



SCHOOL OF PUBLIC HEALTH
UNIVERSITY of WASHINGTON



**Health Impact Assessment
Proposed Cleanup Plan for the
Lower Duwamish Waterway Superfund Site**

Technical Report

June 13, 2013

Assessment and Recommendations

Effects of the proposed cleanup plan on local residents

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Technical report

This technical report supports our overall HIA reports, produced in three stages: *Advance HIA Report* (May 2013), *HIA Public Comment Report* (June 13, 2013), and *Final HIA Report* (due July 2013).

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Duwamish Cleanup Health Impact Assessment: Resident Community Profile

The Duwamish Valley community includes some of the most ethnically diverse and lowest income neighborhoods in Seattle. The residential community is centered in the neighborhoods of South Park and Georgetown, in the 98018 ZIP code (98108 also includes Beacon Hill, the west slope of which is in the Duwamish River watershed, but is not generally considered part of the "Duwamish Valley," as it lies across and above the I-5 Highway).

South Park is the Valley's largest residential center, has a higher than average percent of elderly residents and children, and is ~40% Latino. The 2010 census reports that more than 70% of residents of the 98108 ZIP code are non-white minorities, including Asian, Pacific Islander, Hispanic, African-American, and Native American. King County data for 2006–2010 show that 42% of 98108 residents were foreign born. Thirty-two percent of 98108 residents live below 200% of the poverty level, 78% of children enrolled at South Park's Concord Elementary School qualify for reduced price lunch¹, and over 70% do not have a college degree. In 2000, median household incomes in South Park were ~40% below the Seattle average. Table 1 below compares demographic and socio-economic data from the 98108 ZIP code with the Seattle or King County average.

Table 1: Select demographic data: 98108, Seattle, King County

| | ZIP code 98108 (Beacon Hill/Georgetown/South Park) | Seattle ¹ /King County ² Average |
|--------------------|--|--|
| Non-white minority | 71.2 | 30.5 ¹ |
| Foreign born | 41.5 | 19.8 ² |
| Below 200% poverty | 32.4 | 22.2 ² |
| College degree | 71.7 | 54.8 ² |
| % Elderly (>65) | 12.0 | 10.8 ¹ |
| % Children (<5) | 6.8 | 5.3 ¹ |

Source: US Census Bureau, Census 2010.

Numerous social and environmental health indicators were compiled as part of a Cumulative Health Impacts Analysis (CHIA) funded by an EPA Environmental Justice Research Grant and published by the Duwamish River Cleanup Coalition/Technical Advisory Group (DRCC/TAG) and Just Health Action in 2013.² Findings of the study include:

- the childhood asthma hospitalization rate in 98108 is 299 per 100,000 residents, as compared with a Seattle and King County average of 216 and 130, respectively;
- the rate of deaths from stroke in 98108 is 49%, compared to a Seattle average of 36%;
- 98108 had an assault hospitalization rate of 65%, compared with a citywide average of 43%.

¹ Seattle Public Schools, Data Profile: District Summary, December 2011

² DRCC/TAG, Just Health Action. Duwamish Valley Cumulative Health Impacts Analysis.

² DRCC/TAG, Just Health Action. Duwamish Valley Cumulative Health Impacts Analysis. March 2013.

– 98108 residents have the lowest rates of leisure time citywide: a full 30% of residents reported having no leisure time, compared with a citywide average of 12%.

Other disparities found by the study include higher rates of lung cancer, obesity and diabetes among 98108 residents. Table 2 provides a summary of selected health indicators included in the report.

Table 2: Select health indicators: 98108, Seattle, King County

| Indicator | 98108 | Seattle | King County |
|---|-------|---------|-------------|
| Adults without health insurance (%) | 13.6 | 10.8 | 12.5 |
| Adults with no leisure time physical activity (%) | 30.0 | 11.6 | 15.2 |
| Adults overweight or obese (%) | 55 | 48 | 56 |
| Adults with doctor diagnosed diabetes (%) | 6 | 4 | 6 |
| Adult current cigarette smokers (%) | 10 | 10 | 11 |
| Lung cancer death rates (per 100,000) | 41.4 | 38.1 | 39.8 |
| Stroke death rate (per 100,000) | 48.7 | 36.0 | 36.6 |
| Heart disease death rate (per 100,000) | 123.3 | 138.4 | 137.8 |
| Childhood asthma hospitalization (per 100,000) | 299.1 | 215.9 | 129.7 |
| Assault hospitalization rate (per 100,000) | 65.4 | 43.3 | 29.0 |

Source: DRCC/TAG & JHA, 2013.

While limited data is available and statistically stable at the smaller South Park and Georgetown neighborhood (census tract) level, the disparities evident in the data that is available at this local scale further emphasize the findings at the ZIP code level. Heart disease rates from 2006–2010 in South Park and Georgetown were 168 per 100,000 residents, compared with 138 (18% lower) citywide. Most strikingly, overall life expectancy in South Park/Georgetown is 73.3 years – significantly lower than the Seattle average of 81.5 years, and a full thirteen years less than in Laurelhurst, a relatively wealthy and "white" North Seattle neighborhood, where average life expectancy is 86.4 years. These findings are summarized in Table 3.

Table 3: Georgetown and South Park health disparities

| Indicator | South Park/ Georgetown | Laurelhurst | Seattle | King County |
|-------------------------------------|---------------------------|-------------|---------|----------------|
| Life expectancy at birth (years) | 73.3 | 86.4 | 81.5 | 81.5 |
| Heart disease rate (per 100,000) | 202.9 | 89.6 | 138.4 | 137.8 |

Source: Public Health Seattle & King County.

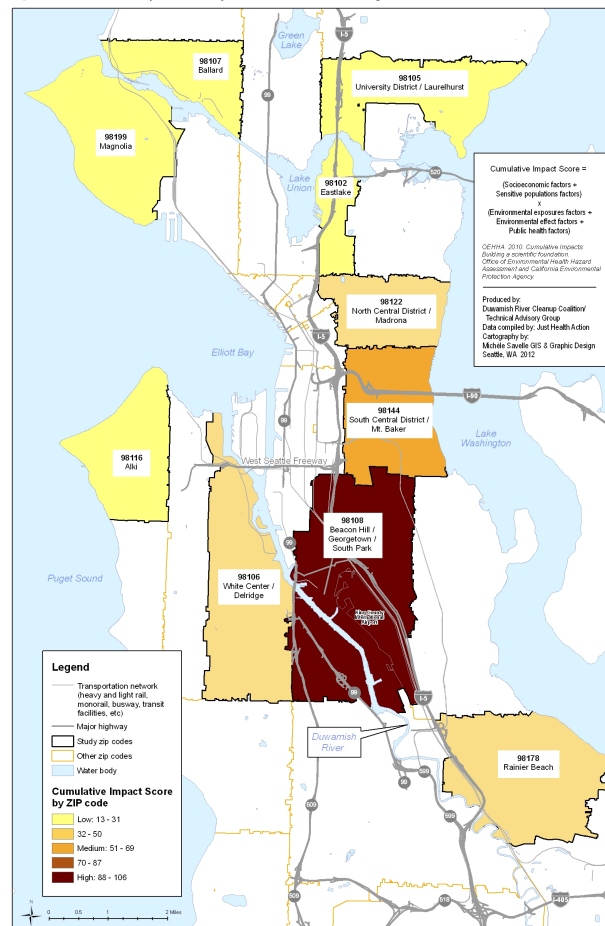
Finally, the Duwamish Valley is burdened with multiple sources of pollution exposures and correspondingly few environmental assets. In addition to the Duwamish River Superfund Site, which exceeds pollution limits for 42 toxic chemicals in the river's sediments – including PCBs, dioxins, arsenic, cPAHs, and phthalates – the 98108 ZIP code hosts the city's highest concentration of facilities releasing high levels of toxic chemicals, as listed by

EPA's Toxics Release Inventory (TRI). 98108 has 38 such facilities – more than twice as many as the next highest ZIP code; all other Seattle neighborhoods host from 0–13 TRI listed facilities. Similarly, the state's "ISIS" ranking of contaminated sites (number of sites x toxicity ranking) totals 142 in 98108 – more than three times greater than the next highest neighborhood; the rankings of sites in the rest of Seattle's ZIP codes total from 3–47. Disproportionate impacts in air pollution are also evident in the data on diesel and benzene concentrations. Annual average diesel particulate matter in outdoor air in 98108 is 2.3 ug/m³, compared to a King County average of 1.03, while benzene levels average 2.7 ug/m³, compared to King County's 1.7 ug/m³ annual average. As an indicator of environmental assets, while 98108 falls in the mid-range of park land per resident, it has among the city's lowest tree canopy per acre: 6% in 98108, in a range of 4–27% citywide.

Figure 1 shows the results of the Duwamish Valley Cumulative Health Impacts Analysis, which takes into account social, environmental, and public health indicators and serves as a summary environmental health "profile" of the 98108 (South Park/Georgetown/Beacon Hill) neighborhoods, as compared with nine other ZIP codes citywide.

Figure 1: Cumulative Impact Scores by ZIP Code, Seattle, WA (DRCC/TAG & JHA, 2013).

Figure 17. Cumulative Impact Score by ZIP Code, Seattle, Washington



Resident Health Impact Assessment Duwamish River Proposed Cleanup Plan

Construction Impacts

Introduction

Background. The current EPA Proposed Cleanup Plan for the Duwamish River Superfund Site anticipates a seven-year active construction phase, and a total of 17 years until site conditions meet objectives and recovery is complete.¹ During scoping for this assessment, potential impacts identified and prioritized by the project team and Resident Community Advisory Committee included health concerns related to short-term construction, as well as potential opportunities that could benefit the health of the community during the construction phase. Priority areas related to short-term construction included:

1. increased water pollution and fish contamination resulting from disruption of contaminated sediments during cleanup activities such as dredging;
2. increased congestion, road wear and safety hazards resulting from construction-related traffic such as truck and rail transport of waste materials;
3. increased air pollution and noise resulting from construction-related activities such as dredging equipment and barges;
4. increased opportunities for local "green" jobs created by cleanup activities, including remediation, pollution source control, and restoration.

Chapter Layout. This section of the Resident Health Impact Assessment will evaluate these construction phase impacts and provide an overview of:

- A. current conditions in the adjacent residential communities, within which project impacts are anticipated to occur;
- B. the likelihood and magnitude of anticipated impacts, as well as any evidence of disproportionate impacts on sub-groups within the community;
- C. potential strategies to minimize harmful impacts, optimize benefits, and promote health equity.

Methods and Resources. Data for assessment of construction-related health impacts for the residential community were compiled from quantitative and qualitative data derived from several sources using a variety of methodologies. Public environmental and demographic databases, formal and informal literature (e.g., peer reviewed scientific papers, internal government reports, newspaper stories), community based participatory research (CBPR) results from related

¹ Complete recovery in this instance means reaching the lowest achievable chemical concentrations and satisfying the regulatory requirements of the EPA cleanup order, not a return to historical natural conditions.

studies, guidance from community advisory groups, and personal communication with topical experts all provided lines of evidence and data that are utilized in this assessment. A full list of citations and sources is provided at the end of this report.

The Resident Community Advisory Group that informed and helped to guide this assessment was comprised of seven residents and two advisors on specific technical issues. The advisory group was selected from established community leaders and representatives recommended by them, and included four South Park residents, including English-, Spanish- and Vietnamese-speaking community members; two Georgetown residents; one representative of the homeless encampment of Nickelsville; and two technical advisors to provide assistance in assessing air-related construction-phase impacts and gentrification – a representative of the non-profit organization Puget Sound Sage and a former WA State legislator representing the Duwamish neighborhoods, respectively. The Advisory Group met four times during the course of the project, and participated in two open community meetings to present and solicit feedback on the draft recommendations. The community meetings, held in South Park and Georgetown, provided opportunities to vet and refine the recommendations with a larger group of neighborhood residents.

Current Conditions

The Resident Community Profile provides an overview of current demographic and environmental baseline conditions in the riverfront neighborhoods of South Park and Georgetown. Additional baseline conditions relevant to the assessment of construction impacts are described below and include current water quality, beach safety, and fish contamination data and related advisories; recent dredging performance data; current road- and rail-related traffic and safety data; and air and noise pollution measures for the surrounding area and existing evidence of associated health risks.

Water quality, beach safety and fish contamination

The lower Duwamish River is listed by EPA and the Washington State Department of Ecology as an impaired waterway for exceeding several state water quality standards, including pH, fecal coliform, and dissolved oxygen, as well as numerous sediment quality standards, including polychlorinated biphenyls (PCBs), carcinogenic polyaromatic hydrocarbons (cPAHs), heavy metals (e.g., mercury and arsenic), and phthalates, among others.² In addition, the Remedial Investigation (RI) for the Lower Duwamish Waterway site notes

² 2012 303(d) list of impaired waterbodies for the state of Washington: <http://www.ecy.wa.gov/programs/wq/303d/currentassessmt.html>

that surface sediment within the Superfund site is regularly resuspended in the water column, causing toxic contaminants to become suspended in the river.³

Beaches throughout the lower Duwamish River have been extensively sampled and evaluated for human health risks as part of the RI for the Superfund site. Several publicly accessible beach areas exceed state health standards for direct (dermal) contact. The beaches that are most accessible to and utilized by South Park and Georgetown residents are at Duwamish Waterway Park in South Park and Gateway Park North in Georgetown. The contaminants with exceedances at these beaches include arsenic and cPAHs.⁴ Human health risks at Duwamish Waterway Park include excess cancer risks associated with frequent beach play and exposure to the elevated pollutants.⁵

Resident (non-anadromous⁶) fish in the lower Duwamish River are highly contaminated with PCBs and other contaminants, and a Department of Health Fish Consumption Advisory recommending *no consumption* of resident seafood is currently in effect.⁷ The degree of cancer risks and other health risks from eating resident seafood depend on the age of the consumer and the amount and species of seafood they eat. Washington State standards for cancer and non-cancer risks are 1 in 1,000,000 and a hazard index of 1, respectively. The Human Health Risk Assessment for the site calculated the following risk levels for various groups of resident seafood consumers:⁸

- Suquamish Tribal adult excess cancer risk = 3 in 100
- Asian/Pacific Islander adult excess cancer risk = 1 in 1,000
- Suquamish Tribal adult non-cancer (developmental, immunological, and neurological) hazard index = 275
- Asian/Pacific Islander adult non-cancer cancer (developmental, immunological, and neurological) hazard index = 29–30.

In addition, a less stringent Puget Sound-wide *limited consumption* advisory has been issued by the Department of Health for certain salmon species, including Duwamish River runs, as follows:⁹

³ Lower Duwamish Waterway Remedial Investigation. Lower Duwamish Waterway Group: July 9, 2010.

⁴ Lower Duwamish Waterway Remedial Investigation, Appendix B: Baseline Human Health Risk Assessment. Lower Duwamish Waterway Group: November 12, 2007

⁵ Cancer risk rate = 8×10^{-6} – 9×10^{-6} : Tables B5.31 and B5.32, Baseline Human Health Risk Assessment.

⁶ Most salmon species are anadromous, spending a relatively short time in the river before migrating out to sea; resident seafood species that live in the river throughout their life cycle include perch, rockfish, herring, and crab.

⁷ Lower Duwamish Waterway Superfund Site Fact Sheet. Washington State Department of Health; November 2007.

⁸ Lower Duwamish Waterway Remedial Investigation, Appendix B: Baseline Human Health Risk Assessment. Lower Duwamish Waterway Group: November 12, 2007

- Limit consumption of Chum, Coho, Pink and Sockeye salmon to 2–3 times/week
- Limit consumption of Chinook salmon to once a week.
- Limit consumption of Blackmouth (resident Chinook) to once a month.

Dredging performance at Early Action Sites

Contaminated site dredging technology has advanced markedly in recent years. As a result, much of the available data on past dredging performance at contaminated sites is quickly supplanted by newer, and sometimes unpublished, results achieved with the most current environmental dredging equipment and techniques. In addition, every site has unique characteristics that make comparison among performance data from different contaminated sites difficult. Several recent dredging experiences on the lower Duwamish River provide the most relevant, recent and site-specific data on dredging performance.

- *Duwamish/Diagonal Combined Sewer Overflow and Storm Drain (CSO/SD) (2003–04)*
An Early Action cleanup conducted at the mouth of the Duwamish Diagonal Combined Sewer Overflow (CSO) at River Mile 0.5 was conducted over the winter of 2003–04. A conventional clamshell dredge was used for the project, which typically releases sediment throughout the water column and at the water's surface, which can cause high turbidity and residuals.¹⁰ During dredging, frequent turbidity violations (22 of 119; 20% of recorded measurements) were documented, indicating that plumes of contaminated sediment were being transported outside of the cleanup area. In addition, pre- and post-sediment characterizations found that relatively clean areas outside of the targeted cleanup zone had been contaminated by spilled material transported by the river currents and tides.¹¹ While important for lessons learned regarding selection of dredging technology, best management practices (BMPs), and operator skill, this data has little relevance to more recent cleanup projects using environmental dredging technologies.
- *Boeing South Storm Drain (2005)*
A small area near the Norfolk CSO/SD was cleaned up in 2005 to remove a plume of sediment contamination that was attributed to releases from Boeing's South Storm Drain in the recent preceding years. The cleanup

⁹ Puget Sound Fish Consumption Advice. Washington State Department of Health; October 2006.

¹⁰ Technical Guidelines for Environmental Dredging of Contaminated Sediments. U.S. Army Corps of Engineers; September 2008.

¹¹ Duwamish/Diagonal CSO/SD Sediment Remediation Project Closeout Report. Elliott Bay/Duwamish Restoration Program Panel; July 2005.

area was intertidal, and the majority of work was conducted during low tide, when the area to be cleaned up was above the water line ("in the dry"). Cleanup was conducted using handheld vacuum excavator connected to a vac truck, which pumped contaminated sediments to an adjacent dewatering system on land.¹² However, this project is not comparable to sediment cleanups in underwater conditions, where handheld vacuum removal is not feasible, or is limited to small areas inaccessible to large bucket dredges.

- *Slip 4 (2011–12)*

To date, the most comparable cleanup that has been completed on the Duwamish River is the Early Action cleanup in Slip 4, at River Mile 2.8. The Slip 4 Early Action Areas was remediated in 2011–12. The primary removal technology planned for the project was an environmental dredge bucket with GPS navigation system and slurry wastewater collection and treatment system. Three other buckets were used during the project as necessary, depending on conditions encountered. During the 43-day dredging project, no violations of water quality standards were recorded, and only one instance of a turbidity violation was recorded during subsequent capping, where the material was clean sand being applied to the cap, not contaminated sediment being removed.¹³ While this is the most recently completed dredging project on the river, it was located on a spur of the river off the main channel, so may have been less subject to the river's currents, which can increase the potential for plumes of contaminated sediment to escape during dredging. However, the data is promising in terms of effectively preventing contaminated sediment releases during dredging.

- *Boeing Plant 2 (2013)*

Dredging of the river's largest Early Action Area at Boeing Plant 2 began in January 2013.¹⁴ The Plant 2 cleanup area is on the main channel of the river, stretching roughly from river mile 3.0–4.0, and directly across the river from the residential South Park waterfront. The project spanned several weeks of dredging with a CableArm environmental dredge with GPS navigation. Monitoring included continuous turbidity sampling, which was posted in real time online, as well as daily turbidity compliance sampling, water chemistry, dredge residuals, and pre- and post construction characterization of nearby sediment areas. Results reported to date show only two exceedances of applicable turbidity

¹² Lower Duwamish Waterway Source Control Action Plan for Early Action Area 7. Washington State Department of Ecology; September 2007.

¹³ Lower Duwamish Waterway Slip 4 Early Action Area: Removal Action Completion Report. City of Seattle; July 2012.

¹⁴ EPA Region 10: <http://yosemite.epa.gov/R10/cleanup.nsf/sites/BP2>

standards, no violations of chemical water quality standards, no detectable dredge residuals, and no significant trends when comparing pre- and post- sediment characterization data.¹⁵ This is the most recent and comparable dredging project to the work that will be required by the pending riverwide cleanup action. Dredging performance at additional Early Action Areas should be monitored and evaluated to predict the performance that can be expected for removal actions during the proposed riverwide cleanup.

Road and rail traffic and safety

There is extensive truck traffic on a daily basis in Georgetown and South Park. Over 3,000 shipping containers are moved by heavy trucks from the Port to local rail yards and warehouses each day.¹⁶ More than 8,000 port-related truck trips occur on an average weekday, the Port of Seattle estimates, based on Washington Department of Transportation traffic counts.¹⁷ A majority (56%) of respondents in a community survey conducted in Georgetown and South Park in 2009 thought that there were too many port trucks driving in their neighborhood. Fifty-six percent also said that port truck traffic made it hard to walk in their neighborhoods. Nearly one in five respondents reported an incident of someone from their home feeling endangered by port truck traffic within the prior year.¹⁸

The Duwamish Valley is also home to major rail lines with trains frequently passing through. Currently, approximately 65 to 85 train movements per day occur at the SODO main line crossings.¹⁹ These include long-haul trains of about 150 cars as well as shorter trains. These figures do not include passenger trains.

Air and noise pollution

Air pollution. Air quality in the Duwamish Valley is poor for several parameters. The Washington State Department of Health (DOH) conducted a Health Assessment of air quality in the Duwamish Valley that concluded that the largest contribution to cancer and other health risks are mobile sources, and that risks are especially elevated within 200 meters of the Interstate 5, State Highway 99 and State Highway 509 corridors, all of which traverse the neighborhoods of

¹⁵ AECOM: Boeing Plant 2 Completion Report. June 2013.

¹⁶ Puget Sound Sage, Community Health Impact Survey Results: Port of Seattle Operations Hazardous to Health in Georgetown and South Park, 2009

¹⁷ McClure, Robert and Cunningham, Jenny, Investigation: Air pollution crisis in South Seattle, mynorthwest.com, June 14, 2011

¹⁸ Supra.

¹⁹ Coal Train Traffic Impact Study. City of Seattle; October 2012.

South Park and/or Georgetown.²⁰ The DOH report also found that particularly vulnerable populations within these neighborhoods are exposed, specifically children at over a dozen child care centers or schools within the 200-meter high impact zone.

A recent Seattle Cumulative Health Impacts Analysis, conducted by HIA project partners DRCC/TAG and JHA, compiled air quality data for the Duwamish Valley's 98108 (South Park/Georgetown/Beacon Hill) ZIP code and compared the data to other Seattle neighborhoods and to the King County averages.²¹ Diesel and benzene concentrations in the Duwamish Valley are significantly higher than the King County average: the annual average benzene concentration in King County is 1.7 ug/m³, vs. 2.7 ug/m³ in the 98108 ZIP code; the annual average diesel concentration in King County is 1.1 ug/m³ vs. 2.3 ug/m³ in the 98108 ZIP code. Among the ten ZIP codes included in the study, the 98108 concentrations were the highest in the city for diesel and second highest in the city for benzene.

The University of Washington School of Public Health and Puget Sound Sage, a non-profit organization, are currently conducting diesel monitoring in South Park and Georgetown in locations identified by residents as areas of high concern.²² As results become available, they will be incorporated into the known existing conditions summarized in this report. In the 2009 community survey mentioned above, three out of five (60%) respondents believed that port truck pollution affected their health and the health of their family.²³

Noise Pollution. Noise pollution is a significant issue in the South Park and Georgetown neighborhoods. Both neighborhoods are bordered by highways that contribute to noise experienced in the adjacent residential corridors, and both are under the SeaTac and King County Airport flight paths, which residents identify as sources of disruptive and harmful noise levels. Georgetown is also impacted by noise from the United Pacific and Burlington Northern rail lines, and is more directly impacted by noise from low-flying aircraft using the King County Airport, creating some disproportionality in the severity of noise impacts from these sources.

²⁰ Health Consultation: Summary of Results of the Duwamish Valley Regional Modeling and Health Risk Assessment, Seattle, WA. Washington State Department of Health/ATSDR; July 2008.

²¹ Duwamish Valley Cumulative Health Impacts Analysis. Just Health Action, Duwamish River Clean Up Coalition/Technical Advisory Group; March 2013.

²² "Grant supports resident-led study of air pollution in the Duwamish." Environmental Health News: University of Washington Department of Environmental and Occupational Health Sciences; Autumn 2011.

²³ Community Health Impact Survey Results: Port of Seattle Operations Hazardous to Health in Georgetown and South Park. Puget Sound Sage; 2009.

Truck traffic through the area also creates noise that can interfere with quality of life. Nearly one-third (30%) of those responding to the survey in Georgetown and South Park in 2009 mentioned above reported sleep disruption from port trucks in their neighborhoods.²⁴

Impacts Assessment

The assessment of potential harmful and beneficial health effects to residents from cleanup construction activities, as well as potential significant differences or disproportionalities in some parts of the neighborhoods, include four areas selected for assessment by the Resident Advisory Group as priorities. The priority areas are:

A. Construction disruption/pollution:

1. increased water pollution and fish contamination resulting from disruption of contaminated sediments during cleanup activities
2. increased congestion, road wear and safety hazards resulting from construction-related road and rail traffic
3. increased air pollution, noise and related emissions resulting from construction-related activities

B. Construction opportunities:

4. opportunities for local "green" jobs created by cleanup activities, including remediation, pollution source control, and restoration

C. Residual contamination:

5. potential for exposure to residual contamination on local shorelines/beaches

A. Construction disruption/pollution

Increased water pollution and fish contamination

Dredging performance at other Duwamish River cleanup sites has been mixed, but the most recent and comparable dredging projects are promising in terms of minimizing releases of contaminated sediment during cleanup operations and associated construction-related water pollution. While some suspension of contaminated sediments into the water column can be expected within the immediate vicinity of any dredging operation, the magnitude of the impacts from any contaminated material that may escape outside the construction zone is expected to be limited, assuming that environmental dredging technologies, best management practices, and skilled operators are employed for the cleanup. Based on evidence from similar recent dredging operations on the river, any

²⁴ Puget Sound Sage, Community Health Impact Survey Results: Port of Seattle Operations Hazardous to Health in Georgetown and South Park, 2009

water pollution plumes are expected to be infrequent and to disperse at low levels within a limited impact zone.

Impact on local beaches from the recent Boeing Plant 2 dredging provides the best comparative case study. EPA's initial assessment is that the data indicate only "white noise," i.e., expected variability in a dynamic estuarine system, with no significant trends in the data attributable to the recent dredging.²⁵ Dredge residuals following removal at Boeing Plant 2 were all non-detect. Sampling in Slip 4 indicated a relatively small residual footprint adjacent to the area subject to dredging, which was treated with a thin layer of clean material (ENR).

Little information is available about the effect of previous Duwamish River dredging activities on levels of contamination in resident fish. Some past reports indicate higher fish tissue concentrations of PCBs following the Duwamish/Diagonal CSO dredging.²⁶ However, that project was not comparable to the environmental dredging anticipated for the riverwide cleanup. Recent fish tissue monitoring during and after dredging on the Hudson River in New York indicate that fish tissue increases sometimes occur with dredging, but are short-lived and transitory, with fish tissue recovering within a matter of weeks or months.²⁷ The Lower Duwamish Waterway Feasibility Study assumes that there will be a short-term increase in fish tissue chemical concentrations; a monitoring program planned for the cleanup will help to verify these assumptions.²⁸

Increased traffic congestion, road wear and safety hazards

The Duwamish River Superfund Site cleanup is focused on riverbed sediments, rather than upland soils. While not explicitly prohibited by the EPA proposed Cleanup Plan, the Lower Duwamish Waterway Group does not plan to rely on trucks as the primary transportation mode for transferring contaminated sediments from the river to disposal sites.²⁹ Rather, the parties intend to rely on barging contaminated sediments from dredging operations to a transloading facility at one or two locations on the river, which will either have a direct rail connection and/or may require short distance truck transport of material from the transloading facility to an available intermodal rail spur. Trains will

²⁵ Personal communication: Holly Arragoni, EPA Remedial Project Manager.

²⁶ Final Data Report: 2006 Fish Tissue Sampling and Chemical Analysis in the Lower Duwamish Waterway. Anchor Environmental, King County; July 2007.

²⁷ PCBs in Fish Tissues at the Hudson River PCBs Superfund Site: Update on Results of Baseline and Remedial Action Monitoring (2004–2012). Marc Greenberg, U.S. Environmental Protection Agency Environmental Response Team; April 2013.

²⁸ Final Feasibility Study: Lower Duwamish Waterway, Seattle, WA. Lower Duwamish Waterway Group; October 2012.

²⁹ Lower Duwamish Waterway Group Liaison Committee representatives. Personal communications, 20012–13.

transport the sediments to a landfills in Roosevelt, Washington and/or Arlington, Oregon.

Any short distance truck transport to rail cars is not likely to impact the South Park neighborhood, where no rail lines exist, but may impact Georgetown, depending on the intermodal facility used. This may cause an impact on Georgetown residents, if trucks are used for short-distance transport.

Approximately 790,000 cubic yards of sediments will be dredged and transferred to rail cars for delivery to the landfill. A typical rail car can carry 66 cubic yards of waste, for a total of 11,800 rail cars. Assuming that trains consist of 50–150 cars, this translates to 80–240 train trips. If these are spread evenly over 7 years, this means an extra 11–34 train trips per year.³⁰ If sediment is only transported during months when removal is occurring, this could be consolidated into a limited number of months, balanced by no sediment transport during non-dredging months. If sediment removal proceeds more quickly overall, there would be a greater number of additional train trips over a shorter number of years.

The increase in train traffic itself is unlikely to have a meaningful effect on population health or wellbeing. Compared to the number of trains already moving through the area, the magnitude of these additional freight trips is small (1–3 additional trains per month, on average). Moreover, potential rail increases from other activities dwarf the increases associated with remediation. Proposed coal transport trains could add 10 extra train trips per day in the region in 2015, and 18 extra trips per day by 2026,³¹ and the Port of Seattle's overall expansion goals could significantly increase rail freight traffic.³²

In terms of any truck traffic required to transfer sediments from barge offloading facilities, the effects could be more substantial. Georgetown is a small residential neighborhood surrounded by industrially zoned-land and bordered by the Duwamish River to the west, I-5 to the east, and the King County Airport (Boeing Field) to the south. The United Pacific rail line bisects the neighborhood, and the Burlington Northern rail facility lies on the opposite side of the residential community from the river, making a route through the neighborhood the shortest distance between the river and the rail facility. If any truck transport of contaminated sediments from the transloading facilities to the intermodal rail station is required, trucks may pass through the neighborhood in order to load the trains.

³⁰ Email communication: Alison Hiltner, Remedial Project Manager, Environmental Protection Agency. Feb. 28, 2013

³¹ Coal Train Traffic Impact Study. City of Seattle; October 2012.

³² Century Agenda. Port of Seattle:

<http://www.portseattle.org/about/commission/pages/century-agenda.aspx>

Impacts may include increased truck traffic volume that can increase risk of injury from pedestrian or vehicle collisions, or increase wear and tear on local roads. Additional traffic congestion can disrupt community cohesion and quality of life. Increased traffic volume, vehicle idling, and rail freight transport could contribute to local air and noise pollution. The likelihood of these impacts on Georgetown are possible, but the Lower Duwamish Waterway Group has stated its intent to avoid truck transport, relying instead on a direct barge-to-rail transfer, so the magnitude of any truck impacts is anticipated to be low. Regardless, to the extent that trucks may be used, the impacts will disproportionately fall on Georgetown residents.

Increased air and noise pollution

Cleanup of the Duwamish River will require an estimated seven years of active construction, including dredging, capping and transport of contaminated materials out of the site, as well as of clean capping material into the site. Dredging and capping operations will require the use of barges and construction machinery (e.g., dredgers). Contaminated and clean material will be transported by a combination of barge, truck, and rail. The Lower Duwamish Waterway Group has predicted that these activities will result in additional air and noise pollution.³³ However, the data for these predicted impacts used do not reflect current EPA fuel regulations or "green remediation" policies, which are expected to substantially reduce air emissions and noise impacts.

Additional air and noise emissions should be placed in the context of current conditions in the adjacent residential communities. Currently, air and noise pollution are long-standing and severe problems and have been identified as issues of concern by local residents. Any additional air and noise pollution resulting from the cleanup construction activities is likely to be minor in comparison to air and noise pollution from current non-cleanup activities, and residents may not perceive any change from current levels. However, since these neighborhoods are already disproportionately impacted by air pollution and noise and experience higher rates of diseases associated with these exposures including asthma, lung and heart disease, stress, and fatigue,³⁴ any additional impact may further exacerbate these impacts.

Air pollution: The Lower Duwamish Waterway Group conducted an evaluation of air pollution impacts from construction and predicted that impacts would be substantial. However, this analysis is outdated, because it assumed that all

³³ Final Feasibility Study, Appendix L: Lower Duwamish Waterway, Seattle, WA. Lower Duwamish Waterway Group; October 2012..

³⁴ Duwamish Valley Cumulative Health Impacts Analysis. Just Health Action, Duwamish River Clean Up Coalition/Technical Advisory Group; March 2013.

cleanup activities will rely on only conventional hydrocarbon fuels.³⁵ New federal rules now require the use of ultra low sulfur fuel in all highway, locomotive (rail), and marine diesel engines, so the conventional hydrocarbon fuels used in the Waterway Group's analysis are no longer legally permissible.³⁶ EPA's has also adopted a "green remediation" policy, which typically requires the use of low emission fuels, no-idling, and other measures which significantly reduce the impact of diesel emissions.³⁷ Since the Feasibility Study was conducted, a survey of diesel particulate emissions in the region has shown that since 2005, emissions from shipping have declined 16%, rail traffic emissions have declined 25%, and heavy truck emissions have declined 50%,³⁸ The Port of Seattle, as part of the Northwest Ports Clean Air Strategy, plans to reduce particulate emissions per ton of cargo by 75% of 2005 levels from by 2015, and by 80% by 2020.³⁹ Given the baseline conditions in the area, EPA's new fuel regulations, the agency's use of "green remediation" policies, and the Port's own Clean Air Strategy, while some air pollution impacts from cleanup construction are likely, the magnitude of these impacts is expected to be limited.

Noise pollution: Each stage of remediation entails noise that could impact quality of life for nearby residents or workers at other facilities. As with all construction-type work, there are also hearing safety issues and comfort concerns for those who conduct the remediation work.

Noise minimization and monitoring at other Superfund sites provide useful models and data for developing the Duwamish cleanup plan. Materials produced for the Hudson River PCB Superfund Site, for example, include modeling results and proposed mitigation measures for activities that could exceed noise standards.⁴⁰ They also include actual measurement data from other sites, including data showing exceedances of noise standards. Many variables affect whether noise will be a problem and must be considered in planning a remediation that minimizes noise problems for neighbors and workers. These include, but are not limited to proximity of residences and businesses to remediation activities, wind and air conditions, time of year, time of day, type of equipment used, etc.

³⁵ Final Feasibility Study, Appendix L: Lower Duwamish Waterway, Seattle, WA. Lower Duwamish Waterway Group; October 2012.

³⁶ Emissions Standards Reference Guide. Environmental Protection Agency: <http://www.epa.gov/otaq/standards/basicinfo.htm>

³⁷ Superfund Green Remediation Strategy. Environmental Protection Agency; September 2010.

³⁸ "Air pollution from Puget Sound ports is declining, survey finds." The Seattle Times; October 30, 2012.

³⁹ Draft Northwest Ports Clean Air Strategy, 2013 Update. Port of Seattle; June 2013.

⁴⁰ See for example: Hudson River PCBs Superfund Site, Phase 1 Final Design Report, Attachment J – Noise Abatement Assessment. Epsilon Associates; March 21, 2006.

As discussed above, noise pollution is also already a significant issue in the South Park and Georgetown neighborhoods. While additional noise from cleanup construction may not make a big difference, it could exacerbate an already acute problem. Lying directly on the river, South Park is more likely to be affected than Georgetown, since the closest Georgetown residences are half a mile from the river. However, most cleanup construction in proximity to the residential areas will be completed during the Early Action Area remediation, so only a small portion of the riverwide cleanup plan will be conducted close to residences.

Recent river-based construction activities have provided a reference point for evaluating noise impacts that can be expected from cleanup-related construction. The South Park Bridge is undergoing reconstruction, requiring round-the-clock construction activities in close proximity to both waterfront residences and "live-aboards" in the South Park Marina. The King County Department of Transportation (DOT), which is constructing the bridge, conferred with the community and instituted a noise and light abatement program to minimize impacts. Despite 24-hour construction activity, complaints have been minimal, and residents praise the performance of the bridge construction crews.⁴¹ Earlier this year, Boeing began cleanup construction activities at Plant 2, directly across the river from waterfront residences in South Park. Following King County DOT's example, Boeing negotiated a 24-hour construction schedule and noise abatement strategy with South Park residents, and to date, there have been few complaints.⁴²

Minimal complaints from this early action remediation work and other construction activities on the Duwamish bode well. Careful planning is still essential, however, to make sure that the good noise record continues. While the likelihood of noise impacts during cleanup construction exists, if similarly successful noise mitigation measures are employed for cleanup activities within the residential reaches of the river, the magnitude of these impacts is anticipated to be limited.

B. Construction Opportunities: Local "green" cleanup jobs

Employment is one of the strongest favorable determinants of health.⁴³ Employment, job training, and skill development generate personal income and increase the likelihood of future employment and income stability. These can contribute to personal and family adaptive capacity, improved healthful practices, better access to and ability to pay for health care, reduced risk for cardiovascular and other major diseases, and extended lifespan.

⁴¹ Dagmar Cronn, South Park Neighborhood Association President. Personal communications; 2012–13.

⁴² Ibid.

⁴³ Robert Wood Johnson Foundation. "How Does Employment—or Unemployment—Affect Health?" Healthy Policy Snapshot: Public Health and Prevention; March 2013.

The Hudson River cleanup example provides useful information regarding job creation at Superfund sites. Jobs are an important benefit that can accrue to local Superfund communities. The Hudson cleanup created 350 jobs, 210 of which were local, during cleanup in 2012. In addition, 285 regional businesses won contracts to provide supplies and services to the dredging operation there.

King County commissioned a study of the number of jobs expected to be created by the various Duwamish cleanup alternatives evaluated in the Feasibility Study. The alternative closest to the Proposed Plan (5C) was projected to create 270 full-time full-year jobs annually, and an additional 680 full-time part-year jobs annually, during the construction window.⁴⁴ The study notes: "About half the jobs can be classified as 'green jobs' because they are associated with cleaning up and restoring the natural environment, such as construction, dredging, and environmental consulting jobs." EPA's Superfund Jobs Training Initiative has recently begun a program to train and help place local residents in cleanup-related jobs related to the Duwamish Early Action Area cleanup projects.

Similar potential exists for creating jobs for Georgetown and South Park residents during the riverwide cleanup on the Duwamish River. It is likely that EPA's Superfund Jobs Training Initiative or Region 10's Environmental Workforce Development and Job Training Grants program will be part of a long-term strategy to facilitate local hiring for the Duwamish cleanup, with beneficial effects ranging limited to moderate, depending on the scale of the local jobs program and the cleanup itself.

C. Residual Contamination:

All four of the chemicals of concern for human health (PCBs, arsenic, cPAHs, and dioxins/furans) found in the Duwamish River can cause cancer and other health effects in humans, via skin contact, inhalation or ingestion. Beaches throughout the lower Duwamish River have been evaluated and several publicly accessible beach areas exceed State health standards for direct contact for one or more of the chemicals of concern. The EPA predicts that its cleanup plan will approach but not meet direct contact goals for arsenic on some publicly accessible shorelines. There are uncertainties in the predictive model, particularly the potential influence of pollution source controls, so while some impact is likely, the magnitude is difficult to predict, as actual residual contamination could prove to be either higher or lower. Washington State is also considering evidence that the arsenic standard is not sufficiently health-protective and should be updated, so current standards may not fully reflect harmful health effects from predicted residual levels of contamination. However, predicted residual levels are fairly close to Puget Sound background, so it may not be feasible for the cleanup to provide greater levels of protection.

⁴⁴ Estimates of Economic Impacts of Cleanup Activities Associated with the Lower Duwamish Superfund. ECONorthwest; November 29, 2010.

Table 1: POTENTIAL HEALTH EFFECTS

| | Direction | Likelihood | Magnitude | Distribution |
|-----------------------------------|------------------|-------------------|--------------------|---|
| Construction disruption/pollution | ADVERSE | POSSIBLE – LIKELY | LIMITED – MODERATE | Neighborhood differences; Disproportionate harm to fishers, beach users |
| Construction opportunities (jobs) | BENEFICIAL | LIKELY | LIMITED – MODERATE | Restorative equity effect |
| Residual contamination on beaches | ADVERSE | POSSIBLE | LIMITED | Disproportionate harm to beach users |

C) Strategies/Recommendations

Minimize health impacts from construction:

To address water pollution and fish contamination from disruption of sediments:

- Employ environmental dredging technology and equipment, using experienced contractors and operators, based on site-specific conditions.

To address congestion, road wear and safety hazards resulting from construction:

- Work with affected communities to reach agreements on vehicle traffic routes and develop safety and/or mitigation measures for local impacts.

To address air pollution, noise and related emissions resulting from cleanup:

- Use ultra low sulfur fuels and biofuel blends in all construction equipment, machinery, and transport vehicles/vessels (e.g., trucks and barges; new federal rules already require ULSF for rail transport).
- Adopt noise and light minimization plans. Measures included in these plans may include placement requirements for equipment, specifications regarding types of equipment, limiting hours of operation, creating buffers and other measures.

Maximize health opportunities from construction:

To address opportunities for local "green" jobs created by cleanup activities:

- Develop and implement local cleanup (remediation, pollution source control, restoration) jobs training and placement program to benefit affected residents (Superfund Jobs Training Program, or other local initiative).

- Develop a program to solicit and encourage local contractors and service providers to bid on cleanup-related contracting opportunities.

Mitigate health impacts from contamination on beaches:

To address current and residual chemical contamination at local beaches:

- Provide educational signage and hand-washing stations at public local beaches until cleanup goals are met.

**Health Impact Assessment
Proposed Cleanup Plan for the
Lower Duwamish Waterway Superfund Site**

Technical Report

June 13, 2013

Effects of the proposed cleanup plan on local residents (continued)

Revitalization and gentrification

DUWAMISH SUPERFUND CLEANUP HEALTH IMPACT ASSESSMENT

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HOW WILL THE DUWAMISH SUPERFUND CLEANUP AFFECT HEALTH IN ADJACENT RESIDENTIAL COMMUNITIES (GEORGETOWN & SOUTH PARK)?

The substantial and enduring effects of the Lower Duwamish Superfund Cleanup project may reasonably be expected to affect the health of resident populations in Georgetown and South Park, the communities adjacent to the Superfund site. In scoping efforts for the Duwamish HIA, a Residential Community Advisory Committee composed of Georgetown and South Park residents identified two general categories of potential health effects of the Cleanup that are primary concerns for these communities: effects associated with construction activities, and effects connected to community revitalization and gentrification. Accordingly, for each of these two broad classes of potential health effects, the following reports document:

- Existing conditions of the affected environment in which the project effects would be imposed;
- Assessment of the character and likelihood of particular project-related health effects; and
- Recommendations to prevent adverse health effects, and to promote beneficial health outcomes, that may result from the Cleanup.

HOW WILL COMMUNITY REINVESTMENT SPURRED BY THE CLEANUP AFFECT HEALTH?

As described in the community profile of the Duwamish Superfund Cleanup HIA, the Georgetown and South Park neighborhoods of Seattle currently have lower median household incomes than many other Seattle neighborhoods, the City as a whole, or King County. In the future, the evident environmental improvements implemented under the Duwamish Superfund Cleanup would be expected to increase the general esteem of areas surrounding the Superfund site and spur economic reinvestment in Georgetown and South Park. Such flow of resources into these neighborhoods would likely contribute to the evolution of their character. For example, past Superfund Cleanup projects have been found to increase housing values in areas near Superfund sites (Gamper-Rabindran, 2011). The U.S. Environmental Protection Agency (EPA) recognizes the potential problematic implications of such community changes in their draft Environmental Justice Analysis for the Lower Duwamish Waterway (LDW) Cleanup:

“Community groups have raised concerns over gentrification as a negative outcome for a successful Superfund cleanup within the LDW. The community groups envision equitable revitalization rather than gentrification of the neighborhoods surrounding the LDW to preserve the benefits of their diverse and vibrant communities” (EPA, 2013a).”

Framed by such concerns, as voiced by the Residential Community Advisory Committee for the Duwamish HIA, this report investigates how potential Cleanup-related changes in the prevailing economic, physical, and social character of Georgetown and South Park could be expected to yield attendant positive or negative effects on the health of the resident populations. Then, recommendations are made for limiting potential adverse health effects of Cleanup-spurred reinvestment and promoting equitable revitalization and associated health benefits.

1.0 BACKGROUND

Accurately predicting the comprehensive health results from reinvestment-related community changes would be extremely complex and involve controlling for innumerable interacting factors. Yet, there are a number of relatively well-documented associations that are useful in discerning the likely relationships between general trends in urban neighborhood characteristics and population health. In particular, increasing evidence has characterized the intricate interweaving of aspects of “place”- including local economic, physical, and social factors- that substantively influence local population health.

1.1 HOW ARE “PLACE” & HEALTH RELATED?

The Social Ecological Model (SEM) offers one useful theoretical approach for conceiving of the complex relationships between individuals and groups in neighborhoods, their local economic, physical, and social conditions, and their health. Building upon systems theory, the SEM is an “overarching framework... for understanding the interrelations among diverse personal and environmental factors in human health and illness” (Jamner & Stokols, 2000).

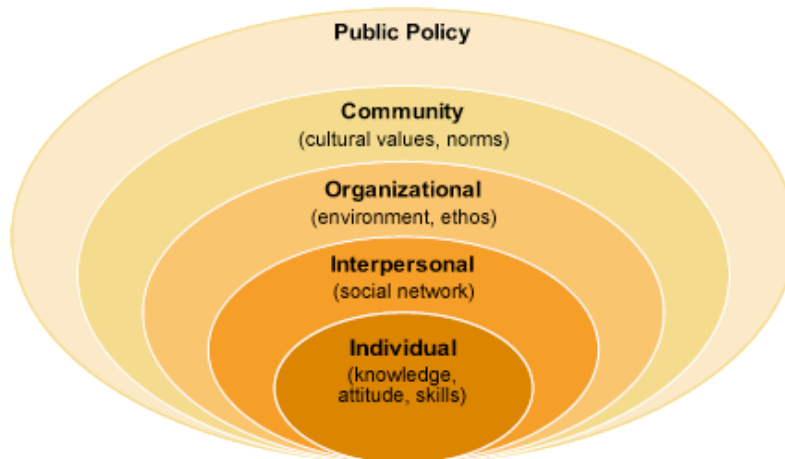


FIGURE 1. The Social Ecological Model

Source: U.S. Department of Health and Human Services, National Institutes of Health, Office of Behavioral and Social Science Research. 2012. Retrieved from <http://www.esourceresearch.org/Default.aspx?TabId=736>. Adapted from Bronfenbrenner, U. 1977. Toward an experimental ecology of human development. American Psychologist, 32(7), 513-531.

In accordance with the SEM, one may conceive of health as the effective product of interactions between numerous health determinants at multiple levels of organization. By attending to individual, interpersonal, organizational, community, and policy factors as nested influences on health, an SEM-based perspective facilitates interpretation of the complicated engagement of such factors in yielding health outcomes. Accordingly, modern researchers often aggregate findings from varied areas of specialized study to accumulate broader understanding of the seemingly disparate factors that can combine to affect health in a given realm of interest. Such an approach is valuable in assessing the complex relationships between “place” and community health that will be of crucial importance to future effects of the Duwamish Superfund Cleanup.

In a previous study addressing the connections between place and health, PolicyLink followed an SEM-based approach to catalog the characteristics of local economic, social, physical, and service environments that have been shown to influence residential health. The researchers concluded that, when a variety of particular aspects of a community are robust, residents’ health improves, while residents’ health declines when such factors are absent (PolicyLink, 2007). Table 1 highlights the PolicyLink findings, as summarized by graduate students studying Health Impact Assessment at the University of Washington.

Because local community characteristics are so influential on health, it is significant that neighborhoods in the United States are often informally but effectively segregated according to race, ethnicity, and income. Such *de facto* segregation limits access to healthy foods, safe and walkable streets, and clean environments. In addition, low-income and minority populations endure disproportionately high crime rates, under-funded schools, insufficient services, and poor transportation and housing options. Communities of color also bear disproportionate rates of diabetes, high blood pressure, obesity, and asthma (PolicyLink, 2007). Considering these health effects of neighborhood stratification, and given that the neighborhoods adjacent to the Duwamish Superfund Cleanup site are lower-income and higher-minority neighborhoods than many Seattle neighborhoods, disparity must be a key consideration in assessing the Cleanup’s effects on place and health.

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TABLE 1. Characteristics of Local Environments that Favorably Influence Health*Source: PolicyLink, 2007. As compiled by 2012 University of Washington HIA Class.*

| Economic Environment | Social Environment |
|--|---|
| <p>A strong economy is protective for neighborhood health. Aspects of a robust economic environment include:</p> <ul style="list-style-type: none"> • Commercial investment • Living-wage jobs with health benefits • Safe workplaces • Businesses that provide healthy food option for all residents • Diverse and quality businesses (including banks, restaurants) • Homeownership • Less residents with low-wage jobs, no benefits, and unsafe working conditions • Racial and economic desegregation | <p>Creating and experiencing strong community empowers individuals to advocate for themselves and for others. Positive social environments allow for:</p> <ul style="list-style-type: none"> • Knowledge, skill, and information sharing • Leadership development to increase the community's capacity for mobilization, civic engagement, and political power • Communities able to make decisions on the physical spaces of their neighborhoods, including investment in parks, schools, etc. |
| Physical Environment | Service Environment |
| <p>A well-designed and well-built physical environment protects the health of residents. Built features that support health include:</p> <ul style="list-style-type: none"> • Parks and other green spaces • Full-service grocery stores and farmers' markets • Safe, walkable streets with sidewalks and less motor vehicle traffic • Convenience to transportation, including public transit and safe and active transportation options • Good accessibility to daily services (shops, schools, jobs) • Houses removed from polluting businesses and highways • Healthy, affordable housing • Urban design that supports physical activity | <p>Equitable distribution of and access to community services is protective for health. The following factors support effective services:</p> <ul style="list-style-type: none"> • Healthcare facilities staffed by culturally competent staff • Police and fire protection • Minimal crime • Active streets and sidewalks • Schools, parks, and recreational facilities available to residents • Water and sewer systems • Facilities for neighborhood meetings • Safe, reliable, and clean mass transit • Culturally competent public health providers • Churches, social clubs, and block groups • Leadership development |

Many residents of Georgetown and South Park have voiced the belief that the overall character of the Duwamish Cleanup's health outcomes, the determination of whether the Cleanup will positively or negatively affect their health, could hinge on how resulting reinvestment plays out in their communities. The residential populations may enjoy widespread health benefits if

Cleanup-spurred reinvestment advances revitalization that equitably benefits a full spectrum of residents. But population health could suffer if reinvestment spurs gentrification that profits primarily newer, wealthier residents. The known potential for such harm is well characterized by the National Environmental Justice Advisory Council (NEJAC), in a 2006 report on unintended impacts of some of EPA’s cleanup, redevelopment and revitalization efforts:

“Displacement, gentrification, public health, and land use concerns are all connected, directly or indirectly, to the EPA’s mission of protecting public health and the environment... When outcomes from cleanup and revitalization projects are assessed, EPA may have unintentionally exacerbated historical gentrification and displacement” (NEJAC, 2006).

1.2 HOW DOES COMMUNITY REINVESTMENT AFFECT “PLACE”?: REVITALIZATION AND GENTRIFICATION

While residents of economically challenged neighborhoods often passionately respond to their impressions of reinvestment in their communities, it is often a matter of debate whether development truly represents equitable revitalization or disparity-promoting gentrification. In practical terms, revitalization efforts may occur at small or large scales; be driven by public or private interests; and be implemented by individuals, groups, or institutions. Accordingly, with respect to given projects, from cleaning and renewal of local sites, to broadcloth land development, various residents may perceive the resulting neighborhood changes as either improvements or problems. Even when community changes lead to shifts in local populations comprising replacement of some lower-income residents by higher-income residents (change commonly labeled “gentrification”), long-term residents may see benefits if the transitions strengthen the local tax base and propel development of new local services and amenities. But if such dynamics extend further, the overall character of neighborhoods may change and the bulk of original residents may be displaced and unable to enjoy the community improvements.

The degree, rate, and character of community development are, thus, critical to residential

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opinions of desirable versus undesirable change. Yet, such residential perceptions are also inherently perspectival, and objective identification of phenomena as equitable revitalization or gentrification can be problematic. As such, in a widely cited 2001 Brookings Institution paper dealing with neighborhood change and addressing gentrification, Maureen Kennedy and Paul Leonard usefully take up the challenge of clarifying definitions. Noting that the “term ‘gentrification’ is both imprecise and quite politically charged,” the authors highlight professional perceptions of distinctions between gentrification and more equitable revitalization, methodically describing the respective phenomena (Kennedy & Leonard, 2001). These distinctions are summarized in Table 2.

Kennedy and Leonard describe revitalization as “the process of enhancing the physical, commercial and social components of neighborhoods and the future prospects of residents through private sector and/or public sector efforts.” They further flesh out that “physical components of revitalization may include upgrading of housing stock and streetscapes, commercial components may include the creation of viable businesses and services in the community, and social components include increasing employment and reductions in crime.” Such revitalization may be considered equitable, the authors contend, when it advances “the creation and maintenance of economically and socially diverse communities that are stable over the long term, through means that generate a minimum of transition costs that fall unfairly on lower income residents.”

The authors also realistically attend to the complexity of community development, noting that, “gentrification sometimes occurs in the midst of the revitalization process.” In contrast to more equitable revitalization, Kennedy and Leonard express that gentrification is a “process by which higher income households displace lower income residents of a neighborhood, changing the essential character and flavor of that neighborhood.” They further specify that the gentrification process typically involves three critical conditions: “displacement of original residents; physical upgrading of the neighborhood (particularly of housing stock); and change in neighborhood character.”

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TABLE 2: Typical Effects of Equitable Revitalization and Gentrification*Source: Kennedy & Leonard, 2001.*

| Result of Reinvestment and Development | Economic Effects | Physical Effects | Social Effects |
|--|---|--|--|
| Equitable Revitalization | <ul style="list-style-type: none"> • Expansion of local businesses and services • Increased employment • Increased economic security • Gradually increasing property values | <ul style="list-style-type: none"> • Improvement of local housing stock • Maintenance and improvement of infrastructure • Improvement and activation of public spaces | <ul style="list-style-type: none"> • Decreased social polarity • Increased social cohesion • Decreased crime • Strengthened fabric of community |
| Gentrification | <ul style="list-style-type: none"> • Influx of higher income residents • Increased demand for upscale services and amenities • Greater regional esteem • Rising costs of living • Rapidly increasing property values • Increased tax base | <ul style="list-style-type: none"> • Upgrade or replacement of local housing stock and neighborhood infrastructure • Development of upscale commercial establishments and amenities • Displacement of previous businesses | <ul style="list-style-type: none"> • Shifting societal structure • Increased social polarity • Increased class tension • Decreased community cohesion • Displacement of lower income residents • Decreased diversity |

2.0 WHAT DO EXISTING CONDITIONS IN GEORGETOWN & SOUTH PARK INDICATE ABOUT FUTURE REINVESTMENT & DEVELOPMENT SCENARIOS?

As described above, community revitalization efforts and related gentrification may lead to changes in the prevailing economic, physical, and social character of communities, and may consequently affect the health of local residents. Thus, the current conditions in Georgetown and South Park that influence future development scenarios, in which reinvestment will lead to either more equitable- or more gentrifying- revitalization, may strongly influence the community health effects of the Duwamish Cleanup.

Analysis Method

In seeking to understand local characteristics that determine the outcomes of reinvestment in neighborhoods, researchers have developed indicators for gauging gentrification in progress in communities and for estimating the likelihood of future gentrification. The next two sections (2.1 and 2.2) utilize data from the U.S. Census Bureau's 2000 and 2010 Census, as well as interim data from the Bureau's American Community Surveys, to assess conditions in Georgetown and South Park (as well as neighboring areas, the City of Seattle, and King County) in relation to these indicators and to convey findings regarding gentrification dynamics in the communities. The following section (2.3) then addresses institutional and grass roots measures that present prospects for more equitable community revitalization, as compiled via literature review with guidance from the Duwamish HIA Residential Community Advisory Committee and Liaison Committee.

2.1 IS GENTRIFICATION IN PROGRESS IN GEORGETOWN AND SOUTH PARK?

Through analysis of neighborhood changes associated with various modes of investment, the Brookings Institution (Kennedy & Leonard, 2001) and the Dukakis Center (Billingham, Bluestone, & Pollack, 2010) have identified multiple measurable neighborhood characteristics that are nationally recognized as indicators of gentrification in progress in

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communities. Table 3 assesses existing conditions in Georgetown and South Park with respect to these indicators, and presents findings regarding trends that would demonstrate gentrification in progress. Table 4 at the end of Section 2.1 summarizes the conclusions from this analysis.

Table 3. Indicators of Gentrification in Progress in Georgetown and South Park

Source: U.S. Census Bureau. 2012. American FactFinder. Retrieved from <http://factfinder2.census.gov>

*Historical dollar figures have been converted to 2010 dollars using the Consumer Price Index (U.S. Bureau of Labor Statistics, 2012)

| Indicators of Gentrification | Existing Conditions in Georgetown | Existing Conditions in South Park | Findings |
|---|--|--|---|
| Increased proportion of higher income residents | <p>Records reflect a recent trend of decreasing poverty in Georgetown. As reflected in Census 2000 data (U.S. Census Bureau, 2000) and the Census Bureau's American Community Survey (ACS) 2006-2010 combined estimates (U.S. Census Bureau, 2010a), the proportion of residents with household incomes below the poverty level decreased from about 19.3% to 14% in Georgetown between 2000 and 2010, compared to a drop from 9.8% to 6.4% in Beacon Hill. This contrasts with increases from 11.8% to 12.7% in the City of Seattle, and from 8.4% to 10.2% in King County.</p> <p>Georgetown also has a decreasing proportion of residents with household incomes over \$100,000. In</p> | <p>Records reflect a recent trend of increasing poverty in South Park. As reflected in Census 2000 data and ACS 2006-2010 estimates, the proportion of residents with household incomes below the poverty level increased from about 12.5% to 16.1% in South Park between 2000 and 2010, contrasting with a drop from 14.7% to 7.4% in adjacent Highland Park. In the same period, there were increases from 11.8% to 12.7% in the City of Seattle, and from 8.4% to 10.2% in King County.</p> <p>South Park also has an increasing proportion of residents with household incomes over \$100,000. In the period between Census 2000 reporting and ACS 2006-2010 estimates, data shows</p> | <p>Distribution of income in Georgetown seems to be trending toward the middle, and slightly downward, with decreasing proportions of impoverished and high-income residents, and a declining median income (when factoring in inflation).</p> <p>In contrast, the distribution of income in South Park seems to be trending toward bipolarity, with increasing proportions of impoverished and high-income residents, and growth in the median income.</p> |

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| Indicators of Gentrification | Existing Conditions in Georgetown | Existing Conditions in South Park | Findings |
|---|---|---|--|
| | <p>the period between Census 2000 reporting and ACS 2006-2010 combined estimates, data shows that the fraction of Georgetown residents with household incomes over \$100,000 dropped from 8.1% to 7.1%, while the share of residents with incomes in this range increased from 13.1% to 27.6% in Beacon Hill, from 15.8% to 28.1% in Seattle, and from 18.7% to 31.7% in King County.</p> <p>During the past decade, median household income (*in 2010 dollars) in Georgetown decreased 15.8% from \$44,048*, as reported in Census 2000 data, to \$37,097, as reflected in ACS 2006-2010 combined estimates. In the same period: the median income in Beacon Hill rose from \$63,738* to \$68,525 (7.5%); Seattle's median income rose slightly from \$59,862* to \$60,665 (1.3%); and median income in King County decreased slightly from \$69,575* to \$68,065 (-2.2%).</p> | <p>that the fraction of South Park residents with household incomes over \$100,000 rose from 9.2% to 12.2%, while the share of residents with incomes in this range increased from 13.2% to 21.5% in Highland Park, 15.8% to 28.1% in Seattle, and from 18.7% to 31.7% in King County.</p> <p>During the past decade, median household income (*in 2010 dollars) in South Park increased 6.0% from \$40,466*, as reported in Census 2000 data, to \$42,907, as reflected in ACS 2006-2010 combined estimates. In the same period: the median income in Highland Park rose from \$61,304* to \$63,333 (3.3%); Seattle's median income rose slightly from \$59,862* to \$60,665 (1.3%); and median income in King County decreased slightly from \$69,575* to \$68,065 (-2.2%).</p> | |
| Increased educational attainment of residents | Data from the Census Bureau indicates the proportion of Georgetown residents, age 25 or older, | Data from the U.S. Census Bureau indicates the share of South Park residents, age 25 or | Data do not indicate a growth trend in educational |

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| Indicators of Gentrification | Existing Conditions in Georgetown | Existing Conditions in South Park | Findings |
|-----------------------------------|---|---|--|
| | with bachelor's degrees decreased from 20.6% in 2000 to 14.9% (+/- 7.7) in the ACS 2006-2010 combined estimates. The reported proportions in Beacon Hill also lightly decreased from 20.9% to 19.6% for the same period. This contrasts with increases reported in Seattle from 47.2% to 55.1%, and in King County from 40% to 45.2%. | older, with bachelor's degrees increased from 6.1% in 2000 to 13.7% (+/- 5.1) in the ACS 2006-2010 combined estimates. This compares with reported increases in Highland Park from 22.6% to 32.9%, in Seattle from 47.2% to 55.1%, and in King County from 40% to 45.2%. | attainment in Georgetown. However, educational attainment among South Park residents has increased during the past decade. |
| Decreased racial/ethnic diversity | According to data from the 2000 and 2010 Census (U.S. Census Bureau, 2010b), the proportion of persons of color in Georgetown decreased from 43.5% to 34.6%, compared to a decrease in adjacent Beacon Hill from 81.8% to 79.6%, and contrasting with increases in the City of Seattle from 32.1% to 33.7%, and in King County from 26.6% to 35.2%. | South Park has a substantially higher representation of person of color than the City of Seattle or King County as wholes. According to data from the 2000 to 2010 Census, the proportion of persons of color in South Park increased from 66.2% to 68.1%, compared to increases in adjacent Highland Park from 48.7% to 50.5%, in the City of Seattle from 32.1% to 33.7%, and in King County from 26.6% to 35.2%. | In the past decade there was a decrease in the proportion of persons of color residing in Georgetown. South Park residents include a large and growing proportion of persons of color, in comparison to the surrounding area. |
| Increased rents and home values | Rents have risen more quickly in Georgetown than in neighboring area or in broader Seattle or King County. Data from the | Rents have risen more quickly in South Park than in neighboring area or in broader Seattle or King County. Data from | Rents and home values have been increasing in Georgetown at faster rates than |

DUWAMISH SUPERFUND CLEANUP HEALTH IMPACT ASSESSMENT

| Indicators of Gentrification | Existing Conditions in Georgetown | Existing Conditions in South Park | Findings |
|------------------------------|---|---|---|
| | <p>2000 Census (*converted to 2010 dollars) and ACS 2006-2010 combined estimates indicate that median rent in Georgetown increased 17.1% during the past decade, from \$714* to \$836. During the same period, median rents in adjacent Beacon Hill decreased 20.4% from \$1,250* to \$995, median Seattle rents rose 4.9% from \$913* to \$958, and median rents in King County grew 4.1% from \$960* to \$999.</p> <p>Similarly, home values have increased at a faster rate in Georgetown than in neighboring area or the City of Seattle or King County as wholes. Data from the 2000 Census (*converted to 2010 dollars) and ACS 2006-2010 combined estimates indicate that median home values in Georgetown increased around 87.8% during the past decade, from \$170,064* to \$319,300. During the same period, median home values in neighboring Beacon Hill rose 65.5% from \$228,187* to \$377,542, median Seattle home values rose</p> | <p>the 2000 Census (*converted to 2010 dollars) and ACS 2006-2010 combined estimates indicate median rent in South Park increased 36.7% during the past decade, from \$677* to \$926. During the same period, median rents in Highland Park decreased 24.5% from \$1,406* to \$1,061, median Seattle rents rose 4.9% from \$913* to \$958, and median rents in King County grew 4.1% from \$960* to \$999.</p> <p>Home values have also increased in South Park at a faster rate than in the City of Seattle or King County as wholes, similar to home values in neighboring area. Data from the 2000 Census (*converted to 2010 dollars) and ACS 2006-2010 combined estimates indicate that median home values in south Park increased around 70.1% during the past decade, from \$151,576* to \$257,800. During the same period, median home values in neighboring Highland Park rose 71.6% from \$197,416* to \$338,700, median Seattle home</p> | <p>those of neighboring Beacon Hill, or broader City of Seattle or King County.</p> <p>Rents have been increasing in South Park at faster rates than those in neighboring Highland Park, the broader City of Seattle, or King County. Home values have also been increasing in South Park at faster rates than in the City of Seattle or King County. This local increase in home values is similar to that in neighboring Highland Park.</p> |

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| Indicators of Gentrification | Existing Conditions in Georgetown | Existing Conditions in South Park | Findings |
|--|---|---|--|
| | 42.9%, from \$319,234* to \$456,200, and median home values in King County grew 42.2% from \$286,690* to \$407,700. | values rose 42.9%, from \$319,234* to \$456,200, and median home values in King County grew 42.2% from \$286,690* to \$407,700. | |
| Increased proportion of home ownership | Data from Census 2000 and Census 2010 indicate the proportion of occupied housing in Georgetown that was occupied by homeowners modestly increased from 36.2% to 37.5% during the past decade, while remaining lower than in other neighboring area and the broader City and County. In contrast, the same period saw modest declines in homeowner occupancy from 76.3% to 71.7% in adjacent Beacon Hill, from 48.4% to 48.1% in the City of Seattle, and from 59.8% to 59.1% in King County. | Data from Census 2000 and Census 2010 indicate the proportion of occupied housing in South Park that was occupied by homeowners increased from 44.9% to 46.7% during the past decade, while remaining lower than in some neighboring area. The same period saw a minimal increase in homeowner occupancy from 64.5% to 64.6% in adjacent Highland Park, and modest declines from 48.4% to 48.1% in the City of Seattle, and from 59.8% to 59.1% in King County. | Both Georgetown and South Park experienced increases in the proportion of homeownership from 2000 to 2010, while other neighboring area and the surrounding City and County saw decreases in levels of owner-occupied housing. Georgetown recently had a lower proportion of owner-occupied housing than Beacon Hill, the City of Seattle, or the County, while South Park recently had a level of owner-occupied housing similar to the City, somewhat less than the County, and less than nearby Highland Park. |

Conclusions Regarding Gentrification in Progress in Georgetown & South Park

As described in Table 3, above, when considering a range of factors recognized to indicate gentrification in progress:

- **In Georgetown**, local trends in racial composition, rents and home values, and home ownership suggest that gentrification is beginning; and
- **In South Park**, local trends in income, educational attainment, rents and homes values, and home ownership suggest that gentrification is well underway and ongoing.

These conclusions are summarized in Table 4.

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TABLE 4. SUMMARY: Indicators of Gentrification in Progress in Georgetown & South Park

| Indicator of Gentrification | Data Analysis | Data Quality | Occurring in Georgetown? | Magnitude in Georgetown | Occurring in South Park? | Magnitude in South Park |
|---|---|---------------------------------------|--|---|--|--------------------------------|
| Increased proportion of higher income residents | Analysis of income data (2000 Census & ACS 2006-2010) | Acceptable | No | (Income decreasing) | Yes | Moderate |
| Increased residential educational attainment | Analysis of education data (2000 Census & ACS 2006-2010) | High margin of error in ACS 2006-2010 | No | (Educational attainment potentially decreasing) | Yes | Substantial |
| Decreased racial/ethnic diversity | Analysis of diversity data (2000 & 2010 Census) | Acceptable | Yes | Substantial | No | (Diversity increasing) |
| Increased rents and home values | Analysis of rent and housing data (2000 Census & ACS 2006-2010) | Acceptable | Yes | Moderate | Yes | Substantial |
| Increased proportion of home ownership | Analysis of home ownership data (2000 & 2010 Census) | Acceptable | Yes | Moderate | Yes | Moderate |
| Overall interpretation of above indicators | Combined analysis of above factors | Acceptable | Indicators suggest gentrification is beginning in Georgetown. | | Indicators suggest gentrification is well underway in South Park. | |

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2.2 IS FUTURE GENTRIFICATION LIKELY IN GEORGETOWN AND SOUTH PARK?

To comprehend potential effects of future reinvestment and development scenarios in communities, it is necessary to understand not only gentrification in progress in the neighborhoods, but also the likelihood of future gentrification. Toward these ends, the Brookings Institution has described multiple local characteristics that can promote gentrification, including rapid job growth, tight housing markets, preference for city amenities, increased traffic and lengthening commutes, and public sector policies (Kennedy & Leonard, 2001). In a recent study, the Center for Community Innovation at the University of California further specifies indicators that can be assessed to identify neighborhoods likely to experience future gentrification (Chapple, 2009). Table 5 provides analysis and findings regarding some of these recognized indicators of likely future gentrification, as they exist in Georgetown and South Park. Table 6 at the end of Section 2.2 summarizes the conclusions from this analysis.

TABLE 5. Indicators of Likely Future Gentrification in Georgetown and South Park

Source: U.S. Census Bureau. 2012. American FactFinder. Retrieved from <http://factfinder2.census.gov>

| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|---|--|---|---|
| Increasing commute time | Records reflect a recent trend of increasing commute times in Georgetown. As reflected in Census 2000 data and ACS 2006-2010 combined estimates, median commute times for Georgetown commuters increased from between 15 and 19 minutes in 2000 to between 30 and 34 minutes in 2010. In the same period, median commute times remained between 20 and 24 minutes in adjacent Beacon Hill, the City of | Records reflect a recent trend of increasing commute times in South Park. As reflected in Census 2000 data and ACS 2006-2010 combined estimates, median commute times for South Park commuters increased from between 20 and 24 minutes in 2000 to between 25 and 29 minutes in 2010. In the same period, median commute times dropped from between 25 and 29 minutes to between 20 and 24 minutes in | In contrast to surrounding areas, median commute times have been increasing in South Park and increasingly substantially in Georgetown. |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|--|--|--|---|
| | Seattle and broader King County. | adjacent Highland Park, and remained between 20 and 24 minutes in the City of Seattle and broader King County. | |
| High percentage of workers taking public transit | <p>Records reflect faster-growing rates of transit use in Georgetown than in adjacent area or the broader surroundings. Data from the Census Bureau indicates the proportion of Georgetown commuters, age 16 or older, that utilized public transit (excluding taxi cabs) to get to work almost doubled in the past decade, from 13.2% in 2000, to 26.0% as estimated for 2006-2010 combined.</p> <p>The same Census 2000 data and ACS 2006-2010 combined estimates show transit use among commuters in adjacent Beacon Hill dropped from 20.3% to 15.2%, the proportion of transit users in Seattle increased from 18.3% to 19.9%, and the rate of transit use in King County increased from 9.9% to 11.7%.</p> <p>In Beacon Hill, new light-rail in Rainier Valley will likely increase transit use.</p> | <p>Records reflect faster-growing rates of transit use in South Park than in adjacent area or the broader surroundings. Data from the Census Bureau indicates the proportion of South Park commuters, age 16 or older, that utilized public transit (excluding taxi cabs) to get to work increased more than 50% in the past decade, from 16.2% of commuters in 2000, to 27.9% as estimated for 2006-2010 combined.</p> <p>The same Census 2000 data and ACS 2006-2010 combined estimates show transit use among commuters in adjacent Highland Park increased from 14.8% to 15.4%, the proportion of transit users in Seattle increased from 18.3% to 19.9%, and the rate of transit use in King County increased from 9.9% to 11.7%.</p> | The proportions of Georgetown and South Park commuters that use transit to travel to work are higher, and increasing faster, than in adjacent area, or in the broader City or County. |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|---|---|---|---|
| High percentage of non-family households | Census 2000 and 2010 data show the proportion of non-family households in Georgetown is higher than in adjacent area and the broader surroundings, having increased from 65.1% of all households in 2000 to 69.1% of all households in 2010. During the same period, the proportion of non-family households increased from 26.6% to 30.4% in adjacent Beacon Hill, from 56.1% to 57.1% in the City of Seattle, and from 40.9% to 41.5% in King County. | Census 2000 and 2010 data show the proportion of non-family households in South Park increased from 39.3% of all households in 2000 to 41.5% of all households in 2010. During the same period, the proportion of non-family households comparably increased from 37.1% to 40.6% in adjacent Highland Park, from 56.1% to 57.1% in the City of Seattle, and from 40.9% to 41.5% in King County. | <p>Georgetown has a higher proportion of non-family households than adjacent area and the broader City of Seattle and King County. The rate of such households is increasing at moderate rates in Georgetown and the surrounding areas.</p> <p>South Park has a proportion of non-family households comparable to adjacent Highland Park and King County, and less than that in the City of Seattle. The rate of such households is increasing at moderate rates in South Park and the surrounding areas.</p> |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|--|---|--|---|
| High proportion of buildings with three or more units | At the neighborhood level, Georgetown has a moderate proportion of buildings with 3 or more units. According to Census 2000 data and ACS 2006–2010 combined estimates, structures with 3 or more units made up 36.4% of Georgetown’s housing in 2000, dropping to 23.6% in 2010. In contrast, buildings with three or more units composed only 2.8% of Beacon Hill’s housing in 2000 and 6.1% in 2010. In the City of Seattle, 44.6% of housing was in structures with 3 or more units in 2000, increasing to 46.7% in 2010; in King County, the proportion of housing in buildings with 3 or more units increased from 34.9% in 2000 to 36.1% in 2010. | At the neighborhood level, South Park has a moderate proportion of buildings with 3 or more units. According to Census 2000 data and ACS 2006–2010 combined estimates, structures with 3 or more units made up 23.8% of Georgetown’s housing in 2000, increasing to 25.6% in 2010. In comparison, buildings with three or more units composed 16.1% of Beacon Hill’s housing in 2000 and 23.5% in 2010. In the City of Seattle, 44.6% of housing was in structures with 3 or more units in 2000, increasing to 46.7% in 2010; in King County, the proportion of housing in buildings with 3 or more units increased from 34.9% in 2000 to 36.1% in 2010. | Georgetown has a moderate proportion of higher-density residences, distinctly higher than adjacent area, and comparable to the broader City and County. South Park has a moderate proportion of such residences, comparable to adjacent area and lower than the broader City and County. |
| Lower median gross rent and home values compared to region | As presented in Table 3 above, median gross rents increased faster during the past decade in Georgetown than in some adjacent area or the broader City of Seattle or King County. However, Georgetown’s estimated median rent of \$836 in 2010 was still lower than the estimated median | Median gross rents also increased faster over the past decade in South Park than in some adjacent area or the broader City of Seattle or King County. However, South Park’s estimated median rent of \$926 in 2010 was still lower than the estimated median rents of \$1,061 in | Although rents and home values increased comparatively quickly in Georgetown and South Park over the past decade, estimated median gross rents and median home values in the two |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|---|---|---|---|
| | <p>rents of \$995 in adjacent Beacon Hill, \$958 in Seattle, and \$999 in King County.</p> <p>Similarly, home values increased faster during the past decade in Georgetown than in neighboring area or the City of Seattle or King County as wholes. Yet, Georgetown's estimated median home value of \$319,300 in 2010 was lower than the estimated median home values of \$377,542 in Beacon Hill, \$456,200 in Seattle, or \$407,700 in King County.</p> | <p>adjacent Highland Park, \$958 in Seattle, and \$999 in King County.</p> <p>Home values similarly increased more quickly over the past decade in South Park than in the City of Seattle or King County as wholes (in keeping with home value changes in neighboring area). Yet, South Park's estimated median home value of \$257,800 in 2010 was lower than the estimated median home values of \$338,700 in Highland Park, \$456,200 in Seattle, or \$407,700 in King County.</p> | <p>neighborhoods are still lower than those in neighboring area, the city, or the county.</p> |
| High proportion of renters compared to homeowners | <p>As the inverse of data above regarding homeownership, data from Census 2000 and Census 2010 indicate the proportion of occupied housing in Georgetown that was occupied by renters modestly decreased from 63.8% to 62.5% during the past decade while remaining higher than in other nearby area and the broader City and County. In contrast, the same period saw modest increases in renter occupancy from 23.7% to</p> | <p>Data from Census 2000 and Census 2010 indicate the proportion of occupied housing in South Park that was renter occupied was higher than in some nearby areas, while also decreasing from 55.1% to 53.3% during the past decade. The same period saw a minimal decrease in renter occupancy from 35.5% to 35.4% in adjacent Highland Park, and modest increases from 51.6% to 51.9% in the City of Seattle, and from 40.8% to 40.9% in</p> | <p>Despite growth in homeownership in Georgetown and South Park, as reflected in Table 3, there is still a relatively high proportion of renter occupancy in these two neighborhoods. The levels of renter occupancy in the communities contrast with lower levels in adjacent areas, are comparable to</p> |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|---|---|---|---|
| | 28.3% in adjacent Beacon hill, from 51.6% to 51.9% in the City of Seattle, and from 40.8% to 40.9% in King County. | King County. | levels for the City, and are higher than levels in King County. |
| High proportion of households spending a large share of household income on housing | <p>Renters: Census 2000 and ACS 2006-2010 combined estimates report the percentage of renter households in Georgetown that spent at least 30% of their household income on rent increased from 38.8% in 2000 to 47.5% in 2010, while those spending at least 50% of income on rent dropped from 28.2% to 15.7%.</p> <p>In adjacent Beacon Hill, the proportion of renter households that spent at least 30% of income on rent increased from 41.1% in 2000 to 50.8% in 2010, and those spending at least 50% of income on rent increased from 21.5% to 24.2%.</p> <p>In the City of Seattle, the percentage of renter households that spent at least 30% of income on rent increased from 41.1% in 2000 to 46.4% in 2010, while those spending at least 50% of income on rent increased from 18.0%</p> | <p>Renters: Census 2000 and ACS 2006-2010 combined estimates report the percentage of renter households in South Park that spent at least 30% of their household income on rent increased from 44.1% in 2000 to 54.8% in 2010, while those spending at least 50% of income on rent rose from 13.0% to 25.2%.</p> <p>In adjacent Highland Park, the proportion of renter households that spent at least 30% of income on rent increased from 40.2% in 2000 to 64.5% in 2010, and those spending at least 50% of income on rent increased from 19.5% to 30.2%.</p> <p>In the City of Seattle, the percentage of renter households that spent at least 30% of income on rent increased from 41.1% in 2000 to 46.4% in 2010, while those spending at least 50% of income on rent increased</p> | <p>The proportion of households spending a large share of income on home rental costs increased between 2000 and 2010 in both the City of Seattle and King County. In the Georgetown and South Park neighborhoods, changes were in keeping with those seen in the broader area.</p> <p>With regard to homeowners, the proportion of households spending a large fraction of their income on ownership costs also rose from 2000 to 2010 across broader City of Seattle and King County. However, the increase was much more</p> |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|--|---|---|--|
| | <p>to 22.4%.</p> <p>In King County, the share of renter households that spent at least 30% of income on rent increased from 40.0% in 2000 to 46.6% in 2010, while those spending at least 50% of income on rent increased from 17.5% to 22.5%.</p> <p>Homeowners: Census 2000 and ACS 2006-2010 combined estimates show the percentage of Georgetown homeowners with mortgages that spent at least 30% of their household income on home ownership costs increased from 23.2% in 2000 to 59.4% in 2010, while those spending at least 50% of income on ownership costs rose from 13.1% to 35.0%.</p> <p>In adjacent Beacon Hill, the proportion of mortgage-holding households that spent at least 30% of income on ownership costs dropped from 48.5% in 2000 to 36.0% in 2010, while those spending at least 50% of income on ownership costs increased from 16.8% to 19.4%.</p> | <p>from 18.0% to 22.4%.</p> <p>In King County, the share of renter households that spent at least 30% of income on rent increased from 40.0% in 2000 to 46.6% in 2010, while those spending at least 50% of income on rent increased from 17.5% to 22.5%.</p> <p>Homeowners: Census 2000 and ACS 2006-2010 combined estimates show the percentage of South Park homeowners with mortgages that spent at least 30% of their household income on home ownership costs increased from 28.0% in 2000 to 56.4% in 2010, while those spending at least 50% of income on ownership costs rose from 13.0% to 46.8%.</p> <p>In adjacent Highland Park, the proportion of mortgage-holding households that spent at least 30% of income on ownership costs rose from 37.4% in 2000 to 53.7% in 2010, while those spending at least 50% of income on ownership costs increased from 9.9% to</p> | <p>dramatic in Georgetown and South Park than in the broader areas. The proportion of households paying at least 30% of income on ownership costs, and those paying at least 50% of income on ownership costs, more than doubled during the decade in each neighborhood.</p> |

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| Indicators of Likely Future Gentrification | Conditions in Georgetown | Conditions in South Park | Findings |
|--|---|---|----------|
| | <p>In the City of Seattle, the percentage of mortgage-holding households that spent at least 30% of income on costs of ownership increased from 33.6% in 2000 to 41.0% in 2010, while those spending at least 50% of income on ownership costs increased from 11.4% to 15.0%.</p> <p>In King County, the proportion of mortgage-holding households that spent at least 30% of income on ownership costs increased from 32.1% in 2000 to 41.4% in 2010, while those spending at least 50% of income on ownership costs increased from 9.9% to 14.7%.</p> | <p>18.0%.</p> <p>In the City of Seattle, the percentage of mortgage-holding households that spent at least 30% of income on costs of ownership increased from 33.6% in 2000 to 41.0% in 2010, while those spending at least 50% of income on ownership costs increased from 11.4% to 15.0%.</p> <p>In King County, the proportion of mortgage-holding households that spent at least 30% of income on ownership costs increased from 32.1% in 2000 to 41.4% in 2010, while those spending at least 50% of income on ownership costs increased from 9.9% to 14.7%.</p> | |

Conclusions Regarding Future Gentrification in Georgetown and South Park

As outlined in Table 5, above, when considering a variety of recognized indicators of likely future gentrification:

- **In Georgetown**, community trends in commute times, share of commuters using transit, prevalence of non-family households, median gross rents and home values, proportion of renters to homeowners, and share of household income spent on home ownership costs indicate future gentrification is likely. Since indicators (discussed in Section 2.1) suggest gentrification is currently beginning in Georgetown, future acceleration of neighborhood gentrification would be expected.
- **In South Park**, community trends in commute times, share of commuters using transit, median gross rents and home values, proportion of renters to homeowners, and share of household income spent on home ownership costs indicate that future gentrification is moderately likely. Since indicators (discussed in Section 2.1) suggest gentrification is already well underway in South Park, ongoing neighborhood gentrification would be expected.

These conclusions are summarized in Table 6. While the conditions assessed in this section are recognized indicators of likely future gentrification, it should be noted that there are also many other economic, environmental, and social factors that will affect local investment and development. Importantly, several known environmental conditions may bear upon development dynamics in Georgetown and South Park. As described elsewhere in this HIA, air, soil, and water pollution are considered problematic in both neighborhoods. These issues are the focus of current health research and may realistically modify future residential behavior and development patterns. In addition, noise due to proximity to freight and air transport is of concern in Georgetown (and to some degree in South Park) and may affect investment and development prospects. Finally, current access to and from South Park has been complicated by the closure of the South Park Bridge. When a new bridge, now under construction, opens to traffic (predicted in fall 2013) the access changes may transform development in South Park.

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TABLE 6. SUMMARY: Indicators of Likely Future Gentrification in Georgetown & South Park

| Indicator of Likely Future Gentrification | Data Analysis | Data Quality | Occurring in Georgetown? | Magnitude in Georgetown | Occurring in South Park? | Magnitude in South Park |
|--|---|---------------------------------------|---------------------------------|--------------------------------|---------------------------------|--------------------------------|
| Increasing commute time | Analysis of commute data (2000 Census & ACS 2006-2010) | High margin of error in ACS 2006-2010 | Yes | Moderate | Yes | Moderate |
| High percentage of workers taking public transit | Analysis of transport data (2000 Census & ACS 2006-2010) | High margin of error in ACS 2006-2010 | Yes | Substantial | Yes | Substantial |
| High percentage of non-family households | Analysis of household data (2000 & 2010 Census) | Acceptable | Yes | Substantial | No | N/A |
| High proportion of buildings with three or more units | Analysis of housing data (2000 Census and ACS 2006-2010) | High margin of error in ACS 2006-2010 | No | N/A | No | N/A |
| Lower median gross rent and home values compared to region | Analysis of rent and housing data (2000 Census & ACS 2006-2010) | Acceptable | Yes | Substantial | Yes | Moderate |

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| Indicator of Likely Future Gentrification | Data Analysis | Data Quality | Occurring in Georgetown? | Magnitude in Georgetown | Occurring in South Park? | Magnitude in South Park |
|---|--|---------------------------------------|--|--------------------------------|---|--------------------------------|
| High proportion of renters compared to homeowners | Analysis of home ownership data (2000 Census & 2010 Census) | Acceptable | Yes | Substantial | Yes | Moderate |
| High proportion of households spending a large share of income on housing | Analysis of rent and ownership cost data (2000 Census and ACS 2006-2010) | High margin of error in ACS 2006-2010 | Yes | Substantial | Yes | Substantial |
| Overall interpretation of above indicators | Combined evaluation of above factors | Acceptable | Indicators suggest accelerating gentrification is likely in Georgetown. | | Indicators suggest ongoing gentrification is likely in South Park. | |

2.3 ARE THERE PROSPECTS FOR MORE EQUITABLE COMMUNITY REVITALIZATION IN GEORGETOWN AND SOUTH PARK?

The above discussion describes indicators, in Georgetown and South Park, of gentrification in progress and likely future gentrification that could displace existing residents or dramatically change the communities to the detriment of existing residents. Alongside these conditions, there is also evidence that institutional and grass roots responses could potentially provide for more equitable revitalization of the neighborhoods. Several potential options for such response are described in the following pages and summarized at the end of Section 2.3, in Table 8.

Institutionally Driven Revitalization: Partnering to Strengthen Communities

Indeed, well-coordinated institutional revitalization measures, implemented by governmental and non-governmental organizations (NGOs), can effectively transform local development dynamics. The EPA's recently forged Urban Waters program provides one example of the potency of such cooperative intervention. The EPA developed their Urban Waters strategy to protect and restore water resources and to reconnect underserved and economically distressed communities to urban water environments (EPA, 2012). Under the program, the EPA and diverse governmental and non-governmental partners coordinate to protect public health and the environment, promote environmental justice in community growth, expand economic opportunities, enhance neighborhoods, and support healthy sustainable development.

The Urban Waters program demonstrates how the EPA's technical environmental management expertise can be leveraged, in partnership, to yield broad and equitable community revitalization with benefits extending well beyond remediation of contamination. Many Urban Waters projects have results that are potentially germane to the situation around the Lower Duwamish. Table 7 outlines program elements in two watersheds that share challenges with the Duwamish Valley.

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TABLE 7. EPA Urban Waters Community Programs

Source: EPA. 2012. Retrieved from <http://www.epa.gov/urbanwaters/communities.html>

| Watershed Location | Partial list of EPA's Partners | Program Background and Achievements |
|--|--|---|
| Anacostia River Washington, D.C. and Maryland | <p>Anacostia Watershed Restoration Partnership:</p> <ul style="list-style-type: none"> • Executives from local jurisdictions • Maryland Department of Environment • Metropolitan Washington Council of Governments • Washington, D.C. Department of Environment • Washington, D.C. Water and Sewer Authority • Washington Sanitary Sewer Commission | <p>The Anacostia receives high volumes of polluted runoff from tributaries and Combined Sewer Overflow discharge, resulting in flooding, erosion, infrastructure damage, health concerns, and heavy trash and sediment deposition.</p> <p>The Partnership recently released a comprehensive Watershed Restoration Plan, facilitating community revitalization via coordination of specific projects that provide environmental, economic, and social benefits and enhance the vitality of local jurisdictions. The EPA is monitoring and enforcing Combined Sewer Overflow reduction commitments under a Long Term Control Plan.</p> |
| South Platte River in Denver, Colorado | <ul style="list-style-type: none"> • City and County parks, planning, public works, and finance departments • Colorado Water Conservation Board • Denver Urban Gardens • Denver Water • Great Outdoors Colorado • The Greenway Foundation • Trust for Public Land • Trout Unlimited • U.S. Army Corps of Engineers • Urban Drainage and Control District | <p>Urban families, paddlers, fishers, walkers, runners, and cyclists enjoy the river and connected parks. The river corridor is also highly industrialized, containing multiple railroad lines and Interstate 25. The river has been polluted by source and non-point source pollution.</p> <p>Significant community input has gone into River North and River South Greenway Master Plans and a River Vision Implementation Plan. Superfund and Brownfields cleanups are ongoing. An EPA Brownfields Area Wide Planning grant will help the City of Denver and the Greenway Foundation coordinate further cleanups toward achieving a swimmably clean river.</p> |

A multitude of organizational efforts are coordinated to transform local situations through EPA's Urban Waters program. Similarly, whether in formal centralized partnership, or simply in intensive ongoing collaboration regarding organizational efforts, a wide array of programs should be incorporated to address the complexities of future reinvestment and development in Georgetown and South Park. Nearby in the Pacific Northwest, the history of Ruston, Washington provides an example of the power of such cooperative engagement.

Ruston, WA: An Example of Powerful Partnership

The town of Ruston was first established in 1890 as "Smelter," a company town for the Tacoma Smelting and Refining Company. The site was then known for decades as the location of the ASARCO copper smelting plant on the shoreline of Commencement Bay. After the smelter closed in 1985, due to a weak copper market and pollution restrictions, a Superfund cleanup of the area was undertaken in the early 1990s. Today, the once toxic area is known as Point Ruston, a site of massive community reinvestment and coordinated land development comprising residences; retail, dining, entertainment, and lodging establishments; and open space (Point Ruston LLC, 2012).



FIGURE 2. Point Ruston Plan

Source: Point Ruston, LLC, 2012

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Based on the experience in Ruston, there is clearly local precedent for effective coordinated intervention to foster energetic community development in the wake of extensive environmental harm. Yet, even in recognition of this substantial achievement, aspects of the new development in Ruston do provide room for critique. Marketing for Point Ruston targets higher-income residents and the development seems disconnected from the previous character of the small town. Indeed, the 2000 Census (Census Bureau, 2000) and 2006-2010 ACS (Census Bureau, 2010a) reflect that Ruston's median household income increased about 23% during the past decade, while decreasing by around 3.5% in the surrounding City of Tacoma. In the midst of great efforts of numerous parties working to brighten the future of Ruston, an influx of higher income residents may be harming or displacing previous residents of the town.

The dynamics that have developed in Ruston accentuate that pursuing transformational progress in Georgetown and South Park, while successfully providing equitable benefits to all residents, will likely require extraordinary effort and concern. A very broad palette of institutional and organizational responses must be simultaneously integrated to promote neighborhood revitalization while forestalling adverse effects of gentrification. In a recent publication on Creating Equitable, Healthy, and Sustainable Communities, the EPA supports such a coordinated approach.

Reporting that, "too often, revitalization efforts in low-income or overburdened neighborhoods end up displacing long-time residents," the EPA suggests that local municipalities and organizations may avoid or mitigate such unintended impacts via "strategies that draw needed resources and amenities into established neighborhoods while helping existing residents and the commercial, service, and cultural establishments they value remain there." Specifying that "a proactive and comprehensive approach to minimizing displacement encompasses affordable housing, commercial stabilization, economic and workforce development, supportive land use policies, and community engagement" the EPA further notes that "To increase the likelihood of success, local governments and community-based organizations should initiate efforts to

mitigate displacement as soon as revitalization planning begins rather than waiting until projects are underway” (EPA, 2013b).

While the notion may seem dauntingly complex, there is precedent for successful implementation of such proactive and comprehensive response to environmental and economic challenges. For example, the California Environmental Justice Alliance (CEJA) has recently formalized an initiative called “Green Zones” that utilizes just such a thoroughgoing approach to transform communities facing environmental hazards and lacking economic opportunities into healthy neighborhoods. There are now several communities following Green Zones’ principles in implementing comprehensive revitalization measures to achieve community-based visions of sustainable economy, environment, and equity (CEJA, 2012).

Closer to the Duwamish Valley, recent developments in the Cully neighborhood of Portland, Oregon provide another example of agencies and organizations partnering to effectively achieve community revitalization via an explicitly anti-displacement model. In Cully, the EPA (via an Urban Waters Small Grant) has aligned with the State of Oregon, the City of Portland, and “Let Us Build Cully Park,” a coalition of community-based organizations, to facilitate improvement of neighborhood environmental assets by employing local residents in community projects. Via this partnership, Cully residents recently designed, built, and opened Cully Park and Community Garden, reclaiming area atop buried landfill as community green space that now supports active, healthy living (Let Us Build Cully Park, 2013).

Drawing on successes like these, it seems feasible that the Duwamish Cleanup, if appropriately planned, may catalyze such coalescence of agency and organizational revitalization measures (potentially including a variety of existing local programs described in the following section) to achieve beneficial community transformation in Georgetown and South Park.

Local Program Options for Facilitating Revitalization in Georgetown and South Park

Coordinating the effective use of revitalization measures among the diverse communities along the Duwamish, during and after the complex Duwamish Cleanup, would be a considerable undertaking. Yet, such synchronized implementation would be in line with the missions of programs that already exist in the area, and would support established plans to address revitalization in these needy Seattle communities. For example, the South Park Action Agenda notes that participation of multiple parties including the “city, county, state, and federal government, and most importantly, the community itself” will be necessary to address critical community issues such as public health and the environment, and community and economic development (South Park Community, 2006).

Toward such ends, the following partial listing of potentially relevant programs in the Seattle area offers a vision of some measures that could be marshaled to strengthen the fabric of community while economically invigorating Georgetown and South Park.

Assisting Tenants

While rent control is illegal in Washington State (Revised Code of Washington 35.21.830), the Seattle Housing Authority provides assistance to help tenants afford housing by:

- Providing tenant-based rental assistance via the Housing Choice Voucher Program (under Section 8 of the Housing Act 1937);
- Managing and operating low income public housing units in apartments are multi-family structures;
- Owning and managing Seattle Senior Housing units; and
- Managing affordable housing in Seattle’s Hope VI mixed-income residential communities at High Point, NewHolly, and Rainier Vista.

(Seattle Housing Authority, 2012)

Developing Affordable Housing

The City of Seattle's Office of Housing encourages development of new affordable housing opportunities via land use code incentives and programs such as the Multifamily Property Tax Exemption (MFTE) Program and the Rental Housing Production and Preservation Program.

Land use code incentives encourage residential and non-residential developers in Seattle to build or financially support affordable housing. Developers may be permitted bonus residential floor area above base height limits in exchange for building or funding affordable housing, and certified Transferable Development Potential can be sold to developers needing residential floor area beyond base height or floor area ratio limits. Developers may also be permitted bonus non-residential floor area above floor area ratio limits for building or funding affordable housing, and certified Transferable Development Rights may be sold to developers needing non-residential floor area beyond base height or floor area ratio limits. (Seattle Office of Housing, 2012a)

The City's MFTE program aims to revitalize communities and encourage mixed income residence by stimulating the construction of new multifamily structures, or the rehabilitation of existing structures, in order to increase the supply of housing for moderate-wage workers. The MFTE provides a 12-year property tax exemption for residential improvements of multifamily projects, located in targeted residential areas, in exchange for 20% of units being set aside for moderate-wage workers (Seattle Office of Housing, 2012b).

Finally, Seattle's Rental Housing Production and Preservation Program supports development of affordable rental housing using funds from the 2009 Housing Levy's Rental Preservation and Production Program, federal funds, and other funding sources. In the seven years from 2003 through 2009, the program completed production of 1,882 units of affordable rental housing in Seattle (Seattle Office of Housing, 2010).

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Fostering Home Ownership

The following downpayment assistance programs utilize a variety of funding, including levy-based funds from the Seattle Office of Housing (Seattle Office of Housing, 2012c), to enable lower-income households to buy their own homes (Seattle Office of Housing, 2012d):

- *Habitat for Humanity* – a nonprofit that builds homes for needy families that invest their own labor to build their home in par a no-interest mortgage (<http://www.seattle-habitat.org/>);
- *Homesight* - a nonprofit Community Development Corporation that promotes affordable homeownership through homebuyer education and financial planning and utilizes private and public partnerships to provide purchase assistance via low interest loans for qualifying first time homebuyers (www.homesightwa.org).
- *Homestead Community Land Trust* - a membership-based nonprofit community housing development organization that facilitates affordable homeownership. Homestead removes the cost of land from the cost of buying a home by acquiring and managing the land, providing a long-term lease for the homeowner's use of the land, and permanently protecting the affordability of the home for future generations (www.homesteadclt.org).
- *HomeTown Home Loans from HomeStreet Bank* - a partnership between the City of Seattle and HomeStreet Bank, the HomeTown Home Loan program offers employees of participating employers, including the City of Seattle, University of Washington, Fred Hutchinson, Seattle Cancer Care Alliance, and other organization, access to free homeownership education, savings on purchases & refinances, and downpayment assistance (<https://www.homestreet.com/programs/index.aspx>).
- *House Key Plus Seattle* - a downpayment assistance program for first-time homebuyers in Seattle, offers low-interest second loans combined with House Key State Bond below-market interest rate first mortgages for first-time homebuyers (<http://www.wshfc.org/buyers/keyplusSeattle.htm>).

- *Parkview Services Homebuyer Program* - a King County based non-profit organization that offers home buying assistance to individuals with developmental disabilities and family members who live with them (parkviewservices.org).
- *Seattle Teacher Homebuyer Program* - a City of Seattle program, in partnership with Evergreen Home Loans, that provides additional financing, waived lender fees, and discounted closing costs for eligible teachers' first home purchases (<http://www.seattle.gov/housing/buying/teachers.htm>).

Nurturing Home Ownership via Tax Relief

To promote continued homeownership by decreasing ownership cost burden, King County facilitates property tax deferral or exemption for senior citizens and disabled taxpayers, tax deferral for limited income households, and tax relief for households with increased tax liability due to home improvements (King County Assessor, 2012).

Preventing Foreclosure

In the event that Georgetown or South Park residents are struggling with the costs of home ownership, the Seattle Foreclosure Prevention Program may help them avoid default and work out viable repayment plans or acceptable terms for home sales. The program, administered by the nonprofits Urban League of Metropolitan Seattle and Solid Ground, provides financial and mortgage counseling, assistance in negotiating with lenders, and stabilization loans of up to \$5000 for homeowners with household income less than 80% of the area median income. Since the program began in 2008, it has helped more than 30 homeowners avoid foreclose and stay in their homes (Seattle Office of Housing, 2012e).

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Promoting Economic Vitality

Local economic conditions in Georgetown and South Park are a key factor in the viability of the residential communities. In general, development of sound local business environments, including strong commercial and service cores, may provide living-wage jobs for neighborhood residents and allow residents, businesses, and organizations to support their communities through local purchasing (PolicyLink, 2012). Accordingly, Seattle's Office of Economic Development (OED) has secured federal grant funding to sustain ongoing work in Georgetown and South Park, along with affiliated non-governmental organizations such as the Environmental Coalition of South Seattle (ECOSS), in pursuit of measures to preserve and enhance local businesses and support local incomes (ECOSS, 2012).

Additional business development opportunities are offered through the Only in Seattle Initiative, a partnership between OED and financiers that strengthens business districts with technical assistance, marketing, and facilitation of Business Improvement Area (BIA) formation (Seattle OED, 2012a). To further develop local business opportunities in South Park and Georgetown, the business districts may consider forming BIAs in contract with the City of Seattle. In essence, business and property owners within BIAs pool their money to fund business district revitalization and management. Each BIA has a Ratepayers Advisory Board, which prepares an annual work program submitted to the City. The City then invoices the ratepayers, collects assessed funds and holds them in a dedicated account, and reimburses the BIA expenses according to the work program (Seattle OED, 2012b).

With regard to local work during the coming years of change in the Duwamish Valley, the EPA's Superfund Job Training Initiative (Super JTI) provides one promising avenue for supporting higher-wage local employment, as workers will be needed for new jobs implementing the Duwamish Cleanup (EPA, 2012). Seattle's OED also continues to support South Seattle Community College's (SSCC) Apprenticeship and Education Center and Puget Sound Industrial Excellence Center, as SSCC builds partnerships and identifies opportunities to train workers for

living wage jobs in communities including South Park and Georgetown (SSCC, 2012a and 2012b). Finally, development of forward-thinking larger enterprise in the industrial areas of the Duwamish Valley, such as sustainable industry encouraged by Green Enterprise Zones (City of Wilmington, 2009), could eventually yield a diverse range of new jobs boosting local employment.

Providing Food Security

As future reinvestment drives changes in Georgetown and South Park, the costs of living in these neighborhoods are likely to increase. To ensure households can continue to meet their basic needs under such conditions, Seattle's Department of Neighborhoods and partner organizations have taken on many projects to address urban food security.

In South Park, Seattle's P-Patch and Cultivating Communities programs, Solid Ground's Lettuce Link, Seattle Youth Garden Works, and the South Park Neighborhood Association have formed the South Park Marra Farm Coalition that manages Marra Farm in Marra-Desimone Park. Many local residents come to the farm to learn, hands-on, about sustainable growth of organic produce and other food issues. The farm cultivates the "innate values of community: gardening, friendships, community building, self-reliance, neighborhood open-space, environmental awareness, hunger relief, improved nutrition, recreation, gardening education, and therapeutic opportunities" (Seattle Department Neighborhoods P-Patch Community Gardens, 2012). During the growing season, fresh produce is harvested from Marra Farm on Fridays and distributed at food banks including the Providence Regina House in South Park. Saturdays are then full of weeding, planting, composting and other jobs that keep the farm working (Solid Ground, 2012).

As another example of innovative response to food needs in Seattle, a community-based group of advocates and planners has received funding from the Department of Neighborhoods to design and develop the nation's largest public food forest in the Beacon Hill neighborhood. Following permaculture principles, hundreds of species of edible trees, bushes, and flowers will

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be planted on public land along the western slope of Seattle’s Jefferson Park. The organic foods sustainably produced by the forest will be free for public harvest (Seattle P-Patch Community Gardens, 2012).

Supporting Vibrant Human Habitat

With reinvestment in Georgetown and South Park, an influx of residents could emphasize opportunities to enhance neighborhood conditions through public improvements. In particular the public management of transportation, open space, and natural resource issues could noticeably improve the neighborhoods.

The Seattle Department of Transportation (SDOT) will plan, develop, and maintain circulation systems in Georgetown and South Park under the framework of the City’s Complete Streets ordinance (Ordinance 122386), passed by the Seattle City Council in 2007. The policy, intended to create and maintain safe Seattle streets for everyone, directs SDOT to design streets for pedestrians, bicyclists, transit riders, and persons of all abilities, while promoting safe operation for all users. SDOT follows a data intensive process to evaluate projects to prioritize safety and mobility, while balancing the existing and projected future needs of all users. Such efforts may be key to equitable revitalization in Georgetown and South Park, as Complete Streets can provide amenities that benefit all residents, including: improved crossings, lighting, and sidewalks for pedestrians; bicycle lanes, sharrows, or wide outside lanes for bicyclists; adequate lane width for freight and transit operation; convenient transit stops for transit riders; and street trees, landscaping, lighting and other features to “make streets good for community life” (SDOT, 2012).

SDOT is also investigating options for the future management of shoreline at the ends of 149 public streets in Seattle that terminate on waterfronts (including several in South Park). These “Shoreline Street Ends” constitute valuable community assets, and are officially considered rights-of-way that should be preserved and developed for public access as their highest and

best use (City Resolution 29370, adopted in September 1996). However, most of these sites are not currently well maintained, or are subject to private encroachment. SDOT intends to improve the sites, in partnership with local residents and community groups, to improve public access and enjoyment of the waterfront. SDOT's Shoreline Street Ends Program guides the process of improving a shoreline street end and permitting uses of the land (SDOT, 2000).

In another example of site-scale land improvement that can benefit communities, the City of Seattle's reLeaf program is focused on increasing beneficial tree canopy in the City. Establishing more healthy trees will enhance ecological functions and urban livability by creating cleaner environments, reducing stormwater runoff and erosion, and promoting enjoyment of nature in the city. The Trees for Neighborhoods program helps Seattle residents plant trees around their homes by providing participants with free trees (up to 4 per household) and watering bags, discounted compost, and ongoing training on planting and care (Seattle Trees for Neighborhoods, 2012). In a separate but related program, Seattle and the Cascade Land Conservancy forged the Green Seattle Partnership in 2004, pursuing of a 20-year plan to combat invasive species and restore health to Seattle's forested areas. By 2025, the Partnership plans to re-establish and maintain 2,500 acres of healthy, invasive-free, forested parklands throughout the city (Green Seattle Partnership, 2012).

Installation of Low Impact Development stormwater systems could further add to the enhancement of local ecological services. By using swales, rain gardens, and similar green infrastructure to control stormwater, discharge could be reduced while water quality could be improved. Such development could enhance local neighborhoods while contributing pollutant source control to protect the Duwamish River.

Finally, King County's Combined Sewer Overflow (CSO) Control Program and Seattle Public Utilities will continue critical environmental work addressing CSOs, the discharge of untreated sewage and stormwater directly into lakes, rivers, and marine waters when sewers reach their capacity during heavy rainfall. While the sewage in CSOs is diluted by stormwater, CSOs and

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stormwater carry chemicals and pathogens that may be harmful to public health and aquatic life (King County CSO Control Program, 2012). CSOs have been noted as a major source of contamination in the Lower Duwamish (Duwamish River Cleanup Coalition, 2008). Thus, prioritizing CSO control and achieving safe and enjoyable waters in the Duwamish would coordinate well with other environmental enhancements, such as street end improvements, urban forestry, and stormwater management via Low Impact Development, that could revitalize Georgetown and South Park via attractive open spaces and expanded recreation opportunities.

Transferring Benefits to All

A concluding set of institutional measures critical for enabling equitable revitalization in Georgetown and South Park are those that expressly address challenges inherent in serving diverse communities through institutional programs. Toward these ends, Seattle's Race and Social Justice Initiative (Seattle Race and Social Justice Initiative, 2012) and King County's Equity and Social Justice Ordinance (King County Equity and Social Justice Ordinance, 2012) are intended to transform systems that create disparities in communities, toward promoting equity for all. Under these relatively recent initiatives, administrators of the various City and County programs previously discussed should strive to ensure that all residents of Georgetown and South Park are appropriately served by revitalization efforts, despite barriers presented by age, income, language, race, or other factors.

Community-Based Revitalization: Grass Roots Endeavors

Alongside formal institutional approaches listed above, there are also a variety of grass roots initiatives that are achieving community revitalization in Georgetown and South Park. In general, the execution of hands-on local service in parallel with broader institutional programs may help strength community ties and avoid situations in which vulnerable residents, such as the elderly or those facing language barriers, fail to receive attention to their needs. For

example, high school students conducting local service projects in which they assist completion of agency forms for neighbors may help secure crucial public assistance for residents who face difficulty negotiating application processes alone. Furthermore, beyond basic needs, creative efforts in Georgetown and South Park are also transcending individual, institutional, and corporate interests to extend the richness of community to all local residents.

As the South Park neighborhood has dealt with loss of access options during the replacement of the South Park Bridge, a variety of community-based responses have provided moral support for the challenged neighborhood. The thriving arts community in South Park has been one source of vitality, organizing activities such as South Park Putts Out, a temporary mini-golf course designed by local artists and installed in the parking strip of a tree-lined residential street. South Park neighbors recently enjoyed the third annual round of this original mini-golf, along with food and live music, in August 2012 (South Park Arts, 2012).

Another locally driven activity that bonds South Park residents and builds community energy is a bonfire social held weekly on the “Sliver on the River.” A resident that used to have solitary bonfires on his property along the Duwamish has opened up the event to his South Park neighbors. Many residents, especially artists and musicians, meet regularly at the fire. Participants are encouraged to walk or bike to the event (Shultz, 2011).

Georgetown also has a strong local arts community that drives community engagement, as illustrated by the annual Georgetown Super 8 Film Festival. The Festival started in 2006 when local artists offered to teach their neighbors how to make super 8 films, with the intent of sharing a created film with the community. The community response was overwhelming and 33 films were made the first year and screened for an audience of 200 at the Georgetown Ballroom. Each of following years, the number of created films, audience attendance, and community support for the Festival has increased. The festivals have now led to the creation of over 200 total films. (Georgetown Super 8 Film Festival, 2012)

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TABLE 8. Sample of Potential Programs/Initiatives to Promote Equitable Revitalization in Georgetown & South Park

| Program Structure | Program Participants | Focal Issues | Exemplary Initiatives |
|--|--|---|---|
| Coalition of Multiple Governmental & Non-Governmental Organizations (NGOs) | Public/private partners in EPA's <i>Urban Waters</i> program | Restoring water resources and enhancing communities | <ul style="list-style-type: none"> • Anacostia River contamination control • South Platte River shoreline cleanup and conversion for community use |
| Government/NGO Alliance | Seattle's Housing Authority and partners | Assisting tenants | <ul style="list-style-type: none"> • Housing Choice Voucher Program • Management of Senior Housing units • Management of affordable housing |
| Government/NGO Alliance | Seattle's Office of Housing and partners | Developing affordable housing | <ul style="list-style-type: none"> • Land use incentives for affordable housing development • Multifamily Property Tax Exemption (MFTE) Program • Rental Housing Production and Preservation Program |
| Government/NGO Alliance | Seattle's Office of Housing and partners | Fostering home ownership | <p>Expansion of home ownership via:</p> <ul style="list-style-type: none"> • Habitat for Humanity • Homesight • Homestead Community Land Trust • HomeTown Home Loans from HomeStreet Bank • House Key Plus Seattle • Parkview Services Homebuyer Program • Seattle Teacher Homebuyer Program |
| Government/NGO Alliance | Seattle Foreclosure Prevention Program | Preventing foreclosure | <ul style="list-style-type: none"> • Since inception in 2008, helping more than 30 homeowners avoid foreclosure and stay in their homes. |

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| Program Structure | Program Participants | Focal Issues | Exemplary Initiatives |
|-----------------------------|--|----------------------------------|--|
| Government/ NGO Alliance | Seattle's Office of Economic Development and partners | Promoting economic vitality | <ul style="list-style-type: none"> • Preserve and enhance local business opportunities • EPA's Superfund Job Training Initiative • Green Enterprise Zone |
| Government/ NGO Alliance | Seattle's Department of Neighborhoods and partners | Providing food security | <ul style="list-style-type: none"> • South Park Marra Farm Coalition (P-Patch and Cultivating Communities programs; Solid Ground's Lettuce Link; Seattle Youth Garden Works, and South Park Neighborhood Association • Beacon Hill Food Forest |
| Government/ NGO Alliance | Seattle's reLeaf Program and Partners | Supporting vibrant human habitat | <ul style="list-style-type: none"> • Trees for Neighborhoods • Green Seattle Partnership |
| Governmental Alliance | King County Combined Sewer Overflow Control Program and Seattle Public Utilities | Supporting vibrant human habitat | <ul style="list-style-type: none"> • Reduction of Combined Sewer Overflow Discharge |
| Governmental Program | King County Assessor | Relieving property tax burden | <ul style="list-style-type: none"> • Tax deferral or exemption for senior citizens and disabled taxpayers • Tax deferral for limited income households • Tax relief supporting home improvements |
| Governmental Program | City of Seattle and King County | Social Equity | <ul style="list-style-type: none"> • Seattle Race and Social Justice Initiative • King County Equity and Social Justice Initiative |
| Governmental Program | Seattle's Department of Transportation and partners | Supporting vibrant human habitat | <ul style="list-style-type: none"> • Complete Streets Program • Shoreline Street Ends Program |

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| Program Structure | Program Participants | Focal Issues | Exemplary Initiatives |
|--------------------------|-----------------------------|------------------------------|--|
| Grass Roots Endeavor | Local community groups | Strengthening community ties | <ul style="list-style-type: none"> • Youth service projects • South Park Arts – South Park Putts Out • Weekly South Park bonfire on the Sliver by the River • Georgetown Super 8 Film Festival |

3.0 HOW WILL REINVESTMENT & DEVELOPMENT AFFECT RESIDENTS' HEALTH IN GEORGETOWN AND SOUTH PARK?

Considering the indicators of existing and future gentrification discussed in sections 2.1 and 2.2, there seems to be some likelihood that the Duwamish Cleanup may contribute to gentrification in Georgetown and South Park. Specifically, indicators suggest that gentrification is currently beginning in Georgetown, and future acceleration of gentrification is likely in that community. In South Park, indicators reveal that gentrification is already well underway and ongoing future gentrification is likely. In light of these conditions, along with the fact that other cleanup projects have been found to boost real-estate prices in areas near Superfund sites (Gamper-Rambindran, 2011), the Duwamish Cleanup may reasonably be expected to stimulate reinvestment and development in Georgetown and South Park that could exacerbate gentrification.

Where community development does spur gentrification, the noticeable consequences (as cataloged by Kennedy and Leonard in 2001) may likely include “changing community leadership, power structures and institutions; conflicts between old and new residents; changing street flavor and new commercial activity; displacement of renters, homeowners and local businesses; greater mixing of incomes and deconcentration of poverty; increasing real estate values and equity for owners, and increasing rents for renters and business owners; increasing tax revenue; and increasing value placed on the neighborhood by outsiders.”

However, as highlighted in section 2.3, propulsion of gentrification and disparity by community reinvestment may also be augmented by institutionally based revitalization efforts and local projects that extend benefits to both existing and new residents. Thus, a varied range of community changes could simultaneously result from Cleanup-spurred reinvestment in Georgetown and South Park. Such changes, from revitalization fostering equity and stability, to disparity-promoting gentrification, could all potentially affect the health of residents.

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In meetings with the Residential Community Advisory Committee and Liaison Committee for the Duwamish HIA, several general types of physical, social, and economic changes were noted as the primary concerns regarding the Cleanup's potential reinvestment-spurred community health effects. Fortunately, recent research has aimed to increase understanding of the health effects of such changes. In general, studies have found that resident health may be substantively affected by local neighborhood characteristics such as physical factors, including housing and transportation, as well as economic capital and social capital

Analysis Method

The discussion below, comprising a review of pertinent community health literature and analysis of its implications in the Duwamish neighborhood, is organized by neighborhood characteristics associated with population health. Each section highlights alternate potential health outcomes that might be associated with gentrifying or revitalizing community development in Georgetown and South Park. Conclusions regarding potential health effects of Cleanup-spurred reinvestment are summarized at the end of Section 3.5, in Table 9.

3.1 HOW WILL REINVESTMENT AND DEVELOPMENT AFFECT HOUSING & HEALTH?

Among the more evident changes that can occur due to reinvestment in communities, changes in housing markets and residential conditions may have pronounced effects on resident health. Srinivasan, O'Fallon, and Dearry (2003) review the findings of multiple studies linking physical and mental health problems to poor urban planning, well-intentioned but damaging urban renewal (Fullilove, 2003) and inadequate housing (Bashir, 2002). Particular associations have been found between housing quality and health problems including infectious diseases, chronic illnesses, injuries, poor nutrition, and mental disorders (Krieger & Higgins, 2002).

If gentrification were to substantially increase housing costs in Georgetown or South Park, the resulting displacement of households into cheaper, lower quality, or more crowded housing

could adversely affect residents' health. Potential relocation to lower-income areas with lower cost housing could also reduce access to healthy foods, transportation choices, non-motorized circulation options, quality schools, and supportive social networks (PolicyLink, 2007).

However, if measures such as tenant assistance, home ownership promotion, and property tax relief allowed existing residents to maintain their presence in areas of rising home values, improvements in housing quality benefit health. The increasing value of properties would provide substantial equity growth for owners, and increased financing options could allow for more maintenance and improvement of existing housing stock. Such enhancement of local housing conditions could yield health benefits for both existing tenants and owners.

3.2 HOW WILL REINVESTMENT AND DEVELOPMENT AFFECT SOCIOECONOMIC CONDITIONS & HEALTH?

As the Georgetown and South Park neighborhoods transition under economic reinvestment, varying influences may well lead to shifts in the demographic composition of the local residential populations. Such changes may likely be accompanied by attendant shifts in the prevailing socioeconomic characteristics of the population and such shifts may results in changes in population health.

Among ample evidence supporting conclusions that socioeconomic conditions affect health status, the Centers for Disease Control and Prevention have compiled the straightforward graph below from survey data collected between 2007 and 2009 (Figure 3). The graph shows the percentage of adults over the age of 25 reporting fair or poor health in the United States, stratified by income level. In all age ranges, those with lower incomes had worse health.

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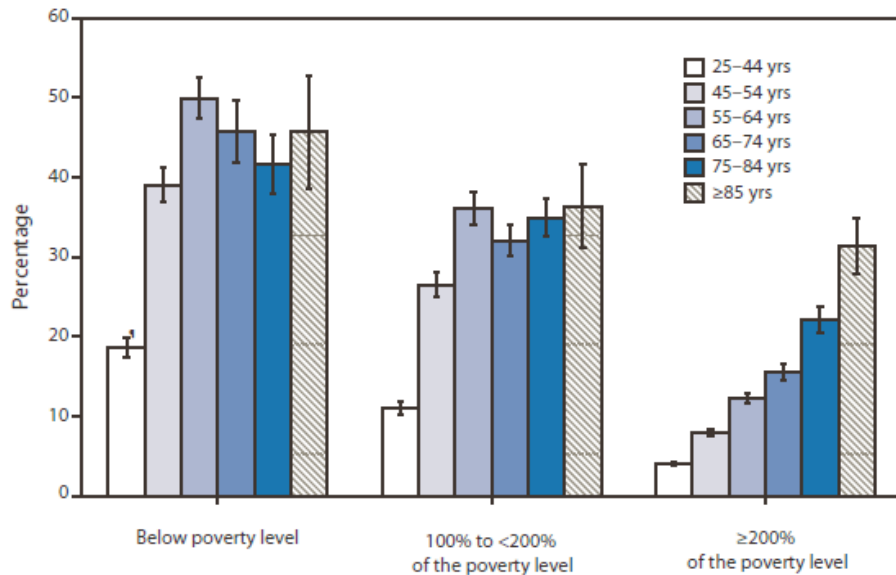


FIGURE 3. Percentage of Adults over 25 Reporting Fair or Poor Health, by Age Group and Income Level

Source: Center for Disease Control and Prevention, 2011

There are many other examples of documented associations between local socioeconomic status and health conditions. For example, research has found that, in general, communities with lower average socioeconomic status have lower quality housing, lack opportunities for outdoor activities, and lack access to fresh fruits and vegetables (Srinivasan et al., 2003). Such conditions may reasonably be expected to play out in health consequences. Rates of illness for lower income and less educated U.S. adults in their 30s and 40s have been found to be comparable to those of affluent adults in their 60s and 70s (Adelman, 2008). In addition, individuals of lower socioeconomic levels have been documented to have higher incidence rates of arthritis, cancer, cardiovascular disease, diabetes, hypertension, low birth weight, and respiratory illness (Adler & Newman, 2002).

Thus, if reinvestment in Georgetown or South Park leads to an influx of higher income residents, those residents may have better health on average than existing residents with lower incomes. Such demographic shifts could lead to less local exposures to disease, and could potentially result in overall improvements in local rates of mortality and morbidity.

Furthermore, if economic development measures were to increase job security and income levels among existing residents, those residents could also personally enjoy the health benefits of their improved socioeconomic status.

However, lower-income residents that were to remain in place among new higher-income residents in gentrifying Georgetown or South Park could be subject to additional stress and associated health risks through exposure to increased costs of living and localized income inequality (Wang & Arnold, 2008). In addition, with the influx of new wealthier residents, previous residents might be displaced by rising costs of living to lower income, lower cost areas. In such areas, residents could be exposed to more adverse health conditions though diminished access to quality housing and healthy foods, decreased transportation and non-motorized circulation options, and lack of quality schools or supportive social networks (PolicyLink, 2007).

3.3 HOW WILL REINVESTMENT AND DEVELOPMENT AFFECT SOCIAL CAPITAL & HEALTH?

As future reinvestment modifies the Georgetown and South Park communities, the social and physical aspects of these urban environments may effectively promote either cohesion or isolation among the residents. Obviously, the displacement of existing households due to increased costs of living could disrupt existing neighborhood cohesion as residents relocate to new areas. In addition, evidence indicates that changes in existing neighborhoods, such as increased geographic barriers, sensed disparities between residents, concerns about crime and safety, higher rates of television and computer usage, and decreased contact among neighbors, may foster isolation and poor interconnection in communities (Srinivasan et al., 2003).

Such isolation has been documented to result in a lack of social networks and diminished social capital – that is, decreased benefits and obligations as conferred by membership in a social group (Hawe & Shiell, 2000). Accordingly, those living in urban isolation may find themselves

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less empowered to utilize communal adaptive capacity to respond to crises or health challenges. Research regarding the complex interaction of social determinants has found that, at the individual level, low social capital and low economic capital are both independently associated with poor health outcomes” and, when combined, these factors “seem to contribute to an increased burden of poor health” (Ahnquist, Wamala, and Lindstrom, 2012). In particular, decreased social capital may be associated with increased obesity, cardiovascular disease, and mental health problems, as well as higher mortality rates (Srinivasan et al., 2003).

In contrast to the health threat posed by neighborhood gentrification eroding social capital, community health could potentially be buoyed by changes under more balanced revitalization of Georgetown and South Park. As the esteem of these areas rises with the cleanup of contamination, an influx of higher income households could coincide with business development (such as the Superfund Job Training Initiative) supporting job security and increased income for existing residents. Such economic development could increase consumer spending and property taxes to fiscally fortify the neighborhoods and their encompassing jurisdictions. If assistance and incentive programs, implemented as part of community revitalization programs, were also able to prevent undesired displacement of existing residents, the populations on whole could be empowered by the stronger political voice that comes from stronger local economic contribution. This empowerment could increase the adaptive capacity of the communities, potentially increasing residential interest in community engagement, interconnection, and responsiveness. Such interconnection may be facilitated if public improvements of streetscapes and open space enhance possibilities for active interaction among neighbors in the communities. Ultimately, such changes could benefit health via strengthened social capital.

3.4 HOW WILL REINVESTMENT AND DEVELOPMENT AFFECT OPEN SPACE, RECREATION, & HEALTH?

Potential health benefits may also be gained through prioritization of open space and recreational needs as part of future reinvestment in Georgetown and South Park. Current conditions along the Lower Duwamish River do not provide much pleasant open recreational area for use by community residents. Industrial expansion has created shorelines largely dominated by fences, storage yards, machinery, and waste. In addition, those recreating in the few areas of green space existing along the Duwamish may harbor reasonable apprehension about exposing themselves, their children, or their pets to contaminated soils, water and air.

While health concerns regarding environmental contamination will be attenuated by the Superfund cleanup activities in the coming years, Georgetown and South Park residents are likely to be subject to additional life stresses during the lengthy and complex cleanup activities. Such stress may contribute to the onset of illness, affect physical and psychological wellbeing, and predispose residents to greater vulnerability to other life stresses (Miller, 2007). Thus, the ability to cope with stress may play a major role in the addressing physical, mental, and behavioral health problems (Taylor & Stanton, 2007), as well as facilitating healthy family and social relationships (Sachser, Dürschlag, & Hirzel, 1998). Providing green and recreation space in the affected neighborhoods could facilitate such coping.

A multitude of studies confirm that stress reduction is major benefit of spending time in green space (Kahn, 1999). More specifically, the opportunity to increase outdoor activity in open recreational space may encourage exercise and its health benefits (Sallis, Millstein, & Carlson, 2011); reduce stress, increase mental wellbeing, assist recovery from mental fatigue (Kuo & Sullivan, 2001b), and improve ability to cope with adversity (Kuo, 2001).

Furthermore, residents' shared experience of well designed and safe open spaces may strengthen social ties in neighborhoods (Coley, Kuo, & Sullivan, 1997), increase a sense of

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community (Sullivan, Kuo, & DePooter, 2004), and decrease crime and fear (Kuo & Sullivan, 2001a). Research has even found that time in green space promotes healthy child development, and may reduce symptoms of Attention Deficit Hyperactivity Disorder (Kuo & Taylor, 2004). Thus, pursuit of programs to develop attractive and active streets and green space as part of revitalization in Georgetown and South Park could be key to health improvement in the coming years.

3.5 SUMMARY: POTENTIAL HEALTH EFFECTS OF CLEANUP-SPURRED REINVESTMENT & DEVELOPMENT IN GEORGETOWN & SOUTH PARK

Overall, based on indicators discussed in sections 2.1 and 2.2, it is reasonable to expect that gentrification currently occurring in Georgetown and South Park will continue, to some degree, irrespective of the outcome of the Duwamish Superfund Cleanup. However, the Cleanup does constitute a pivotal factor in the development of these neighborhoods. As the project addresses local contamination issues, reinvestment in the communities is likely to increase, catalyzing either further gentrification or more equitable revitalization. By approaching the Cleanup project as a focal point for institutional and grass roots revitalization efforts, measures such as those described in Section 2.3 may be pursued to improved the health effects of consequent reinvestment and development. Table 9, below, highlights some key health benefits and harms that Georgetown and South Park residents could foreseeably experience due to reinvestment spurred by the Cleanup.

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TABLE 9. Summary of Cleanup-Spurred Reinvestment's Potential Effects on Existing Residents' Health

| Factor in Local Health | Foreseeable Outcome of Reinvestment | Potential Effect on Health Determinants | Potential Effect on Existing Residents' Health | Likelihood of Health Effect | Potential Magnitude of Health Effect | Potential Distribution of Health Effect | Rationale |
|------------------------|--|--|---|-----------------------------|--------------------------------------|---|---|
| Housing | Improvement of housing stock and associated infrastructure | <ul style="list-style-type: none"> - Decreased exposure to harmful environmental agents in homes - Improved local infrastructure for active community life | <p>Increased emotional and physical fitness, decreased illness</p> <p>Importance: Low</p> | Likely | Moderate | Disproportionate benefit to higher income residents | Development of new housing and infrastructure is likely, given indicators of gentrification in progress and likely future gentrification. Health benefit depends on ability to inhabit improved housing/areas. |
| | Increased housing costs | <ul style="list-style-type: none"> - Reduced funds available for discretionary spending - Reduced adaptive capacity for crisis situations | <p>Increased stress and illness</p> <p>Importance: Low to Medium</p> | Very likely | Substantial | Disproportionate harm to lower income residents | Continued increases in housing costs are very likely, given indicators of gentrification in progress and likely future gentrification. |
| | Displacement of residents to lower cost housing | Increased exposure to harmful environmental agents and crowding | <p>Increased stress and illness</p> <p>Importance: Medium</p> | Very likely | Substantial | Disproportionate harm to lower income residents | Residential displacement is very likely given indicators of gentrification in progress and likely future gentrification. |
| | Increased home values and home equity | <ul style="list-style-type: none"> - Increased financial ability to maintain and improve housing - Decreased exposure to harmful environmental agents and crowding | <p>Decreased stress and illness</p> <p>Importance: Low</p> | Possible | Limited | Disproportionate benefit to higher income residents | Continued increases in home values are very likely, given indicators of gentrification in progress and likely future gentrification. Health benefit depends on ability to inhabit housing with increasing home values and secure financing to make home improvements. |

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| Factor in Local Health | Foreseeable Outcome of Reinvestment | Potential Effect on Health Determinants | Potential Effect on Existing Residents' Health | Likelihood of Health Effect | Potential Magnitude of Health Effect | Potential Distribution of Health Effect | Rationale |
|---------------------------|---|--|--|-----------------------------|--------------------------------------|---|--|
| Socio-economic Conditions | Increased proportion of higher income residents | Increased local median income, associated with decreased local exposure to disease (CDC, 2011) | Decreased illness Importance: Low | Likely | Limited | Disproportionate benefit to higher income residents | Influx of higher income residents is very likely, given indicators of gentrification in progress and likely future gentrification. Health benefit from decreased local disease burden depends on ability to remain in place as local incomes rise. |
| | Development of new local services and amenities and associated infrastructure | <ul style="list-style-type: none"> - Improved public services and private amenities available to residents - Improved local infrastructure for active community life | Improved physical and emotional fitness Importance: Low | Likely | Limited | Disproportionate benefit to higher income residents | Increased demand for new services and amenities is likely, given indicators of gentrification in progress and likely future gentrification. Health benefit depends on ability to use new services and amenities. |
| | Increased cost of living | <ul style="list-style-type: none"> - Reduced funds available for discretionary spending - Decreased food security | Increased stress and illness Importance: Low to Medium | Very likely | Substantial | Disproportionate harm to lower income residents | Increased cost of living, including the cost of food, is very likely, given indicators of gentrification in progress and likely future gentrification. |

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| Factor in Local Health | Foreseeable Outcome of Reinvestment | Potential Effect on Health Determinants | Potential Effect on Existing Residents' Health | Likelihood of Health Effect | Potential Magnitude of Health Effect | Potential Distribution of Health Effect | Rationale |
|------------------------|-------------------------------------|---|--|-----------------------------|--------------------------------------|---|---|
| Social Capital | Expanded local employment | <ul style="list-style-type: none"> - Increased funds for discretionary spending - Increased adaptive capacity for crisis situations | <p>Decreased stress and illness</p> <p>Importance: Medium</p> | Likely | Moderate to Substantial | Equitable benefit to all residents | Duwamish Cleanup will require labor. EPA Superfund Jobs Training Initiative may provide vehicle for training local residents to work in the Cleanup. In addition, increased demand for new local services and amenities is likely, given indicators of gentrification in progress and likely future gentrification. |
| | Increased social polarity | <ul style="list-style-type: none"> - Decreased social cohesion (Miller, 2007) - Decreased adaptive capacity for crisis situations | <p>Increased stress, decreased physical and emotional fitness</p> <p>Importance: Low</p> | Very likely | Moderate to Substantial | Disproportionate harm to lower income residents | Increased proportion of higher income residents is likely, given indicators of gentrification in progress and likely future gentrification. Reduced interconnection between residents reduces social network available in crisis situations. |
| | Increased tax base | <ul style="list-style-type: none"> - Increased political power - Improved public services and infrastructure | <p>Decreased stress, increased physical and emotional fitness</p> <p>Importance: Low</p> | Possible | Limited | Disproportionate benefit to higher income residents | Increasing median income is likely, given indicators of gentrification in progress and likely future gentrification. With increased tax base, political power could increase and drive improvements in local services and infrastructure. Health benefit of political power depends on ability to remain in more empowered local community. |

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| Factor in Local Health | Foreseeable Outcome of Reinvestment | Potential Effect on Health Determinants | Potential Effect on Existing Residents' Health | Likelihood of Health Effect | Potential Magnitude of Health Effect | Potential Distribution of Health Effect | Rationale |
|---------------------------|--|---|---|-----------------------------|--------------------------------------|---|--|
| Open Space and Recreation | Cleaner natural environment | <ul style="list-style-type: none"> - Decreased exposure to harmful environmental agents outdoors - Decreased worry about exposure/ decreased stress | <p>Decreased stress, decreased illness</p> <p>Importance: Low</p> | Likely | Moderate to Substantial | Disproportionate benefit to higher income residents | Implementation of the Duwamish Superfund Cleanup will significantly reduce contamination in the Duwamish River and along its shoreline. Open space along the river will be safer for recreational access by residents. Health benefit of cleaner local environment depends on ability to remain in the area. |
| | Expanded and enhanced open space | <ul style="list-style-type: none"> - Increased options for outdoor recreation - Increased social connection via attractive activated public space - Increased physical activity/ decreased stress (Miller, 2007) | <p>Decreased stress and increased physical and emotional fitness</p> <p>Importance: Low</p> | Likely | Moderate to Substantial | Disproportionate benefit to higher income residents | Expansion and enhancement of well-designed open space along the river is expected as a part of the Cleanup. Health benefit from active use of improved local open space depends on ability to remain in the area. |
| | Improved sidewalk and pathway connectivity | Increased recreation and active transportation | <p>Decreased stress and increased physical and emotional fitness</p> <p>Importance: Low</p> | Likely | Moderate to Substantial | Disproportionate benefit to higher income residents | Improvement of pathways along the river is expected under the Cleanup. Health benefit from active use of such infrastructure depends on ability to remain in local area. |

4.0 POSSIBLE STRATEGIES TO MAXIMIZE HEALTH BENEFITS AND MINIMIZE HARM FROM CLEANUP-SPURRED REINVESTMENT AND DEVELOPMENT

In light of the potential associations between community revitalization, gentrification, and residential population health, changes in local conditions due to reinvestment in Georgetown and South Park could substantially affect the health of the residential populations. Given the previously discussed indicators of gentrification and prospects for revitalization in these neighborhoods, it is of particular interest how health will be affected by measures associated with the Duwamish Superfund Cleanup that either facilitate, or impair, community revitalization efforts and lead to, or inhibit, gentrification. In brief, it will be important for the diverse ranks of professionals planning and implementing the Duwamish Cleanup to consider how reinvestment spurred by the project can be managed to maximize health benefits from equitable revitalization in Georgetown and South Park, while minimizing adverse health effects from gentrification.

Toward these ends, Kennedy and Leonard (2001) propose the following strategies for public-private partnerships seeking to promote revitalization while reigning in gentrification:

- “Knowing the context, and the growth dynamics in the city and region to determine the extent to which gentrification is a reality, a near possibility, or an unlikely occurrence;
- Increasing regional, city and community understanding of the dynamics of gentrification, and conducting analyses that can anticipate pressures;
- Getting organized, again at the regional, city and community levels;
- Developing a unified vision and plan (e.g., for jobs/housing balance at the regional level, for economic and housing needs and opportunities for residents at the city level, and for neighborhood stability and viability at the local level);
- Implementing regulatory and policy fixes at the regional, city and community levels, as appropriate;
- Gaining control of public and private property assets that can be taken out of the market and used to provide affordable housing and office space for neighborhood

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residents and service providers;

- Improving resident understanding of legal rights, and home-buying and selling strategies;
- Improving public education at the local and citywide levels;
- Preparing parties to negotiate for more equitable development in the midst of gentrification; and
- Creating forums to resolve conflicts and to re-knit the community.”

These measures correspond well with approaches the Center for Disease Control and Prevention suggest for addressing the health effects of gentrification, entailing community involvement in strategies to:

- Create affordable housing for residents of all income levels;
- Ensure new housing development benefits existing residents;
- Utilize policy to promote affordable housing and preserve tenure; and
- Increase residents’ assets to reduce public dependency.

(Center for Disease Control, 2012)

Many of the previously discussed institutional and community-based approaches currently pursued to promote revitalization are in line with the tactics listed above. Drawing from those programs as examples, and creatively extrapolating to conceive of other related possibilities, the following strategies may be considered to manage reinvestment, revitalization, and gentrification spurred by the Duwamish Superfund Cleanup.

4.1 STRATEGIES

1. Coordinate management of future community reinvestment.

- Formalize a coalition of agencies and organizations responsible for monitoring, reporting on, and managing neighborhood development in Georgetown and South Park in relation to the Superfund Cleanup. Investigate formal partnership under EPA's Urban Waters program. Pursue social equity through alignment of policies with Seattle's Race and Social Justice Initiative and King County's Equity and Social Initiative; ensuring revitalization measures appropriately serve all residents despite barriers presented by income, language, race or other factors.

2. Produce affordable housing and preserve affordability.

- Publicize and facilitate tenant assistance by Seattle Housing Authority and partner NGOs.
- Promote development of affordable housing in Georgetown and South Park via affordable housing development NGOs and Seattle Office of Housing's land use code incentives, tax incentives for developers, and public funding of affordable housing.

3. Promote and protect home ownership.

- Expand homeownership by lower-income families in Georgetown and South Park by publicizing and facilitating local resident participation in downpayment assistance programs supported by the Seattle Office of Housing and NGOs.
- Publicize and facilitate protection of qualifying local homeowners from increasing tax liability through NGO-based counseling and the King County Assessor's tax deferral, exemption, and relief programs.
- Preserve local homeownership and reduce foreclosures by facilitating use of the NGO-administered Seattle Foreclosure Prevention Program.

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4. Foster local economic strength and sustainable access to basic needs.

- Work with Seattle’s Office of Economic Development and local NGOs to invest in and improve local business environments in Georgetown and South Park.
- Improve local job security and median income through employment programs, such as the EPA Superfund Job Training Initiative.
- Prioritize offsetting increasing costs of living in Georgetown and South Park by expanding secure local access to quality foods.
 - Promote and facilitate expanded resident participation in urban agriculture at Marra Farm.
 - Publicize and facilitate resident receipt of nutritious foods from local food banks as well as local schools.

5. Enhance Human and Natural Habitat

- Create vibrant neighborhoods through pursuit of active streetscapes under SDOT’s Complete Streets program.
- Increase public access to the Duwamish River, safe open space (designed according to principles of Crime Prevention Through Environmental Design), and shared recreational area through SDOT’s Shoreline Street Ends program and additional land use conversion programs. If possible, expand public open space along the shoreline at Boeing Plant 2.
- Improve local ecological services, pollutant source control, and aesthetics through Low Impact Development stormwater systems (swales, rain gardens, etc.), and tree planting and preservation programs.
- Increase local enjoyment of aquatic recreational opportunities by minimizing Combined Sewer Overflow discharge into the Duwamish.

6. Increase Community Engagement

- Publicize, facilitate, and grant funding to support local grass roots activities building social cohesion.

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