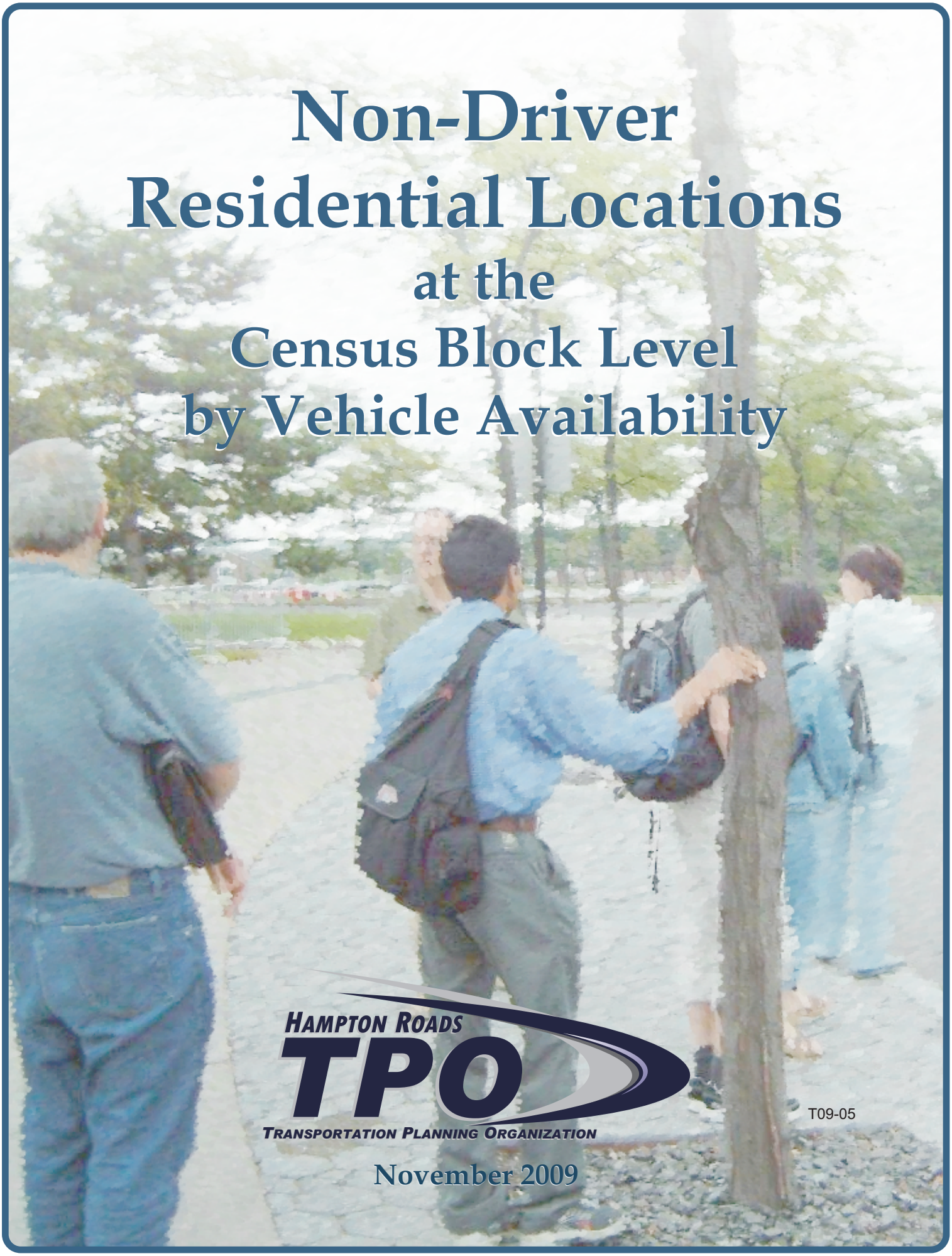
Non-Driver Residential Locations at the Census Block Level by Vehicle Availability



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T09-05

November 2009

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NON-DRIVER RESIDENTIAL LOCATIONS AT THE CENSUS BLOCK LEVEL BY VEHICLE AVAILABILITY

This report was included in the Work Program for Fiscal Year 2009-2010, which was approved by the the Metropolitan Planning Organization at its meeting of June 17, 2009.

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HAMPTON ROADS TPO TRANSPORTATION PLANNING ORGANIZATION

NOVEMBER 2009

REPORT DOCUMENTATION

TITLE
Non-Driver Residential Locations at the Census Block Level by Vehicle Availability

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GRANT AGENCY
FHWA / VDOT / LOCAL FUNDS

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ABSTRACT

Given that non-drivers in zero-vehicle households are vulnerable during evacuation events and have a greater need for the mobility improvement provided by a nearby bus stop and nearby activity locations, locating non-drivers by vehicle availability is valuable. Non-driver data not being available from the Census, TPO staff have applied regression techniques to earlier TPO non-driver location data and applicable Census data to estimate the residential locations of non-drivers age 18+ in Hampton Roads by vehicle availability for each of the 20,000 blocks in Hampton Roads. The Virginia Department of Emergency Management (VDEM) can use this data to plan evacuation aid in its current Regional Catastrophic Preparedness project. Local government and transit agencies can use this data when deciding where to promote the development of activity locations and where to invest in transit, two factors which improve non-driver mobility as measured by previous TPO studies. Because the data includes a break-out of non-drivers in zero-vehicle households, particular emphasis can be placed on these persons.

ACKNOWLEDGEMENTS

This report was prepared by the Hampton Roads Transportation Planning Organization (HRTPO) in cooperation with the Federal Highway Administration (FHWA) and the Virginia Department of Transportation (VDOT). The contents of this report reflect the views of the Hampton Roads Transportation Planning Organization (TPO). The HRTPO staff is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, VDOT, or HRPDC. This report does not constitute a standard, specification, or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

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INTRODUCTION

DEFINITION

"Non-driver" as used in this report refers to a person who does not consider themselves to be a driver. The usage of this term comes from the National Household Travel Survey in which persons are simply asked "Are you a driver?". It is assumed that non-drivers—for whatever reason: physical, financial, legal—do not have a drivers license and therefore *cannot* currently drive. In this report, non-drivers are at least 18 years of age and live in households.

OVERVIEW OF MULTI-YEAR STUDY

This document is the eighth in a series of non-driver documents emanating from work begun by HRTPO staff in 2003. The first non-driver document (published June 2005) examined improvements to the mobility of elderly non-drivers using the National Household Travel Survey (NHTS).[1] It revealed that:

- elderly non-drivers travel half as much as elderly drivers, but
- elderly non-drivers living in denser areas have higher mobility due to walking and bus usage.

The second document (published November 2006) examined non-drivers age 18-64 again using the NHTS.[2] It revealed that:

- 18-64 non-drivers also make half as many trips as their driving counterparts,
- the mobility of 18-64 non-drivers living in central areas is significantly higher than those living in other areas, and
- walking and use of public transit give non-drivers in central areas this higher mobility.

It was concluded in these first two documents that living near destinations and having access to public transit causes the higher non-driver mobility observed in dense areas and central areas. But due to the structure of the NHTS survey, neither study was able to directly measure the mobility impact of living near transit and living within walking distance of destinations. Therefore, a local survey was designed, implemented, and analyzed to measure these factors. A third document (published June 2007) presented a statistical snapshot of local non-drivers based on data from the survey.[3]

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[1] Robert B. Case, *Improving Elderly Transportation Using the NHTS* (Chesapeake, Va.: Hampton Roads Planning District Commission, June 2005).
[2] Robert B. Case, *Improving the Mobility of Non-Drivers Age 18-64 Using the NHTS* (Chesapeake, Va.: Hampton Roads Planning District Commission, November 2006).
[3] Robert B. Case, *Snapshot of Non-Drivers in Hampton Roads* (Chesapeake, Va.: Hampton Roads Planning District Commission, June 2007).

A fourth document (published June 2007) presented a model—developed from the local survey—which indicated numerically the factors which determine non-driver mobility.[4] That mobility model revealed that:

- better-walking non-drivers living in the high activity locations in urban and suburban areas of Hampton Roads have odds of leaving home five (5) times higher than the odds of those living away from activities, and
- better-walking non-drivers living near a bus stop have odds of leaving home two (2) times higher than the odds of those living away from bus stops.

The fourth document presented recommendations to local governments, developed from these findings, for improving the mobility of local non-drivers, including:

1) furthering the location of mobility-enhancing infrastructure near non-drivers:

   - locating bus routes near concentrations of residences
   - locating government facilities near concentrations of residences
   - using zoning authority to ensure that adequate numbers of activity locations (businesses, institutions, etc.) are allowed to be built near concentrations of residences

2) furthering the location of housing near mobility-enhancing activity areas:

   - using zoning authority to ensure that adequate numbers of residences are allowed to be built in High Business Activity Locations

A fifth document (published June 2007) applied the findings of the fourth document to three specific neighborhoods in Hampton Roads.[5] In addition to recommendations concerning deficiencies in neighborhood pedestrian and bus networks, recommendations were made based on the neighborhoods' proximity to activity locations. Additional residential units were recommended for areas proximate to activity locations; additional businesses were recommended for areas away from activity locations.

In the sixth document (published June 2008), a method of locating non-drivers, by residence, in Hampton Roads was developed in order that local government could place bus routes, activity locations, and bicycle and pedestrian facilities near those residences.[6] Non-drivers were located at the Transportation Analysis Zone (TAZ) level of detail. Both successes and prospects for improvement in the proximity of non-drivers, bus routes/stops, and activity locations were identified by locality.

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[4] Robert B. Case, *Improving the Mobility of Non-Drivers Using Proximity to Destinations and Bus Routes* (Chesapeake, Va.: Hampton Roads Planning District Commission, June 2007).
[5] Andy Pickard, *Improving the Mobility of Non-Drivers: Neighborhood Gaps Analysis* (Chesapeake, Va.: Hampton Roads Planning District Commission, June 2007).
[6] Robert B. Case, *The Location of Non-Drivers in Hampton Roads* (Chesapeake, Va.: Hampton Roads Metropolitan Planning Organization, June 2008).

In the seventh document (published June 2009), mobility odds—developed using the model from the fourth document—were used to measure the success of localities' co-positioning of activity locations, bus routes/stops, and residences favored by non-drivers.[7] A method of locating non-drivers at the block level (but not by vehicle availability) was developed and applied. Using this detailed location data, specific successes and prospects in the proximity of these three were identified, building on the similar but less-detailed effort of the sixth document. In addition, this report visually examined the proximity of non-drivers and bike/ped facilities, pointing out successes and prospects in that arena as well. Local government can use the findings of this report to identify prospects for modifying land use and investing in bus, bicycle, and pedestrian infrastructure to improve non-driver mobility.

PURPOSE

The purpose of this current effort is to locate non-drivers, by residence, at the most detailed level of Census geography—the block level—by vehicle availability. The separate identification, or break-out, of non-drivers in zero-vehicle households and those in households with vehicle(s) is valuable because the former are vulnerable during evacuation events and have a greater need for the mobility improvement provided by a nearby bus stop and nearby activity locations—treatments analyzed in earlier TPO non-driver reports.

The Virginia Department of Emergency Management (VDEM) can use this location data to plan evacuation aid in its current Regional Catastrophic Preparedness project. Local government and transit agencies can use this data when deciding where to promote the development of activity locations and where to invest in public transit. Because the data includes a break-out of non-drivers in zero-vehicle households, particular emphasis can be placed on these persons by these agencies.

[7] Robert B. Case, *Non-Driver Opportunity Analysis* (Chesapeake, Va.: Hampton Roads Transportation Planning Organization, June 2009).

DEVELOPMENT OF NON-DRIVER LOCATION DATA AT BLOCK LEVEL BY VEHICLE AVAILABILITY

The non-driver location data at the block level presented in this document were developed by subdividing TAZ-level non-driver data prepared for the TPO's June 2008 report "The Location of Non-Drivers in Hampton Roads". The TAZ-level data had been calculated by multiplying the number of households of each person-vehicle type from the Census Transportation Planning Package (CTPP) table 1-068 ("Vehicles available by Number of persons 16 or over in household") by the average number of non-drivers for that person-vehicle household type, the averages having been calculated using NHTS data. Having been developed from the vehicle deficit data in CTPP table 1-068, the TAZ-level estimates 1) were very accurate[8] and 2) provided estimates of non-drivers by vehicle availability, i.e. non-drivers in zero-vehicle households (ZVHHs) and those in households with vehicle(s).

Because the Census does not provide vehicle deficit information at the block level, a relationship between the type of information Census does provide at that level and non-driver numbers was established through linear regression for this current effort. It should be noted that, in fiscal year 2009, staff developed non-driver estimates at the block level for the TPO's June 2009 "Non-Driver Opportunity Analysis". Whereas the June 2009 effort simply estimated *total* non-drivers based on *one* regression, the current effort estimates *two sets* of non-drivers—non-drivers in ZVHHs and non-drivers in households with vehicle(s)—based on *two* regressions, each set being based on its own regression. Regressions were performed at the TAZ level, where all necessary data was readily available, and applied at the block level to produce the desired break-out of estimates. Therefore, only those data types which are available at the block level[9] were candidates for the current regressions. Each of the two regressions will be addressed in turn below.

ESTIMATING NON-DRIVERS IN ZERO-VEHICLE HOUSEHOLDS AT BLOCK LEVEL

According to the "San Francisco Bay Area 1990 Regional Travel Characteristics – Working Paper #4 - MTC Travel Survey", "zero-vehicle households tend to be more elderly and tend to be poorer than multiple-vehicle households."[10] Therefore, TPO staff looked for age and income data to use as independent variables in a regression examining the relationship between such data and the dependent variable in question: non-drivers in zero-vehicle households. Although income data is not available at the block level, tenure data (i.e. renter occupied vs. owner occupied) is available and tenure is related to income.

Model building began with a base model created by regressing all 16 variables from Census 2000 Summary File 1 (SF1) table H16 "Tenure by Age of Householder" against

[8] See accuracy test on pages 16-19 of *The Location of Non-Drivers in Hampton Roads* (Chesapeake, Va.: Hampton Roads Metropolitan Planning Organization, June 2008).
[9] Data available at the block level is, by aggregation, available at higher, e.g. TAZ, levels.
[10] By Charles L. Purvis, Metropolitan Transportation Commission, Oakland, Dec. 1994, p. 56.

non-drivers in ZVHHs, by TAZ, using Hampton Roads data. This model had a larger value (0.78) but many of the variables were insignificant and/or had negative coefficients. The final model was built progressively, starting with the variable with the largest positive coefficient from the base model, then adding variables one at a time—choosing the variable from the base model with the next-largest positive coefficient—as long as the resulting model revealed all positive coefficients. As shown on the following page, the final model revealed that age and tenure variables explain the number of non-drivers in ZVHHs to a highly significant degree.

Regression of TAZ-Level Household Data for Hampton Roads, The Relationship Between Non-Drivers in ZVHHs and Tenure by Age

Model Summary				
Model	**R**	**R Square(a)**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.859(b)	.738	.737	45.960

a For regression through the origin (the no-intercept model), R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. This CANNOT be compared to R Square for models which include an intercept.

b Predictors: See coefficients table below.

ANOVA(c,d)						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	5790702.634	5	1158140.527	548.276	.000(a)
	Residual	2057411.015	974	2112.332		
	Total	7848113.649(b)	979			

a Predictors: See coefficients table below.

b This total sum of squares is not corrected for the constant because the constant is zero for regression through the origin.

c Dependent Variable: Non-Drivers, Age 18+, in Zero-Veh. Households, 2000

d Linear Regression through the Origin

Coefficients(a,b)						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**	**B**	**Std. Error**
1	**Occupied housing units: Renter occupied; Householder 55 to 64 years**	2.312	.237	.623	9.765	.000
	Occupied housing units: Owner occupied; Householder 85 years and over	.812	.192	.086	4.227	.000
	Occupied housing units: Renter occupied; Householder 85 years and over	.264	.175	.031	1.505	.133
	Occupied housing units: Renter occupied; Householder 65 to 74 years	.340	.153	.084	2.222	.027
	Occupied housing units: Renter occupied; Householder 45 to 54 years	.206	.091	.107	2.250	.025

a Dependent Variable: Non-Drivers, Age 18+, in Zero-Veh. Households, 2000

b Linear Regression through the Origin

Source: output.htm

Based on this regression, the number of non-drivers in ZVHHs in each of the 20,000 blocks in Hampton Roads was estimated by multiplying the above coefficients by the number of housing units of corresponding type, summing the five products to create a draft estimate of non-drivers for each block, summing the blocks by TAZ, and then adjusting each block's draft estimate in order that the TAZ control totals from the June 2008 effort be matched.

Note that, in accordance with the literature quoted above, most of the model's variables represent households which are rented by older householders.[11]

ESTIMATING NON-DRIVERS IN HOUSEHOLDS WITH VEHICLE(S) AT BLOCK LEVEL

Using the relationship revealed by the model developed for locating total non-drivers at the block level in the June 2009 TPO non-driver study,[12] the building of a model to locate non-drivers in households with vehicle(s) at the block level began by regressing both variables from Census 2000 Summary File 1 (SF1) table H4 "Tenure" (owner-occupied housing units, renter-occupied housing units) against non-drivers in households with vehicle(s), by TAZ, using Hampton Roads data. Due to the very large r^2 value of this model (0.93), no further model building was conducted. This model reveals that tenure explains the number of non-drivers in households with vehicle(s) to a highly significant degree, as shown on the following page:

[11] It should be noted that, even though the model is limited to variables representing mostly older renters, the non-driver numbers produced in this effort include non-drivers in zero-vehicle households of all tenure and age-of-householder types due to the matching of TAZ-level control totals which was conducted.
[12] Robert B. Case, *Non-Driver Opportunity Analysis* (Chesapeake, Va.: Hampton Roads Transportation Planning Organization, June 2009), p. 46.

Regression of TAZ-Level Household Data for Hampton Roads, The Relationship Between Non-Drivers in Households with Vehicle(s) and Tenure by Age

Model Summary				
Model	**R**	**R Square(a)**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.965(b)	.932	.932	27.471
a For regression through the origin (the no-intercept model), R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. This CANNOT be compared to R Square for models which include an intercept.				
b Predictors: Renter Occ'd HUs, Owner Occ'd HUs				

ANOVA(c,d)						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	10055367.030	2	5027683.515	6662.333	.000(a)
	Residual	737286.289	977	754.643		
	Total	10792653.320(b)	979			
a Predictors: Renter Occ'd HUs, Owner Occ'd HUs						
b This total sum of squares is not corrected for the constant because the constant is zero for regression through the origin.						
c Dependent Variable: Non-Drivers, Age 18+, in Households w/ Veh(s), 2000						
d Linear Regression through the Origin						

Coefficients(a,b)						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**	**B**	**Std. Error**
1	**Owner Occ'd HUs**	.119	.002	.609	58.374	.000
	Renter Occ'd HUs	.137	.003	.468	44.808	.000
a Dependent Variable: Non-Drivers, Age 18+, in Households w/ Veh(s), 2000						
b Linear Regression through the Origin						

Source: output.htm

Based on this regression, the number of non-drivers in households with vehicle(s) in each of the 20,000 blocks in Hampton Roads was estimated by multiplying the above coefficients by the number of housing units of corresponding type, summing the two products to create a draft estimate of non-drivers for each block, summing the blocks by TAZ, and then adjusting each block's draft estimate in order that the TAZ control totals from the June 2008 effort be matched.

The model structure indicates that non-drivers in households with vehicle(s) can be found wherever occupied housing units exist, with somewhat higher prevalence where rental units are located.

ESTIMATING TOTAL NON-DRIVERS IN HOUSEHOLDS AT BLOCK LEVEL

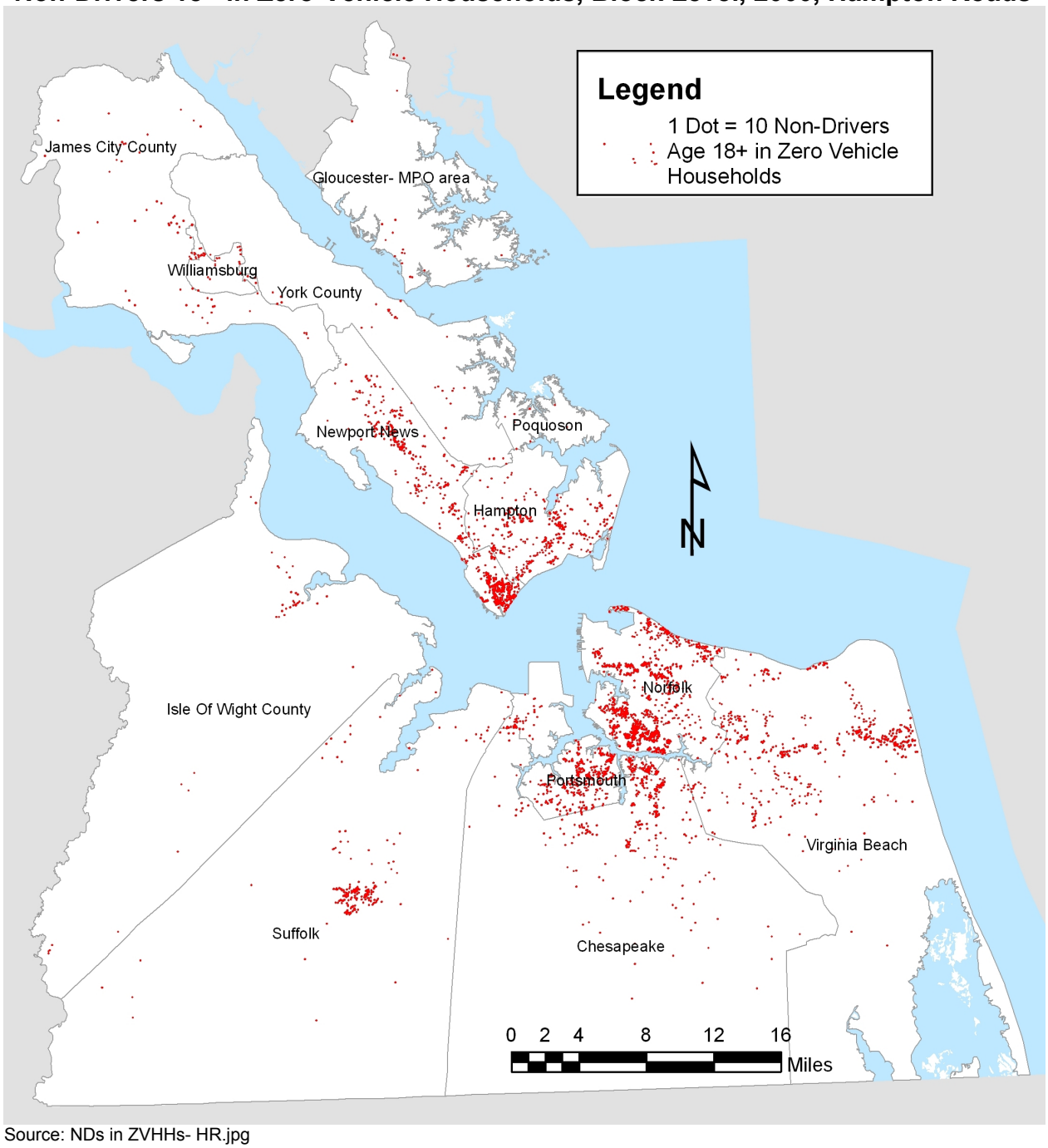
Summing the above two types of data—non-drivers in zero vehicle households and non-drivers in households with vehicle(s)—renders an estimate of *total* non-drivers in households at the block level.[13]

[13] This current estimate of total non-drivers at the block level, being based on two regressions, is considered to be more accurate than that of the TPO staff's June 2009 effort which, although accurate, relied on one regression.

MAPPING OF NON-DRIVER LOCATION DATA AT BLOCK-LEVEL BY VEHICLE AVAILABILITY

In this section, the non-driver residential locations estimated as discussed in the development section above are shown at the block level by vehicle availability. This data can be used in planning the improvement of the mobility of non-drivers on a daily basis (e.g. by the placement of nearby activity locations and bus service, as measured in earlier TPO non-driver reports) or in planning the evacuation of non-drivers in the event of a catastrophe.

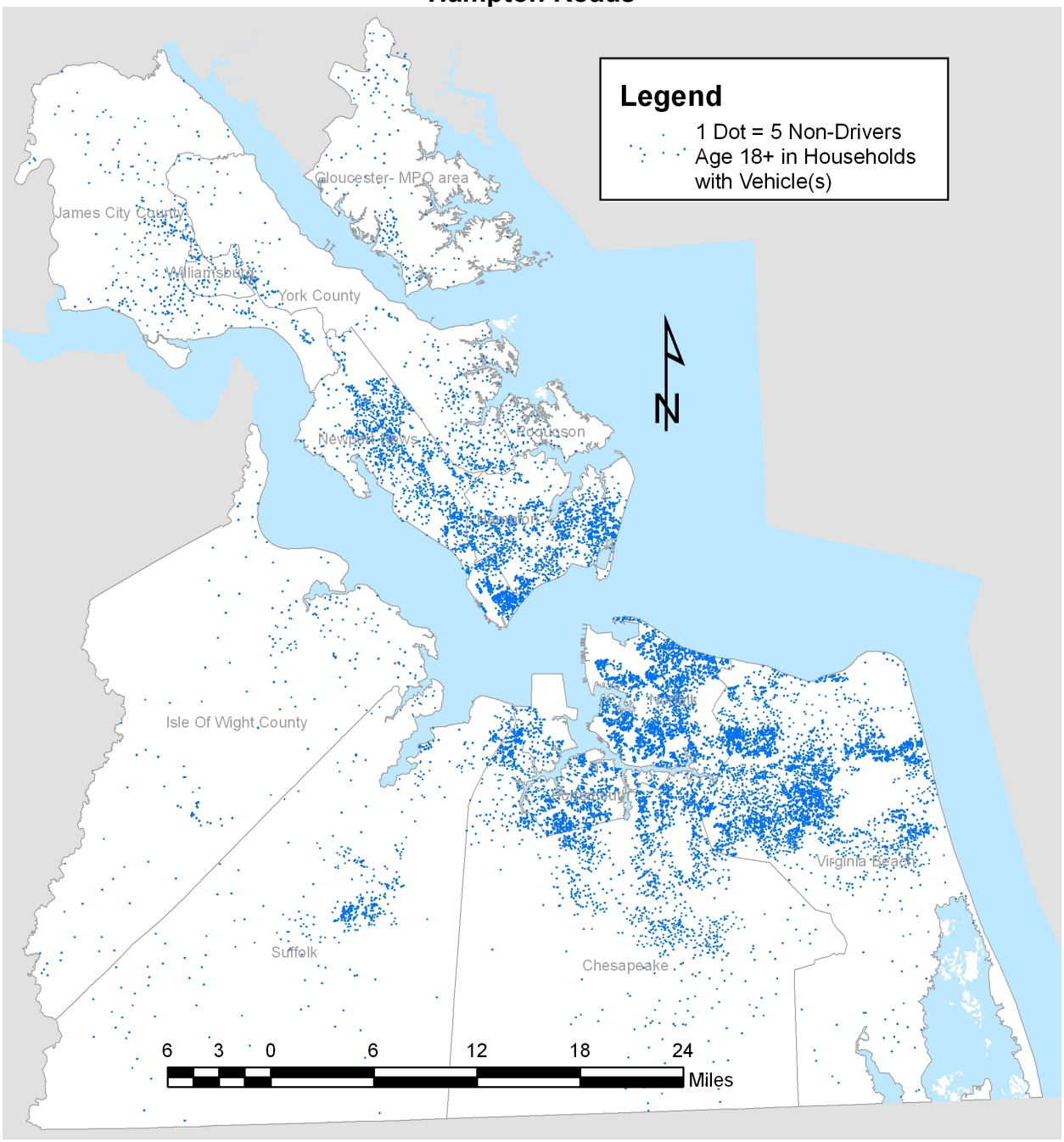
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Hampton Roads



Source: NDs in ZVHHs- HR.jpg

Non-drivers in zero-vehicle households are concentrated in specific parts of Hampton Roads.

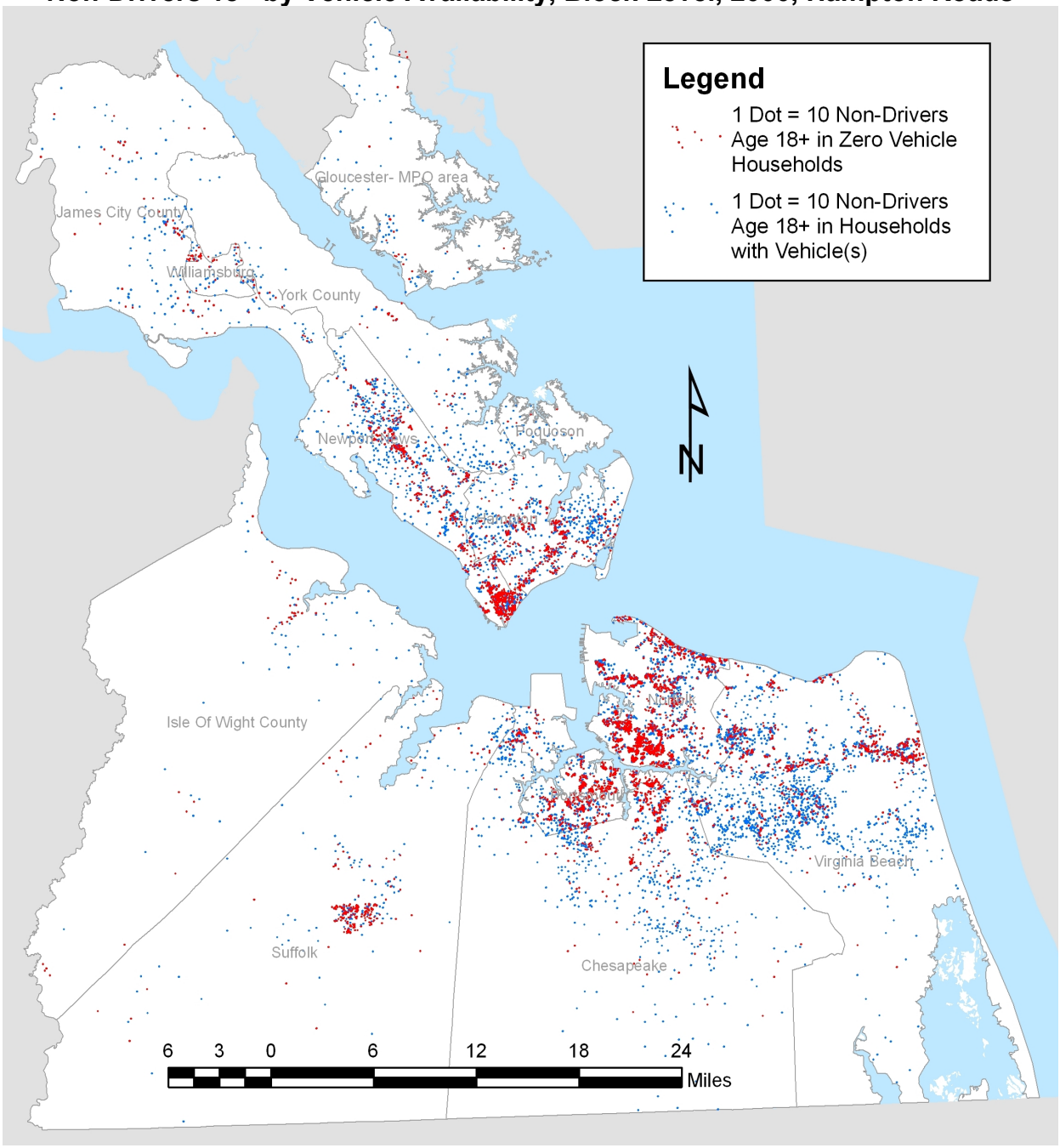
Non-Drivers 18+ in Households with Vehicle(s), Block Level, 2000, Hampton Roads



Source: NDs in HHs w Vehs- HR.jpg

Non-drivers in households with vehicle(s) are spread throughout Hampton Roads wherever occupied housing units are found.

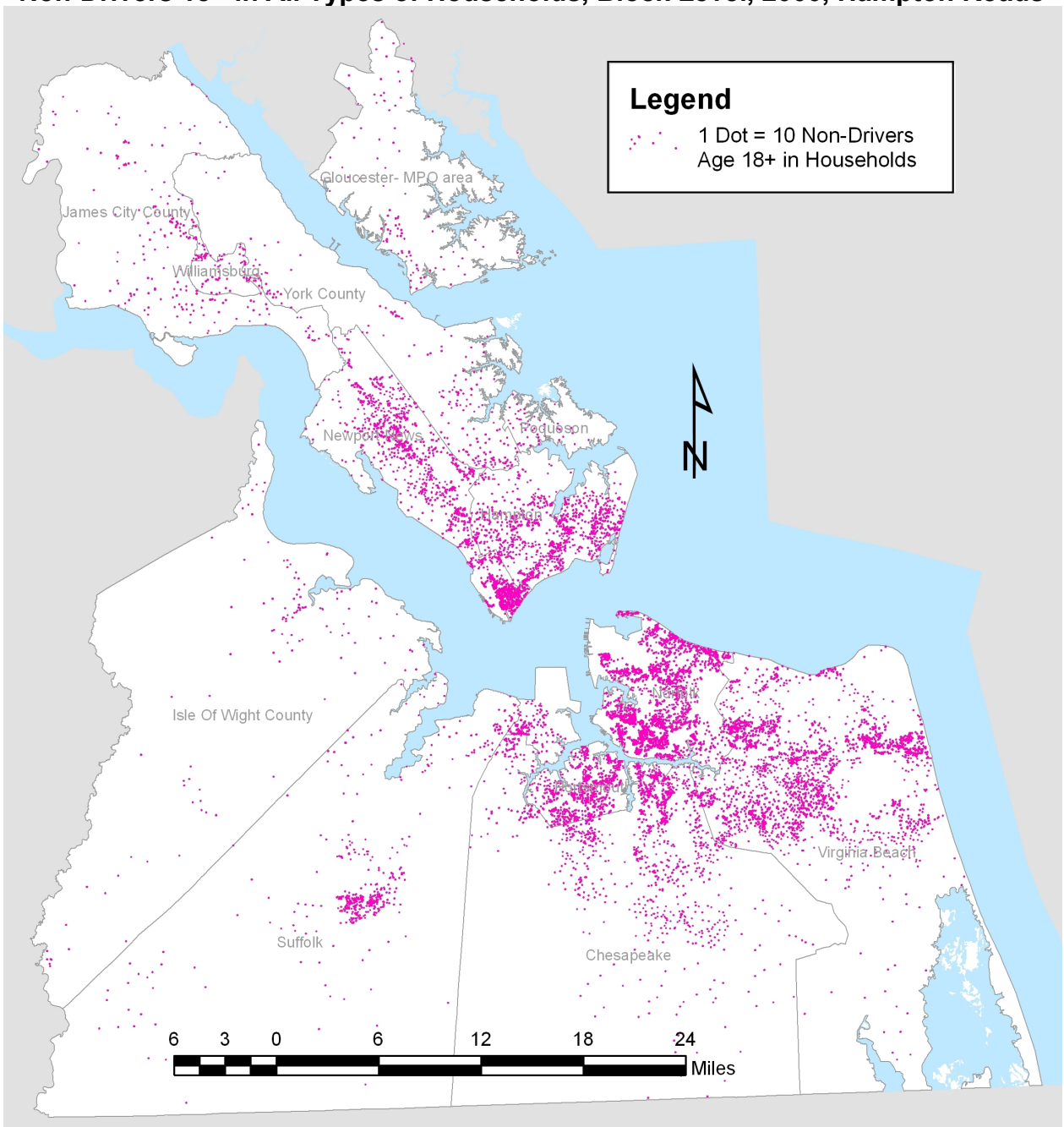
Non-Drivers 18+ by Vehicle Availability, Block Level, 2000, Hampton Roads



Source: NDs by Veh Avail- HR.jpg

This map shows how the dispersion pattern of non-drivers in zero-vehicle households differs from that of non-drivers in households with vehicle(s).

Non-Drivers 18+ in All Types of Households, Block Level, 2000, Hampton Roads



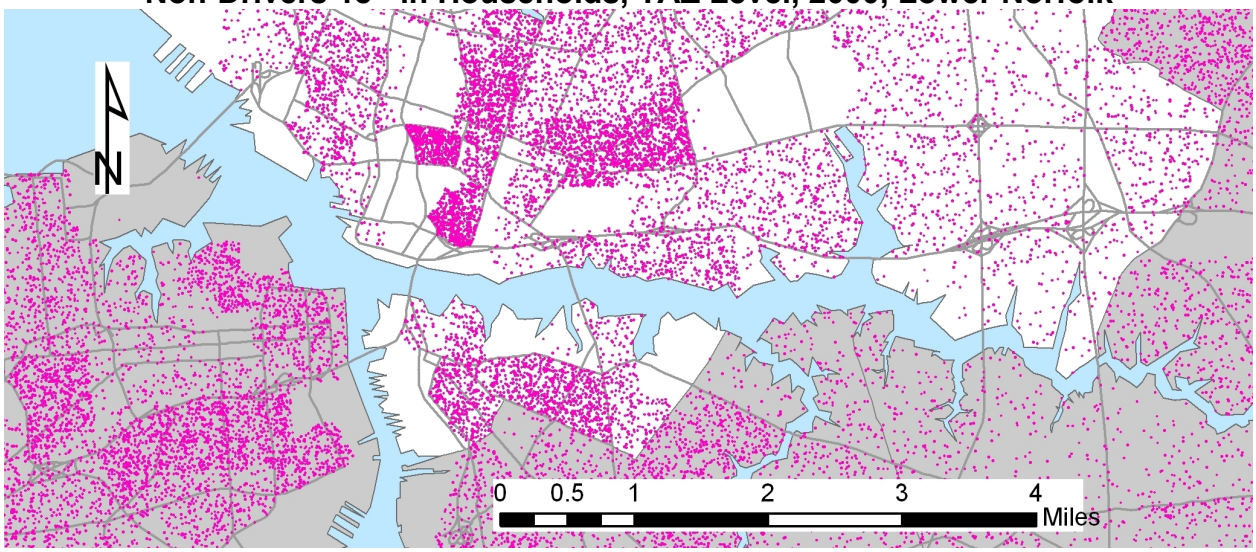
Source: NDs by Veh Avail- HR.jpg

Being comprised of all non-drivers regardless of vehicle availability, this map shows both the concentration and widespread dispersion of non-drivers in Hampton Roads.

EXAMPLE MAPS SHOWING DETAIL OF BLOCK DATA

There being approximately 20,000 blocks vs. 1,000 TAZs in Hampton Roads, mapping at the block level provides better detail, as shown by comparing the following two maps.

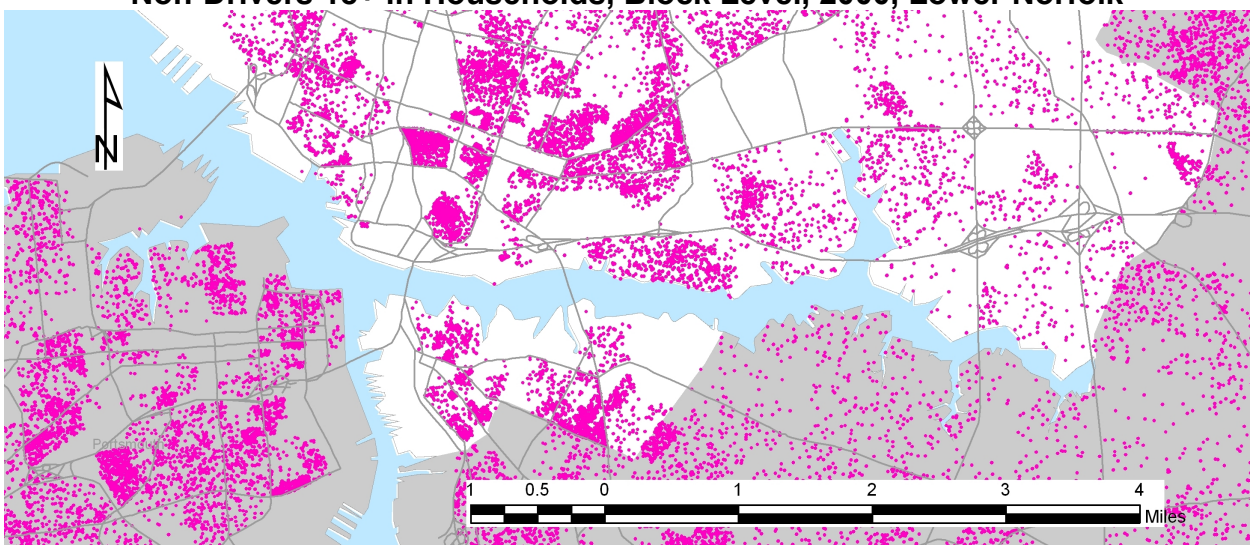
Non-Drivers 18+ in Households, TAZ Level, 2000, Lower Norfolk



Legend: 1 non-driver per dot

Source: Example Norfolk.jpg

Non-Drivers 18+ in Households, Block Level, 2000, Lower Norfolk



Legend: 1 non-driver per dot

Source: Example Norfolk at block.jpg

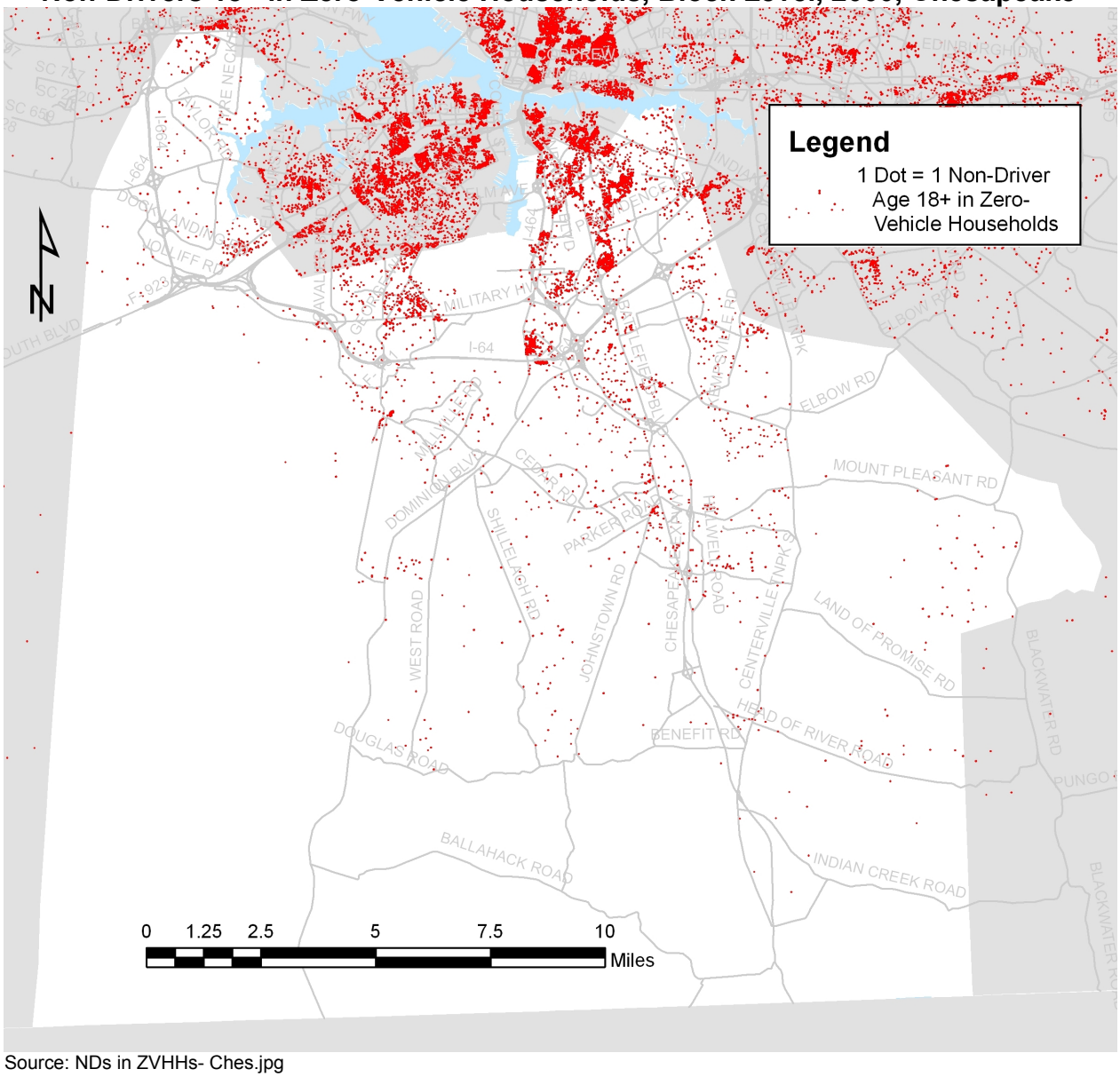
NON-DRIVER LOCATION MAPS AT BLOCK LEVEL BY VEHICLE AVAILABILITY FOR EACH HAMPTON ROADS LOCALITY

In this section, the non-driver residential locations estimated as discussed in the development section above are shown at the block level by vehicle availability for each locality. This data can be used in planning the improvement of the mobility of non-drivers on a daily basis (e.g. by the placement of nearby activity locations and bus service, as measured in earlier TPO non-driver reports) or in planning the evacuation of non-drivers in the event of a catastrophe.

Because non-drivers in households with vehicle(s) are spread across Hampton Roads and found wherever occupied housing units exist, individual locality maps which show only these non-drivers will not be provided in this document. All data—both the locations of non-drivers in ZVHHs and the location of non-drivers in households with vehicle(s)—will be, however, available from the HRTPO website.

Chesapeake

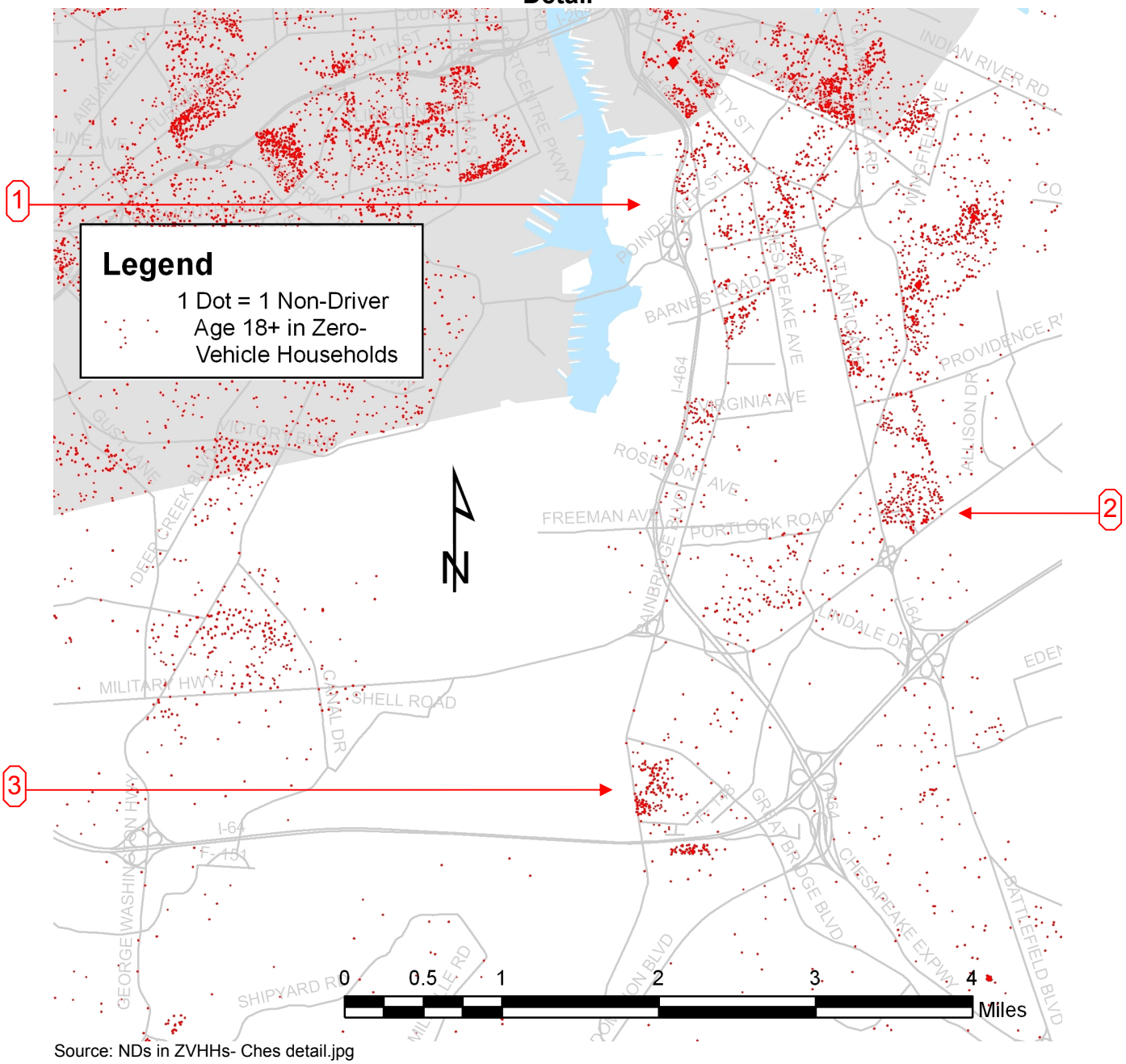
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Chesapeake



Source: NDs in ZVHHs- Ches.jpg

Non-drivers in zero-vehicle households in Chesapeake are mostly located north of I-64.

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Chesapeake-Detail

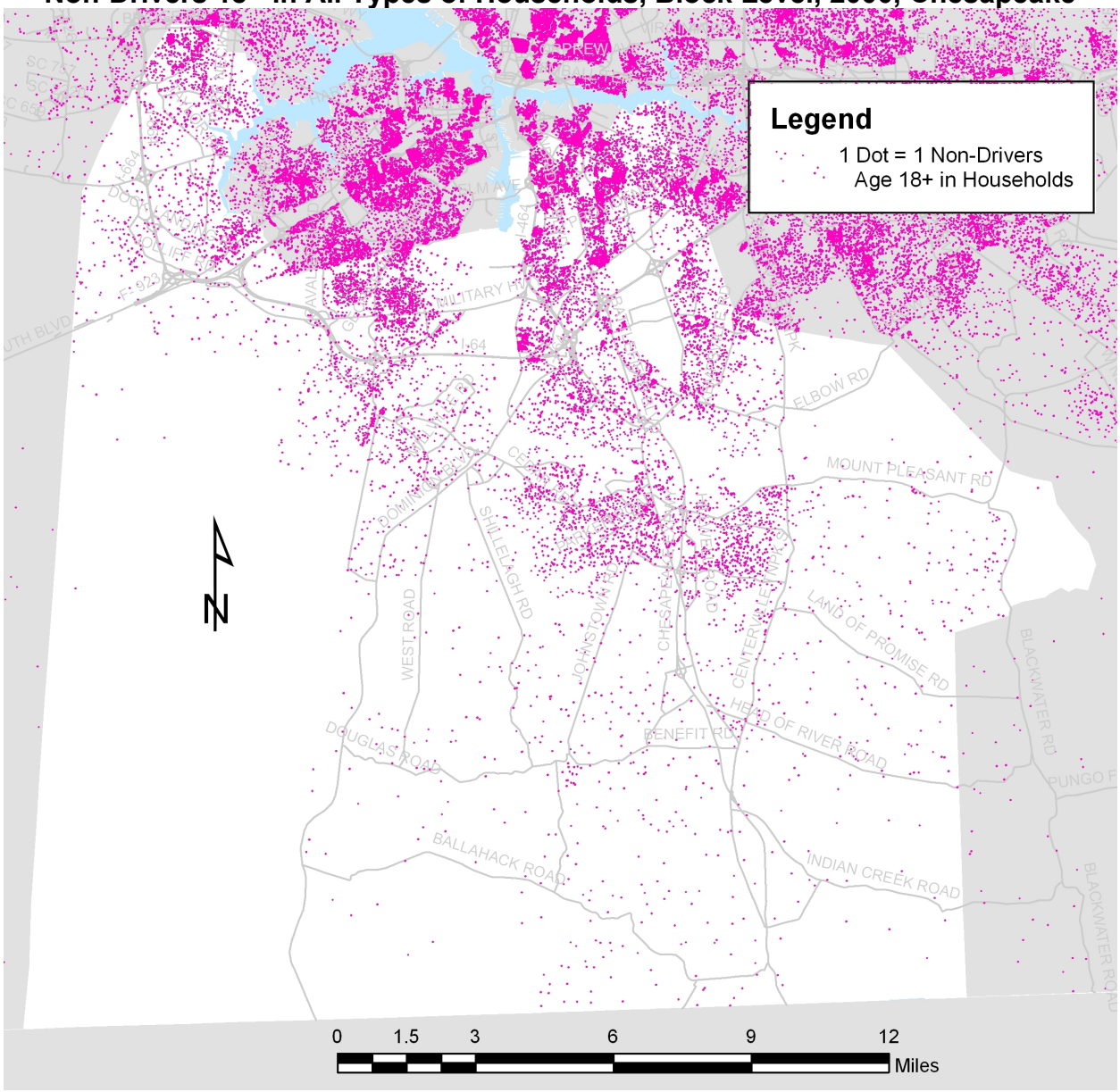


Source: NDs in ZVHHs- Ches detail.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in northern Chesapeake including:

1. South Norfolk
2. Robert Hall Blvd area
3. Crestwood

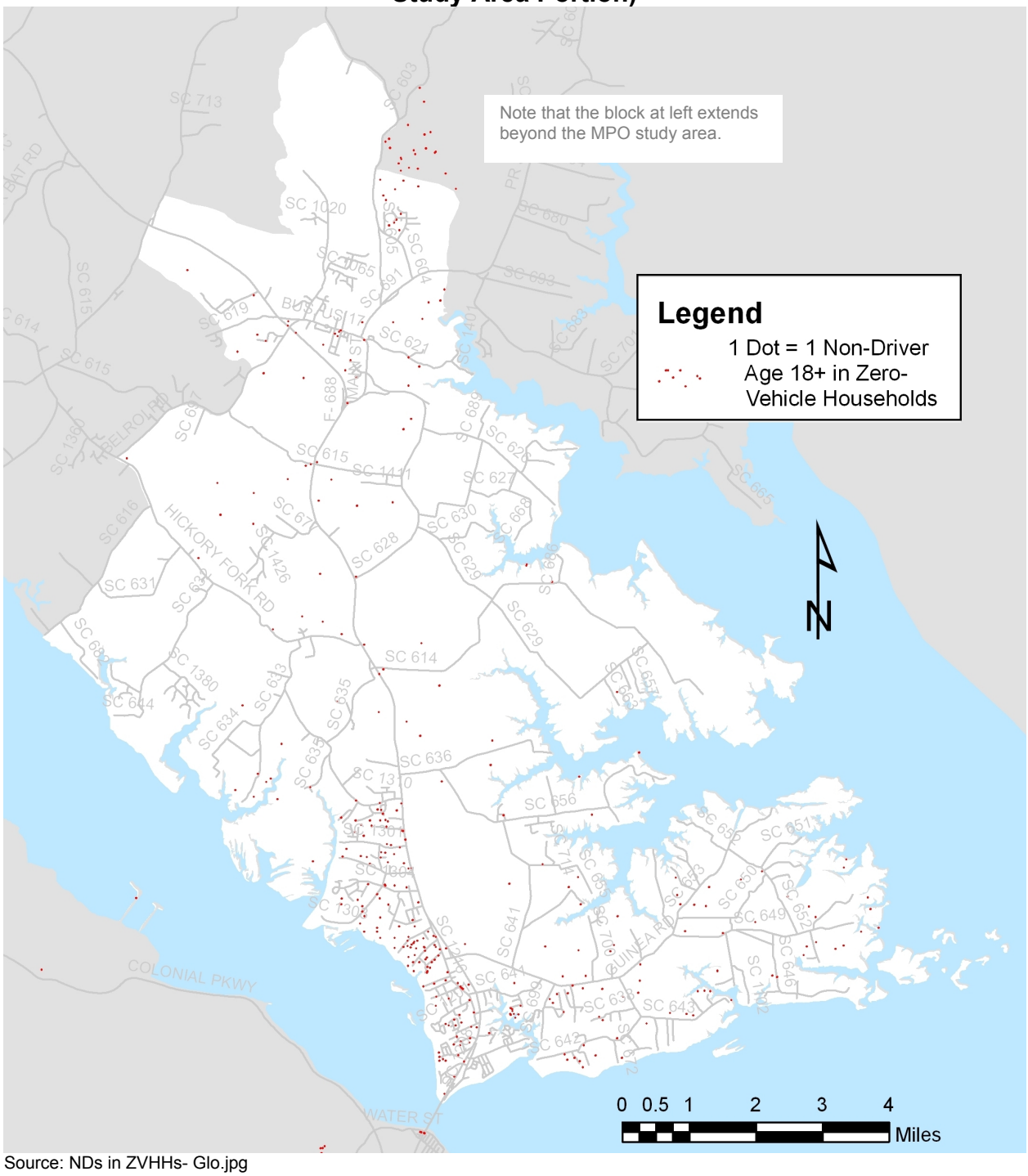
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Chesapeake



Source: NDs by block- Ches.jpg

Gloucester (MPO Study Area Portion)

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Gloucester (MPO Study Area Portion)



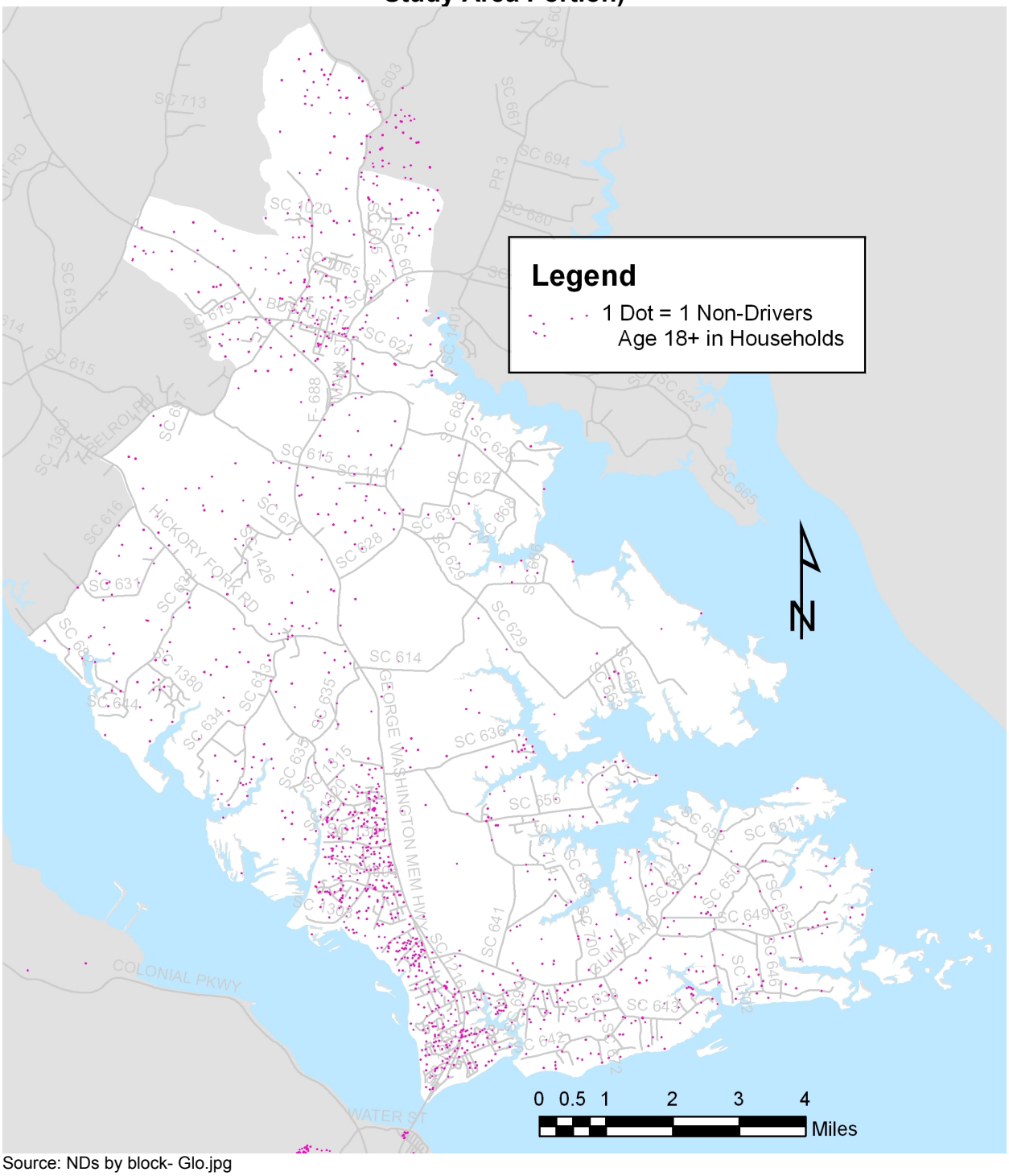
Source: NDs in ZVHHs- Glo.jpg

Non-drivers in zero-vehicle households in Gloucester are mostly located west of US 17 in the southern portion of the county.

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Gloucester-Detail

Source: NDs in ZVHHs- Glo detail.jpg

Non-Drivers 18+ in All Types of Households, Block Level, 2000, Gloucester (MPO Study Area Portion)

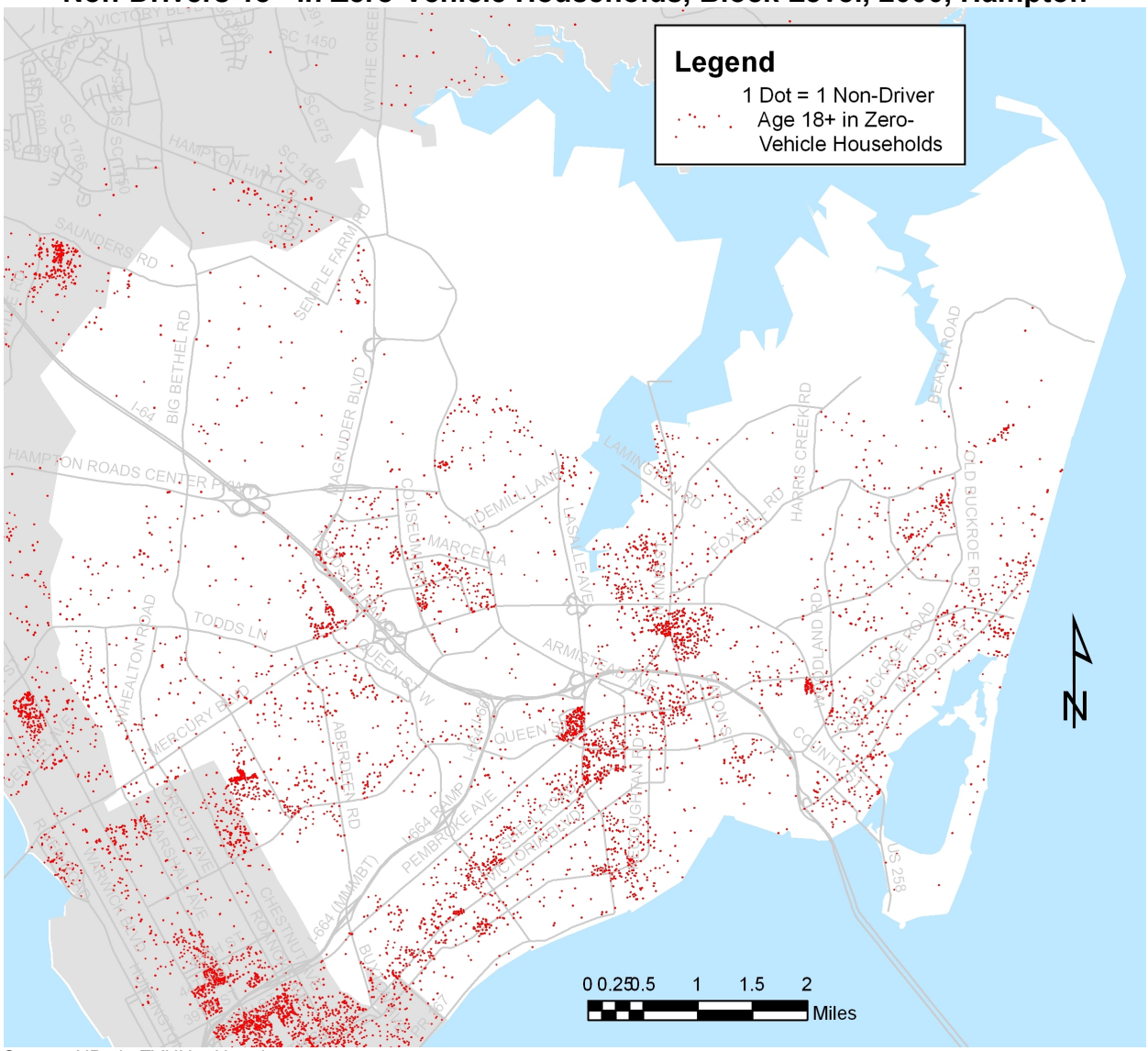


Source: NDs by block- Glo.jpg

According to the above map, there is a large group of total non-drivers (i.e. in households of all vehicle-availability types) in southern Gloucester and a moderate number of non-drivers in the courthouse area.

Hampton

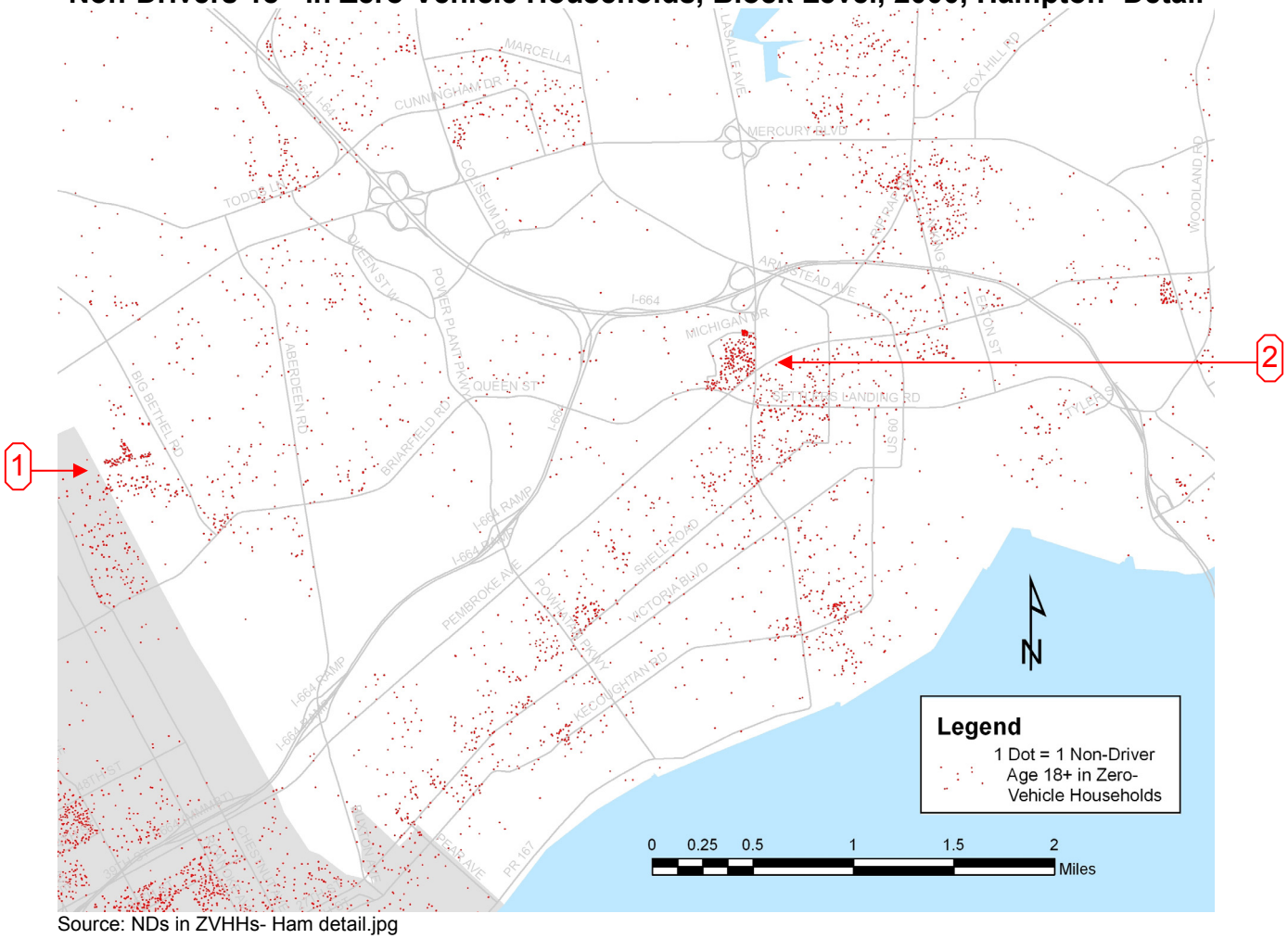
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Hampton



Source: NDs in ZVHHs- Ham.jpg

There are groups of non-drivers in zero-vehicle households in various places across Hampton.

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Hampton- Detail

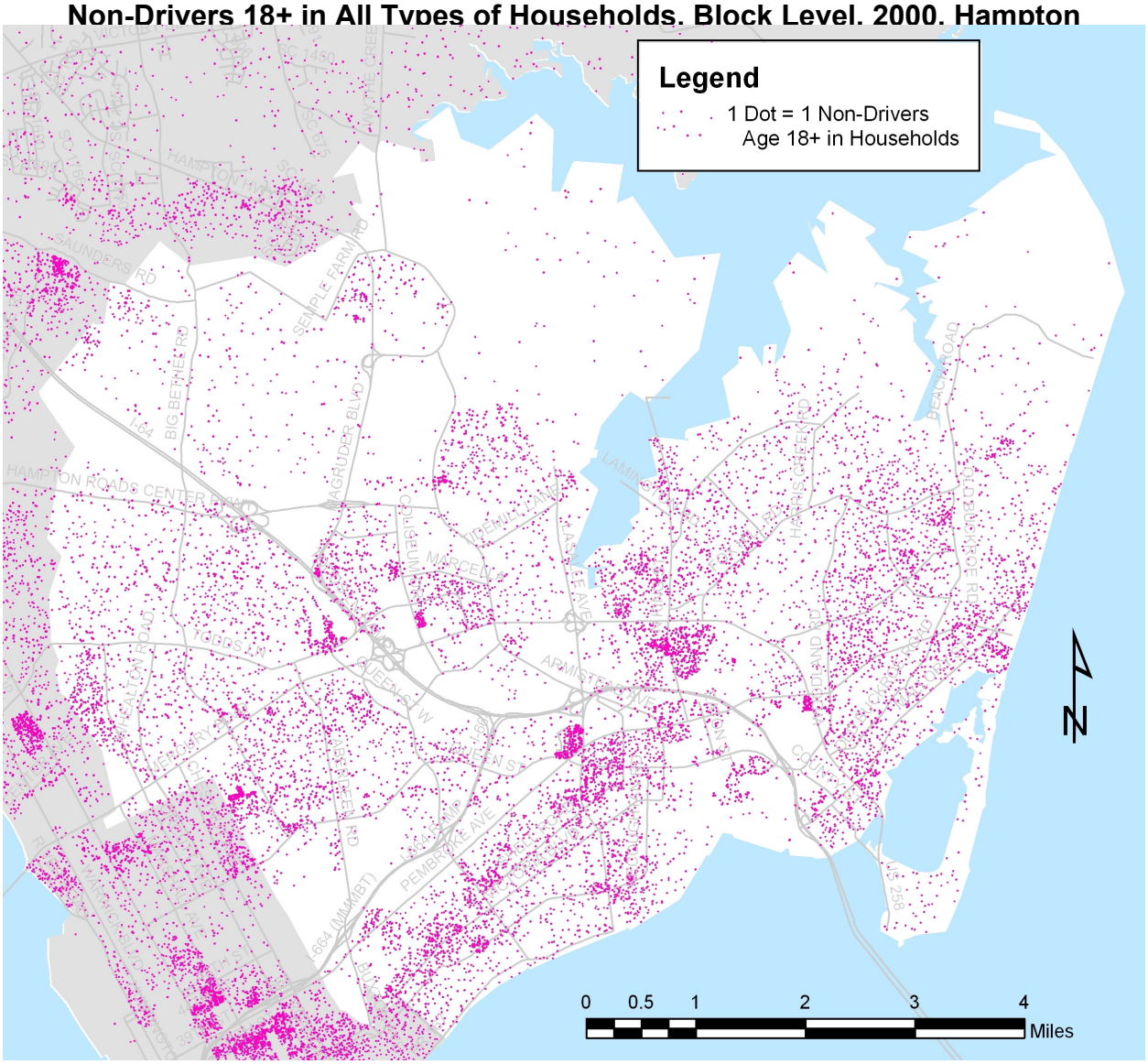


Source: NDs in ZVHHs- Ham detail.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in southern Hampton including:

1. Northampton Village
2. Queens Terrace

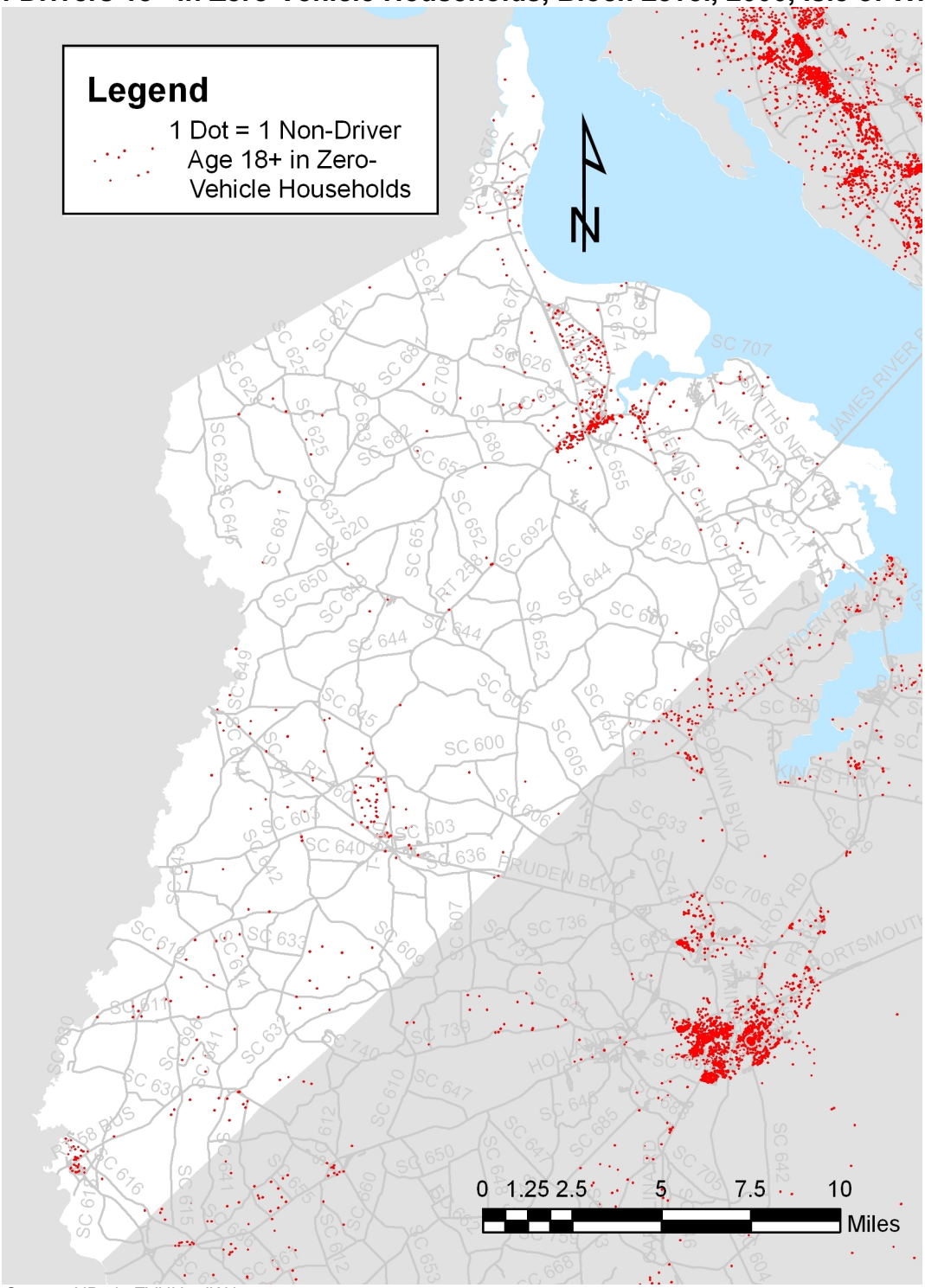
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Hampton



Source: NDs by block- Ham.jpg

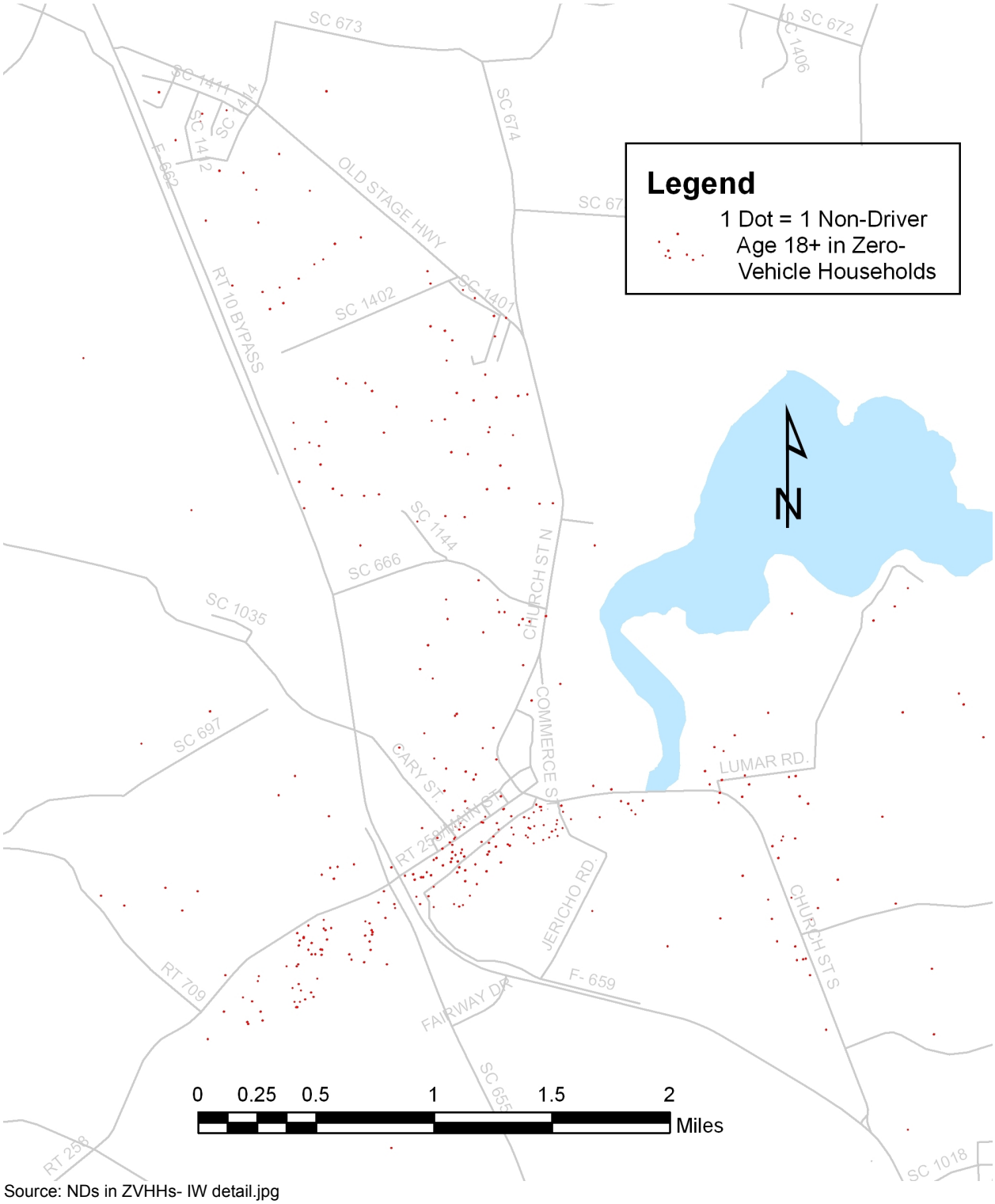
Isle of Wight

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Isle of Wight



Source: NDs in ZVHHs- IW.jpg

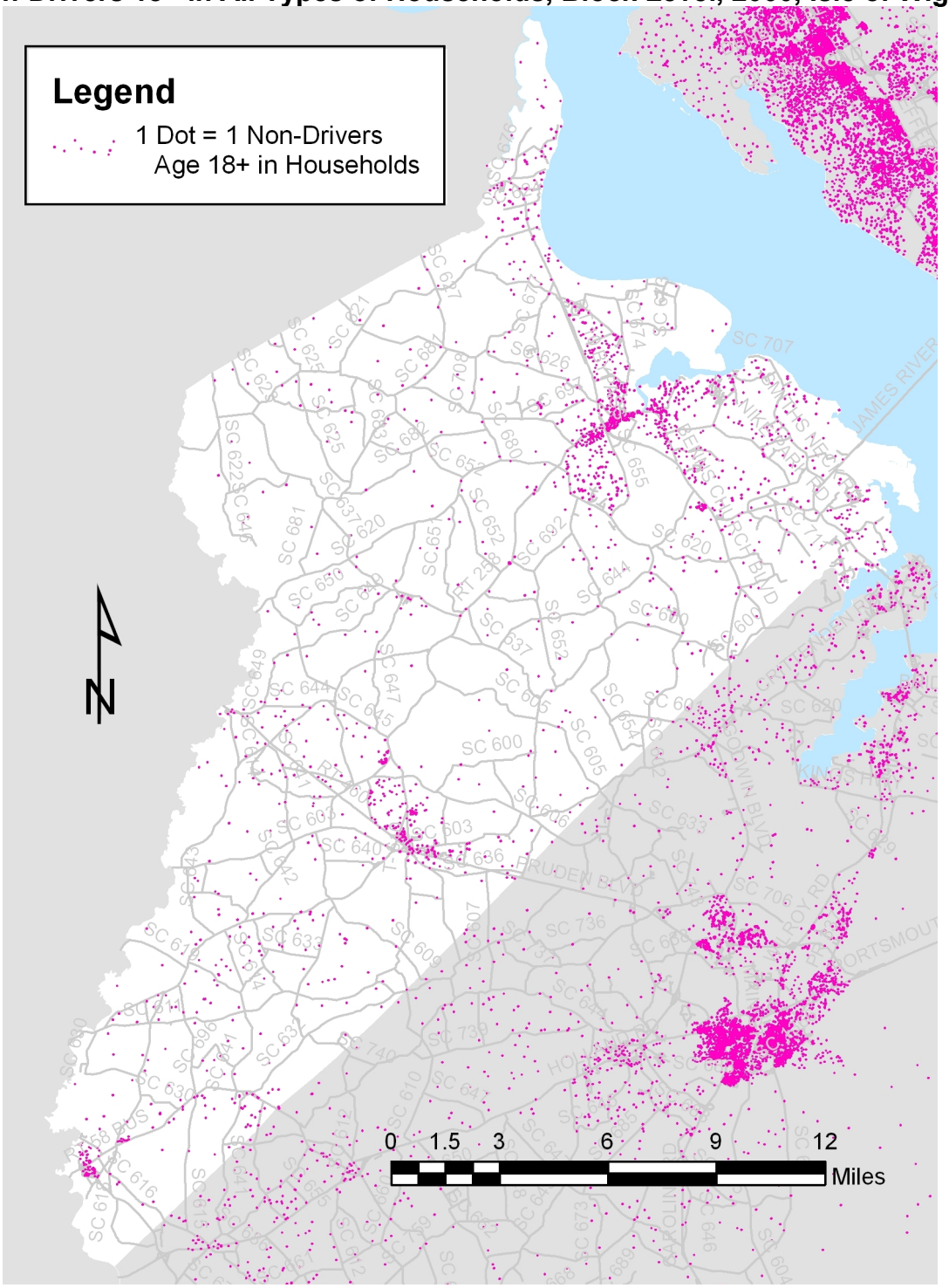
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Isle of Wight- Detail



Source: NDs in ZVHHs- IW detail.jpg

According to the above map, there is a concentration of non-drivers in zero-vehicle households near Main St (Rte 258) in Smithfield.

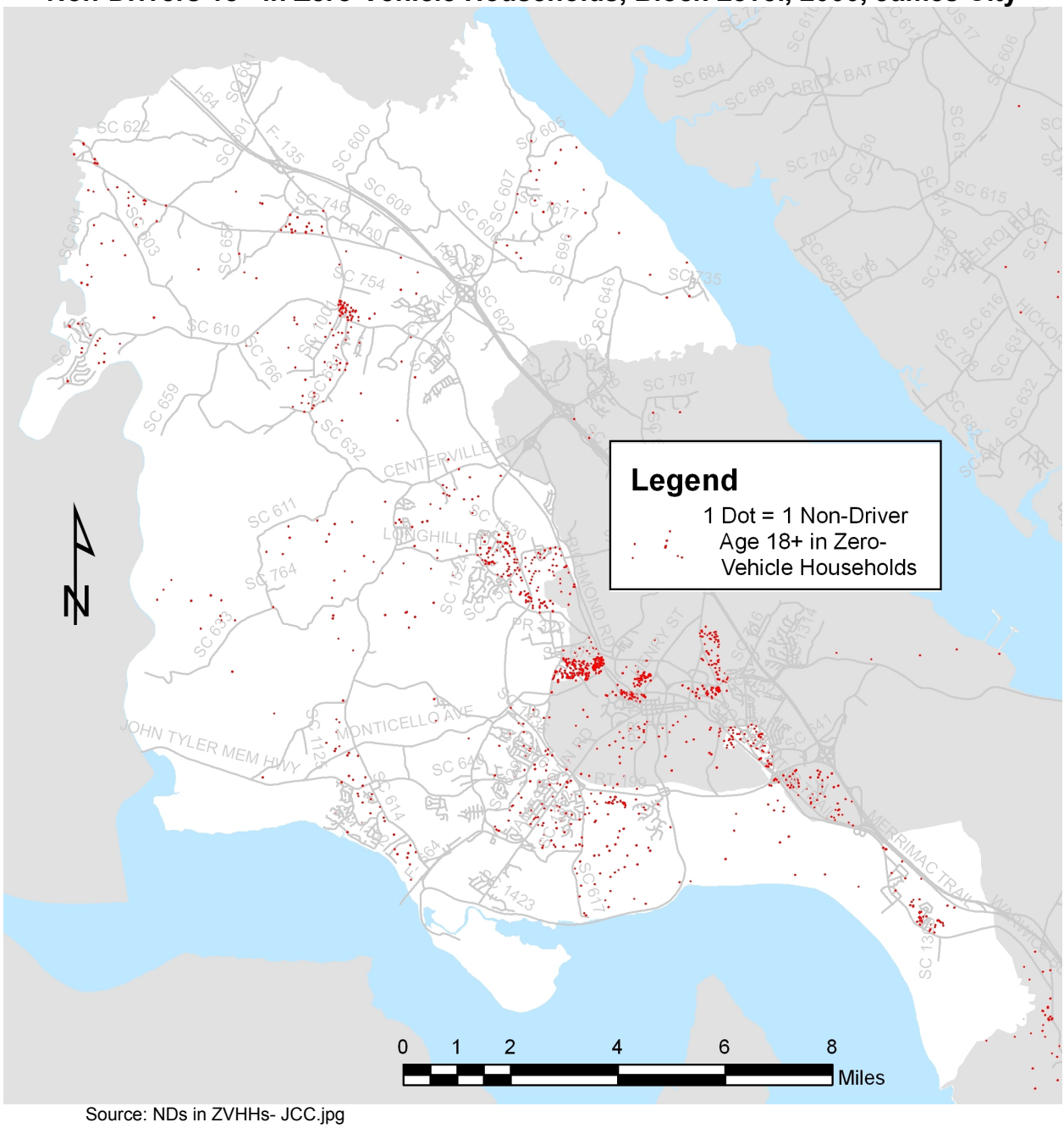
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Isle of Wight



Source: NDs by block- IW.jpg

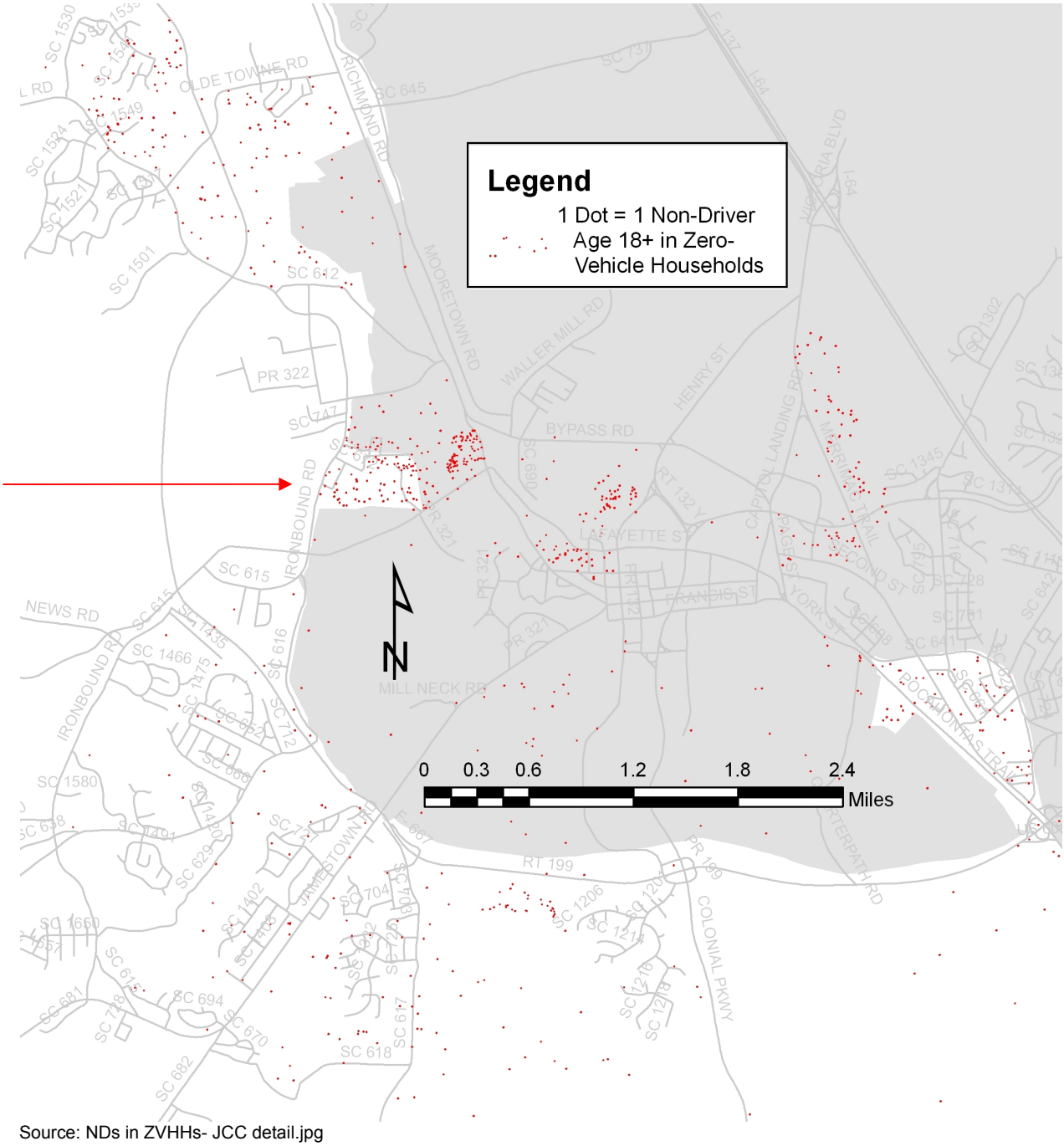
James City

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, James City



Source: NDs in ZVHHs- JCC.jpg

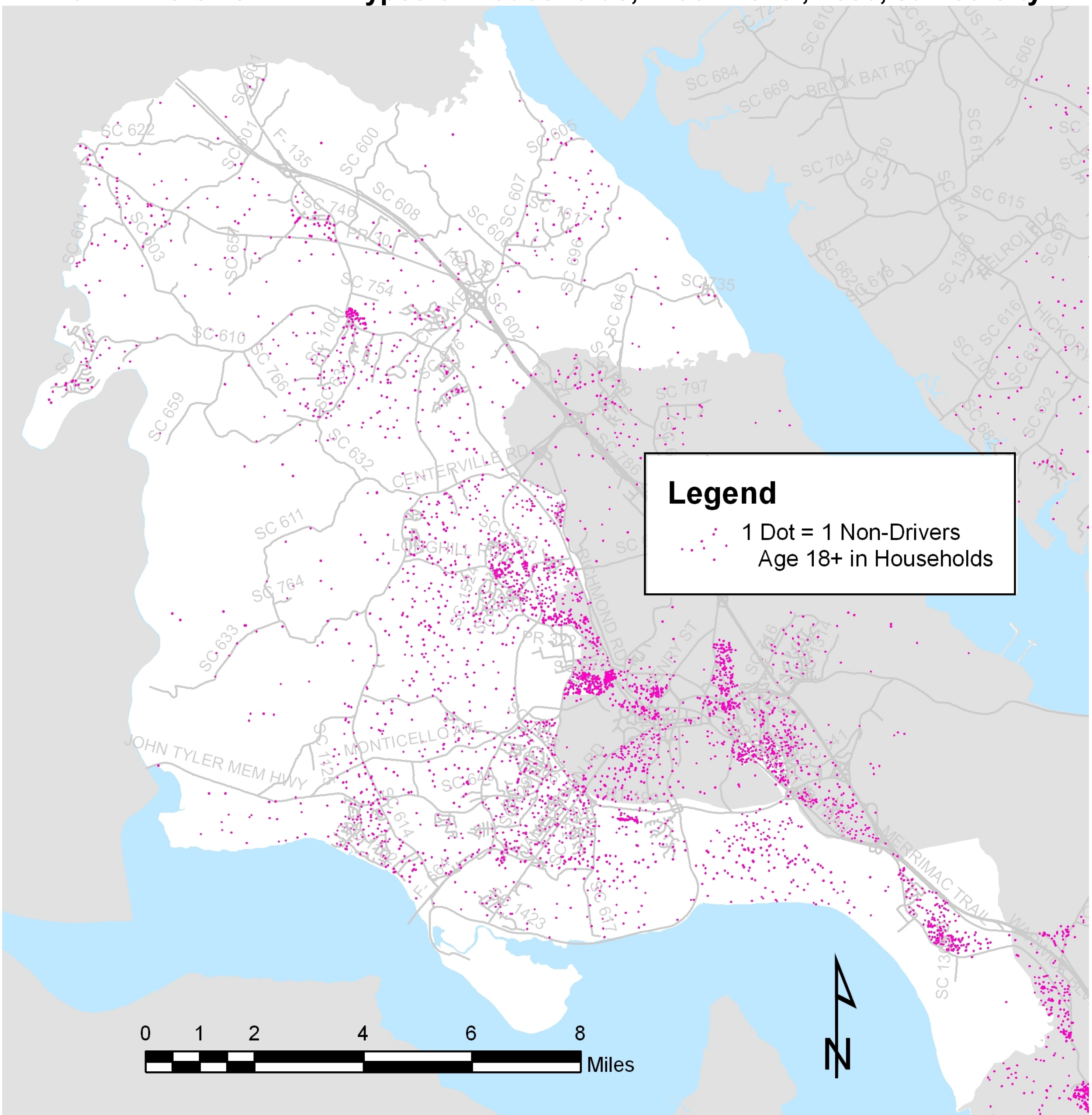
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, James City- Detail



Source: NDs in ZVHHs- JCC detail.jpg

According to the above map, there is a concentration of non-drivers in zero-vehicle households in James City near Williamsburg at Carriage Heights / Chambrel.

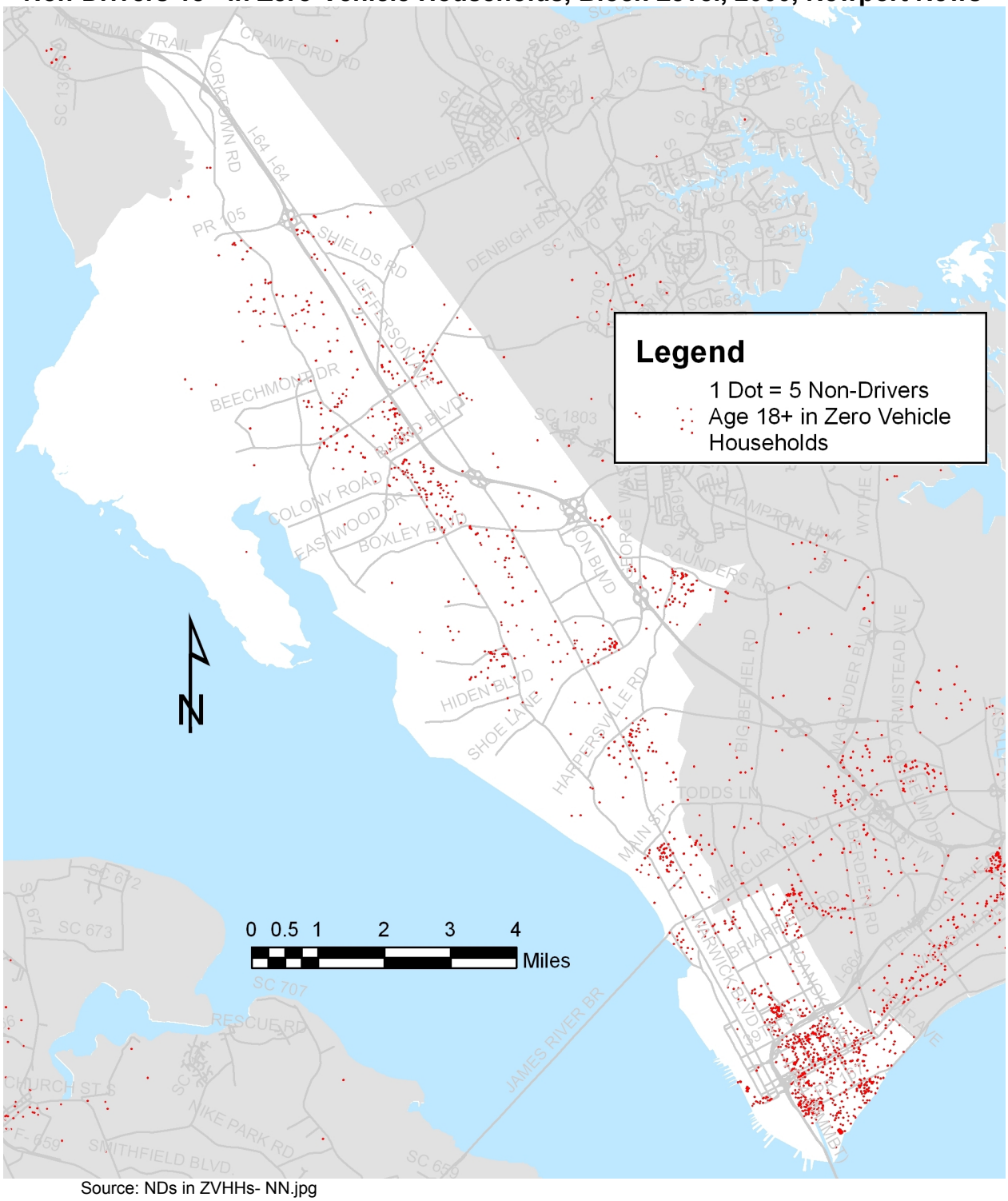
Non-Drivers 18+ in All Types of Households, Block Level, 2000, James City



Source: NDs by block- JCC.jpg

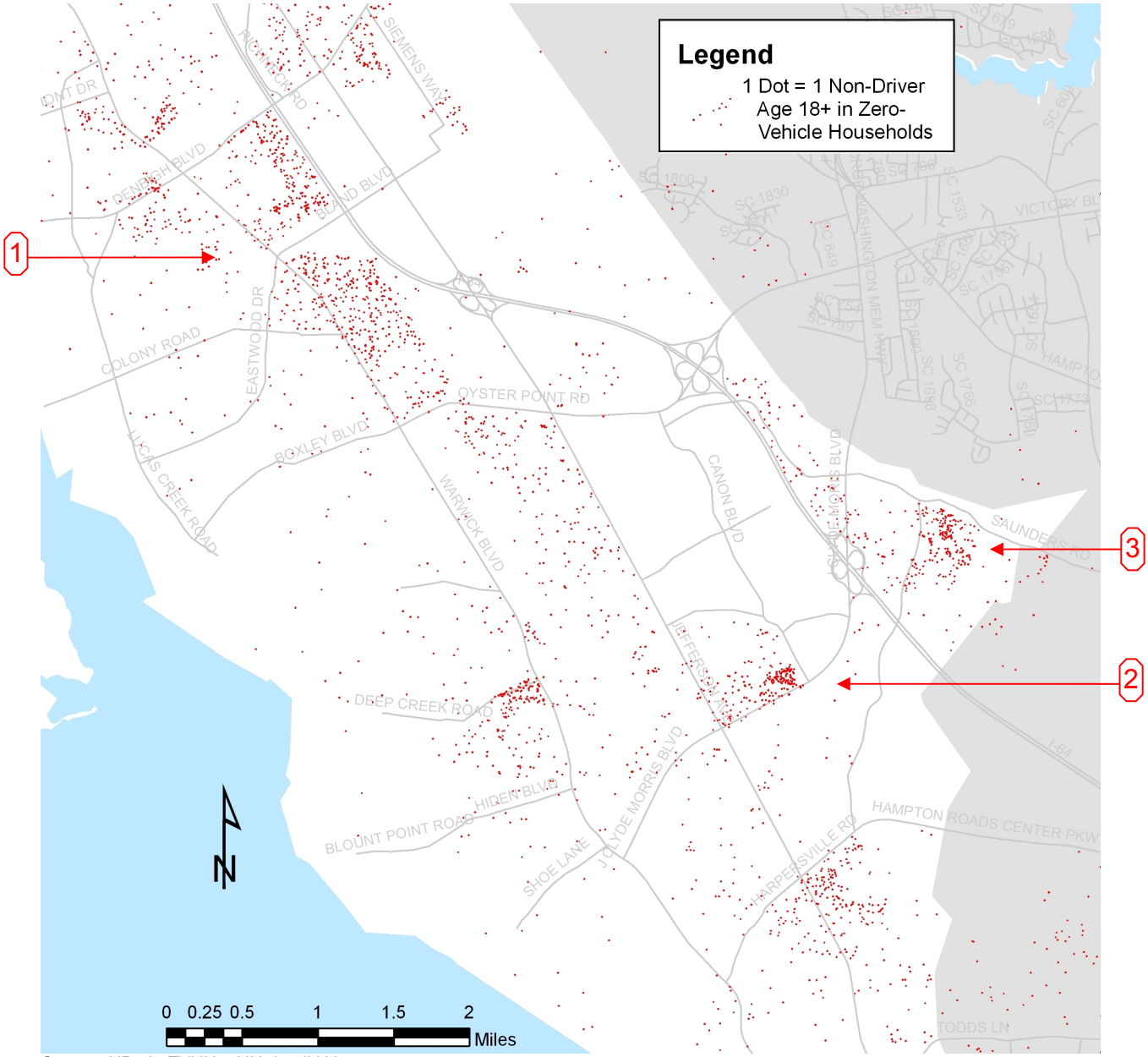
Newport News

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Newport News



Source: NDs in ZVHHs- NN.jpg

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Newport News- Detail

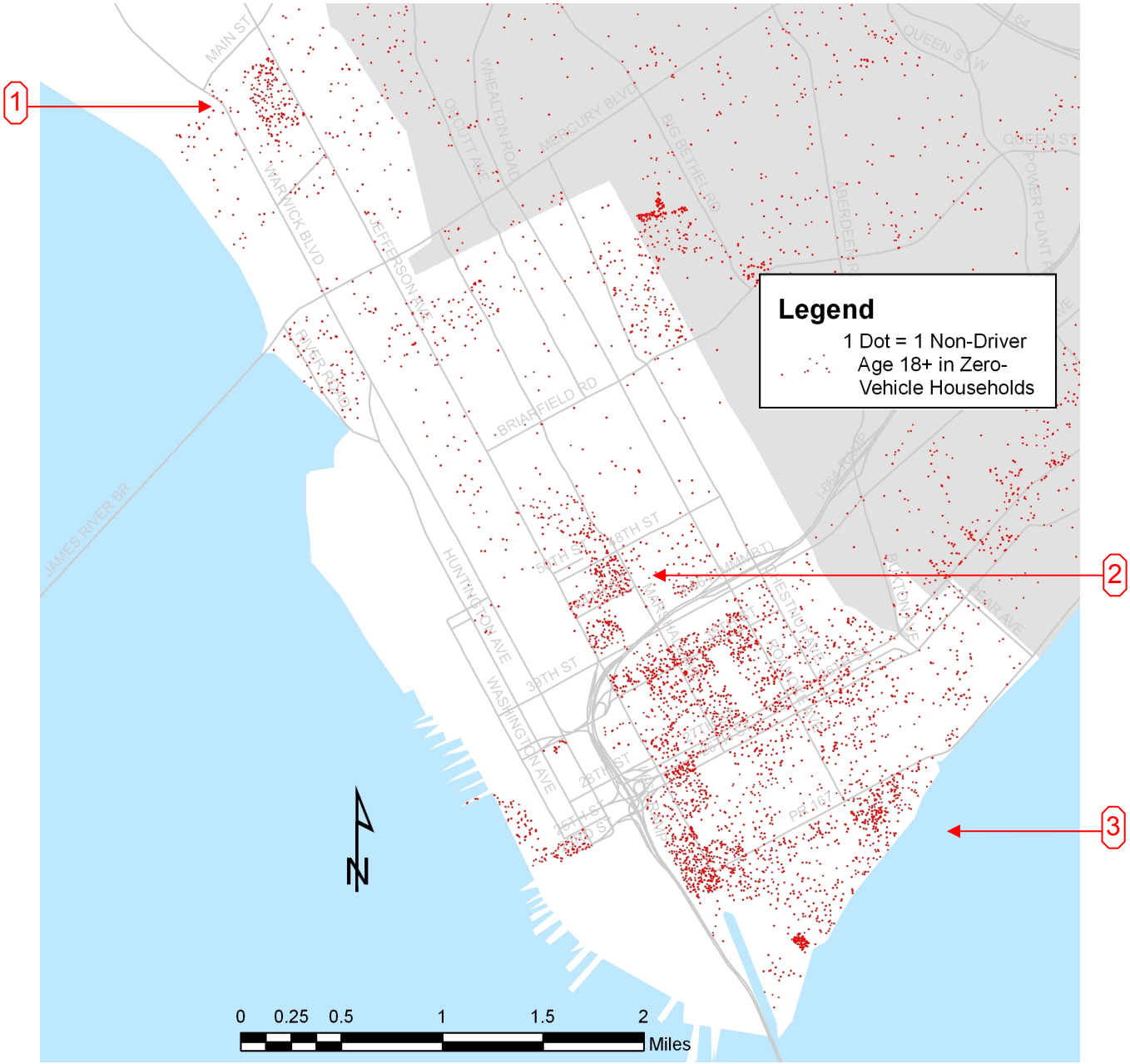


Source: NDs in ZVHHs- NN detail N.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in Newport News including:

1. Area bounded by Denbigh Blvd, CSX r/r, Youngs Mill Ln, and Warwick Blvd
2. Jefferson East
3. Harper Woods

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Newport News- Detail

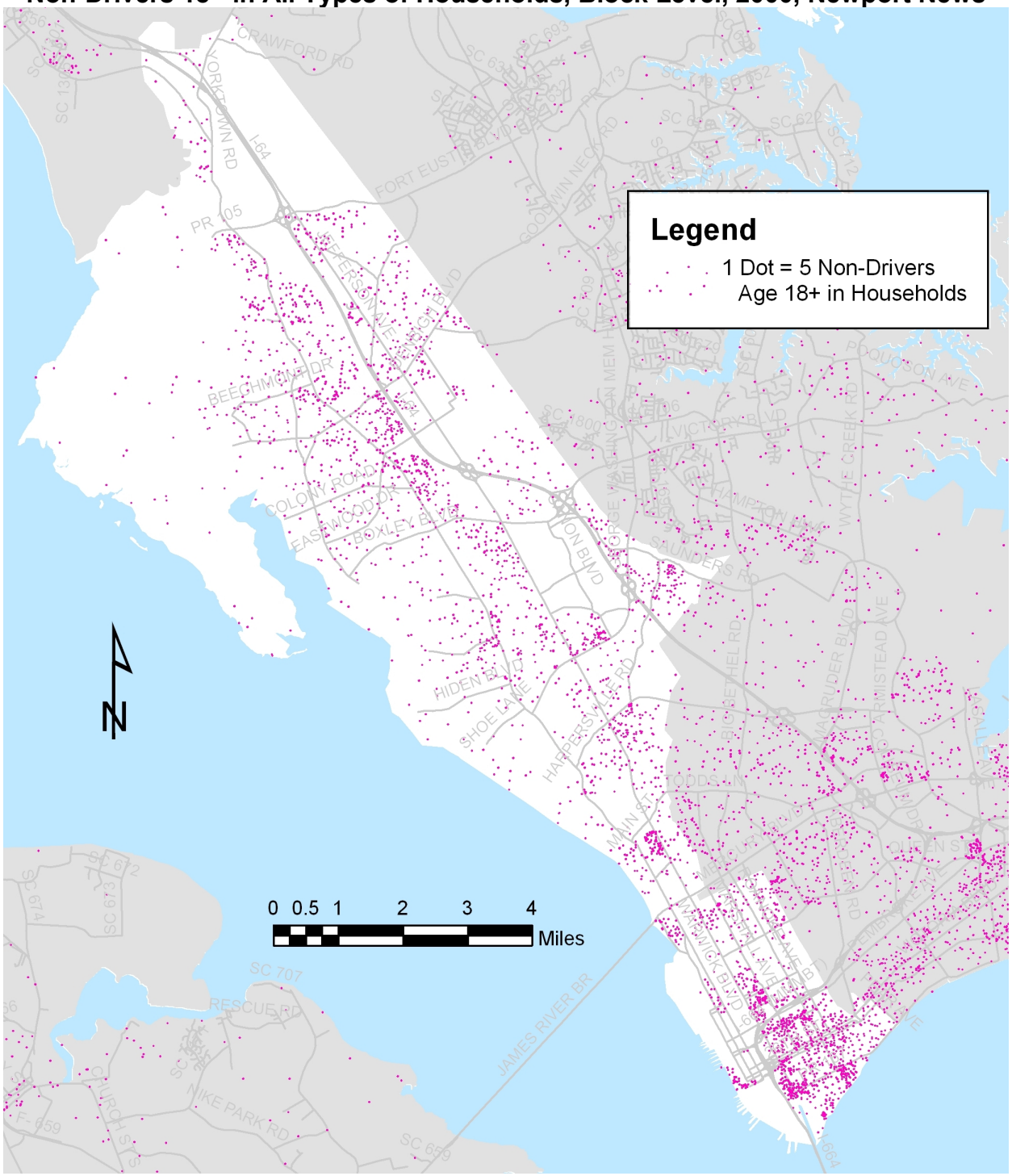


Source: NDs in ZVHHs- NN detail S.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in Newport News including:

1. Area west of Jefferson Ave and south of Main St
2. Area bounded by Jefferson Ave, 48th St, Marshall Ave, 39th St
3. East End

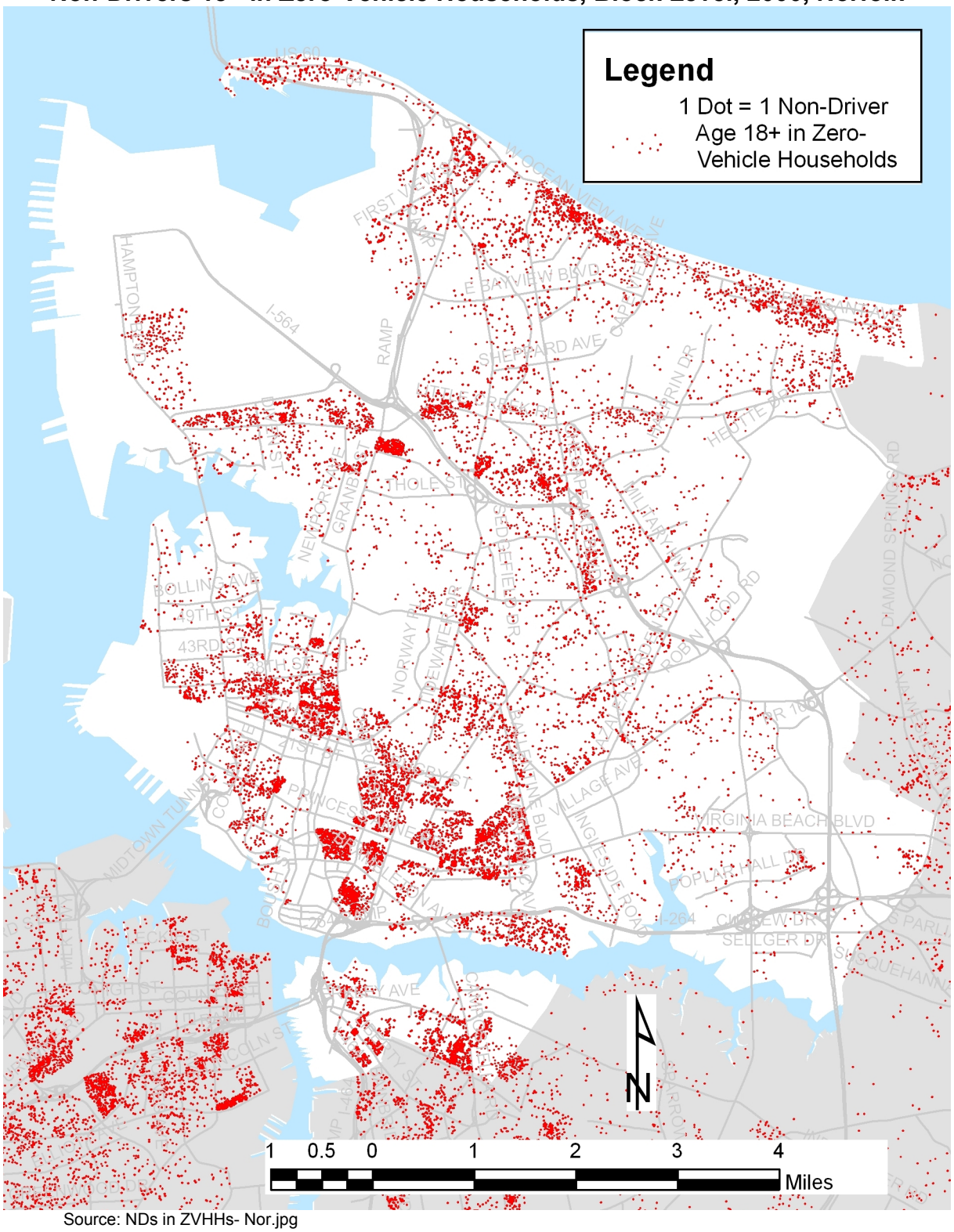
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Newport News



Source: NDs by block- NN.jpg

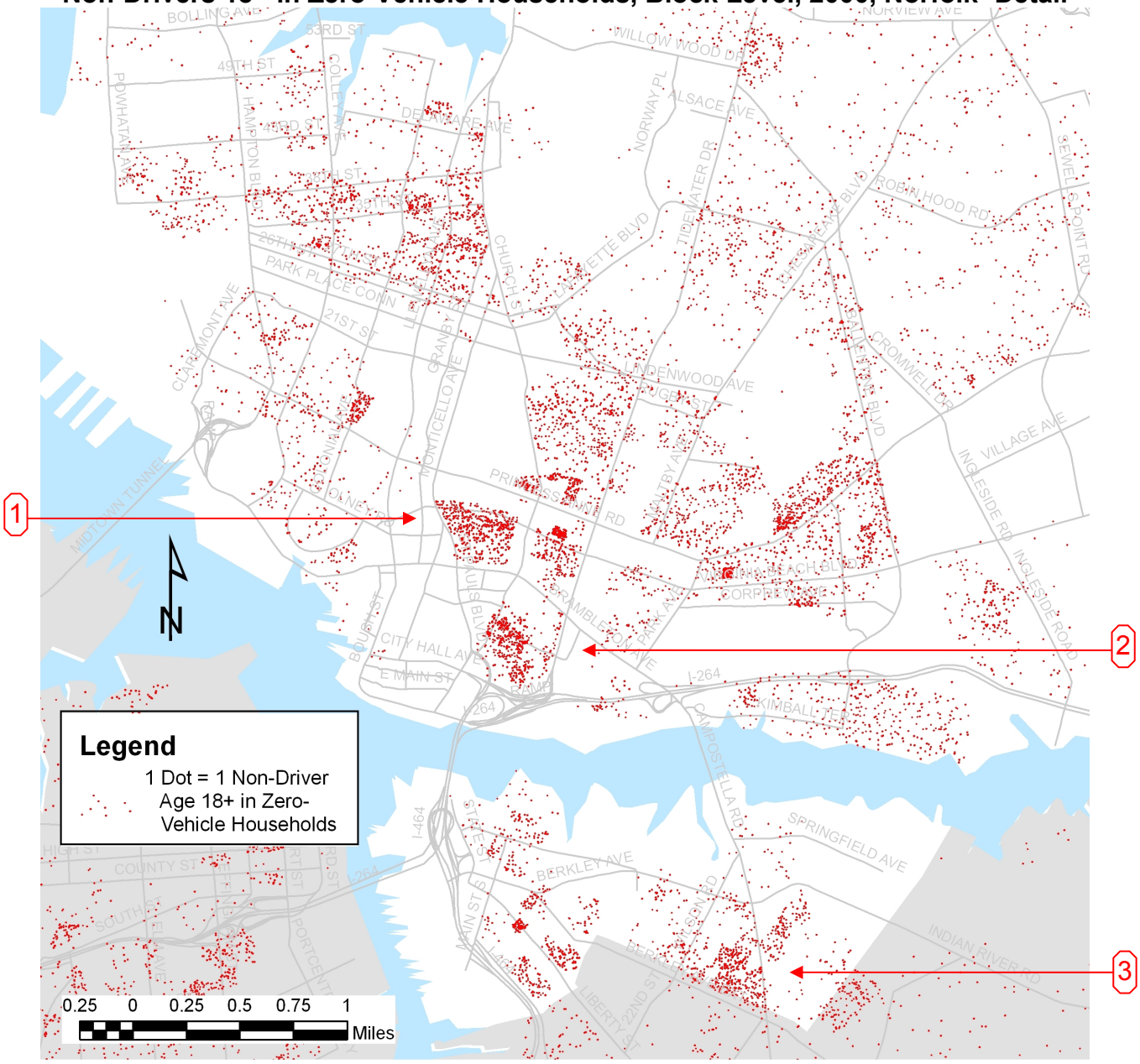
Norfolk

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Norfolk



Source: NDs in ZVHHs- Nor.jpg

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Norfolk- Detail

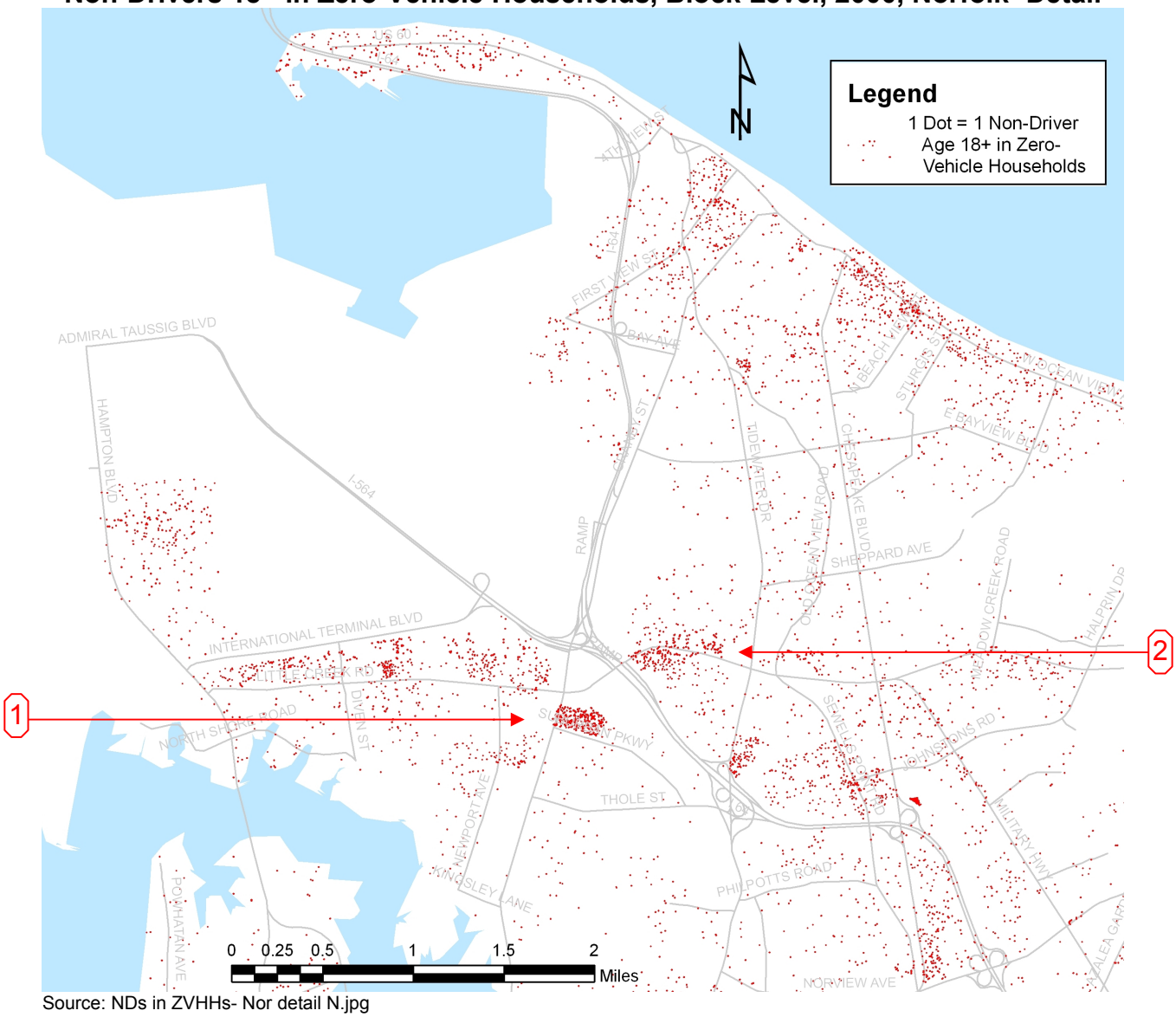


Source: NDs in ZVHHs- Nor detail S.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in southern Norfolk including:

1. Young Terrace
2. Tidewater Park
3. Diggs Park

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Norfolk- Detail

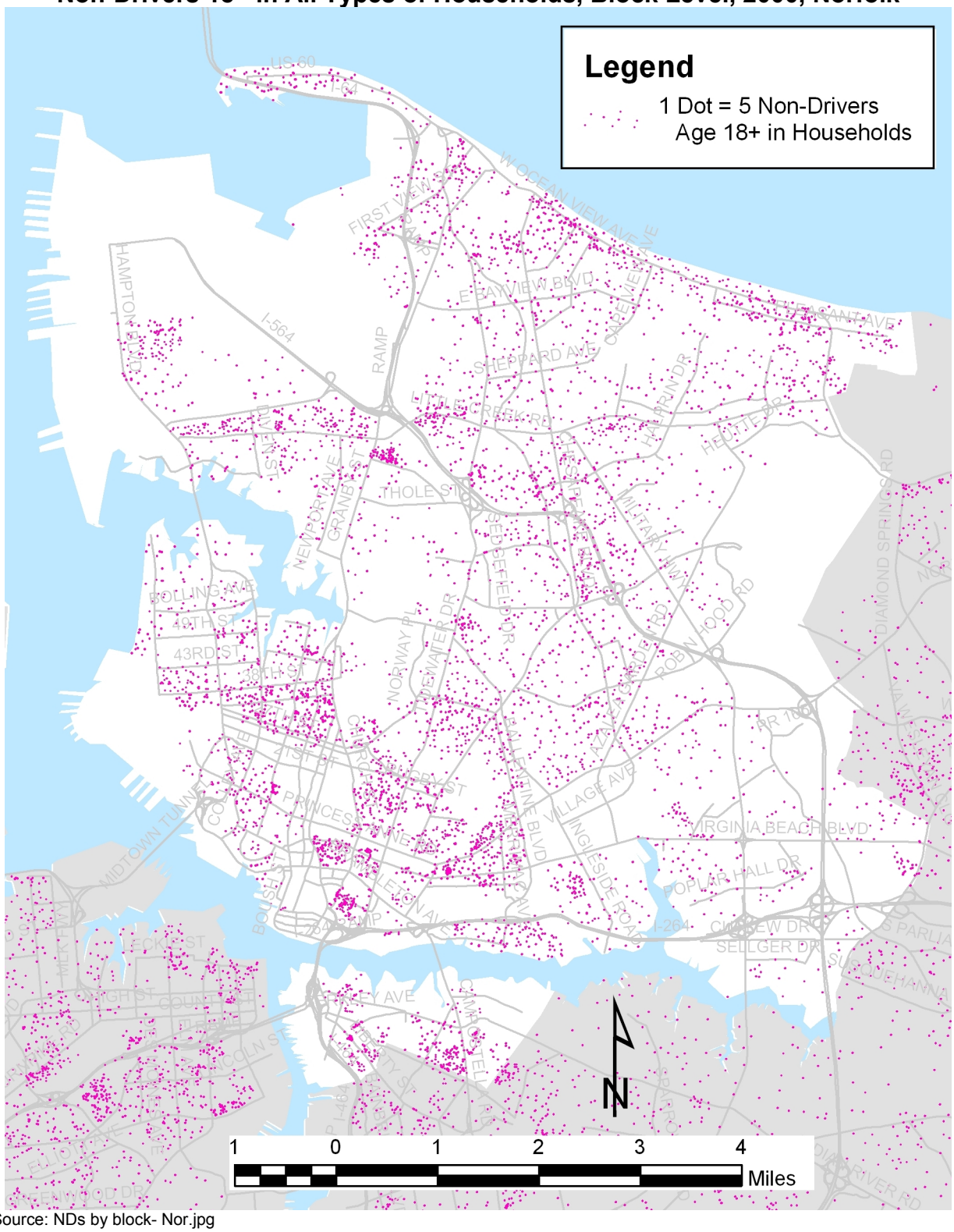


Source: NDs in ZVHHs- Nor detail N.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in northern Norfolk including:

1. Cromwell Pkwy vicinity
2. East Little Creek Rd vicinity (between I-64 and Tidewater Dr)

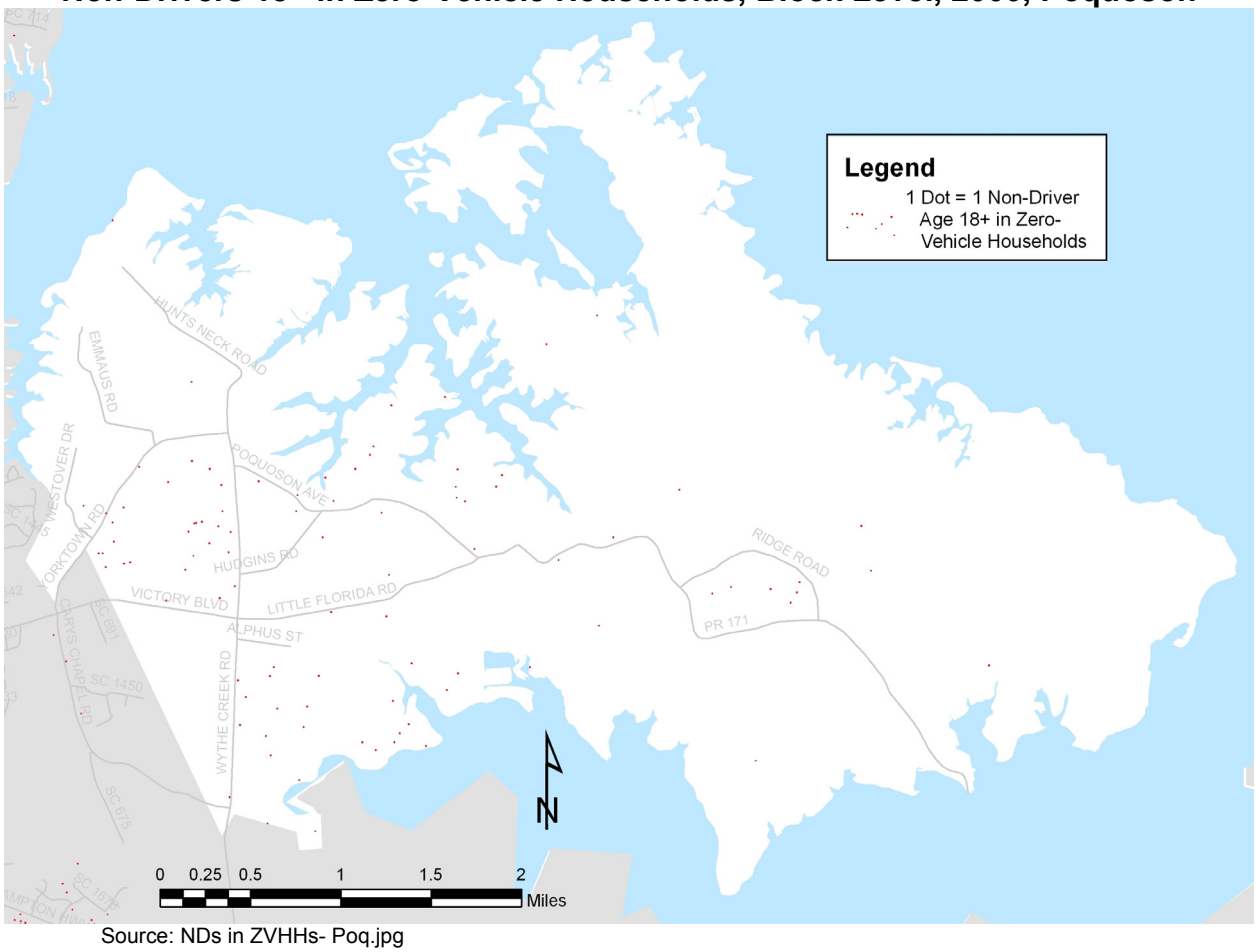
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Norfolk



Source: NDs by block- Nor.jpg

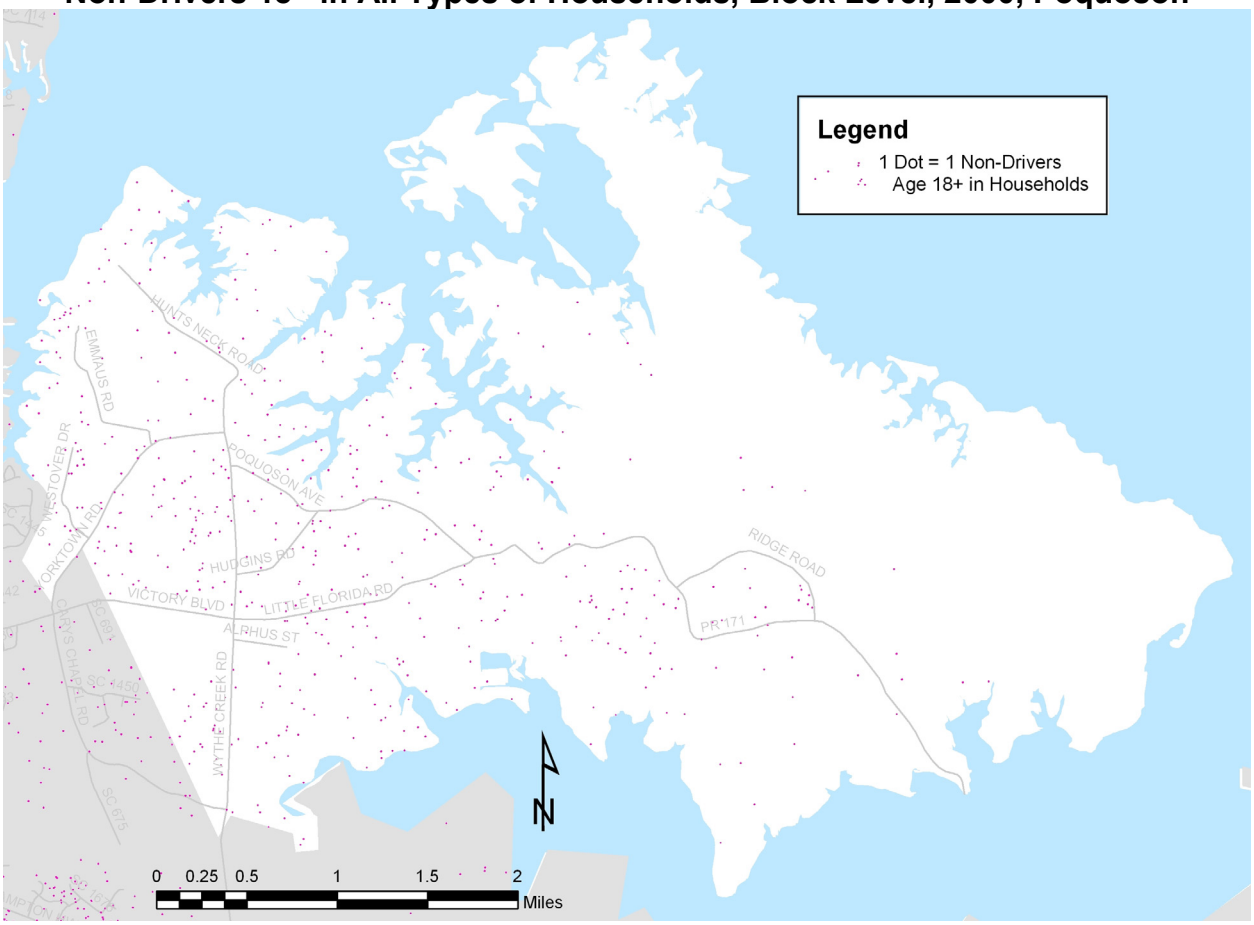
Poquoson

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Poquoson



Source: NDs in ZVHHs- Poq.jpg

Non-Drivers 18+ in All Types of Households, Block Level, 2000, Poquoson

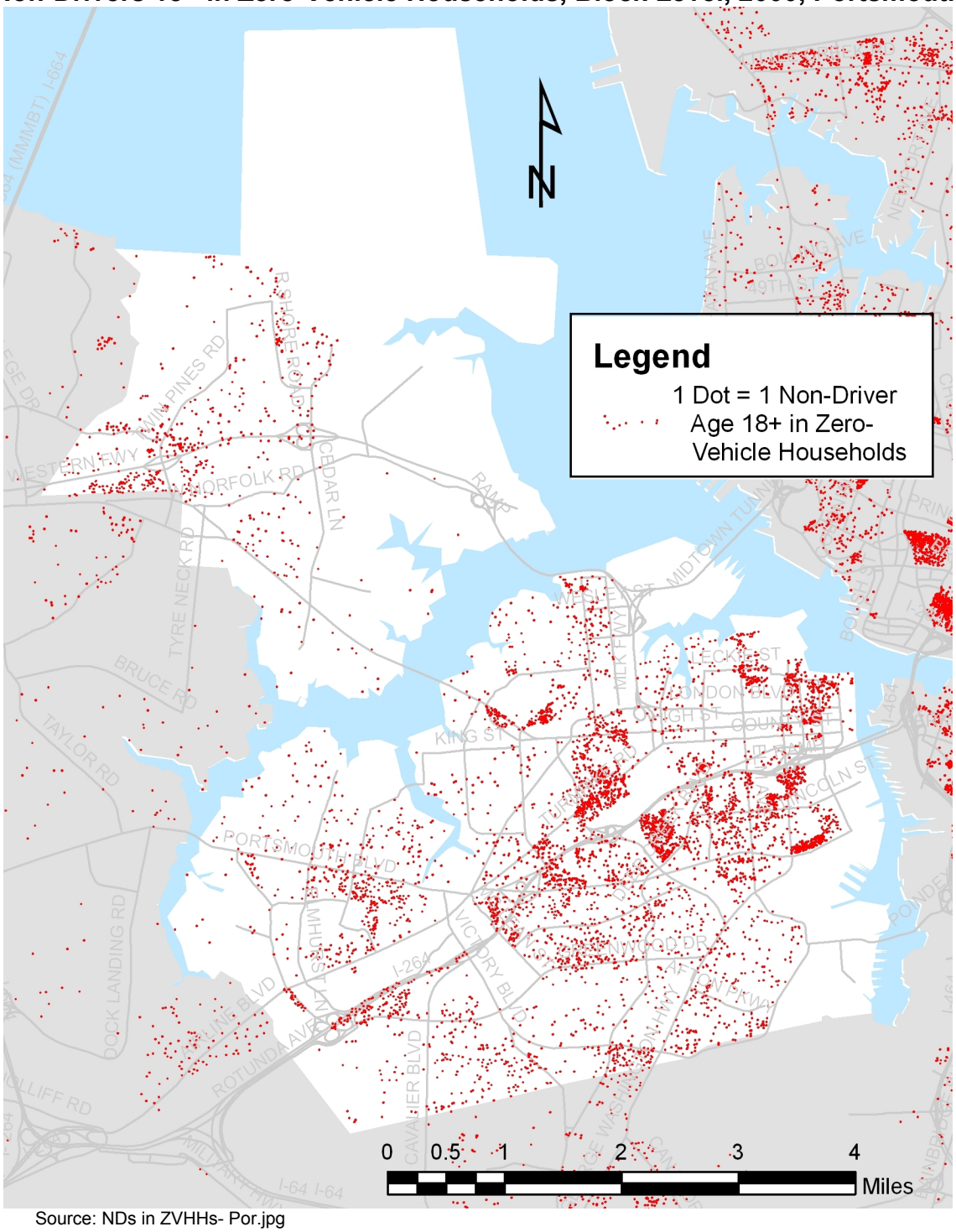


Source: NDs by block- Poq.jpg

There do not appear to be any concentrations of non-drivers in Poquoson.

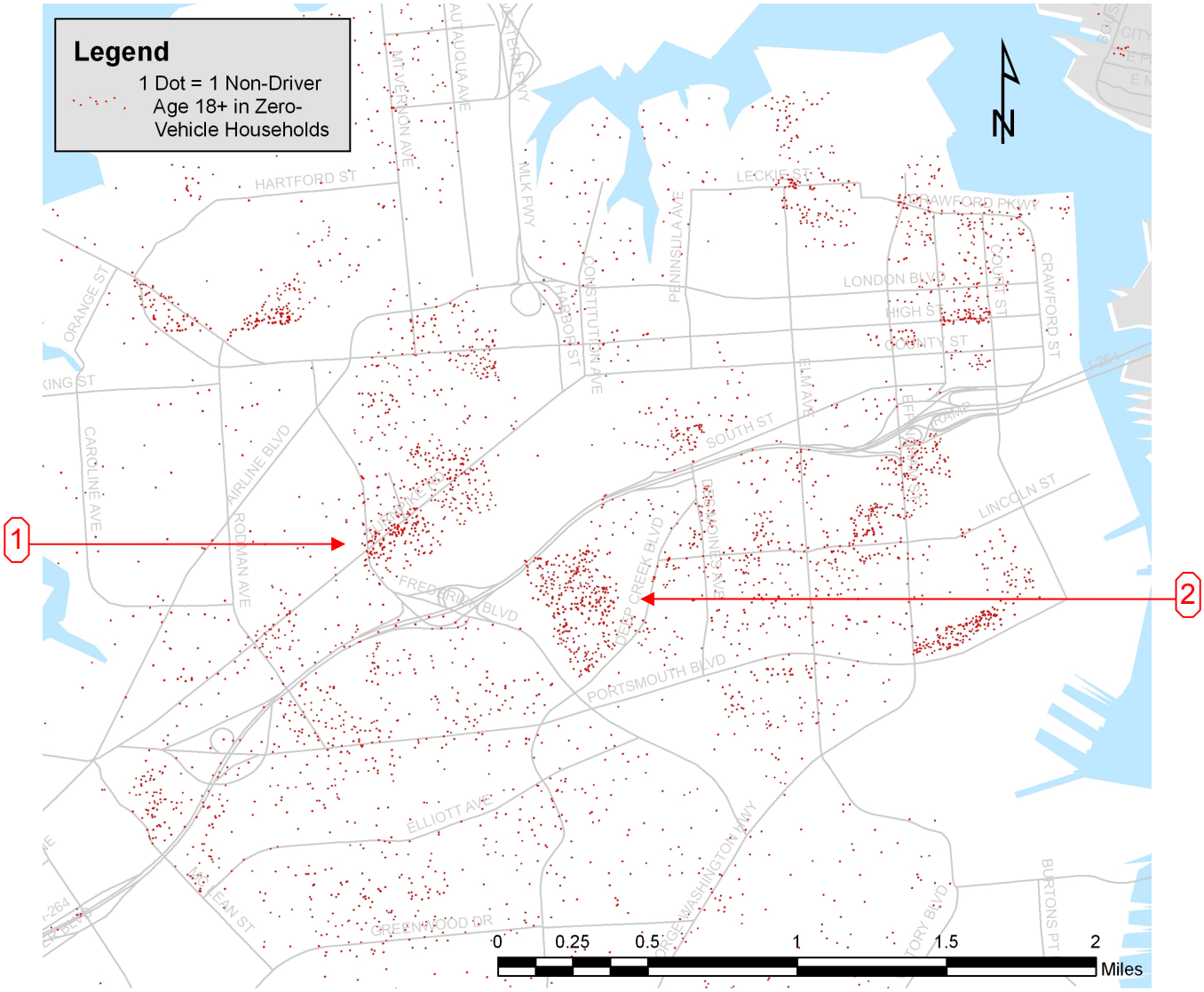
Portsmouth

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Portsmouth



Source: NDs in ZVHHs- Por.jpg

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Portsmouth-Detail

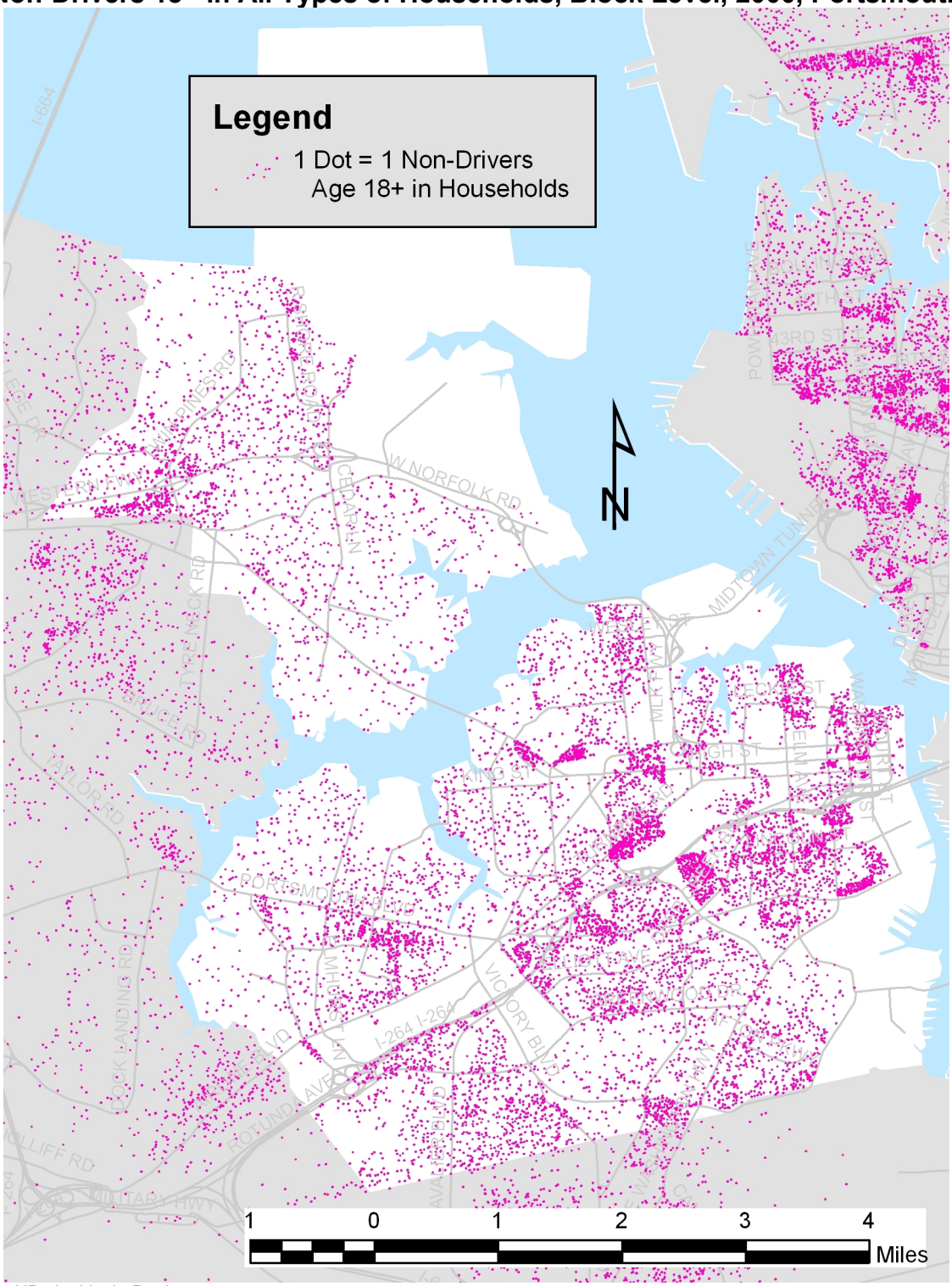


Source: NDs in ZVHHs- Por detail.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in Portsmouth including:

1. Jeffry Wilson (torn down since 2000)
2. Lincoln Park / Dale Homes

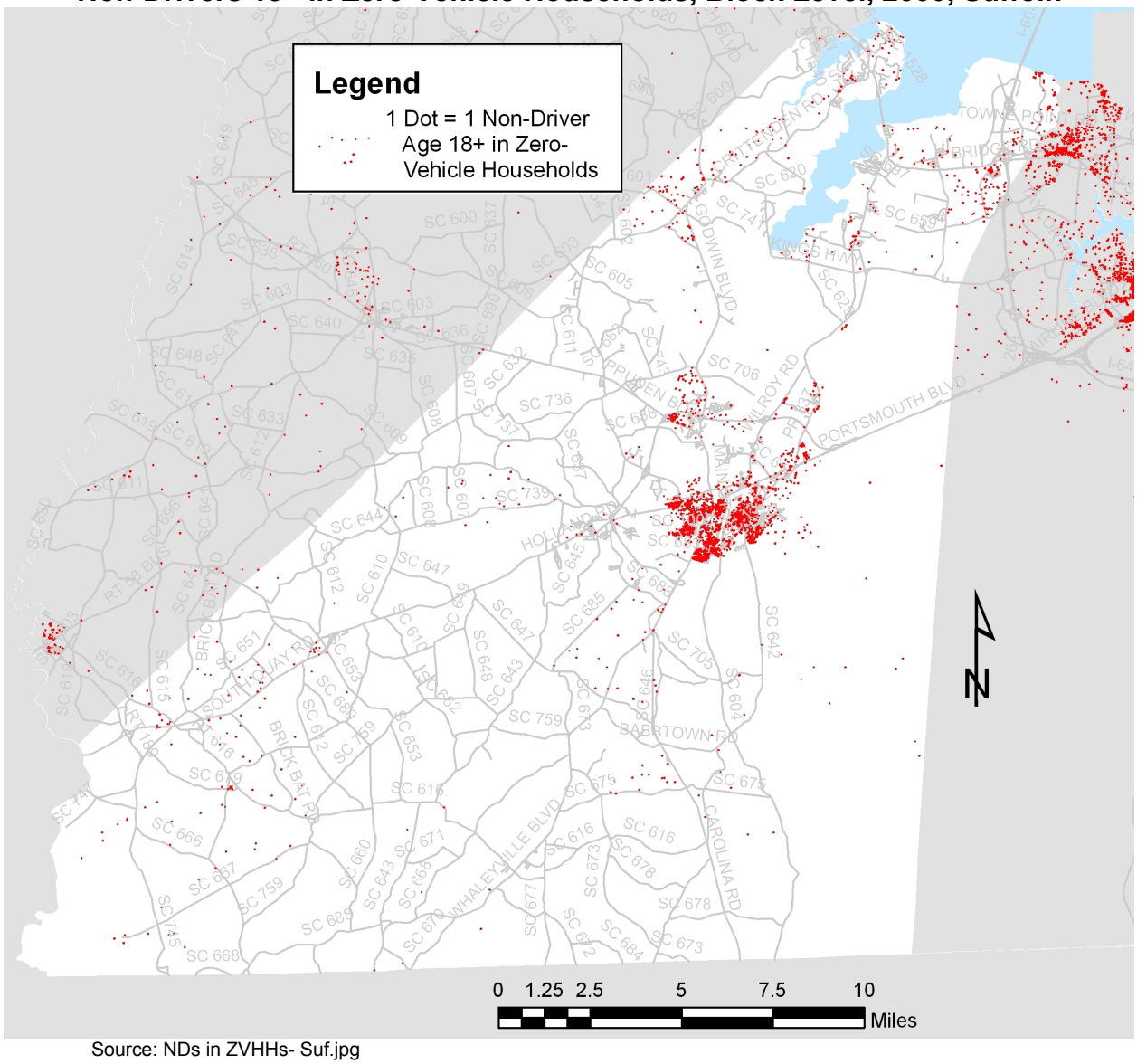
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Portsmouth



Source: NDs by block- Por.jpg

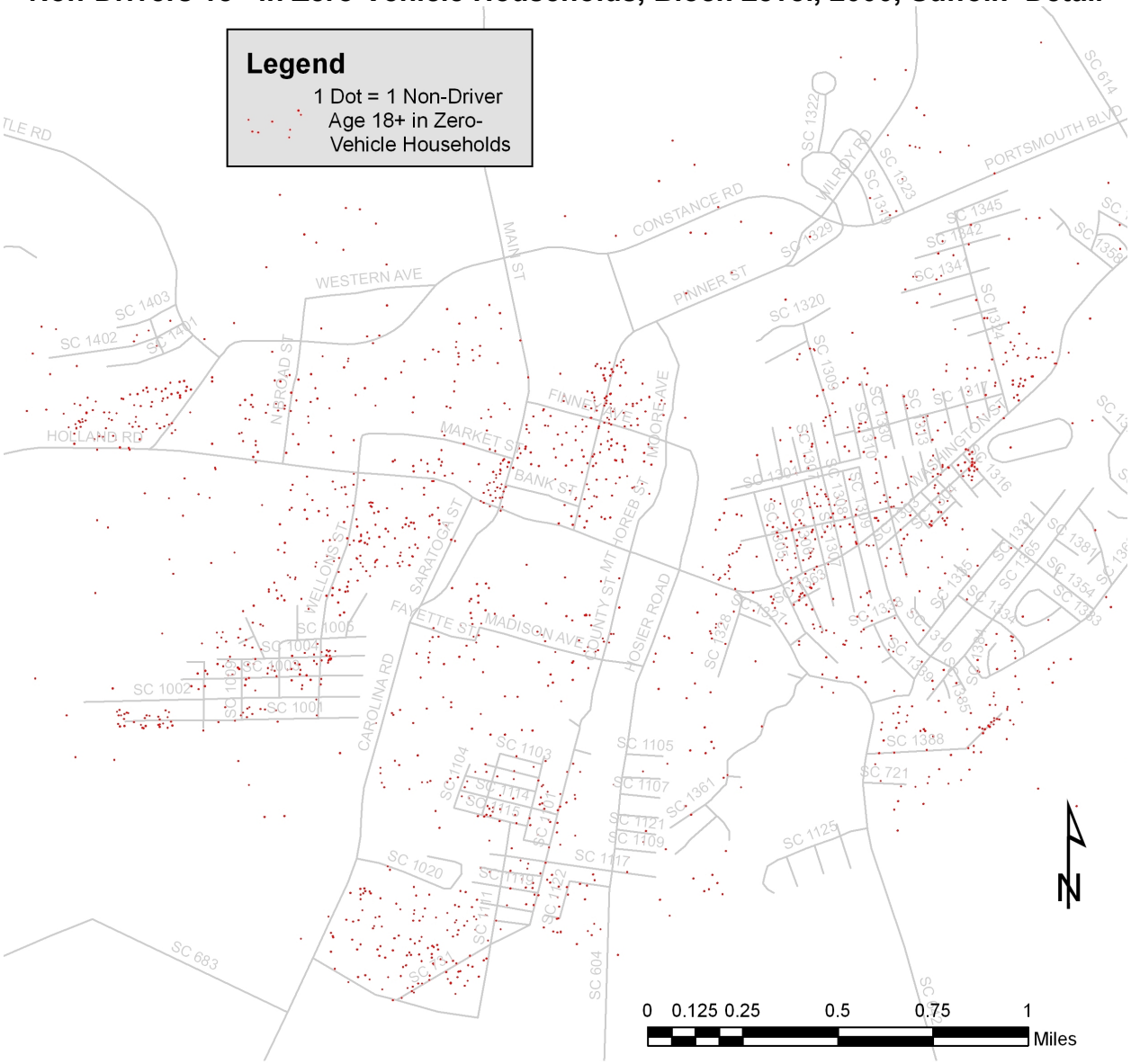
Suffolk

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Suffolk



Source: NDs in ZVHHs- Suf.jpg

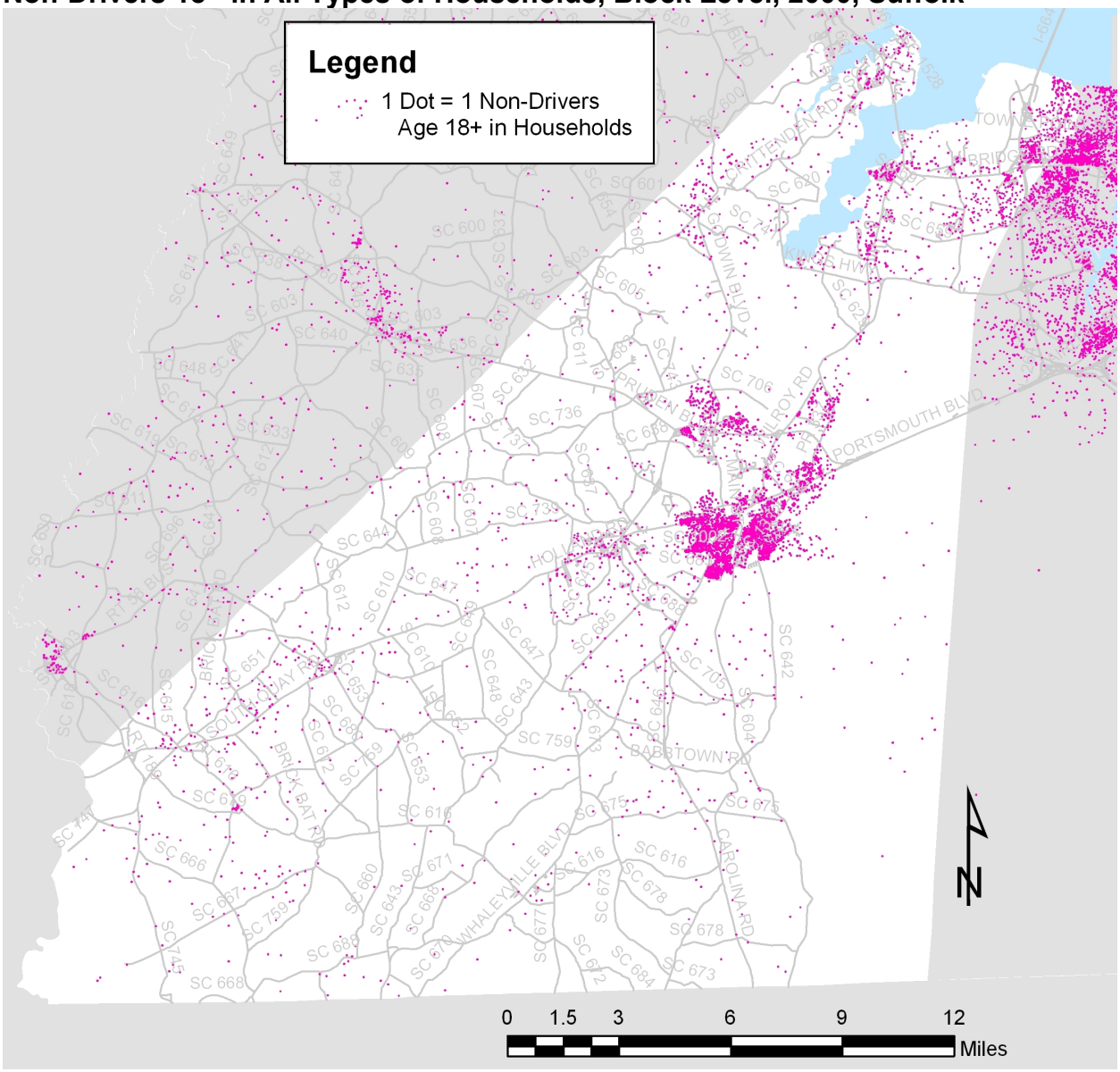
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Suffolk- Detail



Source: NDs in ZVHHs- Suf detail.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in various locations near downtown Suffolk.

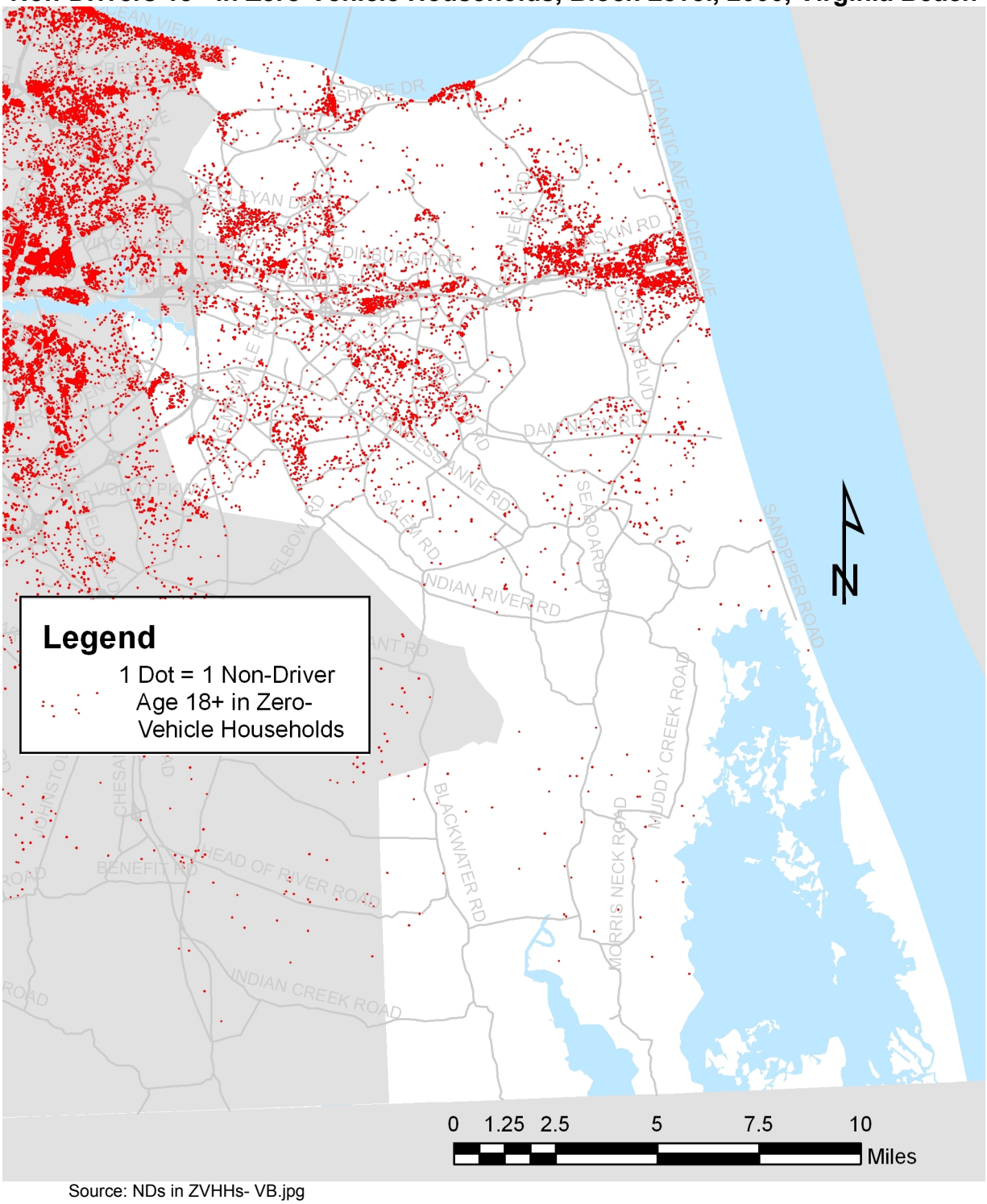
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Suffolk



Source: NDs by block- Suf.jpg

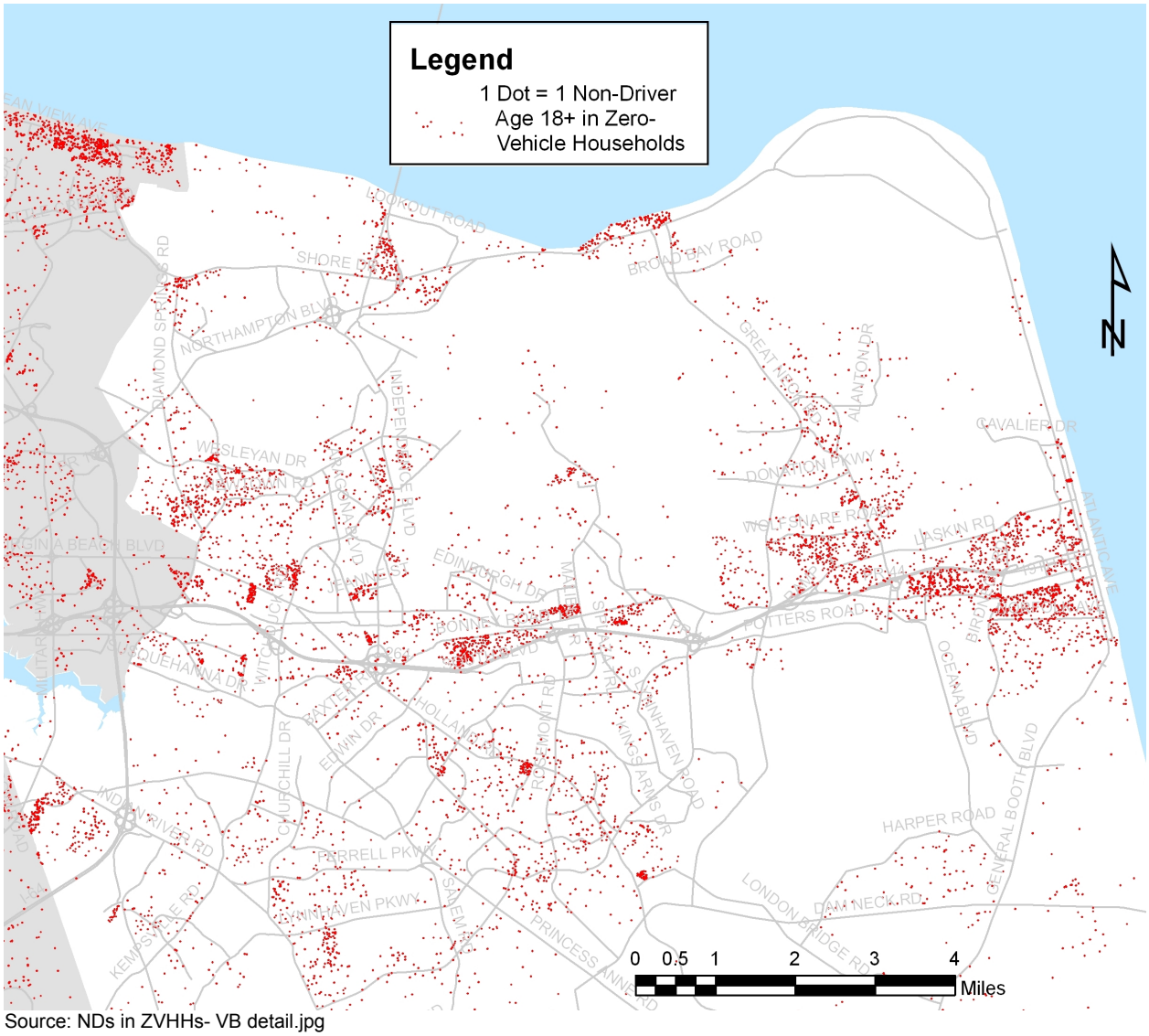
Virginia Beach

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Virginia Beach



Source: NDs in ZVHHs- VB.jpg

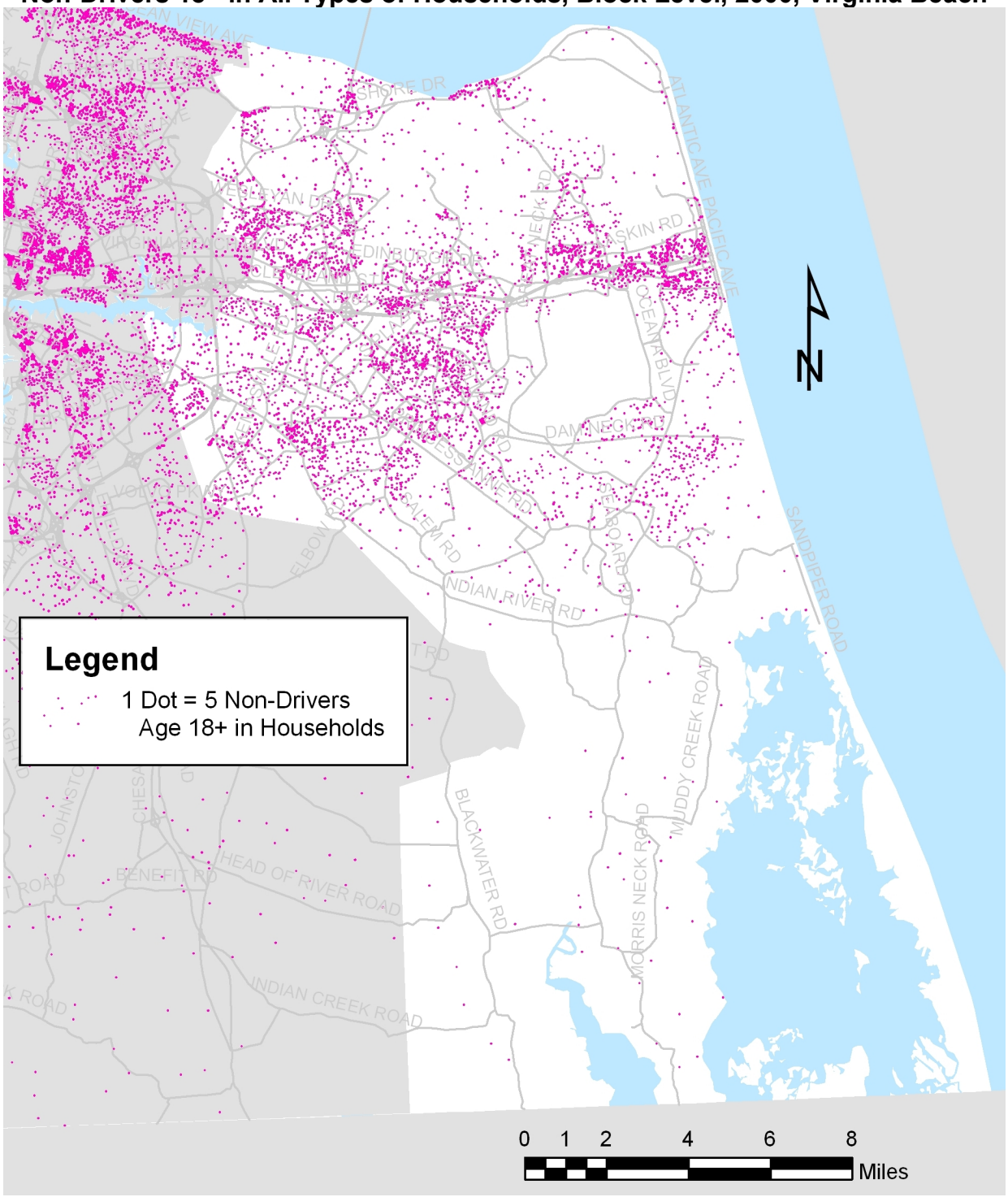
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Virginia Beach-Detail



Source: NDs in ZVHHs- VB detail.jpg

According to the above map, there are concentrations of non-drivers in zero-vehicle households in various locations in northern Virginia Beach, mostly along the Virginia Beach Blvd corridor.

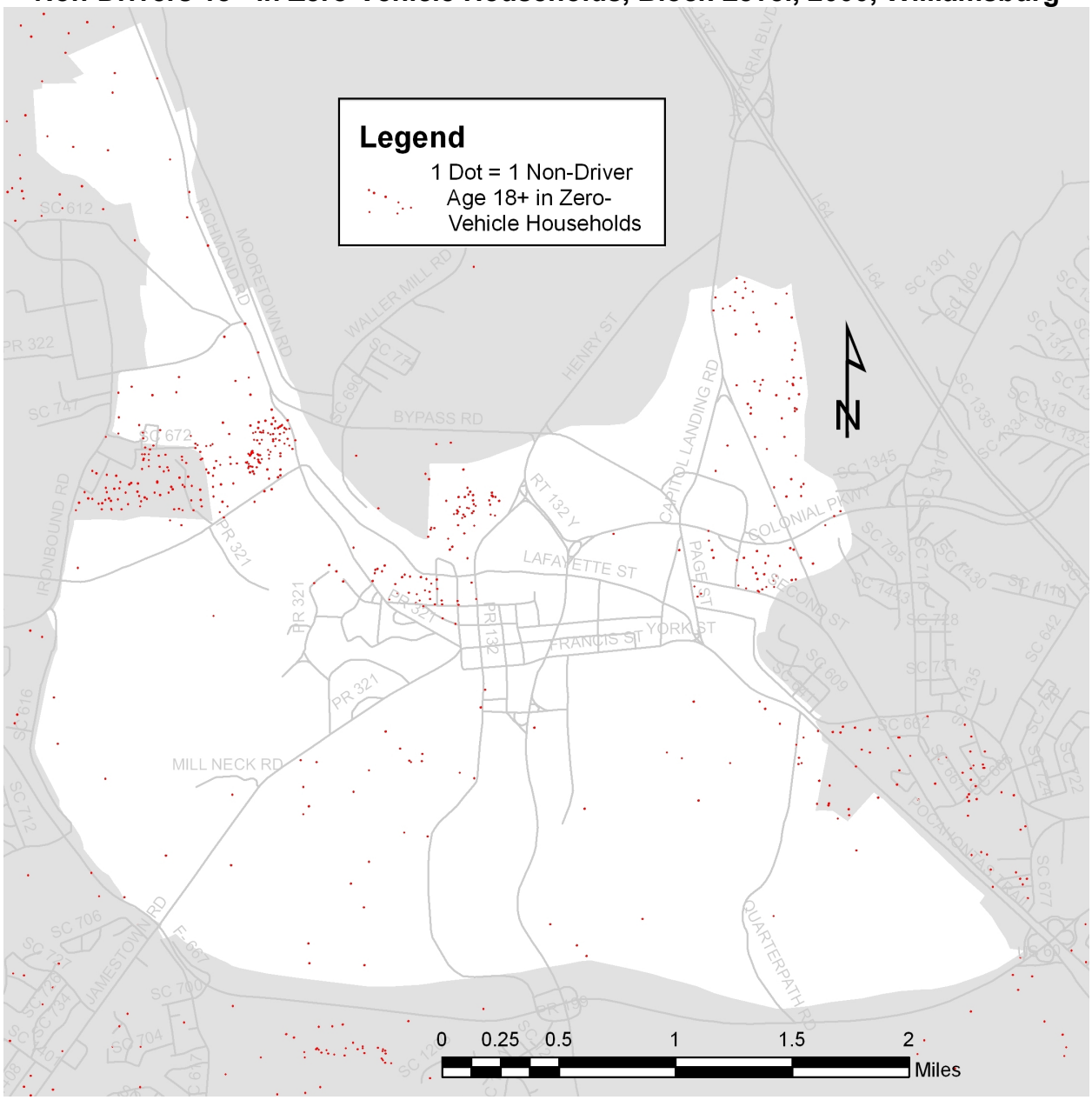
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Virginia Beach



Source: NDs by block- VB.jpg

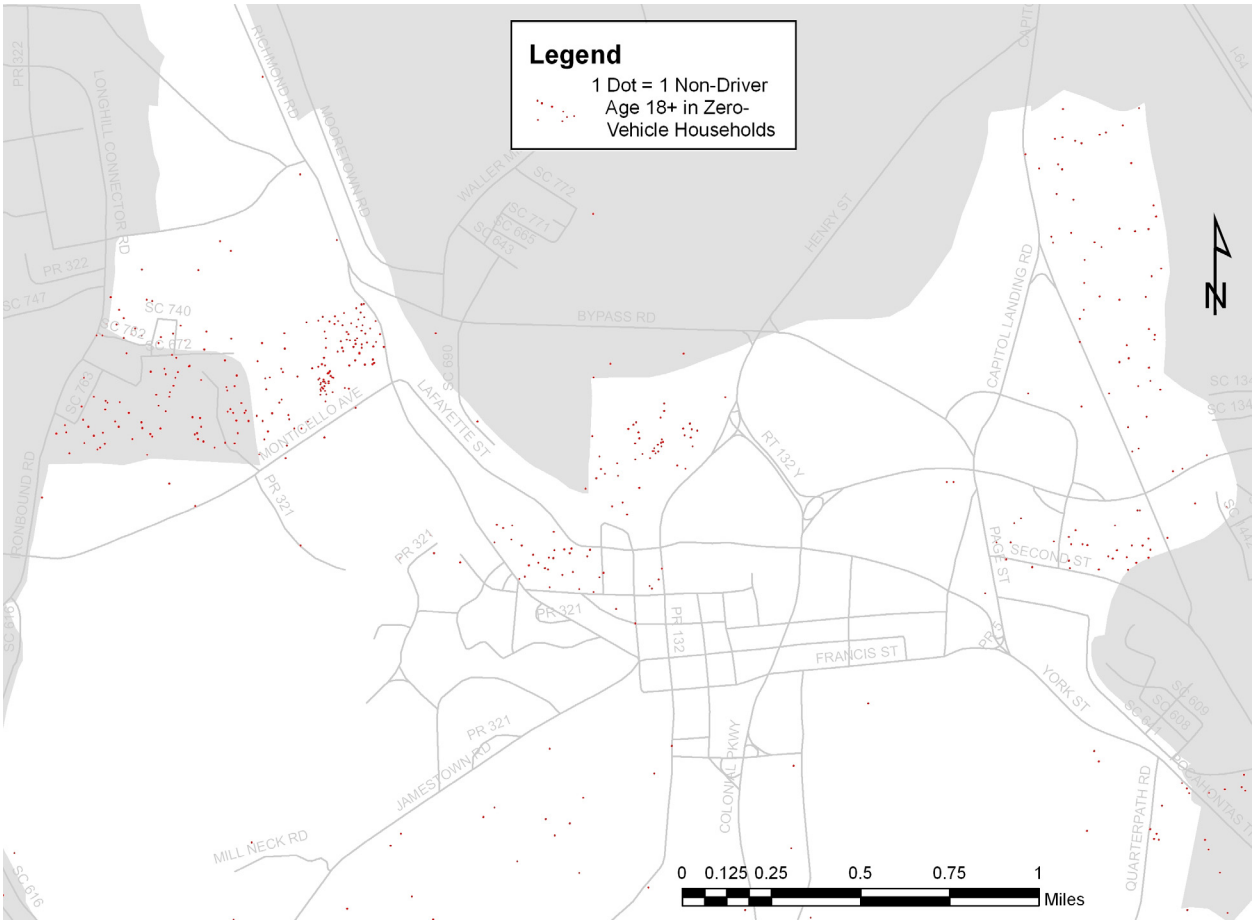
Williamsburg

Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Williamsburg



Source: NDs in ZVHHs- Wlmbg.jpg

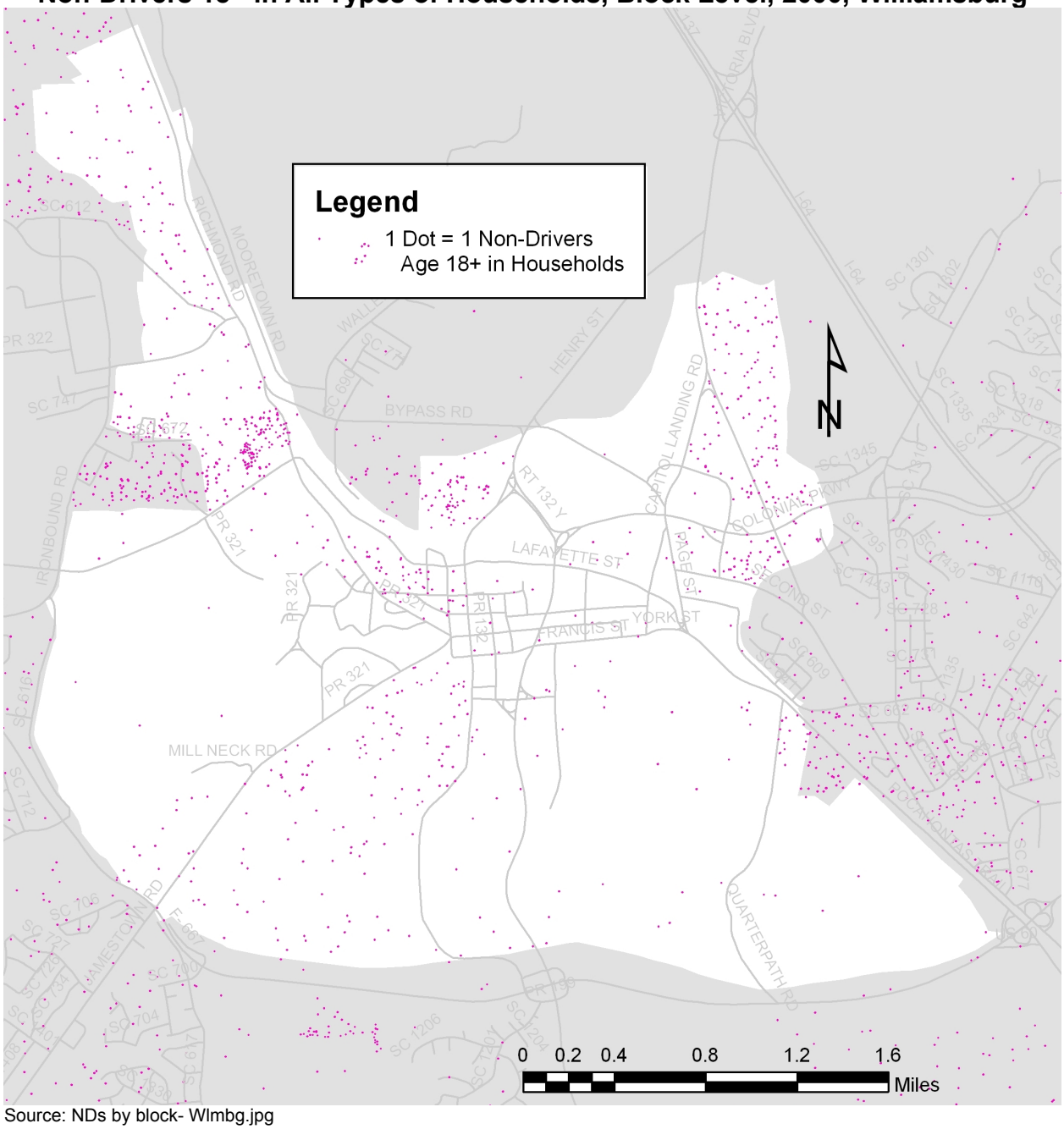
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, Williamsburg-Detail



Source: NDs in ZVHHs- Wlmbg detail.jpg

The largest concentration of non-drivers in Williamsburg is located in the Mount Vernon Avenue area, west of the intersection of Richmond Rd & Monticello Ave.

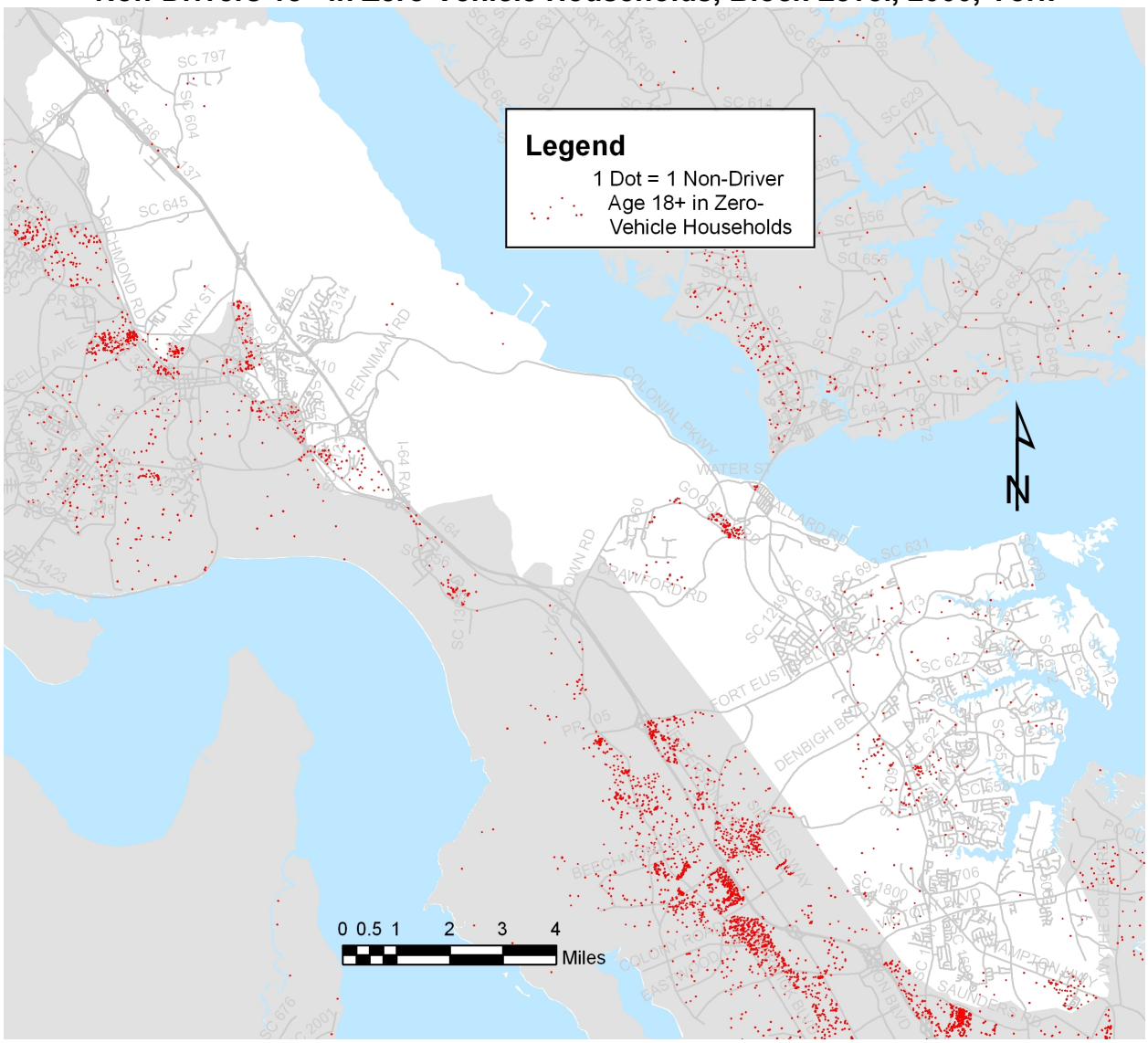
Non-Drivers 18+ in All Types of Households, Block Level, 2000, Williamsburg



Source: NDs by block- Wlmbg.jpg

York

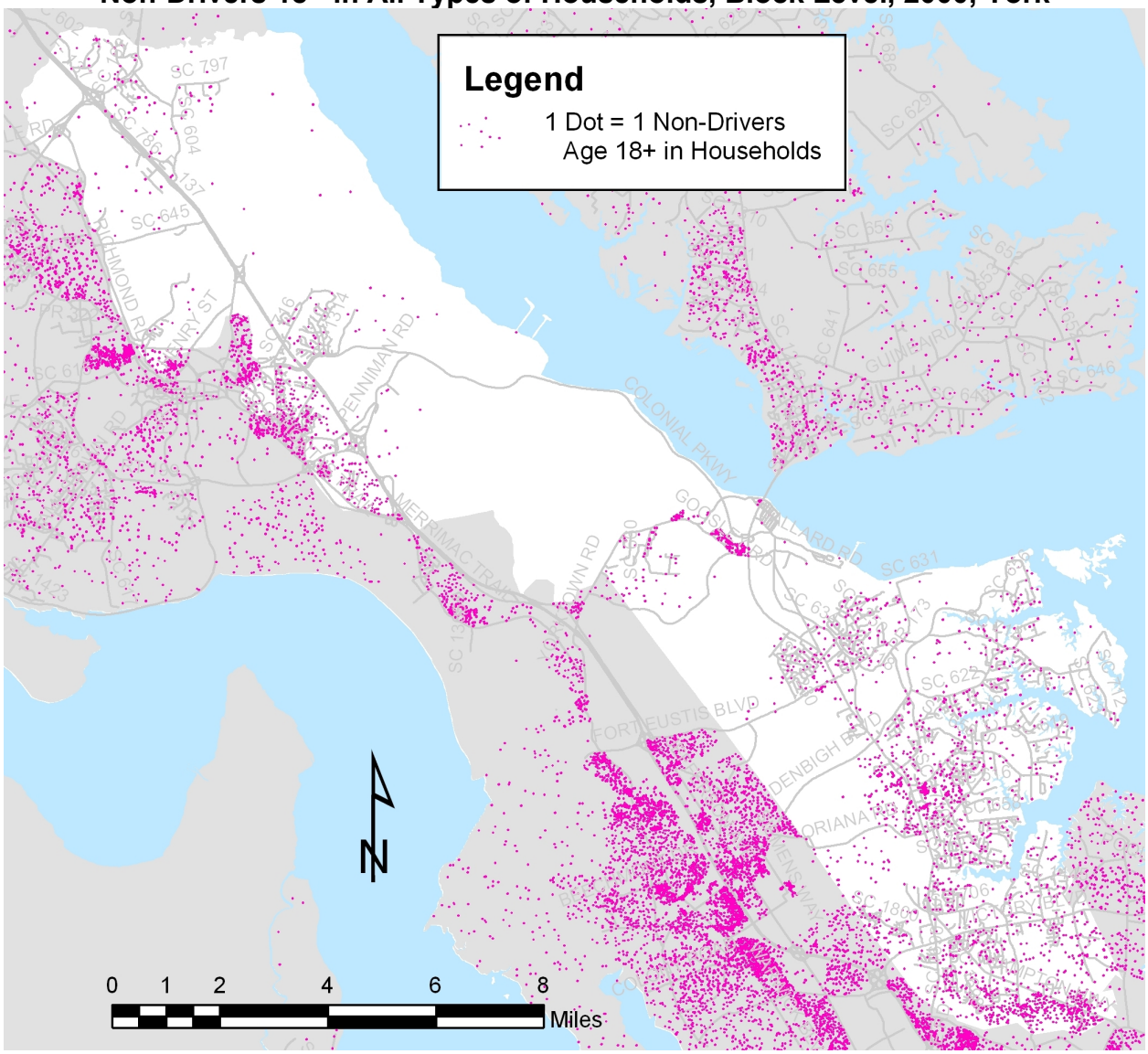
Non-Drivers 18+ in Zero-Vehicle Households, Block Level, 2000, York



Source: NDs in ZVHHs- York.jpg

The largest concentration of non-drivers in York is located near Goosley Rd.

Non-Drivers 18+ in All Types of Households, Block Level, 2000, York



Source: NDs by block- York.jpg

SUMMARY

Given that non-drivers in zero-vehicle households are vulnerable during evacuation events and have a greater need for the mobility improvement provided by a nearby bus stop and nearby activity locations, locating non-drivers by vehicle availability is valuable. Non-driver data not being available from the Census, TPO staff have applied regression techniques to earlier TPO non-driver location data and applicable Census data to estimate the residential locations of non-drivers age 18+ in Hampton Roads by vehicle availability for each of the 20,000 blocks in Hampton Roads. The Virginia Department of Emergency Management (VDEM) can use this data to plan evacuation aid in its current Regional Catastrophic Preparedness project. Local government and transit agencies can use this data when deciding where to promote the development of activity locations and where to invest in transit, two factors which improve non-driver mobility as measured by previous TPO studies. Because the data includes a break-out of non-drivers in zero-vehicle households, particular emphasis can be placed on these persons.