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PPD 631
GIS Final Project

L.A Metro Rail Past, Present, and Future

Background

Los Angeles County is one of the most populous areas in both the United States and the world. In order to serve its large and growing population, the Los Angeles County Metropolitan Transit Authority (METRO) owns and operates the Los Angeles Metro Rail, which combines both subway and light rail lines to create a public transportation network throughout the city. The first metro rail line, the Blue Line, opened in 1990. Since that time, 5 new metro rail lines have opened for the use of Los Angeles residents, with the most recent being the Expo Line, which opened in 2012 and runs from Santa Monica to downtown LA. This is only the beginning of metro rail expansion. With the arrival of the Olympics in Los Angeles in 2028, Metro's Board of Directors approved Mayor Garcetti's "Twenty-eight by '28" initiative that set the goal of the completion of 28 new transit projects by the start of the 2028 Olympics. Some of these transit projects include Metro Rail expansions. These projects include construction of the Crenshaw line between the Expo and Green Lines (slated to open in 2020), and a 2.6 mile, 3.2 billion dollar westward expansion of the purple line from Western avenue to the UCLA/Westwood area.

Issue

One of the primary benefits that comes from public transportation systems such as the LA Metro is the access it provides to both low-income individuals as well as people who do not own vehicles. With the city's push to expand the Metro Rail line before 2028, it is worth examining how well the current Metro Rails, including the newly constructed Expo Line, are serving these groups who benefit from a nearby Metro Rail station. In addition, it is also worth examining the

locations of a few of the proposed Metro Rail locations to determine how well these projects fall in line with public transportation’s broader goals of providing access to low-income people and non-vehicle owners. GIS is a helpful tool for this project because it is able to display exact locations of current Metro Rail stations, and overlay it with data on median household income and vehicle ownership. This displays the data in a way that is much easier to consume and understand than sifting through a data table. Furthermore, the geocoding feature of GIS makes it possible to place the approximate locations of future Metro Rail stations from the Purple and Crenshaw Line Extensions. This makes it much easier to determine if these additions will be serving areas with lower incomes and lower rates of vehicle ownership, which are two populations who greatly benefit from access to public transportation.

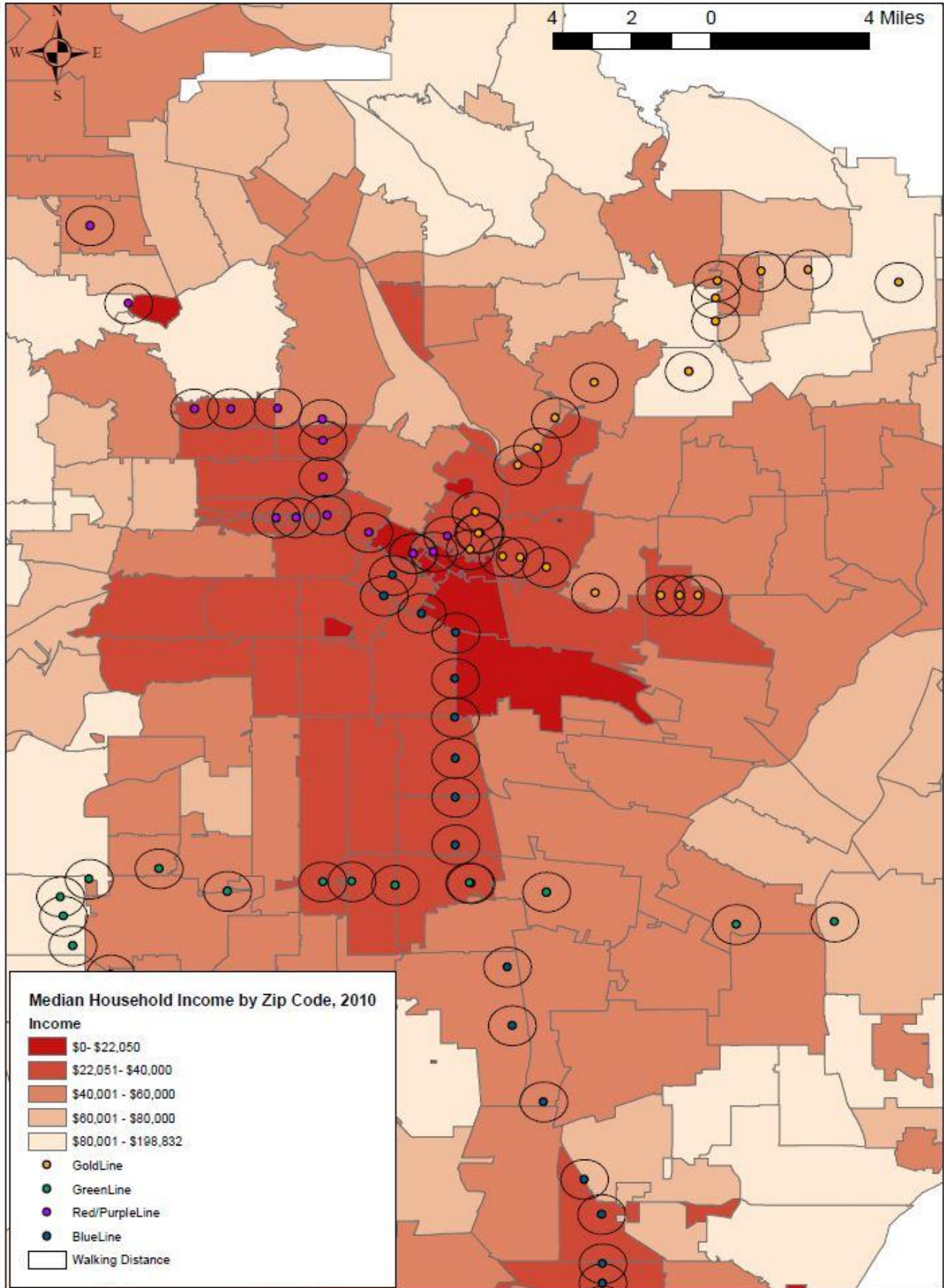
Data Sources

Data	Source
Existing LA Metro Rail Stations	Metro GIS Portal
LA County Divisions by Zip Code	LA County GIS Portals
2010 and 2018 Median Household Income by Zip Code, Los Angeles County	Simply Analytics
2011 and 2018 Percentage of Households with No Vehicles	Simply Analytics
Locations of future Metro Rail stops- Crenshaw Line and Purple Line Expansion	LA Metro website

Expo-Line Before and After

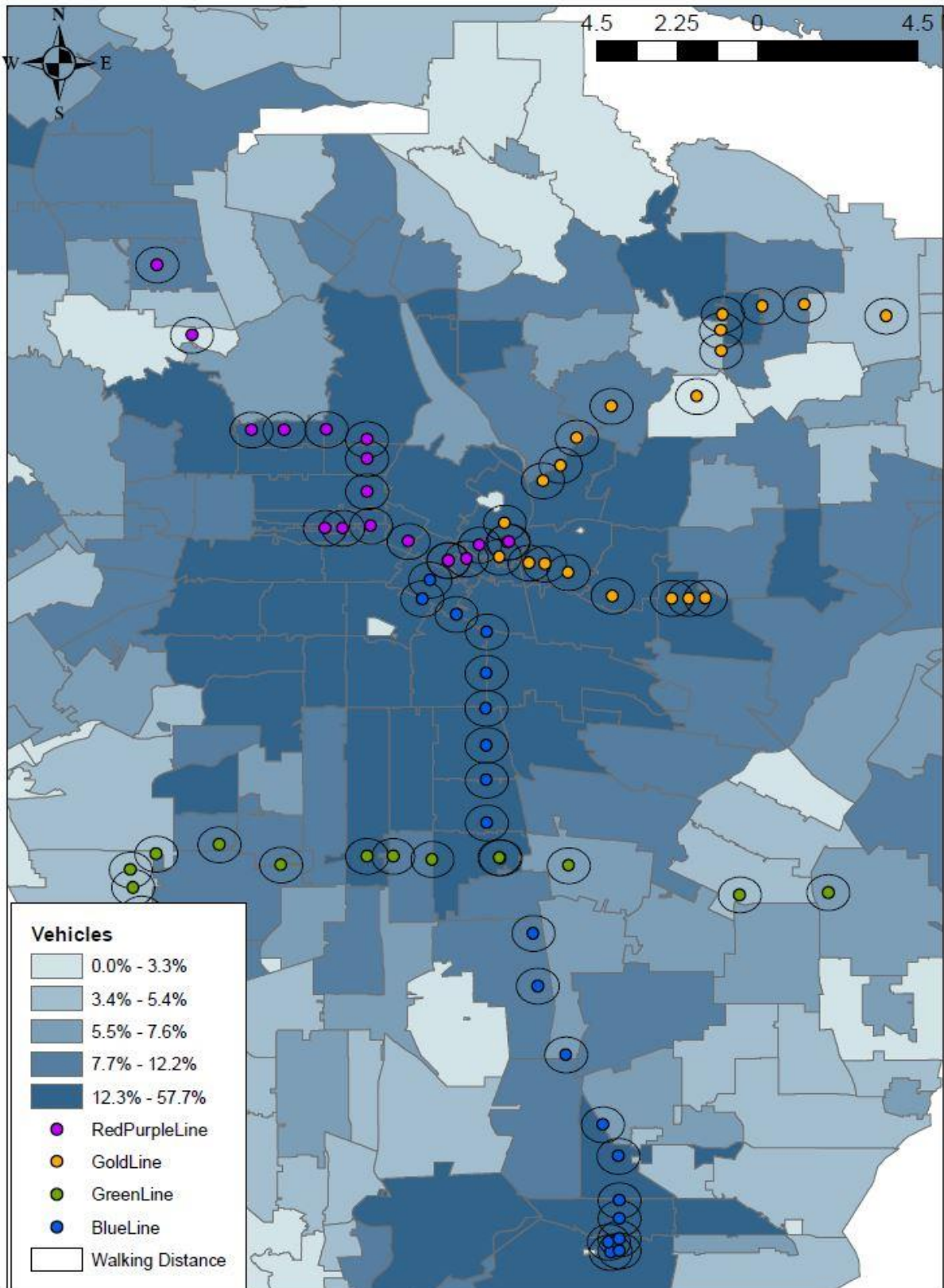
The most recently completed part of the LA Metro Rail was the Expo Line, which officially opened to the public in 2012, and was completed in 2016. The Expo Line provides service to notable areas of the city, including the University of Southern California and Santa Monica. Prior to the Expo Line's completion, the Metro Rail system did not service many low-income areas of Los Angeles, as there were a number of zip codes with a median household income of less than \$40,000 per year that were not within walking distance (0.5 miles, according to Metro's 2014 Strategic Plan) of a metro rail station. This is displayed by the buffer in the map on the next page.

Median Household Income by Zip Code, 2010



In addition, many parts of Los Angeles have high percentages of households with no vehicles. Furthermore, zip codes with lower levels of Median Household Income unsurprisingly tended to have low levels of vehicle ownership. Without a vehicle or a nearby Metro Rail residents had trouble travel to different places throughout the city. Lack of access to transportation can also impact other parts in a person's life, such as employment, health, and safety.

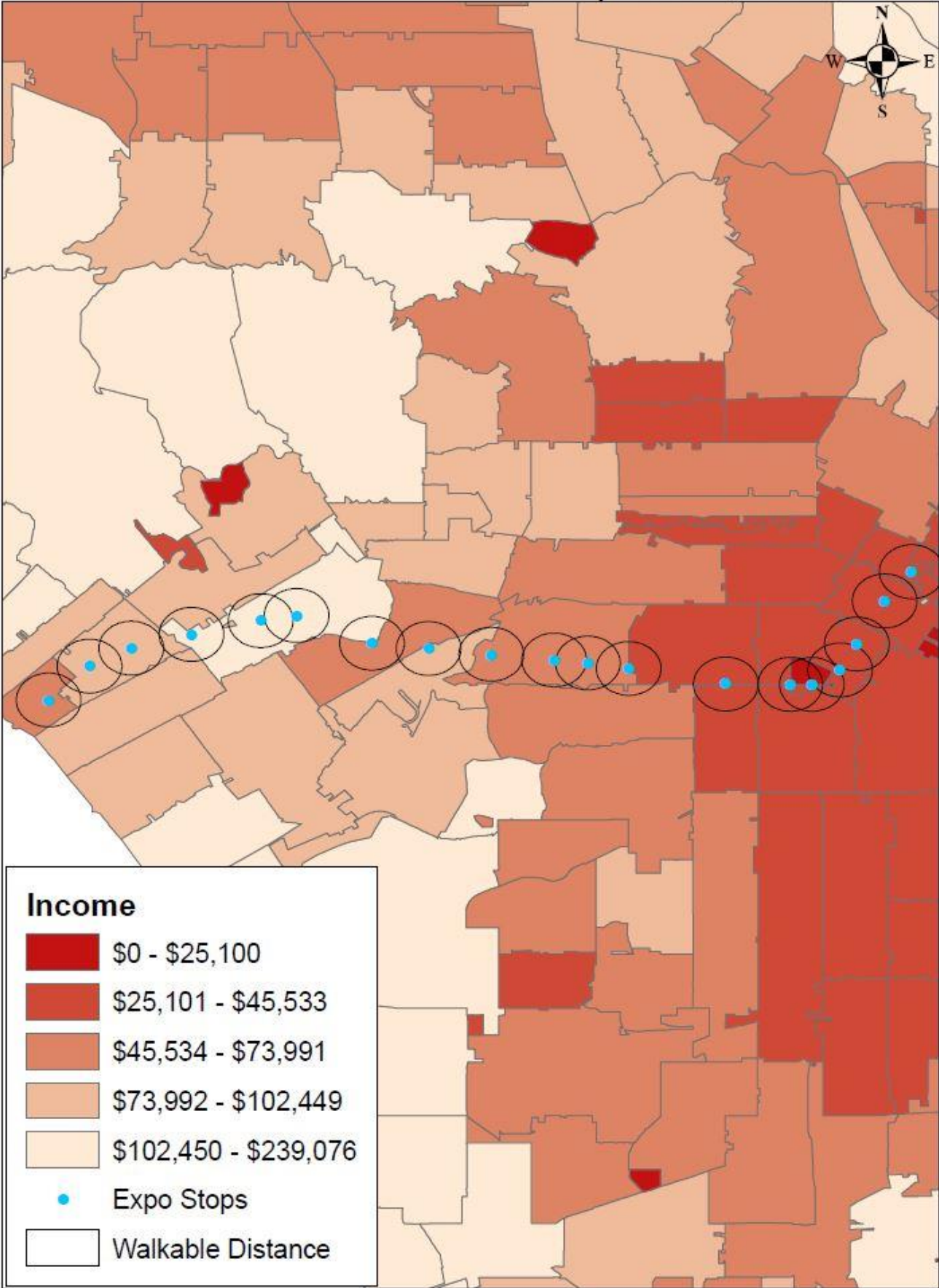
Percentage of Households with No Vehicles, 2011



Expo Line After

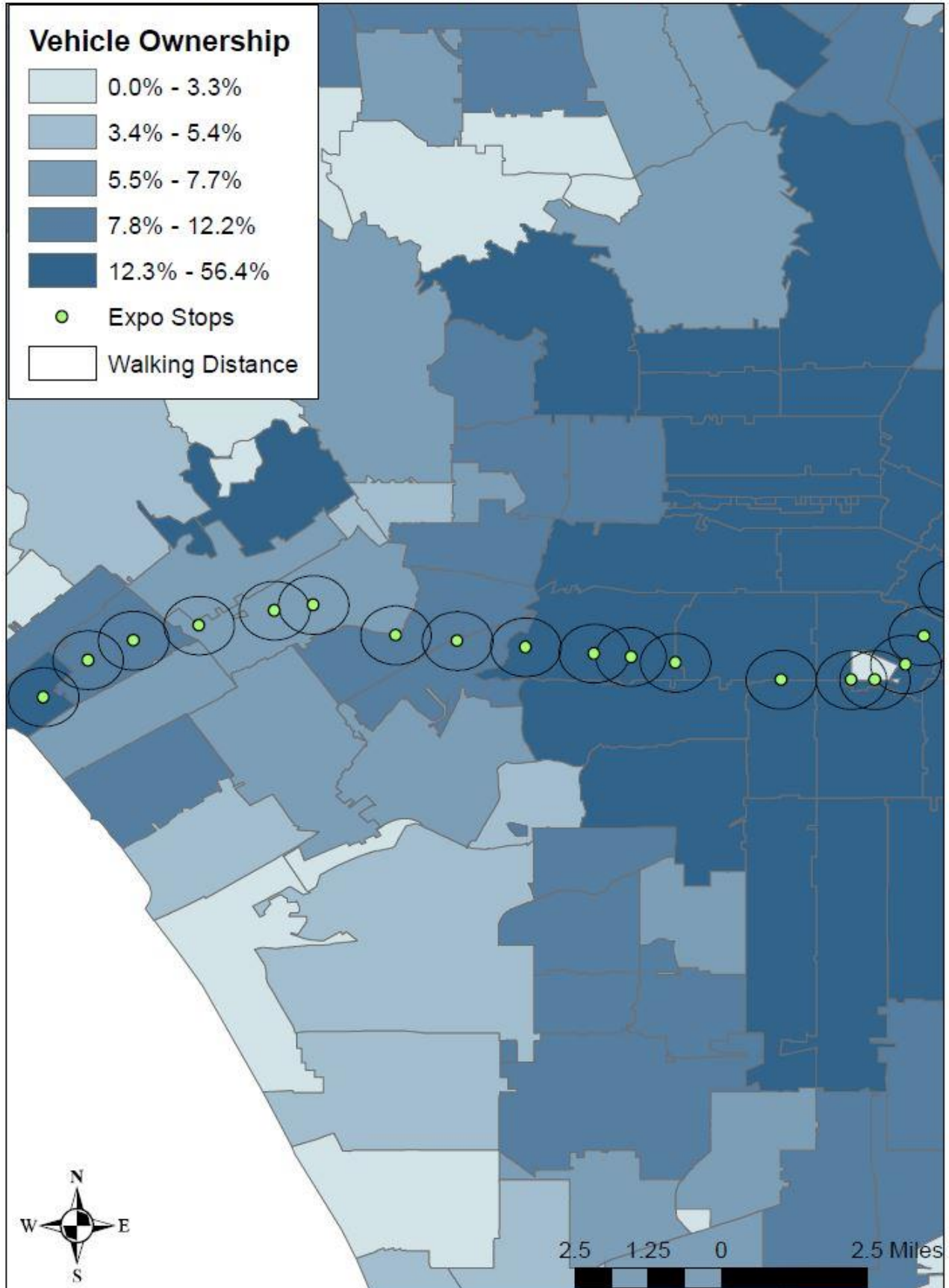
Prior to the construction of the Expo Line, it was evident that there was a lack of a metro rail presence in parts of the city that would benefit based on the demographic trends of household income and vehicle ownership. The installation of the Expo Line between 2012-2016 certainly helped resolve part of this problem, as many of its stops served zip codes with a median household income at or near poverty level (*based on the federal poverty line of \$25,100).

Household Income Near Expo Line, 2018



Many of the zip codes within walking distance of the Expo Line stops also had large numbers of households with no vehicles. The placement of these stops certainly improved access to transportation for the residents of the zip codes served by the Expo Line who do own vehicles.

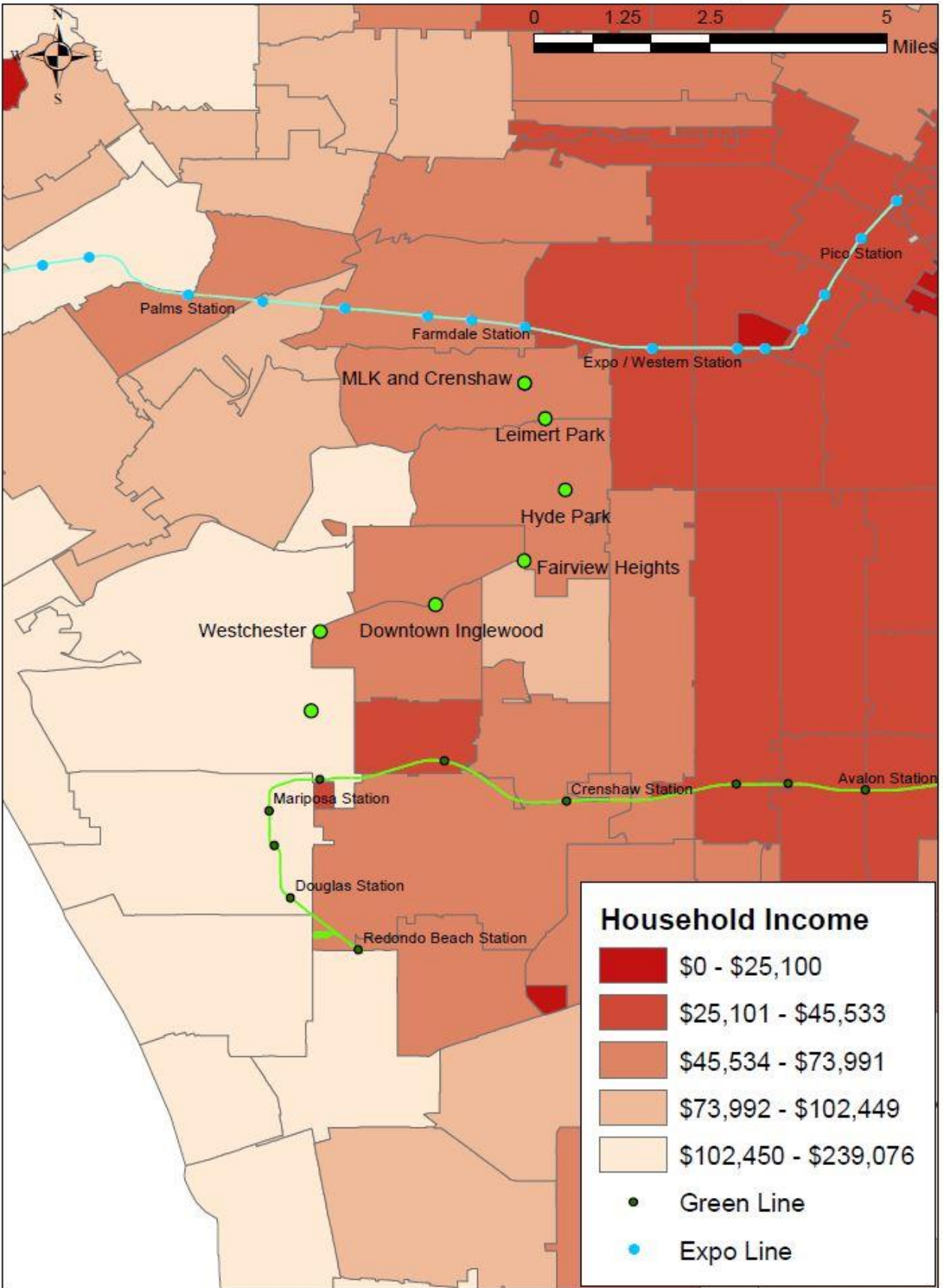
Vehicle Ownership near Expo Line



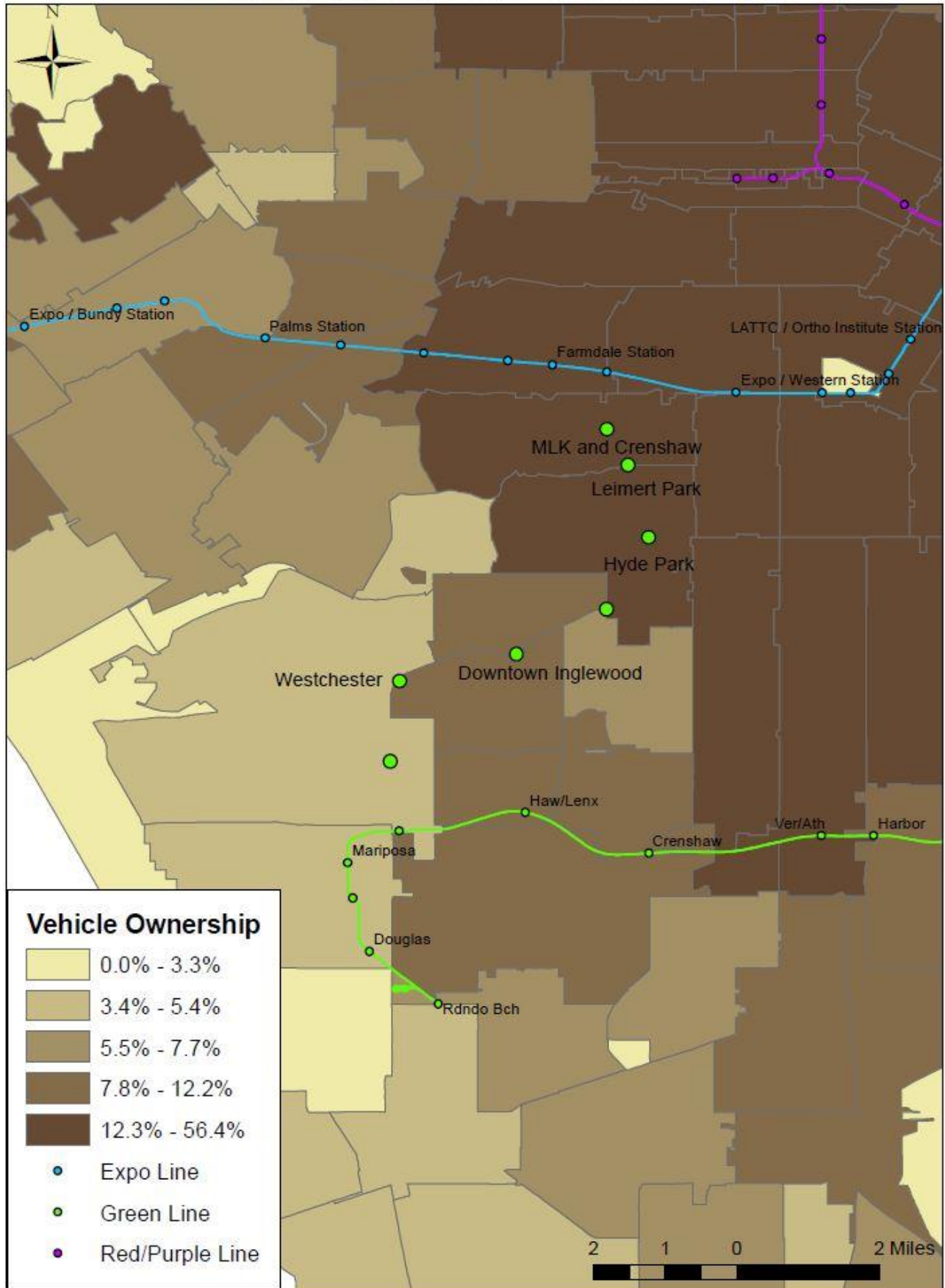
Metro Rail Expansions

The completion of the Expo metro rail provided public transportation access to areas of the city that had lower median household incomes and lower rates of vehicle ownership. However, these are not the only areas of the city that meet these criteria and could benefit from increased metro rail access. Metro has a number of projects scheduled for completion in the next decade, including two significant rail projects; construction of the “Crenshaw Line”, which will bridge the gap between the Expo Line and the Green Line and can take riders to the Los Angeles International Airport (LAX), and a Purple Line extension, a 2.6 mile expansion of the Purple Line westward to UCLA. Since these two metro rail lines do not exist yet, I was unable to find a Shapefile for them, so the bright green dots represent geocoded points based on the approximate location of the future stations.

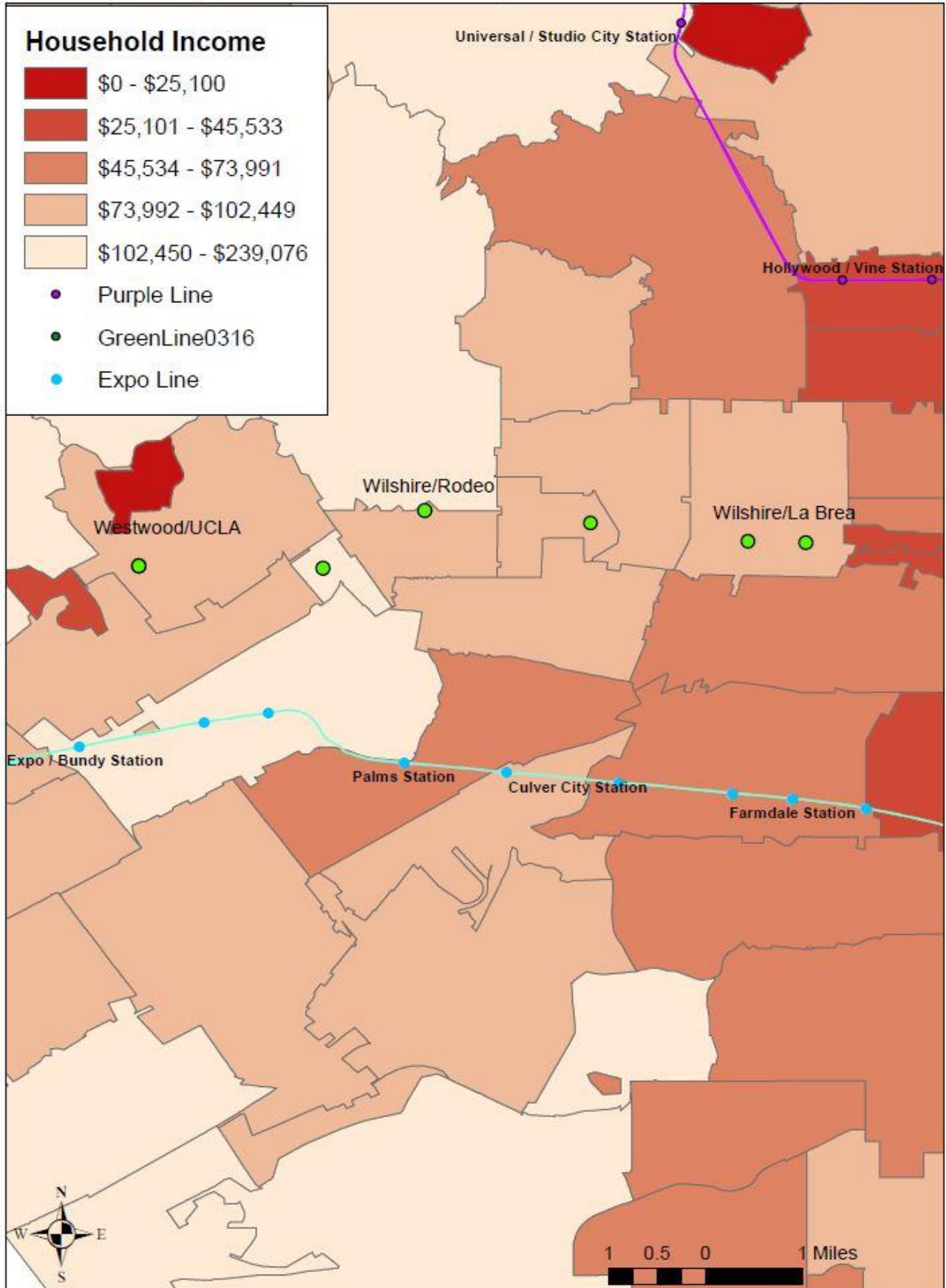
Crenshaw/LAX Line Future Stops



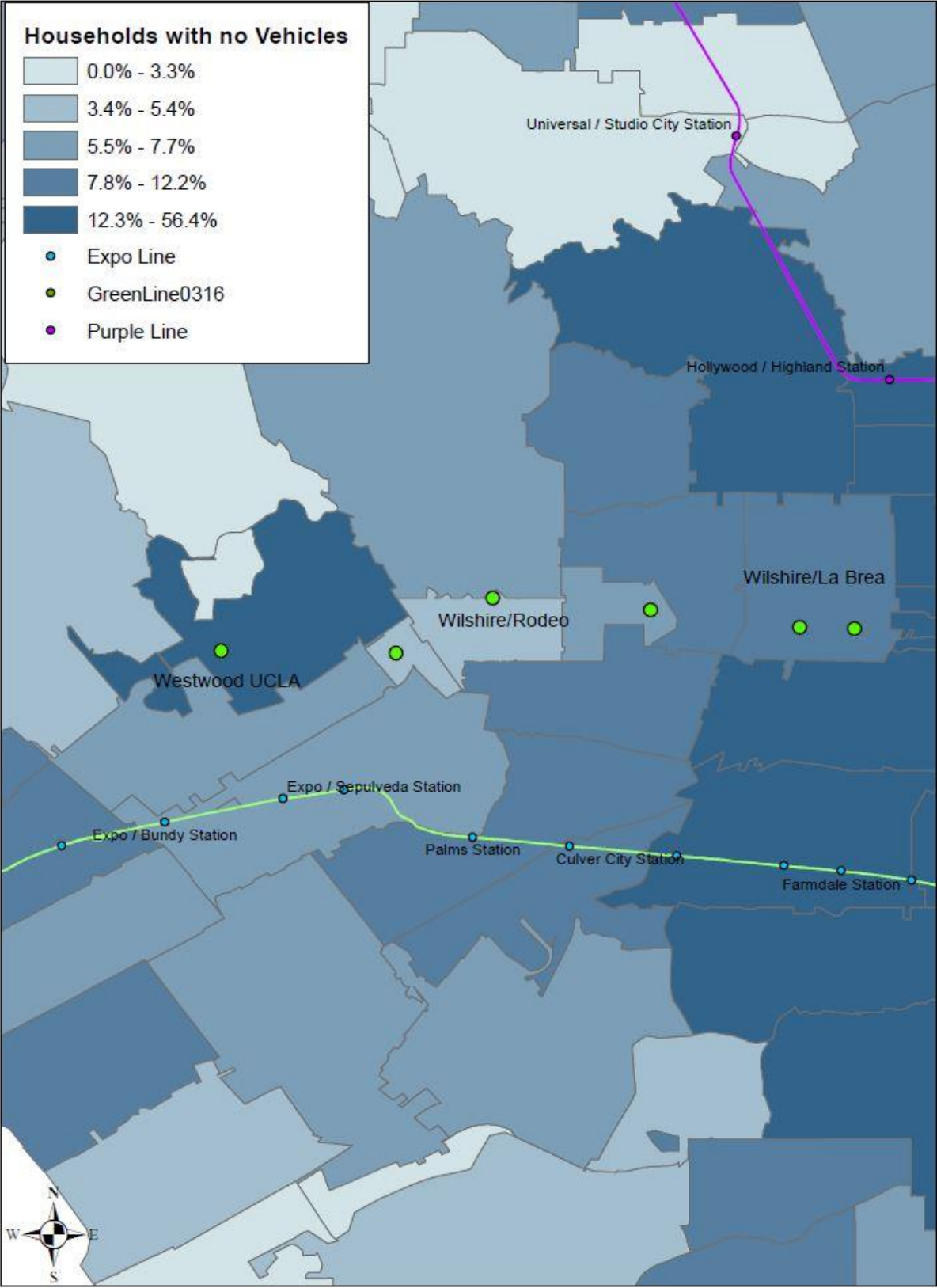
Crenshaw/LAX Line Future Stops



Proposed Metro Purple Line Expansion



Proposed Purple Line Expansion



Analysis

Based on the available data, the construction of the Crenshaw line will certainly be helpful to residents who live near where the completed stations will be. A number of the Crenshaw line stops will be located in zip codes with a median household income between \$25,101-\$45,533, which is above the federal poverty line but still considered low-income. Since part of the purpose of public transportation is to provide transportation options for low-income individuals, it appears that the Crenshaw line would provide value both to these communities and the city as a whole. In addition, the majority of the stations on the Crenshaw line are located in zip codes where the number of households with no vehicles is at least 7%. In the case of the 90008 zip code, where the Martin Luther King/Crenshaw station will be located, nearly 20% of residents do not own a vehicle. The placement of metro rail stations in these areas will help improve access to transportation for non-vehicle owners who would greatly benefit from an additional transportation option. From the perspective of better serving low-income residents and non-vehicle owners, the Crenshaw Line should receive a significant amount of use, benefitting both the residents of Los Angeles and the City itself.

The proposed Purple Line expansion through the Beverly Hills/Westwood area of the city is less necessary, strictly from the perspective of serving low-income areas. Many residents of Los Angeles would be able to tell you from experience that this part of the city is affluent, and the data bears that out. In fact, the median household income in most of these zip codes generally hovers around \$90,000, indicating that it is unlikely the expanded Purple Line would provide much benefit in terms of increasing service to the low-income population of the city. While the portion of the city served by the expanded purple line tends to be high-income, there are some stops that are in zip codes with higher percentages of households with no vehicles. In

particular, the Westwood/UCLA stop has over 12% of households with no vehicle. It is worth noting that these statistics do not take into account the significant student population living in Westwood that have fairly low incomes and do not own or drive cars. While it is difficult to find data that accounts for these students since they are not permanent residents of the area in most cases, it is safe to say that many of them would be likely to use public transportation such as the Metro Rail Purple Line, even if it is difficult to project an exact amount. Furthermore, the Purple Line runs through a fairly well-known area of the city that is likely to attract tourists, including those who will be visiting for the Olympics. Some of these ancillary factors do add to the city's incentive to construct the purple line. However, strictly from income and vehicle ownership data, the Purple Line is less likely to serve low-income and non-vehicle owner populations that are more likely to use public transportation than the Crenshaw line will be.

Limitations

There are a few limitations to this project. First, Shapefiles were unavailable for uncompleted Metro Rail lines. As a result, the geocoded locations of the Crenshaw and Purple Metro Rail stations are an approximation based on a map available on the Metro website, and are not necessarily the exact future locations. Another limitation of this project is that it only looks at two of the many factors that play a role in the effectiveness of a public metro rail system. While low-income and non-vehicle owners are certainly two of the intended populations for public transit systems like the Metro Rail, they are by no means the only people who the system is designed for. A deeper analysis of the overall effectiveness of the Metro Rail system and viability of future projects would need to account for other factors such as additional population trends, construction costs and feasibility, and technological changes in transportation. However, data availability and time limitations limited the amount of information I could analyze.

Conclusion

Overall, the Los Angeles Metro Rail's recent projects have generally been placed in locations that serve low-income populations and non-vehicle owners, two of the target populations and beneficiaries of both Metro and public transportation in general. In particular, the stations of both the recently completed Expo Line and the almost-completed Crenshaw Line certainly meet these criteria. While the Purple Line extension does not fit either of these categories as well, it will have a station near UCLA, in theory helping students, many of whom do not own vehicles. In terms of data, most of my findings were in line with what I expected, both for median household income and vehicle ownership. One finding that did surprise me a little was the relatively low median household income in the zip codes that encompass downtown. Although I expected that area to have lower median income than the western parts of the city, I was surprised that most of the zip codes had median incomes less than \$45,000 per year, particularly given the increased of high-end development in downtown. Perhaps the most important thing I learned was how important and useful public transportation is to most parts of Los Angeles, simply based on income and vehicle ownership. Given the population, income, and vehicle ownership trends of both Los Angeles residents and the general population, it is likely that an increased metro rail will be a necessary and beneficial part of the city's future.

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