NEW CASTLE COUNTY TRANSIT ORIGIN / DESTINATION STUDY

FINAL REPORT

JULY 2014

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1 OVERVIEW

The New Castle County Transit Origin-Destination Study will assist in better understanding the travel behavior of existing DART First State transit customers. In April 2013, the Delaware Department of Transportation (DelDOT) and the Delaware Transit Corporation (DTC) released a report prepared by the State Smart Transportation Initiative (SSTI) titled ***Reimagining a Legacy Transit System: Lessons from Wilmington, Delaware***. The SSTI report recommended that DTC and DelDOT improve the quality of transit data by completing an origin-destination study and a boarding and alighting survey. Both of these new data sets are presented in this report.

On-board surveys were completed from October 15 through November 22, 2013. 5,198 surveys were distributed and 4,490 completed surveys were returned, or an 86% return rate. All of the surveys were geocoded with successful origin-destination pairs for 2,394 surveys, or 53% of all returned surveys.

Some of the key findings include:

- Walking is the primary mode of access to the transit system with approximately 86% of all users walking to the bus.
- 41% of all riders transfer routes.
- 81% of DART First State riders travel to or from their HOME.
- Over 47% of riders commute to or from their WORKPLACE.
- Over 18% of riders use DART First State to travel to and from OTHER destinations.
- Roughly 12% of riders use DART First State as their transportation to or from SCHOOL.
- A subarea travel analysis generally using New Castle County planning areas and the 2,394 geocoded surveys was completed. Of these surveys, 48.5% had origins within the City of Wilmington and 51.5% had origins in other subareas.
- Of the Wilmington based trips, 46% traveled to destinations within the City of Wilmington while 54% traveled to destinations outside the City.
- Of the trips from all other subareas, 50% of the trips traveled to the City of Wilmington, 39% of the trips traveled to other subareas, and 11% of trips began and ended in the same subarea.
- Riders were asked for general comments about the transit service. 74% offered no comment, 16% suggested service improvements such as more frequent service on some routes, 5% identified service problems, and 3% expressed specific complaints.

As shown in Figure 1-1, the origin-destination study has yielded significant data to better understand transit customer behavior. Analysis of these data continued through May 2014 and is presented in this report.

Figure 1-1: Origin-Destination - All Trips - 2013

2 STUDY PURPOSE AND METHODOLOGY

The intent of the New Castle County Transit Origin-Destination Study is to understand the travel behavior of existing DART First State transit customers and to prepare and evaluate preliminary alternatives to the current hub-and-spoke transit system. In April 2013, the Delaware Department of Transportation (DelDOT) and the Delaware Transit Corporation (DTC) released a report prepared by the State Smart Transportation Initiative (SSTI) titled ***Reimagining a Legacy Transit System: Lessons from Wilmington, Delaware***. The SSTI report recommended that DTC and DelDOT improve the quality of the transit data used for short and long term decision making. An origin-destination study and a boarding and alighting survey were specific recommendations of the SSTI report. DelDOT, through an on-call planning contract, retained Whitman, Requardt & Associates, LLP (WR&A) to complete the origin-destination survey while DTC equipped some of its buses with automatic passenger counters to collect the boarding and alighting data. Both of these new data sets are presented in this report.

2.1 Participating Organizations and Consulting Team

DelDOT's Division of Planning managed the origin-destination (O-D) study. DTC's Planning and Operations staff assisted with the development and administration of the survey. A Project Steering Committee including representatives from DelDOT, DTC, the Wilmington Area Planning Council (WILMAPCO), the City of Wilmington, the City of Newark, New Castle County, and DTC riders assisted with the development of the survey and analysis of the survey results.

The O-D survey was completed by WR&A. Nectir Staffing Solutions provided the temporary staff that completed the on-board surveys, and Contemporary Analysis, Inc. (CAN) assisted with the survey development and analytics.

2.2 Survey Development and Administration

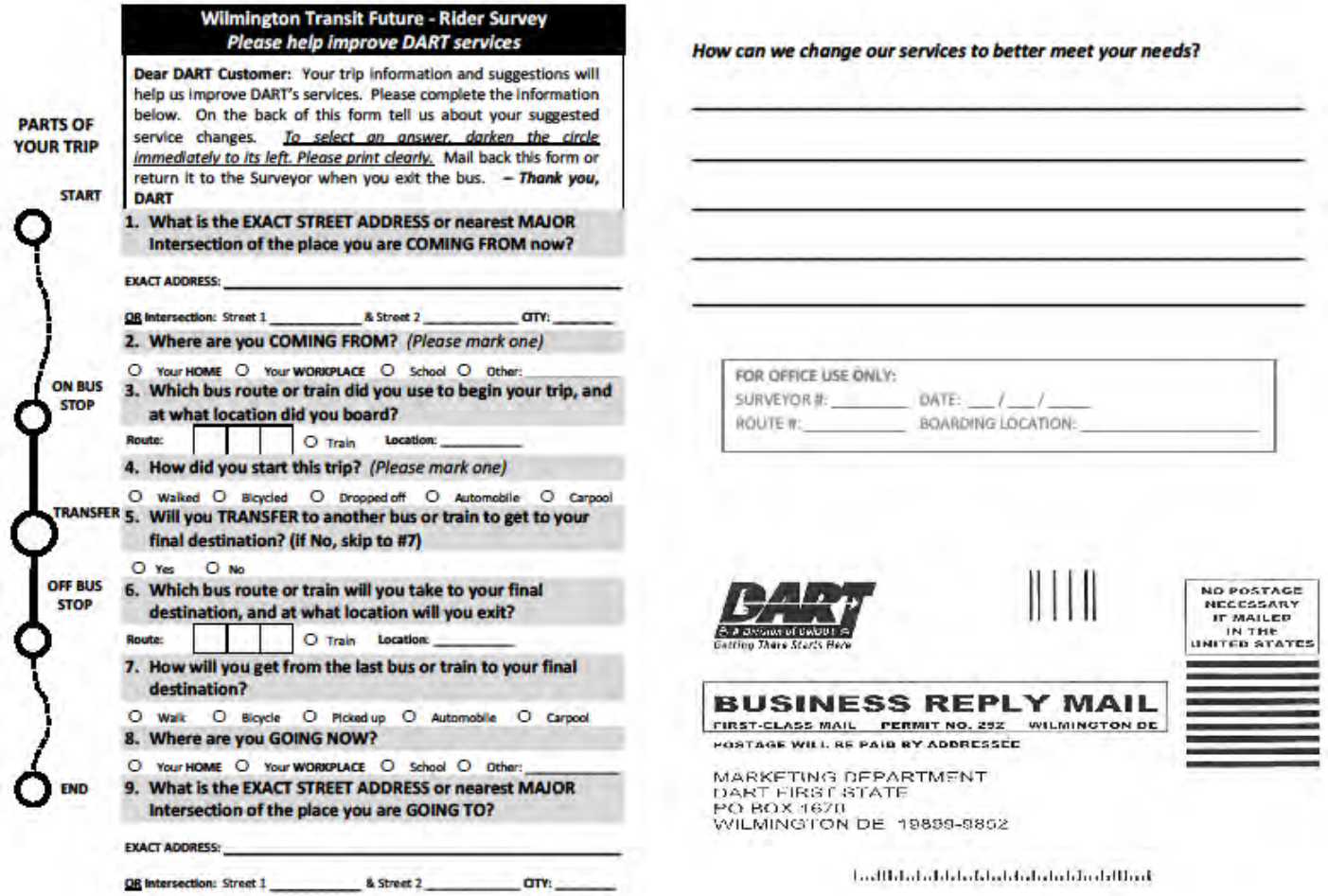
The consultant team, with the Project Steering Committee's assistance, developed a ½ page (front and back) survey instrument (Figure 2-1) to collect detailed trip information for a statistically significant sample size. The sampling plan established the sample size for each route and for the system's Wilmington-based transit routes collectively. The survey goal was to collect completed surveys of at least 10% of the average weekday ridership of each New Castle County based transit route operated by DTC. On an average weekday, DART First State fixed-route buses carry approximately 32,000 passenger trips for an estimated 16,000 persons. Table 2-1 presents the sampling plan and results.

On-board surveys available in English and Spanish were completed from October 15 through November 22, 2013. Surveyors were instructed to ask customers to participate in the survey and hand each participating customer a small clipboard and survey so that the survey could be completed on-board the bus. Passengers were also permitted to mail back the survey or complete the survey online at the DART First State web site. 5,198 surveys were distributed and 4,259 completed surveys were returned to the surveyors. An additional 231 surveys were returned by mail or other methods for a total of 4,490 completed surveys, or an 86 % return rate. All of the surveys were geocoded. Successful origin-destination pairs were identified for 2,394 surveys, or 53% of all returned surveys.

Table 2-1: Sampling Plan and Completed Surveys

	May 2013		Target Surveys		Completed Surveys				
Route	Average Weekday Boardings	Estimated Riders (average/2)	Recommended Minimum Sample Size	% of Riders Completing Survey	Riders on Surveyed Trips	Surveys Distributed	% of Riders	Surveys Returned	% of Goal
1	3,153	1,576	158	10.0%	1728	429	27%	264	167%
2	1,028	514	51	9.9%	722	152	30%	121	237%
3	671	336	34	10.1%	280	143	43%	97	285%
4	2,108	1,054	105	10.0%	1546	375	36%	257	245%
5	2,810	1,405	141	10.0%	1436	397	28%	313	222%
6	2,804	1,402	140	10.0%	1194	301	21%	268	191%
7	106	53	25	47.0%	64	31	58%	31	124%
8	651	325	33	10.1%	259	87	27%	65	197%
9	1,004	502	50	10.0%	562	93	19%	87	174%
10	447	224	25	11.2%	240	80	36%	80	320%
11	892	446	45	10.1%	449	173	39%	122	271%
12	979	489	49	10.0%	507	139	28%	98	200%
15	1,824	912	91	10.0%	622	298	33%	297	326%
16	172	86	25	29.0%	122	80	93%	80	320%
17	620	310	31	10.0%	413	150	48%	144	465%
19	417	209	25	12.0%	299	67	32%	60	240%
20	321	161	25	15.6%	264	82	51%	80	320%
21	582	291	29	10.0%	184	108	37%	97	334%
22	1,335	667	67	10.0%	678	255	38%	199	297%
23	325	162	25	15.4%	187	73	45%	72	288%
24	1,799	900	90	10.0%	765	181	20%	133	148%
25	1,041	521	52	10.0%	596	262	50%	232	446%
28	283	142	25	17.7%	312	86	61%	72	288%
30	55	28	14	50.7%	39	28	101%	28	200%
32	60	30	15	50.0%	54	19	63%	17	113%
33	1,694	847	85	10.0%	926	321	38%	273	321%
34	313	156	25	16.0%	144	49	31%	42	168%
35	499	249	25	10.0%	172	79	32%	53	212%
36	372	186	25	13.4%	91	49	26%	42	168%
38	21	10	5	48.8%	21	11	107%	4	80%
39	144	72	25	34.6%	109	52	72%	50	200%
40	961	480	48	10.0%	554	111	23%	103	215%
41	241	121	25	20.7%	303	52	43%	25	100%
42	151	75	25	33.2%	95	60	80%	58	232%
45	121	61	25	41.2%	94	59	97%	59	236%
54	553	277	28	10.1%	131	67	24%	67	239%
55	638	319	32	10.0%	435	91	29%	65	203%
301	806	403	40	9.9%	210	108	27%	104	260%
Total	**32,004**	**16,002**	**1,784**	**11.1%**	**16,807**	**5,198**	**32%**	**4,259**	**239%**

Figure 2-1: On-Board Survey Form



Wilmington Transit Future - Rider Survey
Please help improve DART services

Dear DART Customer: Your trip information and suggestions will help us improve DART's services. Please complete the information below. On the back of this form tell us about your suggested service changes. *To select an answer, darken the circle immediately to its left. Please print clearly.* Mail back this form or return it to the Surveyor when you exit the bus. ***– Thank you, DART***

PARTS OF YOUR TRIP

START

1. What is the EXACT STREET ADDRESS or nearest MAJOR Intersection of the place you are COMING FROM now?

EXACT ADDRESS: _____

OR Intersection: Street 1 _____ & Street 2 _____ CITY: _____

2. Where are you COMING FROM? *(Please mark one)*

○ Your HOME ○ Your WORKPLACE ○ School ○ Other: _____

ON BUS STOP

3. Which bus route or train did you use to begin your trip, and at what location did you board?

Route: ☐☐☐ ○ Train Location: _____

4. How did you start this trip? *(Please mark one)*

○ Walked ○ Bicycled ○ Dropped off ○ Automobile ○ Carpool

TRANSFER

5. Will you TRANSFER to another bus or train to get to your final destination? (if No, skip to #7)

○ Yes ○ No

OFF BUS STOP

6. Which bus route or train will you take to your final destination, and at what location will you exit?

Route: ☐☐☐ ○ Train Location: _____

7. How will you get from the last bus or train to your final destination?

○ Walk ○ Bicycle ○ Picked up ○ Automobile ○ Carpool

8. Where are you GOING NOW?

○ Your HOME ○ Your WORKPLACE ○ School ○ Other: _____

END

9. What is the EXACT STREET ADDRESS or nearest MAJOR Intersection of the place you are GOING TO?

EXACT ADDRESS: _____

OR Intersection: Street 1 _____ & Street 2 _____ CITY: _____

Thank you for your participation.

How can we change our services to better meet your needs?

_____

_____

_____

_____

_____

FOR OFFICE USE ONLY:
SURVEYOR #: _____ DATE: ___ / ___ / ____
ROUTE #: _____ BOARDING LOCATION: _____

DART
Getting There Starts Here

BUSINESS REPLY MAIL
FIRST-CLASS MAIL PERMIT NO. 252 WILMINGTON DE
POSTAGE WILL BE PAID BY ADDRESSEE

MARKETING DEPARTMENT
DART FIRST STATE
PO BOX 1670
WILMINGTON DE 19899-9852

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

2.3 Data Analysis

Of the total 5,198 riders surveyed, 4,490 surveys were returned by riders, which equates to a response rate of 86%. The margin of error for the entire sample was +/- 1.24% at a 95% level of confidence assuming a two-tail normal distribution. The actual margin of error for individual questions varied based on the number of responses obtained and the unique answers received. The following margins of error were calculated based on the specific route corridors surveyed:

- Philadelphia Pike: +/- 3.84%
- Concord Pike: +/- 5.30%
- Pennsylvania Ave & Lancaster Pike: +/- 4.15%
- Kirkwood Highway: +/- 4.25%
- Maryland Ave: +/- 4.48%
- Market, Dupont and New Castle: +/- 2.60%
- Christiana Mall / Newark: +/- 3.72%
- Mid County: +/- 4.62%
- Downstate: +/- 6.30%

The above margins of error were calculated at a 95% level of confidence assuming a two-tail normal distribution. The actual margin of error for each corridor's individual questions varied based on the number of responses obtained and the unique answers received relative to each route group.

The data analysis has been completed using three data sets, including:

- Returned surveys – 4,490 completed surveys
- Surveys with valid O-D matches – 2,394 completed surveys
- Boarding and alighting counts from DTC

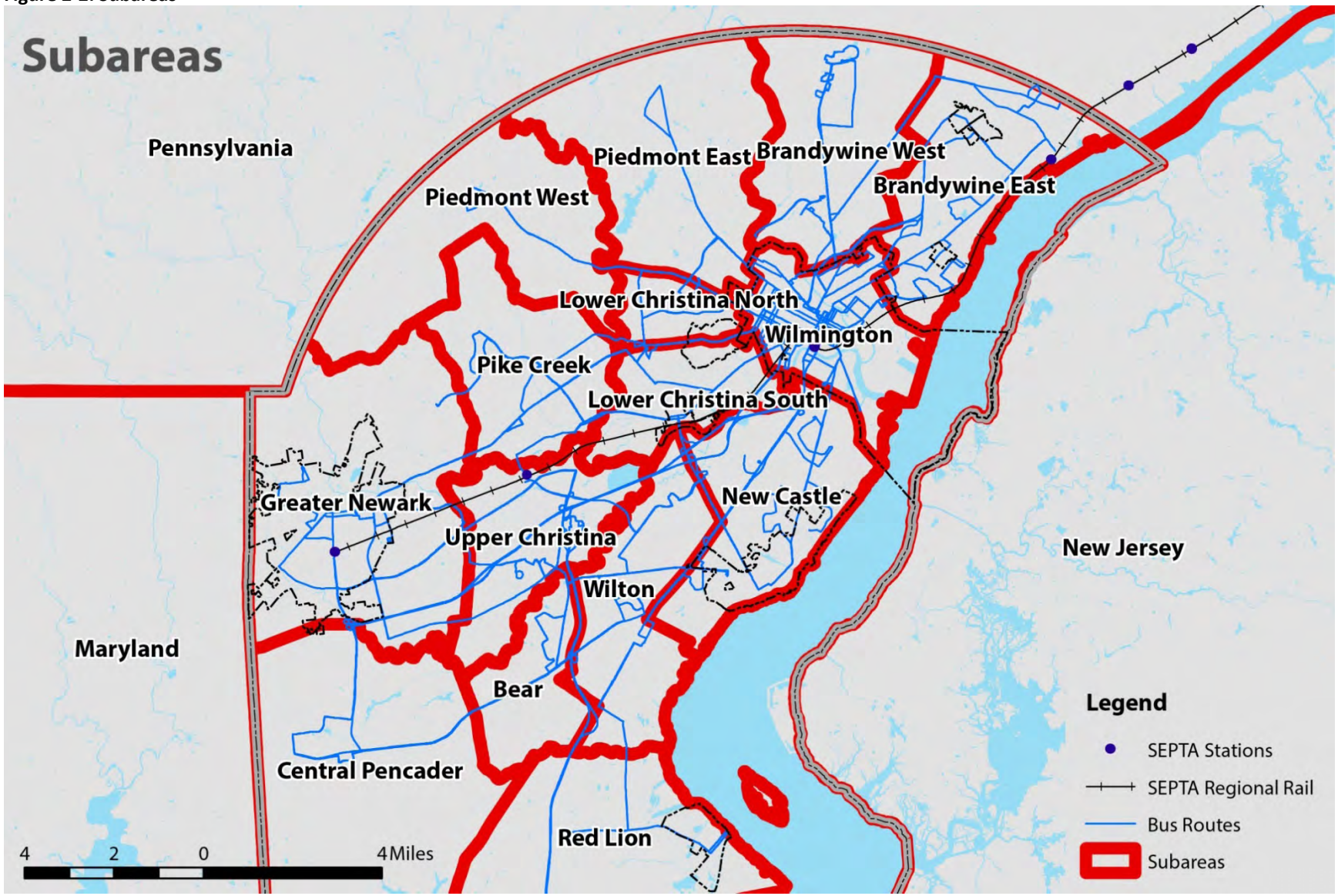
Three methods have been used in analyzing the data, including:

- System-wide, where all northern New Castle County routes are included.
- Transit corridors where the routes are grouped by corridor as shown in Table 2-2. The corridor grouping is based on historical route level data, and the corridors overlap, as some routes have crosstown service. Each route, however, is only assigned to one corridor. Table 2-2 also compares the May 2013 ridership by corridor with the actual surveys received by corridor.
- The subareas shown in Figure 2-2 have been developed utilizing a combination of New Castle County's comprehensive planning districts and the regional travel model's traffic analysis zones. This subarea framework will permit the estimation of unmet demand for transit services by comparing origin-destination data with regional travel forecast results.

Table 2-2: Transit Corridors and Comparison of May 2013 Ridership to Completed Surveys

Corridor	Routes	May 2013 Ridership	Percentage of May 2013 Ridership	Surveys with valid Route #	Percentage of Surveys
Philadelphia Pike	1, 3, 11, 12, 24, 38, 61	165,320	23.5%	909	20.9%
Concord Pike	2, 21, 28, 35	52,637	7.5%	269	6.2%
Pennsylvania Ave and Lancaster Pike	4, 10, 20	63,292	9.0%	407	9.3%
Kirkwood Highway	6, 19, 30, 36	80,268	11.4%	415	9.5%
Maryland Ave	5, 7, 9	86,252	12.3%	386	8.9%
Market, Dupont and New Castle	8, 15, 17, 22, 25, 32	121,673	17.3%	954	21.9%
Christiana Mall / Newark	16, 23, 33, 34, 55, 59, 65	72,273	10.3%	532	12.2%
Mid County	40, 41, 42, 54, 64	41,935	6.0%	325	7.5%
Downstate	45, 301, 305	20,439	2.9%	162	3.7%
Northern New Castle County		704,089	100%	4,359	100.0%

Figure 2-2: Subareas



3 DART FIRST STATE NEW CASTLE COUNTY TRANSIT SERVICES

3.1 Service Area Demographics

New Castle County is the most populous of Delaware's three counties, with an estimated 2010 population of 538,479 persons. Table 3-1 lists data from the 2010 US Census. The County is located within the Philadelphia Metro Urbanized Area, the fifth largest in the country, with a total urbanized area 2010 population of 5,965,343 persons. Fifteen incorporated cities and towns are located within New Castle County. Table 3-2 lists the County's incorporated areas and the percentage of the County's population in each area.

In 2010, Wilmington was the largest city in New Castle County, with 70,851 persons, while Newark was second largest city in the County, with 31,454 persons. 28% of the County's population resides in incorporated areas, while 72% live in unincorporated areas.

Figures 3-1 through 3-5 on the following pages illustrate demographic information that is useful in planning transit services.

Table 3-1: New Castle County, Delaware – 2010 Population Estimates

Population, 2010	538,479
% of Delaware Population	60.0%
Minority Population	185,524
% Minority Population	34.5%
Land area in square miles, 2010	426.29
Population Density, 2010	1,263.2 per square mile
Source: 2010 US Census	

Table 3-2: New Castle County Incorporated Areas - 2010

New Castle County, Delaware	2010 Population	Percent of County Population
Arden Village	439	0.1%
Ardencroft Village	231	0.0%
Ardentown Village	264	0.0%
Town of Bellefonte	1,193	0.2%
Town of Clayton	2,918	0.5%
Delaware City	1,695	0.3%
Town of Elsmere	6,131	1.1%
Town of Middletown	18,871	3.5%
City of Newark	31,454	5.8%
New Castle City	5,285	1.0%
Town of Newport	1,055	0.2%
Town of Odessa	364	0.1%
Town of Smyrna	10,023	1.9%
Town of Townsend	2,049	0.4%
City of Wilmington	70,851	13.2%
Total population in incorporated areas	152,823	28.4%
Population in unincorporated areas	385,656	71.6%
Total County Population	**538,479**	**100.0%**
Source: 2010 US Census		

Figure 3-1: Northern New Castle County Land Use

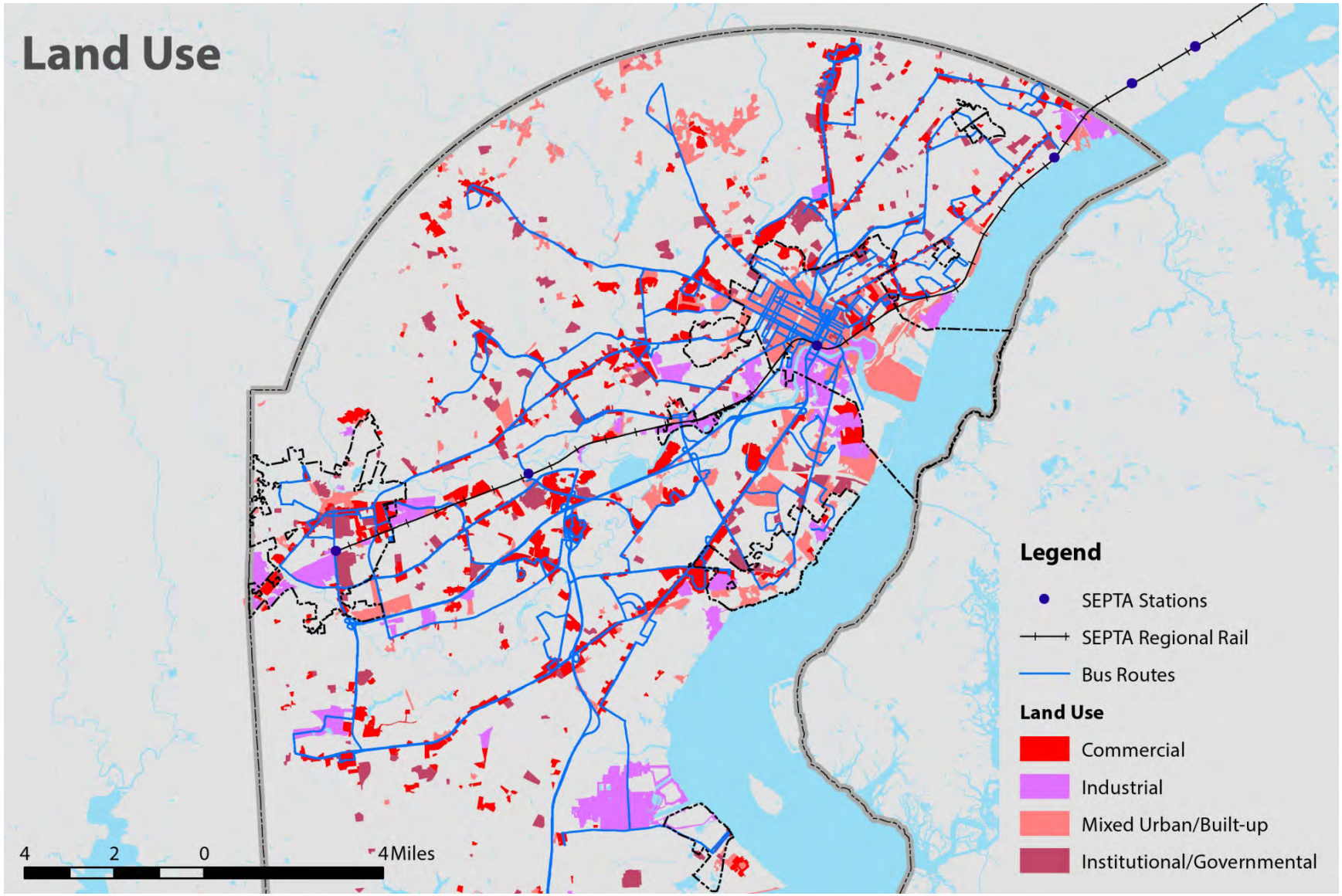


Figure 3-2: Northern New Castle County Census Tracts with Households below the Poverty Line

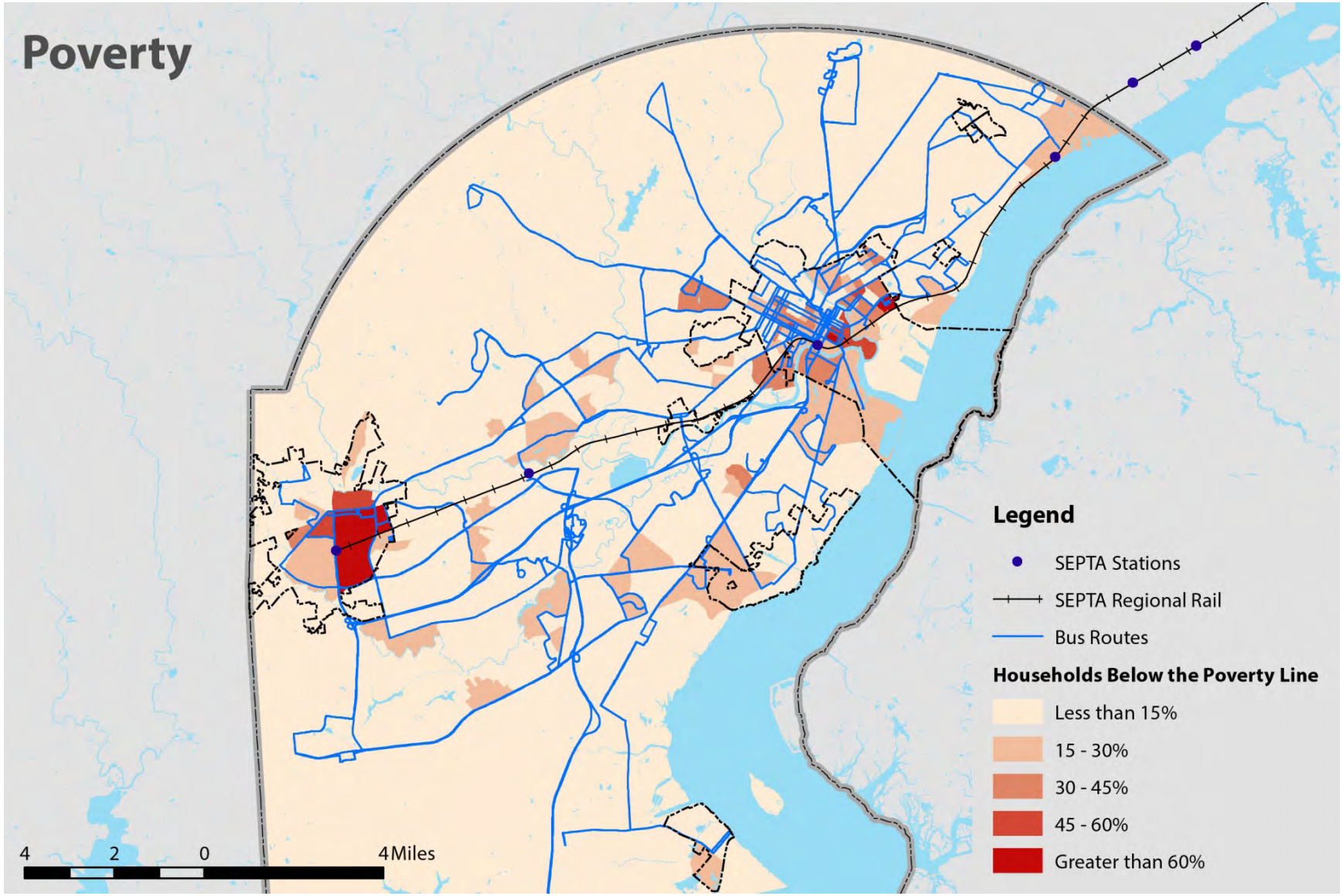


Figure 3-3: Northern New Castle County Census Tracts with Minority Concentrations

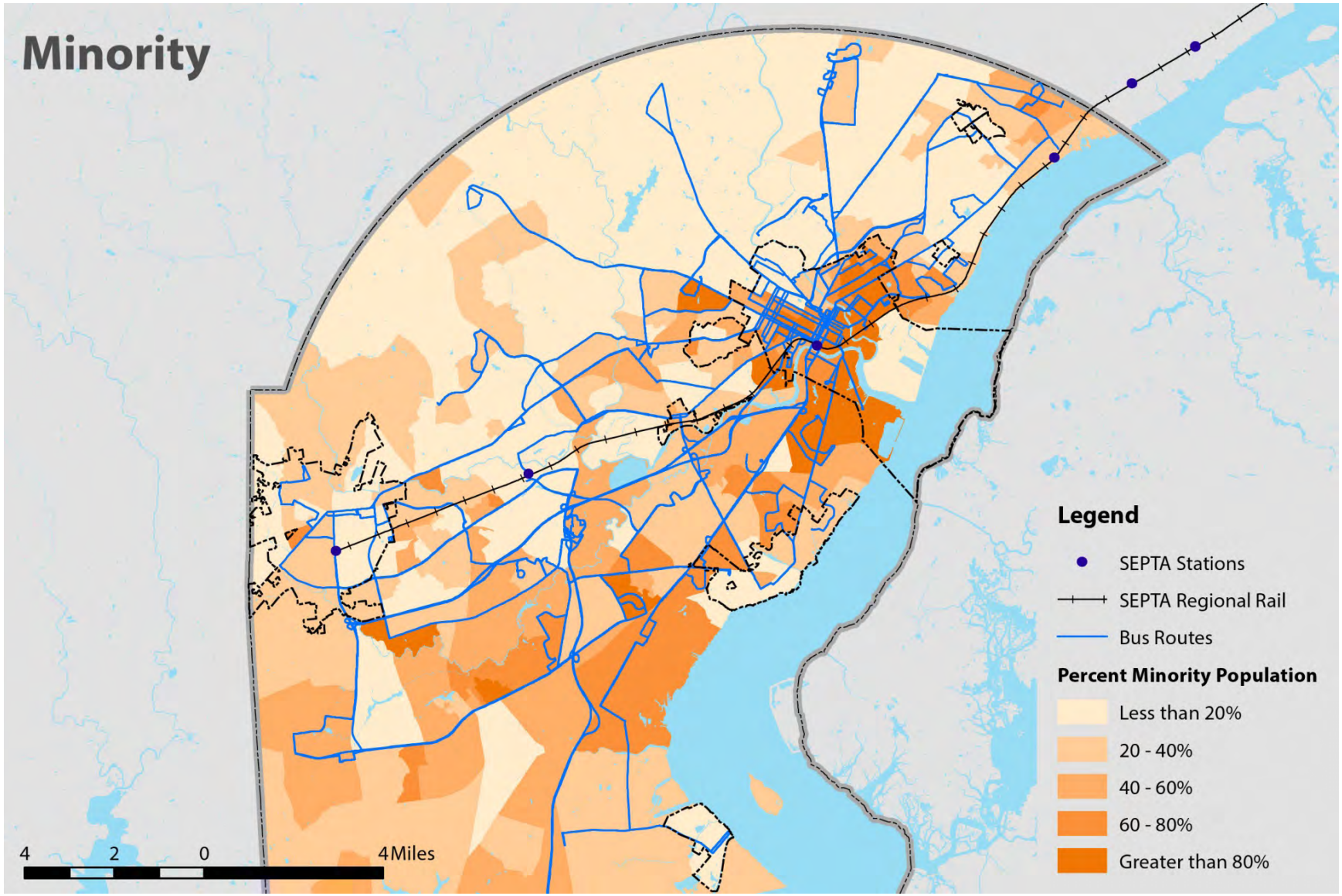


Figure 3-4: Northern New Castle County Subsidized Housing

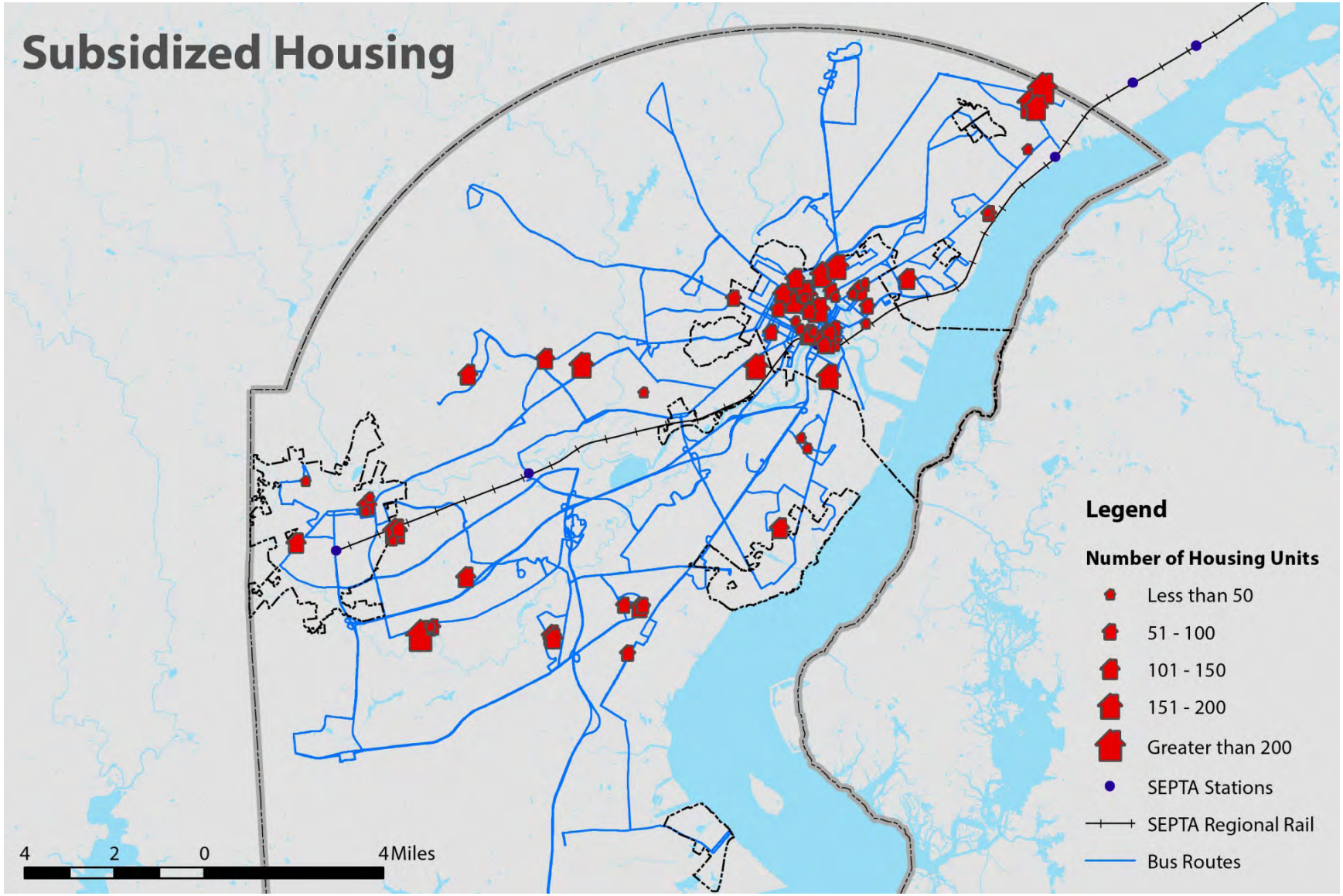
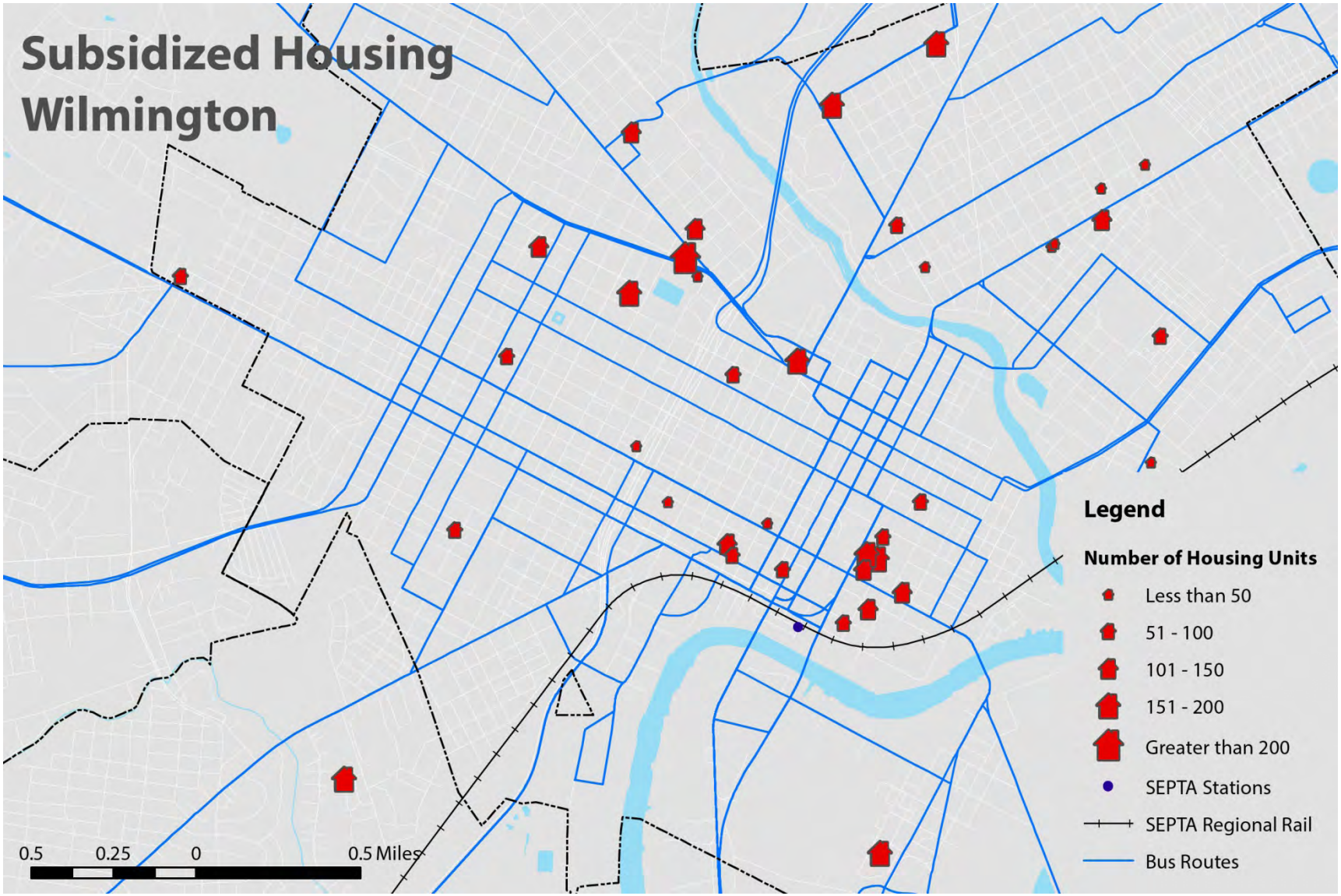


Figure 3-5: Subsidized Housing – City of Wilmington



3.2 Transit Service Summary

DART First State provides transit service for the entire State of Delaware and provided 10.2 million unlinked passenger trips during fiscal year (FY) 2013. As of September 2013, 42 DART First State transit routes serve New Castle County. During FY 2013 these routes provided 8,967,843 unlinked passenger trips in New Castle County, or 88 % of the statewide total. According to the DTC June 2013 operating results, the New Castle County transit services cost $47.6 million to operate during FY 2013. Table 3-3 lists the New Castle County routes with select operating data by corridor.

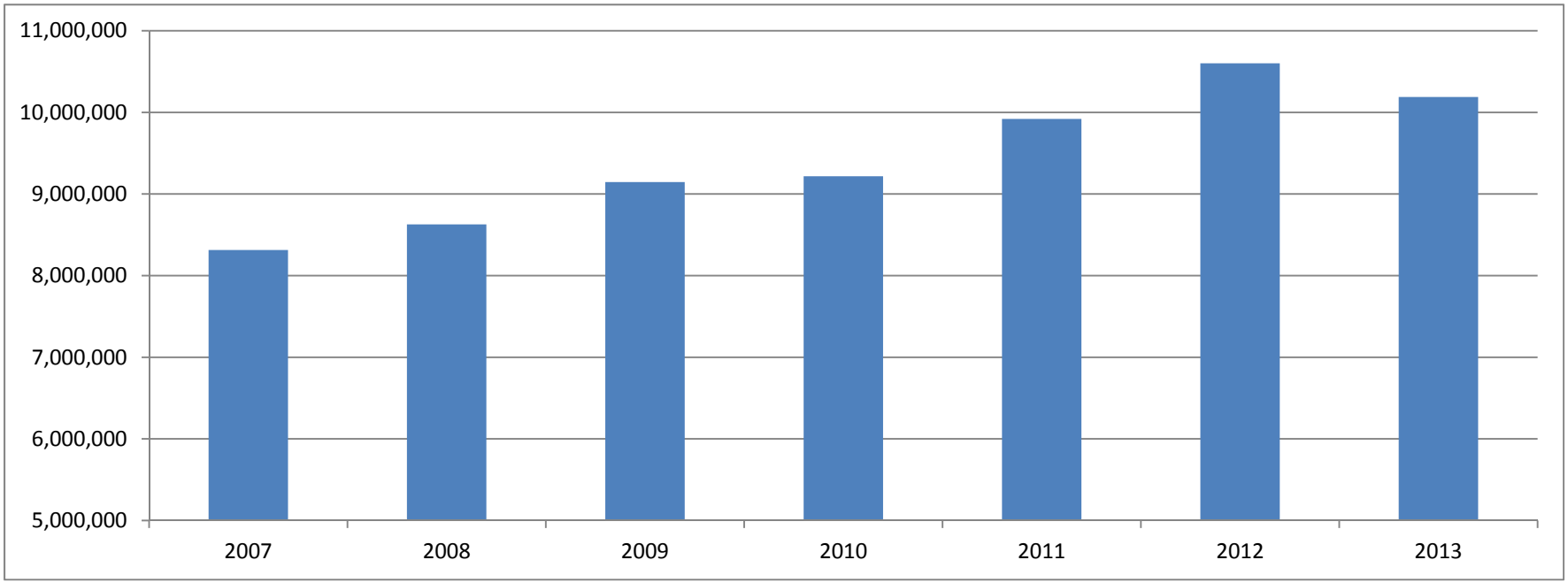
Table 3-3: Northern New Castle County Transit Operating Results by Corridor – May 2013

Corridor	Routes	Ridership	Hours	Net Cost	Net Cost per Rider	Recovery Ratio
Philadelphia Pike	1, 3, 11, 12, 24, 38, 61	165,320	5,719	$ 410,294	$ 2.48	19.1%
Concord Pike	2, 21, 28, 35	52,637	2,275	$ 180,717	$ 3.43	12.4%
Penn Ave & Lancaster Pike	4, 10, 20	63,292	2,314	$ 169,953	$ 2.69	16.5%
Kirkwood Highway	6, 19, 30, 36	80,268	3,459	$ 289,849	$ 3.61	14.6%
Maryland Ave	5, 7, 9	86,252	2,984	$ 243,922	$ 2.83	16.0%
Market, Dupont and New Castle	8, 15, 17, 22, 25, 32	121,673	5,565	$ 508,422	$ 4.18	12.0%
Christiana Mall / Newark	16, 23, 33, 34, 55, 59, 65	72,273	4,227	$ 462,508	$ 6.40	8.6%
Mid County	40, 41, 42, 54, 64	41,935	1,805	$ 200,657	$ 4.78	11.6%
Downstate	45, 301, 305	20,439	1,587	$ 218,972	$ 10.71	17.6%
Northern New Castle County		**704,089**	**29,935**	**$2,685,294**	**$ 3.81**	**12.9%**

3.3 Ridership and Service History

Transit operating statistics are reported annually by DTC to the National Transit Database. As shown in Figure 3-6, DART First State annual statewide unlinked passenger trips have grown from 8.3 million trips in FY 2007 to 10.1 million trips in FY 13. The growth in statewide unlinked passenger trips has averaged 3.45% per year over the period. Table 3-4 compares the ridership growth for Delaware's three counties since 2010. During that period New Castle County unlinked passenger trips have grown by more than 750,000 annual trips, or 2.97% average annual growth. Kent and Sussex County unlinked passenger trips have grown by 216,000 annual unlinked passenger trips, or 6.68% average annual growth.

Figure 3-6: DART First State Unlinked Passenger Trips



Source: National Transit Database and DART First State June 2013 Operating Data

Table 3-4: DART First State Unlinked Passenger Trips by County

County	FY 10	FY 11	FY 12	FY 13	Average Annual Change
New Castle	8,210,195	8,731,967	9,354,285	8,963,344	2.97%
Kent	576,034	687,333	741,714	739,176	8.67%
Sussex	433,162	500,913	505,326	486,045	3.91%
State Total	9,219,391	9,920,213	10,601,325	10,188,565	3.39%
Source: DART First State June 2013 Operating Data					

National Transit Database information has been used to compare DART First State statewide annual change in ridership with other large transit services from Virginia to New Jersey. Table 3-5 compares data from FY 2007 to FY 2011 and demonstrates that, of these ten transit systems, only Harrisburg, PA had a higher average annual rate of ridership growth than DART First State.

Table 3-5: Average Annual Change in Unlinked Passengers - FY 07 to FY 11

System	Annual Change
Port Authority of Allegheny County	-2.0%
Richmond, VA	-1.9%
Maryland Transit Administration	-0.8%
New Jersey Transit	-0.8%
Rockville, MD	-0.4%
WMATA	-0.3%
SEPTA	0.7%
Allentown, PA	1.7%
DART First State	**3.2%**
Harrisburg, PA	3.3%
Source: National Transit Database 2011 Time Series	

Table 3-6 compares the annual rate of change since 2010 for the New Castle County transit corridors. The Downstate Express services had the highest rate of growth, followed by the Maryland Avenue and Christiana Mall / Newark corridors. The Pennsylvania Avenue & Lancaster Pike corridor was the only corridor to show a loss in ridership during the period.

Table 3-6: Average Annual Change in Ridership – FY 10 to FY 13

Corridor	2013 Weekday Riders	Average Annual Change
Philadelphia Pike	7,476	2.7%
Concord Pike	2,257	0.9%
Penn Ave & Lancaster Pike	2,846	-0.8%
Kirkwood Highway	3,699	2.3%
Maryland Ave	3,701	5.1%
Market, Dupont, New Castle	5,718	2.7%
Christiana Mall / Newark	3,514	4.6%
Mid County	2,071	3.6%
Downstate	949	6.7%
Total	32,232	2.8%
Source: DART First State June 2013 Operating Data		

4 SYSTEM WIDE DATA ANALYSIS

4.1 Mode of Access

Survey respondents were asked how they began their trip and how they planned to arrive at their destination. For example, a rider could respond they began their trip by driving an automobile to a park-and-ride and then walking to their final destination after arriving at their last bus stop.

Roughly 75% of respondents indicated they walked to their bus stop and also planned to walk to their final destination. This was also the case for most corridors with the exception of Downstate. Most riders originating in the Downstate corridor used automobiles to arrive at their bus stop and then walked to their final destination.

Table 4-1: System Mode of Access

	Mode of Egress						
		Auto	Carpool	Kiss & Ride	Bike	Walk	Total
Mode of Access	Auto	130	1	3		223	357
	Carpool	6	3			14	23
	Kiss & Ride	68	6	7		14	95
	Bike	7	2		41	72	122
	Walk	217	7	12	12	3,350	3,598
	Total	428	19	22	53	3,673	4,195

4.2 Trip Type

Trip information includes rider responses to the following survey questions:

- Where they are coming from when they ride DART First State
- Where they go when they ride DART First State

Table 4-2: Trip Type

	# of Respondents	Percentage
Home to Work	2151	47.9%
Home to Other	813	18.1%
Home to School	382	8.5%
Home to Home	296	6.6%
Workplace to Other	265	5.9%
Workplace to Workplace	243	5.4%
Other to Other	184	4.1%
Workplace to School	90	2.0%
School to School	58	1.3%
School to Other	8	0.2%
Total	4,490	100.0%

The following points summarize the findings of this section:

- 81% of DART First State riders travel to or from their HOME.
- Over 47% of riders commute to or from their WORKPLACE to HOME using DART First State.
- Over 18% of riders use DART First State to travel to and from HOME to OTHER destinations.
- Roughly 12% of riders use DART First State as their transportation to or from SCHOOL.
- Nearly 6% of riders use DART First State to travel during their workday.
- The Downstate corridor is the heaviest user of DART First State for HOME-to-WORKPLACE, WORKPLACE-to-HOME trips.
- The Market, Dupont, and New Castle corridor tends to use DART First State more for non-work related trips relative to the other corridors.

"OTHER" Trip Purpose Analysis

Riders were asked whether they were heading to or from their HOME, WORKPLACE, SCHOOL, or OTHER destinations when riding DART First State. The purpose of this subsection is to summarize the types of OTHER destinations provided by riders. For simplicity, responses were categorized into eight groups. The list below describes what types of origins or destinations are inclusive within each of the groups. A miscellaneous category was also created for responses that couldn't be easily categorized.

The following were the top 3 OTHER destinations for DART First State riders:

- Shopping, Eating, Errands
- Medical Appointments
- Visiting Friends, Family

Definitions of "OTHER" origins and destinations

Shopping, Eating, Errands
Riders traveling to or from particular shops, grocery stores, shopping centers or malls, restaurants, banks, daycare, laundromats, etc.

Medical Appointments
Riders traveling to the hospital, clinic, or for doctor, dentist, or other appointments.

Friends, Family
Riders traveling to or from their friend's, significant other's, or family's households.

Library
Riders traveling to or from a local library.

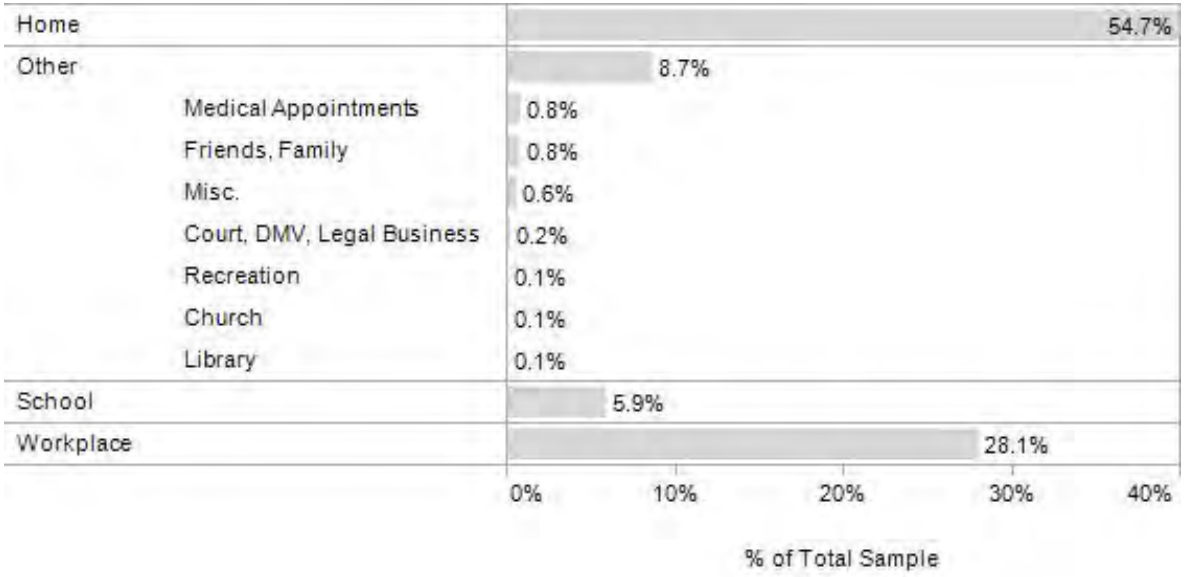
Court, DMV, Legal Business
Riders traveling to or from court hearings, the DMV, parole hearings, probation, rehab, unemployment office, welfare office, social security office, or any other federal building.

Church
Riders traveling to or from a church or to other destinations relating to religious organizations.

Recreation
Riders traveling to or from recreation destinations such as the gym, yoga studios, casinos, etc.

Miscellaneous
All other originations or destinations which are unclassifiable.

Figure 4-1: Trip Type



4.3 Transfer Analysis

System and corridor transfer analyses were completed. Customers were asked to state their starting route and the route they transferred to. Table 4-3 shows the transfer analysis for all of the New Castle County routes. Of the 4,490 surveys, 98 had either blank starting routes or SEPTA or Kent County routes outside the analysis area. Of the remaining 4,392 surveys, 2,581 did not require a transfer to complete their trip, while 1,811 transferred routes, or a transfer rate of 41.2%. The corridor transfer analysis is shown in Table 4-4. The Mid County corridor routes had the highest rate of transfers, at 50.2%, while the Downstate services had the lowest rate of transfers, at 27.8%.

Table 4-3: System Transfer Analysis

Surveys Returned	Blank or Invalid Routes	Surveys for Transfer Analysis	Did not Transfer	Transfer	% Transfer
4,490	98	4,392	2,581	1,811	41.2%

Table 4-4: Corridor Transfer Analysis

Corridor	Estimated Riders	# Surveys	# Transfers	% Transfer
Philadelphia Pike	3,757	909	415	45.7%
Concord Pike	1,196	269	94	36.8%
Pennsylvania Ave and Lancaster Pike	1,438	407	156	39.3%
Kirkwood Highway	1,824	415	147	35.4%
Maryland Ave	1,960	386	178	49.0%
Market, Dupont, New Castle	2,765	954	406	43.5%
Christiana Mall / Newark	1,643	532	191	37.0%
Mid County	953	325	162	50.2%
Downstate	464	162	43	27.8%
Train	-	33	19	57.6%
Total	**16,001**	**4,392**	**1,811**	**41.2%**

5 SUBAREA TRAVEL PATTERNS

The subarea travel analysis utilized the 2,394 surveys that were successfully geocoded with origins and destinations. Figure 2-2 shows the subareas. Table 5-1 compares the trips with origins in the City of Wilmington with the trips with origins in other subareas. Of the 2,394 total trips with valid O-D pairs, 45.8% had origins within the City of Wilmington and 51.5%had origins in other subareas. Of the Wilmington based trips, 46.0%traveled to destinations within the City of Wilmington while 54.0% traveled to destinations outside the City. Trips from all other subareas had 50.2% of trips traveling to the City of Wilmington, 38.8% of the trips traveling to other subareas, and 11.0% of these trips starting and ending in the same subarea.

Table 5-2 presents the origin-destination analysis for all other subareas. Brandywine West (the Concord Pike area) had the highest rate of travel to Wilmington, at 75.4 %.

Table 5-1: Wilmington Subarea Analysis

Subarea	**# Origin**		**Trips Within Subarea**		**Trips to Wilmington (excluding Wilmington)**		**Trips to other Subarea (except Wilmington)**	
	#	%	#	%	#	%	#	%
Wilmington	1,162	48.5%	534	46.0%			628	54.0%
All others	1,232	51.5%	135	11.0%	619	50.2%	478	38.8%

Table 5-2: Subarea Analysis

Subarea (excluding Wilmington)	# Origin	Trips Within Subarea		Trips to Wilmington		Trips to other Subarea (except Wilmington)	
		#	%	#	%	#	%
Brandywine East	128	21	16.4%	66	51.6%	41	32.0%
Brandywine West	57	4	7.0%	43	75.4%	10	17.5%
Piedmont East	8	2	25.0%	3	37.5%	3	37.5%
Piedmont West	20	2	10.0%	15	75.0%	3	15.0%
Lower Christina North	46	1	2.2%	32	69.6%	13	28.3%
Lower Christina South	109	12	11.0%	50	45.9%	47	43.1%
New Castle	214	32	15.0%	100	46.7%	82	38.3%
Pike Creek	71	3	4.2%	40	56.3%	28	39.4%
Upper Christina	114	12	10.5%	49	43.0%	53	46.5%
Wilton	94	8	8.5%	54	57.4%	32	34.0%
Bear	57	2	3.5%	29	50.9%	26	45.6%
Greater Newark	162	26	16.0%	68	42.0%	68	42.0%
Central Pencader	60	6	10.0%	22	36.7%	32	53.3%
Red Lion	4	1	25.0%	1	25.0%	2	50.0%
Middletown	50	2	4.0%	33	66.0%	15	30.0%
Kent / Sussex	16	1	6.3%	4	25.0%	11	68.8%
Maryland	11	-	0.0%	4	36.4%	7	63.6%
Pennsylvania	11	-	0.0%	6	54.5%	5	45.5%
New Jersey	0	-	0.0%	-	0.0%	-	0.0%
Total	**1,232**	**135**	**11.0%**	**619**	**50.2%**	**478**	**38.8%**

6 TRANSIT CORRIDOR TRAVEL MAPS

Four maps are provided for each of the nine transit corridors including:

1. Boarding and alighting data collected by DTC
2. Trips within the corridor
3. Trips to the Downtown area
4. Trips outside the corridor and the Downtown area

Note that boarding and alighting data were not available for the Downstate corridor.

6.1 Philadelphia Pike

Figure 6-1: Boarding and alighting data collected by DTC for the Philadelphia Pike Corridor

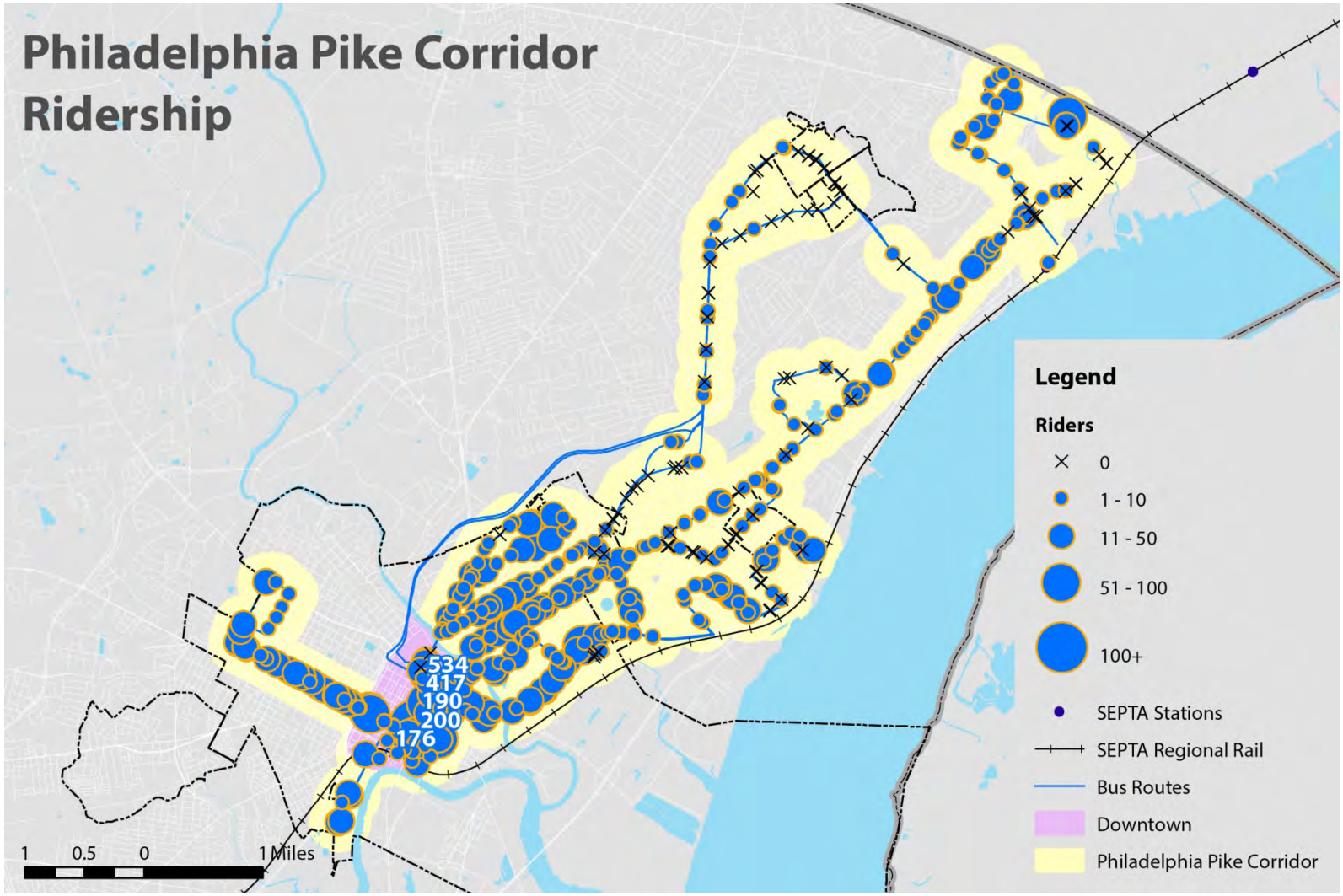


Figure 6-2: Trips within the Philadelphia Pike Corridor

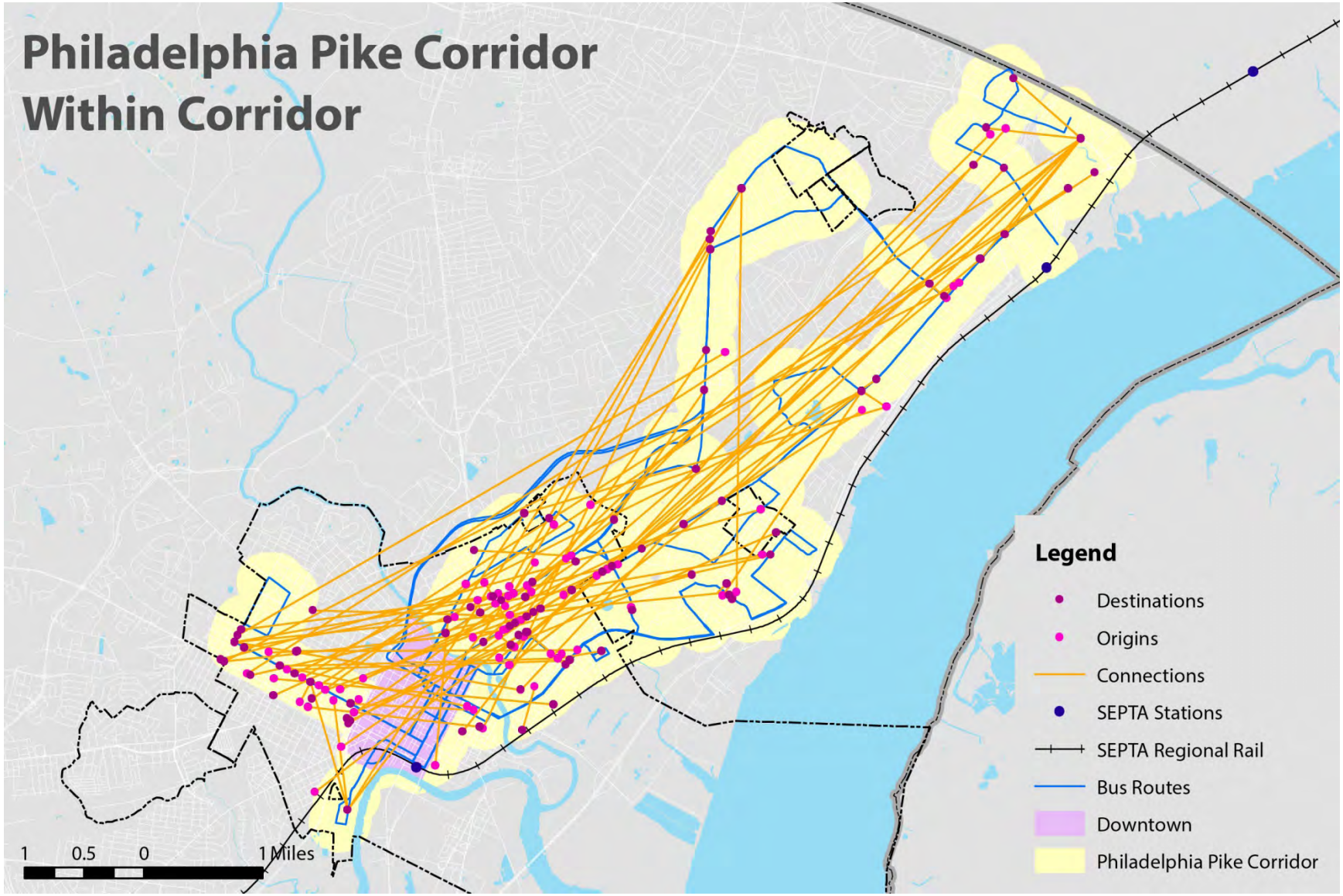


Figure 6-3: Trips from the Philadelphia Pike Corridor to the Downtown area

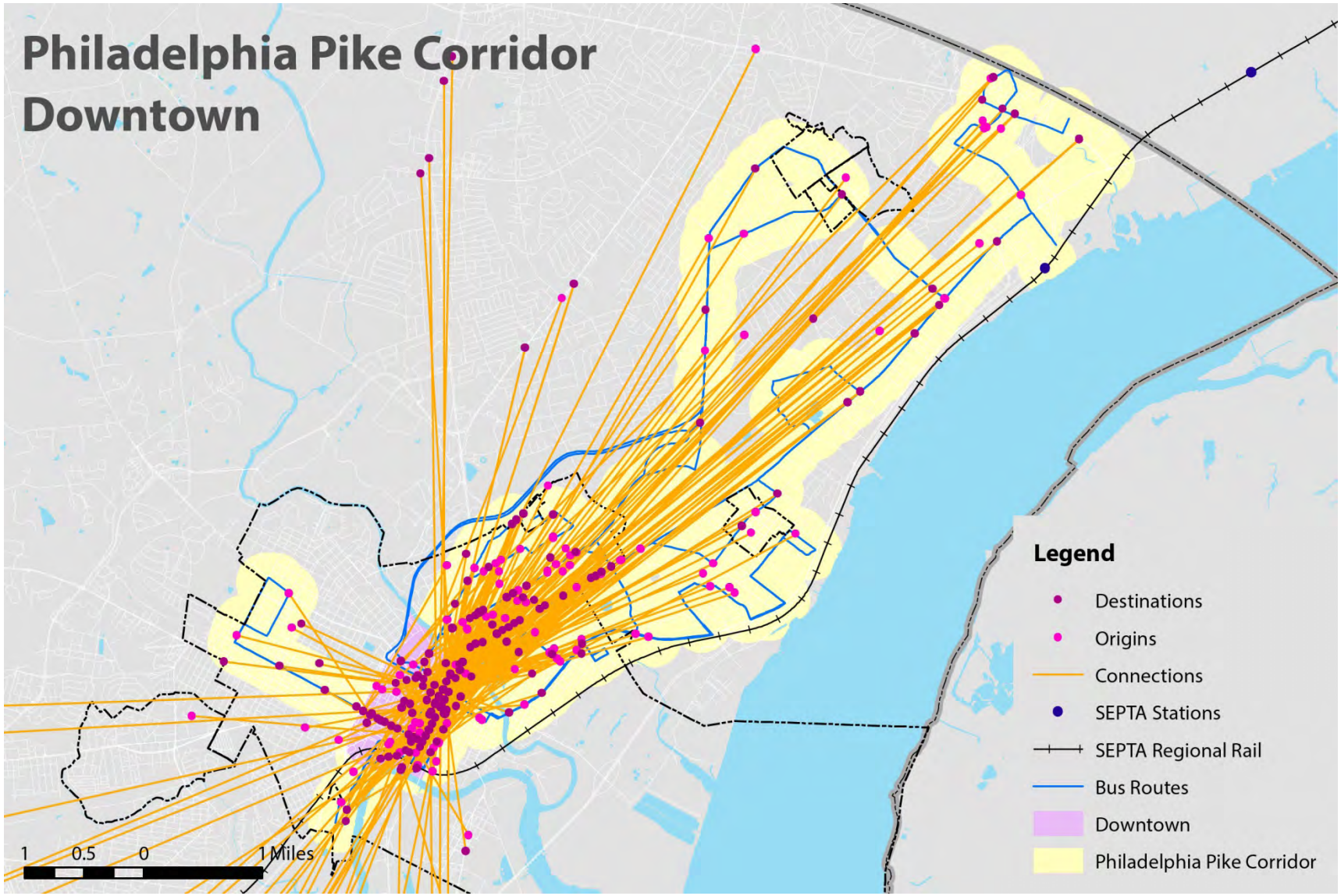
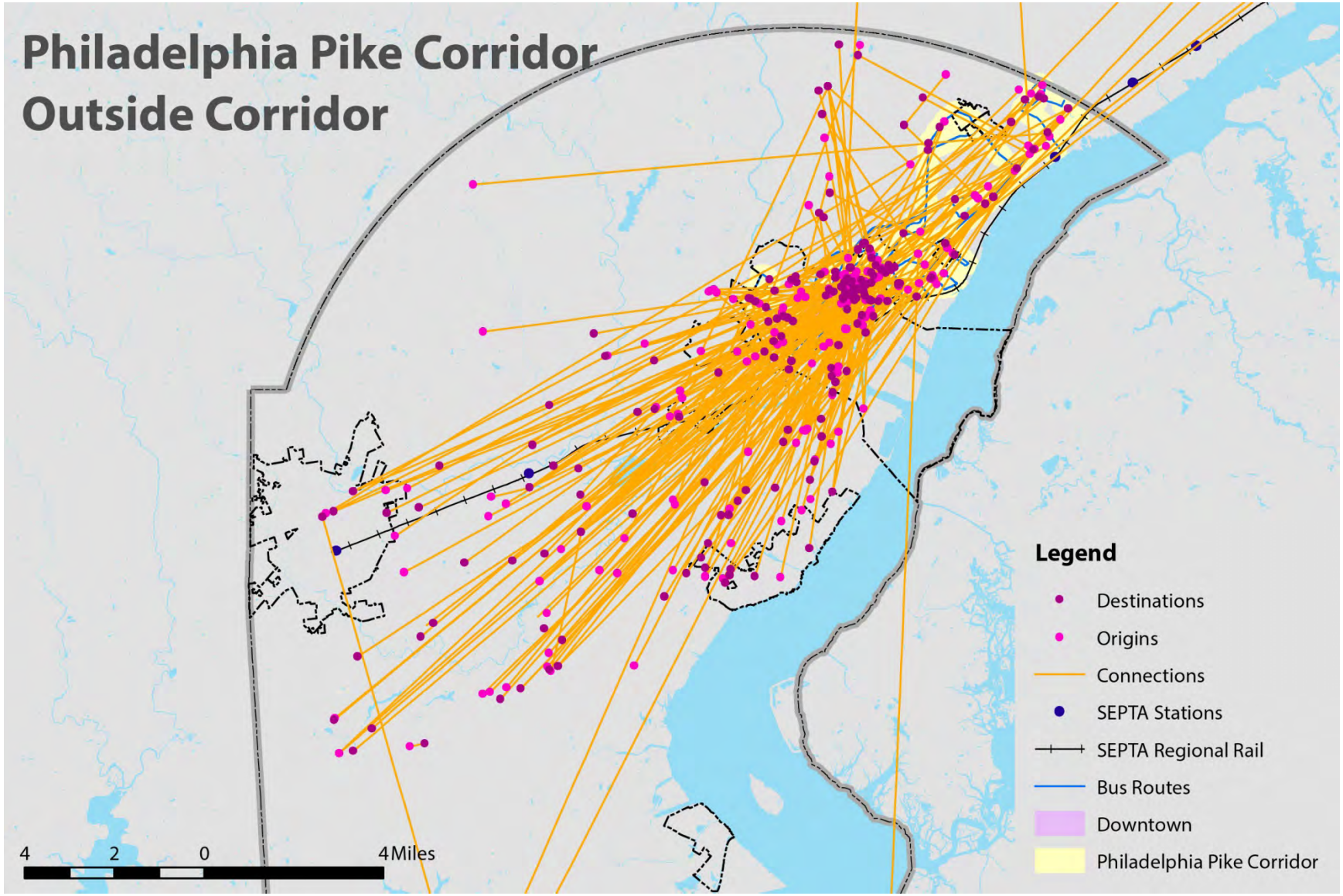


Figure 6-4: Trips outside the Philadelphia Pike Corridor and Downtown area



6.2 Concord Pike

Figure 6-5: Boarding and alighting data collected by DTC for the Concord Pike Corridor

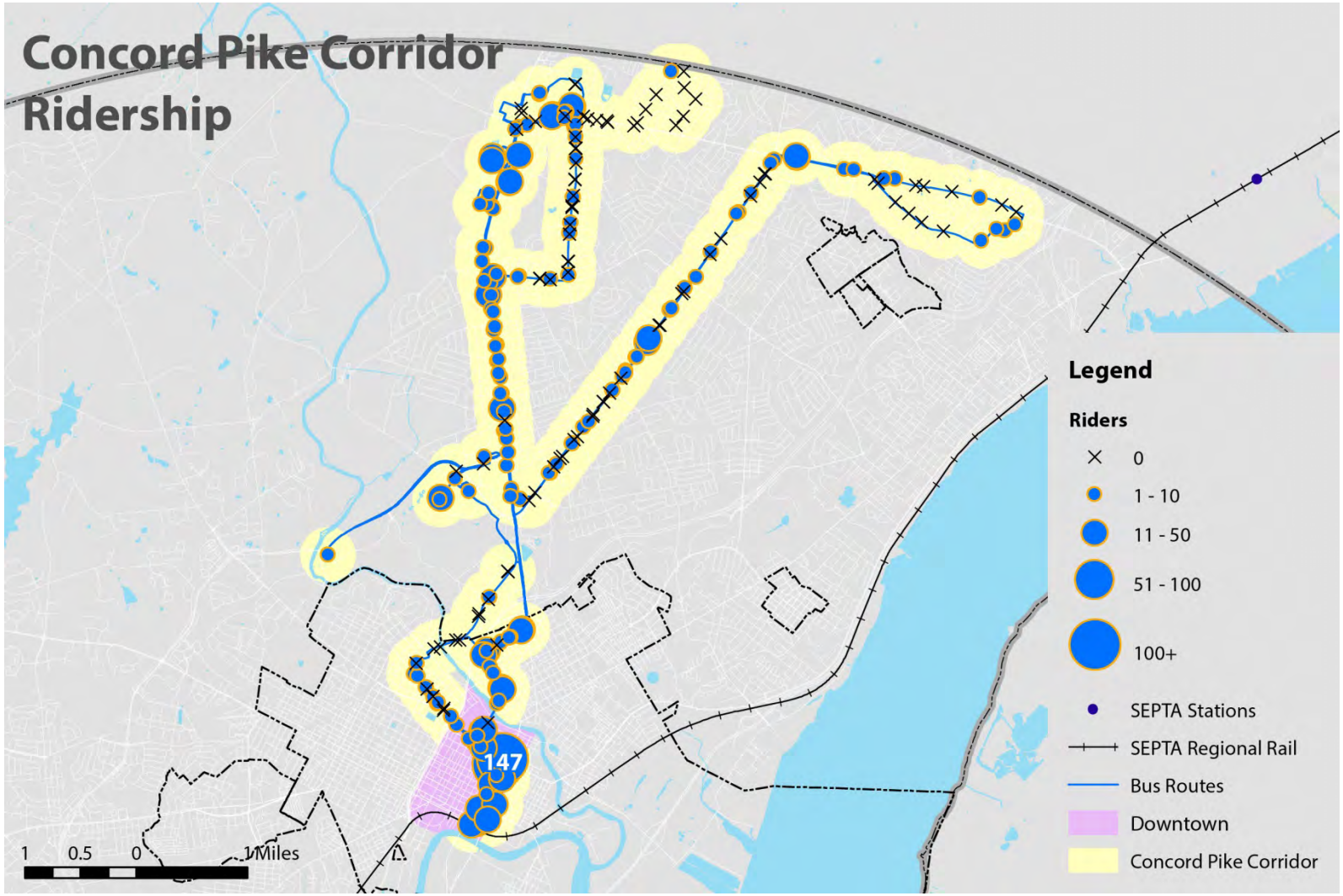


Figure 6-6: Trips within the Concord Pike Corridor

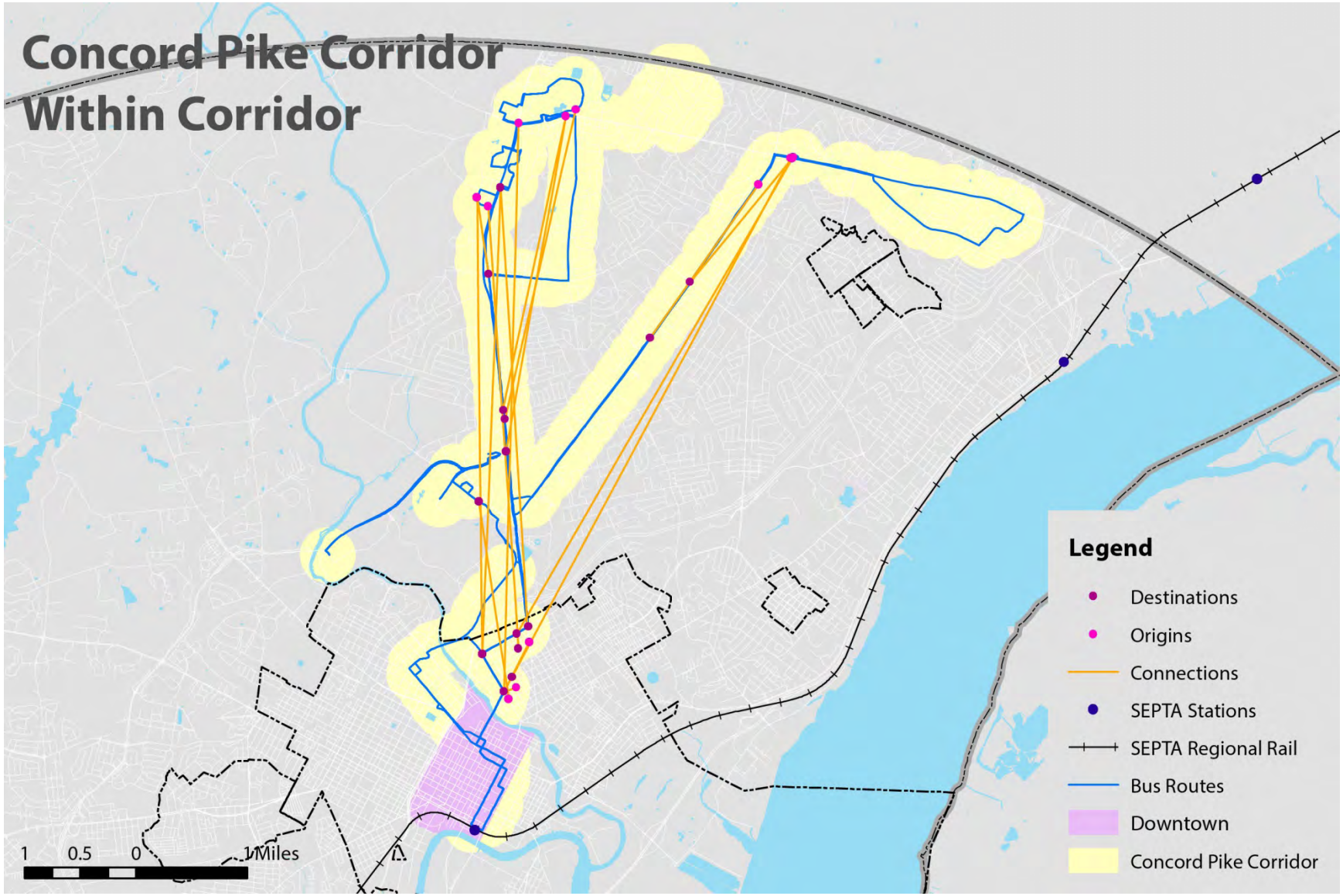


Figure 6-7: Trips from the Concord Pike Corridor to the Downtown area

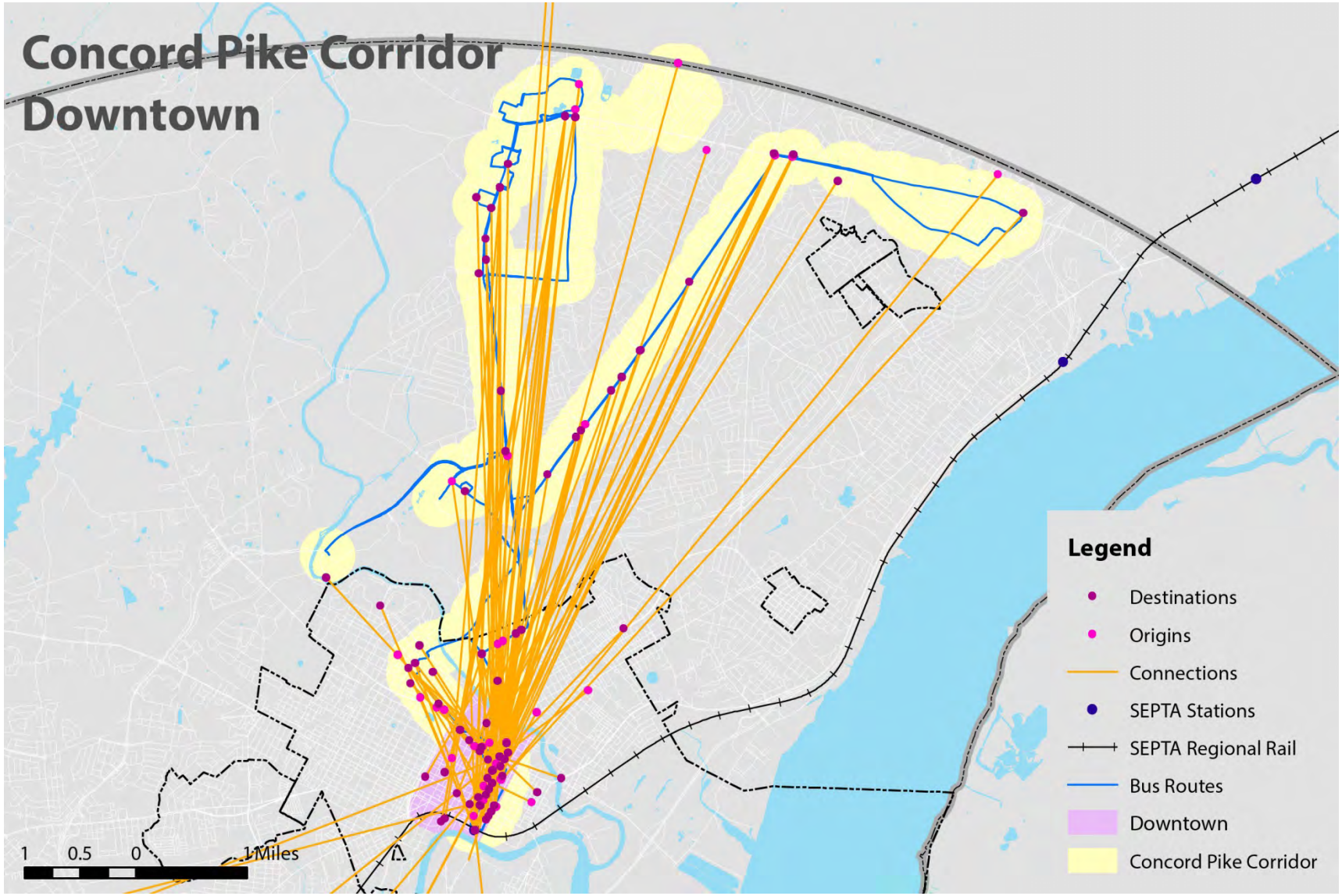
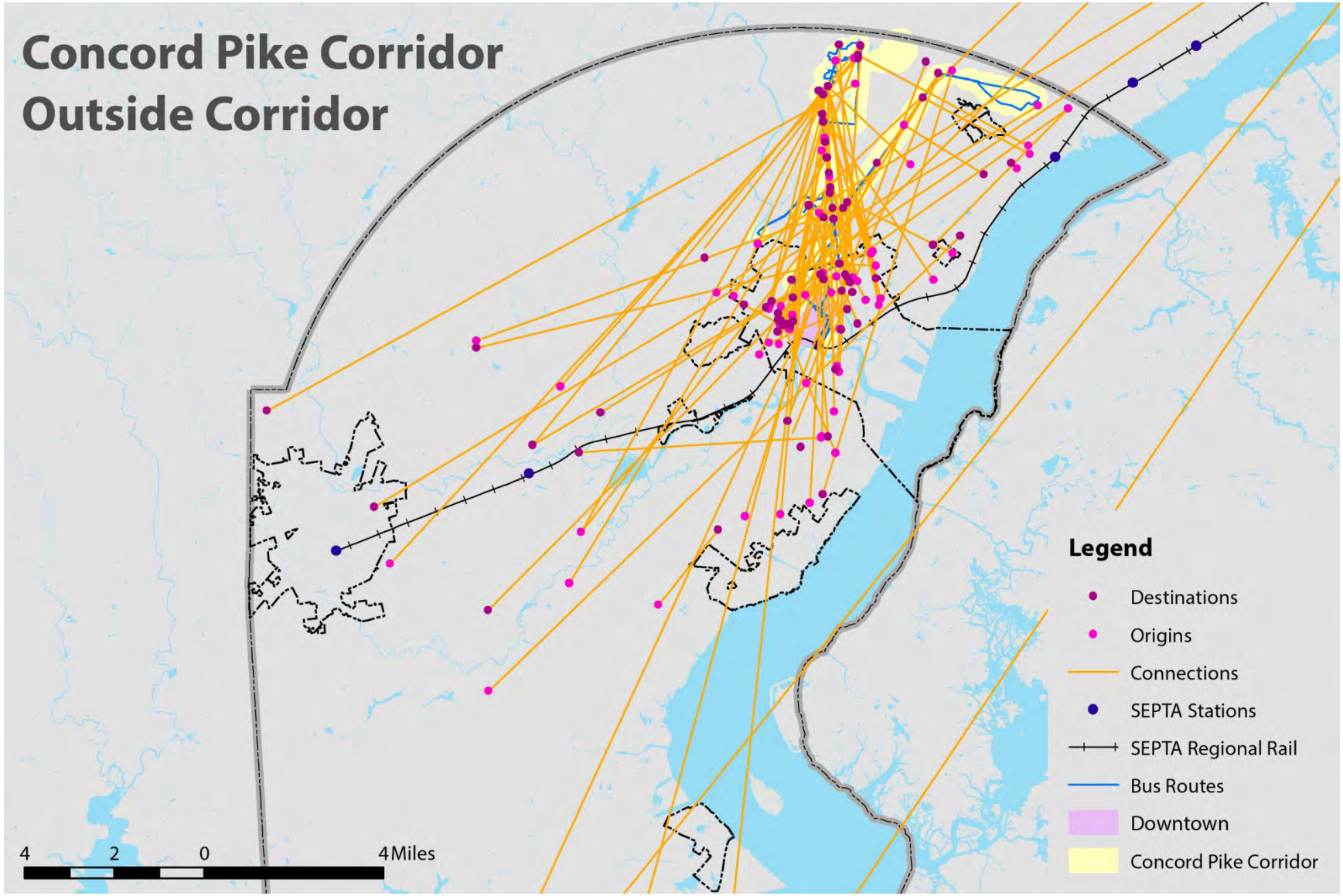


Figure 6-8: Trips outside the Concord Pike Corridor and Downtown area



6.3 Pennsylvania Avenue and Lancaster Pike

Figure 6-9: Boarding and alighting data collected by DTC for the Pennsylvania Avenue / Lancaster Pike Corridor

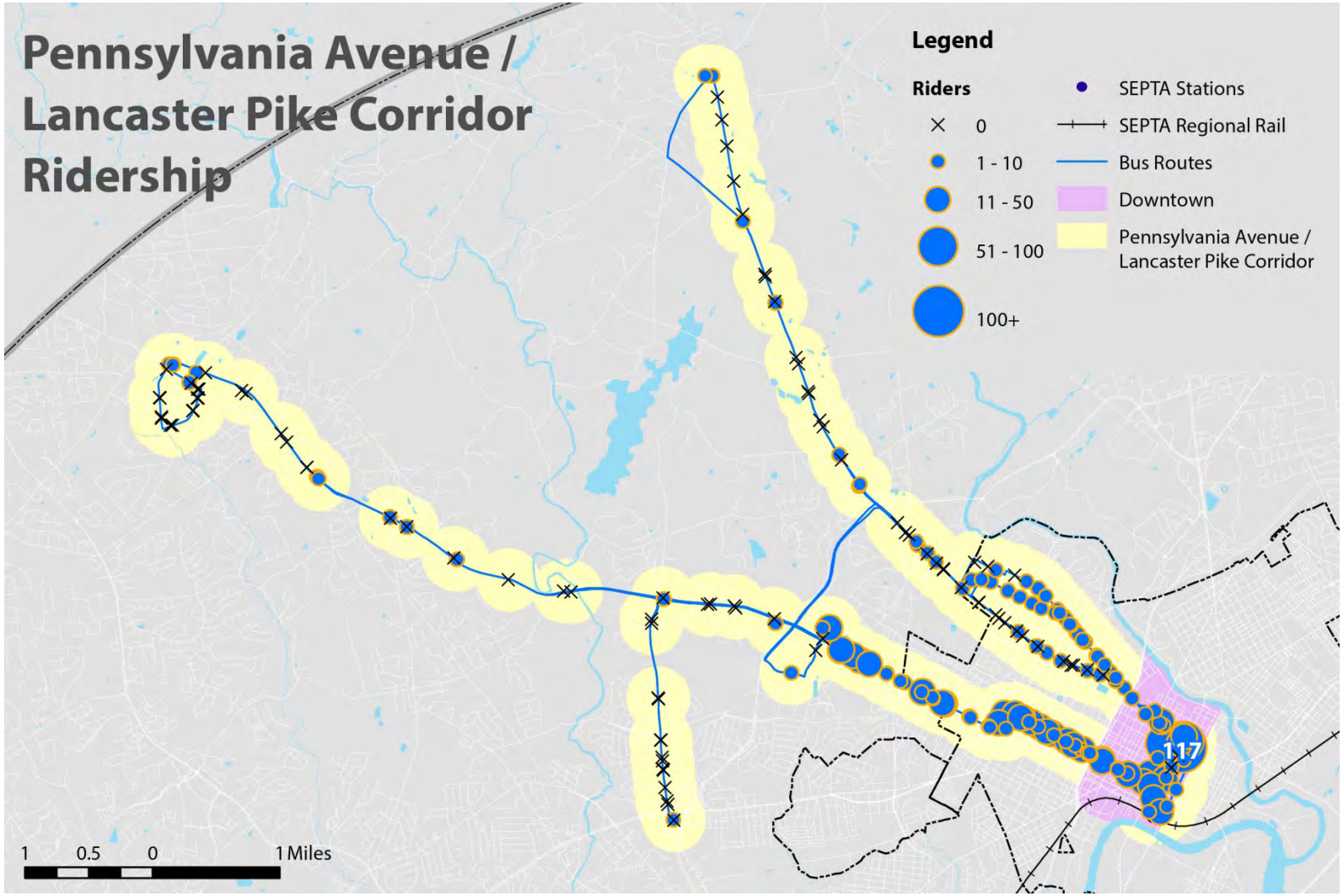


Figure 6-10: Trips within the Pennsylvania Avenue / Lancaster Pike Corridor

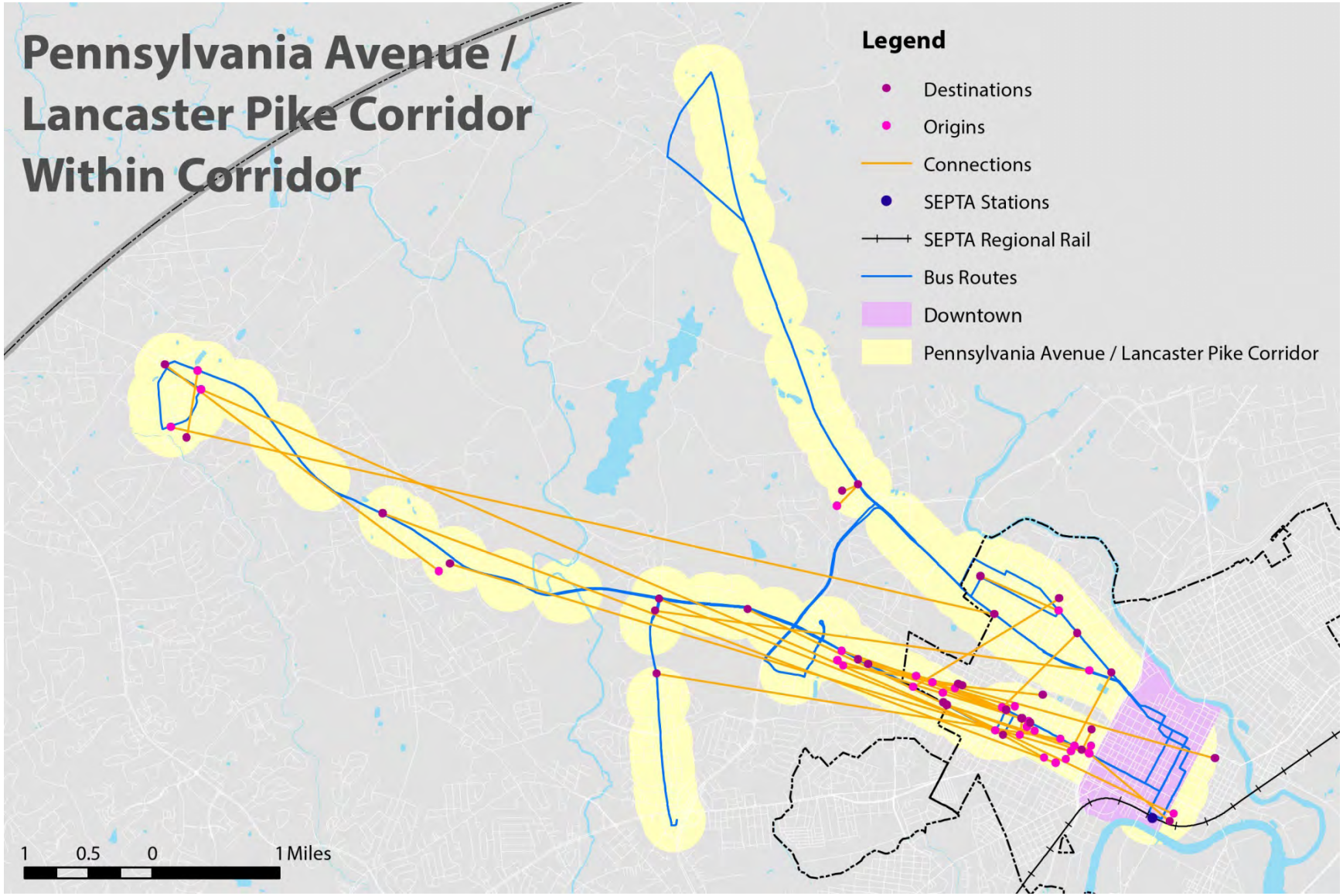


Figure 6-11: Trips from the Pennsylvania Avenue / Lancaster Pike Corridor to the Downtown area

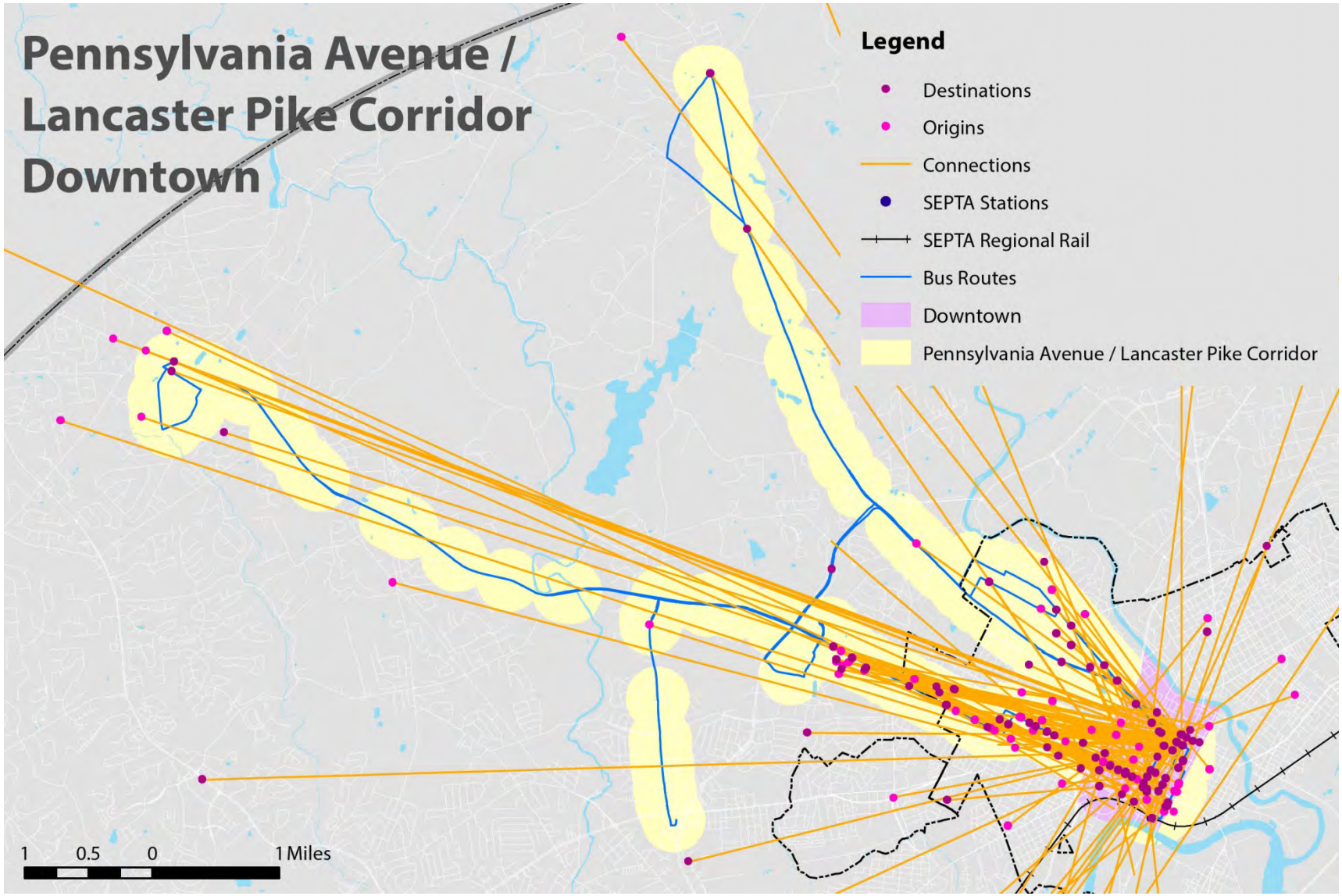
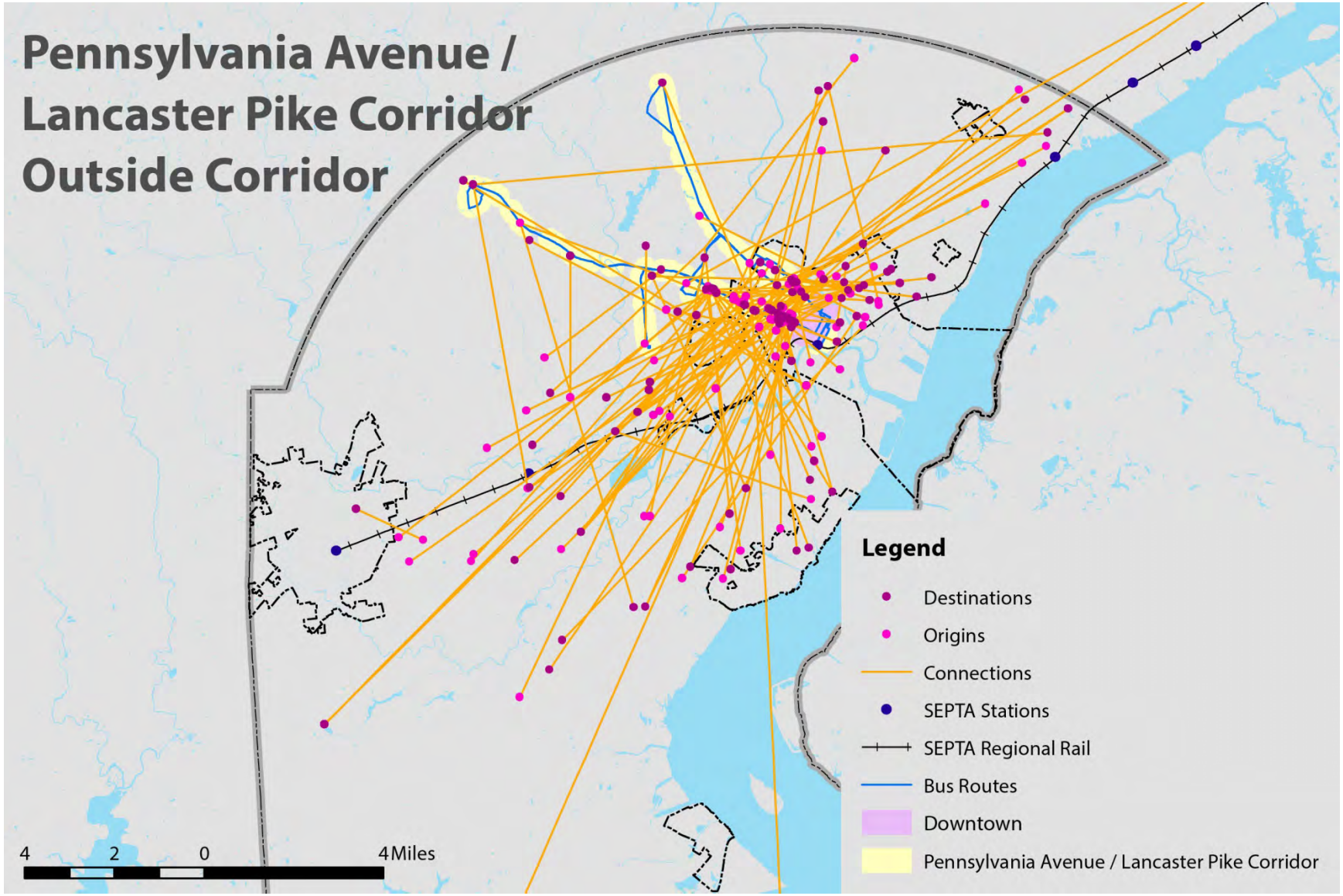


Figure 6-12: Trips outside the Pennsylvania Avenue / Lancaster Pike Corridor and Downtown area



6.4 Kirkwood Highway

Figure 6-13: Boarding and alighting data collected by DTC for the Kirkwood Highway Corridor

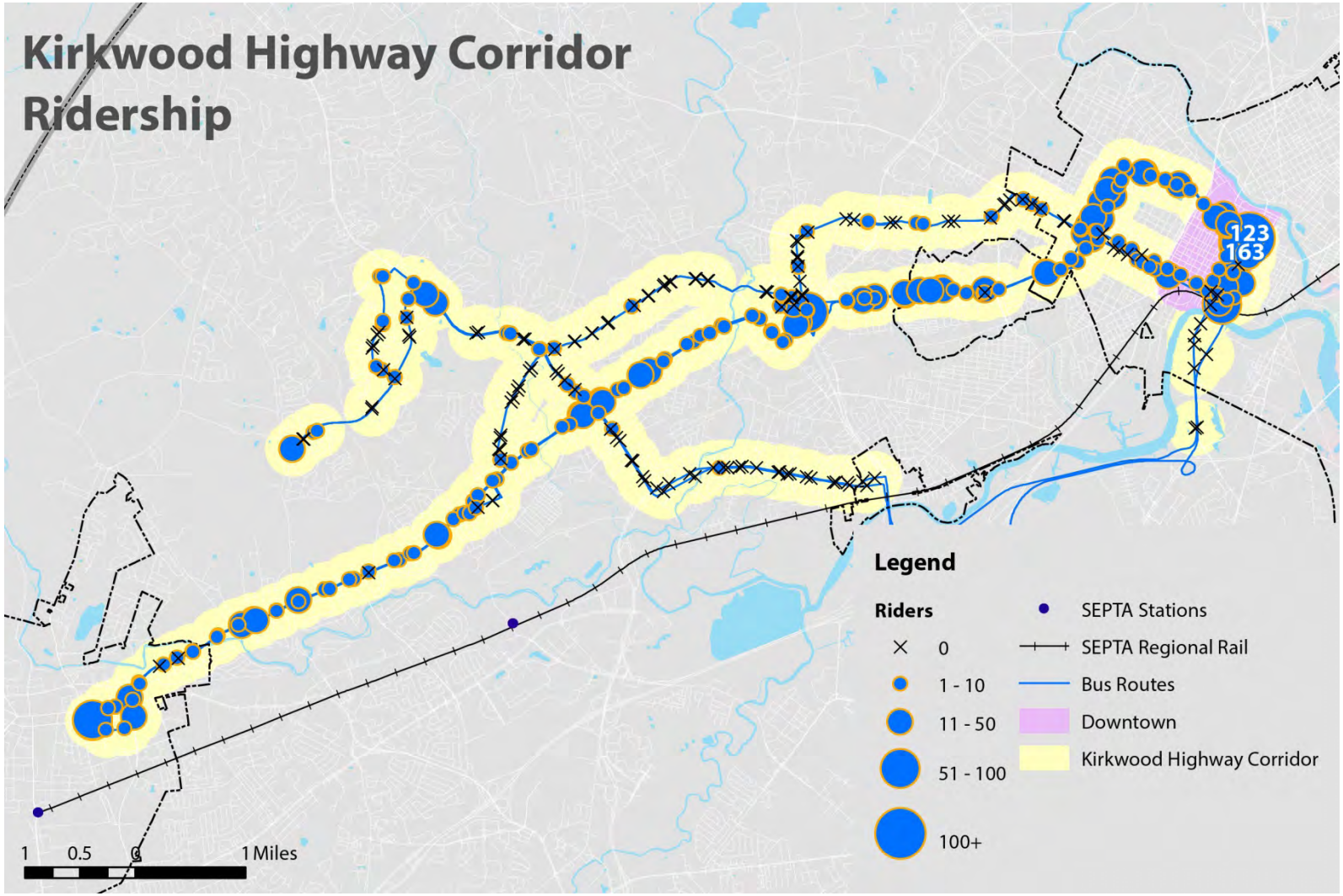


Figure 6-14: Trips within the Kirkwood Highway Corridor

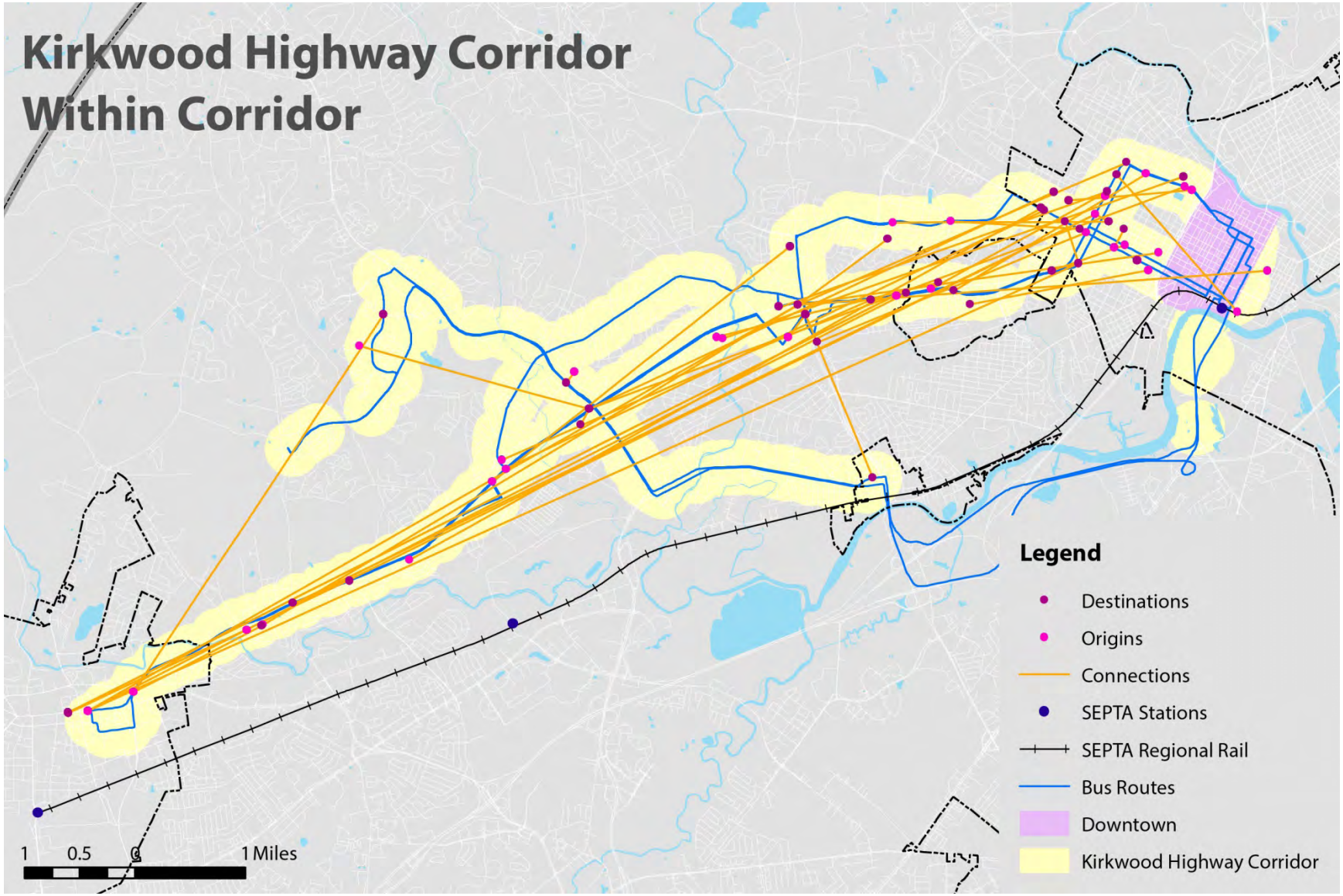


Figure 6-15: Trips from the Kirkwood Highway Corridor to the Downtown area

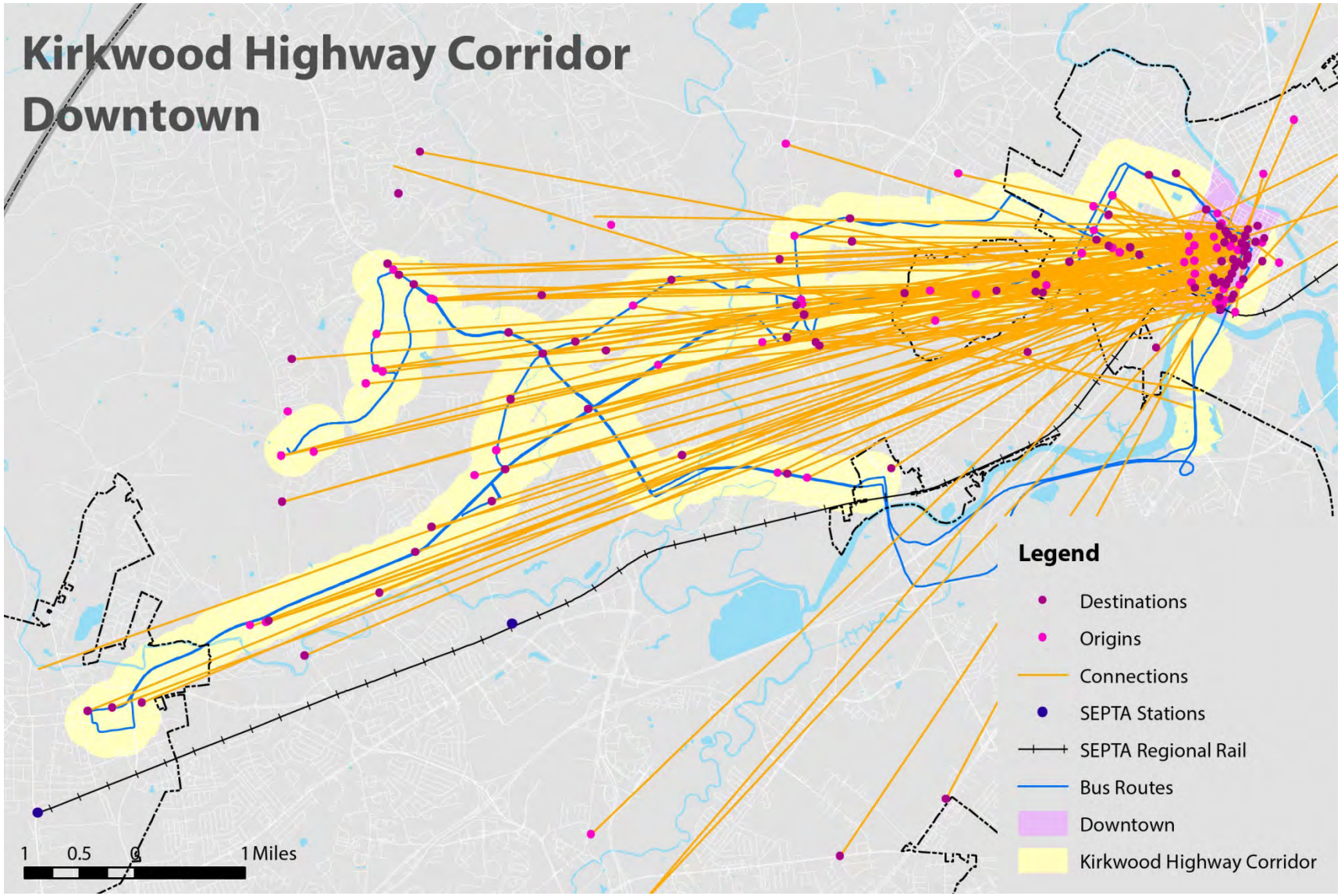
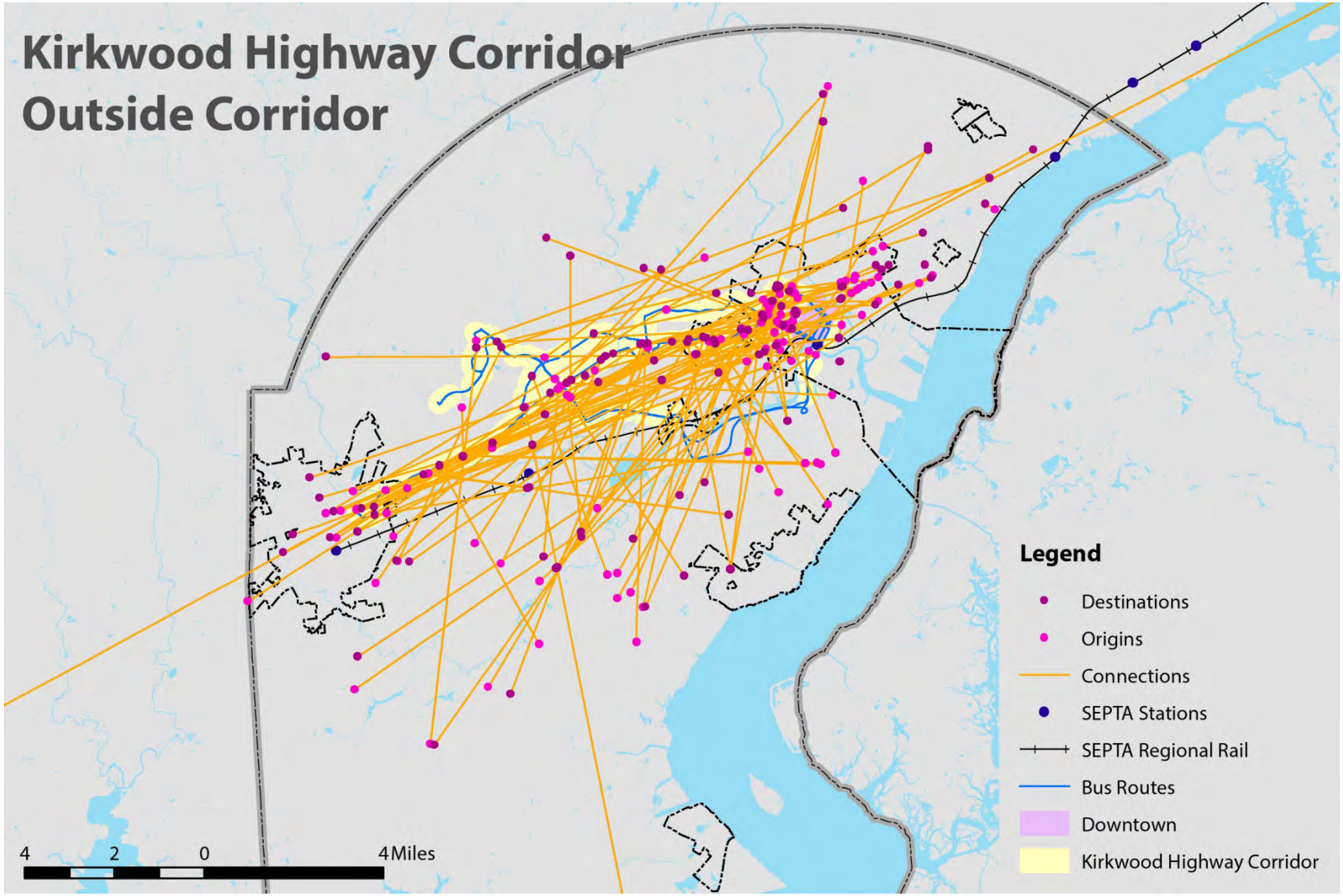


Figure 6-16: Trips outside the Kirkwood Highway Corridor and Downtown area



6.5 Maryland Avenue

Figure 6-17: Boarding and alighting data collected by DTC for the Maryland Avenue Corridor

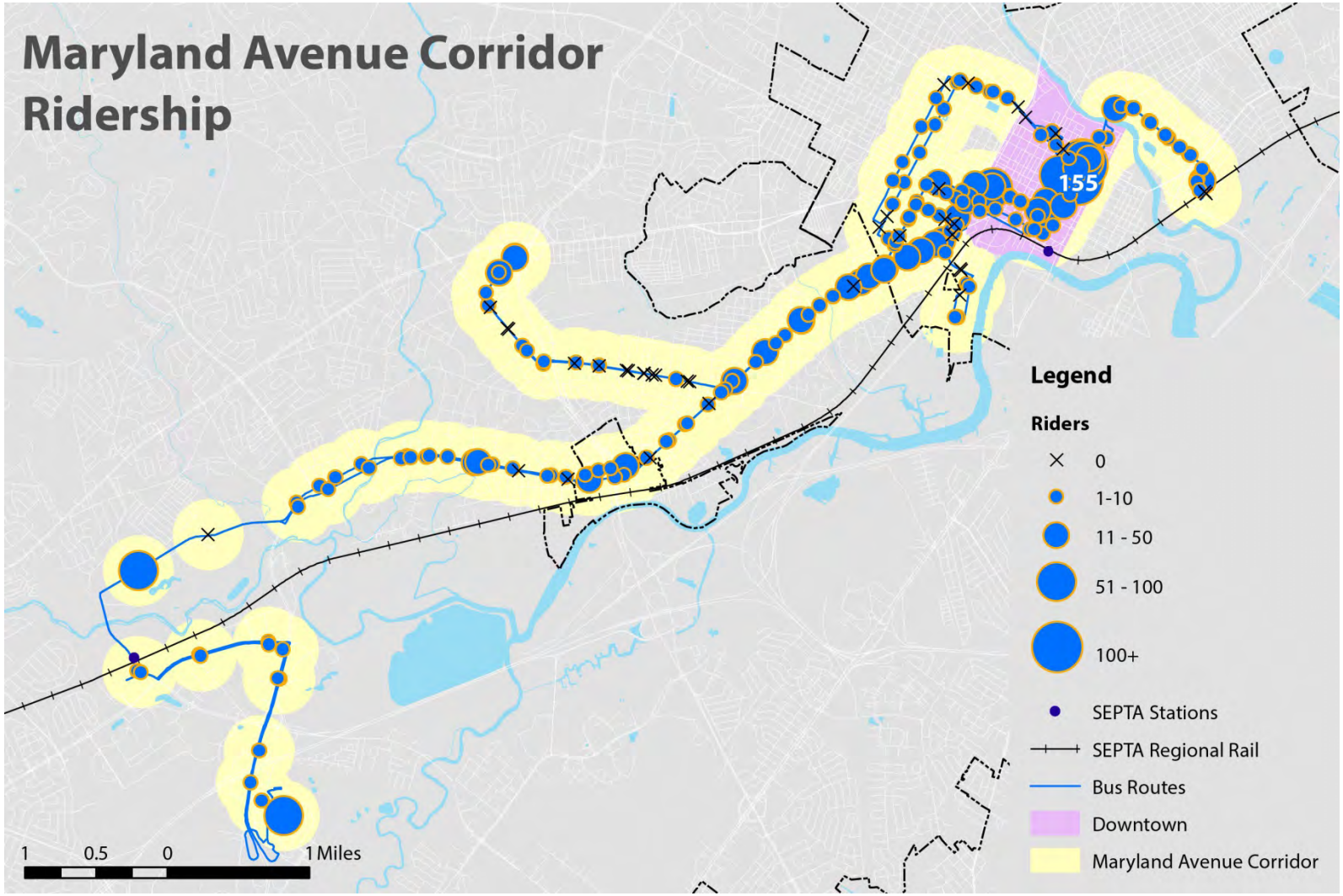


Figure 6-18: Trips within the Maryland Avenue Corridor

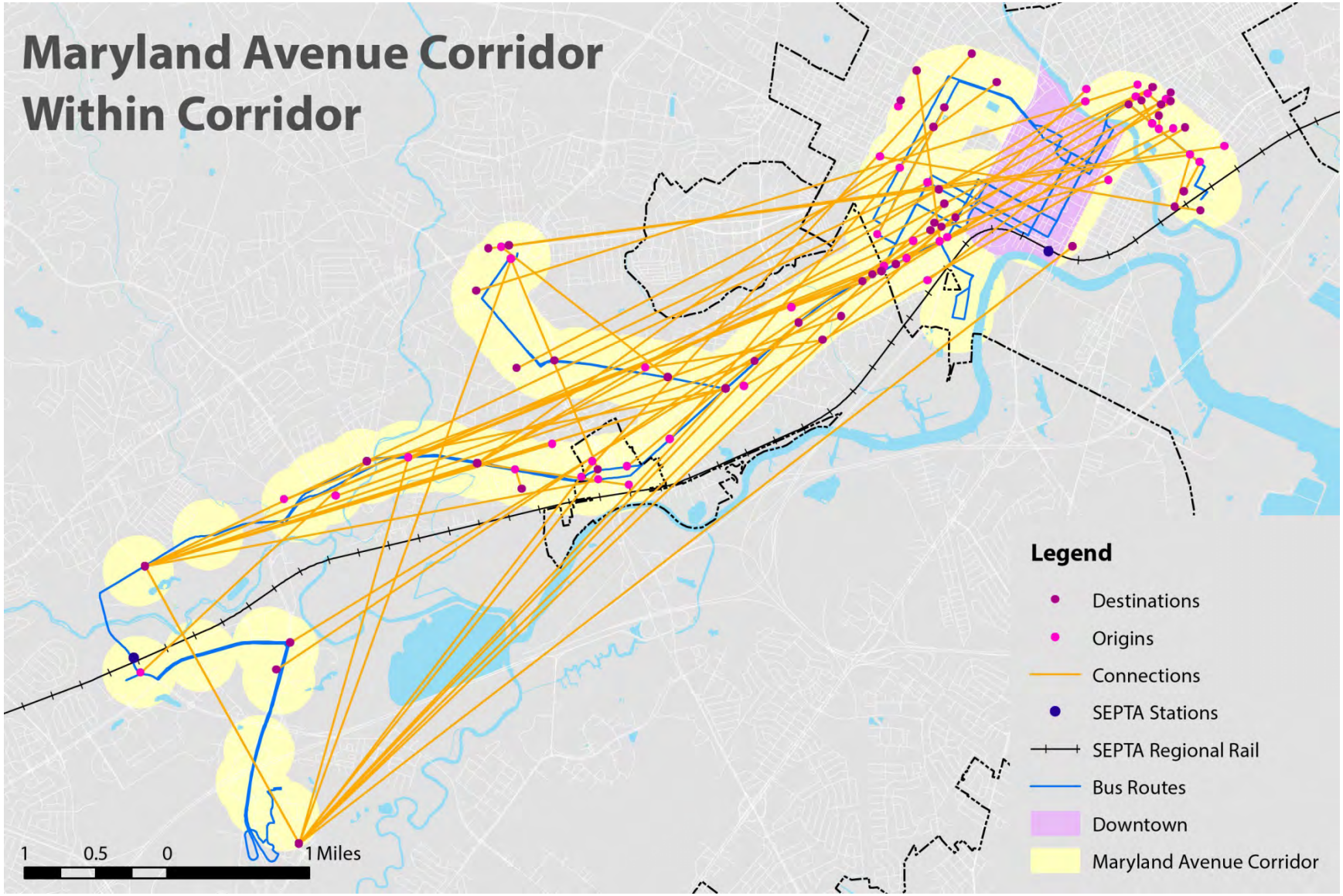


Figure 6-19: Trips from the Maryland Avenue Corridor to the Downtown area

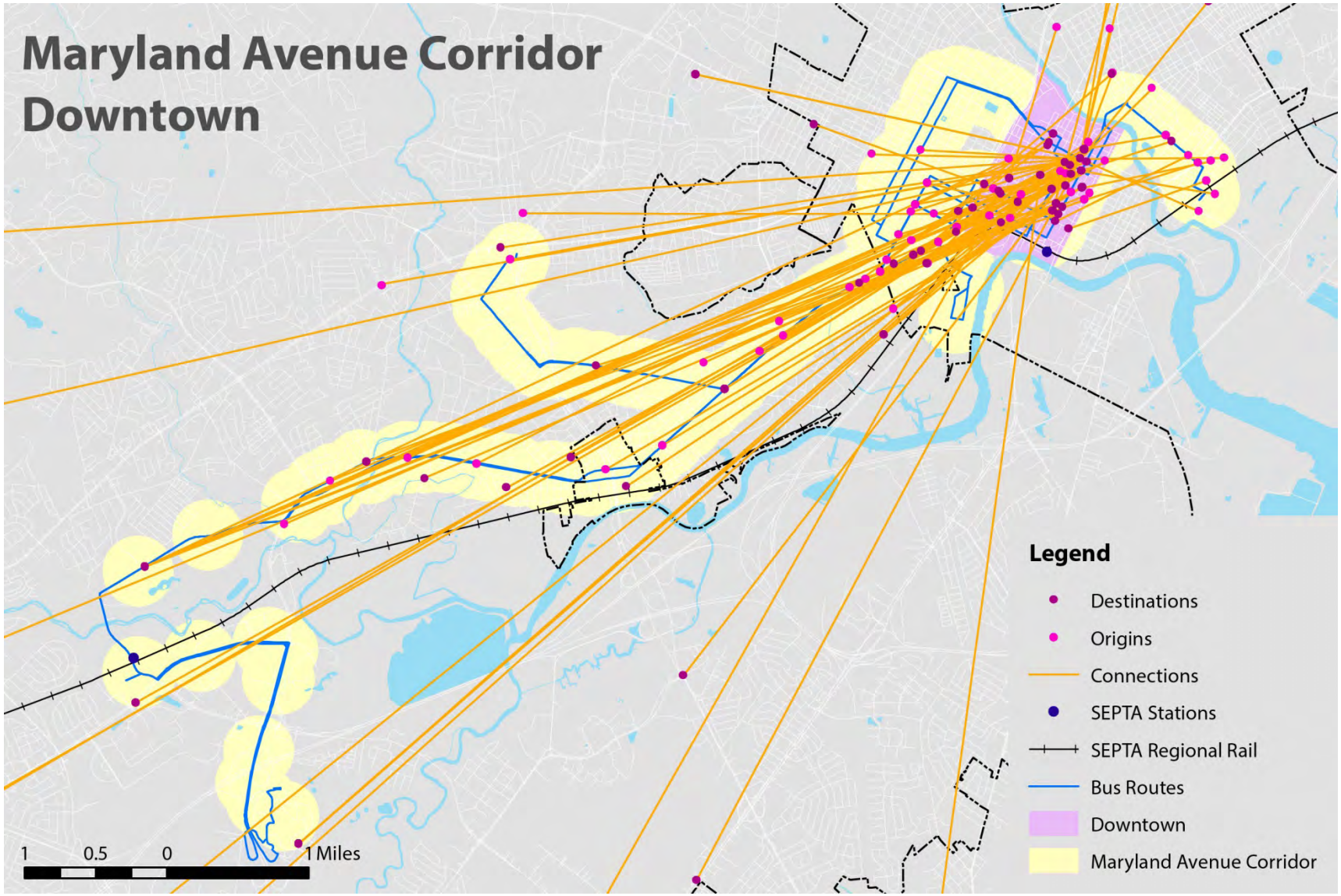
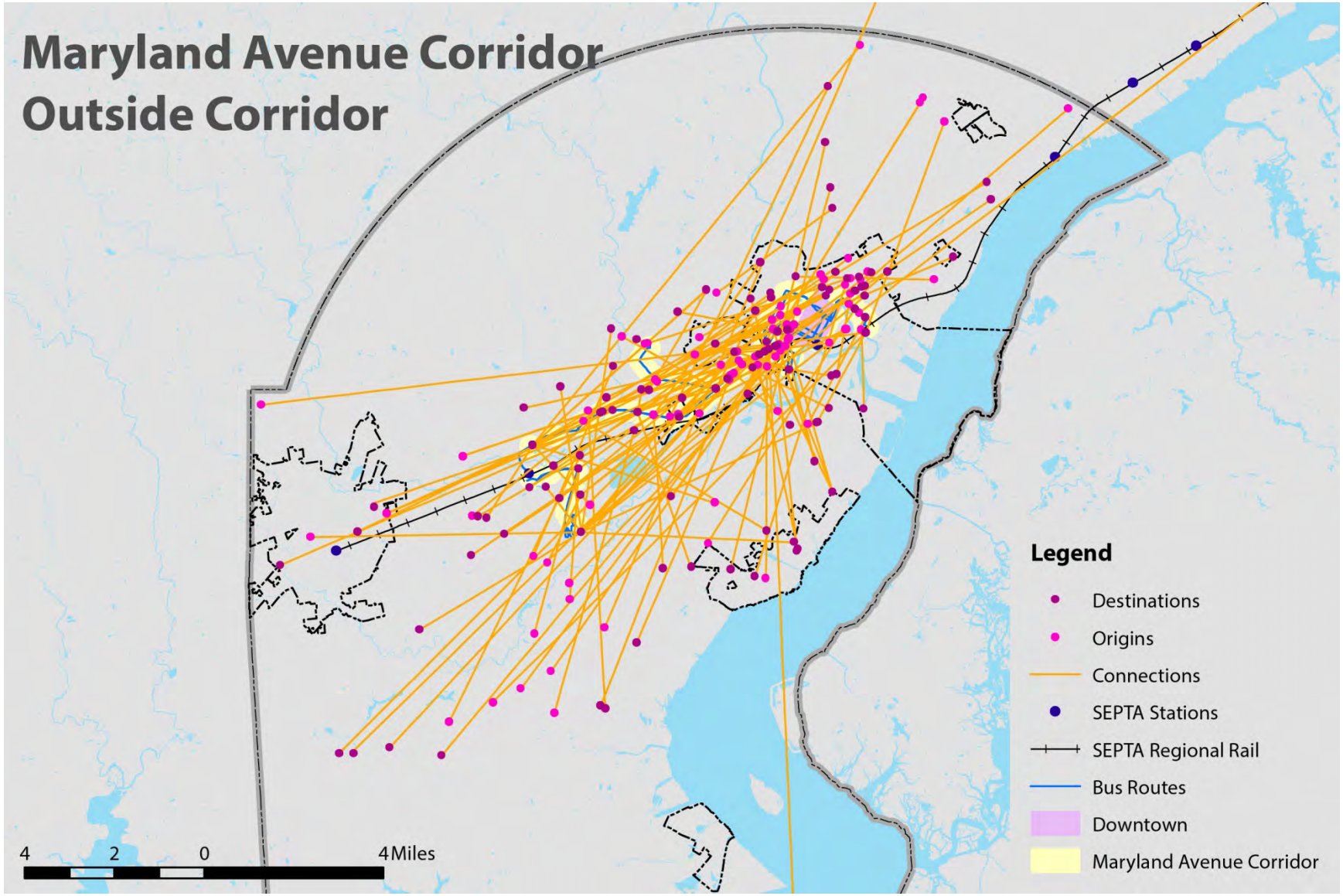


Figure 6-20: Trips outside the Maryland Avenue Corridor and Downtown area



6.6 Market, Dupont and New Castle

Figure 6-21: Boarding and alighting data collected by DTC for the Market, Dupont and New Castle Corridor

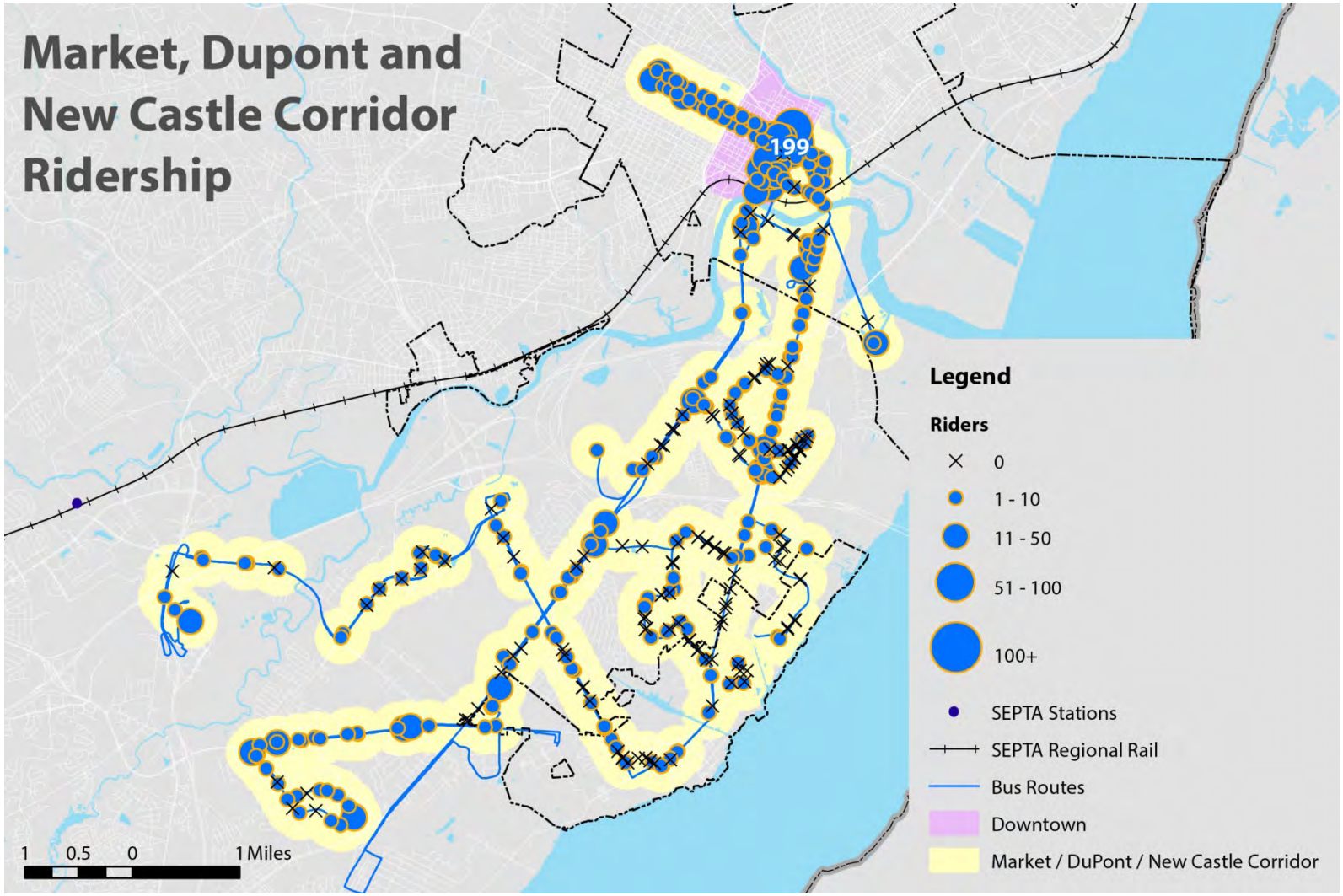


Figure 6-22: Trips within the Market, Dupont and New Castle Corridor

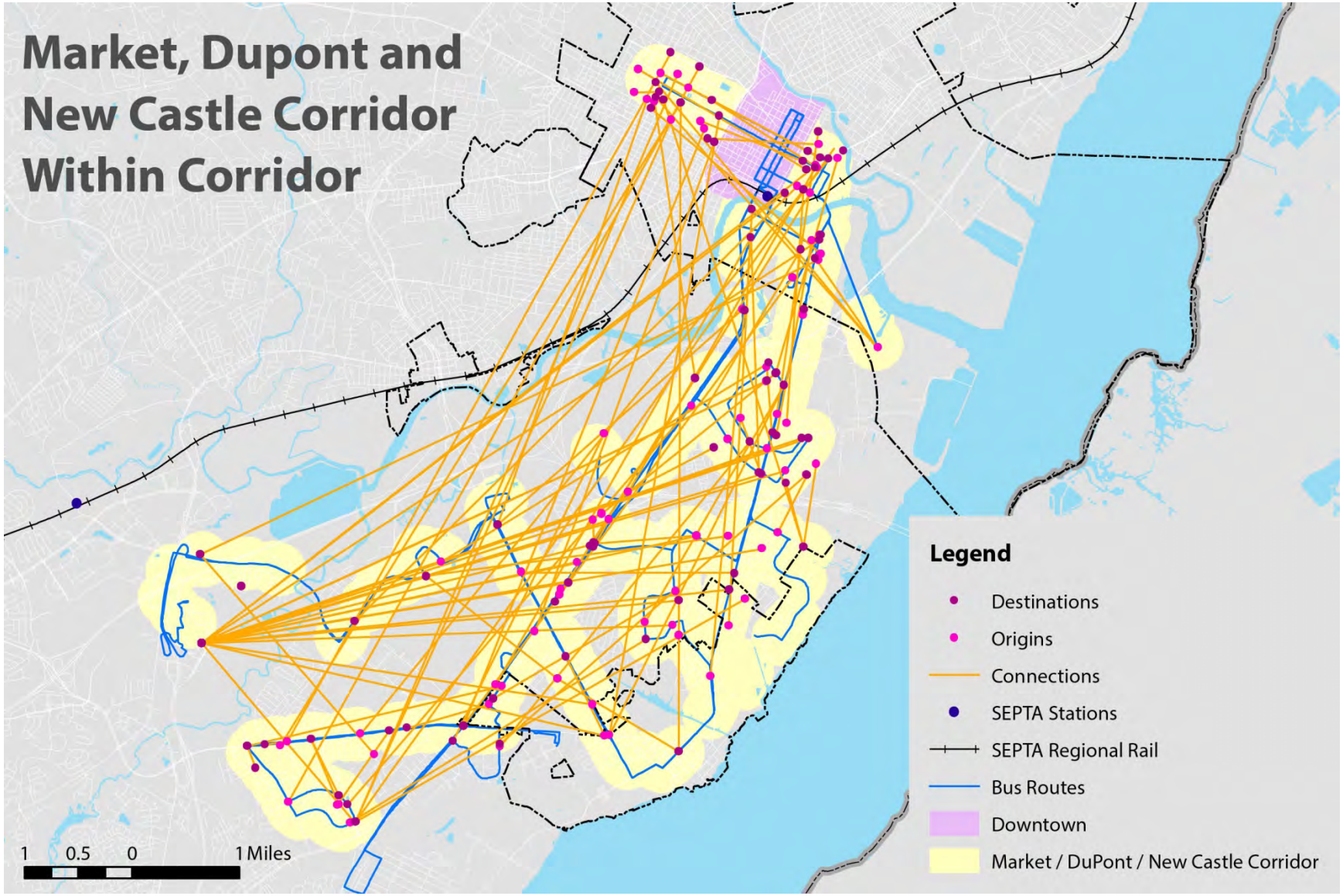


Figure 6-23: Trips from the Market, Dupont and New Castle Corridor to the Downtown area

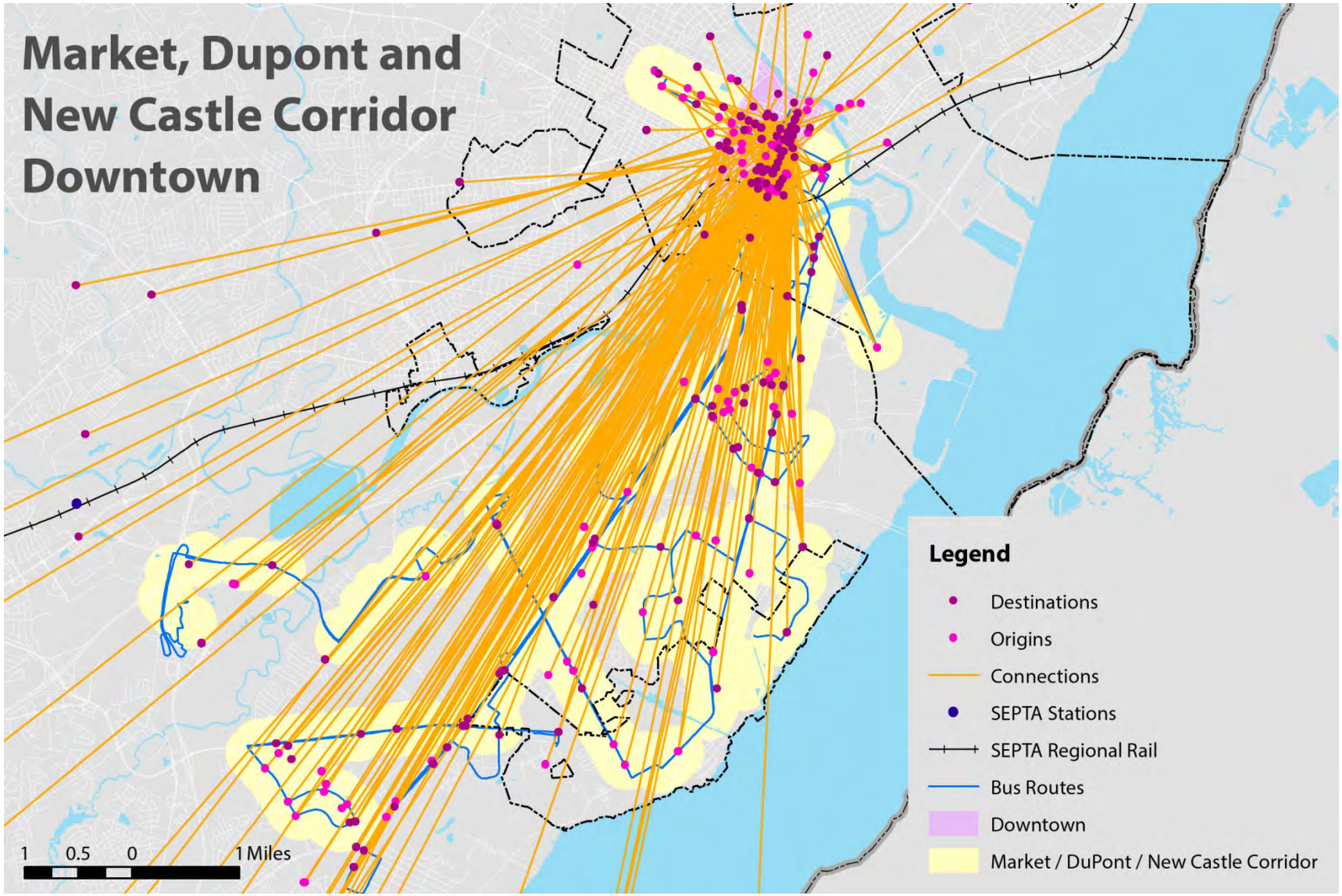
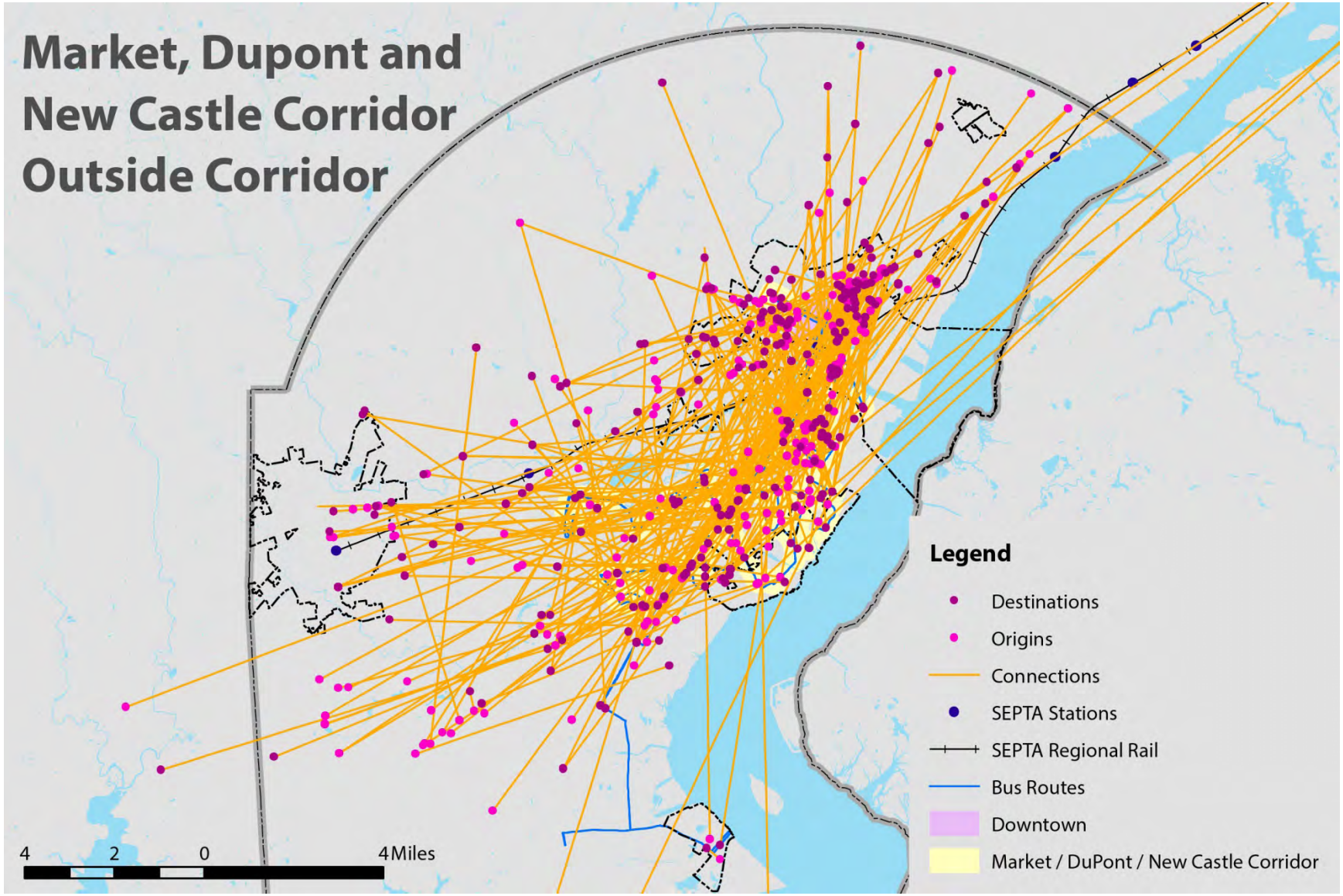


Figure 6-24: Trips outside the Market, Dupont and New Castle Corridor and Downtown area



6.7 Christiana Mall / Newark

Figure 6-25: Boarding and alighting data collected by DTC for the Christiana Mall / Newark Corridor

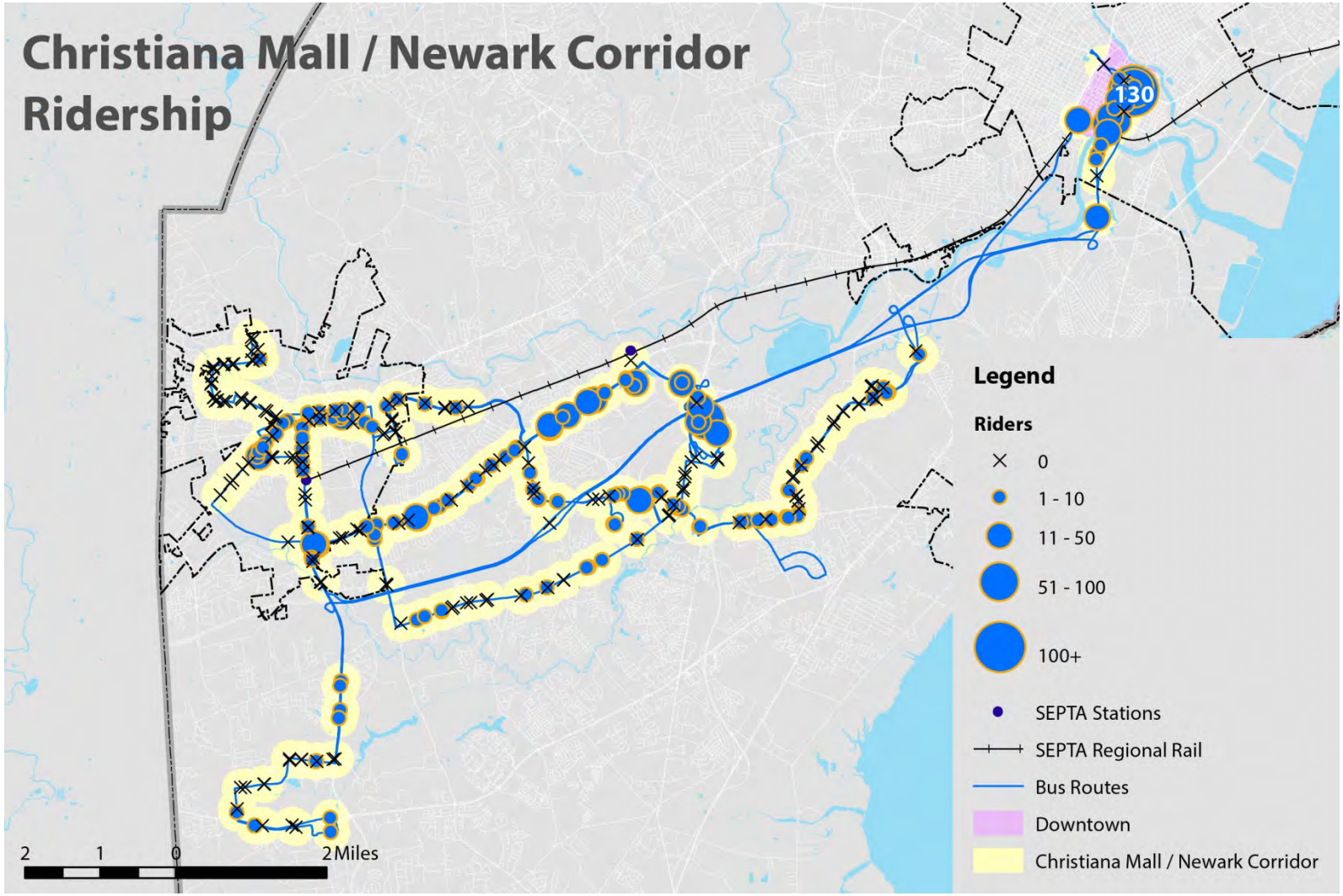


Figure 6-26: Trips within the Christiana Mall / Newark Corridor

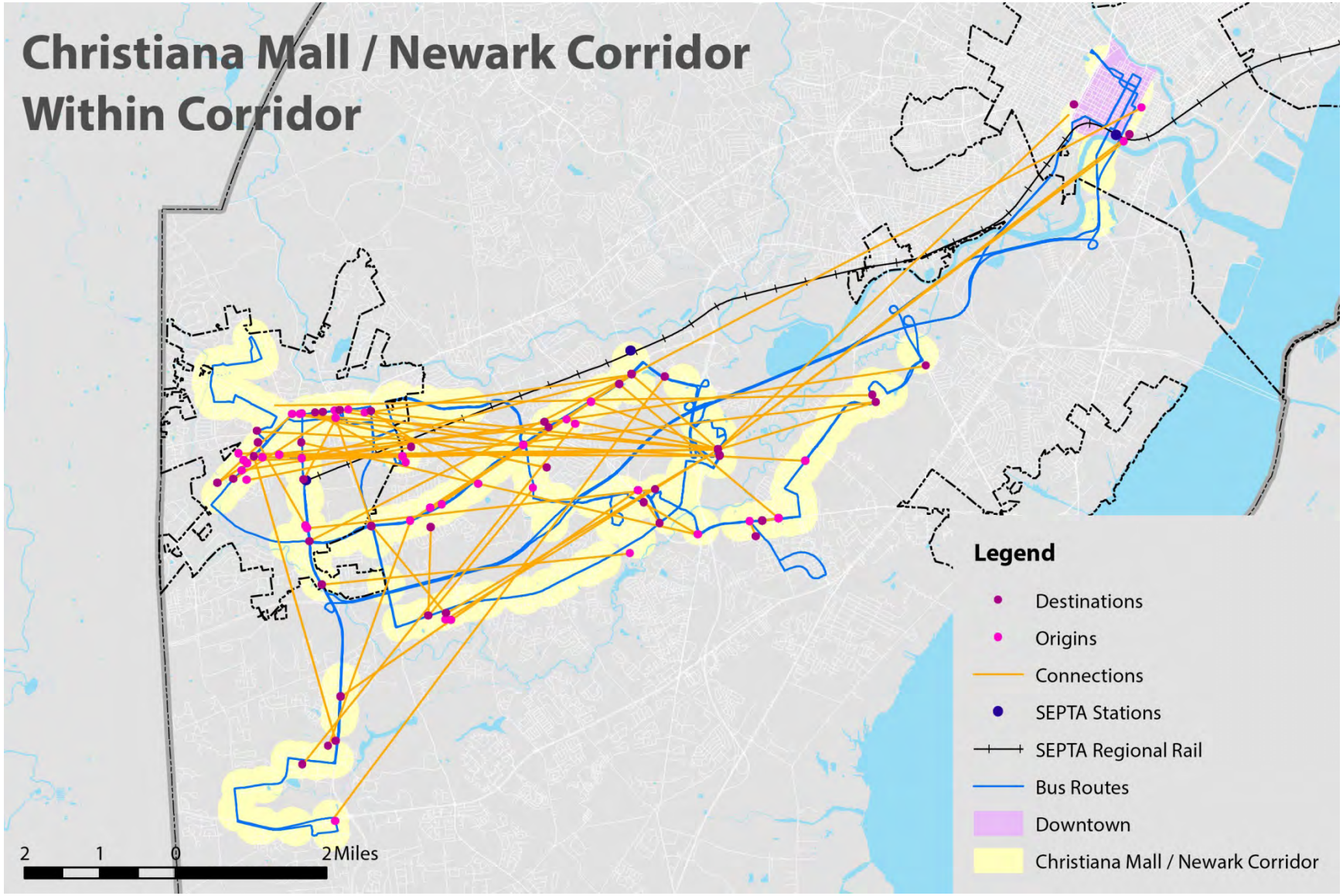


Figure 6-27: Trips from the Christiana Mall / Newark Corridor to the Downtown area

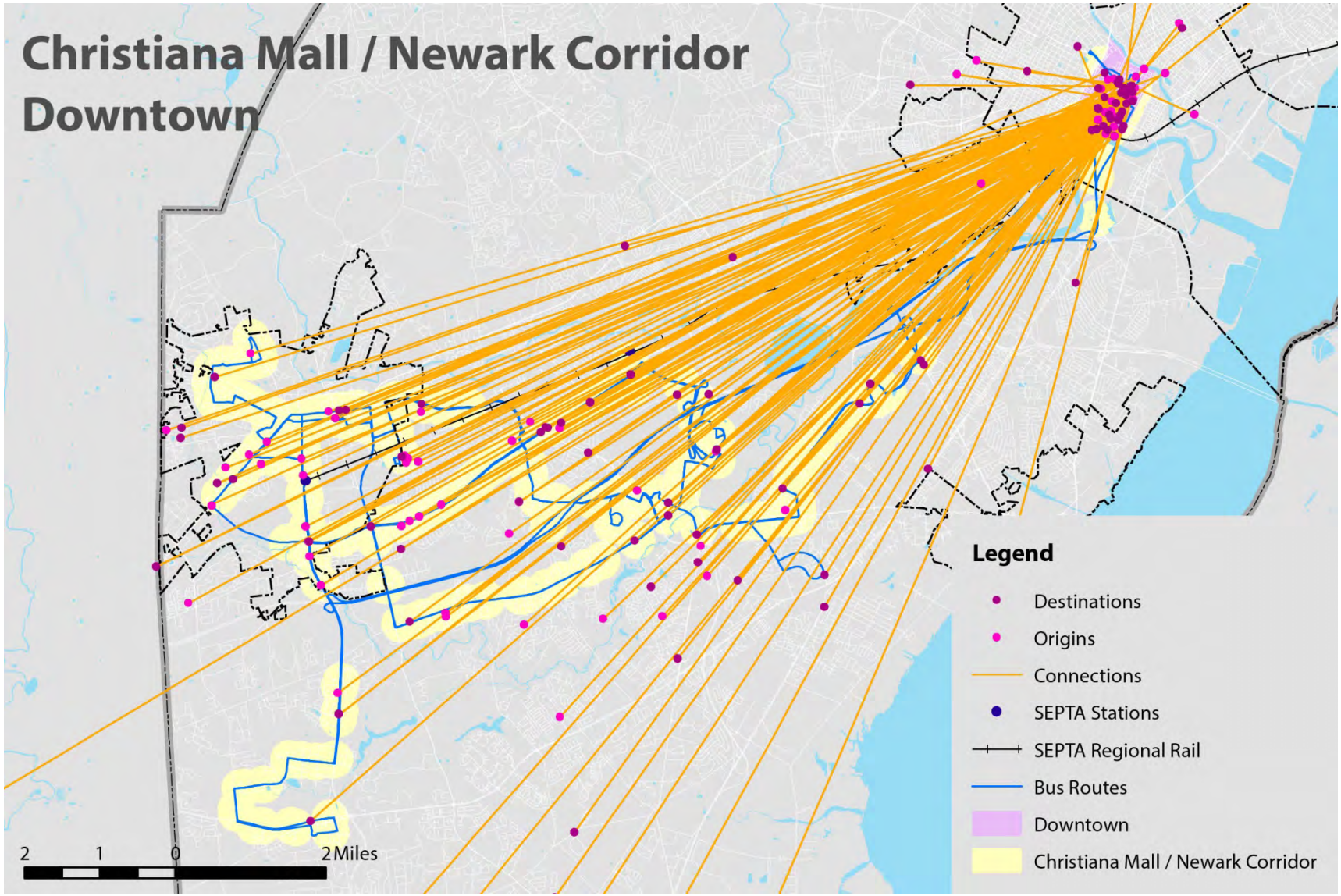
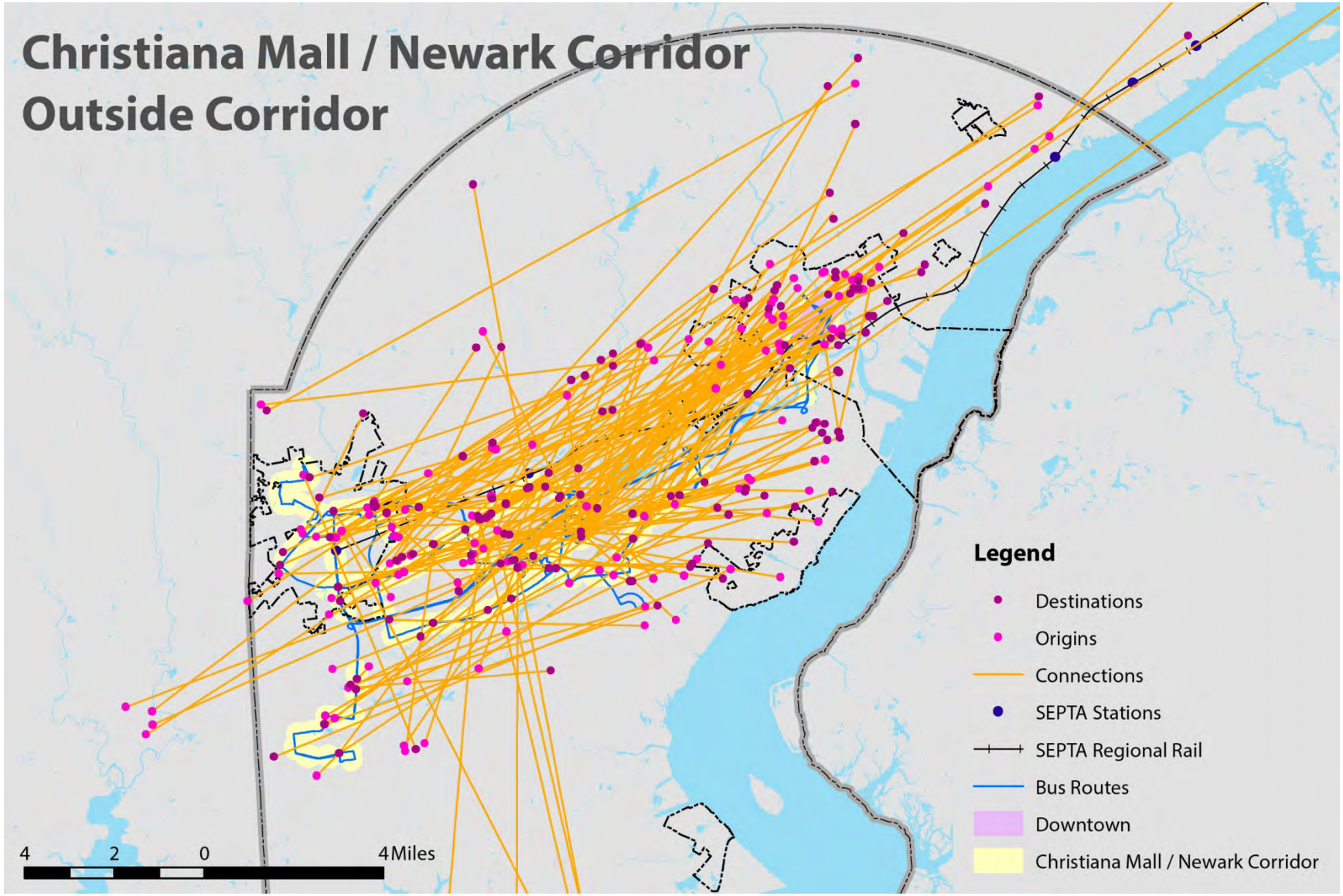


Figure 6-28: Trips outside the Christiana Mall / Newark Corridor and Downtown area



6.8 Mid County

Figure 6-29: Boarding and alighting data collected by DTC for the Mid County Corridor

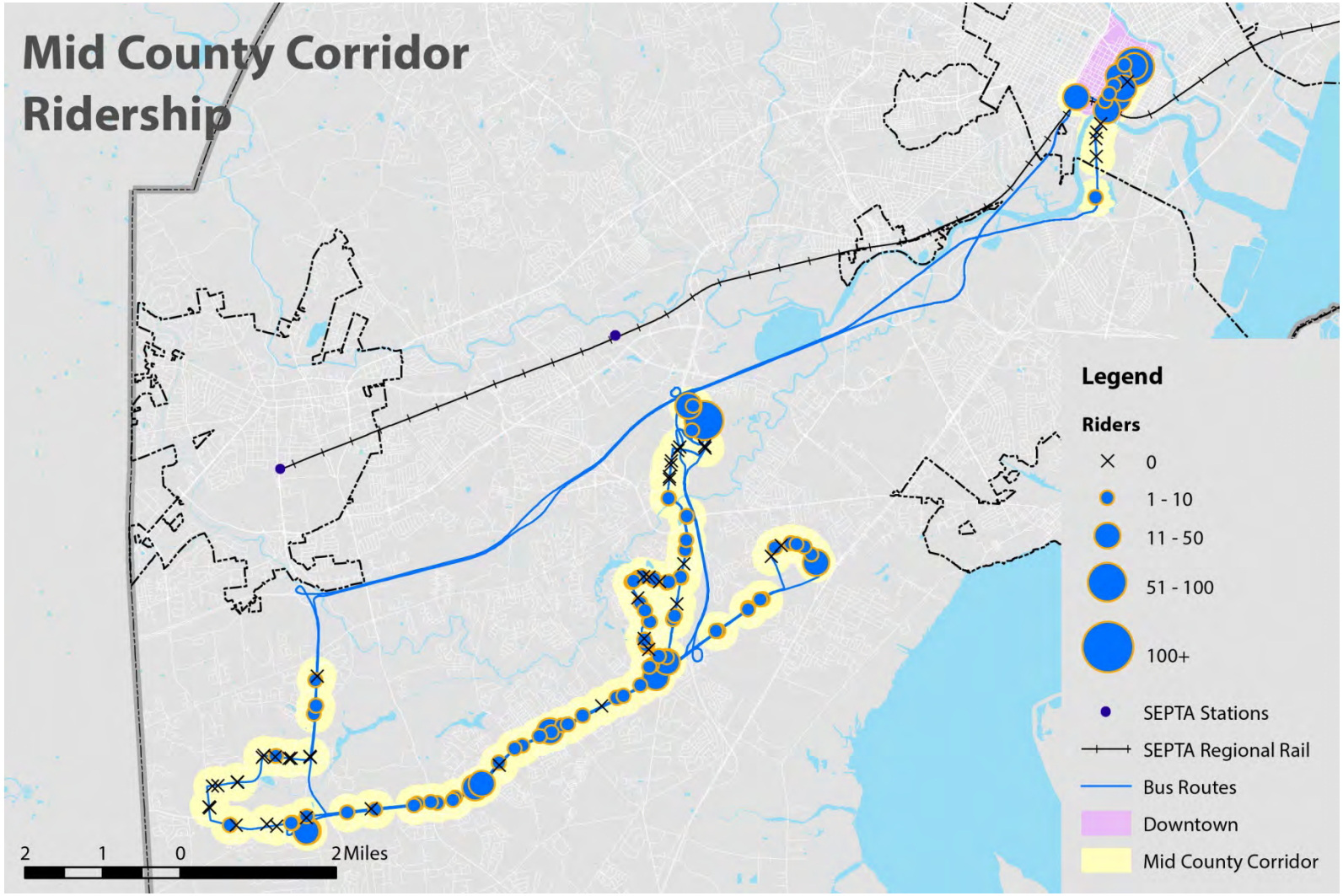


Figure 6-30: Trips within the Mid County Corridor

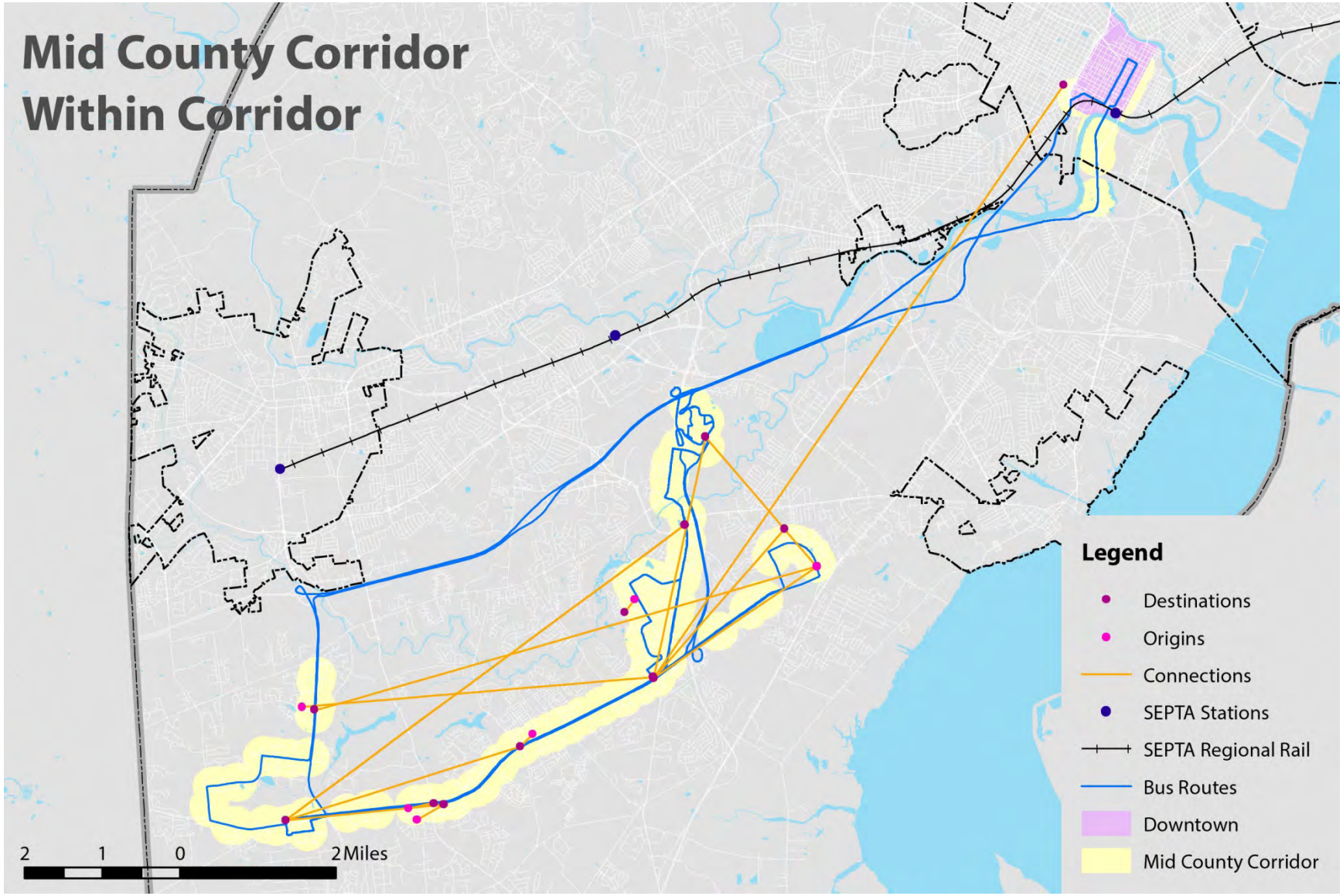


Figure 6-31: Trips from the Mid County Corridor to the Downtown area

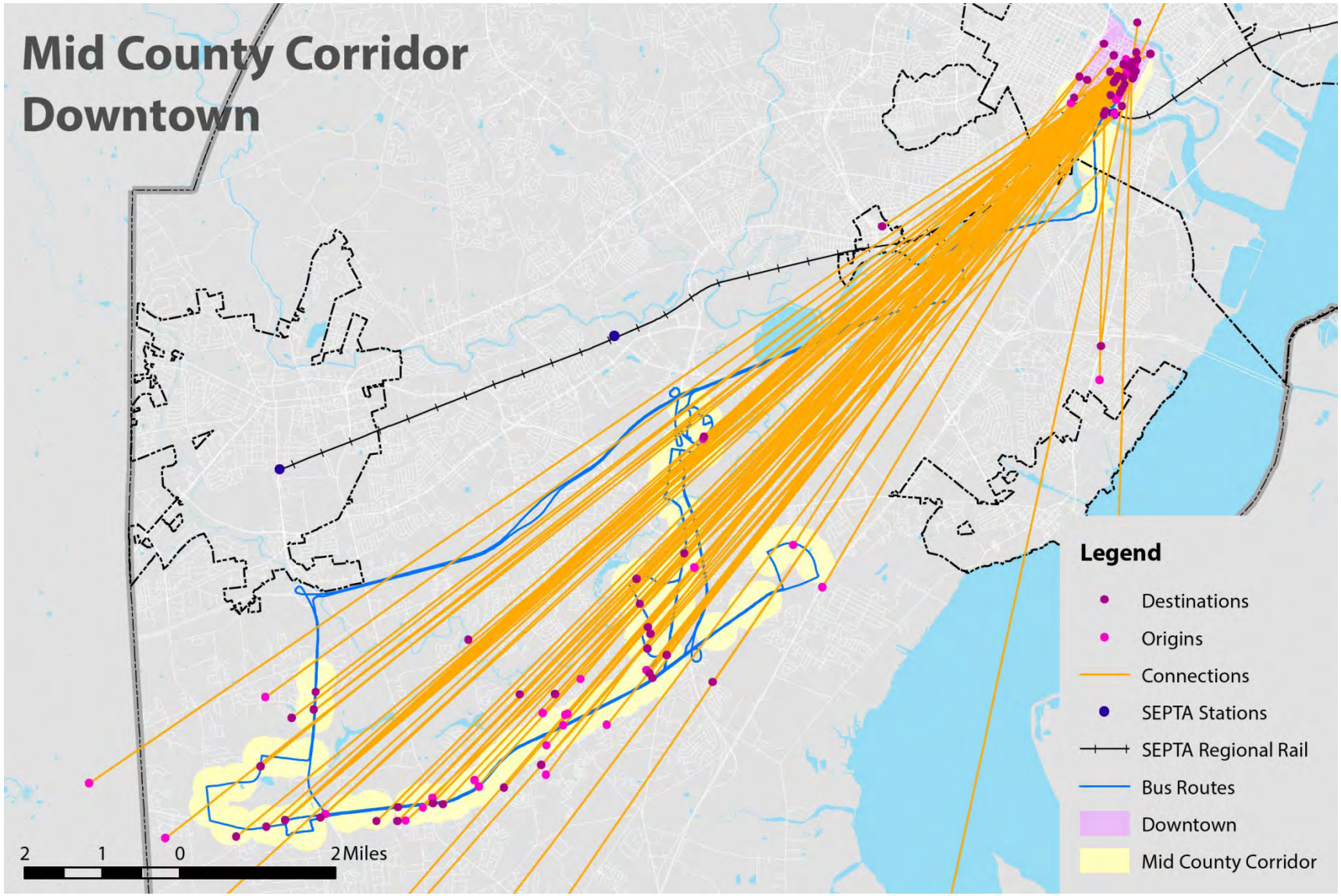
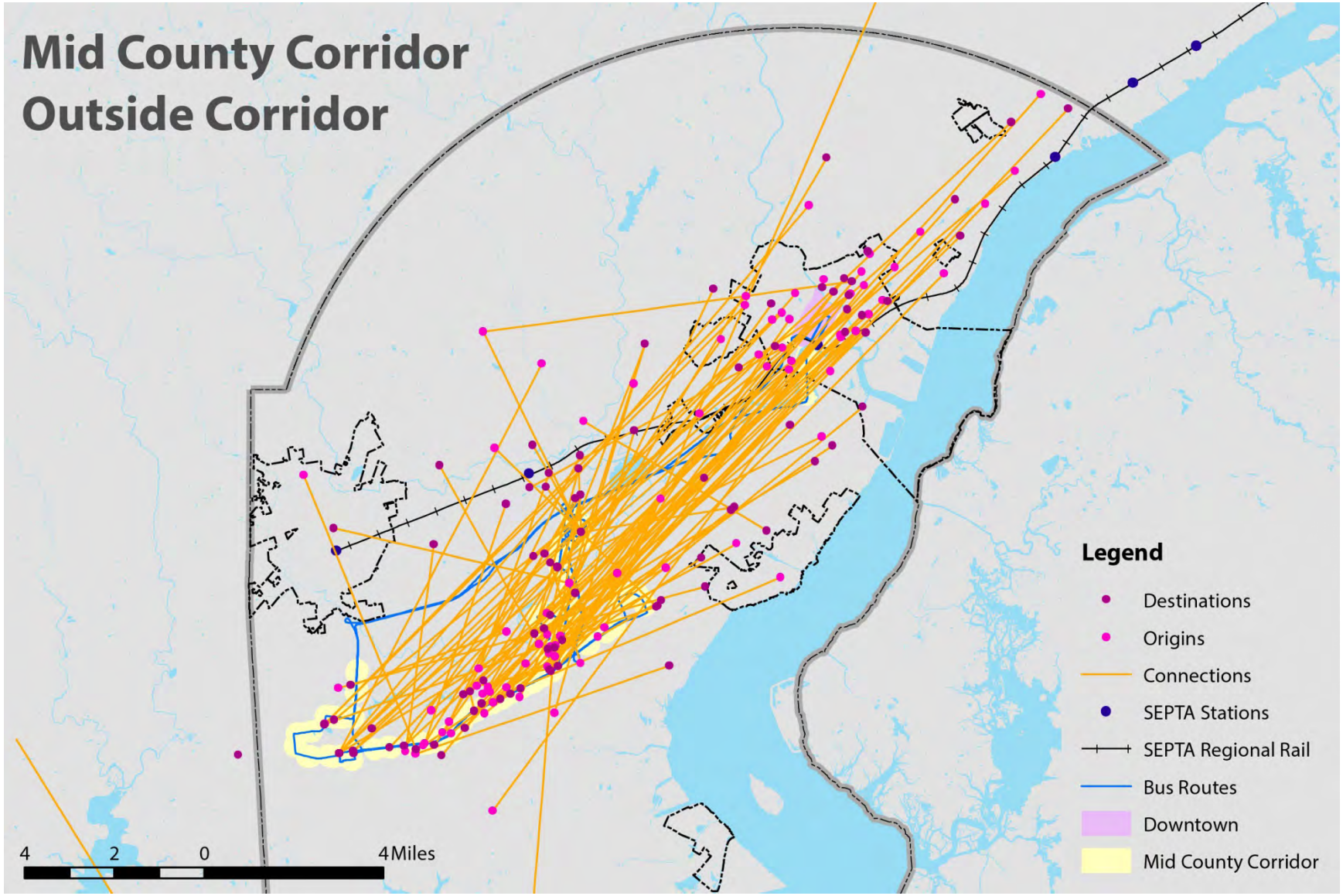


Figure 6-32: Trips outside the Mid County Corridor and Downtown area



6.9 Downstate

Figure 6-33: Trips within the Downstate Express Corridor

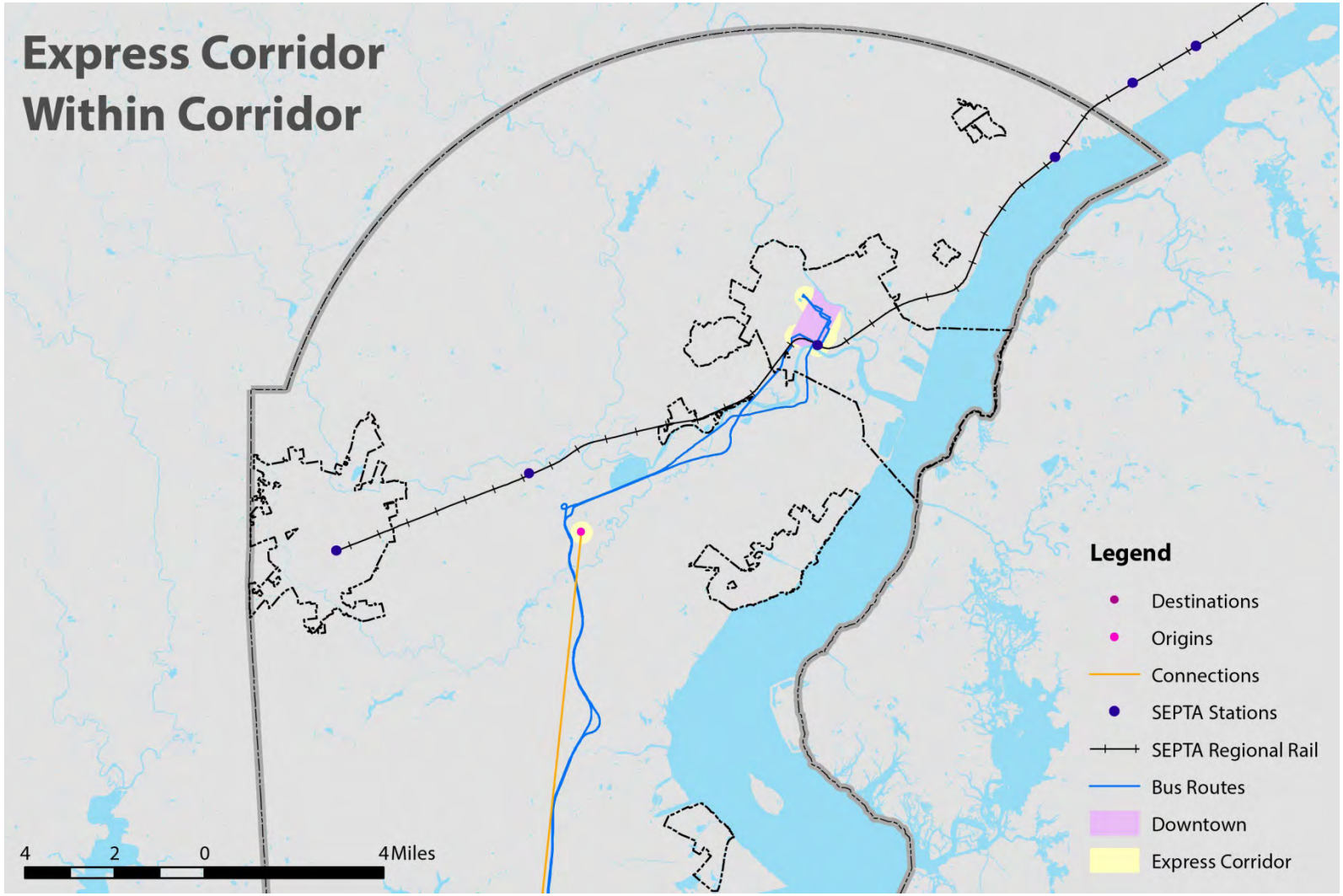


Figure 6-34: Trips from the Downstate Express Corridor to the Downtown area

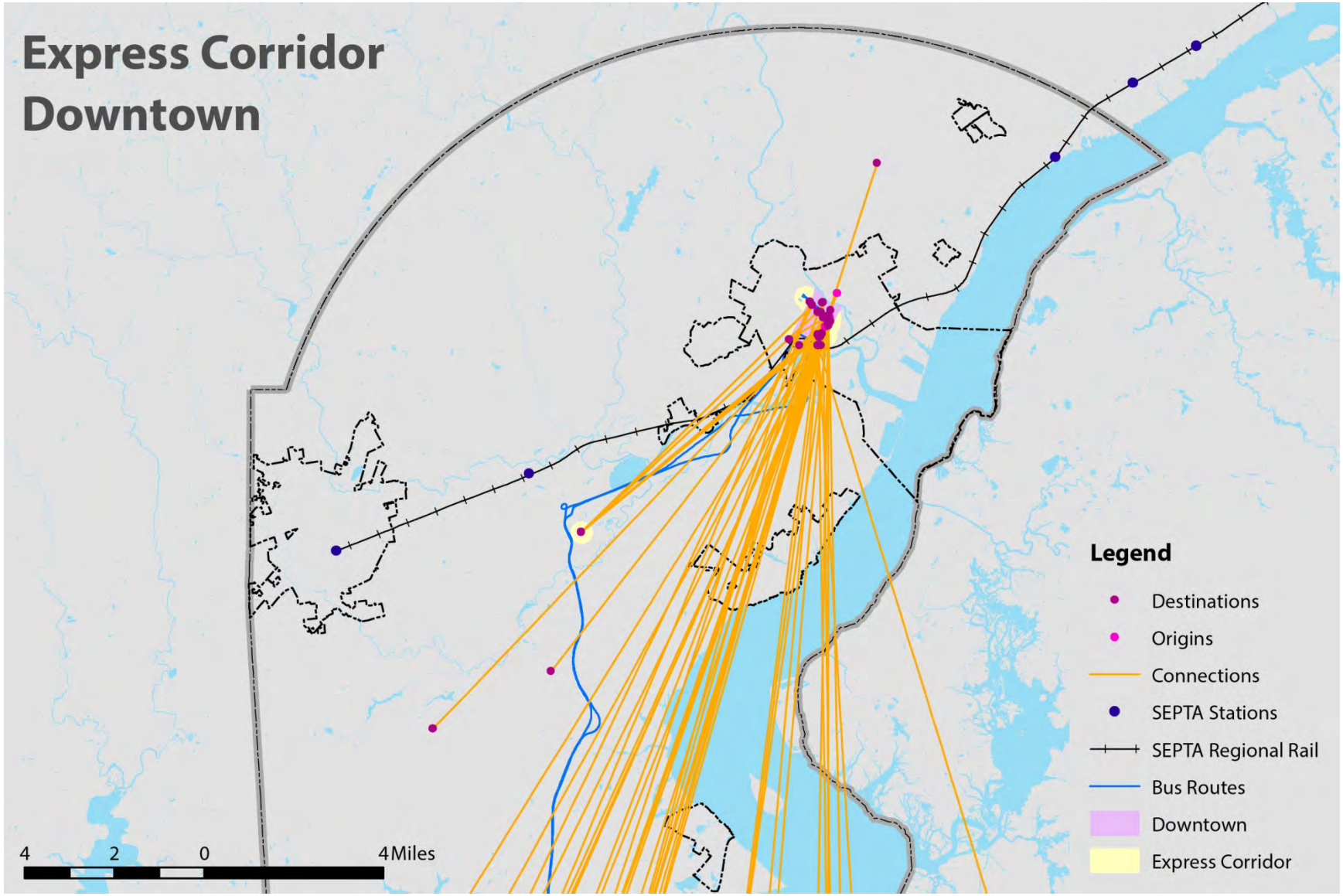
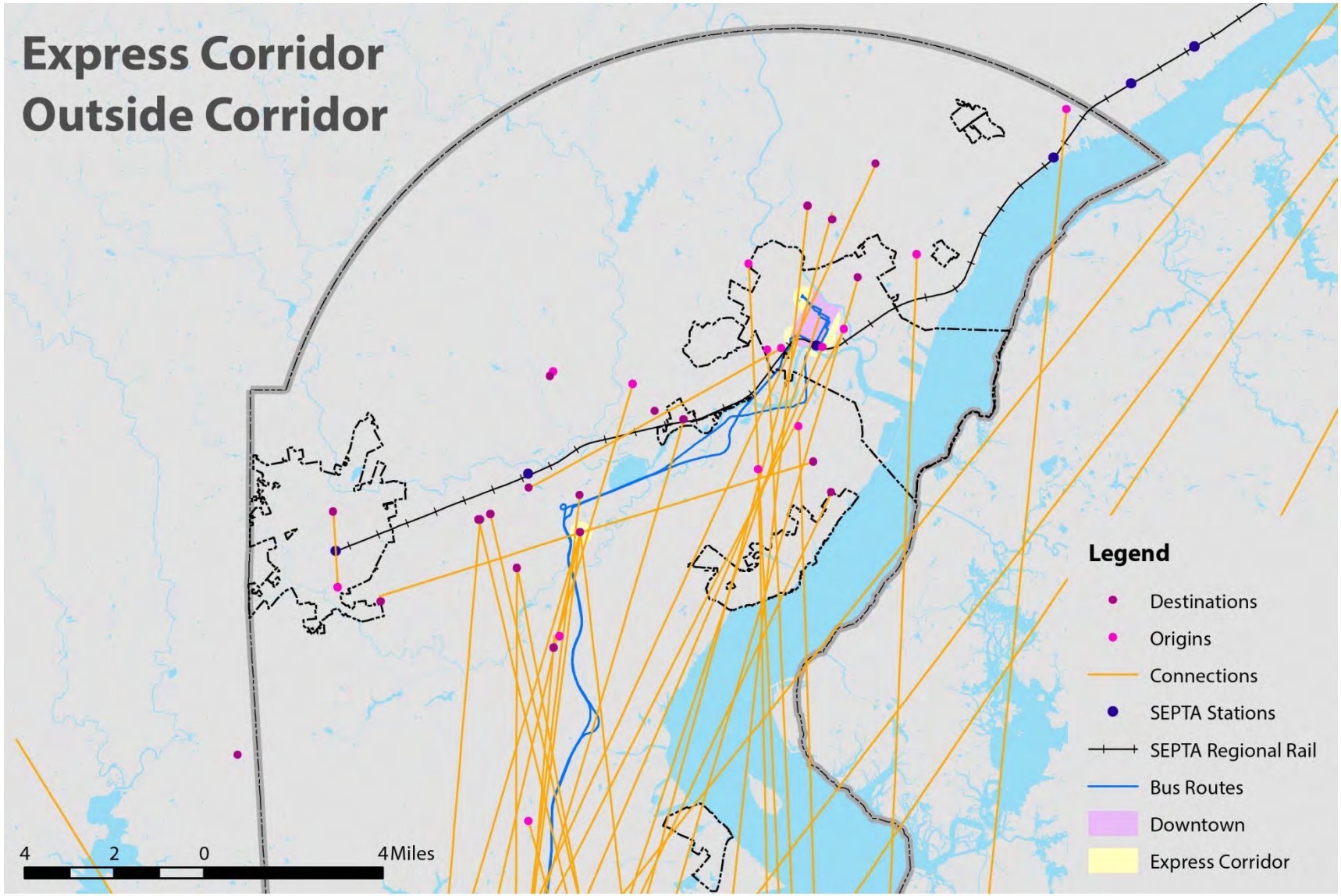


Figure 6-35: Trips outside the Downstate Express Corridor and Downtown area



7 TRANSIT MARKET SHARE AND LATENT DEMAND

As shown in Section 4.2 (page 18), work related trips are more than 60% of DART First State passenger trips. With work trips comprising such a high percentage of transit trips, this analysis seeks to answer the question as to where new transit services might be successful in attracting significant ridership.

This transit market share and latent demand analysis identifies origin-destination pairs that combine a high number of work trips with a low transit market share.

The subareas shown in Figure 2-2 (page 7) have been developed utilizing a combination of New Castle County's comprehensive planning districts and the regional travel model's traffic analysis zones. This subarea framework permits the estimation of unmet demand for transit services by comparing origin-destination data with the US Census Bureau Longitudinal Employer-Household Dynamics (LEHD) data with regional travel forecasts.

The LEHD program is part of the Center for Economic Studies at the US Census Bureau. The LEHD program combines federal, state and Census Bureau data on employers and employees under the Local Employment Dynamics (LED) Partnership. Under the LED Partnership, states share Unemployment Insurance earnings data and the Quarterly Census of Employment and Wages (QCEW) data with the Census Bureau. The LEHD program combines these administrative data, additional administrative data, and data from censuses and surveys to create partially synthetic data on workers' residential patterns.

When using LEHD data it is important to note that they do not include self-employed, sole proprietors, federal military, and railroad workers. Employers with multiple work sites, such as a school district, may not provide data on their multiple work locations. Consequently, the LEHD data should not be considered a perfect tool for predicting work trips. The data should be used carefully and supplemented with local knowledge.

The regional travel forecast model is maintained by DelDOT with assistance from WILMAPCO. The regional model is intended to estimate regional travel flows and is a useful tool for predicting utilization of new or improved transportation projects. The data underlying the model are rigorously developed but are based on 2010 data and future year projections. For this analysis the home based work trip productions and attractions have been averaged to estimate the origins and destinations for each of the travel zone pairs.

Using these two data sets, the number of home-based work trips has been compared with the on-board survey O-D data. Table 2-1 compares the home based work trip estimates of the two data sets.

For New Castle County destinations, the LEHD reports approximately 33% more home based work trips than the regional travel model. The rank order of the work trip destinations in terms of the number of home based work trips is roughly the same for the two data sets. In each case, Wilmington, Greater Newark, Upper Christina, New Castle, and Brandywine West are the top five work trip destinations.

Table 7-1: LEHD - Regional Travel Model Home-Based Work Trip Comparison

Work Trip Destination	LEHD	Regional Model	Difference	% Difference
Wilmington	42,269	36,601	5,668	15%
Greater Newark	28,793	23,422	5,371	23%
Upper Christina	24,936	14,063	10,873	77%
New Castle	21,801	17,793	4,008	23%
Brandywine West	19,385	16,996	2,389	14%
Pike Creek	12,199	7,653	4,546	59%
Wilton	10,699	5,615	5,084	91%
Central Pencader	10,511	5,495	5,016	91%
Brandywine East	10,203	8,241	1,962	24%
Lower Christina South	9,404	7,134	2,270	32%
Lower Christina North	7,884	5,460	2,424	44%
Middletown	7,058	4,991	2,067	41%
Piedmont East	4,446	4,380	66	2%
Piedmont West	3,949	3,131	818	26%
Bear	2,078	1,625	453	28%
Red Lion	1,816	1,243	573	46%
Subtotal – New Castle County	217,431	163,844	53,587	33%
Kent Sussex [1]/ Other[2]	10,993	233,812	(222,819)	-95%
Total	228,424	397,656	(169,232)	-43%

Tables 7-2, 7-3, and 7-4 present the LEHD Transit Market Share Estimates and Tables 7-5, 7-6, and 7-7 present the Regional Travel Model Transit Market Share Estimates. Using the LEHD data, the Wilmington to Wilmington transit market share is 19.4%. Using the Regional Travel Forecasts, the Wilmington to Wilmington transit market share is 19.6%. For all travel to Wilmington from other subareas, the LEHD data estimate the transit market share at 9.6% while the Regional Travel Forecasts indicate a transit market share of 11.1%. Using either set of data it can be concluded that DART First State has achieved a significant share of the home-based work trips within or bound for Wilmington.

Market shares greater than 10% have also been achieved in some reverse commute corridors with more than 500 trips such as Wilmington to:

- Brandywine East (12.9%)
- Brandywine West (12.6%)
- Lower Christina South (16.7%)
- New Castle (10.1%)
- Upper Christina (12.1%)
- Central Pencader (12.9%)

On an average weekday, these data support an estimate of 1,618 Wilmington residents using DART First State to reach jobs outside the City limits.

[1] Kent- Sussex employment for the LEHD comparison
[2] Other TAZ employment was used for the Regional Travel Model comparison

Table 7-2: LEHD Transit Market Share Estimates – Page 1

Sub Area Work Trip Matrix			WORK (Destination)																	
All Income Home Based Work Trip Estimated Transit Market Share			Wilmington			Brandywine East			Brandywine West			Piedmont East			Piedmont West			Lower Christina North		
	Sub Area	Total Origin	Survey	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share
HOME (Origin)	Wilmington	3218	1600	8240	19.4%	163	1266	12.9%	287	2275	12.6%	10	526	1.8%	10	402	2.4%	96	1040	9.2%
	Brandywine East	565	307	3664	8.4%	57	2213	2.6%	29	2844	1.0%	0	356	0.0%	0	235	0.0%	10	501	1.9%
	Brandywine West	230	172	2478	7.0%	0	909	0.0%	38	2142	1.8%	10	385	2.5%	0	168	0.0%	0	304	0.0%
	Piedmont East	19	10	669	1.4%	0	56	0.0%	0	225	0.0%	0	248	0.0%	0	82	0.0%	0	110	0.0%
	Piedmont West	96	96	2124	4.5%	0	272	0.0%	0	928	0.0%	0	338	0.0%	0	654	0.0%	0	378	0.0%
	Lower Christina North	144	86	1005	8.6%	0	187	0.0%	19	446	4.3%	0	184	0.0%	0	121	0.0%	0	334	0.0%
	Lower Christina South	479	259	1648	15.7%	10	321	3.0%	19	638	3.0%	0	220	0.0%	0	176	0.0%	0	492	0.0%
	New Castle	508	153	2180	7.0%	19	457	4.2%	38	847	4.5%	10	179	5.4%	0	166	0.0%	10	427	2.2%
	Pike Creek	307	201	3127	6.4%	10	531	1.8%	10	1259	0.8%	0	523	0.0%	10	507	1.9%	0	696	0.0%
	Upper Christina	287	134	1719	7.8%	0	443	0.0%	10	793	1.2%	0	129	0.0%	0	163	0.0%	0	401	0.0%
	Wilton	259	144	1727	8.3%	10	421	2.3%	0	765	0.0%	0	121	0.0%	0	170	0.0%	0	362	0.0%
	Bear	268	153	1499	10.2%	19	323	5.9%	10	644	1.5%	0	136	0.0%	0	126	0.0%	0	292	0.0%
	Greater Newark	632	316	2839	11.1%	10	617	1.6%	10	1300	0.7%	0	403	0.0%	0	397	0.0%	0	564	0.0%
	Central Pencader	278	115	2535	4.5%	0	484	0.0%	0	1019	0.0%	0	195	0.0%	0	216	0.0%	0	498	0.0%
	Red Lion	19	10	496	1.9%	0	98	0.0%	0	176	0.0%	0	50	0.0%	0	30	0.0%	0	98	0.0%
	Middletown	345	268	2329	11.5%	0	416	0.0%	29	1064	2.7%	0	169	0.0%	0	111	0.0%	0	485	0.0%
	Kent / Sussex	67	29	3990	0.7%	0	1189	0.0%	0	2020	0.0%	0	284	0.0%	0	225	0.0%	0	902	0.0%
	Total	7720	4052	42269	9.6%	297	10203	2.9%	498	19385	2.6%	29	4446	0.6%	19	3949	0.5%	115	7884	1.5%

Key	
Greater than 5,000 trips	
1,000 to 4,999 trips	
Greater than 15% Share	
10% to 14.9% Share	

Table 7-3: LEHD Transit Market Share Estimates – Page 2

Sub Area Work Trip Matrix			WORK (Destination)																
All Income Home Based Work Trip Estimated Transit Market Share			Lower Christina South			New Castle			Pike Creek			Upper Christina			Wilton			Bear		
	Sub Area	Total Origin	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share
HOME (Origin)	Wilmington	3218	163	973	16.7%	211	2088	10.1%	77	912	8.4%	259	2145	12.1%	77	927	8.3%	57	112	51.3%
	Brandywine East	565	0	596	0.0%	67	1206	5.6%	0	651	0.0%	19	1319	1.5%	10	611	1.6%	19	99	19.4%
	Brandywine West	230	0	376	0.0%	0	658	0.0%	0	412	0.0%	0	799	0.0%	0	349	0.0%	0	33	0.0%
	Piedmont East	19	0	63	0.0%	10	105	9.1%	0	137	0.0%	0	240	0.0%	0	63	0.0%	0	7	0.0%
	Piedmont West	96	0	437	0.0%	0	557	0.0%	0	826	0.0%	0	986	0.0%	0	327	0.0%	0	49	0.0%
	Lower Christina North	144	10	302	3.2%	10	434	2.2%	0	375	0.0%	0	430	0.0%	10	244	3.9%	0	29	0.0%
	Lower Christina South	479	48	879	5.4%	10	854	1.1%	19	643	3.0%	48	964	5.0%	10	448	2.1%	10	52	18.4%
	New Castle	508	19	523	3.7%	86	2313	3.7%	0	591	0.0%	105	1306	8.1%	19	705	2.7%	0	124	0.0%
	Pike Creek	307	10	934	1.0%	10	1265	0.8%	19	1995	1.0%	19	2045	0.9%	0	696	0.0%	0	102	0.0%
	Upper Christina	287	0	480	0.0%	10	902	1.1%	29	702	4.1%	29	2003	1.4%	19	584	3.3%	0	139	0.0%
	Wilton	259	0	441	0.0%	29	1341	2.1%	0	504	0.0%	10	1491	0.6%	48	862	5.6%	10	159	6.0%
	Bear	268	10	363	2.6%	10	1025	0.9%	0	460	0.0%	29	1388	2.1%	0	686	0.0%	10	249	3.8%
	Greater Newark	632	29	740	3.9%	19	1582	1.2%	29	1397	2.1%	96	2716	3.5%	19	955	2.0%	0	222	0.0%
	Central Pencader	278	0	557	0.0%	57	1309	4.4%	19	771	2.5%	48	2323	2.1%	10	812	1.2%	10	210	4.6%
	Red Lion	19	0	135	0.0%	0	391	0.0%	0	129	0.0%	0	437	0.0%	0	202	0.0%	0	70	0.0%
	Middletown	345	10	623	1.5%	0	1662	0.0%	0	734	0.0%	19	2189	0.9%	10	892	1.1%	0	152	0.0%
	Kent / Sussex	67	0	982	0.0%	0	4109	0.0%	0	960	0.0%	19	2155	0.9%	0	1336	0.0%	0	270	0.0%
	Total	7720	297	9404	3.2%	527	21801	2.4%	192	12199	1.6%	699	24936	2.8%	230	10699	2.1%	115	2078	5.5%

Key	
Greater than 5,000 trips	
1,000 to 4,999 trips	
Greater than 15% Share	
10% to 14.9% Share	

Table 7-4: LEHD Transit Market Share Estimates – Page 3

Sub Area Work Trip Matrix			WORK (Destination)														
All Income Home Based Work Trip Estimated Transit Market Share			Greater Newark			Central Pencader			Red Lion			Middletown			Kent / Sussex		
	Sub Area	Total Origin	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share	Transit HBW	LEHD	Market Share
HOME (Origin)	Wilmington	3218	115	1640	7.0%	77	595	12.9%	0	64	0.0%	19	125	15.3%	0	999	0.0%
	Brandywine East	565	38	1217	3.1%	0	415	0.0%	0	55	0.0%	0	105	0.0%	10	698	1.4%
	Brandywine West	230	10	816	1.2%	0	229	0.0%	0	41	0.0%	0	81	0.0%	0	475	0.0%
	Piedmont East	19	0	196	0.0%	0	36	0.0%	0	8	0.0%	0	24	0.0%	0	114	0.0%
	Piedmont West	96	0	1211	0.0%	0	309	0.0%	0	47	0.0%	0	54	0.0%	0	310	0.0%
	Lower Christina North	144	0	423	0.0%	10	169	5.7%	0	22	0.0%	0	38	0.0%	0	189	0.0%
	Lower Christina South	479	38	780	4.9%	10	299	3.2%	0	54	0.0%	0	58	0.0%	0	370	0.0%
	New Castle	508	29	963	3.0%	0	426	0.0%	0	110	0.0%	10	128	7.5%	10	831	1.2%
	Pike Creek	307	10	2245	0.4%	0	627	0.0%	0	91	0.0%	0	160	0.0%	10	649	1.5%
	Upper Christina	287	19	1741	1.1%	19	712	2.7%	0	77	0.0%	10	172	5.6%	10	464	2.1%
	Wilton	259	10	1051	0.9%	0	612	0.0%	0	93	0.0%	0	173	0.0%	0	687	0.0%
	Bear	268	10	1231	0.8%	10	663	1.4%	0	74	0.0%	10	194	4.9%	0	466	0.0%
	Greater Newark	632	86	6081	1.4%	19	1224	1.6%	0	119	0.0%	0	316	0.0%	0	1257	0.0%
	Central Pencader	278	10	2731	0.4%	10	1627	0.6%	0	162	0.0%	0	428	0.0%	0	1218	0.0%
	Red Lion	19	0	443	0.0%	0	207	0.0%	0	169	0.0%	0	114	0.0%	10	227	4.2%
	Middletown	345	0	2100	0.0%	0	1292	0.0%	0	288	0.0%	10	2870	0.3%	0	2039	0.0%
	Kent / Sussex	67	0	3924	0.0%	0	1069	0.0%	0	342	0.0%	10	2018	0.5%	10	0	0.0%
	Total	7720	374	28793	1.3%	153	10511	1.5%	0	1816	0.0%	67	7058	0.9%	57	10993	0.5%

Key	
Greater than 5,000 trips	
1,000 to 4,999 trips	
Greater than 15% Share	
10% to 14.9% Share	

Table 7-5: Regional Travel Model Transit Market Share Estimates - Page 1

Sub Area Work Trip Matrix			WORK (Destination)																	
TAZ Home Based Work Trip Estimated Transit Market Share			Wilmington			Brandywine East			Brandywine West			Piedmont East			Piedmont West			Lower Christina North		
	Sub Area	Total Transit HBW	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share
HOME (Origin)	Wilmington	3218	1600	8181	19.6%	163	991	16.4%	287	2358	12.2%	10	561	1.7%	10	191	5.0%	96	514	18.6%
	Brandywine East	565	307	4182	7.3%	57	2612	2.2%	29	3141	0.9%	0	378	0.0%	0	150	0.0%	10	290	3.3%
	Brandywine West	230	172	2110	8.2%	0	826	0.0%	38	2717	1.4%	10	295	3.3%	0	100	0.0%	0	152	0.0%
	Piedmont East	19	10	508	1.9%	0	82	0.0%	0	324	0.0%	0	155	0.0%	0	58	0.0%	0	64	0.0%
	Piedmont West	96	96	1150	8.3%	0	196	0.0%	0	633	0.0%	0	286	0.0%	0	387	0.0%	0	249	0.0%
	Lower Christina North	144	86	918	9.4%	0	113	0.0%	19	388	4.9%	0	200	0.0%	0	89	0.0%	0	202	0.0%
	Lower Christina South	479	259	1686	15.3%	10	197	4.9%	19	514	3.7%	0	222	0.0%	0	108	0.0%	0	485	0.0%
	New Castle	508	153	2092	7.3%	19	328	5.8%	38	598	6.4%	10	170	5.6%	0	101	0.0%	10	308	3.1%
	Pike Creek	307	201	2244	9.0%	10	368	2.6%	10	1032	0.9%	0	437	0.0%	10	540	1.8%	0	673	0.0%
	Upper Christina	287	134	1575	8.5%	0	287	0.0%	10	580	1.7%	0	191	0.0%	0	153	0.0%	0	312	0.0%
	Wilton	259	144	1125	12.8%	10	207	4.6%	0	403	0.0%	0	127	0.0%	0	93	0.0%	0	202	0.0%
	Bear	268	153	1543	9.9%	19	277	6.9%	10	560	1.7%	0	172	0.0%	0	136	0.0%	0	274	0.0%
	Greater Newark	632	316	3019	10.5%	10	546	1.8%	10	1250	0.8%	0	439	0.0%	0	422	0.0%	0	639	0.0%
	Central Pencader	278	115	2385	4.8%	0	453	0.0%	0	934	0.0%	0	275	0.0%	0	208	0.0%	0	415	0.0%
	Red Lion	19	10	424	2.3%	0	82	0.0%	0	167	0.0%	0	50	0.0%	0	37	0.0%	0	76	0.0%
	Middletown	345	268	1652	16.2%	0	311	0.0%	29	625	4.6%	0	184	0.0%	0	143	0.0%	0	277	0.0%
	Other	67	29	1808	1.6%	0	366	0.0%	0	771	0.0%	0	239	0.0%	0	214	0.0%	0	326	0.0%
	Total	7720	4052	36601	11.1%	297	8241	3.6%	498	16996	2.9%	29	4380	0.7%	19	3131	0.6%	115	5460	2.1%

Key	
Greater than 5,000 trips	
1,000 to 4,999 trips	
Greater than 15% Share	
10% to 14.9% Share	

Table 7-6: Regional Travel Model Transit Market Share Estimates – Page 2

Sub Area Work Trip Matrix			WORK (Destination)																	
TAZ Home Based Work Trip Estimated Transit Market Share			Lower Christina South			New Castle			Pike Creek			Upper Christina			Wilton			Bear		
	Sub Area	Total Transit HBW	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share
HOME (Origin)	Wilmington	3218	163	823	19.8%	211	1208	17.4%	77	478	16.0%	259	859	30.1%	77	249	30.8%	57	69	82.9%
	Brandywine East	565	0	430	0.0%	67	1017	6.6%	0	345	0.0%	19	727	2.6%	10	206	4.6%	19	60	31.9%
	Brandywine West	230	0	284	0.0%	0	443	0.0%	0	202	0.0%	0	366	0.0%	0	103	0.0%	0	29	0.0%
	Piedmont East	19	0	167	0.0%	10	118	8.1%	0	91	0.0%	0	119	0.0%	0	32	0.0%	0	9	0.0%
	Piedmont West	96	0	417	0.0%	0	500	0.0%	0	618	0.0%	0	530	0.0%	0	165	0.0%	0	41	0.0%
	Lower Christina North	144	10	426	2.3%	10	282	3.4%	0	234	0.0%	0	285	0.0%	10	81	11.8%	0	21	0.0%
	Lower Christina South	479	48	480	10.0%	10	601	1.6%	19	374	5.1%	48	558	8.6%	10	178	5.4%	10	38	25.1%
	New Castle	508	19	309	6.2%	86	1830	4.7%	0	335	0.0%	105	825	12.8%	19	361	5.3%	0	83	0.0%
	Pike Creek	307	10	890	1.1%	10	1153	0.8%	19	1472	1.3%	19	1338	1.4%	0	370	0.0%	0	84	0.0%
	Upper Christina	287	0	350	0.0%	10	1215	0.8%	29	419	6.9%	29	1249	2.3%	19	505	3.8%	0	94	0.0%
	Wilton	259	0	224	0.0%	29	1254	2.3%	0	355	0.0%	10	1488	0.6%	48	451	10.6%	10	189	5.1%
	Bear	268	10	313	3.1%	10	1346	0.7%	0	316	0.0%	29	808	3.6%	0	566	0.0%	10	224	4.3%
	Greater Newark	632	29	770	3.7%	19	1953	1.0%	29	1003	2.9%	96	1830	5.2%	19	693	2.8%	0	132	0.0%
	Central Pencader	278	0	471	0.0%	57	1877	3.1%	19	441	4.3%	48	910	5.3%	10	678	1.4%	10	197	4.9%
	Red Lion	19	0	82	0.0%	0	372	0.0%	0	95	0.0%	0	226	0.0%	0	126	0.0%	0	48	0.0%
	Middletown	345	10	313	3.1%	0	1327	0.0%	0	379	0.0%	19	919	2.1%	10	432	2.2%	0	154	0.0%
	Other	67	0	386	0.0%	0	1298	0.0%	0	498	0.0%	19	1026	1.9%	0	419	0.0%	0	152	0.0%
	Total	7720	297	7134	4.2%	527	17793	3.0%	192	7653	2.5%	699	14063	5.0%	230	5615	4.1%	115	1625	7.1%

Key	
Greater than 5,000 trips	
1,000 to 4,999 trips	
Greater than 15% Share	
10% to 14.9% Share	

Table 7-7: Regional Travel Model Transit Market Share Estimates – Page 3

Sub Area Work Trip Matrix			WORK (Destination)														
TAZ Home Based Work Trip Estimated Transit Market Share			Greater Newark			Central Pencader			Red Lion			Middletown			Other		
	Sub Area	Total Transit HBW	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share	Transit HBW	TAZ HBW	Market Share
HOME (Origin)	Wilmington	3218	115	1173	9.8%	77	223	34.4%	0	33	0.0%	19	25	77.7%	0	225	0.0%
	Brandywine East	565	38	1004	3.8%	0	200	0.0%	0	29	0.0%	0	25	0.0%	10	236	4.1%
	Brandywine West	230	10	512	1.9%	0	98	0.0%	0	14	0.0%	0	12	0.0%	0	117	0.0%
	Piedmont East	19	0	180	0.0%	0	29	0.0%	0	4	0.0%	0	3	0.0%	0	33	0.0%
	Piedmont West	96	0	972	0.0%	0	127	0.0%	0	22	0.0%	0	17	0.0%	0	200	0.0%
	Lower Christina North	144	0	409	0.0%	10	63	15.2%	0	9	0.0%	0	7	0.0%	0	64	0.0%
	Lower Christina South	479	38	699	5.5%	10	124	7.7%	0	18	0.0%	0	14	0.0%	0	115	0.0%
	New Castle	508	29	1038	2.8%	0	234	0.0%	0	47	0.0%	10	32	29.6%	10	218	4.4%
	Pike Creek	307	10	1671	0.6%	0	233	0.0%	0	48	0.0%	0	33	0.0%	10	328	2.9%
	Upper Christina	287	19	1167	1.6%	19	197	9.7%	0	60	0.0%	10	34	28.2%	10	290	3.3%
	Wilton	259	10	1481	0.6%	0	393	0.0%	0	70	0.0%	0	50	0.0%	0	315	0.0%
	Bear	268	10	763	1.3%	10	288	3.3%	0	121	0.0%	10	51	18.6%	0	355	0.0%
	Greater Newark	632	86	5177	1.7%	19	559	3.4%	0	110	0.0%	0	84	0.0%	0	1124	0.0%
	Central Pencader	278	10	1886	0.5%	10	971	1.0%	0	209	0.0%	0	155	0.0%	0	1244	0.0%
	Red Lion	19	0	326	0.0%	0	147	0.0%	0	81	0.0%	0	39	0.0%	10	168	5.7%
	Middletown	345	0	1734	0.0%	0	721	0.0%	0	220	0.0%	10	3735	0.3%	0	1732	0.0%
	Other	67	0	3230	0.0%	0	889	0.0%	0	146	0.0%	10	674	1.4%	10	227046	0.0%
	Total	7720	374	23422	1.6%	153	5495	2.8%	0	1243	0.0%	67	4991	1.3%	57	233812	0.0%

Key	
Greater than 5,000 trips	
1,000 to 4,999 trips	
Greater than 15% Share	
10% to 14.9% Share	

Using the O-D study home based work trip estimates and the LEHD data, 23 underserved travel markets have been identified. These markets have more than 2,000 daily home-based work trips with a transit market share of less than 5%. The underserved markets, ranked by the number of daily home-based work trips, are shown in Table 7-8.

Table 7-8: Underserved Markets

Rank	From	To	LEHD HBW Trips	Existing Transit Market Share
1	Greater Newark	Greater Newark	6,081	1.4%
2	Kent / Sussex	New Castle	4,109	0.0%
3	Kent / Sussex	Wilmington	3,990	0.7%
4	Kent / Sussex	Greater Newark	3,924	0.0%
5	Middletown	Middletown	2,870	0.3%
6	Brandywine East	Brandywine West	2,844	1.0%
7	Central Pencader	Greater Newark	2,731	0.4%
8	Greater Newark	Upper Christina	2,716	3.5%
9	Central Pencader	Wilmington	2,535	4.5%
10	Central Pencader	Upper Christina	2,323	2.1%
11	New Castle	New Castle	2,313	3.7%
12	Pike Creek	Greater Newark	2,245	0.4%
13	Brandywine East	Brandywine East	2,213	2.6%
14	Middletown	Upper Christina	2,189	0.9%
15	Kent Sussex	Upper Christina	2,155	0.9%
16	Brandywine West	Brandywine West	2,142	1.8%
17	Piedmont West	Wilmington	2,124	4.5%
18	Middletown	Greater Newark	2,100	0.0%
19	Pike Creek	Upper Christina	2,045	0.9%
20	Middletown	Kent / Sussex	2,039	0.0%
21	Kent / Sussex	Brandywine West	2,020	0.0%
22	Kent / Sussex	Middletown	2,018	0.5%
23	Upper Christina	Upper Christina	2,003	1.4%

Of these 23 markets, the Greater Newark to Greater Newark area is served by Unicity and University of Delaware transit services, as well as exceptionally high levels of walking and bicycling to work. As such, this area may not warrant additional DART First State service. As additional operations and capital funding becomes available, the remaining 22 underserved markets should be considered for expanded transit services.

8 TRANSFER LOCATIONS AND ANALYSIS

Nine transit corridors described in Table 3-3 (page 14) were used to evaluate transfer patterns. Of the 4,490 completed surveys, 98 had either blank starting routes or SEPTA or Kent County routes outside the analysis area. Of the remaining 4,392 surveys, 2,581 did not require a transfer to complete their trip, while 1,811 transferred routes. Table 4-4 (page 20) shows the percentage of transfers by corridor while Table 8-1 below shows the corridor transfer matrix. The highlighted green cells identify corridor to corridor transfer rates greater than 20% of the originating corridor transfers.

Corridor transfer maps are shown in Figures 8-1 through 8-9.

Table 8-1: Corridor Transfer Matrix

			TO (Transfer Corridor)																			
Corridor Transfer Matrix			Phila Pike		Concord Pike		Penn Ave & Lancaster Pike		Kirkwood Highway		Maryland Ave		Market, Dupont and New Castle		Christiana Mall / Newark		Bear / Glasgow		Downstate		Train	
	Corridor	# Transfers	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
FROM (Start Corridor)	Philadelphia Pike	415	67	16%	53	13%	41	10%	42	10%	43	10%	93	22%	29	7%	23	6%	3	1%	4	1%
	Concord Pike	94	22	23%	13	14%	14	15%	7	7%	10	11%	19	20%	5	5%	1	1%	0	0%	3	3%
	Penn Ave & Lancaster Pike	156	37	24%	17	11%	10	6%	12	8%	16	10%	31	20%	16	10%	8	5%	6	4%	3	2%
	Kirkwood Highway	147	28	19%	10	7%	16	11%	14	10%	18	12%	29	20%	26	18%	5	3%	0	0%	1	1%
	Maryland Ave	178	44	25%	11	6%	16	9%	13	7%	14	8%	42	24%	25	14%	11	6%	1	1%	1	1%
	Market, Dupont and New Castle	406	75	18%	27	7%	47	12%	51	13%	30	7%	85	21%	59	15%	21	5%	6	1%	5	1%
	Christiana Mall / Newark	191	26	14%	7	4%	15	8%	26	14%	16	8%	43	23%	42	22%	8	4%	3	2%	5	3%
	Bear / Glasgow	162	22	14%	4	2%	7	4%	8	5%	21	13%	40	25%	33	20%	13	8%	12	7%	2	1%
	Downstate	43	6	14%	9	21%	0	0%	1	2%	1	2%	3	7%	7	16%	4	9%	7	16%	5	12%
	Train	19	5	26%	2	11%	1	5%	0	0%	0	0%	4	21%	1	5%	2	11%	0	0%	4	21%
	Total	1,811	332	18%	153	8%	167	9%	174	10%	169	9%	389	21%	243	13%	96	5%	38	2%	33	2%

Figure 8-1: Philadelphia Pike Transfers

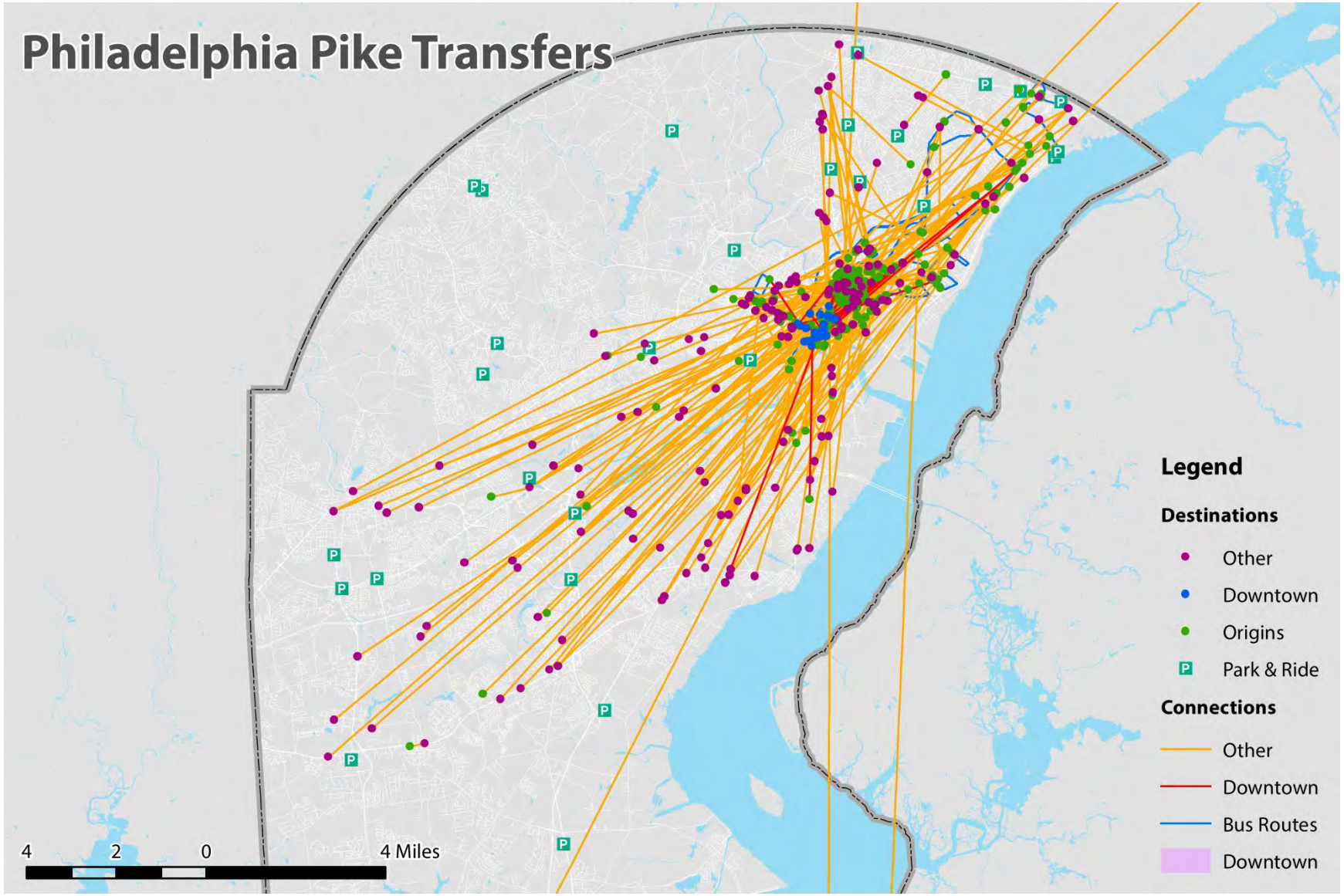


Figure 8-2: Concord Pike Transfers

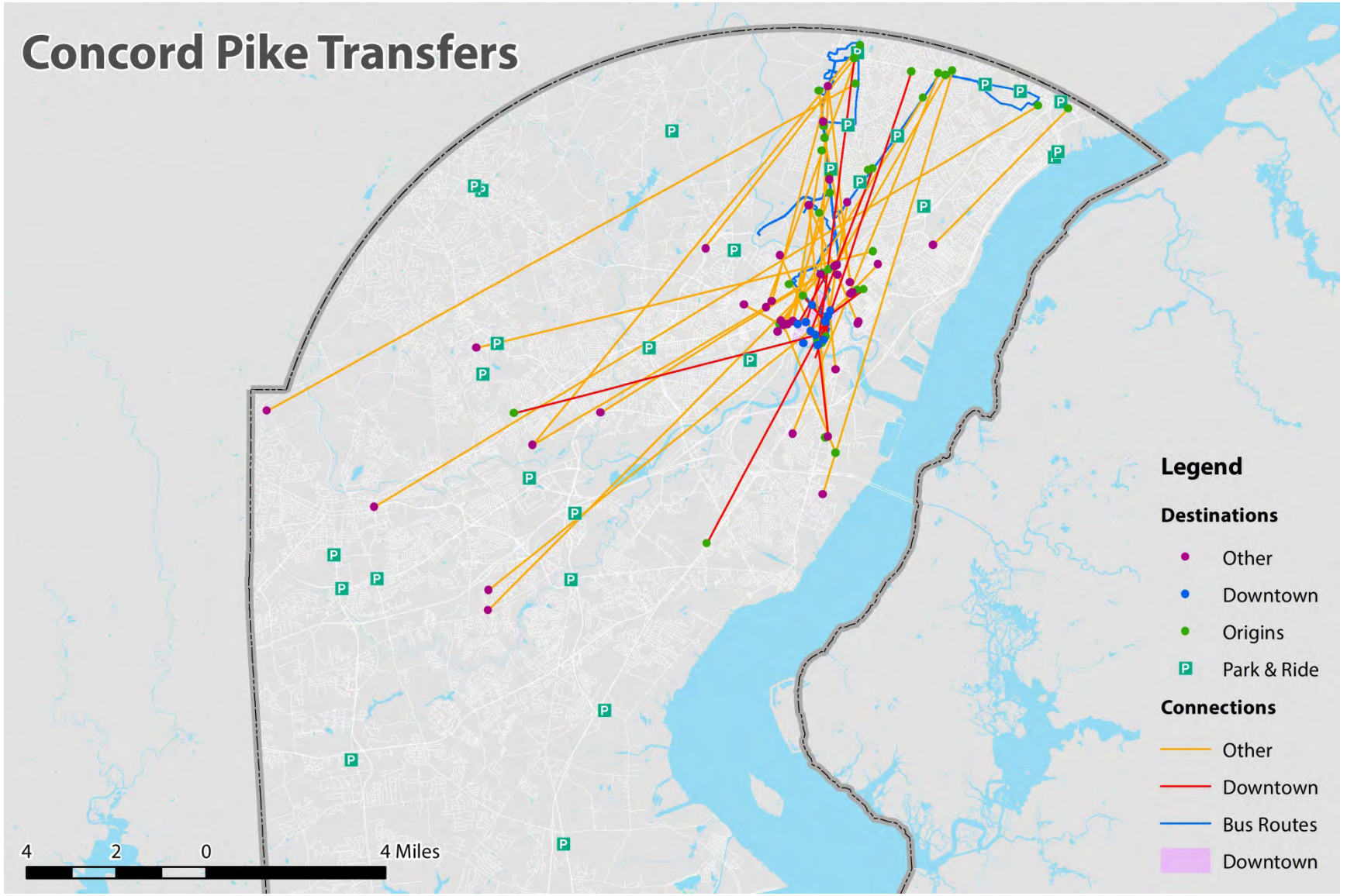


Figure 8-3: Pennsylvania Avenue & Lancaster Pike Transfers

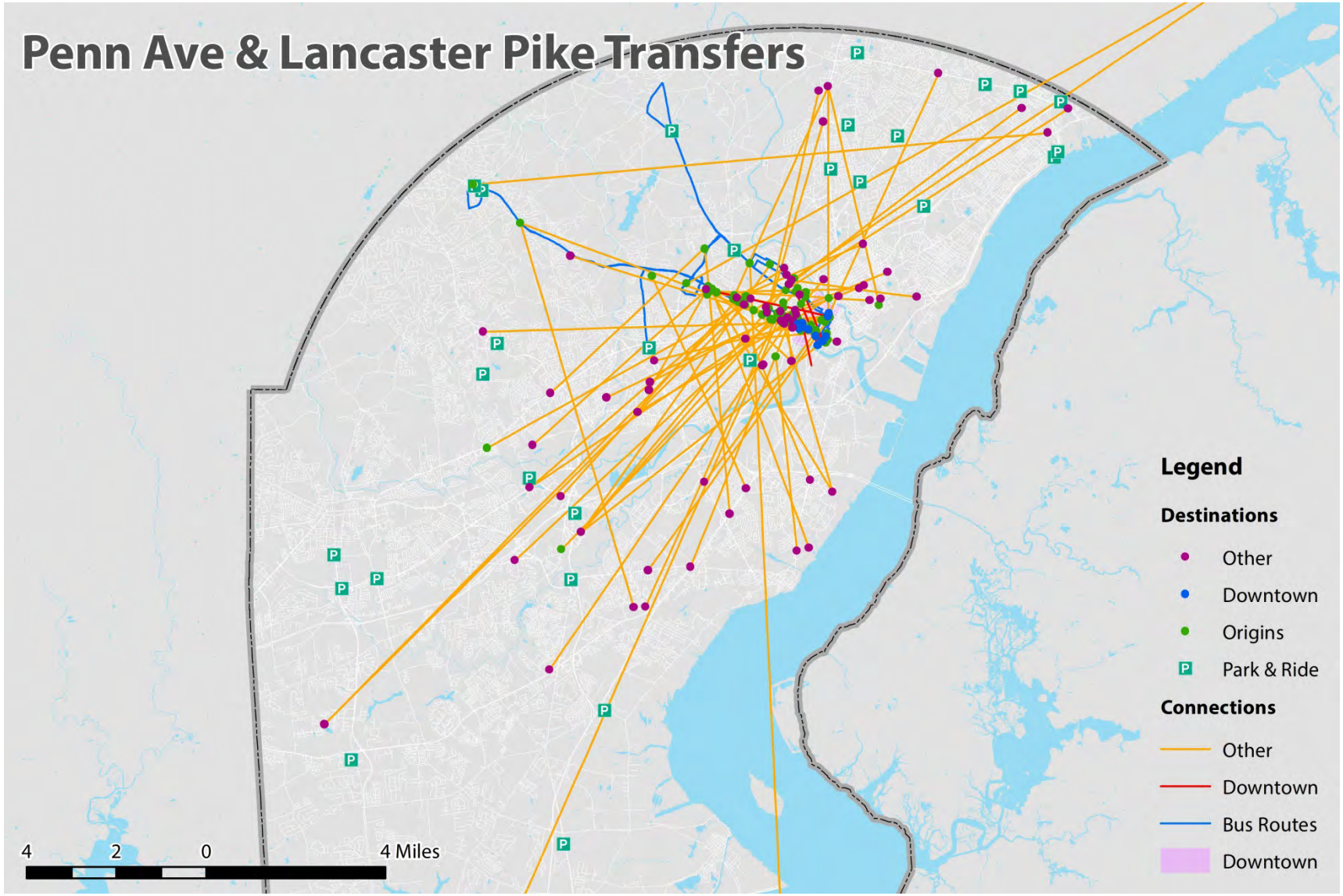


Figure 8-4: Kirkwood Highway Transfers

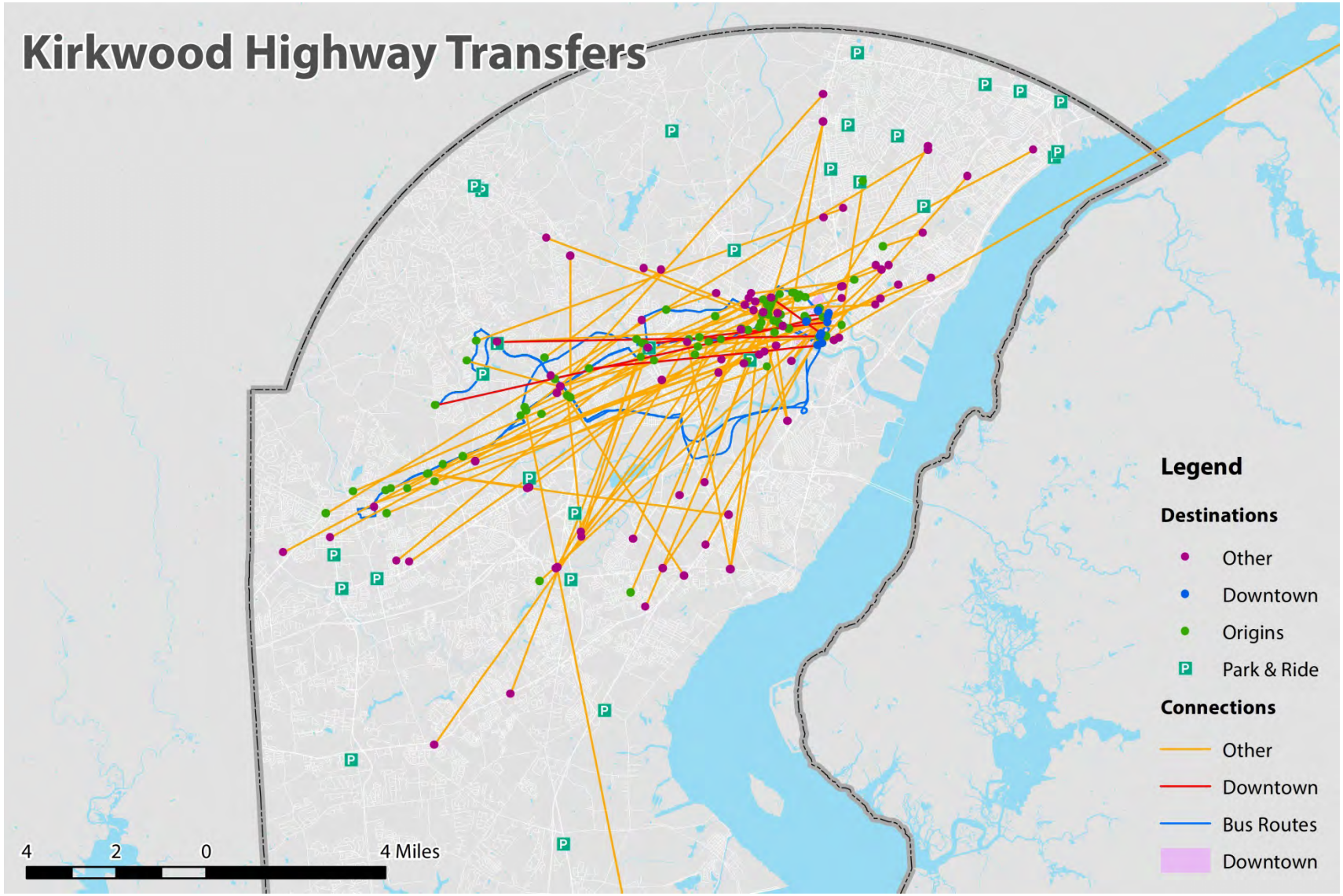


Figure 8-5: Maryland Avenue Transfers

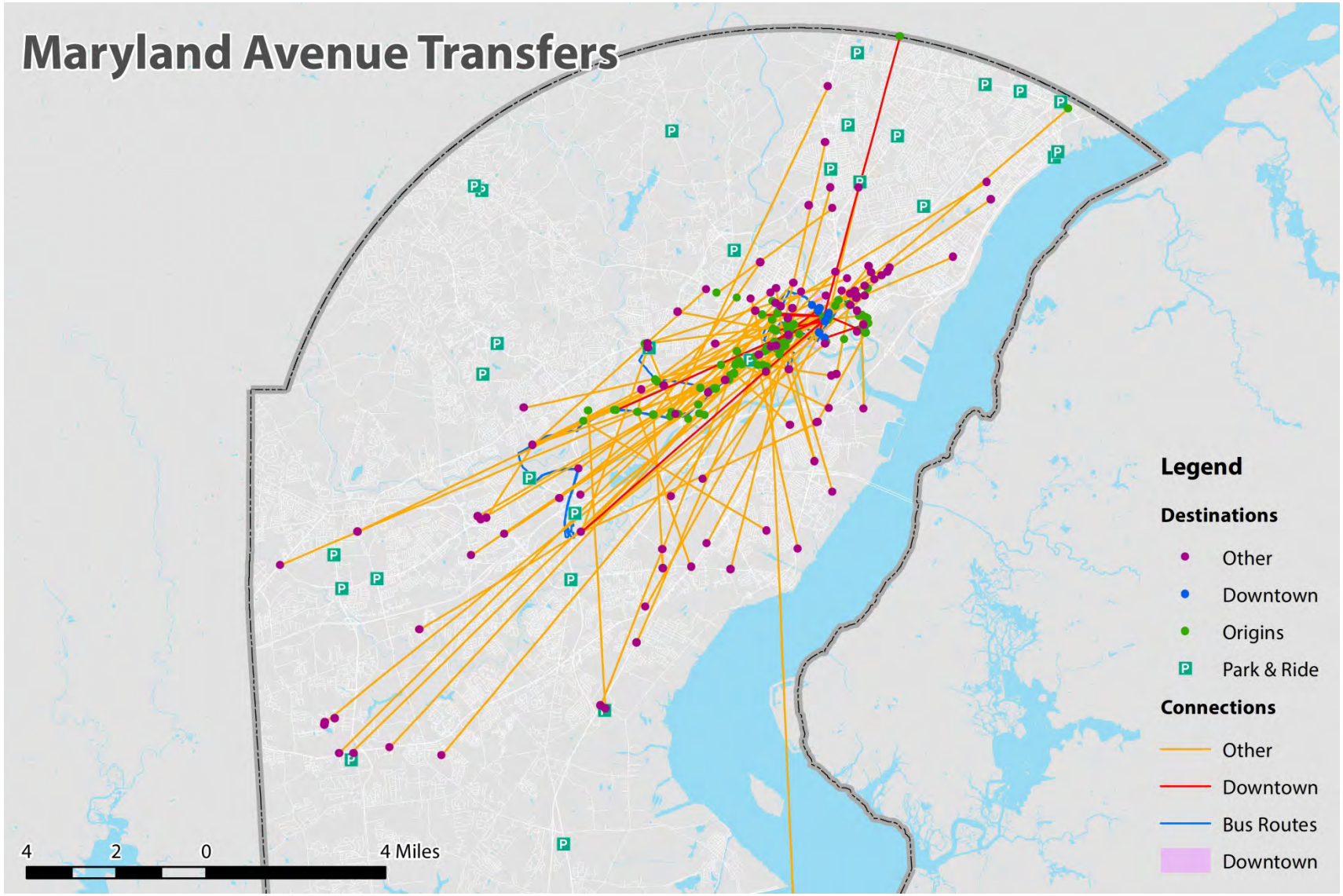


Figure 8-6: Market, Dupont and New Castle Transfers

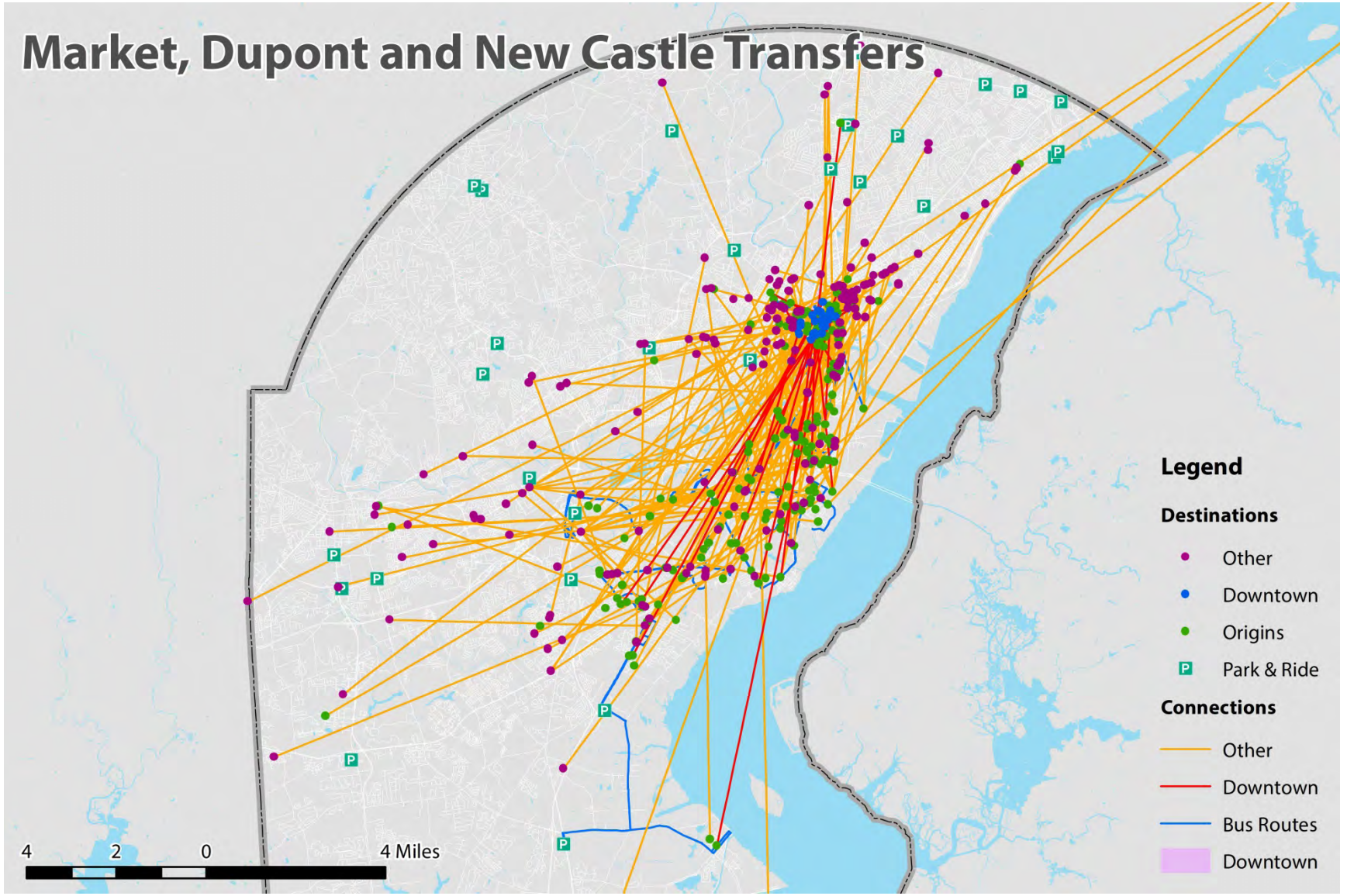


Figure 8-7: Christiana Mall / Newark Transfers

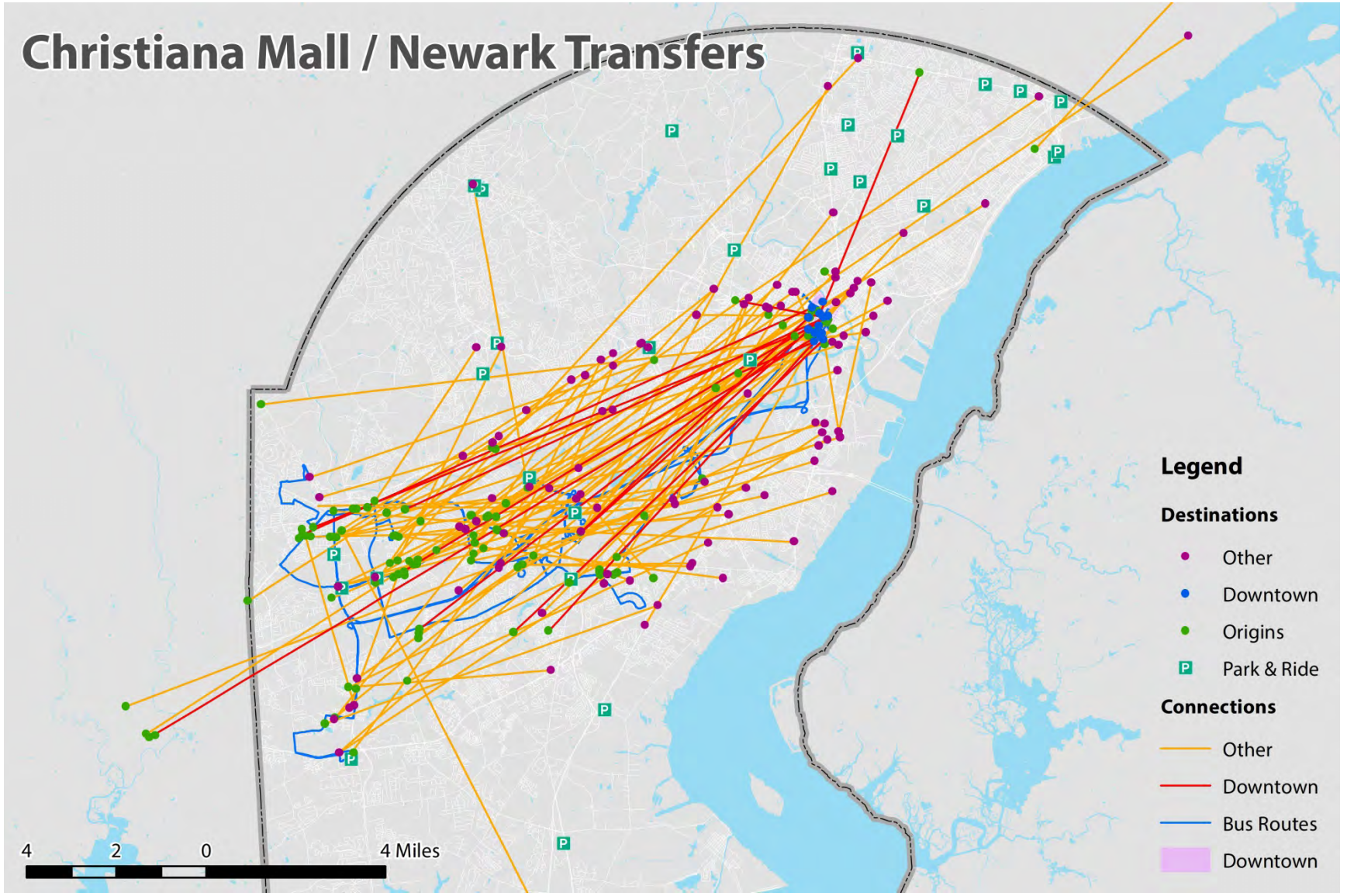


Figure 8-8: Mid County (Bear / Glasgow) Transfers

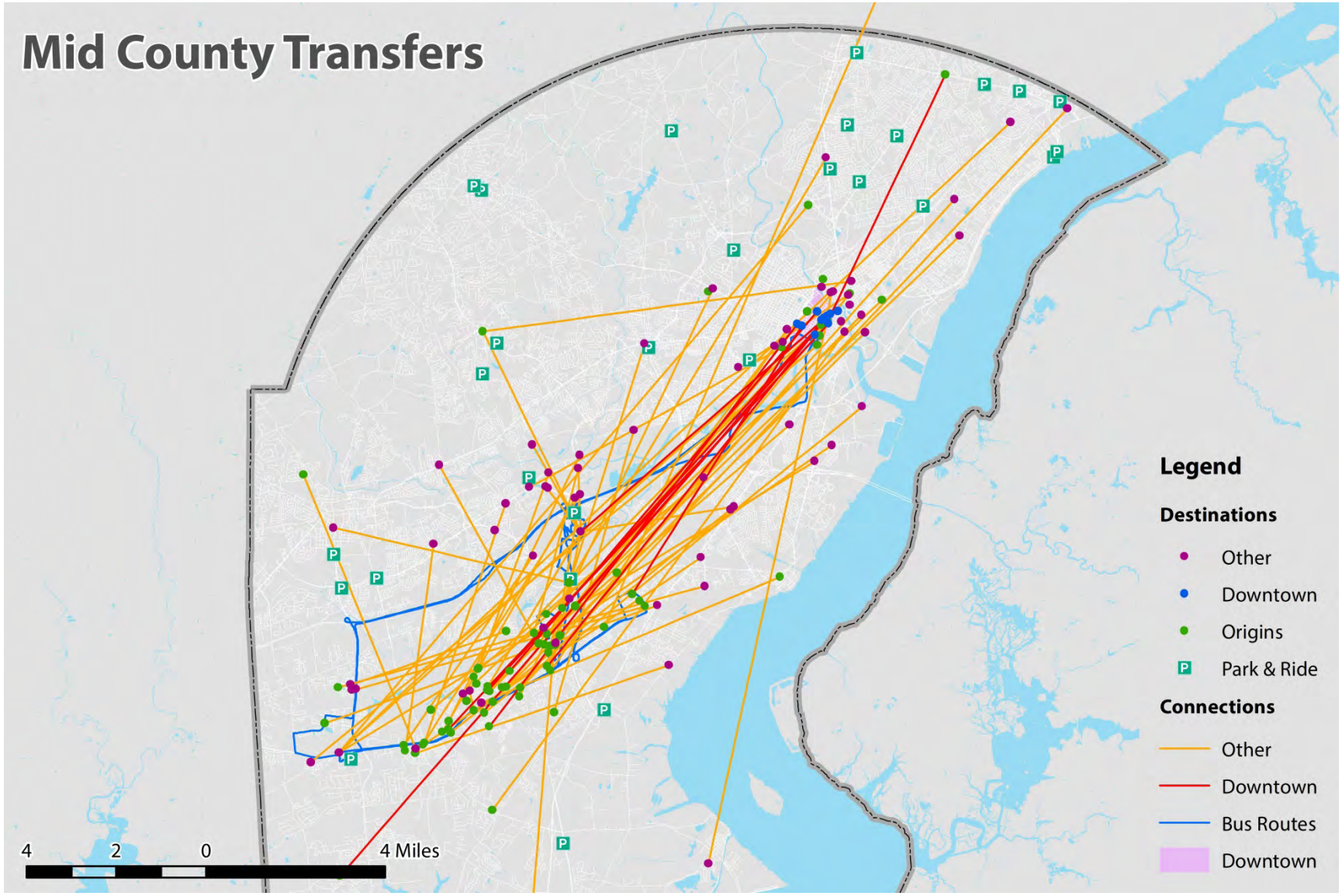
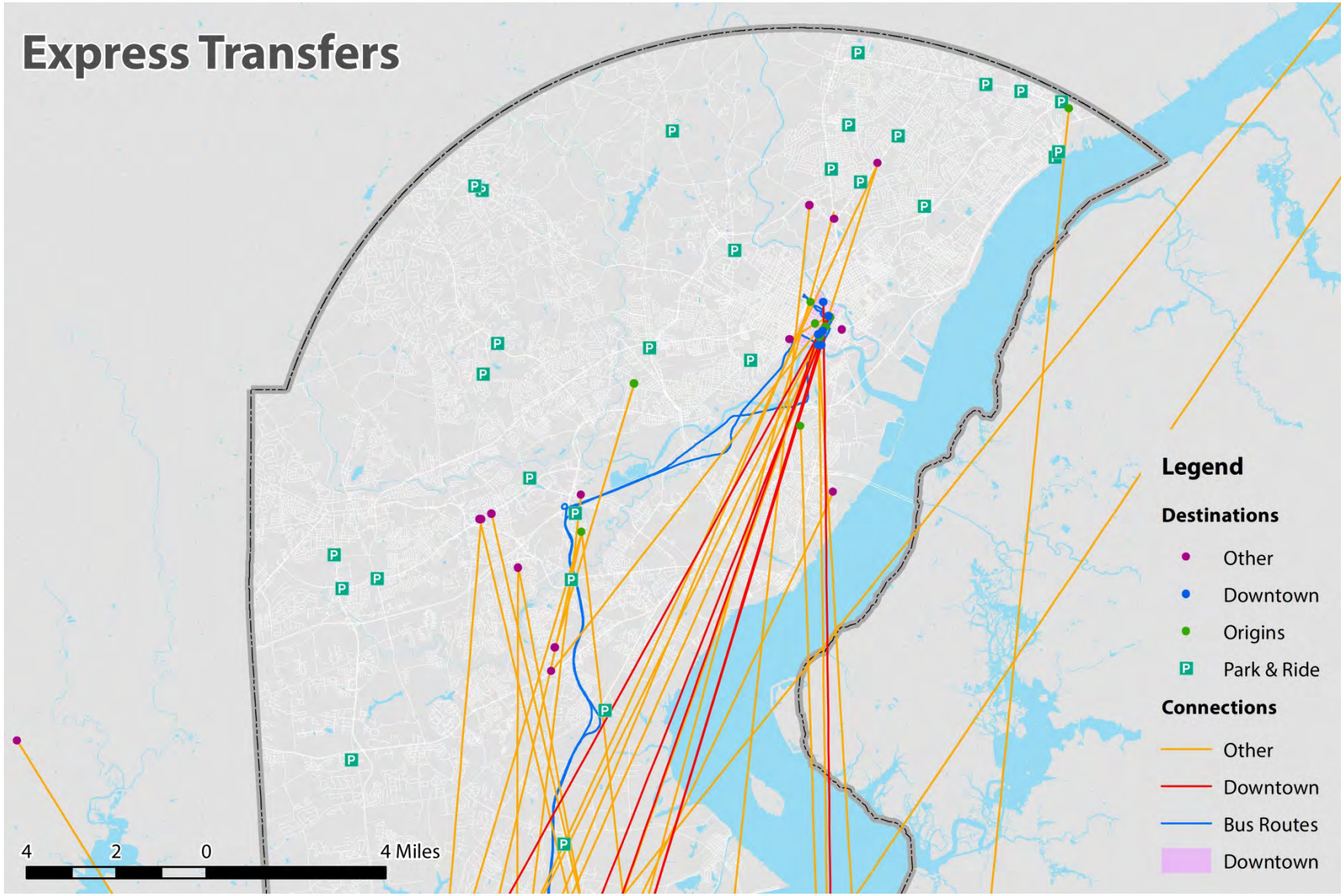


Figure 8-9: Express (Downstate Routes) Transfers



Question 6 of the on-board survey asked respondents to indicate their transfer location. Considering an unlinked trip transfer rate of 29.2%, there are an estimated 9,345 transfers occurring each weekday. Only 455 respondents responded to question 6. However, this number of responses provides a 4.5% error rate at the 95% confidence interval. Table 8-2 summarizes the transfers by location and type while Table 8-3 lists the number of responses by transfer location.

Table 8-2: Estimated Transfers by Location Type

Estimated Transfers by Location Type		
Location	**Percentage**	**Estimated Weekday Transfers**
Rodney Square	60%	5,648
Other Downtown	9%	842
Christiania Mall	10%	924
Other Suburban	21%	1,931
Estimated Total Weekday Transfers		9,345

These data show that DART First State, through its fare structure and route network, has developed a diffuse transfer pattern where about 40% of transfers occur away from Rodney Square.

Table 8-3: Responses to Question 6 – Transfer Location

Transfer Location	# of Responses	Type
Rodney Square	275	Rodney Square
Christiana Mall	45	Christiana Mall
Amtrak Station	14	Other Downtown
Governors Square	6	Other Suburban
4th & King St	5	Other Downtown
Delaware Park	5	Other Suburban
Peoples Plaza	5	Other Suburban
Prices Corner	5	Other Suburban
Orange St & 8th St	4	Other Downtown
Odessa Park & Ride	4	Other Suburban
Amazon Distribution Center	3	Other Suburban
Christiana Hospital	3	Other Suburban
Concord Mall	3	Other Suburban
Newark Transit Hub	3	Other Suburban
333 Shipley St	2	Other Downtown
9th & Market St	2	Other Downtown
896 Park & Ride	2	Other Suburban
Airport Plaza	2	Other Suburban
Claymont Train Station	2	Other Suburban
Delaware State University	2	Other Suburban
Polly Drummond Shopping Center	2	Other Suburban
Tri-State Mall	2	Other Suburban
Other Downtown Locations	14	Other Downtown
Other Suburban Locations	45	Other Suburban

9 REGIONAL GROWTH ANALYSIS

The regional travel forecast model was used to review the forecast change in the number of households and employment (Table 9-1).

Overall the number of New Castle County households is expected to grow by 22% from 2012 to 2040. More than 50% of the household growth is predicted to occur in and around Middletown, with an estimated 23,224 additional households. With these new households, the Middletown subarea will have 42,901 households, more than any other subarea. This suggests that there will be additional opportunities for both local transit within the Middletown subarea and the need for expanded commuter services from Middletown to the five largest employment centers in New Castle County: Wilmington, Greater Newark, Upper Christina, New Castle, and Brandywine West. As the Middletown area develops, transit centers and expanded park and ride facilities should be planned with right of way acquisition so that these facilities can be built when needed.

Employment is predicted to add 21,036 jobs or an 8% increase over the 2012 to 2030 period. The job growth is expected in suburban areas. This suggests that DTC will need to design future services for additional reverse commute and suburb-to-suburb trips.

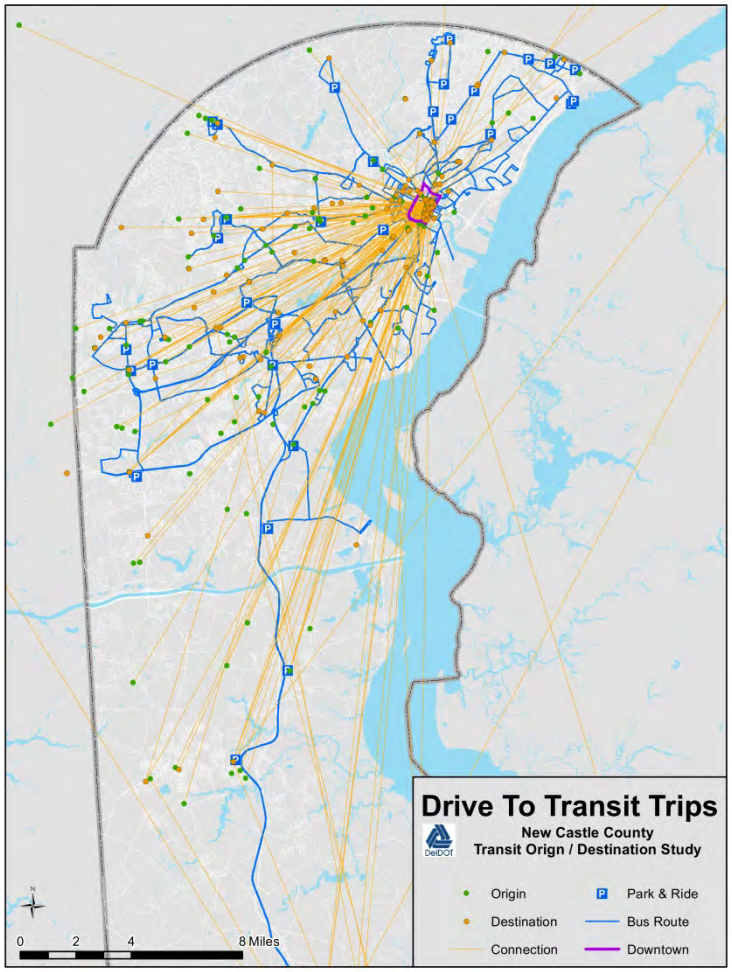
Table 9-1: New Castle County Households and Employment – 2012 to 2040

	Households			Employment		
Sub Area	**Total 2012**	**Change to 2040**	**% Change**	**Total 2012**	**Change to 2040**	**% Change**
Wilmington	28,679	1,529	5%	59,784	(1,057)	-2%
Brandywine East	20,918	1,656	8%	13,462	651	5%
Brandywine West	11,008	767	7%	27,761	1,375	5%
Piedmont East	3,298	927	28%	7,155	831	12%
Piedmont West	7,855	1,353	17%	5,115	375	7%
Lower Christina North	4,847	610	13%	11,652	449	4%
Lower Christina South	9,038	558	6%	8,918	(70)	-1%
New Castle	11,632	1,298	11%	29,062	1,681	6%
Pike Creek	16,954	597	4%	12,500	293	2%
Upper Christina	10,264	703	7%	22,971	2,188	10%
Wilton	10,221	438	4%	9,171	1,156	13%
Bear	9,982	3,397	34%	2,655	671	25%
Greater Newark	23,847	1,577	7%	38,260	2,738	7%
Central Pencader	14,608	4,958	34%	8,980	3,185	35%
Red Lion	2,772	990	36%	2,031	489	24%
Middletown	16,977	23,224	137%	8,170	6,081	74%
Total New Castle County	202,900	44,582	22%	267,647	21,036	8%
Source: DelDOT Travel Forecast Model						

10 DRIVE TO TRANSIT ANALYSIS

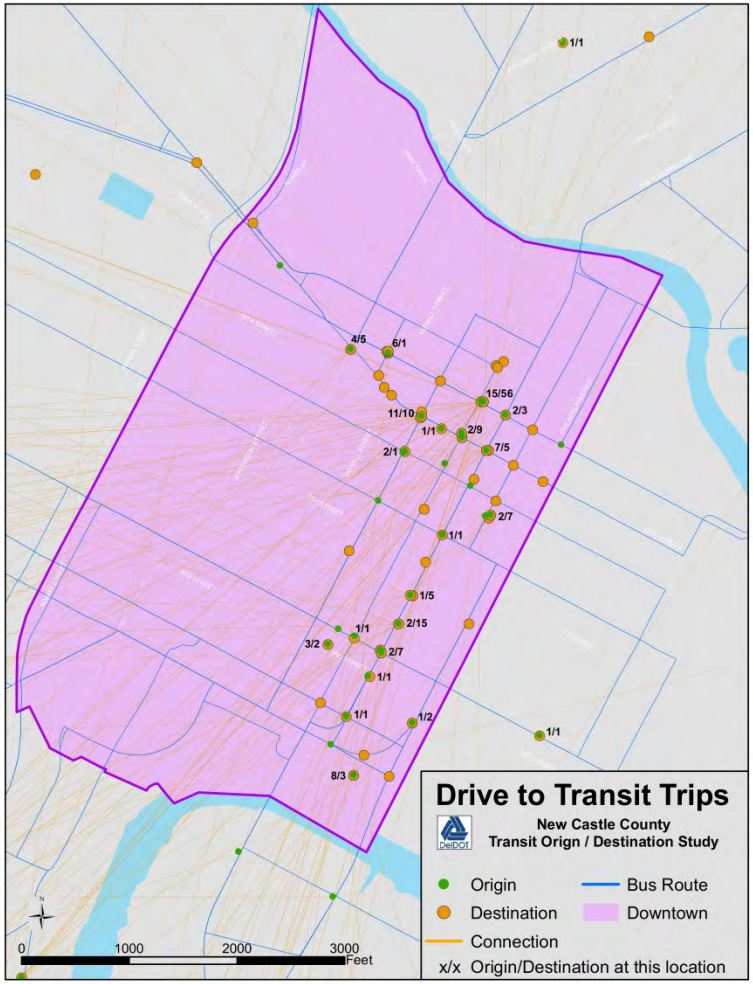
357 of 4,195 respondents used an automobile to access the transit service. Origin-destination pairs for drive to transit trips are shown in Figure 10-1.

Figure 10-1: Drive to Transit Trips



Most drive to transit trips are destined to Downtown Wilmington. Figure 10-2 shows the drive to transit destinations in the Downtown area.

Figure 10-2: Downtown Drive to Transit Trips



11 DOWNTOWN EMPLOYMENT LOCATION ANALYSIS

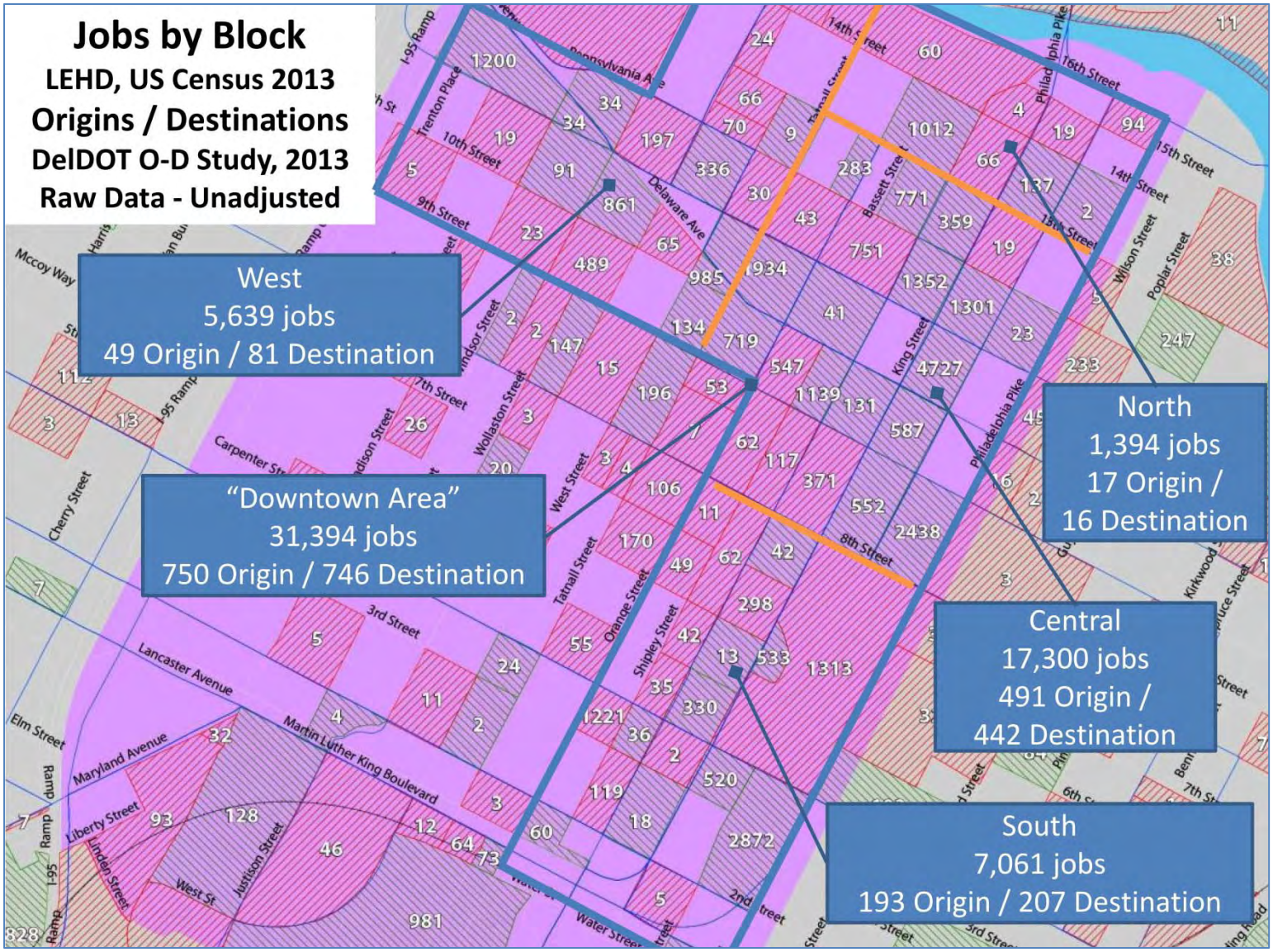
Downtown Wilmington is a compact, walkable, and transit-friendly area. Figure 11-1 shows the downtown area (outlined for this report by I-95, the Christina River, the Brandywine Creek, and Walnut Street) shaded in pink with the highest job concentrations (the "core") outlined in blue.

For the City of Wilmington as a whole, the LEHD reports 2011 employment at 42,269 jobs. Of these jobs, 31,394 are located in the core. The core has been divided into four subareas including North, Central, West and South. The Central subarea, located within two blocks of Rodney Square, has the largest number of jobs at 17,300. The South subarea has 7,061 jobs, the West subarea has 5,639 jobs, and the North subarea has 1,394 jobs.

Of the 4,490 returned surveys, there were 2,394 surveys with valid origins and destinations. Of these 2,394 surveys, 1,496 (62.5%) had an origin or destination in the core.

The Central subarea has the largest number of transit trips, with 933 surveys (39% of all geocoded surveys) having an origin or destination in the Central subarea.

Figure 11-1: Downtown Jobs by Block



12 ALTERNATIVE TRANSIT SERVICE STRATEGIES

Alternative transit service strategies have been analyzed to identify ways to reduce the number of bus trips in downtown Wilmington and the number of transfers occurring at Rodney Square.

In evaluating downtown bus routing, the current one-way street patterns funnel transit services towards Rodney Square. From the northwest, the only eastbound street suitable for buses to reach the central area is 11th Street. Likewise from the north, the only southbound street suitable for buses to reach the central area is King Street. From the south and southwest there are two northbound streets that reach the central area: Orange and Walnut streets. With this limited street network, it almost impossible for the transit service to reach the central area, where the greatest number of jobs are concentrated, without significant transit activity at Rodney Square.

DART First State bus routes have been designed to directly serve the central and south areas of downtown without requiring transfers. This is understandable because together these two areas have 24,361 jobs, or 78% of jobs in the core. Combined with the limited street network, this decision to serve both areas with nearly every route causes high levels of bus traffic on King Street. In the alternatives described below, some routes would no longer directly serve the south area of downtown Wilmington.

As a framework for evaluating alternatives, the number of scheduled buses per weekday has been counted (Table 12-1).

Table 12-1: Weekday Bus Trips, Select Locations

Location	Weekday Bus Trips
Rodney Square – all locations	1,206
King at 7th	774
Walnut at 7th	303
Orange at 7th	483

Six strategies have been evaluated, including:

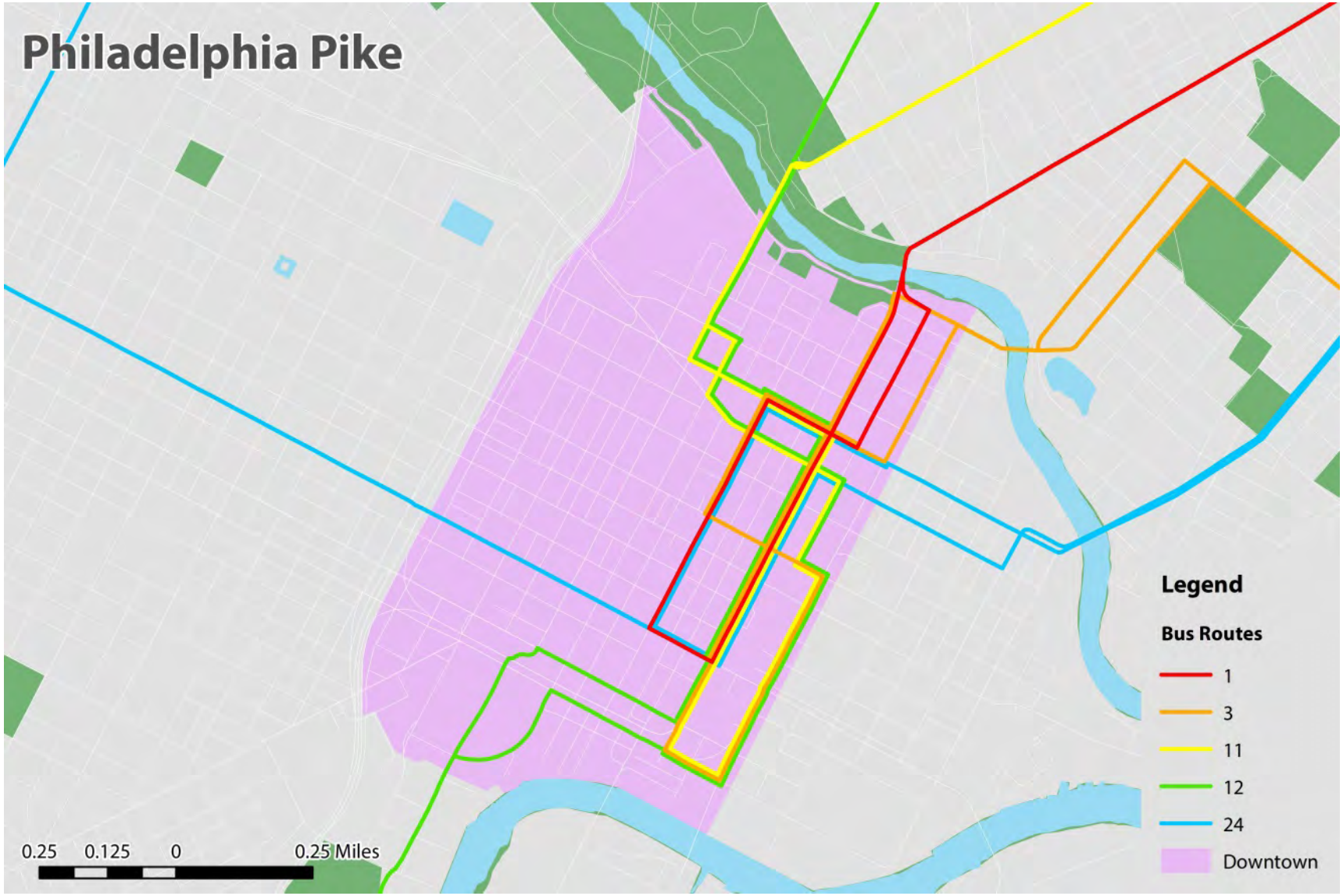
- Connect routes to provide crosstown services
- Remove the downtown loop for some routes
- Develop additional suburban transfer locations
- Implement a split service pattern where commuter routes use different downtown streets than core bus services
- Establish a timed transfer at the proposed Christiana Mall Transit Center with 15 minute peak period frequency to and from Downtown Wilmington
- Use alternative downtown streets for select core routes in order to improve access to some destinations while reducing the amount of bus traffic on other downtown streets

12.1 Connect Routes

Connecting routes or through routing can reduce the number of bus trips in the downtown area. Many of the redesigned routes can continue to serve the central and south subareas.

Figure 12-1 includes the routes from the Philadelphia Pike corridor. This corridor was chosen as an example to illustrate the significant bus loops in the Downtown area. Route 1 (117 daily bus trips), Route 3 (52 daily bus trips), and Route 11 (73 daily bus trips) have bus loops from the north to the Amtrak Station on the south. If these routes could be combined with other routes that enter downtown from the south, one half of these bus trips could be removed from downtown.

Figure 12-1: Philadelphia Pike Corridor Downtown Bus Routing



Four route combinations are suggested.

Route 1 and Route 12 south could be combined (Figure 12-2). The new route would extend from the Philadelphia Pike corridor to the Riverfront. The combined route (Figure 12-3) would stop at Rodney Square in the southbound direction and would use French Street on the northbound trip.

Figure 12-2: Routes 1 and 12: Existing Routing

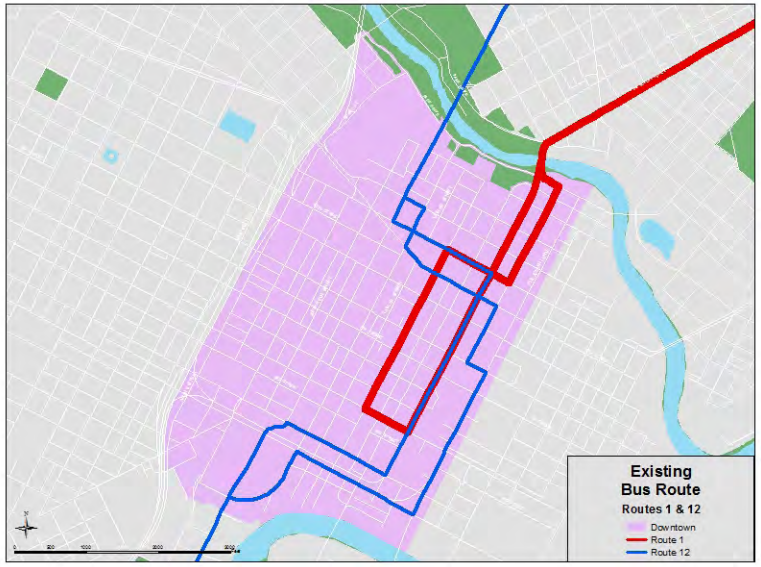
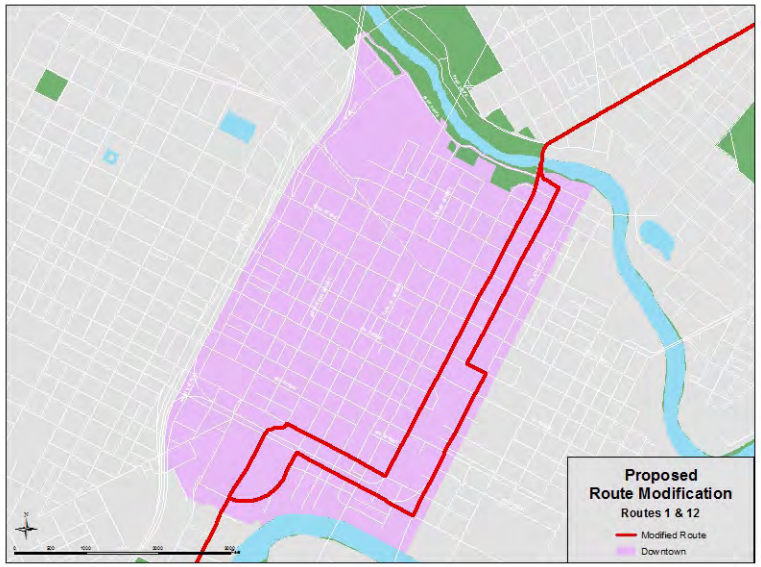


Figure 12-3: Proposed Route 1 and Route 12 Combination



Considering the high level of ridership on Route 1 (3,153 average weekday boardings) and the potential for enhanced transit services in the redeveloping Riverfront area, the combined route could evolve into a form of bus rapid transit service. This route, by providing all day frequent service, could also replace the existing Route 32 – Wilmington Trolley with no degradation of service.

Routes 12 north and 24 west could be combined (Figures 12-4 and 12-5). The primary downside of this change would be that Route 12 north patrons that are traveling to the Amtrak station would have to walk three blocks from 4th Street.

Figure 12-4: Routes 12 and 24 Existing Routing

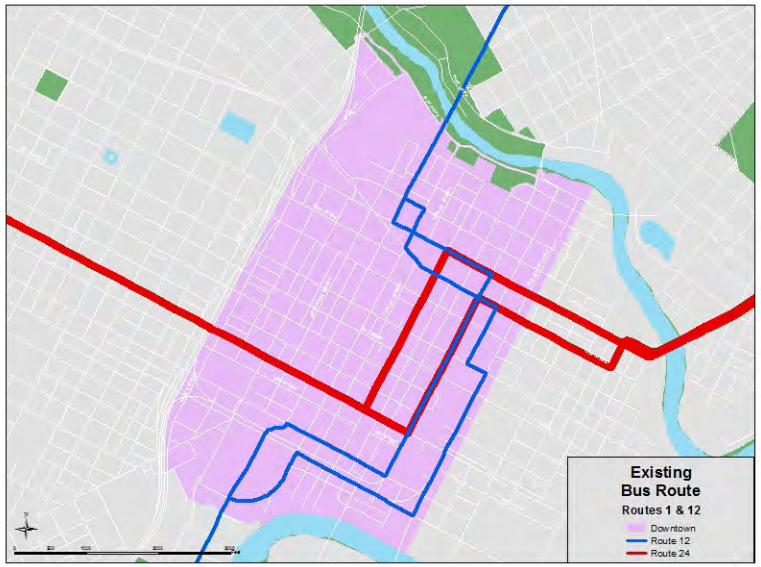
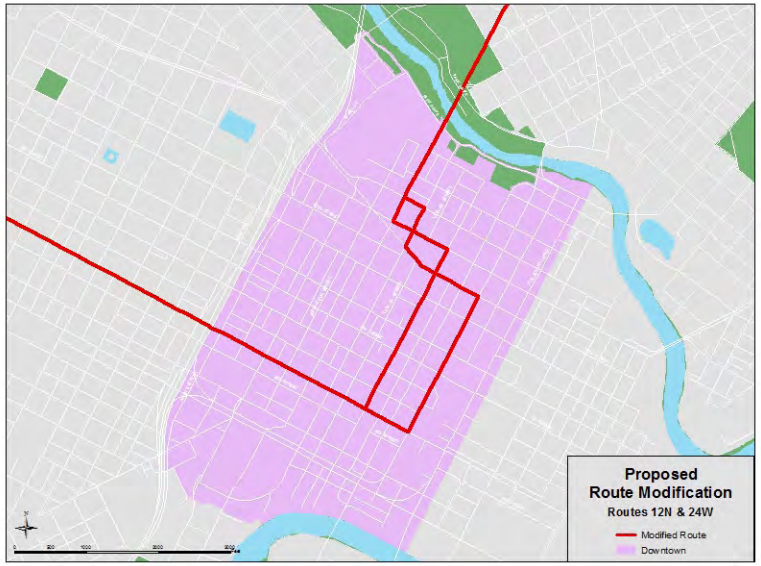
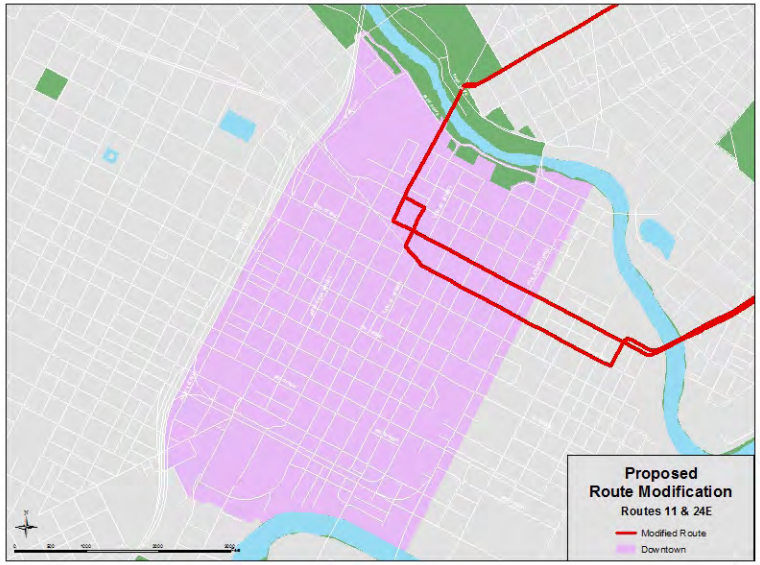


Figure 12-5: Proposed Routes 12 North and 24 West Combination



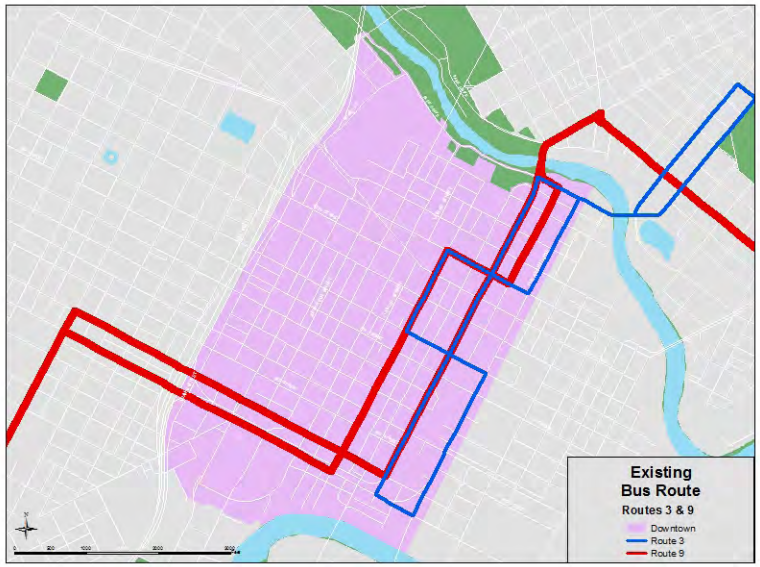
Routes 11 and 24 east could be combined (Figure 12-6). Passengers from these routes would have to transfer to the Route 1/12 south combination or other routes to get to the Amtrak station.

Figure 12-6: Proposed Routes 11 and 24 East



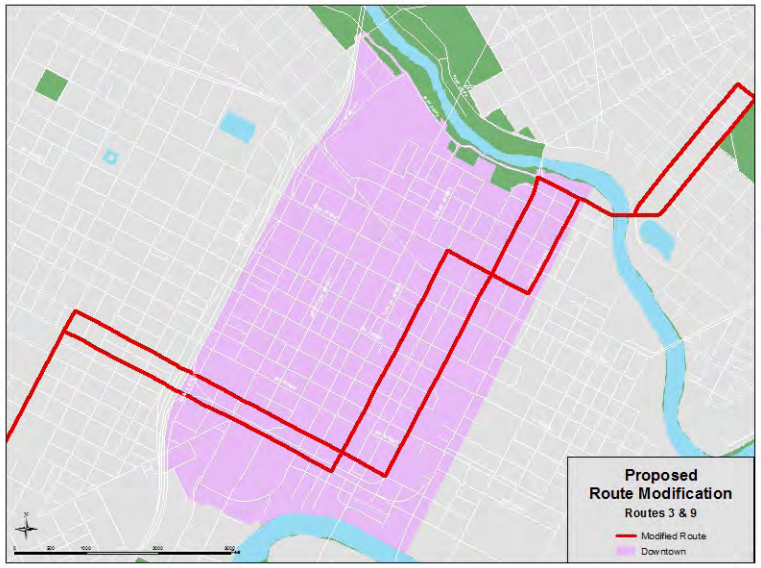
Routes 3 and 9 could also be combined (Figures 12-7 and 12-8).

Figure 12-7: Routes 3 and 9 Existing



On the north end, this new route would follow the Route 3 alignment until reaching Governor Printz Boulevard where the proposed route turns south towards the Howard R. Young Correctional Institution. With this proposed change, bus stops would no longer be served at Vandever Avenue at Spruce Street, Vandever Avenue at Church Street, and Vandever Avenue at Thatcher Street. The Spruce Street and Thatcher Street stops are only one block from the proposed transit services, while the Church Street stop would be three blocks from the proposed routes. Like all rerouting considerations, this proposed change should be reviewed for Title VI and community impacts.

Figure 12-8: Proposed Routes 3 and 9 Combination

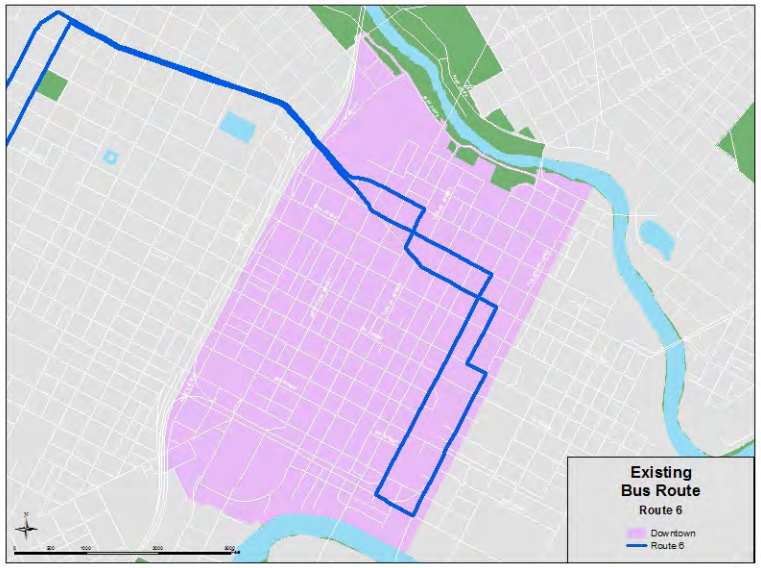


12.2 Remove Downtown Loop

Two routes are suggested for minor changes in the immediate vicinity of Rodney Square. They would reduce the number of buses stopping at that location.

The loop for Route 6 (Figure 12-9) would be shortened, with the route's terminus moved from the Amtrak station to 8th Street west of Market Street.

Figure 12-9: Existing Route 6



On the outbound trip, the revised Route 6 would follow Orange Street to 12th Street without an outbound stop at Rodney Square (Figure 12-10). Route 6 passengers traveling to the Amtrak station would no longer have direct service, but could transfer to Routes 19 or 36 on Union or Lincoln Streets.

Figure 12-10: Proposed Route 6

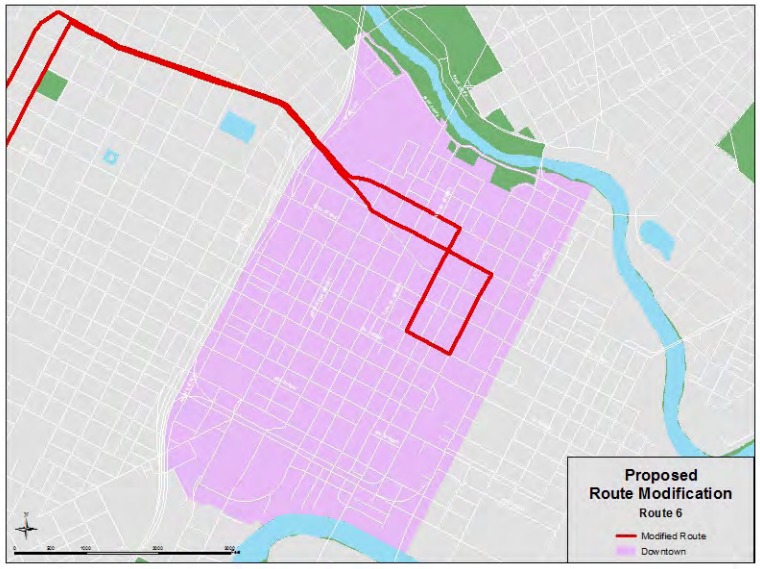
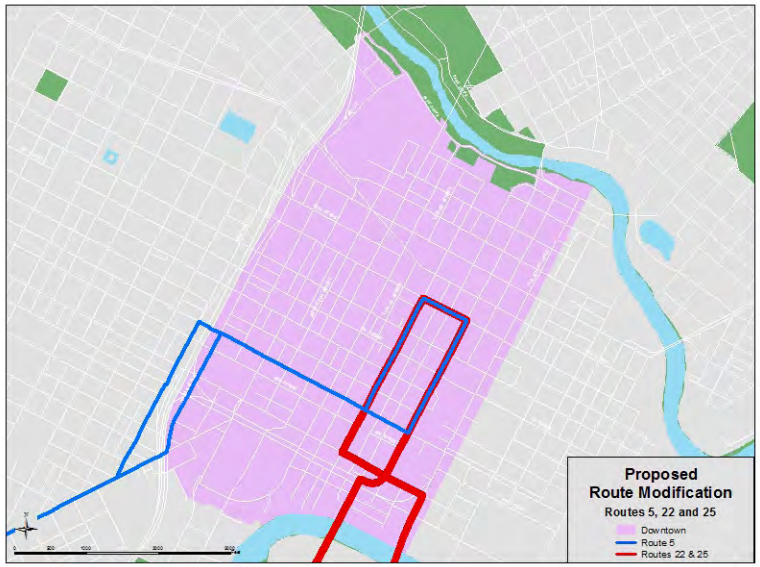


Figure 12-11: Proposed Routes 5, 22 and 25

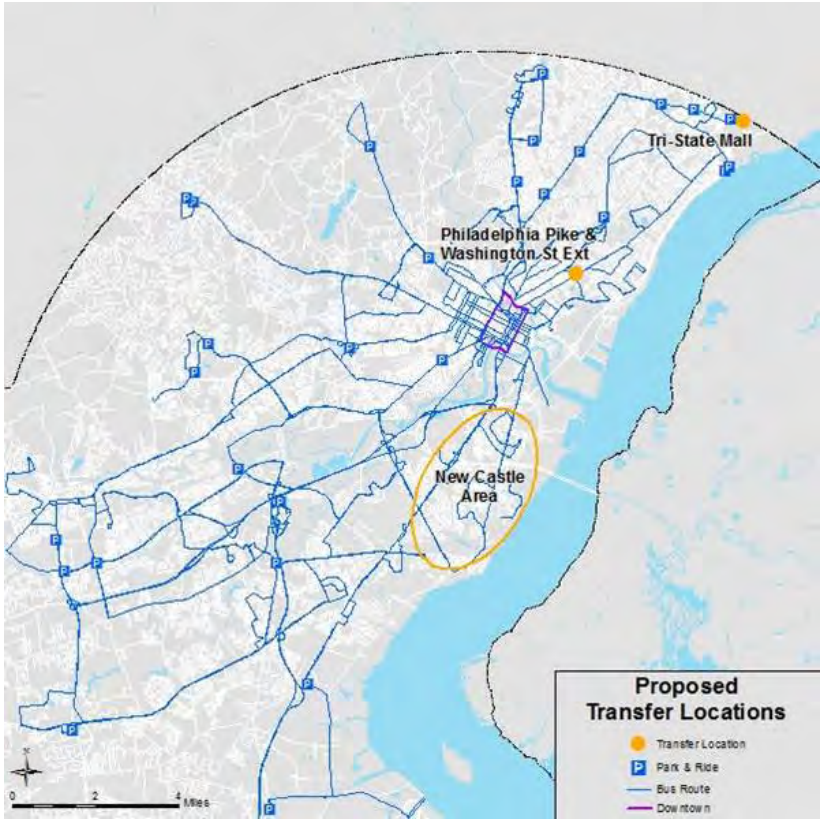


Routes 5, 22 and 25 could also have their downtown circulation pattern shortened. These routes currently use Orange Street to 11th Street with a terminus at Rodney Square. The proposed routing for these three routes (Figure 12-11) would move the terminal location to 9th Street just west of Market Street. Customers needing to transfer to other routes would walk only one block to Rodney Square or utilize transfer locations along Orange or King Streets.

12.3 Additional Suburban Transfer Locations

Over the past few years DART First State has developed suburban transfer locations at Newark and Prices Corner. As shown in Figure 12-12, new transit centers could be considered in the Philadelphia Pike and Washington Street Extension area and in the New Castle area. The existing transfer location at the Tri-State Mall should be considered for improvement.

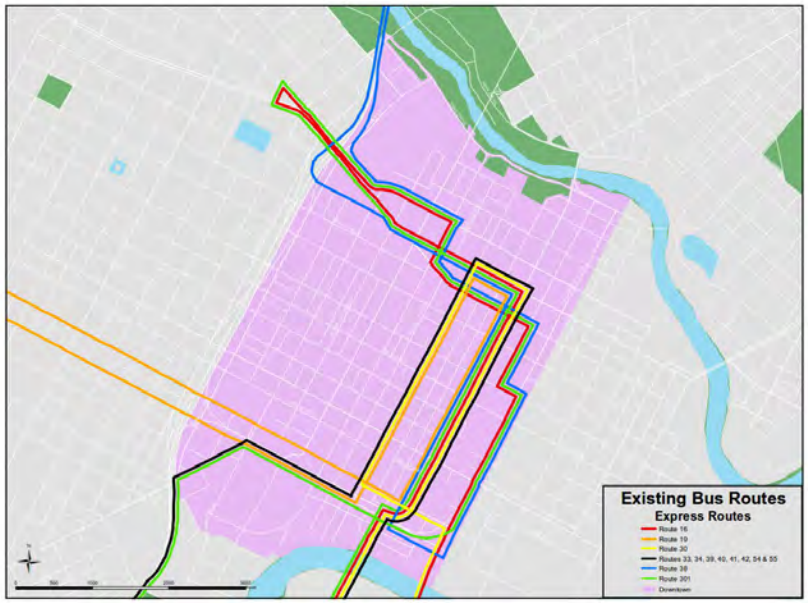
Figure 12-12: Suggested Suburban Transit Centers



12.4 Commuter Routes Downtown Service Pattern

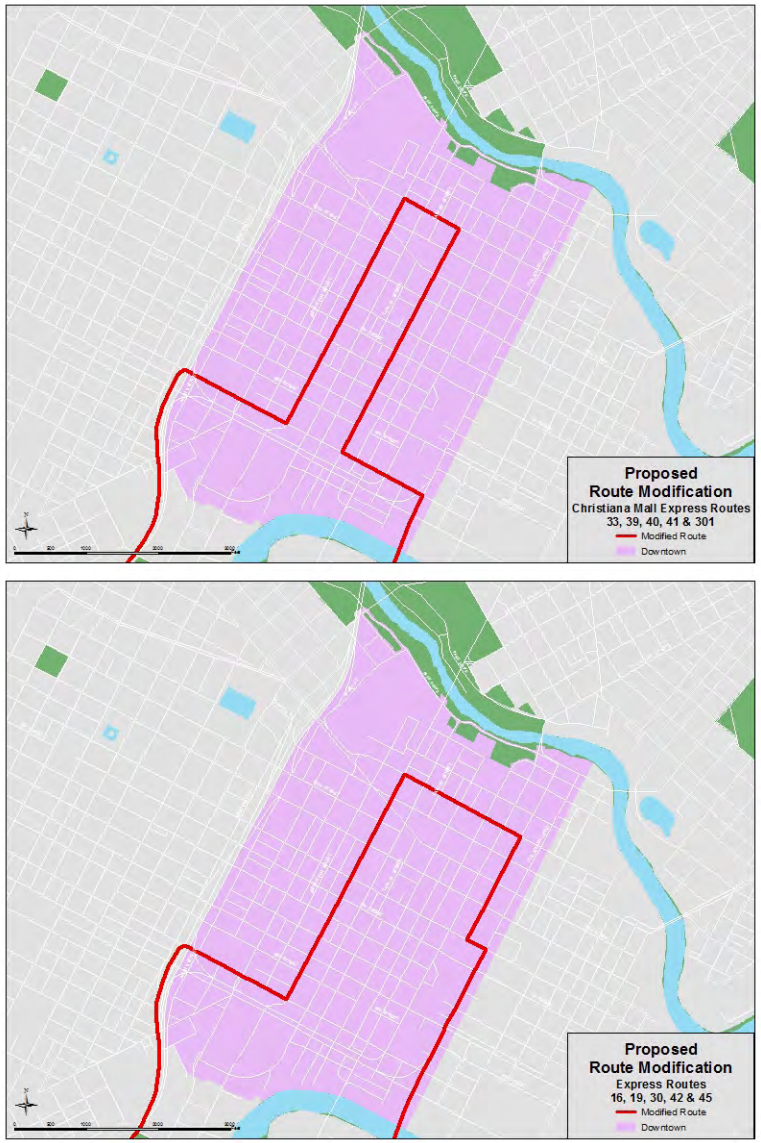
The existing commuter routes utilize much the same pattern as other DART First State routes. Of the 13 express routes, Route 38 comes from the north of downtown and the other 12 routes enter downtown from the south. Most of the routes use Orange Street to 11th Street, returning south on King Street (Figure 12-13).

Figure 12-13: Express Routes – Existing Service Pattern



As an alternative the 12 express routes that enter from the south could use either Orange Street or Walnut Street for the northbound part of the trip and Washington Street for the southbound portion of the trip. Figure 12-14 illustrates potential alternative express routes.

Figure 12-14: Express Routes – Alternative Service Pattern



12.5 Christiana Mall Timed Transfer

DART First State is currently planning a new suburban transit center in the vicinity of Christiana Mall, with funding in place for construction within three years. This project is intended to provide sufficient bus bays for a timed transfer. If implemented, a timed transfer at Christiana Mall would reduce the number of routes directly serving downtown Wilmington. Table 12-2 shows an example of how a timed transfer might function with a pulse every fifteen minutes. Routes 33 and 40 would establish the core service with buses every fifteen minutes between the suburban transit center and downtown. Routes 34, 54 and 55 would not have any trips extending to downtown. However, with the timed transfer, there should be minimal delay for customers on these routes. The suburban transit center should be planned for about ten bus bays to provide some opportunity for service growth, particularly considering anticipated demographics in southern New Castle County.

Table 12-2: Proposed Christiana Mall Timed Transfer – Morning Peak Hours

Route	Headway	6:00 to 7:00 AM				7:00 to 8:00 AM			
		15	30	45	00	15	30	45	00
33 – Inbound	30	X		X		X		X	
33 – Outbound	30		X		X		X		X
40 – Inbound	30		X		X		X	X	
40 - Outbound	30	X		X		X		X	
5	15	X	X	X	X	X	X	X	X
15	30		X		X		X		X
34	60		X				X		
54	30	X		X		X		X	
55	30	X		X		X		X	
62	45	X			X			X	
63	45		X			X			X
301 – Inbound	30		X		X		X		X
301- Outbound	30		X					X	

12.6 Alternative Streets for Transit

The downtown Wilmington street network is composed of a network of north-south streets and east-west streets. Many of these streets are set up for one-way traffic, limiting bus routing flexibility. Some of the streets, such as 9th Street are also very narrow and cannot be used effectively for significant bus traffic. Consequently, there are limited options.

In the north-south direction there are four streets that are generally suitable for buses: Washington, Orange, King, and Walnut Streets. Washington Street is too far from the jobs in the central area to be used for local bus service. However, in its current southbound configuration, it can provide capacity for southbound express buses as described in section 12.4.

The east-west streets suitable for transit include the Martin Luther King, Jr. Boulevard / 2nd Street one-way pair, 4th Street, the 7th and 8th Streets one-way pair, and the 10th and 11th Streets one-way pair. All of these streets are currently used by DART First State bus routes.

Two potential changes that could significantly improve bus routing flexibility would be to change 12th Street to two-way operation from Delaware Avenue to Walnut Street and to change Walnut Street to two-way operations from A Street to 12th Street. Both of these changes would require a comprehensive traffic evaluation before benefits and impacts can be compared.

12.7 Reduction in Bus Trips in the Downtown Area

Implementation of these service suggestions will require further service planning. Once draft routes and schedules have been developed the costs, benefits, and estimated changes in ridership can be estimated. As noted in the description for each area, there may be adverse impacts from some of the changes. Rider comments must be solicited before advancing these ideas, and a Title VI evaluation will be required.

Rather than having a single transit station, these service suggestions could spread the transfer points across downtown Wilmington. In certain cases transfers between routes may require a walk of a block or more. With some of the transferring passengers moved to new locations, these new sites should have improved passenger amenities including architectural shelters, improved lighting, excellent wayfinding, customer information, and security enhancements.

If all of the changes were implemented, there would be a 39% reduction in the number of bus trips at Rodney Square. Bus traffic measured at King and 7th street would also have a 37% reduction.

Table 12-3: Estimated Change in Downtown Bus Trips

	Weekday Bus Trips			
Location	Current	Proposed	Change	% Change
Rodney Square – all locations	1206	740	-466	-39%
King at 7th	774	490	-284	-37%
Walnut at 7th	303	300	-3	-1%
Orange at 7th	483	313	-170	-35%

13 CONCLUSION

The New Castle County Transit Origin-Destination Study permits transportation planners to better understand the travel behavior of existing DART First State customers. 5,198 surveys were distributed from October 15 through November 22, 2013. 4,490 surveys were returned for a response rate of 86%. All surveys were geocoded with successful origin-destination pairs for 53% of all returned surveys. The margin of error for the entire sample was +/- 1.24% at a 95% level of confidence. Higher error rates apply to individual transit routes and routes grouped into corridors.

New Castle County is the most populous of Delaware's three counties, with a 2010 population of 538,479 persons. Wilmington is the largest city in New Castle County, with 70,851 persons, while Newark is the second largest city with 31,454 persons. 28% of the County's population resides in incorporated areas, while 72% live in unincorporated areas.

DART First State provided 10.2 million unlinked passenger trips during FY13. The 42 routes serving New Castle County delivered 88% of the total. From FY07 to FY11, DART First State ridership grew at a 3.2% average annual rate; the second highest growth rate for ten peer systems in Delaware, Virginia, Maryland, and Pennsylvania.

Roughly 75% of respondents indicated they walked to their bus stop and also planned to walk to their final destination. 65% of transit trips are work trips, 12% are school trips and 18% are "other" trips including shopping, medical appointments and visiting friends and family.

59% of riders did not require a transfer to complete their trip, while 41% of all riders transfer between routes. When computed as a percentage of total unlinked trips, 29% are transfers. DART First State, through its fare structure and route network, has developed a diffuse transfer pattern where 40% of transfers occur away from Rodney Square.

Of trips with valid O-D pairs, 48% had origins within the City of Wilmington and 52% had origins in other subareas. Of the Wilmington based trips, 46% traveled to destinations within the City of Wilmington while 54% traveled to destinations outside the City. Trips from all other subareas had 50% of trips traveling to the City of Wilmington, 39% of the trips traveling to other subareas, and 11% of trips starting and ending in the same subarea.

For the City of Wilmington as a whole, the LEHD reports 2011 employment at 42,269 jobs of which 31,394 or 74% are located in the Downtown core. Transit ridership is strong to the Downtown core with 63% of all transit trips having an origin or destination in the core. For work trips with origins and destinations within the City of Wilmington, DART First State has achieved a 20% market share. For all work trips to Wilmington, DART First State has reached an 11% market share.

Using the O-D study and LEHD data, 23 underserved travel markets were identified with more than 2,000 daily home-based work trips and a transit market share of less than 5%. As additional operations and capital funding becomes available, these underserved markets should be considered for expanded transit services.

Alternative transit service strategies were analyzed to identify ways to reduce the number of bus trips in downtown Wilmington and the number of transfers occurring at Rodney Square. The alternatives are limited by the existing Downtown street system which is dominated by one-way streets. Rather than having a single transit station, these service strategies could spread the transfer points across Downtown.

The New Castle County Transit Origin-Destination Study has developed a statistically valid and robust data set that will assist the region's short and long range transit planning.

APPENDIX A – MODE OF ACCESS BY CORRIDOR

Figure A-1: Trip Start, End Matrix – Mid County

	Trip End				
Trip Start	Automobile	Bicycled	Carpool	Dropped Off	Walked
Automobile	13				14
Bicycled		4			5
Carpool			1		
Dropped Off	7				28
Walked	18		1	1	218

Figure A-2: Trip Start, End Matrix – Christiana Mall / Newark

	Trip End				
Trip Start	Automobile	Bicycled	Carpool	Dropped Off	Walked
Automobile	19			1	27
Bicycled		9			6
Carpool			1		2
Dropped Off	7			1	32
Walked	29	1	1	2	345

Figure A-3: Trip Start, End Matrix – Concord Pike

	Trip End		
Trip Start	Automobile	Bicycled	Walked
Automobile	3		8
Bicycled	2	3	2
Dropped Off	7		13
Walked	18		212

Figure A-4: Trip Start, End Matrix – Downstate

	Trip End				
Trip Start	Automobile	Bicycled	Carpool	Dropped Off	Walked
Automobile	29			1	42
Bicycled		2			2
Carpool					1
Dropped Off	8			2	20
Walked	15		1		36

Figure A-5: Trip Start, End Matrix – Kirkwood Highway

	Trip End			
Trip Start	Automobile	Bicycled	Dropped Off	Walked
Automobile	20			26
Bicycled		1		5
Carpool	2			
Dropped Off	5			28
Walked	17		1	310

Figure A-6: Trip Start, End Matrix – Market, Dupont, and New Castle

	Trip End				
Trip Start	Automobile	Bicycled	Carpool	Dropped Off	Walked
Automobile	9				14
Bicycled	3	11			22
Carpool	1				4
Dropped Off	11			2	42
Walked	41	4	2	4	779

Figure A-7: Trip Start, End Matrix – Maryland Ave

	Trip End			
Trip Start	Automobile	Bicycled	Carpool	Walked
Automobile	3			4
Bicycled	1	1	2	5
Carpool				1
Dropped Off	6			22
Walked	10	1		328

Figure A-8: Trip Start, End Matrix – Penn Ave & Lancaster Ave

	Trip End			
Trip Start	Automobile	Bicycled	Carpool	Walked
Automobile	15			29
Bicycled		1		12
Carpool				1
Dropped Off	2		1	15
Walked	25	1		305

Figure A-9: Trip Start, End Matrix – Philadelphia Pike

	Trip End				
Trip Start	Automobile	Bicycled	Carpool	Dropped Off	Walked
Automobile	15				41
Bicycled	1	4			12
Carpool	1				4
Dropped Off	15		3	2	26
Walked	39	5	2	4	723

APPENDIX B – TRIP TYPE BY CORRIDOR

Figure B-1: Trip Type – Mid County

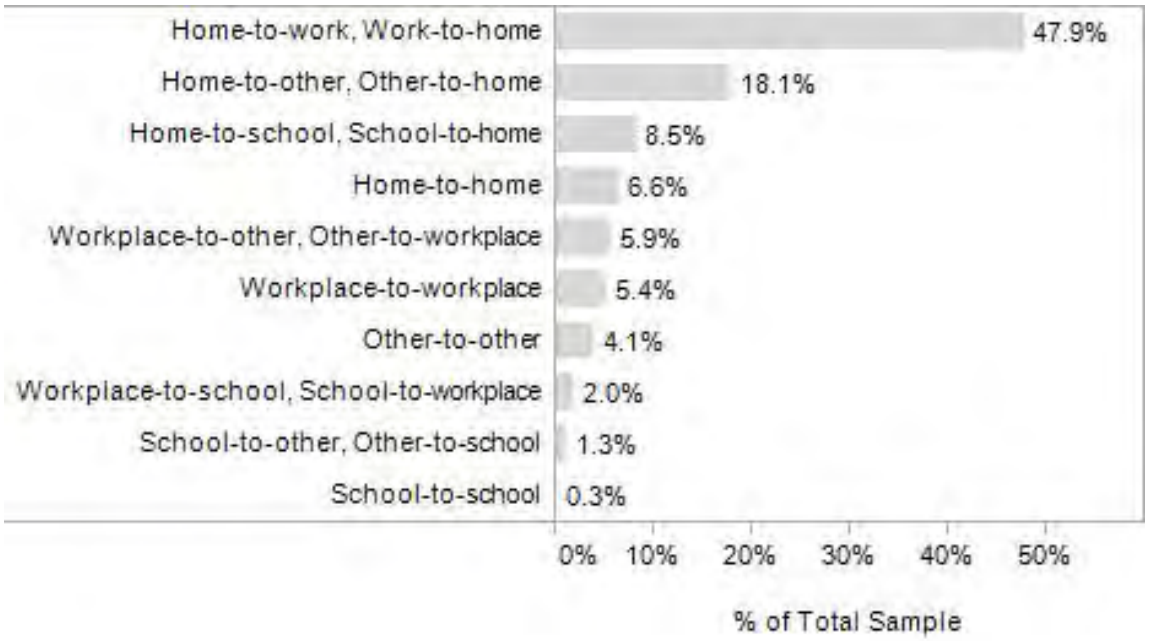


Figure B-2: Trip Type – Christiana Mall / Newark

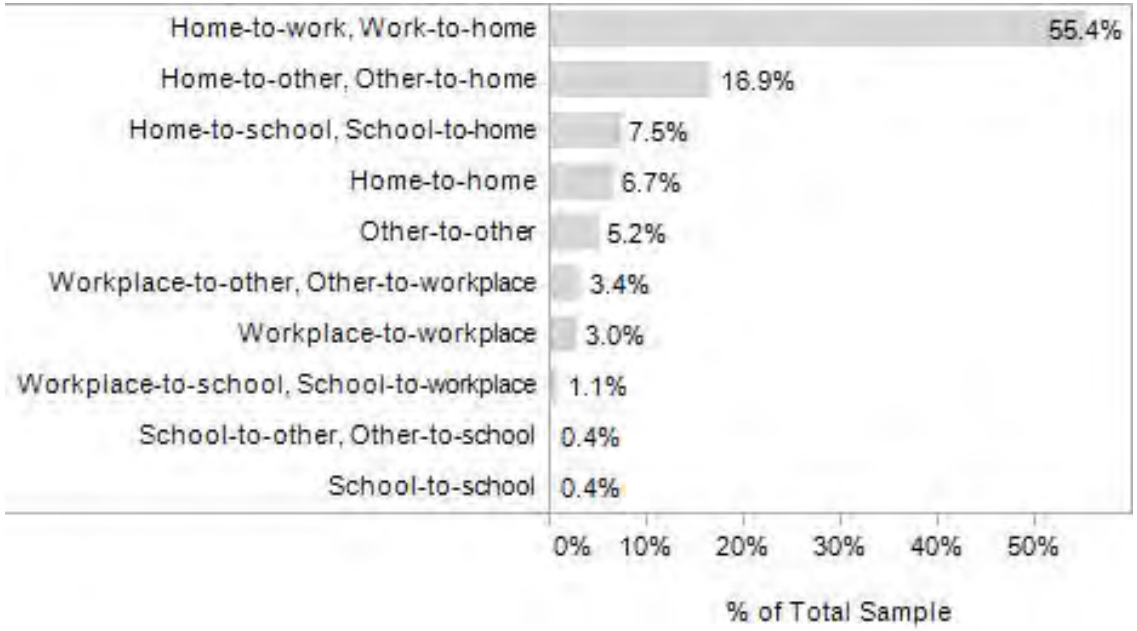


Figure B-3: Trip Type – Concord Pike

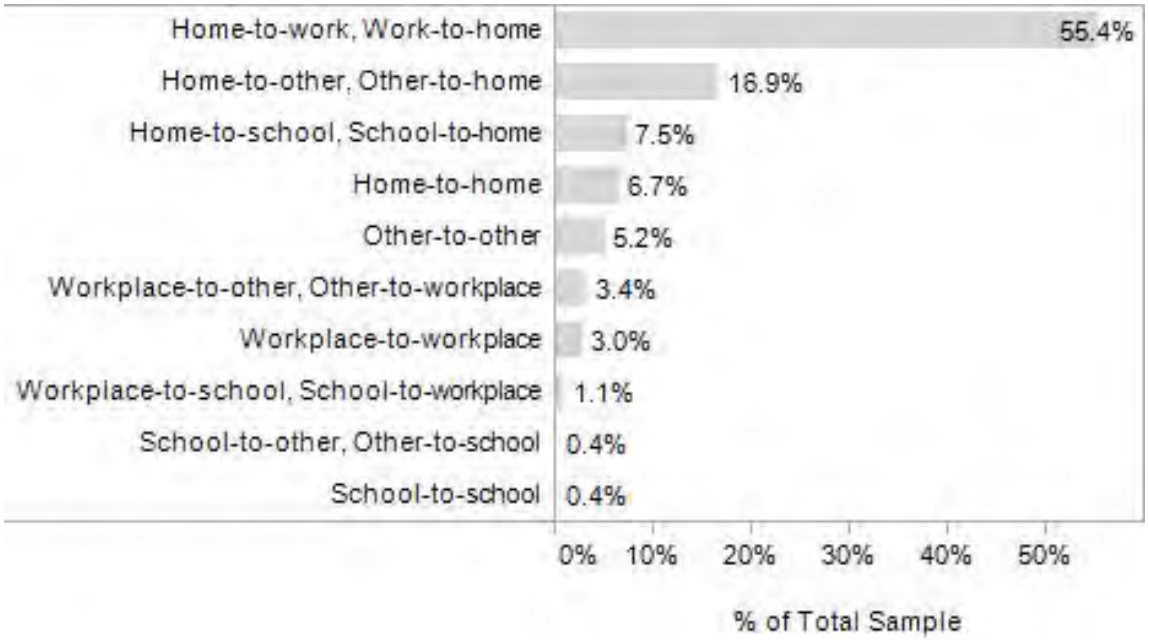


Figure B-4: Trip Type – Downstate

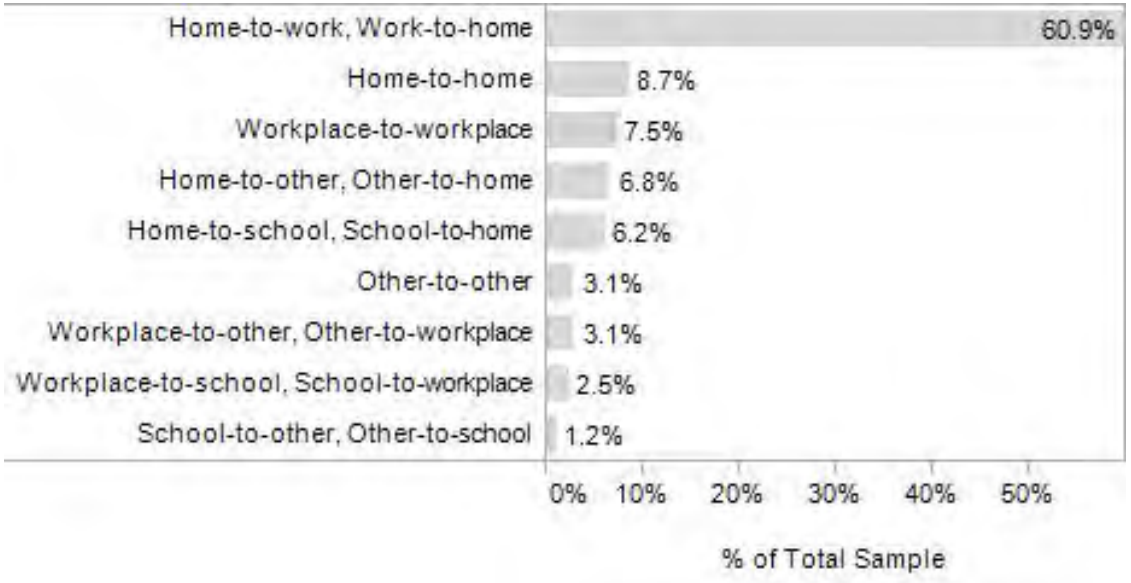


Figure B-5: Trip Type – Kirkwood Highway

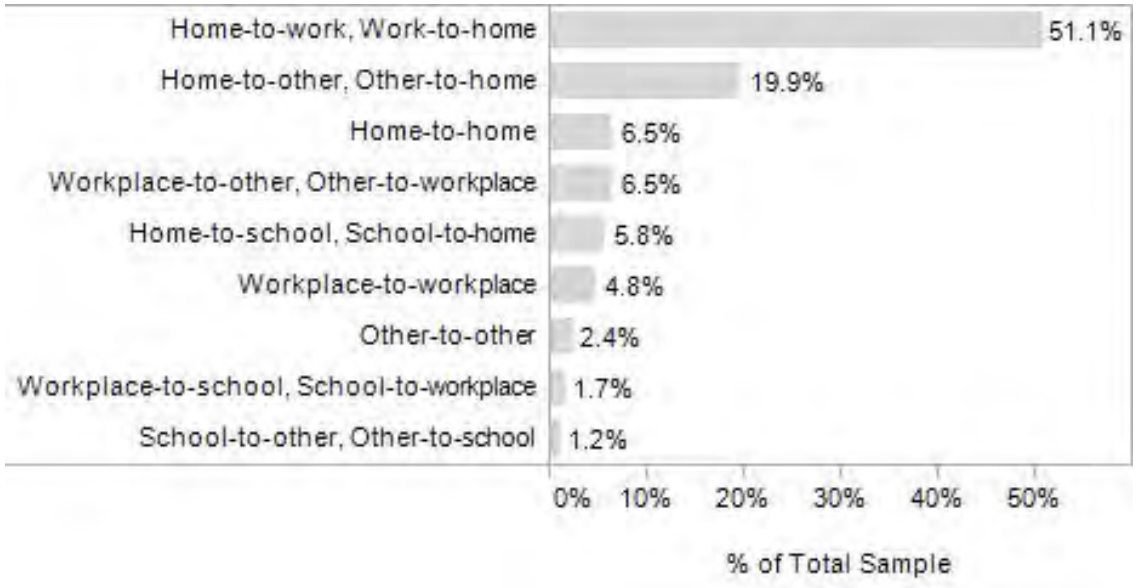


Figure B-6: Trip Type – Market, Dupont, and New Castle

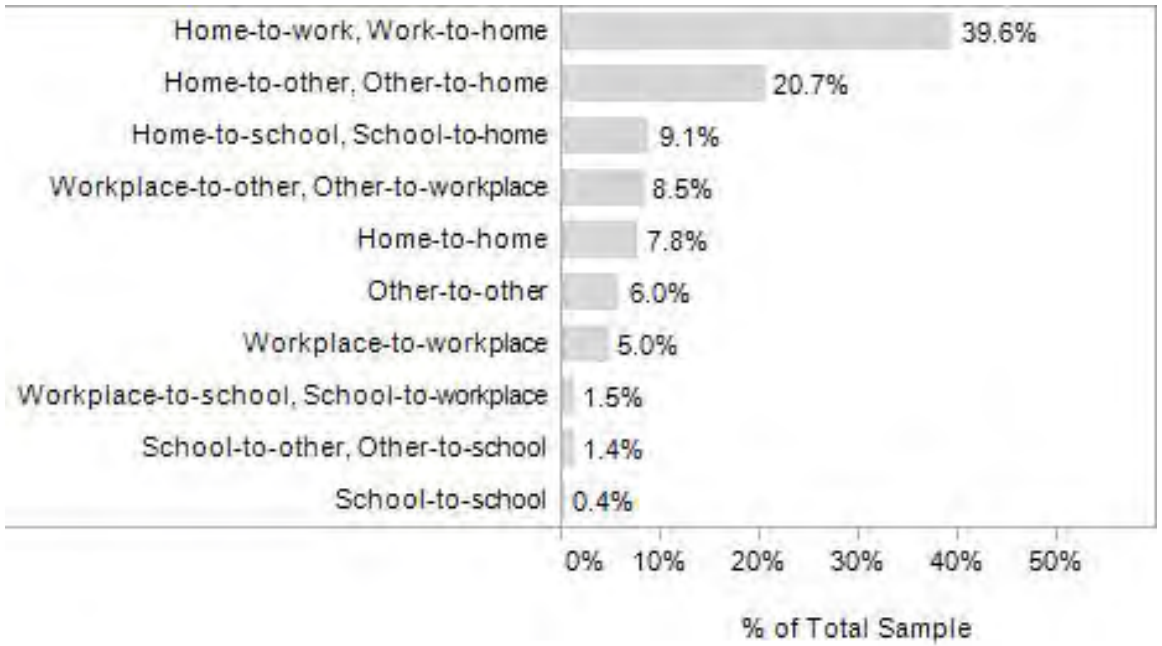


Figure B-7: Trip Type – Maryland Ave

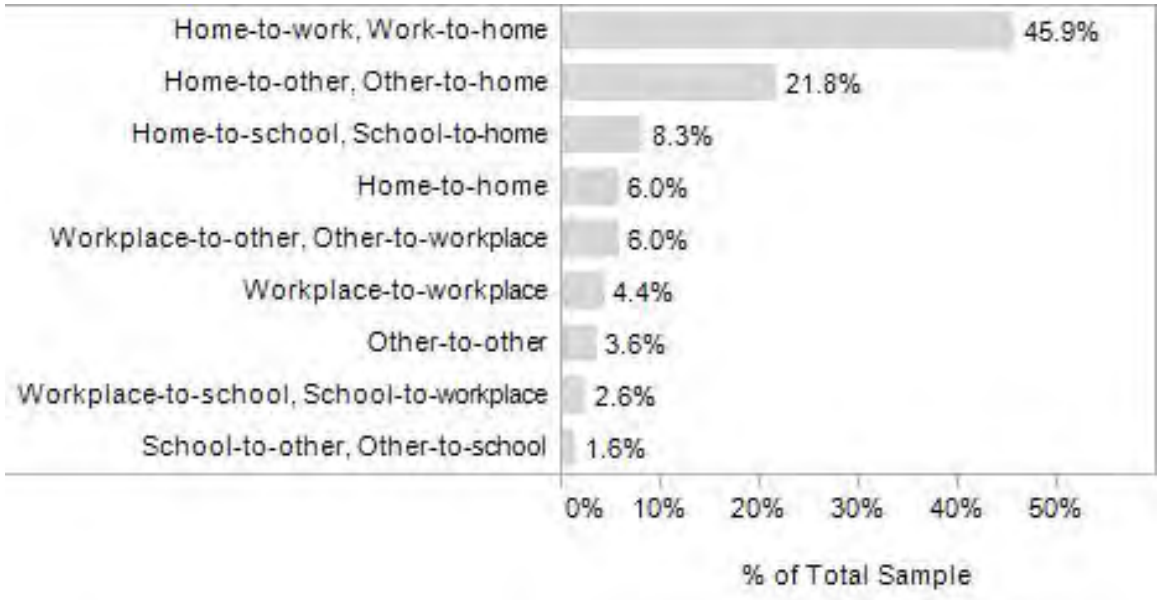


Figure B-8: Trip Type – Penn Ave & Lancaster Pike

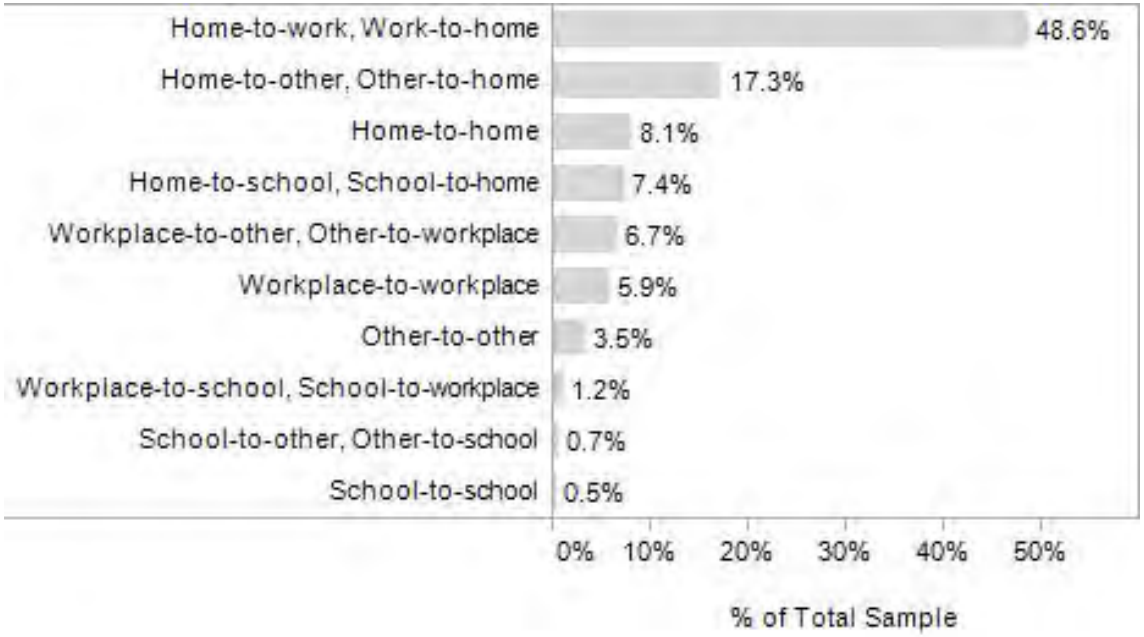
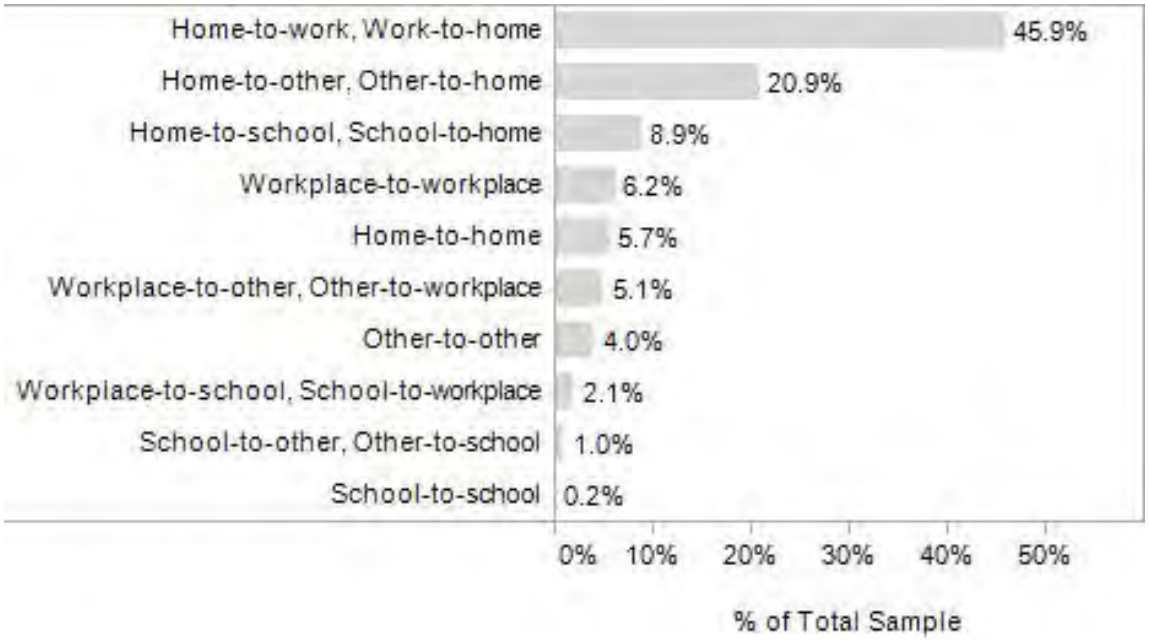


Figure B-9: Trip Type – Philadelphia Pike



APPENDIX C – CUSTOMER COMMENTS

At the end of the survey riders were asked to leave comments about suggested changes or improvements to the DART First State system. The customer comments have been organized into the categories shown in Table C-1. The categorization of comments is also shown in Figure C-1.

Table C-2: Customer Comments by Type

Type of Comment	Number of Respondents	Percentage of Respondents
No Comment	3,356	74.37%
Service Improvement	704	15.68%
Service Problem	212	5.08%
Complaint	141	3.14%
Positive Comment	78	1.74%

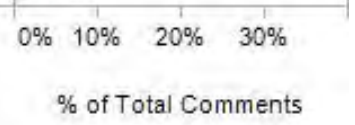
Comments were then processed and categorized into 15 groups. These 15 groups were developed using Natural Language Processing (NLP) methods where like responses were grouped together based on their meaning.

Examples of responses for each category follow.

Nearly a third of riders providing feedback (29%) indicated that there should be more buses on routes, as well as extended hours or 24-hour service, offered by DART First State in the future. Better weekend service or extended hours on the weekend, as well as buses not arriving on time, were the next most common responses from riders providing feedback. This was the case for all corridors except Maryland Avenue. The Maryland Avenue corridor cited the importance of having better weekend service above all other improvements. Most corridors also cited unfriendly drivers as one of their top qualms with their DART First State experience.

Table C-1: Customer Comments by Type

No Comment	No feedback provided	74.4%
Service Improvement	More buses on routes, extended hours or 24-hour service	7.1%
	Better weekend service, extended hours on weekends	4.1%
	Additional bus stops needed	1.2%
	Buses need interior updates, more cleaning, and more storage areas	0.8%
	Additional routes needed	1.0%
	Do not increase fares	0.6%
	Different DART payment methods	0.2%
	Better access to bus schedules; need a better way to track when/if buses are on time	0.7%
Service Problem	Buses aren't arriving on time, need better connection timing to other bus routes	3.9%
	Bus drivers need to wait and not leave passengers trying board busses	0.5%
	Buses are overcrowded	0.4%
	Buses tend to breakdown frequently, need more reliable buses	0.4%
Complaint	Bus drivers are unfriendly, don't provide a great experience, and periodically don't show up	2.3%
	Bus shelters need to be fixed or improved	0.5%
	DART customer service call center is not helpful	0.3%
Positive Comment	Positive feedback	1.7%



Comment Categories and Sample Responses

Sample responses for each of the comment categories are provided below.

More buses on routes, extended hours or 24-hour service

"Add more buses during the morning and evening hours and more during the hours of 2pm-3pm coming to Middletown"

"Add more runs in the afternoon"

"Buses every 30 minutes"

Better weekend service, extended hours on weekends

"Extend weekend hours to more frequently running more buses or bigger weekend buses"

"Increase weekend service"

"Longer times begin and end on weekends, A lot of people work on weekends"

Buses aren't arriving on time, need better connection timing to other bus routes

"Buses need more overlap time so we don't miss the second bus by minutes, Buses should never leave earlier then they should, I've seen some leave as early as 10-15 minutes before they should"

"Just by trying to have the buses arrive on time so I won't be late for work"

"More focus on connecting routes"

Bus drivers are unfriendly, don't provide a great experience, and periodically don't show up

"Train drivers to be more customer friendly"

"Some buses do not stop at the bus stops, some drivers just drive by"

"Adjustment of the temperature on the bus, More friendly when boarding the bus"

Additional bus stops needed

"Add bus 10 and 28 stop at Rodney Square and Delaware Ave"

"Amazon stop needs to go deeper into complex"

"DuPont Hwy does not have a safe crossing section to get on the other side, Safer way to catch the bus DuPont Hwy that goes for the 22 and the 25"

Additional routes needed

"Have the #11 go all the way to Naamans Rd, Have the #61 run on weekends"

"It would be much appreciated if service were provided to the new Middletown businesses from Rodney Square via DART First State"

"Need a bus route near Walmart on Centerville Rd"

Buses need interior updates, more cleaning, and more storage areas

"Outlets for phone chargers, wall chargers etc"

"Clean your buses"

"Cup holders, recliner chairs, more space for strollers, seatbelts, and more schedules on bus"

Better access to bus schedules; need a better way to track when/if buses are on time

"Bus alerts when the buses are running late"

"If you could get the I-phone app that tells us where the bus is on the route that would be so helpful"

"Is it possible to get text alerts to you if a particular route is delayed or on time? It's very beneficial when standing in the cold or rain to know how long it will be"

Do not increase fares

"Don't raise the fare"

"Keep prices down"

"The proposed increase should be implemented over 4-5 years"

Bus drivers need to wait and not leave passengers trying to board buses

"Buses should stop for passengers"

"Don't pull of on people when they are trying to run to catch the bus and their only 2 feet away"

"Wait for passengers to be seated before pulling off"

Bus shelters need to be fixed or improved

"Repair light fixture at the park and ride kiosk and at 52 and DuPont Rd"

"We need Plexiglas in all bus booths where glass has been broken out, thank you for time on this matter"

"Add a bus shelter to the fire hall stop"

Buses tend to break down frequently, need more reliable buses

"Lately the bus has broken down at People's Plaza so I suggest better buses"

"Retire buses that keep breaking down, Last week I had to wait because bus broke down on 2 different days"

"Have backup buses available, Many times 12 plus times over in the past 18 months buses just don't show up at all"

Buses are overcrowded

"Keep current driver, 42 express pm and larger bus, Tony Watson we have full capacity everyday"

"For the most part the bus is on time, #1 bus is too crowded"

"Stop overcrowding buses"

DART First State customer service call center is not helpful

"Train your customer service reps better, I have called several times and gotten incorrect information about Bus Times"

"Improve your customer service, answer emails, voicemails, and stop hanging up on customers when DART First State messes up"

"When calling complaints or concerns in have a return call made within 3 days, it's hard to follow up"

Different DART First State payment methods

"Better and more convenient in purchasing DART First State cards, allow other sales areas besides Acme"

"Have the pay box make change because I don't always have exact change"

"Have the 3 week any route pass available again, Details on how to get a yearly pass"

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