



# SCHOOL OF PUBLIC HEALTH

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## UNIVERSITY of WASHINGTON



### **Duwamish River Superfund Cleanup Health Impact Assessment; Pew #2277**

#### **Scoping Summary July, 2012 (version 1.2)**

## **1. Introduction**

This Health Impact Assessment (HIA) will inform the Environmental Protection Agency (EPA) selection of a cleanup plan for the 5.5-mile long Lower Duwamish Waterway (LDW) Superfund Site in Seattle, Washington. Assessment of possible cleanup plans has been conducted by EPA and a consortium of principal responsible parties called the Lower Duwamish Waterway Group – City of Seattle, King County, Port of Seattle, and The Boeing Company. The existing, completed assessments have a primary focus on contaminated river sediments and health risk associated with fish consumption and river and shoreline use, plus some assessment of nearby soil pollution and cleanup construction impacts, such as air pollution, traffic and noise.

This HIA is conducted as a partnership between three organizations. The grant recipient and nominal project director is William Daniell (UW School of Public Health). The other key project partners are Linn Gould (Just Health Action) and BJ Cummings (Duwamish River Cleanup Coalition/Technical Advisory Group). DRCC/TAG has served as EPA's Community Advisory group for the LDW Superfund site since 2001, and has been engaged in all aspects of site investigation and evaluation of alternatives.

## **2. Status report**

This HIA began in January 2012. We submitted a Screening Report and Stakeholder Engagement Plan in February.

The EPA originally planned to announce its favored LDW cleanup plan in March 2012, but delayed this until August or September. We proposed in March that our Pew deliverable deadlines be revised accordingly; the proposed revision was approved by our Pew project officer (Katherine Houghton) but is still under review by Pew administration. The EPA is now considering a further delay for their announcement, possibly until January 2013. Regardless of these uncertainties, we are kept aware of EPA's cleanup considerations through their representation on our HIA Liaison Committee and through the ongoing formal relationship between EPA and DRCC/TAG. However, depending on the selected EPA

announcement date, it may become necessary to request an additional revision of deliverable deadlines, to ensure that our HIA recommendations and final report are appropriate for the ultimate EPA cleanup proposal.

As suggested by Katherine Houghton, we view this Scoping Summary as a “living document” and not a final report, summarizing our Scoping activities at this point in time. At this juncture, we welcome feedback from our Pew/RWJ Health Impact Project partners and our technical advisor, Marla Orenstein (Habitat Health Impact Consulting).

We have concluded most but not all Scoping activities, but we are nearly ready to begin our Assessment. We will soon share our major draft Scoping materials—logic model, research questions and potential evidence sources—with our Resident and Tribal Community Advisory Committees, and our Liaison Committee; we consider our draft Scoping materials provisional until we have their feedback and support. We are also finalizing connections with Community Advisors to serve as voices for non-tribal subsistence fisher populations; their input may necessitate small but important additions to our Scoping materials and Assessment plans.

Our major activities to date include:

- **Community Advisory Committees (CACs).** We originally envisioned that a single CAC would represent affected community, tribal, fishing and organizational stakeholders. However, based on logistic practicality and differing concerns, we divided our CAC into three separate committees, each representing one of the vulnerable populations that our HIA primarily focuses on:
  - **Resident CAC.** This committee includes: 6 residents of the South Park and Georgetown neighborhoods (SP/GT); 1 resident of Nickelsville, a local self-managed Eco Village for up to 1000 homeless people; and 1 representative of Puget Sound Sage, a local organization conducting a community-based participatory research study of local diesel emissions in SP/GT (other organizational members are anticipated to join this group as the assessment progresses). Members are native English, Spanish and Vietnamese speakers, representing the ethnic diversity of the affected residential neighborhoods. We met once with this group, on April 23, and will meet next on June 25. Membership is adaptive; for example, a local small business owner joined the first meeting, held at a South Park pizza restaurant.
  - **Tribal CAC.** This committee includes: 2 members of the Duwamish Tribe; and 2 professional staff employees of the Suquamish Tribe. The Muckelshoot Tribe has chosen not to participate. We met once with this group, on May 29, and will meet next on June 13. That meeting will be joined by our new, additional technical advisors from Decision Research (see below).
  - **Subsistence (non-tribal) Fisher CAC.** This informal group consists of individual Community Advisors and will not meet as a committee, for logistic practicality. We will conduct individual semi-structured interviews with these Advisors. They will help initiate “snowball” contacts with people who fish, and help identify potential focus group facilitators. Advisors include the Director of the Washington State Commission on Asian American Affairs and Executive

Director of the Vietnamese Friendship Association. We have made and are pursuing other contacts in the Filipino, Chinese, Cambodian and urban Indian communities (the latter encompasses many tribes other than those with treaty or historic connections to the Duwamish River).

- **Liaison Committee.** This committee includes about 20 members, plus alternate members, representing: EPA; State agencies (Departments of Ecology, Health, and Natural Resources); local public entities (City of Seattle,\* King County,\* Port of Seattle,\* and Puget Sound Clean Air Authority); The Boeing Company;\* and two environmental consulting groups. The asterisks denote the four principal responsible parties for the LDW cleanup. We have met twice with this group, on March 28 and May 9.
- **UW graduate students.** Two UW graduate students have joined the HIA team:  
Amber **Lenhart** (Environmental & Occupational Health...EOH MPH program) shares primary responsibility for: engaging non-Tribal fisher Community Advisors; overall HIA assessment of impacts on non-Tribal fishers; and a UW-funded CBPR **research** study focusing on non-Tribal subsistence fishing.  
Jonathan **Childers** (EOH MPH and Built Environment PhD programs) shares primary responsibility for: the ongoing evaluation of HIA process; (probably) overall HIA assessment of gentrification impacts; and a UW-funded **research** project evaluating HIA impacts on decision-makers and other stakeholders.
- **UW HIA Class.** Dr. Andrew Dannenberg instructs an HIA class at UW. This year, the LDW cleanup was the subject of the class project. About 20 enrolled students worked in four groups addressing construction, fish, economic, and social and cultural impacts. The HIA team served as course advisors. The class presentation (May 30) was attended by the HIA team, DRCC/TAG director and staff, Communications staff from UW School of Public Health, and press representatives. A final report was delivered on June 5, and will serve as a resource for our HIA.
- **Decision Research.** Pending final Pew approval of a submitted work plan, two representatives of Decision Research—Drs. Jamie **Donatuto** and Robin **Gregory**—will serve as Technical Advisors for our Scoping, Assessment and Recommendations related to Tribal health impacts. Decision Research is a non-profit research organization that investigates human judgment, decision-making, and risk.  
Drs. Donatuto and Gregory have conducted research on Tribal environmental public health indicators (EPHIs), with a particular focus on fish contamination and shortcomings in conventional risk assessment approaches. Their work to date has focused on the Swinomish Tribe, a Puget Sound area tribe. This tribe traditionally fishes on the Salish Sea (Puget Sound) and not specifically the Duwamish River, but has cultural and historic similarities to the tribes focused on by this HIA.  
In collaboration with the HIA team, Drs. Gregory and Donatuto will prepare an application for National Science Foundation (NSF) or other possible quick-turnaround funds for a **research** study utilizing focus groups/ interviews with Suquamish and Duwamish Tribal representatives, to: identify health-related

concerns, framed by the tribal EPHIs; identify similarities and differences between Tribal and non-Tribal considerations; improve understanding of how HIA methods relating to Tribal concerns could be incorporated by EPA and other agencies as part of the Duwamish Superfund clean-up; and

- **DRCC/TAG and JHA projects.** Work continues on two EPA-funded projects: the Cumulative Health Impacts Analysis (CHIA) of the LDW site, and the Duwamish Valley Healthy Communities Project to identify, prioritize and develop action plans to address local health impacts from other local environmental exposures and socioeconomic health influences. Information from these concurrent activities will inform and complement the Duwamish HIA. DRCC/TAG recently co-sponsored youth group activities as part of Seattle’s International District “WILD” (Wilderness Inner-city Leadership Development) Youth Program, including surveys of Vietnamese residents in Duwamish communities and riverside surveys of fishing people. Those experiences will inform HIA Assessment activities.
- **Press activities.** Environmental journalists from InvestigateWest, an independent non-profit news service, KUOW (public radio), and KCTS (public television) are collaborating on a project prompted by the upcoming 40<sup>th</sup> anniversary of the Clean Water Act. The project includes a major focus on the Duwamish River and the HIA.

The following sections of this Scoping Summary use a structure defined by Scoping guidelines in the *Minimum Elements and Practice Standards for HIA*, prepared by the North American HIA Practice Standards Working Group (November 2010, v2). In general, we provide skeletal details for sections that are not substantially changed since our Screening Summary, and provide details mostly regarding our major Scoping activities and products—logic model, research questions, and potential evidence sources.

### 3. Decision and decision alternatives

- A. Primary decision: LDW sediment cleanup and institutional controls
- B. Decision alternatives
  - 1) LDW Group’s Feasibility study: five removal alternatives (2R-6R), and four combined technologies alternatives (3C-6C).
  - 2) LDW Group’s “Key Elements” proposal.
  - 3) Theoretical cleanup alternative(s) with lower post-cleanup concentrations of hazardous chemical in LDW sediment, closer to preliminary remediation goals (PRGs, desired endpoint concentrations that are believed to provide adequate protection of human health and the environment) and “natural” background.
- C. Related actions and decisions
  - 1) LDW early action and upland cleanup areas
    - a) Boeing Plant 2
    - b) Jorgensen Forge
    - c) Terminal 117
    - d) Completed: Slip 4, Duwamish Diagonal, Norfolk Combined Sewer Overflow
  - 2) LDW habitat restoration
  - 3) Duwamish River ongoing pollution source controls

#### 4. Potential significant health impacts and their pathways (e.g., a logic model)

The accompanying logic model and tables of health impacts summarize our conception of potential pathways that could reasonably link cleanup and related decisions to direct, indirect or cumulative health impacts. The overall logic model is illustrated in detail in Figure 1, and Figure 2 shows the key sections of the model. The major areas of potential significant health impact are:

- Seafood consumption: Duwamish River contamination and fish-related impacts
- Tribal impacts
- Construction impacts: impacts of construction for cleanup and related actions
- Community revitalization and gentrification
- Industry revitalization and gentrification

Tables 1 to 5 list health impacts associated with each major section of the logic model. The yellow section in Figures 1 and 2 includes cleanup and related decisions/actions. The green section includes direct, expected consequences of cleanup actions. The blue sections identify impact domains of greatest potential importance, including direct and indirect impacts that have received substantial but variably incomplete formal attention to date (construction impacts, and Duwamish River contamination and fish-related impacts), and indirect impacts that have received no formal attention (Tribal impacts, beyond disease risk from fish consumption; community revitalization and gentrification; and industry revitalization and gentrification).

**Stakeholder input:** Model construction was informed by concerns and perspectives communicated by members of the Resident and Tribal CACs, and the Liaison Committee (LC). We used a “Good things, bad things” group exercise (Figure 3) as our primary approach to obtain information from CAC members. Figures 4-8 illustrate how sections of the logic model align with CAC concerns and perspectives.

We anticipate that our upcoming Tribal CAC meeting will lead to further optimization of our model. Our Decision Research technical advisors will attend that meeting, and discussion will include consideration of the Swinomish Tribal environmental public health indicators (Figures 9-11).

For LC members, we used a less structured group discussion at our first meeting to identify potential impacts of the LDW cleanup (Figure 12). At our second meeting, the LC members engaged in a “pathway” exercise, where we provided skeletal pathway examples, LC members self-divided into three groups, and each group produced a pathway related to cleanup construction, fish consumption, or “accelerated” gentrification (Figures 13-15). Participants were asked to generate pathway-related research questions and to suggest possible sources of information, but generally found these tasks difficult or confusing. Although this second-meeting exercise was arguably less productive than the CAC meeting exercise, one major goal was to ensure that LC members understand the HIA process, and are optimally prepared to understand the HIA team’s logic model and research questions, so LC members can provide informed suggestions or substantive assistance for identifying and obtaining evidence for the HIA Assessment.

**Prioritization:** Our prioritizations are guided mostly by the potential for disproportionate impacts on the three most vulnerable populations (see section #8) that are a primary focus of this HIA; but balanced against our desire not to duplicate efforts by EPA, other public agencies, and responsible parties.

In view of the latter, we will probably minimize (but still include) HIA Assessment of direct impacts that will probably receive substantial attention during cleanup and/or implementation planning; e.g., cleanup construction disturbance of the river environment, and associated traffic, pollution or spillage; and estimated disease risk from residual LDW sediment and fish/shellfish contamination.

We will, however, prioritize Assessment of indirect effects in the construction and seafood-related impact domains, as well as Assessment of potential impacts related to community revitalization and gentrification.

However, we have not yet decided how much to prioritize our Assessment of industry impacts in this HIA, and particularly the breadth of any such assessment. We will discuss this further with CAC and LC members, and we may solicit input from stakeholders in Duwamish Valley industry sectors.

Industry revitalization and gentrification impacts are potentially closely intertwined with community impacts, particularly in terms of ensuring survival or growth of community businesses, and promoting or preserving blue collar and entry level employment opportunities in Seattle. The Greater Duwamish Industrial District, which surrounds the LDW Superfund Site, is home to 85,000 jobs. Furthermore, the Port of Seattle has proposed its *Century Agenda* which, “over the next 25 years...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.”

## **5. Research questions for impact analysis**

Our research questions for impact analysis are outlined in Tables 1 through 5. These tables are still under construction, especially the research questions and evidence sources. We anticipate that these will undergo revisions after we share these with CAC and LC members (and our Pew partners and technical advisors).

## **6. Demographic, geographical and temporal boundaries for impact analysis**

See #8, vulnerable subgroups.

## **7. Evidence sources and research methods expected for each research question**

The primary evidence sources for our impact analysis are outlined in Tables 1 through 5. As noted, these tables are still under construction, especially the research questions and evidence sources. We anticipate that these will undergo revisions, particularly additions, after we share these with CAC and LC members (and our Pew partners and technical advisors).

The evidence sources include: existing databases; community and other stakeholder voices, collected in CAC meetings, individual interviews, focus groups (non-Tribal subsistence fishers and, depending on ability to obtain additional funds, Tribal representatives); and

input from our Decision Research technical advisors. We will also consider the content and evidence sources in the UW HIA class report.

Existing databases will, as appropriate, be analyzed with descriptive and comparative statistical methods. Community and stakeholder voices that are collected in unstructured meeting or discussion venues will be compiled in summary descriptive manner, with pertinent anecdotal quotes. Key-informant interviews or focus groups will be conducted in semi-structured manner, and where appropriate, will be analyzed with systematic qualitative methods.

Research questions that are addressed primarily by review of existing published information will use a categorical rating system to assess the likelihood, severity, magnitude, and distribution of possible impact or health effect (Figure 16); and also will characterize the degree of uncertainty or gaps in available information.

## **8. Vulnerable subgroups of the affected population**

- A. Residents of two riverside neighborhoods (Georgetown and South Park), who are predominately low-income and ethnic minorities; plus residents of Nickelsville, a self-managed Eco Village with up to 1000 homeless people.
- B. Three Native American Tribes with historic and cultural rights to the river, including two federally recognized Tribes with treaty rights to fish (Suquamish and Muckelshoot Tribes), one of which has a commercial salmon fishery on the river. The Duwamish Tribe historically resides along the Duwamish River, and its Tribal Longhouse is situated near the River.
- C. Non-Tribal subsistence or cultural fishing communities, which are predominantly immigrant (especially Asian and Pacific Islander), low-income and/or homeless.

## **9. Approach to evaluation of the distribution of impacts**

The HIA scoping process is formative and adaptive, and will continue throughout the Assessment phase, facilitated by regular engagement between the HIA team, our CAC and LC members, and our technical advisors.

## **10. Roles for experts and key informants**

Already described in other sections of this Scoping Summary.

## **11. Standards or process for determining the significance of health impacts**

As mentioned above, we will use a categorical rating system to assess the likelihood, severity, magnitude, and distribution of possible impact or health effect (Figure 16); and also will characterize the degree of uncertainty or gaps in available information.

## **12. Plan for external and public review**

See our previously completed Stakeholder Engagement Plan.

## **13. Plan for dissemination of findings and recommendations**

See our previously completed Stakeholder Engagement Plan.

**14. HIA team (and roles).** Team members include:

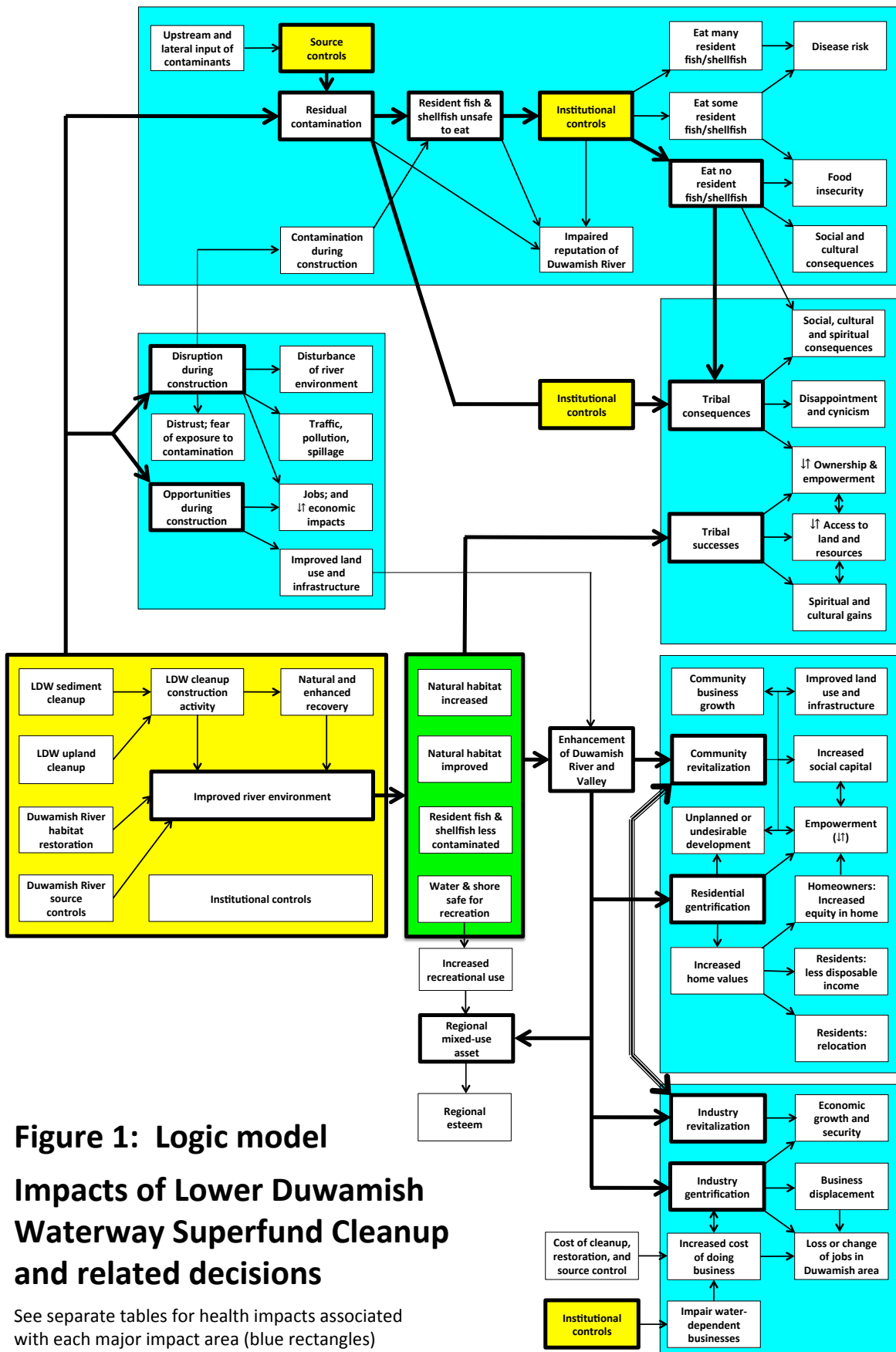
- A. UW School of Public Health
  - 1) William Daniell
  - 2) Amber Lenhart, graduate student
  - 3) Jonathan Childers, graduate student
- B. Just Health Action
  - 1) Linn Gould
- C. Duwamish River Cleanup Coalition (DRCC/TAG)
  - 1) BJ Cummings
  - 2) Paulina Lopez
  - 3) Alberto Rodríguez
- D. Consultants
  - 1) Habitat Health Impact Consulting: Marla Orenstein
  - 2) Decision Research: Robin Gregory; Jamie Donatuto

This HIA is conducted as a partnership between three organizations. The grant recipient and nominal project director is William Daniell (UW). The other key project partners are Linn Gould (Just Health Action) and BJ Cummings (DRCC/TAG). DRCC/TAG serves as the lead partner for Community and Stakeholder Engagement, in consultation with UW and Just Health Action. DRCC/TAG Project Manager (HIA Project Coordinator) BJ Cummings is supported by DRCC/TAG Program Manager, Alberto Rodríguez, and Community Outreach staff member, Paulina Lopez (both Spanish/English bilingual). In addition, field interviewers will be contracted to conduct interviews and other engagement activities in a variety of languages prevalent in the affected communities, including Vietnamese, Chinese, Khmer, Spanish and other languages as needed. Information for residential Community Health Profiles (Georgetown and South Park) will be provided by Just Health Action, and results of community health concerns surveys will be provided by Antioch University, as part of their roles in related community health initiatives managed by DRCC/TAG and funded by EPA. Daniell and Gould have shared primary responsibility for Assessment activities. Lenhart's and Childers' activities are described above (Status report). Other UW and Antioch University students (to be named) may assist with HIA activities.

**15. Version notes:**

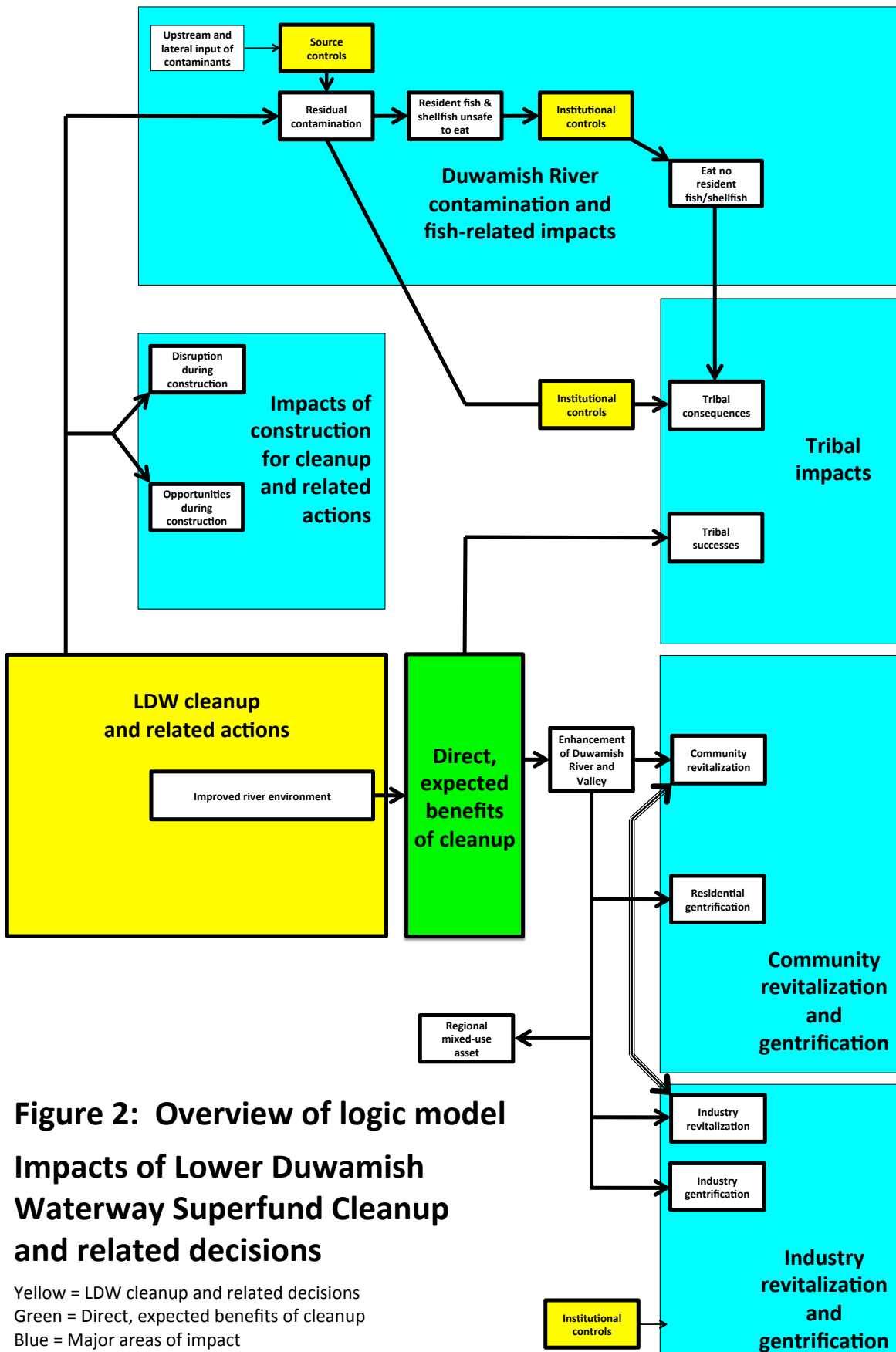
- A. Version 1 – Original version prepared for Pew Health Impact Project, but replaced same day by Version 1.1
- B. Version 1.1 – Revised version prepared for Pew Health Impact Project, to replace Version 1. Made some wording additions/clarifications in the text (first 8 pages), and rearranged the sequence of Tables 1-5. No change in the content of the tables, or in the figures
- C. Version 1.2 – Updated version prepared for Duwamish Superfund HIA Advisors. Tables 1-5 were updated on July 9, in response to helpful suggestions from Dr. Aaron Wernham (Pew Health Impact Project). No other changes.





**Figure 1: Logic model**  
**Impacts of Lower Duwamish Waterway Superfund Cleanup and related decisions**

See separate tables for health impacts associated with each major impact area (blue rectangles)



**Figure 2: Overview of logic model  
Impacts of Lower Duwamish  
Waterway Superfund Cleanup  
and related decisions**

Yellow = LDW cleanup and related decisions  
Green = Direct, expected benefits of cleanup  
Blue = Major areas of impact

**Tables 1a-b Duwamish Superfund HIA Scoping – Health impacts, Research Questions, Evidence: Residual contamination and seafood consumption**

<b>1a. Health impacts: Residual contamination &amp; seafood consumption – Tribal and non-tribal subsistence fishers</b>	
<i>Impact</i>	<i>Health impact</i>
Eat no fish/shellfish – Food insecurity	<ul style="list-style-type: none"> <li>• Reduced income – Eat cheap processed/fast foods – Obesity, diabetes (Seligman et al, 2010; Goetz 2012; Cook et al, 2004; Whitaker, 2006).</li> <li>• Malnourishment – increased vulnerability to disease</li> <li>• Reduced intake of omega fatty acids, vitamins (Simopolous 1991; Roos et al. 2007).</li> <li>• Stress/anxiety - increased vulnerability to disease</li> </ul>
Eat no fish/shellfish – Less exercise	<ul style="list-style-type: none"> <li>• Obesity, diabetes, heart health</li> </ul>
Eat no fish/shellfish – Change in culture	Loss of cultural practices (Cartledge 1999; Bengston et al. 2008; Reis and Hibbeln 2006; Wheatley and Wheatley 2000) and treaty rights? <ul style="list-style-type: none"> <li>• Decrease social cohesion</li> <li>• Change in family recreation</li> </ul>
Fishing increases – Cleaner fish – Increased fish/shellfish consumption	<ul style="list-style-type: none"> <li>• Cancer, noncancer, developmental effects</li> <li>• Increase in omega fatty acids, vitamins, etc</li> </ul>
Fishing increases – Cleaner fish – More fishing	<ul style="list-style-type: none"> <li>• Increased exercise</li> <li>• Cultural practices maintained</li> <li>• Family recreation</li> </ul>
Eat some fish/shellfish – cleaner fish	<ul style="list-style-type: none"> <li>• Cancer, noncancer, developmental effects but less than before</li> <li>• Some food security</li> <li>• Some nutrition</li> </ul>

<b>1b. Research questions: Residual contam. &amp; seafood consumption – Tribal and non-tribal subsistence fishers</b>	
<i>Research Questions</i>	<i>Evidence</i>
<ul style="list-style-type: none"> <li>• What institutional control seafood advisories are currently in place?</li> <li>• Do institutional control seafood advisories currently in place work?</li> <li>• What is known about institutional control seafood advisory effectiveness, in general? What is known about the relationship between seafood advisories and food insecurity and health?</li> <li>• What are the proposed changes, if any, in institutional control seafood advisories?</li> <li>• What is the evidence for their effectiveness? What is known about the relationship between proposed changes in seafood advisories and health?</li> </ul>	<ul style="list-style-type: none"> <li>• White/gray literature</li> <li>• Tribal info</li> <li>• Tribal health indicators (see below)</li> <li>• Interviews</li> </ul>
<ul style="list-style-type: none"> <li>• What factors influence where people fish now?</li> <li>• What factors will influence where people fish during cleanup, and after the cleanup?</li> </ul>	<ul style="list-style-type: none"> <li>• Tribal info</li> <li>• Interviews</li> <li>• Focus groups</li> </ul>
<ul style="list-style-type: none"> <li>• What alternatives are there to fishing the Duwamish River?</li> <li>• Are there chemical or other hazards associated with likely alternative fishing locations?</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews</li> <li>• Focus groups</li> </ul>

What alternatives are available, and culturally appropriate, to reduce consumption of Duwamish resident seafood?	<ul style="list-style-type: none"> <li>• Surveys</li> <li>• Focus groups</li> <li>• Key informant interviews</li> </ul>
How will source control efforts affect amount of residual sediment contamination?	<ul style="list-style-type: none"> <li>• FS?</li> <li>• KC/Seattle/Ecology source control documents</li> </ul>

Note: Tables 1-5 were updated on July 9, in response to helpful suggestions from Dr. Aaron Wernham (Health Impact Project, Pew Charitable Trusts/Robert Wood Johnson Foundation).

**Tables 2a-b Duwamish Superfund HIA Scoping – Health impacts, Research Questions, Evidence:  
Tribal health impacts**

<b>2a. Health impacts: Tribal health</b> (based on Donatuto/Gregory model, 5/29/2012)	
<i>Impact</i>	<i>Health impact</i>
<i>Higher priority impacts</i> (based on Tribal CAC discussion, 6/13/2012)	
<ul style="list-style-type: none"> <li>Natural resources security</li> </ul>	<ul style="list-style-type: none"> <li>Availability</li> <li>Access</li> <li>Sharing</li> </ul>
<ul style="list-style-type: none"> <li>Self determination</li> </ul>	<ul style="list-style-type: none"> <li>Healing</li> <li>Development</li> <li>Restoration (environmental/habitat restoration)</li> </ul>
<ul style="list-style-type: none"> <li>Well-being</li> </ul>	<ul style="list-style-type: none"> <li>Connection to nature</li> <li>Confidence</li> <li>Resilience</li> </ul>
<i>Lower priority impacts</i> (based on Tribal CAC discussion, 6/13/2012)	
<ul style="list-style-type: none"> <li>Community cohesion</li> </ul>	<ul style="list-style-type: none"> <li>Participation and cooperation</li> <li>Roles</li> <li>Familiarity</li> </ul>
<ul style="list-style-type: none"> <li>Ceremonial use</li> </ul>	<ul style="list-style-type: none"> <li>Gatherings and ceremonies</li> <li>Giving thanks</li> <li>Feeding the spirit</li> </ul>
<ul style="list-style-type: none"> <li>Knowledge transfer</li> </ul>	<ul style="list-style-type: none"> <li>The teachings</li> <li>Elders</li> <li>Youth</li> </ul>

<b>2b. Research questions: Tribal health</b>	
<i>Research Questions</i>	<i>Evidence</i>
<p>How does the current state of the Duwamish River affect the Tribes with respect to:</p> <ul style="list-style-type: none"> <li>Natural resources security?</li> <li>Self determination?</li> <li>Well-being?</li> <li>Community cohesion?</li> <li>Ceremonial use?</li> <li>Knowledge transfer?</li> </ul> <p>How will river cleanup (increased and improved natural habitat) affect health and well being of the Tribes?</p> <ul style="list-style-type: none"> <li>Natural resources security?</li> <li>Self determination?</li> <li>Well-being?</li> <li>Community cohesion?</li> <li>Ceremonial use?</li> <li>Knowledge transfer?</li> </ul>	<ul style="list-style-type: none"> <li>Tribal Community Advisory Committee meetings</li> <li>Existing research with Swinomish Tribe</li> <li>Qualitative focus groups and key informant interviews (possible but not certain if feasible)</li> <li>Tribal internal discussions (eg, Ken Workman and Duwamish Tribal Council)</li> </ul>
<p>How does contaminated seafood currently affect the Tribes with respect to:</p> <ul style="list-style-type: none"> <li>Natural resources security?</li> <li>Self determination?</li> <li>Well being?</li> <li>Community cohesion?</li> </ul>	<ul style="list-style-type: none"> <li>Same as above</li> </ul>

<ul style="list-style-type: none"> <li>• Ceremonial use?</li> <li>• Knowledge transfer?</li> </ul>	
<p>How will <i>residual</i> contamination (during and after cleanup) of seafood affect the Tribes with respect to:</p> <ul style="list-style-type: none"> <li>• Natural resources security?</li> <li>• Self determination?</li> <li>• Well-being?</li> <li>• Community cohesion?</li> <li>• Ceremonial use?</li> <li>• Knowledge transfer?</li> </ul>	<ul style="list-style-type: none"> <li>• Same as above</li> </ul>
<p>How does incomplete adherence to treaty rights affect Tribal health?</p>	<ul style="list-style-type: none"> <li>• Same as above</li> </ul>

**Tables 3a-b Duwamish Superfund HIA Scoping – Health impacts, Research Questions, Evidence: Construction impacts \***

<b>3a. Health impacts: Construction</b>	
<i>Impact</i>	<i>Health impact</i>
Dredging – Increased seafood concentrations (spikes)	<ul style="list-style-type: none"> <li>• Cancer effects of consuming contaminated seafood</li> <li>• Non-cancer effects of consuming contaminated seafood</li> <li>• Developmental effects of consuming contaminated seafood</li> </ul>
Dredging – Increased sediment and water quality concentrations	<ul style="list-style-type: none"> <li>• Cancer and non-cancer effects of swimming and beach play</li> </ul>
Increased traffic in GT/SP/DV	<ul style="list-style-type: none"> <li>• Reduced pedestrian mobility – reduced exercise – health</li> <li>• Deaths/injuries</li> </ul>
Decreased/delayed transportation routes through GT/SP/DV	<ul style="list-style-type: none"> <li>• Late to work – anxiety, stress, lose job – income – health</li> <li>• Late home – anxiety, social cohesion – not with kids – kids get into trouble</li> </ul>
Increased air pollution in GT/SP/DV	<ul style="list-style-type: none"> <li>• Worsen asthma symptoms and potential causing new cases of asthma</li> <li>• Lowering immune system’s ability to fight off infections</li> <li>• Increased risk of lung cancer and possibly other cancers</li> <li>• Peters et al 2004; Castranova et al, 2001; Yang et al, 2001; Harrod et al., 2003; Guo et al, 2004; Harriet Ammann and Matthew Kadlec, 2008.</li> </ul>
Increased noise in GT/SP/DV	<ul style="list-style-type: none"> <li>• Hearing impairment</li> <li>• Interference with spoken communication</li> <li>• Sleep disturbances</li> <li>• Cardiovascular disturbances</li> <li>• Disturbances in mental health</li> <li>• Impaired task performance</li> <li>• Negative social behavior and annoyance reactions</li> </ul>
Increase jobs	<ul style="list-style-type: none"> <li>• Income - health</li> </ul>
Partial source control	<ul style="list-style-type: none"> <li>• Reduce recontamination</li> </ul>

<b>3b. Research questions: Construction</b>	
<i>Research Questions</i>	<i>Evidence</i>
<ul style="list-style-type: none"> <li>• How has current or recent dredging affected the River environment and specifically seafood conditions?</li> <li>• What is known about the effects of different dredging techniques?</li> <li>• How will dredging during cleanup affect seafood concentrations?</li> </ul>	<ul style="list-style-type: none"> <li>• FS</li> <li>• EPA monitoring</li> </ul>
<ul style="list-style-type: none"> <li>• How does the current state of river contamination affect access to beaches?</li> <li>• How will cleanup affect access to beaches?</li> </ul>	<ul style="list-style-type: none"> <li>• EPA proposed plans, monitoring</li> <li>• Resident CAC</li> </ul>
<ul style="list-style-type: none"> <li>• How does the current state of river contamination affect the safety of water and beach use for animals and humans?</li> <li>• How will cleanup affect safety of water and beach use on the beaches for animals and humans?</li> </ul>	<ul style="list-style-type: none"> <li>• EPA proposed plans, monitoring</li> <li>• Resident CAC</li> </ul>
<ul style="list-style-type: none"> <li>• What is the current state of GT/SP/DV traffic patterns?</li> <li>• How will cleanup affect GT/SP/DV traffic patterns?</li> </ul>	<ul style="list-style-type: none"> <li>• DOT?</li> <li>• EPA proposed plans, T-117 only?</li> </ul>
<ul style="list-style-type: none"> <li>• What is the current state of air quality in GT/SP/DV?</li> <li>• How will cleanup affect GT/SP/DV air quality?</li> </ul>	<ul style="list-style-type: none"> <li>• DOH study, PSCAA, SAGE study</li> <li>• Riverwide? , T-117/BP2/Jorgensen Forge?</li> </ul>
<ul style="list-style-type: none"> <li>• What is the current state of noise pollution in GT/SP/DV?</li> </ul>	<ul style="list-style-type: none"> <li>• DOT</li> </ul>

<ul style="list-style-type: none"> <li>• How will cleanup affect noise in GT/SP/DV?</li> </ul>	<ul style="list-style-type: none"> <li>• T-117? BP2, Jorgensen Forge, Riverwide</li> </ul>
<ul style="list-style-type: none"> <li>• What is the current rate of employment for GT/SP/DV residents?</li> <li>• How will cleanup improve job opportunities for GT/SP/DV community?</li> </ul>	<ul style="list-style-type: none"> <li>• WA Employment Security?</li> </ul>
<ul style="list-style-type: none"> <li>• What is the current infrastructure (parks, roads, etc) in GT/SP/DV?</li> <li>• How will cleanup improve infrastructure of community?</li> </ul>	<ul style="list-style-type: none"> <li>• T-117?</li> <li>• Resident CAC</li> <li>• Mapping</li> </ul>
<ul style="list-style-type: none"> <li>• How would different lengths of cleanup impact residents?</li> </ul>	<ul style="list-style-type: none"> <li>• EPA proposed plans (T-117 vs bigger cleanup)</li> </ul>
<ul style="list-style-type: none"> <li>• What is the current status of GT/SP commercial operations?</li> <li>• How will cleanup affect GT/SP commercial business operations?</li> </ul>	<ul style="list-style-type: none"> <li>• ???</li> <li>• Resident CAC</li> <li>• Mapping</li> </ul>



**Tables 4a-b Duwamish Superfund HIA Scoping – Health impacts, Research Questions, Evidence: Community revitalization and gentrification (Georgetown and South Park)**

<b>4a. Health impacts: Community revitalization and gentrification</b>	
<i>Impact</i>	<i>Health</i>
Gentrification – Increased property values – taxes	<ul style="list-style-type: none"> <li>• Reduced disposable income for other goods – stress</li> <li>• Displacement – loss of community/social cohesion, inc. travel times/cost/stress</li> <li>• Kennedy (Policylink)</li> </ul>
Gentrification – Increased rents, crowded housing to reduce costs	<ul style="list-style-type: none"> <li>• Increased infections</li> <li>• Increased stress</li> </ul>
Revitalization Recreation - Increased access to river, parks, habitat, fishing	<ul style="list-style-type: none"> <li>• Exercise – reduce blood pressure, reduction diabetes/obesity</li> <li>• Providing opportunity for increased physical activity and therefore reducing stress and increasing mental wellbeing (Sallis, Millstein &amp; Carlson, 2011)</li> <li>• Increasing a sense of community (Sullivan, Kuo &amp; DePooter, 2004)</li> <li>• Strengthening neighborhood social ties (Coley, Kuo &amp; Sullivan, 1997)</li> <li>• Decreasing crime and fear (Kuo &amp; Sullivan 2001b)</li> <li>• Increasing sensory stimulation, creativity and excitement about daily living (Louv, 2005)</li> <li>• Assisting in mental fatigue recovery (Kuo &amp; Sullivan, 2001a)</li> <li>• Increasing the ability to cope with life adversity (Kuo, 2001)</li> <li>• Over one hundred studies confirm that one of the main benefits of spending time in nature and greenspace is stress reduction (Kahn, 1999). Studies have also shown that greenspace promotes healthy child development (Taylor &amp; Kuo, 2006) and may reduce symptoms of Attention Deficit Hyperactivity Disorder (ADHD) (Faber &amp; Kuo, 2009; Kuo &amp; Taylor, 2004).</li> </ul>
Cleaner river/beaches	<ul style="list-style-type: none"> <li>• Reduced anxiety about contamination for humans, children and pets</li> </ul>
Revitalization – equitable development	<ul style="list-style-type: none"> <li>• Increased social capital</li> <li>• Increased political capital – empowerment</li> <li>• Increased economic capital</li> </ul>

<b>4b. Research questions: Community revitalization and gentrification</b>	
<i>Research Questions</i>	<i>Evidence</i>
<ul style="list-style-type: none"> <li>• Is community gentrification currently happening in Georgetown, South Park and the Duwamish Valley, and how is it manifesting? (Note, we include community-based and community-serving commercial businesses in our definition of “community”)</li> <li>• What factors are currently driving community gentrification in SP/GT/DV?</li> <li>• How will river cleanup affect gentrification in SP/GT/DV?</li> <li>• What is known about the impacts of gentrification on health?</li> <li>• How can gentrification be managed to maximize benefits and minimize impacts for the community (aka, community revitalization or equitable development)?</li> </ul>	<ul style="list-style-type: none"> <li>• Real estate records</li> <li>• US census</li> <li>• Rental vs ownership (neighborhood data)</li> <li>• Kennedy (policylink)</li> <li>• CDC</li> <li>• Other HIAs</li> <li>• Search for other gentrified communities</li> <li>• Green impact zones</li> <li>• Tax policies</li> <li>• Housing policies</li> </ul>
<ul style="list-style-type: none"> <li>• How is the GT/SP/DV community currently revitalizing or developing, and is it equitable?</li> <li>• What is known about the relationship between community revitalization and health?</li> <li>• How can cleanup activities facilitate or impair community revitalization efforts?</li> </ul>	<ul style="list-style-type: none"> <li>• Change in commerce</li> <li>• Improved infrastructure</li> <li>• Community initiatives</li> <li>• CDC</li> <li>• Policylink</li> <li>• White/grey literature</li> </ul>

**Tables 5a-b Duwamish Superfund HIA Scoping – Health impacts, Research Questions, Evidence: Duwamish Valley industry revitalization and gentrification**

<b>5a. Health impacts: Duwamish Valley industry revitalization and gentrification</b>	
<i>Impact</i>	<i>Health impact</i>
Business displacement	<ul style="list-style-type: none"> <li>• Lose job/income individual/city</li> </ul>
Business revitalization	<ul style="list-style-type: none"> <li>• Income goes up for individual/city</li> <li>• Decrease poverty, increase health if done equitably</li> </ul>

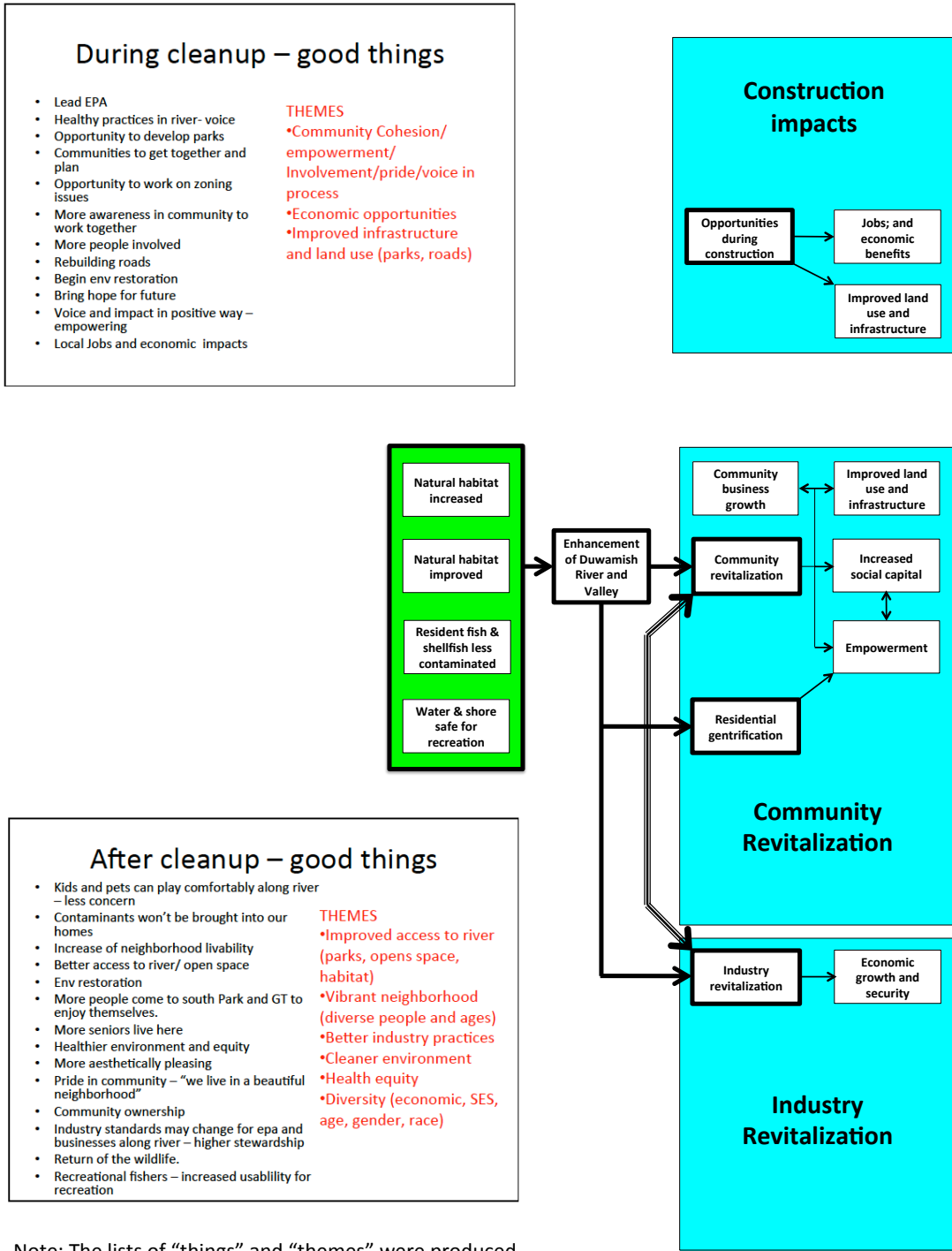
<b>5b. Research questions: Duwamish Valley industry revitalization and gentrification</b>	
<i>Research Questions</i>	<i>Evidence</i>
<ul style="list-style-type: none"> <li>• What industry (business) revitalization efforts are currently happening in the Duwamish Valley?</li> <li>• How will the cleanup impair or facilitate business revitalization efforts in the DV?</li> </ul>	<ul style="list-style-type: none"> <li>• Manufacturing Industrial Council (MIC) of Seattle</li> <li>• Port of Seattle</li> <li>• ECOSS?</li> </ul>
<ul style="list-style-type: none"> <li>• Is industry (business) gentrification currently happening in the DV, and how is it manifesting?</li> <li>• What factors are currently driving gentrification?</li> <li>• How will the cleanup impair or facilitate business gentrification in the DV?</li> </ul>	<ul style="list-style-type: none"> <li>• Stats for greater DV industrial district</li> <li>• MIC</li> <li>• Port of Seattle</li> <li>• WA Employment Security stats</li> <li>• Labor unions – Patrick Neville?</li> </ul>
<ul style="list-style-type: none"> <li>• What types (class) of jobs are currently being lost or gained in the DV business community?</li> <li>• What types (class) of jobs may be lost or gained during the cleanup?</li> <li>• What types (class) of jobs may be lost or gained in the longer term, as a consequence of the cleanup?</li> </ul>	<ul style="list-style-type: none"> <li>• Same as above</li> </ul>
<ul style="list-style-type: none"> <li>• What is known about industry/business gentrification or revitalization near other cleanup efforts?</li> </ul>	<ul style="list-style-type: none"> <li>• Revitalization/gentrification efforts in other industrial areas</li> </ul>
<ul style="list-style-type: none"> <li>• How will cleanup costs facilitate or impair business revitalization/gentrification efforts?</li> </ul>	<ul style="list-style-type: none"> <li>• Dave Templeton (Liaison Committee)?</li> <li>• ECOSS?</li> <li>• MIC?</li> </ul>
<ul style="list-style-type: none"> <li>• How does business revitalization/gentrification affect health?</li> </ul>	<ul style="list-style-type: none"> <li>• White/grey literature – income leads to better health.</li> </ul>

**Figure 3: “Good thing, bad thing” exercise**

**Exercise 1: How could the river cleanup impact or change our community?**

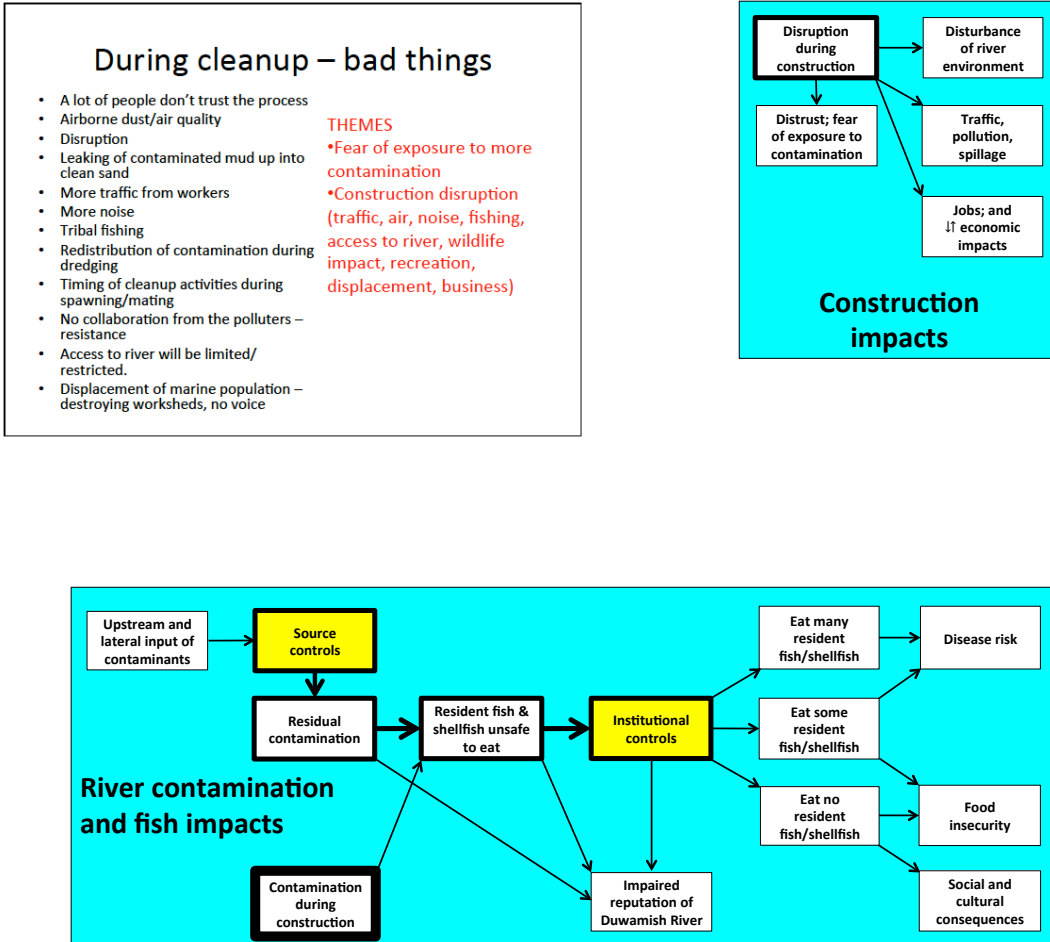
<b>Good things</b>	<b>Bad things</b>
During cleanup:	During cleanup:
After cleanup:	After cleanup:

**Figure 4: Stakeholder concerns reflected in logic model**  
**Resident CAC: “Good” impacts of cleanup**



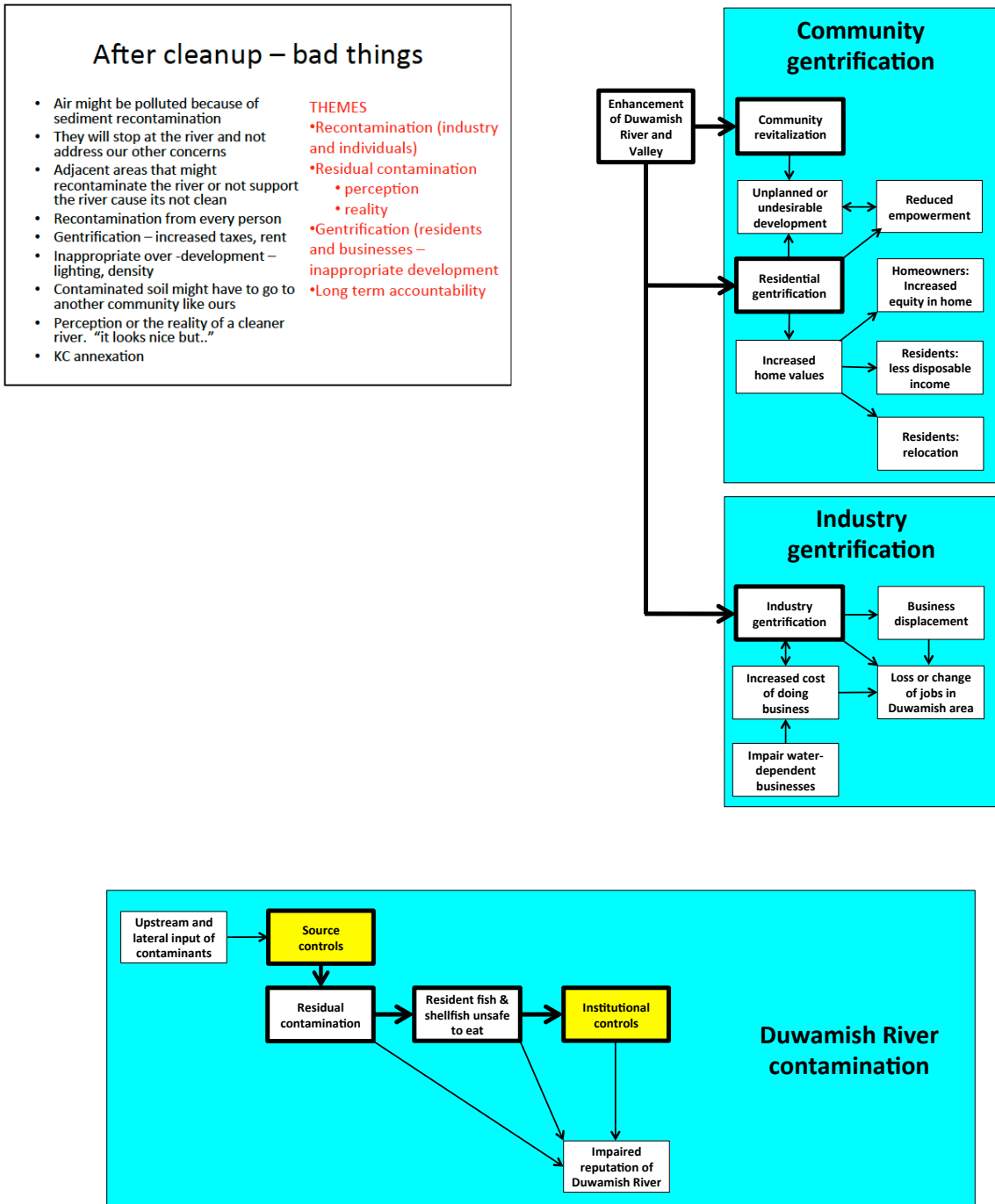
Note: The lists of “things” and “themes” were produced by CAC members, and were recorded in their own words.

**Figure 5: Stakeholder concerns reflected in logic model**  
**Resident CAC: “Bad” impacts during cleanup**



Note: The lists of “things” and “themes” were produced by CAC members, and were recorded in their own words.

**Figure 6: Stakeholder concerns reflected in logic model**  
**Resident CAC: “Bad” impacts *after* cleanup**

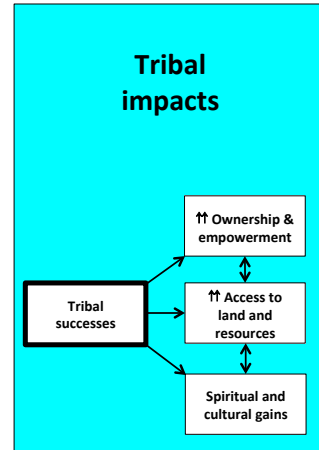


Note: The lists of “things” and “themes” were produced by CAC members, and were recorded in their own words.

**Figure 7: Stakeholder concerns reflected in logic model**  
**Tribal CAC: “Good” impacts of cleanup**

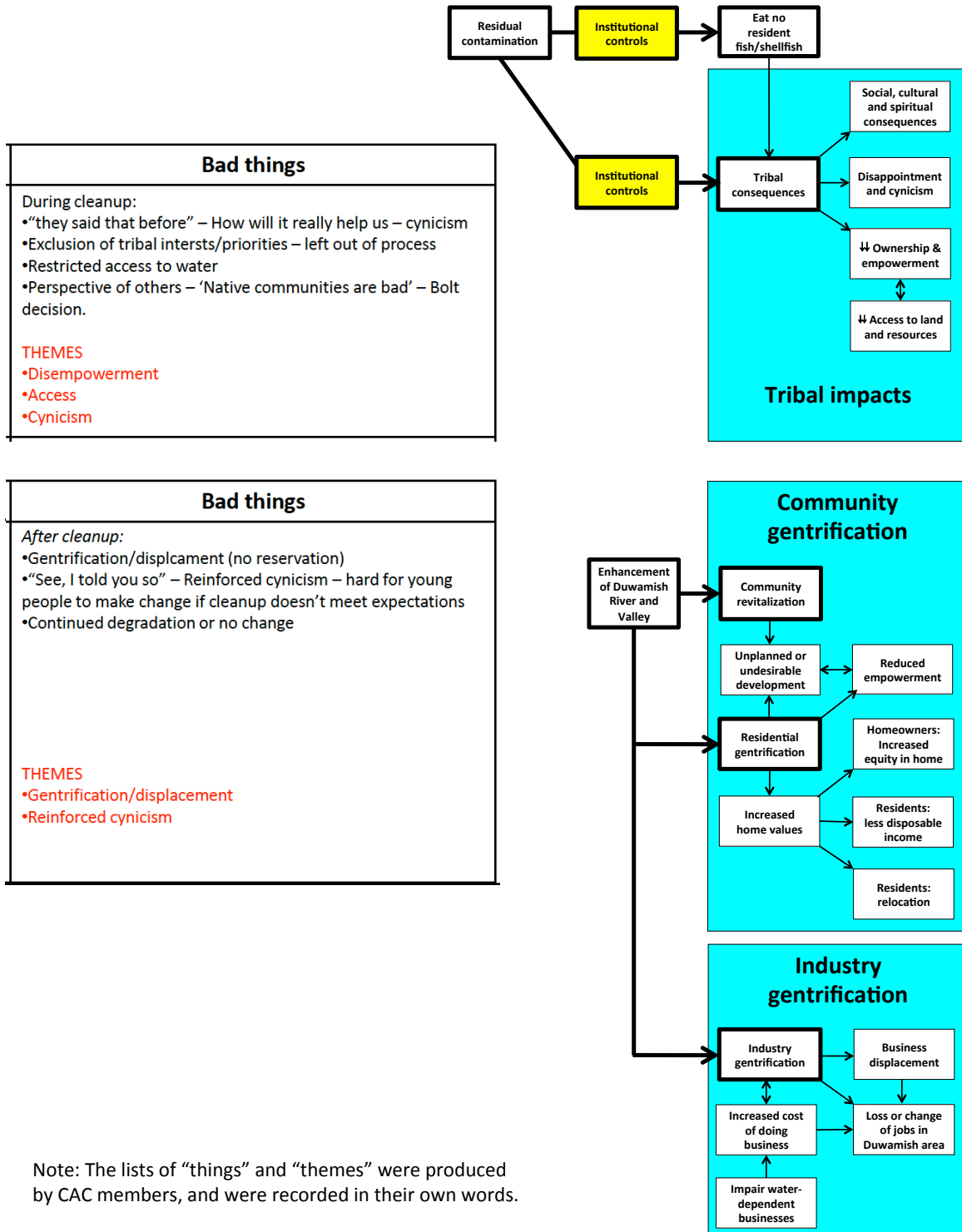
Good things
<p><i>During cleanup:</i></p> <ul style="list-style-type: none"> <li>•Community sense of empowerment</li> <li>•Development of integrated holistic approaches</li> <li>•We got here!</li> <li>•Visual cues – Raising awareness</li> </ul> <p><b>THEMES</b></p> <ul style="list-style-type: none"> <li>•Empowerment in decision making process</li> <li>•Ownership</li> </ul>

Good things
<p><i>After cleanup:</i></p> <ul style="list-style-type: none"> <li>•Increased ability to express tribal rights and connections</li> <li>•Sense of ownership</li> <li>•Opportunity to push farther – higher expectations- this place will be more comfortable for my “family”</li> <li>•Can swim, walk on beach, fish</li> <li>•Accomplishment – coordinated actions together = empowered community</li> <li>•Everyone succeeds – balanced industry – does not have to be winners and losers</li> </ul> <p><b>THEMES</b></p> <ul style="list-style-type: none"> <li>•Sense of ownership</li> <li>•Accomplishment</li> <li>•Access to land/resources</li> <li>•Spiritual aspect of place itself</li> </ul>



Note: The lists of “things” and “themes” were produced by CAC members, and were recorded in their own words.

**Figure 8: Stakeholder concerns reflected in logic model**  
**Tribal CAC: “Bad” impacts of cleanup**



Note: The lists of “things” and “themes” were produced by CAC members, and were recorded in their own words.



## Figure 9: Swinomish Indian Tribe indicators of health

### Community Health in Native Communities

In many Native American communities, Swinomish included, health is defined on a community level, consisting of inseparable strands of human health, ecological health, and cultural health woven together, all equally important. Within this definition, many of the dimensions of good health as defined by the Swinomish are difficult to quantify, such as participation in spiritual ceremonies, intergenerational education opportunities, and traditional harvesting practices, yet they may be negatively impacted or even destroyed when resources are scarce or disappear. (Arquette et al. 2002, Harris and Harper 1997, 2000, 2001, Wolfley 1998)

**Table 4-1. Suggested Top 5 Tribal Health Factors and Associated Health Indicators**  
(Salish Sea natural resources, including seafood, seaweeds, shells, etc.)

Five Health Factors	Fifteen Health Indicators with Definitions for each
<b>Community Cohesion</b>	<i>Participation &amp; cooperation</i> – the community depends on each other; strong support network (e.g., everyone supports the maintenance, harvest and distribution of resources)
	<i>Roles</i> (e.g., harvest, prepare, preserve natural resources) – each member of the community has a role that is respected
	<i>Familiarity</i> – food roles are known and trusted; therefore, it is assumed food is “safe”
<b>Food Security</b>	<i>Availability</i> – natural resources are abundant and healthy
	<i>Access</i> – all resource use areas (i.e., Usual and Accustomed areas) are allowed to be harvested with an emphasis on local resources for subsistence consumers.
	<i>Sharing</i> – ensuring that everyone in the community receives natural resources from the Salish Sea, esp. Elders
<b>Ceremonial Use</b>	<i>Gatherings &amp; ceremonies</i> – particular community assemblies that require natural resources from the Salish Sea
	<i>Giving thanks</i> – thanking Nature/ the Spirit for providing the natural resources when harvesting and preparing them; done with prayers and thoughtful intentions
	<i>Feeding the Spirit</i> – using natural resources from the Salish Sea to satisfy a spiritual “hunger” (e.g., consuming traditional foods)
<b>Knowledge Transmission</b>	<i>The Teachings</i> – knowledge, values and beliefs about tribal health in connection with the Salish Sea
	<i>Elders</i> – the knowledge keepers; they have and are able to pass on the knowledge
	<i>Youth</i> – the future; they receive and respect the knowledge
<b>Self Determination</b>	<i>Healing</i> — ability to choose life-style desired for what is considered “good health” (e.g., traditional medicines, language programs)
	<i>Development</i> —community enrichment opportunities directed by and for the community
	<i>Restoration</i> — environmental or habitat restoration projects that are community driven

**Notes:**

- The Swinomish Tribe is a Puget Sound area tribe, but is not one of the tribal populations directly affected by the Duwamish Superfund cleanup.
- **From:** Office of Planning and Community Development; Swinomish Indian Tribal Community. *Swinomish Climate Change Initiative Climate Adaptation Action Plan*. La Conner, WA; Oct 2010.

**Figure 10:**  
**Swinomish Indian Tribe meanings of health in reference to seafood and contamination of aquatic natural resources**

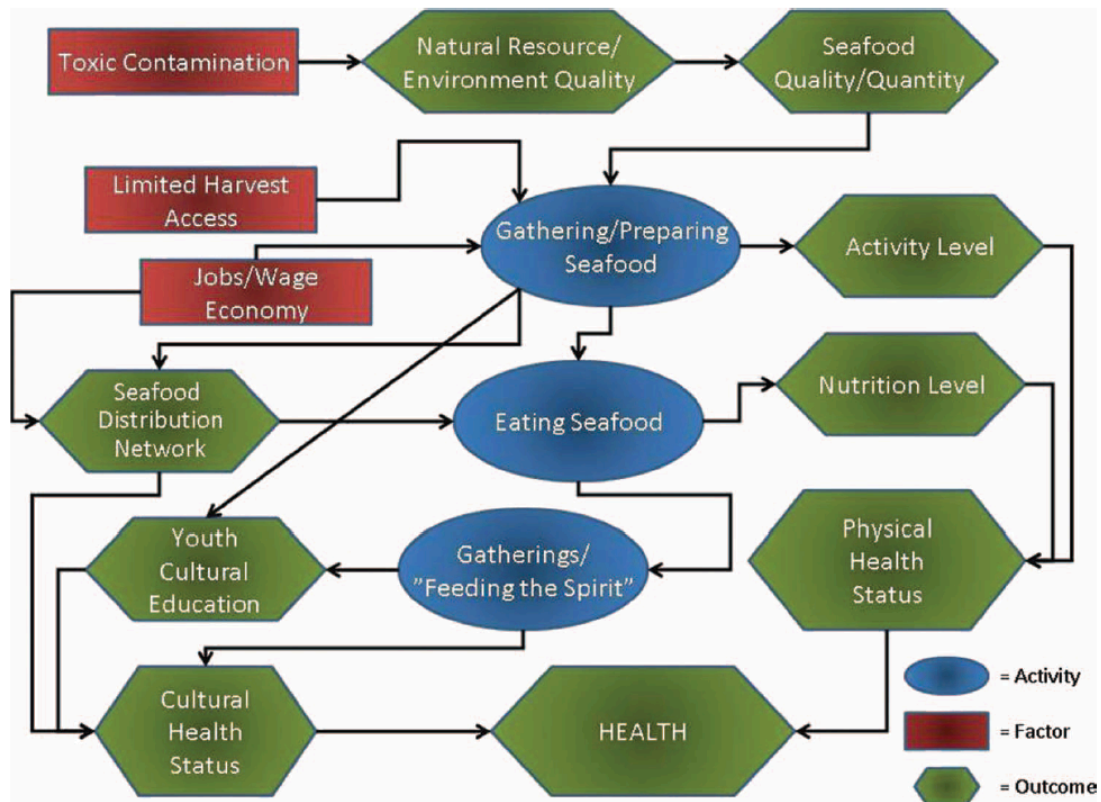


Figure 1. Flow chart depicting mental models information.

**Notes:**

- The Swinomish Tribe is a Puget Sound area tribe, but is not one of the tribal populations directly affected by the Duwamish Superfund cleanup.
- From: Donatuto JL, Satterfeld TA, Gregory R. Poisoning the body to nourish the soul: Prioritising health risks and impacts in a Native American community. *Health, Risk & Society* 2011;13:103-27.

## Figure 11: Swinomish Indian Tribe meanings of health in reference to seafood and contamination of aquatic natural resources

Table 6. The four main non-physical aspects of Swinomish health, key components of the aspects, and impacts, if any, from contaminated shellfish.

Health factor	Health indicator, definition and ranked impact from contaminated shellfish	Averaged ranking of impacts of contaminated shellfish on health factor
Community cohesion	<p><b>Participation &amp; cooperation:</b> the community depends on each other; strong support network. <b>Not at all.</b></p> <p><b>Roles</b> (harvest, prepare, preserve food): each member has a role that is respected. <b>Not at all.</b></p> <p><b>Familiarity:</b> food roles are known and trusted; therefore, it is assumed that the food is 'safe'. <b>A lot.</b></p>	<p><b>A little.</b></p> <p>At times, contaminated shellfish restrict / close harvest sites to members that still harvest, forcing people to purchase seafood, which is not considered a 'safe' alternative. Overall, other factors affect this factor much more than contaminated shellfish.</p>
Food security	<p><b>Availability:</b> seafood is abundant and the stocks are healthy. <b>A lot.</b></p> <p><b>Access:</b> all traditional areas allowed to be harvested. <b>A lot.</b></p> <p><b>Sharing:</b> ensuring that everyone in the community receives traditional foods, esp. Elders. <b>Somewhat.</b></p>	<p><b>A lot.</b></p> <p>Pollution depletes shellfish populations and closes beaches. With shellfish more difficult to acquire, there is less to distribute in the community.</p>
Ceremonial use	<p><b>Gatherings &amp; ceremonies:</b> particular community assemblies that require seafood <b>A lot.</b></p> <p><b>Give thanks:</b> thanking the Spirit for providing the food when harvesting and preparing it; done with prayers and thoughtful intentions. <b>A little.</b></p> <p><b>Feed the Spirit:</b> consuming seafood to satisfy a spiritual 'hunger'. <b>A lot.</b></p>	<p><b>Somewhat.</b></p> <p>Contaminated shellfish impact all categories of ceremonial use due to lower availability and access; yet people continue to eat seafood, even if it's contaminated, because it 'feeds the spirit'.</p>
Knowledge transmission	<p><b>The Teachings:</b> knowledge, values and beliefs about seafood and its importance for the community. <b>A lot.</b></p> <p><b>Elders:</b> the knowledge keepers who pass on the knowledge. <b>Not at all.</b></p> <p><b>Youth:</b> the future; they receive and respect the knowledge. <b>Somewhat.</b></p>	<p><b>Somewhat.</b></p> <p>Lower shellfish populations and restricted access exacerbates intergenerational knowledge transfer loss, as youth do not have the opportunity to learn about the importance of shellfish, harvest practices, etc. Overall, other factors more strongly affect loss of cultural education.</p>
<b>Self determination</b> (noted in Refs 2 and 3)		

### Notes:

- The Swinomish Tribe is a Puget Sound area tribe, but is not one of the tribal populations directly affected by the Duwamish Superfund cleanup.
- Ref 1 (source of table): Donatuto JL, Satterfeld TA, Gregory R. Poisoning the body to nourish the soul: Prioritising health risks and impacts in a Native American community. *Health, Risk & Society* 2011;13:103-27.
- Ref 2: Donatuto J. *White Paper: Key Indicators of Tribal Human Health in Relation to the Salish Sea*. July 2010.
- Ref 3: Office of Planning and Community Development; Swinomish Indian Tribal Community. *Swinomish Climate Change Initiative Climate Adaptation Action Plan*. La Conner, WA; Oct 2010

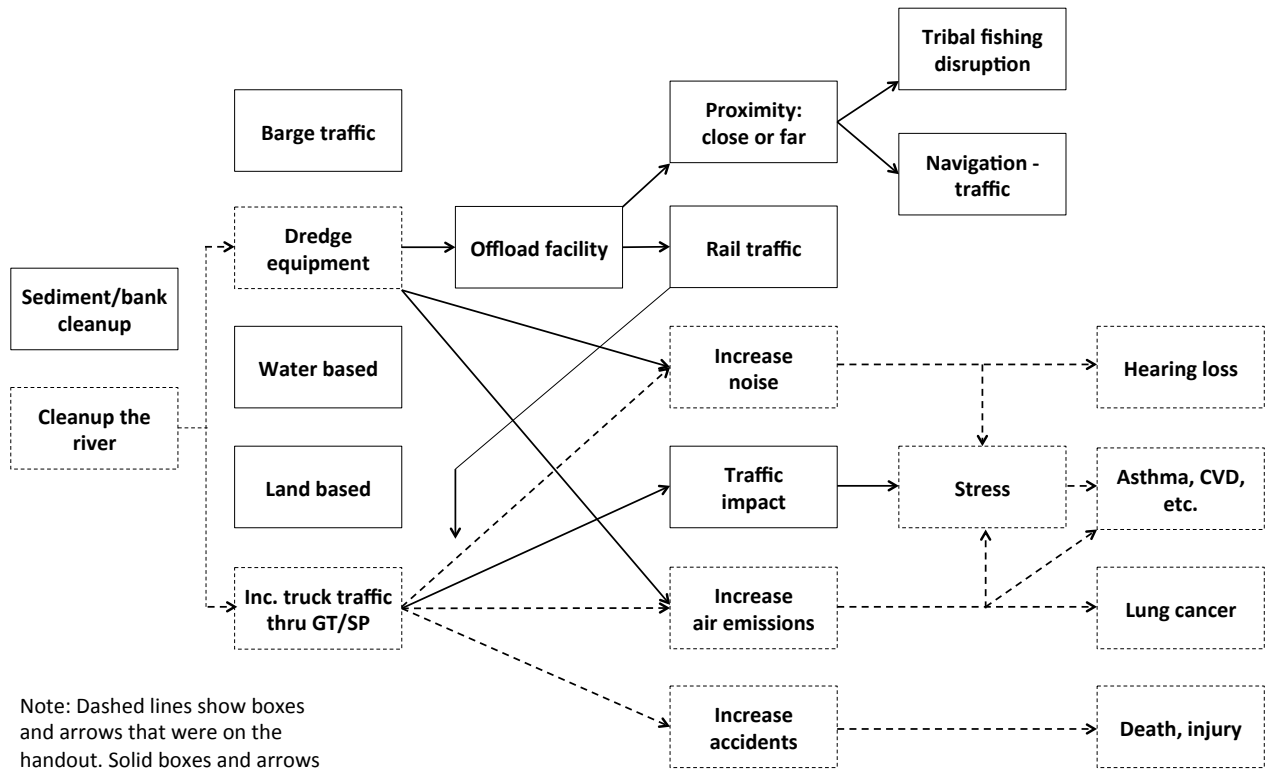
**Figure 12:  
Liaison Committee: Potential impacts of cleanup**

Actions	Associated Benefits& Burdens Long term consequences	Health
Construction <ul style="list-style-type: none"> <li>• Air quality</li> <li>• Time</li> <li>• Sequencing</li> <li>• Disruption of community</li> <li>• Fish tissue spikes</li> </ul> Institutional Controls <ul style="list-style-type: none"> <li>• Outreach</li> <li>• Advisories</li> </ul> Source control <ul style="list-style-type: none"> <li>Air</li> <li>Recontamination</li> <li>Water</li> </ul> Restoration Public Involvement	SHORT/INTERIM <ul style="list-style-type: none"> <li>• Property values</li> <li>• Public costs</li> <li>• Fish tissue concentrations</li> <li>• Duwamish business</li> <li>• Job creation</li> <li>• Fish consumption</li> <li>• Recreation</li> </ul>	Gentrification    Treaty rights  Economic Revitalization  Cultural traditions  Food security  Habitat for people  VOICE =  Nutrition Obesity  HEALTH

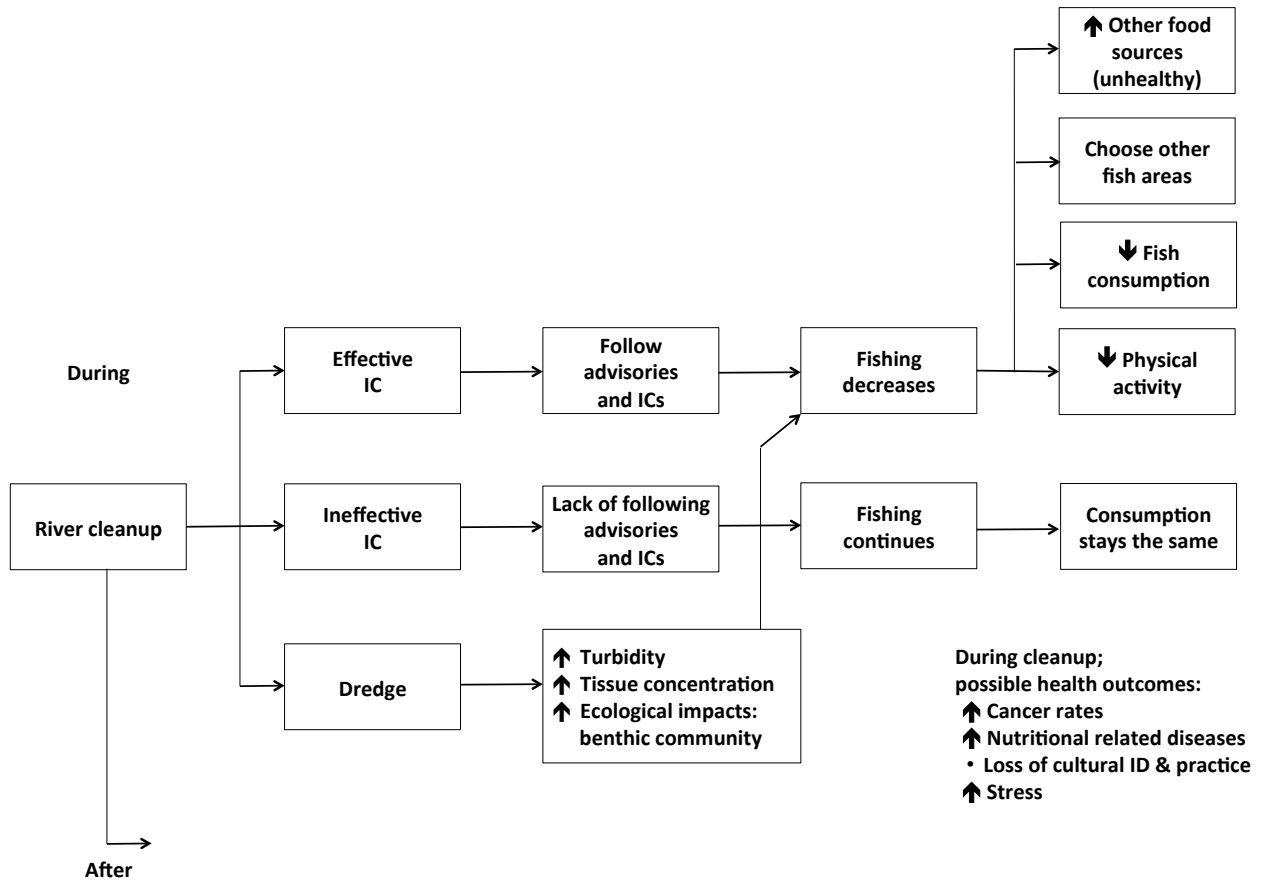
POTENTIAL IMPACTS for assessment in HIA

- Gentrification/displacement
- Erosion of treaty rights
- Economic revitalization
- Reduce/increase/change cultural traditions
- Food security
- Habitat for people (mental, social, physical)

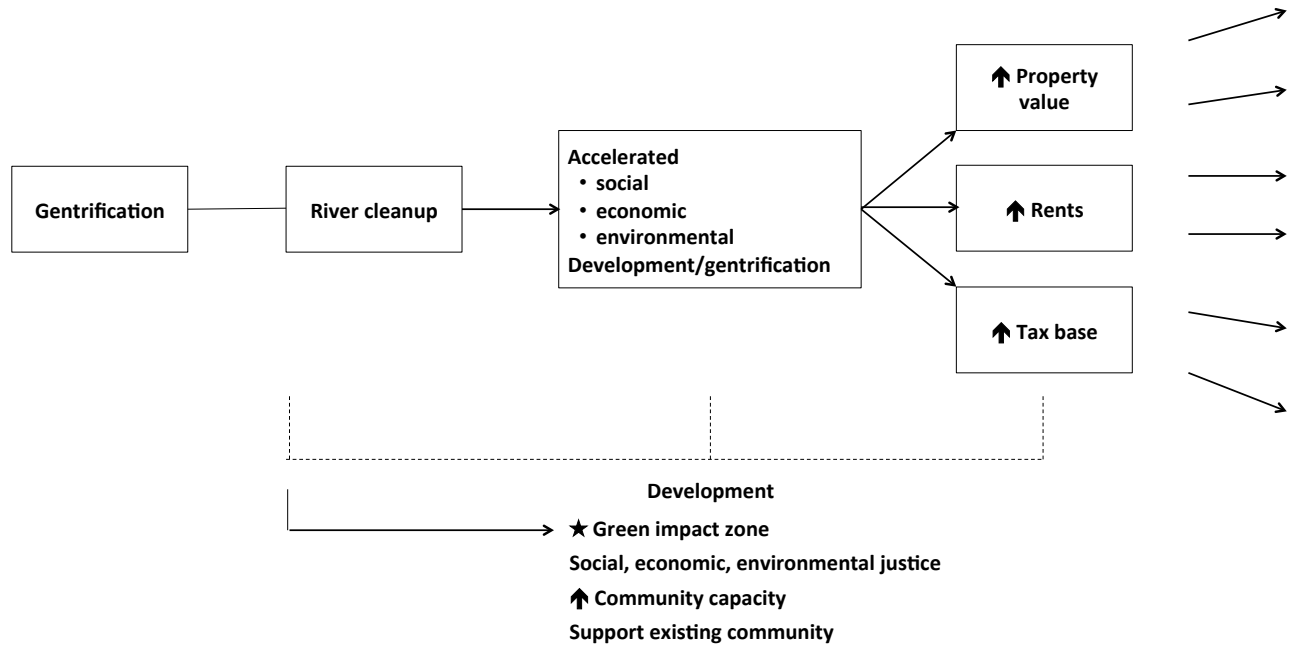
**Figure 13:**  
**Liaison Committee: Construction impacts of cleanup**



**Figure 14:**  
**Liaison Committee: Fish consumption impacts of cleanup**



**Figure 15:**  
**Liaison Committee: “Accelerated” gentrification impacts of cleanup**



## Figure 16: Criteria for assessing evidence of a possible effect

TABLE 4. HEALTH EFFECT CHARACTERISTICS AND THEIR INTERPRETATION

Likelihood	How certain is it that the decision will effect health determinants or outcomes irrespective of the frequency, severity, or magnitude?
Unlikely/ Implausible	Logically implausible effect; substantial evidence against mechanism of effect
Possible	Logically plausible effect with limited or uncertain supporting evidence
Likely	Logically plausible effect with substantial and consistent supporting evidence and substantial uncertainties
Very Likely / Certain	Adequate evidence for a causal and generalizable effect
Insufficient Evidence / Not Evaluated	—
Severity	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?
Low	Acute, short-term effects with limited and reversible effects on function, well-being, or livelihood that are tolerable or entirely manageable within the capacity of the community health system
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; OR Acute, short-term effects on function, well-being, or livelihood that are not manageable within the capacity of the community health system
High	Acute, chronic, or permanent effects that are potentially disabling or life-threatening, regardless of community health system manageability; OR Effects that impair the development of children or harm future generations
Insufficient Evidence / Not Evaluated	—
Magnitude	How much will health outcomes change as a result of the decision (i.e., what is the expected change in the population frequency of the symptoms, disease, illness, injury, disability, or mortality)?
Limited	A change of less than one-tenth of 1% in the population frequency of a health endpoint
Moderate	A change of between 0.1% and 1% in the population frequency of a health endpoint
Substantial	A change of greater than 1% in the population frequency of a health endpoint
Insufficient Evidence / Not Evaluated	—
Distribution	Will the effects, whether adverse or beneficial, be distributed equitably across populations. Will the decision reverse or undo baseline or historical inequities?
Disproportionate harms	The decision will result in disproportionate adverse effects to populations defined by demographics, culture, or geography
Disproportionate benefits	The decision will result in disproportionate beneficial effects to populations defined by demographics, culture, or geography
Restorative equity effects	The decision will reverse or undo existing or historical inequitable health-relevant conditions or health disparities
Insufficient Evidence / Not Evaluated	—