Final Report

Water Transit Feasibility Study

The Economics of Land Use

Prepared for:

Solano Transportation Authority

Prepared by:

Economic & Planning Systems, Inc.

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Economic & Planning Systems, Inc.
One Kaiser Plaza, Suite 1410
Oakland, CA 94612
510 841 9190 tel
510 740 2080 fax

Oakland
Sacramento
Denver
Los Angeles

www.epsys.com

EPS #171141

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1. EXECUTIVE SUMMARY AND KEY FINDINGS

This Report presents a financial feasibility analysis of new and expanded ferry services serving residents and employees in Solano County. The services evaluated include expanded service between Vallejo and the San Francisco Ferry Building and new services, as follows:

1. Vallejo and Larkspur
2. Vallejo and Oakland
3. Benicia and Martinez
4. Benicia and Vallejo
5. Rio Vista and Antioch
6. Rio Vista and Benicia
7. Rio Vista and Martinez
8. Rio Vista and Vallejo

The Solano Transportation Authority (STA) commissioned EPS to prepare this Report, in cooperation with the San Francisco County Transportation Authority (SFCTA), which provided transportation modeling and ridership projections. As the Congestion Management Agency (CMA) for the Solano area, the STA is responsible for countywide transportation planning, programming transportation funds, managing and providing transportation programs and services, delivering transportation projects, and setting transportation priorities. In this context, the STA participates in the State Route (SR) 37 Policy Committee, which is focused on joint county efforts in improving the SR 37 Corridor to address issues such as sea level rise, traffic congestion, transit options and recreational activities. While this Study is not specifically intended to address SR 37 concerns, it may provide some indication of the potential role of ferry service in alleviating SR 37 pressures.

The financial feasibility analysis evaluates the financial feasibility of expanding the Vallejo/San Francisco route as well as the feasibility of proposed new routes. The findings of the financial feasibility assessment can guide future research, planning, investment priorities, and funding efforts as may be conducted by STA, the County, the San Francisco Bay Area Water Emergency Transportation Authority (WETA), other transit providers, or the individual cities for which the service is planned. As a part of considering future routes to/from jurisdictions in Solano County, a variety of strategic discussions were initiated; however, no specific engineering, environmental review, or financial feasibility analyses has been conducted for these routes as a part of this initial feasibility analysis.

Approach

Preparation of this Report included consultations with the expansion ferry service cities and other stakeholders through a working group established by STA. The working group was called the Planning Development Team (PDT). The group met periodically throughout the duration of the Study. Extensive consultations also occurred with WETA staff as well as private ferry operators active in the Bay Area.

To support the evaluation of potential services that most likely would be operated by a public provider, there was in-depth review of key WETA policy and planning documents and related analysis of their ferry service operations. A financial model was prepared that estimates annual operating costs for each of the new ferry service routes between 2020 and 2040 and calculates the level of ridership that would be required to fully fund operating costs with farebox revenue (farebox recovery). This level of required ridership is then compared to the most recent ridership projections prepared by SFCTA to evaluate the need for additional operating funding. A "basic" level of ferry service was studied in each case focusing on serving commuters between the respective cities.

To support the evaluation of potential services that potentially could be operated by a private provider, multiple discussions with two of the region's private operators occurred. These discussions resulted in an approach that solves for "occupancy" rather than farebox recovery.

In all cases, ridership is defined in terms of "boardings," which represents the number of times a person boards a ferry vessel and pays a fare. If daily boardings are 100, for example, and if every person who rides the ferry is making a round-trip, then the 100 boardings would represent 50 unique people.

There may be other considerations beyond financial feasibility to consider. For example, establishing additional ferry services to jurisdictions in Solano County would expand the potential for emergency response services to Solano County, as the vessels and terminals used for transit services could be redeployed to provide emergency response services if needed. Potential emergency response services have not been studied or fully evaluated as part of this Report. Further study of routes deemed feasible will be needed to properly evaluate the need for and/or the potential benefit and cost effectiveness of ferry-related emergency response capabilities. It is generally WETA's position that new ferry routes must be able to operate sustainably from a feasibility perspective so that any emergency benefits realized from new ferry services rest on solid feasibility grounds.

It is important context to note that Senate Bill 976 (Torlakson), which repealed the San Francisco Bay Area Water Transit Authority and established WETA as the replacement entity, authorizes WETA to consolidate and operate ferry services in the San Francisco Bay Area and to plan and respond to emergencies or disasters affecting the transportation system in the San Francisco Bay Area. The bill provides authority to WETA to determine entry of any water transportation service or facility and authorizes WETA to plan, develop, and operate all aspects of water transportation facilities within the San Francisco Bay Area including, but not limited to terminals, parking lots, and structures. Some exclusions apply for the Golden Gate Bridge, Highway and Transportation District (Golden Gate).

Key Findings

Key findings are summarized below and described in more detail throughout the Report.

1. ***Determining financial feasibility of ferry service must account for available public subsidies and farebox revenue.***

   Simply defined, "financial feasibility" typically means that "revenues equal or exceed costs." However, a measure of feasibility must also account for the magnitude of costs over

revenues and also the likelihood that ways can be found to improve revenues or reduce costs. In the case of public transit, where operational subsidies are the norm, feasibility must be recast to evaluate the farebox recovery ratios that may be attainable given ridership forecasts.

More specifically, in the case of ferry services that may be operated by a public operator, such as WETA or Golden Gate, the service routes are compared by their potential farebox revenue recovery ratio (i.e., revenues from ticket sales as a percentage of operating costs) against WETA's minimum feasibility standard of 40 percent farebox revenue recovery ratio.[1] In the case of services that a public provider would not operate, the services are compared by their potential occupancy ratios.[2]

Determining the revenue/cost balance prospectively, given uncertainties regarding future costs, revenues, performance, etc., is challenging; this is particularly true in the case of the proposed ferry service routes where there has been no design work conducted for the proposed terminals. However, WETA has extensive ferry operating cost data derived from its existing service routes, and discussions with private ferry operators have informed this analysis. There has also been considerable effort placed on estimating potential ridership for each of the proposed services. Potential ridership is based on the best available information at this point in time, and future changes to the regional transportation network or changes to development patterns in the region could affect the ridership estimates. As such, the ridership projections and associated findings of feasibility should be viewed in terms of where things stand at this point in time and technically-based forecasts of future land use and transportation trends. Given this body of knowledge, while uncertainties remain, there is a reasonable level of confidence in the data and assumptions used in the analysis in arriving at its feasibility findings.

The key factors driving the financial feasibility analysis are the level of service assumptions, the operating model choice (public or private), the ridership projections, and the ticket price assumptions, which are also factors in the ridership forecasting model. Alternative configurations of routes, service levels, and operating models could result in different conclusions of feasibility.

- The level of service assumptions was based on weekday, peak travel transit service that meets at least the basic requirements of a transit service while not planning for more trips than ridership projections can fill or overburdening any one service.[3]
- A public operating model (i.e., WETA or Golden Gate) is assumed for the Vallejo services, and a private operating model (e.g., PropSF, Tideline) is assumed for the intra-Carquinez

[1] The farebox recovery ratio of 40 percent is based on Regional Measure 3 performance standards for commuter ferry services. WETA uses the figure as a systemwide reference point.

[2] The operating cost structure of private ferry operators is not publicly available, so the feasibility test used in this analysis is different for private vs. public operators.

[3] There are other possible levels of service and/or service combinations that were not studied as part of this evaluation. For example, offering occasional special event or weekend service can be a way to introduce and test the market for potential service.

Strait services. WETA provided fare assumptions for the Vallejo services and PropSF provided fare assumptions for the Benicia and Rio Vista services.

- Ridership projections were prepared by SFCTA at the request of STA. While the ridership projections are speculative and based on a range of uncertain future conditions, the projections have been found to be technically sound and reasonable for planning purposes.

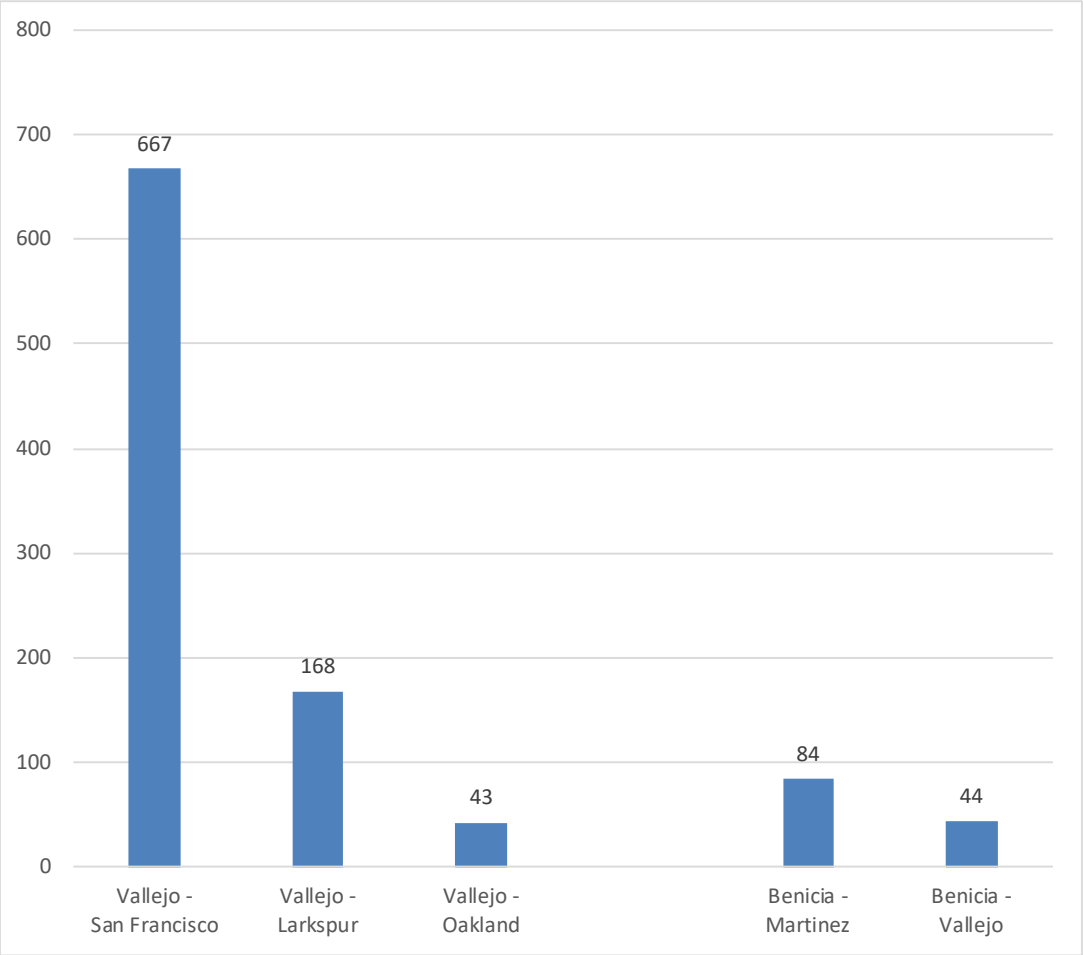
2. The ridership forecast shows additional demand for expanded service between Vallejo and San Francisco, modest demand for service to Marin County (Vallejo to Larkspur), and limited potential among the routes evaluated within the Carquinez Straight.

The determination of which routes to evaluate in this Study was guided by several factors: 1) broad commute pattern data for Solano County residents and employees; 2) transit connectivity opportunities at the points of origin/destination; 3) length of travel time; and 4) thoughtful input from the PDT. Routes to/from Suisun City were excluded from the analysis at an early stage in the study process due to limited demand based on current commute patterns and long travel times (by ferry). The evaluated routes and the 2040 ridership projections for each route are illustrated in **Figure 1** and summarized below as follows:

- Vallejo and San Francisco (expanded service): 667 daily boardings
- Vallejo and Larkspur: 168 daily boardings
- Vallejo and Oakland: 43 daily boardings
- Benicia and Martinez: 84 daily boardings
- Benicia and Vallejo: 44 daily boardings

The Rio Vista routes demonstrated limited potential for ferry service at this time.

Figure 1 Average Daily Boardings by Route in 2040



3. A combination of public operators and private operators is likely to be required.

One of the key unknowns in this analysis at this time is which entity would operate the proposed new services, and this assumption has material implications for the feasibility of the evaluated routes. In the past decade, WETA has assumed operational control of the key San Francisco Bay ferry service routes, expanded services to include two new routes, and planned for additional ferry service routes all primarily serving cross-bay commuting.

Because WETA presently operates the Vallejo/San Francisco service, it makes sense that WETA would operate an expanded Vallejo/San Francisco route, if the expanded service is pursued. This analysis assumes that WETA, or a public entity like WETA, would operate each of the Vallejo services. It is possible that the Vallejo/Larkspur service could be operated by Golden Gate because it already serves Larkspur; however, this would need to be evaluated further in the context of SB 976, the pending EIR to expand trip capacity to Larkspur, and investment in Golden Gate's fleet. Due to the expected potential ridership limitations and costs associated with docking facilities, dredging, and other capital costs, the Benicia and the Rio Vista services are evaluated from the perspective of a private ferry operator that would bring more appropriate smaller boats to the Carquinez Strait.

4. Only the expanded service between Vallejo and the San Francisco Ferry Building generates sufficient ridership demand to indicate feasibility; the other routes do not appear feasible at this time.

The other service routes evaluated in this Study generate low ridership numbers and would require additional State, regional and/or local funding, including subsidies from private companies potentially, to create and sustain ferry service as well as a cost-benefit analysis to determine if the benefits justify the costs. Thus, the financial feasibility of introducing new ferry service to Solano County rests on the ability of STA and the individual cities to reconsider origin/destination combinations and/or identify and develop additional funding sources to cover operating costs as well as initial and future capital expenses in a manner that is financially sustainable and allows for the continued operation of the services.

For the Vallejo services, which are assumed to be operated by WETA for purposes of this analysis, WETA's standard feasibility metrics are used. Systemwide, WETA targets a minimum 40 percent farebox revenue recovery ratio, acknowledging that additional funding is typically needed to support public transit. With respect to this metric, the expanded Vallejo to San Francisco service is the only one that is shown by the financial analysis to be feasible with a projected farebox revenue recovery percentage of approximately 43 percent. Additionally, Vallejo has the opportunity to leverage expanded ferry service to support the City's economic development objectives, particularly for Mare Island as redevelopment activities continue.

The other Vallejo routes have projected farebox revenue recovery ratios of 5 percent (Larkspur) and 1 percent (Oakland). In all cases, ridership in the early years of service will likely be lower than what has been projected and would likely require additional funding in the early years of service, as it takes time to change people's commute behavior and patterns. This "ramp up" period can take ten years or more.

For the Benicia services, which are assumed to be operated by a private operator, vessel occupancy is the primary metric of feasibility. The fares provided by PropSF are based on what the operator would need to charge to recover operating costs assuming each boat is fully occupied. PropSF operates a range of vessel types, but the average ferry accommodates 58 passengers. With this information, the feasibility model calculates the average occupancy of each vessel.[4] It will be up to the STA and other stakeholders to determine what level of subsidy is acceptable from a cost/benefit perspective. Based on the assumed service levels and the projected ridership, the Benicia/Martinez service would result in 14 percent average occupancy. The Benicia/Vallejo service would result in 5 percent average occupancy. As

[4] Ferry services rarely operate at 100 percent occupancy, and, given commuter behavior, it is unreasonable to assume otherwise. However, for purposes of this analysis, PropSF estimated the potential fares that were used in the ridership forecasts assuming 100 percent occupancy, which means that, for purposes of this feasibility analysis, 100 percent occupancy is the threshold target. This provides a clearer estimate of the potential subsidy that would be required from STA, other jurisdictions, and/or private employers to render the service feasible.

noted in the preceding finding, ridership in the early years of service will likely be lower than what has been projected.

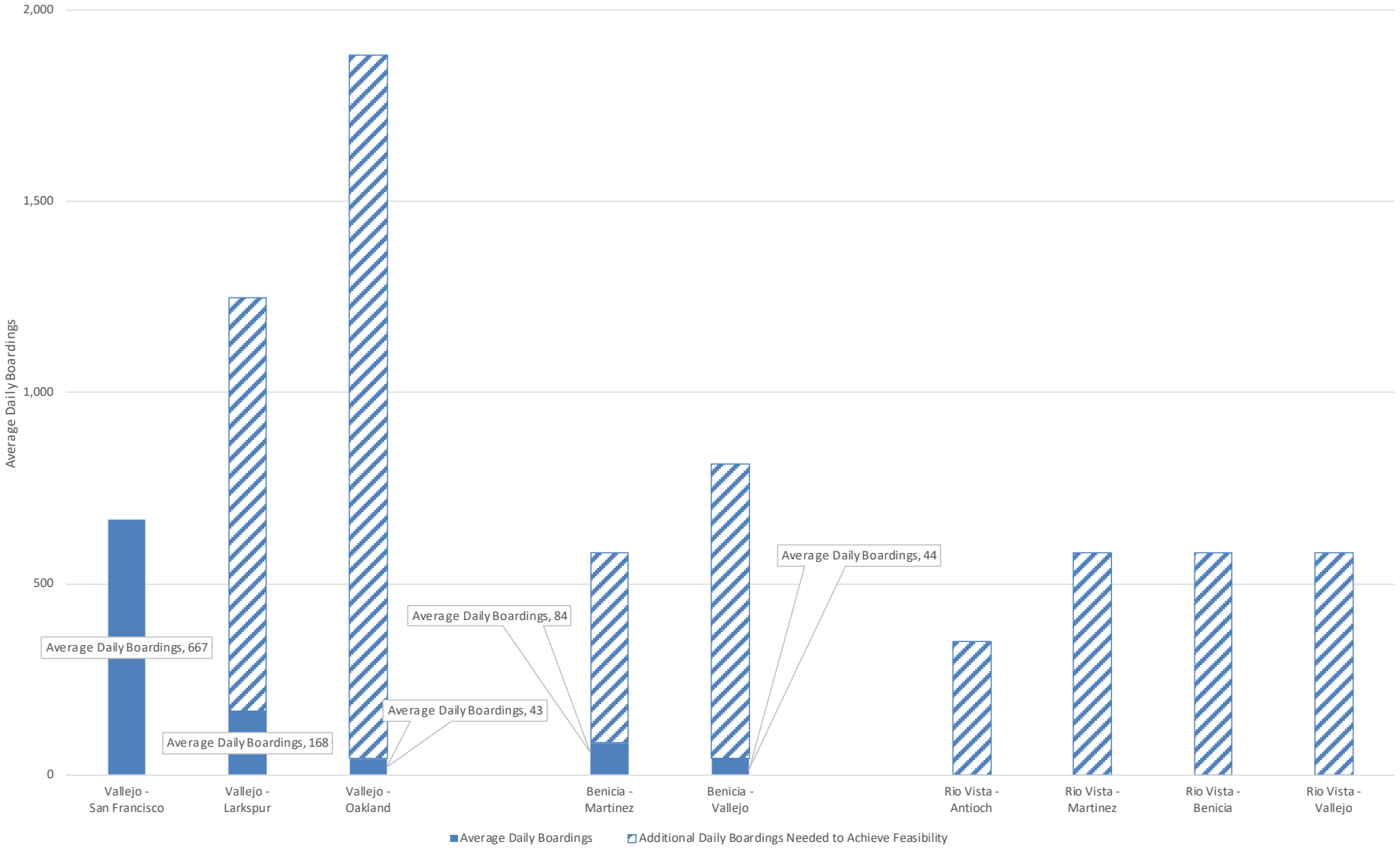
Figure 2 illustrates the forecasted average daily boardings for each service relative to the average daily boardings that would be required to meet the stated feasibility threshold. For the expanded Vallejo/San Francisco route, the 40 percent farebox recovery ratio target is achieved. For the other routes, the hatched lines indicate the additional ridership that would be needed to achieve feasibility.

If pursued, each of the services evaluated will require initial capital expenditures as well as future capital replacement expenditures. Building the terminals and related facilities will be costly, with current estimates ranging from $15 million to $40 million depending on the location of the terminal and the existing conditions encountered. Again, a private operator may not have some of the same land-side requirements that a public transit provider would, and in some cases could make modest improvements to existing marinas to start service.[5] Additionally, WETA's ferry fleet will need to be expanded with multiple vessels required for each service route.[6] Each new ferry is estimated to cost approximately $20 million, though will vary depending on the selected size and technology.

[5] This is not to suggest that private operators may operate out of public facilities without the necessary regulatory and permit approvals; these requirements have not been studied as part of this financial feasibility analysis and need further exploration.

[6] For planning purposes, it is assumed that each service would be required to supply a spare vessel. Additional study would be required to determine if there is potential for certain services to share a spare vessel.

Figure 2 Average Daily Boardings vs. Feasibility Thresholds by Route in 2040



5. While this Study provides a broad indication of potential feasibility and may help the STA prioritize its planning efforts, further analysis and study is needed, particularly for the Solano County (Vallejo) to Marin County route.

Given the context of the SR 37 considerations and the ridership projections, additional study of a Solano County (likely Vallejo) to Marin County service may be warranted. There remains interest in the service due to the increasing travel demand and congestion along the SR 37 corridor; however, the ridership forecasts are low. Two factors account for the relatively low ferry ridership projection: 1) employee-based commute trips make up only a portion of overall travel demand (intraregional trucking and commercial and recreational vehicle trips contribute to the demand as well); and, 2) the employee trip destinations in Marin County are widely distributed (and largely remote) from the Larkspur Terminal.

The highest concentration of jobs in Marin County is in San Rafael, and getting from the Larkspur Terminal to San Rafael requires mode transfers and more time, further reducing the travel time competitiveness. It could be that expanding the transit and other transportation options at the Larkspur Terminal (bike share, car share, private shuttles) could improve access to Marin County's job centers.

An additional constraint associated with the Vallejo/Larkspur route is that the berthing facilities at the Larkspur facility are at capacity. Increasing the berthing capacity at Larkspur would require significant planning and capital investment. Golden Gate currently has an operating cap on trips to Larkspur of 42 trips per day, and the District is preparing an amendment to its EIR to expand capacity.

Exploring the opportunities that may be available to serve Marin County through a private operating model is recommended. Pilot services (operated on a trial basis) could help identify the preferred landing locations in Marin County and the optimal level of service. This pilot flexibility is not available with a public service like WETA or Golden Gate. A private operator may have more flexibility to identify a destination in Marin County that is more time competitive and draws more riders. For example, there may be docking locations in San Rafael (e.g., the Loch Lomond Marina or other privately-owned docks) that can be used by a private operator that help get potential riders closer to their final destinations, improving the time competitiveness and the ridership estimates.[7] The landside improvements needed to accommodate a private operator are not as substantial as those required by WETA or Golden Gate, but still, there will need to be evaluation of waterway conditions and dredging requirements. On the other hand, some riders might find that a cross-Bay journey in one of the smaller boats, like those operated by the private operators, can be more turbulent.

In any case, subsidy from MTC, STA, and/or potentially private employers would probably still be needed to support a Solano/Marin ferry connection.

[7] Destinations in San Rafael were not studied as part of this analysis.

6. The findings of the financial feasibility assessment are intended to guide future planning, investment priorities and funding efforts as may be conducted by STA, the individual cities for which the service is planned, and WETA. Key follow-up efforts may include:

- Expansion of analysis to Yolo and Sacramento counties to identify additional potential ridership.
- Further discussions and coordination with private ferry operators to understand opportunities to expand ferry service in Solano County. For the cities of Benicia and Rio Vista, STA can evaluate the opportunity for private ferry services in more detail. This could include consideration of "pilot" services on weekends or for special events to introduce ferry service.
- Further study of the potential emergency response role that ferries (through WETA or other providers) could fulfill in Solano County.
- Other STA efforts at obtaining capital or operating funding for the proposed ferry service.
- Further planning and development of the ferry terminal areas in the respective cities.

Local efforts to evaluate the benefits of ferry service and to develop sources of local funding including inclusion in cities' own capital improvement programs and creation of special funding sources such as the special property tax that supports the Bay Farm Island service.

2. STUDY BACKGROUND AND METHODOLOGY

This Report provides a financial feasibility assessment of an expanded service between Vallejo and San Francisco and eight potential new ferry service lines that have been identified for Solano County:

1. Vallejo and Larkspur
2. Vallejo and Oakland
3. Benicia and Martinez
4. Benicia and Vallejo
5. Rio Vista and Antioch
6. Rio Vista and Benicia
7. Rio Vista and Martinez
8. Rio Vista and Vallejo

Study Background

Over the past decade STA, in cooperation with the respective local jurisdictions, has contemplated new routes to/from jurisdictions in Solano County but has not fully considered capital financing and operational feasibility. While each service will face significant initial capital costs as well as future capital improvement replacement costs, the financial feasibility assessment focuses on the operating costs of each of the proposed ferry lines and also identifies potential sources of revenue to cover these costs.

Given these costs and revenues, a determination can be made regarding feasibility—can the facility and service be funded with identified sources of money and what is the efficiency and effectiveness of these expenditures given expected ridership? In the case of the Vallejo services, the financial feasibility assessment focuses upon the commuter (and potential emergency response) services presently provided by WETA, assuming continued use of its existing technologies. In the case of Benicia and Rio Vista, feasibility is considered in the context of the operating cost structure of a private ferry operator. In all cases, it is recognized that there are other possible services and technologies available.

Study Methodology

The STA commissioned this effort to better understand the role that expanded ferry service to/from Solano County could have on the County transportation network.

Interaction with Working Group

STA established a PDT Working Group to define the routes and levels of service to be evaluated; to guide the information collection and feasibility analysis effort; and to represent the interests of the participating cities as well as other transit providers. The PDT met four times during the preparation of this Report.

Interaction with Potential Ferry Operators

Due to the uncertainty of which transit provider would operate each route, EPS coordinated with WETA, as a proxy for a public operator model, as well as two, established private ferry operators. Where a public operator model is assumed, the feasibility study occurs within the context of WETA's legislative mandates, plans and programs, and operating experience. In speaking with the private ferry operators, EPS sought input related to service levels and fares.

Interaction with Proposed Ferry Service Cities

In addition to participating in the PDT meetings, each of the proposed ferry service cities (in Solano County) met with STA staff to discuss local objectives regarding bringing ferry services to the cities and planning and funding efforts needed to accommodate ferry service. In advance of these meetings, each City received an information request asking for input related to each city's "readiness" to accommodate ferry service. Specifically, cities were asked to describe the planning activities that may have occurred or are underway in each city to support ferry service, as well as any funding sources each city may have available to contribute toward capital and/or operational expenses. Cities were also invited to describe other considerations, opportunities and obstacles that may affect potential ferry service. The letters that were sent to each city are provided in **Appendix A**.

Financial Feasibility Analysis

The core of the feasibility analysis conducted for this study involved reviewing the operating cost assumptions prepared by WETA and adapting them for each of the Vallejo routes, based on WETA's current operating standards and assumptions. The operating cost analysis identifies and considers efficiency measures where applicable, such as the potential for return trips. EPS incorporated the operating cost assumptions into an economic analysis framework that "solves" for required levels of ridership to sustain the service and then compares that level of required ridership to the 2040 ridership projections.

For the Benicia and Rio Vista routes, the feasibility analysis is based on a private ferry operating model and feasibility is defined in the context of boat occupancy (i.e., how full is each boat based on the ridership forecasts).

Role of Solano Transportation Authority

Agency Overview

The STA was created in 1990 through a Joint Powers Agreement between the cities of Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, Vallejo and the County of Solano to serve as the CMA for Solano. As the CMA for the Solano area, the STA partners with various transportation and planning agencies, such as the Metropolitan Transportation Commission (MTC) and Caltrans District 4.

The STA is responsible for countywide transportation planning, programming transportation funds, managing and providing transportation programs and services, delivering transportation projects, and setting transportation priorities.

Solano Comprehensive Transportation Plan Update

The STA is updating the Comprehensive Transportation Plan (CTP), which identifies and prioritizes the transportation needs and funding throughout Solano County through the year 2040. The current CTP 2030 was finalized in 2005.

The CTP covers policies, programs, and projects for transportation in the seven cities (Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, Vallejo) and unincorporated Solano County. The CTP also covers inter-regional connections to neighboring counties and the northern California region. The CTP includes the following transportation modes and considerations:

- Transit and ridesharing
- Bicycles
- Pedestrians
- Arterial roads
- Highways and freeways
- Water transportation
- Regional rail
- Freight (goods movement)
- Transportation safety
- Seniors and people with disabilities
- Disadvantaged communities
- Air quality and climate change

Programs and projects for the County and the seven cities must be listed in the STA CTP in order to be eligible for regional, state or federal transportation funds and to be included in MTC Regional Transportation Plan (RTP), Plan Bay Area. STA distributes those funds based on the Solano CTP and Plan Bay Area.

SR 37 Policy Committee

The SR 37 Policy Committee is a multi-county committee with policy makers participating from Marin, Napa, Sonoma and Solano counties. The staff support to this committee is provided by all four agencies. The SR 37 Policy Committee was formed in 2015 as part of a Memorandum of Understanding (MOU) to discuss joint County efforts in improving the SR 37 Corridor to address issues such as sea level rise, traffic congestion, transit options and recreational activities.

Role of WETA

WETA operates four ferry routes on San Francisco Bay, providing transbay service from the East Bay and North Bay to San Francisco and from the East Bay to South San Francisco. The Oakland/Alameda, Alameda Harbor Bay, and Vallejo routes provide service to the San Francisco Ferry Building with limited service to Pier 41 at San Francisco's Fisherman's Wharf. The South San Francisco route provides service between Oakland, Alameda, and Oyster Point in South San Francisco with limited service to the San Francisco Ferry Building.

For those services that are evaluated in the context of being operated by a public agency, WETA is used as a proxy for this type of service. Where applicable, this feasibility study occurs within the context of WETA's legislative mandates, plans and programs, and operating experience. This section provides a summary of WETA, its planning and policy documents, and its operations.

Agency Overview

The Water Transit Authority (WTA) was formed in October 1999 by the California State legislature with the mandate to create a long-term plan for new and expanded water borne transit and related services on the San Francisco Bay. The enabling legislation (Senate Bill 428–1999) directed the new regional agency to prepare an *Implementation and Operations Plan* (IOP) in order to evaluate ridership demand, cost-effectiveness and environmental impact of expanded water transit on San Francisco Bay. In July 2003, the State Legislature approved the IOP and authorized the WTA to operate a comprehensive public water transit system of ferries, feeder buses, and ferry terminals.

WTA was dissolved in January 2008 by State law (SB 976), and replaced by a new agency. The new agency, WETA, was given responsibility for consolidating and operating public ferry services in the Bay Area, planning new service routes and coordinating ferry transportation response to emergencies or disasters affecting the Bay Area transportation system. Under SB 976, WETA was directed to gain control over the existing publicly operated ferries in the Bay Area, except those owned and operated by the Golden Gate Bridge Highway and Transportation District. SB 1093 was subsequently adopted by the State Legislature to clarify the transition of existing Alameda and Vallejo ferry services to WETA. In October 2010 the Alameda City Council and WETA Board adopted the transition agreement for the Alameda/Oakland and Alameda/Harbor Bay services. The transition was completed in April 2011, transforming WETA into a transit operating entity. In October 2011, the Vallejo City Council and WETA Board adopted the transition agreement for the Vallejo service. Transition of the Vallejo Service was completed on July 1, 2012. In addition to operating the three routes transitioned from the cities of Alameda and Vallejo, WETA initiated its first expansion of service in June 2012: a ferry running between Alameda, Oakland, and South San Francisco.

Supporting Bay Area emergency response is another mission of WETA. Ferry service is a safe and reliable means of moving commuters in the event of a major bridge failure or other disaster that disrupts other transit choices. Solano County is strategically located outside the Bay Area's urban core with good access to ferry service, I-80, I-505, I-5, and Travis Air Force Base, a key facility for emergency relief efforts. Establishing ferry service to Solano County jurisdictions beyond Vallejo would bring the potential for emergency response services to other parts of the County, as the vessels and terminals used for transit services could be redeployed to provide emergency response services if needed.

WETA Guiding Planning Documents

WETA's operations and investments have been guided by a number of planning documents prepared for and adopted by the WETA Board of Directors. These documents include:

- ***WETA Strategic Plan.*** WETA's 2016 Strategic Plan outlines a vision for the San Francisco Bay Ferry system over the next 20 years that responds to passenger demand, makes critical infrastructure investments, and increases WETA's ability to respond to emergencies and

system disruptions. With funding and environmental approvals, WETA's long-range plan calls for new terminals in Richmond, Treasure Island, Mission Bay, Berkeley, Redwood City, Seaplane Lagoon, the South Bay, and the Carquinez Strait, ultimately creating a robust 16-terminal regional network to meet the Bay Area's demand for a safe, sustainable and environmentally responsible transportation alternative.

- ***WETA's System Expansion Policy.*** The WETA expansion policy is intended to provide a framework for evaluating the feasibility of new ferry projects. The framework consists of policy statements that provide guidance for developing candidate project elements such as landside and waterside facilities, vessels, and service plans. In addition, a set of evaluation measures defines a range of productivity and efficiency metrics that inform the WETA Board and funding partners regarding a project's financial feasibility and sustainability.

- ***Implementation & Operations Plan (IOP).*** WETA prepared a guiding document called A Strategy to Improve Public Transit with an Environmentally Friendly Ferry System – Final Implementation & Operations Plan, in July 2003. This Plan set out how WETA would achieve its legislative mandate.

- ***WETA Short Range Transit Plan 2016 – 2025.*** Federal statute requires MTC, in partnership with State and local agencies, to develop and periodically update a long-range RTP and a Transportation Improvement Program (TIP). The TIP implements the RTP by programming federal funds to transportation projects contained in the RTP. In order to effectively execute these planning and fund programming responsibilities, MTC, in cooperation with Region IX of the Federal Transit Administration (FTA), requires each transit operator receiving federal funding to prepare, adopt, and submit a *Short-Range Transit Plan* (SRTP).

  The WETA SRTP has been prepared consistent with MTC's guidelines for all transit operators in the San Francisco Bay Area. It will be updated periodically, consistent with MTC schedules and requirements, to reflect changes to WETA's plans, projects, operations and funding over time. The SRTP has a ten-year horizon (2016 through 2025) and provides a forecast of operating expenses and revenues and capital expenditures and funding, as well as supporting information about WETA's operations and planning activities.

- ***Capital Improvement Program.*** WETA included a 10-Year Capital Improvement Program (CIP) into the SRTP, as required. The CIP identifies $515 million worth of capital projects to be completed during the duration of the Plan (FY 2016 through FY 2025). These capital projects implement its regional program of public transit and emergency response ferry services. The CIP includes both one-time expansion and cyclical rehabilitation and replacement needs for the combined WETA capital assets. The WETA CIP consists of the following five project categories:

  - **Revenue Generating Vessels** – This includes $329.4 million in projects to rehabilitate, replace and expand the ferry vessel fleet required to operate WETA's ferry vessel fleet, which will consist of a total of 18 revenue vessels by FY2024-25.

  - **Major Facilities** – This includes $17.2 million in projects to rehabilitate and replace floats and gangways, conduct maintenance dredging, and terminal maintenance. The Vallejo ferry basin requires dredging approximately every three years to remove silt

build-up that would otherwise prevent ferries from operating in this area. Dredge work for the Vallejo service is scheduled to take place in FY2019-20 and FY2023-24.

- **Service Expansion Projects** – This includes $92.6 million in projects to build additional ferry terminals and berthing capacity necessary to effectively operate expanded ferry services and emergency response services.
- **Maintenance Facility and Equipment Projects** – This includes $75.0 million to support the Central Bay Facility and the North Bay Facility.
- **Miscellaneous** – This includes $1.1 million in projects to purchase general and emergency response service equipment.

- ***MTC Transbay/Core Capacity Study.*** The study is a joint effort of five transit operators: BART, Muni, AC Transit, Caltrain, and WETA, in coordination with the San Francisco County Transportation Authority (SFCTA) and the Metropolitan Transportation Commission (MTC). The five transit operators are all committed to identifying investments and improvements to increase transit capacity to the San Francisco core, and this study is the first to date to bring the major transit operators together to address this regional issue in a comprehensive, coordinated manner.

Existing WETA Ferry Service Operations

Providing commuter ferry service is WETA's primary mission. WETA's commuter ferry service now consists of five operating lines: Vallejo to San Francisco, Alameda to San Francisco, Bay Farm Island to San Francisco, Alameda to South San Francisco, and most recently, Richmond to San Francisco. WETA's experience operating these service routes are the basis for the operating cost estimates considered in **Chapter 5** of this Report.

New Ferry Service Planning, Engineering Studies and Environmental Review

Planning and development of the other proposed ferry lines has been an ongoing WETA activity with substantial funding directed towards engineering and environmental review of the proposed ferry line terminals and operations. From its outset WETA has been involved in planning and analysis of a set of identified potential ferry service routes. These future service routes include those that have moved through the planning process and have been included in the SRTP capital improvement program (the Near-Term Expansion Services) and those that have not yet been funded (the Additional Expansion Services).

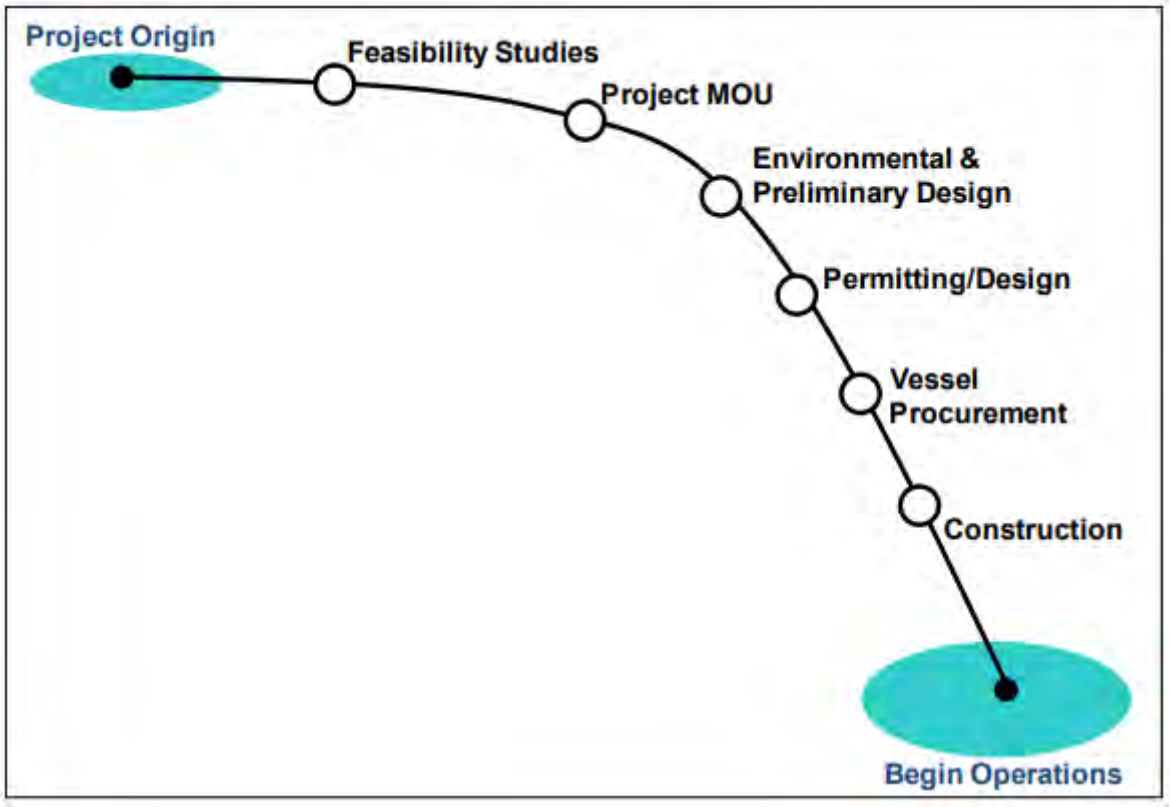
Unspecified routes serving Solano County are potentially reflected in the map below (**Figure 3**) as "Carquinez Strait" routes, although WETA's SRTP identifies the Carquinez Strait cities as Antioch, Martinez, or Hercules. Any future service to Solano County provided by WETA is unfunded.

Figure 3 Map of Current and Future WETA Terminals and Facilities

Source: WETA 2016 Strategic Plan

Developing, and ultimately implementing new ferry services and associated facilities requires an extensive process, including environmental review, design, and construction, as well as securing funding and developing long-term operating plans for new services, as demonstrated in **Figure 4**.

Figure 4 WETA Project Implementation Process



Source: WETA 2016 Short Range Transit Plan

Role of Alternative Operator Models

To understand a fuller range of options for providing new ferry service to Solano County, EPS coordinated with select private ferry operators to understand the potential operations and related costs for providing small-boat ferry service between Solano County jurisdictions within the Carquinez Strait.

Based on early input from WETA, it became clear that a WETA-type service to/from Rio Vista and Suisun City would not be feasible due to WETA's land-side requirements and operating cost structure. However, a privately operated, small-boat ferry service, especially if aligned with WETA's existing service out of Vallejo, warranted closer evaluation. The results of interviews with the private operators, Tideline and PropSF, both of which are operating successful small boat ferries in San Francisco Bay, are summarized in this section.

Tideline

EPS spoke with Nathan Nayman, President of Tideline Marine Group. Tideline is an official Port of San Francisco water transportation service offering public and private commuter service, Bay cruises and private charter trips around the San Francisco Bay. Tideline started service in 2014 when it was awarded a contract by the Port to serve as a water taxi. Tideline is licensed by the California Public Utilities Commission (CPUC), just like Golden Gate or WETA's Bay Ferry services.

Tideline's operating model is built around four lines of business: commuter service, charter service, port management, and consulting services. Tideline currently operates the City of Napa's Monday-through-Friday commuter service between Berkeley and San Francisco. A single one-way ticket is $9.50, which reflects some subsidy from the Port of San Francisco. A service between Richmond and San Francisco was discontinued due to insufficient ridership.

Tideline operates 45-passenger boats that require only 3' of draw, which eliminates the need for dredging. Tideline is authorized to access 24 landing sites around the Bay Area. Per Nayman, any marina may support a Tideline service if there is a minimum of 60' the boat can dock against to allow passengers to embark/disembark.

Nayman understands the potential of the Carquinez Strait service and sees the benefit that a private operator could provide in terms of complementing the existing (or expanded) WETA service out of Vallejo (i.e., providing service from jurisdictions along the Carquinez Strait to Vallejo where riders could then transfer to the Vallejo/San Francisco ferry). He was not able to share his operating cost structure as part of this study but would be available for further consultation if requested.

PropSF

EPS spoke with James Jaber and Alex Kryska of PropSF. PropSF currently operates a chartered commuter service on behalf of Genentech: from Benicia to Tiburon to South San Francisco, from Berkeley to South San Francisco, and from Richmond to South San Francisco.

PropSF has been operating for three years. All boats are new or lightly used and have been purchased by private companies in support of their charter ferry services. Boats are overnighted and maintained in Emeryville. Because the boats have been purchased by private companies, Jaber stated that PropSF can operate at approximately one-tenth the cost of WETA.[8] PropSF can efficiently acquire new boats as well, with relationships with leading boat builders and established financing structures and/or minimal lease payments.

Like Tideline, PropSF sees the market potential in the Carquinez Strait and appreciates the possibility of supporting the existing (and/or future) WETA service out of Vallejo and/or Benicia. PropSF is supporting the STA Water Transit Services Study by providing fare estimates for the Carquinez Strait routes.

Based on information received from Tideline and PropSF, EPS was able to provide SFCTA with the cost information needed to estimate ridership for the service routes under consideration as part of this analysis.

[8] This statement has not been independently verified by EPS.

3. DESCRIPTION OF PROPOSED FERRY SERVICES

As noted previously, STA established a PDT Working Group to define the routes and levels of service to be evaluated; to guide the information collection and feasibility analysis effort; and to represent the interests of the participating cities as well as other transit providers. The PDT is an advisory body, responsible for participating in the Study process and bringing a range of views and perspectives to the Study.

Members of the PDT include:

William Tarbox, City of Benicia
Dave Melilli, City of Rio Vista
Terrance Davis, City of Vallejo
Matt Tuggle, County of Solano
Ron Downing, GGT
Robert Betts, Marin Transit
Dan Tischler/Drew Cooper, SFCTA
Libby Dippel, SMART
Scott McDonald, TAM
Beth Kranda, Soltrans
Kevin Connolly, WETA

Determining Routes and Level of Service

The PDT provided input on the routes for possible evaluation and shared high-level commute data to provide a sense of the relative commute trends to/from jurisdictions in Solano County. This data is included in **Appendix B**. In thinking about potential routes, EPS proposed two layers of screening for initial feasibility.

The first feasibility screen included factors such as broad commute patterns, length of trip, geological considerations, and city and landside readiness. The second feasibility screen delved into route logistics, ridership projections, the financial analysis, and the availability of other funding.

Based on the first screen criteria, the group discussed potential origin/destination combinations. The group determined that evaluating routes to/from Suisun City and to locations further north would not be an efficient use of resources given waterway constraints, very long travel times, and the relative size of the origin and destination markets.[9] The group also decided to reflect the existing Vallejo to San Francisco service, and not evaluate a direct service between Benicia and San Francisco, acknowledging that potential ferry riders will either take the ferry from Benicia to Vallejo or drive directly to Vallejo to link up with the Vallejo to San Francisco service.

[9] Future analysis may want to evaluate demand between Solano County and Sacramento and Yolo counties. These connections were not studies as part of this analysis due to long travel times, but these counties may be a source of potential ridership.

What clearly emerged was the interest in services between jurisdictions within the Carquinez Strait (as shown in **Figure 5**), which raised the issue of using this Study to evaluate a private, small-boat operating model as well for these intra-Carquinez Strait routes.

Figure 5 Preliminary Routes Evaluated by the PDT

Origin	Destination						
	Benicia	Vallejo	San Francisco	Martinez *(Contra Costa County)*	Antioch *(Contra Costa County)*	Larkspur *(Marin County)*	Alameda *(Alameda County)*
Benicia		Yes	Yes	Yes			
Rio Vista	Yes	Yes		Yes	Yes		
Vallejo	Yes			Yes		Yes	Yes

Yellow highlighting indicates route is within the Carquinez Strait.

After the first PDT meeting, EPS, STA, and WETA staff met to discuss logistics of the proposed routes between Vallejo and Larkspur, Oakland, and San Francisco for a WETA-type of service. For small vessel service (like PropSF or Tideline), the group chose to analyze Rio Vista to Antioch, Benicia, and Martinez, and from Benicia to Martinez and Vallejo.

In determining the level of service of each route, the objective was to identify a "sweet spot" level of service that is consistent with WETA's operating mandate to provide weekday, peak travel transit service and that meets at least the basic requirements of a transit service (i.e., more than one outbound trip daily and more than one return trip daily), while not planning for more trips than current ridership projections can fill. While other service configurations are possible, evaluation of the basic service level will adequately illuminate financial feasibility issues.

EPS subsequently worked with WETA and PropSF to develop fare assumptions (**Table 1**). For the Vallejo services, the fares are based on WETA's systemwide fare policies and include Clipper discounts, for regular commuters. For the Benicia and Rio Vista services, the fares are estimated and provided by PropSF and reflect what would need to be charged, assuming a full boat, in order to recover operating expenses.

Table 1 2018 Fares for Prospective Routes

Origin	Destination	Year 2018 Standard Fare	Year 2018 Clipper Fare	Year 2040 Standard Fare	Year 2040 Clipper Fare
Vallejo	SF Ferry Building [1]	$14.20	$10.78	$27.58	$20.94
Vallejo	Larkspur	$14.20	$10.78	$27.58	$20.94
Vallejo	Oakland	$14.20	$10.78	$27.58	$20.94
Benicia	Martinez	$5.55	n/a	$10.63	
Benicia	Vallejo	$11.00	n/a	$21.08	
Rio Vista	Antioch	$12.37	n/a	$23.70	
Rio Vista	Benicia	$17.19	n/a	$32.94	
Rio Vista	Martinez	$16.75	n/a	$32.09	
Rio Vista	Vallejo	$22.80	n/a	$43.69	

[1] The Vallejo/SF Ferry Building service is an expansion of the existing service.

Sources: STA; WETA; PropSF; SFCTA; Economic & Planning Systems, Inc.

Expanded Vallejo/San Francisco Service

The Vallejo ferry service began operations in 1986 with limited commuter ferry service to San Francisco and midday service from San Francisco to Marine World/Vallejo. In July 2012 the responsibility and ownership of the Vallejo service was transferred from the City of Vallejo to WETA. Ridership on the Vallejo service has increased steadily in recent years, with related improvements in farebox recovery, passengers per revenue hour, and cost per passenger measures. Continued peak period congestion on the I-80 corridor makes the ferry service highly time-competitive during commute periods with other travel modes including both automobile and bus transit options between Vallejo and San Francisco. In 2015, the route had increasing numbers of leave-behinds on multiple departures, especially the most popular evening return trips from San Francisco back to Vallejo. Despite some adjustment to fleet assignments in order to try to accommodate the surging demand, these changes are not enough to consistently accommodate all passengers.

With the sustained ridership growth of the current Vallejo/San Francisco service, the City of Vallejo has recognized ferry service as an economic development "asset," creating an activity node along the Napa River waterfront, attracting visitors departing to and arriving from San Francisco, and improving access to employment for Vallejo households. Moreover, existing and expanded ferry service is infrastructure and an amenity that will improve development potential of Mare Island, consistent with the Mare Island Specific Plan. ,

Landside Planning and Preparations

The Vallejo Terminal is located at 289 Mare Island Way in Vallejo in 1999. The terminal includes two berthing slips, a bus loading zone, covered passenger waiting areas, ticket sales outlet, and

restrooms. The City of Vallejo retains ownership of landside facilities, while WETA owns waterside facilities including floats and gangways.

The terminal can accommodate an increase in ridership but may require expanded parking options. The City of Vallejo manages and controls parking at the terminal, including pricing and policy, and the City is currently working on plans to develop a 700-space parking structure at the existing terminal. There is capacity for another 1,000 surface spaces that could be made available on an as-needed basis (i.e., "flex" spaces).

Level of Service Evaluated

For purposes of this evaluation, EPS worked with WETA to understand the operating costs of expanding the existing weekday transit service with two additional trips from Vallejo to San Francisco in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and two trips from San Francisco to Vallejo in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). One reverse trip (from San Francisco to Vallejo) would be offered in the morning and one reverse trip (from Vallejo to San Francisco) would be offered in the afternoon. The 27.8-nautical mile trip between Vallejo and San Francisco takes 54 minutes, which, though a long commute, is much faster than driving in traffic conditions. One additional vessel and one crew are required in the morning and in the afternoon (two crews in all) in order to provide this expanded level of service. An illustrative schedule of how the service could be operated are shown below in **Figure 6**.

Figure 6 Vallejo-San Francisco Expanded Service (Illustrative Only)

	Vessel #	Crew #	Trip #	Time	From		To	Total Miles
	1	***1***	***D1***	***7:45***	***NBMF***		***Vallejo***	***0.3***
AM	1	1	P1	8:00	Vallejo		SF (Ferry Bldg.)	27.8
	1	1	R1	9:00	SF (Ferry Bldg.)		Vallejo	27.8
	1	1	P2	10:00	Vallejo		SF (Ferry Bldg.)	27.8
	1	1	R1	11:00	SF (Ferry Bldg.)		Vallejo	27.8
			D2	***12:00***	***Vallejo***		***NBMF***	***0.3***
	1		LO1	12:15		NBMF		
	1	***2***	***D1***	***3:45***	***NBMF***		***Vallejo***	***0.3***
	1	2	R1	4:00	Vallejo		SF (Ferry Bldg.)	27.8
	1	2	P1	5:00	SF (Ferry Bldg.)		Vallejo	27.8
PM	1	2	R2	6:00	Vallejo		SF (Ferry Bldg.)	27.8
	1	2	P2	7:00	SF (Ferry Bldg.)		Vallejo	27.8
	1	***2***	***D2***	***8:00***	***Vallejo***		***NBMF***	***0.3***
							Total	**223.6**

Sources: WETA; Economic & Planning Systems, Inc.

Connecting Transit Services

Connecting transit services in Vallejo are provided by Soltrans and VINE Transit. VINE Transit operates an express route to BART. Soltrans & WETA provide reciprocal Clipper transfer discounts.

Vallejo (Expanded Service) Opportunities and Constraints

As the existing Vallejo service continues to attract riders, the landscape of opportunities and constraints evolves. The primary opportunity is to capitalize on an already successful service and continue to provide opportunities to get more cars off the road without the risk of uncertain ridership. The required landside improvements and investments are minimal in the sense that the terminal is sufficiently sized to accommodate growth and the waterside improvements (docks, etc.) are adequate. The chief constraint, as noted above, is that while the terminal can accommodate an increase in ridership, expanded parking options are required. Planning for expanded parking is currently underway by the City of Vallejo in partnership with STA.

New Vallejo Services

Vallejo to Larkspur

Level of Service Evaluated

EPS worked again in cooperation with WETA to understand the operating costs of introducing new weekday transit service from Vallejo to Larkspur with three trips from Vallejo to Larkspur in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and three trips from Larkspur to Vallejo in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Two reverse trips (from Larkspur to Vallejo) would be offered in the morning and two reverse trips (from Vallejo to Larkspur) would be offered in the afternoon. The 20.7-nautical mile trip between Vallejo and Larkspur would take 53 minutes, which depending on the time of day, door-to-door, may be slower than or competitive with driving in traffic conditions. Two vessels and two crews are required in the morning and in the afternoon (four crews in all) in order to provide this level of service. An illustrative schedule of how the service could be operated are shown below in **Figure 7**.

Figure 7 Vallejo-Larkspur Service (Illustrative Only)

	Vessel #	Crew #	Trip #	Time	From		To	Total Miles
	1	***1***	***D1***	***5:45***	***NBMF***		***Vallejo***	***0.3***
	1	1	P1	6:00	Vallejo		Larkspur	20.7
	1	1	R1	7:00	Larkspur		Vallejo	20.7
AM	1	1	P3	8:00	Vallejo		Larkspur	20.7
	2	***2***	***D2***	***6:45***	***NBMF***		***Vallejo***	***0.3***
	2	2	P2	7:00	Vallejo		Larkspur	20.7
	2	2	R2	8:00	Larkspur		Vallejo	20.7
	2	***2***	***D3***	***9:00***	***Vallejo***		***NBMF***	***0.3***
	1		LO1	9:00		Larkspur		
	2		LO2	9:00		at NBMF		
	1	3	P1	4:00	Larkspur		Vallejo	20.7
	1	3	R2	5:00	Vallejo		Larkspur	20.7
	1	3	P3	6:00	Larkspur		Vallejo	20.7
PM	***1***	***3***	***D1***	***7:00***	***Vallejo***		***NBMF***	***0.3***
	2	***4***	***D2***	***3:45***	***NBMF***		***Vallejo***	***0.3***
	2	4	R1	4:00	Vallejo		Larkspur	20.7
	2	4	P2	5:00	Larkspur		Vallejo	20.7
	2	***4***	***D3***	***6:00***	***Vallejo***		***NBMF***	***0.3***
							Total	**208.8**

Sources: WETA; Economic & Planning Systems, Inc.

Potential Landside Issues

While the Vallejo Terminal is sized to accommodate additional services and riders, berthing facilities at the Larkspur facility are at capacity. Increasing the berthing capacity at Larkspur would require significant planning and capital investment.

Vallejo to Oakland

Level of Service Evaluated

EPS worked with WETA to understand the operating costs of introducing new weekday transit service from Vallejo to Oakland with four trips from Vallejo to Oakland in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and four trips from Oakland to Vallejo in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Two reverse trips (from Oakland to Vallejo) would be offered in the morning and three reverse trips (from Vallejo to Oakland) would be offered in the afternoon. The 32.5-nautical mile trip between Vallejo and Oakland would take 80 minutes, which is only marginally slower than driving in traffic conditions. Three vessels and three crews are required in the morning and in the afternoon (six crews in all) in order to provide this level of service. An illustrative schedule of how the service could be operated are shown below in **Figure 8**.

Figure 8 Vallejo-Oakland Service (Illustrative Only)

	Vessel #	Crew #	Trip #	Time	From		To	Total Miles
	1	***1***	***D1***	***5:45***	***NBMF***		***Vallejo***	***0.3***
	1	1	P1	6:00	Vallejo		Oakland	32.5
	1	1	R1	7:30	Oakland		Vallejo	32.5
	1	1	P4	9:00	Vallejo		Oakland	32.5
AM	***2***	***2***	***D2***	***6:45***	***NBMF***		***Vallejo***	***0.3***
	2	2	P2	7:00	Vallejo		Oakland	32.5
	2	2	R2	8:30	Oakland		Vallejo	32.5
	3	***3***	***D3***	***7:45***	***NBMF***		***Vallejo***	***0.3***
	3	3	P3	8:00	Vallejo		Oakland	32.5
	1		LO1	10:30		in Oakland		
	2		LO2	10:00		at NBMF		
	3		LO3	9:30		in Oakland		
	1	4	P1	4:00	Oakland		Vallejo	32.5
	1	4	R2	5:30	Vallejo		Oakland	32.5
	1	4	P4	7:00	Oakland		Vallejo	32.5
	1	***4***	***D1***	***8:30***	***Vallejo***		***NBMF***	***0.3***
	3	5	P2	5:00	Oakland		Vallejo	32.5
PM	3	5	R3	6:30	Vallejo		Oakland	32.5
	3	5	P5	8:00	Oakland		Vallejo	32.5
	3	***5***	***D2***	***9:30***	***Vallejo***		***NBMF***	***0.3***
	2	6	R1	4:30	Vallejo		Oakland	32.5
	2	6	P3	6:00	Oakland		Vallejo	32.5
	2	***6***	***D3***	***7:30***	***Vallejo***		***NBMF***	***0.3***
							Total	**456.8**

Sources: WETA; Economic & Planning Systems, Inc.

Vallejo (New Service) Opportunities and Constraints

Because the Vallejo terminal already exists and is built to WETA-specifications, there are efficiencies to be realized by using the Vallejo Terminal as a departure point to locations in Alameda and Marin counties.

The major constraint associated with the Vallejo/Oakland route is that ridership appears low relative to overall commute patterns. Projected ridership is too low at this point to justify a public service, such as WETA, but a private operator may be able to capture some efficiencies with potential interlining at Richmond, Berkeley, and/or Emeryville. Transit connections are reasonable at Jack London Square (the location of the Oakland terminal) but do require multiple modes in order to access BART.

The two major constraints associated with the Vallejo/Larkspur route are 1) berthing facilities at the Larkspur facility are at capacity and 2) the Larkspur terminal has relatively poor access to the job centers of Marin County. Increasing the berthing capacity at Larkspur would require significant planning and capital investment. It may be more efficient to evaluate a private-operator service to another location in Marin County (e.g., San Rafael). The landside improvements needed to accommodate a private operator are not as substantial as those

required by WETA or Golden Gate. On the other hand, some riders might find that a cross-Bay journey in one of the smaller boats, like those operated by the private operators, can be more turbulent.

Exploring the opportunities that may be available to serve Marin County through a private operating model is recommended. Pilot services (operated on a trial basis) could help identify the preferred landing locations in Marin County and the optimal level of service. This pilot flexibility is not available with a public service like WETA or Golden Gate.

New Benicia Services

Landside Planning and Preparations

New Benicia service would have passengers embark/disembark at a new terminal to be located at one of several potential locations along the City's waterfront. The Port of Benicia is a public trust port, controlled by the City, that is currently leased to AMPORTS, one of the largest auto processors in North America. The Benicia Marina is the most likely candidate (see **Figure 9**). It is owned by the City but leased to Benicia Harbor, so the City's operational knowledge of the facility is limited. PropSF currently operates a Genentech charter service between Benicia and South San Francisco out of the Benicia Marina.

Figure 9 Benicia Potential Terminal Locations

Source: STA

From an economic development perspective, the Mayor of Benicia believes that a ferry terminal and associated passenger activity would, in combination with other investments and amenities, serve to attract new investment and development along the City's riverfront and nearby Downtown area. However, at this time, there are no efforts underway, either as part of land use planning or CIP processes, to support or take advantage of ferry service in Benicia. To move forward with ferry service to Benicia, a site for the Terminal would need to be identified and substantial locally-funded landside improvements would be required, along with land use

planning changes that can take advantage of higher density market opportunities and the expanded transit options.

Benicia to Martinez

The objective of the Benicia to Martinez route is to facilitate transit connections between Solano and Contra Costa counties and connect Solano County residents and employees to the transit connections available in Martinez. Martinez is located at the intersection of I-680 and SR 4, directly across the Sacramento River from Benicia and is a regional transit hub for central and east Contra Costa County. The City's expanding Downtown Intermodal facility ("Intermodal") serves local and regional bus operators and passengers as well as the Capitol Corridor and other Amtrak lines.

Level of Service Evaluated

With WETA's assistance, a service contemplating new weekday transit service from Benicia to Martinez was designed with three trips from Benicia to Martinez in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and three trips from Martinez to Benicia in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Two reverse trips (from Martinez to Benicia) would be offered in the morning and two reverse trips (from Benicia to Martinez) would be offered in the afternoon. The 1.8-nautical mile trip between Benicia and Martinez would take six minutes. One vessel would be required to provide this level of service.

Benicia to Vallejo

The objective of the Benicia to Vallejo route would be to expand access for Solano County residents to the existing (or potentially expanded) service between Vallejo and San Francisco. However, getting to Vallejo from Benicia by car is faster and eliminates a mode transition.

Level of Service Evaluated

With WETA's assistance, a service contemplating new weekday transit service from Benicia to Vallejo was designed with four trips from Benicia to Vallejo in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and four trips from Vallejo to Benicia in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Three reverse trips (from Vallejo to Benicia) would be offered in the morning and three reverse trips (from Benicia to Vallejo) would be offered in the afternoon. The 8.0-nautical mile trip between Benicia and Vallejo would take 25 minutes. Two vessels are required to provide this level of service.

Benicia Opportunities and Constraints

While Benicia is further east relative to Vallejo, a ferry vessel does not need to travel up the Mare Island Strait, as it does to access the Vallejo Terminal, so Benicia does not suffer from a travel time penalty. Benicia also has the benefit of several potential terminal locations, the most likely of which would be the Benicia Marina. The primary constraint at this time is that traveling from Benicia to Vallejo by car is comparably faster, and there is available parking at the Vallejo terminal; whereas the ferry ride between Benicia and Vallejo would be approximately 25 minutes. As such, San Francisco-bound commuters would likely opt to drive directly to Vallejo rather than have to transfer ferries. In addition, SolTrans operates the Solano Express Yellow Line, which provides service between Benicia and Vallejo, suggesting that ferry service between Benicia and Vallejo may be a redundant transit investment.

The primary opportunities related to a Benicia Martinez service is improving the connections between Solano and Contra Costa counties, particularly given Martinez's role as the County seat and its place in the regional transportation network. However, at this time, the travel-time penalty appears to be too high for a ferry service. In addition, significant landside improvements would be needed in Martinez to accommodate ferry service.

New Rio Vista Services

Development of a ferry terminal in the City of Rio Vista could enable passenger ferry service from Rio Vista, along the Sacramento River, to Sacramento, to Contra Costa County or to Vallejo with connecting service to San Francisco. The City's objectives in pursuing ferry service are five-fold: 1) economic development, 2) serving the City's senior population and facilitating medical-related trips to Contra Costa County, 3) emergency response, 4) traffic mitigation, and 5) recreation.

Landside Planning and Preparations

New Rio Vista service would have passengers embark/disembark at one of two terminal locations. Two sites are conceptually under consideration, as shown in **Figure 10**, one which is Downtown on the waterfront at the end of Montezuma Street and located within an MTC-designated priority development area (PDA) and one which is adjacent to the Delta Marina Yacht Harbor at the end of Marina Drive.

Figure 10 Rio Vista Potential Terminal Locations

Source: STA

In June 2017, the City prepared a Downtown Plan for the City's PDA. The City's PDA includes several blocks of land along the waterfront but does not specifically reference ferry service or improvements to support ferry service. There are very few existing opportunities to connect to transit within the PDA.

Rio Vista and Antioch

The objective of the Rio Vista to Antioch route is to facilitate transit connections between Solano and Contra Costa counties.

Level of Service Evaluated

A service contemplating new weekday transit service from Rio Vista to Antioch was designed with two trips from Rio Vista to Antioch in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and two trips from Antioch to Rio Vista in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). One reverse trip (from Antioch to Rio Vista) would be offered in the morning and one reverse trip (from Rio Vista to Antioch) would be offered in the afternoon. The 15.1-nautical mile trip between Rio Vista and Antioch would take 28 minutes. One vessel would be required to provide this level of service.

Rio Vista and Benicia

Level of Service Evaluated

A service contemplating new weekday transit service from Rio Vista to Benicia was designed with three trips from Rio Vista to Benicia in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and three trips from Benicia to Rio Vista in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Two reverse trips (from Benicia to Rio Vista) would be offered in the morning and two reverse trips (from Rio Vista to Benicia) would be offered in the afternoon. The 29.6-nautical mile trip between Rio Vista and Benicia would take 55 minutes. Two vessels would be required to provide this level of service.

Rio Vista and Martinez

The objective of the Rio Vista to Martinez route is to facilitate transit connections between Solano and Contra Costa counties and connect Solano County residents and employees to the transit connections available in Martinez.

Level of Service Evaluated

A service contemplating new weekday transit service from Rio Vista to Martinez was designed with three trips from Rio Vista to Martinez in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and three trips from Martinez to Rio Vista in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Two reverse trips (from Martinez to Rio Vista) would be offered in the morning and two reverse trips (from Rio Vista to Martinez) would be offered in the afternoon. The 28.6-nautical mile trip between Rio Vista and Martinez would take 52 minutes. Two vessels would be required to provide this level of service.

Rio Vista and Vallejo

The objective of the Rio Vista to Vallejo route would be to expand access for Solano County residents to the existing (or potentially expanded) service between Vallejo and San Francisco.

Level of Service Evaluated

A service contemplating new weekday transit service from Rio Vista to Vallejo was designed with three trips from Rio Vista to Vallejo in the peak morning hours (between 6:00 a.m. and 9:00 a.m.) and three trips from Vallejo to Rio Vista in the peak afternoon hours (between 3:30 p.m. and 6:30 p.m.). Two reverse trips (from Vallejo to Rio Vista) would be offered in the morning and two reverse trips (from Rio Vista to Vallejo) would be offered in the afternoon. The 37.0-nautical mile trip between Rio Vista and Vallejo would take 67 minutes. Three vessels would be required to provide this level of service.

Rio Vista Opportunities and Constraints

Due to ferry travel time between Rio Vista and likely destinations, it is highly unlikely that Rio Vista can ever be served by a public ferry operator, such as WETA. However, services to/from Rio Vista present opportunities to connect to Contra Costa County (to Antioch and to Martinez) as well as opportunities to link up with service to San Francisco out of Vallejo. One of the benefits of connecting to Contra Costa County is introducing some redundancy in the transportation network in terms of crossing the Carquinez Strait. A private operator model remains the best opportunity to explore these connections.

However, the lack of ridership at this point in time is the major constraint, even for a private service. The required landside improvements have not been explored in any detail because at this point in time, it does not appear that a commuter-type service can be time competitive, particularly if linking up to a ferry between Vallejo and San Francisco. There may be some opportunities in the future in exploring the feasibility of a private-operator model as a recreation-type service (i.e., weekend service, etc.)

4. FERRY RIDERSHIP PROJECTIONS

Ridership projections directly affect operating revenue and are critical assumptions to the feasibility model. The ridership projections presented here and used in the financial feasibility analysis were prepared by San Francisco County Transportation Authority (SFCTA) at the request of the STA. The projections were requested to determine if there is sufficient potential demand for ferry services to justify new ferry services to/from jurisdictions in Solano County.

Throughout this analysis, ridership is defined in terms of "boardings," which represents the number of times a person boards a ferry vessel and pays a fare. If daily boardings are 100, for example, and if every person who rides the ferry is making a round-trip, then the 100 boardings would represent 50 unique people.

Forecast Methodology

The SFCTA is the keeper, or owner, of the San Francisco Chained Activity Modeling Process (SF-CHAMP), the official travel forecasting tool for San Francisco. SF-CHAMP is a regional travel demand model that is used to assess the impacts of land use, socioeconomic, and transportation system changes on the performance of the local transportation system. SF-CHAMP was developed to reflect the region's unique transportation system and socioeconomic and land use characteristics. It uses residents' observed travel patterns, detailed representations of the regional transportation system, population and employment characteristics, transit line boardings, roadway volumes, and the number of vehicles available to households to produce measures relevant to transportation and land use planning. Using future year transportation, land use, and socioeconomic inputs, the model forecasts future travel demand. This study uses SF-CHAMP version 6.0.0-RC1, which incorporates Daysim, an open source model licensed by RSG, Inc, as the core choice model. This allows for more flexible time-of-day and trip purpose specifications, and has resulted in better validation of ferry travel.

The SF-CHAMP Model incorporates a state-of-the-art approach to forecasting travel demand. This activity-based model is more sensitive to a broader array of conditions that influence travelers' choices than the traditional four-step modeling approach. One of the fundamental differences between the San Francisco Model and traditional models is that it is tour-based not trip-based. A tour is a chain of trips made by an individual that begins and ends at home without any intermediate stops at home, whereas a trip is a single movement from an origin to a destination.

While there always will be uncertainties given that the model is projecting people's behavior in the future (in 2040), the model has been refined over time and there is a reasonable level of confidence in the data and assumptions used in the analysis in arriving at its feasibility findings.

Ferry Service Assumptions

In order to run the model to estimate future ridership, the ferry services needed to be defined and certain parameters needed to be identified. Ridership projections are sensitive to the underlying transportation network and transit options, the duration of the trip (compared with driving), the frequency of service (i.e., the service level), the fare, availability and cost of

parking at the origin terminal, and the location of the destination terminals relative to the activities people are seeking.

It should be noted that travel times on the water can vary significantly on a per-trip basis for a variety of factors. Factors include environmental conditions such as sensitive shoreline areas, weather (i.e., vessels slow in dense fog or heavy winds), and other vessel traffic. In some cases, ferry vessels need to slow to half speed when container ships are refueling or they may even need to stop if container ships are turning around. Pleasure boats, which may be operated by inexperienced operators, going in and out of marinas can further affect ferry vessel travel times. The times above represent the travel times that are incorporated into the ridership projection model.

The level of service assumptions is based on weekday, peak travel transit service that meets at least the basic requirements of a transit service while not planning for more trips than ridership projections can fill or overburdening any one service.[10] The services were defined with input from WETA and other stakeholders, as shown in **Figure 11**.

Figure 11 Solano County Ferry Service Assumptions

Origin	Destination	Miles	Travel Time Minutes	Headway	Trips Peak Direction/Reverse AM Trips	Trips Peak Direction/Reverse PM Trips	Boats
Vallejo	SF Ferry Building [1]	27.8	54	15	2/1	2/1	4
Vallejo	Larkspur	20.7	53	60	3/2	3/2	2
Vallejo	Oakland	32.5	80	60	4/2	4/2	3
Rio Vista	Antioch	15.1	28	70	2/1	2/1	1
Rio Vista	Martinez	28.6	52	60	3/2	3/2	2
Rio Vista	Benicia	29.6	55	60	3/2	3/2	2
Rio Vista	Vallejo	37.0	67	60	3/2	3/2	3
Benicia	Vallejo	8.0	25	30	4/3	4/3	2
Benicia	Martinez	1.8	6	30	3/2	3/2	1

[1] The Vallejo/SF Ferry Building service is an expansion of the existing service.

Sources: STA; WETA; PropSF; SFCTA; Economic & Planning Systems, Inc.

Note that the model represents travel during multi-hour time periods. The AM peak period is from 6:00 am to 9:00 am and the PM peak period is from 3:30 PM to 6:30 PM. Other key instructions to SFCTA and assumptions imbedded in the model include the following:

- Projections are for the year 2040. In the model, the underlying regional transportation network includes all projects/services for which funding has been identified as well as projects identified in the current RTP.

[10] There are other possible levels of service and/or service combinations that were not studied as part of this evaluation.

- The model does not include any additional commuter shuttle service connecting the Larkspur ferry terminal to the large employment Traffic Analysis Zones (TAZs) nearby in Marin. The Larkspur ferry terminal is only served by existing Golden Gate Transit bus service.
- For the services with Vallejo as the origin, ticket prices were provided by WETA. Ticket prices for the other services were provided by PropSF, a private operator. For all services, the model was run assuming ticket prices of $0 as well, to understand the scale of demand without the constraint of a fare.
- Parking at each origin/destination was assumed to be in unlimited supply and available at no cost. Again, this assumption was made to understand the full potential scale of demand.

Travel Time Competitiveness

An important factor informing someone's preference to take a ferry as opposed to driving is the travel time competitiveness of the ferry mode. The data is reported as one-way and "terminal-to-terminal."[11] As shown below in **Figure 12**, a ratio of less than 1.0 indicates that travelling by ferry is faster than driving. There are several routes that are time competitive, including Vallejo to San Francisco, Vallejo to Larkspur, Rio Vista to Martinez, Rio Vista to Benicia, and Benicia to Martinez. Vallejo to Oakland is not time competitive. Time competitive routes are shaded in green, marginally time competitive routes are shaded in light orange, and routes that are not time competitive are shaded in red.

[11] A "door-to-door" estimate would more accurately reflect the *total* commute time, including time getting to the origin station, waiting for the ferry, exiting the destination station, and getting to the final destination.

Figure 12 Travel Time Competitiveness

Origin	Destination	Terminal-to-Terminal, One-Way Auto (Minutes) [1]	Terminal-to-Terminal, One-Way Ferry (Minutes)	Ratio of Ferry to Auto [2]
Vallejo	SF Ferry Building [3]	50 to 100	54	0.72
Vallejo	Larkspur	50 to 80	53	0.82
Vallejo	Oakland	40 to 60	80	1.60
Rio Vista	Antioch	22 to 28	28	1.12
Rio Vista	Martinez	50 to 70	52	0.87
Rio Vista	Benicia	50 to 65	55	0.96
Rio Vista	Vallejo	45 to 65	67	1.22
Benicia	Vallejo	16 to 22	25	1.32
Benicia	Martinez	14 to 16	6	0.40

[1] Auto travel time is based on average drive times as estimated by Google Maps, as of May 2019.
[2] Ratio calculation uses the mid-point of the auto drive time estimate.
[3] The Vallejo/SF Ferry Building service is an expansion of the existing service.

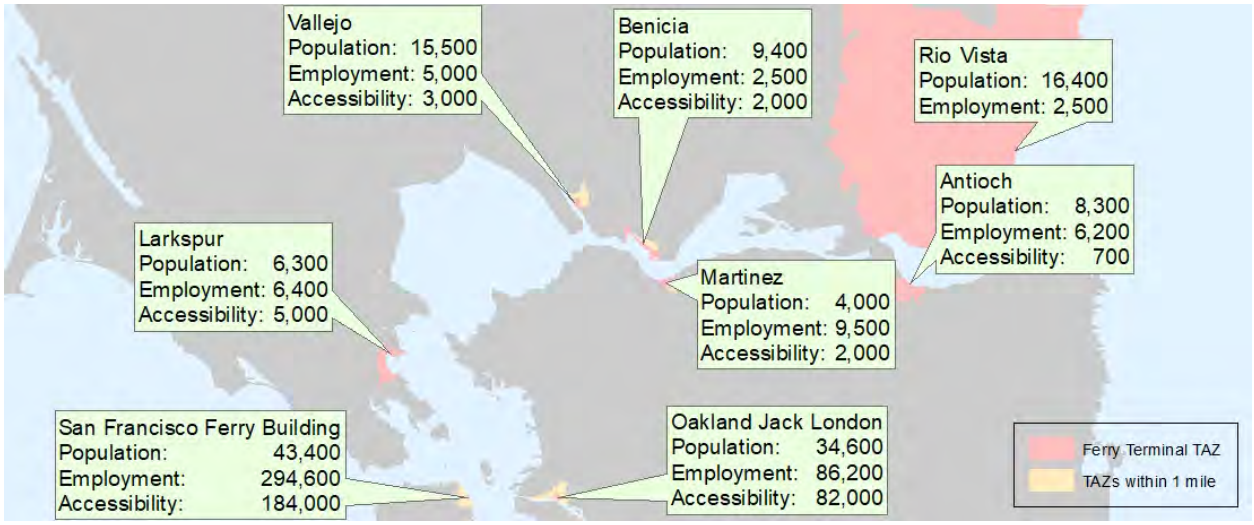
Sources: STA; SFCTA; GoogleMaps; Economic & Planning Systems, Inc.

A route that is marginally time competitive, such as the Benicia/Vallejo route for which travelling by car is about six (6) minutes faster than travelling by ferry, may still capture significant ridership because the "quality" of the commute is better. When travelling by ferry, the commuter is a passenger and can spend the time working, reading, resting, socializing, etc.; whereas, a commuter does not have this same flexibility if driving. In other words, commuters may accept a time penalty as a tradeoff for a better commute experience.

Travel Market Capture and Access to Jobs

An analysis of the size of the travel market at each origin and destination helps provide context for the ridership projections. In **Figure 13** below, employment and population are reported within the TAZ within one mile of the ferry terminal as of 2040. These estimates do not include all potential riders.

Figure 13 Size of Travel Market



Source: SFCTA

In evaluating the potential attractiveness of the services, one measure to consider is what opportunities there are at/around the destination terminal, which takes into account both the number of destinations and the travel time to those destinations. This analysis quantifies the number of jobs accessible without a car (by walking or transit), weighted by distance so that destinations further from the terminal receive a lower weight. Due to the employment density in the areas surrounding the terminals, the routes to San Francisco (184,000 jobs) and Oakland (82,000 jobs) achieve the highest "access to jobs" rating. Larkspur, Vallejo, Benicia, Martinez, and Antioch all have accessibility ratings of 5,000 or less.

The analysis of the travel market indicates the number of ferry trips relative to the number of total trips (all modes) for a specific route. As shown below in **Figure 14**, Only the expanded Vallejo/San Francisco and the new Vallejo/Larkspur services capture a meaningful share of the total trips by all modes.

The expanded Vallejo/San Francisco service is projected to capture 12 percent of total trips between Vallejo and San Francisco, or 667 trips out of 5,575 total trips. The Vallejo/Larkspur service is projected to capture 16 percent of the total trips, or 168 trips out of a total of 1,021 trips.

Figure 14 Ferry as a Share of Total Trips

Origin	Destination		Peak Direction AM	Peak Direction PM	Off-Peak Direction AM	Off-Peak Direction PM	Total Trips
Vallejo	SF Ferry Building [1]						
		Total Trips (All Modes)	2,498	2,261	363	453	5,575
		Ferry Trips	333	312	4	18	667
		Share	13%	14%	1%	4%	12%
Vallejo	Larkspur						
		Total Trips (All Modes)	383	333	141	164	1,021
		Ferry Trips	59	88	9	12	168
		Share	15%	26%	6%	7%	16%
Vallejo	Oakland						
		Total Trips (All Modes)	2,441	2,194	840	1,035	6,510
		Ferry Trips	13	27	1	2	43
		Share	1%	1%	0%	0%	1%
Rio Vista	Antioch						
		Total Trips (All Modes)	10,341	15,051	12,181	16,063	53,636
		Ferry Trips	-	-	-	-	-
		Share	-	-	-	-	-
Rio Vista	Benicia						
		Total Trips (All Modes)	308	314	282	307	1,211
		Ferry Trips	-	-	-	-	-
		Share	-	-	-	-	-
Rio Vista	Martinez						
		Total Trips (All Modes)	936	915	303	456	2,610
		Ferry Trips	-	-	-	-	-
		Share	-	-	-	-	-
Rio Vista	Vallejo						
		Total Trips (All Modes)	347	354	356	338	1,395
		Ferry Trips	-	-	-	-	-
		Share	-	-	-	-	-
Benicia	Martinez						
		Total Trips (All Modes)	3,273	3,379	1,722	2,397	10,771
		Ferry Trips	21	35	16	12	84
		Share	1%	1%	1%	1%	1%
Benicia	Vallejo						
		Total Trips (All Modes)	16,640	21,617	15,210	21,116	74,583
		Ferry Trips	3	23	6	12	44
		Share	-	-	-	-	-

[1] The Vallejo/SF Ferry Building service is an expansion of the existing service.

Sources: SFCTA; Economic & Planning Systems, Inc.

Ridership Projections

Based on the routes, the defined levels of service and other assumptions described above, the table below presents peak period and daily ferry boardings by route in 2040. Projections below in **Figure 15** reflect fares as provided by WETA and PropSF.

Figure 15 Ridership Projections

		Daily Boardings [1]				
		Peak Direction		Off-Peak Direction		Total
Origin	**Destination**	*AM*	*PM*	*AM*	*PM*	
Vallejo	SF Ferry Building [2]	333	312	4	18	**667**
Vallejo	Larkspur [3]	59	88	9	12	**168**
Vallejo	Oakland	13	27	1	2	**43**
Benicia	Martinez	21	35	16	12	**84**
Benicia	Vallejo	3	23	6	12	**44**

Note: The ridership projections for the Rio Vista service indicate limited boardings at this time. Projections could vary in the future based on future changes in the regional transportation network.

[1] Ridership is defined in terms of "boardings," which represents the number of times a person boards a ferry vessel and pays a fare. If daily boardings are 100, for example, and if every person who rides the ferry is making a round tirp, then the 100 boardings would represent 50 unique people.
[2] The Vallejo/SF Ferry Building service is an expansion of the existing service.
[3] The Vallejo/Larkspur service results were adjusted from the raw SF-CHAMP results, because the model underestimates observed ferry ridership between San Francisco and Larkspur. The adjustment was based on modeled vs observed ferry ridership in 2015 on San Francisco - Larkspur and San Francisco - Vallejo routes.

Source: SFCTA.

If ridership is estimated assuming fares of $0, total daily boardings for the Vallejo/Larkspur service increase from 168 to 270. Boardings for the Benicia/Vallejo service increase from 44 to 72, and boardings for the Benicia/Martinez service increase from 84 to 116. Boardings remained limited for the Rio Visa services even when fares were assumed to be $0.

5. *FEASIBILITY OF PROPOSED FERRY SERVICES*

For those routes that have some ridership potential, the financial feasibility of the routes is evaluated. The Vallejo services are evaluated in the context of a public operator model and the Benicia services are evaluated in the context of a private operator model. The purpose of the financial feasibility evaluation of the proposed Solano County ferry services is to identify financial feasibility issues that may exist with the additional ferry service routes, to explore the causes of financial feasibility issues, and to explore how these feasibility issues can be addressed, thus improving financial feasibility. This chapter describes in detail EPS's technical approach to this evaluation of feasibility and the most critical assumptions affecting the feasibility results.

Defining "Financial Feasibility"

Simply defined, "financial feasibility" means that "revenues equal or exceed costs." However, a measure of feasibility must also account for the magnitude of costs over revenues and also the likelihood that ways can be found to improve revenues or reduce costs. This broader definition is used in this analysis.

Determining the revenue/cost balance prospectively, given uncertainties regarding future costs, revenues, performance, etc. is always challenging; however, in this case WETA has extensive ferry operating cost data derived from its existing service routes. There has also been considerable effort placed on estimating potential ridership for all current and potential routes. Given this body of knowledge, while uncertainties remain, there is a reasonable level of confidence in the data and assumptions used in the analysis. Key factors influencing feasibility include capital costs and funding, operating costs, market performance, and the sources and availability of non-farebox operating funding.

This definition of financial feasibility does not directly include considerations regarding either local economic development potential or the value of the individual proposed terminals related to providing emergency services.

Other Metrics of Feasibility

Beyond "financial feasibility," WETA developed performance evaluation measures (**Figure 16**), which are intended to evaluate the competitiveness and fiscal sustainability of both existing and new WETA ferry services. The measures are expressed in three ways: minimum, target and maximum (as applicable). Minimum levels are what will be required after the initial 10 years of operation. Target levels are consistent with expected performance of mature services such as Alameda/Oakland, Vallejo, and Harbor Bay. When a particular service achieves maximum levels, this indicates that a service enhancement or increase may be justified.

Figure 16 WETA Feasibility Metrics

Measure	Standard
Passengers per Revenue Hour (Commute-only services)	Minimum: 100 Target: 150 Maximum: 250
Passengers per Revenue Hour (All-day services)	Minimum: 100 Target: 125 Maximum: 250
Farebox Recovery	Minimum: 40% Target: 50-70% Maximum: 100%
Peak Hour Occupancy	Minimum: 50% Target: 60-75% Maximum: 80%

Source: WETA 2016 Short Range Transit Plan

Financial Feasibility Model Assumptions for Vallejo Services

The Financial Feasibility Model combines service assumptions, operating cost estimates, and ticket price assumptions and then solves for the required level of ridership needed to fully cover operating costs. The required level of needed ridership is then compared against the ridership forecasts. The farebox recovery percentage, or the ratio of projected farebox revenues to total operating costs in any given year is estimated. The operating gap, the amount of funding required in addition to farebox revenue, is also estimated. Solving for the required level of needed ridership avoids the need for precise ridership numbers and provides a target ridership level required to support operational feasibility. Comparing this estimate to the ridership projections provides a general estimate of operational feasibility and provides the STA and interested cities with ballpark estimates of annual funding required from local sources.

Operating Costs

Operating costs are based upon WETA's existing operating experience with the existing ferry routes. As such, there is a high degree of confidence in the cost assumptions. However, a variety of circumstances could affect service costs in unforeseen ways including a fuel price "shock," and any required changes in service configuration requiring additional labor hours and expenses.

Ferry service operating cost items consist of the following broad categories of costs: Vessel Expenses, Non-Vessel Expenses, Fixed Operator Expenses, Direct Expenses, and Fuel/Urea. A summary of the operating costs estimated for each of the Vallejo services is provided in **Table 2**. Both an annual estimate of Year 1 costs and a net present value of costs during a ten-year operating period (2018 – 2027) are presented. The detailed calculations for each service route are provided in **Appendix C**.

Table 2 Summary of Ferry Service Operating Costs by Route (Year 1 Annual and Ten-Year Net Present Value, Rounded)

Item	Vallejo (WETA-Service) San Francisco *Ferry Building*	Larkspur	Oakland *Jack London Square*
Service Assumptions			
AM Trips (Peak Direction/ Reverse)	2/1	3/2	4/2
PM Trips (Peak Direction/ Reverse)	2/1	3/2	4/3
Trip Distance (Nautical Miles)	27.8	20.7	32.5
Trip Time (Minutes)	54	53	80
Total Daily Crews	2	4	6
Number of Vessels/ Speed	1	2	3
Annual Operating Expenses (Year 1, 2018 Dollars)			
Vessel Expenses			
Crew Labor	$938,000	$1,877,000	$2,815,000
Maintenance	$970,000	$2,910,000	$3,880,000
Non-Vessel Expenses	$229,000	$574,000	$803,000
Fixed Operator Expenses	$229,000	$574,000	$803,000
Direct Expenses	$592,000	$1,484,000	$2,076,000
Fuel/Urea	$1,493,000	$1,395,000	$3,051,000
Total, Operating Expenses	**$4,451,000**	**$8,814,000**	**$13,428,000**
Operating Expenses (10-Year NPV)			
Vessel Expenses			
Crew Labor	$9,805,000	$19,610,000	$29,414,000
Maintenance	$10,136,000	$30,408,000	$40,544,000
Non-Vessel Expenses	$2,193,000	$5,500,000	$7,693,000
Fixed Operator Expenses	$2,193,000	$5,500,000	$7,693,000
Direct Expenses	$5,664,000	$14,208,000	$19,873,000
Fuel/Urea	$13,122,000	$12,253,000	$26,807,000
Total, Operating Expenses	**$43,110,000**	**$87,480,000**	**$132,020,000**

Sources: WETA; Economic & Planning Systems, Inc.

Vessel Expenses

Vessel Expenses is the largest cost component of operating a ferry service and includes Crew Labor and Maintenance. The variability across the services occurs within this category based on the number of vessels required to provide service and the number of crews required.

Crew Labor

Crew Labor represents a significant cost item that is affected by required minimum shift lengths and the number of vessels required by the service. Estimated trip length determines how many round-trip trips can be served by a single vessel within a shift period. Crew shifts are 8-hours per labor requirements. Even if actual shift is shorter, crew is paid for 8-hour shift.

The estimated number of crew hours is multiplied by a standard hourly rate consistent with current labor contracts. Four crew members are required per each 299-passenger vessel.

Maintenance

Maintenance is affected by the number of vessels with approximate per vessel annual maintenance costs of approximately $970,100 per vessel per year. New services are assumed to need a spare vessel, and maintenance expenses apply to the spare vessel as well. Assumption provided by WETA based on current operations.

Non-Vessel Expenses

Non-Vessel Expenses are fairly consistent across the services evaluated and include a guest assistance representative, professional fees and non-vessel materials and supplies. Non-vessel expenses are calculated as 12 percent of total Vessel Expenses. Assumption provided by WETA based on current operations.

Other

Other Vessel Expenses include costs for urea,[12] insurance, lease expenses and vessel-related materials and supplies and vary across the services depending on the number of vessels in use.

Fixed Operator Expenses

Fixed Operator Expenses include wages and benefits for dispatch and supervision staff and administration staff. Insurance deductibles are also included in this category. Fixed operator expenses are calculated as 12 percent of total Vessel Expenses, as provided by WETA based on current operations.

Direct Expenses

Direct Expenses include docking fees, advertising and marketing, consultant services, wireless services on the vessels, Clipper card-related technology maintenance, and WETA administration and facility operations and maintenance expenses. Direct Expenses are calculated as 31 percent of total Vessel Expenses, as provided by WETA based on current operations.

Fuel/Urea

Fuel is the most costly component of ferry service operations and is affected by the type of the vessel, the length of the trip (distance and time), and water/current conditions. It is also the least certain as fuel expenses can vary significantly depending on current energy market conditions. The fuel assumption is based on the estimated nautical miles of each service, multiplied by the fuel needed per mile (gallons per mile), multiplied by the forecasted cost per gallon. The cost of urea is assumed to be 10 percent of fuel costs.

[12] Urea is a chemical that is injected into the fuel system to help control emissions. Standard costs for urea are assumed.

Operating Revenue (Fares)

Operating revenue is derived from the fares passengers pay to ride the ferry. The feasibility model uses the same fare assumptions that were used by SFCTA for their ridership forecasts, as provided by WETA and PropSF. They are inflated at an annual rate of 3 percent, consistent with WETA's internal modeling practices.

Non-Farebox Operating Funding

Most ferry operations require a subsidy to offset that portion of operating costs not covered by fares. It is assumed that operating subsidies needed for the expanded ferry service routes will need to be derived primarily from local and/or regional funding sources. Until the services are included as part of the Regional Transportation Plan, they will not be eligible for MTC-administered funding.

It is also possible that with voter approval, STA could provide funding, in the form of a sales tax measure or via the future tolling of SR-37. Local (city) funding sources may also be established within each service expansion city, similar to the funding provided by a local property tax charged in Bay Farm Island to support that route. Stability of funding is also a feasibility concern; it will be important for any new sources to be committed over multi-year periods and be resistant to elimination by voters or elected officials.

Feasibility Model Results and Implications

Financial feasibility in the model is evaluated in terms of the required ridership that would be required to generate the farebox revenue needed to sustain operations for the Vallejo services. The model results are summarized below on **Table 3**. The detailed calculations by route are provided in **Appendix D**. The analysis is for a ten-year period between 2018 through 2027 but uses 2040 ridership projections.[13] Daily ridership numbers are multiplied by 260 (52 weeks x 5 days per week) to estimate annual ridership. This estimate is referred to in the model as the "Unadjusted" ridership projection.

[13] For each of the services, the analysis is for a 10-year period from 2018 through 2027 because operating costs assume 2018 dollars and to be able to compare the services with one another. If any one of the services were to start later, fares would be higher, as would operating expenses. The specific effect of starting service later would vary by service route.

Table 3 Summary of Vallejo Ferry Service Farebox Recovery Ratios by Route[1]

Item	Vallejo Routes		
	San Francisco *Ferry Building*	**Larkspur**	**Oakland** *Jack London Square*
10-Year NPV of Annual Operating Expenses (see Table 3)	$43,110,000	$87,480,000	$132,020,000
Target Ridership			
Required Number of One-Way Trips to Fund Operating Expenses [2]	3,998,744	8,113,803	12,245,357
Analysis of Operating Gap given Ridership Projections			
10-Year Ridership (Assumes 260 Days of Service per Year) [3]	1,734,200	436,800	111,800
Annual Fare Revenue [4]	$18,697,245	$4,709,351	$1,205,370
Farebox Recovery Percentage	43%	5%	1%
Ridership Gap (Variance from Required Passenger Estimate)			
Number	2,264,544	7,677,003	12,133,557
Percent	57%	95%	99%
Operating Expense Gap (Variance from Estimated Operating Expenses)			
Amount	$24,415,134	$82,769,468	$130,817,723
Percent	57%	95%	99%
Adjusted Ridership Analysis [5]			
Daily, Weekday Ridership, Adjusted to Account for Start-Up Period	3,736	941	241
Annual Ridership (Assumes 260 Days of Service per Year)	971,445	244,682	62,627
Annual Fare Revenue	$10,473,619	$2,638,033	$675,211
Operating Expense Gap	$32,638,760	$84,840,786	$131,347,881
Farebox Recovery Percentage	24%	3%	1%

[1] NPV calculation uses an annual discount rate of 3%.
[2] Required number of one-way trips during the 10-year period to fully fund operating expenses.
The unadjusted Daily weekday ridership is based on SFCTA's 2040 Ridership Projection. The annual estimate assumes 260 days of service per
[3] year (52 weeks * 5 days per week).
[4] Fare revenue is number of trips multiplied by the ticket price. Average one-way ticket prices are provided by WETA in 2018 nominal dollars and inflated by an assumed inflation rate of 3.0%.
[5] The adjusted ridership sensitivity is estimated here to illustrate the effect on operating revenue if Year 1 forecasts are 50% of 2040 forecasts.

Sources: WETA; Economic & Planning Systems, Inc.

Clearly, these ridership numbers will not likely be achieved initially; they may take a decade or more to achieve. As such, an analysis based on the adjusted ridership numbers, wherein the projections for the initial year of operations are halved, is also provided. This brackets the range of feasibility concerns and the related need for additional operational funding. If basic feasibility issues revealed by this analysis can be resolved, it will be necessary to conduct a detailed "time-series" analysis to estimate the need for funding during the "start-up" years for each service.

For the Benicia services, the fares provided by PropSF are based on what the operator would need to charge to recover operating costs assuming each boat is fully occupied. PropSF operates a range of vessel types, but the average ferry accommodates 58 passengers. With this information, the feasibility model calculates the average occupancy of each vessel. It should be noted that ferry services rarely operate at 100 percent occupancy, and, given commuter behavior, it is unreasonable to assume otherwise. However, for purposes of this analysis, PropSF estimated the potential fares that were used in the ridership forecasts assuming 100 percent occupancy, which means that, for purposes of this feasibility analysis, 100 percent occupancy is

the threshold target. This provides a clearer estimate of the potential subsidy that would be required from STA, other jurisdictions, and/or private employers to render the service feasible. It will be up to the STA and other stakeholders to determine what level of subsidy is acceptable from a cost/benefit perspective.

Feasibility Model Assumptions for Benicia Services

For the Benicia services, which are assumed to be operated by a private operator, vessel occupancy is the primary metric of feasibility. The fares provided by PropSF are based on what the operator would need to charge to recover operating costs assuming each boat is fully occupied. PropSF operates a range of vessel types, but the average ferry accommodates 58 passengers. With this information, the feasibility model calculates the average occupancy of each vessel. It will be up to the STA and other stakeholders to determine what level of subsidy is acceptable from a cost/benefit perspective. Based on the assumed service levels and the projected ridership, the Benicia/Martinez service would result in 14 percent average occupancy, as shown on **Table 4**. The Benicia/Vallejo service would result in 5 percent average occupancy, as shown on **Table 5**. As noted in the preceding finding, ridership in the early years of service will likely be lower than what has been projected.

Table 4 Benicia-Martinez Route Feasibility

Scenario/Route and Service Level Assumptions

Origin	Peak Direction		Off-Peak Direction		Total
	AM	*PM*	*AM*	*PM*	
Daily Boardings	21	35	16	12	**84**
Number of Trips [1]	3	3	2	2	
Avg. Daily Boardings per Trip	7	12	8	6	
Percent Occupied [2]	12%	20%	14%	10%	**14%**
Daily Fare Revenue	$117	$194	$89	$67	**$466**
Annual Fare Revenue	$30,303	$50,505	$23,088	$17,316	**$121,212**
Daily Operating Subsidy Required [3]	$849	$771	$555	$577	**$2,753**
Annual Subsidy Required [4]	$220,779	$200,577	$144,300	$150,072	**$715,728**
Total Annual Operating Costs					**$836,940**
Annual Operating Cost per Boarding					**$38**

[1] Level of service was established to provide a robust commuter service, while minimizing operating costs.
[2] Full occupancy is based on a 58-passenger boat which reflects an average of the various vessels used by PropSF.
[3] The daily subsidy is calculated as the vacant seats multiplied by the 2018 estimated fare.
[4] The annual subsidy is the daily subsidy multiplied by 260 (260 days of service per year assumes 52 weeks * 5 days per week).

Source: SFCTA; WETA; PropSF; Economic & Planning Systems, Inc.

Table 5 Benicia-Vallejo Route Feasibility

Scenario/Route and Service Level Assumptions

Origin	Peak Direction		Off-Peak Direction		Total
	AM	*PM*	*AM*	*PM*	
Daily Boardings	3	23	6	12	**44**
Daily Number of Trips [1]	4	4	3	3	
Avg. Daily Boardings per Trip	0.75	6	2	4	
Avg. Percent Occupied [2]	1%	10%	3%	7%	**5%**
Daily Fare Revenue	$33	$253	$66	$132	**$484**
Annual Fare Revenue	$8,580	$65,780	$17,160	$34,320	**$125,840**
Daily Operating Subsidy Required [3]	$2,519	$2,299	$1,848	$1,782	**$8,448**
Annual Subsidy Required [4]	$654,940	$597,740	$480,480	$463,320	**$2,196,480**
Total Annual Operating Costs					**$2,322,320**
Annual Operating Cost per Boarding					**$203**

[1] Level of service was established to provide a robust commuter service, while minimizing operating costs.
[2] Full occupancy is based on a 58-passenger boat which reflects an average of the various vessels used by PropSF.
[3] The daily subsidy is calculated as the vacant seats multiplied by the 2018 estimated fare.
[4] The annual subsidy is the daily subsidy multiplied by 260 (260 days of service per year assumes 52 weeks * 5 days per week).

Source: SFCTA; WETA; PropSF; Economic & Planning Systems, Inc.

Implications

A summary of the preceding factors by route to highlight the implications for each of the routes is provided below.

Vallejo Ferry Services

Expanded Service to San Francisco

- Generates approximately 650 additional daily boardings
- Peak period, peak direction headways improved from 25 to 15 minutes
- Modest travel market
- Ferry faster than driving
- Good access to destinations without a car
- Feasible, with a farebox recovery of greater than 40 percent

To Oakland

- Generates approximately 40 daily boardings
- Modest travel market
- Travel time is not competitive
- Good access to destinations without a car
- Infeasible in the context of a WETA-like model, with a farebox recovery of less than 40 percent; potentially feasible under a private-operator model

To Larkspur

- Generates approximately 170 daily boardings
- Small travel market

- Competitive travel time
- Limited access to destinations without a car
- Infeasible in the context of a WETA-like model, with a farebox recovery of less than 40 percent; potentially feasible under a private-operator model

Benicia Ferry Services

To Martinez (approx. 80 daily boardings)

- Generates approximately 80 daily boardings
- Modest travel market
- Competitive travel time
- Limited access to destinations without a car
- Potentially feasible, depending on level of subsidy available under a private operator model

To Vallejo (approx. 40 daily boardings)

- Generates approximately 40 daily boardings
- Relatively large travel market
- Travel time is marginally competitive
- Modest access to destinations without a car
- Potentially feasible, depending on level of subsidy available under a private operator model

Rio Vista Ferry Services

To Antioch (< 10 daily boardings)

- Generates < 10 daily boardings
- Relatively large travel market
- Travel time is marginally competitive
- Very limited access to destinations without a car
- Infeasible, with limited ridership at this time

To Martinez, Benicia, and Vallejo (< 10 daily boardings)

- Generates < 10 daily boardings
- Small travel markets
- Competitive or marginally competitive travel time
- Limited to modest access to destinations without a car
- Infeasible, with limited ridership at this time

Capital Costs and Funding

No significant level of conceptual planning, much less design and engineering work, has been conducted by WETA or STA or the respective cities to study and prepare cost estimates for capital costs required to construct the terminals and related facilities and improvements. If it is determined that further study is warranted, the actual location of the terminals and the facilities included will be determined by the individual cities as they consider the local benefits of the investments, the availability of funding sources, and the related features and uses that can stimulate ridership.

In any case, building the terminals and related facilities will be costly, with current estimates ranging from $15 million to $40 million depending on the location of the terminal and the existing conditions encountered. Again, a private operator may not have some of the same land-side requirements that a public transit provider would, and could make modest improvements to existing marinas to start service. When the Contra Costa Transportation Authority studied the feasibility of ferry service to Antioch, Martinez, and Hercules, it found that estimates ranged from $5.8 million to $36.8 million in Antioch depending on the location of the terminal, from $13.6 million to $18.9 million in Martinez, and from $20 million to $35 million in Hercules. WETA's SRTP states that the Richmond terminal cost $16.2 million. Landside improvements at the destination ferry terminals as well as at maintenance facilities to accommodate new services also will be required.

Historically, the existing terminals have been funded by bridge toll funding revenues, federal grants, County CMA funding, and other local sources. The most recent terminals constructed, South San Francisco and Richmond, were funded through bridge toll revenue, and FTA (federal) grant, a State of California Proposition 1B grant, and regional funding.

Additionally, WETA's ferry fleet will need to be expanded with additional vessels required for each service route (each service requires a spare vessel). Each new ferry is estimated to cost approximately $20 million, though will vary depending on the selected technology. Funding will need to be identified to fund these capital costs.

Steps to Improving Feasibility

The findings of the financial feasibility assessment are intended to guide future planning, investment priorities and funding efforts as may be conducted by STA, the individual cities for which the service is planned, and WETA. Key follow-up efforts may include:

- Expansion of analysis to Yolo and Sacramento counties to identify additional potential ridership.
- Further discussions and coordination with private ferry operators to understand opportunities to expand ferry service in Solano County. For the cities of Benicia and Rio Vista, STA can evaluate the opportunity for private ferry services in more detail.
- Further study of the potential emergency response role that ferries (through WETA or other providers) could fulfill in Solano County.
- Other STA efforts at obtaining capital or operating funding for the proposed ferry service.
- Further planning and development of the ferry terminal areas in the respective cities.
- Local efforts to evaluate the benefits of ferry service and to develop sources of local funding including inclusion in cities' own capital improvement programs and creation of special funding sources such as the special property tax that supports the Bay Farm Island service.

6. SOURCE AND AVAILABILITY OF NON-FAREBOX FUNDING

As a public transit provider, WETA derives its operating funding and capital improvement funding from a variety of federal, state, regional, local, and operational sources. Some of the sources may fund both operations and capital expenditures while some sources are limited to one or the other. These sources are described in WETA's SRTP document.

Operating Funding

A variety of federal, state and local funding sources are programmed and available to fund WETA's operating costs. These operating funds will be derived from the following sources:

- **Fare Revenue.** Passenger fares are projected to provide $251.5 million in revenues to support system operation through 2021. WETA ensures that fares marginally keep up with system cost inflation by projecting fee increases at 3 percent annually.
- **Regional Measure 1 – 5 percent Program.** These funds are derived from an increase in tolls on the Bay Area's state-owned bridges that was approved by the voters in November 1988. The SRTP assumes that these funds do not escalate over time, consistent with MTC projections.
- **Regional Measure 2 Program.**[14] In 2004, voters passed Regional Measure 2, which provides WETA with $18.3 million annually to support existing ferry service and fund WETA's service expansion plans. Of this amount, $3 million is specifically available to support WETA planning and administration, and $15.3 million is available to support service development and operation. WETA's Short Range Transit Plan (SRTP) assumes RM2 expansion funds are used to support operating deficits for existing Alameda/Oakland, Harbor Bay, Vallejo, and South San Francisco services.
- **Regional Measure 3 Program.** Regional Measure 3 (or RM 3) was passed by 55 percent of Bay Area voters in June 2018 authorizing incremental increases to Bay Area bridge tolls to fund significant transportation improvements and help solve some of the Bay Area's growing congestion problems. The measure is expected to generate up to $4.45 billion to fund major transportation project in the toll bridge corridors.
- **Alameda County Measure B/Measure BB.** In 2000, Alameda County voters approved Measure B, the half-cent transportation sales tax and an accompanying 20-year expenditure plan. Alameda CTC administers Measure B funds to deliver transportation improvements and services in Alameda County and to address congestion in each major commute corridor in the county. Measure B funds are allocated annually to support the Alameda ferry services. On November 4, 2014 Alameda County voters approved Measure BB, a 30-year Transportation

[14] While a reallocation of RM2/3 funding may be possible through WETA request and MTC approval, whether to reallocate money away from existing, high-demand services is a policy decision not addressed in this Study. In order for future services to be eligible for MTC funding (such as RM2 or RM3 or something similar in the future), the project/service will need to be part of the RTP. Service to Solano County, beyond the current service to Vallejo, is not currently in the RTP.

Expenditure Plan, which extends the existing 0.5 percent Measure B sales tax, scheduled to terminate on March 31, 2022. Measure BB also augments the tax by 0.5 percent and dedicates the full 1 percent to transportation expenses. Alameda County Measure B/Measure BB funding is not available to fund Contra Costa or Solano County services.

- **Contra Costa Measure J.** On November 2, 2004, Contra Costa voters approved Measure J, which extended the half-percent cent local transportation sales tax first established by Measure C in 1988 for another 25 years (2009 to 2034) to provide funding for continued and new transportation projects in the county. Contra Costa County Measure J funding is not available to fund Solano County services but could support improvements in Martinez.

- **Local Agency Funding.** Other funds available to support ferry system operations include local city funding. For example, the City of Alameda contributes local funds to WETA in support of their ferry service.

- **State Transit Assistance.** State Transit Assistance funds are available annually through MTC on a revenue and population formula basis to support transit operator capital *and* operating needs. As a transit operator WETA qualifies as a State Transit Assistance recipient.

Capital Improvement Funding

A variety of federal, state and local funding sources are needed to support WETA's capital improvements, including the following:

- **Federal Grants.** The majority of funds WETA receives and utilizes to fund CIP projects are Federal Section 5307 and 5337 formula program funds programmed annually by MTC based on regional criteria and secured through direct grant application and contract with FTA. The FTA formula funds provide up to 80 percent funding to support critical vessel replacement, rehabilitation and mid-life refurbishment work, float and gangway rehabilitation and replacement work, and periodic dredging. WETA has also been successful in securing FTA Passenger Ferry Grant Program funds to support construction of the Central Bay Operations and Maintenance Facility.

- **Proposition 1B.** The Highway Safety, Traffic Reduction, Air Quality and Port Security Bond Act, approved by voters in 2006, allows the state to sell up to $1.475 billion in bonds for security and disaster preparedness projects throughout the state. Over a ten-year period, this program promises to provide WETA with $250 million in Proposition 1B funds to support implementation of its regional emergency response ferry system. This plan assumes use of the Proposition 1B funds to construct terminal, float and gangway access projects, system maintenance and operations facilities and new vessels. Proposition 1B also include Public Transportation Modernization, Improvement, and Service Enhancement Account (PTMISEA) funds allocated to transit operators.

- **State Transit Assistance.** As described previously, STA funds are available to support transit operator capital *and* operating needs. STA funds are appropriated by the State Controller's office on a revenue and population formula basis and allocated annually to WETA through grant agreement with MTC.

- **Assembly Bill 664.** Assembly Bill 664 funds are programmed annually by MTC to provide partial local match to Federal Section 5307 and 5309 formula grant funds for projects serving the Bay Bridge Transbay corridor. This plan assumes WETA eligibility for these funds for ferry rehabilitation and replacement projects.

- **Regional Measure 1 – 2 percent Program.** In November 1988, Bay Area voters approved Regional Measure 1 (RM1), authorizing a $1.00 toll increase for all seven state-owned Bay Area toll bridges. Approximately $1 million RM1—2 percent funds are available annually from this program, through MTC, to support capital expenses associated with transbay ferry services in the Carquinez and Bay Bridge corridors.

- **Regional Measure 1 – 5 percent Program.** These funds are derived from an increase in tolls on the Bay Area's state-owned bridges that was approved by the voters in November 1988. The SRTP assumes that these funds do not escalate over time, consistent with MTC projections. These funds can be banked from year to year, so annual use of this revenue source fluctuates depending on the level of capital needs and the availability of other funding sources.

- **Regional Measure 2 Program.** In 2004, voters passed Regional Measure 2 (RM2), raising the toll on the seven state-owned toll bridges in the San Francisco Bay Area by $1.00. RM2 capital funds totaling $84 million were made available to WETA to support specific capital projects, including system environmental and design studies, construction of new vessels and transbay services, construction of spare vessels, and development and construction of expanded berthing capacity in San Francisco.

- **Regional Measure 3 Program.** Regional Measure 3 (or RM 3) was passed by 55 percent of Bay Area voters in June 2018 authorizing incremental increases to Bay Area bridge tolls to fund significant transportation improvements and help solve some of the Bay Area's growing congestion problems. The measure is expected to generate up to $4.45 billion to fund major transportation project in the toll bridge corridors. In Solano County, RM3 revenue is slated to fund the expanded ferry service between Vallejo and San Francisco, among other capital and operational needs, and has the potential to help fund the expanded parking in Vallejo needed to support expanded service between Vallejo and San Francisco.

- **Proposition K.** Proposition K provides $5 million in funding over a 5-year period for a variety of improvements to the San Francisco Downtown Ferry Terminal including WETA's project to expand berthing facilities. With the full build out of the Downtown San Francisco Ferry Terminal Expansion project, these funds will be leveraged by over $100 million in investment of state and federal sources including RM2, Prop 1B, and FTA Section 5309 funds.

- **Alameda County Measure B/Measure BB.** As described above, Alameda County voters approved Measure B in 2000 and Measure BB in 2014. Alameda County Measure B/Measure BB funding is not available to Contra Costa County and Solano County services.

Solano Transportation Authority

- **Senate Bill 1.** SB1 is the Road Repair and Accountability Act of 2017 passed by the California legislature and signed by Governor Brown in April 2017. SB1 generates $5.24 billion/year in transportation funding for California by instituting new gas taxes and registration fees. It provides additional funding to existing transportation programs and

creates new competitive programs. In Solano County, SB1 is expected to fund $16.1 million per year in local streets and roads maintenance; $385 per year towards transit operations (and purchase of capital); and $6 million per year to restore the State Transportation Improvement Program (STIP).

- **Other Potential STA Funding Sources**. In June 2016, a sales tax measure (Measure H and accompanying Measure G) was put on the ballot to generate funding for transportation improvements. Voters did not approve the measure, but a similar sales tax measure, one that includes water-based transportation initiatives, could be crafted and put before voters in the future. As described above, both Alameda County and Contra Costa have approved sales tax measures to fund regional transportation improvements and operations.
- Local jurisdictions can also support transportation (e.g., ferry) initiatives through local tax measures. For example, the City of Alameda provides funds from their property tax assessments to support operation of the Alameda Harbor Bay service.

Solano Transportation Authority Board Members

- Harry Price, Mayor of Fairfield
- Thom Bogue, Mayor of Dixon
- Elizabeth Patterson, Mayor of Benicia
- Ron Kott, Mayor of Rio Vista
- Lori Wilson, Mayor of Suisun City
- Ron Rowlett, Mayor of Vacaville
- Bob Sampayan, Mayor of Vallejo
- Jim Spering, County of Solano District 3 Supervisor

Water Transit Plan Development Team

- Nouae Vue, City of Benicia
- Ron Downing, Golden Gate Transit
- Drew Cooper, SFCTA
- Beth Kranda, SolTrans
- Scott Macdonald, TAM
- Terrance Davis, City of Vallejo
- Kevin Connolly, WETA
- Terrance Davis, City of Vallejo
- Matt Tuggle, County of Solano

STA Staff

- Daryl Halls, Executive Director
- Robert Guerrero, Director of Planning
- Triana Crighton, Assistant Planner (Plan Project Manager)

Others

- PropSF
- Tideline

APPENDIX A:

City Outreach Letters

August 18, 2018

Nouae Vue
Senior Civil Engineer
City of Benicia

Sent via email to: nvue@ci.benicia.ca.us

Cc: Robert Guerrero, STA Director of Planning
Triana Crighton, STA Planning Assistant

Subject: STA Water Transit Services Feasibility Study; EPS #171141

Dear Nouae:

As you may know, Economic & Planning Systems, Inc. (EPS) is working with STA, WETA, private ferry operators, and city stakeholders to prepare a feasibility study evaluating the potential for water transit services to/from key locations in Solano County. In the context of regional commute patterns and planning efforts, the study will evaluate the operational feasibility of expanding services to Solano County. The study will describe landside readiness concerns and potential funding sources and guide next steps. Routes to be studied include the following:

- Expanded public operator service between Vallejo and San Francisco
- New ferry service between Vallejo and Larkspur, both public and private operating models
- New ferry service between Vallejo and Oakland, both public and private operating models
- New private ferry service (i.e., smaller vessels) within the Carquinez Strait between Rio Vista, Antioch, Martinez, Benicia and Vallejo—with all services intended to align with cross-bay services to/from Vallejo

EPS has begun reviewing relevant documents provided by WETA and discussing potential services with private operators. We would like to engage city representatives at this point. EPS has prepared the following questions for your response, which we believe encapsulate the key considerations at this point. Please respond by letter or e-mail so that we have written documentation and, as requested below, please forward any documents that you think we need to review to understand your city's considerations.

The Economics of Land Use

Economic & Planning Systems, Inc.
One Kaiser Plaza, Suite 1410
Oakland, CA 94612-3604
510.841.9190 tel
510.740.2080 fax

Oakland
Sacramento
Denver
Los Angeles

www.epsys.com

1. Please describe your city's objectives in implementing ferry services to/from your city.

2. Recognizing WETA's current vessel technology and marina/terminal requirements, please indicate your city's willingness to consider supporting ferry service provided by a small-boat, private ferry operator, which would provide linkages between your city, and other cities within the Carquinez Strait (e.g., Antioch, Martinez, Rio Vista, and Vallejo) with the goal of aligning with current ferry service to/from Vallejo.

3. Please describe your city's "readiness" to implement ferry service and specifically the planning activities that may have occurred or are underway in your city to support ferry service. Please also describe other, non-terminal-related planning activities that could affect planning for ferry service. Please provide relevant supporting documents. To the extent your city has begun ferry terminal planning efforts, these supporting documents could include area-specific or General Plan references, a CIP that includes ferry terminal-related infrastructure, engineering studies, or council resolutions.

4. Recognizing the substantial resources that are required to develop a ferry terminal and operate a ferry service and the likely local obligation to provide funding, please identify available and/or proposed funding sources that your city could leverage to contribute toward capital and/or operational expenses.

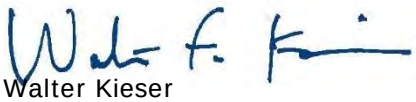
5. Please describe other considerations, opportunities and obstacles that affect potential ferry service to your city.

Please return your response to my and Ashleigh Kanat's attention at wkieser@epsys.com and akanat@epsys.com by Friday, August 31. If you have any questions, both Ashleigh and I can be reached at 510.841.9190. We look forward to receiving your responses as they will inform the content and direction of the study.

Thank you very much for you time and thoughtful consideration of this issue.

Sincerely,

ECONOMIC & PLANNING SYSTEMS, INC.



Walter Kieser
Senior Principal

August 18, 2018

Yujun Du
Director of Finance
City of Rio Vista

Sent via email to: ydu@ci.rio-vista.ca.us

Cc: Robert Guerrero, STA Director of Planning
Triana Crighton, STA Planning Assistant

Subject: STA Water Transit Services Feasibility Study; EPS #171141

Dear Yujun Du:

As you may know, Economic & Planning Systems, Inc. (EPS) is working with STA, WETA, private ferry operators, and city stakeholders to prepare a feasibility study evaluating the potential for water transit services to/from key locations in Solano County. In the context of regional commute patterns and planning efforts, the study will evaluate the operational feasibility of expanding services to Solano County. The study will describe landside readiness concerns and potential funding sources and guide next steps. Routes to be studied include the following:

- Expanded public operator service between Vallejo and San Francisco
- New ferry service between Vallejo and Larkspur, both public and private operating models
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- New private ferry service (i.e., smaller vessels) within the Carquinez Strait between Rio Vista, Antioch, Martinez, Benicia and Vallejo—with all services intended to align with cross-bay services to/from Vallejo.

EPS has begun reviewing relevant documents provided by WETA and discussing potential services with private operators. We would like to engage city representatives at this point. EPS has prepared the following questions for your response, which we believe encapsulate the key considerations at this point. Please respond by letter or e-mail so that we have written documentation and, as requested below, please forward any documents that you think we need to review to understand your city's considerations.

The Economics of Land Use

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510.841.9190 tel
510.740.2080 fax

Oakland
Sacramento
Denver
Los Angeles

www.epsys.com

1. Please describe your city's objectives in implementing ferry services to/from your city.

2. Recognizing WETA's current vessel technology and marina/terminal requirements, please indicate your city's willingness to consider supporting ferry service provided by a small-boat, private ferry operator, which would provide linkages between your city, and other cities within the Carquinez Strait (e.g., Antioch, Martinez, Benicia, and Vallejo) with the goal of aligning with current ferry service to/from Vallejo.

3. Please describe your city's "readiness" to implement ferry service and specifically the planning activities that may have occurred or are underway in your city to support ferry service. Please also describe other, non-terminal-related planning activities that could affect planning for ferry service. Please provide relevant supporting documents. To the extent your city has begun ferry terminal planning efforts, these supporting documents could include area-specific or General Plan references, a CIP that includes ferry terminal-related infrastructure, engineering studies, or council resolutions.

4. Recognizing the substantial resources that are required to develop a ferry terminal and operate a ferry service and the likely local obligation to provide funding, please identify available and/or proposed funding sources that your city could leverage to contribute toward capital and/or operational expenses.

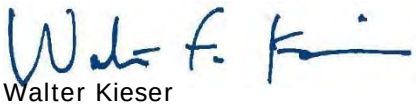
5. Please describe other considerations, opportunities and obstacles that affect potential ferry service to your city.

Please return your response to my and Ashleigh Kanat's attention at wkieser@epsys.com and akanat@epsys.com by Friday, August 31. If you have any questions, both Ashleigh and I can be reached at 510.841.9190. We look forward to receiving your responses as they will inform the content and direction of the study.

Thank you very much for you time and thoughtful consideration of this issue.

Sincerely,

ECONOMIC & PLANNING SYSTEMS, INC.



Walter Kieser
Senior Principal

August 18, 2018

Terrance Davis
Public Works Director
City of Vallejo

Sent via email to: terrance.davis@cityofvallejo.net

Cc: Robert Guerrero, STA Director of Planning
Triana Crighton, STA Planning Assistant

Subject: STA Water Transit Services Feasibility Study; EPS #171141

Dear Terrance:

As you may know, Economic & Planning Systems, Inc. (EPS) is working with STA, WETA, private ferry operators, and city stakeholders to prepare a feasibility study evaluating the potential for water transit services to/from key locations in Solano County. In the context of regional commute patterns and planning efforts, the study will evaluate the operational feasibility of expanding services to Solano County. The study will describe landside readiness concerns and potential funding sources and guide next steps. Routes to be studied include the following:

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EPS has begun reviewing relevant documents provided by WETA and discussing potential services with private operators. We would like to engage city representatives at this point. EPS has prepared the following questions for your response, which we believe encapsulate the key considerations at this point. Please respond by letter or e-mail so that we have written documentation and, as requested below, please forward any documents that you think we need to review to understand your city's considerations.

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Oakland
Sacramento
Denver
Los Angeles

www.epsys.com

1. Please indicate your city's willingness to consider supporting ferry service provided by a small-boat, private ferry operator, which would provide linkages between your city, cities within the Carquinez Strait (e.g., Rio Vista, Antioch, Martinez, and Benicia), and, potentially cities in Marin, such as Larkspur.

2. If WETA's service between Vallejo and San Francisco were expanded, please describe your city's "readiness" to support the additional service and specifically the planning activities that have occurred or are underway in your city to support additional ferry service, if any.

3. Please describe other, non-terminal-related planning activities that could affect planning for expanded ferry service (e.g., parking). Please provide relevant supporting documents. These supporting documents could include area-specific or General Plan references, a CIP that includes ferry terminal-related infrastructure, engineering studies, or council resolutions.

4. Recognizing the substantial resources that are required to expand ferry services and the likely local obligation to provide funding, please identify available and/or proposed funding sources that your city could leverage to contribute toward capital and/or operational expenses.

5. Please describe other considerations, opportunities and obstacles that affect potential expanded ferry service to your city.

Please return your response to my and Ashleigh Kanat's attention at wkieser@epsys.com and akanat@epsys.com by Friday, August 31. If you have any questions, both Ashleigh and I can be reached at 510.841.9190. We look forward to receiving your responses as they will inform the content and direction of the study.

Thank you very much for you time and thoughtful consideration of this issue.

Sincerely,

ECONOMIC & PLANNING SYSTEMS, INC.

Walter Kieser
Senior Principal

APPENDIX B:

Solano County Commute Patterns

Solano County Commute Patterns
Solano Transportation Authority – Water Transit Services

The Solano Transportation Authority is studying the feasibility of extending ferry service to other cities in Solano County: Benicia, Rio Vista, Suisun City, and expanded service in Vallejo. Potential origins/destinations to be evaluated include Contra Costa, Marin, Sacramento, and San Francisco counties. As we collectively identify the routes to be studied, the following broad commute patterns provide additional context. Data is provided by the U.S Census Bureau "On the Map." County-level commute patterns are presented first, followed by city-level commute data.

Where Solano County Residents Work

Table 1: Where Solano County Residents Work (by County)

County	2015 Primary Job Count	2015 Share
Solano	*61,068*	*35.6%*
Contra Costa	21,927	12.8%
Alameda	14,493	8.5%
Sacramento	11,462	6.7%
Napa	11,042	6.4%
San Francisco	10,831	6.3%
Santa Clara	5,858	3.4%
Sonoma	4,976	2.9%
San Mateo	4,908	2.9%
Marin	4,527	2.6%
Yolo	3,629	2.1%
All Other Counties	16,721	9.8%
Total	**171,442**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

- More than one-third of Solano County residents work in Solano County, representing approximately 61,000 people.
- Nearly 13 percent of Solano County residents, or 22,000 people, commute to Contra Costa County.
- Approximately 14,500 Solano County residents, representing 9 percent of employed residents, commute to Alameda County.
- Approximately 11,000 workers commute to Sacramento, Napa and San Francisco counties *each*.
- Less than 3 percent of Solano County residents (approximately 4,500) commute to destinations in Marin County.

Table 2: Where Solano County Residents Work (by City)

Location	2015 Primary Job Count	2015 Share
Solano County		
Fairfield	20,959	12.2%
Vacaville	14,546	8.5%
*Vallejo	12,574	7.3%
*Benicia	5,784	3.4%
Dixon	1,942	1.1%
*Suisun City	1,399	0.8%
*Rio Vista	927	0.5%
Contra Costa County		
Concord	3,889	2.3%
Walnut Creek	2,847	1.7%
*Richmond	2,556	1.5%
*Martinez	2,493	1.5%
San Francisco County		
*San Francisco	10,831	6.3%
Alameda County		
*Oakland	5,154	3.0%
*Berkeley	1,711	1.0%
Sacramento County		
*Sacramento	6,123	3.6%
Napa County		
*Napa	4,925	2.9%
Santa Clara County		
San Jose	2,612	1.5%
Marin County		
*San Rafael	1,760	1.0%
All Other Counties	68,410	39.9%
Total	**171,442**	**100.0%**

*Primary employment centers with access to water.

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

- The primary employment centers for Solano County residents are Fairfield (12.2 percent), Vacaville (8.5 percent), and Vallejo (7.3 percent).
- Nearly 11,000 employed residents commute to San Francisco (6.3 percent).

- Of the 22,000 Solano County residents with commute destinations in Contra Costa County, approximately 6,700 work in Concord and Walnut Creek – two jurisdictions lacking direct access to potential ferry service. Approximately 2,500 commute to Richmond and another 2,500 to Martinez.
- More than 6,000 employed residents commute to the City of Sacramento.
- Approximately 5,000 employed Solano County residents commute to Oakland and Napa, *each*.
- Of the 4,500 Solano County residents who commute to Marin County, approximately 1,760 work in San Rafael – 1 percent of employed Solano County residents.

Table 3: Where Vallejo Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Vallejo	7,628	15.6%
Fairfield	2,301	4.7%
Benicia	1,627	3.3%
San Francisco County		
San Francisco	4,451	9.1%
Contra Costa County		
Concord	1,307	2.7%
Walnut Creek	1,154	2.4%
Richmond	1,126	2.3%
Martinez	775	1.6%
Alameda County		
Oakland	2,124	4.4%
Berkeley	783	1.6%
Napa County		
Napa	1,813	3.7%
Marin County		
San Rafael	926	1.9%
Novato	616	1.3%
Sacramento County		
Sacramento	975	2.0%
Santa Clara County		
San Jose	810	1.7%
Cities in All Other Counties	20,369	41.8%
Total	**48,785**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Table 4: Where Benicia Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Benicia	1,911	15.0%
Vallejo	881	6.9%
Fairfield	544	4.3%
Vacaville	154	1.2%
San Francisco County		
San Francisco	1,006	7.9%
Contra Costa County		
Walnut Creek	533	4.2%
Concord	532	4.2%
Martinez	412	3.2%
Richmond	290	2.3%
Pleasant Hill	156	1.2%
Alameda County		
Oakland	463	3.6%
Berkeley	185	1.5%
Napa County		
Napa	250	2.0%
Sacramento County		
Sacramento	234	1.8%
Santa Clara County		
San Jose	183	1.4%
Cities in All Other Counties	4,990	39.2%
Total	**12,724**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Table 5: Where Suisun City Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Fairfield	2,346	20.3%
Vacaville	830	7.2%
Vallejo	541	4.7%
Suisun City	368	3.2%
Benicia	309	2.7%
San Francisco County		
San Francisco	672	5.8%
Alameda County		
Oakland	318	2.8%
Contra Costa County		
Concord	277	2.4%
Richmond	167	1.4%
Martinez	153	1.3%
Walnut Creek	149	1.3%
Napa County		
Napa	333	2.9%
Sacramento County		
Sacramento	326	2.8%
Santa Clara County		
San Jose	196	1.7%
Cities in All Other Counties	4,569	39.5%
Total	**11,554**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Table 6: Where Rio Vista Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Rio Vista	467	18.8%
Fairfield	147	5.9%
Vacaville	55	2.2%
Vallejo	39	1.6%
Benicia	29	1.2%
Contra Costa County		
Pittsburg	52	2.1%
Antioch	51	2.1%
Walnut Creek	34	1.4%
Concord	30	1.2%
Martinez	27	1.1%
San Francisco County		
San Francisco	125	5.0%
Sacramento County		
Sacramento	88	3.5%
Roseville	27	1.1%
Alameda County		
Oakland	54	2.2%
Cities in Santa Clara County		
San Jose	49	2.0%
Cities in All Other Counties	1,210	48.7%
Total	**2,484**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Table 7: Where Fairfield Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Fairfield	8,996	21.2%
Vacaville	2,923	6.9%
Vallejo	1,963	4.6%
Benicia	1,001	2.4%
Suisun City	562	1.3%
Contra Costa County		
Concord	986	2.3%
Martinez	581	1.4%
Walnut Creek	557	1.3%
Richmond	544	1.3%
San Francisco County		
San Francisco	2,507	5.9%
Alameda County		
Oakland	1,184	2.8%
Napa County		
Napa	1,468	3.5%
Sacramento County		
Sacramento	1,171	2.8%
Santa Clara County		
San Jose	681	1.6%
Cities in All Other Counties	17,273	40.7%
Total	**42,397**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Table 8: Where Vacaville Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Vacaville	8,447	22.4%
Fairfield	5,157	13.7%
Vallejo	1,001	2.7%
Benicia	674	1.8%
Dixon	452	1.2%
Contra Costa County		
Concord	535	1.4%
Martinez	402	1.1%
Walnut Creek	288	0.8%
Richmond	271	0.7%
Sacramento County		
Sacramento	2,202	5.8%
San Francisco County		
San Francisco	1,444	3.8%
Napa County		
Napa	780	2.1%
Alameda County		
Oakland	695	1.8%
Santa Clara County		
San Jose	510	1.4%
Cities in All Other Counties	14,843	39.4%
Total	**37,701**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Table 9: Where Dixon Residents Work

Location	2015 Primary Job Count	2015 Share
Solano County		
Dixon	1,118	13.9%
Vacaville	736	9.1%
Fairfield	567	7.0%
Vallejo	130	1.6%
Sacramento County		
Sacramento	760	9.4%
West Sacramento	136	1.7%
Yolo County		
Davis	295	3.7%
Woodland	205	2.5%
San Francisco County		
San Francisco	257	3.2%
Alameda County		
Oakland	122	1.5%
Santa Clara County		
San Jose	88	1.1%
Cities in All Other Counties	3,638	45.2%
Total	**8,052**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

Where Solano County Employees Live

Table 10: Where Solano County Employees Live (by County)

County	2015 Primary Job Count	2015 Share
Solano	*61,068*	*45.8%*
Sacramento	12,883	9.7%
Contra Costa	10,312	7.7%
Yolo	10,181	7.6%
Alameda	5,092	3.8%
Napa	4,695	3.5%
Sonoma	3,195	2.4%
San Joaquin	3,000	2.2%
Santa Clara	2,841	2.1%
San Francisco	2,118	1.6%
San Mateo	2,008	1.5%
Placer	1,950	1.5%
Los Angeles	1,267	0.9%
Marin	1,195	0.9%
Stanislaus	1,124	0.8%
Fresno	861	0.6%
All Other Counties	9,655	7.2%
Total	**133,445**	**100.0%**

Sources: LEHD On The Map; Economic & Planning Systems, Inc.

- Of the more than 133,000 jobs in Solano County, approximately 61,000 are filled by Solano County residents (46 percent).
- Nearly 10 percent of County employees live in Sacramento County (approximately 13,000 people).
- About 8 percent (approximately 10,000 people) live in Contra Costa and Yolo counties *each*.
- Fewer than 4 percent (approximately 5,000 people) live in Alameda and Napa counties *each*.
- Not even 1 percent of employees in Solano County commute from Marin County.

APPENDIX C:

Detailed Operating Costs for Vallejo Routes

Appendix C, Table 1
Vallejo/San Francisco (Ferry Building) Ferry Service Operating Costs
STA Water Transit Feasibility Study; EPS #171141

Item	Assumptions	10-Year Net Present Value [1]	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Year 6 2023	Year 7 2024	Year 8 2025	Year 9 2026	Year 10 2027	Years 1 - 10 10-Year Total
Service Assumptions													
AM Trips (Peak Direction/ Reverse)	2/1												
PM Trips (Peak Direction/ Reverse)	2/1												
Trip Distance (Nautical Miles)	27.8												
Trip Time (Minutes)	54												
Total Daily Crews	2												
Number of Vessels	1												
Operating Expenses [2]													
Vessel Expenses													
Crew Labor	4.0% per year	$9,804,777	$938,400	$975,936	$1,014,973	$1,055,572	$1,097,795	$1,141,707	$1,187,375	$1,234,870	$1,284,265	$1,335,636	$11,266,531
Maintenance	4.0% per year	$10,135,992	$970,100	$1,008,904	$1,049,260	$1,091,231	$1,134,880	$1,180,275	$1,227,486	$1,276,585	$1,327,649	$1,380,755	$11,647,125
Non-Vessel Expenses	2.0% per year	$2,192,690	$229,020	$233,600	$238,272	$243,038	$247,899	$252,857	$257,914	$263,072	$268,333	$273,700	$2,507,705
Fixed Operator Expenses	2.0% per year	$2,192,690	$229,020	$233,600	$238,272	$243,038	$247,899	$252,857	$257,914	$263,072	$268,333	$273,700	$2,507,705
Direct Expenses	2.0% per year	$5,664,448	$591,635	$603,468	$615,537	$627,848	$640,405	$653,213	$666,277	$679,603	$693,195	$707,059	$6,478,238
Fuel/Urea		$13,121,782	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$1,493,469	$14,934,691
Total, Operating Expenses		**$43,112,379**	**$4,451,644**	**$4,548,978**	**$4,649,785**	**$4,754,196**	**$4,862,346**	**$4,974,377**	**$5,090,435**	**$5,210,672**	**$5,335,245**	**$5,464,319**	**$49,341,995**

[1] NPV calculation uses an annual discount rate of 3%.
[2] Operating expenses and annual rates of inflation provided by WETA based on analysis of current operations.

Source: WETA; Economic & Planning Systems, Inc.

Appendix C, Table 2
Vallejo/Larkspur Ferry Service Operating Costs
STA Water Transit Feasibility Study; EPS #171141

Item	Assumptions	10-Year Net Present Value [1]	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Year 6 2023	Year 7 2024	Year 8 2025	Year 9 2026	Year 10 2027	Years 1 - 10 10-Year Total
Service Assumptions													
AM Trips (Peak Direction/ Reverse)	3/2												
PM Trips (Peak Direction/ Reverse)	3/2												
Trip Distance (Nautical Miles)	20.7												
Trip Time (Minutes)	53												
Total Daily Crews	4												
Number of Vessels/ Speed	2												
Operating Expenses [2]													
Vessel Expenses													
Crew Labor	4.0% per year	$19,609,555	$1,876,800	$1,951,872	$2,029,947	$2,111,145	$2,195,591	$2,283,414	$2,374,751	$2,469,741	$2,568,530	$2,671,272	$22,533,062
Maintenance	4.0% per year	$30,407,975	$2,910,300	$3,026,712	$3,147,780	$3,273,692	$3,404,639	$3,540,825	$3,682,458	$3,829,756	$3,982,947	$4,142,264	$34,941,374
Non-Vessel Expenses	2.0% per year	$5,499,934	$574,452	$585,941	$597,660	$609,613	$621,805	$634,241	$646,926	$659,865	$673,062	$686,523	$6,290,089
Fixed Operator Expenses	2.0% per year	$5,499,934	$574,452	$585,941	$597,660	$609,613	$621,805	$634,241	$646,926	$659,865	$673,062	$686,523	$6,290,089
Direct Expenses	2.0% per year	$14,208,164	$1,484,001	$1,513,681	$1,543,955	$1,574,834	$1,606,330	$1,638,457	$1,671,226	$1,704,651	$1,738,744	$1,773,519	$16,249,397
Fuel/Urea		$12,253,257	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$1,394,617	$13,946,170
Total, Operating Expenses		**$87,478,819**	**$8,814,622**	**$9,058,764**	**$9,311,619**	**$9,573,513**	**$9,844,788**	**$10,125,796**	**$10,416,904**	**$10,718,494**	**$11,030,962**	**$11,354,718**	**$100,250,180**

[1] NPV calculation uses an annual discount rate of 3%.

[2] Operating expenses and annual rates of inflation provided by WETA based on analysis of current operations.

Source: WETA; Economic & Planning Systems, Inc.

Appendix C, Table 3
Vallejo/Oakland (Jack London Square) Ferry Service Operating Costs
STA Water Transit Feasibility Study; EPS #171141

Item	Assumptions	10-Year Net Present Value [1]	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Year 6 2023	Year 7 2024	Year 8 2025	Year 9 2026	Year 10 2027	Years 1 - 10 10-Year Total
Service Assumptions													
AM Trips (Peak Direction/ Reverse)	4/2												
PM Trips (Peak Direction/ Reverse)	4/3												
Trip Distance (Nautical Miles)	32.5												
Trip Time (Minutes)	80												
Total Daily Crews	6												
Number of Vessels/ Speed	3												
Operating Expenses [2]													
Vessel Expenses													
Crew Labor	4.0% per year	$29,414,332	$2,815,200	$2,927,808	$3,044,920	$3,166,717	$3,293,386	$3,425,121	$3,562,126	$3,704,611	$3,852,796	$4,006,907	$33,799,593
Maintenance	4.0% per year	$40,543,967	$3,880,400	$4,035,616	$4,197,041	$4,364,922	$4,539,519	$4,721,100	$4,909,944	$5,106,342	$5,310,595	$5,523,019	$46,588,498
Non-Vessel Expenses	2.0% per year	$7,692,624	$803,472	$819,541	$835,932	$852,651	$869,704	$887,098	$904,840	$922,937	$941,396	$960,223	$8,797,794
Fixed Operator Expenses	2.0% per year	$7,692,624	$803,472	$819,541	$835,932	$852,651	$869,704	$887,098	$904,840	$922,937	$941,396	$960,223	$8,797,794
Direct Expenses	2.0% per year	$19,872,612	$2,075,636	$2,117,149	$2,159,492	$2,202,682	$2,246,735	$2,291,670	$2,337,503	$2,384,253	$2,431,938	$2,480,577	$22,727,635
Fuel/Urea		$26,806,933	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$3,051,059	$30,510,586
Total, Operating Expenses		**$132,023,092**	**$13,429,239**	**$13,770,714**	**$14,124,376**	**$14,490,681**	**$14,870,107**	**$15,263,146**	**$15,670,312**	**$16,092,138**	**$16,529,179**	**$16,982,009**	**$151,221,900**

[1] NPV calculation uses an annual discount rate of 3%.

[2] Operating expenses and annual rates of inflation provided by WETA based on analysis of current operations.

Source: WETA; Economic & Planning Systems, Inc.

APPENDIX D:

Financial Feasibility for Vallejo Routes

Appendix D, Table 1
Vallejo/San Francisco (Ferry Building) Ferry Operating Costs and Farebox Revenues
STA Water Transit Feasibility Study; EPS #171141

Item	Assumptions	10-Year Net Present Value [1]	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Year 6 2023	Year 7 2024	Year 8 2025	Year 9 2026	Year 10 2027	Years 1 - 10 10-Year Total
Service Assumptions													
AM Trips (Peak Direction/ Reverse)	2/1												
PM Trips (Peak Direction/ Reverse)	2/1												
Trip Distance (Nautical Miles)	27.8												
Trip Time (Minutes)	54												
Total Daily Crews	2												
Number of Vessels/ Speed	1												
Total Annual Operating Expenses (see Appendix A)		**$43,112,379**	**$4,451,644**	**$4,548,978**	**$4,649,785**	**$4,754,196**	**$4,862,346**	**$4,974,377**	**$5,090,435**	**$5,210,672**	**$5,335,245**	**$5,464,319**	**$49,341,995**
Fare Assumptions													
Average One-Way Ticket Price [2]	3.0%		$10.78	$11.10	$11.44	$11.78	$12.13	$12.50	$12.87	$13.26	$13.66	$14.07	
Target Ridership													
Required Annual Number of One-Way Trips to Fund Operating Expenses			412,897	409,636	406,518	403,540	400,699	397,992	395,415	392,966	390,641	388,439	3,998,744
Unadjusted Ridership Analysis [3]													
Daily, Weekday Ridership	2.50%		667	667	667	667	667	667	667	667	667	667	6,670
Annual Ridership (Assumes 260 Days of Service per Year) [4]	260		173,420	173,420	173,420	173,420	173,420	173,420	173,420	173,420	173,420	173,420	1,734,200
Annual Fare Revenue		$18,697,245	$1,869,725	$1,925,816	$1,983,591	$2,043,098	$2,104,391	$2,167,523	$2,232,549	$2,299,525	$2,368,511	$2,439,566	$21,434,296
Farebox Recovery Percentage		43%	42%	42%	43%	43%	43%	44%	44%	44%	44%	45%	43%
Ridership Gap (Variance from Required Passenger Estimate)													
Number			239,477	236,216	233,098	230,120	227,279	224,572	221,995	219,546	217,221	215,019	2,264,544
Percent			58%	58%	57%	57%	57%	56%	56%	56%	56%	55%	57%
Operating Expense Gap (Variance from Estimated Operating Expenses)													
Amount		$24,415,134	$2,581,920	$2,623,161	$2,666,194	$2,711,097	$2,757,955	$2,806,854	$2,857,886	$2,911,146	$2,966,734	$3,024,752	$27,907,699
Percent		57%	58%	58%	57%	57%	57%	56%	56%	56%	56%	55%	57%
Adjusted Ridership Analysis [5]													
Daily, Weekday Ridership, Adjusted to Account for Start-Up Period	2.50%		334	342	350	359	368	377	387	396	406	416	3,736
Annual Ridership (Assumes 260 Days of Service per Year) [4]	260		86,710	88,878	91,100	93,377	95,712	98,104	100,557	103,071	105,648	108,289	971,445
Annual Fare Revenue		$10,473,619	$934,862	$986,981	$1,042,005	$1,100,097	$1,161,427	$1,226,177	$1,294,536	$1,366,706	$1,442,900	$1,523,342	$12,079,034
Farebox Recovery Percentage		24%	21%	22%	22%	23%	24%	25%	25%	26%	27%	28%	24%
Operating Expense Gap (Variance from Estimated Operating Expenses)													
Amount		$32,638,760	$3,516,782	$3,561,997	$3,607,780	$3,654,099	$3,700,919	$3,748,200	$3,795,899	$3,843,965	$3,892,344	$3,940,976	$37,262,961
Percent		76%	79%	78%	78%	77%	76%	75%	75%	74%	73%	72%	76%

[1] NPV calculation uses an annual discount rate of 3%.
[2] Average one-way ticket prices are provided by WETA in 2018 dollars and assume a Clipper Card discount. Fares are escalated by 3% per year consistent with WETA's adopted fare structure policies.
[3] The unadjusted Daily weekday ridership is based on SFCTA's 2040 projections and held constant. Estimate reflects the number of daily boardings; actual passenger estimate would be half this number, assuming commuters travel to and from their destination.
[4] 260 days of service per year assumes 52 weeks * 5 days per week.
[5] When the South San Francisco service started up in 2012, ridership was 42% of the Year 1 forecast. The adjusted ridership sensitivity is estimated here to illustrate the effect on operating revenue if 2040 forecasts are reduced by 50% in Year 1 and then allowed to grow at an annual rate of 2.5%.

Sources: WETA; Economic & Planning Systems, Inc.

Appendix D, Table 2
Vallejo/Larkspur Ferry Operating Costs and Farebox Revenues
STA Water Transit Feasibility Study; EPS #171141

Item	Assumptions	10-Year Net Present Value [1]	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Year 6 2023	Year 7 2024	Year 8 2025	Year 9 2026	Year 10 2027	Years 1 - 10 10-Year Total
Service Assumptions													
AM Trips (Peak Direction/ Reverse)	3/2												
PM Trips (Peak Direction/ Reverse)	3/2												
Trip Distance (Nautical Miles)	20.7												
Trip Time (Minutes)	53												
Total Daily Crews	4												
Number of Vessels/ Speed	2												
Total Annual Operating Expenses (see Appendix A)		**$87,478,819**	**$8,814,622**	**$9,058,764**	**$9,311,619**	**$9,573,513**	**$9,844,788**	**$10,125,796**	**$10,416,904**	**$10,718,494**	**$11,030,962**	**$11,354,718**	**$100,250,180**
Fare Assumptions													
Average One-Way Ticket Price [2]	3.0%		$10.78	$11.10	$11.44	$11.78	$12.13	$12.50	$12.87	$13.26	$13.66	$14.07	
Target Ridership													
Required Annual Number of One-Way Trips to Fund Operating Expenses			817,571	815,743	814,090	812,608	811,295	810,148	809,165	808,341	807,676	807,166	8,113,803
Unadjusted Ridership Analysis [3]													
Daily, Weekday Ridership	2.50%		168	168	168	168	168	168	168	168	168	168	1,680
Annual Ridership (Assumes 260 Days of Service per Year) [4]	260		43,680	43,680	43,680	43,680	43,680	43,680	43,680	43,680	43,680	43,680	436,800
Annual Fare Revenue		$4,709,351	$470,935	$485,063	$499,615	$514,604	$530,042	$545,943	$562,321	$579,191	$596,567	$614,464	$5,398,743
Farebox Recovery Percentage		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Ridership Gap (Variance from Required Passenger Estimate)													
Number			773,891	772,063	770,410	768,928	767,615	766,468	765,485	764,661	763,996	763,486	7,677,003
Percent			95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Operating Expense Gap (Variance from Estimated Operating Expenses)													
Amount		$82,769,468	$8,343,687	$8,573,701	$8,812,004	$9,058,910	$9,314,746	$9,579,853	$9,854,583	$10,139,303	$10,434,395	$10,740,255	$94,851,437
Percent		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adjusted Ridership Analysis [5]													
Daily, Weekday Ridership, Adjusted to Account for Start-Up Period	2.50%		84	86	88	90	93	95	97	100	102	105	941
Annual Ridership (Assumes 260 Days of Service per Year) [4]	260		21,840	22,386	22,946	23,519	24,107	24,710	25,328	25,961	26,610	27,275	244,682
Annual Fare Revenue		$2,638,033	$235,468	$248,595	$262,454	$277,086	$292,533	$308,842	$326,060	$344,238	$363,429	$383,690	$3,042,395
Farebox Recovery Percentage		3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Operating Expense Gap (Variance from Estimated Operating Expenses)													
Amount		$84,840,786	$8,579,154	$8,810,169	$9,049,165	$9,296,427	$9,552,255	$9,816,954	$10,090,844	$10,374,256	$10,667,533	$10,971,028	$97,207,785
Percent		97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%

[1] NPV calculation uses an annual discount rate of 3%.
[2] Average one-way ticket prices are provided by WETA in 2018 dollars and assume a Clipper Card discount. Fares are escalated by 3% per year consistent with WETA's adopted fare structure policies.
[3] The unadjusted Daily weekday ridership is based on SFCTA's 2040 projections and held constant. Estimate reflects the number of daily boardings; actual passenger estimate would be half this number, assuming commuters travel to and from their destination.
[4] 260 days of service per year assumes 52 weeks * 5 days per week.
[5] When the South San Francisco service started up in 2012, ridership was 42% of the Year 1 forecast. The adjusted ridership sensitivity is estimated here to illustrate the effect on operating revenue if 2040 forecasts are reduced by 50% in Year 1 and then allowed to grow at an annual rate of 2.5%.

Sources: WETA; Economic & Planning Systems, Inc.

Appendix D, Table 3
Vallejo/Oakland (Jack London Square) Ferry Operating Costs and Farebox Revenues
STA Water Transit Feasibility Study; EPS #171141

Item	Assumptions	10-Year Net Present Value [1]	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 5 2022	Year 6 2023	Year 7 2024	Year 8 2025	Year 9 2026	Year 10 2027	Years 1 - 10 10-Year Total
Service Assumptions													
AM Trips (Peak Direction/ Reverse)	4/2												
PM Trips (Peak Direction/ Reverse)	4/3												
Trip Distance (Nautical Miles)	32.5												
Trip Time (Minutes)	80												
Total Daily Crews	6												
Number of Vessels/ Speed	3												
Total Annual Operating Expenses (see Appendix A)		**$132,023,092**	**$13,429,239**	**$13,770,714**	**$14,124,376**	**$14,490,681**	**$14,870,107**	**$15,263,146**	**$15,670,312**	**$16,092,138**	**$16,529,179**	**$16,982,009**	**$151,221,900**
Fare Assumptions													
Average One-Way Ticket Price [2]	3.0%		$10.78	$11.10	$11.44	$11.78	$12.13	$12.50	$12.87	$13.26	$13.66	$14.07	
Target Ridership													
Required Annual Number of One-Way Trips to Fund Operating Expenses			1,245,584	1,240,055	1,234,856	1,229,982	1,225,425	1,221,179	1,217,239	1,213,598	1,210,250	1,207,190	12,245,357
Unadjusted Ridership Analysis [3]													
Daily, Weekday Ridership	2.50%		43	43	43	43	43	43	43	43	43	43	430
Annual Ridership (Assumes 260 Days of Service per Year) [4]	260		11,180	11,180	11,180	11,180	11,180	11,180	11,180	11,180	11,180	11,180	111,800
Annual Fare Revenue		$1,205,370	$120,537	$124,153	$127,878	$131,714	$135,665	$139,735	$143,927	$148,245	$152,693	$157,273	$1,381,821
Farebox Recovery Percentage		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Ridership Gap (Variance from Required Passenger Estimate)													
Number			1,234,404	1,228,875	1,223,676	1,218,802	1,214,245	1,209,999	1,206,059	1,202,418	1,199,070	1,196,010	12,133,557
Percent			99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Operating Expense Gap (Variance from Estimated Operating Expenses)													
Amount		$130,817,723	$13,308,702	$13,646,561	$13,996,498	$14,358,967	$14,734,441	$15,123,410	$15,526,384	$15,943,893	$16,376,486	$16,824,736	$149,840,079
Percent		99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Adjusted Ridership Analysis [5]													
Daily, Weekday Ridership, Adjusted to Account for Start-Up Period	2.50%		22	22	23	23	24	24	25	26	26	27	241
Annual Ridership (Assumes 260 Days of Service per Year) [4]	260		5,590	5,730	5,873	6,020	6,170	6,325	6,483	6,645	6,811	6,981	62,627
Annual Fare Revenue		$675,211	$60,268	$63,628	$67,176	$70,921	$74,875	$79,049	$83,456	$88,109	$93,021	$98,206	$778,708
Farebox Recovery Percentage		1%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%	1%
Operating Expense Gap (Variance from Estimated Operating Expenses)													
Amount		$131,347,881	$13,368,970	$13,707,086	$14,057,200	$14,419,761	$14,795,232	$15,184,097	$15,586,856	$16,004,030	$16,436,158	$16,883,803	$150,443,192
Percent		99%	100%	100%	100%	100%	99%	99%	99%	99%	99%	99%	99%

[1] NPV calculation uses an annual discount rate of 3%.
[2] Average one-way ticket prices are provided by WETA in 2018 dollars and assume a Clipper Card discount. Fares are escalated by 3% per year consistent with WETA's adopted fare structure policies.
[3] The unadjusted Daily weekday ridership is based on SFCTA's 2040 projections and held constant. Estimate reflects the number of daily boardings; actual passenger estimate would be half this number, assuming commuters travel to and from their destination.
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[5] When the South San Francisco service started up in 2012, ridership was 42% of the Year 1 forecast. The adjusted ridership sensitivity is estimated here to illustrate the effect on operating revenue if 2040 forecasts are reduced by 50% in Year 1 and then allowed to grow at an annual rate of 2.5%.

Sources: WETA; Economic & Planning Systems, Inc.