Eastern Connecticut Corridor Rail and Transit Feasibility Study (ECRTS)

Appendix I: Transit Service Plan

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Table of Contents

Tables

Figures

1. Introduction

As part of the Eastern Connecticut Corridor Rail and Transit Feasibility Study (ECRTS), this Transit Service Plan assesses the current transit needs in the southeastern Connecticut region, as well as the anticipated future needs associated with employment increases and population changes. Previous ECRTS phases utilized a combination of data and discussions with a diverse group of regional stakeholders including transportation and environmental interest groups, educational institutions, public health advocates, businesses, tribal leadership, municipal staff, and legislators (Exhibit A) to understand existing transit and socio-economic conditions. This Transit Service Plan, in conjunction with the ECRTS Rail Service Plan, uses the existing conditions information to identify opportunities to ensure that the region has a transit network that aligns with both present and future regional travel demand.

The Transit Service Plan is a component of a larger feasibility study that examines high-level existing and future conditions to determine the viability of potential transit improvements in the study area; it is the first step in a data-driven decision-making process. Though short- and long-term strategies to advance improvements in transit service in southeastern Connecticut are presented, they are preliminary findings. Further steps would be needed to advance the project's development, including additional studies such as potentially another Comprehensive Operations Analysis, planning, permitting, design, and funding. All future steps are currently unfunded.

2. Existing Transit Services

There are several different public transit services within the study area including intercity and local bus, commuter and intercity passenger rail, and others (Figure 1). The region's most expansive service for localized travel is the Southeast Area Transit District (SEAT). SEAT provides fixed route transit, demand response microtransit, and complementary ADA paratransit services[1]. Additional regional bus transit services also exist at the periphery of the study area, as well as location-specific services for the region's casinos and Mashantucket Pequot Tribal Transportation (Table 1). Those wishing to travel beyond the region can utilize ferries serving several communities in Long Island Sound, Greyhound intercity bus, Shore Line East commuter rail and Amtrak intercity passenger rail.

Because SEAT is the primary transit provider within the study area, the remainder of this report will focus on improvements that can be made to SEAT's existing route alignments and span of service[2]. Rail service improvements are outlined in the **Rail Service Plan (Appendix J)**.

[1] In Spring 2023, SEAT applied for additional pilot funding to run expanded microtransit service.
[2] Improvements to SEAT services are budgeted for FY24 and are anticipated to include the re-introduction of Sunday service, improvements to frequency and span of service, and introduction of new services.

Figure 1. Existing Transit Service Map

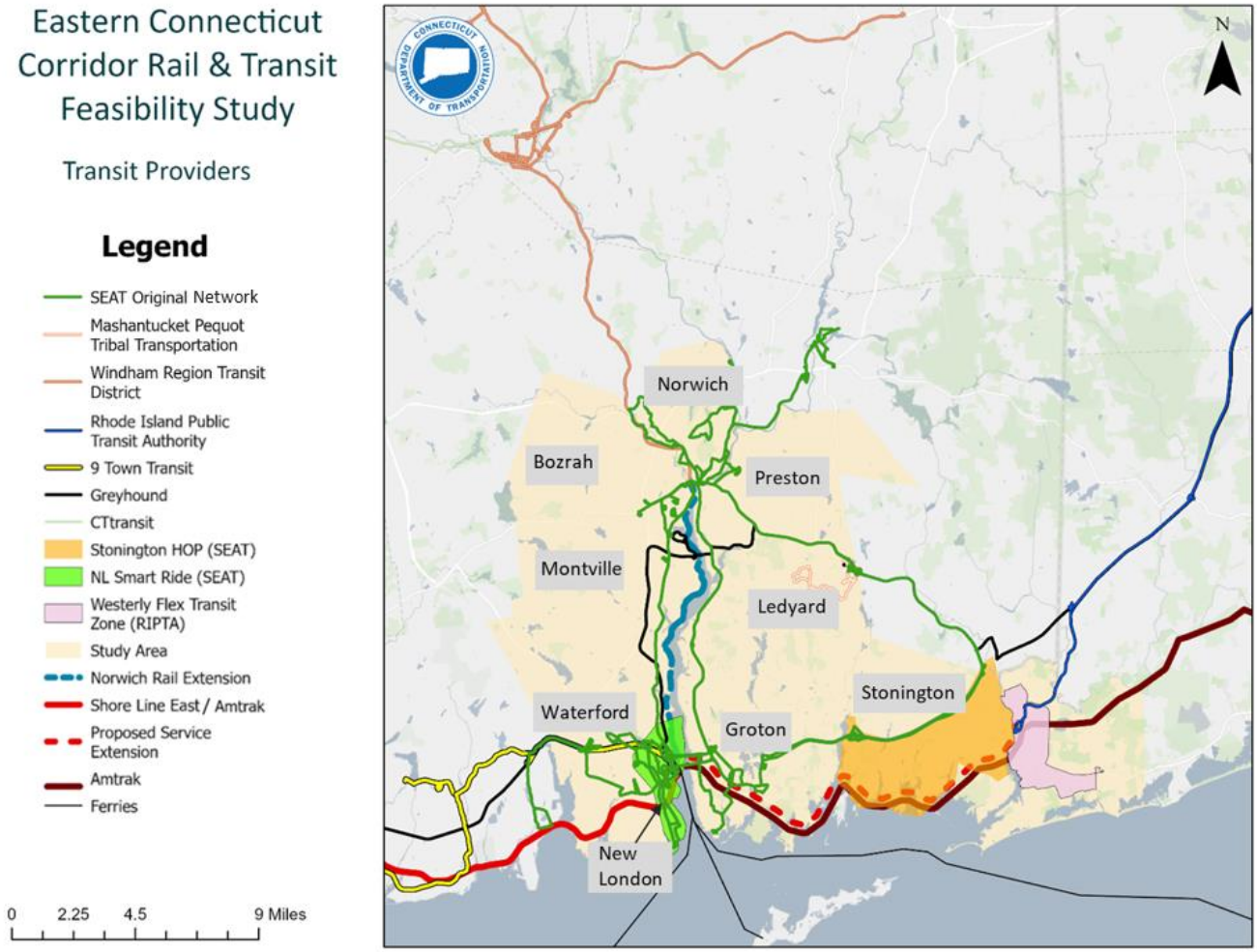


Table 1. Existing Bus Service Overview

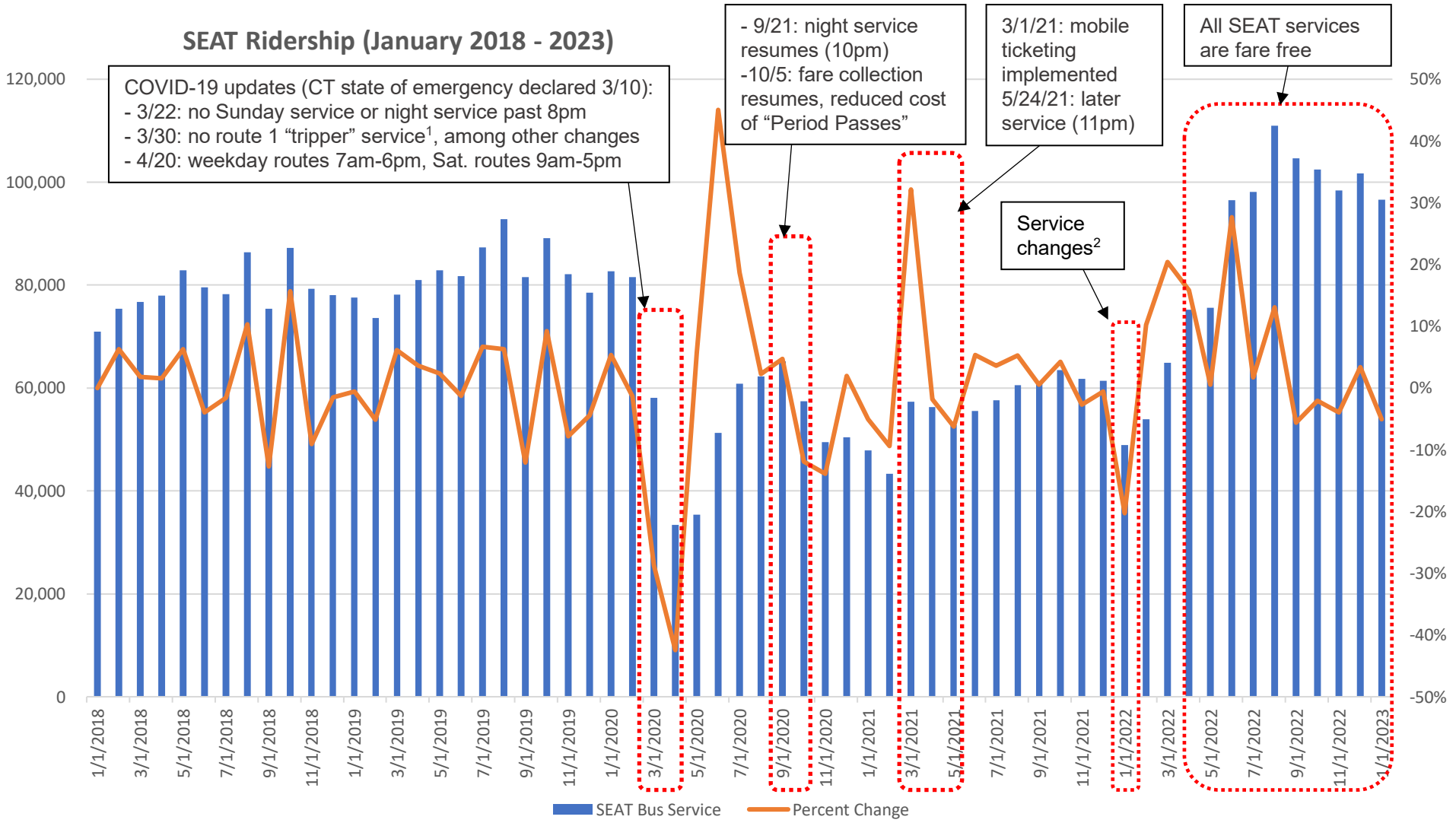
Operator	Type of Service	Routes	Service Span and Frequency	Service Area
Greyhound	Intercity bus	New York-Boston	• 24 schedules 5-7 days • 12 schedules in each direction	Operates 24 schedules, one in each direction, with all 24 stopping in Hartford. 9 schedules include the following stops: Bridgeport (3), New Haven (9), and New Britain (5).
Mashantucket Pequot Tribal Transportation	Fixed route	MPTN-Foxwoods Resort Casino	• M-Sat, 7:50am-3:50pm • 4 roundtrips per day	Local transit bus line from MPTN Spiritual Center to Great Cedar Hotel at Foxwoods
Rhode Island Public Transit Authority	Commuter bus	Route 95X	• M-F, 6-8:15am, 3:40-4:45pm (peak hours) • Inbound: 3 trips in am/ 1 trip in pm; outbound: 1 trip in am/ 4 trips in pm	Express from Westerly Railroad Station to Turks Head (Providence)
	Demand response	Westerly Flex	• M-F, 6am-6:30pm	Demand response service within 7-mile radius of downtown Westerly
Southeast Area Transit District (SEAT)	Fixed route	16 routes	• M-F, start time range: 6-8am; end time range: 7-11pm • Service every hour except on Routes 2, 3, 108 (2 hrs) • Sat (all except Route 3), start time range: 6-9am; end time range: 5-11pm • Service every hour except on Routes 1, 2, 108 (2 hrs)	Range of routes operating in and between New London, Montville, Norwich, Preston, Ledyard, Groton, and Stonington
	Demand response	SEAT Connect (Complementary ADA paratransit)	• M-Sat, 6am-11pm	Trip requests at least a day in advance, all trips begin/end within ¾ mile of a SEAT fixed route
		New London Smart Ride	• M-Sat, 8am-8pm	Microtransit trips beginning and ending within New London
		Stonington HOP	• M-F, 6am-6pm	Microtransit trips beginning and ending within Stonington
Windham Region Transit District	Commuter bus	Route 991	• M-Sun, 5:45am-12:30am • 6 roundtrips per day	Willimantic-Norwich (request stop)-Foxwoods Resort Casino via Rt 32
River Valley Transit	Fixed route	Route 643	• M-F, 7am-6pm • 6 roundtrips per day	Old Saybrook-East & Old Lyme-New London via Rt 1

2.1. Ridership

Prior to the COVID-19 pandemic, annual SEAT fixed route ridership was approximately one million (Figure 2)[3]. Ridership followed a seasonal trend, gradually increasing in the spring and summer before declining during the end of the calendar year. COVID-19 and other events impacted ridership (Table 2), including service cuts (ridership decrease) and the introduction of fare free service (ridership increase)[4].

[3] National Transit Database. Complete Monthly Ridership (with Adjustments and Estimates). Accessed May 2023.
[4] Ibid.

Figure 2. SEAT Fixed-Route Ridership (January 2018 - 2023)



[1] "Tripper" buses: 6am and 8am from New London, 7am from Norwich, 3pm and 5pm from Norwich, and 4pm and 6pm from New London
[2] Winter weather-induced delays January 7; fully suspended service January 29 and 30 (blizzard)

Table 2. Notable Ridership-Influencing Events

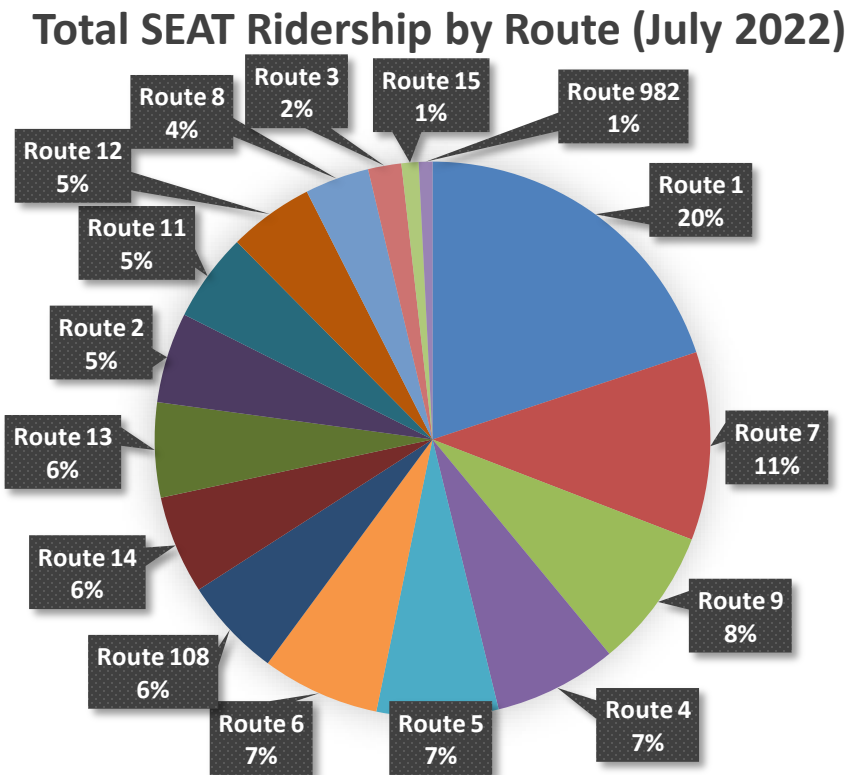
Date	Event	Impact on Ridership
March 10, 2020	State of Connecticut declares a state of emergency.	Ridership begins to decline.
March 30, 2020	SEAT announces service changes including no Route 1 "tripper" service.	Ridership continues to decline and is now 29 percent lower than the previous month.
April 20, 2020	Weekday routes reduce service to 7 AM – 6 PM, Saturday routes run from 9 AM – 5 PM.	Ridership continues to decline and is 42 percent lower than the previous month (March 2020).
September 21, 2020	Night service resumes.	Monthly ridership is 5 percent higher than the previous month (August 2020).
October 5, 2020	Fare collection resumes and the cost of "Period Passes" is reduced.	Monthly ridership is 12 percent lower than the previous month.
March 1, 2021	Mobile ticketing is implemented.	Monthly ridership increases by 32 percent. Ridership increase is also attributed to an uptick in resumed activity, following approximately one year of COVID restrictions.
May 24, 2021	Service is extended to 11 PM.	Monthly ridership grows by 5 percent in April 2021.
January 1, 2022	Winter weather-induced delays and fully suspended service January 29 and 30 (blizzard).	Ridership decreases by 20 percent compared to December 2021.
April 1, 2022	Fares eliminated for all SEAT services.	Ridership initially increases for the next five months, by an average 12 percent per month. Ridership grows to exceed pre-pandemic levels.
April 1, 2023	SEAT fares reinstated.	In the month following fare reinstatement, ridership falls 24 percent compared to the month prior.

Ridership is not uniformly distributed across SEAT routes,[5] Route 1 (operating between Norwich and New London along the west side of the Thames River) accounts for 20 percent of all monthly ridership (Figure 3). Route 2 operates on the east side of the Thames between Norwich and New London, and it has significantly lower ridership than Route 1, accounting for 5 percent of all monthly ridership. Some key findings from analyses of Routes 1 and 2 during fiscal year (FY) 2022, as well as from system-wide ridership analyses, are:

- Routes 1 and 2 followed similar ridership trends – January had the lowest ridership and significant (over 50 percent) monthly increases in ridership occurred between January and June.
    - These monthly trends largely align with the overall system ridership trends of peaking in the summer months and dropping particularly low in January.
- System-wide ridership was even greater than the previous year (15.6 percent higher).
- SEAT's implementation of Fare Free Service on April 1, 2022 (discontinued as of April 1, 2023) coincides with the significant ridership increases in spring 2022.
- August 2022 system-wide ridership reached 110,930 passengers, which marks the greatest monthly ridership in ten years.
- SEAT ridership for April 2023, the first month of fare collection following fare free service, was approximately 24% lower than March 2023 and 20% lower than average ridership for the year of fare free service.

More detailed ridership information can be accessed in **Exhibit B: Existing Transit Services and Operations**.

Figure 3. SEAT Ridership by Route (July 2022)



[5] SEAT. APC Passenger Counts. July 2022.

2.2. Performance Evaluation

Route productivity can be characterized by metrics including passengers per mile and passengers per hour. The former represents the ratio of total passenger trips to revenue miles; the latter represents the ratio of passenger trips to revenue hours. More productive routes will carry higher numbers of passengers per mile and per hour than less productive routes, as these routes serve comparably more riders when normalizing across service area and duration.

In FY 2021, SEAT fixed-route buses carried 10.2 passengers per hour, approximately 25 percent more than the Connecticut average for bus service and 60 percent more than the national average of 6.3 passengers per hour[6]. However, SEAT buses carry fewer passengers per mile than the national average (Table 3). There are several explanations for this including the region's largely suburban land use that decentralized jobs.

Table 3. Route Productivity (2021), Fixed Route Bus Service

Measure	Passengers/Mile	Passengers/Hour
SEAT	0.7	10.2
CT Average	1.0	8.2
National Average	1.3	6.3

Source: National Transit Database. Metrics. 2021.

SEAT demand response operations also serve fewer passengers per mile and per hour than both national and statewide averages (Table 4).

Table 4. Route Productivity (2021), Demand Response

Measure	Passengers/Mile	Passengers/Hour
SEAT	0.093	1.04
CT Average	0.12	1.55
National Average	0.11	2.0

Source: National Transit Database. Metrics. 2021

Three metrics for financial productivity are the cost per revenue hour, cost per passenger, and farebox recovery. The cost per revenue hour is a ratio of total annual operating expenses to vehicle revenue hours; a lower cost per hour indicates that the transit agency is providing service more efficiently than an agency with a higher cost per hour. The cost per passenger is a ratio of the total annual operating expenses to annual ridership; the lower the cost per passenger, the more efficient the service. Farebox recovery is the percentage of fare revenue as compared to the total operating expenses for a service provider; higher farebox recovery indicates that a transit agency is performing with higher financial productivity.

SEAT's cost per revenue hour is $104.45 (2021) for bus service, which is on par with statewide and national averages. SEAT's cost per passenger for bus service is significantly lower than both national and statewide averages, indicating efficient performance. SEAT also has a higher farebox recovery than national and statewide bus service, meaning that the agency covers more of their operating expenses with fare revenue than other providers (Table 5).

[6] National Transit Database. Metrics. 2021. 2022 NTD data was not available at the time this document was drafted.

Table 5. Financial Productivity (2021), Bus Service

Measure	Cost/Revenue Hour	Cost/Passenger	Farebox Recovery
SEAT	$104.45	$10.20	6.9%
CT Average	$104.72	$16.25[7]	4.7%
National Average	$104.80	$38.43	5.6%

Source: National Transit Database. Metrics. 2021.

SEAT's demand response service is more financially efficient than its statewide peers, boasting a lower cost per revenue hour and per passenger while earning a higher proportion of fare revenue covering total operating costs. Though SEAT's cost per revenue hour is much lower than the national average, farebox recovery is markedly less favorable (Table 6).

Table 6. Financial Productivity (2021), Demand Response

Measure	Cost/Revenue Hour	Cost/Passenger	Farebox Recovery
SEAT	$65.60	$62.70	4.1%
CT Average	$99.62	$67.76	3.9%
National Average	$102.64	$60.47	7.3%

Source: National Transit Database. Metrics. 2021.

2.3. Fare Collection

SEAT fare payment options include both onboard cash payments and pre-purchased tickets, which have flat rates (Table 7). Printed tickets are available for purchase online, as well as at local Stop and Shop grocery stores, the SEAT Main Office, and the Norwich Transportation Ticket Office. Passes for taking multiple trips within a specified time period are also available for pre-purchase, though they are not valid for HOP, Smart Ride, or ADA service (Table 8). In addition to printed tickets, SEAT partners with Token Transit to enable riders to purchase and present boarding passes on their smartphones[8].

Table 7. Fares for Individual SEAT Tickets

Ride	Ticket Cost	Cash Cost
Single Ride – Regular Use	$1.75	$1.75
Single Ride – Senior/Disabled	$0.85	$0.85
ADA/Paratransit	$3.50	$35.00 (Book of 10)
Children (<5 y.o.)	Free	Free

Table 8. Fare for SEAT Passes

Ride	Pass Cost
4 Hour Zip Pass	$2.50
1-Day Unlimited Pass	$3.50
5-Day Unlimited Pass	$14.00
31-Day Unlimited Pass	$40.00
10 Ride – Regular Use Pass	$17.50
10 Ride – Senior/Disabled Pass	$8.50

[7] This figure excludes one outlying fixed route bus service – the Mashantucket Pequot Tribal Nation. The Tribal Nation's cost per passenger is $538.34, $484 more than the next highest cost per passenger service. Including the Tribal Nation's service is the cost per passenger average yields $46.38.
[8] SEAT is in the process of conducting a fare study that will consolidate payment types.

2.4. Asset Management

As of FY 2021, SEAT operated 22 vehicles in maximum service: 18 fixed-route vehicles and 4 demand response vehicles[9]. In total, SEAT had 31 revenue vehicles: 24 heavy duty buses and 7 cutaways (Table 9). The heavy duty buses are dedicated to fixed-route service while the cutaways are used on both demand response and fixed route. The overall spare ratio for SEAT is 41 percent; prior to the COVID pandemic, in FY 2019, SEAT operated 23 vehicles in maximum service and had 30 revenue vehicles for a spare ratio of 23 percent[10]. SEAT's FY 2021 spare ratio reflects service reduction during the COVID pandemic. As of April 2023, SEAT operates 27 vehicles in maximum service: 17 for fixed route service, 5 for demand response microtransit, and 4 for ADA paratransit.

Table 9. Types of Fleet Assets Owned by SEAT (2021)

Year	Make & Model	Type	Length	Count
2013	Gillig Low Floor (Hybrid)	Heavy Duty	40'	1
2013	Gillig Low Floor (Hybrid)	Heavy Duty	35'	1
2016	Shepard Bros. E450 Sup	Cutaway	22'	5
2018	New Flyer XD40	Heavy Duty	40'	6
2018	New Flyer XD35	Heavy Duty	35'	5
2019	Gillig G27E	Heavy Duty	30'	4
2020	Gillig G27B	Heavy Duty	35'	5
2020	New Flyer XD40	Heavy Duty	40'	2
2020	Startrans	Cutaway	20'	2

Source: NTD, 2021.

2.5. Key Findings

Key findings of the existing transit service include:

- New London and Norwich are regional hubs for transportation[11]
    - 13 Connecticut communities are accessible by local and regional bus via one-seat ride from New London.
    - 10 Connecticut communities, 8 states, and the District of Columbia are accessible by rail via one-seat ride from New London.
    - 2 states are accessible by ferry as a one-seat ride from New London.
    - 9 Connecticut communities are accessible from Norwich as a one-seat ride using regional bus.

[9] National Transit Database. 2021 Vehicles. Accessed May 2023.
[10] National Transit Database. 2019 Vehicles. Accessed May 2023.
[11] Connecticut Department of Transportation. Preliminary Feasibility Assessment Appendix A Existing Conditions. 2023.

- The current transit service does not include Sunday service, has limited evening service, and does not offer a bus connection between New London and Westerly.
- Overall SEAT fixed route ridership levels have risen dramatically since March 2022, surpassing pre-pandemic levels in the wake of fare free service. However, ridership dropped 24 percent from March to April 2023 following fare reinstatement. More data is needed to determine how ridership will recover in the wake of fare reinstatement.
- Route 1 has the highest ridership (20%).
- All SEAT services were fare-free from April 1, 2022 through March 31, 2023, after which cash, printed tickets, or Token Transit passes were once again required to ride SEAT.
- SEAT 2021 fixed route performance was higher than the Connecticut average in terms of passengers per revenue hour and passengers per revenue mile, while both performance metrics were lower than the state average for demand response.
- SEAT 2021 fixed route and demand response service demonstrated greater cost efficiency than the state and national averages.

3. Transit Demand Analysis

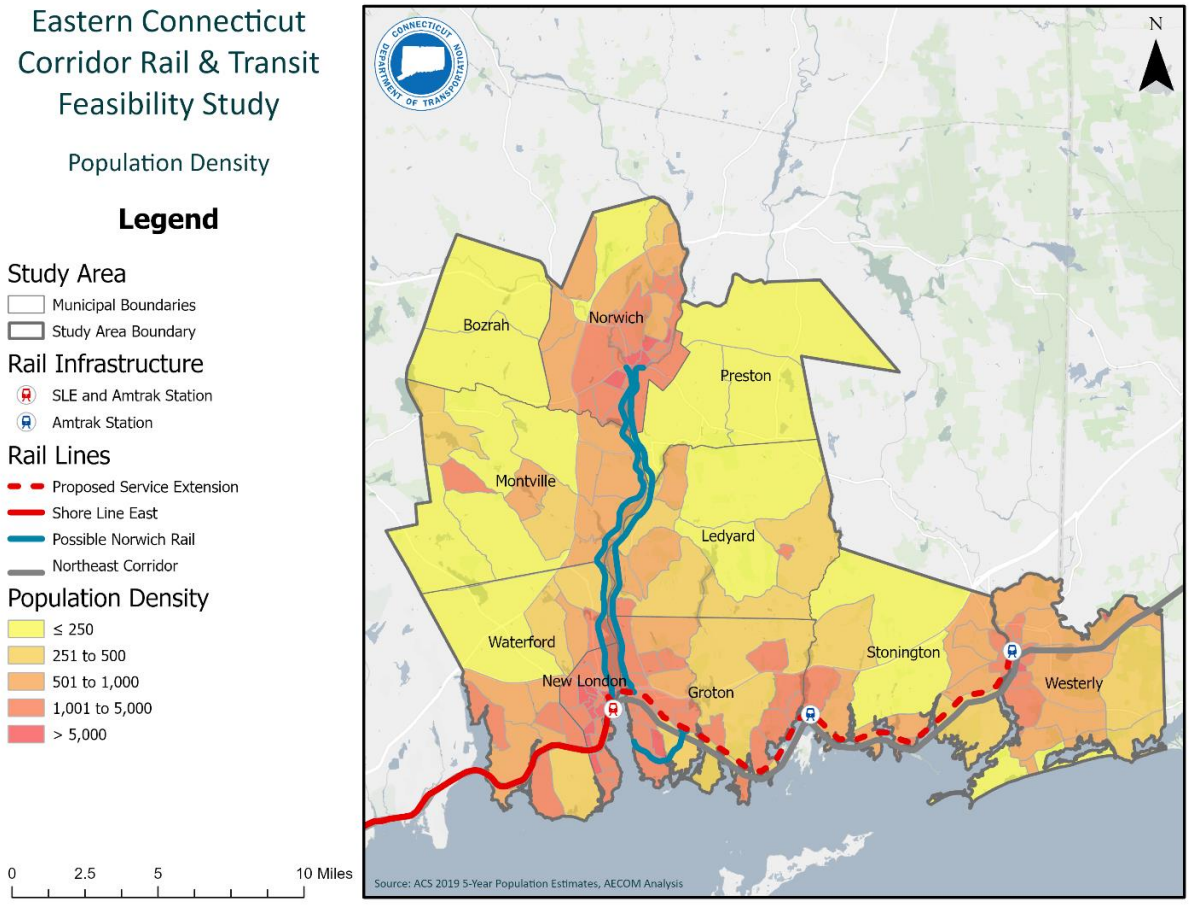
The ECRTS Existing Conditions report included a comprehensive review of demographic and socio-economic conditions within the study area. Below is a summary of key existing conditions findings that are used to inform updates to the region's existing transit network.

3.1. Population Density

The study area is characterized by communities of various sizes and densities, with population nodes in downtown Norwich, New London, eastern Groton, Mystic, and Pawcatuck/downtown Westerly (Figure 4). The region has a total population of 205,817 and is, on average, less dense than Connecticut as a state[12]. Within the study area, New London is the most compactly developed municipality at 4,798 people per square mile, whereas Bozrah is the least at 130 per square mile.

[12] US Census Bureau. American Community Survey 5-Year Estimates. 2021.

Figure 4. Study Area Population Density Map

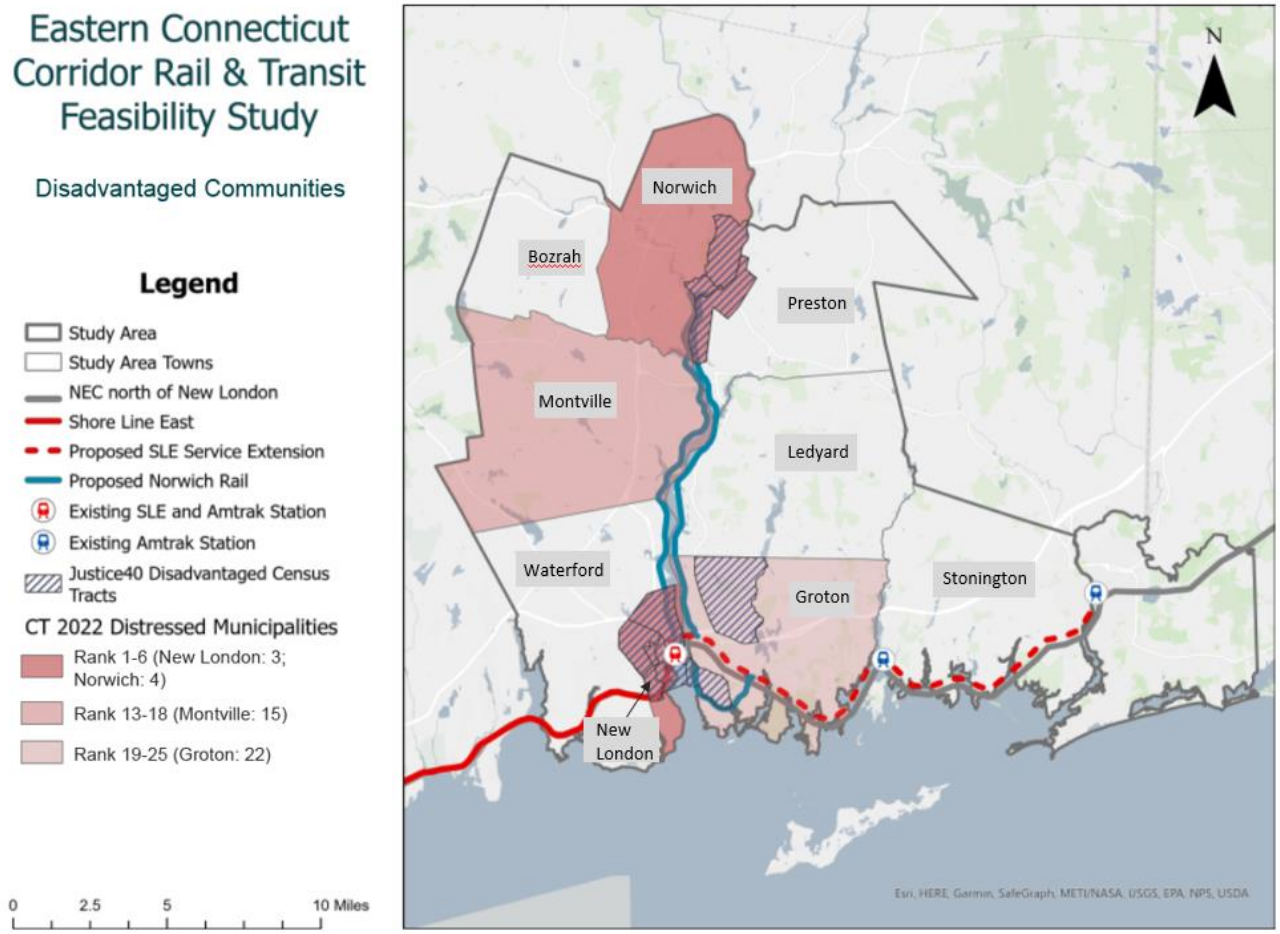


Source: US Census Bureau 2019 American Community Survey

Fifty-one percent of the study area's total population resides in New London, Groton, and Norwich, which also exhibit higher proportions of ethnic diversity, lower average household income, and increased poverty levels in comparison to their neighbors[13]. These three towns, in addition to Westerly, RI, also contain census tracts identified as disadvantaged in the Climate and Economic Justice Screening Tool developed to support the Federal Justice40 Initiative. Tracts are considered disadvantaged when they meet more than one burden threshold and an associated socioeconomic threshold; burden types include climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development[14]. On a state level, Connecticut's Department of Economic and Community Development annually designates its "Distressed Municipalities", determined via a composite score of indicators including unemployment and poverty rates, job growth, aging housing stock, educational attainment rates, and per capita income[15]. Four out of the nine study area towns in Connecticut are included on the 2022 Distressed Municipalities list, and Justice40 disadvantaged communities have been identified as clustered in the New London census tracts north of the existing rail line, downtown Norwich, and the Conning Towers-Nautilus Park and Branford Manor Apartments areas of Groton (Figure 5).

[13] US Census Bureau. 2019 American community Study.
[14] United States Council on Environmental Quality, Climate and Economic Justice Screening Tool, 2022, https://screeningtool.geoplatform.gov/en/#10.43/41.4314/-72.0108
[15] Distressed Municipalities. (2021). Retrieved June 17, 2022, from CT.gov - Connecticut's Official State Website: https://portal.ct.gov/DECD/Content/About_DECD/Research-and-Publications/02_Review_Publications/Distressed-Municipalities

Figure 5. Justice40 Disadvantaged Census Tracts and CT 2022 Distressed Municipalities in the Study Area



3.2. Employment Density

The study area has a greater employment density than the statewide average due to the presence of anchor institutions that largely drive the region's labor market. Over the past two decades, the service and manufacturing industries have consistently generated the most jobs, reflecting the presence of two of the largest casinos in the United States – Mohegan Sun and Foxwoods Resort Casino– as well as the US Navy Submarine Base, which relies on submarine construction by nearby General Dynamics Electric Boat. Together, these industries account for more than 40 percent of jobs in the study area (Table 10)[16] and, as such, correspond to the geographies with the highest employment densities. Groton, home to the US Navy Submarine Base, Electric Boat, and Pfizer, has over 28,000 jobs, 1.7 times more jobs than any other municipality in the study area. New London has the highest employment density, with 2.7 times more density than any other municipality (Figure 6)[17]. Shopping plazas and other top thirty regional employers, accounting for 250+ employees, also spur employment density in downtown Norwich, Mystic, Westerly, and along Routes 1, 83, and 32.

Wages are not evenly spread throughout the region. Employees working in Groton earn a significantly higher average wage than the surrounding municipalities, due to the presence of Pfizer and Electric Boat. These manufacturing, professional, scientific, and technical services jobs pay more than service industry wages. In 2019,

[16] LEHD. 2019.
[17] Ibid.

the lowest average wages in the region were in Ledyard and Montville,[18] where the thousands of hospitality jobs provided by Foxwoods Resort Casino and Mohegan Sun are located. It is critical that transportation networks not only serve densely employed areas, but those destinations where the lowest earning employees commute.

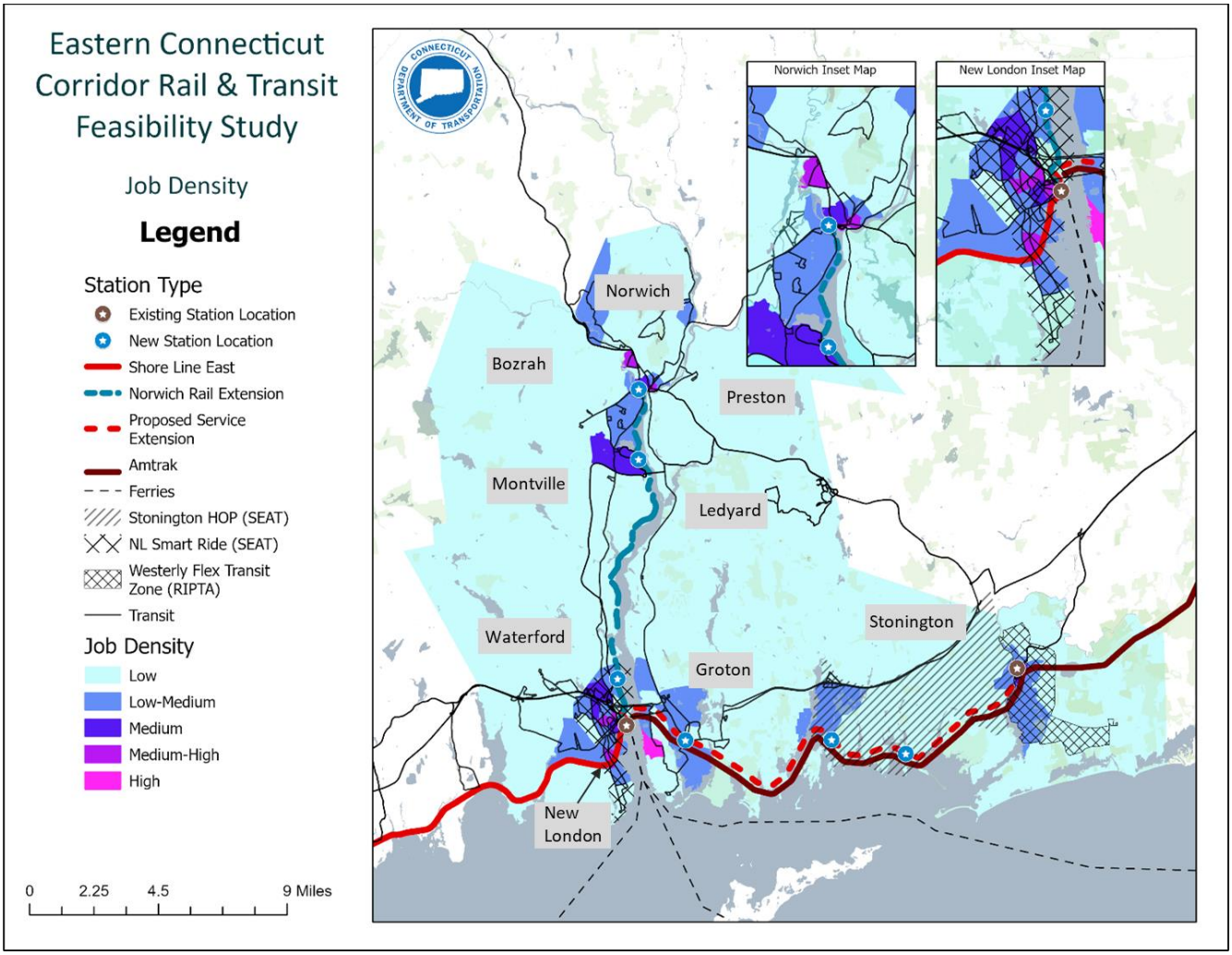
Table 10. Top 5 Industries of Employment in Region (2002 and 2019)

	2019		2002	
Industry	**Total Jobs**	**% of Total Jobs in Region**	**Total Jobs**	**% of Total Jobs in Region**
Accommodation and Food Service or Arts, Entertainment, and Recreation*	24,747	23.0%	28,186	25.2%
Manufacturing	18,657	17.3%	18,159	16.2%
Health Care and Social Assistance	16,049	14.9%	14,189	13.4%
Retail Trade	11,478	10.7%	12,589	11.2%
Educational Services	9,006	8.4%	7,216	6.4%

*These industries were combined for analysis because while data showed there was a significant shift in the number of jobs in each industry over the last two decades, the job market in the region for these industries has not changed significantly.
Source: 2019 LEHD

[18] Ibid.

Figure 6. Employment Density Map



Source: US Census Bureau 2019 American Community Survey

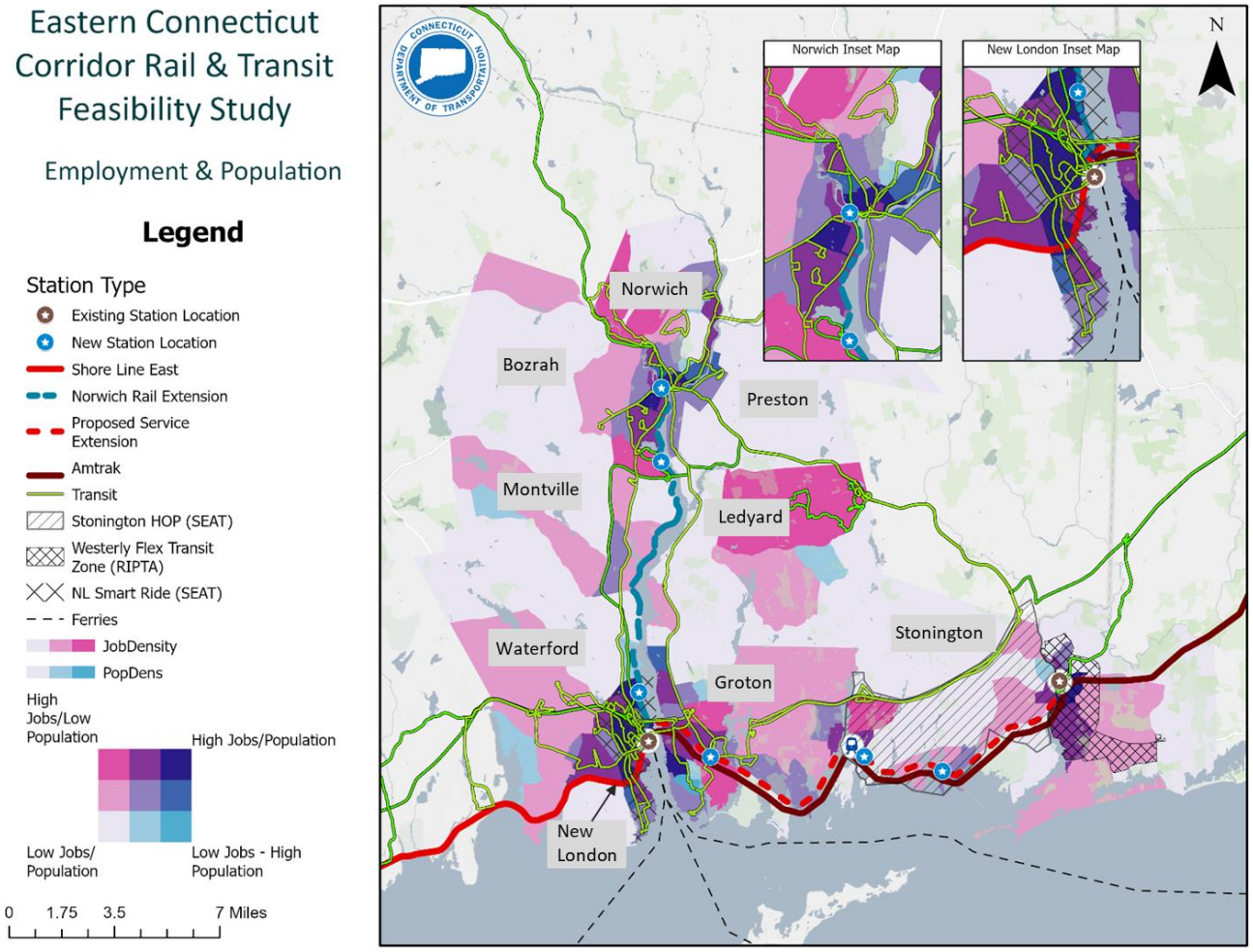
Historically, the unemployment rate in the Norwich-New London-Westerly labor market area has largely mirrored that of the state; both experienced sharp downturns due to the Great Recession, rebounding slowly in the decade following. In 2019, the unemployment rates for both the region and state hovered around three and a half percent, but the onset of the COVID-19 global pandemic caused significant jumps in unemployment which impacted the region and state on different scales[19]. In 2020, the study area experienced a nearly 6.5 percent increase in unemployment, almost 2 percent more than the state. The discrepancy is likely due to the large number of regional jobs in the service industry; Foxwoods Resort Casino laid off nearly all its 5,000-employee workforce in May 2020[20]. Over the following three years, with the development of the COVID vaccine and re-opening of commercial businesses, employment rose; as of March 2023, the Connecticut Department of Labor reports an average unemployment rate of 4.2 percent for the region, as compared to the state's 4.3 percent[21].

Industry guidelines suggest 15 jobs and people per acre – equal to 9,600 people and jobs per square mile – is the minimum level of density recommended to support frequent and cost-effective rail service[22]. Three census tracts

[19] Connecticut Department of Labor. Labor Market Information - Most Recent Labor Force Data for Connecticut Towns (state.ct.us)
[20] https://www.casino.org/news/foxwoods-casino-workers-to-lose-benefits-await-connecticut-reopening/
[21] Connecticut Department of Labor. Labor Market Information - Most Recent Labor Force Data for Connecticut Towns (state.ct.us)
[22] Robert Cervero and Erick Guerra, *Urban Densities and Transit: A Multi-Dimensional Perspective*, 2011; Translink, *Transit-Oriented Communities: A Literature Review on the Relationship between Built Environment and Transit Ridership*, 2010.

in New London, one in Groton's downtown core, and one in Norwich meet this guideline and abut proposed passenger rail stations (Figure 7). The remainder of the region is less densely settled with regards to population and employment. Industry research suggests a density threshold of around 3,000 people per square mile for operating some level of infrequent local bus service, indicating that bus could be a better candidate for transit service in the study area. In addition to people, industry guidelines suggest that housing density levels necessary to support transit are approximately 4,500 units per square mile for bus rapid transit (BRT) and 2,500 units per square mile for regular local bus service.[23] American Community Survey 5-Year estimates indicate that there is one census tract in New London with more than 4,500 units per square mile, and an additional three census tracts located within Norwich and New London that have greater than 2,500 housing units per square mile[24].

Figure 7. Study Area Population and Job Density Map



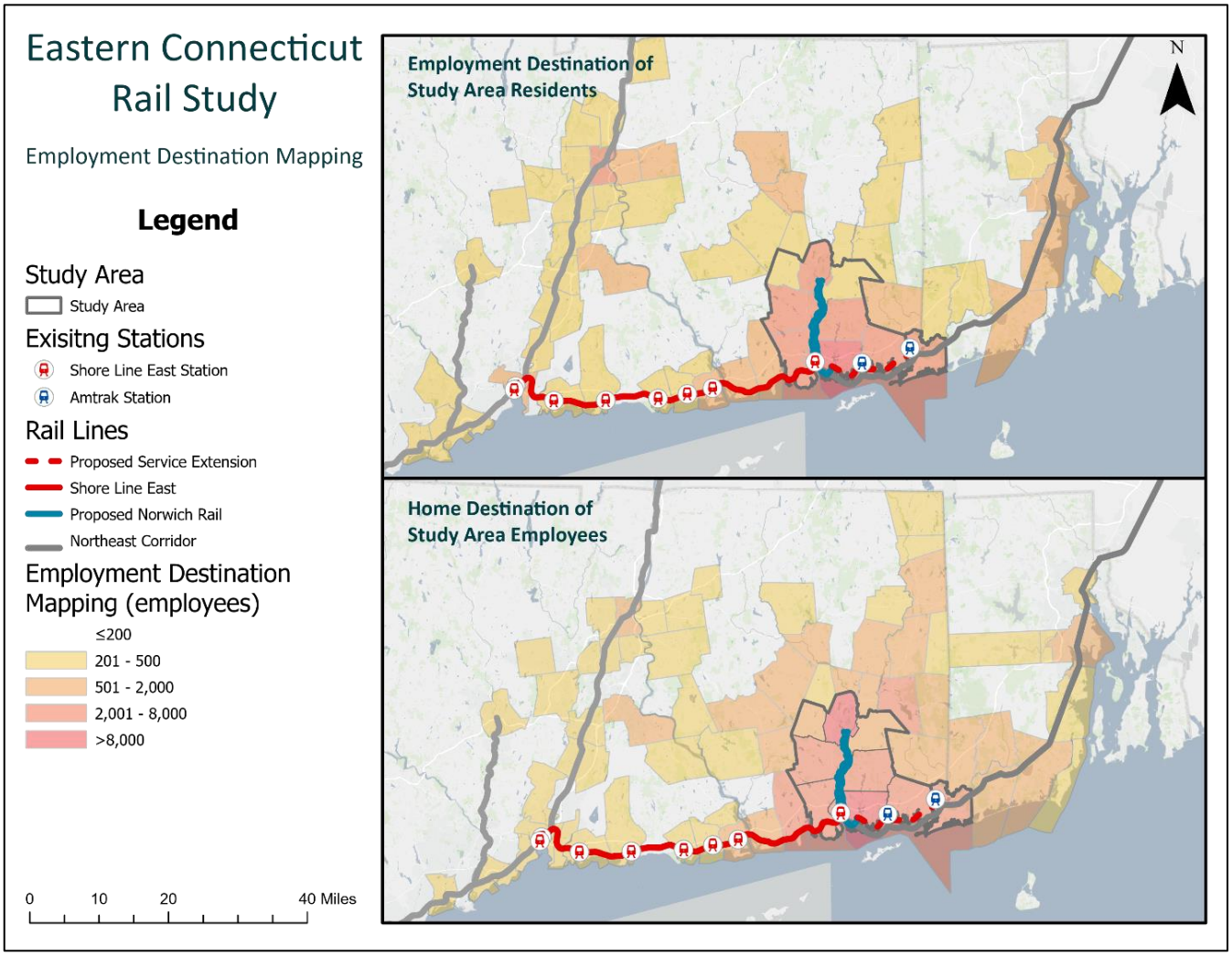
3.3. Travel Patterns

Eastern Connecticut residents largely commute to worksites within the study area and near the region's major highways such as I-395 and I-95 (Figure 8). Sixty-one percent of study area residents also work within the region, indicating large volumes of local commutes within the region[25]. Employers in the study area also generate

[23] CRCOG. Fact Sheet: Transit Oriented Development. 2016. https://crcog.org/wp-content/uploads/2016/07/Ch05_FactSheet_TOD.pdf; PSRC. Transit-Supportive Densities and Land Uses. February 2015. https://www.psrc.org/media/4958
[24] Us Census Bureau. American Community Survey 5-Year Estimates. 2021.
[25] LEHD Data. 2019.

adjacent regional travel from areas along the I-395 corridor in Connecticut and in coastal and inland Rhode Island. Local commute flows follow the regional pattern with Groton, Norwich, and Ledyard employers drawing the most study area residents.

Figure 8. Regional Employment Destinations

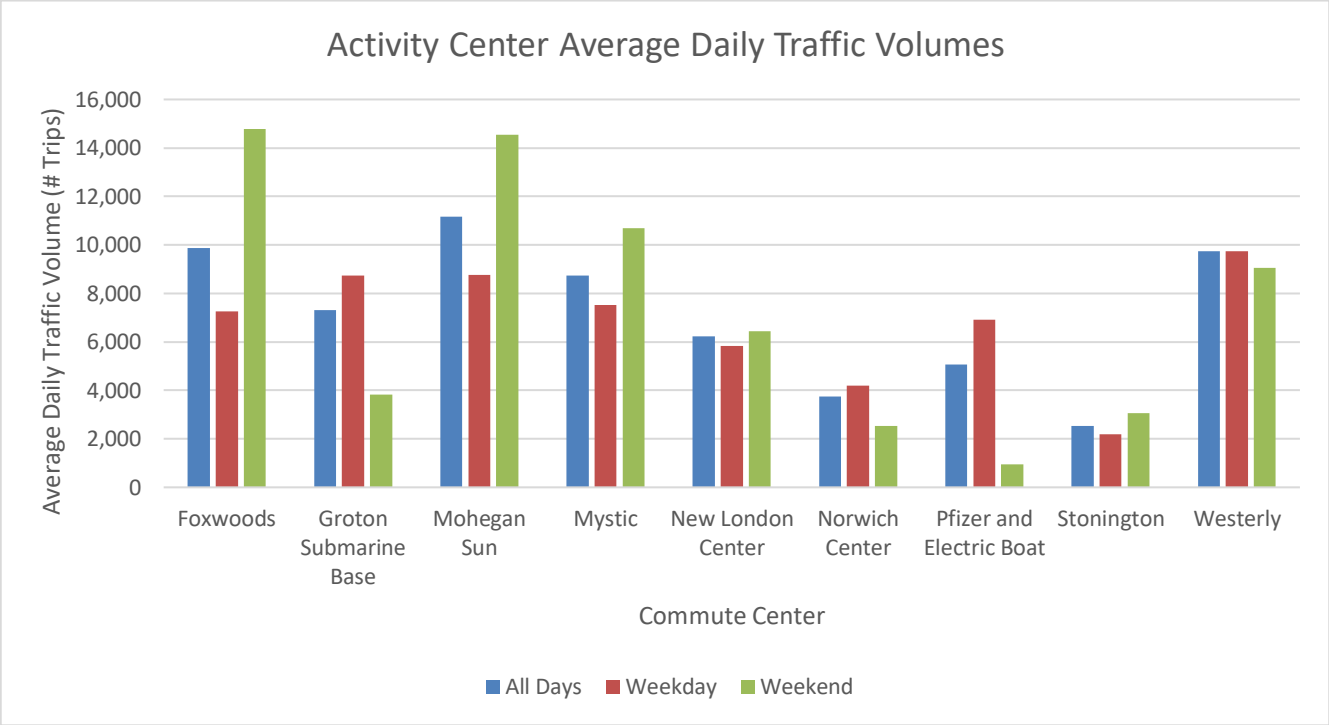


The Existing Conditions study reviewed several regional high-volume trip generators including Mohegan Sun and Foxwoods Resort Casino; employment destinations like General Dynamics Electric Boat and Pfizer; and central business districts like the Village of Mystic, New London Center, and Norwich Center. Of this list, StreetLight data indicates that the top three traffic generating destinations are Mohegan Sun, Westerly, and Foxwoods, inclusive of all transportation modes. Mohegan Sun leads all destinations with more than 11,000 daily trips[26], likely due to the casino's mixture of employees and patrons traveling to the site daily. The US Navy Submarine Base, Pfizer, and General Dynamics Electric Boat in Groton are significant employment destinations. Because Groton is served by a limited public transit network and has major employers with elevated levels of drive-alone commuters, downtown parking availability is an issue[27]. Projected employment growth in these industries will generate more auto traffic than industry-operated private garages can accommodate[28]. Central business districts like the Village of Mystic, New London Center, Norwich Center, and Downtown Stonington draw significant traffic as well (Figure

[26] Streetlight Data, March-April, July-August, and September-October 2019 & 2021.
[27] Connecticut Department of Transportation. Preliminary Feasibility Assessment Appendix A Existing Conditions. 2023.
[28] Stakeholder interviews with employers and municipalities 2022-2023.

9). While activity center traffic originates throughout the region, Stonington and Groton are two locations that produce the highest levels, particularly from the Mystic area.

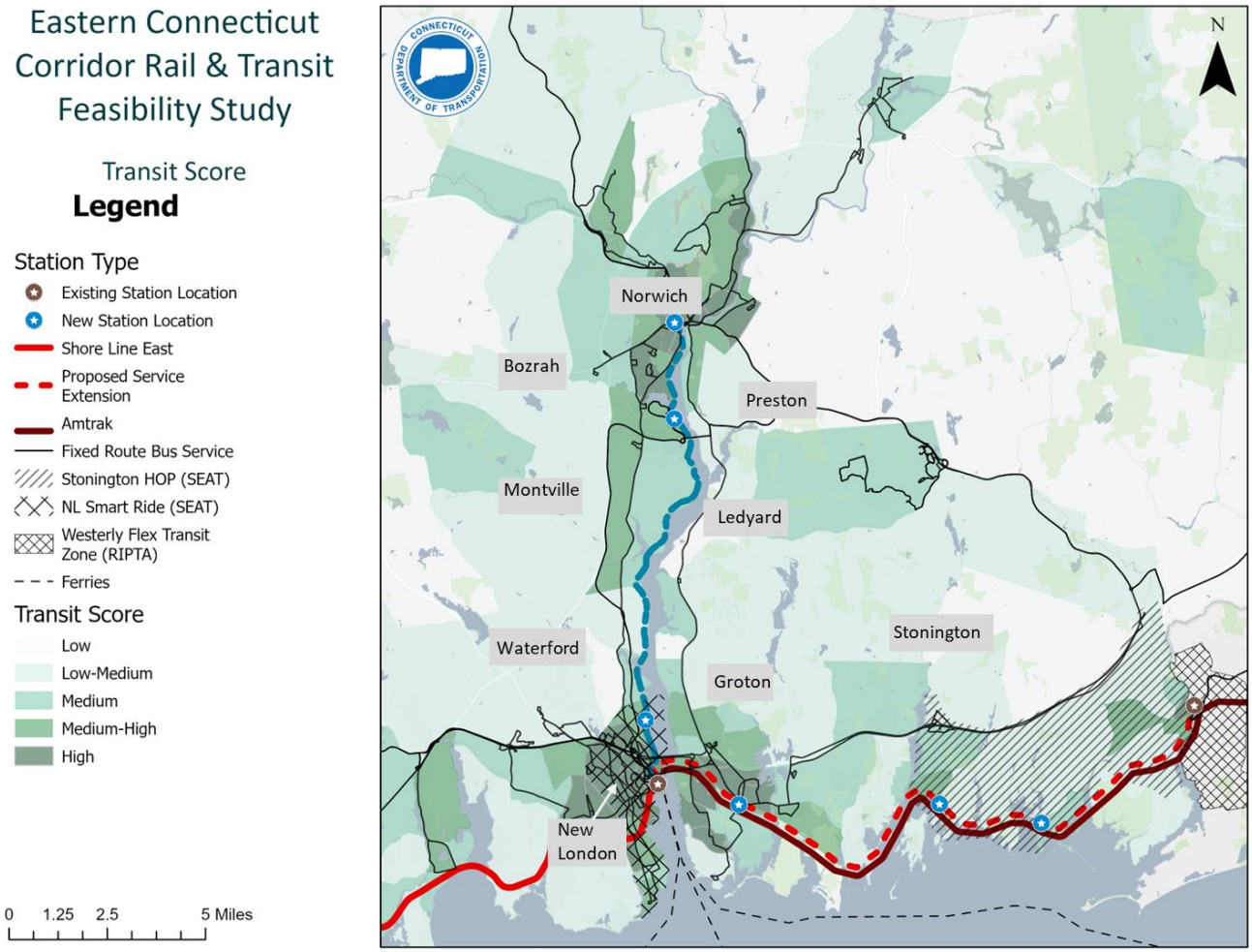
Figure 9. Activity Center Average Daily Traffic Volumes



3.4. Transit Score

To produce a data-driven market analysis, demographic information such as population, senior population, poverty, employment, and single car density was used to determine a composite transit score. The scores for each census unit ultimately produced a ranked list highlighting areas with larger concentrations of residents that would benefit from transit. Locations along the coastline and the Thames River corridor, as well as near urban cores and casinos scored highest. The existing transit network largely serves these areas (Figure 10). Given that these areas would likely produce the most riders, service elements identified in Section 6 focus largely on improving accessibility and efficiency in these areas.

Figure 10. Transit Score



3.5. Key Findings

Key findings of the transit demand analysis include:

- The region's concentration of people and employers largely exists along the Thames River, with hubs in New London, Groton, and Norwich. Approximately 48 percent of all study area jobs and 44 percent of the study area population is within a mile of the corridor.[29]
- Although not along the corridor, Foxwoods Resort Casino has high job density as it is a regional entertainment destination.
- There is a need for transit investment to support local development and growth, as well as attract more people and jobs to the region. Robust transportation options should be implemented in anticipation of the projected increase in manufacturing and defense industry jobs.
- The most common types of employees include service industry staff and employees at the submarine base. Many of these employee types, especially those in the hospitality industry, are open to transit as it

[29] The corridor was measured through generating a 1-mile buffer around the existing Route 1 and Route 2 SEAT routes as they run parallel to the river.

can be a more affordable option compared to car ownership. The convenience of transit would also support the mobility of sailors at the submarine base who do not have cars.[30]

- The region's employment and population density levels are lower than those that traditionally support rail service, indicating that bus service connecting New London and Norwich could be a better alternative.
- Electric Boat offers shuttle services and promotes carpooling among employees, however additional transit service is needed in employment centers, like the City of Groton, where parking demand is projected to exceed capacity.

4. Past Studies

In 2015, SEAT analyzed its network and identified several potential scenarios for modifying routes and service, documenting the results in their Comprehensive Operations Analysis (COA)[31]. These scenarios included two cost-neutral options and a third plan that focused on system expansion (Table 11). Several recommendations have been implemented including improved frequencies on busy routes, like Route 1, and improving connections between Norwich and Foxwoods Resort Casino.

Table 11. Past Service Recommendations

Plan Scenario	Proposed Service Modification	Status
Cost Neutral Plan A	Increase frequency on the former Route 600 (now Route 1) from every two hours to hourly	Implemented
Cost Neutral Plan A	Institute Route 980 that runs parallel to Route 600 express service	Not Implemented
Cost Neutral Plan A	Discontinue low-ridership routes in East Lyme and Stonington	Continued route in East Lyme, Discontinued route in Stonington
Cost Neutral Plan A	Evening service in New London (Route 15) replaced by extended service spans on existing daytime routes	Not Implemented
Cost Neutral Plan B	Same as Plan A, but maintains routes in low-ridership areas (East Lyme/Stonington) instead of increasing service levels along the New London-Norwich corridor	Partially Implemented. Level of service increased on former Route 600/current Route 1, but no express service was implemented; some low-ridership routes retained
System Expansion Plan C	Express service between New London and Norwich	Not Implemented
System Expansion Plan C	Operate Sunday service on 8 routes (as compared to 4 in 2015)	Not Implemented
System Expansion Plan C	Extended service on weekdays and Saturdays	Partially Implemented

[30] Stakeholder Interviews by AECOM & WSP. 2022-2023
[31] SEAT. Comprehensive Operations Analysis. 2015. https://southeastareatransitdistrict.com/wp-content/uploads/2019/01/SEAT-Final-Report-110115_reduced.pdf

Plan Scenario	Proposed Service Modification	Status
System Expansion Plan C	Institute a Norwich / Foxwoods connector	Implemented
System Expansion Plan C	New Groton local route (major employers and residential areas with US Navy Base/Groton Square)	Not Implemented
System Expansion Plan C	Service in Stonington/East Lyme, including new seasonal Mystic Shuttle	Did not implement Mystic shuttle; continued service in East Lyme; discontinued service in Stonington

In 2023, the Southeastern Connecticut Council of Governments (SCCOG) completed a corridor study along Route 32 between Williams Street and Benham Avenue in New London aiming to improve roadway conditions for non-motorists[32]. The approximately one-mile-long corridor is a four lane, highway-grade road running through the Connecticut College campus. The roadway is characterized by vehicles traveling at accelerated speeds, wide shoulders, incomplete and inaccessible sidewalks, long pedestrian crossings, and absence of cyclist infrastructure. The study examined three alternative visions, with the goal of reducing barriers, creating safe connections, and visually enhancing the community along the corridor. The preferred alternative addresses safety by:

- Constructing a new shared use path along both sides of Route 32, effectively extending existing bike lanes on Williams Street.
- Reducing crossing distances at intersections, installing new crosswalks, completing the sidewalk network, adding lighting, and creating a landscaped buffer between the roadway and shared use path.
- Upgrading signal equipment to include reflectorized backplates and video detection.
- Implementing traffic calming measures, such as reducing lane and shoulder widths, introducing roadway curvature, installing planted medians, and increasing public art.

5. Stakeholder Input

As part of the study's Public Involvement Plan (PIP), presentations and discussions were conducted with a diverse group of audiences including municipalities, special-interest groups, government representatives, major employers, and local communities. Presentations and discussions were conducted with six different organized groups – a Steering Committee, the Municipal Working Group, the Rail Working Group, the Transit Working Group, the Customer Focus Working Group, and the Major Employers. Strategies engaging the public have consisted of public meetings, online surveys, and focus groups centering around the topic of customer experience. The engagement efforts revealed the following about transit demand and needs in the region:

- New London and Groton anticipate an increase in jobs due to growth in the local manufacturing and defense industries.
- Opportunities exist to support the current market and the anticipated growth with transit because employers have minimal parking space. Transit connections are needed to draw workers from across the region; additionally, there is demand for service between Electric Boat and the US Navy Submarine Base.

[32] SCCOG. *Route 32 Corridor Study New London, Connecticut Final Report*, June 2023.

- Demographic indicators (minority, low-income, older adult populations, and traffic patterns) signal the largest demand for travel exists along the coast and the Thames River. Transit service oriented towards these higher-demand locations will likely be able to tap into the market.
- Travel demand lessens further inland and further from the Thames.
- Service improvements to the existing transit network would demonstrate the greatest benefit to the region.
- Past analysis recommendations of note: express service between Norwich and New London on the west side of the Thames River, New London evening service, Sunday service, connections to major employers and residential areas in Groton, and a seasonal Mystic shuttle.

6. Strategies to Improve the Transit Network

Because SEAT is the primary transit provider within the study area, the transit service plan focuses on strategies for improving SEAT's existing level of service, infrastructure, and policy. However, timed connections to Windham Region Transit District, 9-Town Transit, Rhode Island Public Transit Authority (RIPTA), Shoreline East (SLE), Amtrak, and the ferry services are vitally important to regional connectivity, workforce development, and tapping into the economic potential of the region, and thus could need to be coordinated regularly with each agency's timetables.

The following subsections detail strategies informed by the transit service and demand analysis, review of past plans, and discussions with regional stakeholders. This includes SEAT route and schedule modifications that address current gaps in service and align the transit network with emerging demand centers. Each section describes route-level strategies for improving service, as well as the associated cost estimates for implementation. Funding for implementing these route-level improvement strategies, as well as those associated with policy changes or infrastructure investments, has not been committed; any next steps are currently unfunded. However, improvements to SEAT services are budgeted for FY24 and are anticipated to include the re-introduction of Sunday service, improvements to frequency and span of service, and introduction of new services.

Strategies for improving mobility within the study area include extending span of service for fixed route and on-demand services, improving frequency, and streamlining routes to create faster, more frequent transit connections between dense residential areas, anchor institutions, employment nodes, and other regional destinations. Short-term strategies have been identified as feasible to implement in the next 5 years, by 2028. Long-term strategies have been identified as feasible to implement in conjunction with passenger rail service at a later date, potentially by 2035. The implementation of short-term strategies can happen independently of future rail service implementation. Table 12 shows the strategies identified for fixed-route transit service.

Table 12. Strategies to Improve Fixed Route Transit

Strategy to Improve Service	Route	Description	Potential Timeline	Net Vehicle Count
Increased LOS	Route 1	Sunday service, faster headways	2028	0
	Route 2	Faster headways, extended hours, alignment	2028	0
	Route 4	Sunday service	2035	0
	Route 6	Sunday service	2035	0
	Route 7	Sunday service	2035	0
	Route 14	Sunday service	2035	0
	Route 108	Sunday service, faster headways, alignment	2028	+1

Strategy to Improve Service	Route	Description	Potential Timeline	Net Vehicle Count
New Route	Route 1E	Additional weekday express service	2028	+2
	Route 32	Seasonal Mystic service	2028	+1, +2
	Route 76	New London-Groton	2028	+1
	Route 85	Groton via. Electric Boat/Pfizer	2028	+2
	Route 123	New London via. Ocean Beach	2028	+1
No Service Change	Route 3 Route 5 Route 8 Route 9 Route 982	-	-	0
Route Eliminated	Route 11	See new Route 76 & 85 (above); See new Grot-On-Demand (below)	-	-1
	Route 13	See new Route 123 (above)		-1
	Route 15	See New London Smart Ride (below)		0
			Total 2028:	**+6**
			Total 2035:	**+5**

Table 13 reflects strategies for improving demand response service within the region.

Table 13. Strategies for Improving Demand Response Service

Strategy to Improve Service	Program	Description	Potential Timeline	Net Vehicle Count
Increase LOS	ADA Paratransit	Sunday service	2028	0
	NL Smart Ride	Extended hours, Sunday service	2028	0
	Stonington HOP	Extended hours, seasonal Sunday service	2028	0
New Service	Grot-On-Demand	7 days a week	2028	+3
			Total:	**+3**

6.1. Route-Level Strategies

The following subsections provide route-level strategies to streamline service, enhance frequency, bolster transit connectivity between areas of interest, and extend the span of operational hours. Most route-level service and alignment changes are strategies that could be implemented in the short-term, by 2028. However, several routes may be impacted by the potential implementation of rail service expansion along the Thames River and along the coastline from New London to Westerly, RI. Where applicable, strategies will characterize improvements in their relation to the status of potential rail service implementation, stating changes to avoid service duplication or shifting alignments to serve newly opened stations. Regardless of the status of future passenger rail operations, short-term strategies for improving the level of bus transit service can improve mobility throughout the study area. Particularly along the Thames River Corridor, implementing transit strategies may be a more viable solution to satisfying mobility needs than implementing passenger rail service.

Note that another possibility to connect New London and Groton and Montville and Ledyard/Preston across the Thames River, is using water transportation like a water shuttle or coordinating to add stops on the ferry routes

in the case of New London and Groton. The shortest connection between each of these two community pairs is across the river, not through the roadway/bridge network. Additional study and coordination with operators are needed to understand the water transportation potential in this region.

6.1.1. Route 1 and Route 1 Express

The existing SEAT Route 1 service operates in a corridor that features a high transit score, demonstrates the most elevated levels of SEAT ridership, and connects the region's two largest cities. Public outreach indicated that there is demand for a frequent, fast service connecting Norwich and New London. In the future, this corridor could include passenger rail service with four total stops, one in Norwich, Mohegan Sun/Montville, Connecticut College/United States Coast Guard Academy, and New London. However, passenger rail service is a long-term strategy for improving mobility within the region. Instituting higher frequency bus service in the short term could allow CTDOT to quickly improve transit in the region and establish travel patterns that can be enhanced once rail service commences.

Prior to the potential implementation of rail service, bus service between New London and Norwich could be improved. In addition to the existing Route 1 service, a weekday Route 1 Express service between New London and Norwich could further boost the connections between the two hubs. The route's alignment could be made more efficient by instituting a direct approach to and departure from New London Union Station, as well as routing along Route 32, rather than Old Norwich Road (Figure 11). The 1E could operate between 6:30am and 10:30pm with 60-minute headways, stopping at Connecticut College/Coast Guard Academy, Montville Town Hall, Montville Commons, Mohegan Sun, and Three Rivers Community College. This service could offset with Route 1 departures to effectively create 30-minute headways between the two cities. Two vehicles could be needed to operate the express service.

Rationale

- A possible short-term transit improvement
- Bus service can supplement future rail service
- Existing Route 1 service has the highest monthly ridership in the region
- High transit score along the corridor
- Demand for frequent, fast connections between Norwich and New London

If passenger rail service is instated along the corridor, the bus service between New London and Norwich should be altered to compliment, not compete with the rail service. By terminating the express service and offsetting departure times with the proposed rail service, 30-minute frequency between both modes could be effectively maintained with fewer buses, avoiding a duplication of services.

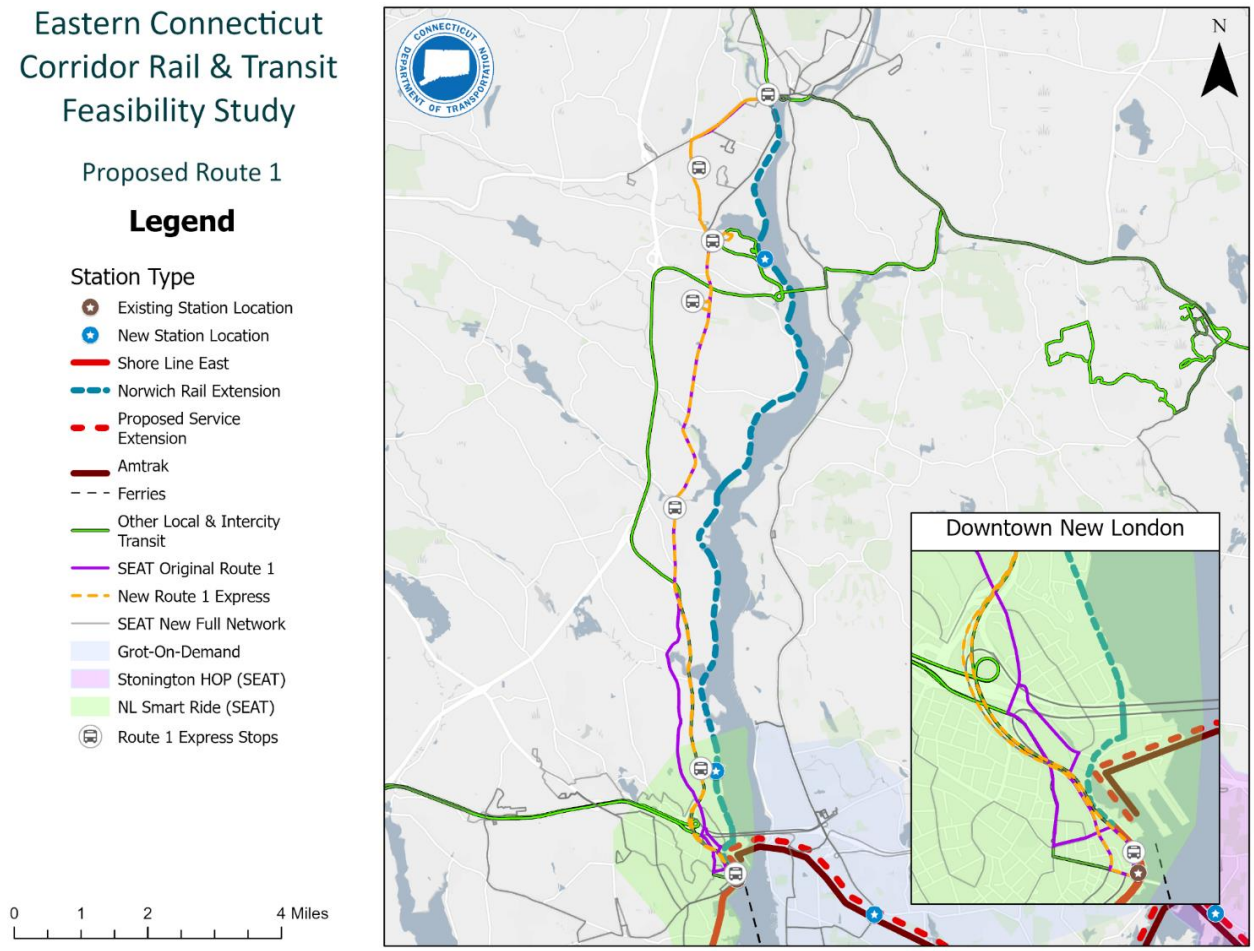
Table 14 provides a summary of route service level strategies in the short-term (before potential passenger rail service is implemented) and in the long-term (after the potential implementation of passenger rail service). Were these strategies to be adopted, Route 1's current alignment and headways would not change prior to or following the implementation of passenger rail service, though it is recommended that service span increases. Proposed schedules for the Route 1E can be found in **Exhibit D: Transit Schedules**.

Table 14. Route 1 and Route 1 Express Service Elements

			Existing Service	2028 Service	2035 Service
Route 1 Local	**Weekdays**	Span	6am to 10:55pm	6am to 10:55pm	6am to 10:55pm
		Frequency	60 minutes	60 minutes	60 minutes
	Saturday	Span	6am to 10:55am	6am to 10:55pm	6am to 10:55pm
		Frequency	60 minutes	60 minutes	60 minutes
	Sunday	Span	-	7am to 6:55pm	7am to 6:55pm

			Existing Service	2028 Service	2035 Service
		Frequency	-	60 minutes	60 minutes
Route 1E	**Weekdays**	Span	-	6:30am to 10:23pm	-
		Frequency	-	60 minutes	-

Figure 11. Route 1 Strategy



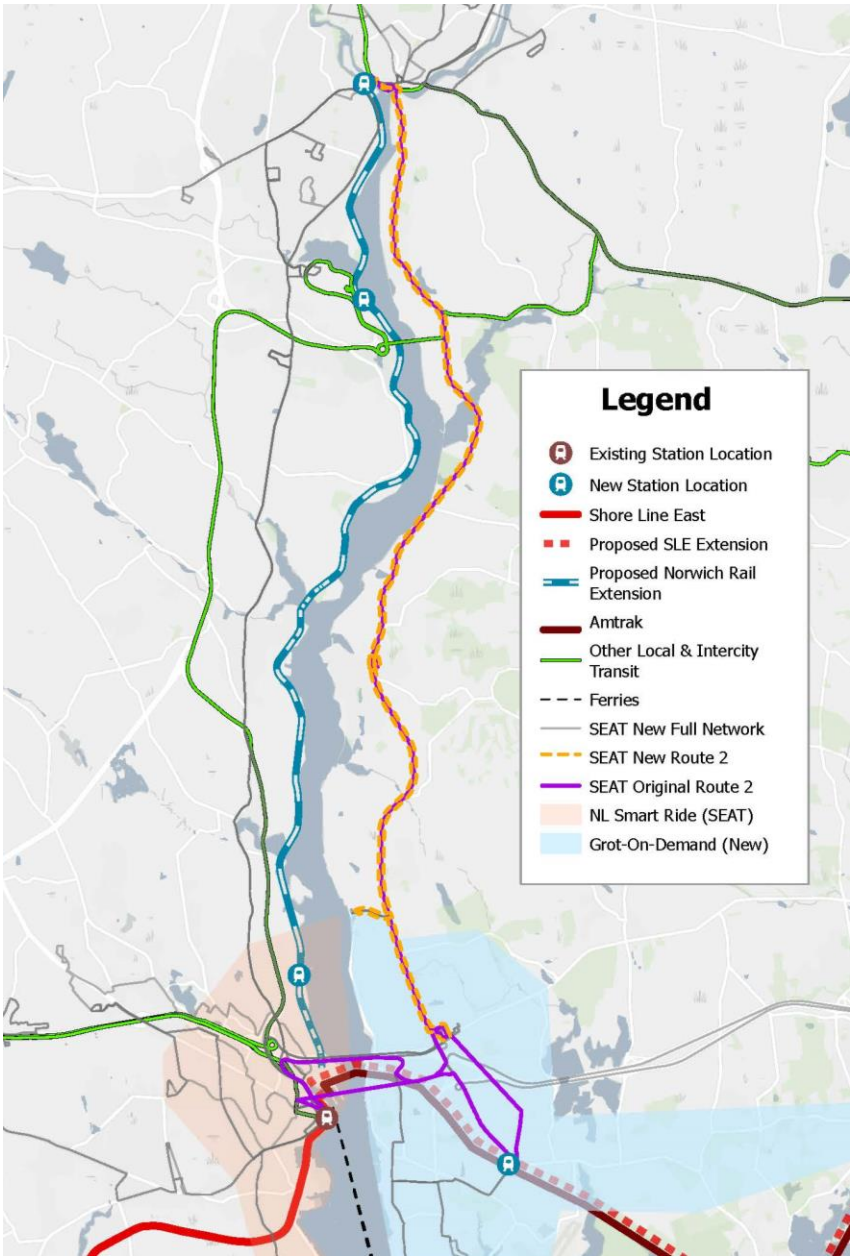
6.1.2. Route 2

Route 2 connects Norwich to New London via Groton. Previous analyses indicated that truncating Route 2 at Groton Square allows for simplification and efficient resource allocation, as doing so shortens the route, allowing for headway improvement. Because there is redundancy in the areas of Groton served by the current Route 2 and other SEAT routes, these populations could continue being served by transit, were the route truncated. Groton Square's connection to Routes 2, 3, 108, and other proposed lines enable efficient transfer to other regional destinations (Figure 12). A short-term strategy for improving weekday headways includes truncating the route at Groton Square and interlining the service with Route 85 (Table 15. Route 2 Service Elements). These changes could be slated for 2028 and continue in the wake of potential passenger rail service implementation. No additional vehicles could be needed to operate the service. Proposed schedules for Route 2 can be found in **Exhibit D: Transit Schedules**.

Table 15. Route 2 Service Elements

		Existing Service	2028 Service	2035 Service
Weekdays	Span	6am to 6:55pm	6am to 6:53pm	6am to 6:53pm
	Frequency	120 minutes	60 minutes	60 minutes
Saturday	Span	7am to 6:55pm	7am to 6:53pm	7am to 6:53pm
	Frequency	120 minutes	60 minutes	60 minutes

Figure 12. Route 2 Strategy



6.1.3. Route 3, 5, 8, 9, 12, and 982

No short- or long-term strategies to improve mobility within the region along these routes have been identified at this time.

6.1.4. Route 4, 6, 7, and 14

In alignment with 2015 COA recommendations, Routes 4, 6, 7, and 14 could expand to include limited Sunday service (Table 16). Increased housing and business development could likely follow the implementation of passenger rail service between New London and Norwich, which could further escalate the need for seven day a week, intracity transit connections, particularly around transportation nodes. Expanding Sunday service along these routes could improve access to grocery stores, medical facilities, faith-based organizations, and other commercial activities to a potentially increased rider base. A long-term strategy of implementing Sunday service along these routes following the potential implementation of passenger rail service in 2035 could not require any additional vehicles.

Table 16. Routes 4, 6, 7, and 14 Sunday Service Elements

		Existing Sunday Service	2035 Sunday Service
Route 4	Span	--	8:00am - 4:32pm
	Frequency	--	120 minutes
Route 6	Span	--	8:00am – 5:23pm
	Frequency	--	120 minutes
Route 7	Span	--	8:00am – 4:56pm
	Frequency	--	60 minutes
Route 14	Span	--	8:00am to 4:52pm
	Frequency	--	60 minutes

6.1.5. Route 11

Route 11 serves Groton, stopping at local destinations such as Groton Square, UConn Avery Point, Plaza Court, and Pequot Medical Center. The hourly route is circuitous and accounts for approximately 5 percent of SEAT's total fixed-route ridership. A short-term strategy to serve the Groton community more effectively could be to eliminate the route and replace it with other services (Routes 76 and 85, creating a new Grot-On-Demand microtransit to fill any remaining gaps). For more details on these new services, see subsections 6.1.9, 6.1.10, and 6.1.14).

6.1.6. Route 13

Route 13 serves south New London via Ocean Beach. The current alignment deviates from Jay and Bank Street to serve Williams Street and Shaw's Cove before traveling south down Montauk Ave to arrive at Ocean Beach. Making substantial changes to the stops along Route 13 could achieve faster, streamlined service. A short-term strategy to improve mobility could be to replace Route 13 with Route 123 (see subsection 6.1.12).

6.1.7. Route 15

Route 15 operates as late-night service in New London and carries less than 1 percent of SEAT's total fixed-route ridership. This route could be eliminated in favor of expanding hours of operation along Route 123 (see

subsection 6.1.13) and the New London Smart Ride as both a short- and long-term strategy for improving mobility within the region.

6.1.8. Route 32 (New)

Rationale

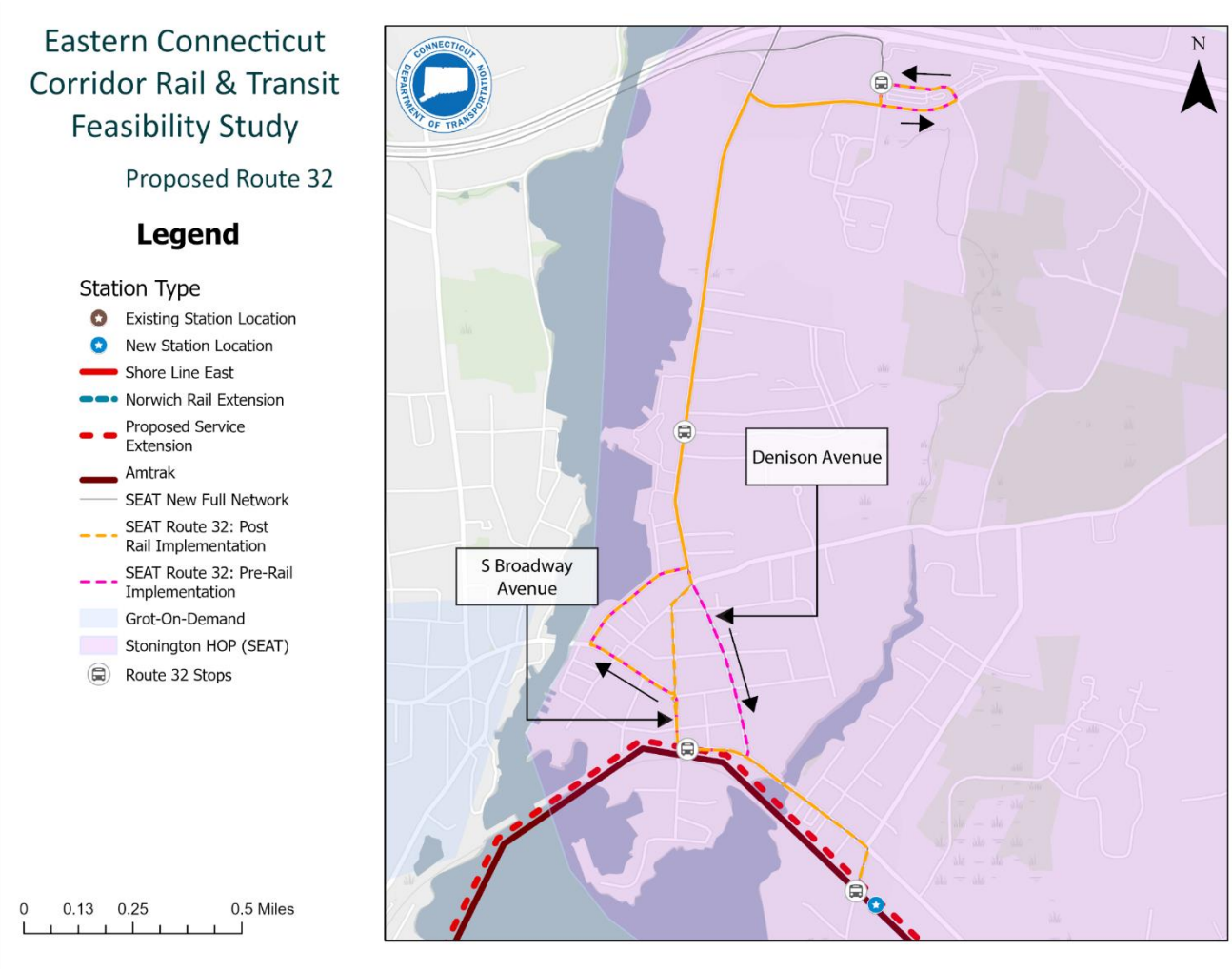
- No existing service between I-95-area destinations (walking takes around 40 minutes)
- Reduce congestion
- Proposed Mystic Station is further from the CBD (30-minute walk)
- High population and job density
- Connect regional tourism hubs with frequent rail

Past studies, data, and public engagement with specific stakeholders and the public at-large indicates that there is demand for a Mystic service that connects destinations near I-95 (Olde Mistick Village and the Mystic Aquarium) to Mystic's Central Business District (CBD) and rail station. Demographic and travel data indicates that this area has a high transit score due to high population and job density. To address demand, a short-term strategy for improving fixed route service could be to implement a new, seasonal service from Memorial Day Weekend to Labor Day, seven days a week, providing service between the Mystic Aquarium and Mystic rail station at 30-minute headways. Prior to potential ECRTS rail implementation, Route 32 could terminate at the current Mystic Station (2 Roosevelt Ave) after traveling south down Denison Avenue. Following the potential ECRTS rail implementation in 2035, Route 32 could travel south down Broadway Avenue before turning onto Williams Avenue, and eventually terminating at the new Mystic Station (Masons Island Rd), as shown in Figure 13. Table 17 highlights service levels in the short- and the long-term. One additional bus could be needed to operate this route at 2028 service levels and two buses could be needed for 2035 service levels. Proposed schedules for Route 32 can be found in **Exhibit D: Transit Schedules**.

Table 17. Route 32 Service Elements

	Season	2028 Service	2035 Service
Weekday & Weekend	Season	Memorial Day – Labor Day	Memorial – Labor Day
	Span	8:00am – 6:57pm	8:20am – 8:57am & 6:00pm – 7:17pm
	Frequency	30 minutes	40 minutes
	Span		9:00am – 5:55pm
	Frequency		20 minutes

Figure 13. Route 32 Strategy



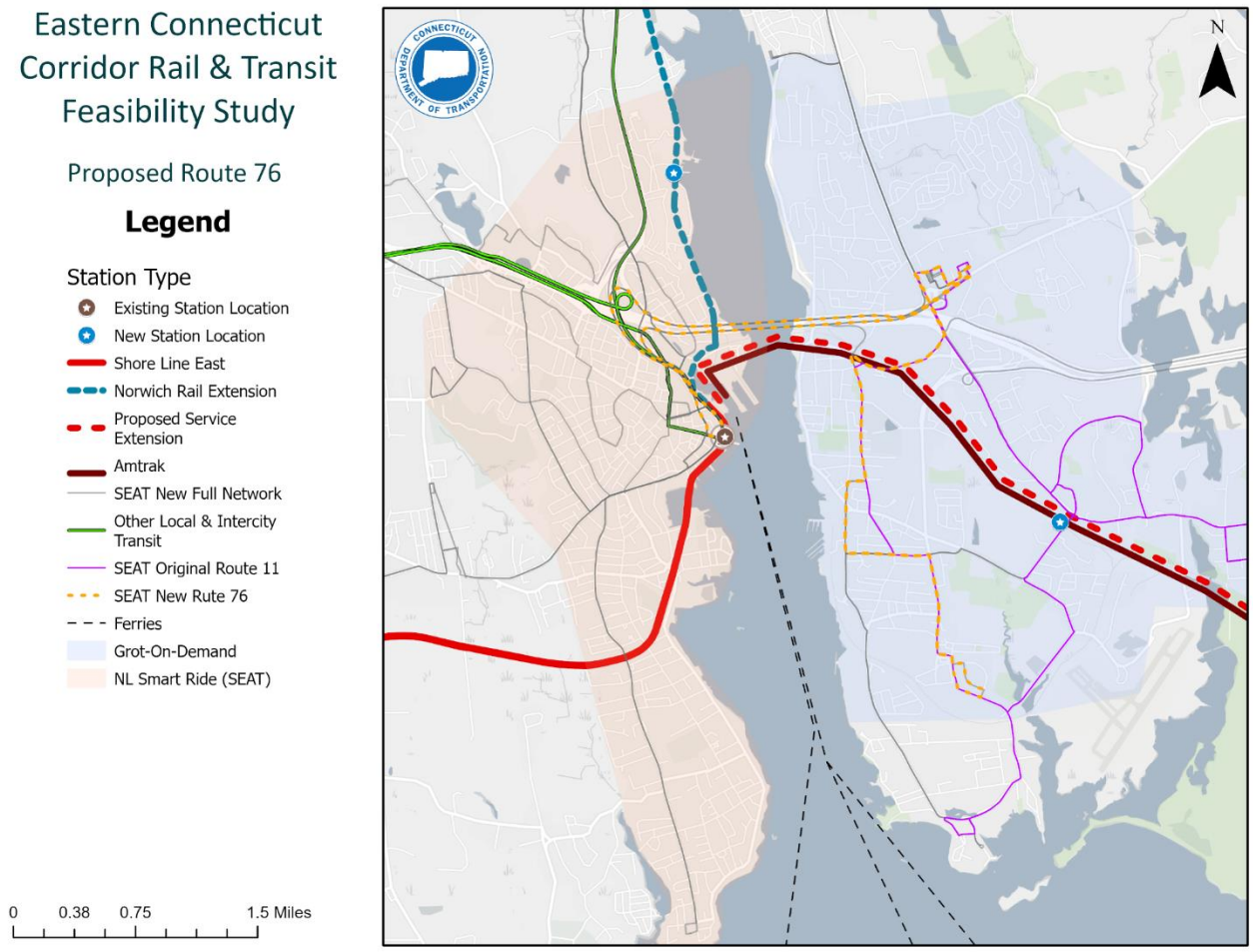
6.1.9. Route 76 (New)

A short-term strategy for improving mobility could include implementing Route 76, which could link New London Union Station with the Branford Manor multifamily housing area in Groton connecting Groton Square, Walmart, Electric Boat, and Pfizer (Figure 14). This potential new route could serve both dense employment and population nodes, as well as census areas exhibiting moderate to high transit scores. By providing connection to two transit hubs – New London Union Station and Groton Square – Route 76 riders could have the opportunity to get to regional destinations utilizing a single transfer. Route 76 could run 7 days a week over the short and long term (Table 18). Demand response microtransit (see subsections 6.1.16 and 6.1.17 for further detail) could supplement evening service beyond 8pm until 11pm. Route 76 could require one bus to provide service at the level described below if interlined with Route 123. Proposed schedules for Route 76 can be found in **Exhibit D: Transit Schedules**.

Table 18. Route 76 Service Elements

Day	Span	Frequency
Weekday	7:10am to 8:07pm	60 minutes
Saturday	7:10am to 7:47pm	60 minutes
Sunday	7:10am to 6:07pm	60 minutes

Figure 14. Route 76 Strategy



6.1.10. Route 85 (New)

Rationale

- Demand for employee connections between Electric Boat and Groton Sub. Base
- Electric Boat anticipated to add thousands more jobs
- UConn Avery Point – NEC connection, and a local bus route serving nearby beaches
- Regional connections via Groton Square stop

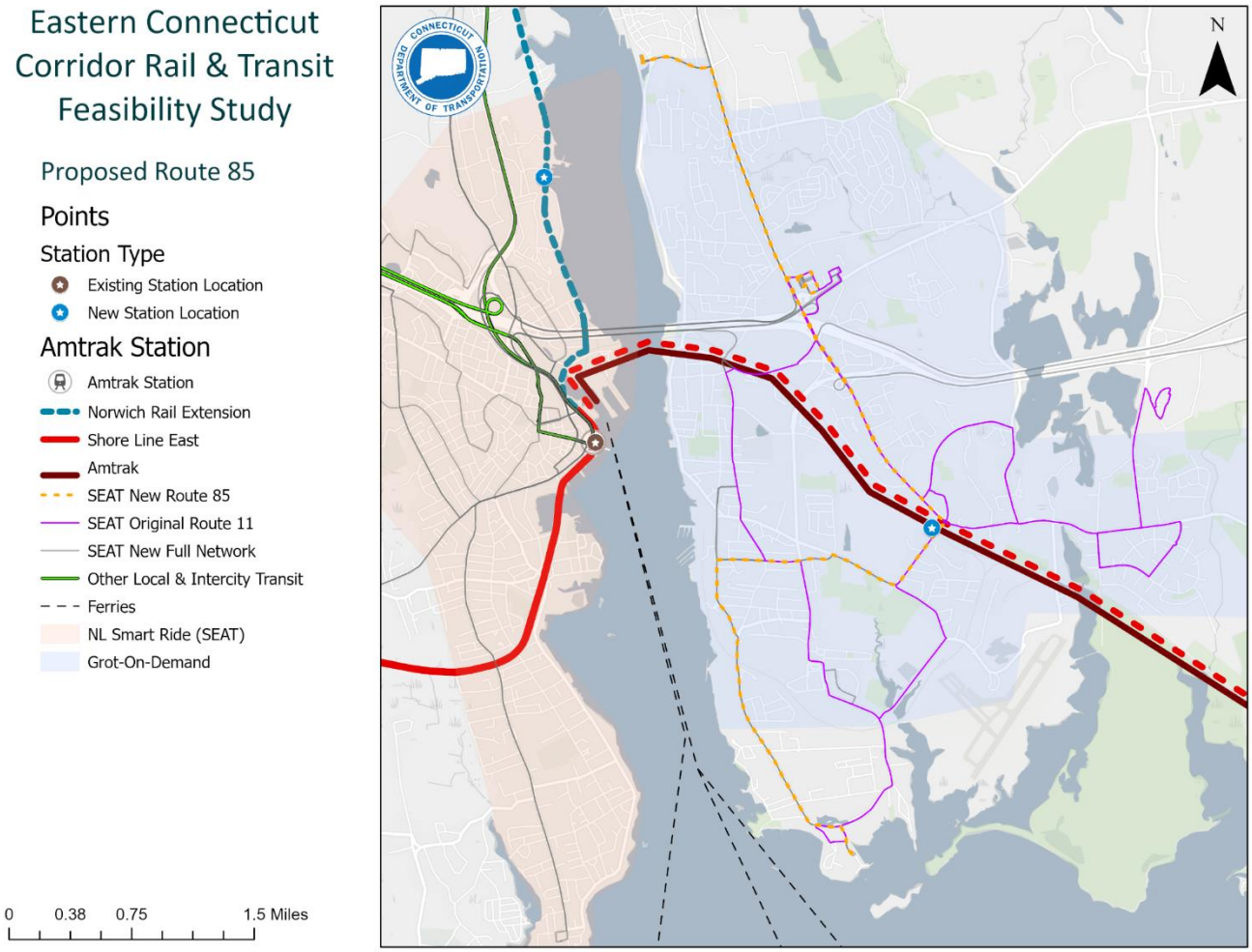
Engagement with different stakeholders and an analysis of employment trends reveals that there is an opportunity to serve the project area by creating a connection between the US Navy Submarine Base and Electric Boat in Groton. By interlining the newly created Route 85, service from Groton Square to UConn Avery Point via Electric Boat, with Route 2, service from Norwich to Groton Square via US Navy Submarine Base, passengers could access a one seat ride between Groton's two largest employers. Route 85, which could operate south of Groton Square at 30-minute headways during weekdays and 60-minute headways during the weekend, could also provide service to the future passenger rail station, Groton West on Poquonnock Road (Figure 15). The service could operate from approximately 6 am to 8pm on weekdays, with reduced service on the weekends (Table 19)[33]**.** In addition to connecting with Route 2 at Groton Square, the transit hub could also allow non-north south users a transfer opportunity to other destinations. The proposed schedule for Route 85 is found in **Exhibit D: Transit Schedules**. This service could be anticipated to require two buses and could be implemented over the short- and long-term time horizons. Understanding that Route 85 could be a public route serving two large employers, it is possible that CT*rides*, the CTDOT Transportation Demand Management Division, could work with the employers to identify strategies that encourage using the service.

Table 19. Route 85 Service Elements

	Span	Frequency
Weekday	6:02am to 7:51pm	30 minutes
Saturday	7:32am to 6:21pm	60 minutes
Sunday	8:32am to 5:21pm	60 minutes

[33] Those wishing to travel between these locations outside of service hours can use the newly proposed micro transit service.

Figure 15. Route 85 Strategy



6.1.11. Route 108

Route 108 connects New London to Foxwoods via Groton. The current Route 108 travels from New London through Groton, stopping at Plaza Court, before using the I-95 to connect to an underutilized park and ride in North Stonington and travel north to Foxwoods Resort Casino. An expedited route utilizing I-95 between New London and Foxwoods Resort Casino could improve the connection between these destinations in the short-term, as well as the connection between the casino and the NEC. Intermediate stops could be located in Groton Square and Olde Mistick Village/Aquarium (Figure 16). By removing the deviations in Groton and the routing through North Stonington, the route could bypass underutilized stops and reduce travel time, allowing for faster headways. Groton riders could use the proposed Groton demand-response service (see subsection 6.1.16) to reach Groton Square and connect to the modified Route 108. It is anticipated that the service could run from approximately 6 am to 11 pm with 60-minute headways on weekdays and reduced service on the weekends (Table 20). The updates to Route 108 are a short-term strategy for improving regional mobility and could not change with the implementation of passenger rail. This service could require one additional bus. Proposed schedules for Route 108 can be found in **Exhibit D: Transit Schedules**.

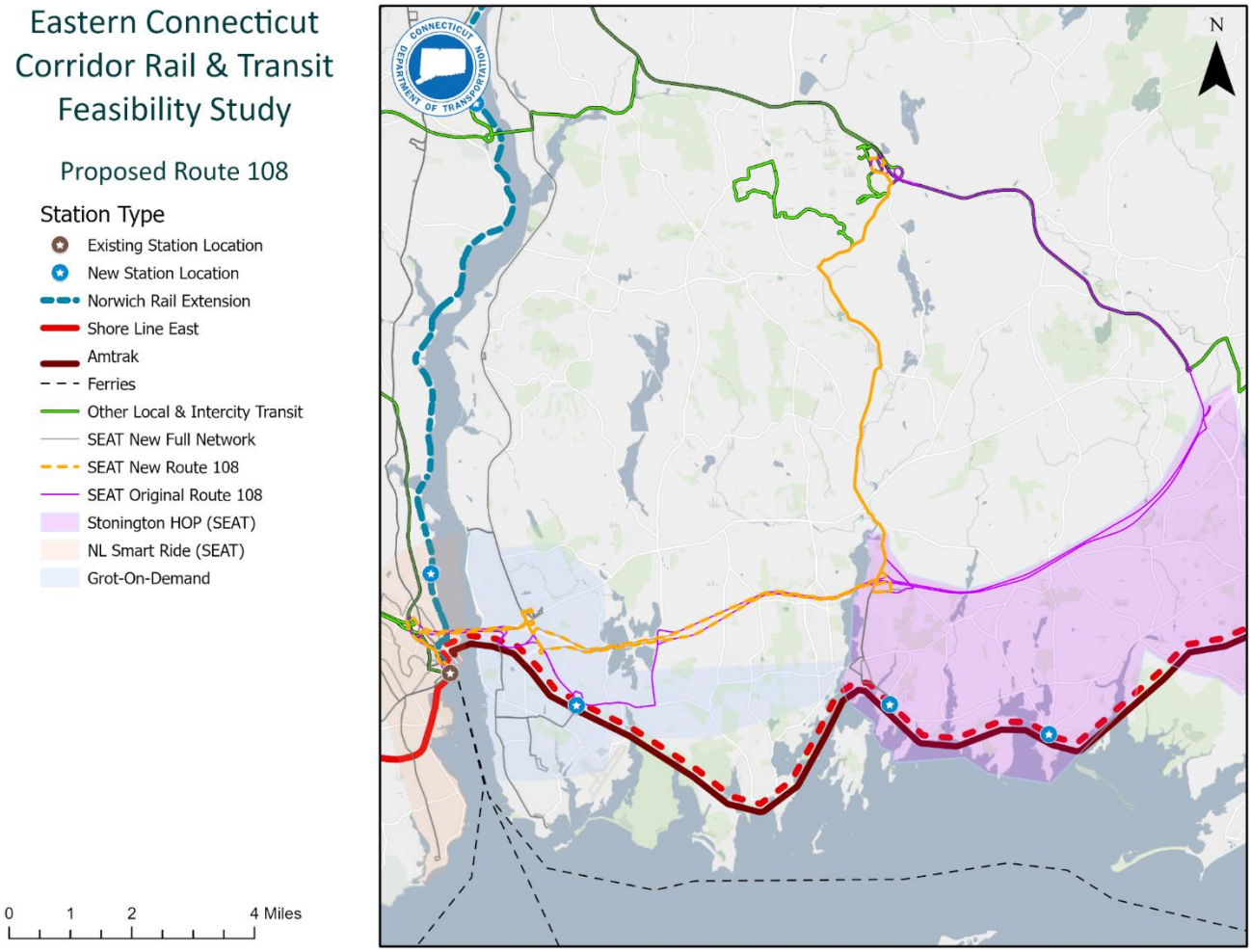
Rationale

- Streamline route by eliminating underutilized stops
- Speed up route and improve headways
- Provide service competitive with rideshare and personal vehicles
- Direct reliable connection to Foxwoods for customers and employees using the NEC

Table 20. Route 108 Service Elements

		Existing Service	Prior To Passenger Rail
Weekdays	Span	6am to 10:45pm	6am to 10:55pm
	Frequency	120 minutes	60 minutes
Saturday	Span	6am to 10:45pm	6:00am to 9:55pm
	Frequency	120 minutes	60 minutes
Sunday	Span	--	6:00am to 7:55pm
	Frequency	--	60 minutes

Figure 16. Proposed Route 108



6.1.12. Route 123 (New)

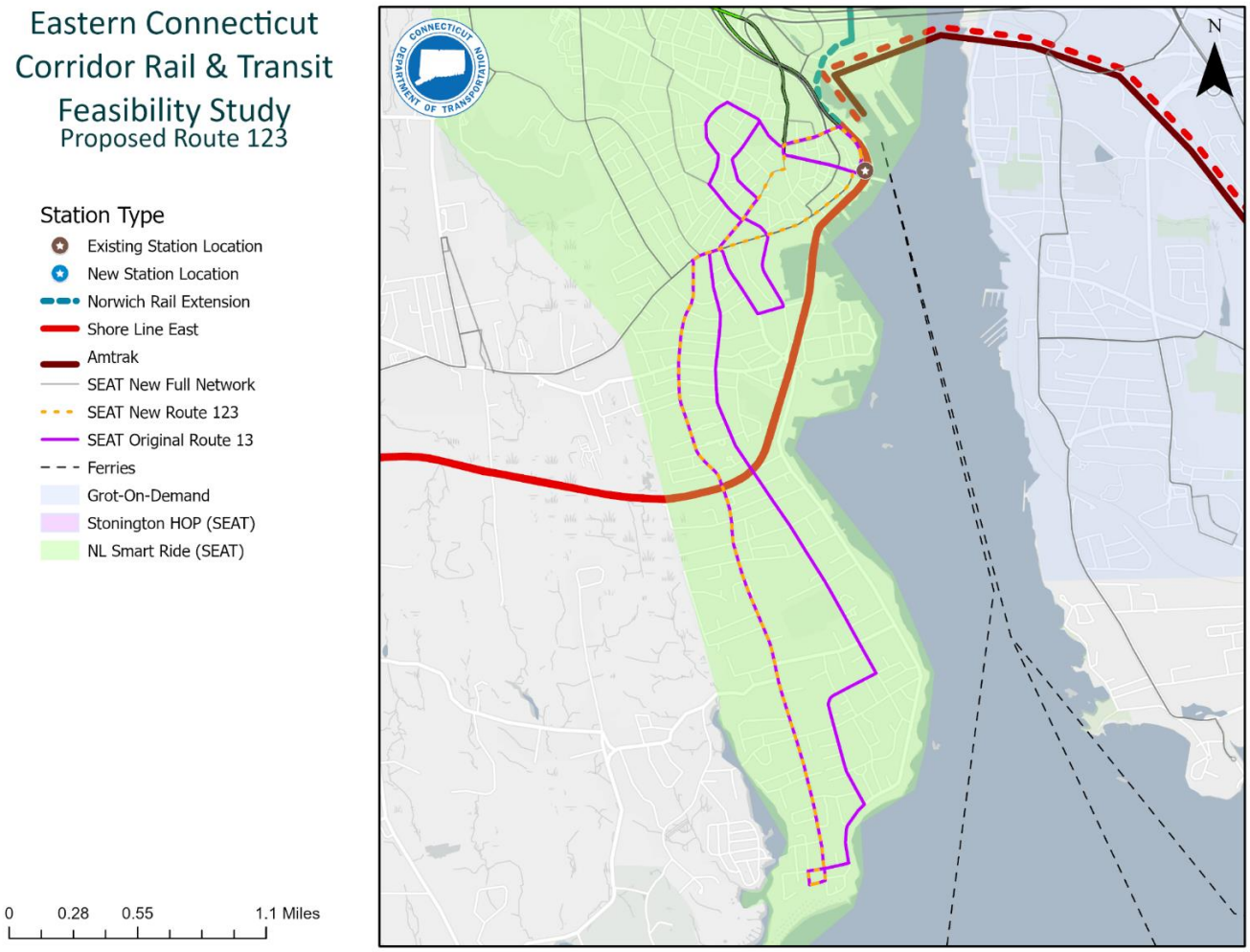
Streamlining the former Route 13's service to avoid deviations and traveling south down Ocean Avenue to arrive at Ocean Beach could shorten the route's travel time (Table 21). Interlining this route with Route 76 could provide an opportunity to serve a comparable geographic area with greater frequency, using fewer buses. The streamlined route could provide areas with higher demand a faster connection to the regional transportation hub, New London Union Station. From there, passengers could be able to transfer to routes serving Norwich, Groton, Mystic, Foxwoods Resort Casino, and beyond. Areas where service could be eliminated along the current Route 13 will maintain transit coverage via the New London Smart Ride microtransit service.

To reflect the substantial alignment changes involved with implementing this potential short-term strategy and to avoid confusion, this line could be renamed from Route 13 to Route 123. The new route could be implemented in the short term, by 2028, and continue on through a longer time horizon. Proposed service strategies can be found below in Figure 17. Because of the interline, the route could not pulse out of New London Union Station on the hour when headed to Ocean Beach; the proposed schedule for the new Route 123 can be found in **Exhibit D: Transit Schedules**. The interline with Route 123 and Route 76 could require 2 total buses.

Table 21. Proposed Route 123 Service Elements

		Existing Service (Route 13)	2028 Service
Weekdays	Span	6:20am to 6:55pm	6:51am to 7:29pm
	Frequency	60 minutes	60 minutes
Saturday	Span	8:00am to 6:55pm	7:51am to 6:29pm
	Frequency	60 minutes	60 minutes
Sunday	Span	-	7:51am to 5:29pm
	Frequency	-	60 minutes

Figure 17. Route 123 Strategy



6.1.13. CT*transit* 914 Hartford Express Extension[34]

Stakeholder discussions, travel data, and public survey data indicated a desire for a connection between Norwich and Hartford, as both are centers of employment. CT*transit* currently operates a weekday 914 Marlborough-Colchester Express service between Hartford and Colchester with intermediate stops in Marlborough. Colchester is a community located approximately 20 miles west of Norwich. Morning service consists of two trips from Hartford to Colchester and six trips from Colchester to Hartford. Afternoon and evening service consists of seven trips from Hartford to Colchester and four trips from Colchester to Hartford. Additional intermediate stops in Glastonbury are scheduled on the combined 904/914 Glastonbury-Marlborough-Colchester Express. One of the morning 914 buses and two of the afternoon and evening 914 buses are combined 904/914 Express buses (Table 22 and Table 23). A short- and long-term strategy to increase regional connectivity between these areas for the 914 Hartford Express route extension include:

- Extending the westbound route from Colchester to begin in Norwich for the trips leaving Colchester at 6:39am and 7:39am, creating two morning trips from the Norwich Transportation Center to Hartford.
- Extending the eastbound route from Colchester to end in Norwich for the trips arriving in Colchester at 6:17pm and 7:17pm, creating two evening trips from Hartford to the Norwich Transportation Center.

[34] Additional considerations for cycle times and crew locations will need to be studied in further detail as this plan involves some buses terminating in Norwich, instead of Colchester.

Table 22. 904 and 914/904 Express Service -- Eastbound

Bus Stops	914	904	914	904	904/914	904	914	904	914	904	914	904	914	904	914	904/914
Hartford																
Asylum St at Bushnell Park	6:00 AM	6:40 AM	7:00 AM	7:40 AM	12:15 PM	3:35 PM	3:35 PM	4:05 PM	4:05 PM	4:35 PM	4:35 PM	5:05 PM	5:05 PM	5:35 PM	5:35 PM	6:25 PM
Pearl St & Ann Uccello St	6:01 AM	6:41 AM	7:01 AM	7:41 AM	12:16 PM	3:36 PM	3:36 PM	4:06 PM	4:06 PM	4:36 PM	4:36 PM	5:06 PM	5:06 PM	5:36 PM	5:36 PM	6:26 PM
Pearl St & Lewis St	6:02 AM	6:42 AM	7:02 AM	7:42 AM	12:17 PM	3:37 PM	3:37 PM	4:07 PM	4:07 PM	4:37 PM	4:37 PM	5:07 PM	5:07 PM	5:37 PM	5:37 PM	6:27 PM
Market St & Talcott St	6:04 AM	6:44 AM	7:04 AM	7:44 AM	–	–	–	–	–	–	–	–	–	–	–	–
State St at Footbridge	–	–	–	–	12:19 PM	3:39 PM	3:39 PM	4:09 PM	4:09 PM	4:39 PM	4:39 PM	5:09 PM	5:09 PM	5:39 PM	5:39 PM	6:29 PM
Glastonbury																
Putnam Bridge Park & Ride	–	6:53 AM	–	7:53 AM	12:28 PM	3:48 PM	–	4:18 PM	–	4:48 PM	–	5:18 PM	–	5:48 PM	–	6:38 PM
Main St & Glastonbury Blvd	–	6:54 AM	–	7:54 AM	12:29 PM	3:49 PM	–	4:19 PM	–	4:49 PM	–	5:19 PM	–	5:49 PM	–	6:39 PM
Main St & Naubac Ave	–	6:56 AM	–	7:56 AM	12:31 PM	3:51 PM	–	4:21 PM	–	4:51 PM	–	5:21 PM	–	5:51 PM	–	6:41 PM
Hebron Ave & Main St	–	6:58 AM	–	7:58 AM	12:33 PM	3:53 PM	–	4:23 PM	–	4:53 PM	–	5:23 PM	–	5:53 PM	–	6:43 PM
Marlborough																
North Main St at Marlborough Park & Ride	6:19 AM	–	7:19 AM	–	12:44 PM	–	3:54 PM	–	4:24 PM	–	4:54 PM	–	5:24 PM	–	5:54 PM	6:54 PM
North Main St at Marlborough Town Hall	6:23 AM	–	7:23 AM	–	12:48 PM	–	3:58 PM	–	4:28 PM	–	4:58 PM	–	5:28 PM	–	5:58 PM	6:58 PM
Colchester																
Lake Hayward Park & Ride	6:35 AM	–	7:35 AM	–	1:00 PM	–	4:10 PM	–	4:40 PM	–	5:10 PM	–	5:40 PM	–	6:10 PM	7:10 PM
Main St at Colchester Green	6:43 AM	–	7:43 AM	–	1:04 PM	–	4:14 PM	–	4:44 PM	–	5:14 PM	–	5:44 PM	–	6:14 PM	7:14 PM
Old Hartford Rd at Colchester Town Garage	6:46 AM	–	7:46 AM	–	1:07 PM	–	4:17 PM	–	4:47 PM	–	5:17 PM	–	5:47 PM	–	6:17 PM	7:17 PM

Trips to Colchester

Extend trip end to Norwich

Table 23. 914 and 904/914 Express Current Service -- Westbound

Bus Stops	904/914	914	904	914	904	914	904	914	904	914	904	914	914	904	914	904	914
Colchester																	
Lake Hayward Park & Ride	5:39 AM	6:09 AM	–	6:39 AM	–	7:09 AM	–	7:39 AM	–	8:09 AM	–	1:00 PM	4:10 PM	–	5:10 PM	–	6:10 PM
Main St at Colchester Green	5:43 AM	6:13 AM	–	6:43 AM	–	7:13 AM	–	7:43 AM	–	8:13 AM	–	1:04 PM	4:14 PM	–	5:14 PM	–	6:14 PM
Old Hartford Rd at Colchester Town Garage	5:46 AM	6:16 AM	–	6:46 AM	–	7:16 AM	–	7:46 AM	–	8:16 AM	–	1:08 PM	4:18 PM	–	5:18 PM	–	6:18 PM
Marlborough																	
North Main St at Marlborough Town Hall	5:55 AM	6:25 AM	–	6:55 AM	–	7:25 AM	–	7:55 AM	–	8:25 AM	–	1:17 PM	4:27 PM	–	5:27 PM	–	6:27 PM
North Main St at Marlborough Park & Ride	6:00 AM	6:30 AM	–	7:00 AM	–	7:30 AM	–	8:00 AM	–	8:30 AM	–	1:22 PM	4:32 PM	–	5:32 PM	–	6:32 PM
Glastonbury																	
Main St & Hebron Ave	6:11 AM	–	6:35 AM	–	7:05 AM	–	7:35 AM	–	8:05 AM	–	8:35 AM	–	–	4:35 PM	–	5:35 PM	–
Main St & New London Tpke	6:12 AM	–	6:36 AM	–	7:06 AM	–	7:36 AM	–	8:06 AM	–	8:36 AM	–	–	4:36 PM	–	5:36 PM	–
Main St & Griswold St	6:13 AM	–	6:37 AM	–	7:07 AM	–	7:37 AM	–	8:07 AM	–	8:37 AM	–	–	4:37 PM	–	5:37 PM	–
Putnam Bridge Park & Ride	6:16 AM	–	6:40 AM	–	7:10 AM	–	7:40 AM	–	8:10 AM	–	8:40 AM	–	–	4:40 PM	–	5:40 PM	–
Hartford																	
Central Row North Side - Old State House	6:25 AM	6:45 AM	6:49 AM	7:15 AM	7:19 AM	7:45 AM	7:49 AM	8:15 AM	8:19 AM	8:45 AM	8:49 AM	1:37 PM	4:47 PM	4:49 PM	5:47 PM	5:49 PM	6:47 PM
Pearl St & Trumbull St	6:26 AM	6:46 AM	6:50 AM	7:16 AM	7:20 AM	7:46 AM	7:50 AM	8:16 AM	8:20 AM	8:46 AM	8:50 AM	1:38 PM	4:48 PM	4:50 PM	5:48 PM	5:50 PM	6:48 PM
Pearl St & Ann Uccello St	6:27 AM	6:47 AM	6:51 AM	7:17 AM	7:21 AM	7:47 AM	7:51 AM	8:17 AM	8:21 AM	8:47 AM	8:51 AM	1:39 PM	4:49 PM	4:51 PM	5:49 PM	5:51 PM	6:49 PM
Asylum St & Union Place	6:29 AM	6:49 AM	6:53 AM	7:19 AM	7:23 AM	7:49 AM	7:53 AM	8:19 AM	8:23 AM	8:49 AM	8:53 AM	1:41 PM	4:51 PM	4:53 PM	5:51 PM	5:53 PM	6:51 PM

Trips from Colchester

Extend trip start to Norwich

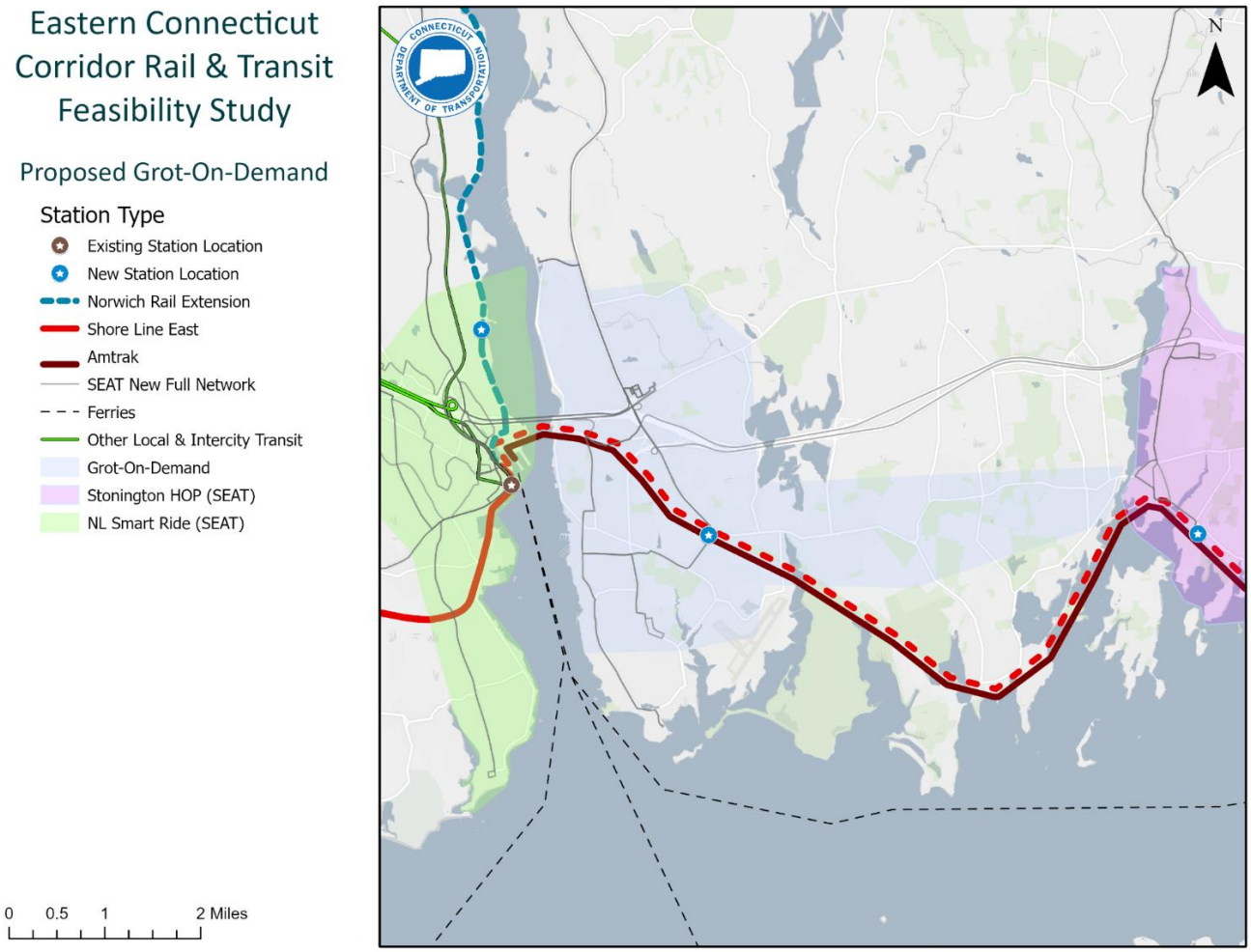
6.1.14. Grot-On-Demand (New)

As stated in other sections, there is considerable stakeholder demand, backed by demographic and travel data, that supports connecting existing Mystic/Groton destinations to each other as well as future rail services. While several services exist, their frequencies, routes, and operating hours may not completely align with specific individual needs. A strategy to address this issue could be the implementation of a microtransit system that largely includes the Route 11 corridor as well as portions of Mystic and Groton (Figure 18). This potential service, Grot-On-Demand, could operate 7 days a week, spanning 6am to 11pm on weekdays and Saturdays, 8am to 11pm on Sundays (Table 24). The service could be implemented in the short-term, by 2028, and could not be linked to the implementation of passenger rail service. Grot-On-Demand could require an additional 3 vehicles to operate service.

Table 24. Grot-On-Demand Service Elements

	Prior to Passenger Rail Service Span
Weekdays	7am to 11pm
Saturday	8am to 11pm
Sunday	8am to 11pm

Figure 18. Grot-On-Demand Strategy



6.1.15. New London Smart Ride

Another strategy for improving mobility is to extend the service hours of New London's on-demand microtransit, New London Smart Ride, from 8am to 11pm seven days a week. If Route 15 is eliminated, the implementation of extended microtransit service hours could ensure that the area retains transit coverage (Table 25). This service span change could go into effect in the short-term, by 2028 and could not be impacted by the potential implementation of passenger rail. No additional vehicles could be required.

Table 25. New London Smart Ride Service Elements

	Existing Span	2028 Span
Weekdays	8am to 8pm	8am to 11pm
Saturday	8am to 8pm	8am to 11pm
Sunday	-	8am to 11pm

6.1.16. Stonington HOP

Stonington HOP, the on-demand microtransit service available in Stonington, could extended its service hours, currently 6:30am to 7:45pm on weekdays, to 6am to 11pm on weekdays year-round to provide additional late-night coverage and align with other transit connections in the region. From Memorial Day Weekend to Labor Day, Stonington HOP could also operate from 8am to 11pm on weekends to serve the influx of seasonal travelers (Table 26). This service span change is a short-term strategy to improve regional mobility and could not need to change with the potential implementation of passenger rail. No additional vehicles could be required.

Table 26. Stonington HOP Service Elements

	Existing Span	2028 Span
Weekdays	6:30am to 7:45pm	6am to 11pm
Saturday	-	8am to 11pm*
Sunday	-	8am to 11pm*

**Seasonal: Memorial Day Weekend to Labor Day*

6.1.17. ADA Paratransit

In adherence with the service strategies identified for fixed route bus service, ADA paratransit could also include Sunday service (Table 27).

Table 27. ADA Paratransit Service Elements

	Existing Span	2028 Span
Sunday	--	7:00am to 11:00pm

6.2. Ridership, VMT, and GHG Reduction

Population growth and increased level of service contribute to the forecasted change in annual SEAT ridership by 2028, the year pre-rail fixed route and demand response transit service could be implemented. From 2023 to 2028, the study area population is anticipated to increase 0.28 percent each year[35]. Growth over this time horizon will result in a larger population base living within ¾ miles of SEAT fixed route transit, as well as within the three microtransit zones, New London, Stonington, and Groton. If SEAT expands service in 2028 in accordance with the outlined short-term strategies, the annual vehicle revenue hours could increase by nearly 54 percent. Additional service and population growth are estimated to result in 300,000 new trips annually beginning in 2028, representing 25 percent total ridership growth. Of those trips, 91 percent are associated with fixed-route service and 9 percent with demand response.

Because the dominant mode of travel in the study area is automobile, transit ridership growth would result in the reduction of vehicle miles travelled (VMT) and the emission of greenhouse gases (GHGs), as compared to current conditions. Using existing route-level ridership characteristics, transit service at the levels suggested by the identified short-term strategies is projected to reduce VMT up to 3.0 million miles annually, which equates to nearly 120 trips around the globe. CTDOT's goal of fleet electrification and SEAT's $20 million grant to electrify facilities are likely to influence SEAT's fleet composition in coming years, shifting from diesel to electric vehicles. If SEAT adopted the short-term strategies outlined in this plan, this could result in a reduction of approximately 1,200 tons of carbon dioxide annually[59]. If SEAT achieves a fifty to one hundred percent electric fleet by the time these strategies are implemented, an additional 3,100 to 6,200 ton carbon dioxide reduction could be realized.

The population of the study area is anticipated to continue climbing at a rate of 0.28 percent each year through 2035, the year passenger rail service may be slated for implementation along the NEC and Palmer Line of the Thames River Corridor. Transit service, as expressed in annual vehicle revenue hours, however, is anticipated to decrease following potential passenger rail service implementation, to compliment rather than compete with service along the Palmer Line. As a result of reduced vehicle revenue hours, 2035 transit service levels could be projected to result in 265,000 new trips annually when compared to current levels, or an approximate increase of 18 percent by 2035. Service at this level is anticipated to reduce VMT by up to 2.6 million miles annually, resulting in a reduction of 1,000 tons of carbon dioxide per year. If SEAT achieves a , assuming a 100%fifty to one hundred percent electric fleet by this time, an additional 2,800 to 5,500 tons of carbon dioxide could be abated annually.

The methodology for forecasting SEAT ridership, VMT, and GHG reduction can be found in **Exhibit E: Ridership, VMT, and GHG Reduction Forecasting Methodology**.

7. Ancillary Infrastructure and Policy Improvements

Beyond employing strategies to increase bus frequency and alter route alignments to better match ridership demand, infrastructure upgrades could increase bus speed and passenger experience. Realigning transit routes, improving intersections, and upgrading stop infrastructure are components of a multimodal strategy to improve transit accessibility to employment, commerce, and recreation within southeastern Connecticut. In addition to the strategies above, it SEAT may consider reviewing its flag policy and consolidating stops.

[35] Southeastern Connecticut Council of Governments. Southeastern Connecticut Metropolitan Transportation Plan FY 2023-2050. 2023. http://seccog.org/wp-content/uploads/2023/05/2023-2050SCCOGMTP-20230506revison.pdf

7.1. Roadway Improvements

To support the potential new bus routes and improve travel times throughout the system, there are several infrastructure elements that could be implemented along bus routes. Performing a TSP evaluation could identify opportunities to support the efficiency of new and existing bus routes. The results of a TSP evaluation could build on other roadway improvement projects; for instance, Connecticut Route 85 in Waterford is currently undergoing upgrades, including fiber optic interconnection for signals, which could also facilitate transit signal priority. Installing TSP in tandem with other upgrades could save money and reduce potential delays for riders. In addition to the TSP study, there are opportunities to improve service through installing queue jumps in high traffic areas like Mystic, Norwich, and New London and reconfiguring intersections. **Exhibit C: Route-Level Infrastructure Improvements** describes this improvement in further detail; the funding for these improvements has not been committed. Examples of roadway improvements in areas with high transit passenger utilization include: intersection signalization and crosswalk installation at bus stops along SEAT Route 1. Additionally, were Route 85 to be implemented, altering the geometry at John St. and Poquonnock Rd. could help to facilitate turning. Similarly, installing a queue jump at Long Hill Rd. and Drozdyk Dr. could facilitate more efficient operations.

7.2. Bus Stop Infrastructure Improvements

In addition to the intersection adjustments and queue jump opportunities highlighted above, increasing the visibility of and improving amenities at bus stop locations can enhance accessibility for passengers. Currently, the majority of stops along SEAT's 16 fixed-route service lack signage and amenities, even at stops with relatively higher levels of ridership (Figure 19).

At a minimum, every stop along fixed-route service should include a sign with the image of a bus, marked with the words "Bus Stop." In municipalities where parking in a bus stop is expressly prohibited – such as New London and Norwich – signage should also denote that the area is an illegal stopping zone. Including the service provider logo and contact information, as well as a QR code to SEAT's website can help passengers with wayfinding or those who have questions regarding service. Installing signage increases awareness within a community by providing a visual cue to people who might not otherwise know that transit service is provided in the area. In addition, wayfinding can help first time users navigate the transit system with confidence and assist transit operators with identifying passengers waiting for a ride.

Installing stop infrastructure beyond signage may be cost prohibitive for every route. Aligned with the Comprehensive Operations Analysis (COA) performed in 2015, the ECRTS Transit Service Plan recommends that those stops where multiple routes intersect and those with relatively higher usage rates be considered for shelter and pedestrian infrastructure upgrades. An inventory of high ridership stops and their respective amenities is found below (Table 28); stops where multiple routes intersect should be studied further to determine infrastructure installation need.

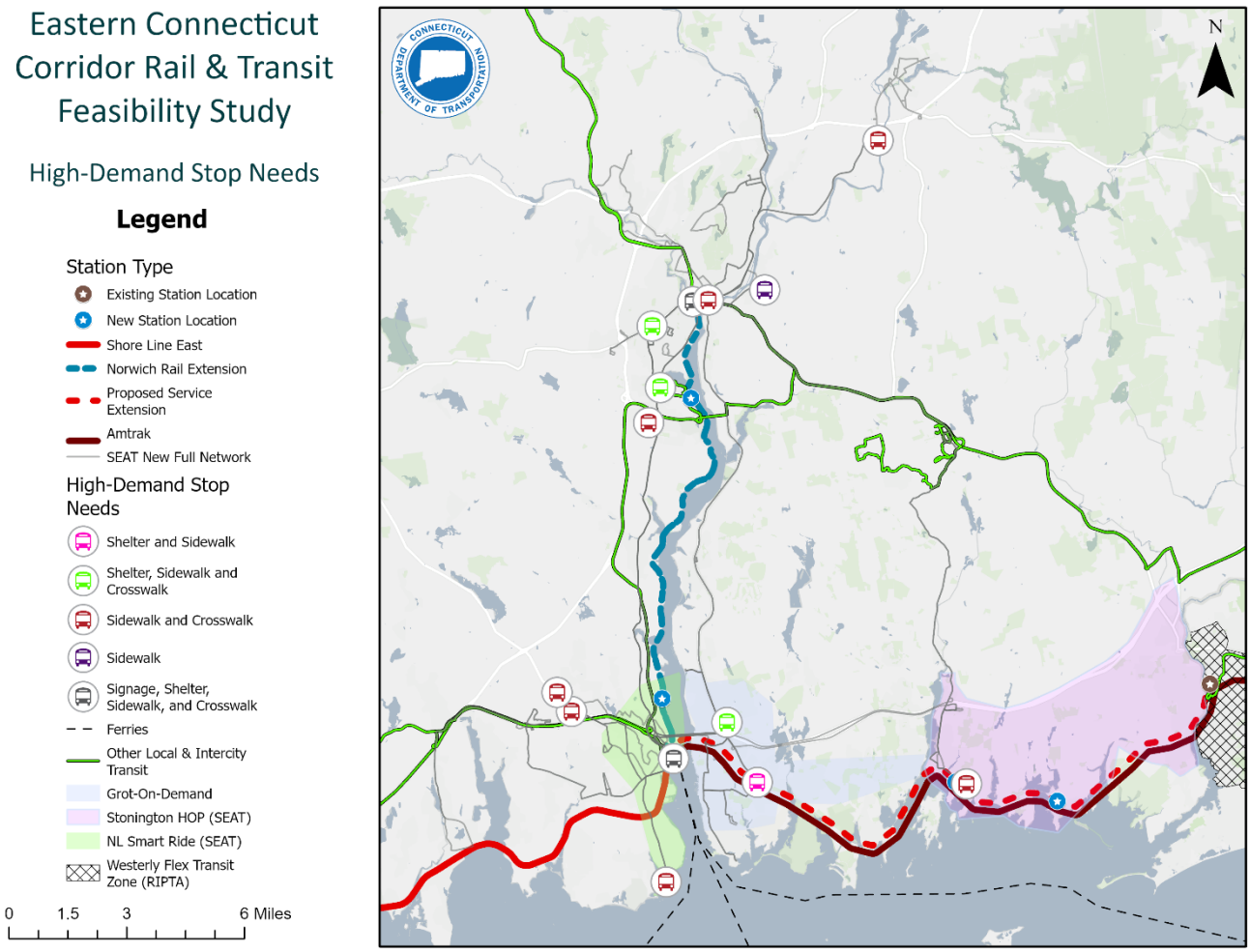
Table 28. High-Demand Stop Infrastructure Inventory

Stop	Municipality	Daily Boardings	Signage	Shelter	Sidewalk	Crosswalk
Norwich Transportation Center	Norwich	331	✓	✓	✓	✓
New London Union Station	New London	292	✓	✓	✓	✓
Mohegan Sun	Montville	162		✓	✓	✓

Stop	Municipality	Daily Boardings	Signage	Shelter	Sidewalk	Crosswalk
Lisbon Landing - Walmart	Lisbon	72			✓	✓
Groton Square	Groton	67		✓	✓	✓
Wisconsin Ave & Hilltop Rd (NB)	Norwich	59				
Poquonnock Road[36]	Groton	48		✓	✓	
Walmart/Big Y	Norwich	35			✓	✓
Waterford Commons	Waterford	31			✓	✓
Bentley Ave & Ocean Ave (EB)	New London	33			✓	✓
Franklin St & Bath St (NB)	Norwich	46			✓	✓
Montville Commons	Montville	24			✓	✓
Crystal Mall	Waterford	20			✓	✓
Marcus Plaza	Norwich	22		✓	✓	✓
NSA Supermarket	New London	18			✓	✓
Quarto Rd & Davis Pl (EB)	Norwich	17			✓	

Figure 19. High-Demand Stops and Infrastructure Needs

[36] Poquonnock Road is listed as Plaza Court is being removed and this will be the stop that replaces it.



Generally, stops with higher ridership are located at transportation stations or in commercial plazas, which are served by sidewalks and crosswalks. However, three stops with a significant number of daily boardings lack appropriate pedestrian infrastructure: Wisconsin Avenue and Hilltop Road (NB), Plaza Court, and Quarto Road and David Place. At each of these stops, it is recommended that crosswalks be installed at nearby intersections. Where financially feasible, SEAT should consider constructing shelter, seating, and system maps.

7.3. Bus Stop Inventory

A bus stop inventory involves systematically assessing and documenting the condition and features of bus stops within a particular area or jurisdiction. Data gathered from an inventory will help transportation agencies, municipalities, or bus operators to maintain and improve the quality and functionality of bus stops for the convenience and safety of passengers. Once the data is collected, it can be analyzed to identify trends, gaps, or areas requiring improvement. This analysis helps transportation agencies prioritize maintenance, upgrades, or the implementation of new bus stops. The bus stop inventory process is typically an ongoing effort, as bus stop conditions can change over time. Regular updates and re-assessments will ensure that the inventory remains accurate and up to date.

7.4. Flag Policy Review

SEAT currently has a flag policy that allows individuals waiting along bus routes to "flag" down a bus and board at any point, even if there is no formal bus stop. While this service does increase flexibility for users, it also introduces safety challenges as individuals may wait for buses in poorly lit areas or in places that are unsafe to board. Understanding the need to balance safety with flexibility, SEAT should continue working with its member communities to review the flag policy and consider its removal. If the flagging policy is removed and new permanent bus stops are established, these stops must be constructed to comply with ADA guidelines, which include a firm stable surface, a compliant landing pad, cross slope restrictions, accessible connections, and a sidewalk width of at least three feet[37]. In the future, state funding will be available to address a portion of these capital costs[38].

7.5. Stop Consolidation

While outside the scope of this study, a short-term strategy to improve speeds and bus operations could be to consider removing low-ridership and redundant bus stops. Such a process could follow the methodology below:

1. Establish baseline ridership data for each bus stop using automatic passenger counters (APCs) onboard buses by sampling passenger count data for at least one week during a typically high-volume travel month.
    a. Determine the daily average number of boardings and alightings at each stop, linking inbound and outbound pairs.
2. Identify stops that directly serve older adults or other transit-dependent populations. Additionally, conducting interviews with bus operators to identify stops beyond senior centers or subsidized housing complexes that serve these populations. These stops should not be eliminated, regardless of their redundancy or ridership.
3. Identify stops with very low ridership (fewer than 1 rider per day) and stops along a route where the abutting stop is less than ¼ mile away. These should be eliminated.
4. Solicit community review for proposed changes and incorporate feedback to finalize consolidated stop locations.

8. Cost Estimates and Revenue Forecast

8.1. Cost Estimates

Implementing new routes, improving the frequency on select routes, and increasing the span of service for SEAT operations as recommended by this report's short- and long-term strategies would incur additional annual expenses. Both operations and capital expenses could increase because of greater annual vehicle revenue hours and expanded fleet size. This increase in expenses only considers SEAT potential service expansion; increasing the length of trips to include service to Norwich on CTtransit's Colchester express route could also incur additional cost. The costs of these improvements is currently unfunded.

[37] TCRP Report 19: Guidelines for the Location and Design of Bus Stops. Transit Research Board National Research Council. 1996. https://nacto.org/docs/usdg/tcrp_report_19.pdf
[38] Connecticut Department of Transportation. Bus Stop Enhancement (BSE) Program Development. 2022. https://portal.ct.gov/-/media/OPM/NRZ/Meetings/2022/DOT-BSE_Program.pdf

Generally, federal funding for transit is provided in two forms: federal apportionments and federal grants, which include loans and loan guarantees. The Federal Transit Administration (FTA) administers annual formula grants to transit agencies nationwide, as well as discretionary grants, which are awarded to recipients based on eligibility and merit. These funds support state and local public transportation systems.

Another federal funding mechanism, the Bipartisan Infrastructure Law, was signed into law by President Biden on November 15, 2021. By authorizing $1.2 trillion in total funding over 10 years (including $550 billion in new spending during FY 2021-FY 2025), it constitutes a substantial investment in intermodal transportation and other core infrastructure in the United States. Of the $550 billion in new spending, $284 billion is dedicated to improving the surface transportation network61, including $103.5 billion dedicated to public transit projects62.

SEAT also receives state grants to support capital and operating costs, as well as local government contributions. Beyond these sources, SEAT generates revenue through fare collection and advertising,

8.1.1. Operating Cost Estimate

Vehicle revenue hours (VRH) is the most substantial factor influencing the cost of a transit system's operations. The increase in SEAT service associated with the strategies outlined in this report can be modeled as a function of the additional VRH associated with system expansion. As of 2023, the cost per vehicle revenue hour for SEAT's fixed route service was $104.12 (2023 Dollars). Implementing service at the identified strategy levels could incur $9.5M (2023 Dollars) estimated operating costs annually in 2028 and $8.9M (2023 Dollars) annually in 2035, following the potential implementation of passenger rail service (Table 29). This figure likely overestimates costs, as there are some operating costs that do not increase with additional hours of service (i.e., administrative overhead or management fees).

Table 29. Estimated Operational Cost of Additional Service, Full Fixed Route Implementation[39]

	Current	Recommended Service: Pre-Passenger Rail	Recommended Service: Post-Passenger Rail
Annual VRH	66,735	91,602	85,675
Estimated Operational Cost (2023$)	$6,948,573	$9,537,622	$8,920,507
Estimated Operational Cost Increase (2023$)	--	$2,589,049 *(+37%)*	$1,971,934 *(+28%)*

As of 2023, the cost per vehicle revenue hour for SEAT's on-demand ADA Paratransit service was $75.81 and $77.92 for microtransit service (2023 Dollars). Implementing service at the level identified in this report could incur approximately $2.8M estimated operating costs annually by 2028 and would not change with the potential addition of passenger rail service (Table 30). This figure includes ADA paratransit service expansion; in this scenario, there could be no change to weekday or Saturday service, but Sunday service could be instituted from 7am to 11pm.

[39] This is a static cost estimate. If this strategy moves forward updated cost estimates will be needed that take into account current market conditions.

Table 30. Estimated Operational Cost of Additional Service, Demand Response[40]

	Current	Recommended Service: Pre- and Post-Passenger Rail
Annual VRH	16,188 *ADA – 5,067* *Microtransit – 11,121*	35,698 *ADA – 5,899* *Microtransit – 29,799*
Estimated Operational Cost (2023$)	$1,250,671 ADA -- *$384,145* *Microtransit - $866,526*	$2,769,062 *ADA – $447,221* *Microtransit – $2,321,841*
Estimated Operational Cost Increase (2023$)	--	$1,518,391 *(+121%)*

In total, the implementation of expanded fixed route and demand response service could accrue an estimated additional $4.1M in estimated operational costs annually prior to passenger rail implementation and an estimated $3.5M annually following passenger rail implementation.

8.1.2. Capital Estimated Costs

In addition to increased operational costs, adopting the strategies outlined above could also increase capital costs in the form of bus procurement for fixed routes. As of 2021, SEAT operated 18 vehicles in maximum service with six spares. However, to adopt the outlined levels of service, SEAT could need 24 vehicles operated in maximum service, or 29 total vehicles including a 20% spare ratio, in the short term, by 2028; in the long term, by 2035, SEAT could need 23 vehicles operated in maximum service. To meet fleet growth requirements, SEAT would likely need to procure five 35-foot vehicles. The cost of a 35 foot electric bus is approximately $1.1M[41]. Acquiring five new vehicles could require an estimated $5.5M in capital investment.

Implementing a new on-demand service may also require the purchase of additional vehicles. Currently, SEAT operates five vehicles during maximum service. To meet recommended service levels, SEAT could need to allocate three additional vehicles to the newly created Grot-On-Demand program, for a total of eight vehicles operating during maximum service; procuring five total vehicles would leave two spares, a20% spare ratio.

The capital costs associated with implementing signaling and intersection improvements – TSP treatments for up to 78 intersections and 28 vehicles, queue jumps, and roadway reconfiguration – are estimated at approximately $1.7 to $2.7 million. Further study is needed to identify where specific TSP treatments and infrastructure improvements should be implemented. The estimated capital costs associated with implementing the minimum level of signage, bus shelters, sidewalks, and crosswalks at the 16 identified high ridership stops is approximately $850,000 (2023 Dollars). For all signaling, intersection, and bus stop infrastructure improvements, a comprehensive inventory of existing infrastructure should be studied in further detail, in tandem with investigations into the feasibility of TSP implementation and efforts to consolidate stops/change the flag stop policy. These cost estimates are preliminary figures and could fluctuate over time, increasing by up to 30%.

[40] This is a static cost estimate. If this strategy moves forward updated cost estimates will be needed that take into account current market conditions.
[41] Rhode Island Public Transit Authority. 2022.

Table 31. Estimated Roadway Improvement Costs[42]

Capital Item	Estimated Cost (per unit)	Units	Total Approximate Cost
Gillig 35' Electric Bus	$1,100,000	5	$5,500,000
Ford Transit Cutaway	$200,000	5	$1,000,000
TSP – Intersection[43]	$11,500 to $23,500	Up to 78	$897,000 to $1,833,000
TSP – Vehicle[44]	$5,250	Up to 28	$147,000
Queue Jump[45]	$12,500 to $17,500	Up to 10	$125,000 to $175,000
Roadway Reconfiguration (1)[46]	$500,000		$500,000
Signage[47]	$300	14	$4,200
Bus Shelter & Bench[48]	$8,500	9	$76,500
Pedestrian Improvements[49]	$250,000	3	$750,000
		Total Cost (not incl. contingency):	**$9,000,000 to $10,000,000**

The estimated capital costs associated with additional fleet vehicles, roadway improvements, and bus stop infrastructure totals $9 to $10 million (2023 Dollars) as shown in Table 31 above.

8.2. Revenue

If mobility improvement strategies are adopted, ridership growth due to population changes and service expansion is projected to yield approximately $370,000 (2023 Dollars) in additional annual SEAT fare revenue by 2028, the year short-term improvement strategies are recommended to begin. In 2035, transit service may adjust to complement the recommended transit service in the study area, resulting in a forecasted revenue increase of $335,000 (2023 Dollars) as compared to current levels.

Methodology for revenue forecasting can be found in **Exhibit F: Revenue Forecasting Methodology**.

[42] This is a static cost estimate. If this strategy moves forward updated cost estimates will be needed that take into account current market conditions.
[43] Alameda County Transportation Commission, *Transit Technology Implementation Guidance,* 2020, https://www.alamedactc.org/wp-content/uploads/2021/02/Appendix-D_Transit_Technology_Implementation_Guidance_20200824.pdf. Adjusted for inflation. *The actual cost may be higher depending on the age of technology.*
[44] City of Durham, *Transit Signal Priority Summary*, 2022. https://meadhunt.com/client/GoDurham/PlansAndStudies/TSPPlanReport.pdf. Adjusted for inflation.
[45] Alameda County Transportation Commission, *Transit Technology Implementation Guidance,* 2020, https://www.alamedactc.org/wp-content/uploads/2021/02/Appendix-D_Transit_Technology_Implementation_Guidance_20200824.pdf. Adjusted for inflation.
[46] Lump sum cost assigned for intersection improvements at John Street/Poquonnock Rd.
[47] AECOM Standard Cost Estimates, 2023.
[48] AECOM Standard Cost Estimates, 2023.
[49] Lump sum to install sidewalks in one location and crosswalks in 3 locations.

9. Rail Service Improvements

As discussed in several sections, CTDOT is also evaluating potential rail service extensions from New London to Norwich and Westerly. Below is an overview of the proposed rail service scenarios that will be supported with the bus network improvements listed in this document. The separate analysis reviewed several service plan options and there are clear preferred options for each of the corridors based on the preliminary service schedules developed, the combined forecasted ridership increase, VMT reduction, GHG abatement, and system and equipment needs. The preferred service is Option 1: SLE Extension to Westerly, RI and Option 5: Palmer Line Hybrid between New London and Norwich. Each preferred service has clear benefits as a proposed long term transit solution in the region if implemented.

Option 1: SLE Extension to Westerly, RI

The SLE Extension to Westerly, Rhode Island is the preferred service option because it reduces the issue of congestion and train storage needs in New London. While only one extension of the SLE service (to Westerly or to Norwich) can be proposed, the extension to Westerly could provide the most benefit to the train passenger by maintaining the SLE service frequency and drawing greater ridership throughout the peak and non-peak hours. This extension could allow service to remain on the Northeast Corridor, making a seamless extension to Westerly. To implement the full service, substantial barriers such as additional planning, permitting, right of way (ROW) securement, and coordination with Amtrak and the US Coast Guard could be needed.

Option 5: Palmer Line Hybrid between New London and Norwich

With the SLE Extension to Westerly, the hybrid service schedule between New London and Norwich could be the preferred service option for the Palmer Line. Even though all alternatives are challenged by the infrastructure needs and geometry of the corridor, this alternative achieved the most uniform hourly service between New London and Norwich in both peak periods. Improved SEAT bus service could support rail through operating routes that service the same destinations at alternate hours, providing could-be users greater travel flexibility. To implement passenger rail service along the Palmer Line, substantial barriers such as additional planning, ROW securement, and funding of up to $1 billion dollars to address infrastructure gaps could be needed.

10. Transit-Oriented Development

There are a variety of economic development opportunities that are associated with additional rail and improved bus service. Analysis of the region notes that opportunities include the following:

- The study area is expected to add an additional 2,000 units in the next 3 to 5 years. Many of these multifamily units will be in transit-accessible locations like New London, Groton, and Norwich.
- Investment in Rail related construction to provide new service and infrastructure in these corridors is estimated to create up to 4,500 jobs and $860 million in sales (2023 Dollars) as well as $340 million in earnings (2023 Dollars).
- Norwich has more parcels with old buildings that are susceptible to change, while Montville has more vacant parcels within 2 miles of proposed stations. Similarly, New London has more parcels with old buildings that are susceptible to change, while Groton and Stonington has more vacant parcels within 2 miles of proposed stations. As transit hubs, these opportunities for additional dense, mixed-use buildings can be accelerated by the above-discussed service improvements.

Exhibit A: Stakeholder Engagement Summary

Meetings & Stakeholder Discussions

As part of the study's public involvement plan (PIP), presentations and discussions were conducted with a diverse group of audiences including municipalities, special-interest groups, government representatives, major employers, and local communities. Presentations and discussions were conducted with six different organized groups – a Steering Committee, the Municipal Working Group, the Rail Working Group, the Transit Working Group, the Customer Focus Working Group, and the Major Employers. Strategies engaging the public have consisted of public meetings, online surveys, and focus groups centering around the topic of customer experience. Table 32 outlines the engagement that has occurred during the study to date. Table 33 lists the specific stakeholders associated with the various interest groups.

Table 32. Public Engagement Efforts

Outreach Group	Engagement	Topics
Steering Committee	• Kick-off meeting: March 2022 • Follow-up presentations and discussions: September 2022, March 2023, August 2023	Identify project goals and contribute to the establishment of a framework for future decision-making
Customer Focus Working Group	• February 2023	Equity, unmet transportation needs, access and mobility needs, safety, amenities
Municipal Working Group	• June 2022, December 2022, April 2023	Planned projects, economic development, station siting
Major Employers	• 2022-2023; 15-20 interviews	Demand for transit services, employee benefit programs (TDM), parking availability and policies, future plans, employee travel patterns
Rail Working Group	• October 2022, February 2023	Data collections, alignment options, constraints and opportunities, confirmation of capital, operating & maintenance estimates, ridership/revenue projections
Transit Working Group	• June 2022, April 2023	Unmet transportation needs, ground transportation options, equity, connectivity between systems
Public Meetings	• December 2022 in Norwich (19 attendees) and Groton (45 attendees, 5 written comments); September 2023	Introduce the public to the study and gather input on proposed improvements, including extending bus services to southeastern CT and enhancing connectivity in the transit system and between transit and rail

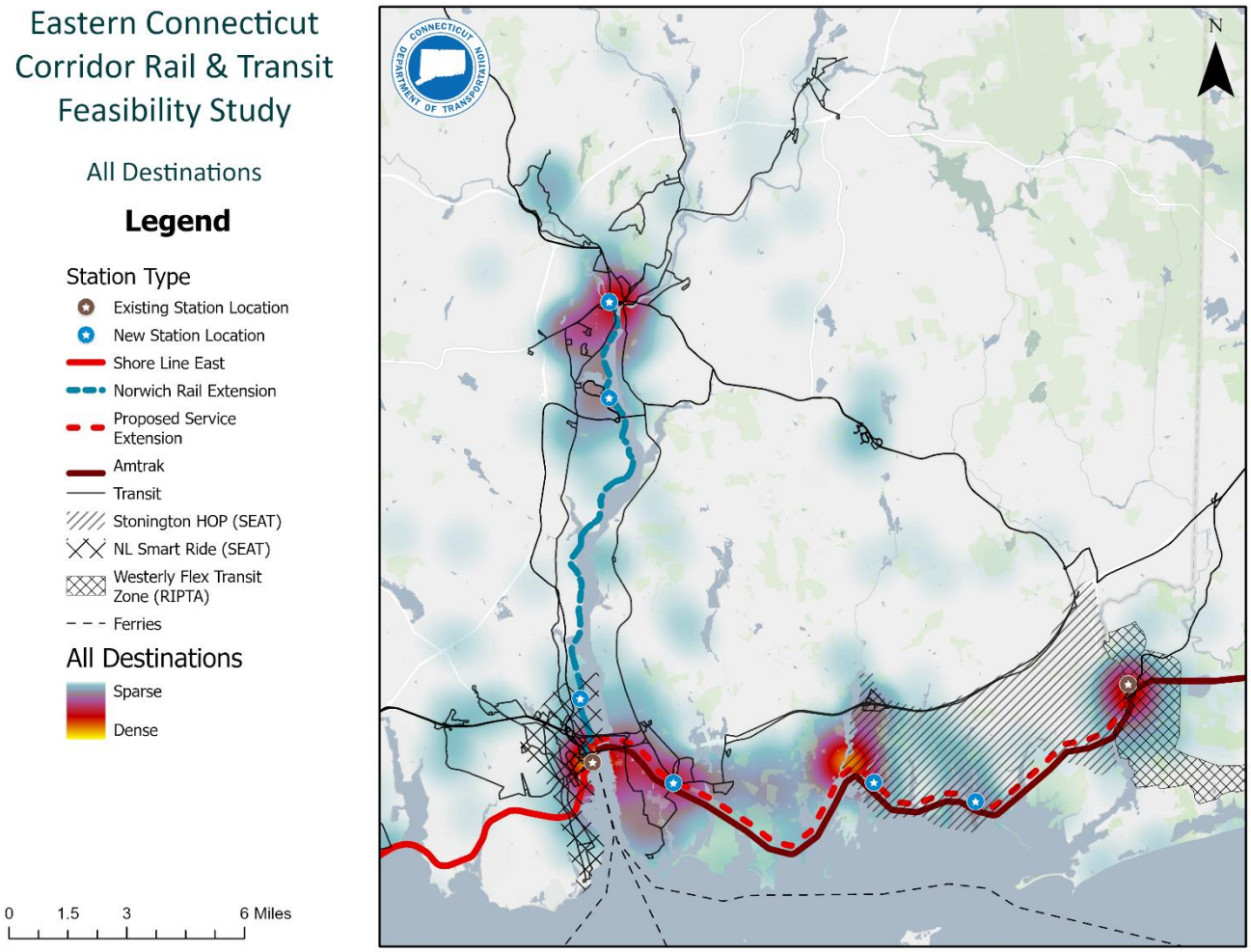
Table 33. Interest Groups and Stakeholders

	Groups	Stakeholders
Interest Groups and Stakeholders	Cyclist Interest Groups	Bike-Walk CT, Bike Groton, Bike New London
	Transportation Groups	Connecticut Commuter Rail Council, Connecticut Commuter Action Group, Eastern Connecticut Transportation Consortium, CT Transportation Future
	Environmental Groups	Audubon Connecticut, Clean Water Connecticut, Connecticut Chapter Sierra Club, Connecticut Land Conservation Council, Respective Land Trusts (Stonington, Waterford, Westerly), Rivers Alliance of Connecticut
	Educational Institutions	Connecticut College, Mitchell College, Three Rivers Community College, United States Coast Guard Academy
	Public Health Advocates	Hispanic Health Council, Disabilities Rights Connecticut
	Business Groups	Chamber of Commerce (Greater Mystic, Norwich, Eastern Connecticut, Ocean Community – RI)
	Major Employers	Groton Submarine Base, General Dynamics/Electric Boat, Pfizer, Foxwoods Resort & Casino, Mohegan Sun Casino & Resort, Hospitals
Governance Groups and Stakeholders	Town/Municipality	Bozrah, Groton (Town & City), Mystic, Ledyard, Montville, New London, Norwich, Preston, Stonington (Town & Borough), Waterford, Westerly – RI
	Tribal Nation	Mohegan Tribal Nation, Mashantucket Pequot Tribal Nation
	Council of Governments	South Central Regional Council of Governments (SCCOG)
Legislative Groups and Stakeholders	United States Senators	Senators Richard Blumenthal (CT), Chris Murphy (CT), Jack Reed (RI), Sheldon Whitehouse (RI)
	Member of Congress	Congressman Joe Courtney (CT)
	State Senator	State Senators Paul Formica (CT), Catherine Osten (CT)
	State Representatives	State Representatives Kevin Ryan (CT), Christine Conley (CT), Joe de la Cruz (CT), Heather Somers (CT), Mike France (CT), Catherine Osten (CT), Kathleen McCarty (CT), Anthony Nolan (CT), Emmett D. Riley (CT), Doug Dubitsky (CT), Greg Howard (CT), Samuel Azzinaro (RI), Brian Patrick Kennedy (RI)

Public Information Survey

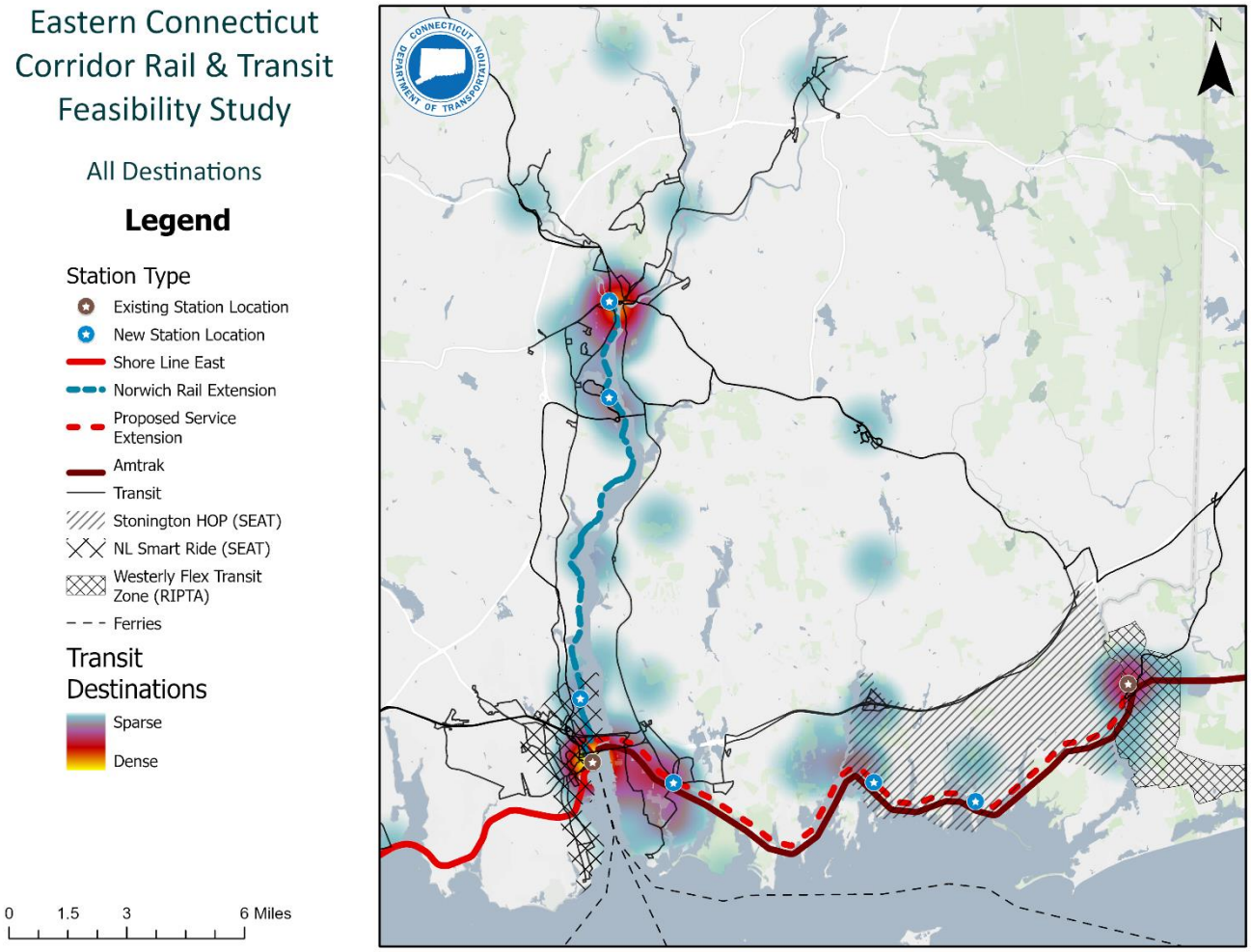
To further engage with those living in the study area, a public survey was electronically launched on December 1, 2022 in English, Spanish, Haitian Creole, and Mandarin (simplified) Chinese. The survey was advertised in print/ digital media outlets, at transit stations, on trains, and shared with transit providers, municipalities, large employers, and anchor institutions. One month later, on January 6, 2023, the survey closed with 164 complete responses. The survey asked respondents to indicate where they live, frequently travel, and the locations where they could like to see added or enhanced public transportation options – New London, Norwich, Mystic, Westerly, and Groton were the most frequently cited destinations (Figure 20).

Figure 20. High-Demand Destinations Map



Participants were also asked a series of questions related to bus transit services, passenger rail services, connectivity, and employment. Respondents indicated that they could most like to see public transit improvements in areas that largely align with high-demand destinations, including New London, Norwich, Westerly, Mystic, and Groton (Figure 21).

Figure 21. Public Transit Improvement Locations



Write-in comments related to bus service focused on improvements to bus frequency, especially during commute hours to New London, Norwich, and Groton. Respondents also noted that more service in Groton, Downtown Mystic, and to the Groton-New London Airport could be desirable.

Most respondents indicated that they use the corridor to travel outside eastern Connecticut, prefer to travel using personal vehicles, and could use the train as an alternative or second transportation option. The survey also found that:

- 83% of participants never use local bus services and 84% never use regional bus services in southeastern Connecticut.
- If transit services were improved, 67% could prefer faster trips with fewer stops and 45% could prefer to have transit services dispersed evenly throughout the day.
- 41% of respondents rated the current public transportation system's convenience of connections between all modes of transportation a two out of five, five being extremely convenient.

- The most useful public transportation amenities were Wi-fi, USB charging stations/ports/electrical outlets, restrooms, bike racks/storage, and paperless/digital ticketing and app.
- 51% of respondents indicated that they travel to work five days a week. The most common sectors include public service, business, education, engineering, and healthcare. This suggests that a large portion of workers are remote or in a hybrid-work setting.

Exhibit B: Existing Transit Services and Operations

Existing Transit Routes

Table 34 provides an overview of all current regional bus service.

Table 34. Regional Bus Service

Route	Mode	Days Operated	Description
SEAT			
Route 1	Fixed Route	Mon-Sat	Norwich to New London via Route 32 & Montville
Route 2	Fixed Route	Mon-Sat	Norwich to New London via Route 12 & Groton
Route 3	Fixed Route	Mon-Fri	New London to Niantic & Crossroads Wal-Mart
Route 4	Fixed Route	Mon-Sat	Norwich Transit Center to Occum/Taftville
Route 5	Fixed Route	Mon-Sat	Norwich Transit Center to Norwich Business Park via Backus Hospital
Route 6	Fixed Route	Mon-Sat	Norwich Transit Center to Norwich Wal-Mart via Marcus Plaza
Route 7	Fixed Route	Mon-Sat	Norwich Transit Center to Hamilton Av, Mohegan Sun & Uncas-on-Thames
Route 9	Fixed Route	Mon-Sat	Norwich Transit Center to Lisbon Landing via Route 12
Route 11	Fixed Route	Mon-Sat	Groton Local Service
Route 12	Fixed Route	Mon-Sat	New London to Crystal Mall & New London Shopping Center
Route 13	Fixed Route	Mon-Sat	New London to Lawrence + Memorial Hospital & Ocean Beach
Route 14	Fixed Route	Mon-Sat	New London to NL Mall, Waterford Commons, Crystal Mall & NL Shopping Center
Route 15	Fixed Route	Mon-Sat	New London to Mitchell College, Waterford Commons, & Crystal Mall
Route 108	Fixed Route	Mon-Sat	New London Union Station to Foxwoods via Groton & Olde Mistick Village
Route 982	Fixed Route	Mon-Sat	Norwich Transit Center to Foxwoods via SR 2.
New London Smart Ride	Demand Response	Mon-Sat	Microtransit service in the City of New London open to all users. Trips must begin and end in New London

Route	Mode	Days Operated	Description
Stonington HOP	Demand Response	Mon-Fri	Microtransit service in the town of Stonington open to all users. Trips must begin and end in Stonington
SEAT Connect	Demand Response	Mon-Sat	ADA Complementary service within ¾ mile of a SEAT fixed Route
WRTD			
Route 991	Commuter Route	Mon-Sun	Willimantic – Norwich – Foxwoods via Rt 32
9 Town Transit			
Route 643	Deviated fixed Route	Mon-Fri	Old Saybrook – East & Old Lyme – New London via Rt 1
Mashantucket Pequot Tribal Transportation (MPTT)			
Community Route	Fixed Route	Mon-Fri	MPTN reservation to Foxwoods Resort Casino, connects to SEAT Route 108 at Great Cedar Hotel
RIPTA			
95x	Express Route	Mon-Fri	Express bus between Westerly and Providence via I-95 and Park & Rides along the way
301	Deviated Fixed Route	Friday	Service from Westerly to the Richmond Stop and Shop via Route 91
Westerly Flex	Demand Response	Mon-Fri	Demand response service within Westerly

Frequency and Span

Fixed-route regional transit service generally operates with 60-minute headways or longer during weekdays, with reduced coverage on Saturdays and little-to-no coverage on Sundays. In addition to the services detailed in Table 34, SEAT also operates SEAT Connect, the ADA complementary paratransit available at the same times and locations as SEAT fixed routes. Service is only available to pre-approved customers; all trips must begin and end within ¾ mile of a SEAT fixed route and must be requested at least a day in advance. SEAT also operates Stonington HOP and New London Smart Ride, two demand response microtransit services open to the public. Each service has a designated zone and customers can request a ride via a mobile app as long as the trip begins and ends within the same zone. Trips can be reserved in advance or scheduled for an immediate pickup. The service is operated using SEAT vehicles and powered by Spare Labs, a scheduling technology platform that allows for same day curb-to-curb microtransit trips.

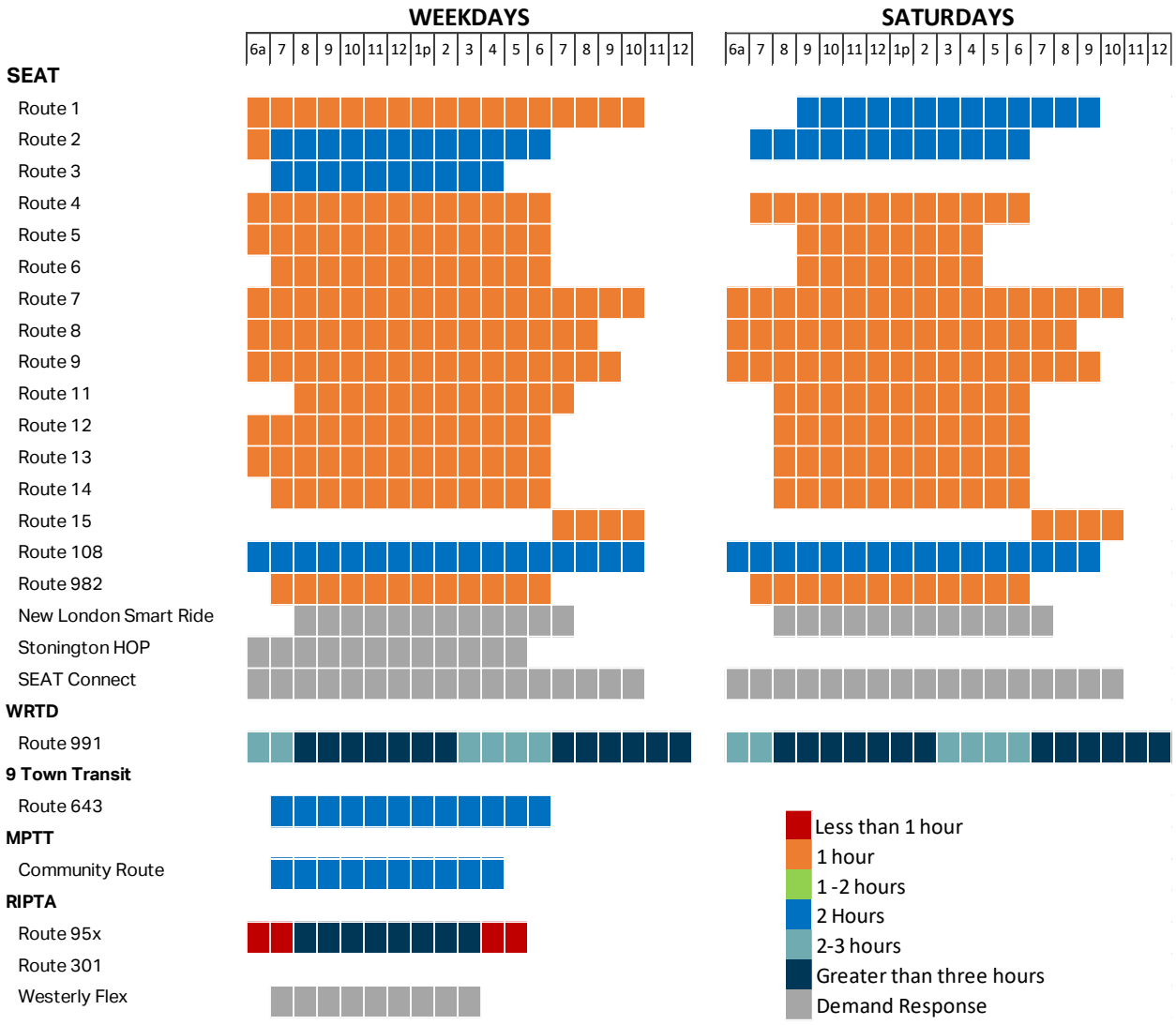
WTRD's Route 991 is the only service within the study area that operates seven days a week, with six trips daily and late-night service, with the last trip northbound departing Foxwoods Resort Casino at 12:10 am. The route is classified as a commuter route, and as such is not required to provide complementary ADA paratransit service.

River Valley Transit and RIPTA only operate during weekdays within the study area. 9 Town Transit's Route 643 operates on weekdays only, with six trips daily. It will deviate up to ¾ a mile off the route to pick up or drop off any passenger, as long as the request is made 24 hours in advance. RIPTA service in Westerly is limited to weekdays only. The 95X operates during peak hours only with service designed to bring individuals to Providence in the morning and back in the afternoon. The Route 301 is a deviated fixed route that operates on Fridays only

with two trips from Westerly to Hope Valley and one trip in the reverse direction. Westerly Flex is a point deviation demand response service that provides service within a seven square mile zone focused around downtown, but also serves a limited number of scheduled timepoints, including the Stedman Center and Salt Pond Plaza, which facilitates transfers to Flex 203, Route 14, and Route 66. All trips that do not begin at one of the scheduled timepoints must be reserved 24 hours in advance.

Mashantucket Pequot Tribal Transportation (MPTT) operates a community route around the reservation and to the Foxwoods Resort Casino approximately every two hours from 7:50 am to 3:50 pm. Passengers can transfer from the MPTT service to SEAT Route 108 at the Great Cedar Hotel, as well as the WRTD Route 991.

Figure 22. Regional Transit Frequency and Span



Connections Between Transit Providers

The Norwich Transportation Center, located on Hollyhock Island in downtown Norwich, is a regional transit hub, with eight SEAT routes and the WRTD Route 991 serving this location. SEAT routes pulse out of the Norwich Transportation Center, which aids with transfers. All routes arrive between 0:50 and 0:55 of the hour and depart on the hour. The WRTD Route 991 timing does not align with SEAT routes to facilitate transfers at the Norwich Transportation Center.

In New London, seven SEAT routes and the 9 Town Transit Route 643 converge at New London Union Station. As with the Norwich Transportation Center, service out of New London Union Station operates using a pulse with SEAT routes arriving at 0:55 of the hour and departing on the hour. Timing of the 9 Town Transit Route 643 is coordinated to allow for transfers, arriving at Union Station at 0:50 of the hour and departing on the hour.

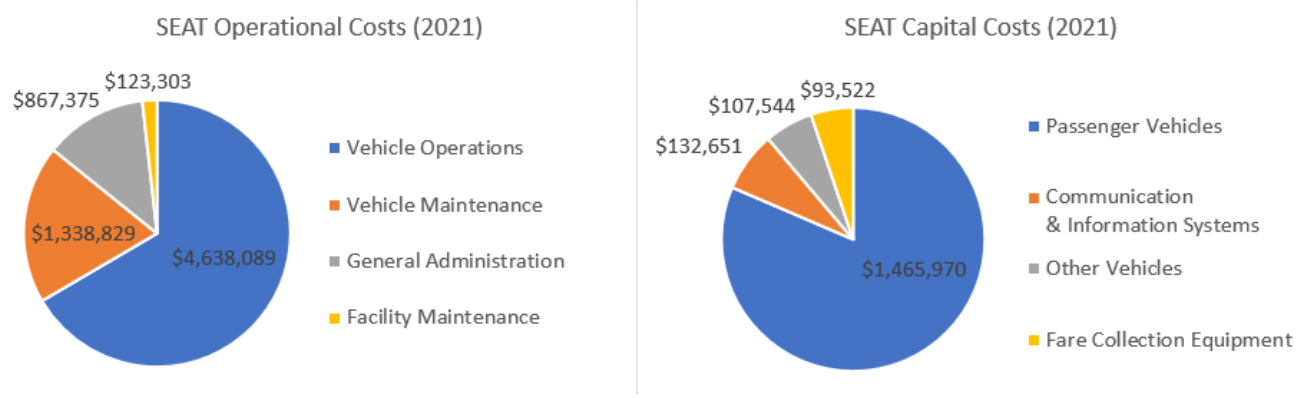
There are two routes that connect the Norwich Transportation Center with New London Union Station. SEAT Route 1 runs along Route 32 on the west side of the Thames River, and SEAT Route 2 travels along Route 12 on the east side of the river. Both routes arrive and depart New London and Norwich at the same time. There is no

bus service that runs parallel to the Northeast Corridor connecting New London to Westerly. Bus service does not cross state borders; SEAT does not enter Rhode Island and RIPTA does not enter Connecticut.

Funding

In 2021, SEAT incurred $6,967,596 in operations costs and $1,799,687 in capital costs, totaling $8,767,283 (Figure 23). Vehicle operations is the largest proportion of costs, comprising approximately two-thirds of annual operations expenses.

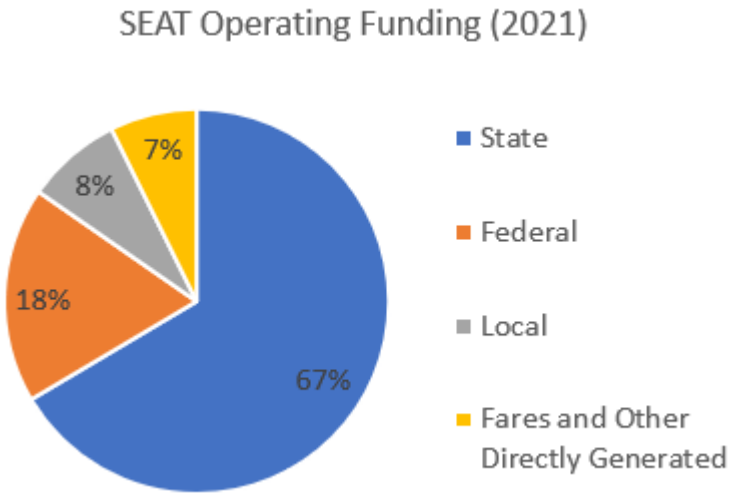
Figure 23. SEAT Operations and Capital Costs (2021)



Source: National Transit Database

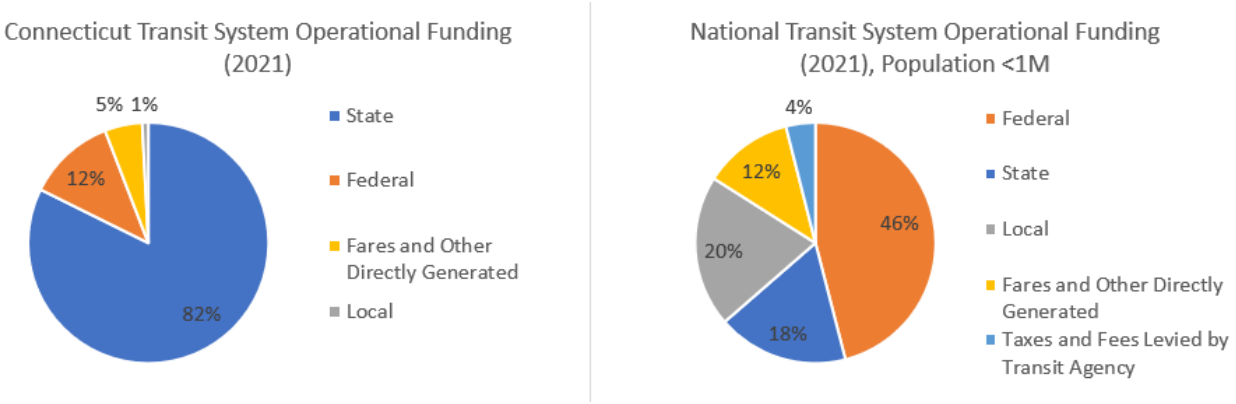
The same year, SEAT generated $509,750 in revenue: $474,746 via fare collection, $31,529 through advertising, and $3,475 through other sources. SEAT received $4,641,300 in state funding, $1,268,032 in federal funding, and $561,808 in local funding to cover operational expenses (Figure 24**Error! Reference source not found.**). In comparison to other transit systems in the Connecticut, SEAT received less funding from the state. However, SEAT collected more revenue and received more federal and local dollars as a percentage of operational expenses (Figure 25).

Figure 24. SEAT Operating Funding (2021)



Source: National Transit Database

Figure 25. State and National Transit System Operational Funding (2021)



Source: National Transit Database

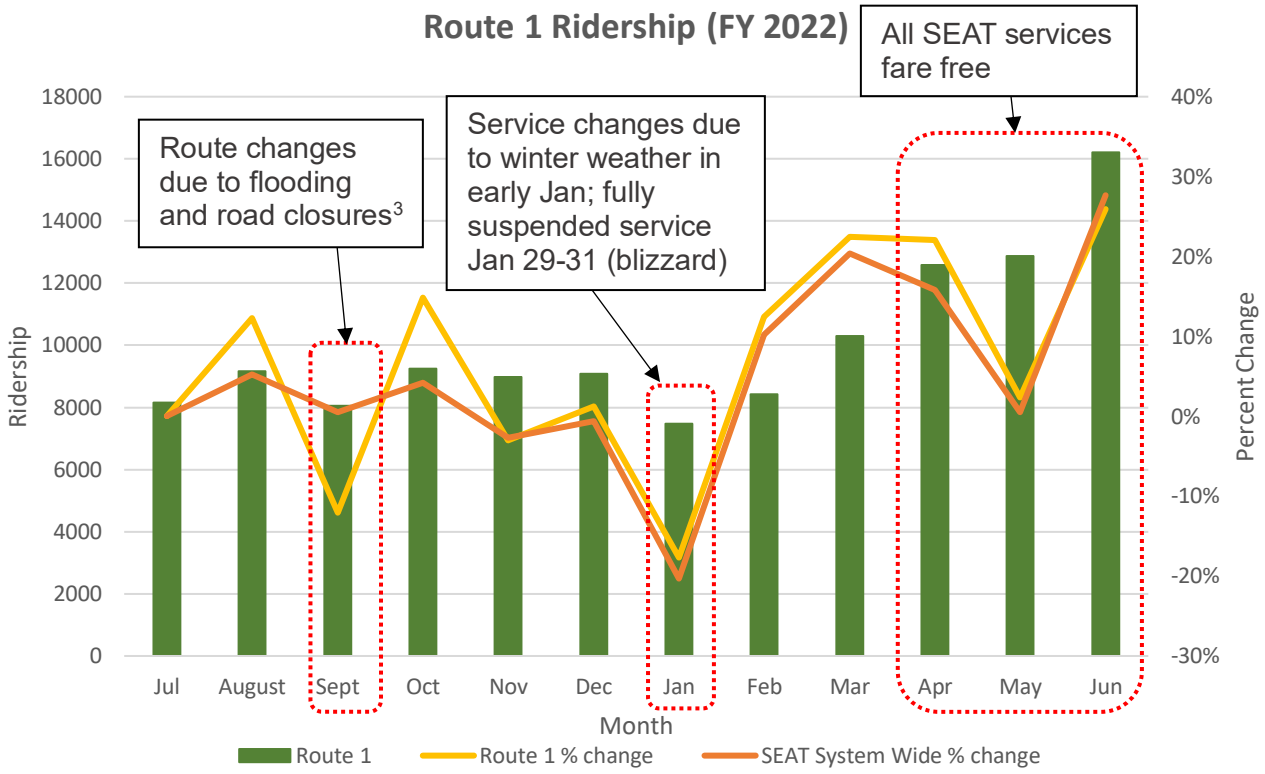
Ridership

Routes 1 and 2

SEAT's Routes 1 and 2 operate along the east and west sides of the Thames River between Norwich and New London. Route 1 has significantly greater overall ridership than Route 2 – the number of Route 1 riders ranged monthly from 8,000 to 16,000 in FY 2022, while the number of Route 2 riders ranged between 2,000 and 4,000. Ridership data on Routes 1 and 2 demonstrated a shift from generally consistent ridership between July 2021 and January 2022 to increasing ridership starting in February 2022. Both routes experienced a more pronounced drop in ridership in January 2022, which marked the lowest ridership for both routes in that fiscal year (7,480 riders for Route 1 and 1,926 riders for Route 2). Historically January has been the lowest ridership month, additionally winter weather conditions caused multiple temporary service changes and service was suspended for two days. From January to June, Route 1 saw significant monthly increases in ridership, expanding to 16,215 riders (a 53.9 percent increase from January). Route 2 saw similar increases in ridership, increasing to a peak of 3,970 passengers in April (a 51.4 percent increase from January), before experiencing a decrease May. While the trend for both routes is in line with the overall system and historical trends of monthly ridership peaking during the summer months, system-wide ridership was 15.6 percent higher than the previous year. The increase in ridership in Spring 2022 coincides with SEAT implementing Fare Free Service on April 1, 2022. Fare Free Service was discontinued as of April 1, 2023. In August 2022, systemwide fixed route ridership reached 110,930 passengers, the greatest monthly ridership since August 2012. The month following fare reinstatement, ridership fell nearly 20 percent compared to the fare free annual average.

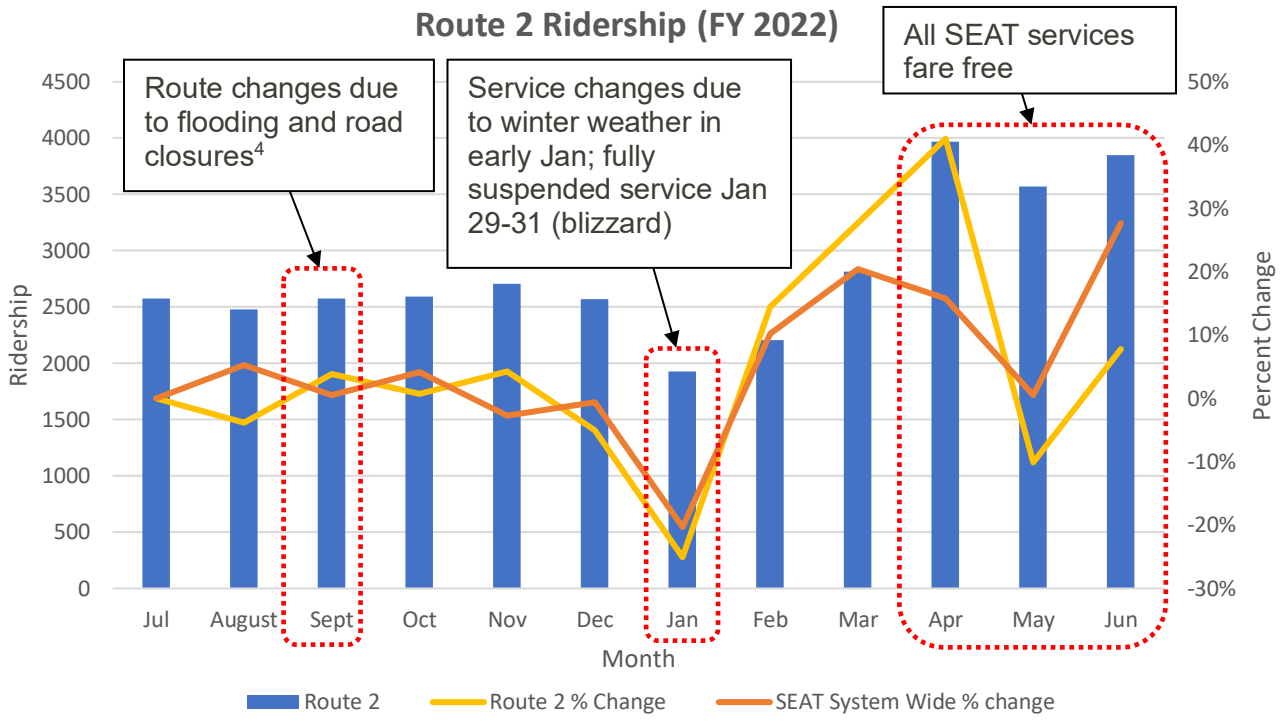
A comparison of Routes 1 and 2 ridership data with systemwide SEAT data shows mostly consistent trends in the month-to-month percent changes in ridership. Variations are most apparent between Route 1 and systemwide ridership from August to October 2021, and between Route 2 and systemwide ridership from April to June 2022. There are no clear causes of these variations. Figure 26 and Figure 27 illustrate ridership on both routes, and Figure 28 and Figure 29 provide a spatial overview of ridership on both routes.

Figure 26. Route 1 Ridership FY22



[3] Routing changes due to flooding for 2 days on Route 1 (not 2): service on Route 32 instead of NL Turnpike, and on Scotch Cap and Richards Grove instead of Old Norwich Rd

Figure 27. Route 2 Ridership FY22



[4] Routing changes due to flooding did not impact Route 2

Key Findings:

Route 1 ridership is over 250% greater than Route 2 ridership

Significant drop in ridership on both routes and throughout all SEAT routes in January 2022, possibly due to winter weather-related service changes and suspensions

Ridership on both routes (and in the whole system) increased after March 2022 to unprecedented high levels

All SEAT services were fare free during April, May, and June 2022 (fare free services ended April 1, 2023)

Figure 28. Route 1 Ridership

Eastern Connecticut Corridor Rail & Transit Feasibility Study

SEAT Route 1

Legend

Exisitng Stations
- Shore Line East & Amtrak Station

Rail Lines
- Existing Passenger Rail
- Possible Norwich Rail - Palmer Line

Transit Routes
- SEAT — Route 1
- All Other Fixed Transit Routes
- High Ridership Activity
- Low Ridership Activity
- # Major Institutions
- ## Top 3 Ridership Stops

Between October 2019 and July 2022, ridership on Route 1 increased from **10,255** to **15,185** riders. In the context of the total SEAT bus system, the percentage of SEAT riders using Route 1 increased from 13% to 20%.

At New London Union Station, total ridership decreased between Oct 2019 and July 2022.

In 2019, 10% of boardings and 10% of alightings could not be assigned to a stop. In 2022, this increased to 26% of boardings and 34% of alightings.

0 0.75 1.5 3 Miles

Source: SEAT; Mashuntucket Pequot Tribal Transportation; WRTD; 9 Town Transit; Greyhound; AECOM Analysis

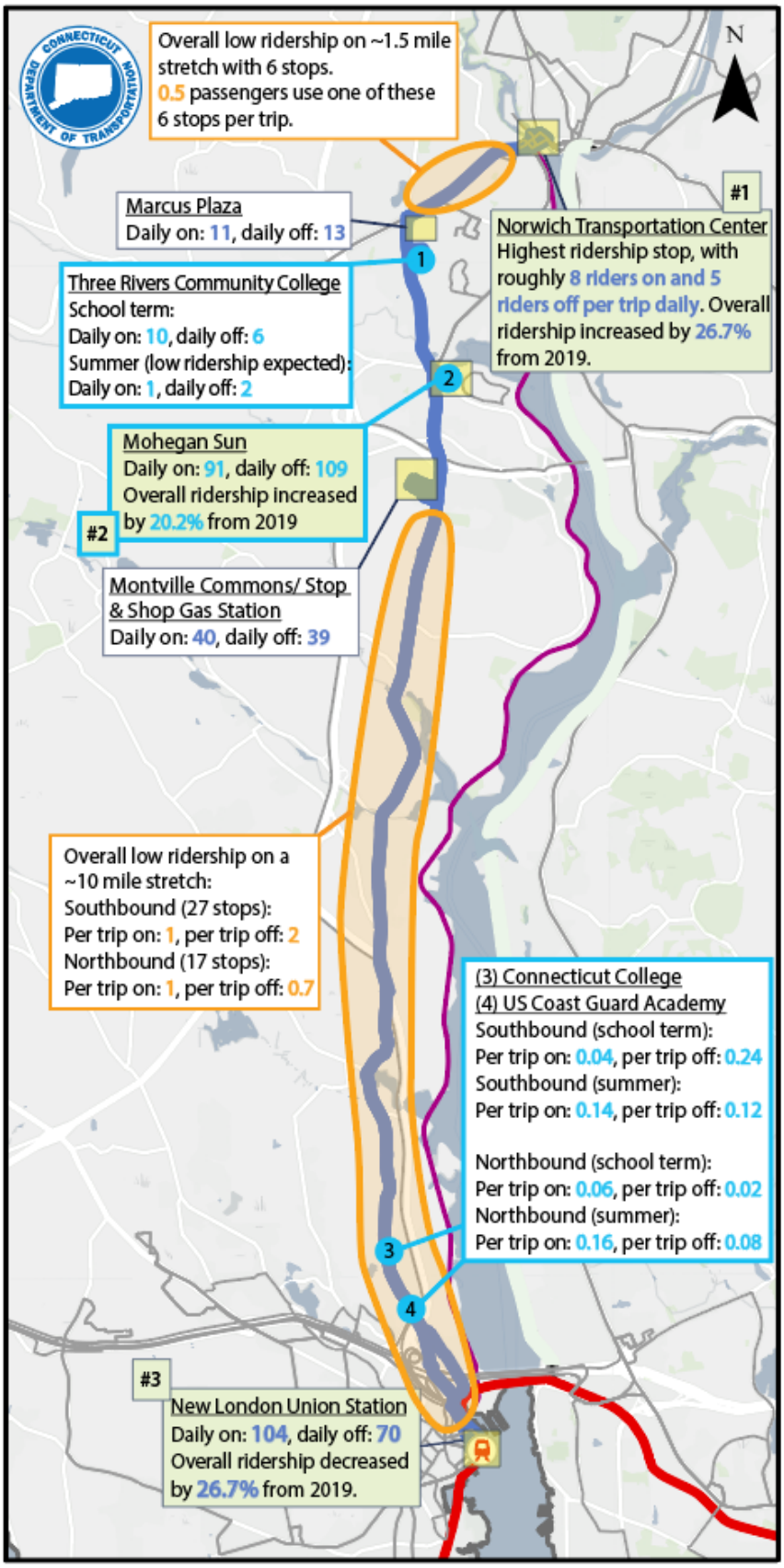
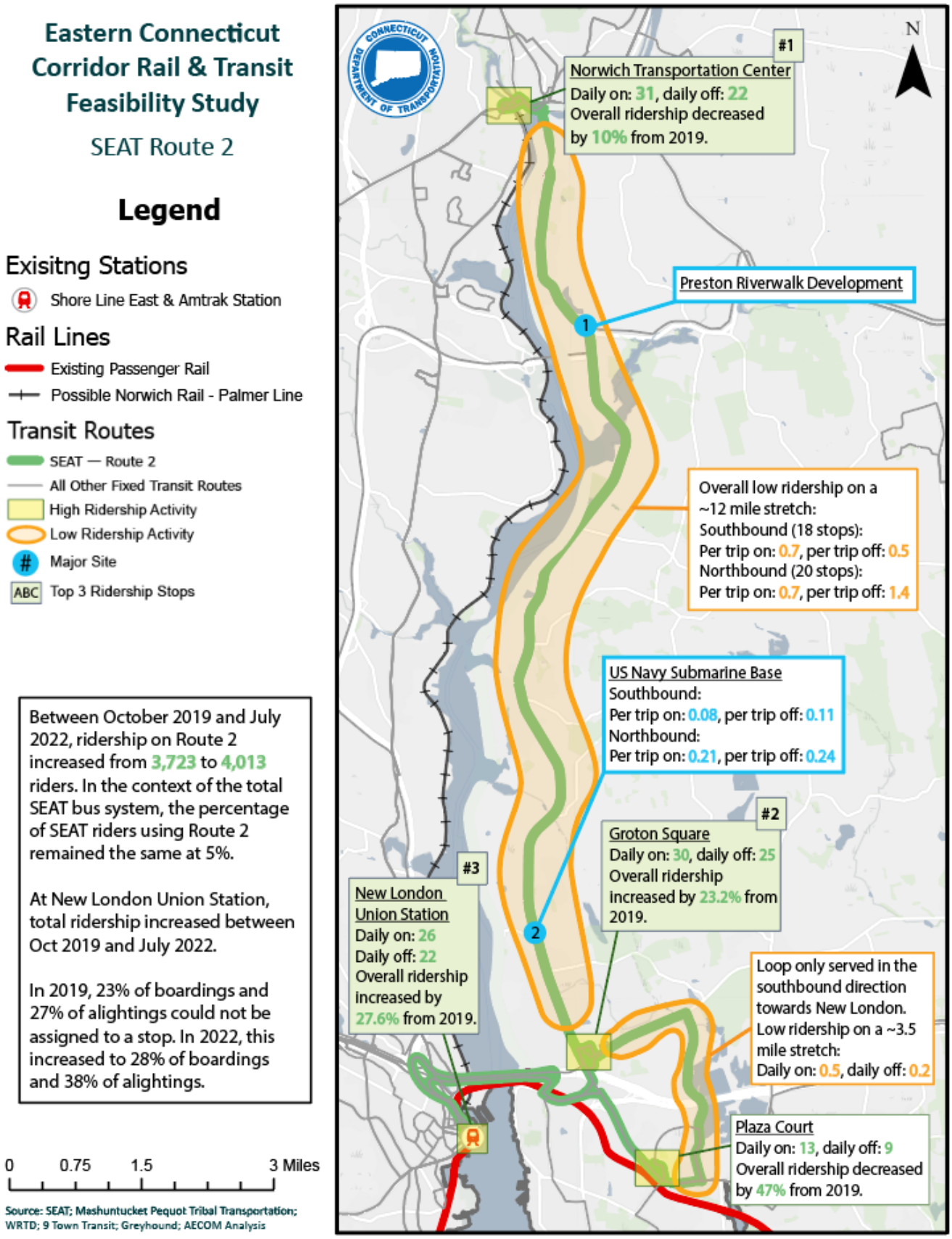


Figure 29. Route 2 Ridership

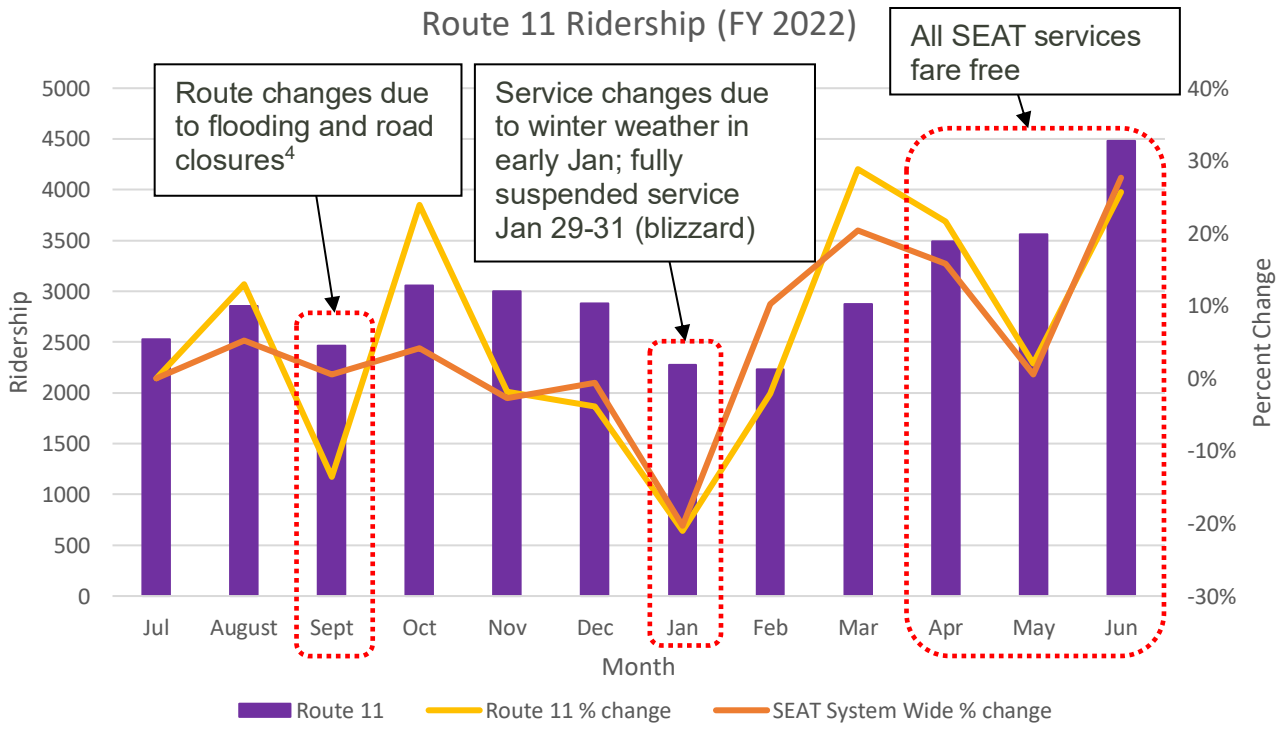


Route 11

Route 11 operates as a circulator route within Groton, stopping at Groton Square, Plaza Court, and UConn Avery Point, as well as near Pfizer and General Dynamics Electric Boat. The number of Route 11 riders ranged monthly from 2,200 to 4,500 in FY 2022, and the ridership trends follow similar patterns to those of Routes 1 and 2. The lowest ridership was in January and February 2022, when winter weather service changes and interruptions on Route 1 likely impacted Route 11 ridership. After February, the route saw significant monthly increases through June 2022 when ridership expanded to 4,479 riders (a 50.2 percent increase from February). A comparison of Routes 11 ridership data with systemwide SEAT data shows mostly consistent trends in the month-to-month percent changes in ridership. Variations are most apparent between Route 11 and systemwide ridership from August to October 2021. There are no clear causes of these variations. Figure 30 graphs Route 11 ridership in FY 2022.

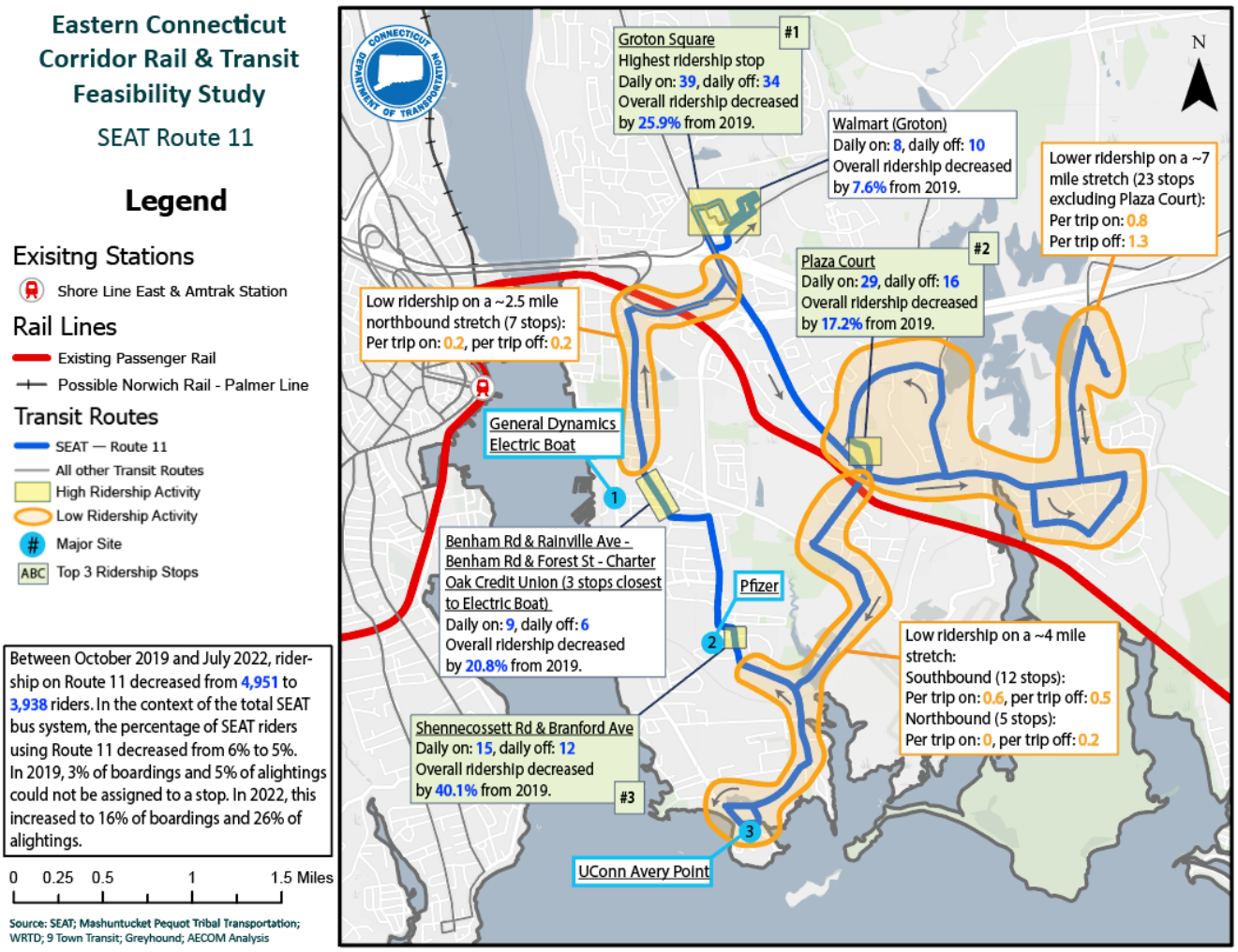
Nearly 15 miles of the route are characterized by low ridership, and high ridership stops (Groton Square, Plaza Court, Walmart, Pfizer, and Electric Boat) have seen decreases in ridership between 2019 and 2022 averaging 22.3 percent. The route as a whole has seen a one percent decrease in ridership between 2019 and 2022. Figure 31 illustrates ridership distribution on Route 11.

Figure 30. Route 11 Ridership FY 2022



[4] Routing changes due to flooding did not impact Route 11 directly, although changes on Route 1 could impact 11

Figure 31. Route 11 Ridership



Key Findings:

Route 11 ridership is 238% lower than Route 1 ridership and 5% greater than Route 2 ridership

Significant drop in ridership on Route 11 in January 2022 (consistent with SEAT's overall fixed route ridership), likely related to winter weather service changes and interruptions

An additional 2% ridership drop in February on Route 11 (not consistent with SEAT's overall 10% ridership increase in February)

Ridership on Route 11 (and in the whole system) increased after February 2022 to unprecedented high levels

All SEAT services were fare free during April, May, and June 2022 (fare free services ended April 1, 2023)

Exhibit C: Route-Level Infrastructure Improvements

While it is recommended that the entire network should have a bus stop audit and TSP-opportunity evaluation, there are several routes that have specific infrastructure improvement needs.

Route 1

As stated earlier, Route 1 is the existing system's most-utilized route. Additionally, service changes proposed in section 6.1.1 will shorten travel times and allow the route to supplement future rail service. The route is intended to function as a regional commuter/express route and there are several BRT-lite elements that can be implemented to support it.

- At all four hubs, install enhanced bus stops that include heated bus shelters, benches, real-time bus signage and queue jump lanes.
- The Connecticut College/Coast Guard Academy Bus Stops should be located near a signalized intersection located next to a crosswalk as Route 32 is a major road.

Route 32

Given that Route 32 is designed to serve seasonal visitors, bus stop amenities should focus on communicating where stops are and when the next bus will arrive. This means that each stop should include the following:

- Shelter
- Bench
- Clear signage regarding scheduled bus departures from each stop
- Wayfinding to destinations

Route 85

Route 85 needs a series of infrastructure investments ranging from road geometry, signal priority investments and stop upgrades. The current road geometry at the eastern point of John Street and Poquonnock Road as the current configuration couldn't allow left turns. Reconfiguring the intersection could allow buses to turn. Alternatively, allowing John Street to run two way could allow buses to make the left turn. Additionally, a queue jump at Long Hill Road and Drozdyk Drive could help buses making stops jump to the front of cars waiting at the light.

Route 108

Route 108 will benefit from many of the already-proposed improvements in New London. As with the Mystic Shuttle and Route 1, this service will benefit from BRT-lite improvements like sheltered stops, benches, and signage.

Exhibit D: Transit Schedules

Route 1E: Prior to Passenger Rail Implementation

Norwich Transportation Center	Mohegan Sun	New London Union (Arrive)	New London Union (Depart)	Mohegan Sun	Norwich Transportation Center
			6:30	7:05	7:20
6:30	6:48	7:23	7:30	8:05	8:20
7:30	7:48	8:23	8:30	9:05	9:20
8:30	8:48	9:23	9:30	10:05	10:20
9:30	9:48	10:23	10:30	11:05	11:20
10:30	10:48	11:23	11:30	12:05	12:20
11:30	11:48	12:23	12:30	13:05	13:20
12:30	12:48	13:23	13:30	14:05	14:20
13:30	13:48	14:23	14:30	15:05	15:20
14:30	14:48	15:23	15:30	16:05	16:20
15:30	15:48	16:23	16:30	17:05	17:20
16:30	16:48	17:23	17:30	18:05	18:20
17:30	17:48	18:23	18:30	19:05	19:20
18:30	18:48	19:23	19:30	20:05	20:20
19:30	19:48	20:23	20:30	21:05	21:20
20:30	20:48	21:23	21:30	22:05	22:20
21:30	21:48	22:23			

Blue denotes no weekend service.

Route 2

Norwich Transportation Center	Crystal Lake Dr	Groton Square (Arrive)	Groton Square (Depart)	Crystal Lake Dr	Norwich Transportation Center
6:00	6:20	6:30	7:21	7:28	7:53
7:00	7:20	7:30	8:21	8:28	8:53
8:00	8:20	8:30	9:21	9:28	9:53
9:00	9:20	9:30	10:21	10:28	10:53
10:00	10:20	10:30	11:21	11:28	11:53
11:00	11:20	11:30	12:21	12:28	12:53
12:00	12:20	12:30	13:21	13:28	13:53
13:00	13:20	13:30	14:21	14:28	14:53
14:00	14:20	14:30	15:21	15:28	15:53
15:00	15:20	15:30	16:21	16:28	16:53
16:00	16:20	16:30	17:21	17:28	17:53
17:00	17:20	17:30	18:21	18:28	**18:53**
18:00	18:20	18:30	---	---	---

Blue denotes no weekend service.

Grey demotes no Sunday service.

Route 32: Prior to Passenger Service Implementation

Olde Mistick Village	Greenmanville/Rossie	Mystic Station (Arrive)	Mystic Station (Depart)	Greenmanville/Rossie	Olde Mistick Village
8:00	8:06	8:12	8:12	8:19	8:27
8:30	8:36	8:42	8:42	8:49	8:57
9:00	9:06	9:12	9:12	9:19	9:27
9:30	9:36	9:42	9:42	9:49	9:57
10:00	10:06	10:12	10:12	10:19	10:27
10:30	10:36	10:42	10:42	10:49	10:57
11:00	11:06	11:12	11:12	11:19	11:27
11:30	11:36	11:42	11:42	11:49	11:57
12:00	12:06	12:12	12:12	12:19	12:27
12:30	12:36	12:42	12:42	12:49	12:57
13:00	13:06	13:12	13:12	13:19	13:27
13:30	13:36	13:42	13:42	13:49	13:57
14:00	14:06	14:12	14:12	14:19	14:27
14:30	14:36	14:42	14:42	14:49	14:57
15:00	15:06	15:12	15:12	15:19	15:27
15:30	15:36	15:42	15:42	15:49	15:57
16:00	16:06	16:12	16:12	16:19	16:27
16:30	16:36	16:42	16:42	16:49	16:57
17:00	17:06	17:12	17:12	17:19	17:27
17:30	17:36	17:42	17:42	17:49	17:57
18:00	18:06	18:12	18:12	18:19	18:27
18:30	18:36	18:42	18:42	18:49	**18:57**

Route 32 runs seasonally, from Labor Day to Memorial Day.

Route 32: Following Passenger Rail Implementation

Olde Mistick Village	Greenmanville/Rossie	Mystic Station (Arrive)	Mystic Station (Depart)	Greenmanville/Rossie	Olde Mistick Village
			8:20	8:30	8:38
8:40	8:46	8:55	9:00	9:10	9:18
9:00	9:06	9:15	9:20	9:30	9:38
9:40	9:46	9:55	10:00	10:10	10:18
10:00	10:06	10:15	10:20	10:30	10:38
10:20	10:26	10:35	10:40	10:50	10:58
10:40	10:46	10:55	11:00	11:10	11:18
11:00	11:06	11:15	11:20	11:30	11:38
11:20	11:26	11:35	11:40	11:50	11:58
11:40	11:46	11:55	12:00	12:10	12:18
12:00	12:06	12:15	12:20	12:30	12:38
12:20	12:26	12:35	12:40	12:50	12:58
12:40	12:46	12:55	13:00	13:10	13:18
13:00	13:06	13:15	13:20	13:30	13:38
13:20	13:26	13:35	13:40	13:50	13:58
13:40	13:46	13:55	14:00	14:10	14:18
14:00	14:06	14:15	14:20	14:30	14:38
14:20	14:26	14:35	14:40	14:50	14:58
14:40	14:46	14:55	15:00	15:10	15:18
15:00	15:06	15:15	15:20	15:30	15:38
15:20	15:26	15:35	15:40	15:50	15:58
15:40	15:46	15:55	16:00	16:10	16:18
16:00	16:06	16:15	16:20	16:30	16:38
16:20	16:26	16:35	16:40	16:50	16:58
16:40	16:46	16:55	17:00	17:10	17:18
17:00	17:06	17:15	17:20	17:30	17:38
17:20	17:26	17:35	17:40	17:50	17:58
17:40	17:46	17:55	18:00	18:10	18:18
18:20	18:26	18:35	18:40	18:50	18:58
19:00	19:06	19:15			

Route 32 runs seasonally, from Labor Day to Memorial Day.

Route 76

Branford Manor	Groton Square	New London Union (Arrive)	New London Union (Depart)	Groton Square	Branford Manor
			7:32	7:47	8:07
7:10	7:32	7:47	8:32	8:47	9:07
8:10	8:32	8:47	9:32	9:47	10:07
9:10	9:32	9:47	10:32	10:47	11:07
10:10	10:32	10:47	11:32	11:47	12:07
11:10	11:32	11:47	12:32	12:47	13:07
12:10	12:32	12:47	13:32	13:47	14:07
13:10	13:32	13:47	14:32	14:47	15:07
14:10	14:32	14:47	15:32	15:47	16:07
15:10	15:32	15:47	16:32	16:47	17:07
16:10	16:32	16:47	17:32	17:47	18:07
17:10	17:32	17:47	18:32	18:47	19:07
18:10	18:32	18:47	19:32	19:47	20:07
19:10	19:32	19:47			

Blue denotes no weekend service.
Grey demotes no Sunday service.

Route 85

Groton Square	Electric Boat	UConn Avery Point (Arrive)	UConn Avery Point (Depart)	Electric Boat	Groton Square
6:02	6:17	6:23	6:30	6:36	6:51
6:32	6:47	6:53	7:00	7:06	7:21
7:02	7:17	7:23	7:30	7:36	7:51
7:32	7:47	7:53	8:00	8:06	8:21
8:02	8:17	8:23	8:30	8:36	8:51
8:32	8:47	8:53	9:00	9:06	9:21
9:02	9:17	9:23	9:30	9:36	9:51
9:32	9:47	9:53	10:00	10:06	10:21
10:02	10:17	10:23	10:30	10:36	10:51
10:32	10:47	10:53	11:00	11:06	11:21
11:02	11:17	11:23	11:30	11:36	11:51
11:32	11:47	11:53	12:00	12:06	12:21
12:02	12:17	12:23	12:30	12:36	12:51
12:32	12:47	12:53	13:00	13:06	13:21
13:02	13:17	13:23	13:30	13:36	13:51
13:32	13:47	13:53	14:00	14:06	14:21
14:02	14:17	14:23	14:30	14:36	14:51
14:32	14:47	14:53	15:00	15:06	15:21
15:02	15:17	15:23	15:30	15:36	15:51
15:32	15:47	15:53	16:00	16:06	16:21
16:02	16:17	16:23	16:30	16:36	16:51
16:32	16:47	16:53	17:00	17:06	17:21
17:02	17:17	17:23	17:30	17:36	17:51
17:32	17:47	17:53	18:00	18:06	18:21
18:02	18:17	18:23	18:30	18:36	**18:51**
18:32	18:47	18:53	19:00	19:06	19:21
19:02	19:17	19:23	19:30	19:36	**19:51**

Blue denotes no weekend service.

Grey denotes no Sunday service.

Route 108

New London Union	Olde Mistick Village	Great Cedar Hotel (Arrive)	Great Cedar Hotel (Depart)	Olde Mistick Village	New London Union
			6:00	6:25	6:55
6:00	6:30	6:55	7:00	7:25	7:55
7:00	7:30	7:55	8:00	8:25	8:55
8:00	8:30	8:55	9:00	9:25	9:55
9:00	9:30	9:55	10:00	10:25	10:55
10:00	10:30	10:55	11:00	11:25	11:55
11:00	11:30	11:55	12:00	12:25	12:55
12:00	12:30	12:55	13:00	13:25	13:55
13:00	13:30	13:55	14:00	14:25	14:55
14:00	14:30	14:55	15:00	15:25	15:55
15:00	15:30	15:55	16:00	16:25	16:55
16:00	16:30	16:55	17:00	17:25	17:55
17:00	17:30	17:55	18:00	18:25	18:55
18:00	18:30	18:55	19:00	19:25	19:55
19:00	19:30	19:55	20:00	20:25	20:55
20:00	20:30	20:55	21:00	21:25	21:55
21:00	21:30	21:55	22:00	22:25	22:55

Blue denotes no weekend service.

Route 123

New London Union	L&M Hospital	Ocean Beach (Arrive)	Ocean Beach (Depart)	L&M Hospital	New London Union
6:51	7:00	7:09	7:11	7:20	7:29
7:51	8:00	8:09	8:11	8:20	8:29
8:51	9:00	9:09	9:11	9:20	9:29
9:51	10:00	10:09	10:11	10:20	10:29
10:51	11:00	11:09	11:11	11:20	11:29
11:51	12:00	12:09	12:11	12:20	12:29
12:51	13:00	13:09	13:11	13:20	13:29
13:51	14:00	14:09	14:11	14:20	14:29
14:51	15:00	15:09	15:11	15:20	15:29
15:51	16:00	16:09	16:11	16:20	16:29
16:51	17:00	17:09	17:11	17:20	17:29
17:51	18:00	18:09	18:11	18:20	18:29
18:51	19:00	19:09	19:11	19:20	19:29

Blue denotes no weekend service.

Grey denotes no Sunday service.

Exhibit E: Ridership, VMT, and GHG Reduction Forecasting Methodology

Ridership

Fixed route:

- Established trips per capita: current ratio of annual trips to population within a 3/4 mile of existing fixed route service.
- Established trips per vehicle revenue hour: current ratio of annual trips to vehicle revenue hours.
- Used projected population growth within a ¾ mile of proposed fixed route service by the anticipated year of implementation and trips per capita to calculate anticipated ridership growth.
- Used proposed fixed route service vehicle revenue hours and trips per vehicle revenue hour to calculate anticipated ridership growth.
- Averaged population growth driven ridership estimate with the vehicle revenue hour driven ridership estimate.

Demand response:

- Estimated the population of disabled individuals living within ¾ mile of existing fixed route service using US Census Data.
- Established trips per capita: current ratio of annual trips to population living within microtransit service area in Stonington, microtransit service area in New London, and population of disabled individuals within fixed route service area.
- Established trips per vehicle area: current ratio of annual trips to vehicle revenue hours.
- Used projected population growth (new service area in Groton, microtransit service in New London/Stonington, and among disabled individuals living within ¾ mile of new routes) by the year of anticipated service and the trips per capita to calculate anticipated ridership growth.
- Used proposed demand response vehicle revenue hours and trips per vehicle revenue hour to calculate anticipated ridership growth.
- Averaged population driven ridership estimate with the vehicle revenue hour driven ridership estimate.

VMT

- Determined route-level characteristics:
    - Used APC data from July 2022 to determine the proportion of passengers along each SEAT route, relative to total ridership.
    - Used NTD monthly ridership data to determine the proportion of passengers using ADA paratransit and microtransit services, relative to total demand response ridership.
    - Estimated ridership proportions of new routes based on the composition of replaced routes or adjacent routes.
        - Microtransit service was estimated to be evenly split among service areas.
    - Identified the length of each route, one-way.

- Multiplied route-level ridership proportions by the anticipated ridership growth to determine the total number of new trips along a given route.
- Multiplied the new number of trips for each given route by the one-way length of the route to calculate VMT.

Note: This method of forecasting likely results in an over-estimate of VMT, as this assumes a passenger rides along a route for its entire duration or travels the full length of the service area for a given microtransit trip.

GHG Reduction

The emissions reductions from each scenario represent the reduction in VMT with the switch to transit, assuming an all-diesel fleet. Reduced vehicle emissions are calculated from Argonne National Lab's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool with the vehicles modeled as passenger cars that run on gasoline. The AFLEET model includes emissions from the entire well-to-wheel process, including extraction, refining, storage, transportation, and usage in a vehicle. This well-to-wheel analysis thoroughly evaluates the emissions avoided from the entire chain of reducing VMT. The emissions themselves are split into greenhouse gas emissions and criteria pollutants. Greenhouse gases trap heat in the atmosphere and includes emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) and results are shown in short tons.

Data sources:

- APC. SEAT Passenger Counts. July 2022.
- National Transit Database. 2023 Complete Monthly Ridership (with Adjustments and Estimates).
- US Census Bureau. 2021 American Community Survey 5-Year Estimates.
- Argonne National Lab. Alternative Fuel Life-Cycle Environmental and Economic Transportation Tool.

Exhibit F: Revenue Forecasting Methodology

Fixed Route Revenue

- Used FY 2020 NTD data for SEAT's bus service to determine the average fare per trip by dividing the reported fare revenue for by number of unlinked trips. An average fare per trip was calculated to project future revenue associated with growth rather than using the 2023 SEAT fares. This is because passengers can purchase multiple types of tickets, including those that offer savings by buying tickets associated with a specific time period rather than number of rides, such as a 31-day unlimited pass.
    - SEAT offered fare free rides beginning March 19, 2020, through the end of the fiscal year. Dividing the total number of trips in FY 2020 by the total revenue collected could yield an average fare lower than the true cost of an average trip during the period when fares were being collected.
    - To reflect an accurate average fare per trip, monthly trip counts were used to subtract out the approximately 141,000 trips taken during the fare free period from the annual total. This adjusted total was used as the trip count when determining the average fare per trip.
- Multiplied average fare per trip by the ratio of pre-COVID fare to April 2023 fare.
    - Prior to COVID-19, SEAT charged $2.00 for a standard trip ticket. As of June 2023, SEAT charges $1.75 for a standard trip ticket, or approximately 88 percent of its FY 2020 fares.
    - To account for the price decrease in fares, the average fare from FY 2020 is multiplied by 88 percent to generate the average fare revenue per trip in 2023 dollars.
- Multiplied the 2023 average fare by the anticipated pre- and post-rail ridership growth to yield the additional annual revenue in both scenarios.
- Projected revenue was inflated assuming 3 percent per year to align the revenue with the year of implementation, 2028 for pre-rail transit service levels and 2035 for post-rail transit service levels.

Microtransit Demand Response Revenue

- Multiplied the cost of a standard, one-way fare to the projected increase in annual microtransit riders in pre- and post-rail service scenarios to yield additional annual revenue.
    - As of June 2023, SEAT charges the same one-way fare for a bus ride as for a one-way microtransit trip. Unlike bus fares, SEAT does not offer an option for passengers to purchase time-bounded unlimited ride passes for microtransit trips. Therefore, it was not necessary, as with bus fare, to utilize an average fare per trip to forecast revenue for microtransit service.
- Projected revenue was inflated assuming 3 percent per year to align the revenue with the year of implementation, 2028 for pre-rail transit service levels and 2035 for post-rail transit service levels.

ADA Paratransit Revenue

- Multiplied the cost of a standard, one-way ADA paratransit fare to the projected increase in annual paratransit riders in pre- and post-rail service scenarios to yield additional annual revenue.

  - Like mircotransit fares, passengers paying ADA paratransit fares do not have the option to buy time-bounded unlimited ride passes. Therefore, it was not necessary, as with bus fare, to utilize an average fare per trip to forecast revenue for ADA paratransit service.

- Projected revenue was inflated assuming 3 percent per year to align the revenue with the year of implementation, 2028 for pre-rail transit service levels and 2035 for post-rail transit service levels.

Data sources:

- National Transit Database. 2023 Complete Monthly Ridership (with Adjustments and Estimates).
- National Transit Database. 2020 Metrics.
- Southeast Area Transit District. Fares Information. https://southeastareatransitdistrict.com/fares-info/