Technical Report 9

Highway 99 Sub-Area Plan Health Impact Assessment

Clark County Public Health, Vancouver, Washington

I. INTRODUCTION TO HIA

A Health Impact Assessment (HIA) is, per the World Health Organization, (WHO, 2005) "A combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population." This HIA looks at features of the Highway 99 built environment (existing and proposed) in terms of the potential effects of the built environment on health outcomes.

II. DETERMINANTS OF HEALTH

The fundamental conditions and resources for health are peace, shelter, education, food, income, a stable ecosystem, sustainable resources, social justice and equity. Improvement in health requires a secure foundation in these basic prerequisites[1].

Socio-ecological Model of Health Promotion

Public Health promotion is based on a conceptual model that connects health outcomes (for example, decreased smoking rates) with personal, relationship, community and societal influences. The socioecological model does not approach such a socially imbedded health problem by working only with individual smokers; it also focuses on interventions at a relational level (peers and family), at a community level (tobacco sales to minors), and at a social and economic policy level (cigarette taxation). The last 20 years of progress in tobacco control provides striking evidence that public health policies and environmental changes (e.g. tobacco price increases, clean indoor air laws) can be much more powerful interventions for population-wide behavior change than those requiring active decision making by individuals.

Health Determinants and Equity

The World Health Organization[2] identified two major groups of social determinants of health: "*Structural* determinants are those that generate social stratification [such as rapid, unplanned urbanization]. These include income, education, gender, age, ethnicity and sexuality. *Intermediate* determinants emerge from underlying social stratification and determine differences in exposure and vulnerability to health-compromising conditions (e.g. living and working conditions, housing, access to health care and education). *Within the urban setting there are multiple structural and intermediate determinants that converge and bring about health inequity*." Land use planning and policy, resulting in a "built environment", has enormous potential to alter the *structural* determinants of health by providing equal resources to diverse social groups (as in the mixed income housing proposed in this project). Part of what we do in this HIA is to examine how the proposed structure will affect diverse social groups in terms of access to resources (like food, parks, or clean air). Part of what we do is look at *intermediate* determinants to examine how such resources or lack thereof will impact the health of these populations.

---

[1] World Health Organization, *Ottawa Charter for Health Promotion*, from http://www.who/int/hpr/background/ottawacharter.htm (1986)

[2] *Our cities, our health, our future: Acting on social determinants for health equity in urban settings.* Report to the World Health Organization Commission on Social Determinants of Health from the Knowledge Network on Urban Settings Hub: WHO Kobe Centre, Kobe, Japan, July (2005)

III. THE DEMOGRAPHICS OF HEALTH IN WASHINGTON

This HIA will touch on many health determinants, but emphasize three: poor nutrition, lack of physical activity, and reliance on motor vehicles. These are the major contributors to the five leading causes of death in Washington: cancer, heart disease, stroke, respiratory disease, and unintentional injury.[3]

Changes in Population

As this is a long-term project that will not come to full fruition for many years, it is critical to consider the changing demographics of Clark County, as any plan made today needs to consider three trends: the projected growth, rapid aging, and increasing ethnic and economic diversity of our population.

A. First, Highway 99 sub-area being studied had a total population of 13,567 in 2006. Between 2006 and 2024 it will is projected to grow 1.7% to a population of 18,621. The primary trade area is projected to grow 1.83%, from 65,692 residents in 2006 to 90,987 in 2024 (see Highway 99 Technical Report # 8).

B. Second, if income inequality increases as may happen in an intentionally mixed use, mixed income neighborhood, there should be an increased relative demand at both high and low ends of the market, for large single-family housing and for affordable multi-family units.

C. Finally, in Clark County, moderate population growth between 2000 and 2025 is projected to result in an overall population increase of 63%; of these, persons aged 50 and older will go from representing 18% to 35% (36% statewide by 2030) of the total population.[4][5] An aging population will create more empty nest and single person households, increasing relative demand for smaller units and multi-family housing that do not require yard or building maintenance. The growing number of middle-aged adults will create demand for grocery stores, medical, and pedestrian friendly environments.

Changes in Health Determinants

A. *Motor Vehicles*: Reliance on personal vehicles is the largest barrier to physical activity, a major contributor to accidental injury and death (the leading cause of death for all Washingtonians ages 1-44), and the largest emitter of particulates that cause chronic respiratory diseases such as asthma (Washington's asthma rate is among the highest in the United States).[6]

   ✓ 53.8% of 15-19 year olds died from unintentional injury in 2006; of those 40.8% were related to accidents, and 10.5% of involved motor vehicles.[7]

---

[3] Washington State Department of Health, Center for Health Statistics, http://www.doh.wa.gov/EHSPHL/CHS/chs-data/death/dea_VD.htm (2006 data)

[4] *Forecast of the State Population by Age and Sex, 1990-2030*, November 2007 Forecast, Washington Office of Financial Management.

[5] *Washington State County Population Projections for Growth Management by Age and Sex: 2000-2025, January 2002 Projections*, Washington Office of Financial Management.

[6] Washington State Department of Health Asthma Program http://www.doh.wa.gov/cfh/asthma/data_surveillance.htm

[7] Washington State Department of Health, Mortality Table C3, *Leading Causes of Death by Age and Sex 2006*, http://www.doh.wa.gov/EHSPHL/CHS/chs-data/death/download/deathC3.xls.

- ✓ 13% of sixth graders and 20% of high school students in Clark County report having asthma; more than 1 in 10 households (with children) have a child with asthma.[8]
- ✓ More than 5,000 people are hospitalized and nearly 100 people die every year in Washington as a direct result of asthma[9]

B. *Physical Activity*: Overwhelming scientific evidence now indicates that regular physical activity can lead to a longer lifespan, enhance psychological well being, lower the risk of falls, and lower the risk of obesity and chronic illnesses such as diabetes, hypertension, and heart disease.

- ✓ 66% of Clark County youth did not meet recommended activity levels in 2006.[10]
- ✓ 45% of Clark County adults did not meet recommended activity levels in 2005. [11]
- ✓ 46% of adults were either overweight or obese in Clark County in 1996; by 2005, three out of five adults (62%) were either overweight or obese. From 1980 to 2002 the percent of overweight 6-11 year olds doubled from 7% in 1980 to 16% in 2002; the percent of overweight 12-19 years olds tripled from 5% to 16% in that same time period.[12]
- ✓ About one-third of people 65 or older who live at home fall at least once a year, and fractures that can result from a fall are a major threat to quality of life and independence for the older adult.[13]

C. *Nutrition:* Diabetes is the 7th leading cause of death in this state, and in Clark County has increased by 55% (from 4.1% in 1994 to 6.5% in 2007).[14]

- ✓ The prevalence is greater among vulnerable populations such as older adults, race/ethnic minorities, and people with lower levels of education or income[15].
- ✓ Weight reduction appears to be a major factor in diabetes prevention but research has not been able to separate impacts of dietary changes and physical activity. The quality and composition of the diet is important for maintaining healthy glucose levels, thus reducing long term and serious health problems associated with diabetes such as eye disease, kidney disease, impaired circulation leading to amputations and neuropathies.[16]
- ✓ The American Diabetes Association states that nutrition is important for good diabetes control, by eating well-balanced meals in the correct amounts, affected persons can keep blood glucose level as close to normal (non-diabetes level) as possible.[17] Evidence-based prevention strategies for Type II diabetes include

[8] RMC Research Corporation. (March 2005 and March 2007). Washington State Healthy Youth Survey 2004 and Washington State Healthy Youth Survey 2006. Portland, OR.

[9] *The Burden of Asthma in Washington State*, Washington State Department of Health, Washington Asthma Initiative, June 2005.

[10] RMC Research Corporation. (March 2005 and March 2007). Washington State Healthy Youth Survey 2004 and Washington State Healthy Youth Survey 2006. Portland, OR.

[11] RMC Research Corporation. (March 2005 and March 2007). Washington State Healthy Youth Survey 2004 and Washington State Healthy Youth Survey 2006. Portland, OR.

[12] National Center for Health Statistics Health, United States, 2004. Hyattsville, Maryland: 2004. Table 70: *Overweight* Children and Adolescents 6-19 Years of Age, According to Sex, Age, Race, and Hispanic Origin: United States, Selected Years 1963-65 through 1999-2002.

[13] Washington Department of Health, *Healthy Aging*, http://www.doh.wa.gov/cfh/OHP/healthy-aging/aging_physicalactivity.htm (2007)

[14] Department of Health, *Washington Diabetes Report 2007,* http://www.doh.wa.gov/cfh/diabetes/current_profile_data.htm (2007)

[15] Department of Health, *Washington Diabetes Report 2007,* http://www.doh.wa.gov/cfh/diabetes/current_profile_data.htm (2007)

[16] National Institute of Health, http://diabetes.niddk.nih.gov/dm/pubs/preventionprogram/ (retrieved 2008)

[17] *Diabetes Care*, 25:202-212, American Diabetes Association http://care.diabetesjournals.org/cgi/content/full/25/1/202 (2002)

lifestyle changes that promote increased activity, dietary changes that limit fat and reduce calories and moderate weight loss. Some studies show whole grains and fiber may also assist in prevention or delay of diabetes.

- ✓ Good nutrition can also help protect against heart disease, stroke, certain cancers, diabetes, and osteoporosis.[18]

IV. HIGHWAY 99 Health Impact Assessment

HIA Methodology. This HIA evaluates a project that is still evolving and is in fact supposed to unfold over the next twenty plus years. Because so many aspects of the project are yet undefined, we chose as our starting point the vision of redevelopment in terms of what the community would like to see the area become. Community input has been and continues to be the driver of this process and critical to its success. "Team 99", a group of residents, businesses and property owners working with Clark County Planning staff, spurred the planned redevelopment. At a Community Design Forum held September 27, 2007, residents and stakeholders identified key "ingredients" of their vision, many of which have the potential to affect the health of area residents. We have clustered the "ingredients" into the following four categories that we believe capture the vision of what the community is seeking to create:

A. An ***economically viable*** community created from a mix of neighborhoods, land use (retail, recreation and mixed-income housing), jobs and commerce.

B. A ***sustainable*** community that provides basic amenities (e.g., restaurants, shopping, high density residences, basic services, recreational opportunities etc.) in a safe, aesthetically pleasing setting.

C. A ***socially cohesive*** community (e.g., heritage trail, community gardens, recreational meeting places to foster sense of belonging, participation, and legitimacy).

D. An ***active*** community engaged in walking, bicycling, use of open space, and use of public transportation.

The goal of the Highway 99 plan is to apply land use planning to build a healthy community as defined above. Our goal in this HIA was to support that vision by using an established socio-ecological model of health promotion to validate the plan's health promoting features. Our HIA therefore focuses on factors influencing key intermediate health determinants, specifically physical activity, nutrition and reliance on motor vehicles. In addition, we identify how to ensure or enhance these features through additional changes to the built environment and point out problems in design that could undermine the intended outcome or lead to outcomes that may differ by the structural health determinants of age, income, and ethnicity. This analysis thus provides the foundation for a cost/benefit approach to planning and design decisions.

[18] Washington State Department of Health, Nutrition and Physical Activity, A Policy Resource Guide, http://www.doh.wa.gov/cfh/steps/default.htm, February 2005. Clark County youth did not meet recommended activity levels in 2006.

Recommendations

The Matrix attached in Appendix I provides specific data on the anticipated health outcomes of the Highway 99 project. The "Health Promoting Features" section lists essential elements of the community's vision and the predicted health impacts of each; the "Design Indicator" section lists a set of design characteristics and policies that can be used to evaluate how well the development in fact actualizes the vision of the community; these indicators can also be interpreted as a list of mitigation options when mitigation is needed. The following recommendations are supported by health impact research as presented in the attached Matrix under the characteristics listed in paragraph IV above.

PROMOTE HEALTHY OUTCOMES IN A MIXED-USE, MIXED-INCOME COMMUNITY

Affordable Housing: The most significant social determinant of health is wealth. Equal access to decent and affordable housing is one way to begin to equalize the health outcomes of all residents across income levels.

Recommendation:

1. In order to not unfairly burden low income residents by high housing prices or forced relocation, the goal of providing affordable housing in the Highway 99 area needs to be prioritized.
2. Every effort made to prevent homelessness due to displacement by providing not only housing options, but the support services necessary to make housing transitions a success.
3. Adhere to the mixed-income single and multi-family housing model advocated by citizens, and avoid segregation of housing units by ethnicity or age.

Living Wage Jobs: As stated earlier, wealth is the single most significant predictor of health. Income equality is essential to creating both an economically vibrant and socially cohesive community.

Recommendation:

1. Enact a local living wage job ordinance to ensure the development of businesses that provide living wage jobs in the area, and to ensure that low-income people can not only benefit economically from the redevelopment, but have sufficient income to contribute to its success.
2. Develop an area economic development and opportunity plan to anticipate the employment needs of area residents.

Mixed Income (Residential): A block group analysis of 2000 US Census data indicates that over 12% of persons in the planning area lived below poverty level at that time. per Technical Report #8, there are 5,378 housing units in the planning area, of which 31.5% are renter occupied. As density is increased, creation of mixed-income housing has the capacity to enhance social equity and social cohesion in a neighborhood. However, if the economics unfairly burden low-income residents through high rents or displacement, such cohesion will be challenging.

Recommendations:

1. Create affordable housing options; include mixed income, mixed use family and individual units.
2. Require developers to set-aside 10% for affordable housing units to avoid displacement or unfair burden on low income residents.
3. Monitor for population stability and housing tenure during evolution of project

Mixed Use (Commercial, Recreational, Residential Nodes): As Form-Based Zoning or other strategies are implemented to attracting small businesses and increase pedestrian circulation, this project's success will be in part be dependent on creating a "destination" based community. However, there are inherent conflicts between the anticipated amount of arterial, freeway and truck traffic (I-5, I-205, and Highway 99 as well as multiple East-West intersecting roadways) and the plan for a mixed use walkable/bikeable community: residents, pedestrians or bicyclists may experience an increased risk of automobile related injury and adverse health outcomes related to air and noise pollution.

Recommendations:

1. Mitigation measures to address pedestrian/bicyclist safety, air pollution and traffic noise are essential.
2. Since mitigation is not possible throughout the 4-mile trade area, create multiple hubs where clustered retail, grocery, and other amenities essential to daily life are within easy walking distance (ideally ¼ mile) of housing.
3. Extend retail/commercial zoning into neighborhoods bordering Highway 99 to provide those residents with similar opportunities for access to goods and services without relying on driving.
4. Ensure a variety of transit options in order to reduce dependence on automobiles which will decrease air and noise pollution.

PROMOTE HEALTHY OUTCOMES FOR A SUSTAINABLE COMMUNITY

Air Quality: This project locates areas where there will be an increase of people walking, biking, or living near high volume motor vehicle traffic. Vehicle traffic is the major source of air pollution in urban environments, which is exacerbated in the Highway 99 area due to the close proximity of I-5, high traffic volumes on Highway 99 and arterials, frequent stoplights, and high truck volume (7-9% of total traffic volume).

Recommendations:

1. Mitigate impacts of air pollution (note indicators in Matrix) by:
    a) Creating barriers, planting trees, and setting the design standards for new residences and businesses to address air pollution from the estimated 100,000 plus vehicles passing area each day;
    b) Decreasing speed limits on Highway 99; and
    c) Locating residential projects and mixed use nodes on the East side of Highway 99 to increase distance from exposure.

Noise Mitigation: While the mixed use and form based design planned for this project are highly conducive to walking, biking and increased density, the location of the sub-area between two freeways and along a major arterial is not. Residents, business owners and

customers, walkers and bicyclists are all at risk for the adverse health impacts of noise pollution.

Recommendations:

1. Hire an engineering firm to do noise study using noise measuring devices throughout the planning area to determine actual noise patterns and volumes.
2. Mitigate impacts of noise pollution by such methods as limiting truck traffic, erecting sound walls between highways and homes, requiring soundproofing of all new buildings, and locating residential projects and mixed use nodes on East side of Highway 99 to increase distance from exposure.
3. Consider ways to reduce traffic volume and speed on Highway 99, including implementation of traffic calming measures as indicated in the attached matrix.
4. Consider locating residential mixed-use hubs on the east side of Highway 99, farther away from I-5 traffic.

Urban Agriculture / Access to Healthy Foods: Unhealthy eating habits are a primary risk factor for *four of the top ten causes of death* in Washington. Neighborhoods that are dominated by fast food chains, gas stations, or convenience stores, or that lack good public transportation to grocery stores, result in "food deserts", areas where good nutrition is a challenge due to lack of places to buy fresh fruit and vegetables and other healthy food. Such "food deserts" are more often characteristic of low-income neighborhoods, so contribute to the disparate health outcomes between upper and lower income groups.

Recommendations:

1. Dedicate some land for community gardens, farmers markets, and use of WSU land as agricultural demonstration site. Encourage fruit and vegetable stands.
2. Ensure a low retail food environment index (total number of fast food restaurants and convenience stores in a geographic area divided by total number of super markets and produce vendors) by limiting the geographic concentration and number of fast food restaurants, convenience stores and liquor retailers.
3. Work with the Food Policy Council and other local partners to increase the percent (so the proximity throughout the sub-area) of fresh, locally produced, organic produce that is available for purchase through stores, restaurants or farmer's markets.
4. Ensure that all such outlets are reachable by walking or transit.

Urban Canopy:

Recommendation:

1. Increase the urban canopy (which has many health benefits, from improved mental health to increased absorption of CO^2), conserve water and avoid the high pollution activity of mowing through street/sidewalk and median planting of native vegetation that is low on water consumption.
2. Mitigate impacts of noise pollution by such methods as
    a. Limiting truck traffic, erecting barriers, soundproofing new buildings,

b. Locating residential projects and mixed use nodes on the East side of Highway 99 to increase distance from exposure.

c. Increasing urban canopy and other solutions that also contribute to greening.

PROMOTE HEALTHY OUTCOMES FOR AN ACTIVE COMMUNITY

Access to Transit:

Recommendation:

1. Increase frequency of transit stops so more residents live within a quarter mile of bus, trolley, or high capacity transit options, which will increase the likelihood of use and decrease reliance on carbon and particulate emitting personal vehicles.
2. Ensure wheelchair and otherwise accessible sidewalks connected to transit stops in order to accommodate elderly and others with disabilities, and that elderly housing is in close proximity to bus stops.
3. Expand transit stops into more areas where low income residents are concentrated.

Bicycle Friendly: Bicycling has enormous health benefits, but can be a high risk activity due to poor road and safety design and traveling along heavily trafficked roadways, resulting in exposure to noise and air pollutants as well as risk of injury.

Recommendations:

1. Provide maximum bicycle safety features such as clear signage and markings, medians, wide bike lanes, reduced curb cuts for cars to enter into parking areas, and reduced traffic speeds.
2. Provide bicycling incentives such as bike parking facilities, bike-transit connections, and complete bike lanes both north-south and east-west, as well as connectivity to bordering neighborhoods.

Parks and Green Spaces: Access to parks and green spaces has multiple physical, psychological, and social health benefits, and contributes to community cohesion and identity. In the Highway 99 area, there is less access to parks for lower income residents, and the majority of opportunities are at the northern end of the sub-area.

Recommendations:

1. Create parks, which may be “pocket parks” or areas integrated into the urban landscape, within one-quarter mile of population hubs.
2. Increase park density and quality.
3. Ensure parks are located in lower income areas and are both safe and easily accessible for the elderly and children.

Pedestrian Friendly: The health benefits of increased physical activity through walking are well established in the literature, and are extremely important to addressing not only health but social equity issues for elderly in particular. Presently the study area is a poor

pedestrian environment due to discontinuous, interrupted and narrow sidewalks, high speeds, multiple vehicle entry points across sidewalks, and segregated land uses. In addition, safety is an issue with Highway 99 a major artery with speed limits posted at 40 MPH (design speed 50 MPH).

Recommendations:

1. Where possible, improve walkability by developing a complete street network that accommodate multiple modes of transportation and simulates a grid pattern. In addition, strive for block sizes in the range of 200-800 feet and maximum distances between intersections of 1,000 feet on arterial streets and 500 feet on local streets.
2. Implement safety measures related to traffic calming, signalized crosswalks, protection from air and noise pollution, etc. as defined in the matrix.

Reduced Traffic Risks: Motor vehicles are the leading cause of accidental death, and the number and severity of injuries increase as speed increases. Two of the top ten highest volume intersections are in the sub-area (Highway 99 and 78th St and Highway 99 and NE 134th St). About 51,000 vehicles enter Highway 99 on an avg. weekday, and are said to not exceed 70% of corridor capacity. Projections are that traffic volumes will increase significantly on Highway 99 north of NE 99th Street, but decrease on NE 134th due to the overpass. Factors potentially contributing to negative health outcomes (see this section in the Matrix for related research):

A. Actual travel speeds are significantly higher than the adopted minimum standards on most of the corridors in the Growth Management Area. Higher traffic speeds mean higher noise pollution and greater incidence of accidents and injury involving motor vehicles and possibly pedestrians/bicyclists.

B. Numerous studies have documented the direct relationship between the number of access points and the accident rate for various road types. Accident rates go up as the number of access points increases. In addition, Clark County Code for a 40 mph street allows 28 driveways per mile (if staggered at equal spacing on opposite sides of the street). From the city limits to 78th Street code allows 65 per mile; from 78th to 99th Street 51 per mile, and from 99th Street to 119th Street 35 per mile. These are much higher numbers of curb entrances than are consistent with the safe and efficient function of a principal arterial street that is always a main route for pedestrian and bicycle traffic.

Recommendations:

1. Four road segments in the area are ranked within the top 50 in the County for vehicle accident rates, expressed in number of accidents per million vehicle miles traveled (from 4.10 to 7.61). Prioritize these for traffic calming measures.
2. Use traffic calming measures as listed in the attached Matrix, such as reducing traffic speeds on Highway 99, making the street narrower and reducing the number of traffic lanes while expanding the width of sidewalks and bicycle lanes

PROMOTE HEALTHY OUTCOMES FOR A SOCIALLY COHESIVE COMMUNITY

Community Safety: Fear of assault is not only a leading cause of anxiety, but a major reason people choose not to walk, use recreational facilities, or allow their children to play outside. While many variables influence violence and crime in communities, aspects of the physical environment can both encourage and discourage street crime.

Recommendations:

1. Ensure adequate levels of community policing/fire/and EMS services.
2. Add safety features through built environment (pedestrian scale architecture, well lit streets) and policy (limited permits to alcohol retail outlets).
3. Identify areas where there are existing pockets of crime, especially assault related, and prioritize those for implementing safety strategies (e.g., focus on the area between 78th Street and 88th Street).
4. Create inviting appearance through form-based zoning, green space (including plazas and pocket parks), clean sidewalks, elimination of graffiti, heritage trail, garbage and recycling containers, etc.

V. Conclusions

A. The issues of health equity have been addressed throughout the matrix, but not as a separate issue in and of itself. In achieving a healthy environment, we must ensure that inequitable burdens are not placed on any one geographic or socioeconomic sector of the population and that the benefits of a sustainable community are accessible to all members of the community. Vulnerable populations (especially low-income, minorities, persons with disabilities and elderly) are often segregated, living in areas of concentrated poverty and disproportionately suffering from a variety of health impacts including violence, HIV/AIDS and other STDs, weather related deaths, lack of access to goods and services, social isolation or segregation, poor nutrition, and traffic fatalities. Planning decisions that fail to take diverse populations into account may adversely impact health outcomes. For instance, car dependent neighborhoods can hinder and impede the seniors' (population projected to increase by 60.8% by 2030) ability to maintain social connections; lack of nearby playgrounds may impede the developmental progress of children (population of 0-4 year olds projected to increase by 32.8% by 2030); and the lack of access to nutritious foods may create health inequities for low income citizens and minorities (in 2004, 11.2% of Clark County residents lived below poverty). In neighborhoods where residents experience lack of equal access to safe housing, food, transportation, green space, physical activity etc., concentrations of health problems develop and the impact is large.

B. The web of environmental factors that influence the health of a community is extremely complex, but there is substantial research, as cited in the attached Matrix, to guide planners, policy makers, and stakeholders. Due to limited time and resources (this project has largely been a volunteer effort by Public Health managers), we have not been able to tie every analysis or recommendation to each planned design or policy, but much of that analysis is being carried out in other Highway 99 Technical Reviews. What we do hope to have accomplished is increasing awareness of the many ways in which the built environment influences population wide health outcomes. We also hope to have provided some guidance in how different elements of the proposed project do promote healthy outcomes and ways that it could even more effectively facilitate improvements in the health of the community.

REFERENCES (ALPHABETICAL BY RECOMMENDATION)

Access to Public Transit

Besser, L.M. and Dannenberg, A.L.. *Walking to public transit: steps to help meet physical activity recommendations.* Am J Prev Med. 29(4):273-80 (2005).

Ewing R, Frank L, Kreutzer R. *Understanding the Relationship between Public Health and the Built Environment: A Report to the LEED-ND Core Committee* (2006).

Lawrence Frank and Company: A Study of Land Use, Transportation, Air Quality, and Health (LUTAQH), King County, Washington (2005)

Affordable Housing

Acevedo-Garcia, D., Lochner K.A., Osypuk, T.L., Subramanian, S.V. *Future Directions in Residential Segregation and Health Research: A Multilevel Approach*. Am J of Pub Health 93:215-221 (2003)

Fang, J., Madhavan, S., Bosworth, W., Alderman, M.H. *Residential segregation and mortality in New York City.* Social Science Medicine, 47:469 (1998)

Guzman, C., Bhatia, R., Durazo, C. *Anticipated Effects of Residential Displacement on Health: Results from Qualitative Research*. San Francisco Department of Public Health (2005)

Gee G.C., Payne-Sturges, D.C. *Environmental health disparities: a framework integrating psychosocial and environmental concepts*. Environmental Health Perspectives. 112(17): 1645-1653 (2004)

Hood, E. *Dwelling Disparities: How Poor Housing Leads to Poor Heath*, Environmental Health Perspectives Volume 113, Number 5, May (2005)

Kawachi, I. and Berkman, L.F. Neighborhoods and Health. New York: Oxford University Press (2003)

LaVeist, T.A. *Segregation, poverty and empowerment: health consequences for African Americans*. Millbank Q. 71:41 (1993)

Manjarezz, C. et al*., Poor Health: Adding Insult to Injury for HOPE VI Families; Hope VI: Where Do We Go From Here*, Metropolitan Housing and Communities Center, The Urban Institute (2007)

Orr, L. et al., *Moving to Opportunity Interim Impacts Evaluation*, US Department of Housing and Urban Development, Office of Policy Development and Research (2003)

San Francisco Department of Public Health, Program on Health, Equity, and Sustainability, Unaffordable Housing: *The Cost to Public Health* (June, 2004)

Shihadeh, E.S and Flynn, N. *Segregation and crime: the effect of black isolation on the rates of black urban violence*. Soc Forces. 74:1352 (1996)

Air Quality

Brauer M, Hoek G, Van Vliet P, et al. *Air pollution from traffic and the development of respiratory infections and asthmatic and allergic symptoms in children*. American Journal of Respiratory and Critical Care Medicine. 166:1092-1098 (2002).

California Air Resources Board. Air Quality and Land Use Handbook: A Community Health Perspective. Accessed at: http://www.arb.ca.gov/ch/handbook.pdfNoise Pollution (2005).

English, P., Neutra, R., Scalf, R., Sullivan, M., Waller, L., Zhu, L. *Examining Associations Between Childhood Asthma and Traffic Flow Using a Geographic Information System.* Environmental Health Perspectives 107(9):761-767(1999).

Ewing, R., Lawrence Frank and Company, Inc.; & Kreutzer, K., Design, *Community and Environment: Understanding the Relationship Between Public Health and the Built Environment.* Prepared for the LEED-Neighborhood Development Core Committee, 120, May (2006)

Frumkin, H., Frank. L, Jackson, R. Urban Sprawl and Public Health, 80-89. Island Press, Washington D.C.(2004)

Hoek, G. et al, *Association Between Mortality and Indicators of Traffic-Related Air Pollution in the Netherlands: A cohort Study*, Vol. 360, The Lancet, 1203-1209 (2000)

Janssen NA, de Hartog J, Harssema H, Knape M, van Vliet P. *Air pollution from truck traffic and lung function in children living near motorways.* Epidemiology.8:298-303 (1997).

Kim, J.J., Smorodinsky, S., Lipsett, M, Singer, B.C., Hodgson, A.T., Ostro, B. *Traffic-related air pollution and respiratory health: East Bay Children's Respiratory Health Study*. American Journal of Respiratory and Critical Care Medicine.170: 520-526 (2004).

Lin, S. et al, *Childhood Asthma Hospitalization and Residential Exposure to State Route Traffic,* Vol. 88, Environmental Research, 73-81 (2002).

Pearson, W. et al, *Distance-Weighted Traffic Density in Proximity to a Home is a Risk Factor for Leukemia and Other Childhood Cancers*, Journal of Air and Waste Management Association. February (2002).

Pope, C.A, Burnett, R.T., Thun, M.J., Calle E.E., Krewski, D., Ito, K., Thurston G.D. *Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution*. JAMA.287:1132-1141 (2002)

Schwartz, J., Slater, D., Larson, T.V., Pierson, W.E., Koenig, J.Q. *Particulate air pollution and hospital emergency room visits for asthma in Seattle*. Am Rev Respiratory Disease 147(4):826-31 (1993).

Venn, A,, Lewis, S.A., Cooper, M., Hubbard, R., Britton, J. *Living near a main road and the risk of wheezing illness in children.* American Journal of Respiratory and Critical Care Medicine.164:2177-2180 (2001).

Bicycle Friendly

Avol, E.L., Linn, W.S., Venet, T.G., Shamoo, D.A., Hackney, J.D. *Comparative respiratory effects of ozone and ambient oxidant pollution exposure during heavy exercise*. J Air Pollution Control Assoc. 34(8):804-809 (2001).

Pekkanen, J., Peters, A., Hoek, G., Tittanen, P., Brunekreef, B., de Hartog, J., et al. *Particulate Air Pollution and Risk of ST-Segment Depression During Repeated Submaximal Exercise Tests Among Subjects With Coronary Heart Disease*. Circulation.106;933-938. (2002).

Task Force on Community Preventive Services. *Increasing Physical Activity: A Report on Recommendations of the Task Force on Community Preventive Services*. Morbidity and Mortality Weekly Report. October 26 (2001).

Community Safety

Lipton, R., Gruenewald, P. *The spatial dynamics of violence and alcohol outlets*. Journal of Studies on Alcohol. 63(2):187-95, Mar (2002)

Newman, O. Creating Defensible Space, US Department of Housing and Urban Development, Office of Policy Development and Research (1996)

Newman, O. Defensible Space: Crime Prevention Through Urban Design. Macmillan, New York (1972)

Personal Communication, Mark Edmonds, Washington State Liquor Control Board (2008Taylor, R. & Harrell, A. *Physical Environment and Crime*, presented to the National Justice Institute (1996)

San Francisco Safety Network (SFSD). *Community Survey on Public Safety*. Analysis provided by the National Council on Crime and Delinquency. April (2006).

Zelinka & Brenna, D. Safescape: *Creating Safer, More Liveable Communities Through Planning and Design,* American Planning Association. Chicago, 42 (2001)

Living Wage Jobs

Bhatia, R. and Katz, M. *Estimation of Health Benefits From a Local Living Wage Ordinance.* Vol 91, No. 9 American Journal of Public Health 1398-1402 (September 2001)

Kahn, H. *Pathways Between Area-Level Income Inequality and Increased Mortality in U.S. Men,* Analysis of the NY Academy of Sciences (1999).

Kawachi, I., and Berkman, L.F. Neighborhoods and Health. New York: Oxford University Press; (2003).

Kawachi, I. *Income Inequality and Health*, in Social Epidemiology. Eds. Lisa Berkman and Ichiro Kawachi. New York: Oxford University Press. Pp. 76-94, (2000)

Lynch, J.W., Kaplan, G.A., Pamuk, E.R., Cohen, R.D., Heck K.E., Balfour, J.L., Yen, I.H. *Income inequality and mortality in metropolitan areas of the United States*. Am J Public Health; 88(7): 1074-1080 (1998).

Yen, I., and Bhatia, R. *How Increasing the Minimum Wage Might Affect the Health Status of San Francisco Residents: A Discussion of the Links Between Income and Health, Working Paper,* February 27 (2002).

Mixed-Use Mixed-Income Communities

Ewing R, Frank L, Kreutzer R. *Understanding the Relationship between Public Health and the Built Environment: A Report to the LEED-ND Core Committee* (2006).

Frumkin, H., Frank. L, Jackson, R. Urban Sprawl and Public Health, 80-89. Island Press, Washington D.C. (2004)

Kuo, F.E., Sullivan, W.C. *Environment and crime in the inner city: does vegetation reduce crime?* Environment and Behavior. 33(3):343-367 (2001).
Lynch, J.W., Kaplan, G.A., Pamuk, E.R., Cohen, R.D., Heck, K.E., Balfour, J.L., Yen, I.H. *Income inequality and mortality in metropolitan areas of the United States*. Am J Public Health. 88(7):1074-1080 (1998).

Mobley L. R., Root E. D., Finkelstein E. A., Khavjou O., Farris R. P., Will, J. C. *Environment, Obesity, and Cardiovascular Disease Risk in Low-Income Women*. American Journal of Preventive Medicine Volume 30, Issue 4, 327, April (2006).

Pope, C.A, Burnett, R.T., Thun, M.J., Calle E.E., Krewski, D., Ito, K., Thurston G.D. *Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution*. JAMA.287:1132-1141 (2002)

Schwartz, J., Slater, D., Larson, T.V., Pierson, W.E., Koenig, J.Q. *Particulate air pollution and hospital emergency room visits for asthma in Seattle*. Am Rev Respiratory Disease 147(4):826-31 (1993).

Noise Mitigation

Department of Transportation, *Highway Traffic Noise: The Price of Progress*. Available at http://nonoise.org/library/highway/traffic/traffic.htm. (1998)

Dora C, Phillips M, eds. Transport, environment and health. WHO Regional Publications, European Series, No. 89. http://www.euro.who.int/document/e72015.pdf (1999)

Environmental Protection Agency. Available at:http://www.epa.gov/history/topics/noise/01.htm

Evans G, Marcynyszyn LA. Environmental Justice, Cumulative Environmental Risk, and Health among Low- and Middle-Income Children in Upstate New York. Am J Pub Health 94:1942-1944 (2004)

National Institute of Deafness and Other Communication Disorders. Available at http://www.nidcd.nih.gov/health/hearing/noise.asp

Noise and Health: Making the Link. London Health Commission, 2003. http://www.phel.gov.uk/hiadocs/noiseandhealth.pdf

Stansfeld S, Haines M, Brown B. Noise and health in the urban environment. Rev Environmental Health Vol15(1-2): 43-82 (2002)

Stansfeld SA, Berglund, B, Clark C, Lopez-Barrio I, Fischer P, E, Haines MM, Head J, Hygge S, Kamp I, Berry BF, and RANCH study team. Aircraft and road traffic noise and children's cognition and health: a cross-national study. The Lancet, June 4-10, Vol. 365 (9475): 1942-49 (2005)

World Health Organization, Press release. Available at http://www.euro.who.int/Noise (1988)

Parks and Green Space

Addy, C. L., Wilson, D. K., Kirtland, K. A., Ainsworth, B. E., Sharpe, P., Kimsey, D. *Associations of Perceived Social and Physical Environmental Supports With Physical Activity and Walking Behavior*. American Journal of Public Health, Vol 94(3), 440-443 March (2004)

Ariane, L., Bedimo-Rung, Mowen, A.J., Cohen, D.A. *The Significance of Parks to Physical Activity and Public Health A Conceptual Model*, Am J Prev Med 28(2S2): 159 –168 (2005)

Cohen, D.A., Ashwood, J.S., Scot, M.M., Overton, A., Evenson, K.R., Staten, L.K., Porter, D., McKenzie, T.L., Catellier, D. *Public parks and physical activity among adolescent girls. Pediatrics*. 118(5):1381-1389 (2006).

Kahn, E.B. *The effectiveness of interventions to increase physical activity*. American Journal of Preventative Medicine. 22:87-88 (2002)

Kuo, F.E. and Sullivan, W.C. *Environment and crime in the inner city: does vegetation reduce crime?* Environment and Behavior. 33(3):343-367 (2001).

Taylor, A.F., Kuo, F.E, Sullivan, W.C. *Coping With ADD: The Surprising Connection to Green Play Settings.* Environment and Behavior. 33(1):54-77(2001).

The effectiveness of interventions to increase physical activity. American Journal of Preventative Medicine. 22:87-88 (2002).

Vries, S. de Veerheij, RA, Groenewegenn, PP, Spreeuwenberg, P. *Natural environments-healthy envrionments? An exploratory analysis of the relationship between green space and health.* Environment and Planning. 35: 1717-1731(2003)

Pedestrian Friendly

Frank, L.D., Schmid, T.L., Sallis, J.F., Chapman, J., Saelens, B.E. *Linking objectively measured physical activity with objectively measured urban form: findings from SMARTRAQ*. Am J Prev Med. 28 (2 Suppl 2):117-25 (2005)

Surface Transportation Policy Project, *Aging Americans: Stranded Without Options* (April 2004)

World Health Organization (WHO), Edited by Penden, M., Scurfield, R., Sleet, D. et al. *World Report on road traffic injury prevention*, (2004).

Reduced Traffic Risks

California Department of Health Services, Epidemiology and Prevention for Injury Control (EPIC) Branch, *Pedestrian Injuries to Young Children*, EPICgram (May 2002).

Ewing R, Frank, L., Kreutzer, R. *Understanding the Relationship between Public Health and the Built Environment: A Report to the LEED-ND Core Committee* (2006).

Ewing, R., Schieber, R.A., Zegeer, C.V. *Urban sprawl as a risk factor in motor vehicle occupant and pedestrian fatalities.* Am J Public Health. 93(9):1541-5 (2003).

Surface Transportation Policy Project, Mean Streets 2004, available at www.transact.org

World Health Organization (WHO), Edited by Penden, M., Scurfield, R., Sleet, D. et al. *World Report on road traffic injury prevention*. Accessed at: http://www.who.int/world-health-day/2004/infomaterials/world_report/en/ (2004)

Urban Agriculture / Access to Healthy Foods

Bazzano, L.A., He, J., Ogden, L.G., Loria, C.M., Vupputuri, S., Myers, L., Whelton, P.K.. *Fruit and vegetable intake and risk of cardiovascular disease in US adults: the first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study*. Am J Clinical Nutrition. 76:93-99 (2002).

Herman, D., Harrison, G., Afifi, A., Jenks, E., *Effect of a targeted subsidy on intake of fruits and vegetables among low-income women in the special supplemental nutrition program for women, infants, and children*, American Journal of Public Health, Jan Vol 98 #1, 98-105 (2008).

Inagami, S, Cohen, D.A., Finch, B.K., Asch, S.M. *You are where you shop: grocery store locations, weight, and neighborhoods.* Am J Prev Med. 31(1):10-17 (2006).

Mari Gallager Research and Consulting Group, *Examining the Impact of Food Desserts on Public Health in Chicago* (July 2006), available at http://www.marigallagher.com/projects

Morland, K., Diez Roux, A, Wing, S. *Supermarkets, other food stores, and obesity: The Atherosclerosis Risk in Communities Study*. Am J Prev Med. 30(4): 333-339 (2006).

SF food Systems, 2005 SF Collaborative Food System Assessment at http://www.sffoodsystems.org/

van't Veer, P., Jansen, M.C., Klerk, M., Kok, F.J. *Fruits and vegetables in the prevention of cancer and cardiovascular disease*. Public Health Nutrition.3:103-107 (2000).

Urban Canopy

Grant R., Heisler G., Gao, W. *Estimation of Pedestrian Level UV exposure under trees. Photochemistry and Photobiology*. 75(4):369-376 (2002).

Kuo, F.E. and Sullivan, W.C. *Environment and crime in the inner city: does vegetation reduce crime?* Environment and Behavior. 33(3):343-367 (2001)

Taylor, A.F., Kuo, F.E., Sullivan, W.C. *Coping With ADD: The Surprising Connection to Green Play Settings*. Environment and Behavior. 33(1):54-77 (2001).
d the Chelatchie Rail Trail.

Recommendations for a Mixed Use, Mixed Income Community

Health Promoting	*Potential Health Impacts*	*Equity Issues*	*Summary*	*Design Indicators*
Access to Public Transit	**Transit Benefits for Individuals**: Almost one-third of Americans who commute to work via public transit meet their daily requirements for physical activity (30 or more minutes per day) by walking as part of their daily life, including to and from the transit stop (Besser & Dannenberg, 2005) **Transit Use by Proximity**: Proximity to public transit helps determine travel choices (Ewing 2006). For every ¼ mile increase in distance to public transit from homes, there was an associated 16% decrease in transit use. (Lawrence Frank & Company, 2005) **Transit Benefit and Environment**: Increased public transit use directly results in decreased air pollution from passenger vehicles (Ewing 2006).	Currently 70% of sub-area residents live within 1/4 mile of transit stop. Less served areas are predominantly lighter residential and **higher income**. Access to transit by **elderly** needs to be facilitated by ensuring close proximity to transit stops.	*If achieved* : ▲Physical Activity ▲Use of transit ▲Health equity *If not achieved:* Status Quo	Transit Routes. Access to transit stops. Access to employment, goods, and services.
Affordable Housing	**Benefits of Affordable Housing**: More equitable, affordable housing increases social cohesion, decreases displacement and homelessness, decreases stress, increases overall health (SFDPH 2004). The National Low Income Housing Coalition classifies people as severely cost-burdened if more than 50% of their household's income is spent on housing costs (theHDMT.org). Lack of affordable housing can increase poverty, crowding, displacement, and homelessness all of which result in poor health outcomes (SFDPH 2004; Hood, 2005). **Benefits of Relocation:** Relocating residents from public housing projects into neighborhoods with lower concentrations of poverty has been associated with weight loss and a decline in reported stress levels among adults, and reduced rates of injury among male youths (Orr et al, 2003; SFDPH, 2004). .	**Gentrification** can push out **low-income** and **ethnic minority** residents, whose housing stability and health outcomes will be affected adversely by increases in housing prices. Housing planning can also result in segregation, which has adverse impacts for health of **African Americans**. In the Highway 99 area, **Hispanics** would be the largest ethnic group and most likely to be affected.	*If achieved:* ▲Social Cohesion ▲Social Equity ▼Stress ▼Homelessness ▼Obesity ▼Injury *If not achieved:* ▲Poverty ▲Crowding ▲Homelessness ▲Cost burden	Stabillity of housing values Availability of affordable housing in proportion to local household incomes and demand Displacement rates Relocation planning and assistance Mixed age, ethnicity, income levels

Recommendations for a Mixed Use, Mixed Income Community

Health Promoting	*Potential Health Impacts*	*Equity Issues*	*Summary*	*Design Indicators*
Affordable Housing continued	Risks of Relocation: Relocating low income public housing residents to higher-quality housing or safer neighborhoods may not improve their health status without substantial relocation assistance, partly due to poorer initial health status and the stress of forced relocation (Manjarezz et al, 2007). Involuntary displacement, particularly of low income individuals and families, can cause or contribute to mental stress, loss of supportive social networks, costly school and job relocations and increased risk for sutstandard housing and overcrowing (Guzman 2005)			
Living Wage Jobs	**Benefits of Living Wages**: Income is an extremely strong predictor of health. It is a determinant for overall health and resilience (Yen, 2002). A study of more than 300 cities in the US found that those with the greatest income inequality also had the greatest rates of mortality (Kahn, 1999) Living wages are associated with decreased mortality and increased educational attainment (Bhatia, 2001). Living wage will benefit low income residents and allow them to become engaged in community. Living wage jobs increase number of people covered by health insurance and promote access to health care, availability of jobs to low income and minority populations within area increases health equity, while reducing crime, injury and illness (Kawachi, 2000) **Risk of Disparate Wages**:Income inequality in a community leads to increased violence and mortality (Lynch 1998).	Health benefits in this area apply largely to **low income** residents, who are also often **ethnic minorities** or **elderly**. These are also the groups at highest risk of displacement if living wage jobs and affordable housing are not ensured.	*If achieved:* ▲Overall health ▼Mortality ▲Educational attainment ▲Health equity *If not achieved*: ▲Violence ▲Mortality ▲Ongoing health inequities	Availability/creation of local jobs. Enactment of local living wage ordinance. Jobs created for residents of the area Greater equity of income and weath within area.

Recommendations for a Mixed Use, Mixed Income Community

Health Promoting	*Potential Health Impacts*	*Equity Issues*	*Summary*	*Design Indicators*
Mixed Use (Commercial, Recreational, Residential Nodes) and Mixed Income (Residential)	**Benefits of Mixed Use:** Women living in an environment of mixed land use had lower BMI and CHD risk was lower by 20% than for those living in single-use uniform environments (Mobley, 2006) Mixed income housing and neighborhoods increases social cohesion, promote increased physical activity, sustainability and livability of neighborhoods (Frumpkin et al, 2004) **Risk of Mixed Use:**Increasing the population density in a major pollution corridor will lead to increased exposure, asthma, lung cancer, and heart disease, especially if the design intent is to promote walking and livable outdoor spaces (Schwartz 1993, Pope et al 2002). **Distance and Mixed Use**: Shorter distances between homes and retail reduces car trips and increases physical activity (Ewing et al, 2006).		*If achieved:* ▼Obesity ▲Nutrition ▲Physical Activity ▲Health Equity *If not achieved:* Status quo	Diverse land use Mixed income housing Proportion of mixed-use zoning Percent of commercial land Penetration of commercial zoning into residential neighborhoods Population stability and increased housing tenure

Recommendations for a Sustainable Community				
Health Promoting	***Potential Health Impacts***	***Equity Issues***	***Summary***	***Design Indicators***
Air Quality	**Air Pollution and Health**: Long term exposure to air pollution contributes to the developmentn of cardiovascular diseases, heart disease, stroke, and lung cancer and increases mortality (Pope, 2002) **Air Pollution and Mixed Use**: Increasing population density in a major pollution corridor will lead to increased exposure, asthma, lung cancer, and heart disease, especially if the design intent is to promote walking and livable outdoor spaces (Pope 2002). **Air Pollution and Traffic:** Motor vehicles are major contributors of particulate matter and other pollutants that contribute to the formation of ozone; diesel trucks in particular emit particulate matter air pollutants that have the potential to cause cancer, premature death, and other health effects (Frumkin et al, 2004). In general, the more vehicle miles traveled the worse the air pollution (Ewing et al, 2006) Air Pollution and Proximity to Traffic: Increased asthma hospitalizations associated with living within 650 feet of heavy traffic and heavy truck volume. Increased asthma symptoms with proximity to roadways with the greatest risk within 300 feet. (Kim et al, 2004; English et al, 1999; California Air Resources Board, 2005)	**Low income** areas are currently located in close proximity to Hwy 99 and I-5. Living near heavily trafficked roads greatly increases asthma severity and other cardiac, vascular and respiratory diseases,a burden borne disproportionately by asthma sufferers whoare **ethnic/racial minorities** or from l**ow income** households (Meng et al, 2006; Hoek, 2000; Lin et al, 2002) A study in the Netherlands found that **elderly** adults living near busy roads had almost twice the risk of dying from cardio-pulmonary disease (Hoek, 2000) **Children** living by heavily trafficked roads experience decreased lung function, greater rates of hospitalization for asthma attacks (Lin et al, 2002), and greater risk for all kinds of cancer (Pearson et al, 2000) People engaging in strenuous work or play more at risk	*<u>If achieved:</u>* ▼Vascular disease ▼Heart disease ▼Stroke ▼Lung disease ▼Mortality *<u>If not achieved:</u>* ▲Increased risk for diseases above ▲Increased asthma ▲Health inequities	Trees Traffic volumes Truck volumes Location of Residential vs. Industrial and I-5 Population density within highway pollution corridor

Recommendations for a Sustainable Community				
Health Promoting	***Potential Health Impacts***	***Equity Issues***	***Summary***	***Design Indicators***
Noise Migitation	**Rates of Exposure:** Over 30 million Americans are exposed to hazardous sound levels on a regular basis, and "hazardous sound levels are louder than 80 decibels, which isn't as loud as traffic on a busy street" (NIDOC). WHO press release (1998) stated noise pollution is increasing, and in Europe individuals exposed to over 65 decibels has risen from 15% in early 1980's to 26% in early 1990's. **Traffic Noise and Health**: Since the 1960's noise pollution has been identified as an adverse impact of traffic. Traffic noise can lead to decreased learning ability and scholastic performance, increase stress related hormones, increase blood pressure, interfere with sleep, recreation, speech and communication, increase annoyance, and in extremes may cause physical and psychological damage (DOT 1997; WHO 1998). It is clearly a barrier to social cohesion and a disincentive for pedestrians. Highway traffic noise is affected by volume of traffic, speed of traffic, and number of trucks (DOT 1997) Noise is not usually a serious problem if more than 500 feet from heavily trafficked freeways or 100 feet from lightly traveled roads).The noise of 1 truck equals the noise of 32 cars (DOT 1997).	As above, the health effects of noise pollution are often borne by **low income, minority** groups who live near freeways or other high traffic areas.	*If achieved:* Status quo *If not achieved*: ▲Disturbance of sleep ▲Stress ▲Heart disease ▼Communication ▼Social cohesion	Noise barriers between highways and homes Dense vegetation Open buffer zones bordering highway Insulating buildings Controlling traffic Prohibiting trucks Traffic lights to smooth out flow Speed limits reduced by 20 mph Restricted hours of operation

Recommendations for a Sustainable Community				
Health Promoting	***Potential Health Impacts***	***Equity Issues***	***Summary***	***Design Indicators***
Urban Agriculture/Access to Healthy Foods	**Health Costs of Lack of Access**: Residents in communities with "food deserts" have more health problems and higher mortality than residents of areas with a higher proportion of grocery stores, when other factors are held constant (Gallagher, 2006) **Benefits of Access**: Nearby grocery stores increase neighborhood walking and increase consumption of fruits and vegetables. Also associated with a lower proportion of overweight and obesity (Morland 2006, Ingami 2006). The presence of supermarkets is associated with a lower prevalence of obesity while the presence of convenience stores was associated with a higher prevalence of obesity (Morland 2006) Greater intake of fresh fruits and vegetables is associated with lowered risk for stroke, heart disease, cancer and death (Bazzano 2002, van't Veer 2007). WIC and senior participants when provided with FM coupons have sustained increase of fruit and vegetables in their diet (Herman 2007). Urban agricultural sites support opportunities for health education (growing preparing and consuming fruits and vegetables) as well as opportunities for social interaction and community building. (SF Food Systems 2005).	**Seniors and low income** families are disproportionately affected as healthy foods such as fruits and vegetables may be more expensive than less healthy alternatives. **Low income** and **ethnic minority** residents lack access, as there are currently no farmers markets, community gardens or fruit and vegetable stands in the sub-area. Locally accessible foods may not be culturally appropriate for some **racial/ethnic** minorities.	*<u>If achieved:</u>* ▲Nutrition ▼Mortality ▼Obesity *<u>If not achieved:</u>* Status quo	Farmers markets CSAs Fruit and vegetable stands Community gardens Agricultural demonstration site Population within 1/2 mile of full scale store for population Distance to store for low-income residents Availability of ethnic foods that meet the needs of diverse population Number of vendors selling fruit and vegetables Number of drive through restaurants Number of restaurants selling healthy food See food access maps

Recommendations for a Sustainable Community				
Health Promoting	***Potential Health Impacts***	***Equity Issues***	***Summary***	***Design Indicators***
Urban Canopy	**Social and Health Impacts**: Trees mitigate temperatures which can reduce heating and cooling costs. Trees can improve air and water quality and their shade can reduce skin cancer risk (Grant, 2002). Green surroundings are associated with fewer crime reports and increased concentration among children (Kuo, 2001; Taylor, 2001). Use of native vegetation decreases ongoing landscaping costs, dependence on water, and groundwater pollution caused by use of fertilizers and weed killers.	**Low income** areas may have lower tree coverage and residents may be exposed to higher levels of UV.	If achieved: ▲Air quality ▲Overall health ▲Health equity *If not achieved:* Status quo	Percent of area with urban tree canopy Percent of native vegitation Amount of shade for pedestrians/bicylists

Recommendations for a Socially Cohesive Community

Health Promoting	*Data on Potential Health Impacts*	*Equity Issues*	*Summary*	*Design indicators*
Community Safety	**Crime Prevention and Built Env**: Features of the built environment that can influence crime prevention include housing design, block layout, land use and circulation patterns, resident-generated territorial features (like street closures or community gardens) and physical deterioration (Taylor & Harrell, 1996) Street crime along particular streets can decline or vanish after implementing building patterns that provide "defensible space" (an area that residents feel they can control), "natural surveillance" (the ability to see what's happening around an area), and "sense of order" (places that are well tended and lack visible signs of deterioration). Equally important, such design features help residents feel safe (Newman, 1972; Newman 1996; Zelinka & Brenna, 2001). Levels of neighborhood crime and perceptions of safety are determined by development-related factors (including those suggested as indicators, at right) (SFSN, 2006)	Mixed use development zoning is proposed for the northern (above 99th) and southern (below 78th) ends of the sub-plan area, but neglects the area with the highest crime, which appears to lie between 78th and 88th in particular.	*If achieved:* ▲Perceived safety ▼Crime rates ▲Increased circulation ▲Health equity *If not achieved*: Status quo	Pedestrian-Scale Lighting Presence of Natural Access and other crime prevention design features Level of pedestrian circulation and "eyes on the street" Level of community policing Response time of police, fire and EMS Density of alcohol outlets Access to guns (pawn shops) Crime rates
	Levels of neighborhood crime and perceptions of safety are determined by development-related factors (including those suggested as indicators, at right) (SFSN, 2006) **Crime and Alcohol Outlets:** Density of alcohol outlets in the Hwy 99 subplan area is 2.9 per 1,000 residents, compared to 1.4 per 1,000 for Clark County (Edmonds). The density of alcohol outlets is strongly associated with greater rates of physical assaults, violent crimes, and violence in general. (Lipton, 2002)			Mix of violence prevention, suppression and enforcement strategies Community perception of safety Mix of violence prevention, suppression and enforcement strategies

Recommendations for an Active Community				
Health Promoting	***Data on Potential Health Impacts***	***Equity Issues***	***Summary***	***Design Indicator***
Bicycle Friendly	See Pedestrian Friendly below **Risk to bicyclists:** Bike lanes and increased street safety increase bicycle ridership and decrease bicycle injuries (MMWR, 2001) Exposure to air pollutants during heavy exercise can irritate lungs, reduce lung function, and impact cardiac function (Avol, 2001; Pekkanen et al, 2002) **Benefits to bicyclists**: Biking in neighborhood, to work, or to services helps residents meet physical activity requirements. Physical activity reduces obesity and decreases the reisk of essentially every type of chronic disease (MMWR 2001).	Residents living or working adjacent to Highway 99 may have higher pollutant exposure during biking and other physical activities.	*If achieved:* ▲ Physical Activity ▼Obesity ▼Accidental Injury ▼Air and Noise Pollution ▼Pollution exposure *If not achieved:* Status quo	**Additional bike- specific indicators:** Complete Bike Lanes Signage and marking Bike parking/facilities Bicycle vs. vehicle MVCs Bicylcist injury/fatality rate Ratio of bike lane/path miles to road miles
Parks and Green Space	**Park Access and Health:** Exercise facilities, including parks, that are conveniently located (as measured by self-reports) have been found to be associated with vigorous physical activity in a number of studies, among both adults and children (Cohen et al, 2006) Residents who had good street lighting; trusted their neighbors; and used recreational facilities, parks, playgrounds, and sports fields were more likely to be regularly active (Addy 2004) In addition to the physical health benefits of parks, there may be numerous psychological benefits for park users that arise from the proximity of “natural environments.” Studies among workers, college students, hospital patients, inner-city girls, public housing residents, and apartment residents have found a variety of psychological, emotional, and mental health benefits stemming from having a view of nature through their windows. Parks may also facilitate social interactions that are critical in maintaining community cohesion, pride, and social capital (Ariane et al, 2005)	Parks and open space are readily accessible to 3/4 of the sub-area population. **Low-income** residents have poorer access to parks and green space. Parks may be smaller and lower in quality. Majority of recreation opportunities exist at the northern end of the sub-area.	*If achieved:* ▲Physical Activity ▼Obesity ▲Social Cohesion ▲Emotional Health ▲Overall health ▼ Crime *If not achieved:* Status quo	Population Within 1/4 mile to Park Density of parks and green spaces Size and quality of parks and green spaces Urban trails Recreational opportunities offered Active neighborhood, cultural, sports and commercial associations Voter participation rates See park access maps.

Recommendations for an Active Community

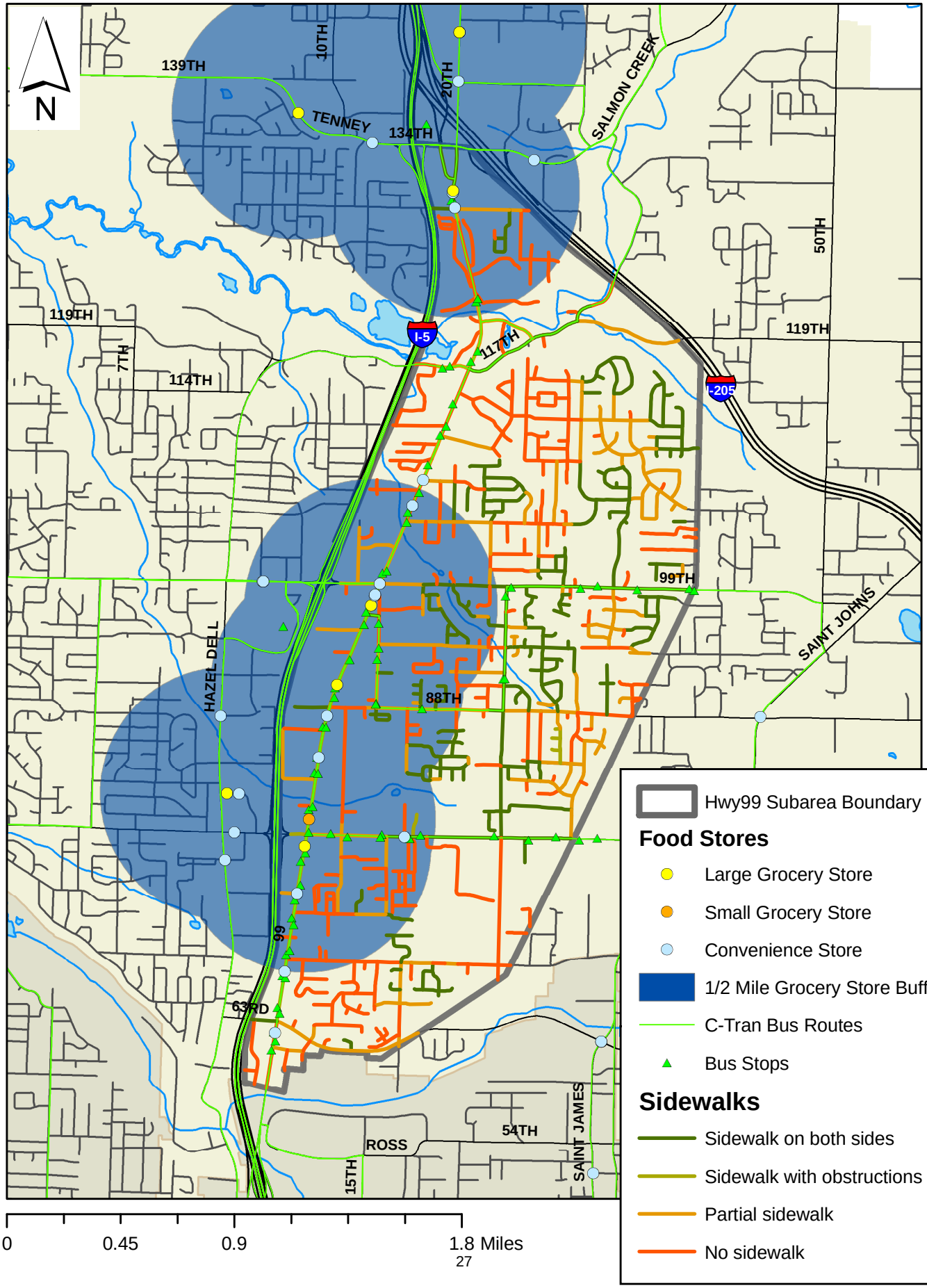
Health Promoting	*Data on Potential Health Impacts*	*Equity Issues*	*Summary*	*Design Indicator*
Parks and Green Space continued	Access to parks, and number of nearby parks is associated with increased physical activity and better self-reported health; Access to places for physical activity combined with outreach and education can produce a 48 percent increase in the frequency of physical activity (Cohen 2006, Kahn 2002, Vries 2003). **Green Space and Crime:** The presence of green surroundings in urban settings is associated with fewer crime reports after controlling for the number of apartments per building, building height, vacancy rate, and number of occupied units per building (Kuo, 2001)	Studies in poor urban areas suggest that park-like natural elements promote increased opportunities for social interactions. In two Chicago public housing developments natural landscaping and spaces with trees attracted larger groups of people than did spaces devoid of nature. Exposure to green common spaces among elderly inner-city individuals is significantly positively correlated with social integration (Ariane et al, 2005)		
Pedestrian Friendly	**Risks to Pedestrians:** In a fast-moving, high-traffic volume environment, fewer pedestrians may be appropriate. However, any increase in pedestrians without concomitant traffic calming measures could otherwise increase pedestrian injury/fatality rates. Unsafe or poorly designed mixes of motor vehicles, pedestrians and cyclists lead to increased risk of injury and death (WHO, 2004) Although only 8.6 percent of all trips are made on foot, 11.4 percent of all traffic deaths are pedestrians. And while the 2001 fatality rate per 100 million miles traveled is 0.75 for public transit riders, 1.3 for drivers and their passengers, 7.3 for passengers of commercial airlines1, the fatality rate for walkers is an astonishing 20.1 deaths per 100 million miles walked (Surface Transportation Policy Project, 2004). Unsafe or poorly designed mixes of motor vehicles, pedestrians and cyclists lead to increased risk of injury and death. (WHO, 2004) Benefits to Pedestrians: In a multivariate analysis, land-use mix had the strongest association with obesity. Each additional hour spent in a car per day was associated with a 6% increase in the likelihood of obesity. Conversely, each additional kilometer walked per day was associated with a 4.8% reduction in the likelihood of obesity (Frank et al, 2005)	Incomplete sidewalks in many neighborhoods make walking unsafe, putting **low income** residents at higher risk for injuries. **Elderly**-Planning for diverse transportation options will only grow in importance as America grays. There are currently about 4.5 million non-drivers over age 75, and projections indication this figure Is likely to grow to about 6 million by 2020 (Kochera & Straight, 2005). Safe, walkable streets and paths are especially important to the **elderly**. Individuals age 50 and older make three-quarters of all trips not taken by private automobile on foot (US DOT, 2001) Older nondrivers take 65% fewer social, family and religious trips than older people who still drive. On a given day, those in lower-density neighborhoods are 50% more likely to stay home than those living in denser neighborhoods (Surface Transportation Policy Project, 2004)	*If achieved:* ▲Physical Activity ▼Obesity ▼Accidental Injury ▼Air and Noise Pollution *If not achieved:* Status Quo	**I**n addition to traffic calming measures noted under "Reduced Traffic Risks" indicators of pedestrian friendly design include: Crosswalks (continuous, frequent, wide and signalized) Pedestrian refuge islands in medians Curb cuts Complete continuous sidewalks Amenties (benches, art) Green buffers between street/sidewalk Urban trails Corner bulb outs for high visibility Timed signal crossings Pedestrian injury/fatality rate And: Pedestrian-specific entrances to buildings Proportion of population living within 1/4 mile of food, transit, work Human-scale, form-based and mixed use development in place to improve pedestrian circulation Percent trips made on foot

Recommendations for an Active Community				
Health Promoting	***Data on Potential Health Impacts***	***Equity Issues***	***Summary***	***Design Indicator***
Reduced Traffic Risks	**Motor Vehicles and Injury**: Motor vehicle collisions are the leading cause of accidental death in Calif, and being hit by a car while walking is the third leading cause of death for children under 12 (Calif Dept of Health Services, 2002). For every mile traveled, a pedestrian's risk of dying is more than 15 time that of drivers, providing a legitimate disincentive for walking. Pedestrian accidents are 2.5 times less likely on streets with sidewalks than on otherwise similar streets. (Surface Transportation Policy Project, 2004) **Motor Vehicle Speed and Injury**: Excess and inappropriate speed is widespread and may contribute to around 30% of road traffic crashes and deaths. An average increase in speed of 1 km/h is associated with a 3% higher risk of a crash involving an injury. Pedestrians have a 90% chance of surviving car crashes at 18 mph or below, but less than 50% chance at 28 mph or above (WHO, 2004) Motor vehicle crashes (MVCs) are correlated with high speeds, resulting in injuries and fatalities. As speeds increase, so do the number and severity of injuries (Ewing et al, 2006) Areas that are compact, with lower levels of vehicle miles traveled per capita, tend to have lower accident and injury rates (Ewing et al, 2003)	Traffic counts and crashes in the sub-area are documented, and particularly high on Hwy 99 and NE 78th Street. Highway 99 is a high-volume, high speed (posted 40 MPH, design for 50 MPH) route.	*If achieved:* ▲ Pedestrian circulation ▼Accidental injuries ▼Severity of injuries *If not achieved:* Status quo	**Traffic calming and risk reduction measures:** Curb bulb-outs Roundabouts Landscaping Pavement treatments Horizontal shifts Speed humps Tighter corner radii Rumble Strips Left turn lanes Channelization lanes Number of lanes Width of lanes Speed limit Appropriate routing of trucks Number of vehicle entry points Location of and pricing of parking that incentivizes reduced driving

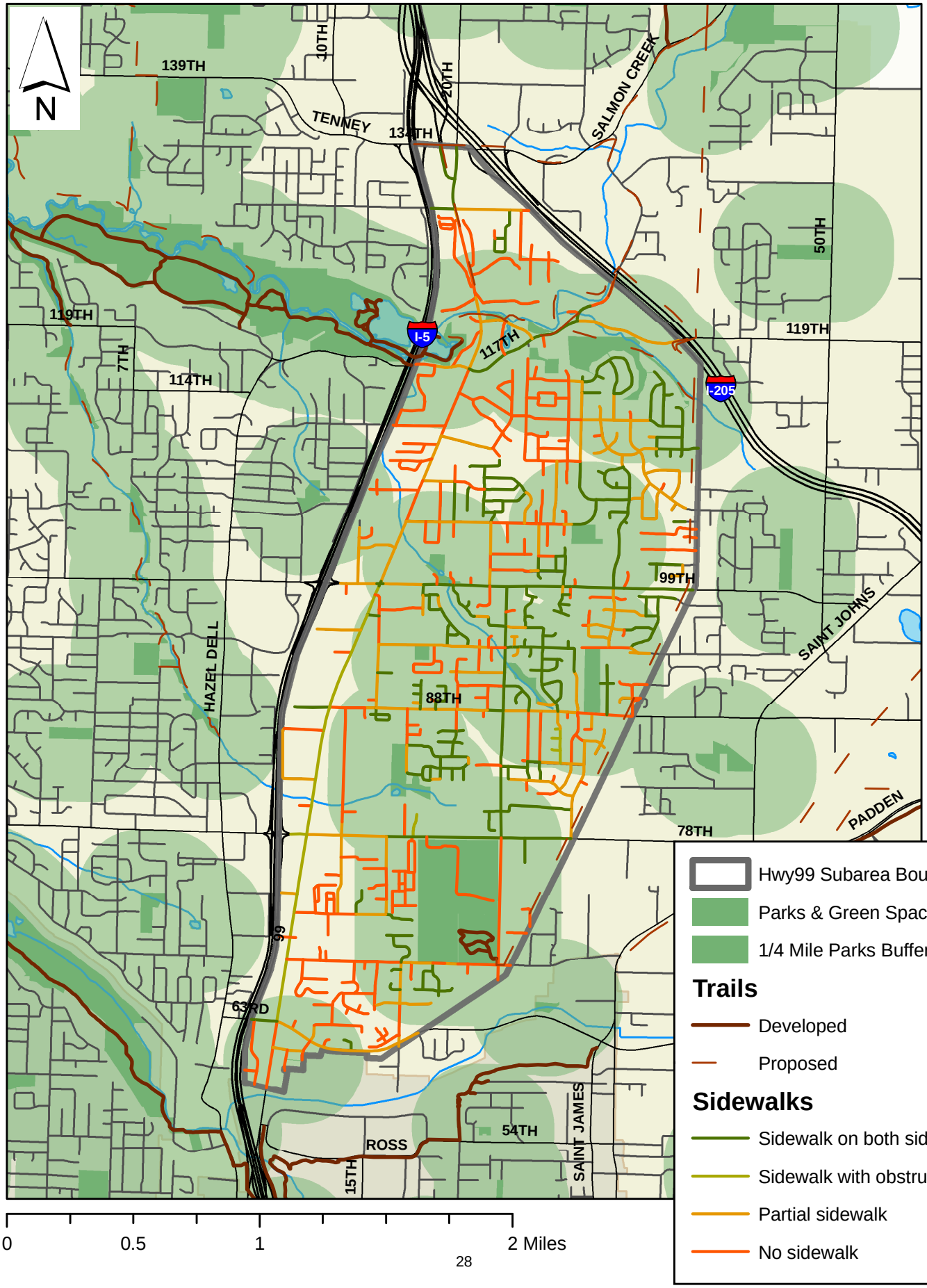
Technical Report
HIGHWAY 99
Health Impact Assessment Maps

ACCESS

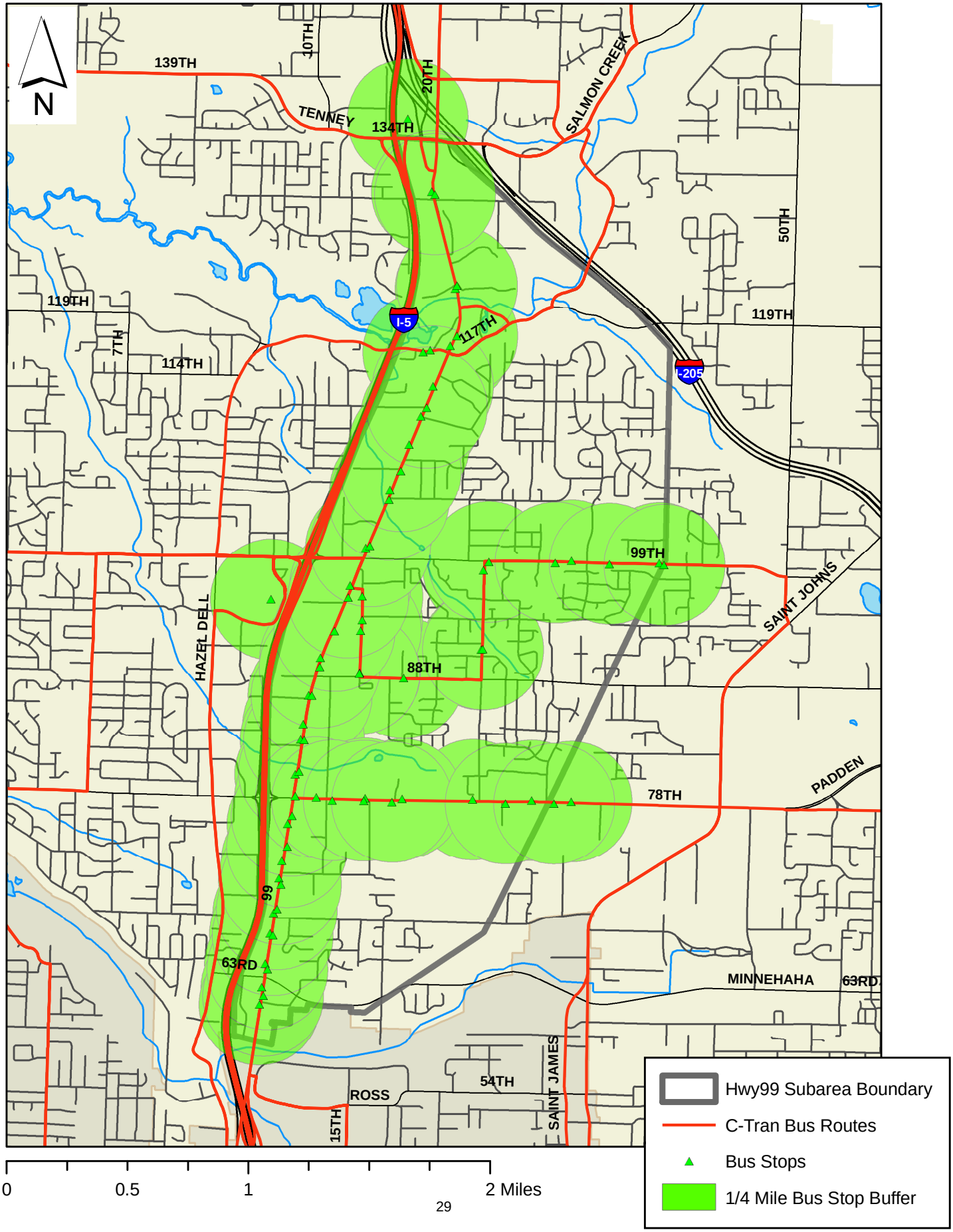
HWY99 - Access to Food



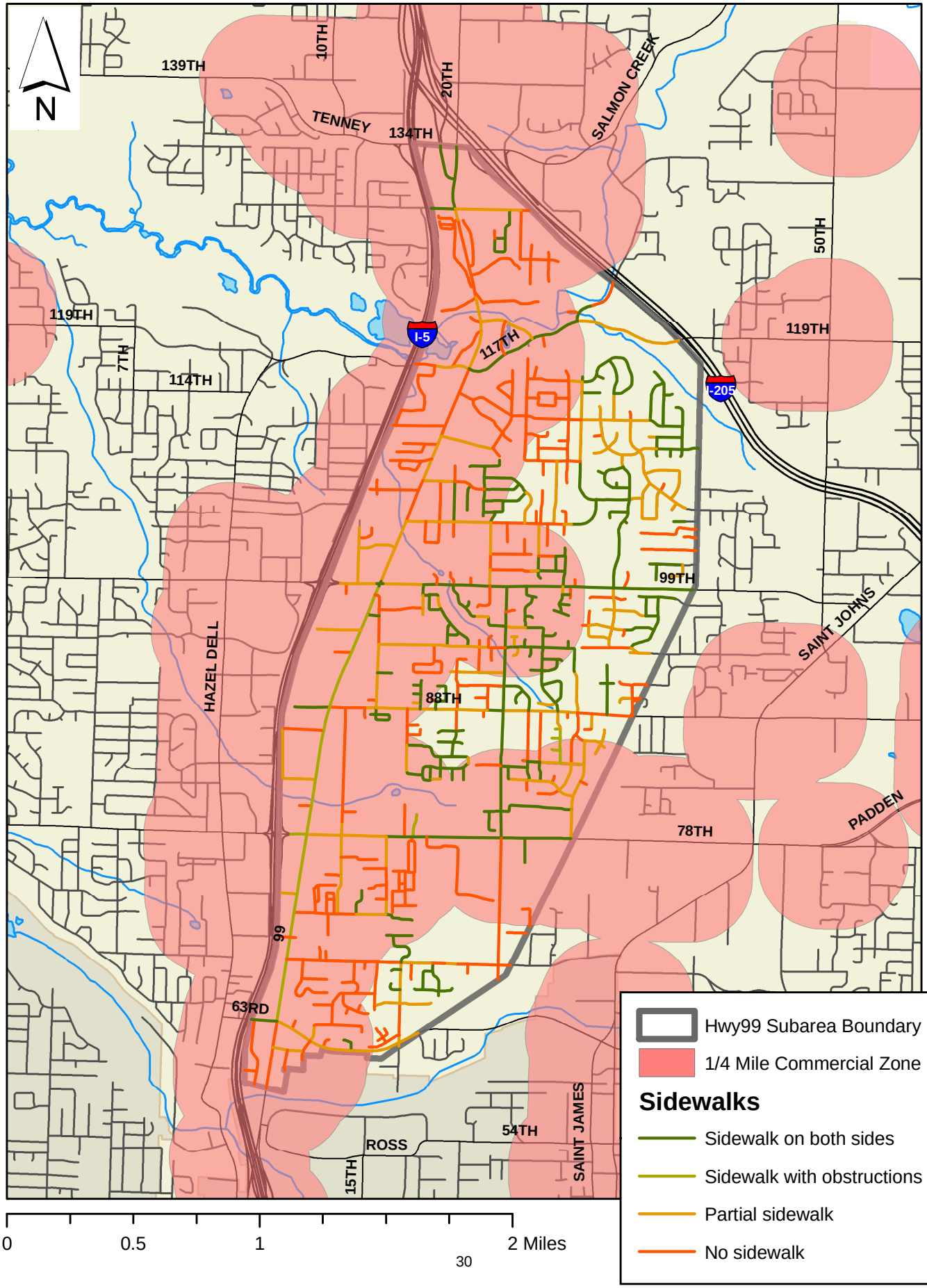
HWY99 - Access to Parks & Green Space



HWY99 - Access to Public Transit

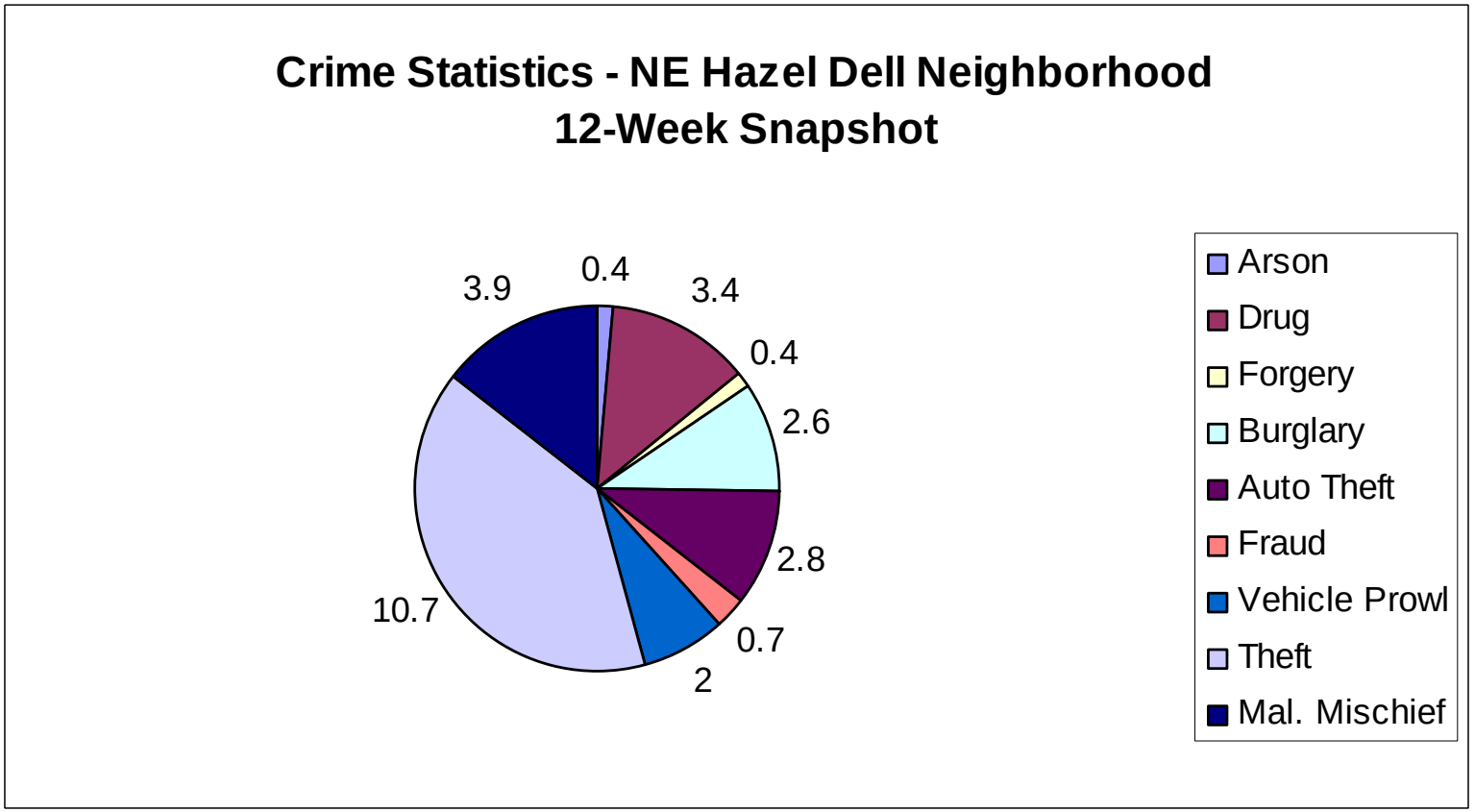


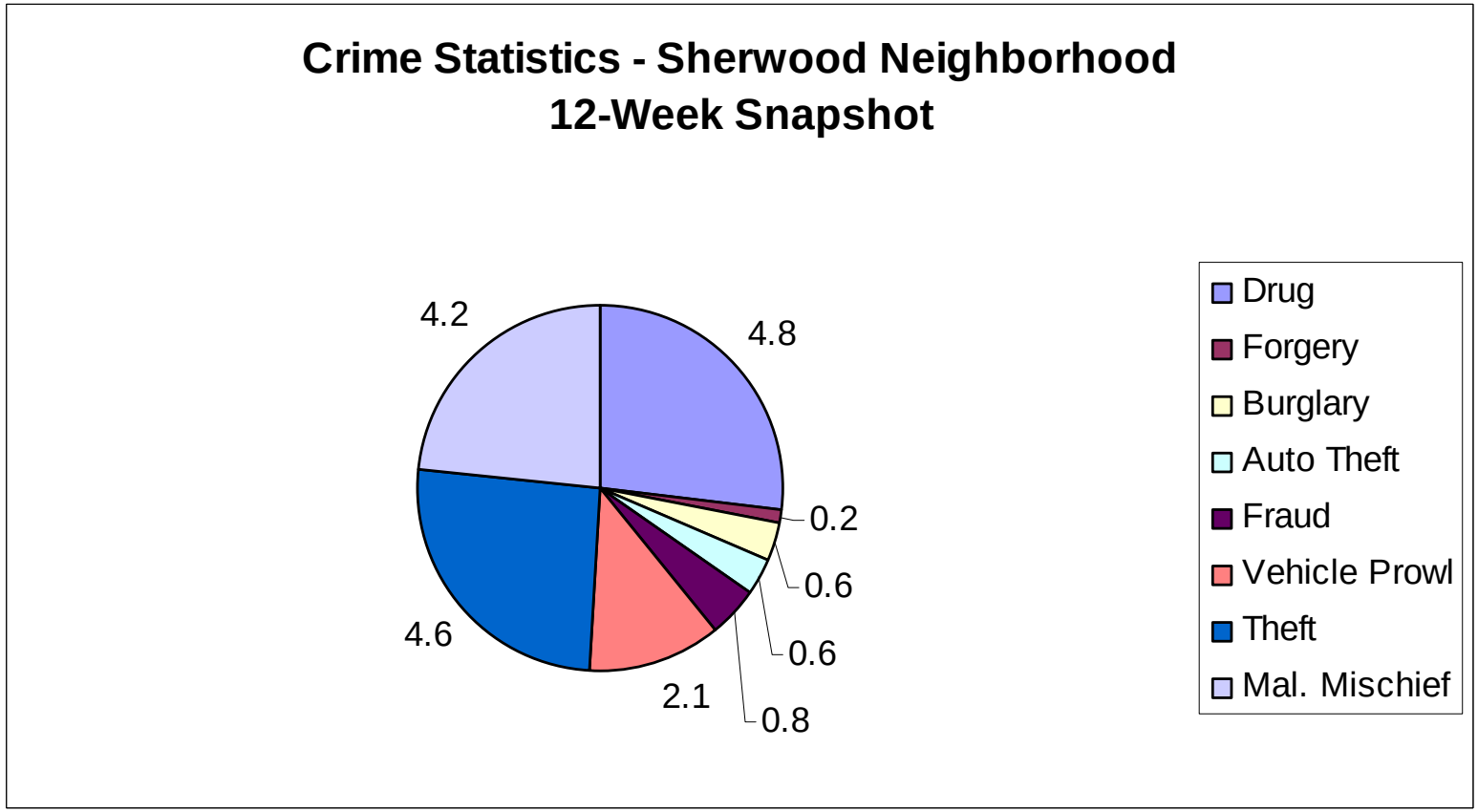
HWY99 - Access to Commercial Areas Within Neighborhoods



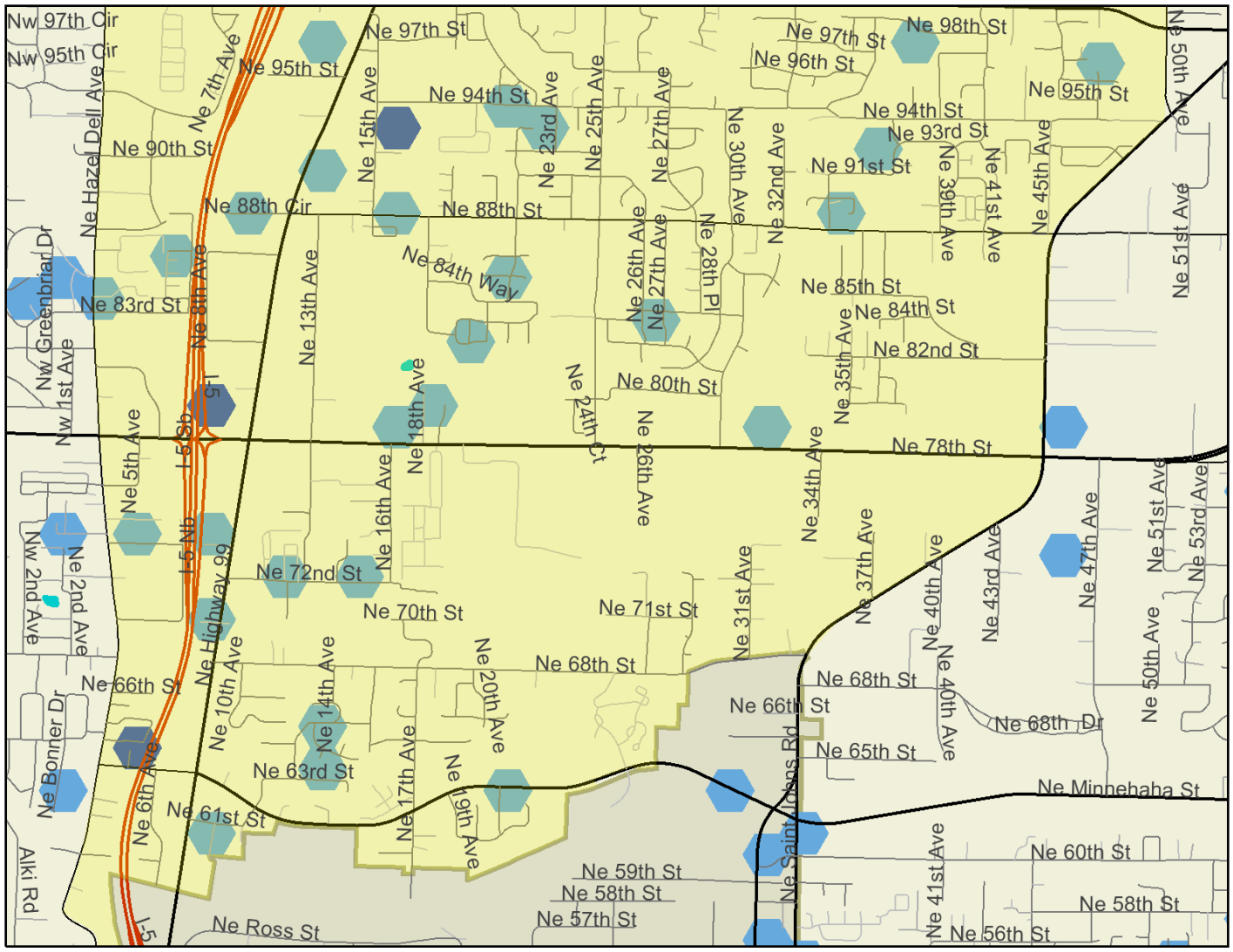
Technical Report
HIGHWAY 99
Health Impact Assessment Maps

CRIME DATA FOR PAST 12 WEEKS


Crime Statistics - NE Hazel Dell Neighborhood
12-Week Snapshot
0.4
3.4
0.4
2.6
2.8
0.7
2
10.7
3.9
Arson
Drug
Forgery
Burglary
Auto Theft
Fraud
Vehicle Prowl
Theft
Mal. Mischief


Crime Statistics - Sherwood Neighborhood
12-Week Snapshot
4.2
4.8
0.2
0.6
0.6
4.6
2.1
0.8
Drug
Forgery
Burglary
Auto Theft
Fraud
Vehicle Prowl
Theft
Mal. Mischief

Auto Theft, Past 12 Wks (4/1/08), NE Hazel Dell



0 2250 4500 6750 ft.

Map center: 45° 40' 40" N, 122° 38' 43" W

Legend

Neighborhoods

Roads

- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Auto Theft Incidents

- 2 or less
- 3 or more

Waterbodies

City Boundaries

Urban Growth Boundaries

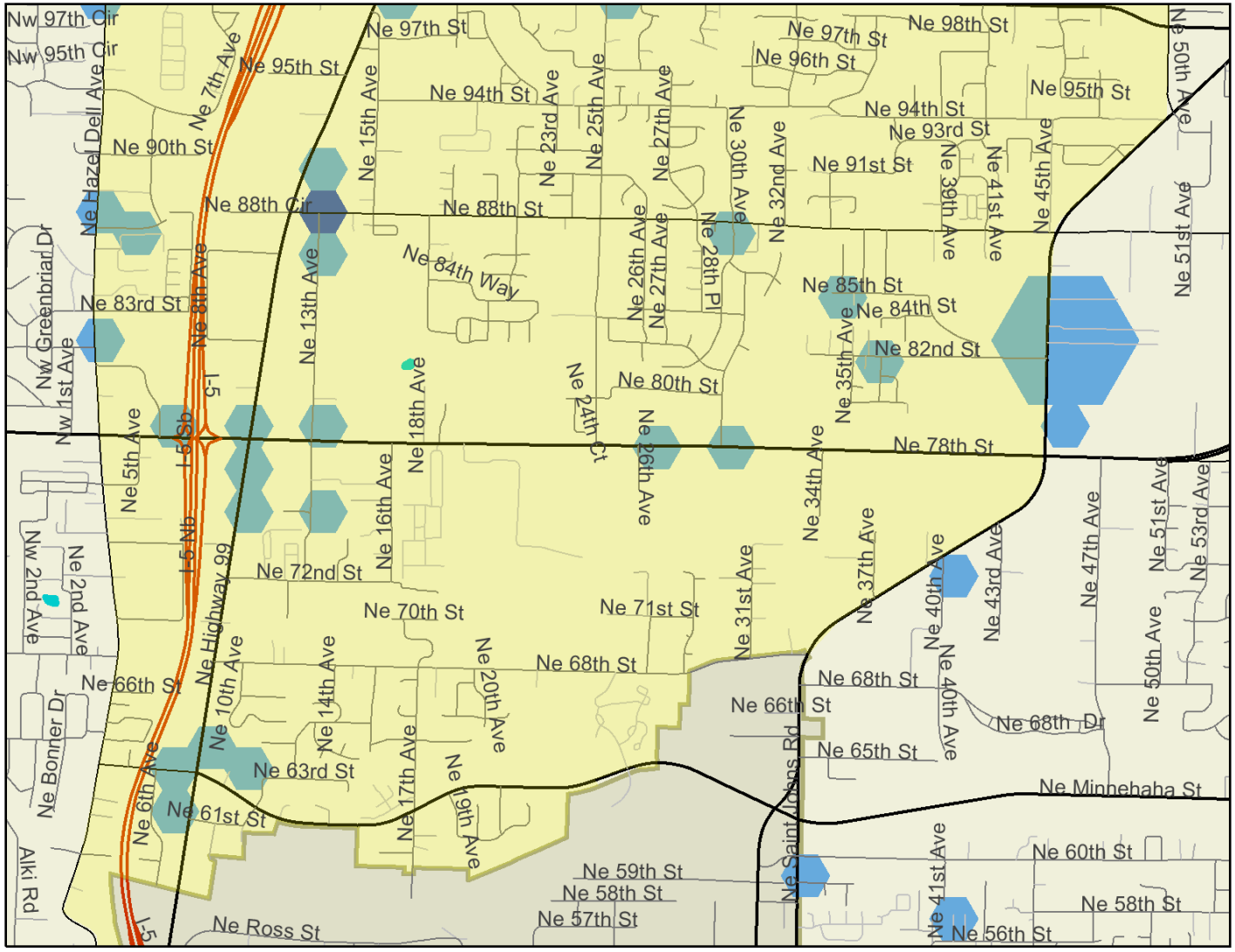
County Boundary

N

Scale: 1:23,588

Clark County GIS

Drug Arrest, Past 12 Wks (4/1/08), NE Hazel Dell



Legend

Neighborhoods

Roads

- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Drug Incidents

- 3 or less
- 4 or more

Waterbodies

City Boundaries

Urban Growth Boundaries

County Boundary

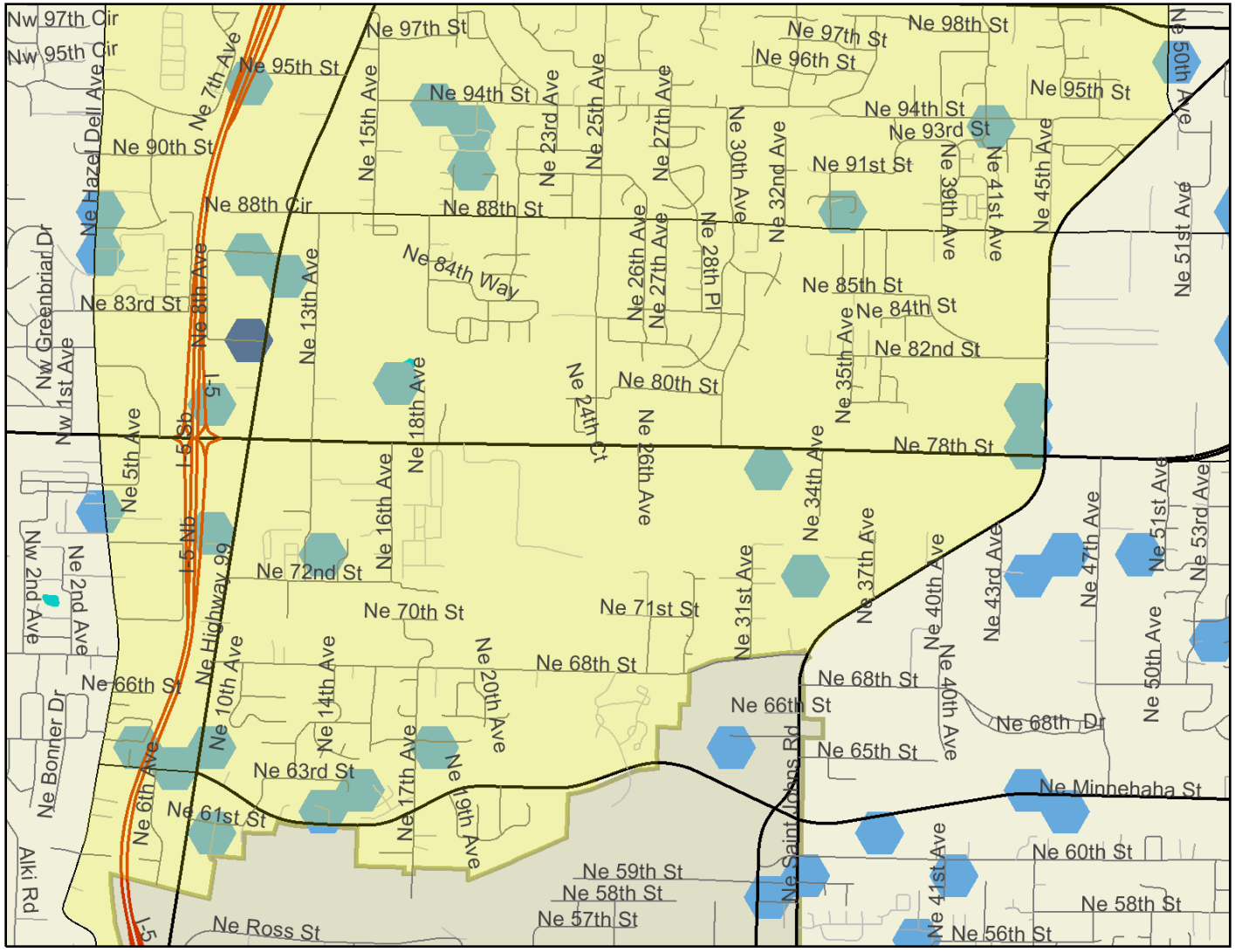
0 2250 4500 6750 ft.

Map center: 45° 40' 40" N, 122° 38' 43" W

Scale: 1:23,588

Clark County GIS

Burglary, Past 12 Wks (4/1/08), NE Hazel Dell



Legend

Neighborhoods

Roads

- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Burglary Incidents

- 2 or less
- 3 or more

Waterbodies

City Boundaries

Urban Growth Boundaries

County Boundary

0 2250 4500 6750 ft.

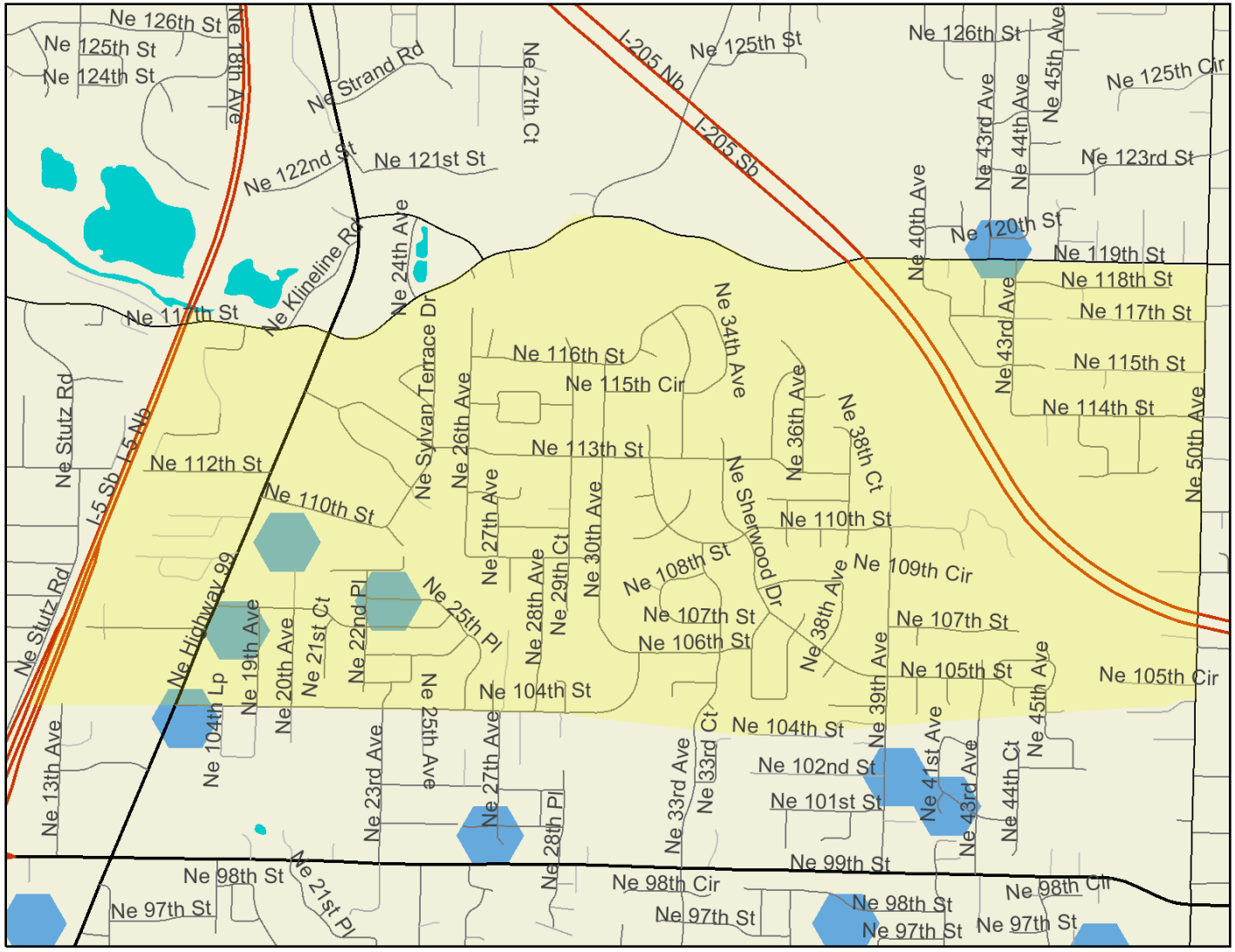
Map center: 45° 40' 40" N, 122° 38' 43" W

Scale: 1:23,588

Information shown on this map was collected from several sources. Neither Clark County, Washington, nor the producer of this document accept responsibility for any inaccuracies that may be present.

Clark County GIS

Auto Theft, Past 12 Wks (4/1/08), Sherwood



Legend

Neighborhoods

Roads

- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Auto Theft Incidents

- 2 or less
- 3 or more

Waterbodies

City Boundaries

Urban Growth Boundaries

County Boundary

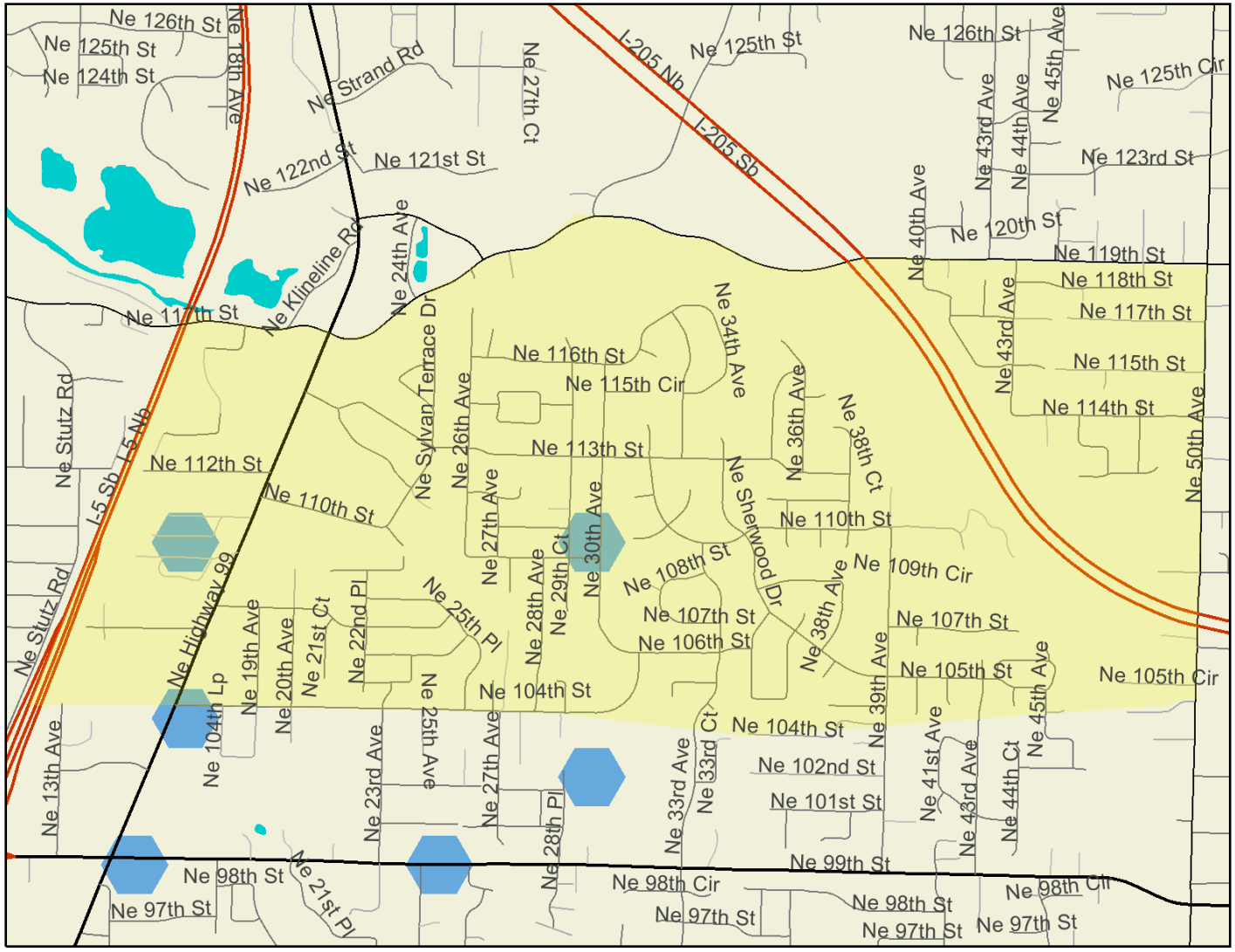
0 1700 3400 5100 ft.

Map center: 45° 42' 8" N, 122° 38' 24" W

Scale: 1:17,230

Clark County GIS

Drug Arrests, Past 12 Wks (4/1/08), Sherwood



Legend

Neighborhoods

Roads

- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Drug Incidents

- 3 or less
- 4 or more

Waterbodies

City Boundaries

Urban Growth Boundaries

County Boundary

0 1700 3400 5100 ft.

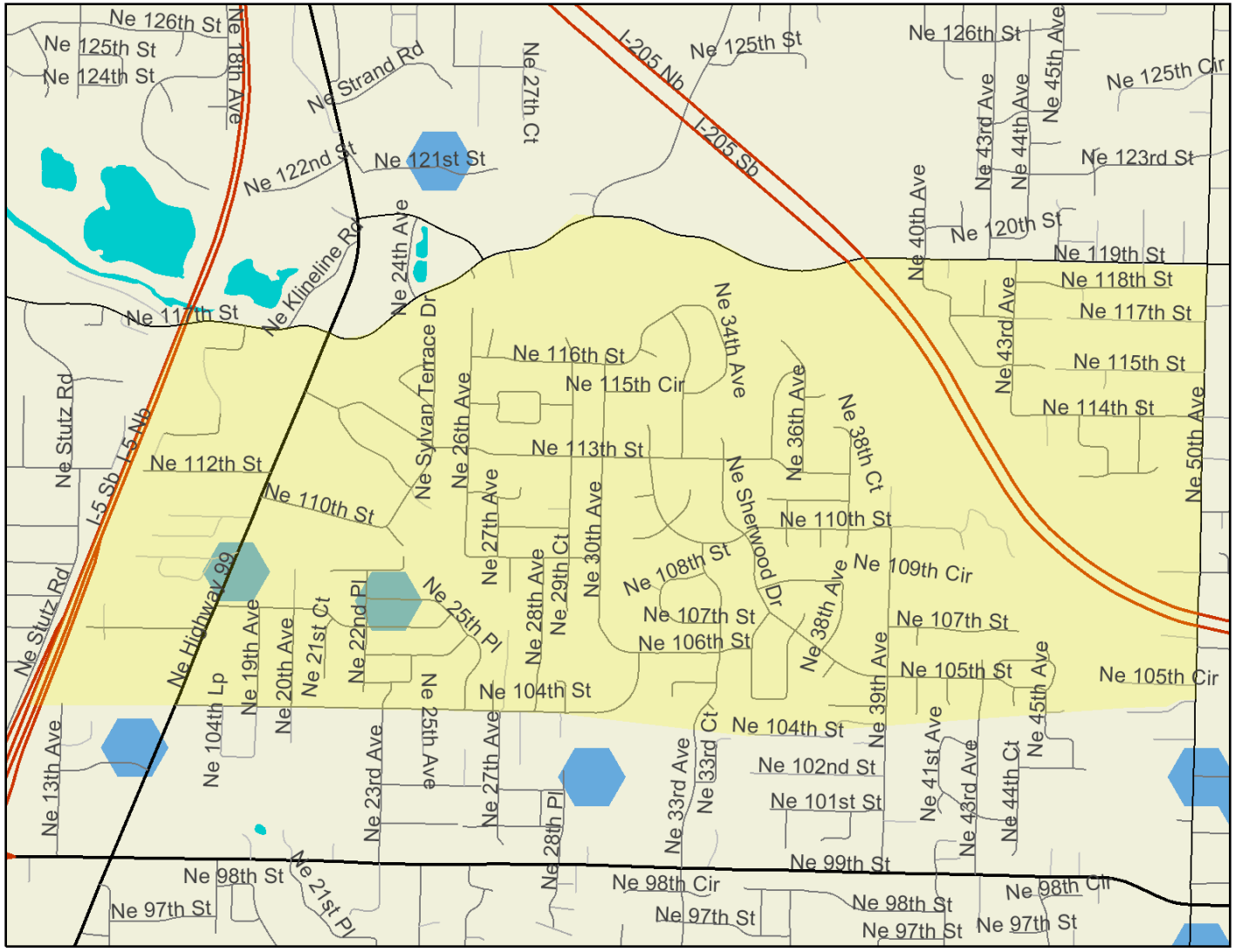
Map center: 45° 42' 8" N, 122° 38' 24" W

Scale: 1:17,230

Information shown on this map was collected from several sources. Neither Clark County, Washington, nor the producer of this document accept responsibility for any inaccuracies that may be present.

Clark County GIS

Burglary, Past 12 Wks (4/1/08), Sherwood



Legend

Neighborhoods

Roads

- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Burglary Incidents

- 2 or less
- 3 or more

Waterbodies

City Boundaries

Urban Growth Boundaries

County Boundary

0 1700 3400 5100 ft.

Map center: 45° 42' 8" N, 122° 38' 24" W

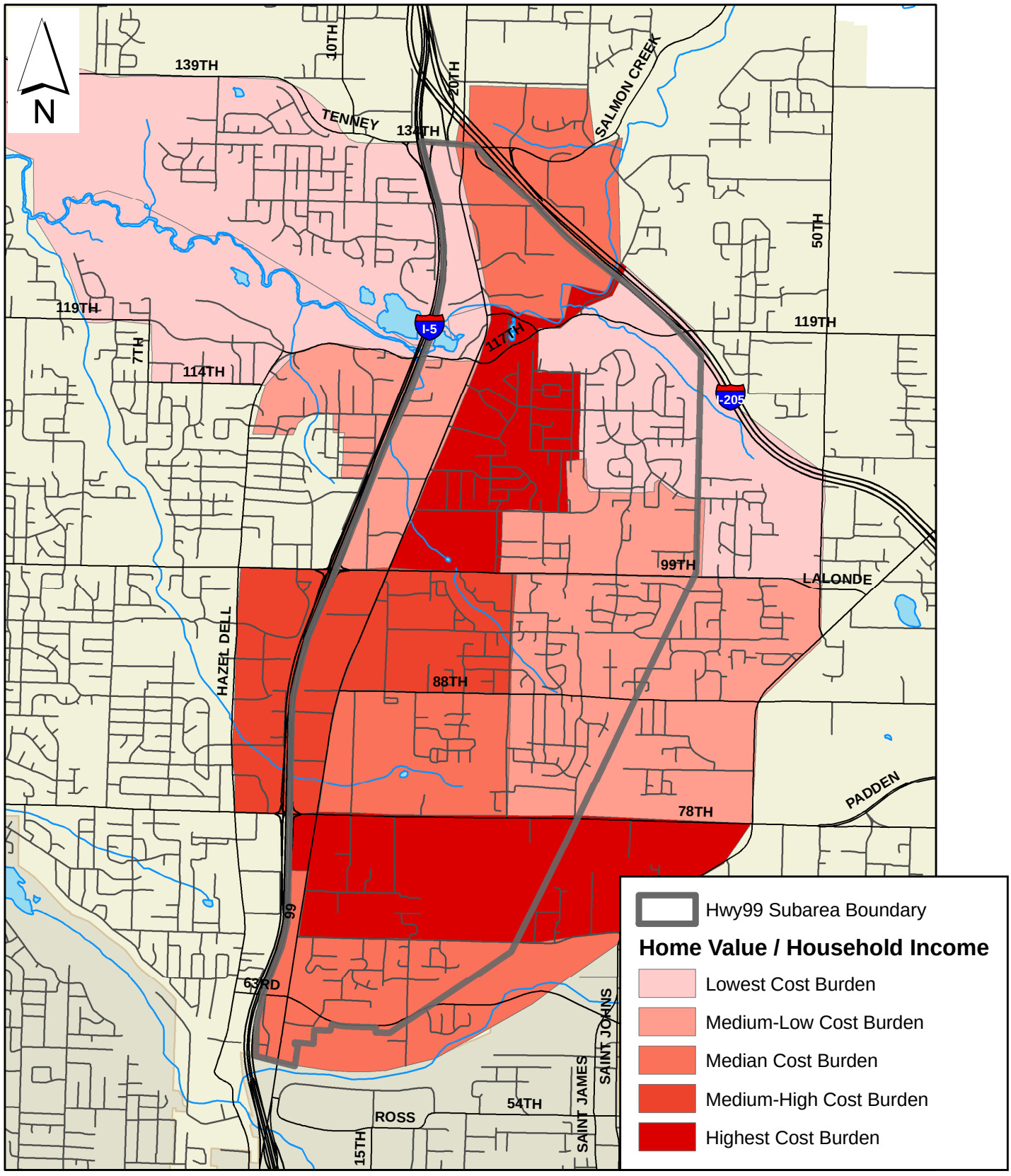
Scale: 1:17,230

Clark County GIS

Technical Report
HIGHWAY 99
Health Impact Assessment Maps

HOUSING AND INCOME DEMOGRAPHICS

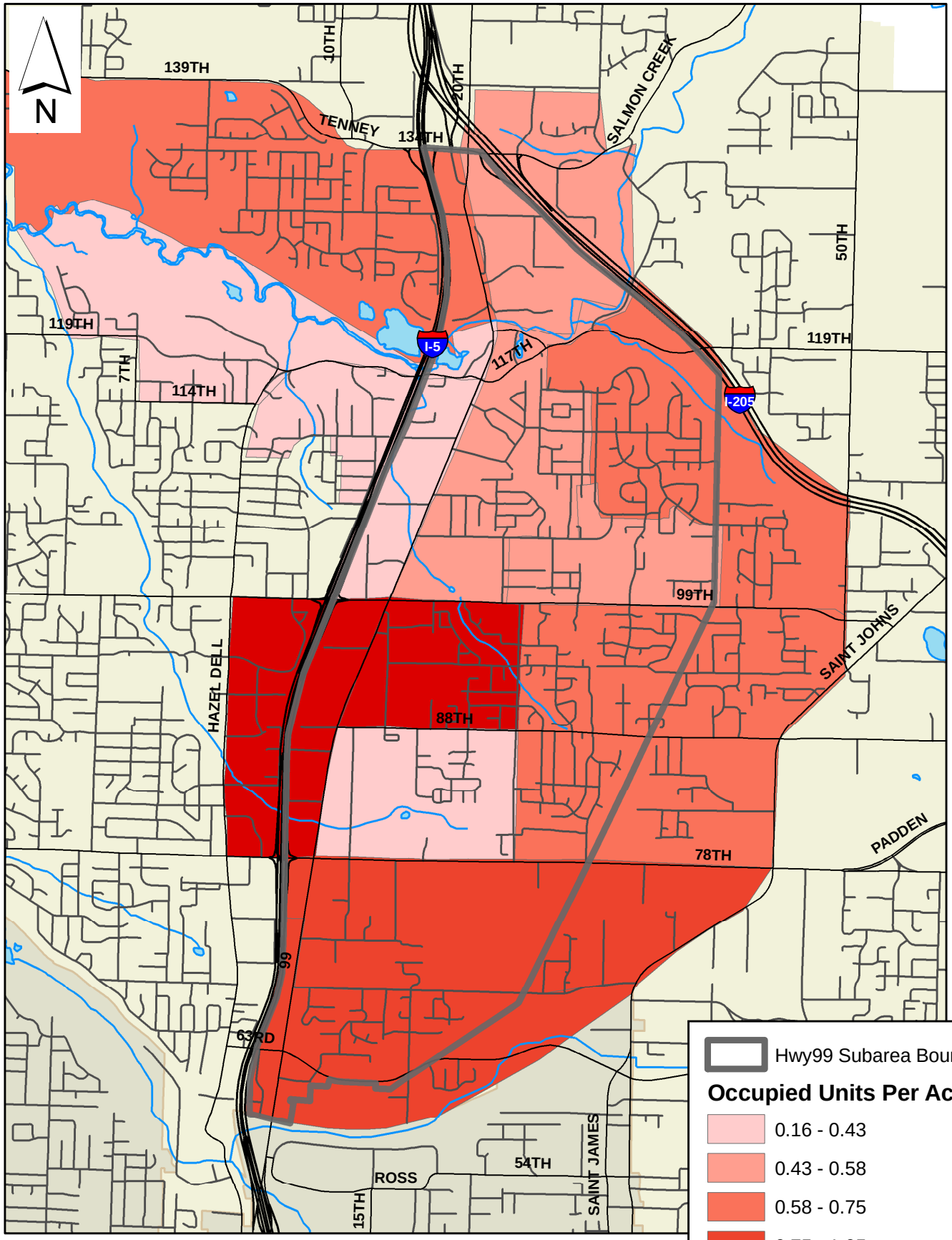
HWY99 - Housing Cost Burden
Median Home Value By Median Household Income
Displays housing costs relative to household income



As the ratio of home value to household income increases, it can be inferred that the proportion of income spent on housing increases, which is described here as the cost burden.

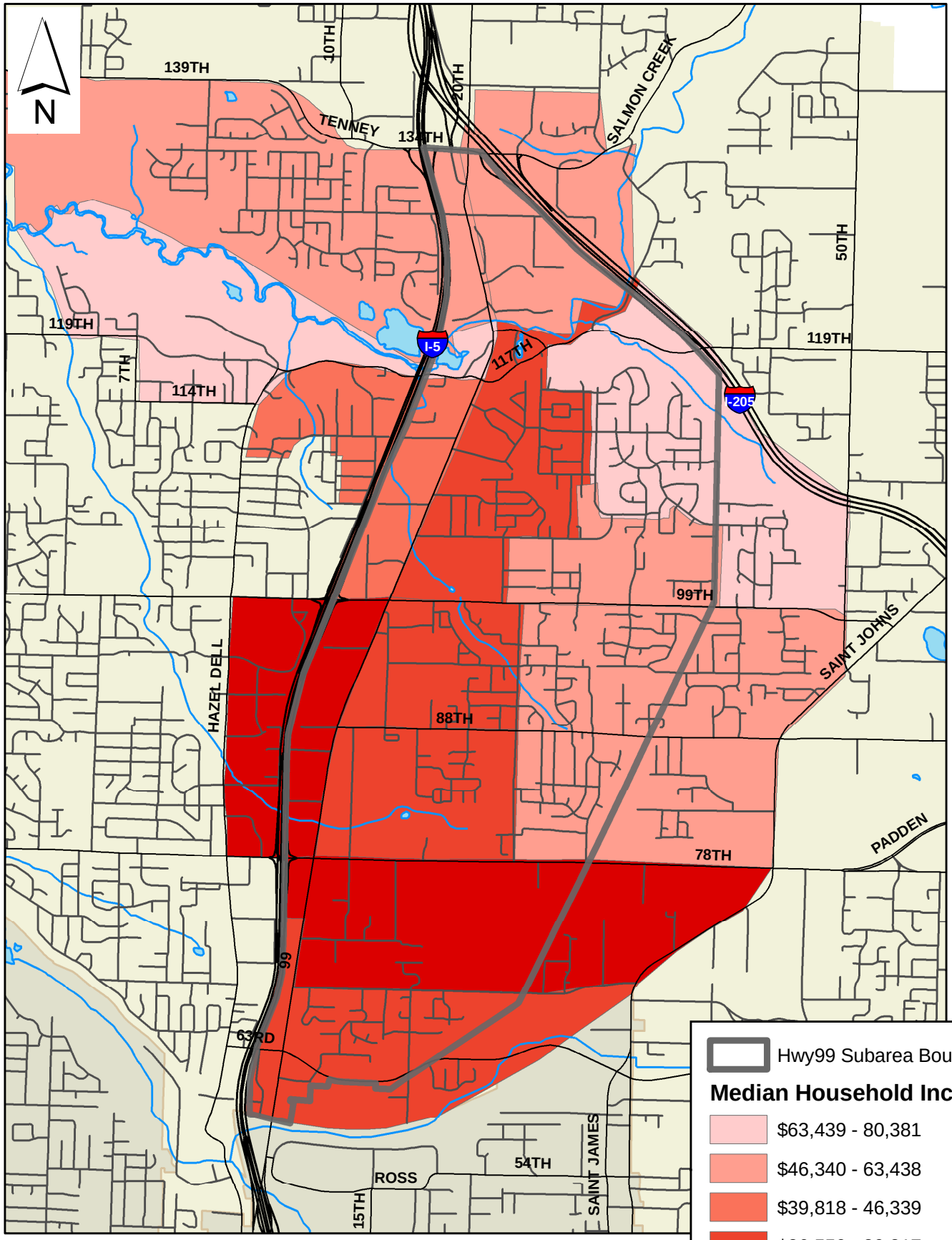
Data Source: 2000 US Census

HWY99 - Housing Density
Occupied Housing Units Per Acre



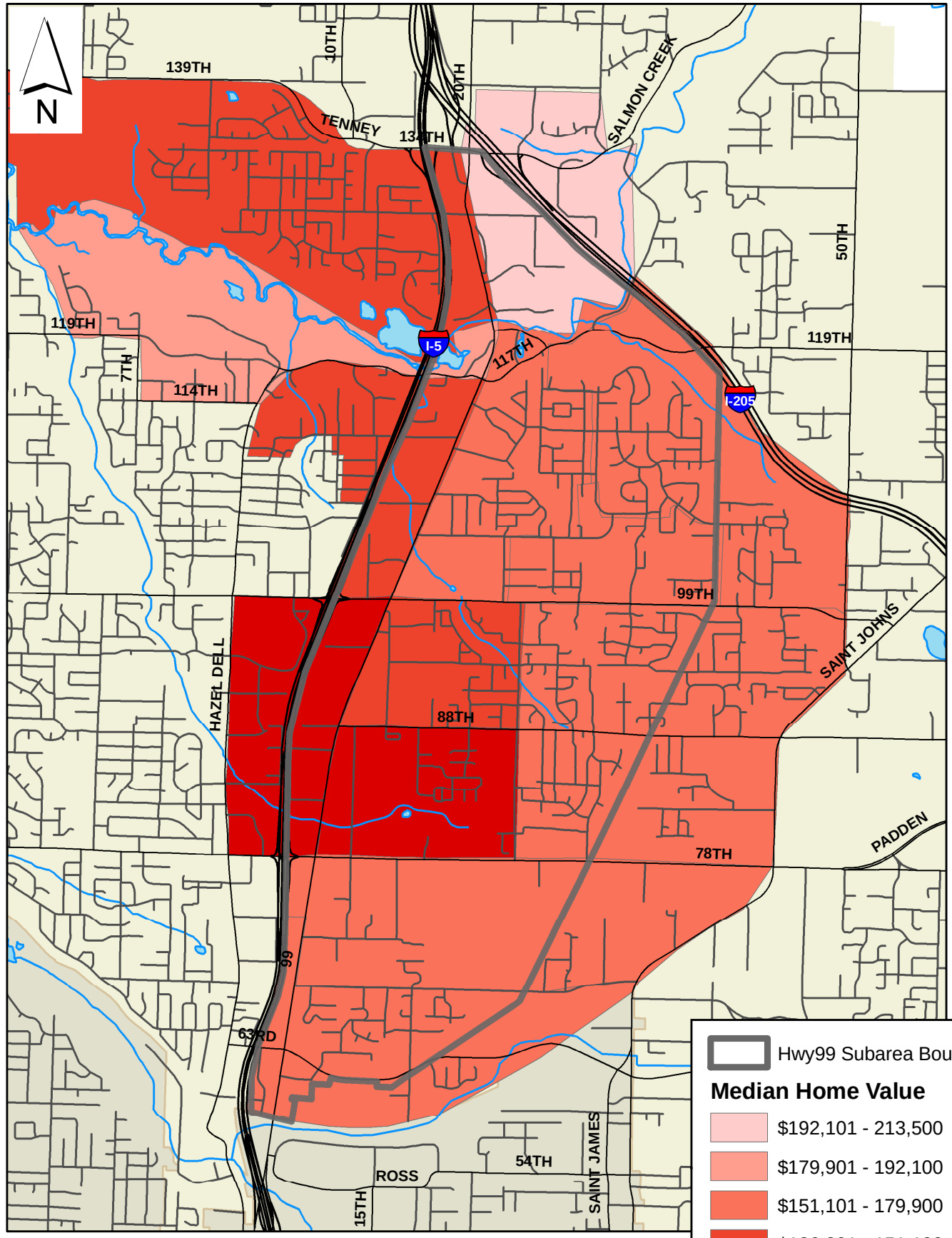
Data Source: 2000 US Census

HWY99 - Median Household Income By Census Block Group



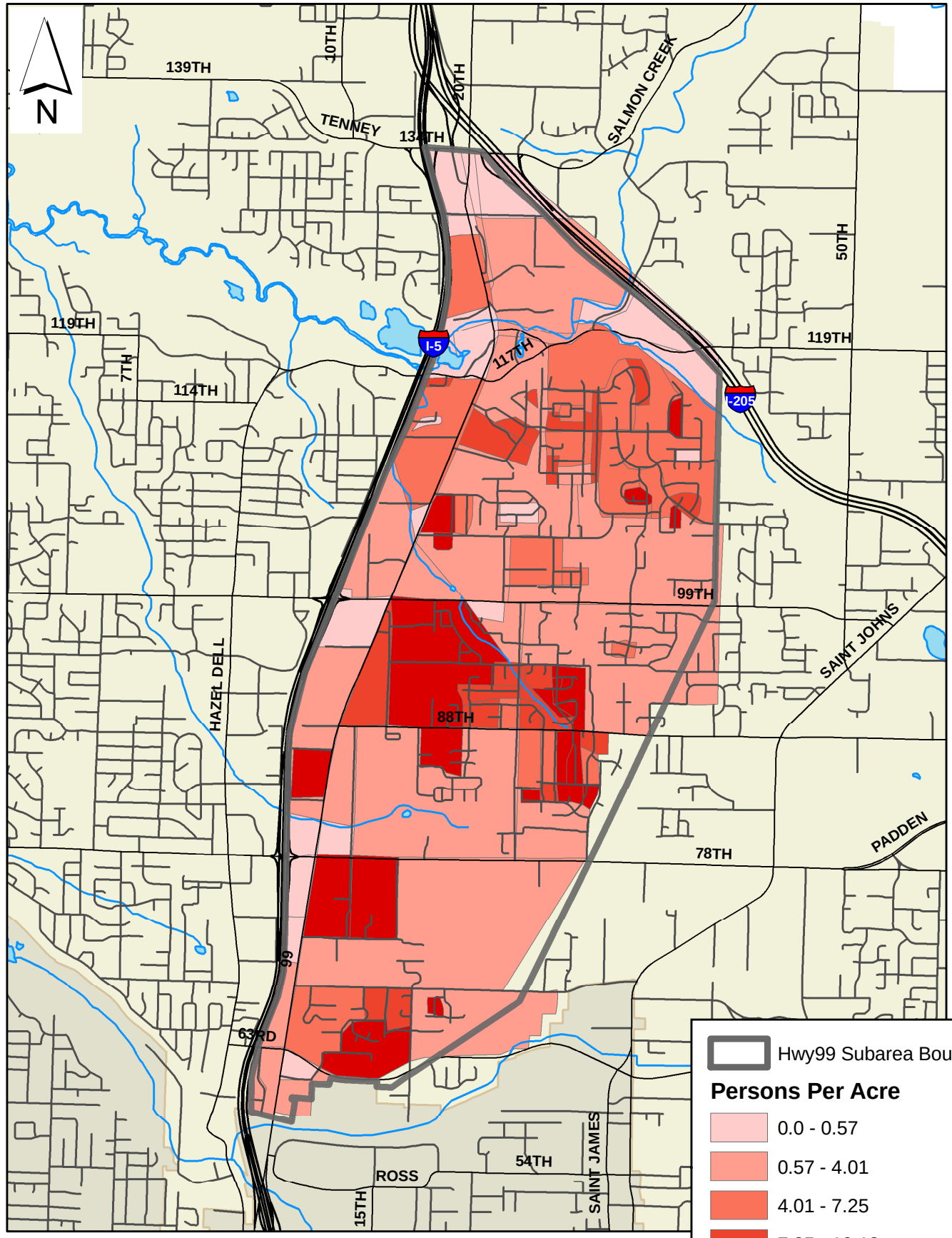
Data Source: 2000 US Census

HWY99 - Median Home Values By Census Block Group



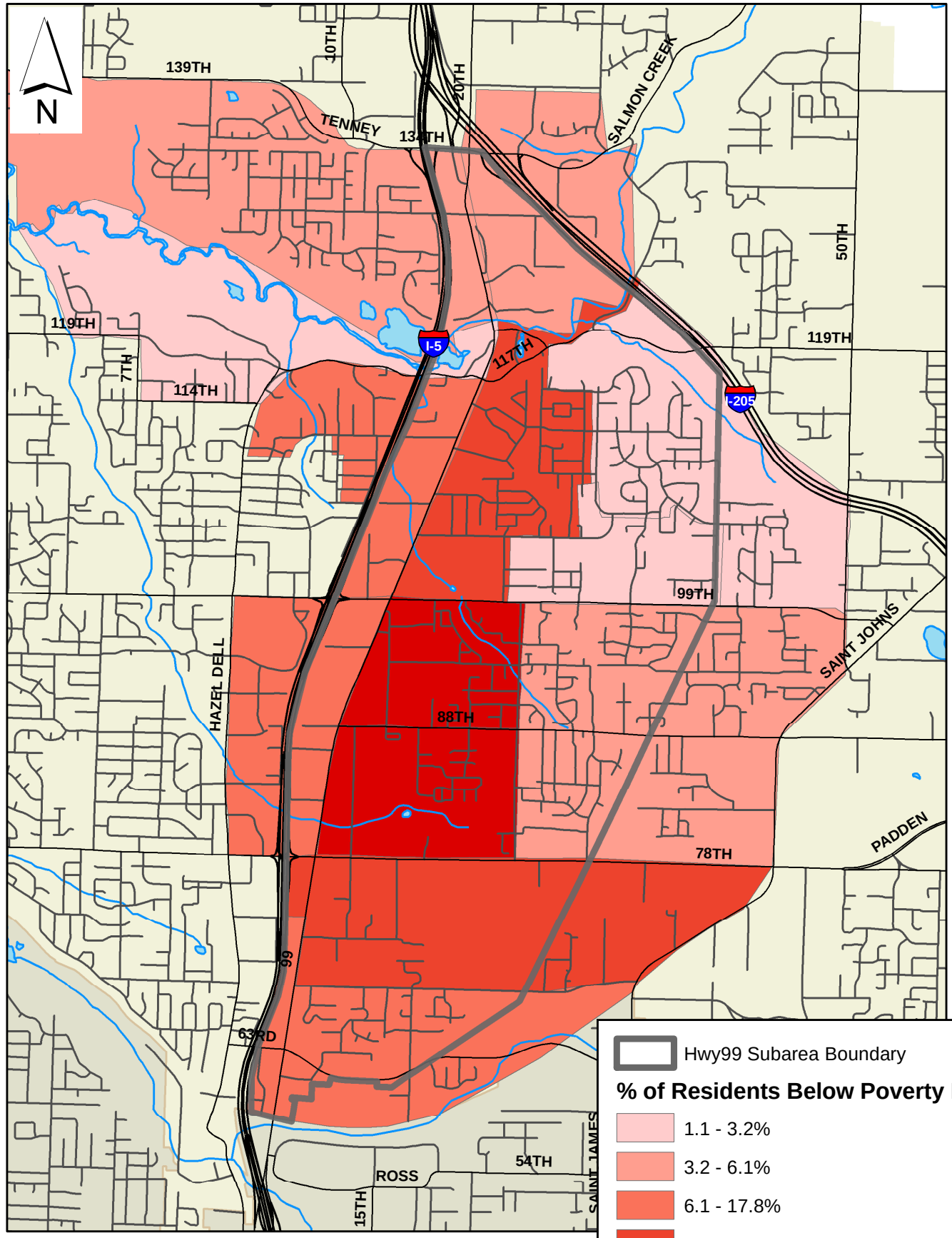
Data Source: 2000 US Census

HWY99 - Population Density
By Census Block



Data Source: 2000 US Census

HWY99 - Poverty Distribution
By Census Block Group

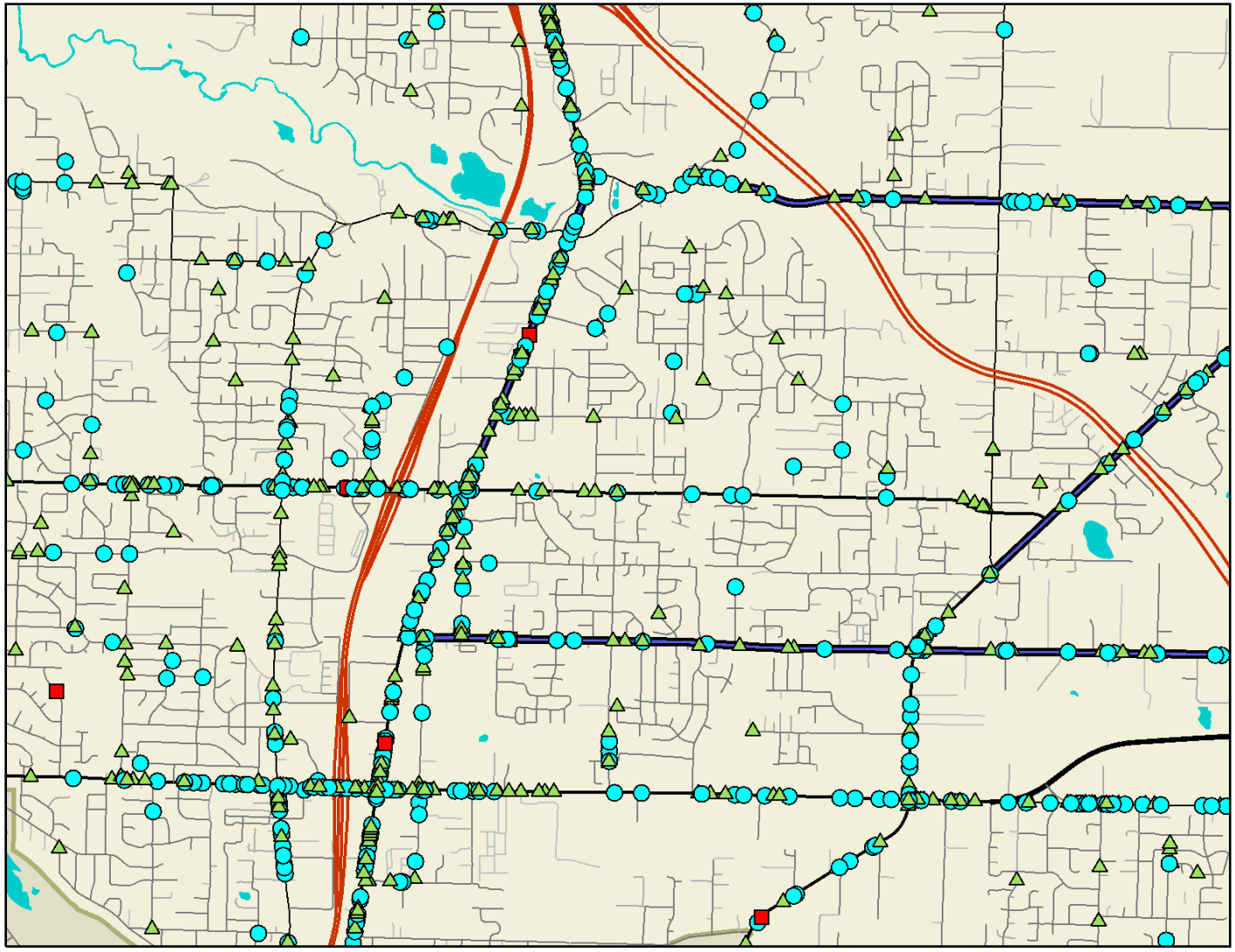


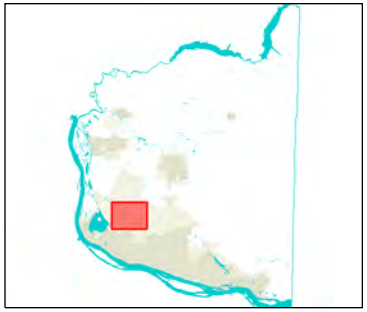
Data Source: 2000 US Census

Technical Report
HIGHWAY 99
Health Impact Assessment Maps

VEHICLE RELATED RISKS

Traffic Crashes Hwy 99





Legend

Accident History
- Fatality
- Personal Injury
- Property Damage

Transportation Projects

Roads
- Alley
- Arterial
- DNR
- DNR (Private Land)
- Driveway
- Interstate
- Interstate Ramp
- Primary Arterial
- Private Roads
- Private Roads w/o Names
- Public Roads
- SR Ramp
- State Route

Waterbodies

City Boundaries

Urban Growth Boundaries

County Boundary

County Boundary

0 3500 7000 10500 ft.

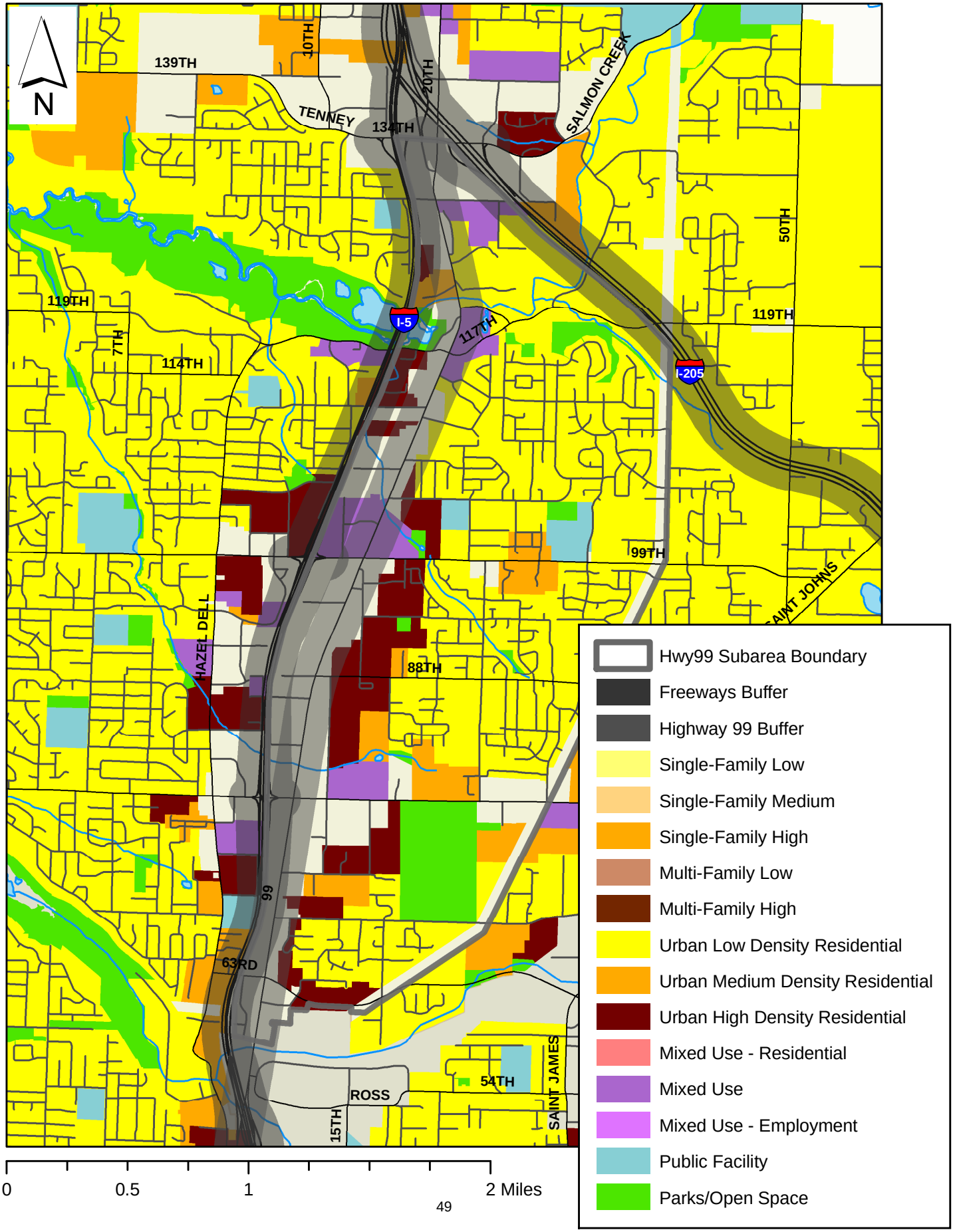
Map center: 45° 41' 38" N, 122° 38' 46" W

N

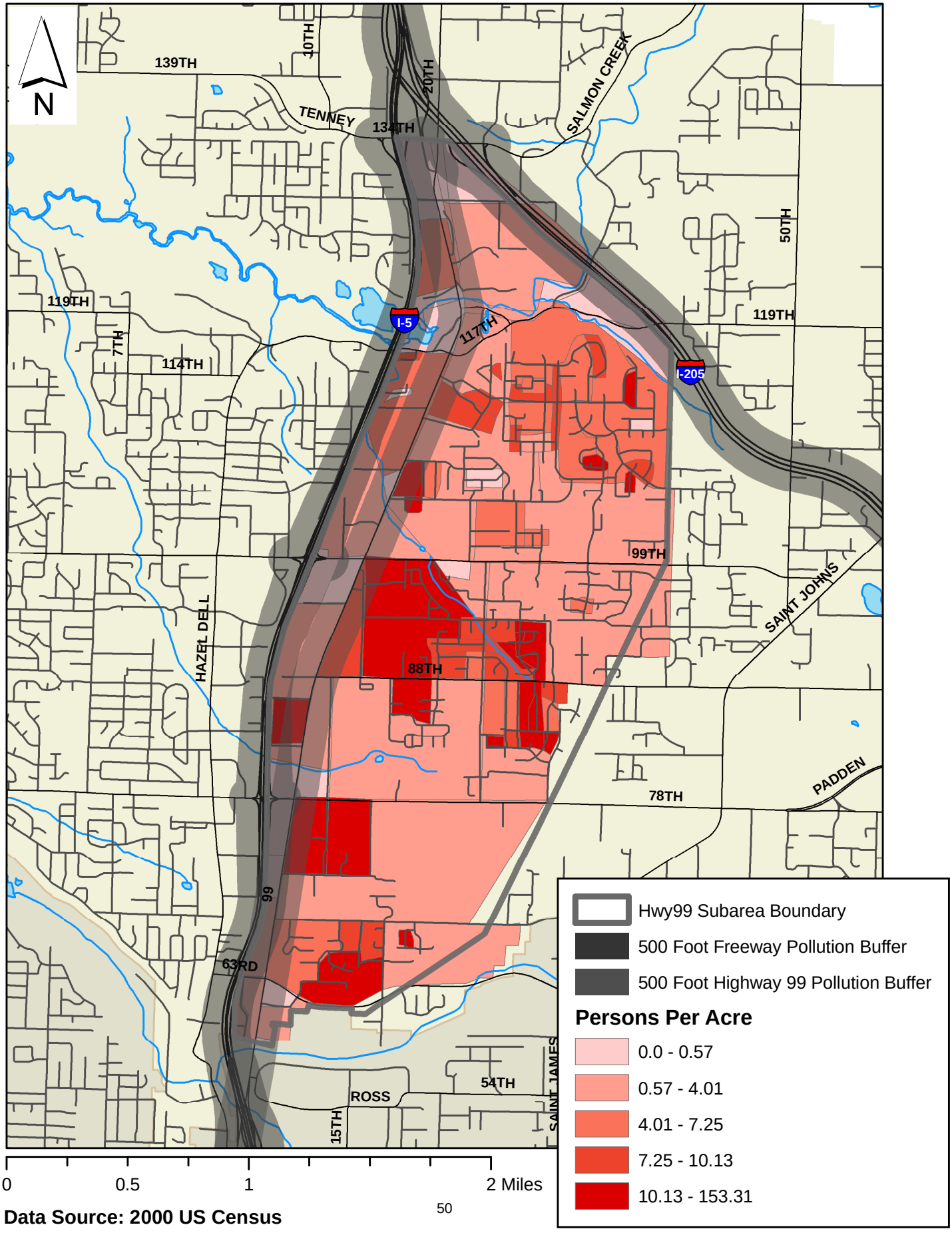
Scale: 1:35,326

Information shown on this map was collected from several sources. Neither Clark County, Washington, nor the producer of this document accept responsibility for any inaccuracies that may be present.

HWY99 - Vehicle Pollution & Planned Residential Uses



HWY99 - Vehicle Pollution & Population Density



Data Source: 2000 US Census