargo containers are transferred by truck to local rail facilities, the majority of exports are delivered to the Port by truck. Thus, street access is essential, and traffic congestion creates a serious bottleneck for Port operations. Street infrastructure improvements in recent years have not alleviated the problem. The situation is worse during events at the existing stadiums and is projected to worsen if a third stadium is constructed (see below).

Moody's Investor Service recently downgraded its outlook rating for Port of Seattle because of a number of "challenges" facing seaport and airport activity, but noted, "Economic conditions in the area remain strong and the rating outlook could stabilize if the growth continues to drive growth in airport and seaport revenues."[9.I.4]

3. Location, location, location

The Lower Duwamish area, and specifically the Manufacturing-Industrial Center (MIC), is an ideal location for many businesses and essential for others.[9.A; 9.B.2; 9.C; 9.D] The marine cargo services of the Port of Seattle could not exist anywhere else. There are few or no alternative choices of location in Seattle, where water-dependent businesses could have as much unrestrained water access and mobility as they have with the Lower Duwamish Waterway and Harbor Island. The marine terminals, Boeing Field, and rail and highway-freeway

infrastructure offer access to sea, land and air transportation that is unrivaled in the region. The high concentration of industry in the Duwamish area allows transactions between suppliers, customers, and interdependent businesses that would be much less robust in a smaller or outlying location. The "close-in" location, close to downtown Seattle, also allows proximity to the urban workforce and professional and technical support services.

The closest alternative manufacturing-industrial center, the Kent MIC, offers many appealing features, such as greater availability of land, more building vacancies, lower lease or purchase costs for buildings or land, and newer and larger building stock.[6.F] However, even if it was feasible for a business to relocate there, the cost savings of relocation could easily be outweighed economically by the loss of advantages available in the Duwamish MIC.

The Duwamish MIC location does, however, have shortcomings. Industry representatives commonly describe problems with road infrastructure and traffic congestion.[9.B.3; 9.C; 9.D; 9.E; 9.G] Some areas are relatively isolated from others by rail lines, major highways, the Duwamish River, and the disabled South Park bridge.[6.G.2; 6.G.3] The Duwamish MIC is built on flat, low-lying landfill, and the associated drainage problems make it difficult to maintain streets.[6.G.2; 6.G.3] Seattle land use policies and regulatory structures are often described as burdensome or restrictive.[9.B.3; 9.C; 9.D; 9.E] Much of the building stock is relatively old, and options for business expansion are substantially constrained by a variety of factors including little to no unbuilt land, fragmented ownership of land parcels, low turnover of property ownership and leases, low lease vacancy rates, and high costs of renovating or replacing existing buildings.[6.D.1; 6.E; 6.E.1; 6.G.2; 6.G.3; 6.G.4]

4. Industrial development

The City of Seattle has made major commitments to sustain industry in the Duwamish MIC, embodied in the Seattle Comprehensive Plan and reinforced by a 2007 ordinance that limits the size of non-industrial development in Seattle MICs, particularly in the general industry IG1 and IG2 zones.[6.C.1; 6.C.2; 6.C.3] The Industrial Development District Pilot Program is one manifestation of this commitment, offering potential incentives and efforts to resolve regulatory challenges to industrial development.[9.E] The Port of Seattle was added to the Seattle Comprehensive Plan in 2012.[6.C.2.c)]

Nonetheless, industry representatives often express concern about encroachment on and conversion of industrial land in and around the MIC.[9.B.3; 9.C] These concerns are readily acknowledged in King County commercial real estate assessments,[6.G.2; 6.G.3] and are reinforced by the highly visible and popular pressures for non-industrial development in the "Stadium Transition Overlay" within the SODO subarea of the Duwamish MIC (see below).[9.H.1]

Pressures to convert industrial land to non-industrial use are not unique to Seattle.[see section B, page 24]

5. Industrial workforce

Several workforce-related trends pose challenges for industry. In one study of Seattle basic industries,[17] half of the interviewed business owners said the limited availability of skilled workers was a major constraint on business growth.[9.B.3] One offered explanation was that younger people are less interested in and less prepared for blue collar jobs than in the past. This impression is supported by the observation that the age distribution is generally older among existing employees in manufacturing, transportation and warehousing industries, compared to the overall regional workforce.[7.A.2.b)] The high cost of living in Seattle is another factor that limits the available labor pool.

17. Basic industries: manufacturing, WTU, and construction.

6. Commercial real estate

Seattle is increasingly a national and even international target for real estate investors. A recent, large nation-wide survey of real estate industry experts placed Seattle in the top ten cities with favorable overall real estate prospects: #7 overall and #4 specifically for industrial/distribution property.[9.F] The report noted, "Interest is also very strong in industrial space, with over 51 percent indicating now is the time to buy. Investors favor Seattle industrial space for a few reasons, including the 'industrial-to-mixed use transition taking place for many suburban industrial and business park sites,' as well as the city's position 'serving as the main corridor to Asia.'"

These survey findings are supported by local statistics for industrial real estate.[6.F] Vacancy rates are signifi-cantly lower for the Seattle "close-in" industrial market than elsewhere in the county and state. Warehouse rental costs are steadily increasing. Real estate speculation is likely to drive conversion of warehouse space, particularly in the SODO district. The 2012 report of the King County Assessor for large warehouses noted:

> The Sodo-Seattle district has seen extensive redevelopment in recent years. The industrial owners are watching this area sharply with the prospect of more new development by the stadiums. Land values have risen near the stadiums which have caused a couple larger warehouses to be obsolesced. A very recent proposal by a wellfunded consortium of investors (headed by a San Francisco hedge fund manager with ties to the local area) to construct a third sports arena just south of Safeco Field is also fueling further interest in this area.... There were no industrial market sales of warehouses over 100,000 square feet in area 500-60 [Seattle close-in] in the last three years…. Many property owners are sitting back and waiting to see what develops in this area.[6.G.4]

7. SODO area and stadiums

Development pressures in the SODO area pose one of the biggest current challenges to the integrity of the Duwamish MIC. A group of investors has proposed building a third athletic stadium in this area, to be home for an NBA team and possibly an NHL team. Seattle and King County have entered into a formal Memorandum of Understanding with the investor group.[9.H.2] In December 2012, two volunteer public boards, Washington State Major League Baseball Stadium Public Facilities District (PFD) and Washington State Public Stadium Authority (PSA) put forth a concept plan with "A Vision for Tomorrow: Create a unique and lively destination Stadium District for all with retail, residential, entertainment and other complementary uses." [9.H.2; see figure on next page] The concept has high profile support, including Seattle former mayor Charles Royer as PFD chair.

SODO development is catalyzed by the ongoing Stadium Place development in the North Lot, between Pioneer Square and CenturyLink Field, and lying just north of the Duwamish MIC and Stadium Overlay.[9.H.6] Stadium West construction began in 2011, and Stadium East construction begins in 2013. This 3.85 acre mixed-use development "…has continued to evolve as the project proceeds through the design phase. Current project design features three residential towers with 740 units, plus 180,000 SF of office, a 300 room hotel and conference center, retail and parking components." The project will "provide space for approximately 1,430 jobs with over 90% of the jobs in the professional and service industries."

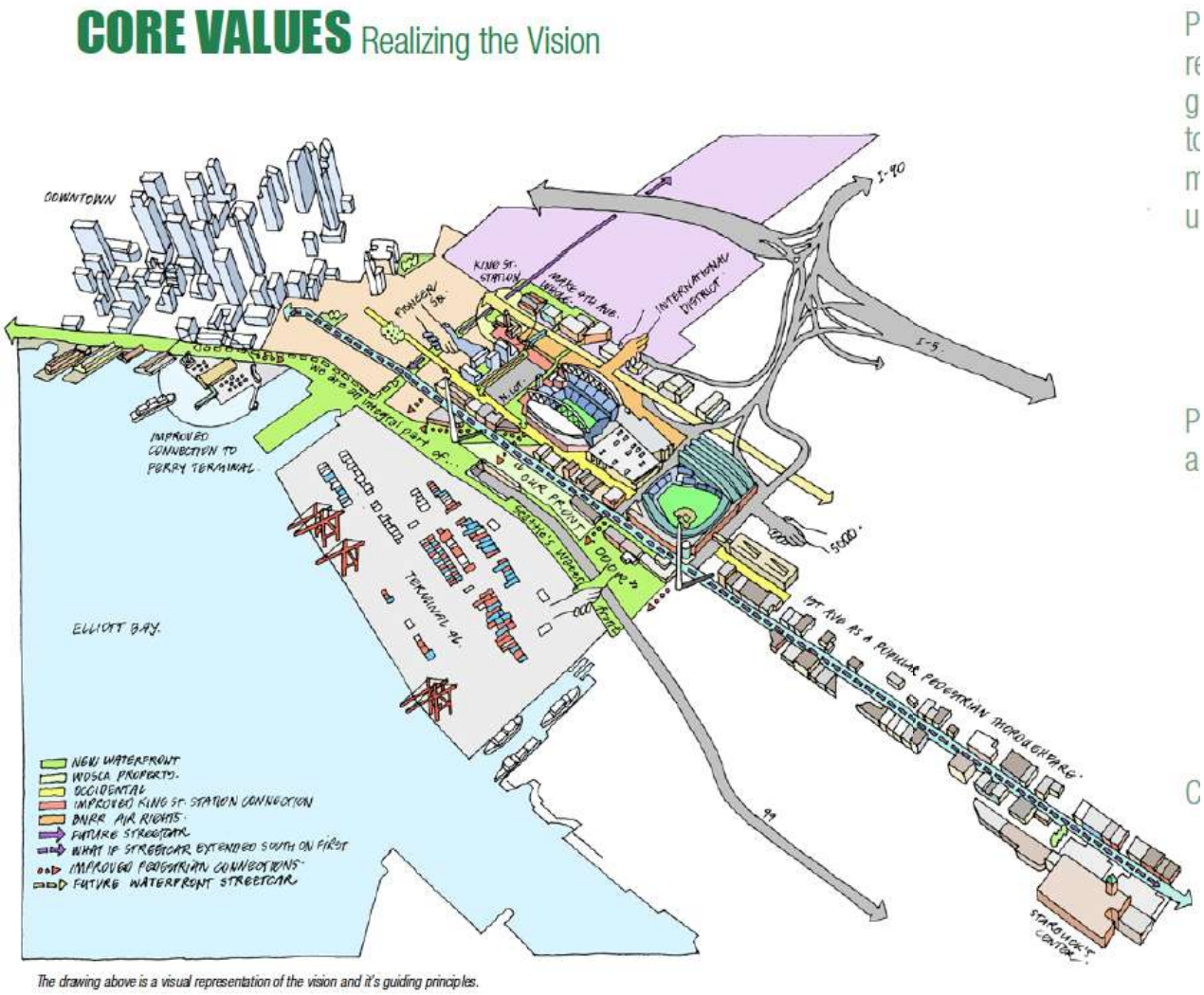
Development pressures in the adjacent International District are likely to shape SODO development (and vice versa). Starbucks, with its corporate headquarters located south of the proposed Stadium District, could also attract or influence additional development to the south. See figure on next page for geographic relationships.

The third arena and SODO development proposals have met resistance, particularly from the Port of Seattle, Seattle Manufacturing Industrial Council, and the International Longshore and Warehouse Union. A report by the Seattle Planning Commission plus reports commissioned by the Port of Seattle voiced concerns about detrimental economic and traffic impacts on the Port and the Duwamish MIC.[9.H.3]

In response to these issues, the City of Seattle began two related studies in February 2013—a Duwamish Industrial Lands Study and a Stadium District Study—each with a stakeholder advisory group.[9.H.4] The goal of Industrial Lands study is "to make sure we can protect industry and port operations in light of the proposed basketball arena and other nearby changes." Draft recommendations were presented at the May 28 stakeholder advisory group meeting. The City has also undertaken an Industrial Areas Freight Access Project.[9.H.4]

Figure: Stadium District Concept

From Stadium District Concept Plan (December 2012)



Note, what is often called the stadium "district" is more correctly identified as the "Stadium Transition Area Overlay District," superimposed on the MIC.[9.H.1] The SODO "district" is a subarea of the Duwamish MIC, most of which is zoned as Industrial Commercial (IC; as opposed to IG1 and IG2, for general industry). Stadium siting is allowed in this zone, as well as office, retail, and restaurant land use. A zoning change or variance would be necessary for more expansive use, such as proposed hotel and residential development. Although the investor group suffered a recent setback in its bid to purchase and relocate an NBA team to Seattle, their continued efforts, the concept plan for development, and associated real estate speculation provide strong momentum towards possible conversion of this MIC subarea to non-industrial uses.

B. Experiences in other places

Pressures to convert industrial land to non-industrial use are not unique to Seattle. The Seattle Department of Planning and Development in 2007 surveyed city staff in eight North American cities about industrial land use issues: Portland, OR; Vancouver, BC; San Francisco, CA; Los Angeles, CA; Chicago, IL; Minneapolis, MN; Boston, MA; and Philadelphia, PA.[11.A] Respondents in all eight cities reported pressures, in some cases "tremendous," to convert industrial lands to non-industrial uses. "According to most respondents, demand generates pressure on city government to change land use regulations or grant special conditions. High demand also generates land speculation, which inflates land values and rents. Respondents also indicated that conversion pressures were keenly felt by industrial lands in shoreline areas."

Urban waterfront revitalization efforts often focus on brownfields or post-industrial lands, where there is no longer a substantial industry presence. However, when revitalization targets abut or overlap active industrial land, particularly in cities with active maritime industries, the result can be intense conflict and encroachment on or conversion of industrial land; contemporary examples include Brooklyn, NY, Providence, RI, and Portland, OR.[11.E; 11.E.1.a); 11.B] Portland provides one opportune situation for comparison with Seattle, especially given its geographic proximity and similarities in "west coast" culture.

The federal Urban Waters partnership, which began in 2011 and now has seven pilot locations, may eventually provide additional examples for comparison.[11.F] However, the Great Lakes restoration efforts provide a particularly interesting examples to consider, especially the active partnerships with industry.[11.G.1]

Many cities have invoked measures to preserve or protect industrial land. There is a plethora of "industrial lands" studies in various U.S. cities, documenting the status of and challenges to industrial land use in that location. The experience in Chicago, however, is probably most informative because of its long history.[11.C]

1. Portland, Oregon

In a situation parallel to that with the Lower Duwamish River of Seattle, the Willamette River in Portland, Oregon has been contaminated by more than a century of urban and industrial pollution. Downstream of downtown Portland, the soil and sediment along the river have been found to contain 29 compounds that constitute risks to human health and 89 chemicals that pose ecological risks.[18] In 2000, EPA added the Portland Harbor site to the Superfund priority list. By the end of 2014, EPA plans to finalize the cleanup plan for the site.

While the EPA has composed its cleanup plan, the City of Portland developed its North Reach River Plan, which encompasses the Portland Harbor Superfund Site.[11.B] As adopted by the Portland City Council in 2009, the River Plan is intended to comprehensively update the City's Willamette Greenway Plan, zoning code, and design guidelines, in order to support "the uses and development that make up the working harbor while balancing the need for a clean and healthy river."[19]

Adding to the complexity of planning in the harbor area, local industries have expressed concerns regarding limited land available for growth and pressures from residential encroachment and industrial land conversion. In addition, the harbor industries report that perceived risks regarding Superfund liability, and the general complexity and difficulty of negotiating brownfield development, currently inhibit industrial waterfront development.[20] In light of these issues, the City Council's adoption of the River Plan was appealed by three industrial parties: Gunderson, Schnitzer, and the Working Waterfront Coalition (WWC), an "organization of

18. Lower Willamette Group. 2011. Executive Summary: Portland Harbor Superfund Site Remedial Investigation Report.
19. City of Portland Bureau of Planning and Sustainability. 2013. North Reach River Plan. www.portlandoregon.gov/bps/42542
20. City of Portland Bureau of Planning and Sustainability. 2006. Working Harbor Reinvestment Strategy Business Interview Results.

businesses concerned about the environmental health and economic vitality of the Portland Harbor."[21] The industries argued that, according to State Planning Goal 15's requirement to protect lands committed to urban uses, the City shouldn't be able to regulate waterfront industrial land, other than for new development.

The local Land Use Board of Appeals and the Court of Appeals upheld the legitimacy of the River Plan in 2011, as did the Oregon Supreme Court in 2012, finding that "nothing in the text of Goal 15, its relevant context, or its adoption history supports the conclusion that the goal unambiguously expresses an intention to preclude local governments from regulating developments of industrial and other urban uses that do not constitute intensifications' or 'changes' to those uses."[22] The legal challenge did reveal the need for additional economic analysis and inventories to inform the River Plan. Planning staff has outlined the intent to review implications of the new findings with stakeholders representing industry, communities, and the environment, in order to make plans that comply with state law, foster ecological recovery, and support health and a working river.[23]
The situation in Portland offers many points for comparison with the Lower Duwamish area, particularly if community or industry revitalization efforts are considered here. However, the Portland situation is still early in its evolution, and comparison options are limited. If nothing else, the situation in Portland illustrates the adversarial relationships that can arise if revitalization efforts are not adequately inclusive of all stakeholder interests, particularly those of industry.

2. Great Lakes restoration

The Great Lakes restoration, propelled by the 2002 Great Lakes Legacy Act, is a regional U.S.-Canadian effort to revitalize waterfront land, and to remediate brownfields and contaminated lake and river sediments, particularly at 40 "Areas of Concern," accomplished through public-private partnerships and coalitions of community organizations, municipalities, industry and academic institutions.[11.G] A 2007 benefit-cost study estimated that investment of $26B (billion dollars) in ecological restoration would eventually yield more than $50B in benefits to the national economy, and $30-50B to the regional economy.[24] Although some of the active restoration sites involve industrial lands or commercially active waterways, one of the more noteworthy aspects for the present HIA are the relatively active partnership roles and contributions of industry.

The Council of Great Lakes Industries (CGLI) "represents industries and businesses with significant investments, facilities, products, or services in the Great Lakes region. Members are drawn from manufacturing, utilities, transportation, natural resources, financial, services, and trade." [11.G.1] Members include major corporations and institutions such as the American Chemistry Council, BP Corporation, Dow Agrosciences, Dow Chemical, DuPont, Lafarge North America, and Shell Canada. Their vision statements provide an enviable model and goals for other industry coalitions to consider; for example:[25]

> Our vision for the future, which we are working to achieve, has been shaped by many of the region's stakeholders. Essential to achieving the following breadth of vision within the Great Lakes basin, is broad implementation of an equitable public. How the region's emerging issues are addressed by all participants in the Great Lakes region policy process. It is the best way to harness all of the region's energy and resources behind a collective vision. This requires that policy in the region is created and implemented utilizing the best science and risk/benefit principles and is based on an integrated view of economic, societal and environmental health and safety issues.

21. Working Waterfront Coalition. 2013. About the Working Waterfront Coalition. www.workingwaterfrontportland.org/about_wwc.shtml
22. *Gunderson, LLC v. City of Portland*, 352 Or. 648, 290 P.3d 803 (Or. 2012)
23. City of Portland Bureau of Planning and Sustainability. 2012. Update on North Reach Court Ruling and the Path Ahead. www.portlandoregon.gov/bps/article/420929
24. Austin JC, et al. *America's North Coast: A Benefit-Cost Analysis of a Program to Protect and Restore the Great Lakes*. Healing Our Waters – Great Lakes Coalition, and Council of Great Lakes Industries. Sept. 2007.
25. CGLI. *Council of Great Lakes Industry's Vision for the Great Lakes Region*. [Accessed June 2013]. www.cgli.org/vision.html

Working together, the members of the CGLI along with the governments of the U.S., Canada, States and Provinces; educational institutions; public and private agencies; and the hundreds of public interest groups focused on the Great Lakes region can achieve this vision of a region for future generations.

Our Vision for the Environment: CGLI's vision for the future of the Great Lakes environment is one that includes lakes which are appreciated for their beauty, healthful to mankind and to wildlife, and useful to the population. This vision of our lakes may be measured by the following criteria:

- Fishability: No restrictions on the human consumption of fish as a result of the presence of contaminants in the lakes.
- Swimmability: No bathing beaches being closed as a result of human activities.
- Drinkability: Treated drinking water is safe for human consumption.
- Healthy Human Populations: Human populations in the Great Lakes basin are healthy and free from acute illness associated with high levels of chemical or microbiological contaminants, or chronic illness associated with long-term exposure to low levels of contaminants in the Great Lakes.
- Biological Community Integrity and Diversity: Evolutionary cycles that encourage the diversity of biological communities and the genetic variation within species are maintained.
- Physical Environment Integrity -- Wetlands are restored in appropriate areas, land use is well planned and sustainable forestry practices are used. Progress in land planning and funding for restoration of wetlands is achieved.

Achieving our environmental vision requires that:

- The public recognizes that current industrial practices in protecting the environment and disposing of wastes are significantly better than historic practices.
- Public policy discussion, decisions and agreements include the principles of prioritized risk, risk assessment and cost-benefit considerations, in other words, consistent with sustainable development principles.
- The best science is used to guide public policy and governmental actions as well as decisions made in the corporate boardroom. For example, mass balance modeling (that includes atmospheric deposition) is utilized as a tool to guide priorities and programs. Potential human health and environmental impacts of chemicals are evaluated scientifically for hazard potential. Exposure assessments are required for risk determinations.
- All companies and business organizations, large and small, have implemented product stewardship programs that evaluate their own products throughout their life cycles for environmental and human health impacts. Through these evaluations, manufacturers identify the action needed to eliminate unreasonable risks and maintain absence of harm for habitat, wildlife and humans.
- Government, environmental groups and the general public recognize industrial leadership in addressing environmental and human health issues and the value in working together to resolve real problems.

Success is achieved in important initiatives such as: -- Great Lakes Binational Toxics Strategy

Inputs of persistent, toxic, bioaccumulating and bioavailable substances are virtually eliminated to below levels of significance in point source, non-point source and combined sewer overflow discharges.

When pursuing environmental policy directions requiring a precautionary approach, it is necessary to include the cost-effective application of UNCED Agenda 21 Principle 15.

3. Chicago

In reaction to gentrification and encroachment on industrial land, the City of Chicago in 1988 created the Clybourn Corridor Planned Manufacturing District (PMD), followed by the Goose Island and Elston Corridor PMDs in 1990, and eventually 11 more PMDs.[11.C] One recent praiseworthy article reported, "Chicago's success has been heralded as a model for economic development in cities across the country, including New York, Seattle, Portland and Milwaukee."[26] However, a 2005 study by University of Wisconsin examined performance of those first three PMDs during 1988-2004 paints a mixed picture of success.[27]

26. Chambers G. *The LEED Council: Three Decades of Industrial Preservation*. LISC Chicago. June 20, 2012. http://www.lisc-chicago.org/news/1898

27. University of Wisconsin-Milwaukee Center for Economic Development. *Curbing Industrial Decline or Thwarting Redevelopment? An Evaluation of Chicago's Clybourn Corridor, Goose Island, and Elston Corridor Planned Manufacturing Districts.* Nov. 2005

> Of the three PMDs, the Clybourn Corridor has fared the worst in terms of industrial retention. Despite the establishment of the PMD in 1988, the Clybourn Corridor has transitioned from a largely industrial area to a retail area. For every new retail job created during the 1988- 2004 period, roughly one manufacturing job was lost.
>
> The Goose Island PMD has performed the strongest of the three PMDs. Jobs on Goose Island rose from 1,256 in 1988 to just over 2,000 in 2004. Manufacturing did not fare as well as 3 other sectors, however, with employment falling from 406 workers in 1988 to 310 workers in 2004. A worker on Goose Island today is more likely to be employed in a warehouse than in an industrial firm. The decline of value-added activities on Goose Island and in the other PMDs has likely affected the earnings of workers in a negative way.
>
> The industrial retention performance of the Elston Corridor PMD has been comparable to Goose Island, with manufacturing experiencing a decline from 1988 to 2000 but showing signs of recovery in more recent years. Confidence in the PMD among Elston Corridor stakeholders is weak in places. Vacant property in some locations has created the perception that the PMD is no longer working effectively.

The first in a University of Chicago series on *Manufacturing Chicago's Future* concluded, "Current enthusiasm for local and regional policies to strengthen manufacturing in metropolitan Chicago is founded."[28] However, the conclusion included a cautionary note about decentralization and inadequate coordination:

> The decentralization of manufacturing from the city of Chicago and, to a lesser extent, from suburban Cook County, presents a challenge for local manufacturing policy because manufacturers are more productive when they locate in areas that have dense concentrations of other manufacturing and service companies. Cook County, with nearly half of all manufacturing jobs in the metropolitan area, offers manufacturers those benefits of density, as do concentrations of business in other parts of the metropolitan area. In deciding where to locate, manufacturers (and other companies) do not take into account the benefits that their individual decisions to locate in areas of greater density have on other companies. Likewise, they do not take into account the costs that they impose on other companies when they move away from such dense areas. Public policy should strengthen manufacturing in existing areas of manufacturing density. To design the right policies, it is important to know why decentralization is occurring (e.g., outlying areas may offer better access to highways and O'Hare Airport or more modern industrial facilities). Such knowledge can help county and municipal governments determine whether it is possible to offset the incentives to decentralize that companies face and, if so, how.
>
> A final challenge for Chicago-area manufacturing policy efforts is that they are not, at present, coordinated with one another. This creates the danger that different policy efforts may work at cross purposes or that separate efforts may not be large enough to take full advantage of economies of scale. Although there is no need for all policy efforts to be conducted by a single public or private organization, manufacturing policy in Chicago would benefit from some looser form of coordination.

Thus, one take-home lesson is that, even with a renowned model of planned-manufacturing development, the pressures against centralized urban industry are continuous and require ongoing maintenance and coordination.

4. Manufacturing innovation centers

President Obama proposed plans in 2012 to invest $1 billion to create up to 15 manufacturing innovation institutes that would "serve as regional hubs of manufacturing excellence that will help to make our manufacturers more competitive and encourage investment in the United States."[11.D] The first institute is in Youngstown, Ohio, "selected through a competitive process, led by the Department of Defense, to award an initial $30 million in federal funding, matched by $40 million from the winning consortium, which includes manufacturing firms, universities, community colleges, and non-profit organizations from the Ohio-Pennsylvania-West Virginia 'Tech Belt.' " The course of this first institute and the broader program warrant monitoring, at least for ideas and potentially for funding opportunities.

28. Wial H. *Manufacturing Chicago's Future*: *Locating Chicago Manufacturing: The Geography of Production in Metropolitan Chicago*. Center for Urban Economic Development, University of Illinois at Chicago. Feb. 2013.

C. Potential health impacts of the proposed cleanup

This HIA assessment considered four major categories of possible cleanup-related effects: cleanup job creation, cleanup costs and business liability, business uncertainty, and industry revitalization. For each category, the health outcomes of concern are related to employment, particularly loss of employment or under-employment attributable to business turnover or change in the types of industry in the Lower Duwamish area. The potential associated health outcomes and their severity/importance are described in Chapter 3 of this report.

In looking at these possible effects, it is important to consider at least three different industry categories where employment and economic output might be affected by the proposed cleanup:

1. All businesses in manufacturing and WTU industries in the Lower Duwamish area;
2. Potentially liable entities: private businesses and public entities that have been identified as Potentially Responsible Parties (PRPs), or that believe EPA might eventually consider them potentially liable, for costs of the Lower Duwamish Waterway cleanup; and
3. Liable entities: private businesses and public entities that are ultimately determined to be liable for cleanup costs.

A City of Seattle study identified 1,083 "basic industry" workplaces in the Duwamish MIC in 2007.[29] [6.A.5] Four PRPs voluntarily organized as the Lower Duwamish Waterway Group (LDWG)—City of Seattle, King County, Port of Seattle, and The Boeing Company—completed the site assessment for the Remedial Investigation and Feasibility Study, and has conducted or planned Early Action cleanups.[10.A] As of November 2012, the EPA had sent General Notice Letters to an additional 111 PRPs, and Information Requests to 325 other entities. The latter will not necessarily be PRPs, but they might reasonably believe themselves to be at risk for PRP determination. The EPA can continue to identify PRPs before, during, and (within limits) after the cleanup. In some situations, the identified PRPs may attempt to identify other, yet unidentified PRPs to potentially share cleanup costs.

1. Cleanup job creation

Will the proposed cleanup create jobs in the Lower Duwamish area, and whom will they benefit?

Direction of effect: **BENEFICIAL**
Likelihood: **Very likely**
Magnitude: **Limited-moderate**
Importance (severity): **Medium**
Distribution: **Disproportionate benefits**
Adequacy of evidence: **Somewhat incomplete**

It is not possible to quantify the number and type of jobs, nor how many local businesses will be involved, until the cleanup plan is finalized and logistic planning begins.

A 2010 economic impact study by ECONorthwest (conducted for King County) estimated economic impacts and job creation for each cleanup alternative identified in the Lower Duwamish Waterway Feasibility Study.[10.D] The analysis assumed that King County firms would do the cleanup work where possible, and ultimately concluded that "as much as three-quarters of spending may be allocated to firms located within King County and 60% allocated to firms in the City of Seattle…. Spending on some clean-up activities, especially

29. The "basic industry" category includes construction, in addition to manufacturing and WTU

landfill costs, will take place outside of King County." EPA originally projected the cleanup costs for the 5C alternative to be $299M (million dollars; note, the proposed plan uses alternative "5C+"). The ECONorthwest study estimated that alternative 5C would produce $377M total economic output in King County, considering the direct costs plus associated indirect and induced economic effects, and would generate an average of 270 "full year" jobs in King County during the 7.7 year construction period. Of these jobs, 69 were estimated to be with firms in the Lower Duwamish area. Many of the jobs would be full-time but part-year (estimated, 480). The amount spent for each King County job was estimated to be about $140,000, which is lower than typical for construction jobs in King County ($170,000), because the materiel needs for cleanup are less than for other types of construction.

a) Magnitude and distribution of beneficial effect

The ECONorthwest analysis suggests that the proposed cleanup is very likely to generate a substantial number of jobs throughout the construction period, and a majority of those jobs could go to King County-based workers and businesses, if there are intentional efforts to do so. Thus, much of the direct cleanup expenditures could be retained in the local economy. The number of jobs generated with local, Lower Duwamish area businesses would be small relative to overall number of workers and businesses in that local area, and the healthful benefits would accrue to workers (and business owners) employed in a limited subset of businesses; for example, marine construction, barging, intermodal transfer (barge to rail), and rail operations. The direct benefits of job creation would probably be limited or none for a substantial majority of the Lower Duwamish businesses that will be liable for cleanup costs.

The healthful benefits of employment are potentially more likely to serve workers who already have necessary trade skills or related job experience, than unskilled and lower-income workers. The Superfund Jobs Training Initiative (see "Local residents" technical report for this HIA) or other training or hiring initiatives could help reduce this potential inequity.

2. Cleanup costs and business liability

Who will bear the costs of the proposed cleanup, and how might that affect employment and health?

Direction of effect:	**ADVERSE**
Likelihood:	**Likely**
Magnitude:	**Insufficient evidence; limited-moderate**
Severity/importance:	**Medium**
Distribution:	**Disproportionate harms**
Adequacy of evidence:	**Moderately incomplete**

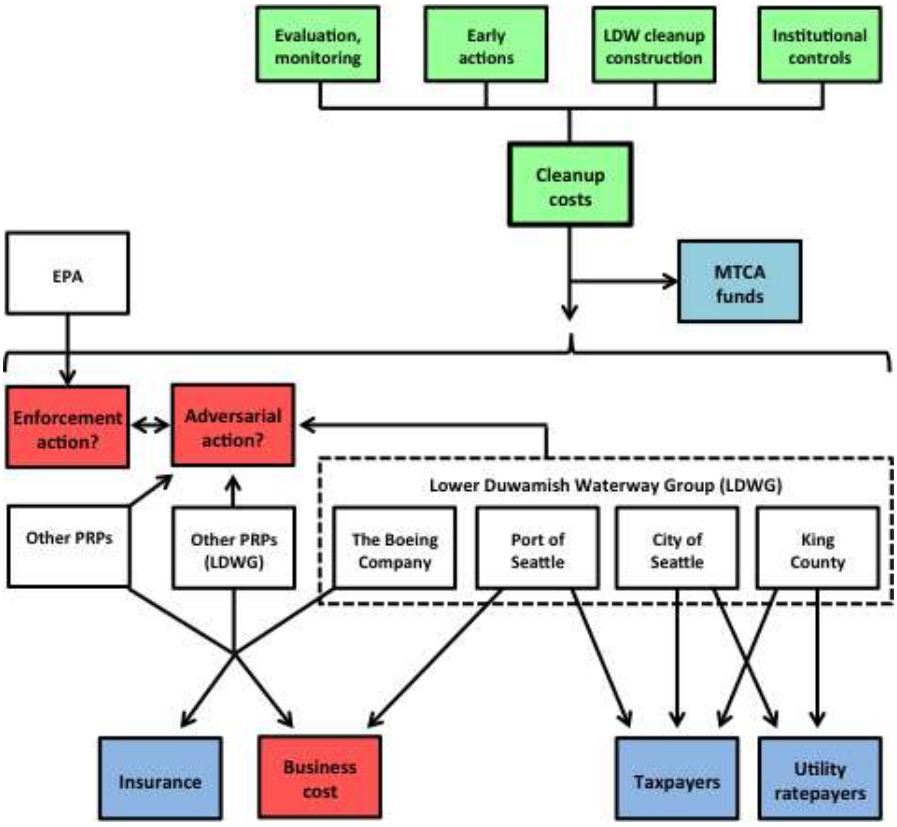
The EPA estimates the cost of the proposed cleanup to be $305M. The Lower Duwamish Waterway Group (LDWG) is a voluntarily formed working group consisting of four potentially responsible parties: King County, City of Seattle, Port of Seattle, and The Boeing Company. LDWG reports having already spent "over $135 million both on studies to date and on cleaning up early action areas." [www.ldwg.org]

The distribution of liability has not been resolved. As of November 2012, the EPA had identified 111 PRPs, in addition to the original four LDWG parties. LDWG indicated in February 2013 that they planned to "invite about forty other parties to participate with them in a non-judicial proceeding designed to allocate the costs associated with the environmental clean-up of the Lower Duwamish Waterway." [10.A]

The ultimate allocation of liability will not mean that responsible parties must directly pay a straight percentage of the *total* cost, because other funding streams will be involved (see figure, next page). Some funds will come from Washington Department of Ecology, supported by a tax on hazardous substances imposed by the voter-approved Model Toxics Control Act (MTCA).[10.B] Euring the 2009-11 biennium, the total Ecology expenditures from the State Toxics Control Account were $120M, including $35M specifically for Toxics Cleanup. Local governments can receive Oversight Remedial Action Grants, which requires a 50% match by the grant recipient. Of note, the $8M cost for the Slip 4 Early Action cleanup was funded by The Boeing Company, City of Seattle, and MTCA matching grant funds.[10.A]

Figure: Conceptual pathways for payment of costs of the proposed cleanup

Note: green boxes = cleanup costs; red boxes = costs paid by businesses; blue boxes = costs paid by other sources.



Some costs will also be borne by insurance companies, although the amount, if any, will differ between parties depending on their insurance coverage and history. The three public entities can potentially pass along their share of costs to taxpayers and/or utility ratepayers. The remaining share of costs for private businesses will presumably be absorbed as a cost of business.

The costs of cleanup could potentially be compounded by legal costs, particularly if allocation of liability becomes adversarial or if a business became a subject of EPA enforcement action (e.g., for not accepting liability). If the actual, direct cleanup costs for any one business were substantial, then those costs could restrict that business' ability to continue operations as usual, invest in improvements, or attract lenders or investors. It is impossible to estimate those potential costs for individual businesses; however, it is conceivable that those costs could be substantial relative to one business' capital resources or operating margin, particularly for a small or

medium size business. This added liability could inhibit a business' ability to secure a loan or attract investors. It is conceivable that a business might have to cut employment as a result of these factors.

a) ECONorthwest economic analysis

A second study by ECONorthwest (for King County) estimated economic impacts of the proposed cleanup.[10.E] Their literature review reportedly identified numerous studies of Superfund site proximity on property values, but few such studies focused on commercial or industrial property. They identified no evidence foundation upon which to estimate the magnitude of potential economic impact. The economic impact analysis was based on assumptions that a business could experience direct liability costs or indirect costs ("economic stigma and uncertainty"), and that business investment could be stimulated by cleanup timeliness and "perception that the cleanup will ultimately be successful." The analysis examined two hypothetical scenarios:

- "**'Pessimistic' Scenario A**: For the Scenario A, we assume that businesses perceive the clean-up effort is not going well and there is a reasonably high likelihood of negative surprises, such as not-yet-identified contamination and/or the possibility of inheriting liability for contamination by a past polluters. One or more of the following occur: Firms operating in the principal industries decide to decrease spending on updating and maintaining current capital and put on hold any investments in additional capital. The operating lines of credit of firms operating in the affected area are decreased or financing costs increased due to banks' perceptions of increased risk associated with the Superfund cleanup. Firms once considering moving into the affected area, look to other sites outside of Seattle and King County because of these concerns."

  "Because no definitive figure was available from a literature review, the analysis examines the regional impacts resulting from a 10 percent decrease in economic output in the principal industry sectors in the affected area from current levels. This decrease in economic activity by the principal industries will persist into the future as long as businesses and investors perceive that the clean-up effort is not going well."

- "**'Optimistic' Scenario B**: For the Scenario B, we assume that businesses perceive the clean-up effort is going well and there is a low likelihood of any negative surprises, such as not-yet-identified contamination and/or the possibility of inheriting liability for contamination by a past polluters. Firms operating in the principal industries decide to increase investments and/or additional firms in these industries move into the affected area. The converse of scenario A, this assumes that economic output in these sectors in the affected area increases by 10 percent from current levels. This increase in output by the principal industries will persist into the future as the new baseline of economic activity."

The authors stressed:[10.E]

> "…while both scenarios appear well within the realm of possibilities given the potential magnitude and complexity of the Duwamish Superfund cleanup, neither scenario represents a projection of anticipated outcome. We affix no likelihood to occurrence or outcome of either scenario. Rather, the two scenarios are intended to be illustrative of what could happen given the perceptions of businesses and investors regarding cleanup of the site. They demonstrate the regional economic significance of the Lower Duwamish area."

One table from the ECONorthwest report (Table 10, next page) shows the predicted *annual* economic impact of a cleanup-associated 10% change in economic output.[10.E] In the "optimistic" scenario, annual output would *increase* by these amounts. In the "pessimistic" scenario, annual output would *decrease* by these amounts.

The arbitrarily chosen 10% decrease in economic output probably substantially over-estimates the potential outcome of a "pessimistic" scenario, when considered in context. The predicted *annual* decrease in wages for Lower Duwamish area workers ($192M) is approximately equal to half of the *total* potential cleanup costs (including LDWG expenses to date, plus the EPA estimated cost of the proposed cleanup, which will extend over 7-8 years). In addition, that total cost would be reduced by MTCA grant(s) and insurance coverage. Furthermore, the City of Seattle, King County, and Port of Seattle, who will probably bear a substantial share of liability, would more likely pass their share of cleanup costs along to utility ratepayers and/or taxpayers, rather

than significantly cutting government or utility services. The 10% pessimistic scenario would require negative responses among private businesses that are markedly disproportionate to their shares of cleanup liability. Therefore, the speculated 10% decrease in economic output (and loss of "3,052" direct jobs) seems highly implausible; if any such decrease occures, it would probably be substantially smaller.

On the other hand, there is no context against which to assess validity of the estimated impact for the speculated "optimistic" scenario. Arguably, the original ECONorthwest premise is still valid, or at least not disproven: "what could happen given the perceptions of businesses and investors regarding cleanup of the site."[10.E]

Table 10: Impacts of a 10 Percent Change in Economic Output by the Principal Industry Sector Located in the Tier 2 Lower Duwamish Manufacturing/Industrial Center (Estimated for 2010)

Impact Measure	Direct	Indirect	Induced	Total
Within Affected Area (Tier 2: Industrial/Manufacturing Center)				
Output	$727,460,892	$171,168,657	$40,849,524	$939,485,736
Total Value Added	$335,877,996	$92,734,475	$25,033,510	$453,656,140
Wages	$192,929,347	$51,271,825	$11,881,980	$256,081,272
Business & Other Income	$103,561,800	$32,892,330	$10,324,400	$146,786,056
Indirect Business Taxes	$39,386,849	$8,570,321	$2,827,130	$50,788,812
Jobs	3,052	883	277	4,214
Elsewhere in Seattle				
Output	$0	$48,743,559	$136,287,361	$181,641,939
Total Value Added	$0	$25,169,509	$86,023,179	$109,405,188
Wages	$0	$12,157,051	$43,580,160	$54,708,814
Business & Other Income	$0	$11,939,832	$34,508,683	$45,830,637
Indirect Business Taxes	$0	$1,072,626	$7,934,338	$8,865,738
Jobs	0	219	962	1,158
Elsewhere in King County				
Output	$0	$131,947,686	$113,380,927	$246,909,812
Total Value Added	$0	$69,362,789	$63,975,170	$133,999,872
Wages	$0	$36,094,765	$30,065,698	$66,662,269
Business & Other Income	$0	$29,219,577	$27,907,063	$57,231,525
Indirect Business Taxes	$0	$4,048,447	$6,002,409	$10,106,079
Jobs	0	612	601	1,227
Total Countywide Impacts				
Output	$727,460,892	$351,859,902	$290,517,812	$1,368,037,487
Total Value Added	$335,877,996	$187,266,773	$175,031,859	$697,061,200
Wages	$192,929,347	$99,523,641	$85,527,838	$377,452,355
Business & Other Income	$103,561,800	$74,051,739	$72,740,146	$249,848,218
Indirect Business Taxes	$39,386,849	$13,691,394	$16,763,877	$69,760,629
Jobs	3,052	1,714	1,840	6,599

Source: ECONorthwest analysis of data from 2008 IMPLAN modeling system

It is conceivable that an *increase in employment* could occur if "businesses perceive the clean-up effort is going well and there is a low likelihood of any negative surprises, such as not-yet-identified contamination and/or the possibility of inheriting liability for contamination by a past polluters. Firms operating in the principal industries decide to increase investments and/or additional firms in these industries move into the affected area."[10.E] We discuss this further in the next section (Business uncertainty). [0]

b) Magnitude and distribution of adverse effect

It is not possible with available information to estimate the magnitude or distribution of a potential adverse effect of cleanup costs on employment and associated health outcomes. It is possible such an effect could occur. Any adverse effect would disproportionately harm workers in private businesses, particularly smaller businesses, where there may be fewer options for the business to absorb their allocated cleanup cost. In any given business, it is conceivable that less skilled or lower paid workers might be considered more expendable, and they could be disproportionately impacted.

The ECONorthwest estimate helps to set an upper bound on possible magnitude of such an effect. The hypothesized "pessimistic" 10% adverse impact on economic output in the Lower Duwamish area appears to be a substantial over-estimate, particularly for the overall industry population. "Moderate" magnitude seems unlikely overall, across the potentially affected businesses and worker population. "Limited magnitude seems more likely, overall, although any one business might be affected much more than another.

3. Business uncertainty

Could business uncertainty about cleanup liability or cleanup progress affect employment?

Direction of effect: **ADVERSE**
Likelihood: **Possible to likely**
Magnitude: **Insufficient evidence; limited, possibly moderate**
Severity/importance: **Medium**
Distribution: **Disproportionate harms**
Adequacy of evidence: **Substantially incomplete**

OR

Direction of effect: **BENEFICIAL**
Likelihood: **Possible**
Magnitude: **Insufficient evidence; limited to moderate**
Severity/importance: **Medium**
Distribution: **Diffuse; possible disproportionate benefit**
Adequacy of evidence: **Substantially incomplete**

As discussed in the preceding section, it is plausible that business perceptions about the proposed cleanup could affect business behavior, investment, and economic output, and this could influence a business' ability or choice to sustain the usual level of employment. There is no concrete evidence upon which to assess the likelihood or distribution of such an effect in the present situation. We identified little information or research about perceptions or consequences of uncertainty in Superfund or comparable situations involving environmental liability. However, there is no doubt, "The prospect of shouldering a cleanup burden for a mess they did not necessarily create is worrying small businesses and property owners along the Duwamish, many of whom contend they had nothing to do with creating the problem." [30]

A 2009 U.S. Government Accountability Office (GAO) report identified many points where uncertainty can arise in the EPA process for identifying PRPs and allocating liability, but notes that the frequency of EPA Superfund litigation has declined over time, in favor of non-judicial settlements.[10.C] Presumably that has resulted in some reduction of uncertainty overall in the Superfund liability process. One line of research distinguishes between two sources of Superfund uncertainty: "site" uncertainty, about overall cleanup cost and duration; and "allocation" uncertainty, about allocation of total cleanup cost across multiple parties. In one study of large companies, greater uncertainty of either type was associated with higher valuation of a firm's estimated Superfund liability, which in turn affects the firm's cost of capital.[31] However, this was only observed in one industry, the chemical industry, and was not affected by the source of uncertainty. A later study by the same researchers found that (large) companies' uncertainty was reduced by disclosure of company-held information about the site, beyond publicly available EPA information.[32]

It is difficult if not impossible with the available information to assess the potential influence of business uncertainty in the Lower Duwamish area, associated with the proposed cleanup. Most of the information about uncertainty in the Superfund liability process is descriptive or anecdotal in nature, and the limited available research has little applicability. However, it is at least intuitively plausible that uncertainty could *adversely*

30. Wilhelm S. Businesses brace for Duwamish cleanup bills, without knowing the final amount. *Puget Sound Business J.* April 27, 2012.
31. Campbell K, et al. Site uncertainty, allocation uncertainty, and superfund liability *valuation. J Account Pub Policy* 1998; 17:331-366.
32. Campbell K, et al. Disclosure of Private Information and Reduction of Uncertainty: Environmental Liabilities in the Chemical Industry. *Review of Quantitative Finance and Accounting* 2003; 21: 349–378.

influence business decisions and secondarily, employment. The plausibility should also be acknowledged, as hypothesized in the ECONorthwest study, that resolution of some uncertainty could have a *beneficial* effect, the "optimistic" scenario, with resultant increase in regional economic output and employment. Finally, it is essential that any cleanup-related uncertainty be considered in the broader context of uncertainties affecting Lower Duwamish area industries. It is helpful to consider these variables in one place.

Unfavorable cleanup-related uncertainties (note, this is not intended to be a comprehensive list):

- Although there is an estimated cost for the proposed cleanup, the eventual cost could be higher.
- Although unlikely, unidentified contamination could be discovered.
- Some cleanup modes, such as capping in place, are not as permanent or certain as others, such as dredging.
- Moving targets: cleanup requirements could become more stringent in the future; what is "clean enough" at one point in time, may not meet later requirements.
- A liable party could later be liable for new costs to remove capped sediments, if circumstances change in the future: disruption of capped contaminants; improved technology making removal more feasible; reduction in contaminant concentrations from upstream or lateral source controls
- Entities that are not currently identified as PRPs, could still eventually be identified as a PRP.
- Designation as a PRP does not necessarily mean a PRP will ultimately be deemed liable.
- Allocation of liability is still completely unknown.
- It is hopeful that LDWG is promoting a non-judicial process to allocate liability among some PRPs, presumably the larger PRPs; however, excluded or smaller PRPs could be at a disadvantage, particularly if the allocation process became adversarial.
- Need for legal representation even if the liability allocation process is non-judicial.
- Possible litigation between PRPs, or legal actions if EPA initiates enforcement actions.
- Independent of EPA, larger PRPs could make their own efforts to identify yet-unidentified PRPs, to increase the number of parties and reduce costs per party, but creating hostility within the industry community.
- Smaller PRPs fear aggression by larger PRPs, who have more resources including legal representation.
- Liable parties could be liable for "orphan" liability, from companies that no longer exist or are bankrupt.

"Pessimistic" cleanup-related scenarios, as described in the ECONorthwest study: Businesses believe the cleanup is not going well and negative surprises are likely: [10.E]

- PRPs (or firms with self-perceived risk for PRP status) decrease capital or updating expenditures.
- Banks associate risk with the cleanup, and decrease credit or increase financing costs for businesses.
- Businesses choose not to move into the area, because of liability concerns.

"Optimistic" cleanup-related scenarios, as described in the ECONorthwest study: Businesses ultimately believe that cleanup is going well, with less chance of negative surprises, with the opposite consequences:

- Regional businesses increase capital and updating expenditures.
- Banks increase credit or decrease financing costs for businesses in the area.
- Businesses choose to move into the area (if they can find space).

Unfavorable uncertainties, with no direct connection to the proposed cleanup, as described in section 5A:

- Proposed third stadium and development in the SODO area.
- Real estate speculation
- Gentrification in Georgetown and South Park neighborhoods (see "Local residents" report for this HIA).
- Longstanding and still unrelieved problems with freight routes and traffic congestion.
- West coast competition for international trade and port activity.

a) Magnitude and distribution of adverse or beneficial effect

It is not possible with available information to predict the net result of these uncertainties, particularly in the context of substantial uncertainties that have no direct connection to the proposed cleanup. Both adverse and beneficial cleanup-related effects on business performance are plausible, with secondary effects on employment and worker health. It is plausible that efforts to address areas of uncertainty, such as the LDWG-promoted non-judicial process for allocation of liability, could decrease the likelihood of adverse effects and increase the likelihood of beneficial effects.

As described in the preceding "Cleanup costs" section, the ECONorthwest "pessimistic" scenario is very unlikely to be as high as the arbitrarily postulated 10% decrement in economic output, and any adverse impact of uncertainty would probably have much lower magnitude, particularly when considered across all Lower Duwamish area industry. The impact could be greater for some individual businesses, particularly if their situation was complex. The "optimistic" scenario remains a realistic possibility, and although there is no context with which to judge the potential magnitude, neither is there any evidence to refute the 10% increment that was arbitrarily postulated in the ECONorthwest study.

Again, any adverse effects related to uncertainty would disproportionately harm workers in private businesses, where there may be fewer options for the business to create a real or perceived margin of safety. In any given business, it is conceivable that less skilled or lower paid workers might be considered more expendable, and they could be disproportionately impacted.

On the other hand, any beneficial effects of reduced uncertainty would probably be relatively diffuse across Lower Duwamish area industry, but possibly with some disproportionate benefit for businesses that currently have PRP status or perceive themselves at risk for PRP status.

4. Industry revitalization

Does the proposed cleanup offer opportunities or a foundation upon which industry revitalization might occur?

Direction of effect:	**BENEFICIAL**
Likelihood:	**Possible**
Magnitude:	**Insufficient evidence**
Severity/importance:	**Medium**
Distribution:	**Insufficient evidence**
Adequacy of evidence:	**Substantially incomplete**

There is no evidence to suggest that the proposed cleanup would produce substantial industry revitalization, without intentional and planned revitalization efforts. The "optimistic" scenario mentioned in preceding sections would, if it occurred, probably have a diffuse beneficial effect on business performance, employment, and worker health in the Lower Duwamish area. However, even though it is impossible to predict its magnitude, it is unlikely the effect would be so pervasive or systematic that it would constitute "revitalization."

Furthermore, cleanup-related industry revitalization seems unlikely unless it occurs in parallel with other, more broadly based industry revitalization efforts. One such ongoing effort is the City of Seattle's Industrial Development Pilot Projects.[9.E] It is hopeful that the City is also undertaking a Duwamish MIC Industrial Lands Study, to reevaluate policies in light of the proposed third stadium and SODO development.[9.H.4] Ideally, the City will also consider possible influences of the proposed cleanup in this study. Regardless, this

study occurs in the context of a series of fairly recent Seattle "basic industry" and "industrial lands" studies,[33-35] perhaps justifying reserved optimism about additive influence of the current study.

On the other hand, the proposed cleanup could provide an opportunity to stimulate expanded interest in industry revitalization. Eventually, the stigma of a contaminated river will be removed, the natural environment will be restored, immersed in a functioning industrial setting. Enhancements of the Lower Duwamish River will undoubtedly continue to attract attention of members of the public, beyond the local residential neighborhoods and industry employees and owners. At least theoretically, this could be an opportunity for industry representatives to build supportive connections beyond their usual circles of stakeholders, to pursue shared goals of revitalization. Realistically, however, as described in the "Experiences in other places" section, collaborative ventures with industry do not always work out in favor of industry, particularly when there are active trends or pressures toward community gentrification. Nonetheless, there are examples from other cities that could provide models or lessons (including "don't do that" lessons) to pursue industry revitalization in the context of broader urban revitalization efforts. The Great Lakes restoration efforts, however, show promise as a model for active partnerships with industry.

There also may be a timely opportunity to align any regional industry revitalization efforts, cleanup-related or otherwise, with national efforts to stimulate American manufacturing.[11.D] In 2012, President Obama announced his plan to invest $1B to develop hubs of manufacturing excellence around the country, built around manufacturing innovation institutes. The ultimate goal is to "make America a magnet for jobs by investing in manufacturing."[36] The first public-private institute was funded in August 2012, in Youngstown, OH. Up to 15 institutes are proposed.

a) Magnitude and distribution of effect

The existing evidence is inadequate to assess the likelihood or magnitude of industry revitalization efforts in Seattle, and particularly whether the proposed cleanup might influence any such efforts. However, there are reasons to believe that this is possible, with models and examples to learn from, and national momentum to align with.

33. Seattle Planning Commission. *The Future of Seattle's Industrial Lands*. July 2007.
34. Mayor Greg Nickels. *The Future of Seattle's Industrial Lands: Mayor's Recommendations.* August 2007.
35. Medford C, Forsyth M, Babb M, Couch D, Schrag T, Schwed R. (Community Attributes; for Seattle Office of Economic Development). *Basic Industries Economic Analysis*. July 2009.
36. White House, Office of the Secretary. *The President's Plan to Make America a Magnet for Jobs by Investing in Manufacturing* [fact sheet]. Feb. 13, 2013

D. Recommendations

Democracy is a core principle of HIA, "emphasizing the right of people to participate in the formulation and decisions of proposals that affect their lives, both directly and through elected decision-makers. In adhering to this value, the HIA method should involve and engage the public, and inform and influence decision-makers."[37]

We acknowledge again that our assessment of "workers and employment in local industry" has been conducted as a desk-based HIA. In contrast to our three other population assessments, this assessment was *not* guided by a population-specific advisory committee or community advisors. We drafted plans to conduct key-informant interviews (and obtained UW Human Subjects exempt-status approval), but did not have enough time or staff to conduct them. Also in contrast to our three other assessments, we did not complete this assessment in time to share draft recommendations with our Liaison Committee, for Committee suggestions on how to word recommendations to be optimally understandable and potentially implementable by decision-makers.

In the absence of such input, we will provide recommendations, but we offer them for broader consideration and discussion by stakeholders and decision-makers, along with the findings of our assessment.

We welcome opportunities to meet with stakeholders, discuss our findings, explore recommendations and options, and consider whether modifications or enhancements are warranted.

1. Hire local

Selection of firms for cleanup construction and related activities should, as much as possible, give priority to firms that are based in Seattle or King County.

This recommendation is directed to the City of Seattle, King County, and Port of Seattle.

Barring an unforeseen turn of events, we anticipate that the Potentially Responsible Parties will continue their primary role in the cleanup (with EPA oversight), including remedial design and action. It is noteworthy that Seattle and King County are not only Potentially Responsible Parties for the cleanup, but as civic entities they are also responsible for protecting and improving the health and well-being of all people in their jurisdictions. This recommendation could optimize their ability to meet both sets of responsibilities. Placing a priority on hiring local firms and local workers will maximize the likelihood that healthful benefits of employment will go to local workers, *and* that indirect and induced economic impacts of the cleanup will further support local employment.

We refer readers to our other job-related recommendation, based on our "Local residents" assessment: EPA should provide cleanup job training and placement assistance to local community members and affected residents.

2. Minimize uncertainty

Selection of the final remedy (cleanup plan) and the process for allocating liability should attempt to reduce or eliminate uncertainty, whenever possible.

This recommendation is directed to EPA, as well as the City of Seattle, King County, and Port of Seattle.

37. From the International Association of Impact Assessment (Quigley 2006). As printed in: Bhatia R. *Health Impact Assessment: A Guide for Practice*. Oakland, CA: Human Impact Partners, 2011.

We offer these options to explore and welcome the opportunity to discuss these or other options:

- Allocation of liability: It is hopeful that the first four identified PRPs—the Lower Duwamish Waterway Group (LDWG)—are promoting a non-judicial process to allocate liability, and that they plan to invite other PRPs to participate. Ideally, this will engage all willing PRPs, so that exclusion will not feed into uncertainties or adversarial relations between LDWG members and excluded parties.
- Scope of cleanup: We purposely focused this HIA exclusively on the proposed cleanup plan ("5C+"), and we did not assess alternative cleanup scenarios. However, we encourage EPA and the PRPs to consider that uncertainty about the finality of the chosen remedy will probably be higher with a heavy reliance on lower cost and more uncertain and impermanent methods (such as natural recovery and, to a lesser extent, capping). In contrast, uncertainty will probably be lower with increased reliance on permanently removing contaminated sediments and taking measures to prevent recontamination.

3. Pursue opportunities for industry revitalization

Convene a Duwamish Valley Revitalization Task Force with broad stakeholder representation to explore options for sustainable coexistence of industry with Tribes and community.

This recommendation is directed to the City of Seattle, King County, and Port of Seattle.

We believe that Seattle is at the cusp of a new era. Beginning with the cleanup, and accompanied by source control and natural restoration efforts, the Lower Duwamish River and surrounding area have a chance to become a regional asset and symbol of pride, rather than an environmental stigma. There will be opportunities to turn river cleanup and restoration into a national model for healthful and sustainable coexistence of industry, Tribes, and community. It will be a challenging task to find the optimal balance between economic, traditional, subsistence, and recreational uses. However, the alternative—turning away from this opportunity—will create challenges and problems of its own.

It would be a devastating loss for Seattle and Washington state to suffer any substantial erosion of industry, port capacity, or employment in the Lower Duwamish area. Experiences in other places suggest that industry does not necessarily fare well with urban revitalization efforts, but a broad-based, collaborative endeavor might be more likely to achieve success than if industry pursues its own path.

In this report we described experiences in other places that could provide models upon which to build a collaborative Duwamish Valley revitalization effort. There are undoubtedly others to consider too. Portland has proposed a river renaissance, and Seattle can probably draw lessons from industry dissatisfaction with that proposal. Chicago offers the example of a city with longstanding efforts to preserve manufacturing in the urban center and plans to renew those efforts. Efforts such as these will undoubtedly give cities the advantage in trying to become one of the proposed national hubs of manufacturing innovation. Finally, the Great Lakes restoration efforts, particularly the vision of the Council of Great Lakes Industries, offers inspiration to find new and better modes of public-private collaboration.