Proposal Summary

The Willardsons, owners of Fishhook Sunrise Bed & Breakfast, located near Palmer, AK, demonstrated interest in expanding their existing bed and breakfast to accommodate future visitors. The expansion includes three new cabins on the northwest side of the property, across Wasilla Creek, which has no existing infrastructure. The expansion, therefore, includes the installation of a drinking water well, access road, septic system, and bridge. Fishhook Engineering proposed providing a site layout for the expansion with high level recommendations for the septic system and roadway material. The project scope also included the complete design of a one lane bridge to span Wasilla Creek.

Criteria & Decision Matrix

In conjunction with the client, Fishhook Engineering rated the alternatives according to the six criteria shown in the Pugh matrix in Figure 1. For the bridge and access road, cost was weighted heavier than the other criteria. For the septic system, cost and environmental impact were also weighed more than the other criteria, with environmental impact as the deciding factor.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Cost</th>
<th>Constructability</th>
<th>Environmental Impact</th>
<th>Maintenance</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Girder</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Concrete Girder</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wood Girder</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 1. Pugh Matrix for alternative evaluation.

The concrete and steel superstructure alternatives were designed for an HS-20 rated vehicle. The timber superstructure alternative was designed for an HS-10 rated vehicle.

Final Design

The final design of the Fishhook Sunrise Bed & Breakfast expansion project includes a detailed design of a steel bridge to cross Wasilla Creek (see Figures 5 and 7). The final bridge implementation is estimated to cost $366,790, including engineering, materials, equipment, and labor costs. Fishhook Engineering also produced a site layout with recommendations for the additional aspects of the expansion (see Figure 6).

Acknowledgements

Fishhook Engineering would like to thank the following individuals for their guidance throughout the duration of this project:

- External PE: Paul Taylor, PE, JUB Engineers
- Faculty Advisor: Bethany Neilson, PhD
- Client: Fishhook Sunrise Bed & Breakfast
- Professor: Austin Ball, PE

Alternatives & Selected Alternative

Bridge

- Steel Girder: The steel girder alternative has many benefits and satisfies the criteria used for evaluation. Long-term cost, low maintenance, environmental impact, and constructability make the steel girder bridge a competitive option (Figure 2).
- Concrete Girder: The concrete girder alternative is a valid option due to its longevity, low maintenance, and availability (Figure 3).
- Wood Girder: The wood girder alternative is a feasible option due to low cost and constructability. Timber bridges require specialized installation but have comparable lifespans to concrete and steel bridges. This bridge alternative is also the most aesthetically pleasing (Figure 4).

Access Road

The access road allows bed and breakfast patrons to cross through the client’s property and over Wasilla Creek to the cabin site. Since cost is the primary factor for decision of this alternative, the gravel option is the most viable because gravel is cheaper than asphalt.

- Gravel
- Asphalt

Septic System

The recommended septic system alternative is a mound system option. Despite the higher cost, the soil characteristics and classifications do not allow for a conventional septic system due to environmental concerns.

- Conventional
- Mound

Figure 2. Example steel bridge with sheet piles.

Figure 3. Decked bulb tee concrete bridge.

Figure 4. Cross section of wood and concrete girder.

Figure 5. Plan view of bridge design.

Figure 6. Site layout.

Figure 7. Cross-sectional view of bridge design.