

# **GUEMES ISLAND FERRY REPLACEMENT**

## **Project Overview**

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### **Introduction**

In December 1979, five and a half years after the replacement effort began, Skagit County took delivery of M/V *Guemes*, shown below in Figure 1. This vessel has been serving Skagit County and the residents of Guemes Island for 38 years, operating on a short 5/8<sup>th</sup> mile crossing between Anacortes and Guemes Island, Washington (Figure 2 and Figure 3).

Ferry service outages and vessel maintenance costs have increased in recent years, and a study conducted in 2013 found that it would be more economical to replace the ferry than to refurbish it. Skagit County began considering replacement options in earnest in 2014.

Recognizing that advancements in battery technology and electric propulsion were changing the operation of marine vessels, and that the Skagit County community could benefit from an environmentally friendly ferry, the idea to build an all-electric ferry gained momentum.

Glosten, a consultant to Skagit County Public Works, was hired in 2017 to develop a concept design and study propulsion system options, building upon two years of all-electric exploratory work by Skagit County.

Glosten has developed a concept design and supporting documents that represent a 30% complete design. A significant portion of this design effort has focused on the propulsion system option, as this decision will have the largest impact on the vessel operating costs. The final propulsion system has not been selected by Skagit County at this time.

Although there are technical hurdles with a battery-electric propulsion system and charging system, all are surmountable with proper design and construction oversight. The primary remaining challenge lies in acquiring the capital funding necessary to build the shore side

charging infrastructure. An electric replacement vessel for Guemes Island would represent a landmark design, paving the way for other ferry systems in our region and beyond.



Figure 1 Existing Guemes Island ferry, M/V *Guemes*

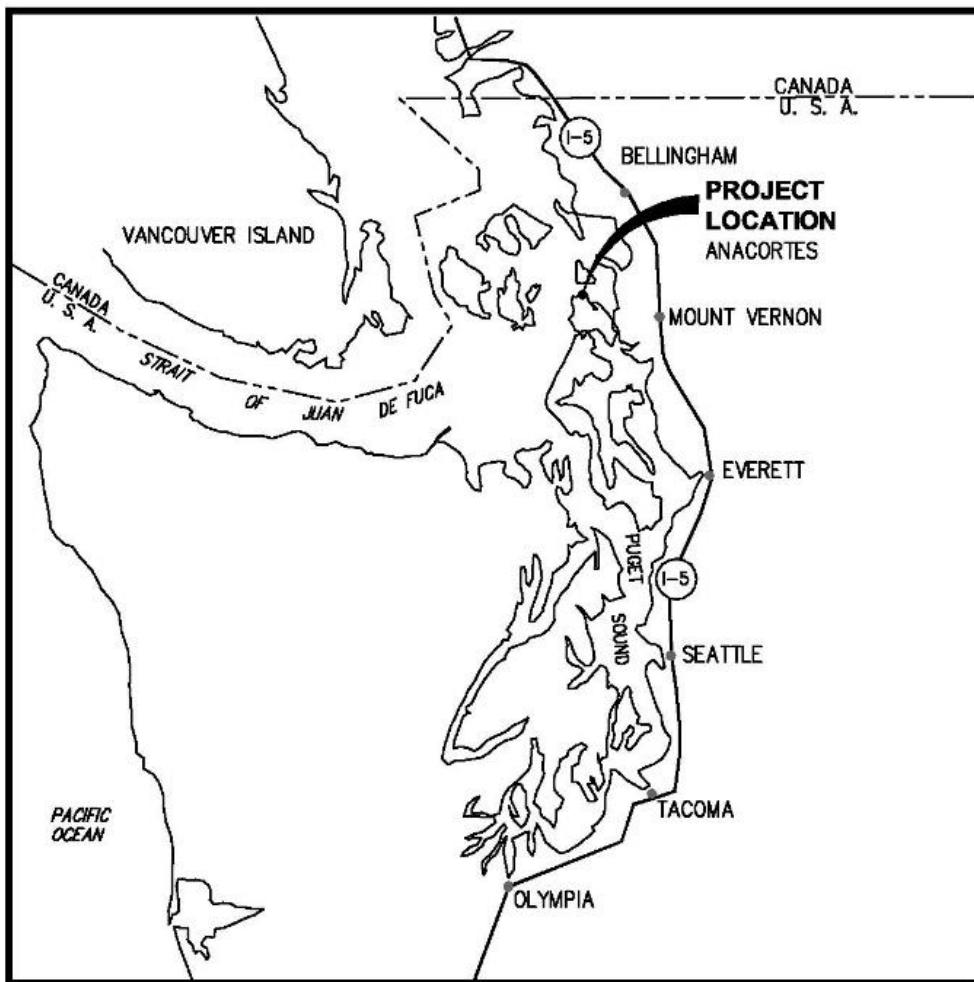


Figure 2 Vicinity map showing project location at Anacortes, Washington

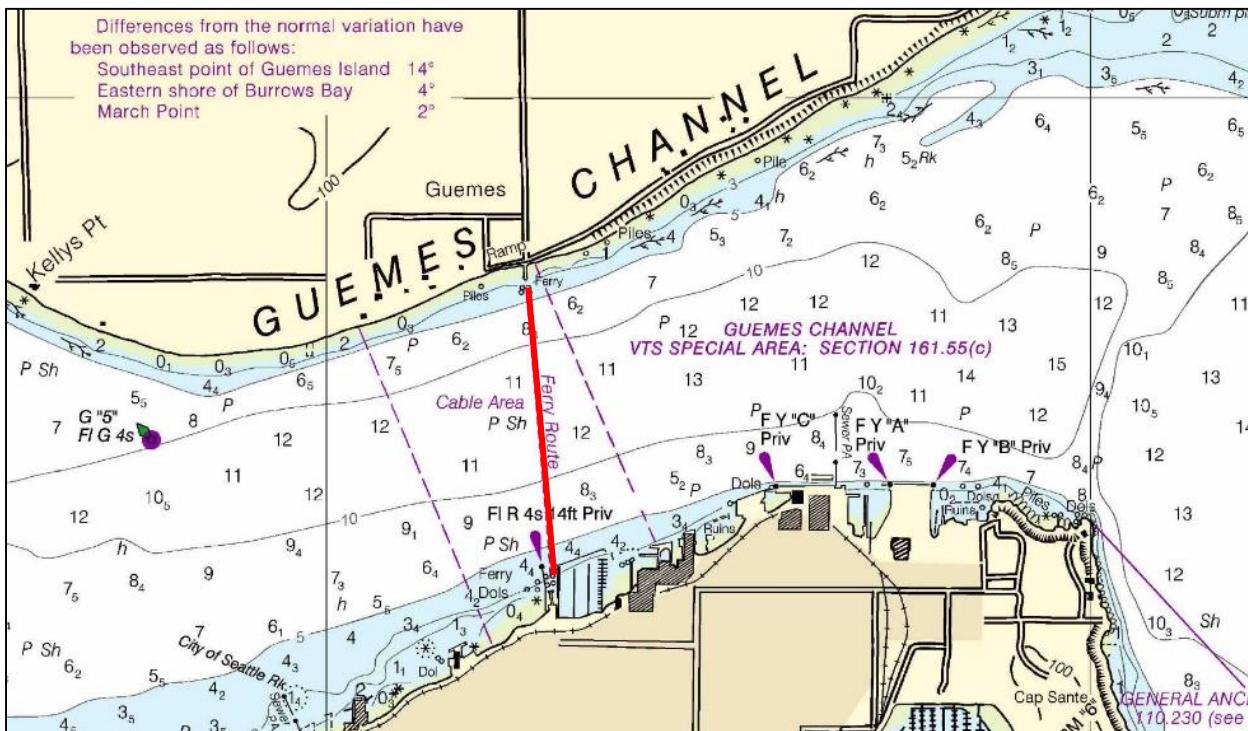


Figure 3 Excerpt from NOAA Nautical Chart No. 18427 showing established route between Anacortes and Guemes Island, depth in fathoms

## Concept Design Report

This report describes the concept design developed to replace the M/V *Guemes*. Included with this report is a General Arrangement drawing, showing the layout of the replacement vessel, and a Structural Midship Section drawing, showing the structural system that will be used. Both drawings are provided at the end of this section.

Figure 4 and Figure 5 present the concept replacement vessel, which is a double-ended vehicle and passenger ferry, with a three-tiered deckhouse located to one side of the vessel. The design accommodates four lanes of vehicles, including highway-rated trucks and emergency vehicles.



**Figure 4** View of the replacement vessel, showing the East side of the vessel



**Figure 5** View of the replacement vessel, showing the West side of the vessel

Skagit County desires to build an all-electric replacement vessel that will operate with batteries as the primary source of power. To understand the benefits and trade-offs for this type of propulsion system, a trade off study was completed. The study included comparing the all-electric option to a baseline (geared diesel) propulsion system, and three other alternate systems (diesel-electric, series hybrid, and plug-in hybrid). A description of each system is provided in the concept design report as well as a propulsion system life cycle cost analysis.

Key findings of the concept design report include:

- The concept design and all five propulsion systems meet the requirements for the replacement vessel.
- The capital cost of shore-power charging infrastructure more than doubles the propulsion system cost for the All-Electric and Plug-in Hybrid propulsion systems.
- All-Electric and Plug-in Hybrid options will likely have lower operating costs than the three diesel options, with Plug-in Hybrid offering the lowest operating cost.
- At the current price of diesel fuel (\$2.09/gallon), the All-Electric and Plug-in Hybrid propulsion systems have the highest overall life cycle costs. The Plug-in Hybrid vessel has a similar life cycle cost to the diesel powered options when diesel fuel prices increase to approximately \$2.50 to \$3.00 per gallon, and a lower life cycle cost at diesel prices above \$3.00/gallon.
- Capital costs can be reduced if the frequency of service or vessel capacity is reduced.

## Vessel Capacity Study

The vessel capacity study analyzes past Guemes Island Ferry ridership and estimates the capacity of the replacement vessel intended to be in service from 2020 to 2060.

Skagit County provided annual ridership records from 1980 through 2000 and detailed ridership records from January 2001 through July 2017. Glosen analyzed the full record set to produce graphs and commentary on annual ridership and to determine the probability distributions of passenger and vehicle load size. Key findings are:

- Passenger ridership (including passengers in vehicles) increased 101% from 1980 to its peak in 2007, and 85% from 1980 to 2016.
- Vehicle ridership increased 158% from 1980 to its peak in 2002, and 125% from 1980 to 2016.
- Truck and trailer ridership increased from 2% of the total vehicle count in 1980 to 6% of the total vehicle count in 2016.
- Approximately 1% of all existing ferry trips are likely to contain a full load of walk-on passengers.
- Approximately 22% of all existing ferry trips are likely to contain a full load of vehicles.
- Increasing population increases ridership, whereas increasing fares reduces ridership, and increasing parking reduces vehicle ridership. Glosen found that these three factors have statistically significant impacts on ridership.

A 40-year forecasting period was chosen to match a common economic life of a steel ferry in the Pacific Northwest. Skagit County has chosen to pursue a ridership growth that includes a medium Skagit County population prediction with fares and parking to discourage ridership. This medium-low growth yields the following ridership targets:

- Annual passenger ridership is forecasted to be approximately 346,000 in 2060, an increase of 77% over 2016 levels.
- Annual vehicle ridership is forecasted to be approximately 170,000 in 2060, an increase of 74% over 2016 levels.

Glosten scaled the capacity of the new vessel from the capacity of the existing vessel by the ratio of forecasted ridership in 2060 to the existing vessel's ridership in its busiest year. A replacement vessel capacity of 32 vehicles corresponds with Skagit County's ridership target.

## Transportation System Assessment

The transportation system assessment analyzes shore side infrastructure, ferry terminal operations, total system throughput, total lifecycle cost of ferry system alternatives, emergency services provided by the ferry system, and environmental considerations.

While the design of the replacement ferry will have the biggest impact on the future performance of the ferry system, this report investigates other opportunities for system improvement, and provides feedback to the replacement ferry design, to ensure that all aspects of the system that impact its stakeholders have been considered. The objective of this study is to ensure the Guemes Island ferry is optimized as a whole system.

Key findings in the report include:

- Maximum recommended replacement vessel length and beam are 180' and 54', respectively. The optimal freeboard with the existing infrastructure is approximately 6'-0".
- Both terminal ramp aprons are recommended for replacement to permit concurrent vehicle and passenger loading; required to load 32 vehicles and maintain two round trips per hour.
- All 11 terminal dolphin fender systems are recommended for replacement to maintain the acceptable approach velocity of the existing ferry, given that the replacement ferry will transfer more energy at the same velocity due to its larger mass.
- Queuing lane length and parking stall quantity are adequate for the near term but will require improvements prior to 2060.
- The ticketing system requires replacement to avoid being a bottleneck while loading vehicles at the Anacortes terminal.
- A throughput analysis revealed that 33 vehicles is the maximum vehicle capacity that could meet the two round-trips per hour schedule requirement provided concurrent passenger and vehicle loading is achieved through modification of the aprons.
- A single replacement ferry results in a lower life cycle cost as compared to a two-ferry system.

## Engineers Cost Estimate

An engineer's cost estimate has been developed for the Guemes Island Ferry Replacement Project, showing the capital cost breakdown of the vessel, shore-side infrastructure, and terminal upgrades. The estimated shipyard contract cost ranges from \$12.8 to \$15.9 million, and the total estimated program costs (including all design, taxes, and oversight) range from \$15.8 to \$25.7 million, depending on propulsion system choice and related infrastructure improvements anticipated.

## **Financial Plan**

A financial plan has been developed by PFM Financial Advisors, working as a consultant to Skagit County Public Works. PFM developed pro forma financial models, including a capital funding plan, for each of the propulsion system.

## **Cash Flow and Amortization Schedules**

Cash flow and amortization schedules have been developed by PFM Financial Advisors, working as a consultant to Skagit County Public Works. These are presented for all five propulsion system options.

## **Letters of Support**

This final section includes letters of support for the project from various public and private entities.