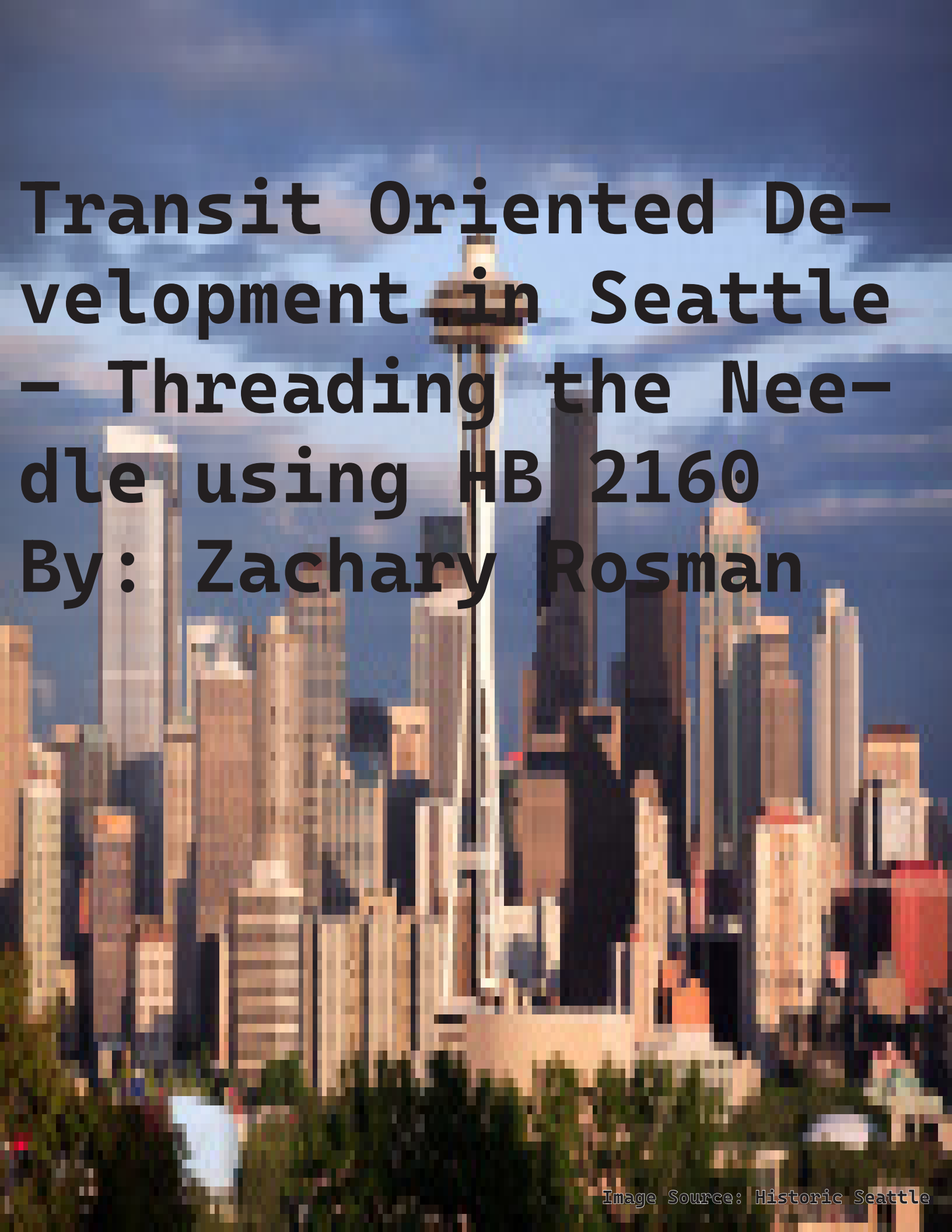




Transit Oriented Development in Seattle – Threading the Needle using HB 2160

By: Zachary Rosman

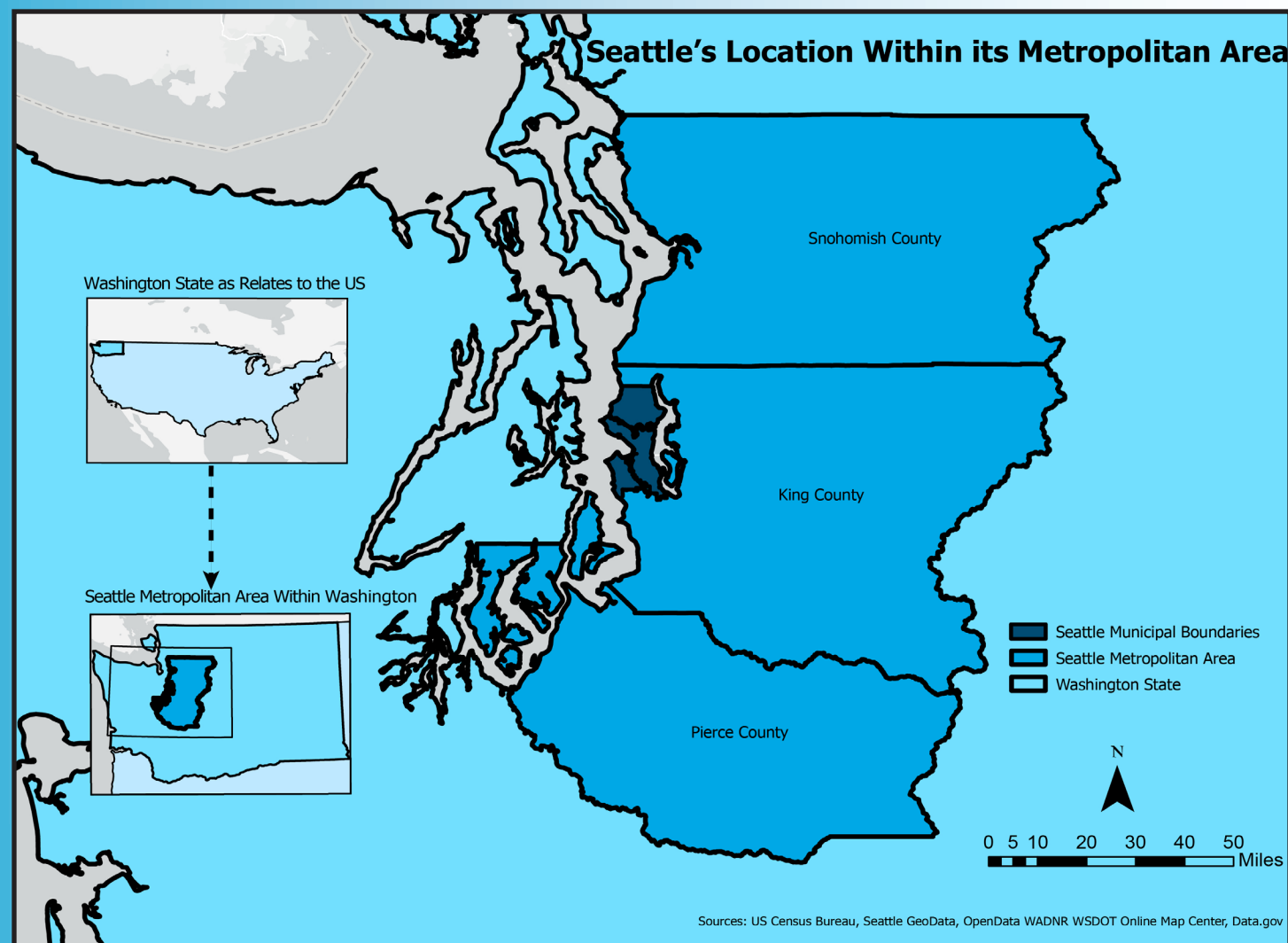
Part One: Context



Top Image: Seattle Skyline. Source Wikipedia/ Spicypepper999. Bottom Image - A soundtransit train in action. Source: SoundTransit

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Chapter 1: On Seattle

Land Acknowledgement - Paraphrased with permission from the Duwamish Tribe:

“I would like to acknowledge that the scope of this project occurs on the traditional land of the first people of Seattle, the Duwamish People, and this project intends to honor the Duwamish Tribe as well as the land that they inhabit.”

Seattle is the center of a three-county metropolitan area (King, Pierce, and Snohomish Counties), which has over four million people. It is on an isthmus between Lake Washington and the Puget Sound which is an inlet that feeds into the Pacific Ocean.

Moreover, Seattle, according to the 2023 ACS and Census Reporter is the largest city in the state of Washington with a population of over 755,000 people.

It has grown fairly rapidly, growing about 2.5 percent between 2020 and 2023, and growing over 20 percent between 2010 and 2020 census. While being majority white, it is diverse, with large Black, Hispanic, Asian, and multiracial communities in the city. 19.8 percent of the population is foreign born which is 1.5x the average of the United States. Historically, the city has been a hotbed of racism, with its systemic variant continuing to affect it to this day.

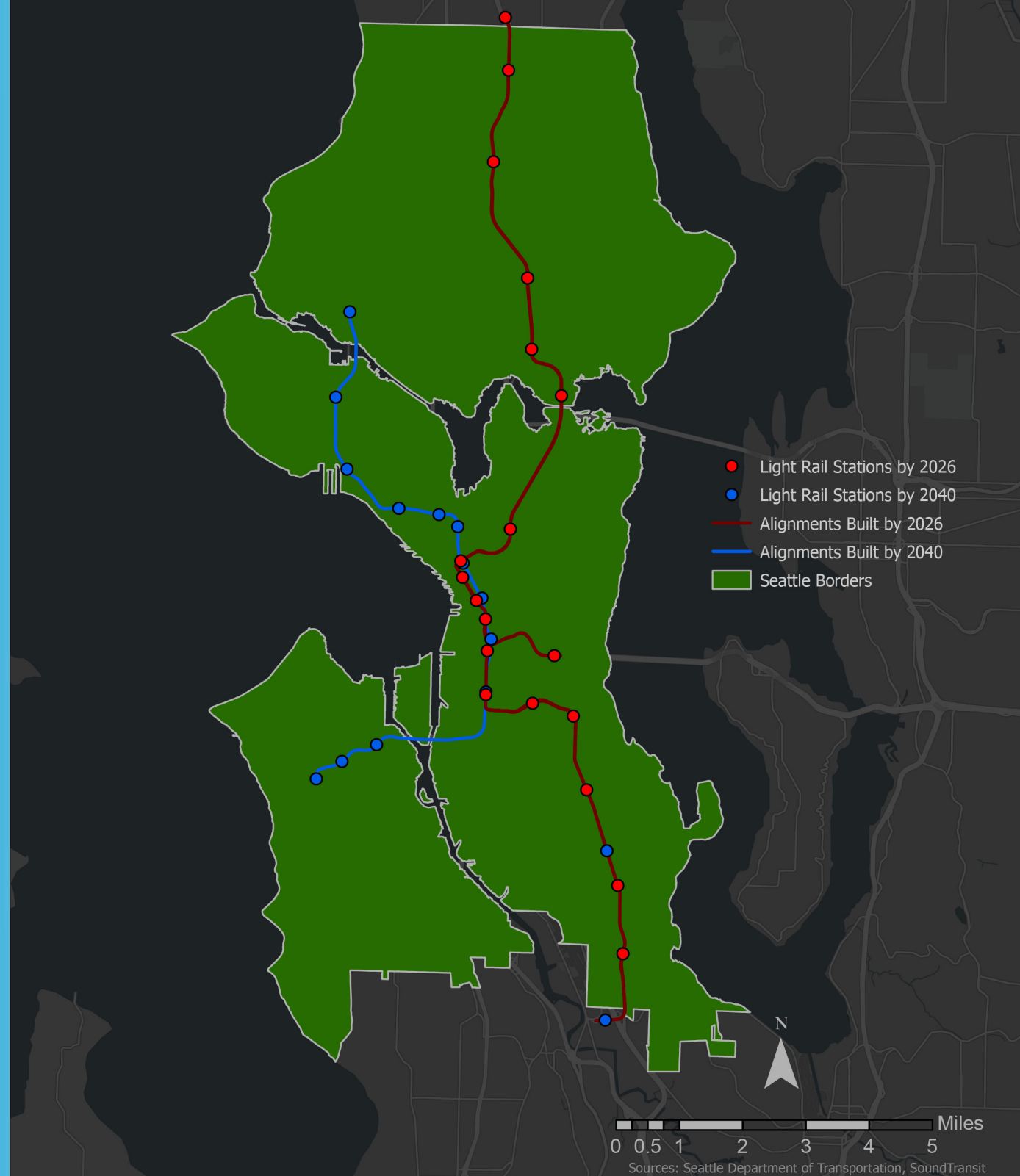
According to Encyclopedia Britannica the city has plenty of national parks nearby, with North Cascades, Mt. Rainier, and Olympic National Parks all being a short distance away. It is also a cultural hub, with a large art scene, both in museums and in public arts and famous music acts like Nirvana, Jimi Hendrix all from this area, all contributing to its music scene. Most importantly, its economy is diverse, with large companies like Microsoft, Amazon and Starbucks having headquarters in the area, while it is a hub for trading, manufacturing, electronics industries, and biotechnology industries. In other words, it is a bustling economic hub of the Pacific Northwest. On top of the natural beauty and cultural amenities, the economic engine in the city drives people to want to move here, which has led to and will lead to a housing crisis if not addressed properly.



From Left to Right: Redlined Seattle, from historylink.org, Mt. Rainier from Wikipedia/Caleb Riston, and the Amazon logo from NAWBO

Chapter 2: On SoundTransit

Present and Future Light Rail Alignments



To connect the metropolitan area together without highways in a more sustainable way, SoundTransit was founded in 1993 by Pierce, Snohomish, and King Counties. SoundTransit's first foray was in Seattle in 2009, when the 1 line opened, servicing Downtown Seattle. Throughout the intervening years it expanded northward and southward, going all the way to the international airport to the south by 2009, and northward in 2016 to the university, and all the way to the northern border of Seattle and beyond in 2024, with a few infill stations being completed within the next two years. Meanwhile, more infill stations on the 1 line, will be completed in 2031, while a new 3 line will be established with the West Seattle Extension in 2032, going to underserved neighborhoods in West Seattle and a Ballard Link going to the northwest to Ballard will be completed by 2039, shifting the 1 line west, and the two and three line taking the northward extensions, completing Sound Transit's expansion until 2040. All of these stations will be used in my TOD analysis, the present and imminent future batch because they will affect the urban fabric imminently, and the future stations will also be lumped together as there is a binding political commitment to these post-2026 stations, meaning it is going to be built, even if it occurs eventually due to delays, and preparations regarding what will be done around these stations are necessary.



1 train for SoundTransit. Source: Wikipedia/SounderTransit

Chapter 3: Housing Crisis



Apartment Construction in Seattle. Source: Bloomberg News

Assuming no change, according to the Seattle Department of Commerce and Free-mark et al., the Seattle metropolitan area of Pierce, Snohomish, and King Counties will need to build 615,425 homes by 2044 and will face a housing deficit of around 140,000 by that year (This study assumes that Kitsap County in the report by Free-mark et. al is assumed to be trivial in the home gap). Even with more permissive laws regarding zoning being recently passed in the state, it will still not be enough to fill the gap. Such a housing shortage is, quite bluntly, not good for Seattle. According to Investopedia, a housing crisis increases inflation, something that many have already struggled with in the wake of the COVID-19 pandemic. It makes it harder both for employers to hire and for employees to find work, slows down economic growth, and contributes to wealth inequality. Moreover, because Seattle is an economic hub in the area, housing prices especially skyrocket due to higher demand,

and all of these aforementioned problems are more severe.

Finally, look inwardly, all these issues sound familiar, because you and/or someone you know has suffered from the housing crisis and these knock-on effects in the past year, making this issue all the more urgent. So what do we do to fix this crisis in Seattle, and how can we use these conclusions across the country?

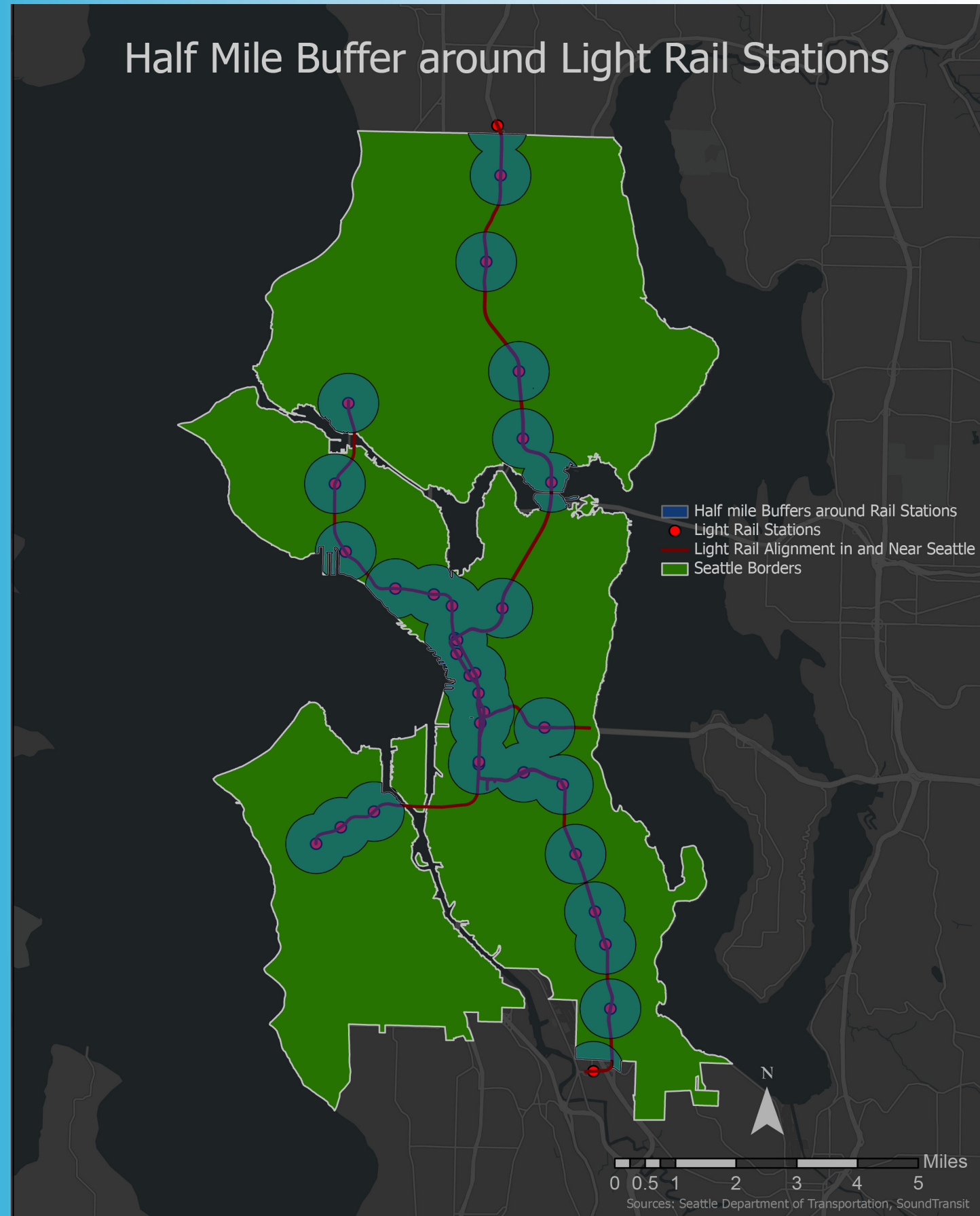
Economy Most Important Issue to 2024 Presidential Vote

The Housing Crisis affects the economy severely, and that has led to plenty of consequences as to America as a country. Thus, fixing it is a must to fix the economy. Source Gallup Polls.



Apartments in Seattle: Source: Seattle Times/Ellen Banner

Chapter 4: TOD and HB 2160



One way to contribute to fixing the housing crisis, according to the Washington State Department of Commerce would be to use Transit Oriented Development (TOD) because it can contribute to solving the housing crisis while limiting sprawl, enable sustainable growth, and provide job opportunities both in construction and those who live near transit (Washington State Department of Commerce, 2024). According to Sound Transit, the state's transit agency The state has also been building transit over the past two decades, building a ton of transit and light rail stops, and it is on track to build more in the coming two decades.

Thus, to absorb the increased demand while being more sustainable, there have been proposals to use TOD to resolve the housing crisis. With TOD, increased density would help fill the 140,000 home gap that would be present by 2044, while making up a large proportion of the 615,425 homes needed in the Seattle metropolitan area in the same period. One of these proposals, according to Ryan Packer in the Urbanist, is HB 2160, which this project will focus on.

According to, the Urbanist's Ryan Packer HB 2160 is a bill that is currently being debated in Washington regarding Transit Oriented development, while it has died in the state senate, it has passed the lower house already, giving it a decent shot of being passed in a later session. Given its recent reforms regarding housing, such a bill was bound to come up. In the bill is an affordability mandate, which mimics Seattle's current Mandatory Housing Authority (MHA) program, which according to the Seattle



Image of Transit Oriented Development - Source: Puget Sound Regional Council

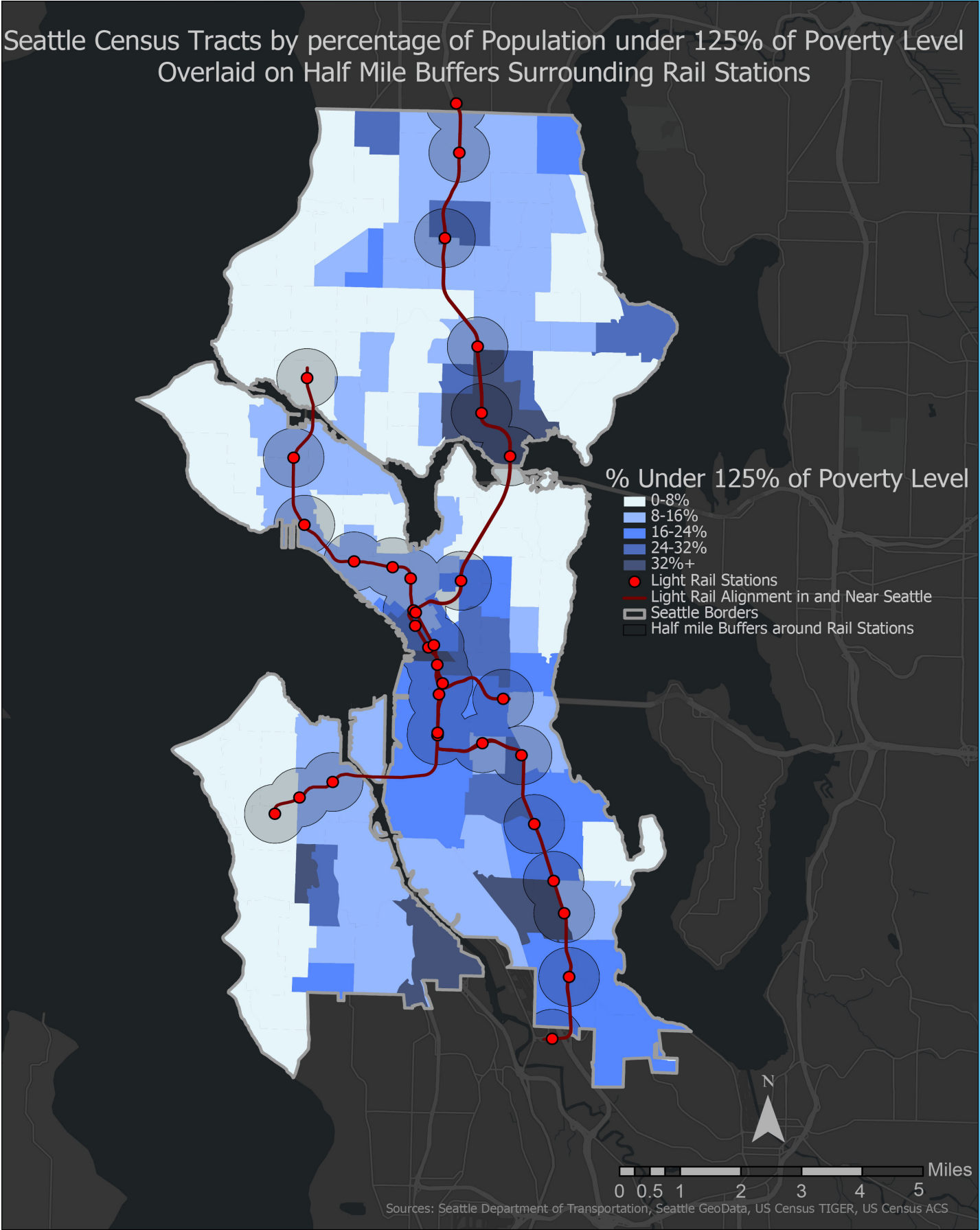
Department of Construction & Inspections incentivizes affordable housing whether through a payment by the developer or through direct incorporation into the new development, but spreads it statewide. However, more importantly, it mandates that within a half-mile radius of rail, which includes streetcar and regional rail, an average Floor area ratio of 3.5. I will, however, focus on SoundTransit light rail. A floor area ratio is a ratio between the area of the lot and the amount of floor space. For example, a one story building taking up 100% of the lot would have a FAR of 1 while a three story building taking up a quarter of the lot would have a FAR of 0.75.

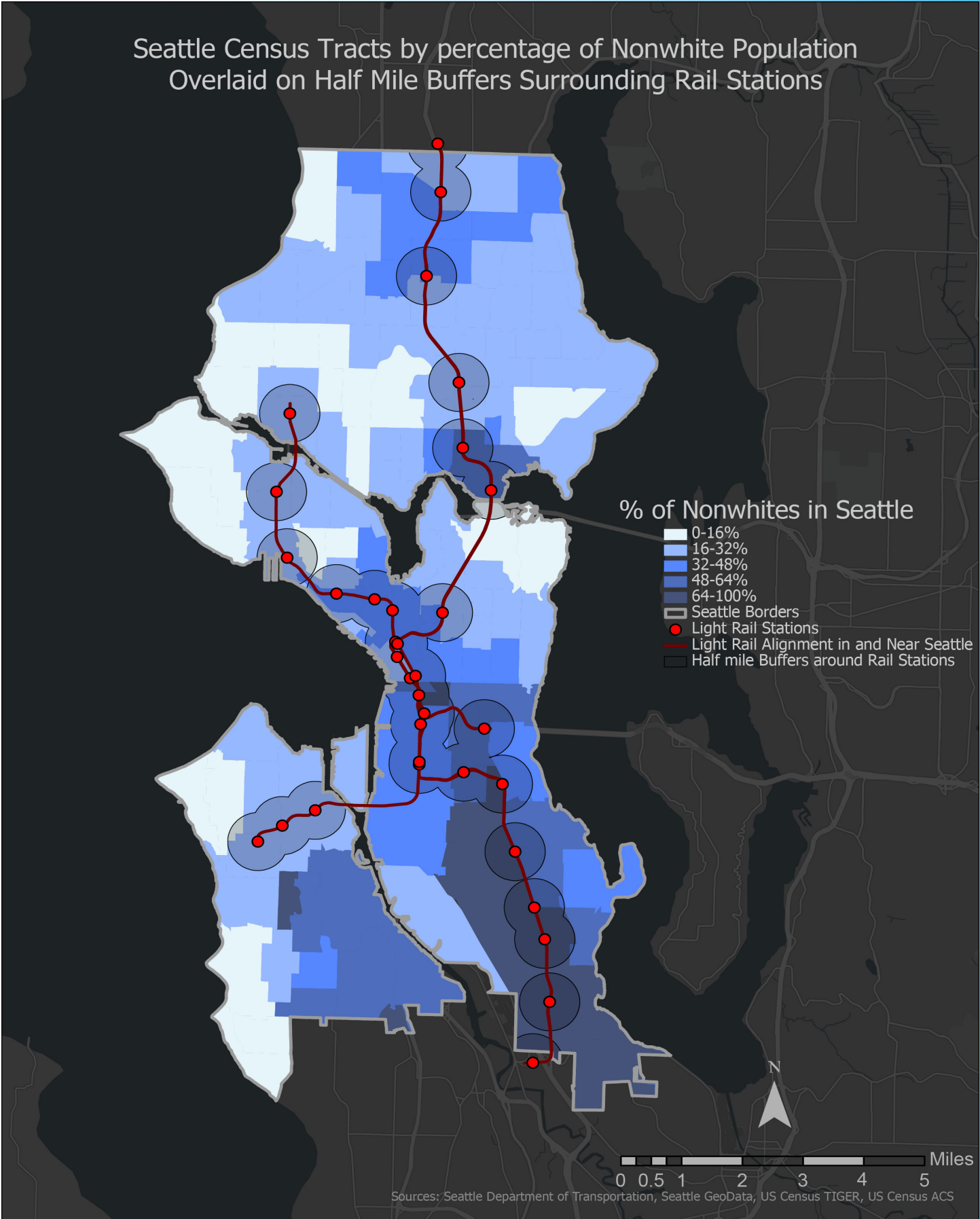
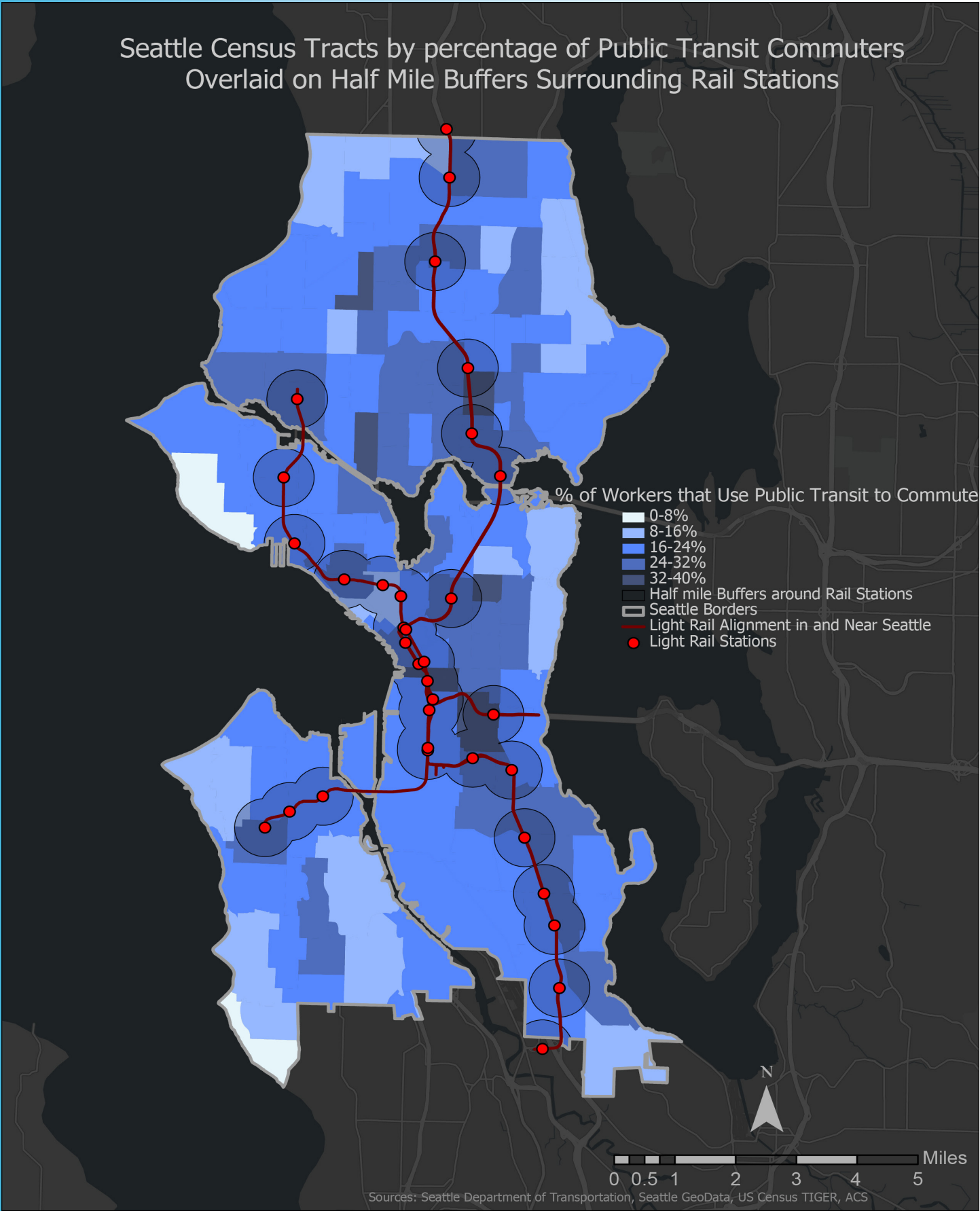
Finally, the size of the dissolved buffers clipped to the shorelines that are within 0.5 mile as the crow flies of any light rail stop, which is 497,922,278.271187 square ft or about 17.86 square miles. The size of Seattle Boundaries clipped to the shorelines are 2,331,257,622.958016 square ft or about 83.62 square miles, which is very close to the correct estimate per the census. Thus, the area available for TOD within 0.5 miles of a station contains roughly 21.36 percent of the city. 21.36 percent of the city is a very limited amount regarding the rail corridors in the state and begs the solution to 1. expand the radius of the buffer or 2. Expand the rail area to the transit deserts which occupy roughly 80 percent of the city, further increasing the opportunities for TOD.

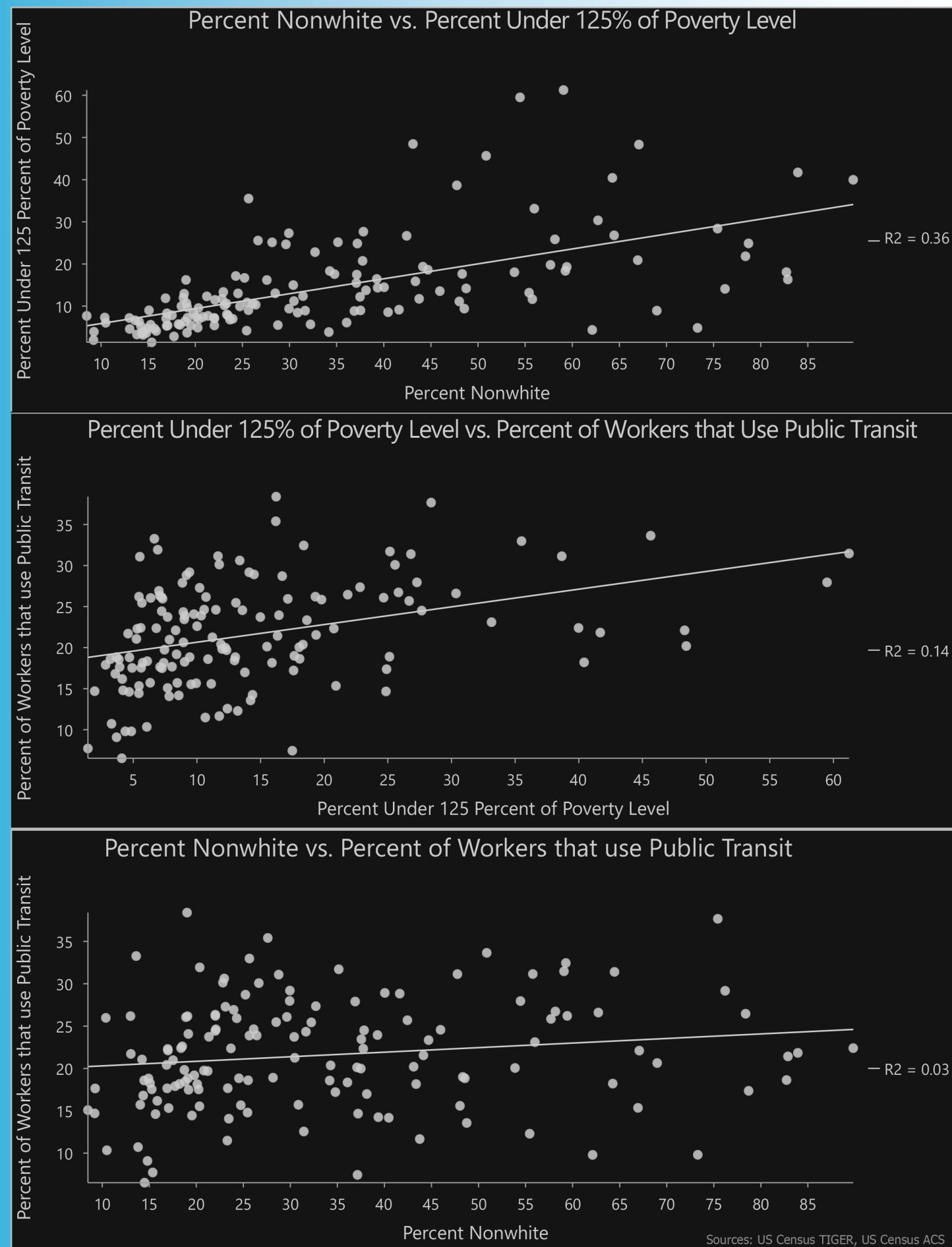


Image of Washington State Capitol. Source: Columbia Basin Herald

Chapter 5: Vital Maps







Note: The unit of analysis is in census tracts, and any Census Tract at least partially in Seattle is assumed to have 100% of its population in Seattle
Using Summary statistics to get the data

101,553 workers predominantly using public transit/459,676 total workers in all census tracts means about 22.09 percent of workers currently use public transit as a method of commuting per the 2019 ACS, which is not a bad amount in a country as car-dominated as the US, and shows the potential for Transit Oriented Development in Seattle to get those numbers up

103,714 people whose poverty rate under 125% (closest value in census data to 100%) of the poverty level /756,583 total people whose poverty status is determined in all census tracts shows a 13.7 percent rate of poverty per the 2019 ACS, which is higher than the national average for this time period of 10.5 percent.

The nonwhite population in Seattle as of the 2019 ACS is 263,022/775,949 people in all census tracts=about 33.90 percent, with the white population being 66.10 percent. For Reference, in the whole country, the white percentage is 58.40 percent, with 41.60 percent nonwhite, making Seattle whiter than average. However, using a scatterplot, I was able to find that in Seattle, that 36 percent of the variance of the poverty rate (Below 125% of poverty level) can be explained by the nonwhite percentage, which is a very high amount, and shows the scar of systemic racism exists in Seattle.

Moreover, I found out that 14 percent of the variance in the Percent of people that use public transit, is explained by the percentage of people under 125 percent under the poverty level, which is still a substantial amount, and shows that impoverished people, at least to a certain degree, seem to rely on transit for their daily needs more so than non-impoverished people. Through this, by building Transit Oriented Development en masse, and making it predominantly affordable, which both seem to be goals of HB 2160, we can both make housing prices cheaper, which help impoverished people, while making transit access more convenient for those who live there.

Finally, only three percent of the variance in the percent of people that use public transit is explained by the percentage nonwhite, showing that while systemic racism is a problem, public transit usage seems to be relatively equitably balanced.

Chapter 6: Project Breakdown

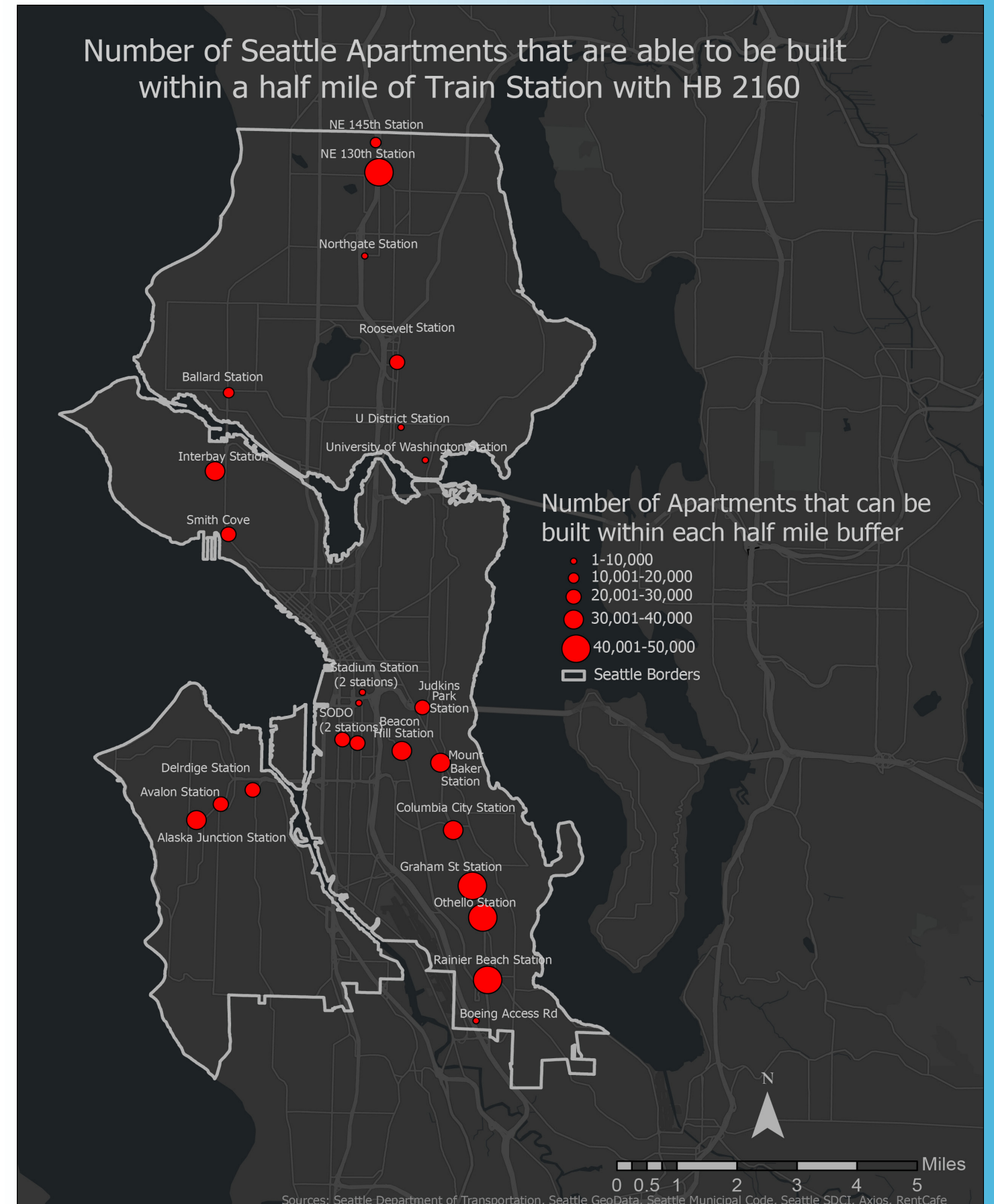
To see the effect of HB 2160,

I intend to go in to show the Average FAR of certain buffers, and use that see how many units can be built with this law around light rail areas, and how many of that 140,000 deficit can be absorbed using TOD from the current situation. I will do it in two ways: one using the average Seattle Apartment size of 661 square feet (TOD-Math 1, and the other, separating Seattle into certain areas: the core, semiperiphery, and periphery, with 661, 1000, and 1500 square feet respectively (TODMath 2).

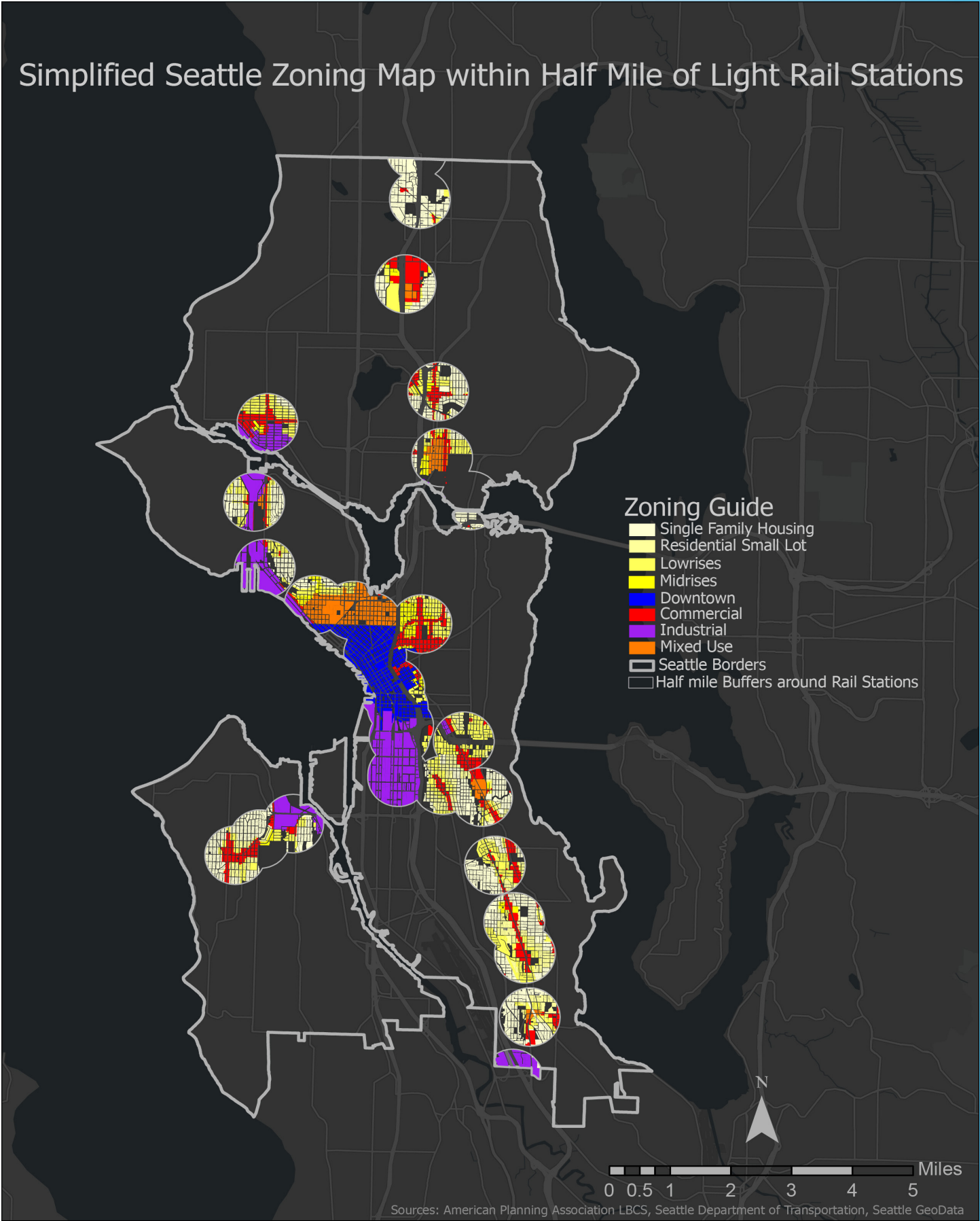
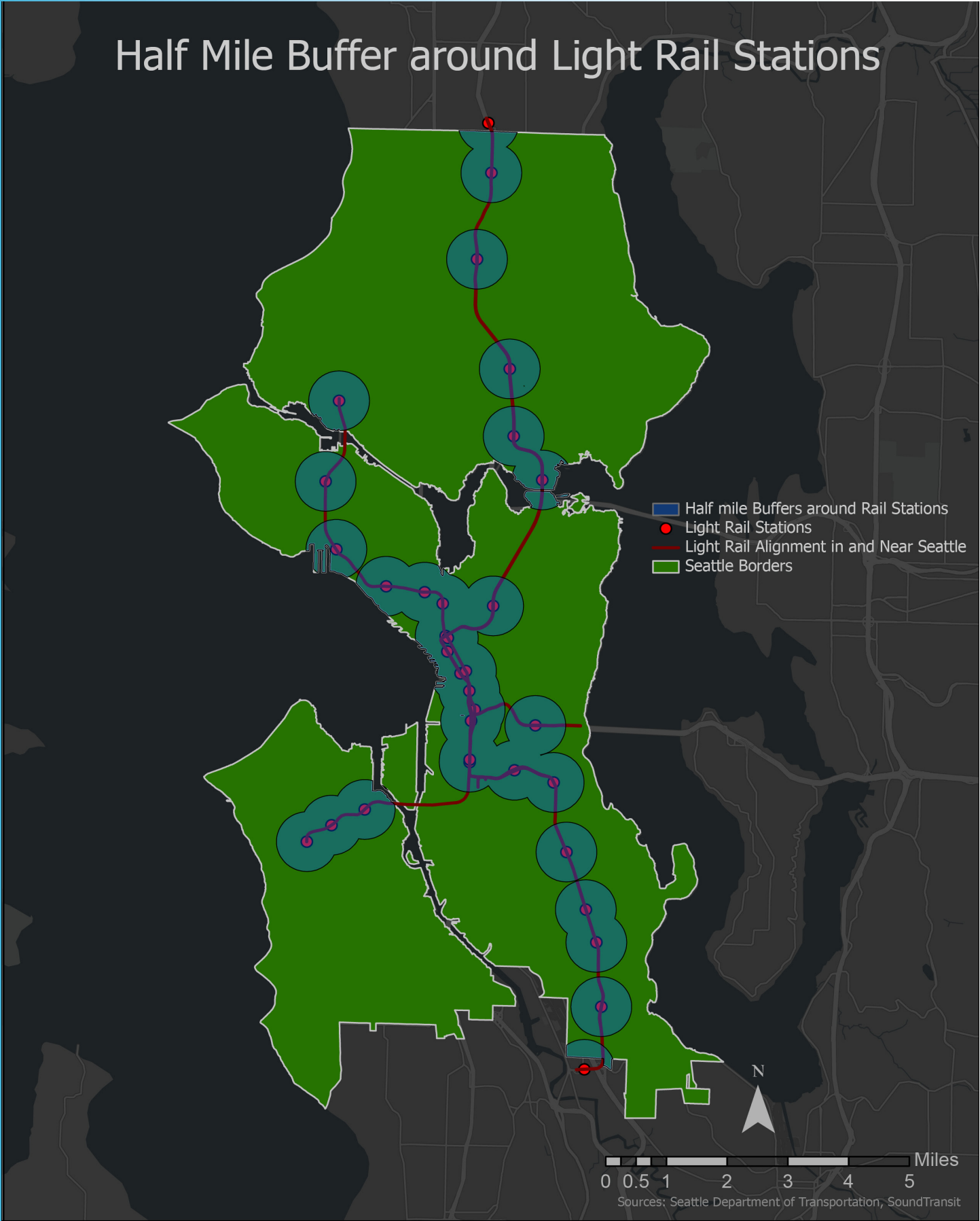


Image of Transit Oriented Development surrounding a SoundTransit Station. Source: Washington State Department of Commerce

Part Two: FAR Zoning



Chapter 1: Simplified Zoning



The methodology regarding this part involves making 0.5 mile buffers around the rail stations, which I got from the Seattle Department of Transportation. Then I clip those buffers to the Seattle Borders. Next, I get the First: use Zoning development capacity map from Geodata with the class field as a unique color map. The class field simplifies the zoning categories, and I simplified them further by merging downtown and Highrises together as they are in the same area, merging Neighborhood Commercial and Commercial into one bigger Commercial Category, and merging the Master Planned Community into lowrises. I finally had eight categories which I zoned according to the LBCS codes from the American Planning Association. Residential (Single Family, Residential Small Lot, Low Rises, Midrises) were shades of yellow, while, Industrial was purple, Commerical was Red. Mixed use was a mix of red and yellow - orange, while Downtown was Blue.

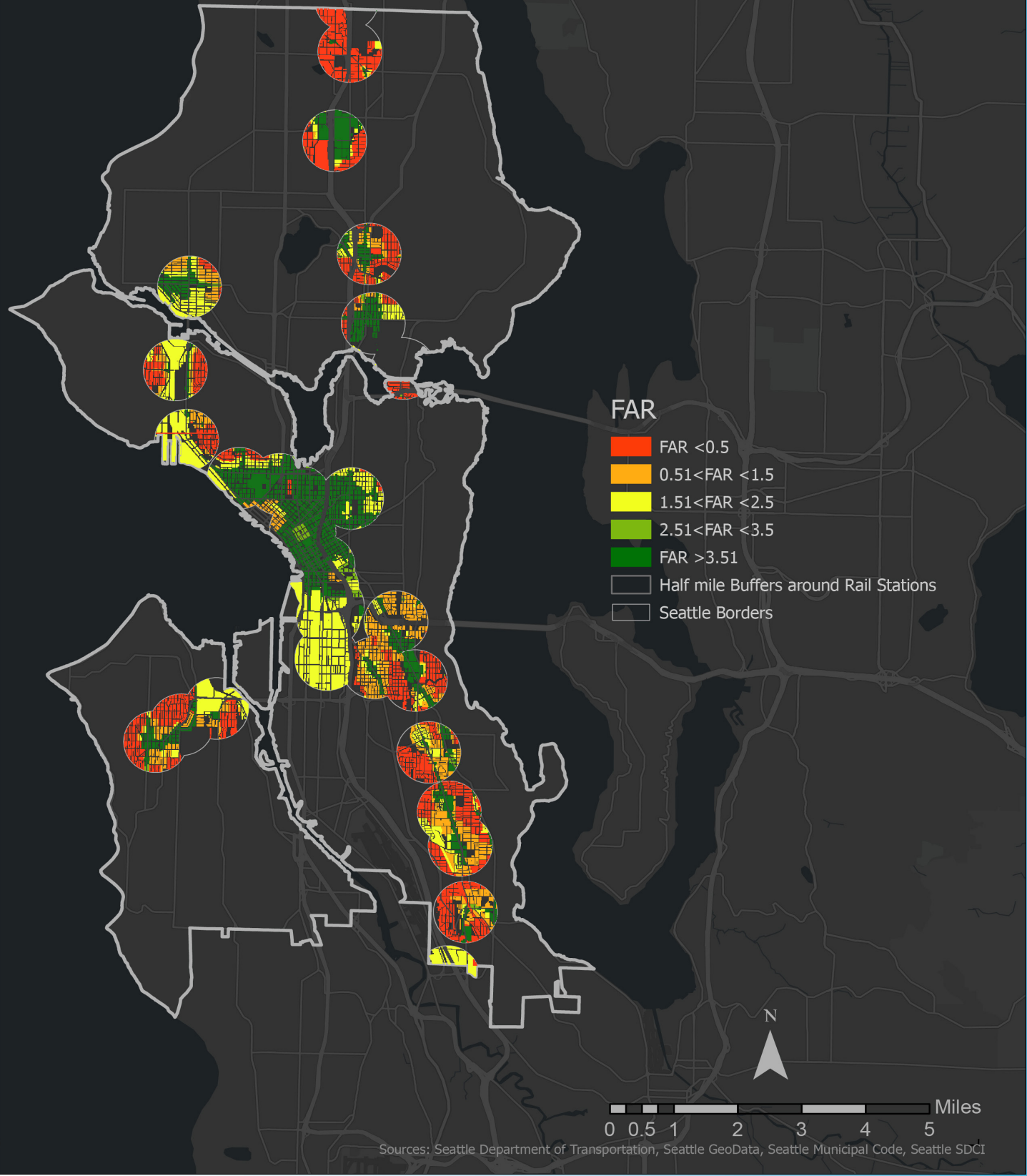
As said before, this area is only about 21.36 percent of the city, however that small portion can go a long way to fixing the city’s housing crisis if used to its full potential.



Image of Upzoned area. Source: Planitzen, Neils Kliim/Shutterstock

Chapter 2: Going Far with FAR

FAR Map Within 0.5 Mile Buffer of Rail Station

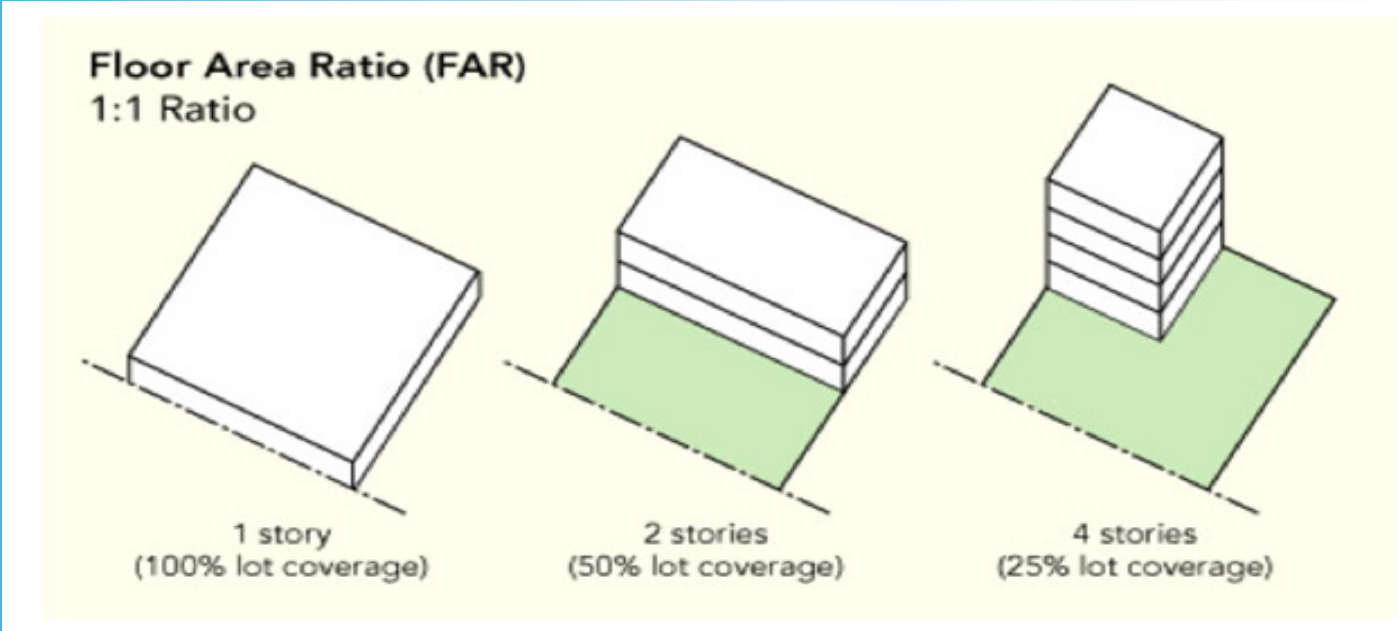


This above map shows a Choropleth Floor Area Ratio within 0.5 miles of a SoundTransit Stop. First, some assumptions. Note: The FAR values used are base values rather than maximum values. The FAR values used also assume that the station area overlay districts apply, which is a FAR bonus regarding TOD near light rail stations, which happens to be my area of study. Moreover, they also assume Mandatory Housing Affordability Suffix (MHA) suffix, which incentivizes affordable housing whether through a payment by the developer or through direct incorporation into the new development, which can provide another bonus to FAR, applies due to HB 2160 mandating it (or a similar program) statewide. Without the bill, MHA applies to most, but not all areas near stations, and for simplifying purposes it will be applied to all areas near stations. Such FAR finally assumes, where possible, the variant of FAR that includes non-hotel residences (as hotels do not help solve the housing crisis).

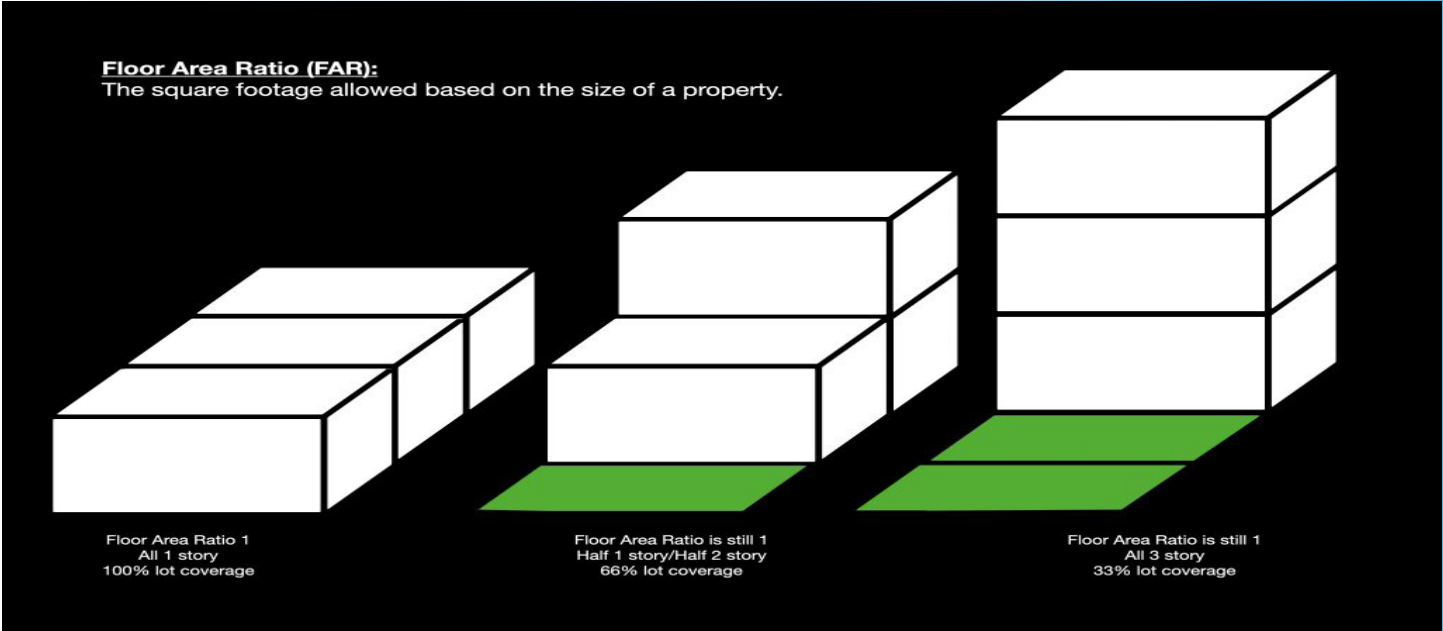
Finally, regarding MIOs or major institution overlays which have special rules regarding FARs, I either used their master plan which sometimes states their FAR, or if that was not possible, divided their floor area by total area, using data from the master plan or other documents as a backup method. Finally, if that did not work, I will assume that the underlying Base FAR is the true FAR. This backup method was also used for the Master Planned Community Yesler Terrace (MPC-YT) zoning designation. If there is no FAR limit explicitly stated, a value of 25 will be assumed.

Such methods reduce variance in FAR, making the project understandable enough without going into too much detail, and allowing me to focus more broadly on the FAR gains done via HB 2160. The assumptions for this note were informed by the Seattle Department of Construction & Inspections, the Seattle zoning code, and Seattle GeoData.

I got the FAR data in via making my own data by scraping the municipal code and the Seattle Department of Construction & Inspections, and then joining them together. I then, to prevent my computer from crashing, turned it into a raster and reclassified it. Then I clipped the raster using the “extract by mask” tool. There are five categories: between 0 and 0.5, 0.51 to 1.5, 1.51 to 2.5, 2.51-3.5, and 3.51+. The colors are red, orange, yellow, light green, and green respectively to emphasize which areas are optimally zoned and which areas need to be more upzoned. As you can see by looking at the above figures, the green and light green categories mostly correlates with downtown, the yellow category mostly correlates with industry, while the red and orange categories are single family homes and lowrises, respectively. Thus, the map shows that the areas with the lowest FAR and the most potential upzoning are the red and orange zones (i.e single family and lowrise zoned areas).

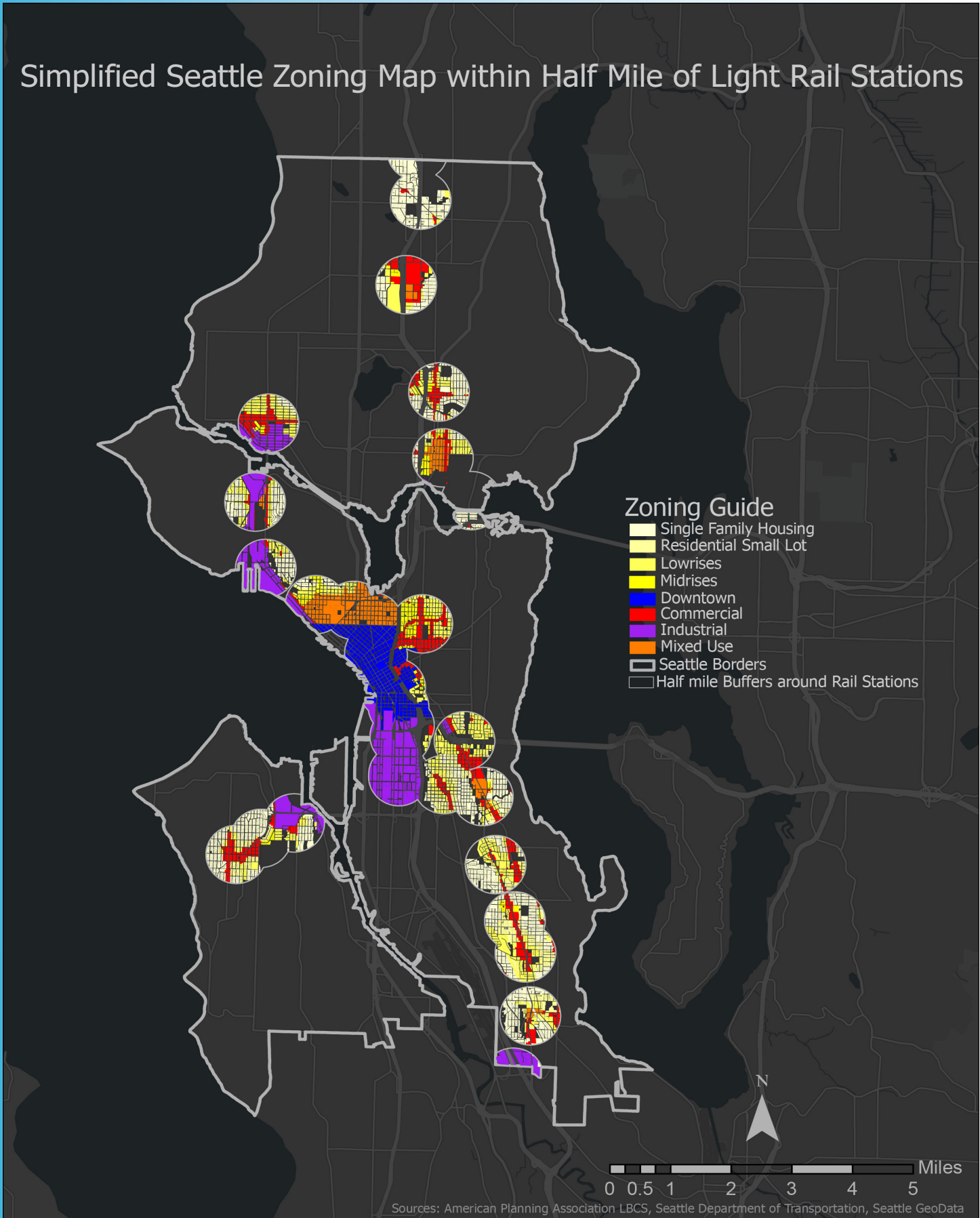


A simple guide to FAR. One Story building with 100% coverage=1 FAR, same thing with 2 stories and 50% lot coverage, and 4 stories and 33% Lot Coverage. Source: MinnPost and City of St. Paul

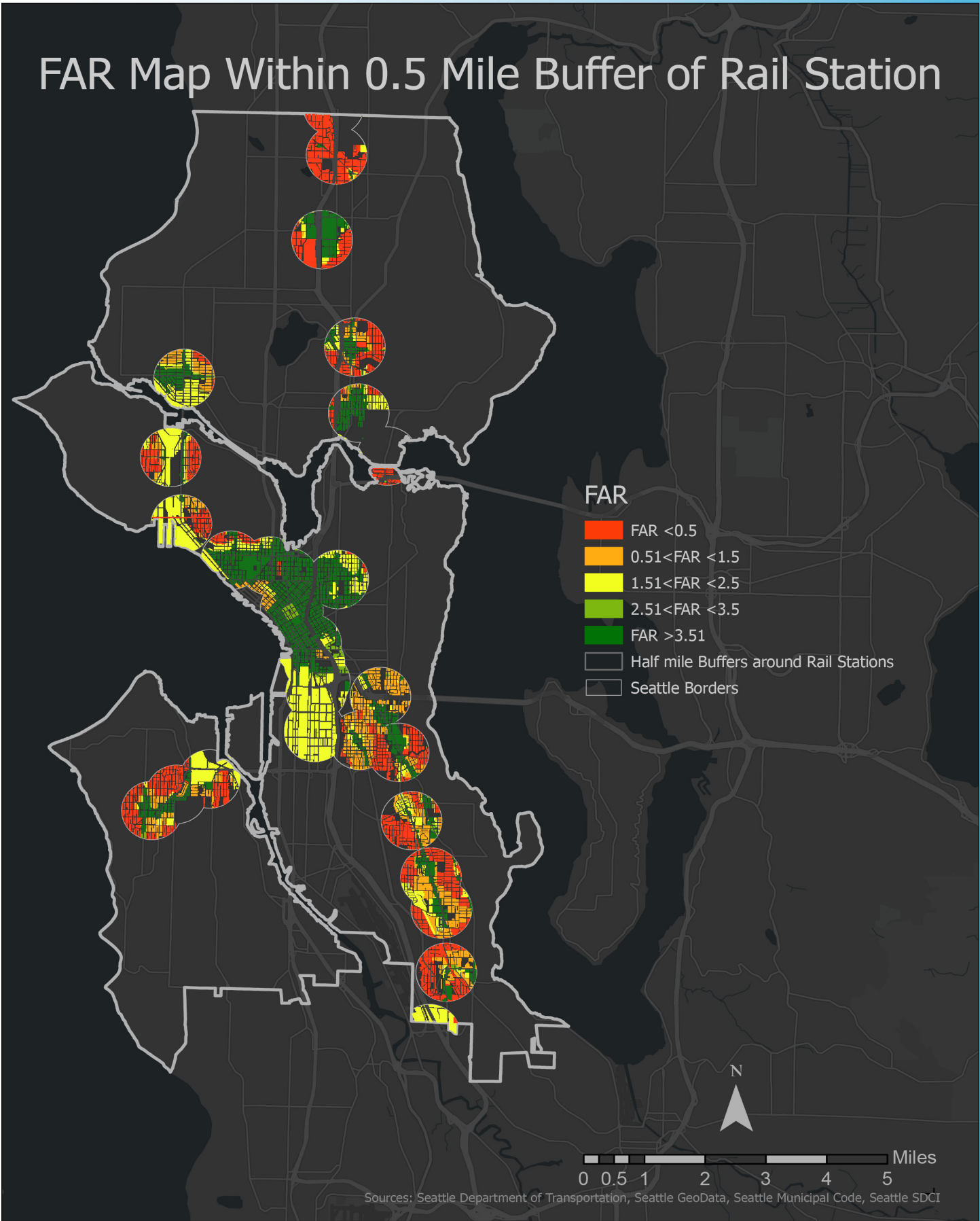


Another guide to FAR. One Story building with 100% coverage=1 FAR, same thing with 1.5 stories and 67% lot coverage, and 3 stories and 33% Lot Coverage. Source: The Urbanist’s Ryan Dubicki

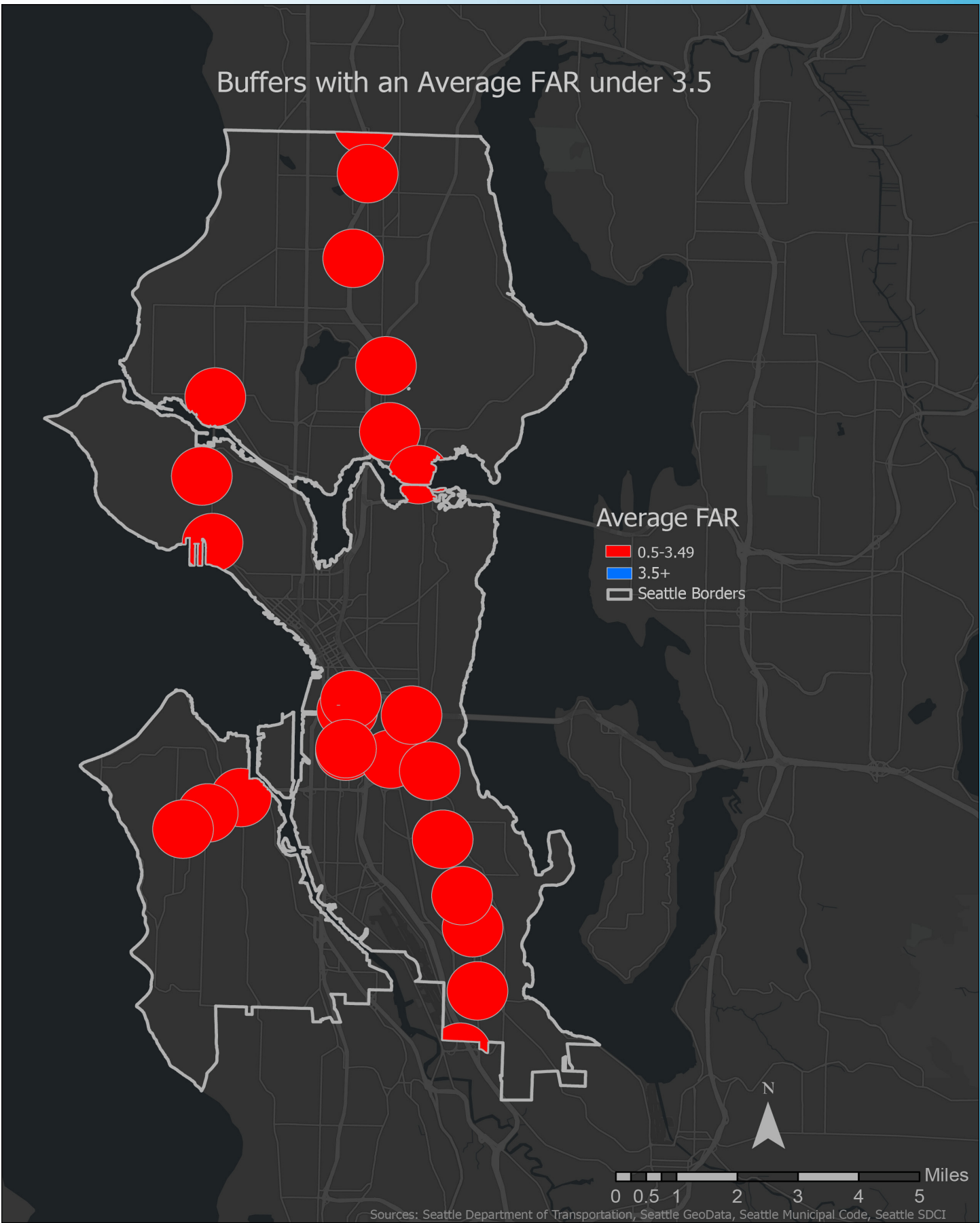
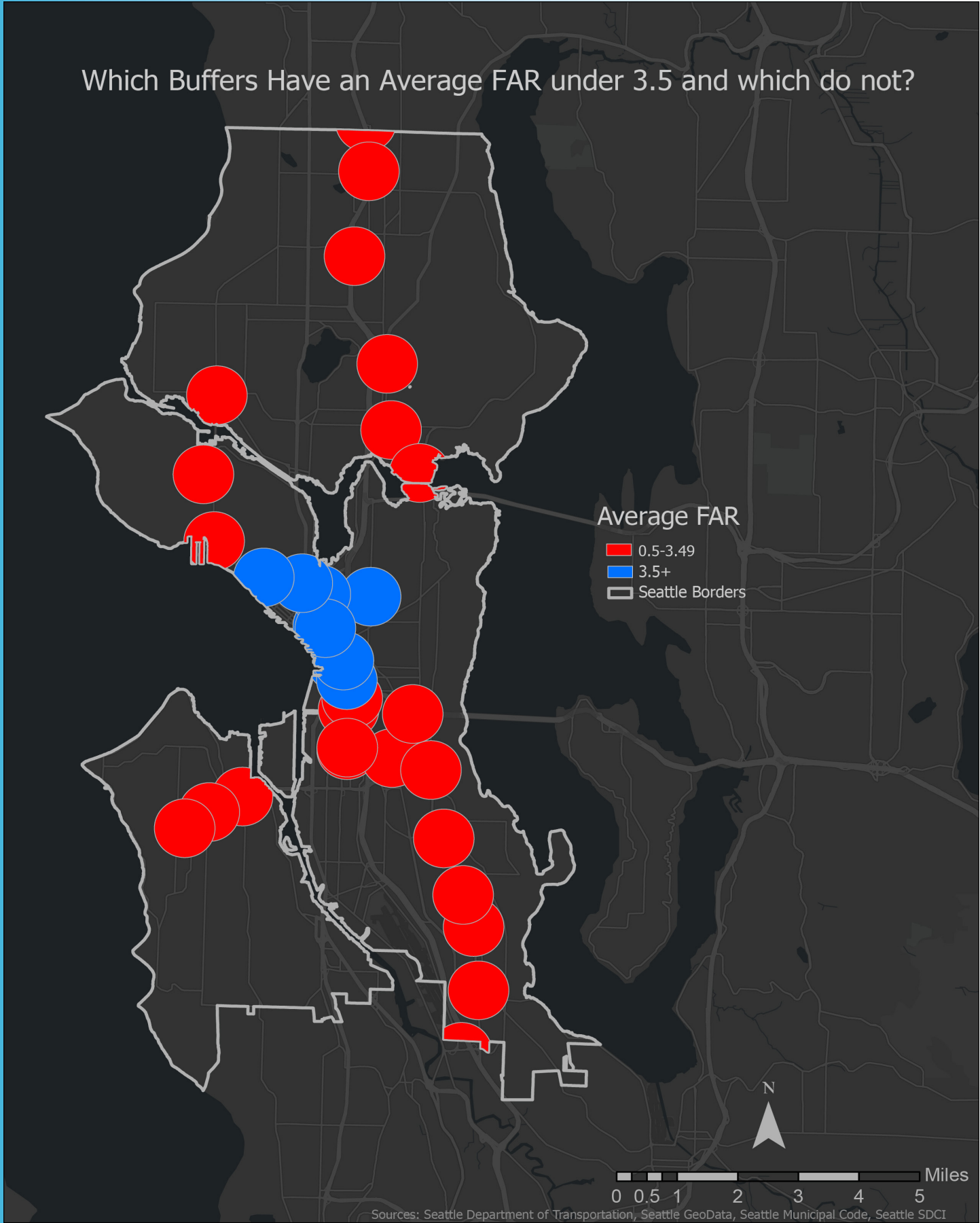
Simplified Seattle Zoning Map within Half Mile of Light Rail Stations



FAR Map Within 0.5 Mile Buffer of Rail Station



Chapter 3: Average FAR + 2160



Regarding HB 2160, TOD would only be used to upzone areas with less than 3.5 Average FAR, which would promote it to 3.5. Moreover, Zones partially in Seattle will use the average of that partial sector within the city to simplify this assignment To find the average FAR, I first did a pairwise intersect between The Undissolved Buffers and FAR map of Seattle- Zoned Development Capacity. However, before the intersect I made a new field for Buffer ID then joined them; keeping the IDs separate but joining everything else, keeping the buffers unique. After the intersect, I made an intersect_area field and did calculated geometry, calculating nature used square us survey feet due to the state plane being measured in that way. Next, I created a new field which was Weighted_FAR - Weighted FAR is the current floor area assuming all housing is used to its full potential - Weighted_FAR= intersect_area*- FAR. There were some null results, but null Weighted_FAR values are assumed to be zero for there is no FAR value, due to no zoning existing for values. To get the final stretch towards area, I did Summary Statistics, summing Weighted_FAR and Intersect_Area, while using the summary field as Buffer ID, keeping the buffers unique As a result: I got these new fields in the table, which are Sum Weighted_FAR - Total Floor Area in buffer, and Sum Intersect_Area - Total Lot Size in buffer. Then to get Average FAR I divided the total floor area in buffer/total lot size in buffer. Average_FAR=Sum_Weighted_FAR/Sum_Intersect_Area = Total Floor Area/Total Lot Size. Then I joined the table to the undissolved buffers. And I set a two color choropleth of less than and 3.5 or greater, red with less than 3.5, blue with 3.5 or greater.

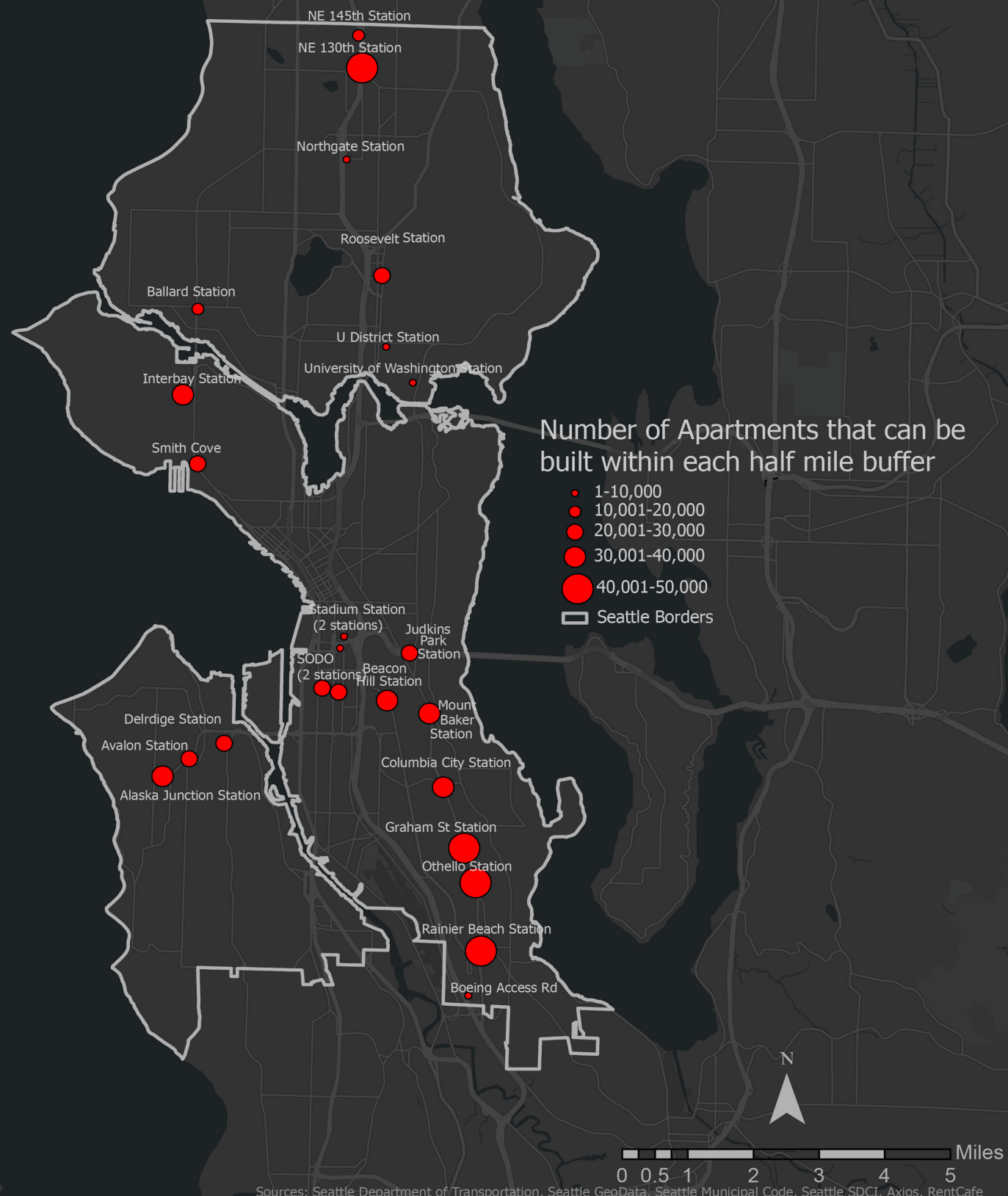
As you can see by the simplified zoning map and the FAR map above above, the areas with Average FARs above 3.5 match with downtown and areas immediately surrounding downtown, while more peripheral areas have an FAR less than 3.5, showing that the bill would in effect upzone areas not in the downtown, spreading out urbanism into the hinterlands of Seattle, areas, where single family housing, residential small lot and lowrise residential predominates and which have low FARs.

Zoning Description	FAR
Single-Family	0.5
Residential Small Lot	0.75
Lowrises	1.3-1.4, 2.3
Midrises	4.5
Downtown	Generally >5
Comercial	Various
Industrial	2.5
Seattle Mixed	Various, but generally >3.5

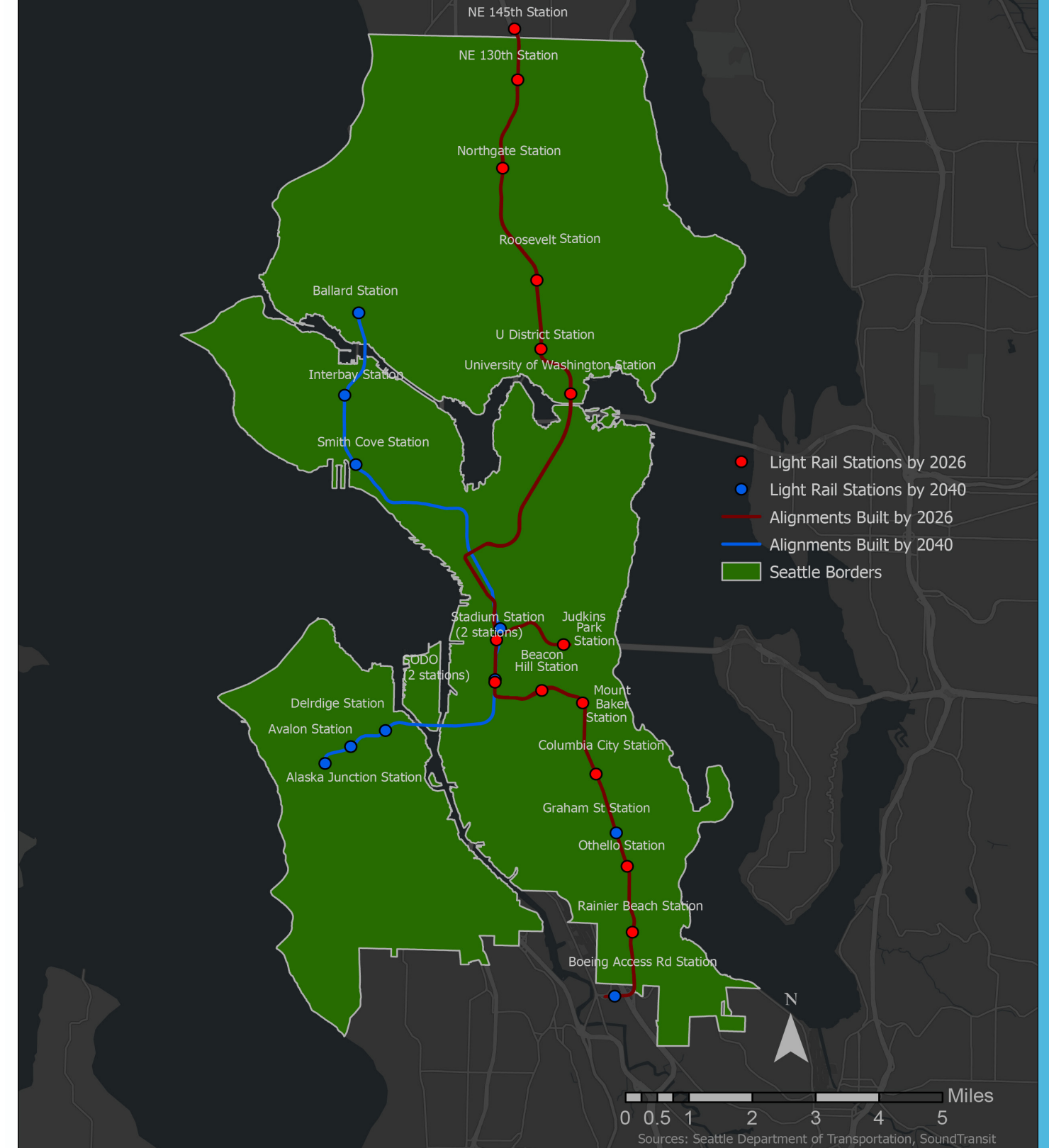
Using this table, it seems that for upzoning, the most bang for your buck comes from single family, residential small lot, and lowrises, and thus that should be the focus for any TOD induced upzoning in the future. Areas that can be upzoned but later are Industrial, as you get little bang for your buck, the industries may be profitable, and it would take a lot of clean up. Meanwhile, commercial upzoning could hamper businesses, while seattle mixed and downtown are more lower priority when it comes to upzoning

Chapter 4: TODMath

Number of Seattle Apartments that are able to be built within a half mile of Train Station with HB 2160



Present and Future Light Rail Alignments



How many Apartments can Each Station with Less than 3.5 Average FAR handle?

Note: all values are rounded

Station Name	Average FAR	Number of Sq. Ft to 3.5	Number of Apartments
NE 145th Station	0.510	8,371,430	12,664
NE 130th Station	0.674	32,410,551	49,032
Northgate Station	3.157	5,252,798	7946
Roosevelt Station	1.835	19,332,657	29,247
U District Station	3.173	2,776,268	4200
U Wash Station	0.598	4,148,472	6276
Ballard Station	2.861	8,622,450	13,044
Interbay Station	1.625	25,283,414	38,250
Smith Cove Station	2.106	19,488,524	29,483
Stadium 1	3.017	6,130,802	9275
Stadium 2	3.299	2,406,478	3640
Judkins Park Station	2.190	13,752,908	20,806
SODO 1	2.474	14,745,108	22,307
SODO 2	2.471	14,726,378	22,278
Delridge Station	1.980	18,049,391	27,306
Avalon Station	1.892	17,273,532	26,132
Alaska Junction Station	1.960	20,443,762	30,928
Beacon Hill Station	1.522	23,225,617	35,137
Mount Baker Station	1.975	19,906,090	30,115
Columbia City Station	1.503	26,247,216	39,708
Graham St Station	1.621	28,831,923	43,618
Othello Station	1.608	29,781,298	45,054
Rainier Beach Station	1.338	29,936,126	45,289
Boeing Access Rd	2.295	5,308,600	8031
Total	-	396,451,794	599,766

Note: Zones partially in Seattle will use the average of that partial sector within the city to simplify, and this map assumes that 100% of the FAR is used.

To find the average FAR, I first did a pairwise intersect between The Undissolved Buffers and FAR map of Seattle- Zoned Development Capacity. However, before the intersect I made a new field for Buffer ID then joined them; keeping the IDs separate but joining everything else, keeping the buffers unique. After the intersect, I made an intersect_area field and did calculated geometry, calculating nature used square us survey feet due to the state plane being measured in that way. Next, I created a new field which was Weighted_FAR - Weighted FAR is the current floor area assuming all housing is used to its full potential - Weighted_FAR= intersect_area*-FAR. There were some null results, but null Weighted_FAR values are assumed to be zero for there is no FAR value, due to no zoning existing for values. To get the final stretch towards area, I did Summary Statistics, summing Weighted_FAR and Intersect_Area, while using the summary field as Buffer ID, keeping the buffers unique As a result: I got these new fields in the table, which are Sum Weighted_FAR - Total Floor Area in buffer, and Sum Intersect_Area - Total Lot Size in buffer. Then to get Average FAR I divided the total floor area in buffer/total lot size in buffer. Average_FAR=Sum_Weighted_FAR/Sum_Intersect_Area = Total Floor Area/Total Lot Size. Then I joined the table to the undissolved buffers. And I set a two color choropleth of less than and 3.5 or greater, red with less than 3.5, blue with 3.5 or greater

To get the number of apartments, I first need to get additional floor area needed to boost up to average of 3.5 FAR as allowed by bill
Note 1 : This FAR calculation assumes that the the floor area is flush with the current FAR, something that is not true, but something which dramatically simplifies the project

I did some calculations to get the additional floor area.
 $3.5 = \text{Extra Floor Area} + \text{Sum_Weighted_FAR} / \text{Sum_Intersect_Area}$
To

$$3.5 * \text{Sum_Intersect_Area} = \text{Sum_Weighted_FAR} + \text{Extra_Floor_Area}$$

$$(\text{3.5} * \text{Sum_Intersect_Area}) - \text{Sum_Weighted_FAR} = \text{Extra_Floor_Area}$$

And derived the quantity for extra floor area.

I divided Extra_Floor_Area by 661 square feet, which is the average size of a new Seattle apartment, according to RentCafe and use int function to round down to get number_of_apartments as a new field, and put it into a graduated symbol map to see which stations can have more apartments and some have less. As you can see stations in the Southeast area seem to need the most.

Note 2: In this calculation I assumed 100% of space is used for apartment housing for TOD, and that 1 apartment=1 home, even though that is not necessarily true.

Using this calculation, you get 599,766 apartments if the law is implemented relative to the current laws, which is not only more than the number of homes/apartments needed to plug in the gap (140,000) by 2044, it is almost enough to absorb 100% of the projected demand in the metropolitan area by that time which is 615,725 homes. This value is crazy and 1. Shows the efficacy of TOD in the housing crisis and 2. Shows the underutilization of zoning throughout the city but 3. Also to put in context: it shows that Seattle's housing crisis has become so acute that it has some of the smallest apartments in the country and 4. May be inflated due to overlapping buffers. To solve this, using other stations outside of Seattle but still in the metro area, or expanding the SoundTransit network within Seattle would help to spread outside of the demand.

Out of curiosity, under current zoning, the extra number of units under current laws would be, assuming 100 percent zoning, using the fields Sum all_res_pot (potential units) and (Exist_units) existing units in summary statistics on the intersect field to get summation with current laws within 0.5 miles subtract exiting units, that equals 904,371 (1,294,72 units-391,001 units), shows that while HB 2160 is effective in theory, it is not nearly as effective in theory as filling out current laws on all lots within 0.5 miles of Seattle transit stops , and using the same assumption as 100 percent filled with residential, but unchained from any average apartment size, and you get 1.5x the value. That however does not undermine the value of TOD that while HB 2160 is a help with almost 599,766 extra units, it may also be able to get some of these 904,371 units quicker (given that the lack of 904,371 units almost certainly reduces average FAR way below its potential, making the 599,766 value assuming full FAR potential perhaps an undercount, even with the overlapping buffers inflating the value). Indeed, with the slow turnover of buildings, it highly likely

that the TOD law would be more useful overall (as you can build larger units to get that average FAR up more quickly and easily, at least in the short run, than you can go to force every lot to go to its full potential in current laws. Either way would put a major dent in the housing crisis in Seattle, however.

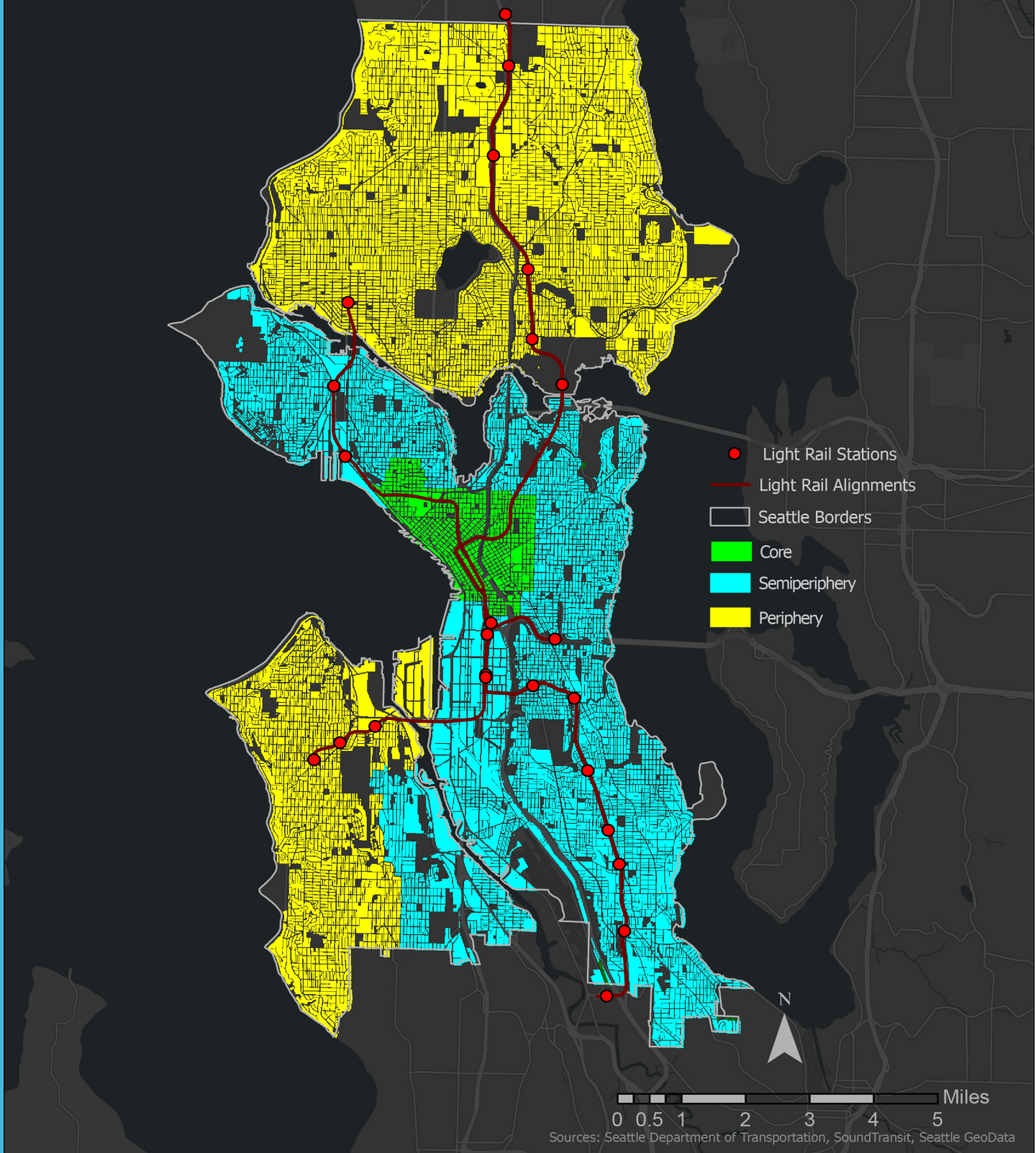
While the current data is detailed, it is not enough to provide the degree to which FAR is undercounted from its potential, and thus how to unlock the full potential of upzoning under current laws which can only be enhanced by HB 2160. Obtaining Potential FAR was already extremely difficult, and current average FAR is even more challenging due to its vulnerability to change rapidly, and significant variation from unit to unit.



Image of Transit Oriented Development. Source: Brandon Bell/Getty Images and Business Insider

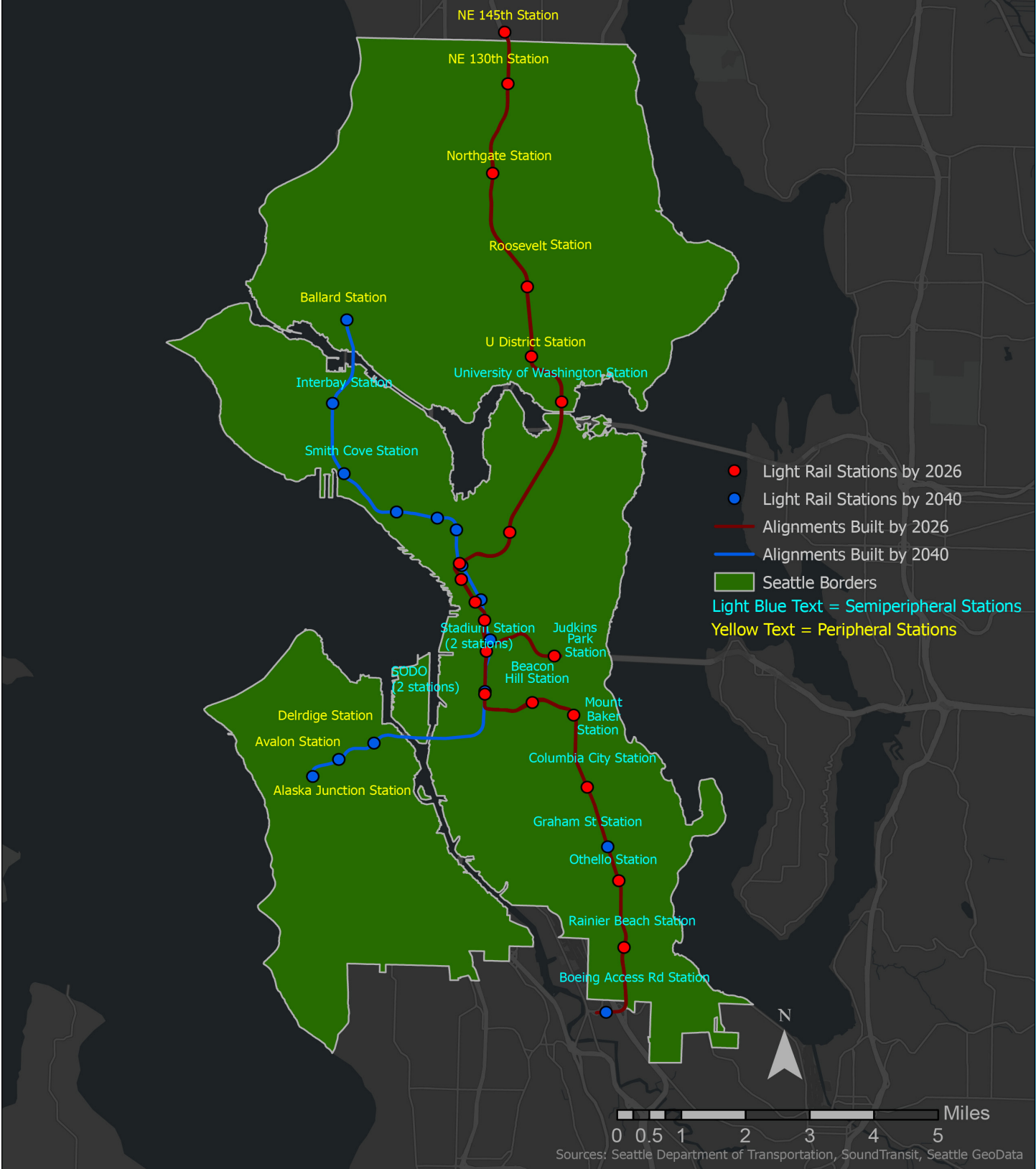
Chapter 5: TODMath 2

Light Rail Alignments and Stations Overlaid on Core, Semiperipheral, and Peripheral Areas

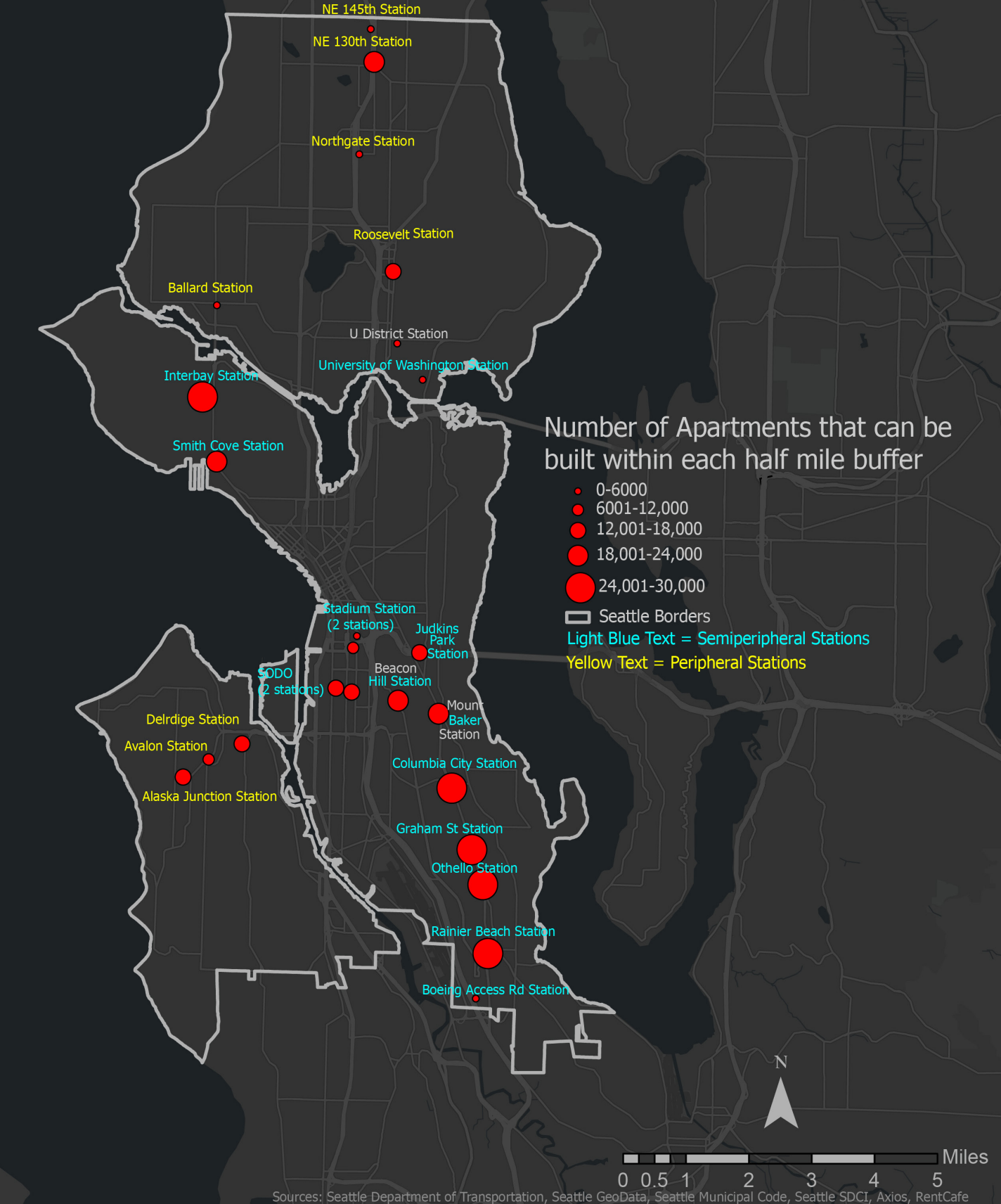


Present and Future Light Rail Alignments

With Stations Relative to Core, Semiperipheral, and Peripheral Areas



Number of Seattle Apartments that are able to be built
Within a half mile of Train Station with HB 2160 with extra Assumptions



To get the Core, Periphery, and Semiperiphery of Seattle, I based it off of the Housing Needs Area (HNA) in the dataset in Seattle Zoning Development Capacity Map. Greater Downtown was considered the core, the HNA areas directly bordering downtown are the semiperiphery, while the HNA areas not in those two categories are the Periphery. Overall, all the stations whose FARs below 3.5 are either in the Semiperiphery or the Periphery. I separated these stations in order to do a more nuanced FAR calculation. In the core, the apartment sizes would be 661 sq. ft. if there were any stations, while in the semiperiphery they will be an even 1000 sq. ft.m almost exactly 1.5x as large as the core, while in the periphery, they will be 1500 sq. ft, which is 1.5x as large as the semiperiphery and 2.25 times as large as the core, the average Seattle apartment size. I did this because people in the periphery would want more space than people who live downtown.

How many Apartments can Each Station with Less than 3.5 Average FAR handle in the semiperiphery ? Note: all values are rounded

Station Name	Average FAR	Number of Sq. Ft to 3.5	Number of Apartments
U Wash Station	0.598	4,148,472	4148
Interbay Station	1.625	25,283,414	25,283
Smith Cove Station	2.106	19,488,524	19,488
Stadium 1	3.017	6,130,802	6130
Stadium 2	3.299	2,406,478	2406
Judkins Park Station	2.190	13,752,908	13,752
SODO 1	2.474	14,745,108	14,745
SODO 2	2.471	14,726,378	14,726
Beacon Hill Station	1.522	23,225,617	23,225
Mount Baker Station	1.975	19,906,090	19,906
Columbia City Station	1.503	26,247,216	26,247
Graham St Station	1.621	28,831,923	28,831
Othello Station	1.608	29,781,298	29,781
Rainier Beach Station	1.338	29,936,126	29,936
Boeing Access Rd	2.295	5,308,600	5308
Subtotal	-	263,918,954	263,912

How many Apartments can Each Station with Less than 3.5 Average FAR handle in the Periphery ? Note: all values are rounded

Station Name	Average FAR	Number of Sq. Ft to 3.5	Number of Apartments
NE 145th Station	0.510	8,371,430	5580
NE 130th Station	0.674	32,410,551	21,607
Northgate Station	3.157	5,252,798	3501
Roosevelt Station	1.835	19,332,657	12,888
U District Station	3.173	2,776,268	1850
Ballard Station	2.861	8,622,450	5748
Delridge Station	1.980	18,049,391	12,032
Avalon Station	1.892	17,273,532	11,515
Alaska Junction Station	1.960	20,443,762	13,629
Subtotal	-	132,532,839	88,350

Totals

-	Average FAR	Number of Sq. Ft to 3.5	Number of Apartments
Total	-	396,451,794	352,262

Using this calculation, you get 352,262 apartments if the law is implemented relative to the current laws, which is not only more than the number of homes/apartments needed to plug in the gap by 2044 (140,000), it is almost enough to absorb more than 50% of the projected demand in the metropolitan area by that time which is 615,725 homes. This value is crazy and 1. Shows the efficacy of TOD in the housing crisis and 2. Shows the underutilization of zoning throughout the city but 3. May be inflated due to overlapping buffers. To solve this, using other stations outside of Seattle but still in the metro area, or expanding the SoundTransit network within Seattle would help to spread outside of the demand.

This value, however, is even further from 904,371 units able to be made under the current laws than without this separation into Core, Periphery, and Semiperiphery. However, That however does not undermine the value of TOD that while HB 2160

is a help with almost 352,262 extra units, it may also be able to get some of these 904,371 units quicker (given that the lack of 904,371 units almost certainly reduces average FAR way below its potential, making the 352,262 value assuming full FAR potential perhaps an undercount, even with the overlapping buffers inflating the value). Indeed, with the slow turnover of buildings, it highly likely that the TOD law would be more useful overall (as you can build larger units to get that average FAR up more quickly and easily, at least in the short run, than you can go to force every



Homeless Encampment in Seattle, such will happen if the crisis is not solved promptly. Source: Wikipedia/Gil-photo

Part Three: Conclusion

Overall, this investigation was very enlightening, as it showed the places that could be upzoned in Seattle by 2040 if HB 2160 is passed, showing that plenty of apartments could be made within 0.5 mile radius of a SoundTransit station, especially in areas with single family housing, residential small lot, and lowrises and while the total 599,766, or even 352,262 is surely an overestimate due to the overlapping buffers, and the small size of Apartments in Seattle, the fact that it could even get close to that value, shows that it somehow managed to put a dent in the housing crisis, blowing past the 140,000 needed by 2044. Such values show the utility of TOD, which if even some of this housing would be built, would reduce the housing crisis., reducing inflation and income inequality, at least locally, something which is quite good. If many of these housing units are built affordably, as the law wants to, then, then Seattle might be able to house its impoverished population which is above average, while providing ample transit access to them. Such housing would also help the economic engine, allowing people to move in for work, and further improving the conomy. To investigate further, and with a better computer, I intend to figure out a way to get a truer value by doing a similar analysis with the current laws as I did with HB 2160 extending my analysis beyond Seattle, where the data is not as present, disentangling the buffers, and using a MCDA to show where the next rail line should be.



Upzoning. Source: archive.curbed.com

Part Four: References

- American Planning Association. (2001). Introduction to LBCS Tables. In Land Based Classification System. American Planning Association.
- Both, A. (2024, June 13). National average apartment size. RentCafe. Retrieved from <https://www.rentcafe.com/blog/rental-market/market-snapshots/national-average-apartment-size/>
- Brenan, M. (2024, October 9). The economy: Most important issue for 2024 presidential vote. Gallup. Retrieved from <https://news.gallup.com/poll/651719/economy-important-issue-2024-presidential-vote.aspx>
- Census Reporter. (2024). Seattle-Tacoma-Bellevue, WA metro area. Retrieved December 15, 2024, from <https://censusreporter.org/profiles/31000US42660-seattle-tacoma-bellevue-wa-metro-area/>
- City of Seattle GIS Program. (2024). Seattle city GIS data. Retrieved December 15, 2024, from <https://data-seattlecitygis.opendata.arcgis.com/>
- City of Seattle. (n.d.). Seattle municipal code. Retrieved December 15, 2024, from https://library.municode.com/wa/seattle/codes/municipal_code
- Clarridge, C. (2024, January 12). Housing shortages last decades. Axios. Retrieved from <https://www.axios.com/local/seattle/2024/01/12/housing-shortages-last-decades>
- Clarridge, C., & Sparber, S. (2024, July 8). Seattle apartments: Micro, tiny, and smaller. Axios. Retrieved from <https://www.axios.com/local/seattle/2024/07/08/seattle-apartments-micro-tiny-smaller>
- Davis, G. (2024, February 23). WA House passes transit-oriented housing bill. Columbia Basin Herald. Retrieved from <https://columbiabasinherald.com/news/2024/feb/23/wa-house-passes-transit-oriented-housing-bill/>
- Duwamish Tribe. (n.d.). Land acknowledgement. Retrieved from <https://www.duwamishtribe.org/land-acknowledgement>
- Dubicki, R. (2023, March 17). ST3 misunderstanding. The Urbanist. Retrieved from <https://www.theurbanist.org/2023/03/17/st3-misunderstanding/>
- Dubicki, R. (2024, January 19). The numbers that make your city. The Urbanist. Retrieved from <https://www.theurbanist.org/2024/01/19/the-numbers-that-make-your-city/>
- Edgerton, A. (2023, November 6). Seattle weighs tripling property levy to ease housing crisis. Bloomberg. Retrieved from <https://www.bloomberg.com/news/articles/2023-11-06/seattle-weighs-tripling-property-levy-to-ease-housing-crisis>
- EPSG.io. (n.d.). NAD83 / Washington South (ftUS) EPSG:2285. Retrieved Decem-

ber 15, 2024, from <https://epsg.io/2285>

Freemark, Y., Garcia, R., Lieberman, S., & Rosenow, A. (2023, December). Unifying upzoning with affordable housing production strategies. Urban Institute. Retrieved from https://www.urban.org/sites/default/files/2023-12/Unifying_Upzoning_with_Affordable_Housing_Production_Strategies.pdf

Historic Seattle. (2010, October 10.). What price Seattle's skyline?. Retrieved December 15, 2024, from <https://historicseattle.org/what-price-seattles-skyline/>

HistoryLink.org. (2021, October 29). What price Seattle's skyline? Retrieved from <https://www.historylink.org/file/21296>

Honig, D. (2021, October 29). What price Seattle's skyline? HistoryLink.org. Retrieved from <https://www.historylink.org/file/21296>

Hyatt, D. (2024, April 21). The housing shortage is hurting almost every part of the economy. Investopedia. Retrieved from <https://www.investopedia.com/the-housing-shortage-is-hurting-almost-every-part-of-the-economy-8636226>

Lindeke, B. (2016, October 10). Floor area ratio (FAR) 101: An obscure but useful planning tool that shapes a city. MinnPost. Retrieved from <https://www.minnpost.com/cityscape/2016/10/floor-area-ratio-101-obscure-useful-planning-tool-shapes-city/>

McNamee, G. L., & Editors of Encyclopaedia Britannica. (2024, December 11). Seattle, Washington. In Britannica. Retrieved from <https://www.britannica.com/place/Seattle-Washington>

National Association of Women Business Owners (NAWBO). (n.d.). Amazon. Retrieved December 15, 2024, from <https://nawbo.org/partner/amazon>

Packer, R. (2024, February 19). What's in the transit-oriented development bill the WA House just passed? The Urbanist. Retrieved from <https://www.theurbanist.org/2024/02/19/whats-in-the-transit-oriented-development-bill-the-wa-house-just-passed/>

Packer, R. (2024, March 11). Year of housing 2.0 mostly fizzles out at Washington legislature. The Urbanist. Retrieved from <https://www.theurbanist.org/2024/03/11/year-of-housing-2-0-mostly-fizzles-out-at-washington-legislature/>

Planetizen. (n.d.). Upzoning. Retrieved December 15, 2024, from <https://www.planetizen.com/definition/upzoning>

Puget Sound Regional Council. (n.d.). Transit-oriented development. Retrieved December 15, 2024, from <https://www.psrc.org/our-work/transit-oriented-development>

Relman, E. (2024, December 4). Rents falling in Southern Sunbelt cities as new apartments are built. Business Insider. Retrieved from <https://www.businessinsider.com/rents-falling-southern-sunbelt-cities-building-apartments-housing-2024-12>

Seattle Department of Construction and Inspections. (n.d.). Zoning. Retrieved December 15, 2024, from [https://www.seattle.gov/sdci/codes/codes-we-enforce-\(a-z\)/zoning](https://www.seattle.gov/sdci/codes/codes-we-enforce-(a-z)/zoning)

Sound Transit. (n.d.). Retrieved from <https://www.soundtransit.org/>

State of Washington. (n.d.). Washington State geospatial data. Retrieved December 15, 2024, from <https://geo.wa.gov/>

U.S. Census Bureau. (2023). QuickFacts: Seattle city, Washington. Retrieved from <https://www.census.gov/quickfacts/seattlecitywashington>

U.S. Census Bureau. (n.d.). Explore Census Data. Retrieved December 15, 2024, from <https://data.census.gov/>

U.S. Census Bureau. (n.d.). TIGER/Line Shapefiles and geodatabases. Retrieved December 15, 2024, from <https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html>

U.S. General Services Administration. (n.d.). Data.gov. Retrieved December 15, 2024, from <https://data.gov/>

Washington State Department of Commerce. (2023, March). Retrieved from <https://deptofcommerce.app.box.com/s/6z6bjbnbat83wikpp23yiuktutm0z4zv>

Washington State Department of Commerce. (2024, December 9). Transit-oriented development. Retrieved from <https://www.commerce.wa.gov/growth-management/housing-planning/transit-oriented-development/>

Washington State Legislature. (2023). House Bill 2160: Concerning housing and transit-oriented development. Retrieved December 15, 2024, from <https://lawfilesexternal.wa.gov/biennium/2023-24/Pdf/Bills/House%20Bills/2160.pdf?q=20241206181327>

Wikipedia contributors. (n.d.). 1 Line (Sound Transit). In Wikipedia. Retrieved December 15, 2024, from https://en.wikipedia.org/wiki/1_Line_%28Sound_Transit%29

Wikipedia contributors. (n.d.). Mount Rainier. In Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Mount_Rainier

Wikipedia contributors. (n.d.). Seattle. In Wikipedia. Retrieved from <https://en.wikipedia.org/wiki/Seattle>

Wikipedia contributors. (n.d.). Homelessness in Seattle. In Wikipedia. Retrieved December 15, 2024, from https://en.wikipedia.org/wiki/Homelessness_in_Seattle