LEHIGH VALLEY ENHANCED BUS/BRT STUDY

EXECUTIVE SUMMARY

March 3, 2014

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EXECUTIVE SUMMARY

Moving LANTA Forward

On August 29, 2011, the Lehigh and Northampton Transportation Authority (LANta) implemented a fully re-designed route network, a key component of *Moving LANTA Forward*, a twelve-year strategic vision for public transportation in the Lehigh Valley. *Moving LANTA Forward* was completed in accordance with both the bi-county *Comprehensive Plan – The Lehigh Valley 2030*, which prioritized congestion reduction, suburban growth management, establishment of a link between land use and transportation decisions, revitalization of urban centers and preservation of agricultural land, and the *LANTA Strategic Plan 2004-2015*, which established a part of LANta's mission to "support desired economic and environmental goals".

The Service Plan of *Moving LANTA Forward* included four elements:

1. Core Service Improvement Plan;
2. Service Coverage Expansion Plan;
3. Enhanced Bus/Bus Rapid Transit Plan; and
4. Rail Modes Planning.

To further the planning of element 3, the Enhanced Bus/Bus Rapid Transit Plan, LANta commissioned this study, which includes the preparation of a conceptual enhanced bus/bus rapid transit service plan, identification of regional goals and objectives for the service, analysis of demand and potential benefits within each corridor, identification of a "trunk" corridor or corridors, development of a conceptual design plan for the corridor(s), and a final implementation plan which together may be considered as an application to the FTA for the Very Small Starts program.

Goals and Objectives of Enhanced Bus Service – *The Problem Statement*

The following are the goals and objectives of enhanced bus service (EBS) in the Lehigh Valley, as determined by the study team with input from the LANta Board and the Study Advisory Committee. Input from the series of public meetings was also considered and incorporated. The broad program goals for the development of Enhanced Bus Service in the Lehigh Valley include:

- Benefit current riders;
- Expand the transit market – attract new and choice riders;
- Promote revitalization of the Valley's urban core;
- Maximize productivity (riders per hour); and
- Be financially feasible.

In accordance with these goals, all potential enhanced bus corridors were evaluated utilizing the aforementioned criteria to identify a recommended implementation corridor for more detailed

planning. It was also recognized that the Problem Statement this study would therefore address is:

In response to growth in population and vehicle traffic in the Lehigh Valley, implementation of Enhanced Bus Service would encourage sustainable growth and revitalization of the region's urban cores as well as growth in transit use rather than private vehicle use.

Documents

In addition to this Executive Summary, the Lehigh Valley Enhanced Bus/BRT Study includes five technical memoranda and a final report document as follows:

- Technical Memorandum 1: Kickoff Meeting Summary Memo
- Technical Memorandum 2: Public Involvement Plan
- Technical Memorandum 3: Transportation Setting and Data Collection
- Technical Memorandum 4: Conceptual Service Plan
- Technical Memorandum 5: Conceptual Design
- Final Project Report

Corridor Selection Process

In the initial phase of the *Lehigh Valley Enhanced Bus/BRT Study*, eight corridors of the LANtaBus system were selected to be "trunk corridors" for further analysis. These corridors represent many of the busiest segments of the existing LANtaBus system, connecting the downtowns of Allentown, Bethlehem and Easton with many of the most popular trip generators in the Lehigh Valley, such as major employment areas, hospitals, shopping districts, university districts, park-and-ride facilities and entertainment destinations. While most of the corridors are centered on Allentown where bus ridership is the strongest, three corridors connect Allentown with Bethlehem and one corridor connects Bethlehem with Easton. The eight selected trunk corridors are shown in Figure ES-1.

These trunk corridors were further developed to show comparative boardings and alightings, productivity and transit mode share. The corridors were then combined and reconfigured into four priority corridors, including those portions of the eight trunk corridors primarily with the highest ridership and thus the best candidates for implementation of Enhanced Bus Service. Each priority corridor connects several major generators and/or high-ridership areas and impacts more than 3,000 passengers. Figure ES-2 shows the extent of the four priority corridors chosen.

The priority corridors were evaluated based on a set of eight criteria, designed to reflect the goals and objectives of the Enhanced Bus Service as determined at the outset of the study and which would thus address the Problem Statement. The corridors were then ranked for each criterion, aggregated, then given an overall score and rank. Criteria included: travel time

savings, net gain in passenger trips, transit-supportive land-use potential, productivity (passengers per revenue hour), total cost of the project, financial effectiveness (subsidy per passenger) and total corridor ridership. The corridors selected as a result of this project were then developed into full service, financial and capital plans.

Figure ES-1: Initial Eight Trunk Corridors

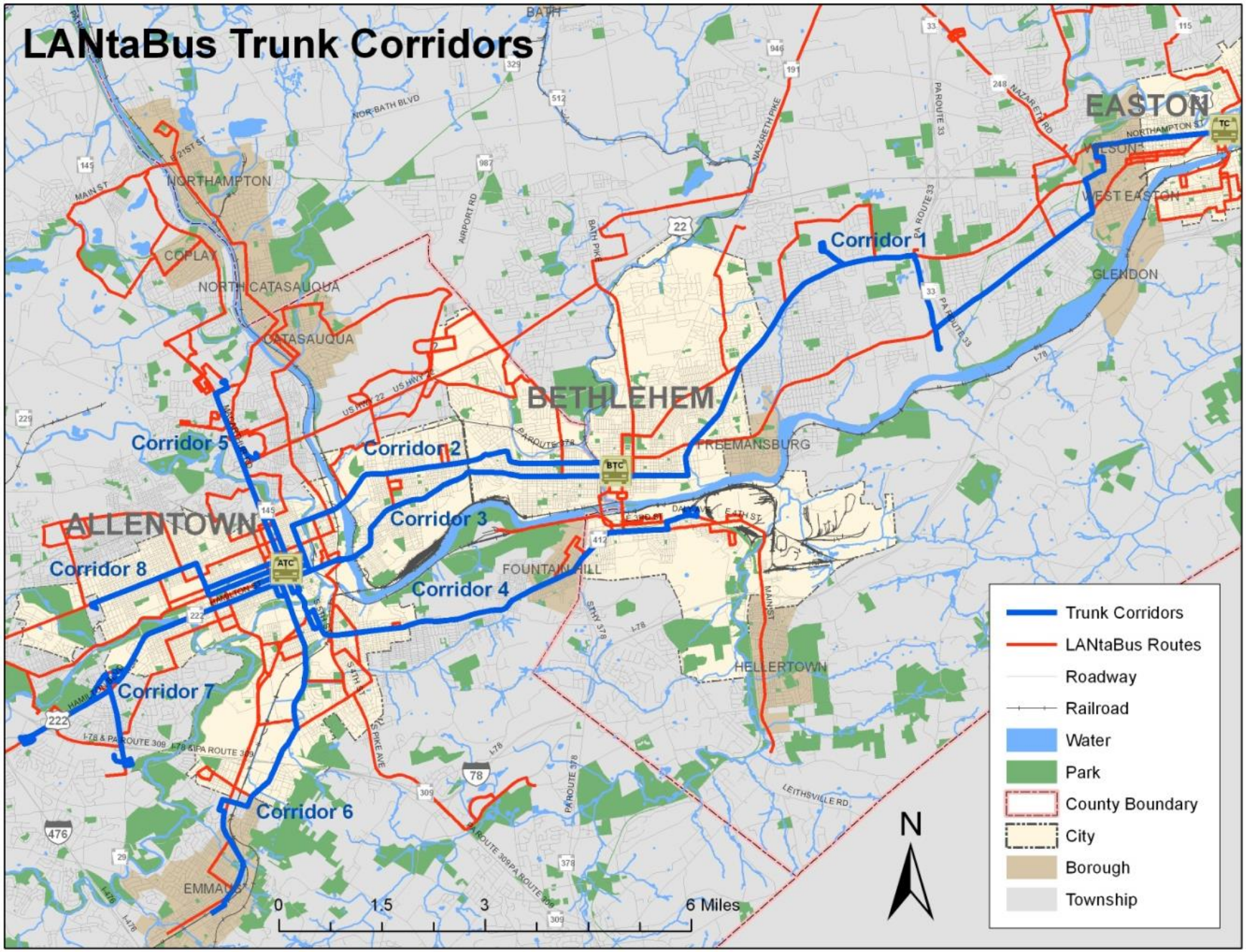
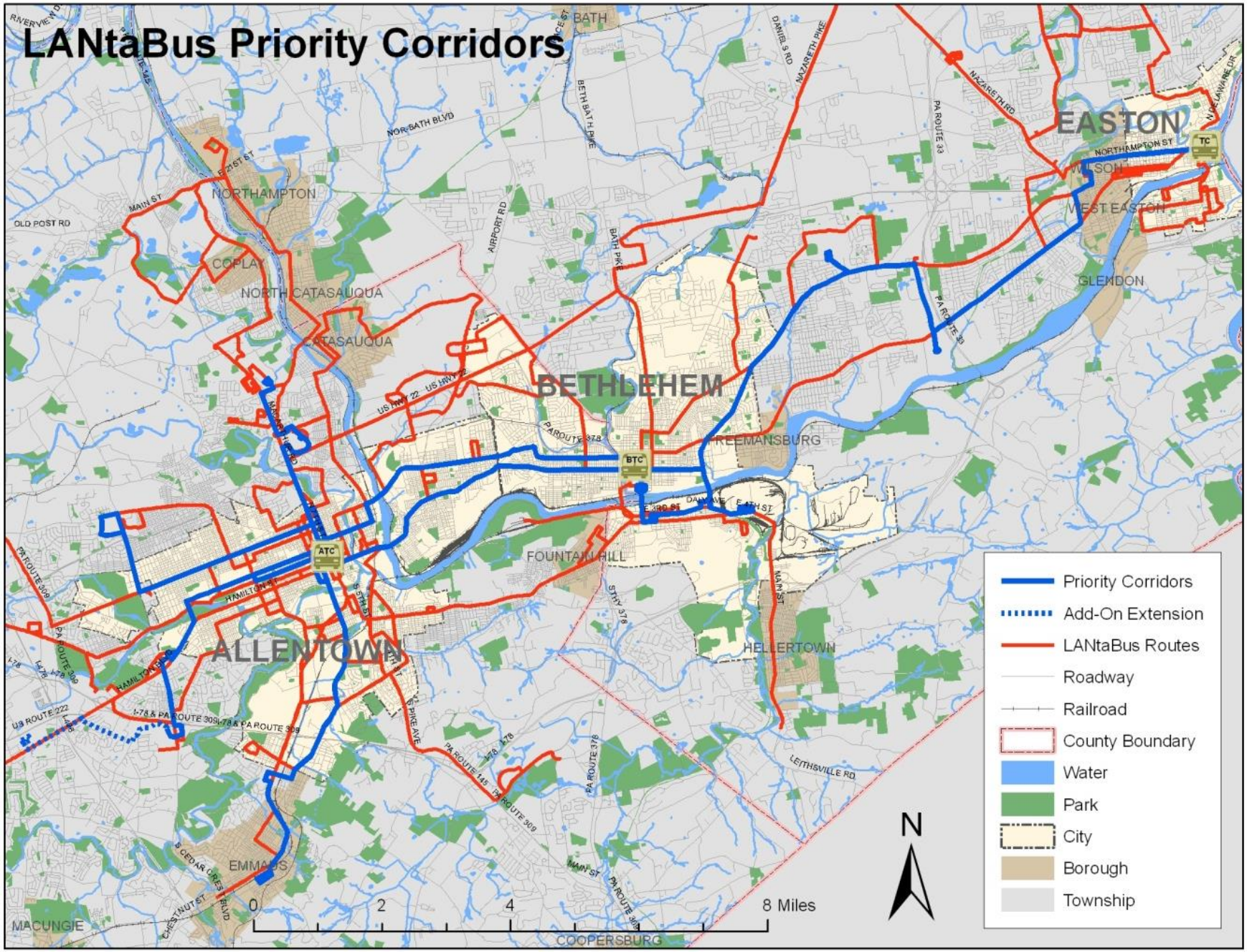


Figure ES-2: Four Priority Corridors



Public Involvement

A public involvement plan enriches the planning process by obtaining key input from key community members and stakeholders in a project. The public involvement process for this study was broken down into four major components:

1) **Advisory Committee Meetings** – A project Advisory Committee was assembled early-on in the study, comprised of representatives from LANta, the Lehigh Valley Planning Commission, PennDOT, the local municipalities, and leaders of key stakeholder groups. Six meetings were held where the Consultant Team and LANta staff presented to the Advisory Committee and answered questions and obtained input.

2) **Board Workshops** – Three workshops were held with the consultant team, LANta staff and the LANta Board in order to provide the Board with an opportunity to comment and provide guidance to the consultant team.

3) **Public Open Houses** – Approximately midway through and again near the end of the study Public Open Houses were held in Allentown, Bethlehem and Easton in order to provide an opportunity for the public to comment on the initial ideas (first round of meetings) and proposals (second round of meetings) presented by the study team.

4) **Stakeholder Meetings** – After the initial plans for the recommended EBS corridors had been developed, the study team consulted with representatives from the Cities of Allentown, Bethlehem and Easton, as well as Whitehall Township and PennDOT, to determine the feasibility of the recommended improvements and Enhanced Bus treatments along each corridor.

Selected Corridors

Upon review of the Priority Corridors, it was determined that an amalgamation of the some of the strongest corridors would provide service to many of the Lehigh Valley's densest neighborhoods and most heavily used stops/popular destinations. A recommended Enhanced Bus Service (EBS) "system" was developed, consisting of two routes that serve the densest portions of the Lehigh Valley—both with respect to land use and to ridership—as well as link the Valley's three cities. This system would be implemented in phases, which are further outlined in *Technical Memorandum 5: Conceptual Design* and included in the final project report.

The recommended EBS "system" includes two routes, which for the purposes of this study will be referred to as "EBS 1" and "EBS 2", with official names to be determined by LANta upon development of branding for the system. EBS 1 would span between the Walmart on MacArthur Road in Whitehall Township and the Lehigh Valley Industrial Park (LVIP) VII on PA 412 in South Bethlehem, via MacArthur Road and the 6th/7th Street Couplet (PA 145), Hamilton Street,

Hanover Avenue, West Broad Street, New Street, 4th/3rd Streets in South Bethlehem, and Daly Avenue. EBS 2 would span between Muhlenberg College in Allentown and the planned Easton Intermodal Transportation Center in Easton roughly via the Chew/Turner Street couplet, Hamilton Street, Hanover Avenue, West Broad Street, New Street, 4th/3rd Streets in South Bethlehem, the Minsi Trail Bridge, Stefko Boulevard, Easton Avenue, Emrick Boulevard, Freemansburg Avenue, 25th Street, and Northampton Street.

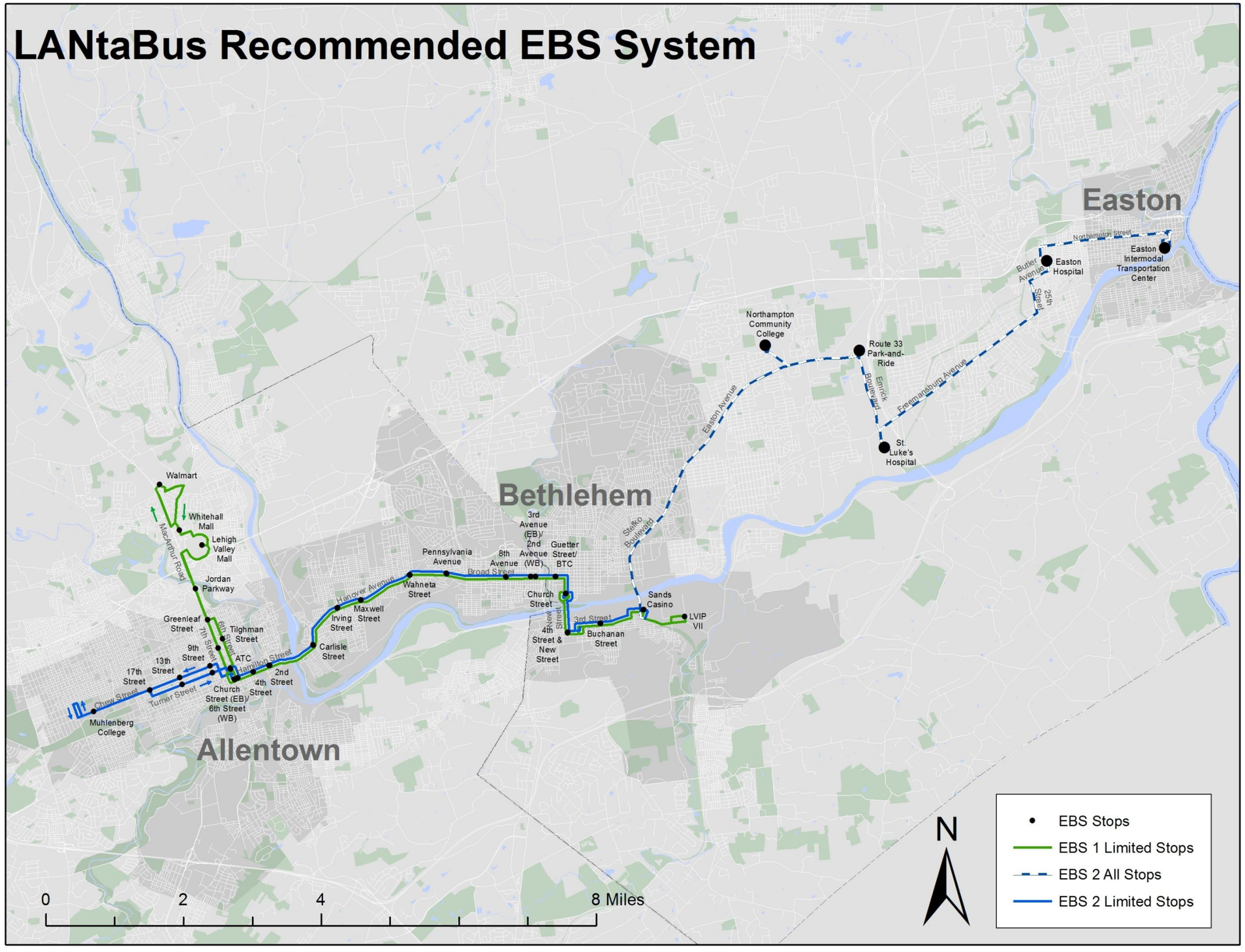
Figure ES-3 shows the recommended system as of Phase III of implementation (please refer to *Technical Memorandum 5* and/or the final project report for the specifics of each phase), when service would be extended from South Bethlehem to Easton. The two EBS routes would operate as "limited-stop" services throughout much of the Lehigh Valley, meaning that they would stop approximately every half mile (rather than every two blocks) in order to help reduce travel times. However, EBS 2 east of the Sands Casino would initially operate as a local service, serving all stops, to be upgraded to limited-stop service in the future if demand warrants.

Transit Service Plan

The recommended EBS system includes two routes, which are designed to be as convenient and reliable as possible, as well as to serve the portions of the Lehigh Valley with the greatest demand for bus service. "Convenient", in this case, refers to service operating seven days per week, as frequently as possible given existing and potential ridership, and for a maximum possible span of service. Thus, service on both proposed EBS routes would operate seven days per week, on approximately the longest span of service of LANtaBus's existing routes, from 5:00 AM to 11:00 PM on weekdays, 6:00 AM to 11:00 PM on Saturdays, and 10:00 AM to 6:00 PM on Sundays. Depending on the initial popularity of EBS 1, service might be extended to operate until midnight; however, for the purposes of this report, it will be assumed that service will operate until 11:00 PM.

On weekdays, EBS 1 would operate every 15 minutes during the peak periods, every 20 minutes off-peak, and every 60 minutes in the evening. EBS 2 would operate every 30 minutes during the peak, and every 60 minutes off-peak and during the evening. The combined frequency along segment common to both EBS 1 and EBS 2 (between the ATC and the Sands Casino) would be every 10 minutes during the peak periods, every 15 minutes off-peak, and every 30 minutes in the evening. It should be noted that these frequencies would not be achieved at the initial implementation of service on EBS 1 and EBS 2—the routes would initially implemented at lower frequencies, then service would be increased in latter phases. At full build-out, the aforementioned span and frequencies would imply 54 trips per weekday in each direction on EBS 1 and 24 trips per weekday in each direction on EBS 2 (total of 78 weekday round-trips).

Figure ES-3: Recommended Enhanced Bus Service System



Also during the full build-out phase, on Saturdays service on EBS 1 would operate every 20 minutes between 8:00 AM and 6:00 PM, and hourly in the morning and evening; service on EBS 2 would operate every 60 minutes all day. On Sundays, service on EBS 1 would operate every 20 minutes, with service on EBS 2 every 60 minutes.

Phasing

Implementation of the full Enhanced Bus System at once would be an expensive proposition, requiring a large amount of capital expenditure on new vehicles and priority treatments, as well as a large increase in operating costs all at once. Therefore, in order to create more financially feasible changes, as well as to encourage steady ridership growth, implementation is broken out into six phases. Each phase would last approximately one to two years, allowing LANta service planners the ability to analyze impacts incrementally. Subsequent phases would only be implemented when resources are available.

Modifications to existing local LANtaBus routes will occur throughout the plan's implementation. These modifications were designed to minimize the number of stops at which the frequency of service would be reduced, as well as to avoid the occurrence where existing riders lose service. Modifications were tailored to demand levels, focusing resources where they are most needed as possible while continuing to maximize coverage of the LANtaBus service area.

Phase I would commence as resources become available. For additional information on Phasing, please refer to *Technical Memorandum 5: Conceptual Design* or the final project report. Phasing of the EBS system can be summed up as follows:

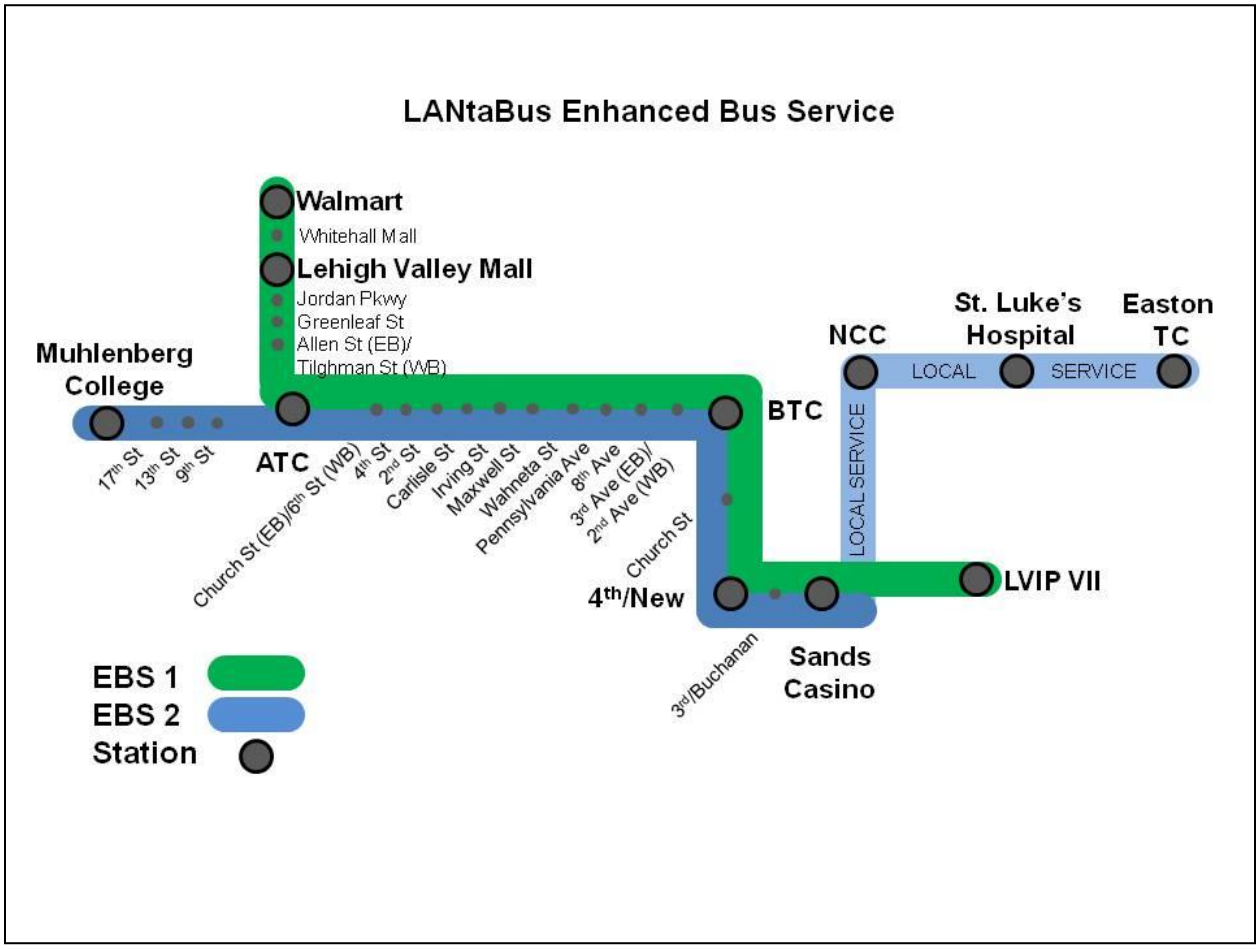
- **Phase I** represents the "***Minimum Operable Segment***", as determined by the study team. This phase would include local service along the EBS 1 alignment (to be named "Route 100") between the Walmart in Whitehall Township and LVIP VII in South Bethlehem. This service would provide improved connections between Whitehall Township, Center City Allentown, Bethlehem and South Bethlehem. Adjustments would be made to local routes in Allentown, Bethlehem and Whitehall Township during this phase.
- **TSM (Transportation Systems Management)** represents a less-resource-intensive alternative to the full build-out of the EBS system. The TSM for this study would include the implementation of Route 100 and all improvements included in Phase I, as well as modifications to local LANtaBus services on Routes 101, 107 and 108 to improve connections between Allentown, South Bethlehem and Easton.
- **Phase II** would include upgrades to Route 100 to Enhanced Bus (EBS 1) service, as well as implementation of bus priority treatments along the EBS 1 corridor.
- **Phase III** would include the implementation of service on EBS 2, and additional priority bus treatments along the EBS 2 corridor in Allentown. This phase also includes the

restructuring of local bus service between Bethlehem and Easton, and construction of bus lanes immediately adjacent to the Allentown Transportation Center.

- **Phase IV** would include frequency improvements on EBS 1 and EBS 2, reaching full build-out of the system in terms of both coverage and level of service.
- **Phase V** would include the upgrade of EBS 2 service within the City of Easton and Wilson Borough (east of Easton Hospital), including limited-stop service and the implementation of bus priority treatments, as well as improved frequency of service on Route 106 in Easton.
- **Phase VI** would include an upgrade to limited-stop service along EBS 2 between the Sands Casino and Easton Hospital. At this time, Route 101 would be re-instated to serve as an underlying local service for EBS 2 east of the Bethlehem Transportation Center.

Figure ES-4 shows a schematic of the recommended EBS system. All stops are shown along EBS 1 and the limited-stop portion of EBS 2. As this schematic represents Phase III/IV of implementation, service east of the Sands Casino on EBS 2 is shown as local service. Along that segment, only a few major stops are shown.

Figure ES-4: Schematic of Recommended Phase III/IV EBS System



Running Way Treatments

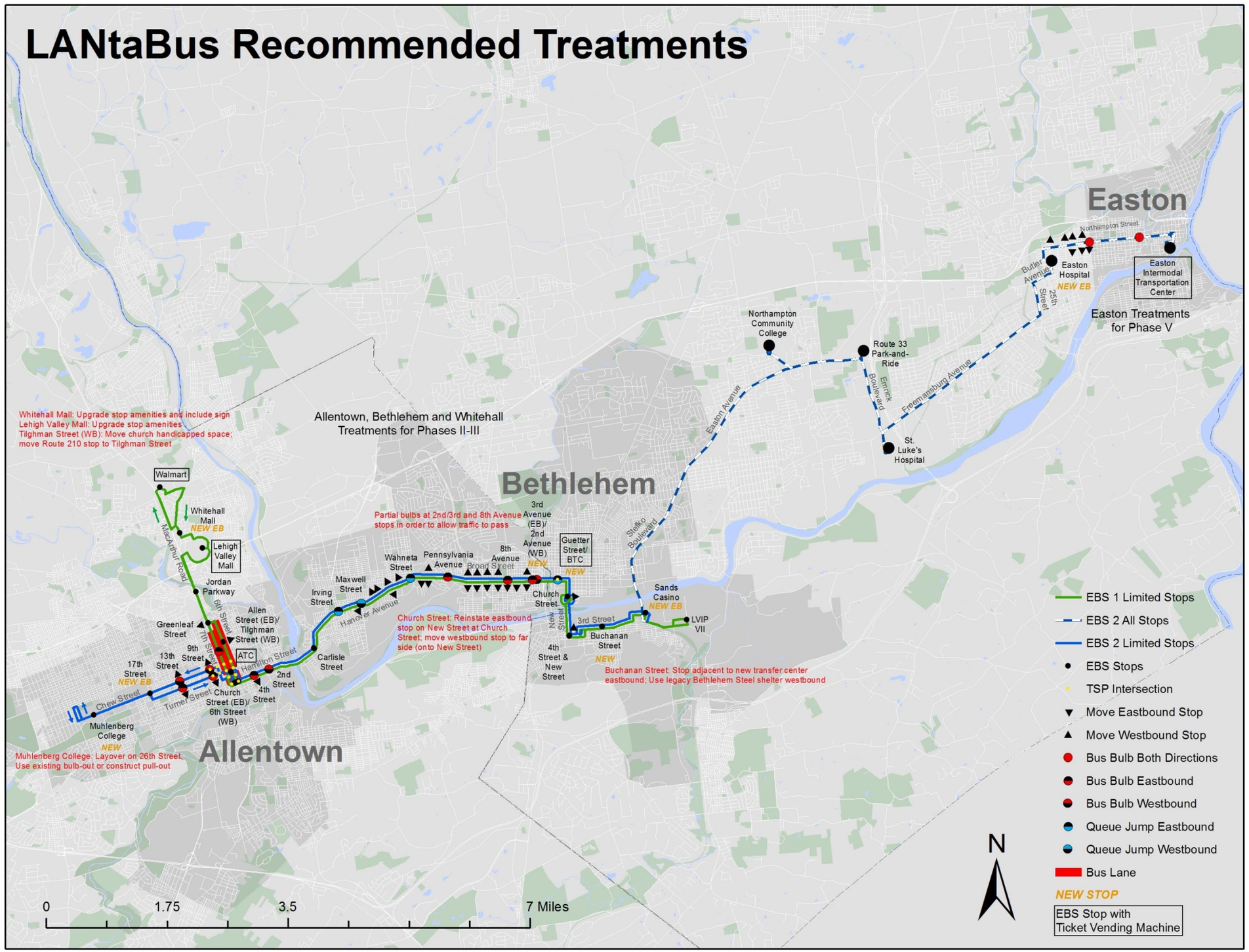
Running way treatments adjust the streetscape to be more accommodating to bus service, either by improving the pedestrian environment or by allowing buses to more easily or more quickly navigate the route, thus improving overall reliability. The following running way treatments were considered for LANtaBus Enhanced Bus Service:

- **Bus Lanes** – lanes used exclusively by buses all or part of the day
- **Transit Signal Priority (TSP)** – signals that are triggered by proximate buses to stay green longer or change to green sooner
- **Queue Jumps** – lanes/signals that allow buses to bypass traffic queued at signals
- **Bus Bulbs** – sidewalk expansion across the parking lane to the travel lane to provide enhanced passenger amenities and allow buses to remain in the travel lane at stops
- **Off-Board Fare Collection** – fare payment at machines prior to boarding
- **Moving Bus Stop Locations** – moving local bus stops to locations that allow limited-stop buses to pass
- **Signal Optimization** – adjustments to traffic signal phases to decrease travel times for buses

Figure ES-5 shows recommended priority treatments along the EBS 1 and EBS 2 corridors. Near-term treatments include bus bulbs, queue jumps and TSP, as well as moving near-side local stops to the far side in order to facilitate EBS service passing local bus service on narrow roadways. Bus lanes are a long-term option, and the lanes shown in the map on 6th and 7th Streets in Allentown would not be implemented until the number of buses per hour along those streets reaches a threshold point. Ticket Vending Machines (TVMs) are shown for major transfer centers—these machines would be used for purchase of fare cards/passes, and would not be dependent on the implementation of off-board fare collection.

It should be noted that a black triangle is used to symbolize that a stop should be moved from its current near-side location to a far-side location. This symbol is used for different reasons both at local stops (to allow EBS service to pass local buses in the stops) as well as at limited stops (where moving the stop was deemed appropriate).

Figure ES-5: Recommended EBS Treatments



Stop/Station Design

All stations would be equipped with branded shelters, and would include benches, trash receptacles, a system map, a schedule for each route serving the stop, and a branded bus stop sign. Five stations—the ATC, BTC, EITC, Lehigh Valley Mall and Walmart—would also feature TVMs, where passengers can purchase LANtaBus fare media.

Vehicles

LANtaBus Enhanced Bus Service would utilize standard 42-foot, low-floor hybrid buses, as currently comprise the majority of new vehicle purchases for fixed-route LANtaBus service today. These buses cost approximately $600,000 each, and would be branded as appropriate for the EBS service.

Ridership

Ridership projections are based on existing stop-level ridership tabulated using manual Automatic Passenger Counter (APC) data from Fall 2011, shortly after implementation of the new route network proposed in *Moving LANta Forward*. Elasticities were applied to account for increased ridership due to frequency enhancements and travel time savings. This methodology was used to calculate daily ridership from which approximate Saturday and Sunday ridership were inferred. These ridership projections do not take into account the land use changes proposed as a part of this study—if the density of development is increased along the corridors, then it can be assumed ridership would be impacted and would further increase accordingly.

Table ES-1 shows annualized ridership for the corridor, including all local routes (ridership reflects just those stops located along the Enhanced Bus Service corridor), each individual EBS route, both EBS routes combined, and a total for the corridor. Projections are shown for each phase.

Table ES-1: Annual Ridership Projections

Annual						
Phase	Local Routes Boardings	EBS 1 Boardings	EBS 2 Boardings	Total Corridor Boardings	Increase over Previous Phase	Increase over Current
Current	1,859,652	0	0	1,859,652	0	0
Phase I	1,908,726	455,124	0	2,363,850	504,198	504,198
TSM	1,953,256	432,303	0	2,385,558	21,708	525,906
Phase II	1,814,516	560,928	0	2,375,445	11,595	515,792
Phase III	1,505,534	517,663	431,186	2,454,382	78,938	594,730
Phase IV	1,367,097	648,231	474,067	2,489,396	35,014	629,744
Phase V	1,384,061	648,231	464,490	2,496,783	7,387	637,130
Phase VI	1,502,504	636,440	399,845	2,538,789	42,006	679,137

Operating Cost, Fare Revenue and Operating Subsidy

Table ES-2 shows proposed revenue hours and projected operating cost, fare revenue and subsidy for the proposed EBS system. Gross revenue hours for the new service were determined based on the estimated travel times for each route, combined with the proposed frequency. Net revenue hours incorporate the increase/decrease in revenue hours required to operate local service, based on the recommendations for adjustments to local service included in the implementation plan for each phase. Assuming an operating cost of $88.23 per revenue hour, operating cost was then calculated based on the proposed net revenue hours for each phase. Projected fare revenues were calculated based on the increase in projected total corridor ridership over current fare revenues and an average fare of $1.13 per passenger. The operating subsidy, or additional amount of funding required to operate the service, was calculated by subtracting the projected fare revenues from the projected operating cost.

Table ES-2: Projected Operating Cost, Fare Revenues, and Operating Subsidy

Phase	Gross EBS Revenue Hours	Revenue Hours Offset from Local Route Changes	Net Revenue Hours	Operating Cost of Implementing EBS Service and Local Route Changes	Increase in Corridor Ridership from Current	Increase in Corridor Fare Revenues from Current	Operating Subsidy of Implementing EBS Service
Current	0	0	0	$0	0	$0	$0
Phase I	19,355	-10,164	9,191	$810,918	504,198	$569,743	$241,175
TSM	19,355	-3,745	15,611	$1,377,320	525,906	$594,274	$783,046
Phase II	25,340	-10,164	15,176	$1,338,968	515,792	$582,845	$756,123
Phase III	48,374	-19,129	29,245	$2,580,321	594,730	$672,045	$1,908,276
Phase IV	66,687	-19,139	47,548	$4,195,175	629,744	$711,611	$3,483,565
Phase V	66,280	-17,297	48,983	$4,321,727	637,130	$719,957	$3,601,769
Phase VI	65,048	-6,552	58,496	$5,161,121	679,137	$767,425	$4,393,696

Capital Plan

Table ES-3 following summarizes the capital costs needed for LANta to implement Enhanced Bus Service as recommended in this study. Costs are broken out by item and by phase. Bus lane mileage is assuming the conversion of existing roadway to curbside bus lanes. Most costs were determined based on those included in the Transit Cooperative Research Board's *TCRP Report 118: Bus Rapid Transit Practitioner's Guide* and adjusted to 2012 prices using the online Consumer Price Index (CPI) calculator. The total capital cost of implementation is $11,738,275.

Table ES-3: Capital Cost Estimates by Phase

Phase	Queue Jumps	Curb Lanes	Bus Bulbs	Off-Board Fare Machines	Shelters	Vehicles	Transit Signal Priority	Total
Unit Cost	**$12,500** (per queue jump)	**$83,350** (per mile)	**$55,550** (per bulb)	**$72,200** (per machine)	**$12,000** (per location)	**$600,000** (per vehicle)	**$37,000** (per intersection)	
Units								
Phase I	0	0	0	0	40	0	0	
TSM*	0	0	0	0	0	0	0	
Phase II	4	0	7	4	0	0	9	
Phase III	0	0.2	4	1	12	1	4	
Phase IV	0	0	0	0	0	10	0	
Phase V	0	0	4	0	4	1	0	
Phase VI	0	1.3	0	0	18	3	0	
Total Units	**4**	**1.5**	**15**	**4**	**74**	**17**	**13**	
Cost								
Phase I	$0	$0	$0	$0	$480,000	$0	$0	$480,000
TSM*	$0	$0	$0	$0	$0	$0	$0	$0
Phase II	$50,000	$0	$388,850	$288,800	$0	$0	$333,000	$1,060,650
Phase III	$0	$16,670	$222,200	$72,200	$144,000	$600,000	$148,000	$1,203,070
Phase IV	$0	$0	$0	$0	$0	$6,000,000	$0	$6,000,000
Phase V	$0	$0	$222,200	$0	$48,000	$600,000	$0	$870,200
Phase VI	$0	$108,355	$0	$0	$216,000	$1,800,000	$0	$2,124,355
Total Cost	**$50,000**	**$125,025**	**$833,250**	**$361,000**	**$888,000**	**$9,000,000**	**$481,000**	**$11,738,275**

*Not included in the total