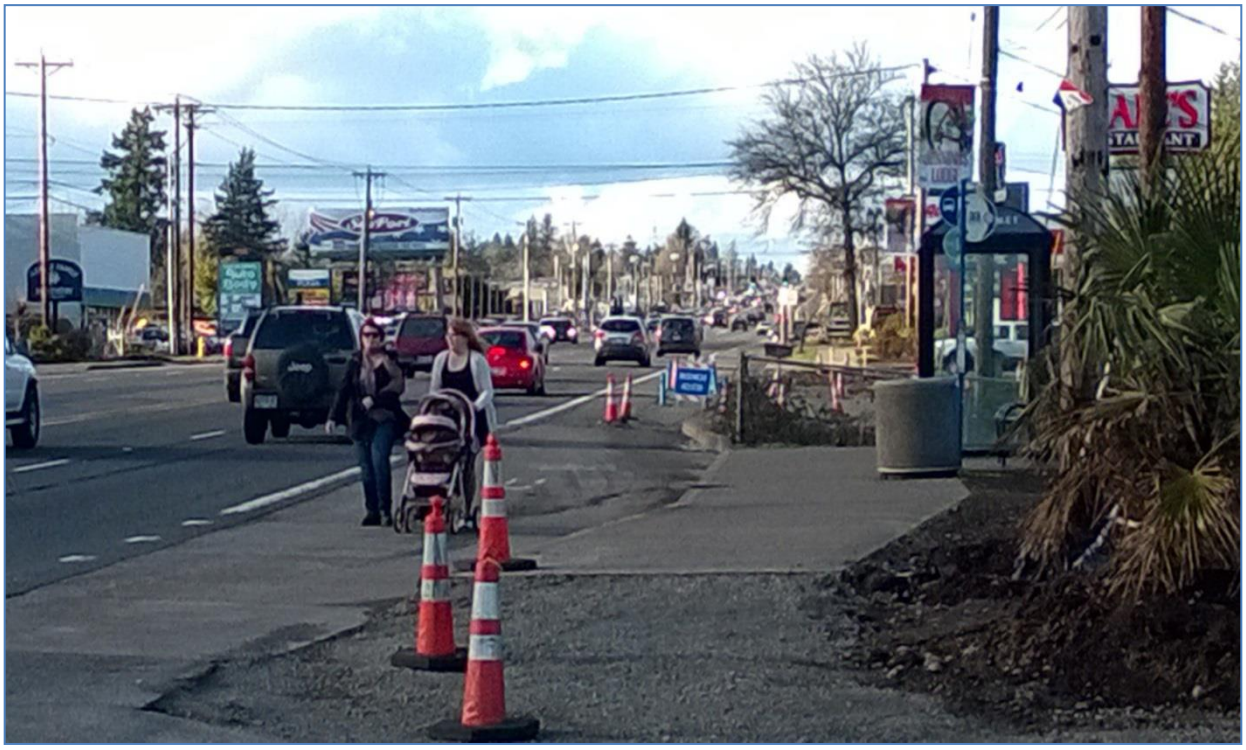
SE McLoughlin Boulevard (OR 99E) Active Transportation Road Safety Audit Health Impact Assessment



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Aknowledgements

This project relied on the dedication and expertise of numerous groups and individuals. The HIA team included Steve White and Karli Thorstenson from the Oregon Public Health Institute; Paul Lewis and Scott France from Clackamas County Public Health, and Karen Buehrig and Joe Marek from Clackamas County Department of Transportation and Development. The Road Safety Audit Team was led by Richard Nys from the Clackamas County of Transportation and Development, and consisted of several other team members from Clackamas County, the Oregon Department of Transportation, and Trimet.

Executive Summary

Introduction

In January, 2014, with funding from the Oregon Health Authority (OHA), Oregon Public Health Institute (OPHI) partnered with Clackamas County Public Health (CCPH) and the Clackamas County Department of Transportation and Development (DTD) to conduct a Health Impact Assessment (HIA) of the "Active Transportation Road Safety Audit" (RSA) that was being conducted on a half-mile section of McLoughlin Boulevard in the unincorporated community of Jennings Lodge, Oregon in the northwestern corner of Clackamas County. An RSA is a commonly used tool for transportation planners and engineers working to identify and mitigate crash risk for defined sections of a transportation system. RSAs typically result in a set of proposed projects designed to mitigate identified crash risk factors. This RSA was initiated by DTD as part of the larger McLoughlin Area Plan Implementation Team (MAP-IT) project, which is focused on implementing the recommendations that came out of the recently completed McLoughlin Area Plan. This RSA resulted in 42 proposed projects for reducing crash risks for bicyclists and pedestrians traveling through this section of McLoughlin Blvd.

HIA is a methodology developed by public health professionals in order to facilitate efforts with non-health sectors to explicitly consider and address the potential direct and indirect health impacts of proposed plans, policies, and projects.[1] This HIA has three main goals:

1. Provide Clackamas County Department of Transportation and Development (DTD) and Oregon Department of transportation (ODOT) staff with information about the potential health impacts of the RSA recommendations that will be useful for assessing the RSA recommendations to identify gaps or opportunities for addressing additional health issues based on identified health impacts, and assessing the RSA process/framework to determine whether it could provide opportunities for including additional public health issues.

2. Build capacity for HIA and other Health in All Policies (HiAP) strategies in Clackamas County Public Health (CCPH) and DTD.

3. Conduct an HIA according to OHA HIA guidelines.

The HIA provides a set of findings that characterize the relative health impacts of each proposed crash safety solution based on potential changes in opportunities for physical activity, exposure to air and noise pollution, and access to jobs and schools. In addition, the HIA provides a set of recommendations for informing this RSA and future RSA projects as well.

HIA Study Area

The study area for this HIA is based on the study area delineated in the RSA. The RSA study area is a 1/2 mile section of McLoughlin Blvd between Boardman Avenue and Hull Avenue (See Figure 1). This section was chosen in part because it is representative of many of other parts of McLoughlin Blvd, but also because of known crash risk issues along this particular stretch of McLoughlin Blvd. The RSA was done only in the McLoughlin public right-of-way, and does not directly address issues in the surrounding neighborhood or

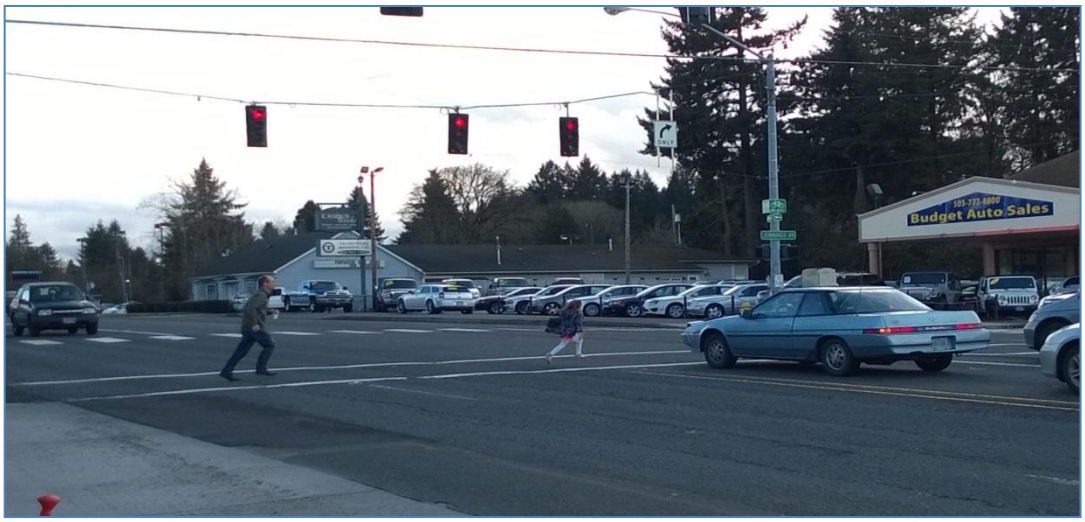
[1] A more complete overview of HIA practice, including tools and resources, can be found on the Oregon Health Authority's HIA program webpage: http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Pages/index.aspx

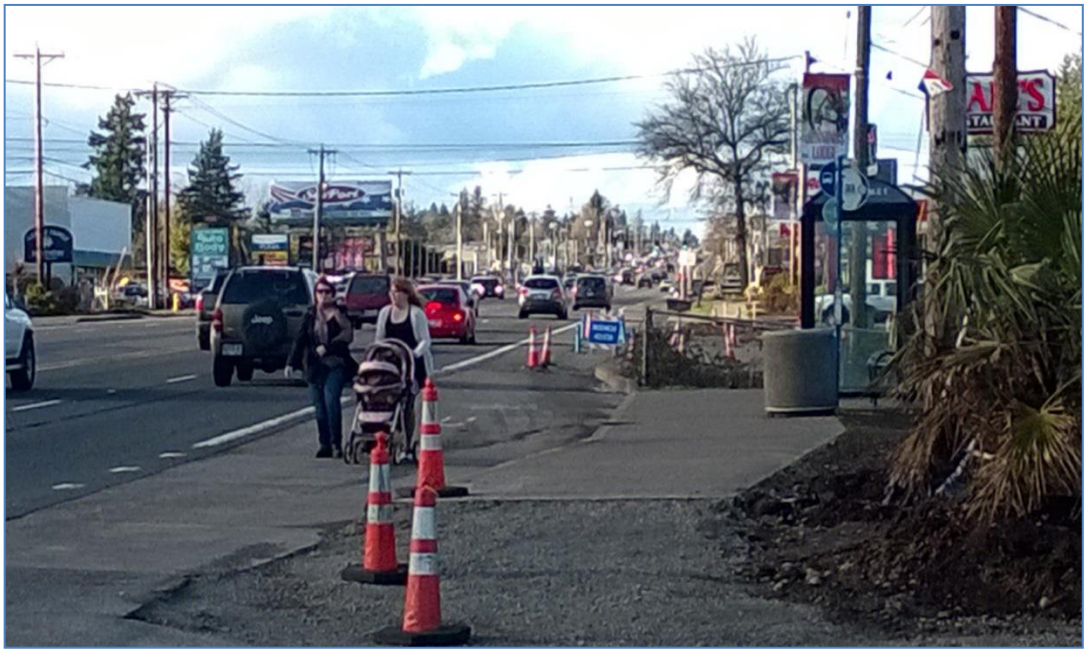
side streets. However, it did take into consideration the location of neighborhood features such as schools and parks that did not border McLoughlin Blvd in order to better understand traffic behavior and patterns on McLoughlin Blvd.

McLoughlin Blvd (OR 99E) is a five lane, high-use, multi-modal corridor that serves about 20,000 vehicles per day. Within both the Greater McLoughin Area and the RSA study area, McLoughlin is bordered almost exclusively by auto-oriented businesses and shopping areas. With signaled intersections spaced approximately 1/2 mile apart and a posted speed limit of 45 MPH, McLoughlin is designed primarily to facilitate motor vehicle mobility. While these conditions have made McLoughlin attractive to motorists, they have contributed to an unsafe and inhospitable environment for pedestrians and bicyclists, particularly when they need to cross McLoughlin.

Figure 1: RSA Study Area

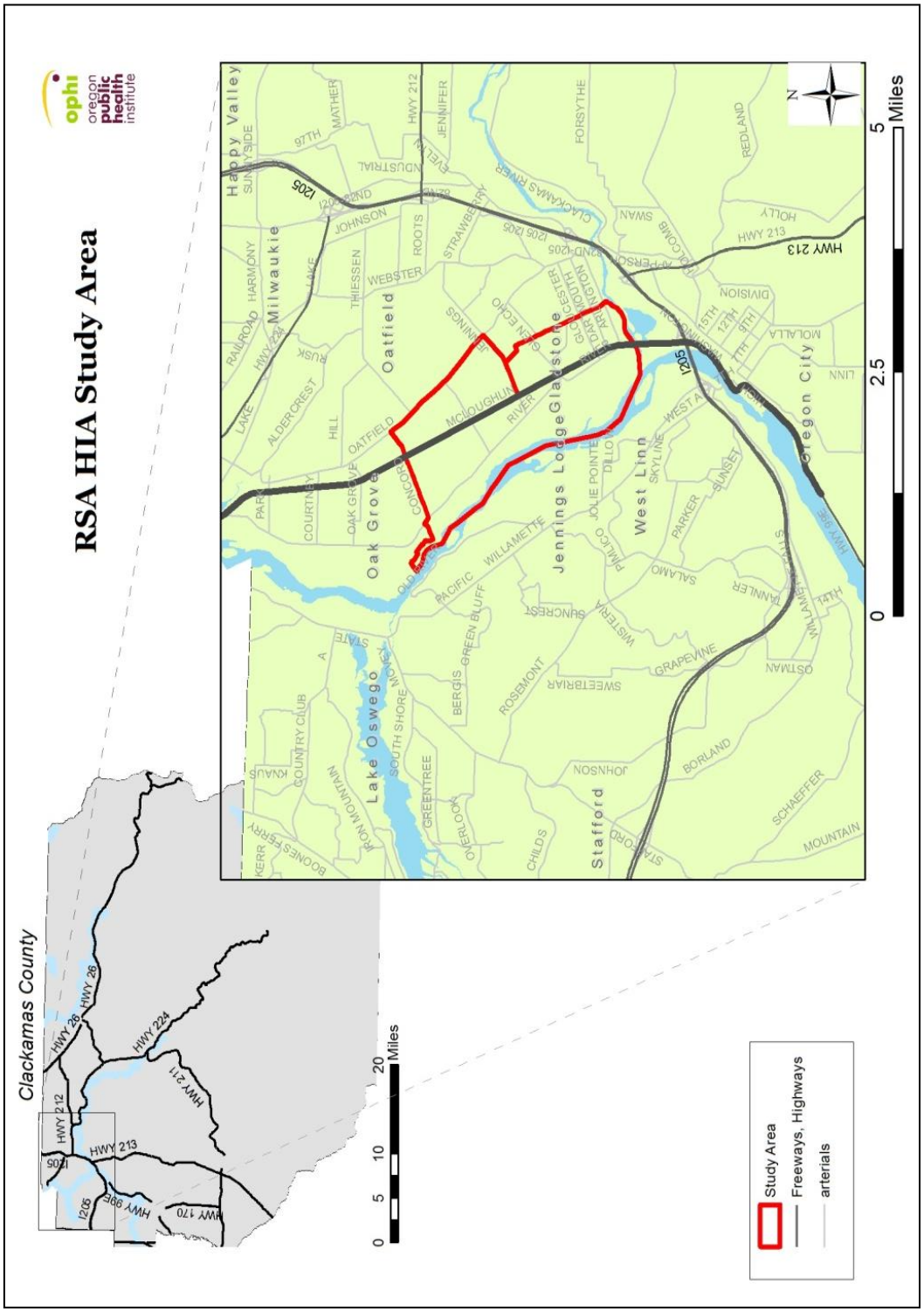
Photo credit: Bing Maps





Photos courtesy of Clackamas County

Figure 1. The HIA study area



The HIA study area was defined as the three Census tracts[2] that encompassed the RSA study area (Figure 1), forming a rough ½ mile buffer around the section of McLoughlin Blvd examined in the RSA. Demographically, the HIA study area has a slightly higher percentage of vulnerable populations than the rest of Clackamas County, with lower-income households and a higher percentage of populations of color. Vulnerable populations are those at higher risk for poor health outcomes, and carry a disproportionate burden of disease. Low-income families, persons living with mental health challenges, older adults, and people of color are more likely to have less economic, educational, and housing opportunities. They also have poorer access to health care, healthy food and affordable, safe transportation. As it relates to traffic safety, vulnerable populations such as low income communities, pedestrians, and children bear the highest burden of injuries and fatalities. Vulnerable populations are also more susceptible to the health risks associated with toxic air pollution from cars, trucks and other engines, especially in high traffic areas. Not surprisingly, the study area population has higher-than-county-average rates of four key transportation-related health outcomes: asthma, diabetes, heart disease, and obesity.

HIA Scope

The HIA team reviewed and discussed the possible pathways (Figure 2) through which health would be impacted by the RSA recommendations, and discussed some possible criteria for determining which issues to explore in assessment.

Selection criteria for health issues included:

- Likelihood that the RSA recommendations would result in differential impacts on a particular health determinant;
- Whether the health issue was being addressed as part of the RSA;
- Likelihood that the RSA recommendations would likely impact a particular health determinant; and
- Ability to develop an assessment approach that would effectively gauge likely impacts of the RSA recommendations.

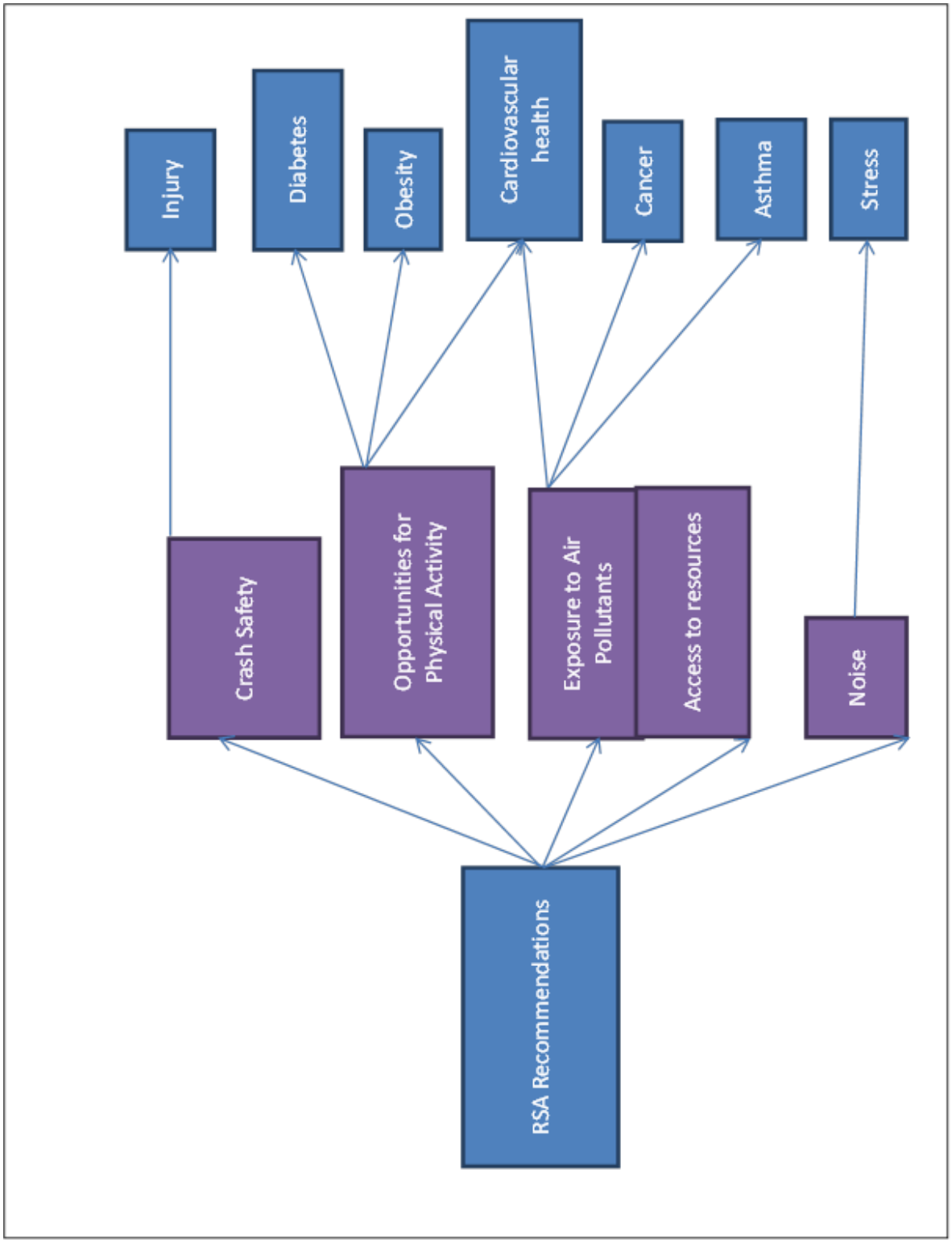
Based on the existing conditions of the combined study area's health determinants feedback from previous community engagement efforts, and suggestions and advice from the MAP-IT group, OPHI and the HIA team decided to focus on assessing the study outcome's potential for impacting the following health determinants:

- Opportunities for Physical Activity
- Exposure to Air and Noise Pollutants
- Access to Health Supportive Resources

While crash safety would likely be the pathway most impacted by the RSA recommendations, the group decided that it would be effectively examined through the RSA process, and including it in the HIA would be duplicative.

[2] Tracts 217, 218.02 and 219

Figure 2: Clackamas County RSA-Health Pathway Diagram



Assessment

The goal of the assessment phase of this HIA was to characterize the relative community health impacts of each proposed solution in the Road Safety Audit (RSA). The RSA, done by an interdisciplinary team formed by the Clackamas County Traffic Engineering group and led by a private consulting firm, aimed to help improve roadway safety for all road users by identifying improvement strategies to reduce the number and severity of crashes involving bicyclists and pedestrians. To accomplish this, the RSA team observed traffic patterns on two consecutive days and then categorized them based on exposure of users to a road feature, the probability that a crash was influenced by that feature, and the consequence or severity of a crash. The RSA produced 42 recommendations in 11 different areas of concern for improving crash safety for all modes:

Table ES1. Areas of concern identified in the RSA	
Area of Concern ("finding")	**RSA Relative Risk Category**
Left-turn crossing movements	2
Location of pedestrian crossings	2
Visibility of pedestrian crossings at unsignalized locations	2
Rolling stops	2
Definition of sidewalks/pedestrian walkway	3
Nighttime visibility	2
Corridor speeds	2
Network connectivity	2
Sidewalk quality	1
Trolley Trail	2
Permissive turns at SE Jennings Avenue intersection	2

To help identify possible assessment approaches and research questions, the HIA team reviewed a matrix (Table ES2) that aligned the 42 RSA recommendations with the four health pathways, and applied a draft set of assessment questions for assessing and characterizing impacts. It is important to note the HIA team scored a draft set of RSA recommendations. The language of the final recommendations was not substantially different and scores were not affected by the revisions. A language comparison between the draft and final recommendations is shown in Appendix B.

Based on the discussion surrounding the initial application of these assessment questions to the RSA recommendations, the group made the following decisions:

1. Regarding assessment of impacts on opportunities for physical activity, the group indicated that the Trolley Trail provided the greatest opportunity for physical activity that would be impacted by the RSA recommendations. Accordingly, RSA recommendations that improved access to the Trail would likely have the greatest impacts on opportunities for physical activity, followed by recommendations that would improve access to parks and schools, and recommendations that encouraged walking, biking and transit use.
2. Regarding assessment of impacts on exposure to noise and to air pollutants, the group determined that they would each be impacted in the same way by the various RSA recommendations, so could be combined for purposes of assessment.
3. Regarding assessment of impacts on access to health supportive resources, the group decided that the primary health supportive resources not already being captured in the assessment of opportunities for physical activity are jobs and education.
4. Regarding how to characterize impacts, the group indicated that it would be possible to characterize impacts according to likelihood, direction, and relative magnitude—while the overall magnitude of impacts of each of the recommendations would be small, the group thought it would be possible to determine whether different RSA recommendations would have greater or lesser impacts on each of the health pathways being examined.

Methods

The assessment approach focused on assessing each of the 42 RSA recommendations according to their relative impacts on the chosen health determinants, using a project scoring approach designed to help ODOT and DTD planners identify and characterize a broader set of health impacts than the safety impacts considered in the RSA in order to help prioritize and revise/refine the actions recommended in the RSA, and potentially identify additional opportunities for improving safety and health for people using the study area.

The scoring approached was based on answering the following questions for each recommendation:

- Opportunities for Physical Activity
    - Does the recommendation improve access to the Trolley Trail?
    - Does the recommendation encourage walking, biking, or transit use?
    - Does the recommendation improve access to schools and parks?
- Exposure to Air Toxics and Noise
    - Does the recommendation encourage walking/biking along streets/paths parallel to McLoughlin?
- Access to Health Supportive Resources
    - Does the recommendation improve access to schools and employment opportunities?

Based on collaborative scores determined from professional judgment and research, the RSA potential solutions are grouped into four categories:

- "High Impact" for solutions with scores of eight and above. This breaking point was chosen because all of these solutions received at least one score of ten or higher in one of the two sets of scores
- "Moderate Impact" for solutions with scores between six and seven and a half
- "Low Impact" for solutions with scores between three and six
- "Negative-No Impact" for solutions with scores less than one

36 out of the 42 RSA recommendations positively impact physical activity, exposure to noise and air pollution, and access to resources. The recommendations with the highest degree of impact were:

- Building sidewalks and filling sidewalk gaps
- Improve lighting
- Provide crossing enhancements to increase visibility and attract pedestrians

Findings

- Compared with Clackamas County as a whole, the RSA study area has relatively high rates of four key transportation-related health outcomes: obesity, asthma, diabetes, and heart disease.
- In addition to improved crash safety, all but five of the 42 solutions are likely to have a positive impact on health outcomes related to physical activity, exposure to air quality and noise, and access to jobs and employment. Key health outcomes related to these health determinants include obesity, diabetes, heart disease, asthma, and stress.
- Of the 42 RSA proposed solutions, only one solution received a negative score because of potential safety risks that it would create for pedestrians trying to cross McLoughlin:
    - "Increase median width to provide sufficient space for two-stage crossings"
- Physical activity is the primary health determinant impacted by most interventions, followed by access to resources.
- When comparing the HIA scores to the RSA qualitative risk scores:
    - There appears to be general alignment with the HIAs "low impact" solutions and the RSA's Category I solutions
- The "high impact" solutions generally appear to be relatively large pedestrian infrastructure projects that both improve pedestrian mobility and encourage changes in driver behavior due to increased visibility and awareness

Recommendations

Drawing from the HIA team's wide breadth of professional knowledge in transportation, health and safety, the following recommendations were developed:

For this particular RSA:

- Use HIA scores to inform decisions about project selection and prioritization in the study area.
- To facilitate use of the HIA scores in future decisions about project funding and implementation, integrate the HIA scores into the RSA report, either as an Appendix or in the body or the report, alongside the RSAs qualitative risk categories.
- When implementing specific solutions, review project to determine whether opportunities exist to improve the solution's ability to improve access to parks, Trolley Trail, schools, and employment, as well as use of parallel facilities for north-south travel in the corridor.
- Consider additional solutions outside of the right-of-way that would support proposed solutions
    - E.g., education/encouragement campaigns with local schools/employers that would help encourage safe and health promoting behaviors.

For Future RSAs:

- ODOT should work with OHA's HIA program staff to develop screening criteria for helping transportation agencies determine when and how public health expertise on an RSA team will add value to the project. Possible strategies for including public health on an RSA team include:
    - having an HIA team member join the RSA team if an HIA is being conducted along with the RSA
    - contacting the Oregon Health Authority's HIA program to request their participation in the RSA, or ask for a referral to appropriate staff at the county health department in the county where the project is located
    - Adding language to the RSA RFP that requires the consultant team to demonstrate having public health expertise on their team
    - contracting with a public health consultant experienced in assessing the public health impacts of transportation plans, policies, and projects
- Develop similar project scoring criteria for proposed RSA solutions and integrate scores into RSA reports. Project scoring criteria will be context-specific, but should be designed to assess the following transportation-related health issues:
    - Opportunities for physical activity
    - Access to health-supportive resources such as full-service grocery stores, schools, jobs, and social and medical services
    - Exposure to air and noise pollution
    - Health equity—i.e., disproportionate impacts on vulnerable groups such as youth, elderly, disabled, and low-income individuals and households.
- Conduct similar health impact scoring exercises as part of future RSAs, then evaluate to determine usefulness.
- For each identified finding (problem) in the RSA, identify a set of solutions that include at least one action for the primary "behavior modification" strategies:
- For future Clackamas County RSAs, ensure that the proposed solutions are designed to support the County's "Drive to Zero" campaign by identifying a set of solutions for each problem area that include at least one action for the primary strategies identified as essential for establishing a culture of safety in Clackamas County. These strategies are:
    - Engineering
    - Education
    - Enforcement
    - Encouragement
    - Emergency Medical Services

Table ES2: HIA raw and average scores for each health determinant

Scoring: possible scores for each impact area ("Access to the Trolley Trail", "Walking, biking, or transit use," etc) ranged from -2 (relatively strong negative impact) to +2 (relatively strong positive impact). The sub-total scores are the sum of scores for each health determinant and indicate the relative impacts of each proposed solution on the three health determinants. The "HIA Score" is the sum of the sub-totals and provides an indication of the relative overall health impacts of each of the potential solutions. The "RSA Risk Score" was provided by the RSA and is on a scale of 1-3, and indicates the relative likelihood and severity of the crash risk posed by the conditions that the proposed solution is meant to address.

			PHYSICAL ACTIVITY			EXPOSURE TO AIR AND NOISE POLLUTION	ACCESS TO RESOURCES		SUB-TOTALS (sum of scores for each health determinant—highest scores are highlighted)		
Potential Solutions proposed by the RSA	**HIA Score**	***RSA Risk score***	***Access to the Trolley Trail***	***Walking, biking, or transit use***	***Access to schools and parks***	***Walking/biking along parallel streets/paths***	***Access to schools***	***Access to employment***	***Physical Activity***	***Exposure to Air and Noise Pollution***	***Access to resources***
HIGH IMPACT											
Evaluate constructing sidewalks at key locations	**12**	*2*	2	2	2	2	2	2	6.0	2.0	4.0
Consider installing new street lighting poles for improved lighting uniformity and to increase pedestrian visibility.	**12**	*2*	2	2	2	2	2	2	6.0	2.0	4.0
Consider providing additional enhancements to increase visibility and driver awareness (e.g. warning signs, crosswalk markings, reflectors, advanced stop bars, rectangular rapid flashing beacons, etc.)	**12**	*2*	2	2	2	2	2	2	6.0	2.0	4.0
Evaluate adding or improving street lighting to remove contrast with private illuminated signs and lights.	**9.5**	*2*	2	2	0.5	2	1	2	4.5	2.0	3.0
Consider installation of a bicycle only signal with an exclusive bicycle phase and diagonal crossing. This treatment would create a designated connection with an exclusive bicycle phase	**9.5**	*2*	2	1.5	1.5	2	1.5	1	5.0	2.0	2.5
Evaluate installing sidewalk at existing gap locations. On the east side of SE McLoughlin Boulevard, sidewalk should be constructed from just south of SE Boardman Avenue 500 feet south to where the sidewalk begins again.	**9.5**	*3*	2	2	2	0.5	1	2	6.0	0.5	3.0

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Evaluate installing a Flashing Yellow Arrow (FYA) with pedestrian logic. This pedestrian signal programming prevents the pedestrian walk signal and the FYA from being on at the same time. This "logic" can only be done at locations with advanced signal controllers. For older signal controllers, pedestrian safety can be enhanced at locations operating the FYA by giving pedestrians more lead time to cross the street before the left turns are permitted	**9**		*2*	1.5	1.5	1.5	1	2	1.5	4.5	1.0	3.5
Evaluate protected/permissive phasing option. This would require striping modifications at the intersection.	**9**		*2*	1.5	1.5	1.5	1	2	1.5	4.5	1.0	3.5

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Evaluate enhancements to existing pedestrian crossings at SE Boardman Avenue, SE Jennings Avenue, and SE Hull Avenue intersections to promote driver yielding and encourage pedestrians to use these locations such, as Rectangular Rapid Flash Beacons (RRFB), regulatory signs, intersection street lighting and painting of existing pedestrian refuge islands.	**8.5**		*2*	1.5	1.5	1.5	1	1.5	1.5	4.5	1.0	3.0
Evaluate protected left turns to remove decision (gap detection)	**8.5**		*2*	1.5	1.5	1	1	2	1.5	4.0	1.0	3.5
Consider installing intersection ahead and crossing location signs to support visibility and give advanced notice	**8**		*2*	1	1.5	1	1.5	1.5	1.5	3.5	1.5	3.0
Consider installing design enhancements such as curb extensions, landscaping, etc. to reduce travel speeds	**8**		*2*	0.5	1.5	1.5	1.5	1.5	1.5	3.5	1.5	3.0
MODERATE IMPACT												
Evaluate installing wayfinding and/or bicycle/pedestrian signage and pavement markings. Wayfinding and bicycle/pedestrian	**7.5**		*2*	1.5	1	1	2	1	1	3.5	2.0	2.0

Table ES2: HIA raw and average scores for each health determinant

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guide signs are usually a coordinated system of signs that direct road users, in this case pedestrians and bicyclists, to key civic, cultural, visitor and recreational destinations within a city or a local urbanized or downtown area. They shall not be installed in a position that obstructs the view of other traffic control devices and shall not provide direction to streets and highways. Wayfinding signage added should be consistent with other wayfinding signage used along the Trolley Trail.												
Change the lane configuration on the south leg of the intersection from the existing left/thru shared lane and right turn only lane to a left turn only and a shared right/thru lane	**7**		*2*	1	1	1	1	2	1	3.0	1.0	3.0
Consider supporting current midblock crossing demand with enhanced midblock crossings in addition to existing intersection crossings. To be consistent with other County treatments along SE McLoughlin Boulevard, it is recommended that raised refuge islands with the cut through design be constructed.	**7**		*2*	1.5	2	0.5	0.5	0.5	2	4.0	0.5	2.5

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Evaluate implanting access management along SE McLoughlin Boulevard to reduce conflict points between motor vehicles, pedestrians and bicycles	**6.5**	*3*	0.5	1.5	1.5	0.5	1	1.5	3.5	0.5	2.5
Evaluate relocating TriMet bus stops closer to marked pedestrian crossing locations.	**6.5**	*2*	1	2	1	1	0.5	1	4.0	1.0	1.5
Consider installation of a positive offset traffic separator that prohibits minor street left turn movements at the intersections but allows drivers to make left turns from SE McLoughlin Boulevard.	**6.5**	*2*	1	1	1.5	1	1	1	3.5	1.0	2.0
Evaluate leading pedestrian phase for east-west crossings	**6.5**	*2*	1	1	1	1	1.5	1	3.0	1.0	2.5
Consider installing driver speed feedback signs along the corridor	**6.5**	*2*	0.5	1	1	1	1.5	1.5	2.5	1.0	3.0
LOW IMPACT											
Review compliance with county and state codes and improve lighting as necessary. Consider code changes to address issues with distracting private signs and lights.	**6**	*1*	1	1	1.5	0.5	1	1	3.5	0.5	2.0
Consider increasing enforcement to change	**6**	*2*	1	1	1	1	1	1	3.0	1.0	2.0

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driver behavior and reduce the number of drivers failing to stop.												
Consider installation of devices (e.g. bollards or other devices) to separate pedestrian and vehicular traffic and to differentiate between public right-of-way and private	**6**		*3*	0.5	1.5	1	0.5	1	1.5	3.0	0.5	2.5
Evaluate enhancing crossing at SE Boardman Avenue to encourage	**5.5**		*3*	1	1	1	0.5	1	1	3.0	0.5	2.0
Evaluate reducing travel lane width	**5.5**		*2*	0.5	1	1.5	0	1	1.5	3.0	0.0	2.5
Consider installing Stop Ahead signs on the minor streets in advance of the two-way stop controlled intersections along the study corridor for additional emphasis of the primary traffic control device	**5.25**		*2*	1	1	0.75	1	0.5	1	2.8	1.0	1.5
Evaluate adjusting signal timing progression to encourage traveling at the posted speed and discourage exceeding the posted speed	**5**		*2*	0	1	1	1	1	1	2.0	1.0	2.0
Consider mitigations that alert pedestrians and help them from falling off the sidewalk edge	**5**		*1*	1	1	1	0	1	1	3.0	0.0	2.0
Evaluate enforcement of property parking encroachments within the right-of-way	**5**		*3*	0.5	1	1.5	0	1	1	3.0	0.0	2.0

Table ES2: HIA raw and average scores for each health determinant

Scoring: possible scores for each impact area ("Access to the Trolley Trail", "Walking, biking, or transit use," etc) ranged from -2 (relatively strong negative impact) to +2 (relatively strong positive impact). The sub-total scores are the sum of scores for each health determinant and indicate the relative impacts of each proposed solution on the three health determinants. The "HIA Score" is the sum of the sub-totals and provides an indication of the relative overall health impacts of each of the potential solutions. The "RSA Risk Score" was provided by the RSA and is on a scale of 1-3, and indicates the relative likelihood and severity of the crash risk posed by the conditions that the proposed solution is meant to address.

				PHYSICAL ACTIVITY			EXPOSURE TO AIR AND NOISE POLLUTION	ACCESS TO RESOURCES		SUB-TOTALS (sum of scores for each health determinant—highest scores are highlighted)		
Potential Solutions proposed by the RSA	**HIA Score**		***RSA Risk score***	***Access to the Trolley Trail***	***Walking, biking, or transit use***	***Access to schools and parks***	***Walking/biking along parallel streets/paths***	***Access to schools***	***Access to employment***	***Physical Activity***	***Exposure to Air and Noise Pollution***	***Access to resources***
• Consider sending violation letters to property owners who are maintaining sidewalks • Consider contacting property owners and requiring upgrades to sidewalks to be ADA compliant	**5**		*1*	1	1	0.5	0.5	1	1	2.5	0.5	2.0
Conduct speed zone investigation to determine if the posted speed limit of SE McLoughlin Boulevard can be reduced	**4.5**		*2*	0	1	1	0.5	1	1	2.0	0.5	2.0
Insure stop bars on the stop controlled minor approaches are placed properly and per standard. MUTCD guidelines suggest stop lines should have a base of 12 to 24 inches wide and should be placed a minimum of 4 feet in advance of the nearest crosswalk line at controlled intersections. Confirm stop signs meet the ODOT plaque size requirement of 36"x36" and replace if needed. Increase in sign size, even with single lane existing configurations may be necessary. Consider installing sign mounted stop beacons or a stop sign with embedded LEDs	**4.25**		*2*	0.5	1	0.25	1	0.5	1	1.8	1.0	1.5
Enforcement	**4**		*2*	0	1	0	1	1	1	1.0	1.0	2.0

Table ES2: HIA raw and average scores for each health determinant

Scoring: possible scores for each impact area ("Access to the Trolley Trail", "Walking, biking, or transit use," etc) ranged from -2 (relatively strong negative impact) to +2 (relatively strong positive impact). The sub-total scores are the sum of scores for each health determinant and indicate the relative impacts of each proposed solution on the three health determinants. The "HIA Score" is the sum of the sub-totals and provides an indication of the relative overall health impacts of each of the potential solutions. The "RSA Risk Score" was provided by the RSA and is on a scale of 1-3, and indicates the relative likelihood and severity of the crash risk posed by the conditions that the proposed solution is meant to address.

			PHYSICAL ACTIVITY			EXPOSURE TO AIR AND NOISE POLLUTION	ACCESS TO RESOURCES		SUB-TOTALS (sum of scores for each health determinant—highest scores are highlighted)		
Potential Solutions proposed by the RSA	**HIA Score**	***RSA Risk score***	***Access to the Trolley Trail***	***Walking, biking, or transit use***	***Access to schools and parks***	***Walking/biking along parallel streets/paths***	***Access to schools***	***Access to employment***	***Physical Activity***	***Exposure to Air and Noise Pollution***	***Access to resources***
Improve/replace existing sidewalks that are a hazard to users, are not ADA compliant, and do not meet current design standards.	**4**	*1*	1	1	0	0	1	1	2.0	0.0	2.0
Consider adding reflective tape along raised sidewalk/breaks in pavement and along extreme sidewalk elevations to improve visibility at nighttime	**3**	*1*	0	1	0	0	1	1	1.0	0.0	2.0
NO IMPACT/NEGATIVE IMPACT											
Consider implementing educational tools such as positive reinforcement on TriMet bus doors reminding pedestrians to use crosswalk	**0.5**	*2*	0	0	0	0	0	0.5	0.0	0.0	0.5
Evaluate upgrading street name signs to meet 2009 MUTCD standards to improve minor street visibility	**0.5**	*2*	0.5	0	0	0	0	0	0.5	0.0	0.0
Review compliance with county and state codes and improve lighting as necessary.	**0**	*2*	0	0	0	0	0	0	0.0	0.0	0.0
Consider providing increased median width to provide sufficient space for two-stage crossings	**-4.5**	*2*	-1	-1	-1	-0.5	-0.5	-0.5	-3.0	-0.5	-1.0

Introduction

In January, 2014, with funding from the Oregon Health Authority (OHA), Oregon Public Health Institute (OPHI) partnered with Clackamas County Public Health (CCPH), Clackamas Safe Communities (CSC) and the Clackamas County Department of Transportation and Development (DTD) to conduct a Health Impact Assessment (HIA) of the "Active Transportation Road Safety Audit" (RSA) that was being conducted on a one-half-mile section of McLoughlin Boulevard in the unincorporated community of Jennings Lodge, Oregon in the northwestern corner of Clackamas County. This section was chosen for the RSA in part because it is representative of many of other parts of McLoughlin Blvd, but also because of known crash risk issues along this particular stretch of McLoughlin Blvd.

An RSA is a commonly used tool for transportation planners and engineers working to identify and mitigate crash risk for defined sections of a transportation system. RSAs typically result in a set of proposed projects designed to mitigate identified crash risk factors. This RSA was initiated by DTD as part of the larger McLoughlin Area Plan Implementation Team (MAP-IT) project, which is focused on implementing the recommendations that came out of the recently completed McLoughlin Area Plan. This RSA resulted in 42 proposed projects for reducing crash risks for bicyclists and pedestrians traveling through this section of McLoughlin Blvd.

HIA is methodology developed by public health professionals in order to facilitate efforts with non-health sectors to explicitly consider and address the potential direct and indirect health impacts of proposed plans, policies, and projects. [1] This RSA was chosen as a focus for the HIA because it provided DTD and CCPH staff with an opportunity to build off of Clackamas County's recently completed Transportation System Plan Update, which included health improvement goals and initiated partnerships between DTD and CCPH, as well as Clackamas County's recently initiated "Drive to Zero" campaign, which aims to eliminate traffic crashes by promoting a culture of health throughout the county as part of the adopted Clackamas County Transportation Safety Action Plan.

This HIA has three main goals:

1. Provide Clackamas County Department of Transportation and Development (DTD) and Oregon Department of transportation (ODOT) staff with information about the potential health impacts of the RSA recommendations that will be useful for:
    a. assessing the RSA recommendations to identify gaps or opportunities for addressing additional health issues based on identified health impacts, and
    b. assessing the RSA process/framework to determine whether it could provide opportunities for including additional public health issues.
2. Build capacity for HIA and other Health in All Policies (HiAP) strategies in Clackamas County Public Health (CCPH) and DTD.
3. Conduct an HIA according to OHA HIA guidelines.

The HIA provides a set of findings that characterize the relative health impacts of each proposed crash safety solution based on potential changes in opportunities for physical activity, exposure to air and noise

[1] A more complete overview of HIA practice, including tools and resources, can be found on the Oregon Health Authority's HIA program webpage: http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Pages/index.aspx

pollution, and access to jobs and schools. In addition, the HIA provides a set of recommendations for informing this RSA and future RSA projects as well.

Report Overview

This report documents the HIA's process, findings, and recommendations. Following a description of the RSA itself and the HIA study area, the Scoping section will summarize how the HIA team (OPHI, DTD, CCPH) determined which health issues to analyze; the Assessment section will detail how health impacts were assessed, present information on existing conditions on the relevant health determinants and outcomes, and present the resulting findings; and the Recommendations section will present a set of recommendations developed by the HIA team with input from key stakeholders.

RSA Overview

A Road Safety Audit (RSA) is a commonly used tool for transportation planners and engineers working to identify and mitigate crash risk for defined sections of a transportation system. RSAs typically result in a set of proposed projects designed to mitigate identified crash risk factors. This RSA was initiated by DTD as part of the larger McLoughlin Area Plan Implementation Team (MAP-IT) project, which is focused on implementing the recommendations that came out of the recently completed McLoughlin Area Plan. It was conducted on a one-half-mile section of McLoughlin Boulevard in the unincorporated community of Jennings Lodge, Oregon in the northwestern corner of Clackamas County (see Figure 1). It was conducted by an interdisciplinary team formed by DTD and led by a private consulting firm. The RSA's primary purpose was to identify challenges to and propose solutions for improving crash safety for bicyclists and pedestrians.

RSA Study Area

The RSA study area is a 1/2 mile section of McLoughlin Blvd between Boardman Avenue and Hull Avenue (Figure 1). This section was chosen in part because it is representative of many of other parts of McLoughlin Blvd, but also because of known crash risk issues along this particular stretch of McLoughlin Blvd. The RSA was done only on the McLoughlin public right-of-way, and does not directly address issues in the surrounding neighborhood or side streets. However, it did take into consideration the location of neighborhood features such as schools and parks that did not border McLoughlin Blvd in order to better understand traffic behavior and patterns on McLoughlin Blvd.

McLoughlin Blvd is a five lane, high-use, multi-modal corridor that serves about 20,000 vehicles per day. Within both the Greater McLoughin Area and the RSA study area, McLoughlin is bordered almost exclusively by auto-oriented businesses and shopping areas. With signaled intersections spaced approximately 1/2 mile apart and a posted speed limit of 45 MPH, McLoughlin is designed primarily to facilitate motor vehicle mobility. While these conditions have made McLoughlin attractive to motorists, they have contributed to an inhospitable and vulnerable environment for pedestrians and bicyclists, particularly when they need to cross McLoughlin.

Figure 1: RSA Study Area

Photo credit: Bing Maps

P

Photos courtesy of Clackamas County

The RSA process included a review and assessment of existing infrastructure, as well as direct observation of travel behavior in the RSA study area. The RSA team then identified key areas of concern for bicycle and pedestrian safety and categorized each area based on exposure of users to a road feature, the probability that a crash was influenced by that feature, and the consequence or severity of a crash. For each area of concern, the RSA team proposed a set of short and long term solutions designed to mitigate the crash risks posed by each area of concern. In all, the RSA produced 42 potential solutions in 11 different areas of concern for improving crash safety for all modes (Table 1 lists the areas of concern. Table 5 on p. 14 lists the area of concern, along with their potential solutions).

In the RSA, each area of concern is categorized according to relative risk, based on crash severity and frequency as determined by the professional judgment of the consultants who prepared the report.

- ***Category I*** indicates the least risk compared to the other observed issues; they are associated with low crash severity and low crash frequency.

- ***Category II*** indicates higher risk than some issues and lower risk relative to other observed safety issues.

- ***Category III*** indicates potentially the greatest risk compared to the other observed issues; they are associated with higher frequency and higher severity than other issues.

Table 1. Areas of concern identified in the RSA	
Area of Concern	**RSA Relative Risk Category**
Left-turn crossing movements	2
Location of pedestrian crossings	2
Visibility of pedestrian crossings at unsignalized locations	2
Rolling stops	2
Definition of sidewalks/pedestrian walkway	3
Nighttime visibility	2
Corridor speeds	2
Network connectivity	2
Sidewalk quality	1
Trolley Trail	2
Permissive turns at SE Jennings Avenue intersection	2

For each area of concern identified by the RSA team, the consultants developed a set of 2-7 corresponding (see above Table ES2) potential solutions designed to increase safety for all modes of transportation and reduce crashes along the corridor. For example, for the problem of "location of pedestrian crossings" the RSA proposes the following set of solutions:

- Enhance pedestrian crossings to promote driver yielding and encourage pedestrians to use these locations
- Consider moving the southbound bus stop between Jennings and Hull, or support by adding a mid-block crossing
- Positive reinforcement on doors on buses that reminds people to use crosswalk
- Mid-block enhanced crossing location in addition to existing intersection crossings

This finding was classified as a Category II, reflecting higher rate of exposure, a higher likelihood of pedestrians being hit by vehicles, and a very high risk of pedestrian/vehicle collisions, resulting in severe injury or death.

HIA Study Area

Clackamas County, part of the tri-county Portland Metropolitan area, encompasses 1,868 square miles, and as of the 2012 Census estimate, has a population of 383,857. It is one of the largest and most economically diverse counties in the state of Oregon. Third most populous in the state, Clackamas County is home to about 10% of the population and is also one of the fastest growing counties. The county has grown in population by more than 11% since 2000.

The HIA study area along McLoughlin Boulevard encompasses Census tracts 217, 218.2 and 219 and has a population of 13,962 people. Table 2 shows a breakdown by age. The study area has a slightly lower number of school-aged children and seniors, but a higher percentage of adults than the surrounding area and county.

Table 2. Estimated Population by Age

Geographic Area	Population	0-17	18-64	65+
Clackamas County	383,857	87,136 (22.7%)	239,143 (62.3%)	57,579 (15%)
Study Area *	13,962	2,992 (21.4%)	8,961 (64.2%)	2,009 (14.4%)

Source: 2008-2012 American Community Survey 5-Year Estimates
*census tracts 217, 218.02 and 219

Table 3. Median household income and size

Geographic Area	Median household income	Average household size
Clackamas County	$63,951	2.56
Study Area	$46,489	2.40

2008-2012 American Community Survey 5-Year Estimates for census tracts 217, 218.02 and 219

Table 3 compares median household income and average household size. Although household sizes are not that different, the study area has a significantly lower median household income than the surrounding area and county.

Table 4. Race/Ethnicity by area

Race/ Ethnicity	White	Black or African American alone	American Indian & Alaska Native alone	Asian alone	Native Hawaiian and other Pacific Islander alone	Hispanic or Latino	White alone, not Hispanic or Latino	Two or more races
Clackamas County	90.8%	1.0%	1.1%	3.9%	0.3%	8.1%	83.9%	3.0%
Study Area*	91.1%	2.2%	2.3%	2.3%	0.8%	10.7%	82.7%	N/A

Source: 2008-2012 American Community Survey 5-Year Estimates
*census tracts 217, 218.02 and 219

Table 4 shows a comparison of demographics between Clackamas County and the three study area Census tracts. The study area, like the county as a whole, is predominantly white, but has slightly more Black, American Indian, Native Hawaiian, and Hispanic residents, and slightly fewer Asian residents.

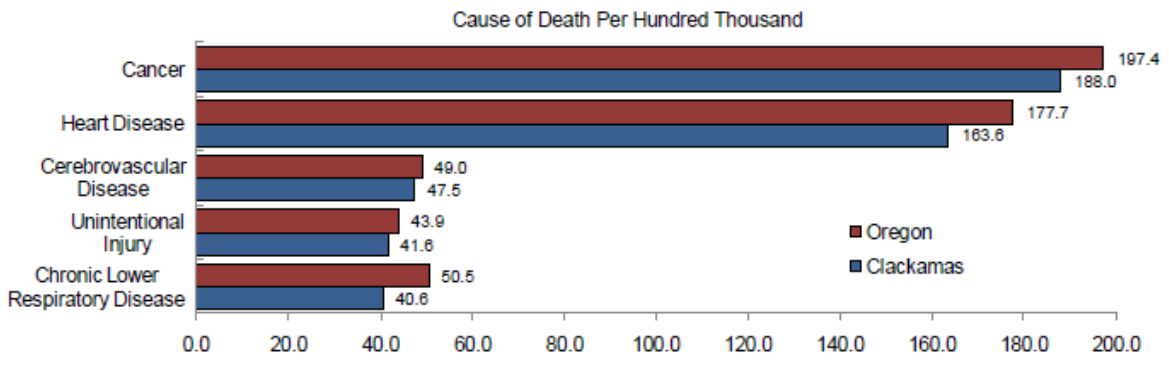
Vulnerable populations

The study area has a higher percentage of vulnerable populations than surrounding Jennings Lodge and Clackamas County, as indicated by the relatively low average household incomes in the area. Vulnerable populations are those at higher risk for poor health outcomes, and carry a disproportionate burden of disease. Low-income families, persons living with mental health challenges, older adults, and people of color are more likely to have less economic, educational, and housing opportunities. They also have poorer access to health care, healthy food and affordable, safe transportation.[1] As it relates to traffic safety, vulnerable populations such as low income communities, pedestrians, and children bear the highest burden of injuries and fatalities. Vulnerable populations are also more susceptible to the health risks associated with toxic air pollution from cars, trucks and other engines, especially in high traffic areas.[2]

Transportation-Related Health Determinants

Existing transportation systems in the US have been shaped by multiple policy inputs and decisions provided by planners, funding agencies and others at local, state, and national levels that have focused largely on building a system designed to move people and goods efficiently. An increasingly large body of research now shows that transportation decisions also directly and indirectly impact human health in multiple ways by influencing a wide range of health determinants. These "health determinants"—also referred to as "social determinants of health" or "risk factors"—are features of the built, social, and natural environment that are known to impact an exposed individual's risk of experiencing negative health outcomes (injury or illness). According to the American Public Health Association, "fifty percent of the leading causes of death and illness in the United States—traffic injuries, heart disease, cancer, diabetes, and respiratory illness—are preventable" because "these diseases have several risk factors that can be mitigated by transportation policies."[3] In Clackamas County, these five health issues are the top five causes of death (see Figure 3). In addition to these health outcomes, research has linked transportation systems to other health issues such as stress, depression, and obesity.

Figure 3. Top Five Causes of Death in Clackamas County, 2007



Source: Clackamas County Health Profile (2011)

There are six primary health determinants, or pathways, through which transportation systems can impact health outcomes. They include:

- Crash safety for bicyclists and pedestrians, as well as for motor vehicles
- Opportunities physical activity
- Exposure to air pollutants
- Exposure to noise
- Access to a wide variety of health supportive resources such as healthy food retail, employment, affordable housing, and parks and recreation facilities
- Income, particularly for low-income and minority households

Based on a review of the draft recommendations of the Road Safety Audit and on stakeholder input, it was determined that the primary health determinants that would be impacted by the recommendations would be crash safety, opportunities for physical activity, exposure to air pollutants and noise, and access to health supportive resources. Because crash safety is the primary focus of and is effectively addressed in the RSA, it will not be addressed in the HIA.

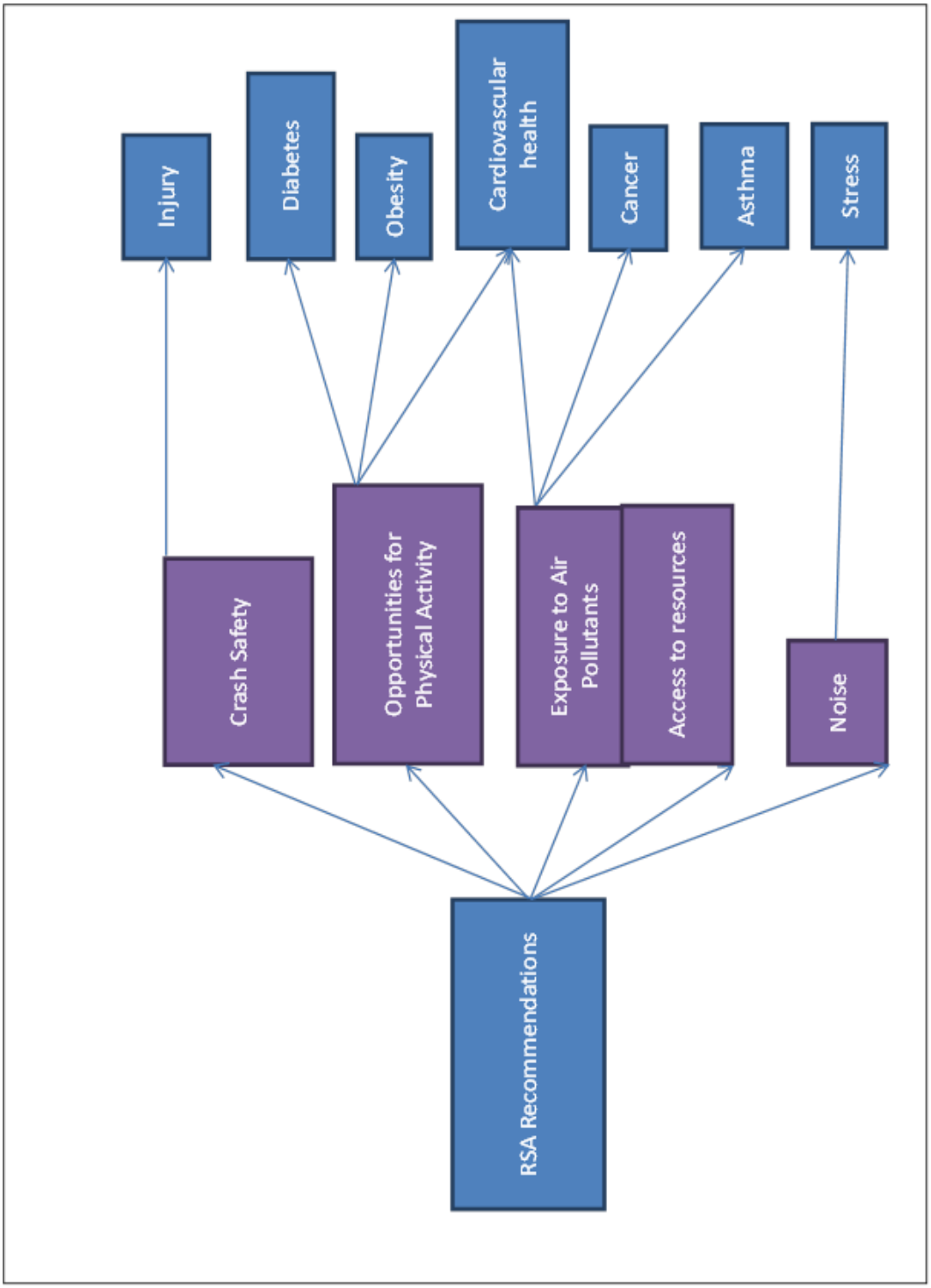
Scoping Key Issues

During the scoping phase of an HIA, the team identifies key issues that should be considered in the HIA, the affected population(s) and the methods to be used in the assessment. Scoping for an HIA relies on input from as many participants as possible: public health experts to help identify all potential direct and indirect health impacts of a project, and community and stakeholder input to help determine which impacts are most relevant and in need of analysis. In many cases, an HIA steering committee consisting of experts and stakeholders will be assembled to help with the scoping process. Because of the rapid timeline for this HIA, OPHI instead held a scoping workshop with ODOT staff and the HIA team (staff from Clackamas County Department of Transportation and Development, and Clackamas County Public Health), and also met with the established MAP-IT group to complete the scoping process by presenting information on the study area's existing conditions and research relating the built and social environments to health. The HIA team reviewed and discussed the possible pathways (Figure 4) through which health would be impacted by the RSA recommendations, and discussed possible criteria for determining which issues to explore in assessment.

Selection criteria included:

- Likelihood that the RSA recommendations would result in differential impacts on a particular health determinant;
- Whether the health issue was being addressed as part of the RSA;
- Likelihood that the RSA recommendations would likely impact a particular health determinant; and
- Ability to develop an assessment approach that would effectively gauge likely impacts of the RSA recommendations.

Figure 4: Health Pathway Diagram



Based on the existing conditions of the combined study area's health determinants feedback from previous community engagement efforts, and suggestions and advice from the MAP-IT group, OPHI and the HIA team decided to focus on assessing the study outcome's potential for impacting the following three health determinants:

- Opportunities for Physical Activity
    - Does the recommendation improve access to the Trolley Trail?
    - Does the recommendation encourage walking, biking, or transit use?
    - Does the recommendation improve access to schools and parks?

- Exposure to Air and Noise Pollutants
    - Does the recommendation encourage walking/biking along McLoughlin?
    - Does the recommendation encourage walking/biking along streets/paths parallel to McLoughlin?

- Access to Health Supportive Resources
    - Does the recommendation improve access to schools and employment opportunities

While crash safety would likely be the pathway most impacted by the RSA recommendations, the group decided that it would be effectively examined through the RSA process, and including it in the HIA would be duplicative.

The three scoped health determinants were then used throughout the assessment stage of the HIA, which is described in the next section.

Assessing the Health Impacts of the McLoughlin Blvd RSA Potential Solutions—Findings and Recommendations

The assessment component of an HIA involves making judgments about a project's, plan's or policy's, probable impacts on the health of the affected population. It builds on the project's scoping phase, which involves delineating the affected population, identifying which health determinants and outcomes to analyze, and determining which analytic methods will be employed in the analyses. The following describes the assessment process for this project, as well as the resulting findings and recommendations. It will be followed by a more detailed discussion of the potential impacts of both the RSA proposed solutions and the recommendations.

The methods used for gathering and analyzing relevant information for an HIA vary from project to project and are determined by staff and stakeholder capacity and resources. Assessment of the McLoughlin Boulevard RSA health impacts employed the following methods:

- Collection and analysis of demographic, land use, and urban form data[2]
- Review of health research literature establishing links between the built environment and health
- Soliciting community input on neighborhood health issues at MAP-IT and HIA team meetings
- Review of recent previous local efforts to gather community input related to a wide variety of livability and health-related issues
- Field visits and site observations of the study area

The key outcomes of the assessment component of this HIA include documentation of the established links between each health determinant and transportation infrastructure based on published research, an assessment of the existing conditions of the scoped health determinants in the study area as well as qualitative estimates of the impacts of the proposed RSA recommendations on the scoped determinants. This section outlines the methodology used for assessment of impacts and presents the key findings and recommendations. Existing conditions and the links between each health determinant and transportation infrastructure will be discussed in the next section of the report.

Assessment

To help identify possible assessment approaches and research questions, the HIA team reviewed a matrix (Table ES2) that aligned the RSA proposed solutions with the four health pathways, and applied a draft set of questions for assessing and characterizing impacts. Based on the discussion surrounding the initial application of these assessment questions to the RSA proposed solutions, the group made the following decisions:

1. Regarding assessment of impacts on opportunities for physical activity, the group indicated that the Trolley Trail provided the greatest opportunity for physical activity that would be impacted by

[2] This analysis was limited by time, resources and available data within the time frame of the HIA. Demographic data is from the 2010 Census, retrieved from the US Census FactFinder website for census tracts 217, 218.2 and 219. Population data was also collected from the 2008-2012 American Community Survey 5-year estimates. Health outcome data was collected from the Coalition for a Livable Future Health Equity Atlas, the Clackamas County website and the Healthy Columbia Willamette Community Dashboard, which included BRFSS and 2005-2006 Oregon Healthy Teens Survey.
Maps, land use, zoning and transportation data was provided by the 2012 Clackamas County Transportation System Plan Update and refer to the Greater McLoughlin Area.

the RSA recommendations. Accordingly, RSA recommendations that improved access to the Trail would likely have the greatest impacts on opportunities for physical activity, followed by recommendations that would improve access to parks and schools, and recommendations that encouraged walking, biking and transit use.

2. Regarding assessment of impacts on exposure to noise and to air pollutants, the group determined that they would each be impacted in the same way by the various RSA recommendations, so could be combined for purposes of assessment.
3. Regarding assessment of impacts on access to health supportive resources, the group decided that the primary health supportive resources not already being captured in the assessment of opportunities for physical activity are jobs and education.
4. Regarding how to characterize impacts, the group indicated that it would be possible to characterize impacts according to likelihood, direction, and relative magnitude—while the overall magnitude of impacts of each of the recommendations would be small, the group thought it would be possible to determine whether different RSA recommendations would have greater or lesser impacts on each of the health pathways being examined.

It is important to note that, in assessing the RSA solutions' impacts, this HIA assumes that some of the solutions will be implemented and have their desired impact. It does not attempt to gauge the likelihood of a RSA solution actually being implemented. Implementation of any RSA solutions, even if approved by ODOT, depends on hard-to-predict future availability of resources and stakeholder support.

Method for Assessing Impacts

The assessment approach focused on assessing each of the 42 RSA draft recommendations according to their relative impacts on the chosen health determinants, using a project scoring approach designed to help ODOT and DTD planners identify and characterize a broader set of health impacts than the safety impacts considered in the RSA in order to help prioritize and revise/refine the actions recommended in the RSA, and potentially identify additional opportunities for improving safety and health for people using the study area.

The scoring approach was based on answering the following questions for each recommendation. Questions were developed based on site visits, review of study area maps, community input from prior planning efforts, and knowledge of research-based relationships between transportation infrastructure and health behaviors and outcomes.

- Opportunities for Physical Activity
    - Does the recommendation improve access to the Trolley Trail?
    - Does the recommendation encourage walking, biking, or transit use?
    - Does the recommendation improve access to schools and parks?
- Exposure to Air Toxics and Noise
    - Does the recommendation encourage walking/biking along McLoughlin?
    - Does the recommendation encourage walking/biking along streets/paths parallel to McLoughlin?
- Access to Health Supportive Resources
    - Does the recommendation improve access to schools and employment opportunities?

Answers to each of the questions were based on professional judgment and expressed in numerical scores (-2, -1, 0, 1, 2). The scoring matrix (Table ES2) was developed in an iterative fashion, with OPHI staff assigning

each recommendation a score for each health pathway, along with a brief description of the rationale for each score. Each HIA team member was then asked to fill out their own assessment worksheet that contained the RSA recommendations aligned with the assessment questions above.

It is important to note the HIA team scored a draft set of RSA recommendations. The language of the final recommendations was not substantially different and scores were not affected by the revisions. A language comparison between the draft and final recommendations is shown in Appendix A.

To assist with the exercise, team members were given OPHI's initial score and rationalization, maps that were developed that identify locations of RSA recommended improvements, as well as locations of key locations such as the Trolley Trail, schools, parks, parallel streets, and businesses. The Active Transportation Road Safety Audit report was also shared as a way to provide more detail in describing each finding, as well as some supportive photos and images.

The HIA team then met to discuss initial individual reviews of the assessment worksheet. The group discussed strengths and challenges to the scoring method and applying their own judgment to each score. The group also discussed challenges to the Reduction in Exposure to Air and Noise assessment question, "Does the recommendation encourage walking and biking along McLoughlin?" A positive score of encouraging use along McLoughlin would lead to increased exposure to air toxics and noise, whereas encouraging walking and biking along parallel streets provided more health benefits. The question was ultimately removed from the scoring worksheet because team members felt that the behavior change that it was highlighting was already being captured in the other Exposure question—"Does the recommendation encourage walking and biking along streets/paths parallel to McLoughlin?" and was thus "double-counting" the impact.

Each HIA team member was asked to revisit their scores and to fully complete the assessment. In the end, the group coalesced around two sets of similar scores, which were resolved by averaging the scores to produce a final "HIA Score". Based on these scores, the RSA potential solutions are grouped into four categories:

- "High Impact" for solutions with scores of eight and above. This breaking point was chosen because all of these solutions received at least one score of ten or higher in one of the two sets of scores
- "Moderate Impact" for solutions with scores between six and seven and a half
- "Low Impact" for solutions with scores between three and six
- "Negative-No Impact" for solutions with scores less than one

The scoring matrix (ES2) displays the scores broken down by the individual assessment questions. In addition, Table ES2 displays the average scores for each of the three health issues addressed by the assessment questions in order to help determine which health issues are being more or less impacted by each solution, as well as by the overall set of RSA solutions. The final HIA scores for each RSA proposed solution are displayed in Table 5 below.

Based on the final scores and existing conditions data, the HIA team developed a set of findings that identified key issues raised by the HIA. The key findings are summarized below, and described in greater detail in the following section.

- Compared with Clackamas County as a whole, the RSA study area has relatively high rates of three key transportation-related health outcomes: obesity, asthma, and heart disease.
- In addition to improved crash safety, all but five of the 42 solutions are likely to have a positive impact on health outcomes related to physical activity, exposure to air quality and noise, and access to jobs and employment. Key health outcomes related to these health determinants include obesity, diabetes, heart disease, asthma, and stress.
- Of the 42 RSA proposed solutions, only one solution received a negative score because of potential safety risks that it would create for pedestrians trying to cross McLoughlin:
    - Increase median width to provide sufficient space for two-stage crossings
- Physical activity is the primary health determinant impacted by most interventions, followed by access to resources.
- When comparing the HIA scores to the RSA qualitative risk scores:
    - There appears to be general alignment with the HIAs "low impact" solutions and the RSA's Category I solutions
- The "high impact" solutions generally appear to be relatively large pedestrian infrastructure projects that both improve pedestrian mobility and encourage changes in driver behavior due to increased visibility and awareness

Table 5. HIA scores for RSA findings			
Problem identified in the RSA	**Locations**	**Potential Solutions proposed by the RSA**	**HIA Score**
High Impact			
Network Connectivity	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave; SE McLoughlin Blvd/SE Jennings Ave	Build sidewalks	**12**
Visibility of (Driver yielding for) Pedestrian Crossings	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Improve lighting	**12**
Visibility of (Driver yielding for) Pedestrian Crossings	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Provide additional crossing enhancements to increase visibility and attract pedestrians (e.g. warning signs, crosswalk markings, reflectors, advanced stop bars)	**12**
Visibility of (Driver yielding for) Pedestrian Crossings	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Flashing Beacons, RRFB, etc.	**11.5**
Nighttime Visibility	Project wide	Add street lighting to remove contrast with private illuminated signs.	**9.5**
Trolley Trail	SE McLoughlin Blvd/Trolley Trail	Consider diagonal crossing for bikes with exclusive bike signal/phase.	**9.5**
Definition of Pedestrian Walkway	Sidewalk gaps near Pete's Lair	Install sidewalk gaps	**9.5**
Permissive Turns at Jennings	SE McLoughlin Blvd/SE Jennings Ave	FYA with not ped logic	**9**
Permissive Turns at Jennings	SE McLoughlin Blvd/SE Jennings Ave	Protective/permissive phasing	**9**
Location of Pedestrian Crossings	Bus stop locations	Enhance pedestrian crossings to promote driver yielding and encourage pedestrians to use these locations	**8.5**
Permissive Turns at Jennings	SE McLoughlin Blvd/SE Jennings Ave		**8.5**
Visibility of (Driver yielding for) Pedestrian Crossings	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Install intersection ahead and crossing location signs to support visibility	**8**

Table 5. HIA scores for RSA findings			
Problem identified in the RSA	**Locations**	**Potential Solutions proposed by the RSA**	**HIA Score**
Corridor Speeds	Project wide	Traffic calming – curb extensions, landscaping, etc.	**8**
Moderate Impact			
Trolley Trail	Project wide	Adding way finding signage and pavement markings	**7.5**
Permissive Turns at Jennings	SE McLoughlin Blvd/SE Jennings Ave	Change lane configuration from left/thru to Left turn only lanes	**7**
Location of Pedestrian Crossings	Mid-block between Jennings and Hull	Mid-block enhanced crossing location in addition to existing intersection crossings.	**7**
Definition of Pedestrian Walkway	Sidewalk gaps near Pete's Lair	Access Management Plan to control driveway use.	**6.5**
Location of Pedestrian Crossings	Bus stop between Jennings and Hull, southbound	Consider moving the bus stop – this one (not in TriMet data) is mid-block, or support by adding a mid-block crossing.	**6.5**
Left-Turn Crossing Movements	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Install a traffic separator that allows drivers to make left turns from SE McLoughlin Blvd onto SE Boardman Ave, but prohibits lefts from the minor street onto SE McLoughlin Blvd.	**6.5**
Permissive Turns at Jennings	SE McLoughlin Blvd/SE Jennings Ave	Leading pedestrian phase	**6.5**
Corridor Speeds	Project wide	Speed feedback signs	**6.5**
Low Impact			
Sidewalk Quality	Project wide	Code enforcement	**6**
Visibility of (Driver yielding for) Pedestrian Crossings	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Enforcement	**6**

Table 5. HIA scores for RSA findings			
Problem identified in the RSA	**Locations**	**Potential Solutions proposed by the RSA**	**HIA Score**
Definition of Pedestrian Walkway	Sidewalk gaps near Pete's Lair	Put in bollards to differentiate pedestrian ROW and business use	**6**
Definition of Pedestrian Walkway	Sidewalk gaps near Pete's Lair	Enhance crossing at Boardman so pedestrians can use sidewalks on the west side	**5.5**
Corridor Speeds	Project wide	Reduce travel lane width	**5.5**
Rolling Stops	SE McLoughlin Blvd/SE Boardman Ave	Add stop bars at side streets to encourage vehicles to stop in advance of pedestrian movements.	**5.25**
Corridor Speeds	Project wide	Adjust signal timing progression to encourage driving the speed limit	**5**
Sidewalk Quality	Project wide	Create delineation to prevent pedestrians from falling off sidewalk edge	**5**
Definition of Pedestrian Walkway	Sidewalk gaps near Pete's Lair	Enforcement of property impacts within the right-of-way	**5**
Sidewalk Quality	Project wide	Enforcement to property owners	**5**
Sidewalk Quality	Project wide	Increase sidewalk width	**5**
Corridor Speeds	Project wide	Lower speed limit	**4.5**
Rolling Stops	SE McLoughlin Blvd/SE Boardman Ave	Confirm stop signs meet ODOT size requirements	**4.25**
Rolling Stops	SE McLoughlin Blvd/SE Boardman Ave	Enforcement	**4**
Sidewalk Quality	Project wide	Improve sidewalk grade	**4**
Sidewalk Quality	Project wide	Add reflective tape to improve visibility at nighttime.	**3**

Table 5. HIA scores for RSA findings			
Problem identified in the RSA	**Locations**	**Potential Solutions proposed by the RSA**	**HIA Score**
No Impact/Negative Impact			
Location of Pedestrian Crossings		Positive reinforcement on doors on buses that reminds people to use crosswalk.	**0.5**
Visibility of (Driver yielding for) Pedestrian Crossings	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Upgrade street name signs to meet MUTCD	**0.5**
Nighttime Visibility	Project wide	Review compliance.	**0**
Nighttime Visibility	Project wide	Review county and state codes.	**0**
Left-Turn Crossing Movements	SE McLoughlin Blvd/SE Boardman Ave; SE McLoughlin Blvd/SE Hull Ave	Increase median width to provide sufficient space for two-stage crossings	**-4.5**

Recommendations

The following recommendations were based upon the HIA team's wide breadth of professional knowledge, as well as on evidence-based best practices. Recommendations for this particular RSA focus on implementation of future projects in the study area, whereas recommendations for future RSAs emphasize integrating health into the RSA process. The potential impacts or these recommendations will be discussed in greater detail in the following section.

For this particular RSA:

- Use HIA scores to inform decisions about project selection and prioritization in the study area.
- To facilitate use of the HIA scores in future decisions about project funding and implementation, integrate the HIA scores into the RSA report, either as an Appendix or in the body or the report, alongside the RSAs qualitative risk categories.
- When implementing specific solutions, review project to determine whether opportunities exist to improve the solution's ability to improve access to parks, Trolley Trail, schools, and employment, as well as use of parallel facilities for north-south travel in the corridor.
- Consider additional solutions outside of the right-of-way that would support proposed solutions
    - E.g., education/encouragement campaigns with local schools/employers that would help encourage safe and health promoting behaviors.

For Future RSAs:

- ODOT should work with OHA's HIA program staff to develop screening criteria for helping transportation agencies determine when and how public health expertise on an RSA will add value to the project. Possible strategies for including public health on an RSA team include:
    - having an HIA team member join the RSA team if an HIA is being conducted along with the RSA
    - contacting the Oregon Health Authority's HIA program to request their participation in the RSA, or ask for a referral to appropriate staff at the county health department in the county where the project is located
    - Adding language to the RSA RFP (have you defined RFP earlier)that requires the consultant team to demonstrate having public health expertise on their team
    - contracting with a public health consultant experienced in assessing the public health impacts of transportation plans, policies, and projects
- Develop similar project scoring criteria for proposed RSA solutions and integrate scores into RSA reports. Project scoring criteria will be context-specific, but should be designed to assess the following transportation-related health issues:
    - Opportunities for physical activity
    - Access to health-supportive resources such as full-service grocery stores, schools, jobs, and social and medical services
    - Exposure to air and noise pollution
    - Health equity—i.e., disproportionate impacts on vulnerable groups such as youth, elderly, disabled, and low-income individuals and households.
- Conduct similar health impact scoring exercises as part of future RSAs, then evaluate to determine usefulness.

- For each identified finding (problem) in the RSA, identify a set of solutions that include at least one action for the primary "behavior modification" strategies:
- For future Clackamas County RSAs, ensure that the proposed solutions are designed to support the County's "Drive to Zero" campaign by identifying a set of solutions for each problem area that include at least one action for the primary strategies identified as essential for establishing a culture of safety in Clackamas County. These strategies are:
    - Engineering
    - Education
    - Enforcement
    - Encouragement
    - Emergency Medical Services

Discussion of Findings

What follows is a detailed discussion of the key findings that emerged from this HIA. For each health determinant, we summarize the impacts based on the scoring methodology, document the relationship between the health determinant and transportation infrastructure, and describe the existing conditions of both the health determinant in the study area, and the related health outcomes.

Opportunities for Physical Activity

Summary of impacts of RSA solutions

Physical activity is the primary health determinant impacted by most of the suggested RSA interventions. Table 5 shows that 36 of the 42 RSA recommendations will have a positive impact on physical activity; these would encourage walking, biking and transit use along McLoughlin, as well as access to the Trolley Trail and schools and parks in the area through various methods of infrastructure improvement. Improving lighting, sidewalk quality, way-finding, and limiting vehicle-pedestrian interactions are evidence-based methods to promote safety and physical activity.

The RSA recommendations with the highest impact were:

- Build new sidewalks and fill sidewalk gaps
- Improve lighting
- Provide additional crossing enhancements to increase visibility and attract pedestrians

The RSA's set of recommendations will likely increase walking, biking, and active recreation levels in the area. This change in behavior would improve health outcomes related to physical activity, including lower rates of obesity, type 2 diabetes, heart disease, high blood pressure, colon cancer, and premature death, as well as improved musculoskeletal and mental health.

• Resulting increases in physical activity would also likely improve the health of McLoughlin area residents by improving social cohesion and reducing accident rates for bicyclists and pedestrians.

• The improvements resulting from these recommendations will likely benefit all neighborhood residents, as well as those using the Trolley Trail and McLoughlin Blvd for recreation and commuting.

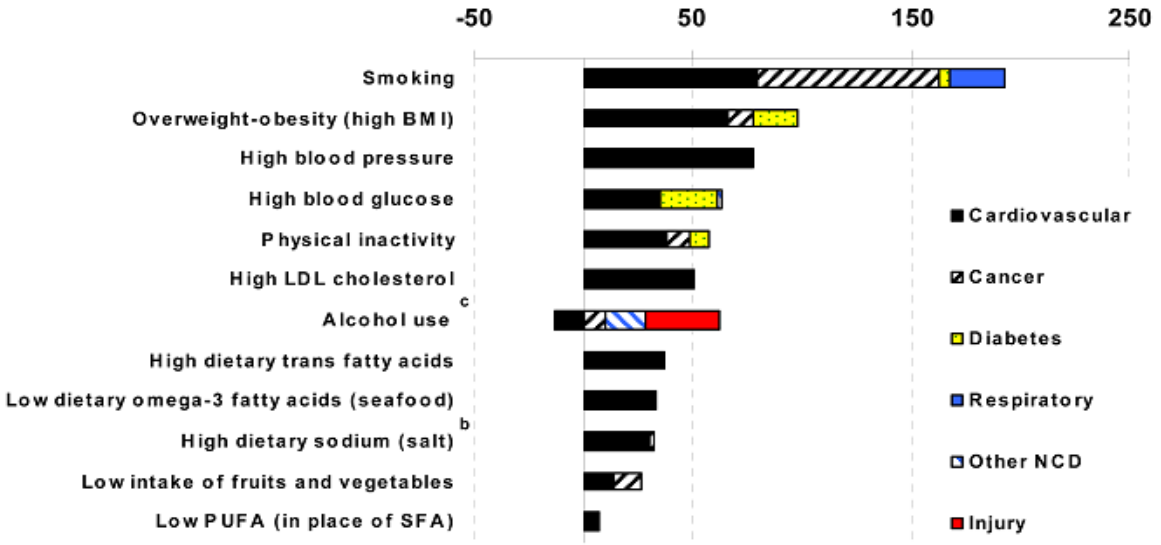
Physical activity and health

Researchers' understanding of the relationships between physical activity and health has steadily improved since the early 1990s when they expanded the focus of their work from assessing the impacts of intensive vigorous exercise to include a wider range of low or moderate intensity physical activities. In 1996, the US Surgeon General released its first report on physical activity and health which concluded that moderate physical activity (defined as activities that use large muscle groups and are at least equivalent to brisk walking, such as swimming, cycling, dancing, gardening and yard work, and various domestic and occupational activities) can substantially reduce the risk of developing or dying from coronary heart disease, colon cancer, high blood pressure, and diabetes. In addition, physical activity has been demonstrated to improve mental health and, for people with joint or bone problems, improve muscle function, cardiovascular function, and physical performance.[4,5] Since the Surgeon General's report was issued,

research has built on its conclusions and has also more conclusively demonstrated that for people who are inactive, even small increases in physical activity can yield numerous measurable health benefits.[5] In addition, physical activity has been solidly linked to improved learning and educational attainment among adolescents.[6] Finally, types of physical activity that bring people into contact with each other, including walking about one's neighborhood and using parks and recreation facilities, have also been demonstrated to improve mental health and social cohesion.[7],[8],[97] High levels of social cohesion can contribute to good health outcomes by enabling the dissemination of health-related information such as care options, establishing, maintaining, and promoting social norms and practices associated with healthful behaviors.[7]

This improved understanding of physical activity's positive impact on health has also been accompanied by an increasing awareness of the magnitude of the impact of increasingly sedentary lifestyles on Americans' health. In a recent study that ranked the leading preventable causes of death in the United States[10], physical inactivity ranked 5th on the list, and was estimated to have been responsible for 191,000 premature deaths in 2005 (Figure 5).

Figure 5. Deaths (thousands) attributable to total effects of individual Risk factors, by disease*



***Source: Danaei G, Ding EL, Mozaffarian D, Taylor B, Rehm J, et al. (2009) The Preventable Causes of Death in the United States: Comparative Risk Assessment of Dietary, Lifestyle, and Metabolic Risk Factors. *PLoS Med* 6(4): e1000058.**

The U.S. Centers for Disease Control and Prevention (CDC) currently recommends that adults should either engage in moderate exercise for at least 30 minutes 5 days a week, or in vigorous exercise (defined as rhythmic, repetitive physical activities that use large muscle groups at 70 percent or more of maximum heart rate for age, e.g., jogging, lap swimming, competitive team sports) for at least 20-minutes 3 days a week.[5] For adolescents, CDC recommends at least 60 total minutes of physical activity per day on 5, but preferably all, days of the week.[6]

According to the Oregon Behavioral Risk Factor Surveillance System (BRFSS) annual survey, 44.4% of Clackamas County adults aren't meeting the CDC recommendations for physical activity, compared to 44.2% for all Oregon adults. Among youth in Clackamas County, 58.0% of 8th graders and 49.2% of 11th graders are meeting the CDC benchmark, compared to 59.5% and 51.2% of 8th and 11th graders statewide. In Oregon, as elsewhere in the US, adults who are young, affluent, and/or well-educated were more likely to get recommended levels of physical activity than their counter-parts. Of the different primary racial/ethnic groups, American Indians (67.0%) were most likely to meet the CDC recommendations for adults, followed by African-Americans (63.9%), White (59.0%), and Asian/Pacific Islanders (54.6%). Latinos posted the lowest rates of attainment with only 42.1% meeting the recommended levels of physical activity.[3]

Transportation systems and physical activity

As the loosely linear dose-response relationship between physical activity and health has become better documented and understood, so has our understanding of the impact that transportation systems can have on physical activity levels. Numerous studies have demonstrated that neighborhoods with well-connected street networks and a wide variety of retail opportunities produce high rates of walking for transport[11–15], and that these rates also correlate with obesity levels which can serve as a rough proxy for other physical activity-related health outcomes.[16–23] A much smaller body of research has also looked at the impact of the built environment on biking for transport, and has demonstrated that the presence of bicycle infrastructure such as bike lanes, bike boulevards, and multi-use paths correlate with increased rates of cycling and, thus, physical activity.[24,25] In addition to impacting opportunities for physical activity via active transportation, research has also demonstrated that access to parks and open space is also positively correlated with levels of physical activity because of the active recreational opportunities they provide.[13,20,26–29]

Taken together, the primary components of a transportation system that research most frequently identified as correlating with increased levels of physical activity include:

- Safe, convenient, and well-connected pedestrian infrastructure
- Safe, convenient, and well-connected bicycle infrastructure
- High levels of transit service, especially high-frequency and multiple route choices
- Convenient access to parks, recreation facilities, and open space

Much of this research also indicates that these and other less-examined variables tend to be synergistic, having a cumulative effect on physical activity levels when multiple features are present in a community. This synergy is important because much of this research also indicates that the changes in behavior resulting from making changes in many of these variables in isolation will likely be relatively modest. In a recent meta-analysis of published empirical studies of the associations of various features of the built environment and walking, for example, Ewing and Cervero found that the relationship between each individual variable and walking rates is inelastic, meaning that a 1% change in the variable produces a less-than-1% change in walking rates. As they point out in their conclusion, however, "the combined effect of several built environment variables on travel could be quite large" (p. 275). [15] Similarly, regarding bicycling rates, Pucher et al., conclude that "individual interventions can increase bicycling to varying degrees, but the increases are not usually large… Substantial increases in bicycling require an integrated package of many

3 Racial Categories do not include respondents of Latino ethnicity. Rates are age-adjusted.

different, complementary interventions, including infrastructure provision and pro-bicycle programs, as well as supportive land use planning and restrictions on car use." [25]

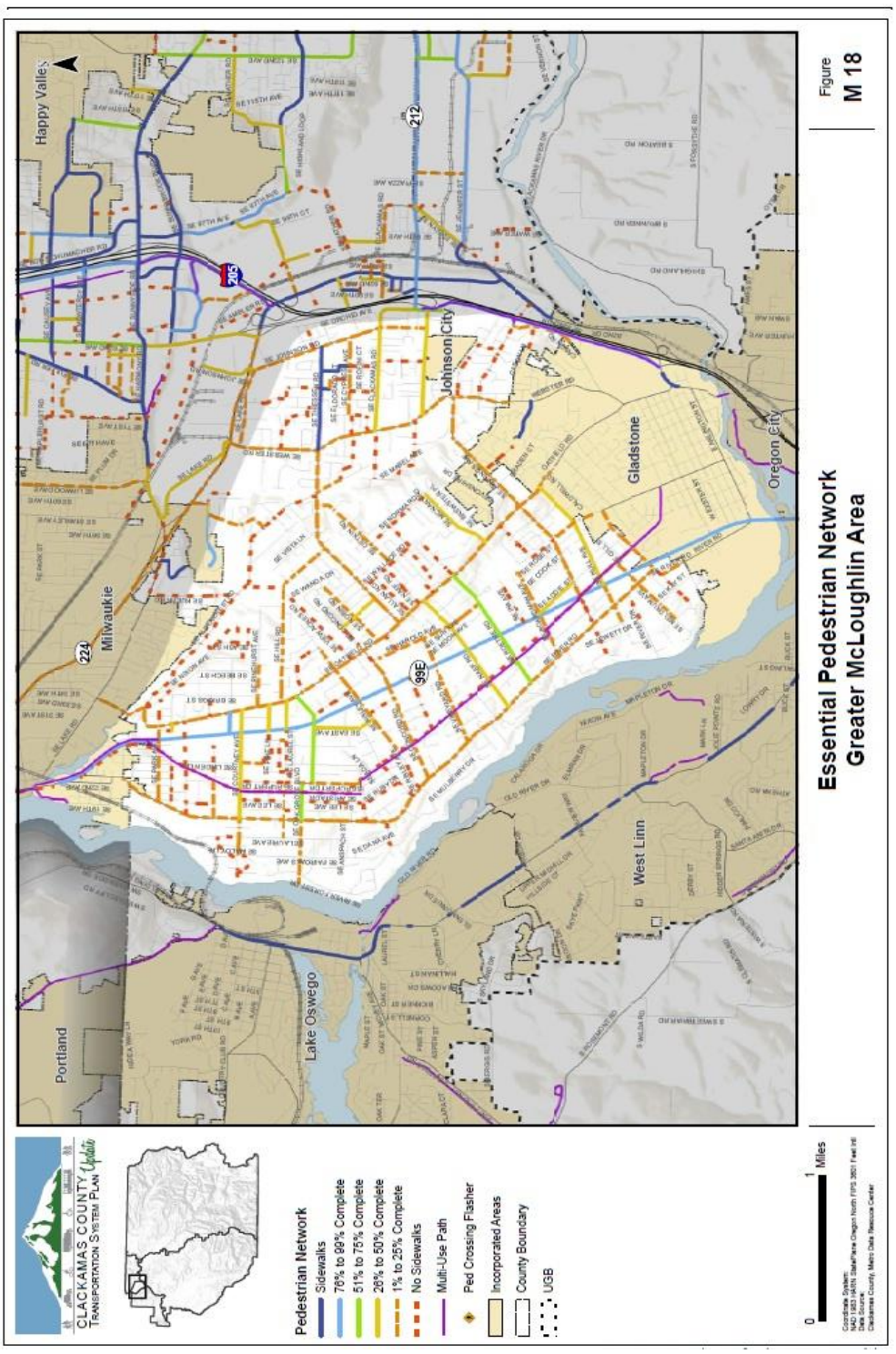
Table 6. Commute data by mode.					
Geographic Area	**Means of Transportation to Work**				
	Car, truck or van (alone)	Carpool	Public Transportation	Bike	Walk
Clackamas County	76.6%	9.2%	2.8%	0.4%	2.2%
Study Area (average)	72.7%	11.9%	4.8%	0.3%	2.5%
Source: 2012 ACS 5-Year Estimates					

Opportunities for physical activity in the study area

Pedestrian infrastructure

As Figure 6 below indicates, the sidewalk network in the study area is very incomplete, with many streets lacking sidewalks along most or all of their length. McLoughlin Boulevard has the highest level of sidewalk completion, but is oriented to primarily serve auto traffic- both motorists making local trips and through traffic.[30] The McLoughlin sidewalks in the study area are disconnected or non-existent in some parts, including at some intersections. As a result, it is not uncommon to see pedestrians walking in the bike lanes where sidewalks are absent. Even where sidewalks do exist, they are frequently interrupted by curb cuts for parking lots. In addition, because McLoughlin is a high traffic corridor serving about 20,000 vehicles per day, noise, air pollution, and fast-moving traffic make for an uncomfortable, unsafe, and unhealthy walking environment. While the side streets offer relief from these issues, the lack of connected sidewalks means that pedestrians and cyclists must use the roads and run the risk of being hit by cars.

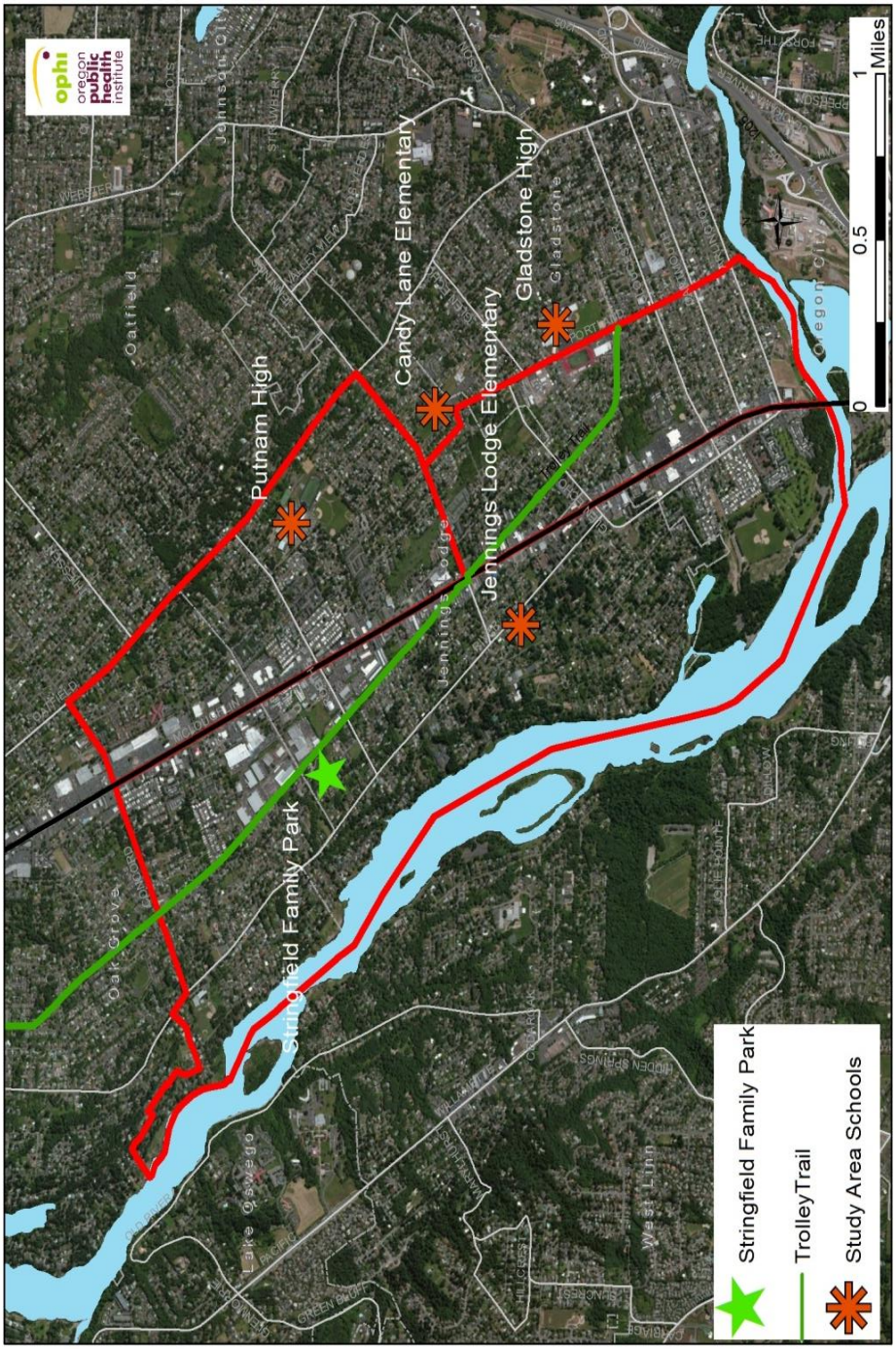
Figure 6. Essential Pedestrian Network, Greater McLoughlin Area



In addition to sidewalks, McLoughlin also provides other pedestrian infrastructure components such as crosswalks, signals, and pedestrian islands. Signalized intersections with marked crosswalks occur about every half mile on McLoughlin, including in the study area. The remaining intersections are unsignalized and lack painted crosswalks, but a few, such as those at Boardman and Hull, have a pedestrian island in the middle of McLoughlin to provide pedestrians a place to stand and wait for traffic to clear.

In addition to the pedestrian infrastructure in and immediately adjacent to roadways, the other primary piece of pedestrian infrastructure is the multi-use Trolley Trail, a recently completed ails-to-trails project which is connected to a larger regional trail system, and provides a paved and separated path for thorough biking and walking (Figure 7).

Figure 7. Trolley Trail, Greater McLoughlin Area

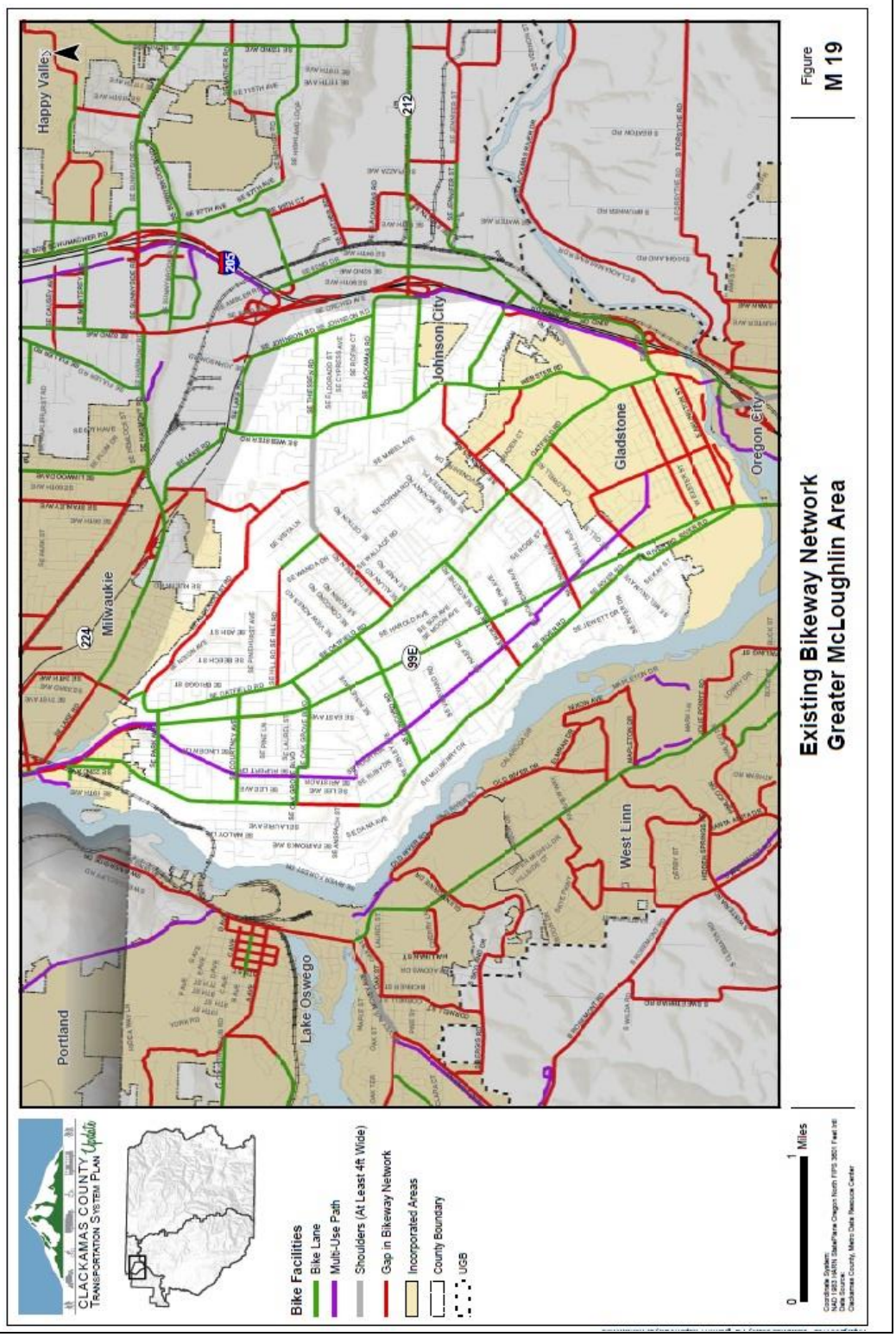


Map crated by Steve White, Oregon Public Health Institute

Bicycle infrastructure

Figure 8 displays the bike infrastructure in the area, which consists of bike lanes on many of the primary roads, including McLoughlin, and the Trolley Trail. As this map also indicates, there are multiple gaps in the bike lane network, meaning that bicyclists would have to ride in traffic to complete their trips, depending on where they were riding. In addition, because of the high traffic levels on McLoughlin, many bicyclists either avoid riding on McLoughlin, ride on the sidewalks, or ride in the bike lanes in the wrong direction because of the difficulty of crossing the street. The Trolley Trail is a popular, safe and comfortable bicycling option.

Figure 8. Existing Bike Network, Greater McLoughlin Area



Transit service

Trimet bus line 33 provides weekday service along SE McLoughlin Boulevard approximately every 15 minutes. Stops are available about every quarter miles along the road. There is a mix of sheltered and non-sheltered stops. According to 2013 Trimet passenger data, approximately 70 passengers get on and off the 33 bus per day at the Boardman and Jennings intersections along McLoughlin, and 28 passengers board at Hull. TriMet buses also run along River Road and Oatfield Road, which run parallel to McLoughlin.

Figure 9 displays the existing transit level-of-service analysis results for service coverage in the Greater McLoughlin area. Areas defined as transit supportive that have service are shown in blue. Areas defined as transit supportive but lacking service are shown in red. Areas that have transit service, but do not qualify as a TSA, are shown in orange. A majority of the areas shown in red would require additional transit routes or the development of new pathway connections (increasing the area that is within ¼ mile walking distance) to existing transit routes to be served. Within the study area, more commuters carpool, take public transportation and walk to their place of work than in the county as a whole, and a smaller percentage drive to work alone.

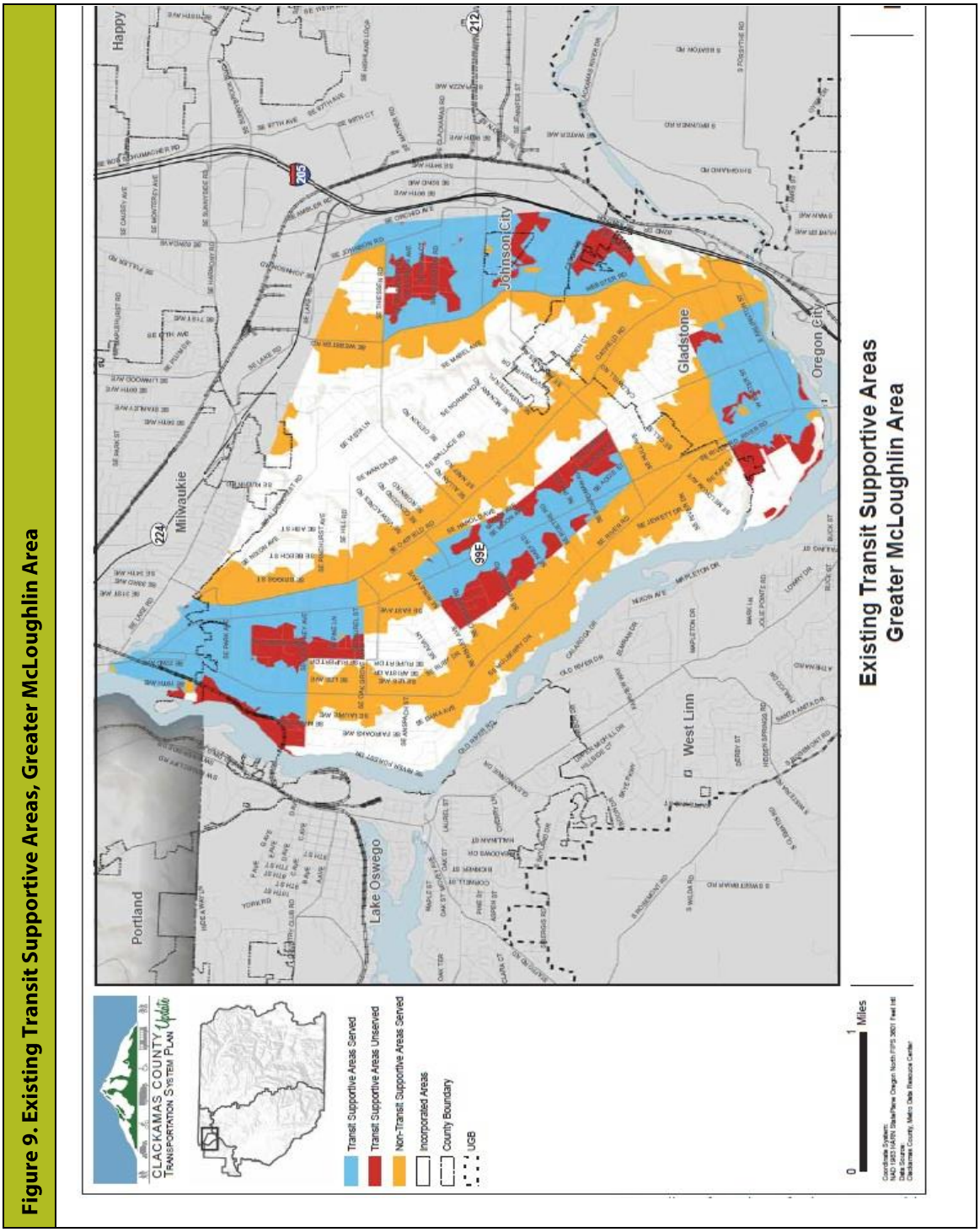


Figure 9. Existing Transit Supportive Areas, Greater McLoughlin Area

Parks, recreation facilities, and open space

The study area is relatively well-served by parks, recreation facilities, and open space. Parks include Glen Echo Wetlands to the east of McLoughlin Boulevard, just south of Hull, Olson wetlands, and Stringfield Family Park. These parks contain a variety of amenities that support physical activity, and are complemented by three public schools Jennings Lodge and Candy Lane Elementary Schools and Rex Putnam High School, each of which have playfields available for student use, as well as for community use during non-school times. The multi-use Trolley Trail also provides opportunities for walking and biking. Figure 10 shows all activity centers within the study area.

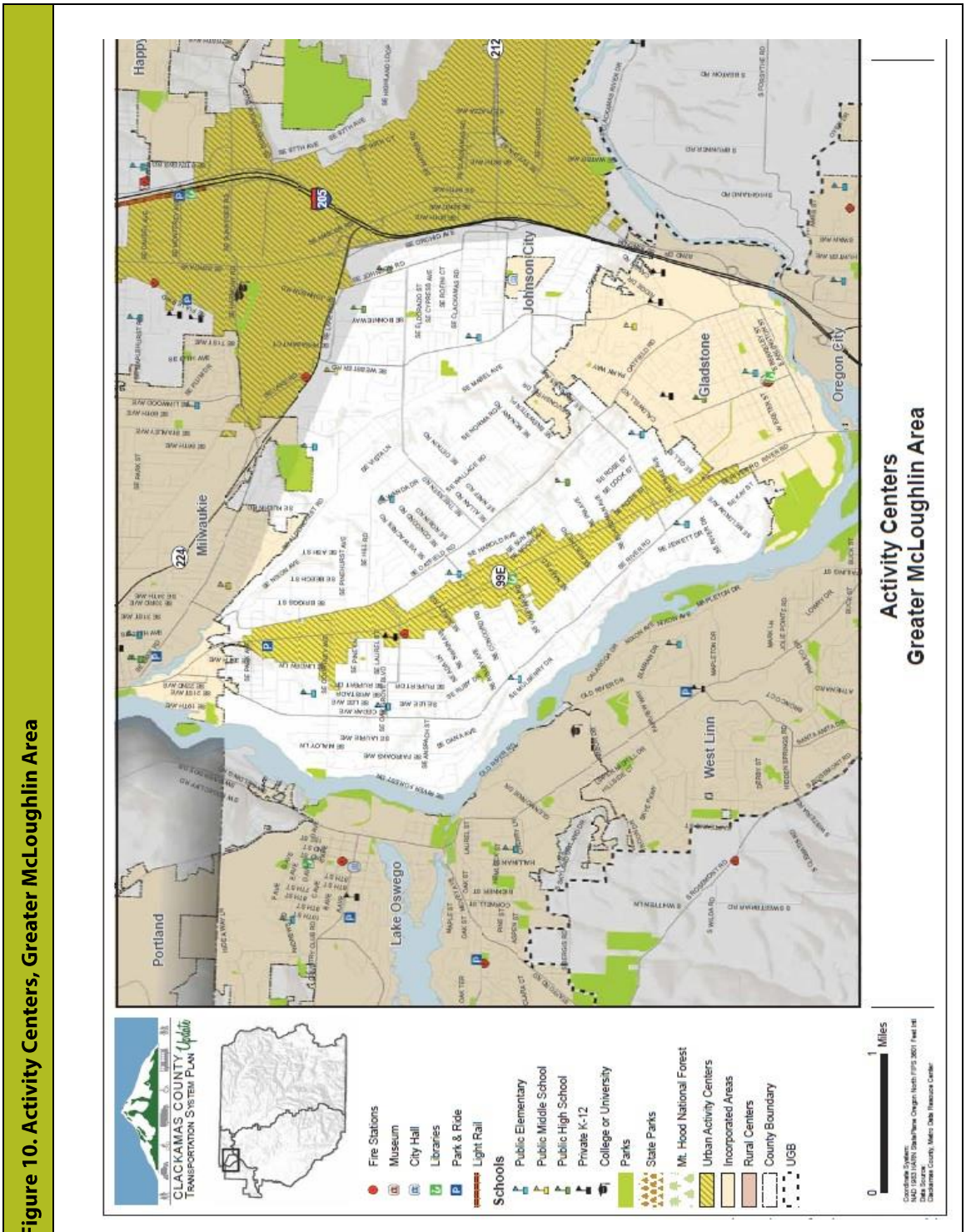


Figure 10. Activity Centers, Greater McLoughlin Area

Physical activity-related health outcomes

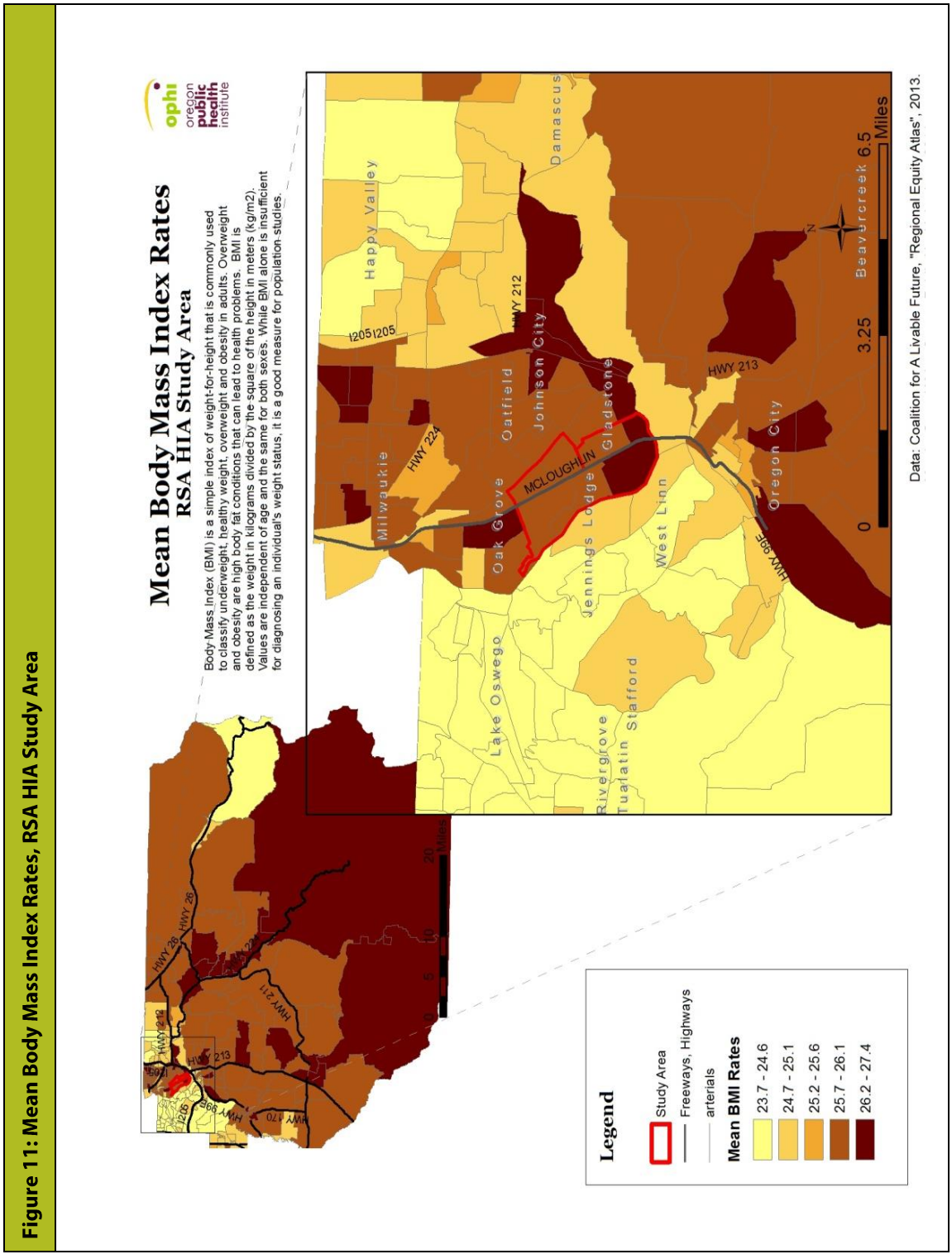
Overweight and Obesity

Overweight and obesity are labels for ranges of weight that are greater than what is generally considered healthy for a given height. The terms also identify ranges of weight that have been shown to increase the likelihood of certain diseases and other health problems. For adults, overweight and obesity ranges are determined by using weight and height to calculate a number called the "body mass index" (BMI).[4] BMI is used because, for most people, it correlates with their amount of body fat. An adult who has a BMI between 25 and 29.9 is considered overweight, and an adult who has a BMI of 30 or higher is considered obese.

According to 2005-2006 BRFSS data, approximately one in three Clackamas County adults are overweight (35.7%) and nearly a quarter (23.6%) are obese. The number of adults in Clackamas County with a BMI greater than 30 has increased from less than 15% in 1997 to 20% in 2002-2005, well above the Healthy People 2010 goal of 15%. According to a recent study of driver's license data by the Oregon Health Authority, the mean BMI of all Clackamas County residents is 26.3, while the mean BMI of the study area is 26.0, with some variation in the study area (see Figure 11).

[4] BMI is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). Values are independent of age and the same for both sexes. While BMI alone is insufficient for diagnosing an individual's weight status, it is a good measure for population studies.

Figure 11: Mean Body Mass Index Rates, RSA HIA Study Area



Diabetes

Diabetes is a disease in which blood glucose levels are elevated, due either to a body's insufficient insulin levels or inability to effectively use its own insulin. Diabetes can lead to multiple serious health issues such as heart disease, blindness, kidney failure, and lower-extremity amputations, and is the seventh leading cause of death in the United States. People whose bodies do not produce sufficient insulin are said to have "Type 1" diabetes, and people whose bodies can't effectively use their own insulin are said to have "Type 2" diabetes. According to CDC, 95% of people with diabetes have Type 2 diabetes. Multiple studies have demonstrated that regular physical activity can significantly reduce the risk of developing Type 2 diabetes. In Oregon, African Americans have the highest prevalence of diabetes. Compared to non-Latino whites, American Indians/Alaska Natives and Latinos also have a higher prevalence of diabetes (Figure 12), as to people with low incomes.[30]

Figure 12. Prevalence of select chronic conditions among adult Oregonians by race/ethnicity

Prevalence of select chronic conditions among adult Oregonians by race/ethnicity

	Non-Latino				Latino
	African American	American Indian / Alaska Native	Asian / Pacific Islander	White	
Asthma	16.5%	15.3%	6.4%	10.1%	4.9%
Diabetes	13.4%	12.2%	7.2%	6.2%	9.6%
Hypertension	41.4%	29.5%	18.9%	25.3%	19.2%

Source: Oregon Behavioral Risk Factor Surveillance System, Race Oversample, 2004-2005
Data Note: All estimates age adjusted to the U.S. standard population, 2000.

In Clackamas County, 7.3% of residents have diabetes. In the study area census tracts, diabetes rates range from 10.0% to 8.2% (Figure 13). It is likely that at least some of the relatively high rates in the study area can be attributed to the area's relatively high proportions of racial/ethnic minorities and low income households.

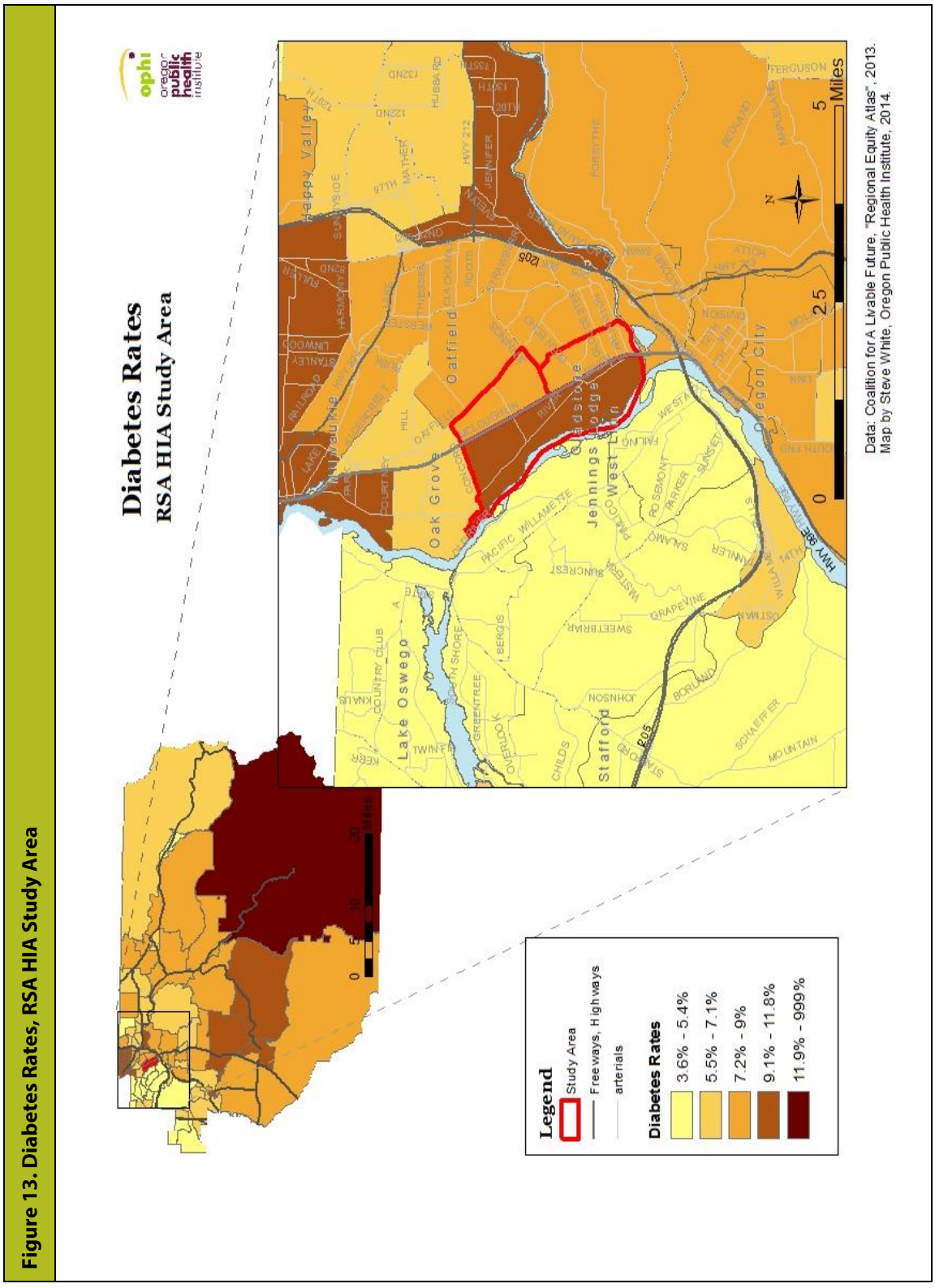


Figure 13. Diabetes Rates, RSA HIA Study Area

Cardiovascular Disease

Heart, or cardiovascular, disease refers to several types of heart conditions, including coronary artery disease, which can cause heart attack, angina, heart failure, and arrhythmias. It is the second highest cause of deaths in Clackamas County. Based on a recent analysis of insurance claims, the rate of heart disease in Clackamas County for adults age 18-75, is 1.9%, while the rate in the study area census tracts ranges from 2.0--2.9% (Figure 14) .

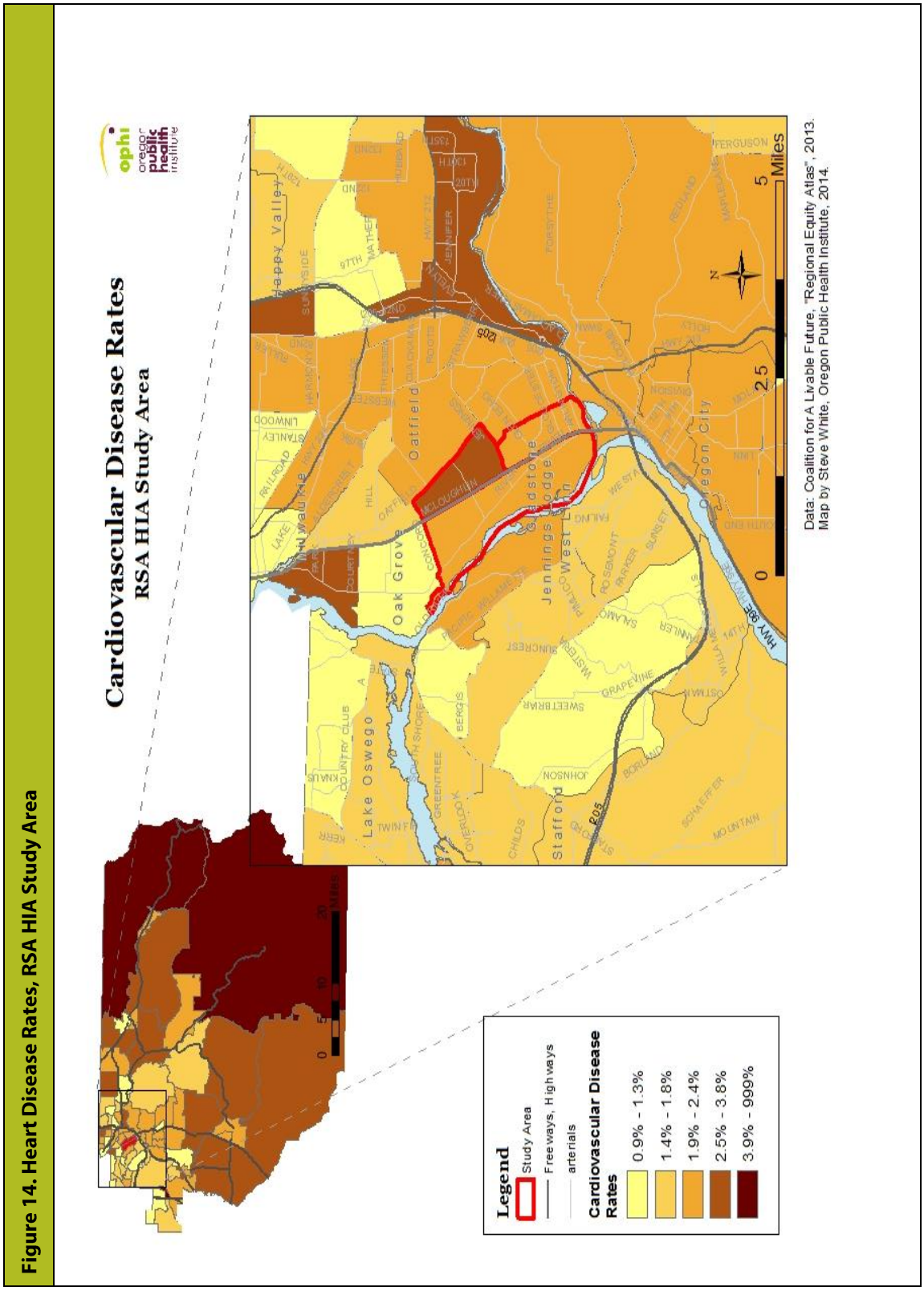


Figure 14. Heart Disease Rates, RSA HIA Study Area

Improving lighting, sidewalk quality, way-finding, and limiting vehicle-pedestrian interactions are evidence-based methods to promote safety and physical activity.

The RSA's set of recommendations will likely increase walking, biking, and active recreation levels in the area. This change in behavior would improve health outcomes related to physical activity, including lower rates of obesity, type 2 diabetes, heart disease, high blood pressure, colon cancer, and premature death, as well as improved musculoskeletal and mental health.

Exposure to Air Pollutants and Noise

Summary of impacts

The RSA recommendations have the potential to alter people's exposure to outdoor air pollutants in positive and negative ways, primarily by changing travel behaviors. While recommendations that encourage walking, biking, and transit use along McLoughlin could increase resident's exposure to outdoor air pollutants, the majority of the recommendations encourage access to and use of the Trolley Trail, leading to a reduction of pedestrian and bicyclist use of McLoughlin, where exposure to air and noise pollution is extremely high. Increased use of the Trolley Trail and parallel streets will help reduce short-term and long-term exposure to pollutants. These recommendations may also lead to an increase in walking, biking and transit use, leading to a reduction in car use by area residents.

Prioritization of those RSA recommendations that would lead to improvements in bicycle and pedestrian infrastructure and bicycle and pedestrian network connectivity would facilitate movement through the area while also minimizing exposure to air toxics by reducing the need to walk and bike along McLoughlin, which would generate localized air pollution and safety issues.

The RSA recommendations with the highest impact were:

- Build new sidewalks and fill sidewalk gaps
- Improve lighting
- Provide additional crossing enhancements to increase visibility and attract pedestrians
- Adding wayfinding signage and pavement markings

Pollutants and health

There are many different types of outdoor air pollutants that are either known or strongly suspected to negatively impact human health. The US Environmental Protection Agency (EPA) currently regulates six "criteria" pollutants by requiring cities or regions to keep emissions of these pollutants below certain health-based benchmark levels. The criteria pollutants include ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead. Cars and trucks are significant emitters of all of these criteria pollutants, with the exception of lead. In addition to the EPAs regulated criteria pollutants, the Oregon Department of Environmental Quality (DEQ) also monitors 19 other air toxics with known or suspected negative health outcomes, and has established health-based benchmarks for each pollutant. Cars and trucks are significant sources of many of these toxics, particularly acrolein, butadiene, benzene, acetaldehyde, and diesel particulate matter.

In general, high air pollution levels can cause immediate health problems including:

- Aggravated cardiovascular and respiratory illness;
- Added stress to heart and lungs, which must work harder to supply oxygen;
- Damage to cells in the respiratory system.
- Long-term exposure can also have permanent health effects, including:
- Accelerated aging of the lungs and loss of lung capacity;
- Decreased lung function;
- Development of diseases such as asthma, bronchitis, emphysema, and possibly cancer;
- Shortened life span.
- People most susceptible to severe health problems from air pollution are:
- Individuals with heart or lung disease;
- Individuals with respiratory problems such as asthma or emphysema;
- Pregnant women;
- Outdoor workers;
- Children under age 14 (their lungs are still developing); and
- Athletes who exercise vigorously.

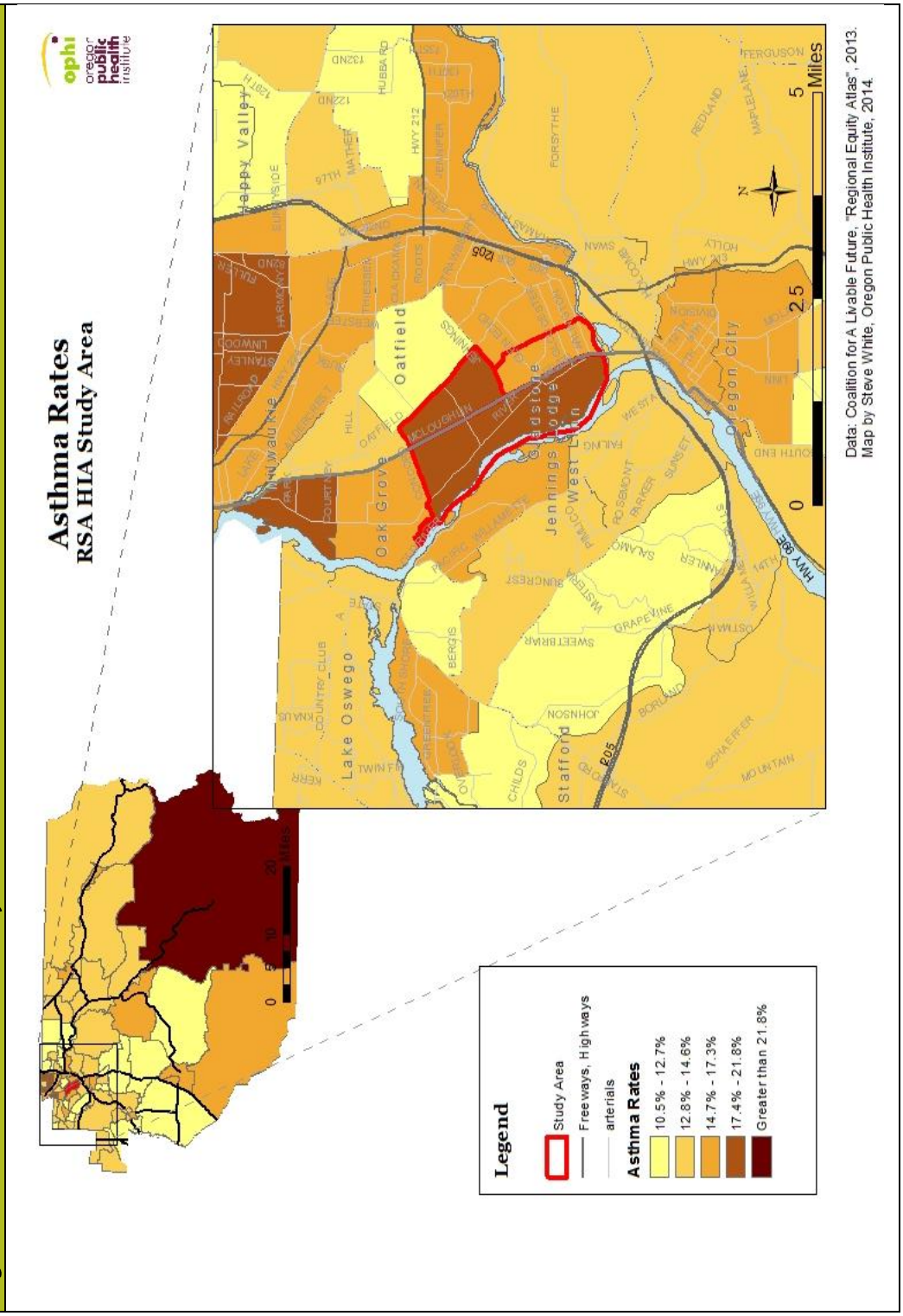
Exposure to Noise and Air Pollution in Study Area

For many communities, asthma is a primary health concern that is commonly impacted by exposure to transportation-related air pollutants. Figure 15 displays the asthma rates for adults, age 18-75, in Clackamas County and the RSA study area. The average asthma rate for Clackamas County is 14.3%. The asthma rate in the study area ranges from 16.0—20.8%.

Noise

Elevated noise levels can contribute to a number of avoidable health conditions including stress, impaired hearing, memory loss, poorer sleep, aggravation of high blood pressure, and greater risk of heart attack. No data on noise levels was gathered for the study area for this HIA. However, local stakeholders and a site visit indicated that the noise created by traffic on McLoughlin was a significant nuisance. However, people also noted that the noise level drops significantly within a short distance from the roadway.

Figure 15: Asthma rates: RSE HIA study area



Access to Health Supportive Resources

Summary of impacts

Table 5 shows that 36 of the 42 recommendations will positively impact access to health supportive resources. These recommendations would directly impact access to health supportive resources and indirectly impact opportunities for social cohesion by improving infrastructure to encourage use of the Trolley Trail and improve safety will increase residents' access to schools and places of employment. Sidewalks and other pedestrian and bicycle infrastructure would not only provide people with space to interact, but would also improve access to other public and private spaces such as parks and neighborhood oriented retail operations.

The RSA recommendations with the highest impact on access to health supportive resources were:

- Build new sidewalks and fill sidewalk gaps
- Improve lighting
- Provide additional crossing enhancements to increase visibility and attract pedestrians

Access to resources and health

Good health requires access to resources such as healthy food retail, healthcare, employment, education, parks and recreation facilities, publicly accessible gathering spaces, and social services. Research has shown that a person's ability to conveniently access each of these resources can influence their health:

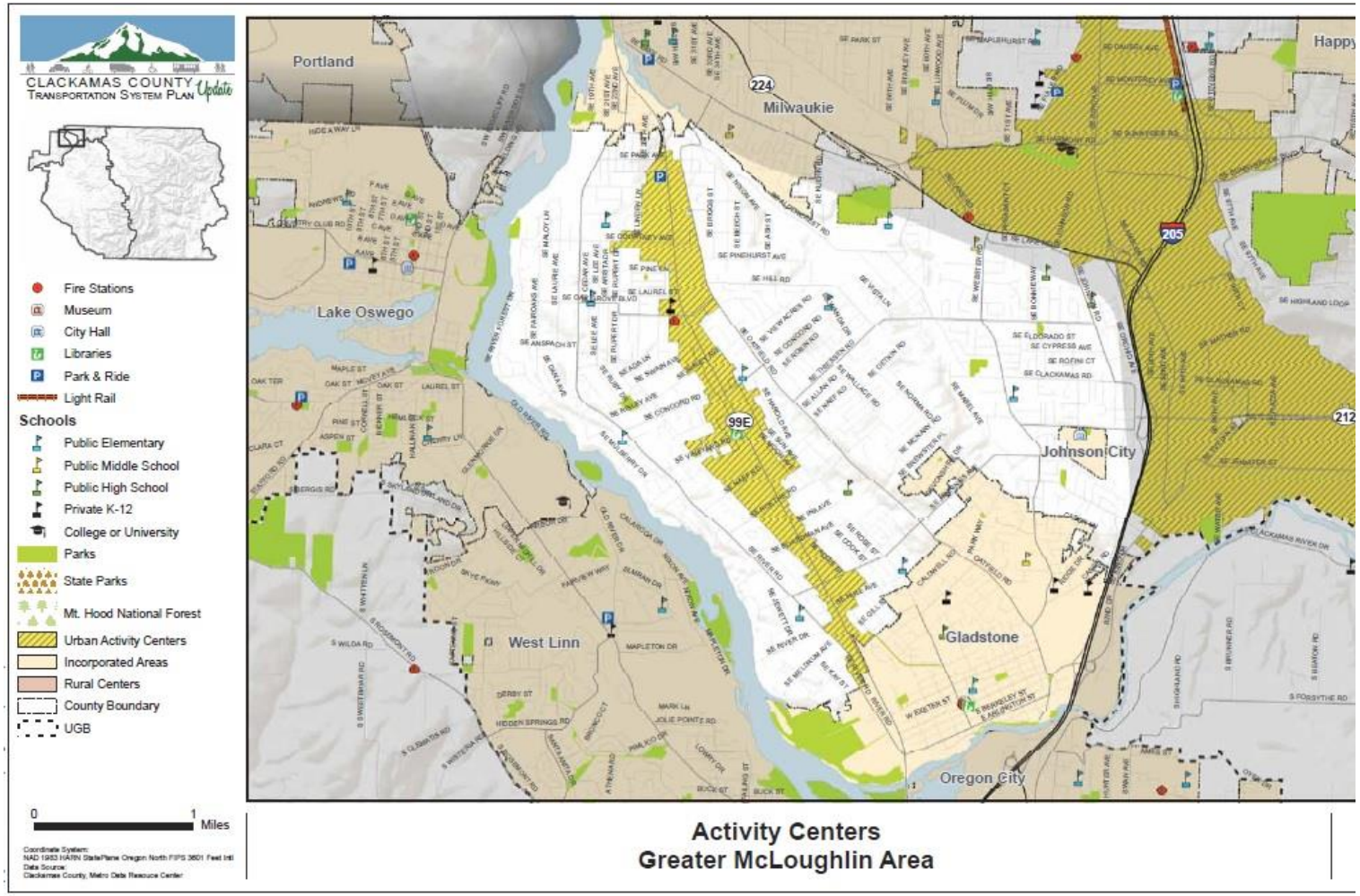
- Access to **healthy food** has been linked with rates of obesity and type-2 diabetes.
- **Clinical healthcare** access has been linked with a wide variety of health outcomes, and has been identified as a primary driver of health disparities between different socio-economic groups in America.
- **Employment** is the primary source of income for most people, and income is one of the strongest determinants for predicting multiple health outcomes.
- **Education** impacts health primarily through its influence on a person's income levels. In addition, education can impact health by providing access to information and by allowing a person the opportunity to develop cognitive skills useful for identifying, avoiding and/or changing unhealthful or risky behaviors. Schools also offer opportunities for social engagement. Social engagement influences social cohesion which can contribute to improved health outcomes by enabling the dissemination of health-related information about healthcare options and healthful behaviors, and by reinforcing social norms and practices associated with healthful behaviors.
- **Parks, trails, and recreation facilities** offer opportunities for physical activity and social engagement with attendant health benefits. Access to greenspace has also been correlated with mental health benefits.
- Accessible **gathering spaces**, including public spaces such as libraries, parks, plazas, schools, and community centers, as well as private spaces such as restaurants and neighborhood retail establishments that facilitate chance encounters with other community members, can increase social engagement and social cohesion.
- **Social services** encompass a broad set of services which directly and indirectly address numerous physical and mental health issues. Such services include helping people cope with issues stemming from aging, disability, substance abuse, domestic violence, social isolation, poverty, and mental illness. These services can be provided by both public and private sector organizations.

A person's ability to access such resources is influenced by a variety of factors including a resource's location and cost, as well as the transportation infrastructure and travel options that a person has access to. Numerous studies have demonstrated that, because of the auto-oriented nature of most transportation systems, people without access to cars often have more difficulty accessing health-supportive resources and suffer poorer health as a result. Where additional options such as transit, walking, and biking are present, safe, and convenient, people are more able and likely to access such resources and less likely to be in poor health. As with the other health issues discussed in this paper, the fact that low-income and minority households are less likely to own cars and less likely to live in areas with good transportation options, access to health-supportive resources raises equity concerns that have helped make it a public health priority.

Access to health supportive resources in the study area

According to stakeholder input, the two most important types of health supportive resources in and around the study area are schools and businesses. McLoughlin Boulevard itself is zoned for commercial use and is considered an urban activity center (Figure 16) and the surrounding study area is residential. There are two elementary schools, Jennings Lodge and Candy Lane, and one high school, Rex Putnam. There are multiple businesses, primarily along Gladstone, that provide employment opportunities for people in the community and region. The majority of the businesses are restaurants, motor vehicle sales and repair, and other privately-owned establishments.

Figure 16. Activity Centers, Greater McLoughlin Area



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Appendix A: Language Changes in Potential RSA Solutions	
Potential Solutions proposed by the RSA Final Report: August, 2014	**Potential Solutions proposed by the RSA Draft Report : May 2014**
HIGH IMPACT	
Evaluate constructing sidewalks at key locations	Build sidewalks
Consider installing new street lighting poles for improved lighting uniformity and to increase pedestrian visibility.	Improve lighting
Consider providing additional enhancements to increase visibility and driver awareness (e.g. warning signs, crosswalk markings, reflectors, advanced stop bars, rectangular rapid flashing beacons, etc.)	Provide additional crossing enhancements to increase visibility and attract pedestrians (e.g. warning signs, crosswalk markings, reflectors, advanced stop bars)
N/A	Flashing Beacons, RRFB, etc.
Evaluate adding or improving street lighting to remove contrast with private illuminated signs and lights.	Add street lighting to remove contrast with private illuminated signs.
Consider installation of a bicycle only signal with an exclusive bicycle phase and diagonal crossing. Figures 31 & 32 show an example of a bicycle only configuration constructed at the intersection of the Springwater Corridor and SE Johnson Creek Blvd in Clackamas County. This treatment would create a designated connection with an exclusive bicycle phase	Consider diagonal crossing for bikes with exclusive bike signal/phase.
Evaluate installing sidewalk at existing gap locations. On the east side of SE McLoughlin Boulevard, sidewalk should be constructed from just south of SE Boardman Avenue 500 feet south to where the sidewalk begins again.	Install sidewalk gaps
Evaluate installing a Flashing Yellow Arrow (FYA) with pedestrian logic. This pedestrian signal programming prevents the pedestrian walk signal and the FYA from being on at the same time. This "logic" can only be done	FYA with not ped logic

Appendix A: Language Changes in Potential RSA Solutions	
Potential Solutions proposed by the RSA Final Report: August, 2014	**Potential Solutions proposed by the RSA Draft Report : May 2014**
at locations with advanced signal controllers. For older signal controllers, pedestrian safety can be enhanced at locations operating the FYA by giving pedestrians more lead time to cross the street before the left turns are permitted	
Evaluate protected/permissive phasing option. This would require striping modifications at the intersection.	Protective/permissive phasing
Evaluate enhancements to existing pedestrian crossings at SE Boardman Avenue, SE Jennings Avenue, and SE Hull Avenue intersections to promote driver yielding and encourage pedestrians to use these locations such, as Rectangular Rapid Flash Beacons (RRFB), regulatory signs, intersection street lighting and painting of existing pedestrian refuge islands.	Enhance pedestrian crossings to promote driver yielding and encourage pedestrians to use these locations
Evaluate protected left turns to remove decision (gap detection)	Provide protected left turns to remove decision (gap detection)
Consider installing intersection ahead and crossing location signs to support visibility and give advanced notice	Install intersection ahead and crossing location signs to support visibility
Consider installing design enhancements such as curb extensions, landscaping, etc. to reduce travel speeds	Traffic calming – curb extensions, landscaping, etc.
MODERATE IMPACT	
Evaluate installing wayfinding and/or bicycle/pedestrian signage and pavement markings. Wayfinding and bicycle/pedestrian guide signs are usually a coordinated system of signs that direct road users, in this case pedestrians and bicyclists, to key civic, cultural, visitor and recreational destinations within a city or a local urbanized or downtown area. They shall not be installed in a position that obstructs the view of other traffic control devices and shall not provide direction to streets and highways.	Adding way finding signage and pavement markings

Appendix A: Language Changes in Potential RSA Solutions	
Potential Solutions proposed by the RSA Final Report: August, 2014	**Potential Solutions proposed by the RSA Draft Report : May 2014**
Error! Reference source not found. shows examples of community wayfinding signage. Wayfinding signage added should be consistent with other wayfinding signage used along the Trolley Trail.	
Change the lane configuration on the south leg of the intersection from the existing left/thru shared lane and right turn only lane to a left turn only and a shared right/thru lane	Change lane configuration from left/thru to Left turn only lanes
Consider supporting current midblock crossing demand with enhanced midblock crossings in addition to existing intersection crossings. To be consistent with other County treatments along SE McLoughlin Boulevard, it is recommended that raised refuge islands with the cut through design be constructed.	Mid-block enhanced crossing location in addition to existing intersection crossings.
Evaluate implanting access management along SE McLoughlin Boulevard to reduce conflict points between motor vehicles, pedestrians and bicycles	Access Management Plan to control driveway use.
Evaluate relocating TriMet bus stops closer to marked pedestrian crossing locations.	Consider moving the bus stop – this one (not in TriMet data) is mid-block, or support by adding a mid-block crossing.
nsider installation of a positive offset traffic separator that prohibits minor street left turn movements at the intersections but allows drivers to make left turns from SE McLoughlin Boulevard. As a result of the traffic separator, the frequency and severity of collisions and injuries are reduced. **Error! Reference source not found.** shows the traffic separator option that would restrict left turn movements from the minor street. This design could be done to maintain the existing pedestrian refuge.	Install a traffic separator that allows drivers to make left turns from SE McLoughlin Blvd onto SE Boardman Ave, but prohibits lefts from the minor street onto SE McLoughlin Blvd.
Evaluate leading pedestrian phase for east-west crossings	Leading pedestrian phase

Appendix A: Language Changes in Potential RSA Solutions	
Potential Solutions proposed by the RSA Final Report: August, 2014	**Potential Solutions proposed by the RSA Draft Report : May 2014**
Consider installing driver speed feedback signs along the corridor	Speed feedback signs
LOW IMPACT	
Review compliance with county and state codes and improve lighting as necessary. Consider code changes to address issues with distracting private signs and lights.	Code enforcement
Consider increasing enforcement to change driver behavior and reduce the number of drivers failing to stop.	Enforcement
Consider installation of devices (e.g. bollards or other devices) to separate pedestrian and vehicular traffic and to differentiate between public right-of-way and private	Put in bollards to differentiate pedestrian ROW and business use
Evaluate enhancing crossing at SE Boardman Avenue to encourage	Enhance crossing at Boardman so pedestrians can use sidewalks on the west side
Evaluate reducing travel lane width	Reduce travel lane width
Consider installing Stop Ahead signs on the minor streets in advance of the two-way stop controlled intersections along the study corridor for additional emphasis of the primary traffic control device	Add stop bars at side streets to encourage vehicles to stop in advance of pedestrian movements.
Evaluate adjusting signal timing progression to encourage traveling at the posted speed and discourage exceeding the posted speed	Adjust signal timing progression to encourage driving the speed limit

Appendix A: Language Changes in Potential RSA Solutions	
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Consider mitigations that alert pedestrians and help them from falling off the sidewalk edge	Create delineation to prevent pedestrians from falling off sidewalk edge
Evaluate enforcement of property parking encroachments within the right-of-way	Enforcement of property impacts within the right-of-way
Consider sending violation letters to property owners who are maintaining sidewalks Consider contacting property owners and requiring upgrades to sidewalks to be ADA compliant	Enforcement to property owners
N/A	Increase sidewalk width
Conduct speed zone investigation to determine if the posted speed limit of SE McLoughlin Boulevard can be reduced	Lower speed limit
Insure stop bars on the stop controlled minor approaches are placed properly and per standard. MUTCD guidelines suggest stop lines should have a base of 12 to 24 inches wide and should be placed a minimum of 4 feet in advance of the nearest crosswalk line at controlled intersections. Confirm stop signs meet the ODOT plaque size requirement of 36"x36" and replace if needed. Increase in sign size, even with single lane existing configurations may be necessary. Consider installing sign mounted stop beacons or a stop sign with embedded LEDs	Confirm stop signs meet ODOT size requirements
Enforcement	Enforcement

Appendix A: Language Changes in Potential RSA Solutions	
Potential Solutions proposed by the RSA Final Report: August, 2014	**Potential Solutions proposed by the RSA Draft Report : May 2014**
Improve/replace existing sidewalks that are a hazard to users, are not ADA compliant, and do not meet current design standards.	Improve sidewalk grade
Consider adding reflective tape along raised sidewalk/breaks in pavement and along extreme sidewalk elevations to improve visibility at nighttime	Add reflective tape to improve visibility at nighttime.
NO IMPACT/NEGATIVE IMPACT	
Consider implementing educational tools such as positive reinforcement on TriMet bus doors reminding pedestrians to use crosswalk	Positive reinforcement on doors on buses that reminds people to use crosswalk.
Evaluate upgrading street name signs to meet 2009 MUTCD standards to improve minor street visibility	Upgrade street name signs to meet MUTCD
N/A	Review compliance.
Review compliance with county and state codes and improve lighting as necessary.	Review county and state codes.
Consider providing increased median width to provide sufficient space for two-stage crossings	Increase median width to provide sufficient space for two-stage crossings