



# APPENDIX 12:

*Additional Field Study Reports and Memoranda*



WETLAND DELINEATION AND FUNCTIONAL ASSESSMENT  
MIGRATORY BIRDS  
INTERTIDAL HABITAT  
EELGRASS DELINEATION  
GEOPHYSICS INVESTIGATION  
VISUAL ASSESSMENT





# WETLAND DELINEATION AND FUNCTIONAL ASSESSMENT JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

■ July 2024



DOWL No: 1138.63234.01

State No: SFHWY00299

Federal No: 0003259

# **JUNEAU DOUGLAS NORTH CROSSING PEL STUDY**

## **Wetland Delineation and Functional Assessment**

Program No: SFHWY00299  
Federal No: 0003259

### **Prepared for:**

The State of Alaska, Department of Transportation and Public Facilities  
Southcoast Region  
6860 Glacier Highway  
Juneau, AK 99811

### **Prepared by:**

DOWL  
5015 Business Park Blvd  
Suite 4000  
Anchorage, AK 99503

July 2024

DOWL Project No: 1138.63234.01

*The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by DOT&PF pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated April 13, 2023, and executed by the Federal Highway Administration and the State of Alaska Department of Transportation and Public Facilities.*

# TABLE OF CONTENTS

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>EXECUTIVE SUMMARY .....</b>                                | <b>II</b> |
| <b>1.0 INTRODUCTION .....</b>                                 | <b>1</b>  |
| 1.1 Environmental Setting .....                               | 1         |
| 1.1.1 <i>Regional Characteristics</i> .....                   | 1         |
| 1.1.2 <i>Study Area Characteristics</i> .....                 | 2         |
| 1.2 Precipitation and Climatic Data .....                     | 3         |
| <b>2.0 METHODS .....</b>                                      | <b>4</b>  |
| 2.1 Existing Data and Preparatory Analysis .....              | 4         |
| 2.2 Field Data Collection .....                               | 5         |
| 2.2.1 <i>Wetland Delineation Methods</i> .....                | 5         |
| 2.2.2 <i>Functional Assessment Method</i> .....               | 6         |
| <b>3.0 RESULTS .....</b>                                      | <b>6</b>  |
| 3.1 Data Summary .....                                        | 6         |
| 3.2 Hydrophytic Vegetation, Hydric Soils, and Hydrology ..... | 9         |
| 3.2.1 <i>Vegetation</i> .....                                 | 9         |
| 3.2.2 <i>Soils</i> .....                                      | 10        |
| 3.2.3 <i>Hydrology</i> .....                                  | 10        |
| 3.3 Wetlands .....                                            | 11        |
| 3.3.1 <i>Palustrine Emergent Wetland</i> .....                | 11        |
| 3.3.2 <i>Palustrine Scrub-Shrub Wetland</i> .....             | 12        |
| 3.3.3 <i>Palustrine Forested Wetland</i> .....                | 12        |
| 3.4 Waterbodies .....                                         | 14        |
| 3.4.1 <i>Estuarine</i> .....                                  | 14        |
| 3.4.2 <i>Lacustrine</i> .....                                 | 15        |
| 3.4.3 <i>Riverine</i> .....                                   | 15        |
| 3.4.4 <i>Marine</i> .....                                     | 16        |
| 3.5 Uplands .....                                             | 17        |
| <b>4.0 FUNCTIONAL ASSESSMENT .....</b>                        | <b>17</b> |
| 4.1 WESPAK-SE .....                                           | 20        |
| 4.1.1 <i>Mendenhall Peninsula</i> .....                       | 20        |
| 4.1.2 <i>Sunny Point West</i> .....                           | 20        |
| 4.1.3 <i>Sunny Point East</i> .....                           | 21        |
| 4.1.4 <i>Sunny Point East and West</i> .....                  | 21        |
| 4.1.5 <i>Vanderbilt</i> .....                                 | 21        |
| 4.1.6 <i>Twin Lakes</i> .....                                 | 21        |
| 4.1.7 <i>Salmon Creek</i> .....                               | 22        |
| <b>5.0 DISCUSSION .....</b>                                   | <b>22</b> |
| <b>6.0 REFERENCES .....</b>                                   | <b>22</b> |

# TABLES

|                                                                                                                       |    |
|-----------------------------------------------------------------------------------------------------------------------|----|
| Table 1: Project Location within the Copper River Meridian .....                                                      | 1  |
| Table 2: National Wetlands Inventory Mapped Wetlands and Waterbodies .....                                            | 5  |
| Table 3 Project Location, Wetlands, Waterbodies, and Uplands .....                                                    | 6  |
| Table 4: Summary of Wetland Determination Form Data .....                                                             | 8  |
| Table 5 Dominant Plant Species within the Study Area.....                                                             | 9  |
| Table 6: Soil Observations at Full Sample Point within the Study Area.....                                            | 10 |
| Table 7: WESPAK-SE Function and Value Groups Tidal or Non-Tidal, Rated as High,<br>Overall AA Score, and Rating ..... | 19 |

# PHOTOSETS

|                                                                                                                             |    |
|-----------------------------------------------------------------------------------------------------------------------------|----|
| Photo Set 1: Typical Palustrine Emergent Wetlands in the Study Area (SP-41, PP-47) .....                                    | 11 |
| Photo Set 2: Typical Scrub-shrub Wetlands in the Study Area (SP-8, SP-11) .....                                             | 12 |
| Photo Set 3: Typical Forested Wetlands in the Study Area (SP-1).....                                                        | 13 |
| Photo Set 4: Typical Estuarine Intertidal Irregularly Flooded Wetlands in the Study Area<br>(SP-12, PP-52).....             | 13 |
| Photo Set 5: Typical Estuarine Intertidal Irregularly Flooded or Exposed Wetlands in the<br>Study Area (PP-16, PP-37) ..... | 14 |
| Photo Set 6: Typical Estuarine Subtidal Wetlands in the Study Area (PP-37, PP-52).....                                      | 15 |
| Photo Set 7: Typical Lacustrine Habitat in the Study Area (PP-41) .....                                                     | 15 |
| Photo Set 8: Typical Riverine Habitat in the Study Area (R1: PP-39, R2: PP-34) .....                                        | 16 |
| Photo Set 9: Typical Marine Habitat in the Study Area (PP-52 and a photo taken near<br>North Douglas Boat Launch) .....     | 16 |
| Photo Set 10: Typical Upland Habitats in the Study Area, (SP-5, SP-6) .....                                                 | 17 |

# APPENDICES

|                                              |
|----------------------------------------------|
| Appendix 1: Figures                          |
| Appendix 2: Datasheets and Plant Species     |
| Appendix 3: Photo Log                        |
| Appendix 4: Wetland Functional Assessment    |
| Appendix 5: Antecedent Precipitation Figures |

# ACRONYMS AND ABBREVIATIONS

|                       |                                                          |
|-----------------------|----------------------------------------------------------|
| AA .....              | Assessment Area                                          |
| ADF&G.....            | Alaska Department of Fish and Game                       |
| APT .....             | Antecedent Precipitation Tool                            |
| DOT&PF .....          | Department of Transportation & Public Facilities         |
| EM.....               | Emergent                                                 |
| FAC .....             | Facultative                                              |
| FACU .....            | Facultative Upland                                       |
| FACW .....            | Facultative Wetland                                      |
| FO .....              | Forested                                                 |
| GIS.....              | Geographic information system                            |
| HTL .....             | high tide line                                           |
| HUC .....             | Hydrologic unit codes                                    |
| in .....              | inches                                                   |
| MHW .....             | Mean High Water                                          |
| mm .....              | millimeters                                              |
| MWGSR or Refuge ..... | Mendenhall Wetlands Game State Refuge                    |
| NWI .....             | National Wetlands Inventory                              |
| NRCS .....            | National Resource Conservation Service                   |
| OBL.....              | Obligate                                                 |
| PEL .....             | Planning and Environmental Linkage                       |
| PP .....              | Photo Point                                              |
| SB .....              | Streambed                                                |
| SP .....              | Sample Point                                             |
| SS .....              | Scrub-shrub                                              |
| UB .....              | Unconsolidated bottom                                    |
| USACE.....            | United States Army Corps of Engineers                    |
| USGS .....            | U.S. Geological Survey                                   |
| US .....              | Unconsolidated shore                                     |
| WESPAK-SE.....        | Wetland Ecosystem Services Protocol for Southeast Alaska |

## EXECUTIVE SUMMARY

---

The City and Borough of Juneau has partnered with Alaska Department of Transportation and Public Facilities to explore a north crossing between Juneau and Douglas Island, north of the existing Douglas Island Bridge. DOT&PF has chosen the Planning and Environmental Linkage process to evaluate the purpose and need for a north crossing, identify potential north crossing alternatives, evaluate the alternatives, and identify recommended crossing(s).

The approximate 695.5-acre study area, which includes a 150-foot buffer for the six potential crossing alignments: Mendenhall Peninsula, Sunny Point West, Sunny Point East, Vanderbilt, Twin Lakes, and Salmon Creek. The beginning of the project is located 58.341963 North Latitude; -134.628022 West Longitude and the end of the project is located at 58.299292 North Latitude; -134.429609 West Longitude, Copper River Meridian.

The study area crosses tidally influenced Gastineau Channel separating Douglas Island from mainland Juneau. The Mendenhall Wetlands State Game Refuge is located between Juneau and Douglas Island from the Mendenhall Peninsula to approximately the intersection of Glacier Highway and Channel Drive.

Collection of data followed Part IV of the Corps of Engineers Wetlands Delineation Manual, the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region [Version 2.0], and the Wetland Ecosystem Services Protocol for Southeast Alaska.

The study area comprises of approximately 29.3 acres (4.2 percent of the study area) of potentially jurisdictional wetlands and 346.4 acres of waterbodies (49.8 percent of the study area), and 319.8 acres of non-jurisdictional uplands (46 percent of the study area). The following table summarizes the wetland delineation and functional assessment (there is overlap between alignments, so acreages will total greater than 695.5 acres).



| Alignment            | Habitat Type | Acres  | Assessment Area  | Functional Score |
|----------------------|--------------|--------|------------------|------------------|
| Mendenhall Peninsula | Wetland      | 12.54  | AA-1, AA-2, AA-3 | 6.26, 7.56, 4.18 |
|                      | Waterbodies  | 67.91  | AA-4             | 2.51             |
|                      | Uplands      | 142.35 | N/A <sup>1</sup> | N/A              |
| Sunny Point West     | Wetland      | 12.56  | AA-5             | 6.26             |
|                      | Waterbodies  | 60.11  | AA-7             | 6.64             |
|                      | Uplands      | 74.48  | N/A              | N/A              |
| Sunny Point East     | Wetland      | 5.96   | AA-6             | 6.23             |
|                      | Waterbodies  | 48.75  | AA-7             | 6.64             |
|                      | Uplands      | 74.48  | N/A              | N/A              |
| Vanderbilt           | Wetland      | 2.00   | AA-9             | 5.54             |
|                      | Waterbodies  | 93.58  | AA-10            | 5.28             |
|                      | Uplands      | 33.12  | N/A              | N/A              |
| Twin Lakes           | Wetland      | 0.72   | AA-11            | 8.08             |
|                      | Waterbodies  | 80.83  | AA-12            | 6.97             |
|                      | Uplands      | 27.77  | N/A              | N/A              |
| Salmon Creek         | Wetland      | 1.00   | AA-13            | 6.22             |
|                      | Waterbodies  | 27.34  | AA-14            | 6.73             |
|                      | Uplands      | 45.60  | N/A              | N/A              |

The acreages of wetlands and waterbodies within the proposed alignments from greatest to least are Vanderbilt, Twin Lakes, Mendenhall Peninsula, Sunny Point West, Sunny Point East, Salmon Creek. The highest functioning wetlands and waterbodies within the proposed alignments from highest to lowest are Vanderbilt, Sunny Point West, Twin Lakes, Sunny Point East, Salmon Creek, Mendenhall Peninsula.

---

<sup>1</sup> N/A=Not Applicable

# 1.0 INTRODUCTION

---

The City and Borough of Juneau has partnered with Alaska Department of Transportation and Public Facilities (DOT&PF) to explore a north crossing between Juneau and Douglas Island, north of the existing Douglas Island Bridge. DOT&PF has chosen the Planning and Environmental Linkage (PEL) process to evaluate the purpose and need for a north crossing, identify potential north crossing alternatives, evaluate the alternatives, and identify recommended crossing(s). In support of the evaluation of alternatives environmental data is being collected to understand potential impacts of six proposed alternatives. One study being undertaken to collect current data on proposed alternatives is a wetland delineation.

The approximate 695.5-acre study area includes the tidally influenced Gastineau Channel between Douglas Island and mainland Juneau, Alaska. The Mendenhall Wetlands State Game Refuge (MWSGR or Refuge) is located between Juneau and Douglas Island from the Mendenhall Peninsula to approximately the intersection of Glacier Highway and Channel Drive. The beginning of the project is located 58.341963 North Latitude; -134.628022 West Longitude and the end of the project is located at 58.299292 North Latitude; -134.429609 West Longitude, Copper River Meridian. (Table 1 for Township, Range, Section (Appendix 1; Figure 1).

*Table 1: Project Location within the Copper River Meridian*

| Township | Range   | Sections                                          |
|----------|---------|---------------------------------------------------|
| 40 South | 65 East | 25, 26, 27, 34, 36                                |
| 40 South | 66 East | 30, 31, 32, 33, 34                                |
| 41 South | 66 East | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17 |
| 41 South | 67 East | 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 21, 22, 23, 27  |

DOWL was contracted to conduct a wetland delineation and function and values assessment to identify areas that may fall under the United States Army Corps of Engineers (USACE) jurisdiction per Section 404 of the Clean Water Act.

While this report is in support of a planning study, a future recommended alternative may impact jurisdictional Waters of the United States. The data herein is intended to provide a planning level analysis with sufficient information to determine regulatory jurisdiction of aquatic resources subject to Section 404 of the Clean Water Act, and to evaluate the hydrological connectivity of such resources to a traditional navigable waterway, territorial sea, or navigable interstate waterway.

## 1.1 Environmental Setting

### 1.1.1 Regional Characteristics

The study area spans between Juneau and Douglas Island, Alaska, which are within two different yet similar United States Department of Agriculture, Natural Resources Conservation



Service (NRCS) defined *Major Land Resource Areas*. Juneau is located within the Alaska's Pacific Coastal Mountains ecoregion, while Douglas Island is located within Alaska's Coastal Western Hemlock-Sitka Spruce Forest ecoregion (NRCS 2022).

The Alaska Pacific Coastal Mountains ecoregion has steep terrain with active glaciers in higher elevations and experiences heavy precipitation. Dwarf and low scrub species dominate the region as slopes are typically barren of vegetation while lower elevations near drainage systems consist of needleleaf forests and dense thickets of low scrub communities (Gallant 1995). The annual growing season spans from May 29th to September 27th (USACE 2007).

The Alaska Coastal Western Hemlock-Sitka Spruce Forest ecoregion has the mildest winter temperatures in Alaska and receives a large amount of precipitation. Much of the terrain (deep and narrow bays, steep valley walls, irregular coastlines, high sea-cliffs, etc.) resulted from intense glaciation. Surface water is present for extended periods, especially early in the growing season, but is absent toward the end of the growing season in most years. When surface water is absent, the water table is often near the land surface. The abundant precipitation, mild temperatures, and undulating terrain with steep slopes generally restrict the establishment of permafrost. Vegetation is a mixture of needle-leaved evergreen forests, tall-to-mid-level scrub-shrub swamps or peatlands, and saturated emergent bogs (Gallant 1995). The annual growing season extends from April 29th to September 28th (USACE 2007).

### **1.1.2 Study Area Characteristics**

The study area is approximately 695.5 acres, which includes a 150-foot buffer for the six potential crossing alignments: Mendenhall Peninsula, Sunny Point West, Sunny Point East, Vanderbilt, Twin Lakes, and Salmon Creek. The study area crosses the MWGSR, spans Gastineau Channel separating Douglas Island from mainland Juneau. The majority of the six alignments are within the Salmon Creek-Frontal Gastineau Channel 12-digit Hydrologic Unit watershed (U.S. Geological Survey [USGS] 2023). The southern portion of Mendenhall Peninsula is within Fritz Cove-Frontal Lynn Canal 12-digit Hydrologic Unit watershed (USGS 2023). The western end of Egan Drive crossing Lemon Creek is within Lemon Creek 12-digit Hydrologic Unit watershed (USGS 2023).

The study area has several mapped anadromous stream crossings, depositing freshwater to the Gastineau Channel (Alaska Department of Fish & Game [ADF&G] 2023a). The elevations within the study area range from sea level to 375 feet (ft) above sea level. The MWSGR is a large game refuge managed by ADF&G, approximately 4,000 acres and extends approximately nine miles along the shores of the Gastineau Channel, from Salmon Creek to the eastern side of the Mendenhall Peninsula. The airport was constructed in the 1930s and islands within the Refuge were formed when the channel was dredged in the 1950s (ADF&G 2023b). The study area was once entirely glaciated which still has a strong influence as silt is deposited from several streams into the Gastineau Channel from the Mendenhall Glacier, Thomas Glacier, and Lemon Glacier. Isostatic rebound is causing the land to rise therefore some wetlands to dry as groundwater moves near the surface

Federal and state definitions of navigable waters differ. Federal jurisdiction applies to waters subject to the ebb and flow of the tide, and/or are used or have been used for interstate or

foreign commerce. State jurisdiction applies to tidally influenced areas and rivers/streams used for commerce or travel. The USACE has jurisdiction for structures constructed in or over navigable waterbodies. Navigable waterbodies are areas below the mean high water (MHW) influenced by the ebb and flow of the tide.

Wetlands within the study area include the submerged and intertidal regions dictated by the ebb and flow of the tides. The high tide line (HTL) for Juneau is 20.6 feet and the MHW is 15.6 feet (DOWL 2022b).

## 1.2 Precipitation and Climatic Data

The USACE Antecedent Precipitation Tool (APT) was used to evaluate climatic conditions prior to fieldwork. The APT uses global historical climatology network weather stations. The APT accumulates the daily precipitation values over a 30-day period and compares to historic normal range of precipitation to determine if surface hydrology or soil moisture conditions observed are normal, drier than normal, or wetter than normal (USACE 2023). The Coastal Western Hemlock-Sitka Spruce Forest and Pacific Coastal Mountains ecoregions have the mildest winters in the State and receives the most precipitation. The Coastal Western Hemlock-Sitka Spruce Forest approximate mean precipitation is from 1,350 millimeters (mm) (53 inches) to 3,900 mm (153.5 inches) while the Coastal Pacific Mountain receives approximately 2,030 mm (80 inches) to 7,000 mm (575.5 inches) (Gallant et al 1995).

The APT (2023) reported general conditions based on data from the following weather stations:

- Auke Bay
- Juneau 3.0 NW
- Juneau 2.8 NW
- Juneau Forecast Office
- Juneau Airport

Based on the APT, Juneau reported normal conditions for fieldwork conducted on September 18th followed with drier than normal conditions from September 19th through 20th (Appendix 5, Figure 1 and Figure 2). Wetter than normal conditions were reported from September 21st through 22nd (Appendix 5, Figure 3). Douglas Island reported normal conditions from September 18th through 19th (Appendix 5, Figure 4). Wetter than normal conditions were reported from September 20th through 22nd (Appendix 5, Figure 5). During the four field days, Juneau Airport reported approximately 4.33 inches of precipitation. The Juneau area received approximately 13.64 inches of precipitation during the month of September, which exceeds 10.42 inches (threshold for 30 percent chance precipitation is more than for September) (Utah Climate Center 2023).

Observed surface water reflected normal conditions. The week preceding fieldwork Juneau Airport reported 6.03 inches of precipitation and additional precipitation occurred during fieldwork; precipitation exceeded September's monthly average. Areas of the project located where normal conditions were reported, surface and groundwater field observations were typical

for this time of year. In areas of the project where wetter than normal conditions were reported, surface and groundwater field observations may be present in uplands as well as marginal wetlands with saturated soils, areas of inundations (surface water), or high groundwater table.

## 2.0 METHODS

---

### 2.1 Existing Data and Preparatory Analysis

The following sources were reviewed for the study area:

- USGS Juneau B-2 SW and SE Quadrangle
- USGS National Hydrography Dataset (2023)
- Aerial imagery (2023)
- Federal Emergency Management Agency Flood Insurance Rate Maps
- ADF&G Alaska Fish Resource Monitor (2023a)
- NRCS Web Soil Survey (NRCS 2021)
  - o The NRCS has mapped approximately 309 acres of saline water and 22.2 acres of water within the study area while the remaining 363.9 acres have no digital data available (NRCS 2023).
- City and Borough of Juneau Wetlands Management Plan (2016)
- Geographic Information System (GIS) Mapping for Mendenhall Wetland State Game Refuge (Carstensen 2004)
- Juneau Douglas North Crossing PEL Study Wetlands and Waterways Data Summary (DOWL 2022).
- U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) (USFWS 2023). The NWI has mapped a total of 355.92 acres (51.18 percent) of wetlands within the study area (Appendix 1, Figure Set 2.1 to 2.7).
- Manual for Wetland Ecosystem Services Protocol for Southeast Alaska (Adamus 2015)
- Southeast Alaska GIS Library

Table 2: National Wetlands Inventory Mapped Wetlands and Waterbodies

| Jurisdictional Type | Habitat Classification | Acres |
|---------------------|------------------------|-------|
| Wetlands            | Palustrine Emergent    | 31.5  |
|                     | Palustrine Scrub-shrub | 2.4   |
|                     | Palustrine Forested    | 19.7  |
|                     | Estuarine Intertidal   | 250.8 |
| Waterbodies         | Estuarine Subtidal     | 54.4  |
|                     | Lacustrine Limnetic    | 0.7   |
|                     | Riverine               | 2.4   |
| Uplands             | Non-Labeled Areas      | N/A   |
| Total               | 355.92 acres           |       |

## 2.2 Field Data Collection

### 2.2.1 Wetland Delineation Methods

DOWL Environmental Specialists Adam Morrill, PWS and Emily Anderson conducted the wetland delineation fieldwork on September 19th to September 22nd, 2023 in accordance with *Part IV of the Corps of Engineers Wetlands Delineation Manual* (USACE 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region [Version 2.0, (USACE 2007)]*.

Wetlands were classified and grouped according to guidelines outlined in the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Sampling locations were selected to verify the preliminary mapping of proposed paired point locations. Data was collected using the three-parameter approach combining site-specific indicators of hydrophytic vegetation, hydric soils, and wetland hydrology. Field notes were taken to document landscape topography, stream crossings, and general site characteristics. Additionally, photo points were taken to document site conditions, confirm dominant plant species, extrapolate data to similar habitat areas, or to make a wetland/upland determination when soil excavation was not necessary.

At each sampling location, soil pits were excavated to a depth of at least 24 inches, or to the presence of a restrictive digging layer. Soil and hydrology characteristics of texture, color, saturation, and depth to water table were recorded on USACE Routine Wetland Determination forms (Appendix 2). Soil color was recorded using *Munsell Soil-Color Charts* (Munsell Color 2012). In the event soil excavation was not necessary to make a wetland/upland determination, a photographic point was taken. Data collected at test holes are prefixed with 'SP.' Photo point locations are prefixed with 'PP.' Wetland SPs were used to identify the HTL in the field, and aerial interpretation along with few PP to document tidally influenced wetlands.

A Global Positioning System unit with 30-foot accuracy was used to pinpoint sample locations and photo point locations for GIS mapping reference using ESRI FieldMaps while ArcGIS Pro

was used to calculate acreages. Final mapping was based on a combination of professional interpretation of aerial and site photos, topographic data, and field observations.

## 2.2.2 Functional Assessment Method

The Wetland Ecosystem Services Protocol for Southeast Alaska (WESPAK-SE) functional assessment provides a tool to evaluate wetland habitats. Wetland habitats are evaluated by assessment areas (AA), which combine wetlands habitats based on hydrogeomorphic class (i.e., depression, riverine, flat, and slope). Each AA is evaluated based on data collected from field data (i.e., sampling points and photo points), GIS data (i.e., Anadromous Waters Catalog, National Hydrologic Database), and wetland mapping to fill out WESPAK-SE forms (Appendix 4). The WESPAK-SE forms categorize AAs into wetland categories (i.e., high functioning, low functioning) based on functional scores.

## 3.0 RESULTS

### 3.1 Data Summary

The 695.5-acre study area is comprised of approximately 29.3 acres (4.2 percent of the study area) of potentially jurisdictional wetlands and 346.4 acres of waterbodies (49.8 percent of the study area), and 319.8 acres of non-jurisdictional uplands (46 percent of the study area). Table 2 summarizes the results by Cowardin classification and all data sheets are included in Appendix 2 while the photo log is included in Appendix 3.

The following tables and sections describe vegetation, soils, and hydrology observations.

*Table 3 Project Location, Wetlands, Waterbodies, and Uplands*

| Proposed Alignment   | Habitat Type | Cowardin Classification | Acres  | Data Points                                             |
|----------------------|--------------|-------------------------|--------|---------------------------------------------------------|
| Mendenhall Peninsula | Wetland      | Palustrine Emergent     | 0.38   | PP-22-24                                                |
|                      |              | Palustrine Scrub-Shrub  | 1.02   | SP-7, 8                                                 |
|                      |              | Palustrine Forested     | 11.14  | SP-1                                                    |
|                      |              | Estuarine Intertidal    | 16.18  | PP-17, 18, 52                                           |
|                      | Waterbodies  | Estuarine Subtidal      | 16.17  | PP-16                                                   |
|                      |              | Marine                  | 35.28  | N/A                                                     |
|                      |              | Riverine                | 0.28   | PP-14, 19, 57, 59, 60, 64                               |
|                      | Uplands      | N/A                     | 142.35 | SP-2-6, 9-11, PP-1-13, 15, 20, 21, 53, 54-56, 58, 61-63 |
| Sunny Point East     | Wetland      | Palustrine Emergent     | 0.71   | N/A                                                     |

| Proposed Alignment | Habitat Type | Cowardin Classification | Acres | Data Points                     |
|--------------------|--------------|-------------------------|-------|---------------------------------|
|                    |              | Palustrine Scrub-Shrub  | 4.71  | SP-15                           |
|                    |              | Palustrine Forested     | 0.54  | N/A                             |
|                    |              | Estuarine Intertidal    | 47.99 | SP-12, PP-27, 44, 45            |
|                    | Waterbodies  | Riverine                | 0.76  | PP-33-35                        |
|                    | Uplands      | N/A                     | 74.48 | SP-13, 14, PP-28-32, 36         |
| Sunny Point West   | Wetland      | Palustrine Emergent     | 6.35  | PP-42                           |
|                    |              | Palustrine Scrub-Shrub  | 5.67  | SP-15                           |
|                    |              | Palustrine Forested     | 0.54  | N/A                             |
|                    |              | Estuarine Intertidal    | 59.35 | SP-12, PP-27, 44-46             |
|                    | Waterbodies  | Riverine                | 0.76  | PP-33-35                        |
|                    | Upland       | N/A                     | 74.48 | SP-13, 14, PP-28-32, 36, 43, 47 |
| Vanderbilt         | Wetland      | Palustrine Emergent     | 1.36  | N/A                             |
|                    |              | Palustrine Scrub-Shrub  | 0.64  | N/A                             |
|                    |              | Estuarine Intertidal    | 73.86 | PP-25, 26                       |
|                    | Waterbodies  | Estuarine Subtidal      | 1.79  | N/A                             |
|                    |              | Lacustrine Limnetic     | 13.15 | PP-41                           |
|                    |              | Lacustrine Littoral     | 0.36  | N/A                             |
|                    |              | Riverine                | 4.42  | PP-39                           |
|                    | Upland       | N/A                     | 33.12 | PP-40                           |
| Twin Lakes         | Wetland      | Palustrine Emergent     | 0.45  | N/A                             |
|                    |              | Palustrine Scrub-Shrub  | 0.27  | PP-48                           |
|                    |              | Estuarine Intertidal    | 49.48 | N/A                             |
|                    | Waterbodies  | Estuarine Subtidal      | 14.46 | N/A                             |
|                    |              | Lacustrine Limnetic     | 16.36 | PP-41                           |
|                    |              | Lacustrine Littoral     | 0.31  | PP-48                           |
|                    |              | Riverine                | 0.22  | N/A                             |
|                    | Uplands      | N/A                     | 27.77 | N/A                             |
| Salmon Creek       | Wetlands     | Palustrine Emergent     | 0.43  | N/A                             |
|                    |              | Palustrine Scrub-Shrub  | 0.36  | N/A                             |
|                    |              | Palustrine Forested     | 0.17  | N/A                             |

| Proposed Alignment                               | Habitat Type | Cowardin Classification          | Acres | Data Points       |
|--------------------------------------------------|--------------|----------------------------------|-------|-------------------|
|                                                  |              | Palustrine Unconsolidated Bottom | 0.04  | N/A               |
|                                                  |              | Estuarine Intertidal             | 11.19 | PP-37, 38, 49, 50 |
|                                                  | Waterbodies  | Estuarine Subtidal               | 14.89 | N/A               |
|                                                  |              | Riverine                         | 1.26  | N/A               |
|                                                  | Uplands      | N/A                              | 45.60 | PP-51             |
| <b>Total Study Area: 695.5 acres<sup>2</sup></b> |              |                                  |       |                   |

Notes:

N/A – Not Applicable

Table 4: Summary of Wetland Determination Form Data

| ID    | Hydrophytic Vegetation Present | Hydric Soils Present | Wetland Hydrology Present | Cowardin Type |
|-------|--------------------------------|----------------------|---------------------------|---------------|
| SP-1  | Yes                            | Yes                  | Yes                       | PFO4/SS1B     |
| SP-2  | No                             | No                   | Yes                       | Upland        |
| SP-3  | Yes                            | No                   | Yes                       | Upland        |
| SP-4  | Yes                            | No                   | No                        | Upland        |
| SP-5  | No                             | No                   | Yes                       | Upland        |
| SP-6  | No                             | No                   | No                        | Upland        |
| SP-7  | Yes                            | Yes                  | Yes                       | PSS1/EM1C     |
| SP-8  | Yes                            | Yes                  | Yes                       | PSS4/EM1B     |
| SP-9  | No                             | Yes                  | No                        | Upland        |
| SP-10 | No                             | Yes                  | Yes                       | Upland        |
| SP-11 | No                             | Yes                  | No                        | Upland        |
| SP-12 | Yes                            | Yes                  | Yes                       | E2EM1N        |
| SP-13 | No                             | No                   | No                        | Upland        |
| SP-14 | No                             | Yes                  | Yes                       | Upland        |
| SP-15 | Yes                            | Yes                  | Yes                       | PSS4/EM1B     |

Notes: Antecedent precipitation wetter than normal, so upland areas may observe positive wetland hydrology indicators.

E2EM1N: Estuarine intertidal emergent persistent regularly flooded

PFO4/SS1B: Palustrine forested needle-leaved evergreen/scrub-shrub broad-leaved deciduous saturated

PSS1/EM1C: Palustrine scrub-shrub broad-leaved/emergent persistent seasonally flooded

PSS4/EM1B: Palustrine scrub-shrub needle-leaved/emergent persistent saturated

<sup>2</sup> Sum of habitat acreages exceed the total area acreage due to overlap of footprint alignments with 150-foot buffer.



## 3.2 Hydrophytic Vegetation, Hydric Soils, and Hydrology

### 3.2.1 Vegetation

Hydrophytic vegetation was present in seven of fifteen test hole locations. All identified species and indicator status are shown by dominance test and/or prevalence on each data sheet in Appendix 2. The following dominant species were present (USACE 2020).

Table 5 Dominant Plant Species within the Study Area

| Scientific Name                | Indicator Status | Common Name               |
|--------------------------------|------------------|---------------------------|
| <i>Alnus viridis</i>           | FAC              | Sitka Alder               |
| <i>Andromeda polifolia</i>     | FACW             | bog-rosemary              |
| <i>Athyrium cyclosorum</i>     | FAC              | western lady fern         |
| <i>Carex livida</i>            | OBL              | livid sedge               |
| <i>Carex lyngbyei</i>          | OBL              | Lyngbye's Sedge           |
| <i>Carex pauciflora</i>        | OBL              | few-flower sedge          |
| <i>Cornus canadensis</i>       | FAC              | Canadian Bunchberry       |
| <i>Deschampsia caespitosa</i>  | FAC              | tufted hair grass         |
| <i>Dryopteris expansa</i>      | FACU             | spreading wood fern       |
| <i>Equisetum pratense</i>      | FACW             | meadow horsetail          |
| <i>Gymnocarpium dryopteris</i> | FACU             | northern oak fern         |
| <i>Lysichiton americanus</i>   | OBL              | yellow-skunk-cabbage      |
| <i>Menziesia ferruginea</i>    | FACU             | fool's-huckleberry        |
| <i>Picea sitchensis</i>        | FACU             | Sitka Spruce              |
| <i>Pinus contorta</i>          | FAC              | lodgepole pine            |
| <i>Potentilla anserina</i>     | FACW             | Silverweed                |
| <i>Rhododendron tomentosum</i> | FACW             | marsh Labrador-tea        |
| <i>Rubus idaeus</i>            | FACU             | common red raspberry      |
| <i>Rubus pedatus</i>           | FAC              | strawberry-leaf raspberry |
| <i>Sambucus racemosa</i>       | FACU             | red elder                 |
| <i>Tsuga heterophylla</i>      | FAC              | western hemlock           |
| <i>Tsuga mertensiana</i>       | FAC              | mountain hemlock          |
| <i>Vaccinium ovalifolium</i>   | FAC              | oval-leaf blueberry       |

Notes: FAC = Facultative; FACU = Facultative Upland; FACW = Facultative Wetland; OBL = Obligate

### 3.2.2 Soils

Soils observed within the study area had anywhere from one to twenty-four inches of organic layer. During the four field days, Juneau Airport reported approximately 4.33 inches of precipitation. Table 6 describes observations made in the field.

*Table 6: Soil Observations at Full Sample Point within the Study Area*

| ID    | Organic Mat Thickness (inches) | Mineral Soil below Organic Layer | Saturated Organics | Hydric |
|-------|--------------------------------|----------------------------------|--------------------|--------|
| SP-1  | 18                             | Loamy Clay                       | Yes                | Yes    |
| SP-2  | 2                              | Sandy Loam                       | No                 | No     |
| SP-3  | 7                              | Sandy                            | No                 | No     |
| SP-4  | 3                              | Loamy Clay                       | No                 | No     |
| SP-5  | 1                              | Loamy Clay                       | No                 | No     |
| SP-6  | 10                             | Loamy Clay                       | Yes                | No     |
| SP-7  | 24                             | None (Peat)                      | Yes                | Yes    |
| SP-8  | 25                             | None (Peat)                      | Yes                | Yes    |
| SP-9  | 24                             | None (Peat)                      | Yes                | Yes    |
| SP-10 | 10                             | Loamy Clay                       | No                 | Yes    |
| SP-11 | 24                             | None (Peat)                      | Yes                | Yes    |
| SP-12 | 5                              | Sandy Loam                       | No                 | Yes    |
| SP-13 | 9                              | Sandy Loam                       | No                 | No     |
| SP-14 | 24                             | None (Peat)                      | Yes                | Yes    |
| SP-15 | 24                             | None (Peat)                      | Yes                | Yes    |

Hydric soils were observed at nine out of the fifteen sample points. Over half of the sample points had Histosol or a Histic Epipedon. Histosol were the dominant hydric soil type and were observed at seven out of the fifteen sample points. The other hydric soils had either a histic epipedon or Alaska Redox.

### 3.2.3 Hydrology

Wetland hydrology was present at ten of the fifteen sample points. Due to the antecedent precipitation being wetter than normal it is anticipated positive wetland hydrologic indicators may be present in non-wetland areas. Of the ten test holes with positive wetland hydrologic indicators present, eight exhibited both primary hydrologic indicators of high-water table and saturation.

Wetter than normal climatic conditions occurred during the field investigation, with approximately 4.33 inches of precipitation. High water table was observed at five of the sample points, with groundwater depths between two to nine inches below the ground surface. Soil saturation was observed at nine of the fifteen sample points, with saturation depths between

zero and twelve inches below the surface (Appendix 2). Four of the nine sample points with had saturated soils non-hydrophytic vegetation and/or non-hydric soils, positive hydrology observation at these locations is likely due to wetter than normal antecedent precipitation conditions.

Hydrology within estuarine habitats is influenced by tidal fluctuations, with areas either regularly or irregularly flooded or exposed. MHW and HTL data (USACE 2017) were used to determine water regime modifiers. Tidal areas above the MHW were considered *irregularly flooded* and below either *regularly flooded* or *irregularly exposed*.

### 3.3 Wetlands

Wetlands consist of areas meeting hydrophytic vegetation, hydric soils, and positive (i.e., primary and/or secondary indicators) wetland hydrology.

The study area spans Gastineau Channel, connecting Juneau area with Douglas Island. The HTL was used to demarcate the extent of estuarine and palustrine habitats. The study area above HTL (20.6 feet in elevation) typically rises quickly from the tidal flats into steep (i.e., 10 to 30 percent) slopes into upland areas (as high as 375 feet in elevation). Areas with zero to five percent slopes and near the toe of steep slopes contain wetlands or have developed bed and bank (i.e., stream) to convey surface water to Gastineau Channel.

#### 3.3.1 Palustrine Emergent Wetland

Palustrine emergent persistent are depressional wetlands associated with nearly flat low areas located above the HTL within the study area. Palustrine emergent wetlands within the study area have a robust herbaceous layer typically over 30 percent aerial cover dominated by grasses and sedges.



*Photo Set 1: Typical Palustrine Emergent Wetlands in the Study Area (SP-41, PP-47)*

### 3.3.2 Palustrine Scrub-Shrub Wetland



*Photo Set 2: Typical Scrub-shrub Wetlands in the Study Area (SP-8, SP-11)*

Palustrine scrub-shrub habitats typically consist of wetlands with less than 30 percent tree cover with a robust shrub and herbaceous stratum typically over 30 percent. Scrub-shrub habitats within the study area are typically dominated by stunted Sitka Spruce (*Picea sitchensis*), Western Hemlock (*Tsuga heterophylla*), Fool's-Huckleberry (*Menziesia ferruginea*), and Oval-leaf Blueberry (*Vaccinium ovalifolium*) or by stunted Lodgepole Pine (*Pinus contorta*). Soils in this habitat consisted of Histosols and had persistent soil saturation.

### 3.3.3 Palustrine Forested Wetland

Palustrine forested needle-leaved evergreen with broad-leaved scrub-shrub understory habitats are located in flat areas at the toe of slope typically within the forested Mendenhall Peninsula and outside of the tidally influenced areas of the Gastineau Channel. Hydrology of these wetlands consist of seasonally saturated soils. Vegetation is dominated by Sitka Spruce (*Picea sitchensis*) and Western Hemlock (*Tsuga heterophylla*).





*Photo Set 3: Typical Forested Wetlands in the Study Area (SP-1)*

### **3.3.4 Estuarine Intertidal**

Estuarine intertidal habitats are tidal wetlands located above mean high water and is the dominant subsystem in the study area as the substrate is irregularly flooded by the tide. Much of this habitat above MHW is dominated by herbaceous vegetation and has visible flow patterns (e.g., grasses laying down in direction of surface flow).



*Photo Set 4: Typical Estuarine Intertidal Irregularly Flooded Wetlands in the Study Area (SP-12, PP-52)*

Estuarine intertidal habitats which are regularly flooded or irregularly exposed during tide cycle typically are unvegetated mudflats or rocky shorelines and are located below MHW.



*Photo Set 5: Typical Estuarine Intertidal Irregularly Flooded or Exposed Wetlands in the Study Area (PP-16, PP-37)*

### **3.4 Waterbodies**

Waterbodies were identified by ordinary high-water mark through “physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris...” (33 CFR 328.3). Waterbodies located in the Study Area consist of upper perennial and lower perennial streams, and tidally influenced areas below the HTL. Waterbodies consist of estuarine, lacustrine, riverine, and marine habitats.

#### **3.4.1 Estuarine Subtidal**

Estuarine subtidal habitats are typically deep-water habitats partially enclosed by land with freshwater inputs such as the Mendenhall River and other stream tributaries. Estuarine subtidal habitats are areas mapped below the MHW. Ocean water is occasionally diluted with fresh water such as from Mendenhall River and other freshwater streams terminating within the Gastineau Channel. The study area’s water regime which influences the estuarine is dominantly through the varying tidal levels with mean range of tide of 13.74 feet and highest astronomical tide of 20.65 feet (NOAA 2024).

Subtidal estuarine are permanently flooded areas at low tide.





*Photo Set 6: Typical Estuarine Subtidal Wetlands in the Study Area (PP-37, PP-52)*

### **3.4.2 Lacustrine**

Lacustrine habitats are associated with a lake or other body of freshwater greater than 20 acres in size which is permanently flooded. The only lacustrine habitat encountered within the study area are Twin Lakes.



*Photo Set 7: Typical Lacustrine Habitat in the Study Area (PP-41)*

### **3.4.3 Riverine**

Riverine habitats are associated with flowing water and mapped as waterways. Riverine habitats occur within tidally influenced environments and in localized channels which convey water off slopes. Streams which maintain bed and bank characteristics at low tide but are submerged at high tide are labeled R1. These streams were mapped starting at the HTL and

end at subtidal estuarine or marine habitats. Streams with low slope, perennial flow, and unconsolidated bottoms were labeled R2, extending from the HTL upstream. Intermittent streams consist of areas exhibiting bed and bank but lack perennial flow. These streams are labeled R4 and were identified by culverts, topography, and aerial interpretation.



*Photo Set 8: Typical Riverine Habitat in the Study Area (R1: PP-39, R2: PP-34)*

#### **3.4.4 Marine**

Marine habitats are exposed to the waves and currents of the open ocean. Marine habitats in the study area include subtidal deep-water habitats of Fritz Cove.



*Photo Set 9: Typical Marine Habitat in the Study Area (PP-52 and a photo taken near North Douglas Boat Launch)*



### 3.5 Uplands

Upland habitats within the study area are classified as areas lacking hydrophytic vegetation, hydric soils, and/or wetland hydrologic indicators. Upland habitats also consist of disturbed/built environment (e.g., roadways and built infrastructure). Vegetation in upland habitats is dominated by Western Hemlock (*Tsuga heterophylla*) and Sitka Spruce (*Picea sitchensis*) with an understory of Fool's Huckleberry (*Menziesia ferruginea*), Oval-leaf Blueberry (*Vaccinium ovalifolium*), and Western Lady Fern (*Athyrium cyclosorum*). Upland habitats within roadway embankments are dominated by Bluejoint (*Calamagrostis canadensis*), Cow Parsnip (*Heracleum maximum*), Narrow-Leaf Fireweed (*Chamaenerion angustifolium*), and Sitka Alder (*Alnus viridis*). Soils consist of an organic layer typically between two and ten inches and are underlain by sandy loam or loamy mineral soil. This habitat typically lacked primary wetland hydrologic indicators. However, due to the heavy amount of precipitation within the week preceding fieldwork some areas were observed with pockets of surface inundation or saturated soils. Areas with primary wetland hydrologic indicators typically lacked hydrophytic vegetation and hydric soils.



Photo Set 10: Typical Upland Habitats in the Study Area, (SP-5, SP-6)

## 4.0 FUNCTIONAL ASSESSMENT

---

The proposed project consists of fourteen (Appendix 1, Figure 4) AAs distinguished by location, topography, tidal influence, and infrastructure barriers. WESPAK-SE analyzes tidal and non-tidal habitats separately based on function and value attributes. Scores from WESPAK-SE are normalized by comparing tidal or non-tidal AAs scores with 55 tidal reference wetlands or 119 non-tidal reference wetlands, respectively. Analysis used either the tidal WESPAK-SE calculator for AAs within Gastineau Channel (Mendenhall Bar) or Fritz Cove, or non-tidal WESPAK-SE calculator for AAs located inland from the HTL (Appendix 4).

The following data sources were used to derive at the WESPAK-SE overall scores and to determine which tidally influenced AA's may have experienced potential stressor such as the

construction of Egan Drive in the mid-1970s (AA9, AA10, AA11) or construction of facilities creating the wetland (AA13).

- Field data, photographs, and notes
- USGS Juneau B-2 SW Historical Topographic Map (USGS 1947)
- Southeast Alaska GIS Library
- Various federal, state, and local databases (e.g., ADF&G Alaska Fish Resource Monitor)
- Manual for Wetland Ecosystem Services Protocol for Southeast Alaska (Adamus 2015)

Table 7 summarizes the ratings for the tidal and non-tidal AAs.

Table 7: WESPAK-SE Function and Value Groups Tidal or Non-Tidal, Rated as High, Overall AA Score, and Rating

| AA | Alignment(s) <sup>3</sup>             | AA Acreage | Tidal or Non-tidal | Overall Score | Rating   | Group Rating of Higher                                                                                           |
|----|---------------------------------------|------------|--------------------|---------------|----------|------------------------------------------------------------------------------------------------------------------|
| 1  | Mendenhall Peninsula                  | 11.14      | Non-tidal          | 6.26          | Higher   | Fish and Terrestrial Habitat                                                                                     |
| 2  |                                       | 1.02       | Non-tidal          | 7.56          | Higher   | Hydrologic, Water Quality, and Terrestrial Habitat                                                               |
| 3  |                                       | 0.38       | Non-tidal          | 4.18          | Moderate | Terrestrial Habitat                                                                                              |
| 4  |                                       | 67.63      | Tidal              | 2.51          | Low      | Anadromous Fish Habitat, Waterbird Feeding Habitat, Songbird, Raptor, & Mammal Habitat, and Native Plant Habitat |
| 5  | Sunny Point West                      | 3.76       | Non-tidal          | 6.26          | Higher   | Fish and Aquatic Habitat                                                                                         |
| 6  | Sunny Point East                      | 0.25       | Non-tidal          | 6.23          | Higher   | Hydrologic, Fish, and Aquatic Habitat                                                                            |
| 7  | Sunny Point West and Sunny Point East | 90.69      | Tidal              | 6.64          | Higher   | Sediment Retention & Stabilization and Waterbird Feeding Habitat                                                 |
| 8  |                                       | 5.08       | Non-tidal          | 3.35          | Moderate | None                                                                                                             |
| 9  | Vanderbilt                            | 16.35      | Tidal              | 5.54          | Moderate | Anadromous Fish Habitat and Waterbird Feeding Habitat                                                            |
| 10 |                                       | 58.17      | Tidal              | 5.28          | Moderate | Anadromous Fish Habitat, Waterbird Feeding Habitat                                                               |
| 11 | Twin Lakes                            | 30.78      | Non-tidal          | 8.08          | Higher   | Water Quality, Fish, Aquatic Habitat, and Social                                                                 |
| 12 |                                       | 61.4       | Tidal              | 6.97          | Higher   | Carbon Sequestration, Organic Nutrient Export, Waterbird Feeding Habitat, and Songbird, Raptor, & Mammal Habitat |
| 13 | Salmon Creek                          | 0.04       | Non-tidal          | 6.22          | Moderate | Social                                                                                                           |
| 14 |                                       | 22.0       | Tidal              | 6.73          | Higher   | Waterbird Feeding Habitat                                                                                        |

## 4.1 WESPAK-SE

The overall score and rating for AAs are based on the WESPAK-SE calculation spreadsheets of functions and values performed by the AA. Data entered into WESPAK-SE spreadsheets are normalized to proportionally rank each AA by comparing minimum, median, and maximum scores of previously assessed wetlands.

### 4.1.1 Mendenhall Peninsula

AA1 consists of 11.14 acres of non-tidal wetlands located at the base of a steep slope within the Mendenhall Peninsula. The dominant wetland habitats in AA1 consists of FO<sup>4</sup> with an understory of SS<sup>5</sup>. The overall score for AA1 is 6.26 with a rating of Higher. AA1 consists of wetlands considered to provide important values for fish and terrestrial habitat.

AA2 consists of 1.02 acres of non-tidal wetlands found at the change in slope (e.g., bench) within the Mendenhall Peninsula. The dominant wetland habitats in AA2 consists of SS with an understory of EM<sup>6</sup>. The overall score for AA2 is 7.56 with a rating of Higher. AA2 consists of wetlands considered to provide important values for hydrologic functions, water quality, and terrestrial habitat.

AA3 consists of 0.38 acres of non-tidal wetlands found at the toe of a steep slope near the Mendenhall Peninsula, approximately 400 feet from Fritz Cove. This wetland consists of EM habitat. The overall score for AA3 is 4.18 with a rating of Moderate. AA3 consists of wetlands considered to provide important values for terrestrial habitat.

AA4 consists of 67.63 acres of tidally influenced wetlands found in marine and intertidal waterbodies of Fritz Cove, north of the Mendenhall Peninsula to Douglas Island. US<sup>7</sup> is the dominant habitat type within this AA at 52 percent, followed by UB<sup>8</sup> at 24 percent. The overall score for AA4 is 2.51 with a rating of Low. AA4 consists of wetlands considered to provide important values for anadromous fish habitat, waterbird feeding habitat, songbird, raptor, & mammal habitat, and native plant habitat.

### 4.1.2 Sunny Point West

AA5 consists of 3.76 acres of non-tidal wetlands found between Egan Drive and the Glacier Highway. EM is the dominant habitat type within this AA at 81 percent, followed by SS at 19 percent. The overall score for AA5 is 6.26 with a rating of Higher. AA5 consists of wetlands considered to provide important values for hydrologic functions, fish habitat, and aquatic habitat.

---

<sup>4</sup> FO=Forested

<sup>5</sup> SS=Scrub-shrub

<sup>6</sup> EM=Emergent

<sup>7</sup> US=Unconsolidated shore

<sup>8</sup> UB=Unconsolidated bottom

#### **4.1.3 Sunny Point East**

AA6 consists of 0.25 acres of non-tidal wetlands north of the intersection of Egan Drive and Glacier Highway Access Road (CBJ 2021). EM is the dominant habitat type within this AA at 85 percent, followed by SS at 19 percent. The overall score for AA6 is 6.23 with a rating of Higher. AA6 consists of wetlands considered to provide important values for hydrologic function, fish habitat, and aquatic habitat.

#### **4.1.4 Sunny Point East and West**

AA7 consists of 90.69 acres of tidally influenced wetlands found on the east and west side of Sunny Point, across Gastineau Channel to Douglas Island. EM is the dominant habitat type within this AA at 83 percent, followed by SB<sup>9</sup> at six percent. The overall score for AA7 is 6.64 with a rating of Higher. AA7 consists of wetlands considered to provide important values for sediment retention and stabilization and waterbird feeding habitat.

AA8 consists of 5.08 acres of non-tidal wetlands found on the Douglas Island side of Sunny Point, north of the Douglas Highway. SS is the dominant habitat type within this AA at 89 percent, followed by FO at 11 percent. The overall score for AA8 is 3.35 with a rating of Moderate.

#### **4.1.5 Vanderbilt**

AA9 consists of 16.35 acres of non-tidal wetlands found north of Egan Drive from Vanderbilt Hill Road to slightly past Lemon Creek. EM is the dominant habitat type within this AA at 97 percent. The overall score for AA9 is 5.54 with a rating of Moderate. AA9 consists of wetlands considered to provide important values for anadromous fish habitat and waterbird feeding habitat.

AA10 consists of 58.17 acres of intertidal wetlands found south of Egan Drive from Lemon Creek to just past Vanderbilt Hill Road until meeting Douglas Island across the Gastineau Channel. EM is the dominant habitat type within this AA at 44 percent, followed by US at 43 percent. The overall score for AA10 is 5.28 with a rating of Moderate. AA10 consists of wetlands considered to provide important values for anadromous fish habitat and waterbird feeding habitat.

#### **4.1.6 Twin Lakes**

AA11 consists of 30.78 acres of non-tidal littoral wetlands found south of Vanderbilt Hill Road, along Egan Drive to the intersection of Glacier Highway, consisting of Twin Lakes. UB is the dominant habitat type within this AA at 88 percent, followed by EM at six percent. The overall score for AA11 is 8.08 with a rating of Higher. AA11 consists of wetlands considered to provide important values for water quality, fish, aquatic habitat, and social groups.

---

<sup>9</sup> SB=Streambed



AA12 consists of 61.4 acres of subtidal and intertidal wetlands found south of Egan Drive between Twin Lakes to Douglas Island. Intertidal US is the dominant habitat type within this AA at 55 percent, followed by subtidal UB at 23 percent. The overall score for AA12 is 6.97 with a rating of Higher. AA12 consists of wetlands considered to provide important values for carbon sequestration, organic nutrient export, waterbird feeding habitat, and songbird, raptor, & mammal habitat.

#### **4.1.7 Salmon Creek**

AA13 consists of 0.04 acres non-tidal wetlands found at the Douglas Island Pink and Chum hatchery<sup>10</sup>. UB is the dominant habitat type within this AA at 100 percent. The overall score for AA13 is 6.22 with a rating of Moderate. AA13 consists of wetlands considered to provide important values for social groups.

AA14 consists of 22 acres of subtidal and intertidal wetlands found at the Salmon Creek dock to Falls Creek on Douglas Island. UB is the dominant habitat type within this AA at 68 percent, followed by US at 20 percent. The overall score for AA14 is 6.73 with a rating of Higher. AA14 consists of wetlands considered to provide important values for waterbird feeding habitat.

## **5.0 DISCUSSION**

---

The study area mainly consists of areas influenced by the tide (approximately 360 acres) and extends typically 160 feet above HTL, except for on Mendenhall Peninsula where elevations extend up to 375 feet. Steep slopes typically end near Egan Drive or Douglas Highway, where the land flattens out into the tidal flats.

Palustrine wetland habitats within the study area typically connect into a perennial stream and flow into Gastineau Channel or Fritz Cove. There are two wetlands on Mendenhall Peninsula located south of Engineers Cutoff Road which appear to not be connected to a perennial stream and potentially are isolated, totaling approximately 1.4 acres.

## **6.0 REFERENCES**

---

Adamus, P.R. 2015. *Manual for Wetland Ecosystem Services Protocol for Southeast Alaska (WESPAK-SE)*.

ADF&G. 2023a. *Alaska Fish Resource Monitor*.  
<https://adfg.maps.arcgis.com/apps/MapSeries/index.html?appid=a05883caa7ef4f7ba17c99274f2c198f>

ADF&G. 2023b. *Mendenhall Wetlands – State Game Refuge*.  
<https://www.adfg.alaska.gov/index.cfm?adfg=mendenhallwetlands.main>

---

<sup>10</sup> Douglas Island Pink and Chum, Inc. Accessed February 2024. <https://www.dipac.net/>

- Bosworth Botanical Consulting. April 2016. *City and Borough of Juneau Wetlands Management Plan. Final Report, Volume One*. <https://juneau.org/wp-content/uploads/2019/02/JWMPVolume1FinalApril2016.pdf>
- CBJ. 2021. *City & Borough of Juneau Street & Property Atlas*. <https://juneau.org/index.php?gf-download=2021%2F04%2FCURRENT-STREET-ATLAS.pdf&form-id=106&field-id=4&hash=c077378deffdf2c43001d39aa0f18c13743b863245cc08228106a1714fdb3e2>
- Code of Federal Regulations. 1986. *Part 328 – Definition of Waters of the United States*. <https://www.ecfr.gov/current/title-33/chapter-II/part-328>
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitat of the United States*. Jamestown: US Department of the Interior.
- DOWL. 2022a. *Wetlands and Waterways Data Summary, Juneau Douglas North Crossing PEL Study*.
- DOWL. 2022b. *Navigable Waterways Technical Memorandum, Juneau Douglas North Crossing PEL Study*.
- Gallant, A.L., E.F. Binnian, J.M. Omernik, and M.B. Shasby. 1995. *Ecoregions of Alaska*. USGS Professional Paper, Washington: United States Printing Office.
- Munsell Color. 2012. *Munsell Soil-Color Charts with genuine Munsell color chips*. Grand Rapids: Munsell Color.
- NRCS. 2015. *Part 650 Engineering Field Handbook*. Guidance for Documenting Wetland Hydrology, United States Department of Agriculture.
- NRCS. 2021. Web Soil Survey. Accessed September 30, 2023. <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.
- NRCS. 2005. Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.
- Pojar, A., and A. Mackinnon. 2004. *Plants of the Pacific Northwest Coast*. Vancouver, BC: Lone Pine.
- Pratt, V.E. 1989. *Field Guide to Alaskan Wildflowers*. Anchorage, AK: Alaskakrafts.
- Tande, G., and R. Lipkin. 2003. *Wetland Sedges of Alaska*. Anchorage, AK: University of Alaska Anchorage, Environmental and Natural Resources Institute, Alaska Natural Heritage Program.
- USFWS. 2023. *National Wetlands Inventory Mapper*. <https://www.fws.gov/wetlands/data/Mapper.html>.
- USGS. 1947. *Juneau B-2, AK*. <https://ngmdb.usgs.gov/topoview/viewer/#14/58.3524/-134.5196>
- USGS. 2023. *The National Map*. <https://apps.nationalmap.gov/viewer/>

- USACE. 1987. *Corps of Engineers Wetlands Delineation Manual*. Technical Report Y-87-1, Washington D.C.: Wetlands Research Program.
- USACE. 2007. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0)*. ERDC/EL TR-07-24, Washington D.C.: Wetlands Regulatory Assistance Program.
- USACE. 2020. "Alaska Subregional Wetland Plant List."
- USACE. 2023. *The Antecedent Precipitation Tool*. Juneau, Alaska. September 30, 2023.
- Utah Climate Center. 2023. *Juneau International Airport (USW00025309)*. Logan: Utah State University.
- Vierick, L.A., and Little E.L. 2007. *Alaska Trees and Shrubs*. Fairbanks, Alaska: University of Alaska Press.
- Vierick, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. *The Alaska Vegetation Classification*. Gen. Tech. Rep. PNW-GTR-286, Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.



# Juneau Douglas North Crossing PEL Study Bird and Habitat Surveys Report

*Prepared for*  
Alaska Department of Transportation and Public Facilities



January 2024

**ParametriX**

# Citation

Parametrix. 2024. Juneau Douglas North Crossing PEL  
Study Bird and Habitat Surveys Report. Prepared for Alaska  
Department of Transportation and Public Facilities  
by Parametrix, Seattle, Washington.  
January 2024.



# Contents

|                                                       |    |
|-------------------------------------------------------|----|
| 1. Introduction.....                                  | 1  |
| 2. Methods .....                                      | 1  |
| 3. Results .....                                      | 5  |
| 3.1 Habitat Evaluations .....                         | 7  |
| 3.2 Bird/Habitat Interactions .....                   | 18 |
| 4. Recommendations/Additional Information Needs ..... | 19 |
| 5. References.....                                    | 20 |

## FIGURES

|                                                        |   |
|--------------------------------------------------------|---|
| Figure 1. Study Area and Preliminary Alternatives..... | 2 |
| Figure 2. Bird Survey Areas and Habitat Types.....     | 4 |

## TABLES

|                                                                                                             |   |
|-------------------------------------------------------------------------------------------------------------|---|
| Table 1. Distribution of Habitat Types in Survey Areas (acres).....                                         | 6 |
| Table 2: Acreage of Habitat Types in the Potential Impact Footprints of the Alternative<br>Alignments ..... | 6 |

## ATTACHMENTS

1. Draft Work Plan for Bird and Upland Habitat Surveys
2. eBird Sighting Frequency Data for the Mendenhall Wetlands Important Birding Area
3. Site Visit Summaries
4. Revisions to Preliminary Habitat Type Mapping from the Wildlife and Fish Resources  
Technical Memorandum
5. Common and Scientific Names of Species Mentioned in this Report

# Acronyms and Abbreviations

|        |                                                |
|--------|------------------------------------------------|
| CBJ    | City and Borough of Juneau                     |
| DOT&PF | Alaska Department of Transportation and Public |
| GIS    | Facilities geographic information system       |
| NEPA   | National Environmental Policy Act              |
| PEL    | Planning and Environmental Linkages            |

# 1. Introduction

The City and Borough of Juneau (CBJ) has partnered with Alaska Department of Transportation and Public Facilities (DOT&PF) to study a possible transportation corridor to connect Juneau with the northern end of Douglas Island. DOT&PF has chosen the Planning and Environmental Linkages (PEL) process to identify and evaluate a purpose and need and recommend alternatives for such a connection. The PEL study considers potential crossing locations between Douglas Island and mainland Juneau in the channel area north of the existing Douglas Island Bridge. The analyses conducted for the PEL may be incorporated into a future National Environmental Policy Act (NEPA) review.

In April 2023, DOT&PF identified six alternatives to advance for detailed development in the Juneau Douglas North Crossing PEL Study (Figure 1). To support further evaluation of these alternatives, the project team performed field surveys to expand our understanding of environmental resources potentially affected by each alternative. This report identifies the goals and objectives of the field survey effort for birds and upland habitats, describes the methodology employed, summarizes the findings of the field surveys, and provides recommendations for refining the data that will support future evaluations.

A substantial amount of information about species and habitats in the study area is available from the sources identified in Section 2 (Methods) of this report. The goal of this field survey effort was to supplement that information with observations of (1) bird species in the study area during the fall migration period and (2) bird use of the habitat types that have been identified in the study area. To accomplish that goal, the field survey effort included the following tasks:

- Refining our understanding of the habitat types in the study area by collecting observations of the structural and vegetative composition of the land cover types that were defined and mapped in the *Wildlife and Fish Resources Technical Memorandum* for the Juneau Douglas North Crossing PEL Study.
- Conducting area-search surveys to document bird species and characterize the interactions of birds with different habitat types.

# 2. Methods

In September 2023, DOT&PF shared a draft work plan with the Technical Advisory Committee and the Stakeholder Advisory Committee for the Juneau Douglas North Crossing PEL Study (Attachment 1). The field study team revised the work plan in response to review comments from committee members. The methodology described in this report incorporates those revisions.

*Preliminary Research:* Before beginning fieldwork, biologists reviewed aerial imagery, bird species lists, observation records, and additional information from multiple resources, including:

- *Wildlife and Fish Resources Technical Memorandum* for the Juneau Douglas North Crossing PEL Study (Parametrix 2022).
- Juneau Audubon Society (<http://www.juneau-audubon-society.org/>).
- Alaska Audubon Society (<https://ak.audubon.org/southeast-alaska-birding-trail/juneau>).
- eBird (<https://ebird.org/hotspots>).
- Alaska Department of Fish and Game (<https://www.adfg.alaska.gov/index.cfm?adfg=animals.listbirds>).
- Hotspots: Bird Survey of Mendenhall Wetlands, April 2002 to May 2003 (Armstrong et al. 2004).

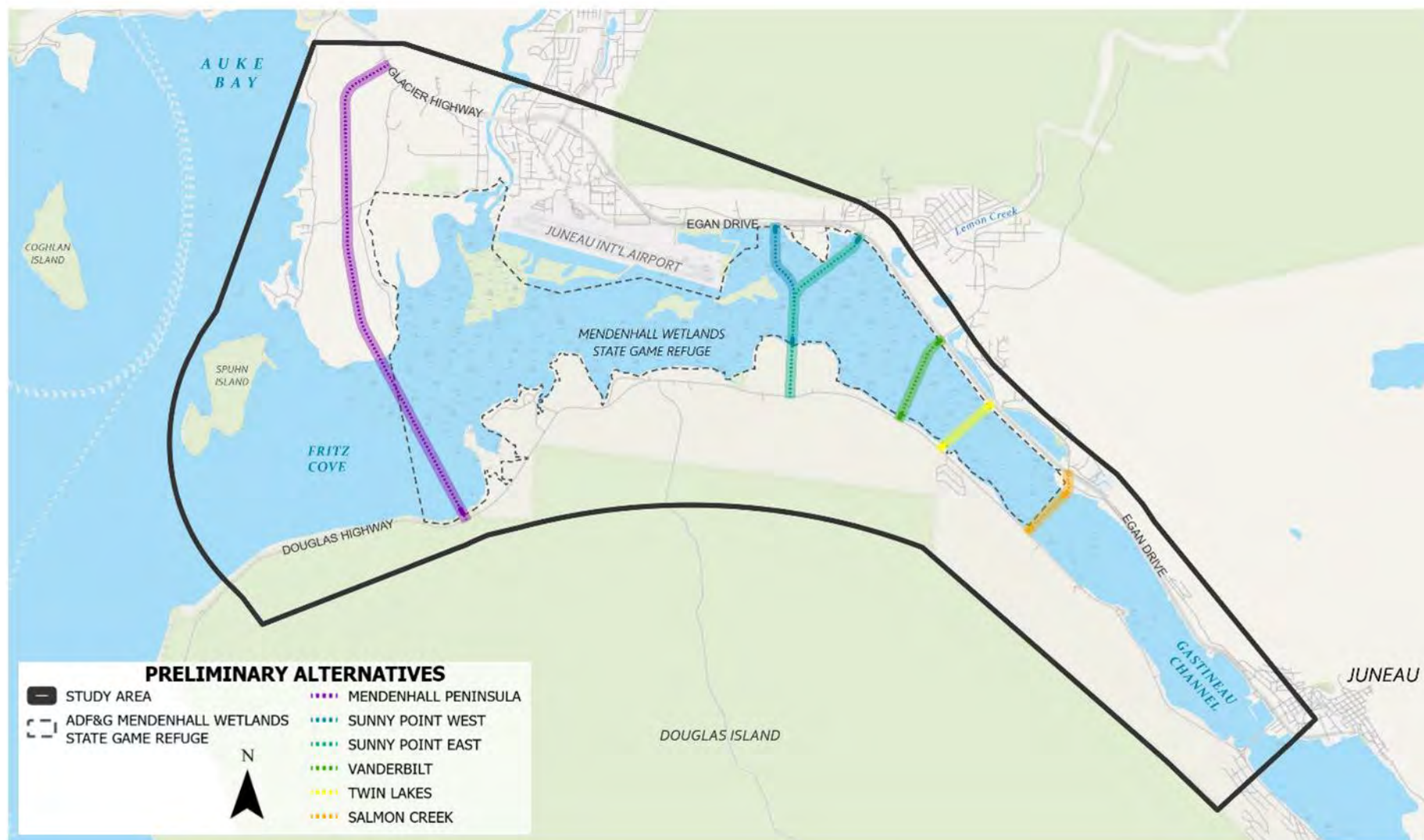


Figure 1. Study Area and Preliminary Alternatives

- The Mendenhall Wetlands: A Globally Recognized Important Bird Area (Armstrong et al. 2009).
- Juneau Second Channel Crossing Project Development Summary Report (HDR Alaska, Inc. 2005).
- Bird use of the Mendenhall Wetlands in Juneau, Alaska (Cain et al. 1988).
- Juneau International Airport. Final EIS and Section 4(f) Evaluation (FAA & CBJ 2007).

To gain insight about species likely to be encountered, the biologists compiled and reviewed sighting frequency data from eBird (2023) for bird species that have been observed in the Mendenhall Wetlands Important Birding Area during the months of September and October (Attachment 2).

*Study Area:* The study area for habitat evaluations and bird surveys consisted of the PEL study area, as described in the *Wildlife and Fish Resources Technical Memorandum* (Parametrix 2022). Biologists identified 13 locations for habitat evaluations and area-search surveys (Figure 2). These locations were based on proximity to the alternative alignments under review, proximity to known birding hot spots, accessibility, and opportunities to conduct surveys in a variety of habitat types.

*Equipment:* Biologists used a tablet computer with the ArcGIS Field Map application to record field observations (e.g., photograph locations, adjustments to previously mapped cover type boundaries). The tablet was linked to a Trimble DA2 Catalyst Global Navigation Satellite System GPS receiver with submeter accuracy. For personal safety, crew members wore high-visibility field vests during surveys.

*Habitat Evaluations:* Biologists collected data to characterize each of the nine land cover types identified in the *Wildlife and Fish Resources Technical Memorandum*, taking representative photographs and identifying characteristic plant species. Biologists performing field surveys gained access to the study areas via public lands (typically Mendenhall Wetland State Game Refuge access points and CBJ- or State-owned parcels). As discussed below, observations made during the field surveys resulted in the classification of a 10th land cover type, Bog/Fen. Data collected in each land cover type included plant species, structural characteristics, habitat quality, land use, and interactions of birds with habitat features. While collecting habitat evaluation data, biologists also confirmed and corrected cover type classifications and boundaries, as needed. Biologists also recorded incidental observations of non-avian taxa and evidence of their presence (e.g., mammal tracks and scat).

*Area-Search Surveys:* Two biologists conducted area-search surveys, walking through the survey areas and stopping at various points to observe bird activity. The entirety of the survey area polygons identified on Figure 2 were surveyed by walking through vegetation or viewing open areas with binoculars. A single, 1- to 3-hour survey visit was conducted in each survey area. The biologists identified, estimated the abundance of, and collected information about habitat use by the bird species observed. In accordance with methodologies developed for bird surveys during migratory periods (e.g., Alberta Environment and Parks 2020), most surveys were conducted during the morning and evening hours. This approach allowed the collection of data on a wider array of species than would be present during just one of these time periods, because different species are active at different times of the day. The morning surveys tend to capture nocturnal migrants landing after nighttime flights and diurnal migrants beginning migration in the daylight hours. The evening surveys tend to capture soaring migrants using thermals, waterfowl during foraging flights, and nocturnal migrants beginning nighttime flights (Alberta Environment and Parks 2020). These morning and evening periods also aligned with low tides, when the maximum amount of habitat was available to birds and surveyors in each survey area. Surveys were not conducted during periods of strong wind or heavy rain. Biologists also timed survey visits to avoid being in popular hunting areas under twilight conditions.



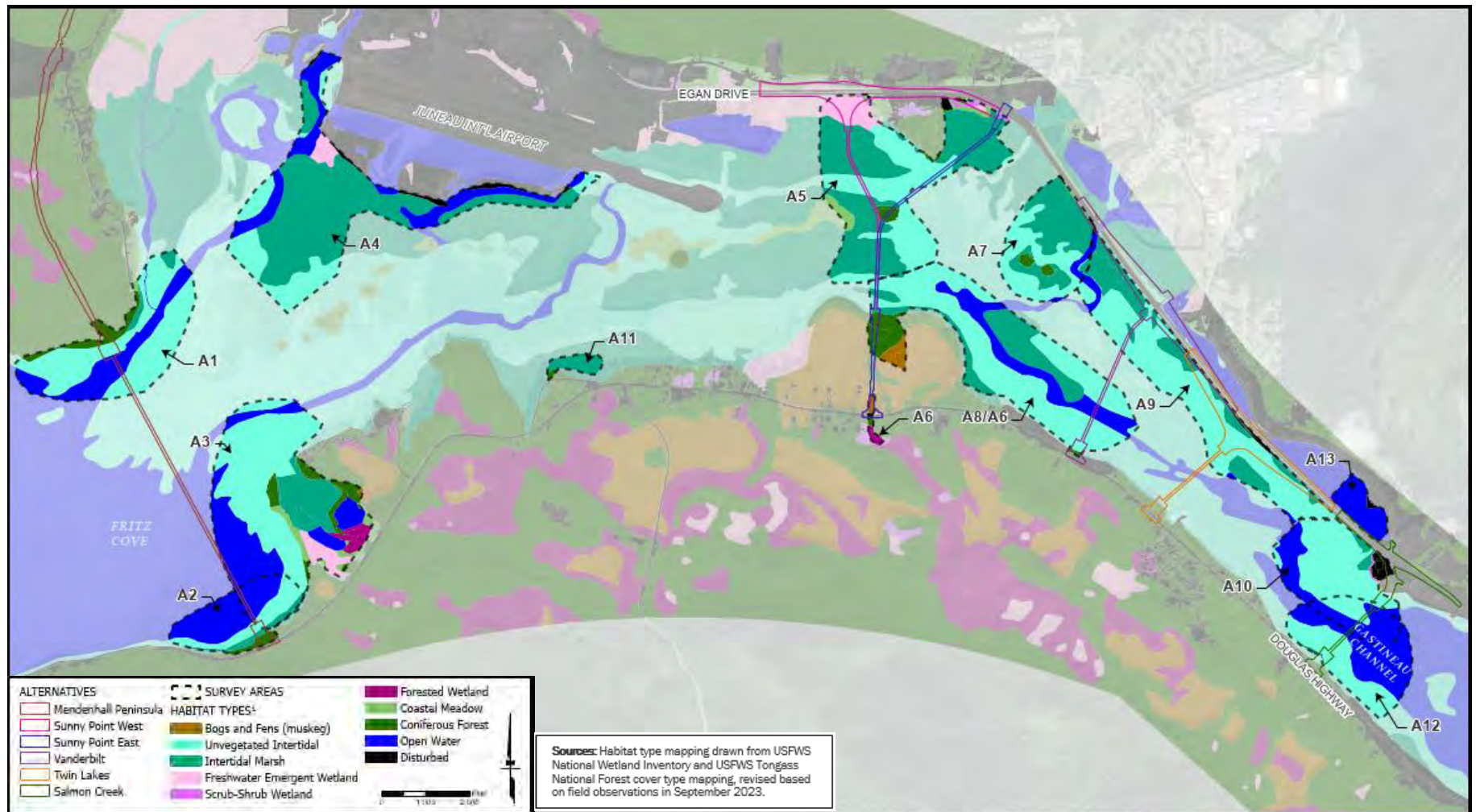


Figure 2. Bird Survey Areas and Habitat Types

To maximize opportunities for collecting observations of the interactions of birds with different habitat types, the survey areas encompassed a variety of land cover types. When identifying target areas for surveys, areas near the alternative alignments were favored, but the alternative locations were not the primary driver for determining the locations of survey areas. Part of the purpose in favoring those locations was to gain on-the-ground familiarity with each alternative alignment, facilitating future evaluations of the potential impacts of the alternatives.

### 3. Results

Parametrix biologists Mike Hall and Kaylee Moser conducted the field surveys from September 19 through September 28, 2023. Weather during the surveys was generally overcast and mild (45 °F to 55 °F) with periods of light rain and sunshine. See Attachment 3 for site visit summaries.

The biologists conducted surveys in 13 survey areas encompassing a total of 1,825 acres across 10 different habitat types (Table 1). Preliminary identification of habitat types in the study area was based on mapping developed for the *Wildlife and Fish Resources Technical Memorandum* (Parametrix 2022). During the surveys, biologists made pertinent alterations to the habitat type mapping based on field observations. The alterations consisted of boundary adjustments and habitat type reclassification, reflecting differences between remote sensing data and on-the-ground conditions.

Figure 2 displays the survey areas and mapped habitat types. Habitat type mapping in Figure 2 reflects the changes made by biologists during field surveys. Attachment 4 shows specific revisions informed by the field surveys.

Three habitat types (Unvegetated Intertidal, Intertidal Marsh, and Open Water) made up more than half of the area surveyed. This reflects the predominance of these habitat types in the areas that were emphasized for field review, combined with the ability of surveyors to detect birds at great distances in these open areas (sight distance was a factor in determining the size and shape of each survey area). Table 1 below provides the breakdown of the acreage of survey areas for each of the 10 habitat types. Table 2 summarizes the acreage of the habitat types within the potential impact footprint that has been defined for each alternative alignment.

In the course of conducting habitat evaluations, biologists observed some areas with distinctive features (e.g., stunted trees, a thick layer of *Sphagnum* mosses, certain plant species) characteristic of bogs and/or fens. Most such areas were preliminarily classified as Freshwater Emergent Wetland or Scrub-Shrub Wetland in the 2022 *Wildlife and Fish Resources Technical Memorandum*. Given the unique value of bog and fen habitats, the biologists recognized the importance of classifying Bog/Fen as a separate habitat type. Bogs support specialized flora and fauna adapted to acidic water, low available nutrients, and water-logged conditions. Fens are typically less acidic and more productive and biologically diverse than bogs. Both bogs and fens store large amounts of carbon in deep peat layers and play a beneficial role in regulating the global climate (ADF&G 2015).

Through further analysis, the biologists determined that the locations of the Bog/Fen areas identified in the field corresponded with the locations of polygons classified as “muskeg”<sup>1</sup> in geographic information system (GIS) data (the Forest Productivity data layer) obtained from the Tongass National Forest. This information, combined with the distinctive visual signature of these areas in aerial imagery, allowed biologists and GIS specialists to reclassify several habitat polygons in the study area as Bog/Fen.

---

<sup>1</sup> Although “muskeg” is commonly used in Southeast Alaska to refer to *Sphagnum* moss- or sedge-dominated peatlands, the word has fallen out of widespread use in technical literature and has been replaced by more narrowly defined terms, such as “bog” or “fen” (Carstensen 2013).

**Table 1. Distribution of Habitat Types in Survey Areas (acres)**

| Survey Area ID     | Habitat Type |                        |                  |                |                             |                     |                  |          |                |           |
|--------------------|--------------|------------------------|------------------|----------------|-----------------------------|---------------------|------------------|----------|----------------|-----------|
|                    | Open Water   | Unvegetated Intertidal | Intertidal Marsh | Coastal Meadow | Freshwater Emergent Wetland | Scrub-Shrub Wetland | Forested Wetland | Bog/Fen  | Conifer Forest | Disturbed |
| A1                 | 42           | 96                     | 5                | 1              | –                           | –                   | –                | –        | 12             | –         |
| A2                 | 45           | 20                     | 7                | –              | –                           | –                   | –                | –        | 4              | –         |
| A3                 | 79           | 124                    | 38               | 8              | 10                          | –                   | 7                | <0.5     | 15             | –         |
| A4                 | 50           | 50                     | 153              | –              | 6                           | –                   | –                | –        | –              | 6         |
| A5                 | –            | 78                     | 132              | 8              | 16                          | 2                   | –                | –        | 5              | 2         |
| A6 <sup>1</sup>    | –            | –                      | –                | –              | –                           | –                   | 2                | 1        | 1              | <0.5      |
| A7                 | 4            | 39                     | 53               | 1              | –                           | –                   | –                | –        | 3              | <0.5      |
| A6/A8 <sup>1</sup> | 39           | 139                    | 48               | –              | –                           | –                   | –                | 6        | 15             | –         |
| A9                 | 6            | 122                    | 51               | 1              | –                           | –                   | –                | –        | –              | 3         |
| A10                | 41           | 71                     | 4                | –              | –                           | 1                   | –                | –        | –              | 5         |
| A11                | –            | –                      | 10               | –              | –                           | –                   | –                | –        | 1              | –         |
| A12                | 66           | 48                     | 1                | –              | –                           | –                   | –                | –        | –              | –         |
| A13                | 21           | –                      | –                | –              | –                           | –                   | –                | –        | –              | 1         |
| <b>TOTAL</b>       | <b>393</b>   | <b>787</b>             | <b>502</b>       | <b>19</b>      | <b>32</b>                   | <b>3</b>            | <b>9</b>         | <b>7</b> | <b>56</b>      | <b>17</b> |

Note: The area calculations for each survey area include portions that overlap neighboring survey areas.

<sup>1</sup> The acreage values for survey area A6 represent only a small area near N Douglas Highway. Survey area A6/A8 covers the intertidal areas along the north shore of Douglas Island, extending from the Sunny Point alignment to the Vanderbilt alignment.

**Table 2: Distribution of Habitat Types Areas within the Potential Impact Footprints of the Alignments (acres)**

| Alternative Alignment | Habitat Type |                        |                  |                |                             |                     |                  |          |                |           |
|-----------------------|--------------|------------------------|------------------|----------------|-----------------------------|---------------------|------------------|----------|----------------|-----------|
|                       | Open Water   | Unvegetated Intertidal | Intertidal Marsh | Coastal Meadow | Freshwater Emergent Wetland | Scrub-Shrub Wetland | Forested Wetland | Bog/Fen  | Conifer Forest | Disturbed |
| Mendenhall Peninsula  | 6            | 7                      | 1                | –              | –                           | 1                   | 6                | –        | 34             | 7         |
| Salmon Creek          | 2            | 6                      | <0.5             | <0.5           | –                           | <0.5                | –                | –        | 1              | 18        |
| Sunny Point East      | –            | 3                      | 5                | –              | <0.5                        | <0.5                | –                | 2        | 4              | 2         |
| Sunny Point West      | –            | 2                      | 6                | 7              | 11                          | 1                   | –                | 2        | 4              | 20        |
| Twin Lakes            | <0.5         | 20                     | 9                | 5              | –                           | –                   | –                | –        | 2              | 15        |
| Vanderbilt            | 7            | 11                     | 12               | 8              | –                           | –                   | –                | –        | 1              | 17        |
| <b>TOTAL</b>          | <b>15</b>    | <b>49</b>              | <b>33</b>        | <b>20</b>      | <b>11</b>                   | <b>2</b>            | <b>6</b>         | <b>4</b> | <b>46</b>      | <b>79</b> |

## 3.1 Habitat Evaluations

On the following pages are profiles that provide overviews of the 10 habitat types in the study area. Each habitat profile includes a representative photograph, a brief description, characteristic plant species, and bird species observed in the habitat type during the September 2023 area-search surveys. These profiles build on and supplement existing reports (e.g., HDR Alaska, Inc. 2005) and species lists (e.g., eBird, Alaska Audubon Society, Juneau Audubon Society, Armstrong et al. 2004). See Attachment 5 for the scientific names of species mentioned in this report.

| Habitat Profile: Open Water                                                         |                                                                                                                                                                                                                |                                                                             |                                                                               |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|
|  |                                                                                                                                                                                                                |                                                                             |                                                                               |
| Gastineau Channel near Survey Area A9, facing west.                                 |                                                                                                                                                                                                                |                                                                             |                                                                               |
| <b>Description</b>                                                                  | These areas in the subtidal zone are permanently inundated—generally, below the mean lower low water elevation—and include the deeper waters of Gastineau Channel, Fritz Cove, river outlets, and ponds/lakes. |                                                                             |                                                                               |
| <b>Characteristic Plant Species</b>                                                 | Submerged aquatic vegetation (e.g., eelgrass, macroalgae)                                                                                                                                                      |                                                                             |                                                                               |
| <b>Bird Species Observed</b>                                                        | American wigeon<br>California gull<br>Canada goose<br>glaucous-winged gull<br>green-winged teal                                                                                                                | herring gull<br>hooded merganser<br>horned grebe<br>lesser scaup<br>mallard | short-billed gull<br>northern pintail<br>red-necked grebe<br>ring-necked duck |



### Habitat Profile: Unvegetated Intertidal



Gastineau Channel at low tide in Survey Area A8, facing northwest.

|                                     |                                                                                                                                                                                                                                                                                                        |                                                                                                                         |                                                                                   |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <b>Description</b>                  | These areas regularly alternate between being inundated and exposed by tidal fluctuations. Biota include nonvascular plants, mollusks, crustaceans, and polychaete worms. Fish and other aquatic species are present when inundation occurs. Sparse low marsh vegetation may be present in some areas. |                                                                                                                         |                                                                                   |
| <b>Characteristic Plant Species</b> | Rockweed<br>Various green algae species<br>Sparse coverage of goosetongue, sea milkwort, and Pacific alkali grass                                                                                                                                                                                      |                                                                                                                         |                                                                                   |
| <b>Bird Species Observed</b>        | American crow<br>American pipit<br>American wigeon<br>bald eagle<br>Bonaparte's gull<br>California gull                                                                                                                                                                                                | glaucous-winged gull<br>greater yellowlegs<br>green-winged teal<br>herring gull<br>least sandpiper<br>lesser yellowlegs | mallard<br>merlin<br>short-billed gull<br>pectoral sandpiper<br>western sandpiper |



### Habitat Profile: Intertidal Marsh



Intertidal marsh habitat north of Hendrickson Point in Survey Area A8, facing northwest.

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                |                                                                                                                     |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>                  | These areas are largely restricted to elevational zones between areas where the Unvegetated Intertidal and Coastal Meadow habitat types are found. Estuarine areas sheltered from wave energy provide optimal conditions for bird nesting and foraging, as these areas have a reduced threat of wave washout. Lower elevations with relatively coarse substrates commonly feature succulent vascular plants such as goosetongue and arrowgrass. Terraces near tidal sloughs support dense stands of Lyngbye's sedge. |                                                                                                                |                                                                                                                     |
| <b>Characteristic Plant Species</b> | Lyngbye's sedge<br>arrowgrass<br>beach rye<br>Canadian sandspurry                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Gmelin's saltweed<br>goosetongue<br>low chickweed<br>Pacific alkali grass                                      | sea milkwort<br>seabeach sandwort<br>seablite<br>silverweed                                                         |
| <b>Bird Species Observed</b>        | American crow<br>American dipper<br>American pipit<br>bald eagle<br>Canada goose<br>common raven                                                                                                                                                                                                                                                                                                                                                                                                                     | golden-crowned sparrow<br>green-winged teal<br>herring gull<br>Lincoln's sparrow<br>merlin<br>Northern harrier | Pacific wren<br>red-winged blackbird<br>Savannah sparrow<br>song sparrow<br>white-crowned sparrow<br>Wilson's snipe |

### Habitat Profile: Coastal Meadow



Coastal Meadow habitat on the fringe of a dredge spoils island in Survey Area A5, facing northwest.

|                                     |                                                                                                                                                                                                                                                                                                                          |                                                                           |                                                           |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>Description</b>                  | These areas are typically found in areas that were previously tidelands but that are now above the high tide line due to post-glacial rebound (i.e., uplift following the removal of the huge weight of ice sheets during the last glacial period). Dominant vegetation consists of grasses and other herbaceous plants. |                                                                           |                                                           |
| <b>Characteristic Plant Species</b> | beach rye<br>beach pea<br>cow parsnip<br>fireweed                                                                                                                                                                                                                                                                        | foxtail barley<br>hemlock parsley<br>kneeling angelica<br>Lyngbye's sedge | Nootka lupine<br>red fescue<br>tufted hairgrass<br>yarrow |
| <b>Bird Species Observed</b>        | American robin<br>belted kingfisher<br>common yellowthroat                                                                                                                                                                                                                                                               | Lincoln's sparrow<br>Pacific wren<br>red-winged blackbird                 | Savannah sparrow<br>song sparrow<br>white-crowned sparrow |



### Habitat Profile: Freshwater Emergent Wetland



Freshwater emergent wetland located near West Creek in Survey Area A5, facing north.

|                                     |                                                                                                                                                                              |                                                                          |                                                         |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------|
| <b>Description</b>                  | These grass- and sedge-dominated areas are generally found on riverine terraces and along the edges of ponds. They are occasionally flooded by seawater during storm surges. |                                                                          |                                                         |
| <b>Characteristic Plant Species</b> | bluejoint reedgrass<br>cleavers<br>Douglas' water-hemlock<br>Lyngbye's sedge                                                                                                 | marsh cinquefoil<br>Northern grass-of-Parnassus<br>Pacific water-parsley | sweet gale<br>tufted hairgrass<br>yellow marsh-marigold |
| <b>Bird Species Observed</b>        | great blue heron                                                                                                                                                             | spotted sandpiper                                                        |                                                         |

### Habitat Profile: Scrub-Shrub Wetland



Scrub-shrub wetland habitat west of Sunny Point in Survey Area A5, facing south.

|                                     |                                                                                                                                                                                                          |                                                  |                                                                         |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------|
| <b>Description</b>                  | These areas are dominated by shrubs and sapling trees, generally along permanent streams. At many sites, this habitat type is a transition zone between freshwater marshes and wooded plant communities. |                                                  |                                                                         |
| <b>Characteristic Plant Species</b> | Barclay willow<br>black cottonwood                                                                                                                                                                       | Sitka alder                                      | Sitka willow                                                            |
| <b>Bird Species Observed</b>        | American crow<br>common raven<br>common yellowthroat<br>Lincoln's sparrow                                                                                                                                | merlin<br>orange-crowned warbler<br>Pacific wren | ruby-crowned kinglet<br>song sparrow<br>Steller's jay<br>yellow warbler |



### Habitat Profile: Forested Wetland



Forested wetland directly north of North Douglas Highway in Survey Area A6, facing north.

|                                     |                                                                                                                                                                                                                                                                                                                                          |                                               |                                          |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------|
| <b>Description</b>                  | These areas are generally found on steeper terrain than other wetland types in the study area, primarily near small drainages on the flatter parts of Douglas Island. Conifer species characterize these wetlands as the dominant species, although the trees may be stunted compared to trees found in areas with better-drained soils. |                                               |                                          |
| <b>Characteristic Plant Species</b> | fool's huckleberry<br>oval-leaf blueberry                                                                                                                                                                                                                                                                                                | Sitka spruce<br>Shore pine<br>western hemlock | western redcedar<br>yellow skunk cabbage |
| <b>Bird Species Observed</b>        | American robin<br>belted kingfisher                                                                                                                                                                                                                                                                                                      | common raven                                  | Pacific wren                             |



| Habitat Profile: Bog/Fen                                                            |                                                                                                                                                                                                                                      |                                              |                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------|
|  |                                                                                                                                                                                                                                      |                                              |                                                      |
| Bog/Fen habitat located on Hendrickson Point in Survey Area A8, facing northeast.   |                                                                                                                                                                                                                                      |                                              |                                                      |
| <b>Description</b>                                                                  | These areas are generally found in areas away from tidal influence, interspersed throughout the forest. Dominant plant species are sphagnum mosses (in bogs), and sedges (in fens), along with stunted trees, low shrubs, and forbs. |                                              |                                                      |
| <b>Characteristic Plant Species</b>                                                 | bog cranberry<br>bog rosemary<br>crowberry<br>Labrador tea                                                                                                                                                                           | lingonberry<br>fewflower sedge<br>shore pine | sphagnum moss<br>tall cottongrass<br>tufted clubrush |
| <b>Bird Species Observed</b>                                                        | common raven                                                                                                                                                                                                                         |                                              |                                                      |

### Habitat Profile: Conifer Forest



Conifer forest growing on a dredge spoils island in Survey Area A5, facing west.

|                                     |                                                                                                                                                                                                                                                                                                          |                                                                                                                                    |                                                                                                                       |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>                  | This is the most common upland habitat type in the study area. The dominant tree species are Sitka spruce and western hemlock, typical of low- to mid-elevation areas in Southeast Alaska. Patches of young forest have become established on the small islands created from dredging Gastineau Channel. |                                                                                                                                    |                                                                                                                       |
| <b>Characteristic Plant Species</b> | bunchberry<br>devil's club<br>fool's huckleberry                                                                                                                                                                                                                                                         | fernleaf goldthread<br>five-leaf bramble<br>lady fern                                                                              | oval-leaved blueberry<br>Sitka spruce<br>western hemlock                                                              |
| <b>Bird Species Observed</b>        | American robin<br>bald eagle<br>black-billed magpie<br>belted kingfisher<br>chestnut-backed chickadee<br>common raven                                                                                                                                                                                    | dark-eyed junco<br>Eurasian collared-dove<br>golden-crowned sparrow<br>Lincoln's sparrow<br>orange-crowned warbler<br>Pacific wren | sharp-shinned hawk<br>song sparrow<br>Steller's jay<br>ruby-crowned kinglet<br>white-crowned sparrow<br>varied thrush |



Habitat Profile: Disturbed



Riprap bank armoring along Gastineau Channel in Survey Area A9, facing south.

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                 |                                       |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------|
| Description                  | These areas are defined by past and ongoing human activities. Vegetation may include plant communities that colonize areas immediately after disturbance or species directly introduced by grass seeding and planting shrubs and trees. Areas classified as Disturbed include roads, residential and commercial development, industrial buildings, hatcheries, communication towers, power lines, and riprap armoring along Egan Drive. |                                 |                                       |
| Characteristic Plant Species | beach rye<br>fireweed                                                                                                                                                                                                                                                                                                                                                                                                                   | pasture grasses<br>mosses       | Sitka willow<br>Sitka spruce          |
| Bird Species Observed        | American robin<br>bald eagle<br>European starling                                                                                                                                                                                                                                                                                                                                                                                       | northern harrier<br>rock pigeon | song sparrow<br>white-crowned sparrow |

## 3.2 Bird/Habitat Interactions

Biologists observed 55 bird species during the field surveys. For each observation, biologists noted species, abundance, and associated habitat type. Many species were observed in a wide range of habitat types; others were more limited in their distribution. The following paragraphs summarize field observations of various species' use of each habitat type, with some additional insights drawn from literature.

The **Open Water** habitat type provides an important staging area for migratory birds to rest and feed (Armstrong et al. 2004). Biologists observed rafts of dabbling and diving ducks, such as mallards, American wigeons, Canada geese, and green-winged teals in this habitat type. Most such observations occurred in Fritz Cove, near the mouth of the Mendenhall River, and in the western Gastineau Channel. Small rafts (approximately 10 individuals) of lesser scaup and ring-necked ducks were observed feeding in the southern lake of the Twin Lakes area, as was a lone hooded merganser. Two horned grebes were seen feeding at the pond near the Fish Creek estuary. Large groups of gulls (including Bonaparte's, California, glaucous-winged, herring, and short-billed gulls) were observed in and near areas classified as Open Water throughout the study area.

The **Unvegetated Intertidal** habitat type provides important foraging habitat for a wide range of species. Biologists observed ducks, shorebirds, eagles, and gulls feeding on barnacles, mussels, rockweed, sand lance, and other food sources in this nutrient-rich habitat. Most of these observations were made during low tide along the expanses of exposed mud flats and mussel/barnacle beds between Lemon Creek and Salmon Creek. Greater yellowlegs, lesser yellowlegs, and sandpipers foraged in the tidal channels and estuaries near Sunny Point, the Fish Creek estuary, and the sloughs near the Airport Trail during low tides. Many gulls and eagles were observed near the Salmon Creek estuary, feeding on small fish and invertebrates as the tide receded.

The **Intertidal Marsh** habitat type is dominated by Lyngbye's sedge, an important food source for many species. Sedge seeds make up a large portion of the fall diet of resident Canada geese, and sedge-dominated areas support populations of invertebrates that are prey for a wide range of bird species (Armstrong et al. 2004). In survey area A11 near Ninemile Creek Road, biologists observed several juvenile western toads in and near small (approximately 1 to 2 square feet), shallow patches of freshly disturbed ground among the sedges. The disturbed areas may have represented predation attempts, possibly by birds. Areas of intertidal marsh habitat also provide resting areas for geese, ducks, shorebirds, and other species during migration or high tides. Near Sunny Point, biologists observed a northern harrier flushing and chasing a group of green-winged teal; a dispute between a merlin and northern harrier was also observed in this area. Seeds and insects in intertidal marshes provide forage for passerines, and the dense grasses provide hiding cover. Biologists frequently flushed sparrows and other songbirds while walking through these areas, and groups of American pipits were seen foraging.

Grasses in the **Coastal Meadow** habitat type provide foraging habitat and hiding cover for many species. Many of the bird species present in intertidal marsh areas were also seen in areas classified as Coastal Meadow, albeit less frequently; this may be attributable to the lower forage value of the plant species that make up most of the vegetative cover in coastal meadows, compared to that of Lyngbye's sedge (which is the predominant plant species many areas classified as Intertidal Marsh). Biologists observed red-winged blackbirds and American pipits foraging for seeds and insects. Burrows and tunnels in the grasses indicated the presence of voles and other small mammals, which provide prey for raptors. Seaweed, plant debris, trash, and other materials left by high tides provide foraging opportunities for corvids, gulls, and other species. Several Wilson's snipes were flushed from clumps of grass during field surveys near Sunny Point and survey area A11. Similar to areas of intertidal marsh, coastal meadows also provide resting areas for geese, ducks, shorebirds, and other species.



Areas classified as **Freshwater Emergent Wetland** bear many floristic and structural similarities to both intertidal marshes and coastal meadows. As such, the use of these areas by birds is substantially similar to what was described above for those habitat types. The two species observed in areas specifically classified as Freshwater Emergent Wetland (great blue heron and spotted sandpiper) are commonly seen in a variety of intertidal and other habitats.

Biologists encountered the **Scrub-Shrub Wetland** habitat type mainly at the edges of coastal meadows. Songbirds such as common yellowthroats, yellow warblers, orange-crowned warblers, Pacific wrens, common yellowthroats, and ruby-crowned kinglets were observed darting around among the willows.

The **Forested Wetland** habitat type provides foraging, resting, and breeding areas for a wide variety of birds. However, biologists conducting field surveys in September 2023 observed few birds in areas classified as Forested Wetland. This paucity of observations can be attributed to several factors, including (1) the scarcity of this habitat type in the survey areas, (2) the timing of the survey effort during the migration period, when most birds are not singing, (3) the abundance of hiding cover in this habitat type, and (4) limited sight distances for observers.

Structurally, the **Bog/Fen** habitat type is similar to both Freshwater Emergent Wetland and Scrub-Shrub Wetland. For reasons akin to those laid out for Forested Wetland—with the addition of the distance that separated Bog/Fen areas from bird-rich intertidal areas—biologists recorded few observations of birds in this habitat type.

Similar to Forested Wetland, the **Conifer Forest** habitat type supports a rich and diverse assemblage of bird species. This was the fourth most-abundant habitat type in the survey areas, providing opportunities to observe and document a comparatively large number of species. In addition, biologists found evidence of porcupine presence in survey area A3.

Although many areas classified as the **Disturbed** habitat type offer little in the way of forage or shelter, several opportunistic species make use of such areas. Gulls and eagles were frequently seen perched on utility poles and light standards, searching for prey.

## 4. Recommendations/Additional Information Needs

This report identifies several updates to the land cover type mapping that was developed for the 2022 *Wildlife and Fish Resources Technical Memorandum* for the Juneau Douglas North Crossing PEL Study. We recommend incorporating those updates—most notably, the identification of the Bog/Fen cover type—into the GIS data that are carried forward to support further analysis.

This report does not provide an analysis of potential effects of the alternatives on bird species or habitats, nor is it intended to rank or prioritize the alternatives. Such assessments would be performed during the NEPA process, as part of a comprehensive review of the project. Analyses of potential project-related impacts on wildlife should be based primarily on impacts to habitat. In other words, if an alternative would affect a certain habitat type, it should be assumed those effects would translate into impacts on any wildlife species known or expected to use that habitat, regardless of whether those species have been observed at that location.

In addition to the data sources identified in this and other reports, information about bird species in the study area can be drawn from bird activity logs prepared in support of the Juneau Airport's Wildlife Hazard Management Program.

Finally, if more information on the interactions of birds with habitats is desired, additional surveys during the spring migration and breeding periods would offer more direct insight. As noted in the work plan for this survey effort (Attachment 1), survey data collected during late September offer a snapshot of the activity of resident bird species and species that migrate through the study area. Information about seasonal and interannual variability in abundance can be drawn from existing data sources, such as eBird (2023).

## 5. References

- Alaska Audubon Society. 2023. Southeast Alaska birding trail—Juneau trails bird species checklists. Accessed September 2023. <https://ak.audubon.org/southeast-alaska-birding-trail/juneau>.
- Alaska Department of Fish and Game (ADF&G). 2015. Alaska wildlife action plan. Juneau, Alaska. Accessed April 2022. [https://www.adfg.alaska.gov/static/species/wildlife\\_action\\_plan/2015\\_alaska\\_wildlife\\_action\\_plan.pdf](https://www.adfg.alaska.gov/static/species/wildlife_action_plan/2015_alaska_wildlife_action_plan.pdf).
- Alberta Environment and Parks. 2020. Bird migration survey protocol. Published January 2020. Alberta, Canada. Accessed September 2023. <https://open.alberta.ca/dataset/e7a8a3c5-8c36-41d4-acdd-1694fb5f5880/resource/e9193de6-14c9-462c-b81f-78b1f995bbdb/download/aep-bird-migration-protocol-2020.pdf>.
- Armstrong, R.H., R.L. Carstensen, M.F. Wilson, and M.H. Osborn. 2009. The Mendenhall Wetlands: A globally recognized important bird area. Accessed April 2022. <https://www.southeastalaskalandtrust.org/wp-content/uploads/45yl789N/2011/01/Mendenhall-Wetlands-book.pdf>.
- Armstrong, R.H., R.L. Carstensen and M.F. Wilson. 2004. Hotspots: Bird survey of Mendenhall Wetlands, April 2002 to May 2003. Juneau Audubon Society and Taku Conservation Society. 74 pp.
- Alaska Department of Fish and Game. 2023. Birds Species List. Accessed September 2023. <https://www.adfg.alaska.gov/index.cfm?adfg=animals.listbirds>.
- Cain, S., J. Hodges, and E. Robinson-Wilson. 1988. Bird use of the Mendenhall Wetlands in Juneau, Alaska. USFWS, Juneau, AK. 72 pp.
- Carstensen, R. 2013. A natural history of Juneau trails: A watershed approach. Discovery Southeast. 71 pp.
- Chesser, R.T., S.M. Billerman, K.J. Burns, C. Cicero, J.L. Dunn, B.E. Hernández-Baños, R.A. Jiménez, A.W. Kratter, N.A. Mason, P.C. Rasmussen, J.V. Remsen, Jr., and K. Winker. 2023. Checklist of North American Birds (online). American Ornithological Society. Accessed October 2023. <https://checklist.americanornithology.org/taxa/>.
- eBird. 2023. Mendenhall Wetlands State Game Refuge Bird Observations. Accessed September 2023. Available at: <https://ebird.org/region/US-AK-110/hotspots?yr=all&m=>
- Federal Aviation Administration and City and Borough of Juneau, Alaska (FAA and CBJ). 2007. Juneau International Airport. Final EIS and Section 4(f) Evaluation.
- HDR Alaska, Inc. 2005. Draft Environmental Impact Statement (DEIS): Project Development Summary Report, Juneau Second Crossing. Prepared for Alaska Department of Transportation and Public Facilities. May 2005.

Juneau Audubon Society. 2004. Fall bird migration observations—Juneau, Alaska. Accessed September 2023. <http://www.juneau-audubon-society.org/Birds/Reports/migrate2004.htm>.

Juneau Audubon Society. 2007. Birds of Juneau, Alaska Checklist. Accessed September 2023. <http://www.juneau-audubon-society.org/Birds/Check Lists/JUNEAU Checklist Rev Jan 2007.pdf>.

Parametrix. 2022. Wildlife and Fish Resources Technical Memorandum for the Juneau Douglas North Crossing PEL Study. April 21, 2022.

Watson, S. 1979. Avian habitats and use of the Mendenhall Wetlands Wildlife Refuge. ADF&G unpublished report, Juneau, AK 28 pp.

# **Attachment 1**

## **Draft Work Plan for Bird and Upland Habitat Surveys**



## TECHNICAL MEMORANDUM

**DATE:** September 14, 2023  
**TO:** Ben Storey, Regional Environmental Manager, AK DOT&PF Southcoast Region  
**FROM:** Kaylee Moser and Mike Hall, Parametrix  
**SUBJECT:** Bird Survey Work Plan  
**CC:** Christy Gentemann, Environmental Impact Analyst, AK DOT&PF Southcoast Region  
Theresa Dutchuk, Senior NEPA Specialist, DOWL  
**PROJECT NAME:** Juneau Douglas North Crossing (JDNC)

---

### INTRODUCTION

The City and Borough of Juneau (CBJ) has partnered with Alaska Department of Transportation and Public Facilities (DOT&PF) to explore a north crossing between Juneau and Douglas Island, north of the existing Douglas Island Bridge. DOT&PF has chosen the Planning and Environmental Linkage (PEL) process to evaluate the purpose and need for a north crossing, identify potential north crossing alternatives, evaluate the alternatives, and identify recommended crossing(s). In support of the evaluation of alternatives the project team is collecting environmental data to understand potential impacts of six proposed alternatives. This work plan has been developed to outline the goals, objectives, and methods for field surveys to document habitat use by birds during the fall migration period.

### GOALS AND OBJECTIVES

The goals of this effort are to document bird species present in the study area during the fall migration period and to identify differences in bird use of the habitat types that have been identified in the study area. Information collected through this effort will be used to evaluate the potential impacts of the alternatives on birds and bird habitat.

To accomplish these goals, we propose to

- Collect observations of the structural and vegetative composition of the land cover types that were defined and mapped in the Wildlife and Fish Resources Technical Memorandum for the Juneau Douglas North Crossing PEL Study and
- Conduct field surveys to document bird species detected and to characterize the interactions of birds with different habitat types.

### METHODOLOGY

*Preliminary Research:* Before beginning fieldwork, biologists will review available aerial photos, bird species lists, and observation records from multiple resources, including:

- Wildlife and Fish Resources Technical Memorandum for the Juneau Douglas North Crossing PEL Study (Parametrix 2022)
- Juneau Audubon Society (<http://www.juneau-audubon-society.org/>)
- Alaska Audubon Society (<https://ak.audubon.org/southeast-alaska-birding-trail/juneau>)

- eBird (<https://ebird.org/hotspots>)
- Alaska Department of Fish and Game (<https://www.adfg.alaska.gov/index.cfm?adfg=animals.listbirds>)
- *The Mendenhall Wetlands: A Globally Recognized Important Bird Area* (Armstrong et al. 2009)
- Google Earth images
- Other relevant reports (e.g., FAA and CBJ 2007).

*Study Area:* The study area for habitat evaluations and bird surveys will consist of the PEL study area, as identified in Wildlife and Fish Resources Technical Memorandum (Parametrix 2022). Biologists identified 10 preliminary locations for field surveys (see Figure 1, attached). A primary consideration in identifying survey area locations was to provide opportunities for collecting observations of habitat conditions and bird presence in a variety of habitat types. Survey area locations were also based on proximity to the proposed alternatives, proximity to identified birding hotspots, and access.

*Equipment:* Biologists will use a Trimble DA2 Catalyst Global Navigation Satellite System Global Positioning System (GPS) receiver with submeter accuracy, accompanied by a tablet computer with the ArcGIS Field Map application containing the base condition mapping layers.

*Habitat Evaluations:* Biologists will collect data to describe the characteristics of each land cover type. Observations of birds in these cover types will be used to identify the associations of birds with each habitat type. Data collected in each land cover type will include plant species, stand structure, habitat quality, and land use. While collecting habitat evaluation data, biologists will confirm and, as needed, correct assigned cover type classifications and boundaries. Corrections to the boundaries and cover type designations will be made in ArcGIS Field Maps. Biologists will also record incidental observations of non-avian taxa and evidence of their presence (e.g., tracks and scat).

*Bird Surveys:* Two biologists will conduct area-search surveys in mid-to-late September. Area-search surveys will be performed by walking through areas surrounding the yellow lines depicted on Figure 1, stopping as needed to observe bird activity and record observations. A single, 1- to 3-hour survey visit will be conducted in each survey area. For each detection, biologists will record the species, estimated number of individuals, and what habitat type birds were using.

Biologists aim to survey 2 or 3 areas per day, weather permitting, and will target surveys around dawn and dusk. In accordance with methodologies developed for bird surveys during migratory periods (e.g., Alberta Environment and Parks 2020), surveys will be conducted during the morning and the evening. Morning surveys begin around sunrise and will continue for 3 to 4 hours. Evening surveys will be conducted during the 3- to 4-hour period leading up to sunset. This approach will allow biologists to collect data on a wider array of species than would be present during just one of these time periods, as different species are active at different times of the day. The morning surveys may capture nocturnal migrants landing after nighttime flights and diurnal migrants beginning migration in the daylight hours. The evening surveys may capture soaring migrants using thermals, waterfowl during foraging flights, and nocturnal migrants beginning nighttime flights (Alberta Environment and Park 2020). Surveys will not be conducted during periods of strong wind or heavy rain. To minimize the risk of conflict with hunters, biologists will avoid conducting surveys in popular hunting areas during twilight hours (approximately 30 to 60 minutes after sunrise and 30 to 60 minutes before sunset, depending on cloud cover).

Table 1 on the following page provides details for each area. Access to at least four of the areas will depend on tidal conditions. Biologists will review tide charts before conducting surveys and plan appropriately.

## BACKGROUND INFORMATION

Survey data collected during late September offers a snapshot of the activity of resident bird species and species that use the study area as a migratory corridor. The fall migration period in Juneau extends from August 1 through November 30 (Juneau Audubon Society 2004). A list of bird species expected to be observed in September will be compiled before bird surveys begin, using the resources identified above.

**Table 1.** JDNC Bird Survey Area Information

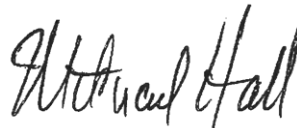
| Survey Area ID | Approximate Survey Area Size (acres) | Habitat Types Present <sup>1</sup>                                                                                   | Access to Survey Area                                                                                                                          | Tide Dependency                |
|----------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| A1             | 19                                   | Coniferous Forest, Coastal Meadow, Unvegetated Intertidal, Open Water                                                | Follow Mendenhall Peninsula Trail                                                                                                              | No                             |
| A2             | 11                                   | Coniferous Forest, Intertidal Marsh, Unvegetated Intertidal, Open Water                                              | Park at North Douglas Boat Launch Ramp and walk east                                                                                           | No                             |
| A3             | 30                                   | Coniferous Forest, Freshwater Emergent Wetland, Coastal Meadow, Intertidal Marsh, Unvegetated Intertidal, Open Water | Follow the Fish Creek Trail                                                                                                                    | No                             |
| A4             | 40                                   | Freshwater Emergent Wetland, Intertidal Marsh, Open Water                                                            | Follow the Mendenhall Refuge Trail                                                                                                             | No                             |
| A5             | 9                                    | Freshwater Emergent Wetland, Coastal Meadow, Intertidal Marsh, Unvegetated Intertidal                                | Park at the western end of Sunny Drive and walk southwest                                                                                      | Yes- Survey closer to low tide |
| A6             | 12                                   | Coniferous Forest, Forested Wetland, Scrub-Shrub wetland, Freshwater Emergent Wetland                                | Walk through City and Borough of Juneau Lands and Resources parcels 6D0901060110 and 6D0901070050                                              | No                             |
| A7             | 10                                   | Coastal Meadow, Unvegetated Intertidal, Open Water                                                                   | Park at the Mendenhall Wetland Scenic View pull out and walk southeast towards Lemon Creek.                                                    | Yes- Survey closer to low tide |
| A8             | 6                                    | Intertidal Marsh, Unvegetated Intertidal, Open Water                                                                 | Park at pullout along North Douglas Highway, walk through City and Borough of Juneau Lands and Resources parcels 6D0901000090 and 6D0901000080 | Yes- Survey closer to low tide |
| A9             | 18                                   | Coastal Meadow, Unvegetated Intertidal, Open Water                                                                   | Park at the Mendenhall Wetland Scenic View pull out and walk southeast.                                                                        | No                             |
| A10            | 12                                   | Coastal Meadow, Unvegetated Intertidal, Open Water                                                                   | Walk along the Salmon Creek outlet                                                                                                             | Yes- Survey closer to low tide |

<sup>1</sup> See the JDNC PEL Wildlife and Fish Technical Memorandum for habitat type descriptions.

If you have any questions, we are available to discuss.



Kaylee Moser, Biologist  
kmoser@parametrix.com



Mike Hall, Senior Scientist  
mhall@parametrix.com

REFERENCES:

- Alaska Audubon Society. 2023. Southeast Alaska Birding Trail—Juneau Trails Bird Species Checklists. Available at: <https://ak.audubon.org/southeast-alaska-birding-trail/juneau>
- Alberta Environment and Parks. 2020. Bird Migration Survey Protocol. Published January 2020. Alberta, Canada. Available at: <https://open.alberta.ca/dataset/e7a8a3c5-8c36-41d4-acdd-1694fb5f5880/resource/e9193de6-14c9-462c-b81f-78b1f995bbdb/download/aep-bird-migration-protocol-2020.pdf>
- Armstrong, R.H., R.L. Carstensen, M.F. Wilson, and M.H. Osborn. 2009. The Mendenhall Wetlands: A Globally Recognized Important Bird Area. Available at <https://www.southeastalaskalandtrust.org/wp-content/uploads/45yl789N/2011/01/Mendenhall-Wetlands-book.pdf>.
- Alaska Department of Fish and Game. 2023. Birds Species List. Available at: <https://www.adfg.alaska.gov/index.cfm?adfg=animals.listbirds>
- Federal Aviation Administration and City and Borough of Juneau, Alaska (FAA and CBJ). 2007. Juneau International Airport. Final EIS and Section 4(f) Evaluation.
- Juneau Audubon Society. 2004. Fall Bird Migration Observations—Juneau, Alaska. Available at: [2004 Juneau Fall Bird Migration Report \(juneau-audubon-society.org\)](http://juneau-audubon-society.org/2004-Juneau-Fall-Bird-Migration-Report)
- Juneau Audubon Society. 2007. Birds of Juneau, Alaska Checklist. Available at: [http://www.juneau-audubon-society.org/Birds/Check Lists/JUNEAU Checklist Rev Jan 2007.pdf](http://www.juneau-audubon-society.org/Birds/Check%20Lists/JUNEAU%20Checklist%20Rev%20Jan%202007.pdf)
- Parametrix. 2022. Wildlife and Fish Resources Technical Memorandum for the Juneau Douglas North Crossing PEL Study. April 21, 2022.



# **Attachment 2**

eBird Sighting Frequency  
Data for the Mendenhall  
Wetlands Important  
Birding Area



▼ **Date Range:** Sep, 1900-2023

Change Location **Mendenhall Wetlands**

Updated ~20 hr(s) ago.

178 species (+30 other taxa)

[illegible]

| 178 species (+30 other taxa)                          |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------------------------------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="#">Pied-billed Grebe</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Horned Grebe</a>                          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-necked Grebe</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| grebe sp.                                             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rock Pigeon</a>                           |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Eurasian Collared-Dove</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Mourning Dove</a>                         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| pigeon/dove sp.                                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Nighthawk</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Vaux's Swift</a>                          |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                                       |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Sora</a>                                  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Coot</a>                         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sandhill Crane</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Avocet</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black-bellied Plover</a>                  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Golden-Plover</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pacific Golden-Plover</a>                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
| American/Pacific Golden-Plover (Lesser Golden-Plover) |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Killdeer</a>                              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Semipalmated Plover</a>                   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Upland Sandpiper</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bar-tailed Godwit</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hudsonian Godwit</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Short-billed Dowitcher</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Long-billed Dowitcher</a>                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                                       |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Short-billed/Long-billed Dowitcher                    |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Wilson's Snipe</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-necked Phalarope</a>                  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Spotted Sandpiper</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Solitary Sandpiper</a>                    |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Lesser Yellowlegs</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Greater Yellowlegs</a>                    |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Lesser/Greater Yellowlegs                             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black Turnstone</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Surfbird</a>                              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Ruff</a>                                  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sharp-tailed Sandpiper</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Stilt Sandpiper</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Buff-breasted Sandpiper</a>               |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sanderling</a>                            |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                                       |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Dunlin</a>                                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rock Sandpiper</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Baird's Sandpiper</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Least Sandpiper</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |

| 178 species (+30 other taxa)             |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------------------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="#">Pectoral Sandpiper</a>       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Western Sandpiper</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Semipalmated Sandpiper</a>   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| peep sp.                                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
| shorebird sp.                            |  |     |     |     |     |     |     |     |     |     |     |     |     |
| jaeger sp.                               |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Marbled Murrelet</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black-legged Kittiwake</a>   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bonaparte's Gull</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Gull</a>              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Short-billed Gull</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                          |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Ring-billed Gull</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Herring Gull</a>             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Glaucous Gull</a>            |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Lesser Black-backed Gull</a> |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">California Gull</a>          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Glaucous-winged Gull</a>     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Herring x Glaucous-winged Gull (hybrid)  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Herring/Glaucous-winged Gull             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Slaty-backed Gull</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Iceland Gull</a>             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| gull sp.                                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Caspian Tern</a>             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Arctic Tern</a>              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-throated Loon</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| loon sp.                                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                          |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Pelagic Cormorant</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Great Blue Heron</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Turkey Vulture</a>           |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Osprey</a>                   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Golden Eagle</a>             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Harrier</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sharp-shinned Hawk</a>       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Goshawk</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Accipiter sp.                            |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bald Eagle</a>               |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Swainson's Hawk</a>          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-tailed Hawk</a>          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rough-legged Hawk</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Buteo sp.                                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Great Horned Owl</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                          |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Short-eared Owl</a>          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Belted Kingfisher</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-breasted Sapsucker</a>   |  |     |     |     |     |     |     |     |     |     |     |     |     |

| 178 species (+30 other taxa)                  |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="#">Downy Woodpecker</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hairy Woodpecker</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Flicker</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| woodpecker sp.                                |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Kestrel</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Merlin</a>                        |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Gyr Falcon</a>                    |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Peregrine Falcon</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| large falcon sp.                              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| falcon sp.                                    |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Olive-sided Flycatcher</a>        |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Western Wood-Pewee</a>            |   |     |     |     |     |     |     |     |     |     |     |     |     |
|                                               |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Alder Flycatcher</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| Alder/Willow Flycatcher (Traill's Flycatcher) |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Least Flycatcher</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hammond's Flycatcher</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Western Flycatcher</a>            |   |     |     |     |     |     |     |     |     |     |     |     |     |
| Empidonax sp.                                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Say's Phoebe</a>                  |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Warbling Vireo</a>                |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Shrike</a>               |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Steller's Jay</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black-billed Magpie</a>           |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Crow</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Raven</a>                  |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Chestnut-backed Chickadee</a>     |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Horned Lark</a>                   |   |     |     |     |     |     |     |     |     |     |     |     |     |
|                                               |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Bank Swallow</a>                  |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Tree Swallow</a>                  |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Violet-green Swallow</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Barn Swallow</a>                  |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Cliff Swallow</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
| swallow sp.                                   |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Ruby-crowned Kinglet</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Golden-crowned Kinglet</a>        |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-breasted Nuthatch</a>         |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Brown Creeper</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pacific Wren</a>                  |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Dipper</a>               |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">European Starling</a>             | * |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Mountain Bluebird</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Townsend's Solitaire</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
|                                               |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Varied Thrush</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hermit Thrush</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |



178 species (+30 other taxa)



KEY: = insufficient data | = rare to widespread

[Download Histogram Data](#)



▼ **Date Range:** Oct, 1900-2023

Change Location **Mendenhall Wetlands**

Updated ~20 hr(s) ago.

163 species (+27 other taxa)

| 163 species (+27 other taxa)                |                                      | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---------------------------------------------|--------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="#">Snow Goose</a>                  |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Greater White-fronted Goose</a> |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Brant</a>                       |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Cackling Goose</a>              |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Canada Goose</a>                |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| Cackling/Canada Goose                       |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Trumpeter Swan</a>              |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Tundra Swan</a>                 |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| Trumpeter/Tundra Swan                       |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| goose sp.                                   |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Cinnamon Teal</a>               |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Shoveler</a>           |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Gadwall</a>                     |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Eurasian Wigeon</a>             |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Wigeon</a>             |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
|                                             | JanFebMarAprMayJunJulAugSepOctNovDec |     |     |     |     |     |     |     |     |     |     |     |     |
| Eurasian x American Wigeon (hybrid)         |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Mallard</a>                     |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Pintail</a>            |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Green-winged Teal</a>           |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Canvasback</a>                  |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Redhead</a>                     |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Ring-necked Duck</a>            |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Greater Scaup</a>               |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Lesser Scaup</a>                |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| Greater/Lesser Scaup                        |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Harlequin Duck</a>              |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Surf Scoter</a>                 |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">White-winged Scoter</a>         |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black Scoter</a>                |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| scoter sp.                                  |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
|                                             | JanFebMarAprMayJunJulAugSepOctNovDec |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Long-tailed Duck</a>            |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bufflehead</a>                  |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Goldeneye</a>            |                                      |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Barrow's Goldeneye</a>          |                                      |     |     |     |     |     |     |     |     |     |     |     |     |

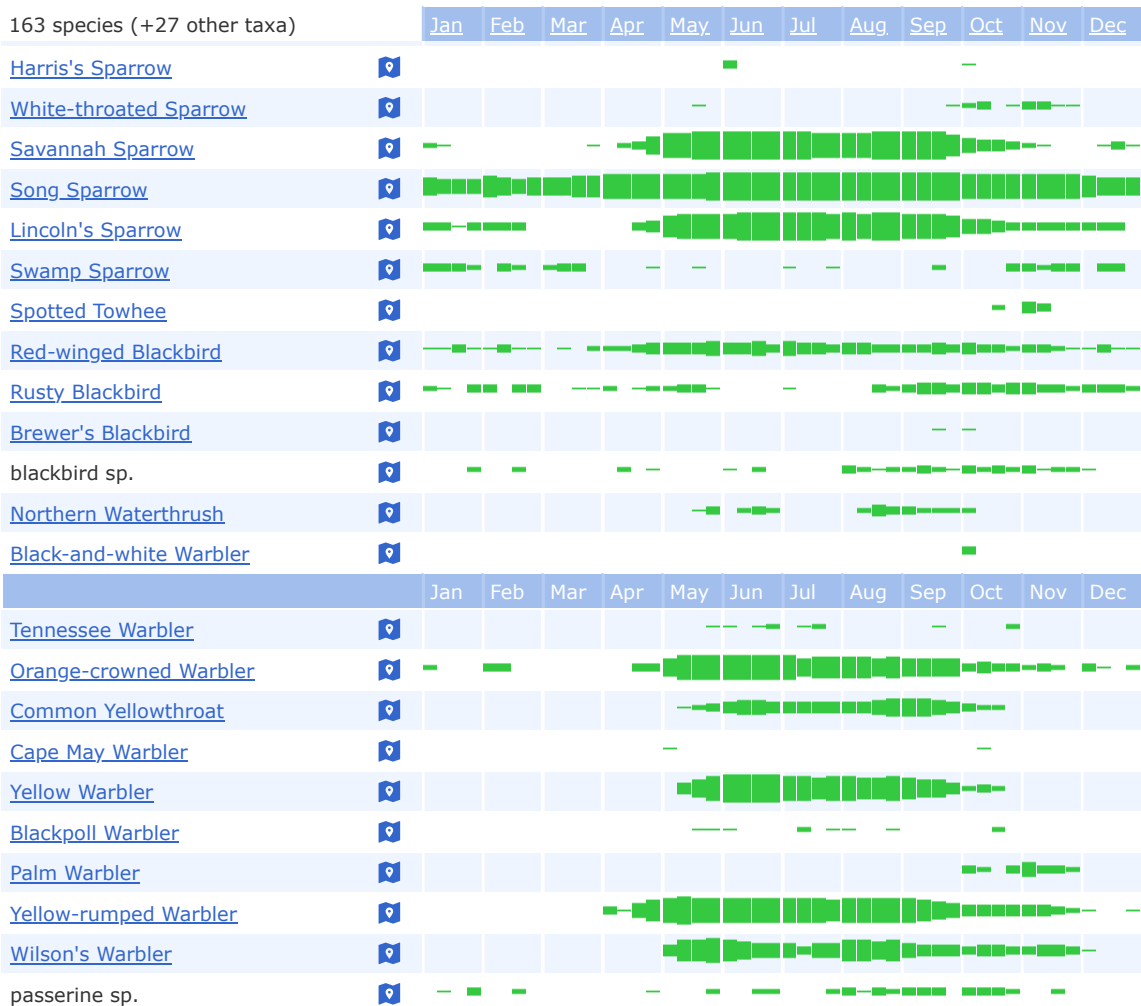
| 163 species (+27 other taxa)                          |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------------------------------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Common/Barrow's Goldeneye                             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hooded Merganser</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Merganser</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-breasted Merganser</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Ruddy Duck</a>                            |  |     |     |     |     |     |     |     |     |     |     |     |     |
| duck sp.                                              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sooty Grouse</a>                          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Willow Ptarmigan</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rock Ptarmigan</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pied-billed Grebe</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Horned Grebe</a>                          |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                                       |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Red-necked Grebe</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| grebe sp.                                             |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rock Pigeon</a>                           |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Eurasian Collared-Dove</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Nighthawk</a>                      |  |     |     |     |     |     |     |     |     |     |     |     |     |
| hummingbird sp.                                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Virginia Rail</a>                         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Coot</a>                         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sandhill Crane</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Avocet</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black Oystercatcher</a>                   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black-bellied Plover</a>                  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pacific Golden-Plover</a>                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
| American/Pacific Golden-Plover (Lesser Golden-Plover) |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Killdeer</a>                              |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                                       |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Long-billed Dowitcher</a>                 |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Short-billed/Long-billed Dowitcher                    |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Wilson's Snipe</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Spotted Sandpiper</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Lesser Yellowlegs</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Greater Yellowlegs</a>                    |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black Turnstone</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Surfbird</a>                              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sharp-tailed Sandpiper</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Dunlin</a>                                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rock Sandpiper</a>                        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Baird's Sandpiper</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Least Sandpiper</a>                       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pectoral Sandpiper</a>                    |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Western Sandpiper</a>                     |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                                       |  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| peep sp.                                              |  |     |     |     |     |     |     |     |     |     |     |     |     |
| shorebird sp.                                         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| Marbled Murrelet                                      |  |     |     |     |     |     |     |     |     |     |     |     |     |

| 163 species (+27 other taxa)             |                                                                                     | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------------------------------------------|-------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="#">Pigeon Guillemot</a>         |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Murre</a>             |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black-legged Kittiwake</a>   |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bonaparte's Gull</a>         |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Short-billed Gull</a>        |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Ring-billed Gull</a>         |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Herring Gull</a>             |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Lesser Black-backed Gull</a> |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">California Gull</a>          |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Glaucous-winged Gull</a>     |    |     |     |     |     |     |     |     |     |     |     |     |     |
| Herring x Glaucous-winged Gull (hybrid)  |    |     |     |     |     |     |     |     |     |     |     |     |     |
| Herring/Glaucous-winged Gull             |    |     |     |     |     |     |     |     |     |     |     |     |     |
|                                          |                                                                                     | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Slaty-backed Gull</a>        |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Iceland Gull</a>             |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">gull sp.</a>                 |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-throated Loon</a>        |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pacific Loon</a>             |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Loon</a>              |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Yellow-billed Loon</a>       |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pelagic Cormorant</a>        |    |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Double-crested Cormorant</a> |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Great Blue Heron</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Osprey</a>                   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Harrier</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Sharp-shinned Hawk</a>       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Goshawk</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bald Eagle</a>               |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                          |                                                                                     | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Red-tailed Hawk</a>          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Rough-legged Hawk</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Buteo sp.</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Snowy Owl</a>                |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Great Horned Owl</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Hawk Owl</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Pygmy-Owl</a>       |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Barred Owl</a>               |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Short-eared Owl</a>          |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">owl sp.</a>                  |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Belted Kingfisher</a>        |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-breasted Sapsucker</a>   |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Downy Woodpecker</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hairy Woodpecker</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Flicker</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |
|                                          |                                                                                     | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">woodpecker sp.</a>           |  |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Kestrel</a>         |  |     |     |     |     |     |     |     |     |     |     |     |     |

| 163 species (+27 other taxa)              |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------------------------------------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <a href="#">Merlin</a>                    |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Gyr Falcon</a>                |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Peregrine Falcon</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| large falcon sp.                          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| falcon sp.                                |   |     |     |     |     |     |     |     |     |     |     |     |     |
| Empidonax sp.                             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Tropical Kingbird</a>         |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Northern Shrike</a>           |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Steller's Jay</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Black-billed Magpie</a>       |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Crow</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Raven</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Chestnut-backed Chickadee</a> |   |     |     |     |     |     |     |     |     |     |     |     |     |
|                                           |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Boreal Chickadee</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Ruby-crowned Kinglet</a>      |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Golden-crowned Kinglet</a>    |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red-breasted Nuthatch</a>     |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Brown Creeper</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pacific Wren</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Dipper</a>           |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">European Starling</a>         | * |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Mountain Bluebird</a>         |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Varied Thrush</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hermit Thrush</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Robin</a>            |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Bohemian Waxwing</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Pipit</a>            |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Brambling</a>                 |   |     |     |     |     |     |     |     |     |     |     |     |     |
|                                           |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">Pine Grosbeak</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Common Redpoll</a>            |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Hoary Redpoll</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| Common/Hoary Redpoll                      |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Red Crossbill</a>             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">White-winged Crossbill</a>    |   |     |     |     |     |     |     |     |     |     |     |     |     |
| crossbill sp.                             |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Pine Siskin</a>               |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Goldfinch</a>        |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Lapland Longspur</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Snow Bunting</a>              |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Chipping Sparrow</a>          |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">American Tree Sparrow</a>     |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Fox Sparrow</a>               |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Dark-eyed Junco</a>           |   |     |     |     |     |     |     |     |     |     |     |     |     |
|                                           |   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| <a href="#">White-crowned Sparrow</a>     |   |     |     |     |     |     |     |     |     |     |     |     |     |
| <a href="#">Golden-crowned Sparrow</a>    |   |     |     |     |     |     |     |     |     |     |     |     |     |



163 species (+27 other taxa)



**KEY:** | = insufficient data | = rare to widespread

[Download Histogram Data](#)

# **Attachment 3**

## **Site Visit Summaries**

## Survey Area A1

**Date and time:** 9/22/2023, 3:45pm – 6:15pm

**Conditions:** overcast, light rain, 45°F

| Species                | Habitat Association    | Approximate Abundance |
|------------------------|------------------------|-----------------------|
| mallard                | Fly-over               | 60                    |
| song sparrow           | Intertidal Marsh       | 5                     |
| bald eagle             | Fly-over               | 2                     |
| Lincoln's sparrow      | Conifer Forest         | 3                     |
| short-billed gull      | Open Water             | 50                    |
| American wigeon        | Open Water             | 5                     |
| spotted sandpiper      | Unvegetated Intertidal | 2                     |
| Pacific wren           | Conifer Forest         | 4                     |
| common raven           | Fly-over               | 2                     |
| golden-crowned sparrow | Intertidal Marsh       | 2                     |

## Survey Area A2

**Date and time:** 9/21/2023, 2:40pm – 4:20pm

**Conditions:** overcast, 45°F

| Species                | Habitat Association             | Approximate Abundance |
|------------------------|---------------------------------|-----------------------|
| bald eagle             | Fly-over                        | 2                     |
| short-billed gull      | Unvegetated Intertidal          | 5                     |
| mallard                | Intertidal Marsh/Open Water     | 10                    |
| golden-crowned sparrow | Conifer Forest/Intertidal Marsh | 2                     |
| song sparrow           | Intertidal Marsh                | 3                     |
| Pacific wren           | Intertidal Marsh                | 3                     |
| herring gull           | Intertidal Marsh/Open Water     | 10                    |
| Bonaparte's gull       | Unvegetated Intertidal          | 3                     |
| common raven           | Conifer Forest                  | 2                     |
| red-necked grebe       | Open Water                      | 1                     |
| Canada goose           | Open Water                      | 10                    |

### Survey Area A3

Date and time: 9/25/2023, 3:20pm – 6:00pm

Conditions: partially sunny, 55°F

| Species             | Habitat Association               | Approximate Abundance |
|---------------------|-----------------------------------|-----------------------|
| belted kingfisher   | Conifer Forest/Coastal Meadow     | 1                     |
| varied thrush       | Conifer Forest                    | 2                     |
| black-billed magpie | Conifer Forest                    | 1                     |
| horned grebe        | Open Water                        | 2                     |
| herring gull        | Open Water                        | 5                     |
| short-billed gull   | Open Water                        | 2                     |
| bald eagle          | Unvegetated Intertidal            | 5                     |
| Lincoln's sparrow   | Intertidal Marsh                  | 3                     |
| green-winged teal   | Open Water/Intertidal Marsh       | 5                     |
| Pacific wren        | Conifer Forest                    | 3                     |
| greater yellowlegs  | Unvegetated Intertidal            | 2                     |
| American crow       | Intertidal Marsh                  | 2                     |
| mallard             | Fly-over/Open Water               | 4                     |
| dark-eyed junco     | Conifer Forest                    | 5                     |
| American wigeon     | Unvegetated Intertidal/Open Water | 500                   |

### Survey Area A4

Date and time: 9/19/2023, 3:30pm – 7:30pm

Conditions: sunny, 55°F

| Species                   | Habitat Association             | Approximate Abundance |
|---------------------------|---------------------------------|-----------------------|
| Lincoln's sparrow         | Intertidal Marsh                | 15                    |
| white-crowned sparrow     | Intertidal Marsh                | 5                     |
| northern harrier          | Intertidal Marsh                | 1                     |
| western sandpiper         | Unvegetated Intertidal          | 50                    |
| Canada geese              | Open Water                      | 100                   |
| mallard                   | Open Water                      | 70                    |
| Savannah sparrow          | Intertidal Marsh                | 2                     |
| common raven              | Fly-over/Conifer Forest         | 2                     |
| Eurasian collared-dove    | Conifer Forest/Intertidal Marsh | 2                     |
| sharp-shinned hawk        | Conifer Forest                  | 1                     |
| merlin                    | Fly-over/Intertidal Marsh       | 1                     |
| chestnut-backed chickadee | Conifer Forest                  | 50                    |
| orange-crowned warbler    | Conifer Forest                  | 3                     |
| bald eagle                | Fly-over/Conifer Forest         | 4                     |
| dark-eyed junco           | Conifer Forest                  | 5                     |
| great blue heron          | Freshwater Emergent Wetland     | 1                     |
| herring gull              | Open Water                      | 5                     |
| greater yellowlegs        | Unvegetated Intertidal          | 10                    |

**Survey Area A5** (western and southern portions)**Date and time:** 9/25/2023, 8:40am – 12:00pm**Conditions:** partially cloudy/foggy, 50°F

| <b>Species</b>         | <b>Habitat Association</b>         | <b>Approximate Abundance</b> |
|------------------------|------------------------------------|------------------------------|
| American robin         | Coastal Meadow                     | 2                            |
| Bald eagle             | Fly-over                           | 3                            |
| Steller's jay          | Scrub-Shrub Wetland                | 2                            |
| common raven           | Fly-over                           | 2                            |
| common yellowthroat    | Scrub-Shrub Wetland/Coastal Meadow | 1                            |
| Lincoln's sparrow      | Scrub-Shrub Wetland/Coastal Meadow | 2                            |
| Pacific wren           | Scrub-Shrub Wetland                | 3                            |
| orange-crowned warbler | Scrub-Shrub Wetland                | 3                            |
| ruby-crowned kinglet   | Scrub-Shrub Wetland                | 2                            |
| song sparrow           | Coastal Meadow                     | 2                            |
| red-winged blackbird   | Coastal Meadow                     | 15                           |
| Wilson's snipe         | Intertidal Marsh                   | 2                            |
| Savannah sparrow       | Intertidal Marsh                   | 3                            |
| northern harrier       | Intertidal Marsh                   | 1                            |
| merlin                 | Intertidal Marsh                   | 1                            |
| white-crowned sparrow  | Intertidal Marsh/Coastal Meadow    | 2                            |
| American crow          | Fly-over                           | 5                            |
| mallard                | Fly-over                           | 40                           |
| northern shoveler      | Fly-over                           | 2                            |
| American wigeon        | Fly-over                           | 30                           |
| American pipit         | Unvegetated Intertidal             | 30                           |

**Survey Area A5** (eastern portion)**Date and time:** 9/26/2023, 3:30pm – 5:00 pm**Conditions:** light rain, 45°F

| <b>Species</b>        | <b>Habitat Association</b>      | <b>Approximate Abundance</b> |
|-----------------------|---------------------------------|------------------------------|
| Song sparrow          | Scrub-shrub Wetland             | 5                            |
| Steller's jay         | Conifer Forest                  | 2                            |
| Pacific wren          | Coastal Meadow/Conifer Forest   | 5                            |
| red-winged blackbird  | Intertidal Marsh                | 20                           |
| dark-eyed junco       | Conifer Forest                  | 5                            |
| white-crowned sparrow | Intertidal Marsh/Conifer Forest | 5                            |
| northern pintail      | Open Water                      | 2                            |
| glaucous-winged gull  | Unvegetated Intertidal          | 10                           |
| American pipit        | Intertidal Marsh                | 5                            |
| bald eagle            | Fly-over                        | 2                            |
| Savannah sparrow      | Coastal Meadow                  | 3                            |
| cackling goose        | Fly-over                        | 5                            |



## Survey Area A6

**Date and time:** 9/21/2023, 4:45pm – 5:45pm

**Conditions:** overcast, light rain, 45°F

| Species        | Habitat Association | Approximate Abundance |
|----------------|---------------------|-----------------------|
| common raven   | Conifer Forest      | 1                     |
| American robin | Conifer Forest      | 2                     |

## Survey Area A7

**Date and time:** 9/22/2023, 9:15am – 11:30am

**Conditions:** overcast, 45°F

| Species              | Habitat Association               | Approximate Abundance |
|----------------------|-----------------------------------|-----------------------|
| common raven         | Intertidal Marsh                  | 5                     |
|                      | Intertidal Marsh/Conifer Forest/  |                       |
| bald eagle           | Unvegetated Intertidal            | 15                    |
| Canada goose         | Intertidal Marsh/Open Water       | 60                    |
| glaucous-winged gull | Fly-over/Unvegetated Intertidal   | 10                    |
| ruby-crowned kinglet | Conifer Forest                    | 5                     |
| song sparrow         | Intertidal Marsh/Conifer Forest   | 2                     |
| fox sparrow          | Intertidal Marsh                  | 1                     |
| northern harrier     | Intertidal Marsh                  | 1                     |
| green-winged teal    | Open Water                        | 30                    |
| short-billed gull    | Unvegetated Intertidal/Open Water | 50                    |
| herring gull         | Unvegetated Intertidal/Open Water | 200                   |
| California gull      | Unvegetated Intertidal/Open Water | 100                   |
| glaucous-winged gull | Unvegetated Intertidal/Open Water | 100                   |
| Bonaparte's gull     | Unvegetated Intertidal/Open Water | 50                    |
| Wilson's snipe       | Intertidal Marsh                  | 1                     |
| merlin               | Intertidal Marsh                  | 1                     |

## Survey Area A6/A8

**Date and time:** 9/20/2023, 9:00am – 12:30pm

**Conditions:** overcast, periodic light rain, 45°F

| Species                | Habitat Association               | Approximate Abundance |
|------------------------|-----------------------------------|-----------------------|
| dark-eyed junco        | Conifer Forest                    | 2                     |
| common raven           | Fly-over                          | 2                     |
| bald eagle             | Unvegetated Intertidal            | 20                    |
| short-billed gull      | Unvegetated Intertidal/Open Water | 20                    |
| herring gull           | Unvegetated Intertidal/Open Water | 20                    |
| glaucous-winged gull   | Unvegetated Intertidal/Open Water | 20                    |
| northern pintail       | Unvegetated Intertidal/Open Water | 5                     |
| American wigeon        | Unvegetated Intertidal/Open Water | 10                    |
| Canada geese           | Unvegetated Intertidal            | 40                    |
| Steller's jay          | Conifer Forest                    | 2                     |
| ruby-crowned kinglet   | Conifer Forest                    | 5                     |
| merlin                 | Unvegetated Intertidal            | 1                     |
| lesser yellowlegs      | Unvegetated Intertidal            | 3                     |
| American robin         | Conifer Forest                    | 1                     |
| golden-crowned sparrow | Conifer Forest                    | 2                     |

## Survey Area A9

**Date and time:** 9/28/2023, 7:00am – 11:00am

**Conditions:** partially cloudy, 45°F

| Species               | Habitat Association                   | Approximate Abundance |
|-----------------------|---------------------------------------|-----------------------|
| American robin        | Disturbed (in alders along riprap)    | 3                     |
| bald eagle            | Fly-over/Unvegetated Intertidal       | 10                    |
| song sparrow          | Disturbed (in alders along riprap)    | 1                     |
| green-winged teal     | Unvegetated Intertidal                | 9                     |
| American crow         | Fly-over                              | 5                     |
| Bonaparte's gull      | Unvegetated Intertidal/Open Water     | 10                    |
| Herring gull          | Unvegetated Intertidal/Open Water     | 20                    |
| short-billed gull     | Unvegetated Intertidal/Open Water     | 20                    |
| glaucous-winged gull  | Unvegetated Intertidal/Open Water     | 10                    |
| mallard               | Fly-over                              | 15                    |
| least sandpiper       | Unvegetated Intertidal                | 2                     |
| green-winged teal     | Unvegetated Intertidal                | 20                    |
| common raven          | Fly-over                              | 5                     |
| western sandpiper     | Unvegetated Intertidal                | 15                    |
| greater yellowlegs    | Unvegetated Intertidal                | 2                     |
| pectoral sandpiper    | Unvegetated Intertidal                | 1                     |
| American pipit        | Intertidal Marsh                      | 3                     |
| white-crowned sparrow | Disturbed (in alders along riprap)    | 1                     |
| rock pigeon           | Disturbed (along riprap near highway) | 1                     |

## Survey Area A10

Date and time: 9/19/2023, 9:15am – 11:05am

Conditions: partially sunny, 55°F

| Species              | Habitat Association                                      | Approximate Abundance |
|----------------------|----------------------------------------------------------|-----------------------|
| American crow        | Fly-over/Scrub-Shrub Wetland                             | 20                    |
| common raven         | Fly-over/ Scrub-Shrub Wetland/<br>Unvegetated Intertidal | 20                    |
| short-billed gull    | Unvegetated Intertidal/Open Water                        | 20                    |
| herring gull         | Unvegetated Intertidal/Open Water                        | 40                    |
| Bonaparte's gull     | Unvegetated Intertidal/Open Water                        | 20                    |
| California gull      | Unvegetated Intertidal/Open Water                        | 10                    |
| glaucous-winged gull | Unvegetated Intertidal/Open Water                        | 40                    |
| bald eagle           | Fly-over/ Unvegetated Intertidal                         | 20                    |
| merlin               | Fly-over/ Scrub-Shrub Wetland                            | 1                     |
| Steller's jay        | Scrub-Shrub Wetland                                      | 1                     |
| green-winged teal    | Unvegetated Intertidal/Open Water                        | 20                    |
| song sparrow         | Intertidal Marsh/ Scrub-Shrub Wetland                    | 1                     |
| yellow warbler       | Scrub-Shrub Wetland                                      | 1                     |
| European starling    | Fly-over/ Unvegetated Intertidal                         | 100                   |
| American dipper      | Intertidal Marsh                                         | 1                     |

## Survey Area A11

Date and time: 9/19/2023, 12:00pm – 1:00pm

Conditions: sunny, 55°F

| Species                | Habitat Association | Approximate Abundance |
|------------------------|---------------------|-----------------------|
| Lincoln's sparrow      | Intertidal Marsh    | 15                    |
| Pacific wren           | Forested Wetland    | 1                     |
| Savannah sparrow       | Intertidal Marsh    | 15                    |
| Wilson's snipe         | Intertidal Marsh    | 1                     |
| golden-crowned sparrow | Intertidal Marsh    | 1                     |
| song sparrow           | Conifer Forest      | 1                     |

## Survey Area A12

**Date and time:** 9/25/2023, 6:20pm – 7:00pm

**Conditions:** partially sunny, 50°F

| Species           | Habitat Association              | Approximate Abundance |
|-------------------|----------------------------------|-----------------------|
| mallard           | Open Water                       | 40                    |
| American crow     | Conifer Forest                   | 5                     |
| bald eagle        | Fly-over/ Unvegetated Intertidal | 15                    |
| short-billed gull | Unvegetated Intertidal           | 5                     |
| herring gull      | Unvegetated Intertidal           | 5                     |
| American pipit    | Unvegetated Intertidal           | 2                     |
| European starling | Disturbed                        | 30                    |

## Survey Area A13

**Date and time:** 9/19/2023, 8:00am – 8:30am

**Conditions:** partially sunny 50°F

**Date and time:** 9/28/2023, 3:30pm – 4:45pm

**Conditions:** overcast, light rain, 45°F

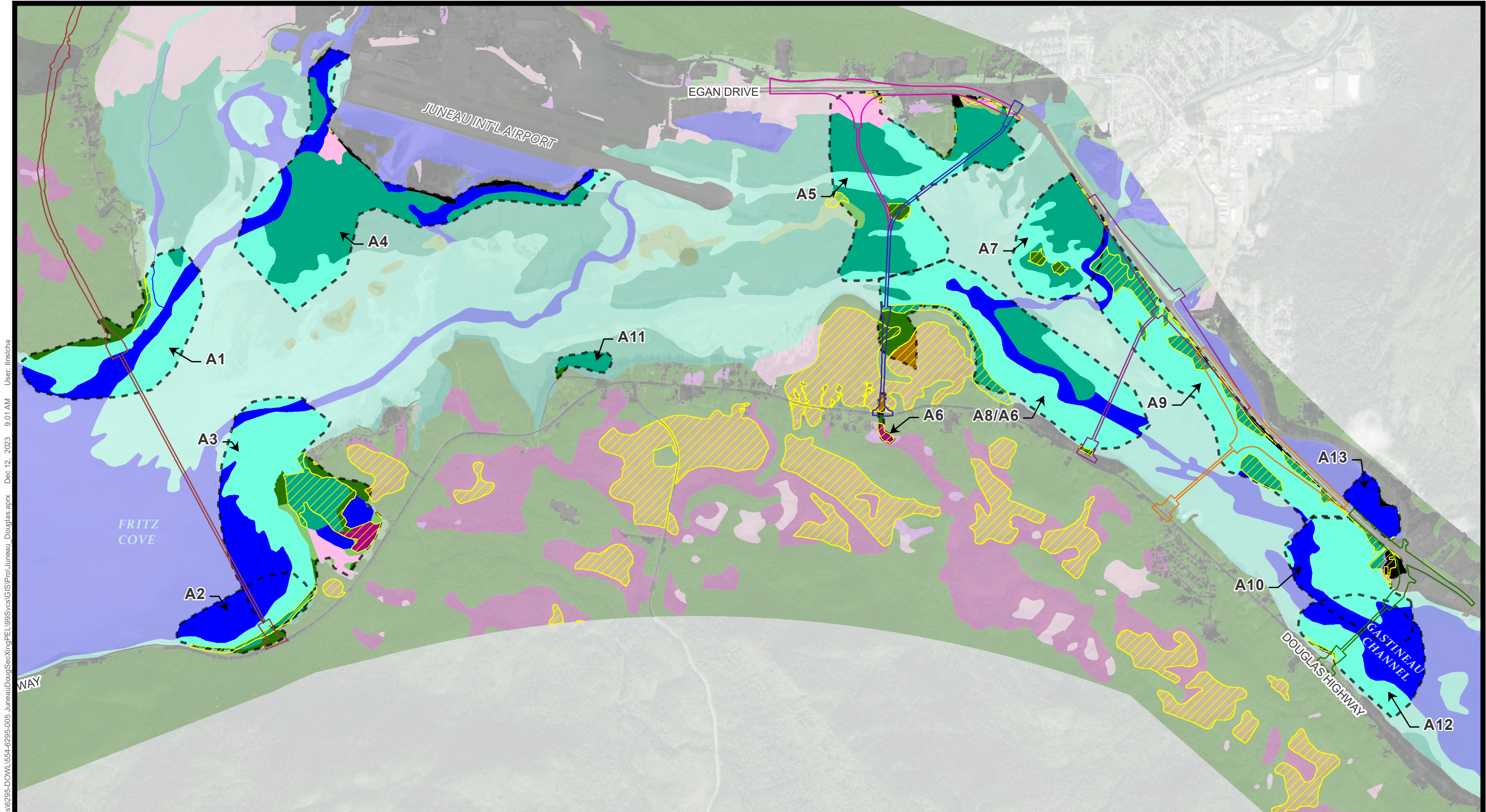
| Species          | Habitat Association               | Approximate Abundance |
|------------------|-----------------------------------|-----------------------|
| northern harrier | Disturbed (perched on light pole) | 1                     |
| hooded merganser | Open Water                        | 1                     |
| bald eagle       | Disturbed (perched on light pole) | 2                     |
| song sparrow     | Conifer Forest                    | 1                     |
| ring-necked duck | Open Water                        | 10                    |
| lesser scaup     | Open Water                        | 10                    |

# **Attachment 4**

Revisions to Preliminary  
Habitat Type Mapping from  
the Wildlife and Fish  
Resources Technical  
Memorandum



\\paramatrix.com\mnt\PSQ\Projects\Clients\6295-DOWL\654-6295-005 JuneauDouglasSecondCrossingPEL199Svcs\GIS\Pro\Juneau\_Douglas.aprx Dec 12, 2023 9:01 AM User: tinslcha Imagery Credits: World Imagery: Maxar, Microsoft



ALTERNATIVES

Mendenhall Peninsula

Sunny Point West

Sunny Point East

Vanderbilt

Twin Lakes

Salmon Creek

REVISD HABITAT MAPPING

HABITAT TYPES<sup>1</sup>

Bogs and Fens (muskeg)

Unvegetated Intertidal

Intertidal Marsh

Freshwater Emergent Wetland

Scrub-Shrub Wetland

Forested Wetland

Coastal Meadow

Coniferous Forest

Open Water

Disturbed

0

1,000

2,000

Feet

Sources:  
1: ORIGINAL HABITAT TYPE MAPPING WAS MADE UP OF THE FOLLOWING DATASETS: FWS NATIONAL WETLAND INVENTORY, USFS TONGASS NATIONAL FOREST COVER TYPE MAPPING. THIS LAYER HAS BEEN REVISED IN THE SURVEY AREAS BASED ON FIELD OBSERVATIONS IN OCTOBER 2023

**BIRD SURVEY AREAS AND HABITAT TYPES**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA

STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259

JUNEAU DOUGLAS SECOND CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

DECEMBER 12, 2023

FIGURE 1



# **Attachment 5**

Common and Scientific Names  
of Species Mentioned in this  
Report

## Common Names and Scientific Names of Species Mentioned in this Report

### Animals

| Common Name               | Scientific Name                     |
|---------------------------|-------------------------------------|
| American crow             | <i>Corvus brachyrhynchos</i>        |
| American dipper           | <i>Cinclus mexicanus</i>            |
| American pipit            | <i>Anthus rubescens</i>             |
| American robin            | <i>Turdus migratorius</i>           |
| American wigeon           | <i>Mareca americana</i>             |
| bald eagle                | <i>Haliaeetus leucocephalus</i>     |
| belted kingfisher         | <i>Megaceryle alcyon</i>            |
| black-billed magpie       | <i>Pica hudsonia</i>                |
| Bonaparte's gull          | <i>Chroicocephalus philadelphia</i> |
| cackling goose            | <i>Branta hutchinsii</i>            |
| California gull           | <i>Larus californicus</i>           |
| Canada goose              | <i>Branta canadensis</i>            |
| chestnut-backed chickadee | <i>Poecile rufescens</i>            |
| common raven              | <i>Corvus corax</i>                 |
| common yellowthroat       | <i>Geothlypis trichas</i>           |
| dark-eyed junco           | <i>Junco hyemalis</i>               |
| Eurasian collared-dove    | <i>Streptopelia decaocto</i>        |
| European starling         | <i>Sturnus vulgaris</i>             |
| fox sparrow               | <i>Passerella iliaca</i>            |
| glaucous-winged gull      | <i>Larus glaucescens</i>            |
| golden-crowned sparrow    | <i>Zonotrichia atricapilla</i>      |
| great blue heron          | <i>Ardea herodias</i>               |
| greater yellowlegs        | <i>Tringa melanoleuca</i>           |
| green-winged teal         | <i>Anas crecca</i>                  |
| herring gull              | <i>Larus argentatus</i>             |
| hooded merganser          | <i>Lophodytes cucullatus</i>        |
| horned grebe              | <i>Podiceps auritus</i>             |
| least sandpiper           | <i>Calidris minutilla</i>           |
| lesser scaup              | <i>Aythya affinis</i>               |

| Common Name              | Scientific Name                  |
|--------------------------|----------------------------------|
| lesser yellowlegs        | <i>Tringa flavipes</i>           |
| Lincoln's sparrow        | <i>Melospiza lincolnii</i>       |
| mallard                  | <i>Anas platyrhynchos</i>        |
| merlin                   | <i>Falco columbarius</i>         |
| North American porcupine | <i>Erethizon dorsatum</i>        |
| northern harrier         | <i>Circus hudsonius</i>          |
| northern pintail         | <i>Anas acuta</i>                |
| northern shoveler        | <i>Spatula clypeata</i>          |
| orange-crowned warbler   | <i>Leiothlypis celata</i>        |
| Pacific wren             | <i>Troglodytes pacificus</i>     |
| pectoral sandpiper       | <i>Calidris melanotos</i>        |
| red-necked grebe         | <i>Podiceps grisegena</i>        |
| red-winged blackbird     | <i>Agelaius phoeniceus</i>       |
| ring-necked duck         | <i>Aythya collaris</i>           |
| rock pigeon              | <i>Columba livia</i>             |
| ruby-crowned kinglet     | <i>Corthylio calendula</i>       |
| Savannah sparrow         | <i>Passerculus sandwichensis</i> |
| sharp-shinned hawk       | <i>Accipiter striatus</i>        |
| short-billed gull        | <i>Larus brachyrhynchus</i>      |
| song sparrow             | <i>Melospiza melodia</i>         |
| spotted sandpiper        | <i>Actitis macularius</i>        |
| Steller's jay            | <i>Cyanocitta stelleri</i>       |
| varied thrush            | <i>Ixoreus naevius</i>           |
| vole                     | <i>Microtus spp.</i>             |
| western sandpiper        | <i>Calidris mauri</i>            |
| western toad             | <i>Anaxyrus boreas</i>           |
| white-crowned sparrow    | <i>Zonotrichia leucophrys</i>    |
| Wilson's snipe           | <i>Gallinago delicata</i>        |
| yellow warbler           | <i>Setophaga petechia</i>        |

Avian nomenclature drawn from the American Ornithological Society checklist of North American birds (Chesser et al. 2023).

## Common Names and Scientific Names of Species Mentioned in this Report

### Plants

| Common Name            | Scientific Name                                    |
|------------------------|----------------------------------------------------|
| arrowgrass             | <i>Triglochin maritimum</i>                        |
| Barclay willow         | <i>Salix barclayi</i>                              |
| beach pea              | <i>Lathyrus japonica</i> var. <i>maritimus</i>     |
| beach rye              | <i>Leymus mollis</i>                               |
| black cottonwood       | <i>Populus balsamifera</i>                         |
| bluejoint reedgrass    | <i>Calamagrostis canadensis</i>                    |
| bog cranberry          | <i>Vaccinium oxycoccos</i>                         |
| bog rosemary           | <i>Andromeda polifolia</i>                         |
| bunchberry             | <i>Cornus canadensis</i>                           |
| Canadian sandspurry    | <i>Spergularia canadensis</i>                      |
| cleavers               | <i>Galium trifidum</i>                             |
| cow parsnip            | <i>Heracleum maximum</i>                           |
| crowberry              | <i>Empetrum nigrum</i>                             |
| devil's club           | <i>Oplopanax horridus</i>                          |
| Douglas' water-hemlock | <i>Cicuta douglasii</i>                            |
| eelgrass               | <i>Zostera marina</i>                              |
| fool's huckleberry     | <i>Menziesia ferruginea</i>                        |
| fernleaf goldthread    | <i>Coptis aspleniifolia</i>                        |
| fewflower sedge        | <i>Carex pauciflora</i>                            |
| fireweed               | <i>Chamerion angustifolium</i>                     |
| five-leaf bramble      | <i>Rubus pedatus</i>                               |
| foxtail barley         | <i>Hordeum jubatum</i>                             |
| Gmelin's saltweed      | <i>Atriplex gmelinii</i>                           |
| goosetongue            | <i>Plantago maritima</i>                           |
| green algae species    | <i>Vaucheria</i> spp.,<br><i>Enteromorpha</i> spp. |
| hemlock parsley        | <i>Conioselinum gmelinii</i>                       |
| kneeling angelica      | <i>Angelica genuflexa</i>                          |
| Labrador tea           | <i>Ledum palustre</i>                              |
| lady fern              | <i>Athyrium cyclosorum</i>                         |

| Common Name                 | Scientific Name                          |
|-----------------------------|------------------------------------------|
| lingonberry                 | <i>Vaccinium vitis-idaea</i>             |
| low chickweed               | <i>Stellaria humifusa</i>                |
| Lyngbye's sedge             | <i>Carex lyngbyei</i>                    |
| marsh cinquefoil            | <i>Comarum palustre</i>                  |
| Nootka lupine               | <i>Lupinus nootkatensis</i>              |
| northern grass-of-Parnassus | <i>Parnassia palustris</i>               |
| oval-leaved blueberry       | <i>Vaccinium ovalifolium</i>             |
| Pacific alkali grass        | <i>Puccinellia nutkaensis</i>            |
| Pacific water-parsley       | <i>Oenanthe sarmentosa</i>               |
| red fescue                  | <i>Festuca rubra</i>                     |
| rockweed                    | <i>Fucus vesiculosus</i>                 |
| sea milkwort                | <i>Glaux maritima</i>                    |
| seabeach sandwort           | <i>Honckenya peploides</i>               |
| seablite                    | <i>Suaeda calceoliformis</i>             |
| shore pine                  | <i>Pinus contorta</i>                    |
| silverweed                  | <i>Potentilla anserina</i>               |
| Sitka alder                 | <i>Alnus viridis</i> ssp. <i>sinuata</i> |
| Sitka spruce                | <i>Picea sitchensis</i>                  |
| Sitka willow                | <i>Salix sitchensis</i>                  |
| sphagnum moss               | <i>Sphagnum</i> species                  |
| sweet gale                  | <i>Myrica gale</i>                       |
| tall cottongrass            | <i>Eriophorum angustifolium</i>          |
| tufted clubrush             | <i>Trichophorum cespitosum</i>           |
| tufted hairgrass            | <i>Deschampsia cespitosa</i>             |
| western hemlock             | <i>Tsuga heterophylla</i>                |
| western redcedar            | <i>Thuja plicata</i>                     |
| yarrow                      | <i>Achillea millefolium</i>              |
| yellow marsh-marigold       | <i>Caltha palustris</i>                  |
| yellow skunk cabbage        | <i>Lysichiton americanus</i>             |



# Juneau Douglas North Crossing PEL Study Intertidal Habitat Survey Report

*Prepared for*  
Alaska Department of Transportation and Public Facilities



December 2023

**Parametrix**

# Citation

Parametrix. 2023. Juneau Douglas North Crossing PEL Study  
Intertidal Habitat Survey Report. Prepared for Alaska  
Department of Transportation and Public Facilities  
by Parametrix, Seattle, Washington.  
December 2023.



# Contents

|                                                       |    |
|-------------------------------------------------------|----|
| 1. Introduction.....                                  | 3  |
| 2. Methods .....                                      | 3  |
| 3. Results .....                                      | 5  |
| 3.1 Salmon Creek.....                                 | 5  |
| 3.2 Twin Lakes .....                                  | 7  |
| 3.3 Vanderbilt.....                                   | 7  |
| 3.4 Sunny Point East.....                             | 8  |
| 3.5 Sunny Point West.....                             | 9  |
| 3.6 Mendenhall Peninsula.....                         | 9  |
| 4. Recommendations/Additional Information Needs ..... | 10 |
| 5. References .....                                   | 11 |

## TABLES

|                                                                                                                      |   |
|----------------------------------------------------------------------------------------------------------------------|---|
| Table 1. Intertidal Habitat Type Definitions and Comparison to Other Classification Systems .....                    | 4 |
| Table 2. Amount of Intertidal Habitat Type in Each Alternative Study Area, Rounded to the<br>Nearest Tenth-Acre..... | 6 |

## PHOTOGRAPHS

|                                                                                |    |
|--------------------------------------------------------------------------------|----|
| Photograph 1. Intertidal Habitats in the Salmon Creek Study Area .....         | 5  |
| Photograph 2. Intertidal Habitats in the Twin Lakes Study Area .....           | 7  |
| Photograph 3. Intertidal Habitats in the Vanderbilt Study Area.....            | 8  |
| Photograph 4. Intertidal Habitats in the Sunny Point East Study Area.....      | 8  |
| Photograph 5. Intertidal Habitats in the Sunny Point West Study Area .....     | 9  |
| Photograph 6. Intertidal Habitats in the Mendenhall Peninsula Study Area ..... | 10 |

## ATTACHMENTS

1. Intertidal Mapbook
2. Intertidal Habitat Profiles

# Acronyms and Abbreviations

|        |                                                           |
|--------|-----------------------------------------------------------|
| CBJ    | City and Borough of Juneau                                |
| DOT&PF | Alaska Department of Transportation and Public Facilities |
| GIS    | geographic information system                             |
| MHHW   | mean higher high water                                    |
| MLLW   | mean lower low water                                      |
| NEPA   | National Environmental Policy Act                         |
| PEL    | Planning and Environmental Linkages                       |

# 1. Introduction

The City and Borough of Juneau (CBJ) has partnered with Alaska Department of Transportation and Public Facilities (DOT&PF) to study a possible transportation corridor to connect Juneau with the northern end of Douglas Island. DOT&PF has chosen the Planning and Environmental Linkage (PEL) process to evaluate a purpose and need and recommend alternatives for such a connection. The PEL study considers potential crossing locations between Douglas Island and mainland Juneau in the channel area north of the existing Douglas Island Bridge. The analyses conducted for the PEL may be incorporated into a future National Environmental Policy Act (NEPA) review.

In April 2023, DOT&PF identified six alternatives to advance for detailed development in the Juneau Douglas North Crossing PEL Study (see Attachment 1, Page 1). To support further evaluation of these alternatives, the project team performed field surveys to expand our understanding of environmental resources potentially affected by each alternative. This report identifies the goals and objectives of the field survey effort for intertidal habitats, describes the methodology employed, summarizes the findings of the field surveys, and provides recommendations for refining the data that will support future evaluations.

The goal of the intertidal habitat survey was to develop detailed mapping that would serve as the basis for evaluating the potential impacts of each alternative on intertidal habitats. The following objectives were defined:

- Prepare a preliminary version of the intertidal habitat map using existing data.
- Perform field-based habitat surveys in the intertidal zone of the study area.
- Verify or refine the intertidal habitat map and calculate the area of each habitat type in the survey area.

# 2. Methods

Existing data that were identified and reviewed before beginning fieldwork included the following:

- Google Earth imagery.
- Multispectral Landsat Imaging (<https://earthexplorer.usgs.gov/>).
- USGS Topographic Data (<https://apps.nationalmap.gov/viewer/>).
- The Alaska ShoreZone mapping system (<https://alaskafisheries.noaa.gov/mapping/sz/>).
- USFWS National Wetlands Inventory (<https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/>).
- Maps and documents developed for prior studies of the Juneau Douglas North Crossing (e.g., Parametrix 2022; HDR 2005) as well as other relevant reports (e.g., FAA and CBJ 2007).

Pertinent data from these resources were incorporated into a geographic information system (GIS) geodatabase and used to develop a preliminary map of intertidal habitat types. Data was made accessible in an ESRI ArcGIS Online webmap developed specifically for the project.

Habitat type classifications for this study were developed based in part on the existing national schema (Cowardin et al. 1979) as well as on categories developed for the Juneau International Airport Environmental Impact Statement (FAA and CBJ 2007). A crosswalk of these classifications is

provided in Table 1. Some degree of modification and refinement of these classifications was necessary based on observed field conditions.

Table 1. Intertidal Habitat Type Definitions and Comparison to Other Classification Systems

| Habitat Type                    | NWI<br>(Cowardin et al.<br>1979) | Juneau Airport EIS<br>(FAA & CBJ 2007,<br>Table 3-29) | Description                                                                                                                                                                                                                                                                |
|---------------------------------|----------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subtidal                        | M1, E1, R1                       | Open Water                                            | These are areas that remain inundated at extreme low tides (approximately -4 feet relative to MLLW). Submerged aquatic vegetation may or may not be present.                                                                                                               |
| Lower intertidal mudflat        | E2 AB/SB/US                      | Unvegetated                                           | These areas are exposed at low tide and are unvegetated. They may include mud, sand, algal mats, and sparse vegetation.                                                                                                                                                    |
| Lower intertidal emergent marsh | E2 EM                            | Low Marsh                                             | These areas are exposed at low tide and are vegetated. They may include Pacific alkali grass, goosetongue, and Lyngbye's sedge communities.                                                                                                                                |
| Intertidal rocky                | E2 RS, M2 RS                     | N/A                                                   | These are areas of rocky or hard substrate anywhere in the intertidal zone.                                                                                                                                                                                                |
| Upper intertidal natural        | E2 SS/FO                         | High Marsh, Supratidal, Shrub-scrub, Forest           | These are areas in the upper portion of the intertidal zone that have established vegetation communities. They may include beach rye, coastal grass meadow, coastal forb meadow, reed canarygrass, deciduous shrub-scrub, deciduous forest, mixed woodland, spruce forest. |
| Upper intertidal developed      | Special modifiers<br>r,s,e       | Disturbed, Seeded<br>Grassland                        | These are areas in the upper portion of the intertidal zone that have been modified from the natural state. They may include human-created grassy areas, spoils, roadways, etc.                                                                                            |

Notes: Sources include Cowardin et al. 1979; HDR Inc. 2005; FAA and CBJ 2007; Parametrix 2022. MLLW = mean lower low water

The study area for each alternative was defined as all intertidal areas<sup>1</sup> within the anticipated construction footprint for that alternative, plus a 150-foot buffer in all directions. Biologists performing field surveys gained access to the study areas via public lands (typically Mendenhall Wetland State Game Refuge access points and CBJ- or State-owned parcels). Surveys were conducted between September 28 and October 1, 2023, when low tides (ideally less than -1 foot relative to mean lower low water [MLLW]) occurred during daylight hours.

Biologists walked the accessible portions of the intertidal study areas and ground-truthed the preliminary field maps with a Trimble DA2 Catalyst Global Navigation Satellite System GPS receiver with submeter accuracy and iPad controller running an ArcGIS Field Map application. Where the preliminary map appeared outdated or inaccurate compared to existing conditions, biologists delineated the boundaries of defined habitat types and uploaded data to the webmap. Other observations, such as relative tide level, submerged aquatic vegetation communities, plant species, sediment grain sizes, visible benthic epifauna, wildlife use, and other habitat features were documented with notes and photographs.

<sup>1</sup> For this study, the intertidal zone was considered elevations between the shallow subtidal (approximately -10 feet MLLW) and the upper limit of tidal influence on community structure (in some places up to +25 feet MLLW).

Three additional habitat types were added as options to reflect field conditions. The first type, called Channel, included areas that were within intertidal elevations (i.e., higher than -4 feet relative to MLLW) but that remained submerged at low tides due to freshwater drainage from local creeks. This habitat type was used to distinguish creek mouths from lower intertidal mudflat. All other non-intertidal land covers within the study areas were considered Upland. In this report, Upland is a catch-all term that may include developed areas, forested areas, freshwater wetlands, and streams. This term may be defined and used differently in the wetland report. Finally, a habitat type was added to capture the unique characteristics of Twin Lakes study area, where water is impounded year-round by human-made control structures. These lake areas are neither upland nor intertidal; they were dubbed Impounded.

### 3. Results

The observed distribution of intertidal habitat types in the study area for each alternative is illustrated in Attachment 1 and summarized in Table 2. The total number of acres of each study area varied considerably, as did the nature of intertidal habitats. These differences are described for each alternative below. A descriptive profile of each habitat type is provided in Attachment 2.

#### 3.1 Salmon Creek

The Salmon Creek study area covers a total of 79.5 acres, of which 28.2 acres are intertidal (Attachment 1, Page 2). The Salmon Creek alternative is the shortest alternative alignment, with an intertidal crossing distance<sup>2</sup> of approximately 2,100 feet. The study area includes the mouth of Salmon Creek where it flows under a bridge (Egan Drive) and an area of impounded water on the northeast side of Egan Drive where water levels are managed as part of Twin Lakes (Photograph 1A). It also includes the mouth of Falls Creek on Douglas Island. This alternative is one of only two that contain subtidal habitats due to its position at the head of Gastineau Channel, which is deeper to the southeast. The extensive unvegetated intertidal areas were characterized by mud and sand substrates, with scattered cobble and boulders. Proximity to the creek mouths resulted in other organic and inorganic debris across the beach and extensive mussel beds that have formed where hard attachment points exist (Photograph 1B).



**Photograph 1. Intertidal Habitats in the Salmon Creek Study Area**

1A (left): Mouth of Salmon Creek flowing under Egan Drive and across intertidal mudflat (upper right corner). Photo: NOAA ShoreZone  
1B (right): Intertidal mudflat with patchy coverage of blue mussels (*Mytilus edulis*) and rockweed (*Fucus* spp.). Photo facing northeast.

<sup>2</sup> Intertidal crossing distance is measured along the length of the alignment from MHHW on the Juneau side to MHHW on the Douglas Island side.



Table 2. Amount of Intertidal Habitat Type in Each Alternative Study Area, Rounded to the Nearest 10th Acre

| Alignment            | Intertidal Habitat Type |         |                          |                                 |                  |                          |                            | Other Type |        | Study Area Total |
|----------------------|-------------------------|---------|--------------------------|---------------------------------|------------------|--------------------------|----------------------------|------------|--------|------------------|
|                      | Subtidal                | Channel | Lower Intertidal Mudflat | Lower Intertidal Emergent Marsh | Rocky Intertidal | Upper Intertidal Natural | Upper Intertidal Developed | Impounded  | Upland |                  |
| Salmon Creek         | 5.6                     | 0.7     | 16.3                     | 3.0                             | -                | 1.1                      | 1.5                        | 4.2        | 47.1   | 79.5             |
| Twin Lakes           | -                       | 3.5     | 54.8                     | 1.7                             | -                | 0.4                      | 3.8                        | 15.8       | 29.6   | 109.4            |
| Vanderbilt           | -                       | 5.5     | 33.0                     | 24.1                            | -                | 13.3                     | 2.8                        | 13.6       | 36.5   | 128.7            |
| Sunny Point East     | -                       | 2.0     | 3.7                      | 21.5                            | -                | 17.9                     | -                          | -          | 35.0   | 80.1             |
| Sunny Point West     | -                       | 2.6     | 1.8                      | 17.4                            | -                | 16.1                     | -                          | -          | 109.2  | 147.1            |
| Mendenhall Peninsula | 36.6                    | -       | 29.2                     | 0.9                             | 0.1              | 0.8                      | -                          | -          | 155.3  | 222.8            |

## 3.2 Twin Lakes

The Twin Lakes study area covers a total of 109.4 acres, of which 64.1 acres are intertidal (Attachment 1, Page 3). Twenty-five percent of the intertidal area is northeast of Egan Drive, where water levels are controlled to maintain the Twin Lakes. The intertidal crossing distance of the Twin Lakes alignment is approximately 2,600 feet, but the study area also includes intertidal areas parallel and adjacent to Egan Drive for approximately 0.5 mile in either direction from where a crossing would connect. Within the study area, lower intertidal mudflat is the dominant habitat type (Photograph 2A), with a fringe of lower intertidal emergent marsh backed by an upper intertidal natural and developed. Channel areas correspond with culverts under Egan Drive, the mouth of Neilson Creek on Douglas Island, and the primary tidal channel(s) between Juneau and Douglas Island (Photograph 2B).



**Photograph 2. Intertidal Habitats in the Twin Lakes Study Area**

2A (left) Aerial view of the Twin Lakes alignment looking from Douglas Island across to Juneau. Photo: NOAA ShoreZone  
2B (right) Intertidal mudflat with sandbars and channels of standing water. Photo facing west.

## 3.3 Vanderbilt

The Vanderbilt study area covers a total of 128.7 acres, of which 78.6 acres are intertidal (Attachment 1, Page 4). Thirty-nine percent of the intertidal area is northeast of Egan Drive. The intertidal crossing distance of the Vanderbilt alignment is approximately 3,600 feet, but the study area also includes approximately 1.2 miles of the intertidal zone parallel and adjacent to Egan Drive, some of which overlaps the Twin Lakes study area. A mix of intertidal mudflat and emergent marsh are found in this study area between Juneau and Douglas Island (Photograph 3A). Channels are associated with culverts under Egan Drive, the outlet of Lemon Creek (Photograph 3B), and the primary tidal channel(s).



**Photograph 3. Intertidal Habitats in the Vanderbilt Study Area**

3A (left) Douglas Island intertidal zone with unvegetated mudflat in the foreground and lower emergent marsh and upper intertidal natural habitat types in the background. Photo facing northwest.

3B (right) Mouth of Lemon Creek with Egan Drive on the left side of the frame. Photo facing southeast.

## 3.4 Sunny Point East

The Sunny Point East study area covers a total of 80.1 acres, of which 45.1 acres are intertidal (Attachment 1, Page 5). All of the intertidal area is south of Egan Drive. The intertidal crossing distance of the Sunny Point East alignment is approximately 5,200 feet with roughly half of this length shared with the Sunny Point West alignment. In this study area, the intertidal zone is predominantly emergent and upper marsh, with a network of tidal channels and mudflat edges (Photographs 4A and 4B). On the north end, the border of the intertidal zone is subtle as the marsh vegetation communities transition from freshwater wetland to estuarine plant communities. The study area runs through an isolated upland area halfway across the marsh and then continues south along the same alignment as the Sunny Point West alternative.



**Photograph 4. Intertidal Habitats in the Sunny Point East Study Area**

4A (left) Aerial view of emergent marsh and tidal channel network. Photo: NOAA ShoreZone

4B (right) Small tidal channel fringed by Lyngbye's sedge. Photo facing east



### 3.5 Sunny Point West

The Sunny Point West study area covers a total of 147.1 acres, of which 37.9 acres are intertidal (Attachment 1, Page 6). All of the intertidal area is south of Egan Drive. The intertidal crossing distance of the Sunny Point West alignment is approximately 4,000 feet with roughly half of this length shared with the Sunny Point East alignment; therefore, the mosaic of habitat types is similar to those described above (Photographs 5A, 5B).

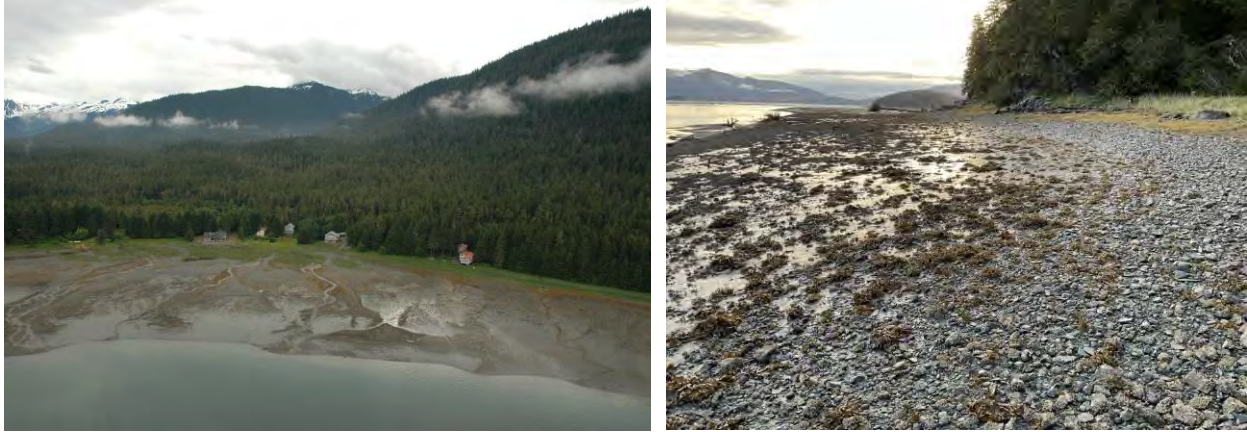


**Photograph 5. Intertidal Habitats in the Sunny Point West Study Area**

5A (left) Small tidal channel with mudflat and emergent marsh. Photo facing south.  
5B (right) Large tidal channel through the marsh. Photo facing west.

### 3.6 Mendenhall Peninsula

The Mendenhall Peninsula study area covers a total of 222.8 acres, of which 67.5 acres are intertidal (Attachment 1, Pages 7 and 8). The intertidal crossing distance of the Mendenhall Peninsula alignment is approximately 7,500 feet. This alternative contains the most subtidal habitat, spanning the head of Fritz Cove at the mouth of the Mendenhall River, and it also contains the only intertidal rocky habitat that was identified during the survey. The glacier-fed Mendenhall River supplies a large volume of freshwater and silt to this area; additionally, the mouth of Fish Creek on Douglas Island is east of the study area and contributes freshwater to the estuarine mixing zone (Photograph 6A). The upper portion of the unvegetated intertidal consisted of large gravels with barnacles, evidence of a higher-energy environment, and exposure to wave action, particularly on the north end of the study area (Photograph 6B).



**Photograph 6. Intertidal Habitats in the Mendenhall Peninsula Study Area**

6A (left) Aerial view of the south end of the study area, with the mouth Fish Creek to the left (out of frame) and alternative alignment on the right side of frame. Photo: NOAA ShoreZone

6B (right) Mudflat on Mendenhall Peninsula with rockweed attached to cobble (left), transitioning to a gravel beach with barnacles (right). Photo facing west

## 4. Recommendations/Additional Information Needs

The results of this survey largely confirm information from prior efforts to map intertidal and other types of habitat. Similar to previous studies, this survey effort documents a vertical gradient of habitats based on frequency and duration of inundation, along with a mosaic across the landscape based on proximity to deeper marine water and freshwater sources. Biologists performing the field surveys identified discrepancies between the previously mapped boundaries of these habitat types and those observed in the field. Those differences likely arise both from the application of different methodologies and from the dynamic nature of the intertidal environment, where conditions may change over time and maps must be frequently updated.

Further refinement of the habitat types into more specific categories may be possible. For example, it may be possible to denote differences in substrates or benthic infauna communities. However, this increased precision may not be useful for decision-making at the landscape level. Any proposed refinement of these habitat types should consider which specific attributes would be useful in distinguishing the potential impacts of the alternatives. Mapping refinements may also be necessary based on changes to the alternative alignments during the design process, consideration of construction methods, and the size of the buffer needed to incorporate all potential impacts.

This memo does not provide an analysis of the potential effects on intertidal habitats, nor is it intended to rank or prioritize the alternatives. Such assessments would be performed during the NEPA process, as part of a comprehensive review of the project.



## 5. References

- Beaudreau, A.H., C.A. Bergstrom, E.J. Whitney, D.H. Duncan, and N.C. Lundstrom. 2022. Seasonal and interannual variation in high-latitude estuarine fish community structure along a glacial to non-glacial watershed gradient in Southeast Alaska. *Environ. Biol. Fish* 105:431-452.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services. Washington, D.C. FWS/OBS-79/31.
- Federal Aviation Administration and City and Borough of Juneau, Alaska (FAA and CBJ). 2007. Juneau International Airport. Final EIS and Section 4(f) Evaluation.
- HDR Alaska, Inc. 2005. Draft Environmental Impact Statement (DEIS): Project Development Summary Report, Juneau Second Crossing. Prepared for Alaska Department of Transportation and Public Facilities. May 2005.
- Lundstrom, N.C., A.H. Beaudreau, F.J. Mueter, and B. Konar. 2022. Environmental drivers of nearshore fish community composition and size structure in glacially influenced Gulf of Alaska estuaries. *Estuaries and Coasts* 45:2151-2165.
- Parametrix. 2022. Wildlife and Fish Resources Technical Memorandum for the Juneau Douglas North Crossing PEL Study. April 21, 2022.

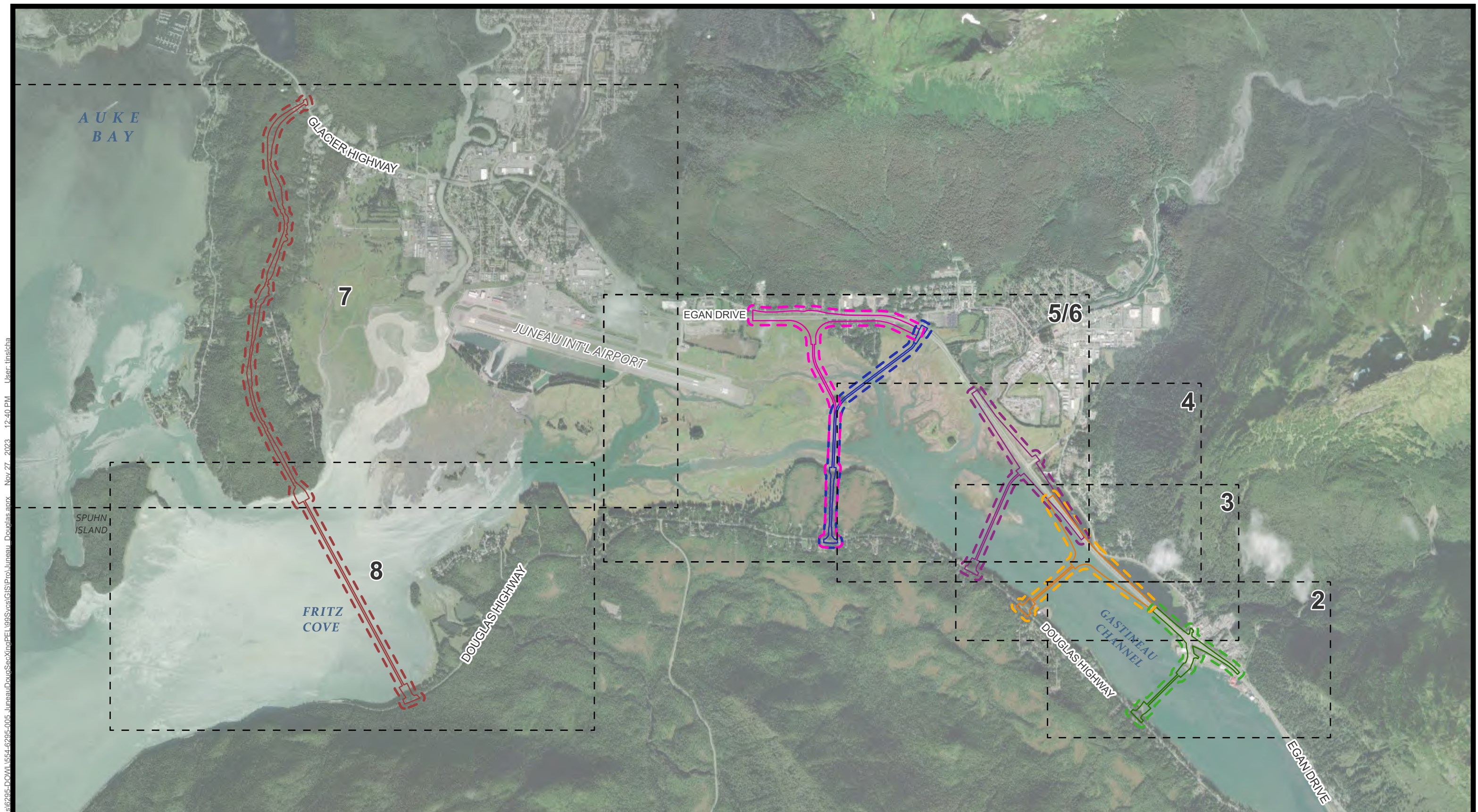


# **Attachment 1**

## **Intertidal Mapbook**



\\paramatrix.com\pmatrix\PSQ\Projects\Clients\6295-DOW\1554-6295-005 - JuneauDouglasSecXingPEL199Svcs\GIS\Pro\Juneau Douglas.aprx Nov 27, 2023 12:40 PM User: tinslcha



|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------|--|--|----------------------|--|--|------------|--|--|------------------|--|--|------------------|--|--|----------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------|--|------------------------------------|--|-------------------|--------------|
| <p>ALTERNATIVE FOOTPRINTS / STUDY AREAS</p> <table border="0"><tr><td></td><td>Salmon Creek Footprint</td><td></td></tr><tr><td></td><td>Twin Lakes Footprint</td><td></td></tr><tr><td></td><td>Vanderbilt</td><td></td></tr><tr><td></td><td>Sunny Point East</td><td></td></tr><tr><td></td><td>Sunny Point West</td><td></td></tr><tr><td></td><td>Mendenhall Peninsula</td><td></td></tr></table> <p>--- PAGE EXTENTS</p> <p>0 0.5 1 Miles</p> |                        | Salmon Creek Footprint |  |  | Twin Lakes Footprint |  |  | Vanderbilt |  |  | Sunny Point East |  |  | Sunny Point West |  |  | Mendenhall Peninsula |  | <p>Sources:<br/>1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.<br/>2: GOOGLE AERIAL IMAGERY</p> <p>NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)</p> | <p><b>INTERTIDAL HABITAT TYPES<br/>JUNEAU DOUGLAS SECOND<br/>CROSSING ALTERNATIVES<br/>PAGE 1 OF 8</b></p> <p>SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E<br/>SEC 1 - 12, 15 - 17, T 41S, R 66E;<br/>SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E</p> <p>COPPER RIVER MERIDIAN, ALASKA</p> |  | <table border="1"><tr><td colspan="2"><b>STATE OF ALASKA</b><br/>DEPARTMENT OF TRANSPORTATION<br/>AND PUBLIC FACILITIES</td></tr><tr><td colspan="2">DOT&amp;PF PROJECT NO. SFHWY00299/0003259<br/>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY</td></tr><tr><td colspan="2">CITY AND BOROUGH OF JUNEAU, ALASKA</td></tr><tr><td>NOVEMBER 27, 2023</td><td>ATTACHMENT A</td></tr></table> | <b>STATE OF ALASKA</b><br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES |  | DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |  | CITY AND BOROUGH OF JUNEAU, ALASKA |  | NOVEMBER 27, 2023 | ATTACHMENT A |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Salmon Creek Footprint |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Twin Lakes Footprint   |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Vanderbilt             |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sunny Point East       |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Sunny Point West       |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Mendenhall Peninsula   |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
| <b>STATE OF ALASKA</b><br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES                                                                                                                                                                                                                                                                                                                                                                     |                        |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY                                                                                                                                                                                                                                                                                                                                                                   |                        |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                                                                                                                                                                                                                                                                                                                                                                                  |                        |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |
| NOVEMBER 27, 2023                                                                                                                                                                                                                                                                                                                                                                                                                                   | ATTACHMENT A           |                        |  |  |                      |  |  |            |  |  |                  |  |  |                  |  |  |                      |  |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                               |  |                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                 |  |                                                                                   |  |                                    |  |                   |              |



\\paramatrix.com\pmatrix\Projects\Clients\6295-DOW\1554-6295-005 - JuneauDouglasSec2ndCrossingPEL199Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:09 PM User: tinscha



SALMON CREEK STUDY AREA

ALTERNATIVE FOOTPRINTS

Salmon Creek Footprint

Twin Lakes Footprint

Vanderbilt

Sunny Point East

Sunny Point West

Mendenhall Peninsula

INTERTIDAL HABITAT¹

Subtidal

Channel

Lower Intertidal Mudflat

Lower Intertidal Emergent Marsh

Intertidal Rocky

Upper Intertidal Natural

Upper Intertidal Developed

Impounded

Upland

0

500

1,000

Feet

Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

INTERTIDAL HABITAT TYPES

SALMON CREEK

PAGE 2 OF 8

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E

SEC 1 - 12, 15 - 17, T 41S, R 66E;

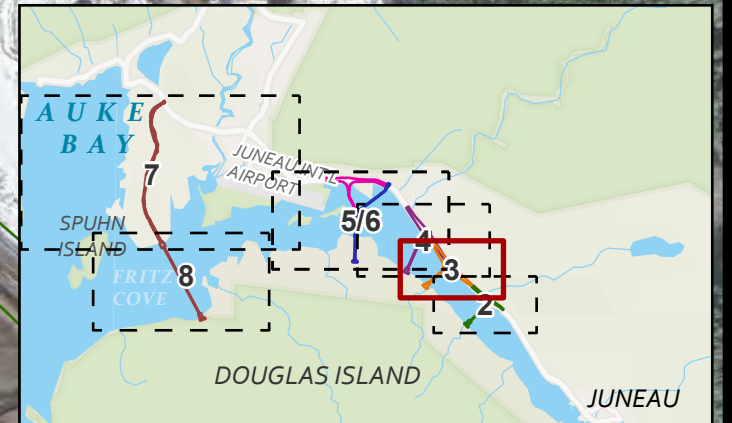
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA

|                                                                                   |              |
|-----------------------------------------------------------------------------------|--------------|
| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES          |              |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                |              |
| NOVEMBER 27, 2023                                                                 | ATTACHMENT A |



\\paramatrix.com\pmatrix\PSQ\Projects\Clients\6295-DOW\1554-6295-005 - JuneauDougSecXingPEL199Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:09 PM User: tinscha



- TWIN LAKES STUDY AREA**
- ALTERNATIVE FOOTPRINTS**
- Salmon Creek Footprint
  - Twin Lakes Footprint
  - Vanderbilt
  - Sunny Point East
  - Sunny Point West
  - Mendenhall Peninsula

- INTERTIDAL HABITAT<sup>1</sup>**
- Subtidal
  - Channel
  - Lower Intertidal Mudflat
  - Lower Intertidal Emergent Marsh
  - Intertidal Rocky
  - Upper Intertidal Natural
  - Upper Intertidal Developed
  - Impounded
  - Upland

Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

### INTERTIDAL HABITAT TYPES TWIN LAKES PAGE 3 OF 8

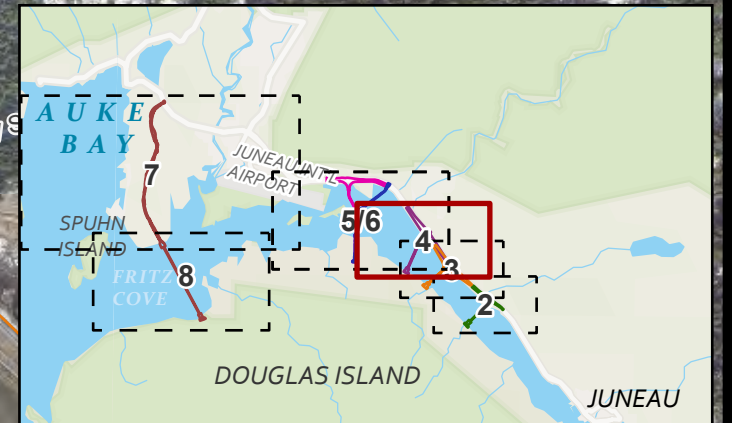
SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES          |              |
|-----------------------------------------------------------------------------------|--------------|
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                |              |
| NOVEMBER 27, 2023                                                                 | ATTACHMENT A |



\\paramatrix.com\pmatrix\Projects\Clients\6295-DOW\1554-6295-005\_Juneau\DouglasSecondCrossing\PEL199\Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:09 PM User: tinscha



VANDERBILT STUDY AREA

ALTERNATIVE FOOTPRINTS

Salmon Creek Footprint

Twin Lakes Footprint

Vanderbilt

Sunny Point East

Sunny Point West

Mendenhall Peninsula

INTERTIDAL HABITAT<sup>1</sup>

Subtidal

Channel

Lower Intertidal Mudflat

Lower Intertidal Emergent Marsh

Intertidal Rocky

Upper Intertidal Natural

Upper Intertidal Developed

Impounded

Upland

0

500

1,000

Feet

Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

INTERTIDAL HABITAT TYPES

VANDERBILT

PAGE 4 OF 8

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E

SEC 1 - 12, 15 - 17, T 41S, R 66E;

SEC 4 - 10, 15 - 17, 21 - 23, T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA

|                                                                                   |              |
|-----------------------------------------------------------------------------------|--------------|
| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES          |              |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                |              |
| NOVEMBER 27, 2023                                                                 | ATTACHMENT A |



\\paramatrix.com\pmatrix\Projects\Clients\6295-DOW\1554-6295-005\_JuneauDouglasSecXingPEL199Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:11 PM User: tinscha



- SUNNY POINT EAST STUDY AREA**
- ALTERNATIVE FOOTPRINTS**
- Salmon Creek Footprint
  - Twin Lakes Footprint
  - Vanderbilt
  - Sunny Point East
  - Sunny Point West
  - Mendenhall Peninsula

- INTERTIDAL HABITAT<sup>1</sup>**
- Subtidal
  - Channel
  - Lower Intertidal Mudflat
  - Lower Intertidal Emergent Marsh
  - Intertidal Rocky
  - Upper Intertidal Natural
  - Upper Intertidal Developed
  - Impounded
  - Upland
- 0 500 1,000 Feet

Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

**INTERTIDAL HABITAT TYPES  
SUNNY POINT EAST  
PAGE 5 OF 8**

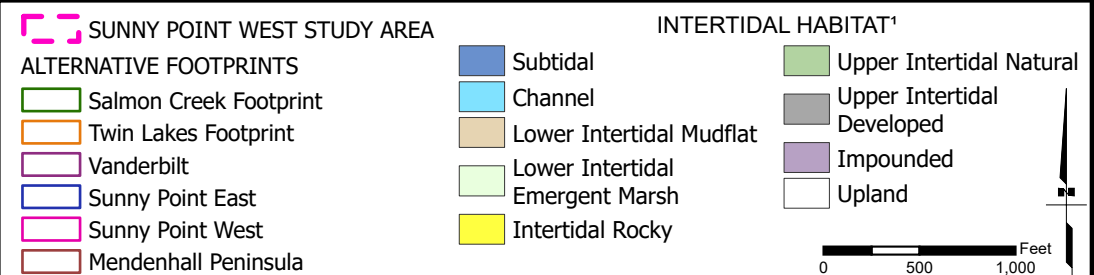
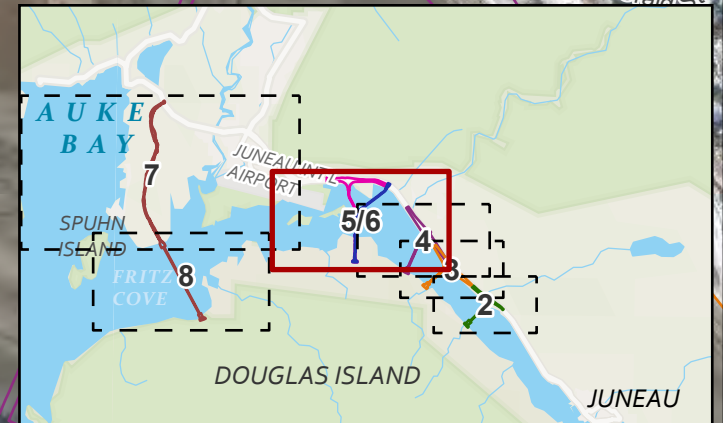
SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES          |              |
|-----------------------------------------------------------------------------------|--------------|
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                |              |
| NOVEMBER 27, 2023                                                                 | ATTACHMENT A |



\\paramatrix.com\pmatrix\Projects\Clients\6295-DOW\1554-6295-005\_JuneauDouglasSecXingPEL199Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:11 PM User: tinscha



Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

**INTERTIDAL HABITAT TYPES  
SUNNY POINT WEST  
PAGE 6 OF 8**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

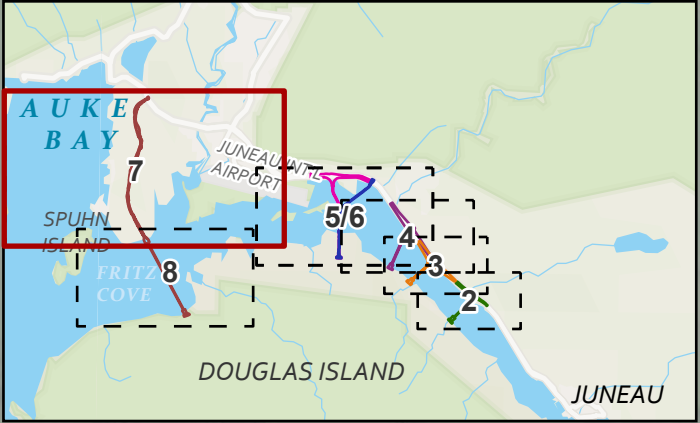
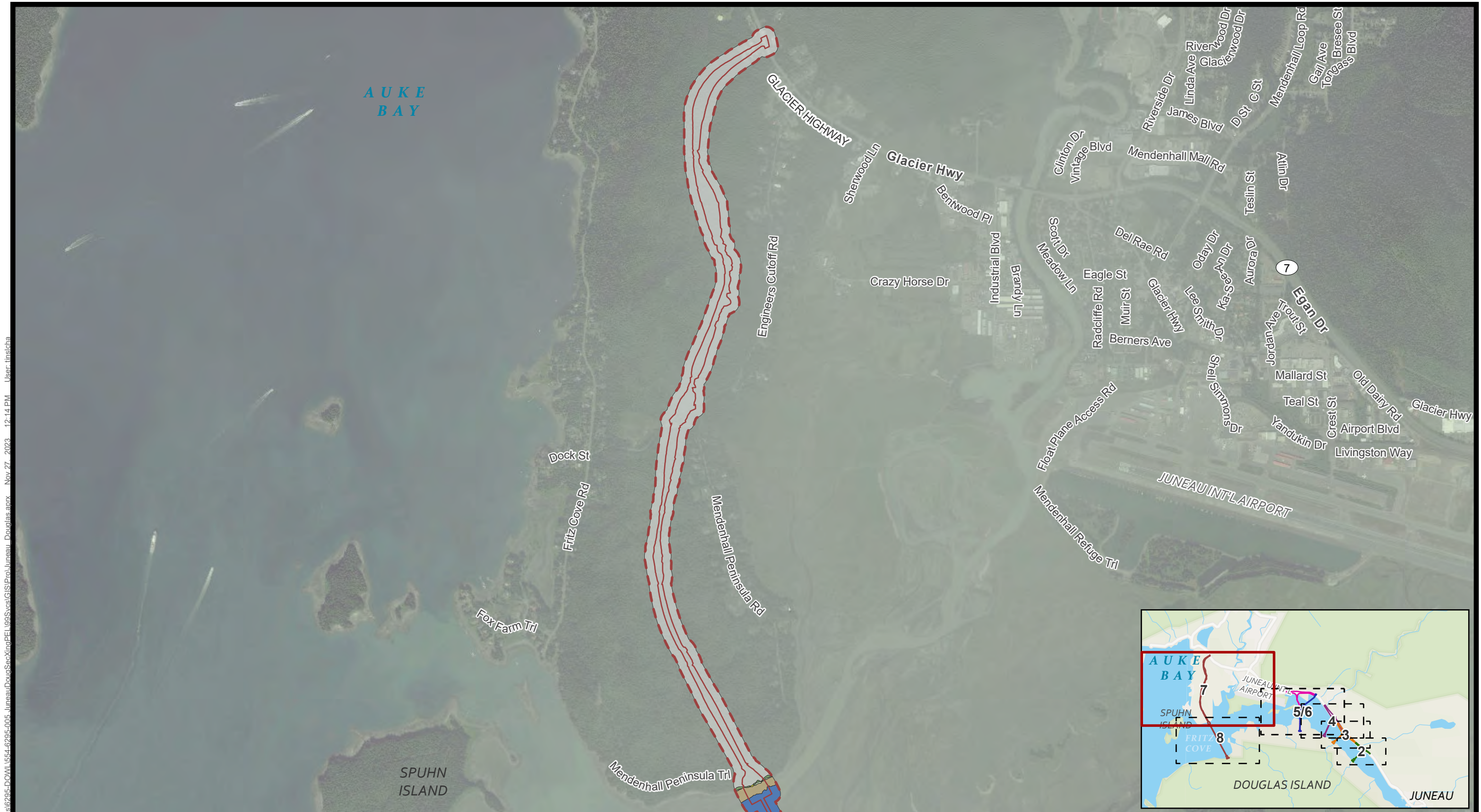
DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS SECOND CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

NOVEMBER 27, 2023 ATTACHMENT A



\\parametrix.com\pmx\Projects\Clients\6295-DOW\1554-6295-005\_JuneauDouglasSecXingPEL199\Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:14 PM User: tinscha



**MENDENHALL PENINSULA STUDY AREA**

**ALTERNATIVE FOOTPRINTS**

- Salmon Creek Footprint
- Twin Lakes Footprint
- Vanderbilt
- Sunny Point East
- Sunny Point West
- Mendenhall Peninsula

**INTERTIDAL HABITAT¹**

- Subtidal
- Channel
- Lower Intertidal Mudflat
- Lower Intertidal Emergent Marsh
- Intertidal Rocky
- Upper Intertidal Natural
- Upper Intertidal Developed
- Impounded
- Upland

0 500 1,000 Feet

Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

**INTERTIDAL HABITAT TYPES  
MENDENHALL PENINSULA (NORTH)  
PAGE 7 OF 8**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

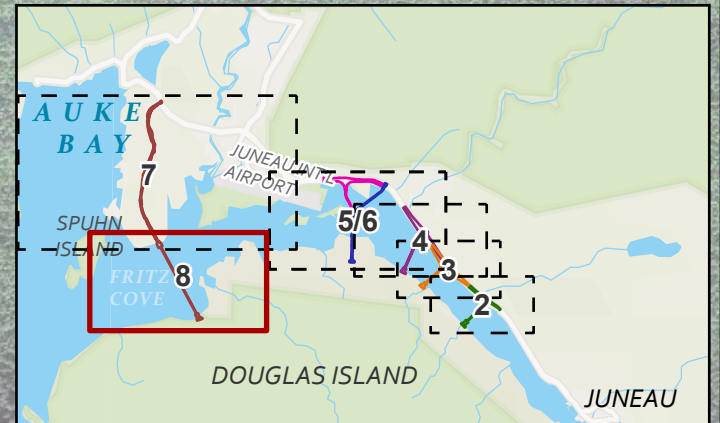
COPPER RIVER MERIDIAN, ALASKA



| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES          |              |
|-----------------------------------------------------------------------------------|--------------|
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                |              |
| NOVEMBER 27, 2023                                                                 | ATTACHMENT A |



\\paramatrix.com\pmatrix\PSQ\Projects\Clients\6295-DOW\1554-6295-005 - Juneau\DougSecXingPEL199\Svcs\GIS\Pro\Juneau\_Douglas.aprx Nov 27, 2023 12:15 PM User: tinscha



MENDENHALL PENINSULA STUDY AREA

ALTERNATIVE FOOTPRINTS

Salmon Creek Footprint

Twin Lakes Footprint

Vanderbilt

Sunny Point East

Sunny Point West

Mendenhall Peninsula

INTERTIDAL HABITAT¹

Subtidal

Channel

Lower Intertidal Mudflat

Lower Intertidal Emergent Marsh

Intertidal Rocky

Upper Intertidal Natural

Upper Intertidal Developed

Impounded

Upland

0

500

1,000

Feet

Sources:  
1: NATIONAL WETLAND INVENTORY, TOPOGRAPHY DERIVED FROM LIDAR (2013 AND 2021), FIELD VERIFICATION ON SEPTEMBER 27-29, 2023.  
2: GOOGLE AERIAL IMAGERY

NOTE: "UPLAND" INCLUDES ALL NON-INTERTIDAL LAND COVERS (E.G., FORESTED, FRESHWATER WETLAND, DEVELOPED, ETC.)

**INTERTIDAL HABITAT TYPES  
MENDENHALL PENINSULA (SOUTH)  
PAGE 8 OF 8**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES          |              |
|-----------------------------------------------------------------------------------|--------------|
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS SECOND CROSSING PEL STUDY |              |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                                |              |
| NOVEMBER 27, 2023                                                                 | ATTACHMENT A |



# **Attachment 2**

## **Intertidal Habitat Profiles**





| Habitat Type Profile: Subtidal                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Description</b>                                                                  | <p>Subtidal areas remain inundated at extreme low tides (approximately -4 feet relative to mean lower low water [MLLW]). The substrate may be mud, sand, gravel, or rocky. Submerged aquatic vegetation (such as eelgrass) may or may not be present.</p> <p>In most cases, the boundary of this habitat type was estimated based on aerial photographs and field-verified at the lowest tide available.</p>                                                                                                                       |
| <b>Characteristic Flora</b>                                                         | Submerged aquatic vegetation (e.g., eelgrass, macroalgae)                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Characteristic Fauna</b>                                                         | <p><b>Birds:</b> American wigeon, bufflehead, Canada goose, common merganser, greater scaup, green-winged teal, hooded merganser, lesser scaup, mallard, northern pintail, northern shoveler, ring-necked duck, surf scoter</p> <p><b>Fish:</b> Pacific herring, Pacific staghorn sculpin, starry flounder, rock sole, Pacific sand lance, salmonids</p> <p><b>Mammals:</b> harbor seal, river otter, Steller sea lion</p> <p><b>Invertebrates:</b> crabs, shrimp, sessile benthic marine invertebrates, Pacific giant octopus</p> |
| <b>Other Comments</b>                                                               | The only subtidal habitat identified was in the Salmon Creek and Mendenhall Peninsula study areas. Other areas that remained submerged at low tide were characterized as Channel.                                                                                                                                                                                                                                                                                                                                                  |

| Habitat Type Profile: Channel                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Description</b>                                                                  | Channel areas are above MLLW but remain inundated at low tides due to delayed drainage from tidal or freshwater sources. The substrate may be unvegetated mud, sand, or gravel.                                                                                                                                                                                                                                                                                                                                          |
| <b>Characteristic Flora</b>                                                         | Unvegetated; occasional filamentous algae                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Characteristic Fauna</b>                                                         | <p><b>Birds:</b> American crow, American wigeon, bald eagle, Bonaparte's gull, bufflehead, Canada goose, California gull, glaucous-winged gull, green-winged teal, herring gull, mallard, northern pintail, northern shoveler, ring-necked duck, short-billed gull</p> <p><b>Fish:</b> juvenile flatfish, starry flounder, Pacific sand lance, Pacific staghorn sculpin, snake prickleback, yellowfin sole, salmonids</p> <p><b>Mammals:</b> river otter</p> <p><b>Invertebrates:</b> crabs, shrimp, benthic infauna</p> |
| <b>Other Comments</b>                                                               | Channels are found at the mouths of local creeks, where they have been formed by freshwater runoff across the tide flats as well as by depressions within the salt marsh that retain water even at low tide, when most tidal channels or sloughs are dry.                                                                                                                                                                                                                                                                |



### Habitat Type Profile: Lower Intertidal Mudflat/Unvegetated



|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>          | Lower intertidal mudflat includes all areas that are exposed at low tide that are unvegetated; typically from the subtidal zone up to +10 ft MLLW. May include mud, sand, algal mats, brown and green algae, and sparse vegetation. Cobble and boulders may be present, which allow for colonization by blue mussels, barnacles, and other invertebrates.                                                                                                |
| <b>Characteristic Flora</b> | Brown algae (i.e., <i>Fucus</i> spp.)<br>Green algae spp.                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Characteristic Fauna</b> | <b>Birds:</b> American crow, American pipit, American wigeon, bald eagle, Bonaparte's gull, California gull, glaucous-winged gull, greater yellowlegs, green-winged teal, herring gull, least sandpiper, lesser yellowlegs, mallard, short-billed gull, pectoral sandpiper, semipalmated plover, western sandpiper<br><b>Mammals:</b> river otter, mink<br><b>Invertebrates:</b> amphipods, isopods, snails, clams, polychaete worms, mussels, barnacles |
| <b>Other Comments</b>       | This unvegetated intertidal habitat type includes a wide range of substrates, from silt, mud, sand, gravel to intermittent cobble/boulder. Additionally, mussel beds and macroalgae are common in higher-energy locations.                                                                                                                                                                                                                               |



### Habitat Type Profile: Lower Intertidal Emergent Marsh



|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>          | <p>These are areas that are frequently inundated but exposed at low tide and are vegetated with vascular plants. Communities may include Pacific alkali grass, goosetongue, and Lyngbye's sedge.</p> <p>These are typically found between approximately +10 ft MLLW to +16 ft MLLW (the mean higher high water [MHHW] elevation is 16.3 ft).</p>                                                                                                                                                                                                                                           |
| <b>Characteristic Flora</b> | <p>Lyngbye's sedge (<i>Carex lyngbyei</i>)<br/> arrowgrass (<i>Triglochin maritimum</i>)<br/> beach rye (<i>Leymus mollis</i>)<br/> Canadian sandspurry (<i>Spergularia canadensis</i>)<br/> Gmelin's saltweed (<i>Atriplex gmelinii</i>)<br/> goosetongue (<i>Plantago maritima</i>)<br/> low chickweed (<i>Stellaria humifusa</i>)<br/> Pacific alkali grass (<i>Puccinellia nutkaensis</i>)<br/> sea milkwort (<i>Glaux maritima</i>)<br/> seabeach sandwort (<i>Honckenya peploides</i>)<br/> seablite (<i>Suaeda calceoliformis</i>)<br/> silverweed (<i>Potentilla anserina</i>)</p> |
| <b>Characteristic Fauna</b> | <p><b>Birds:</b> American pipit, Canada goose, dabbling ducks (e.g., mallard, green-winged teal), dunlin, great blue heron, greater white-fronted goose, gulls, merlin, northern harrier, swans, whimbrel<br/> <b>Fish:</b> salmonids, sculpins, sticklebacks<br/> <b>Mammals:</b> black bear, river otter, mink</p>                                                                                                                                                                                                                                                                       |
| <b>Other Comments</b>       | <p>The upper extent of Lyngbye's sedge typically denotes the break between low and high marsh.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



### Habitat Type Profile: Intertidal Rocky



|                             |                                                                                                                                                                                                                   |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>          | These are areas of rocky or hard substrate anywhere within the intertidal zone.                                                                                                                                   |
| <b>Characteristic Flora</b> | Lyngbye's sedge ( <i>Carex lyngbyei</i> )<br>beach rye ( <i>Leymus mollis</i> )<br>mosses<br>lichens                                                                                                              |
| <b>Characteristic Fauna</b> | <b>Birds:</b> American crow, black oystercatcher, common raven, great blue heron, plovers, ruddy turnstone, sandpipers, surfbird<br><b>Invertebrates:</b> barnacles, chitons, isopods, limpets, sea stars, snails |
| <b>Other Comments</b>       | This habitat type was only observed in the Mendenhall Peninsula study area, although isolated boulders within the mudflats and riprap can function similarly in other study areas.                                |



| Habitat Type Profile: Upper Intertidal Natural                                      |                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                                                                                                                                                                                                                 |
| <b>Description</b>                                                                  | These are areas in the upper portion of the intertidal zone that have established vegetation communities. They may include beach rye, coastal grass meadow, coastal forb meadow, reed canarygrass. They are typically found above MHHW elevation.               |
| <b>Characteristic Flora</b>                                                         | beach rye<br>beach pea<br>cow parsnip<br>fireweed<br>foxtail barley<br>hemlock parsley<br>kneeling angelica<br>Lyngbye's sedge<br>Nootka lupine<br>red fescue<br>tufted hairgrass<br>yarrow                                                                     |
| <b>Characteristic Fauna</b>                                                         | <b>Birds:</b> American crow, American kestrel, American pipit, greater white-fronted goose, Lapland longspur, merlin, northern harrier, short-eared owl, snow goose<br><b>Mammals:</b> black bear, long-tailed vole, mink, river otter, Sitka black-tailed deer |
| <b>Other Comments</b>                                                               | This habitat type begins immediately above the Lyngbye's sedge community and extends to the upper limits of tidal influence.                                                                                                                                    |



### Habitat Type Profile: Upper Intertidal Developed



|                             |                                                                                                                                                                                         |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>          | These are areas in the upper portion of the intertidal zone that have been modified from the natural state. They may include human-created grassy areas, spoils, roadways, riprap, etc. |
| <b>Characteristic Flora</b> | Sitka willow saplings<br>Sitka spruce saplings<br>pasture grasses<br>fireweed<br>beach rye<br>mosses                                                                                    |
| <b>Characteristic Fauna</b> | <b>Birds:</b> American crow, bald eagle, European starling, gulls                                                                                                                       |
| <b>Other Comments</b>       | A developed shoreline was found predominantly on the Juneau side of the Gastineau Channel, with the riprap-protected roadway prism along Egan Drive.                                    |



# TIER 1 EELGRASS DELINEATION REPORT

Juneau Douglas North Crossing PEL Study

1138.63234.01

Prepared for:

Alaska Department of Transportation and Public Facilities South Coast Region  
6860 Glacier Highway  
Juneau, AK 99811

Prepared by:

DOWL  
5015 Business Park Blvd  
Suite 4000  
Anchorage, AK 99503

FEB 2024

# TABLE OF CONTENTS

|                                   |          |
|-----------------------------------|----------|
| <b>APPENDICES</b> .....           | <b>I</b> |
| <b>1.0 INTRODUCTION</b> .....     | <b>1</b> |
| 1.1 Study Area .....              | 1        |
| 1.2 Previous Investigations ..... | 1        |
| <b>2.0 METHODS</b> .....          | <b>2</b> |
| <b>3.0 RESULTS</b> .....          | <b>3</b> |
| <b>4.0 DISCUSSION</b> .....       | <b>4</b> |
| <b>5.0 REFERECES</b> .....        | <b>5</b> |

## PHOTO SETS

|                                                                                 |   |
|---------------------------------------------------------------------------------|---|
| Photoset 1: Location on south end of the proposed Salmon Creek Alignment, ..... | 4 |
|---------------------------------------------------------------------------------|---|

## TABLES

|                                                                  |   |
|------------------------------------------------------------------|---|
| Table 1: Project Location within the Copper River Meridian ..... | 1 |
| Table 2: Alignment Traverse and Tide Stage .....                 | 3 |
| Table 3: Eelgrass Survey Summary of Findings.....                | 4 |

## APPENDICES

Figures



## 1.0 INTRODUCTION

The City and Borough of Juneau has partnered with Alaska Department of Transportation and Public Facilities to explore a north crossing between Juneau and Douglas Island, north of the existing Douglas Island Bridge. DOT&PF has chosen the Planning and Environmental Linkage (PEL) process to evaluate the purpose and need for a north crossing, identify potential north crossing alternatives, evaluate the alternatives, and identify recommended crossing(s). In support of the evaluation of alternatives environmental data is being collected to understand potential impacts of six proposed alternatives. One study being undertaken to collect current data on proposed alternatives is a wetland delineation.

### 1.1 Study Area

The study area is within six potential crossing alignments: Mendenhall Peninsula, Sunny Point West, Sunny Point East, Vanderbilt, Twin Lakes, and Salmon Creek. The study area encompasses a 150-foot buffer zone for each of six potential proposed bridge alignments across Gastineau Channel (Figure 1).

The approximate 695.5 study area includes the tidally influenced Gastineau Channel between Douglas Island and mainland Juneau, Alaska. The Mendenhall Wetlands State Game Refuge (MWSGR) is located between Juneau and Douglas from the Mendenhall Peninsula to approximately the intersection of Glacier Highway and Channel Drive. The beginning of the project is located 58.341963 North Latitude; -134.628022 West Longitude and the end of the project is located at 58.299292 North Latitude; -134.429609 West Longitude, Copper River Meridian, see Table 1 for Township, Range, Section (Figure 1).

*Table 1: Project Location within the Copper River Meridian*

| Township | Range   | Sections                                          |
|----------|---------|---------------------------------------------------|
| 40 South | 65 East | 25, 26, 27, 34, 36                                |
| 40 South | 66 East | 30, 31, 32, 33, 34                                |
| 41 South | 66 East | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17 |

### 1.2 Previous Investigations

Biological mapping units were acquired from the National Oceanic and Atmospheric Administration National Marine Fisheries Service's ShoreZone website. Patchy eelgrass is mapped on the south shore of the Salmon Creek crossing (Figure 1).

## 2.0 METHODS

---

Each proposed crossing alternative was traversed and photo points were used to document representative locations of the traversed area and document the presence or absence of eelgrass. Photos of the substrate were taken to document whether the conditions were appropriate for eel grass growth. Areas were not traversed if during the survey the area was under greater than one foot of water or was unconsolidated mud. As eelgrass was identified, a Tier 1 Delineation Survey (USACE, 2018) was conducted to define and delineate eelgrass bed boundaries. The survey identified eelgrass boundaries, spatial distribution (continuous or patchy), and relationship to tidal elevation(s). Density of eelgrass beds is not part of this survey and a more detailed survey may be needed prior to initiation of the Project.

Eelgrass bed boundaries were identified using Method B (eelgrass within one square meter quadrat and within one meter of another shoot); for small beds (i.e., contained within the alignment buffer zone) the perimeter of the bed would be mapped, for large beds (i.e., extending outside of the alignment buffer), beds would be mapped using transects (spaced between three and twelve meters). Geo-referenced photographs were taken of all identified eelgrass beds. If individual eelgrass beds were spaced less than sixteen feet (five meters) apart, each individual bed will not be delineated. However, mapping will identify the outer boundaries of these discontinuous beds and identify it as a patchy eelgrass bed. In areas where there are too few eelgrass shoots to meet the bed threshold, then a note in the report will indicate eelgrass is present, but no discernable beds.

Data collection was conducted per US Army Corps of Engineers *Components of a Complete Eelgrass Delineation Report*.

### 3.0 RESULTS

The eelgrass survey was conducted by David DeKrey and Tad Schwager September 27<sup>th</sup> through 29<sup>th</sup>, 2023. Survey activities were conducted during daylight hours within four hours of low tide (typical range between -0.27 and +6.15 reference mean low low water). Each proposed bridge alternative was traversed to approximate mean low low water (Table 1).

*Table 2: Alignment Traverse and Tide Stage*

| Alignment        | Date (2023)  | Start Time | End Time | Tide Stage |
|------------------|--------------|------------|----------|------------|
| Mendenhall       | September 28 | 6:01 PM    | 6:48 PM  | Ebb        |
|                  | September 29 | 5:12 PM    | 6:06 PM  | Ebb        |
| Sunny Point West | September 29 | 9:23 AM    | 10:51 AM | Flow       |
| Sunny Point East | September 29 | 10:09 AM   | 12:09 PM | Flow       |
| Vanderbilt       | September 27 | 5:40 PM    | 5:48 PM  | Ebb        |
|                  | September 28 | 8:16 AM    | 9:05 AM  | Flow       |
| Twin Lakes       | September 28 | 7:06 AM    | 8:03 AM  | Flow       |
|                  | September 27 | 6:01 PM    | ~6:29 PM | Ebb        |
| Salmon Creek     | September 27 | ~6:29 PM   | 6:40 PM  | Flow       |
|                  | September 28 | 9:06 AM    | 10:01 AM | Flow       |

Only one location documented “dwarf” eelgrass *Zostera japonica* outside the study area (approximately 25 feet) on the south side of the Salmon Creek alternative (Table 3, Photo Set 1, and Figure 2).



Table 3: Eelgrass Survey Summary of Findings

| Site Name | Date      | Time    | Tide Stage  | Approximate Contour (feet) | Eelgrass Present |
|-----------|-----------|---------|-------------|----------------------------|------------------|
| EG1       | 9/27/2023 | 6:25 PM | Ebb Current | 0.3                        | Yes              |



Photo Set 1: Location on south end of the proposed Salmon Creek Alignment

Note: Left photo view is oriented toward the northeast across the Eelgrass bed, and right photo view is oriented down on the Eelgrass bed

## 4.0 DISCUSSION

The National Oceanic and Atmospheric Administration Alaska ShoreZone Mapping (NOAA, 2023) has mapped patchy eelgrass on the south shore near the Salmon Creek alignment. No eelgrass was previously identified at any of the alignments between 2004 and 2011 (Harris et al., 2008, Harris et al., 2012). Based on these previous surveys and the survey conducted in 2023, the proposed alignments are absent the presence of eelgrass. However, the proposed Salmon Creek alignment is adjacent to a patchy eelgrass bed. Changes in the project may require additional eelgrass survey on the southside of the proposed Salmon Creek alignment.

## 5.0 REFERECES

---

Harris, P.M., A.D. Neff, S.W. Johnson, and J.F. Thedinga. 2008. *Eelgrass habitat and faunal assemblages in the City and Borough of Juneau, Alaska*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-AFSC-182, page 46.

Harris, P.M., A.D. Neff, S.W. Johnson. 2012. *Changes in eelgrass habitat and faunal assemblages associated with coastal development in Juneau, Alaska*. U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-AFSC-240, page 47.

National Oceanic and Atmospheric Administration. 2023. *Alaska ShoreZone Mapping Website*. <https://alaskafisheries.noaa.gov/mapping/sz/> Accessed August 29, 2023.

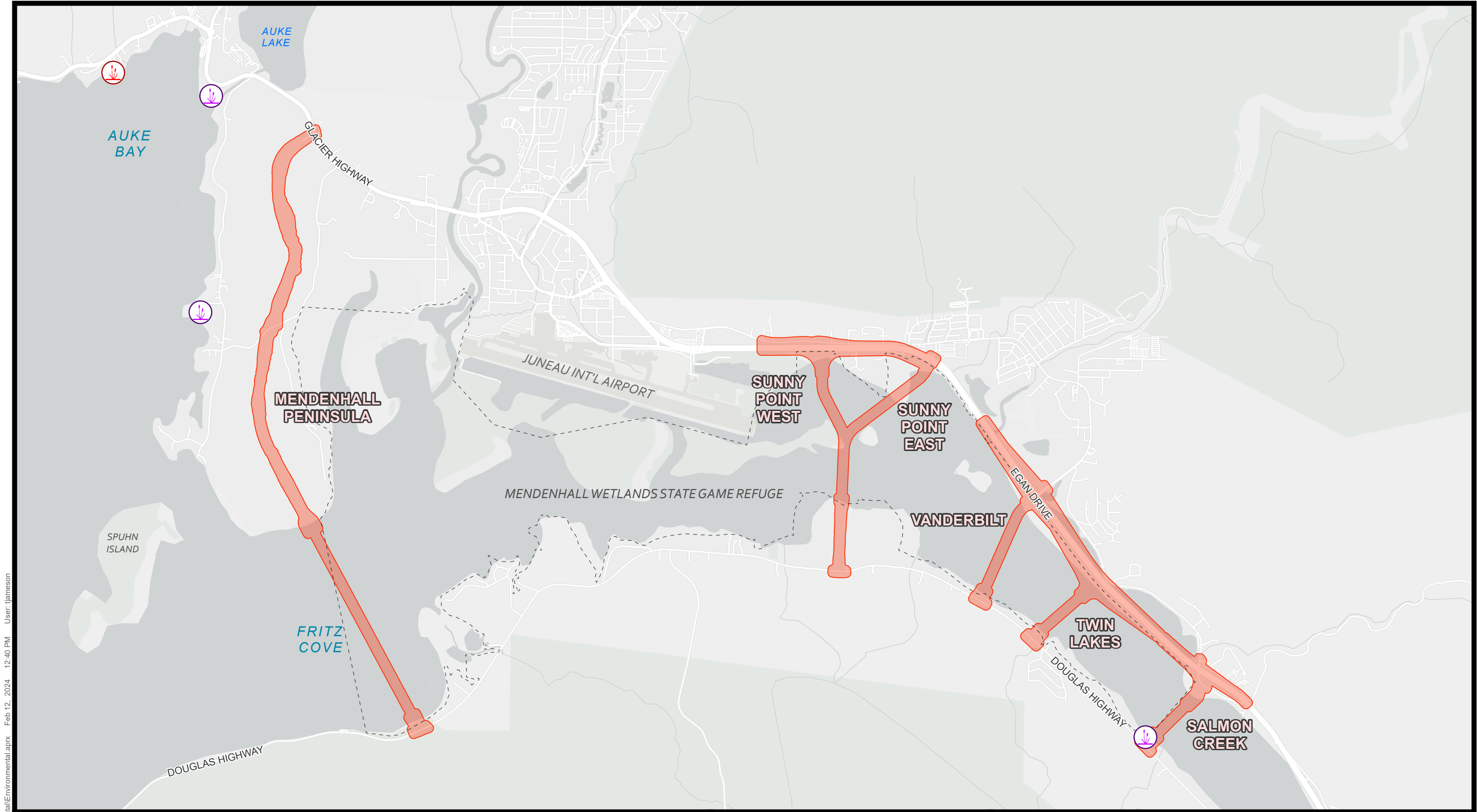
U.S. Army Corps of Engineers. 2018. *Components of a Complete Eelgrass Delineation Report*.

# FIGURES





J:\38\63234-01\60GIS\Carto\Environmental\Environmental.aprx Feb 12, 2024 12:40 PM User: Jameson



|            |  |                       |                   |
|------------|--|-----------------------|-------------------|
| STUDY AREA |  | NOAA MAPPED EEL GRASS | ADF&G GAME REFUGE |
|            |  | CONTINUOUS            |                   |
|            |  | PATCHY                |                   |

### EEL GRASS LOCATION

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA

**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

|                   |          |
|-------------------|----------|
| FEBRUARY 12, 2024 | FIGURE 1 |
|-------------------|----------|

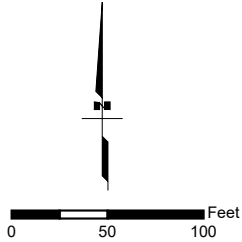
Imagery Credits: Light Gray Base: State of Alaska, Esri Canada, Esri, TomTom, Garmin, SafeGraph, MET/MASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, NRCAN, Parks Canada



J:\3863234-0160GIS\Carto\Environmental\Environmental.aprx Feb 12, 2024 12:41 PM User: Jameson



STUDY AREA FIELD VERIFIED EEL GRASS NOAA MAPPED EEL GRASS (PATCHY)



FIELD MAPPED EEL GRASS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



|                                                                                  |          |
|----------------------------------------------------------------------------------|----------|
| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES         |          |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS NORTH CROSSING PEL STUDY |          |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                               |          |
| FEBRUARY 12, 2024                                                                | FIGURE 2 |

# TECHNICAL MEMORANDUM

TO: Greg Lockwood, PE  
FROM: David Barrick, PE, and Chloe Jungwirth, EIT  
DATE: June 5, 2024  
PROJECT: **Juneau Douglas Second Channel Crossing, Juneau, Alaska.**  
**DOT&PF Project Numbers: SFHWY00299/0003259**  
**DRAFT Geophysics Data Summary Memorandum**

---

This memorandum provides subsurface data from eight seismic and two electrical resistivity transects collected during our geophysical exploration conducted February 13 through 17, 2024.

## Purpose and Scope of Work

The City and Borough of Juneau has partnered with Alaska Department of Transportation and Public Facilities (DOT&PF) to explore a north crossing between Juneau and Douglas Island, north of the existing Douglas Island Bridge. DOT&PF has chosen the Planning and Environmental Linkage (PEL) process to evaluate the purpose and need for a north crossing, identify potential north crossing alternatives, evaluate the alternatives, and identify recommended crossing(s). In support of the evaluation of alternatives environmental data is being collected to understand potential impacts of six proposed alternatives. One study being undertaken to collect current data on proposed alternatives is a seismic investigation. The seismic investigation intends to provide an understanding of bedrock depth within the proposed second connections crossing Gastineau Channel between mainland Juneau and Douglas Island. Geophysical data was collected on five proposed crossing alternatives: Salmon Creek, Twin Lakes, Vanderbilt, Sunny Point East, and Sunny Point West.

## Field Investigation

The seismic data collection transects extended inward toward the channel center from approximately each proposed crossing abutments. Eight of the nine proposed abutments underwent seismic data collection. Data was not collected at the south abutment of the Twin Lake crossing as access along public property was deemed unsafe. The geophysical transects were “field-fit” to maximize data collection while considering the efficiency of equipment, cable, and geophone placement. Seismic transect performed on the Juneau side crossings produced data considerably noisier than that of the Douglas side crossings due to the vehicular traffic on Egan Drive.

DOWL performed eight seismic transects ranging from 225 feet to 600 feet in length, as shown in the data collection location map in Appendix A. General information for each seismic transect are provided in Table 1. Two seismic data collection methodologies were implemented along each transect: the Multichannel Analysis of Surface Waves (MASW) and seismic refraction methods. The seismic refraction data were collected in general accordance with *ASTM D5777-18, Standard Guide for Using the Seismic Refraction Method for Subsurface Investigations*. Electrical resistivity was performed at select sites to supplement the seismic data.



**Table 1: Summary of Seismic Transects**

| <b>Seismic Transect</b> | <b>Transect Length (feet)</b> | <b>Transect Start (latitude &amp; longitude)</b> | <b>Transect End (latitude &amp; longitude)</b> | <b>Description</b>                             |
|-------------------------|-------------------------------|--------------------------------------------------|------------------------------------------------|------------------------------------------------|
| West Sunny Point North  | 600                           | 58° 21' 29.60" N<br>134° 32' 11.20" W            | 58° 21' 23.76" N<br>134° 32' 10.75" W          | Juneau Abutment North-South Alignment          |
| East Sunny Point North  | 600                           | 58° 21' 26.99" N<br>134° 31' 17.52" W            | 58° 21' 21.20" N<br>134° 31' 15.52" W          | Juneau Abutment North-South Alignment          |
| Sunny Point South       | 225                           | 58° 20' 42.91" N<br>134° 32' 11.75" W            | 58° 21' 44.92" N<br>134° 32' 9.98" W           | Douglas Abutment South-North Alignment         |
| Vanderbilt North        | 300                           | 58° 20' 41.46" N<br>134° 30' 2.66" W             | 58° 20' 38.91" N<br>134° 30' 5.13" W           | Juneau Abutment Northeast-Southwest Alignment  |
| Vanderbilt South        | 300                           | 58° 20' 10.83" N<br>134° 30' 37.82" W            | 58° 20' 13.64" N<br>134° 30' 35.10" W          | Douglas Abutment Southwest-Northeast Alignment |
| Twin Lakes North        | 300                           | 58° 20' 11.50" N<br>134° 29' 16.16" W            | 58° 20' 9.32" N<br>134° 29' 19.87" W           | Juneau Abutment Northeast-Southwest Alignment  |
| Salmon Creek North      | 300                           | 58° 19' 40.73" N<br>134° 28' 15.37" W            | 58° 19' 38.00" N<br>134° 28' 17.62" W          | Juneau Abutment Northeast-Southwest Alignment  |
| Salmon Creek South      | 300                           | 58° 19' 23.64" N<br>134° 28' 49.51" W            | 58° 19' 25.33" N<br>134° 28' 45.05" W          | Douglas Abutment Southwest-Northeast Alignment |

Implementation of seismic recording parameters was dictated by site conditions and varied along each transect. In some cases, surface conditions are prohibited using standard recording equipment such as a spike geophone. In these cases, geophones were placed on plates in contact with the ground surface. Example site conditions are shown in Site Photograph 1.

**Site Photograph 1: Seismic Transect Sunny Point North – View North**



DOWL performed two electrical resistivity transects ranging from 617 feet to 771 feet in length at the West Sunny Point North and East Sunny Point North locations. General information for each electrical resistivity transect is provided in Table 2. DOWL collected the electrical resistivity data in general accordance with *ASTM D6431-18, Standard Guide for Using the Direct Current Resistivity Method for Subsurface Site Characterization*.

**Table 2: Summary of Electrical Resistivity Transects**

| Resistivity Transect   | Transect Length (feet) | Transect Start (latitude & longitude) | Transect End (latitude & longitude)   | Description                           |
|------------------------|------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| West Sunny Point North | 771                    | 58° 21' 29.60" N<br>134° 32' 11.20" W | 58° 21' 22.02" N<br>134° 32' 10.64" W | Juneau Abutment North-South Alignment |
| East Sunny Point North | 617                    | 58° 21' 26.99" N<br>134° 31' 17.52" W | 58° 21' 21.02" N<br>134° 31' 15.47" W | Juneau Abutment North-South Alignment |

## Seismic Data Collection

The seismic source (shot) or energy introduced into the ground was initiated by a 16-pound sledgehammer striking a plate on the ground surface. Four hammer hits were used at each shot location and summed to reduce background ambient noise. Sixteen shot locations were implemented along each profile. Shot spacings were determined based on subsurface ray path coverage suitable for seismic refraction tomography (SRT) and subsequent use in MASW analysis. Seismic survey parameters used for all data collection transects are summarized in Table 3.

**Table 3: Seismic Survey Parameters**

|                                       |                                                                                                |
|---------------------------------------|------------------------------------------------------------------------------------------------|
| <b>Recording Instrument</b>           | Geometrics Geode                                                                               |
| <b>Geophone Natural Period</b>        | 4.5 Hertz                                                                                      |
| <b>Number of Geophones</b>            | 24                                                                                             |
| <b>Sample Rate</b>                    | 0.250 millisecond                                                                              |
| <b>Number of Samples</b>              | 6,000 per channel                                                                              |
| <b>Record Length</b>                  | 1.5 seconds                                                                                    |
| <b>Low Cut Filter</b>                 | Out                                                                                            |
| <b>High Cut Filter</b>                | Out                                                                                            |
| <b>Seismic Source</b>                 | 16-pound sledgehammer                                                                          |
| <b>Stack Number</b>                   | 4                                                                                              |
| <b>Refraction Analysis Software</b>   | Rayfract®                                                                                      |
| <b>Surface Wave Analysis Software</b> | SeisImagerSW™ Geometrics, Inc. MASW 1D<br>Surface Wave Wizard/Geoplot Geometrics, Inc. MASW 2D |

## Electrical Resistivity Data Collection

Electrical Resistivity Tomography (ERT) data is collected by inserting 48 3/8-inch metal electrodes in the ground in an array and injecting a low-voltage direct current. The electrical method estimates the depth of bedrock via an electrical resistivity inversion of the field data when a contrast of conductivity of the bedrock and overlying sediment is present. Electrical resistivity survey parameters used for all data collection transects are summarized in Table 4.

**Table 4: Electrical Resistivity Survey Parameters**

|                                      |                     |
|--------------------------------------|---------------------|
| <b>Recording Instrument</b>          | ABEM Terrameter LS2 |
| <b>Number of Electrodes</b>          | 48                  |
| <b>Array</b>                         | Gradient            |
| <b>Error Limit</b>                   | 1%                  |
| <b>Acquisition Time</b>              | 1.5 seconds         |
| <b>Maximum Stack Number</b>          | 4                   |
| <b>Data Filtering Software</b>       | ABEM Toolbox®       |
| <b>Resistivity Analysis Software</b> | Res2Dinv®           |

## Seismic Analysis

### Seismic Refraction Method

The seismic refraction method calculates subsurface compressional wave velocity ( $V_p$ ). This approach uses seismic *body* waves, contrasting with the MASW method, which uses seismic *surface* waves.

Using the same first arrival times, a tomographic solution can be calculated by discretizing the subsurface into cells instead of layers. The tomographic approach thus lends itself to characterizing laterally variable subsurface media.



## MASW Method

The MASW method provides a shear wave velocity ( $V_s$ ) result as a 1D profile located at the center of the geophone spread layout. Optimal MASW data collection requires the seismic source (shots) to be offset from the nearest geophone, ideally ranging between 10 to 30 percent of the geophone spread length. Thus, shots taken inside the geophone spread will not give accurate results for MASW analysis.

MASW uses the velocity dispersion characteristics of the high amplitude surface wave (Rayleigh wave) to calculate  $V_s$  with depth. SeisImagerSW software was used for MASW analysis. Seismic Site Classifications per AASHTO LRFD Table 3.10.3.1-1 for each transect are presented in Appendix B.

2D MASW profiles are presented in Appendix B. 2D MASW uses Common-Mid-Point (CMP) gathers to generate shear wave velocities. Although the 2D s-wave velocity profiles resemble discretized velocity models, the 2D profiles are formed from 1D s-wave velocity profiles calculated at two times the geophone spacing. The starting model was set to 12 layers for the calculations. Thus, the resolution of the MASW 2D model is twice the geophone spacing horizontally and 12 layers vertically, resulting in a coarser resolution than SRTs. The figures are the gridded and contoured results from the individual 1D s-wave depth velocity profiles.

## Seismic Interpretation

Interpretations of the seismic data are presented as eight sites in Appendix B. The seismic profiles represent the corresponding calculated 2D SRTs of compressional wave velocity ( $V_p$ ) and 2D (MASW) tomograms. The 2D MASW tomograms had a consistent color banding ranging from 277 to 4,473 feet per second with an interval of 155 feet per second.

Appendix B contains 1D shear wave velocity profiles with converted standard penetration test values (i.e., n-values) calculated from the s-wave velocity profiles using the equation below. The 1D s-wave velocity profiles show calculated n-values as a red line with a legend at the top of the figure. There are other penetration test to shear wave velocity correlations and the correlations do vary. Use blow count profiles converted from shear wave velocities with caution.

$$n = 10^{\left\lfloor \frac{1}{0.314} \times \log_{10} \left( \frac{V_s}{318.241} \right) \right\rfloor}$$

Where:

n = blow count

$V_s$  = shear wave velocity in feet/second

The approximate depth to bedrock or dense or very dense sediment was estimated within each seismic profile. Seismic profiles along the northern abutments are interpreted to encounter dense sediment based on correlations from the nearest available geotechnical test holes. Existing data from the following reports were used in the correlation:

- DOT&PF. 1970. *Lemon Creek Bridge. Project No.: F-095-8*. Test hole and penetrometer data documents dense to very dense sand with some silt and trace gravel was encountered between 80 to 100 feet below ground surface.

- DOT&PF. 1970. *Salmon Creek Bridge. Project No.: F-095-8(3)*. Test hole data documents hard silt and very dense sand with gravel encountered at 50 feet below ground surface.

Bedrock in the region is mapped as layered greenstone, graywacke, slate, greenschist, and metavolcanic flow breccia that were formed mainly during the Mesozoic age (Miller, 1975). Along the southern abutments, bedrock is exposed at the surface or encountered at shallow depths in the following report:

- DOT&PF. 1979. *Kowee Creek Bridge. Project No.: S-0959(10)*. Test hole data documents phyllitic slate bedrock encountered 10 to 14 feet below ground surface.

Bedrock and dense sedimentary material depth was estimated based on test hole data from the previously listed reports, known correlations of seismic velocities for bedrock and dense sediments, and spacing of seismic tomogram contours. For SRT, the compression wave velocities for bedrock are typically greater than 3,000 feet per second. Compression wave velocities larger than 10,000 feet per second indicate competent bedrock. The topography elevations used for the tomograms were taken in the field using a Bad Elf GPS.

The shear wave velocities for geomaterials are typically 40 to 60 percent of the compression wave velocities if there is no groundwater table. If there is a groundwater table, the shear wave velocities are approximately 20 percent of the compression wave velocity. Groundwater does not impact the shear wave velocities as water has no shear strength. In geotechnical engineering terms, compression waves can be regarded as a total stress parameter as they tend to induce volume change, and their propagation velocity in saturated soil is practically identical to that of compression waves in water. Shear waves impose only shear deformation, and the velocity can be considered an effective stress parameter.

DOWL researched published representative p-wave velocities to interpret depths to bedrock or dense sediment below the existing ground surface. Since the data was collected in a tidal flat environment, DOWL assumed that the ground is saturated at the surface. Table 5 lists published seismic wave velocities for various materials (Press, 1966). Shear wave velocities were calculated and tabulated based on the following rule-of-thumb relationships (Burger, Sheehan, and Jones, 2006):

- $V_s = 0.6V_p$  for crystalline rocks
- $V_s = 0.5V_p$  for sedimentary rocks
- $V_s = 0.4V_p$  for soils and unconsolidated sediment materials.

**Table 5: Range of Seismic Velocities (feet per second)**

| Unconsolidated Materials    |                          |                           | Competent Bedrock (no groundwater) |                          |                           |
|-----------------------------|--------------------------|---------------------------|------------------------------------|--------------------------|---------------------------|
|                             | <u>P-wave Velocities</u> | <u>S-wave Velocities*</u> |                                    | <u>P-wave Velocities</u> | <u>S-wave Velocities*</u> |
| Alluvium                    | 1,640-6,560              | 660-2,620                 | Granite                            | 16,400-19,680            | 9,840-11,810              |
| Clay                        | 3,610-8,200              | 1,440-3,280               | Basalt                             | 17,710-20,990            | 10,630-12,600             |
| Unsaturated Sand            | 660-3,280                | 262-1,310                 | Metamorphic Rocks                  | 11,480-22,960            | 6,890-13,780              |
| Saturated Sand              | 2,620-7,220              | 262-1,310                 | Sandstone and Shale                | 6,560-14,760             | 3,280-7,380               |
| Unsaturated Sand and Gravel | 1,310-1,640              | 525-660                   | Limestone                          | 6,560-19,680             | 3,280-9,840               |
| Saturated Sand and Gravel   | 1,640-4,920              | 525-660                   | <b>Non-geomaterials</b>            |                          |                           |
| Unsaturated Glacial Till    | 1,310-3,280              | 525-1,310                 |                                    | <u>P-wave Velocities</u> | <u>S-wave Velocities</u>  |
| Saturated Glacial Till      | 5,580                    | 525-1,310                 | Water                              | 4,592-5,248              | N/A                       |
| Very Dense Glacial Till     | 3,940-6,890              | 1,574-2,760               | Air                                | 1,087                    | N/A                       |

\*S-waves were calculated using the rule of thumb listed above.

Velocities are in feet per second and converted from published meters per second.

As shown in Table 5, saturated unconsolidated material or sediment has a higher p-wave velocity range than unsaturated sediments. However, s-wave velocities don't change with the presence of groundwater. From the interpretation of published data and DOWL's experience comparing seismic velocities to known ground truths, DOWL used a p-wave velocity range of 7,000 to 9,000 feet per second and an s-wave velocity range of 1,300 to 1,700 feet per second as the threshold for what is interpreted to be a consolidated geomaterial. However, there is nuance when interpreting the geophysics profiles, especially in complex geological environments.

## Seismic Line Summary

The following descriptions provide a summary of each seismic line and an interpretation of the estimated depth to bedrock or very dense sedimentary material. As there is uncertainty on if the interpreted strata are bedrock or very dense sedimentary material without ground-truth test hole data, the materials are referred to as consolidated geomaterials in the following descriptions and the figures within Appendix B.



**Table 6: Seismic Line Summary**

| Seismic Transect       | Depth to Interpreted Consolidated Geomaterial – SRT (feet below ground surface) | Depth to Interpreted Consolidated Geomaterial – MASW 2D (feet below ground surface) |
|------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| West Sunny Point North | 75 – 90                                                                         | 75 – 90                                                                             |
| East Sunny Point North | 35 – 45                                                                         | 35 – 45                                                                             |
| Sunny Point South      | 25 – 30                                                                         | 25 – 30                                                                             |
| Vanderbilt North       | 25 – 40                                                                         | 35 – 50                                                                             |
| Vanderbilt South       | 15 – 30                                                                         | 20 – 35                                                                             |
| Twin Lakes North       | 70 – 75                                                                         | 75 – 85                                                                             |
| Salmon Creek North     | 55 – 65                                                                         | 55 – 65                                                                             |
| Salmon Creek South     | 35 – 55                                                                         | 35 – 55                                                                             |

### **Seismic Line – West Sunny Point North**

West Sunny Point North is on the Juneau side of the proposed crossing, oriented on a north-south axis and approximately perpendicular to Egan Drive. The SRT and the MASW 2D profiles agree well. Consolidated geomaterials were observed at depths of 75 to 95 feet. The consolidated geomaterials slope towards the channel at an approximate slope of 2.6 percent. Materials with s-wave velocities greater than 1,300 feet per second ranged in depths of 75 to 110 feet in the MASW 1D profiles.

### **Seismic Line – East Sunny Point North**

East Sunny Point North is on the Juneau side of the proposed crossing, oriented on a north-south axis and approximately perpendicular to Egan Drive. The SRT profile illustrates evidence of a potential fault within the first third of the profile. The edges of the SRT profile show artifacts of higher velocities that should be ignored during interpretation. However, the fault is not apparent in the 2D MASW profile. Seismic investigations typically have better resolution vertically than laterally, which may explain why the potential fault is not apparent within the MASW 2D profile. The depth to consolidated geomaterials ranges from 35 to 45 feet with an approximate slope of 1.9 percent dipping towards the channel. The MASW 1D indicates consolidated geomaterial at approximately 50 feet below the ground surface.

### **Seismic Line – Sunny Point South**

Sunny Point South is on the Douglas side of the proposed crossing, oriented on a south-north axis and approximately perpendicular to North Douglas Highway. The SRT and the MASW 2D profiles agreed well. Consolidated geomaterials were observed at depths of 25 to 30 feet. Bedrock did outcrop at variable locations throughout the Douglas Island coastline. The edges of the SRT profile show artifacts of higher velocities that should be ignored during interpretation. The consolidated geomaterial slopes toward the channel at approximately 2.5 percent. The MASW 1D shows consolidated geomaterial at an approximate depth of 25 feet.

### **Seismic Line – Vanderbilt North**

Vanderbilt North is on the Juneau side of the proposed crossing, oriented on a northeast-southwest axis and approximately perpendicular to Egan Drive. The SRT and the MASW 2D profiles do not agree well as the interpreted depths to consolidated geomaterials differ. For SRT, the interpreted depths to consolidated geomaterials range from 25 to 40 feet. For MASW 2D, the interpreted depths to consolidated geomaterials range from 35 to 40 feet. From the MASW 2D profile, the consolidated geomaterial slopes toward the channel at approximately 4.4 percent. The MASW 1D data shows consolidated geomaterial at depths ranging from 40 to 50 feet.

### **Seismic Line – Vanderbilt South**

Vanderbilt South is on the Douglas side of the proposed crossing, oriented on a southwest-northeast axis and approximately perpendicular to North Douglas Highway. The SRT and the MASW 2D profiles agree well. The consolidated geomaterials were observed at depths of 15 to 35 feet. The edges of the SRT profile show artifacts of higher velocities that should be ignored during interpretation. The consolidated geomaterial slope towards the channel at an approximate slope of 6.2 percent. The MASW 1D indicates consolidated geomaterial at depths ranging from 25 to 40 feet.

### **Seismic Line – Twin Lakes North**

Twin Lakes North is on the Juneau side of the proposed crossing, oriented on a northeast-southwest axis and approximately perpendicular to Egan Drive. The SRT and the MASW 2D profiles disagree. SRT indicates a depth to consolidated geomaterials at 70 to 75 feet. The MASW 2D suggests consolidated geomaterials at depths ranging from 75 to 85 feet. The consolidated geomaterial slopes toward the channel at approximately 2.5 percent within the SRT profile. The MASW 1D data shows consolidated geomaterial at depths ranging from 80 to 90 feet.

### **Seismic Line – Salmon Creek North**

Salmon Creek North is on the Juneau side of the proposed crossing, oriented on a northeast-southwest axis and approximately perpendicular to Egan Drive. The SRT and the MASW 2D profiles agree well. Consolidated geomaterials were observed at depths of 55 to 65 feet. The consolidated geomaterials slope towards the channel at approximately 4.2 percent. The MASW 1D indicates consolidated geomaterial at depths of approximately 65 feet.

### **Seismic Line – Salmon Creek South**

Salmon Creek South is on the Douglas side of the proposed crossing, oriented on a southwest-northeast axis and approximately perpendicular to North Douglas Highway. The SRT and the MASW 2D profiles agree well. Consolidated geomaterials were observed at depths of 35 to 55 feet. The consolidated geomaterials slope towards the channel at approximately 8.3 percent. The MASW 1D indicates consolidated geomaterial at depths of 35 to 45 feet.

## **Resistivity Analysis**

The ERT method utilizes differences and contrasts in electrical resistivity to identify the subsurface materials, depth to water, and subsurface structures. This method measures the subsurface bulk (apparent) electrical resistivity providing information about changes in subsurface lithology and groundwater saturation. The measured apparent resistivity is a function of different parameters, such as porosity, groundwater salinity, clay content, water saturation, and how the subsurface conducts electricity.

## Resistivity Line Summary

The following descriptions provide a summary of each electrical resistivity line and an interpretation of the estimated depth to bedrock or consolidated geomaterial:

**Table 7: Resistivity Line Summary**

| <b>Seismic Transect</b> | <b>Depth to Interpreted Consolidated geomaterial - ERT (feet below ground surface)</b> |
|-------------------------|----------------------------------------------------------------------------------------|
| West Sunny Point North  | 75 - 90                                                                                |
| East Sunny Point North  | 40 - 50                                                                                |

### **Resistivity Line – West Sunny Point North**

West Sunny Point North is on the Juneau side of the proposed crossing, oriented on a north-south axis and approximately perpendicular to Egan Drive. The ERT profile illustrates consolidated geomaterials observed at depths of 75 to 90 feet. The consolidated geomaterial slope towards the channel at an approximate slope of 2.6 percent. The ERT data agrees well with the seismic data at this location.

### **Resistivity Line – East Sunny Point North**

East Sunny Point North is on the Juneau side of the proposed crossing, oriented on a north-south axis and approximately perpendicular to Egan Drive. The ERT profile illustrates evidence of a potential fault within the first third of the profile; this feature was also observed within the seismic data. The ERT profile suggests consolidated geomaterials at depths of 45 to 55 feet. The ERT profile at this location doesn't indicate the layering observed at West Sunny Point North. The consolidated geomaterials slope towards the channel at an approximate slope of 2.1 percent.

## **Limitations**

DOWL prepared this memo for the DOT&PF and their Consultants' use on this project. DOWL prepared this memo, including figures specifically for the above-referenced sites. The data does not apply to other sites. Do not separate the figures from the text or appendices for independent use.

DOWL performed these services consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar time and budgetary constraints. No warranty is made or implied.

Any conclusions made by a construction contractor or bidder relating to construction means, methods, techniques, sequences, or costs based upon the information provided in this memo are not the responsibility of DOT&PF or DOWL.

Attachments:

Appendix A: Geophysical Data Collection Maps

Appendix B: Seismic 2D Tomograms and Resistivity Profiles



## References

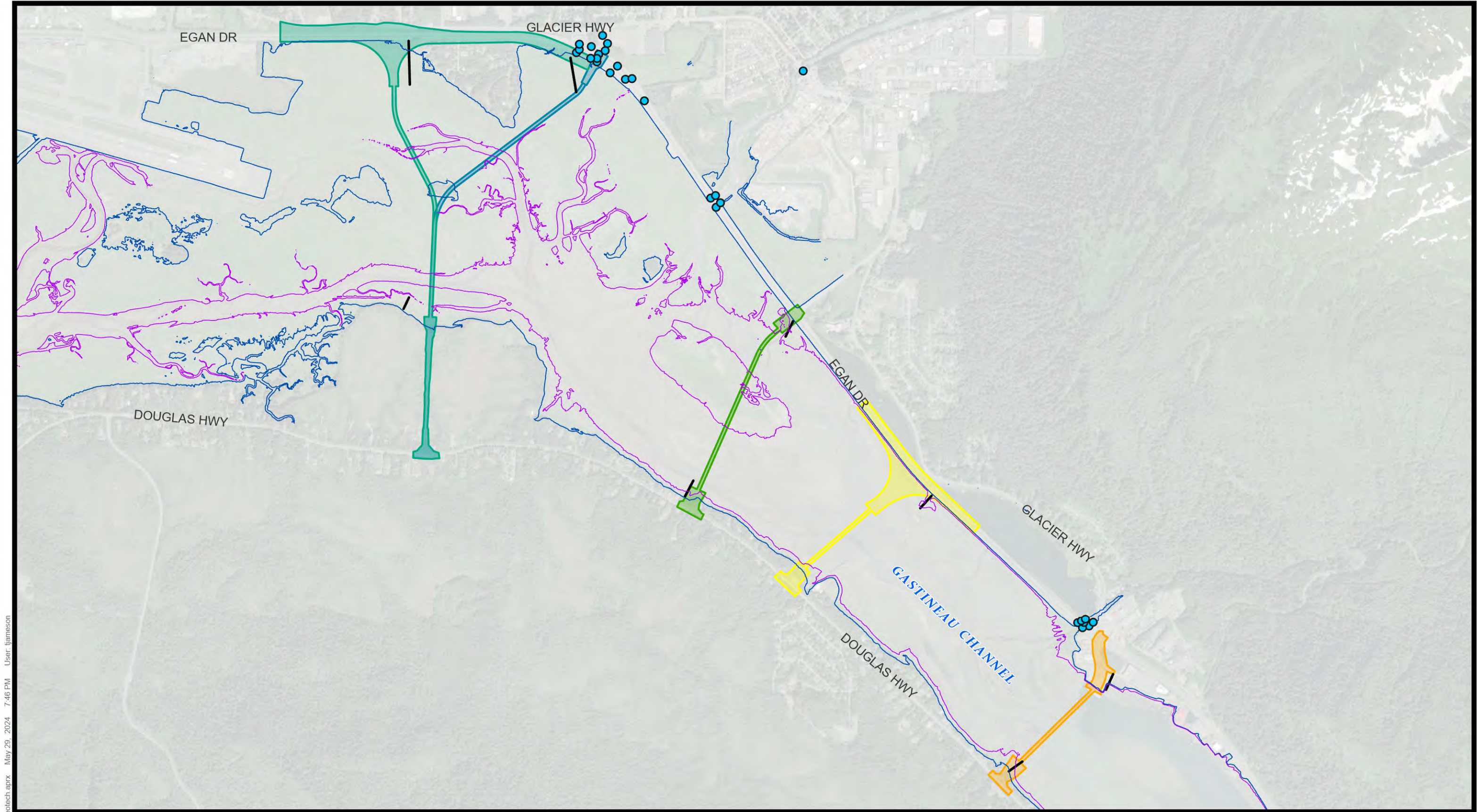
- Burger, H.R., Sheehan, A.F., and Jones, C.H. 2006 Introduction to Applied Geophysics, page 20. W.W. Norton & Company, Inc.
- DOT&PF. 1970. *Lemon Creek Bridge. Project No.: F-095-8.*
- DOT&PF. 1970. *Salmon Creek Bridge. Project No.: F-095-8(3).*
- DOT&PF. 1979. *Kowee Creek Bridge. Project No.: S-0959(10).*
- Miller, R.D. 1975. *Surface Geologic Map of the Juneau Urban Area and Vicinity, Alaska*, Department of Interior Geological Survey, Reston, Va.
- Press, F. 1966. *Seismic velocities*. In Handbook of Physical Constants, rev. ed., ed S.P. Clark Jr., pages 195-218. Geological Society of America Memoir 97.

## **APPENDIX A**

### **GEOPHYSICAL DATA COLLECTION MAPS**

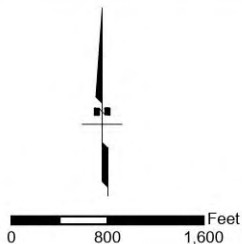


J:\38\63234-01\60GIS\Carto\Geotech\Geotech.aprx May 29, 2024 7:46 PM User: jameson



**PROPOSED PROJECT STUDY AREA**

- |                  |            |                     |                  |
|------------------|------------|---------------------|------------------|
| SALMON CREEK     | TWIN LAKES | LOW TIDE (3.4 FT)   | DOT&PF TEST HOLE |
| SUNNY POINT EAST | VANDERBILT | HIGH TIDE (20.6 FT) | GEOPHYSICAL LINE |
| SUNNY POINT WEST |            |                     |                  |



**GEOPHYSICAL EXPLORATION  
OVERVIEW**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES         |                |
|----------------------------------------------------------------------------------|----------------|
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS NORTH CROSSING PEL STUDY |                |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                               |                |
| MAY 29, 2024                                                                     | ATTACHMENT A-1 |





J:\3863234-01\60GIS\Carto\Geotech\Geotech.aprx Mar 06, 2024 11:40 AM User: jameson

PROPOSED PROJECT STUDY AREA

SUNNY POINT EAST

SUNNY POINT WEST

LOW TIDE (3.4 FT)

HIGH TIDE (20.6 FT)

DOT&PF TEST HOLE

GEOPHYSICAL LINE

0

500

1,000

Feet

GEOPHYSICAL EXPLORATION  
SUNNY POINT

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA

The logo of the State of Alaska Department of Transportation & Public Facilities. It features a circular seal with a yellow background, a red airplane, and a green landscape with a bridge. The text "STATE OF ALASKA" is at the bottom and "TRANSPORTATION & PUBLIC FACILITIES" is at the top.

|                                                                                  |                |
|----------------------------------------------------------------------------------|----------------|
| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES         |                |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS NORTH CROSSING PEL STUDY |                |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                               |                |
| MARCH 06, 2024                                                                   | ATTACHMENT A-2 |

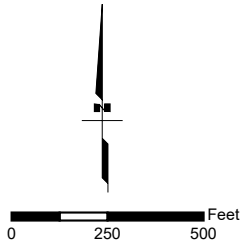


J:\38\63234-01\60GIS\Carto\Geotech\Geotech.aprx Mar 06, 2024 11:40 AM User: jameson



**PROPOSED PROJECT STUDY AREA**

- VANDERBILT
- LOW TIDE (3.4 FT)
- HIGH TIDE (20.6 FT)
- DOT&PF TEST HOLE
- GEOPHYSICAL LINE



**GEOPHYSICAL EXPLORATION  
VANDERBILT**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



|                                                                                  |                |
|----------------------------------------------------------------------------------|----------------|
| <b>STATE OF ALASKA</b><br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES  |                |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS NORTH CROSSING PEL STUDY |                |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                               |                |
| MARCH 06, 2024                                                                   | ATTACHMENT A-3 |

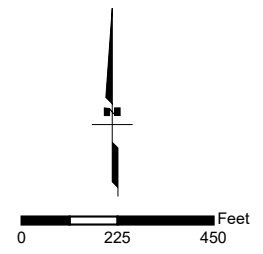




J:\38\63234-01\60GIS\Carto\Geotech\Geotech.aprx Mar 06, 2024 11:40 AM User: tjameson

**PROPOSED PROJECT STUDY AREA**

- TWIN LAKES
- LOW TIDE (3.4 FT)
- HIGH TIDE (20.6 FT)
- DOT&PF TEST HOLE
- GEOPHYSICAL LINE



**GEOPHYSICAL EXPLORATION  
TWIN LAKES**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

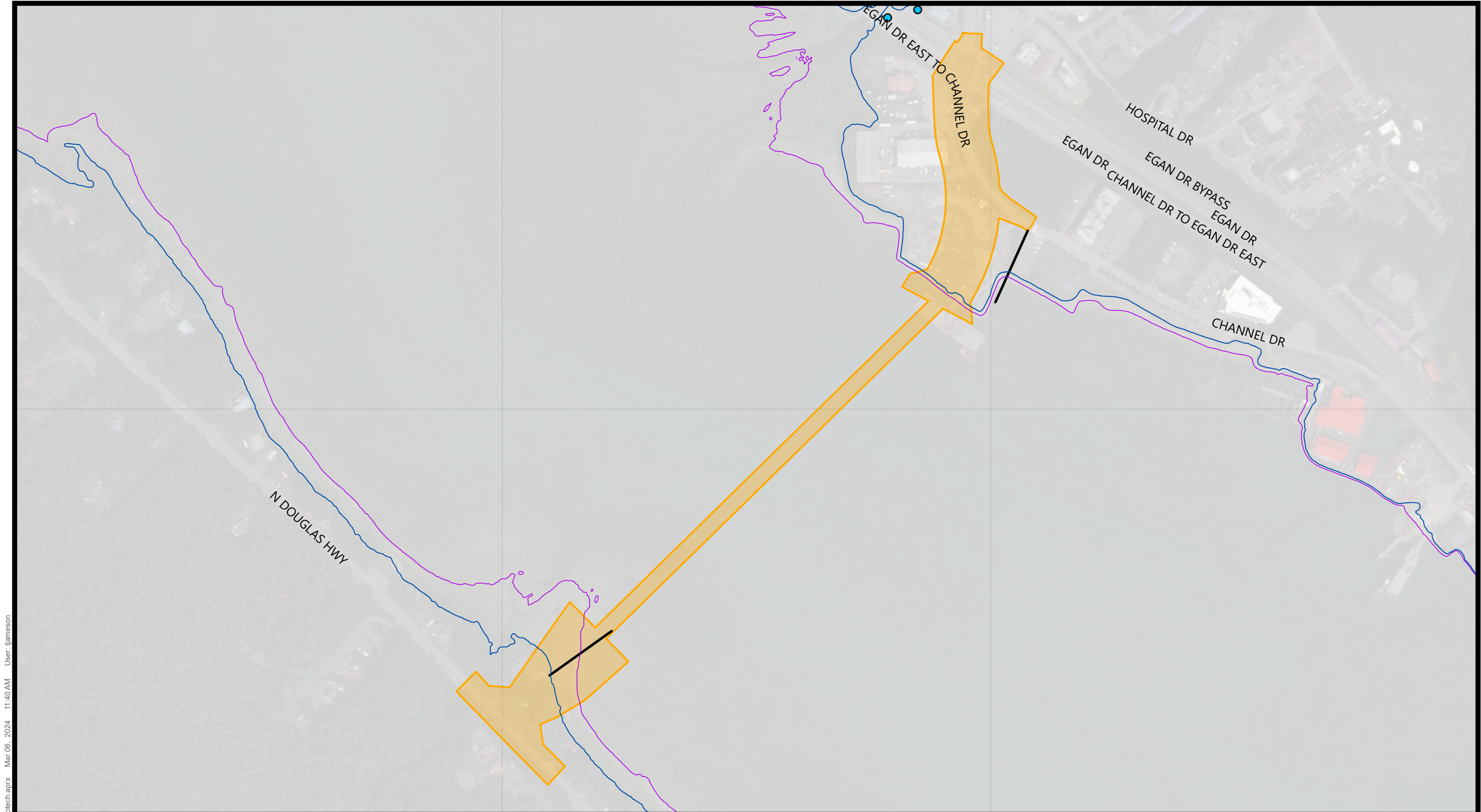
CITY AND BOROUGH OF JUNEAU, ALASKA

MARCH 06, 2024

ATTACHMENT A-4

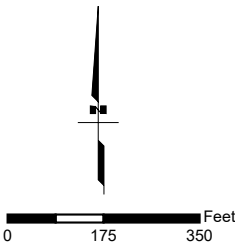


J:\38\63234-01\60GIS\Carto\Geotech\Geotech.aprx Mar 06, 2024 11:40 AM User: tjameson



**PROPOSED PROJECT STUDY AREA**

- SALMON CREEK
- LOW TIDE (3.4 FT)
- HIGH TIDE (20.6 FT)
- DOT&PF TEST HOLE
- GEOPHYSICAL LINE



**GEOPHYSICAL EXPLORATION  
SALMON CREEK**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

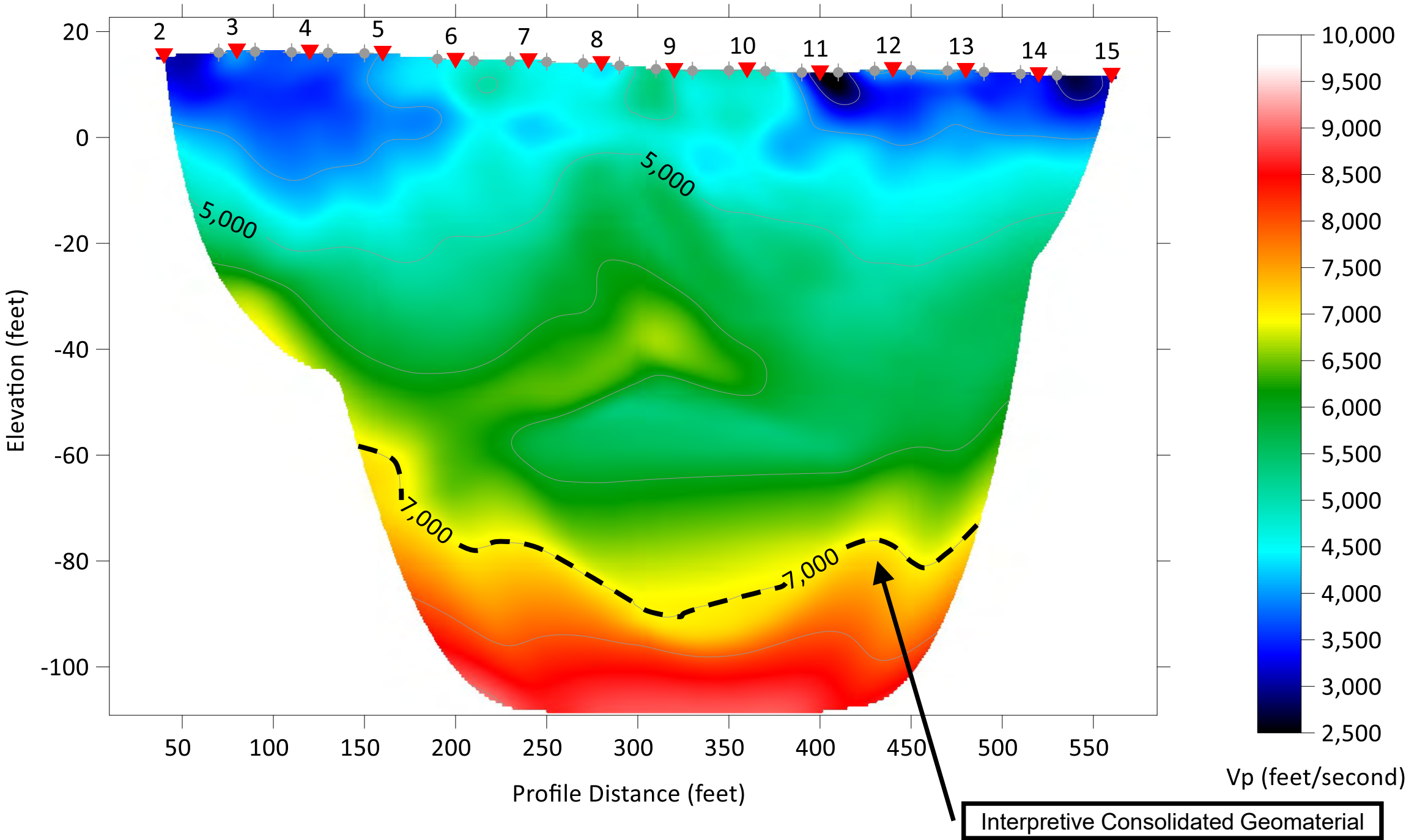
MARCH 06, 2024

ATTACHMENT A-5

## **APPENDIX B**

### **SEISMIC 2D TOMOGRAMS AND RESISTIVITY PROFILES**

WestSunnyPointNorth RMS error 6.9%=2.08ms 20 WET itr. 50Hz Width 4.5% initial GRADIENT.GRD v. 4.02

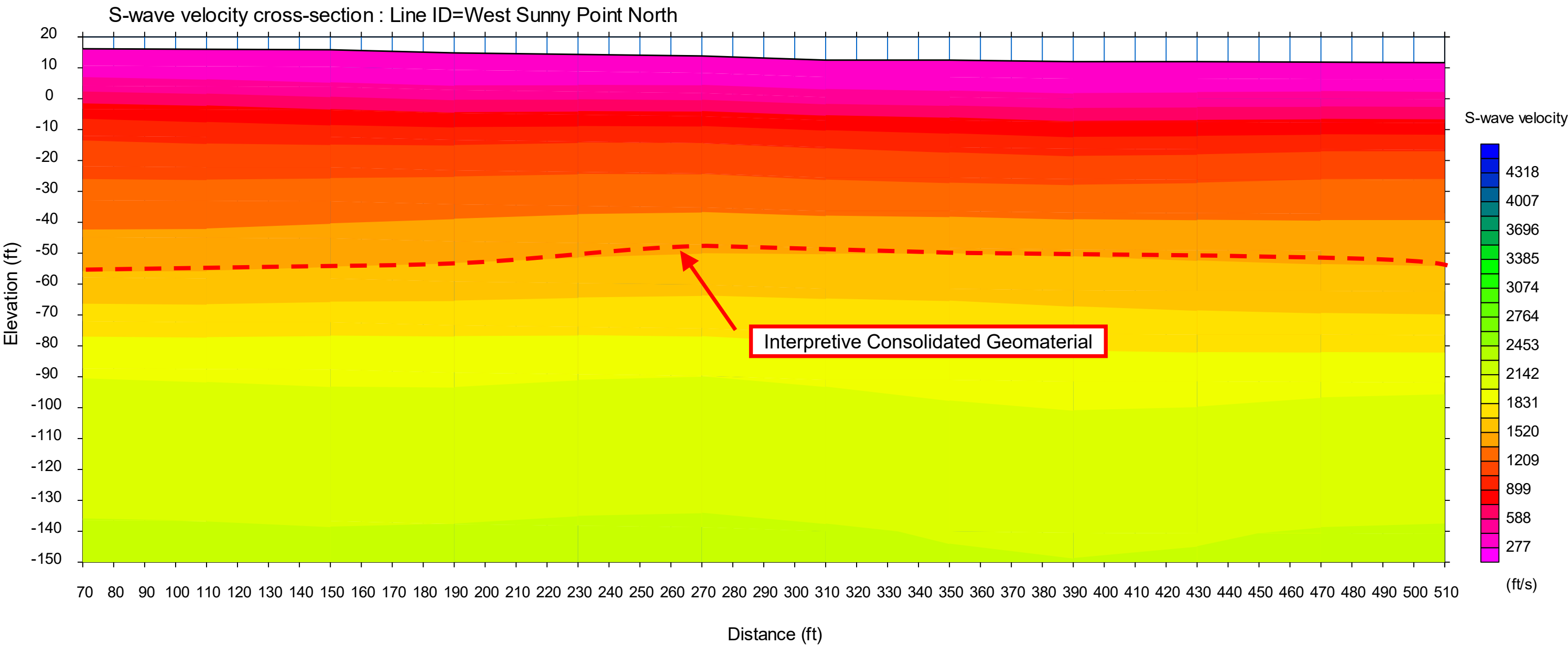


**Legend**  
Seismic Survey



| Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities |  |                                  |  |
|------------------------------------------------------------|--|----------------------------------|--|
| West Sunny Point North                                     |  |                                  |  |
| Analysis by: David Barrick                                 |  | Project: Douglas Island Crossing |  |
| Date: February 14, 2024                                    |  | Project No.: 1138.63234.01       |  |





RMS Error = 8.79% after 10 Iterations

Legend

— Seismic Survey



**Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities**

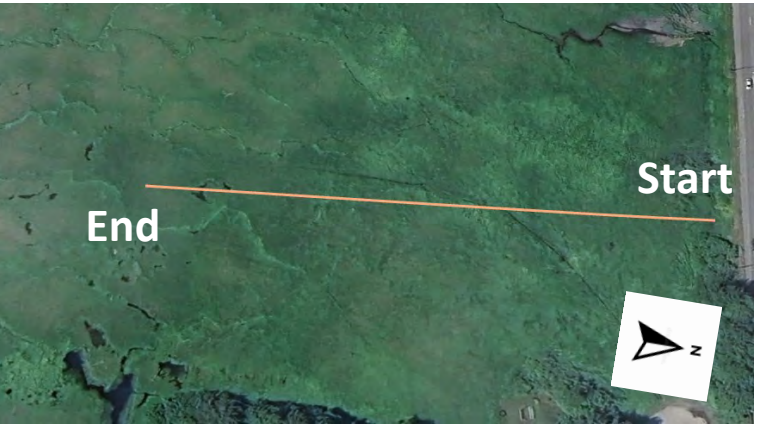
West Sunny Point North

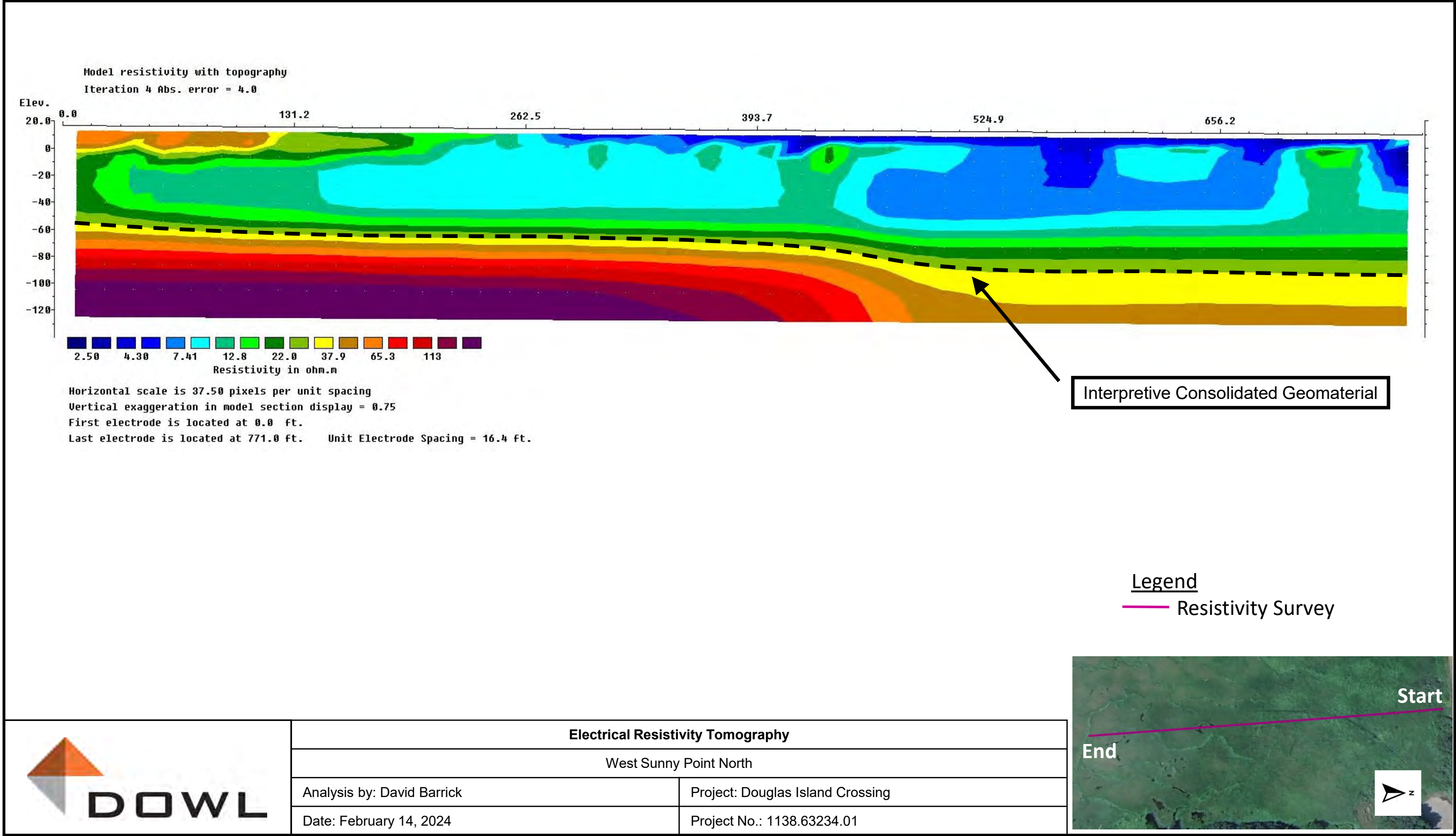
Analysis by: David Barrick

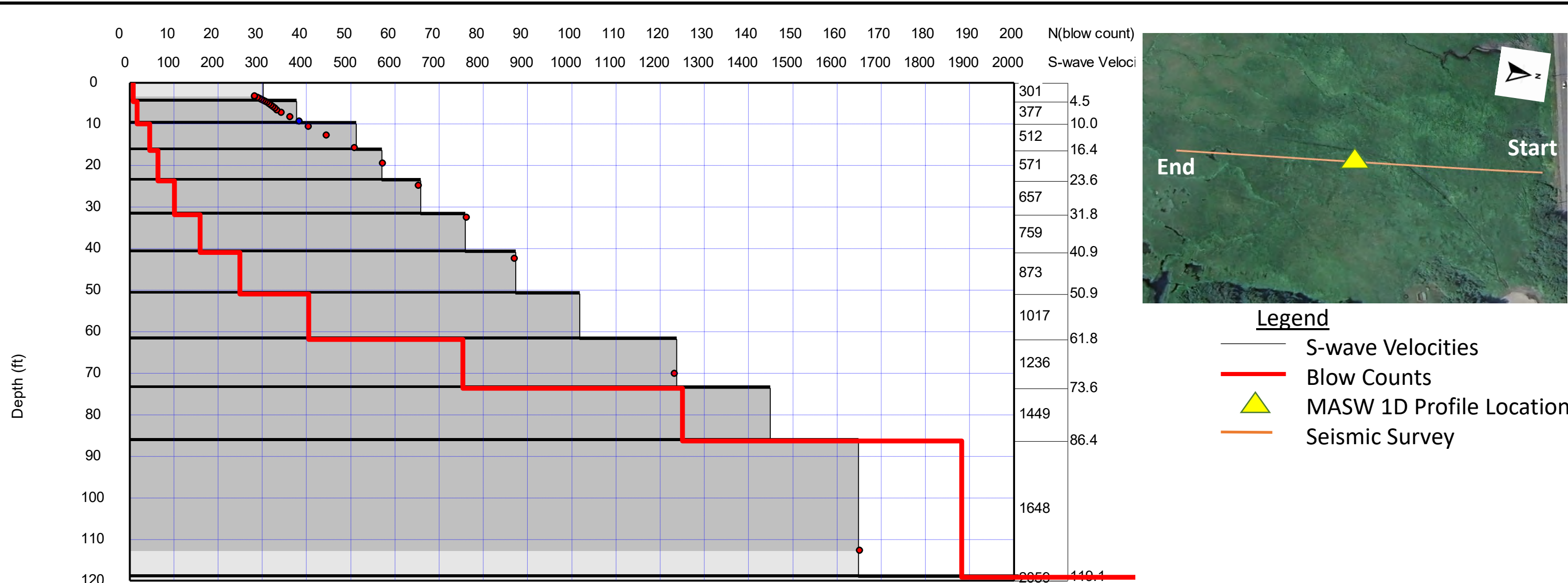
Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01







S-wave velocity model (inverted) : 2001.dat

Average Vs to 100ft = 782.1 ft/sec

RMS Error = 5.58% after 10 Iterations

Average Vs to 100 feet = 782.1 ft/sec



Multichannel Analysis of Surface Waves (MASW) 1D – West Sunny Point North – Shot 2001

West Sunny Point North

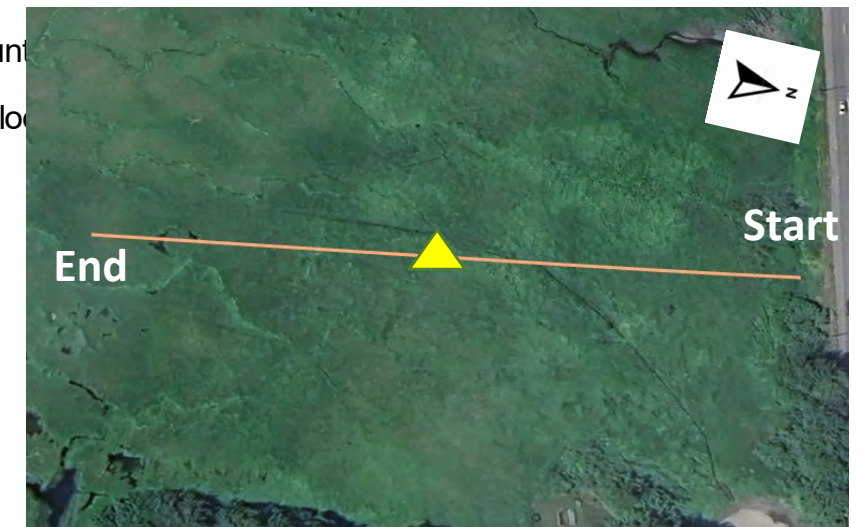
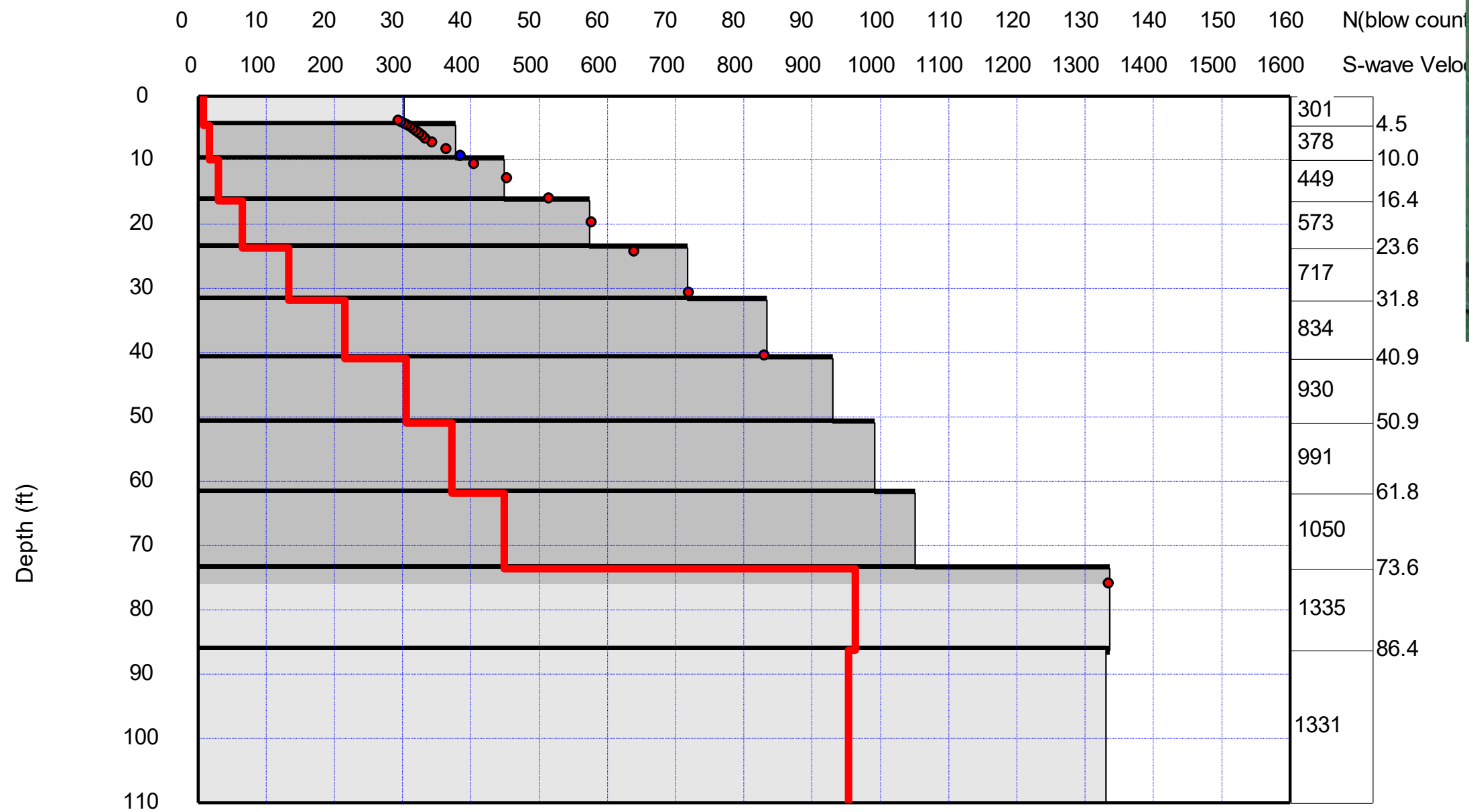
Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





**Legend**

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 6.45% after 10 Iterations  
Average Vs to 100 feet = 761.0 ft/sec



**Multichannel Analysis of Surface Waves (MASW) 1D – West Sunny Point North – Shot 2002**

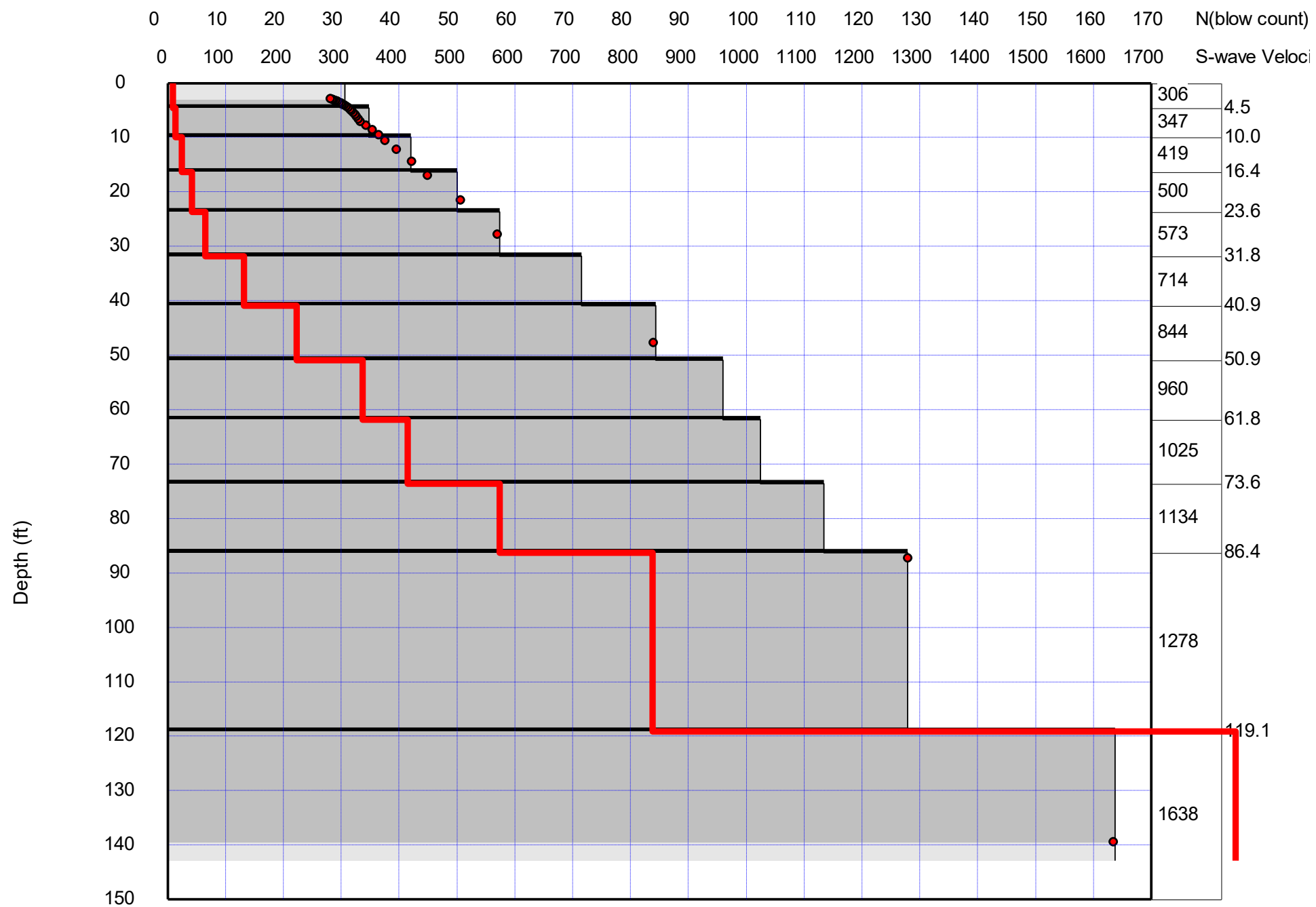
West Sunny Point North

Analysis by: David Barrick

Project: Douglas Island Crossing

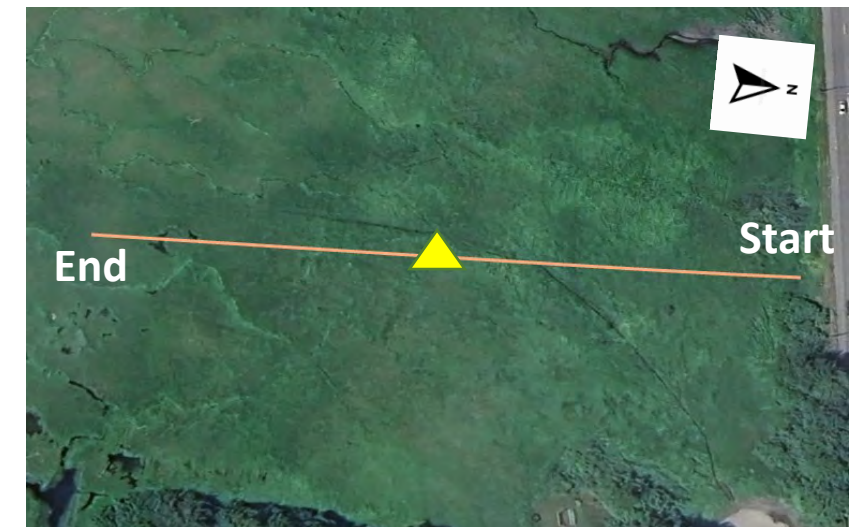
Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 2015.dat

Average Vs to 100ft = 695.5 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 6.77% after 10 Iterations

Average Vs to 100 feet = 695.5 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – West Sunny Point North – Shot 2003

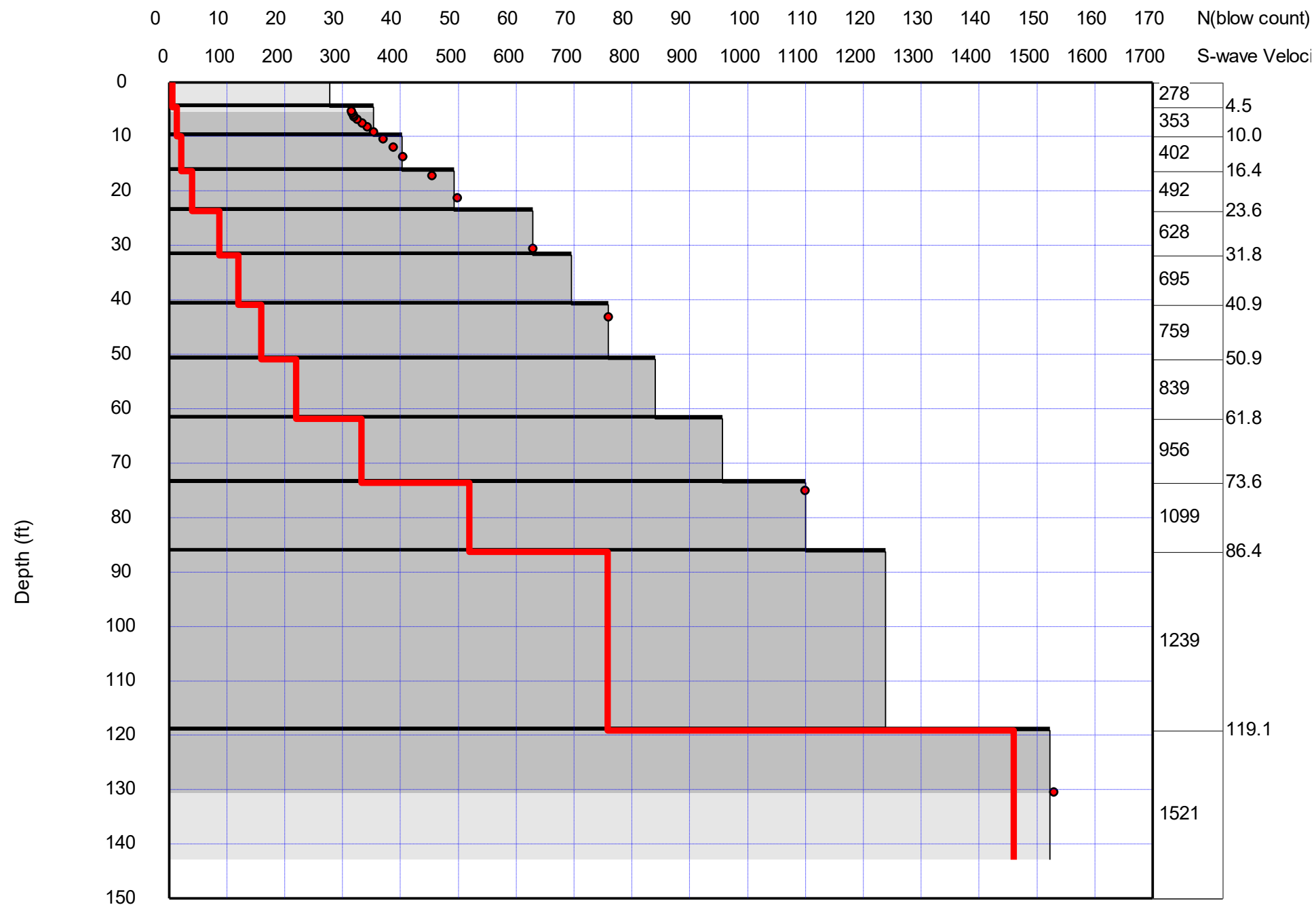
West Sunny Point North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 2016.dat

Average Vs to 100ft = 668.7 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 7.37% after 10 Iterations

Average Vs to 100 feet = 668.7 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – West Sunny Point North – Shot 2004

West Sunny Point North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



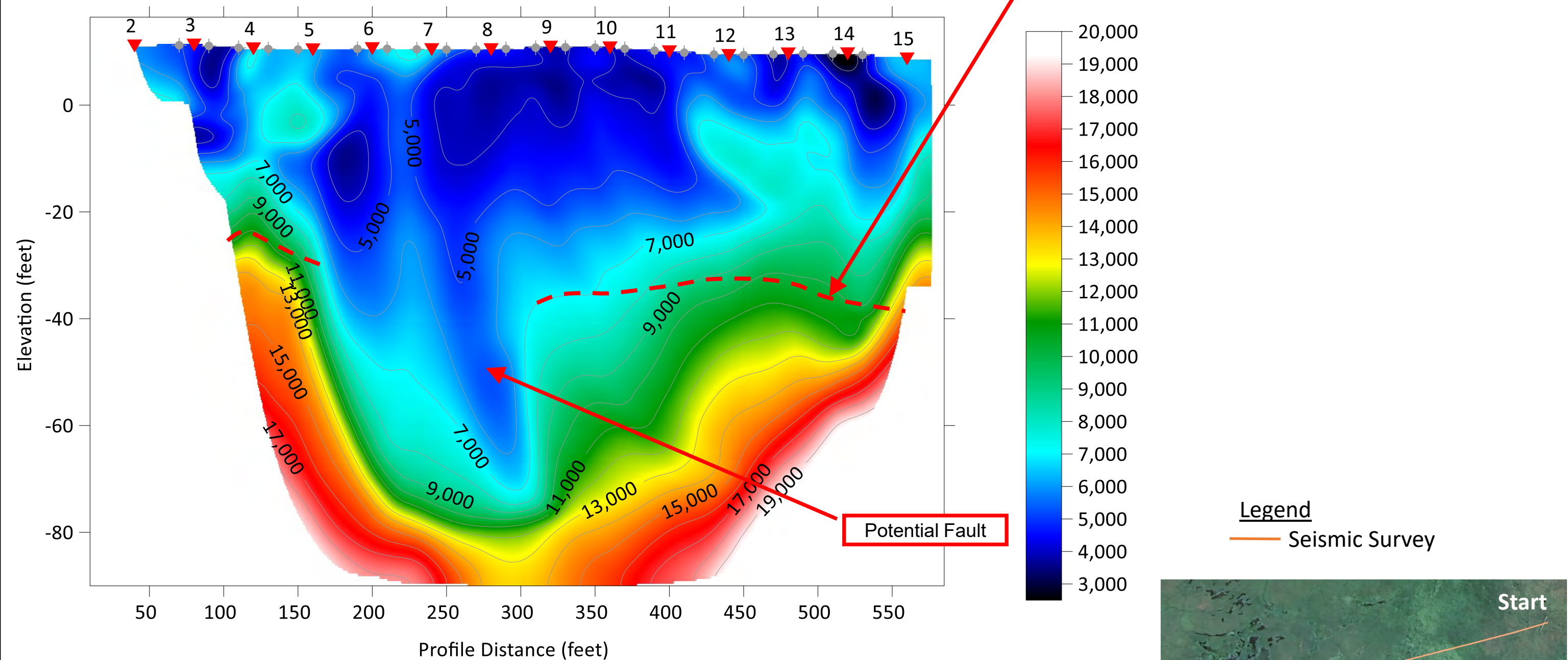
| West Sunny Point North – MASW 1D Results |                     |            |
|------------------------------------------|---------------------|------------|
| Geophysical Investigation                |                     |            |
| Shot File Number                         | Vs100 (feet/second) | Site Class |
| 2001                                     | 782.1               | D          |
| 2002                                     | 761.0               | D          |
| 2015                                     | 695.5               | D          |
| 2016                                     | 668.7               | D          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                       |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities (feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                |
| B                                                  | Rock                                      | 2,500 to 5,000                                                        |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                        |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                          |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                  |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                             |

|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | West Sunny Point North                                                |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |

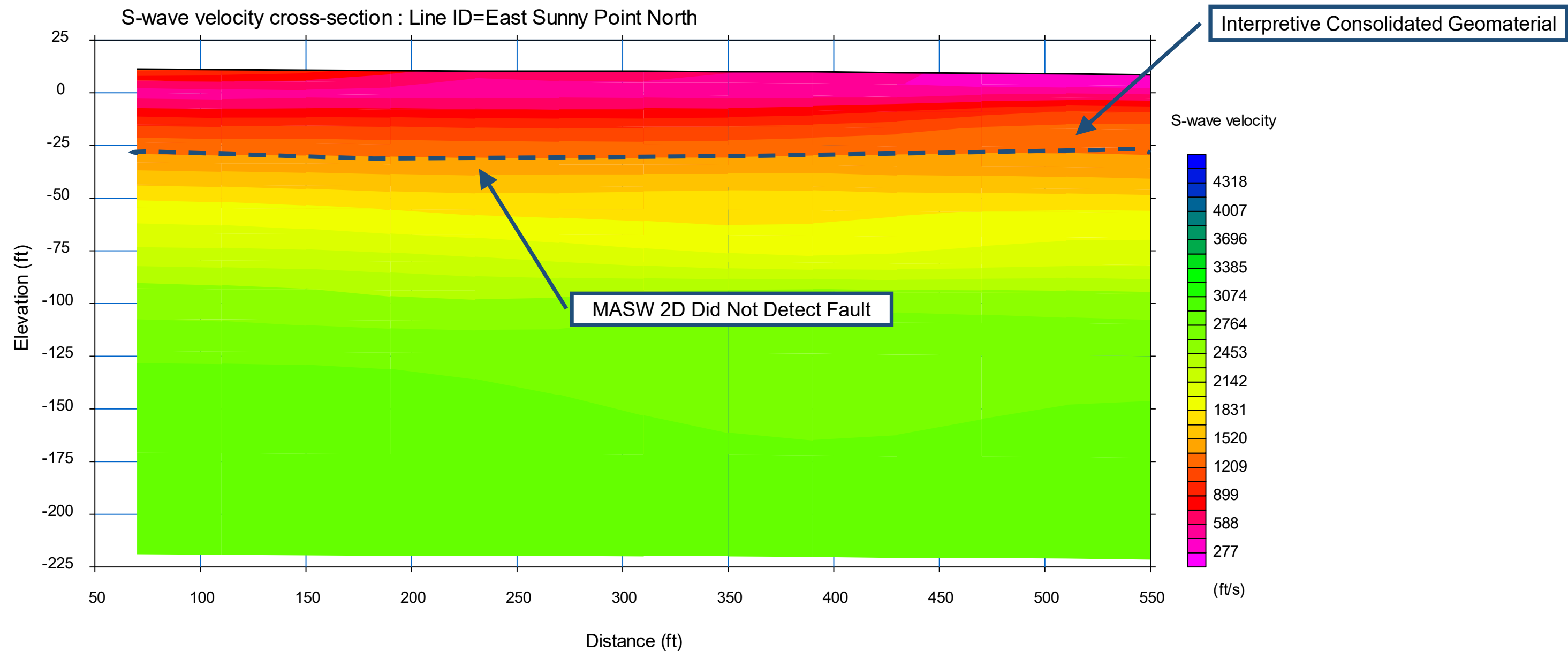
East Sunny Point North - Seismic Refraction

East Sunny Point North RMS error 12.2%=2.17ms 20 WET itr. 50Hz Width 3.0% initial GRADIENT.GRD v. 4.05



| Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities |  |                                  |  |
|------------------------------------------------------------|--|----------------------------------|--|
| East Sunny Point North                                     |  |                                  |  |
| Analysis by: David Barrick                                 |  | Project: Douglas Island Crossing |  |
| Date: February 14, 2024                                    |  | Project No.: 1138.63234.01       |  |





RMS Error = 10.08% after 10 Iterations

Legend  
— Seismic Survey



**Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities**

East Sunny Point North

Analysis by: David Barrick

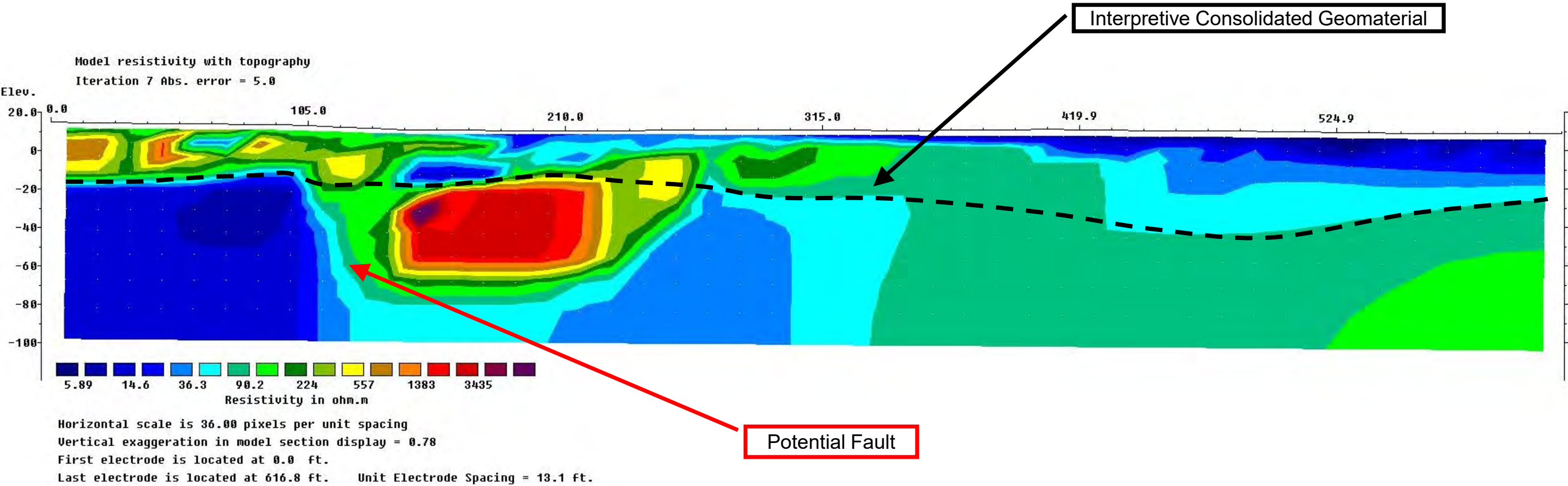
Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





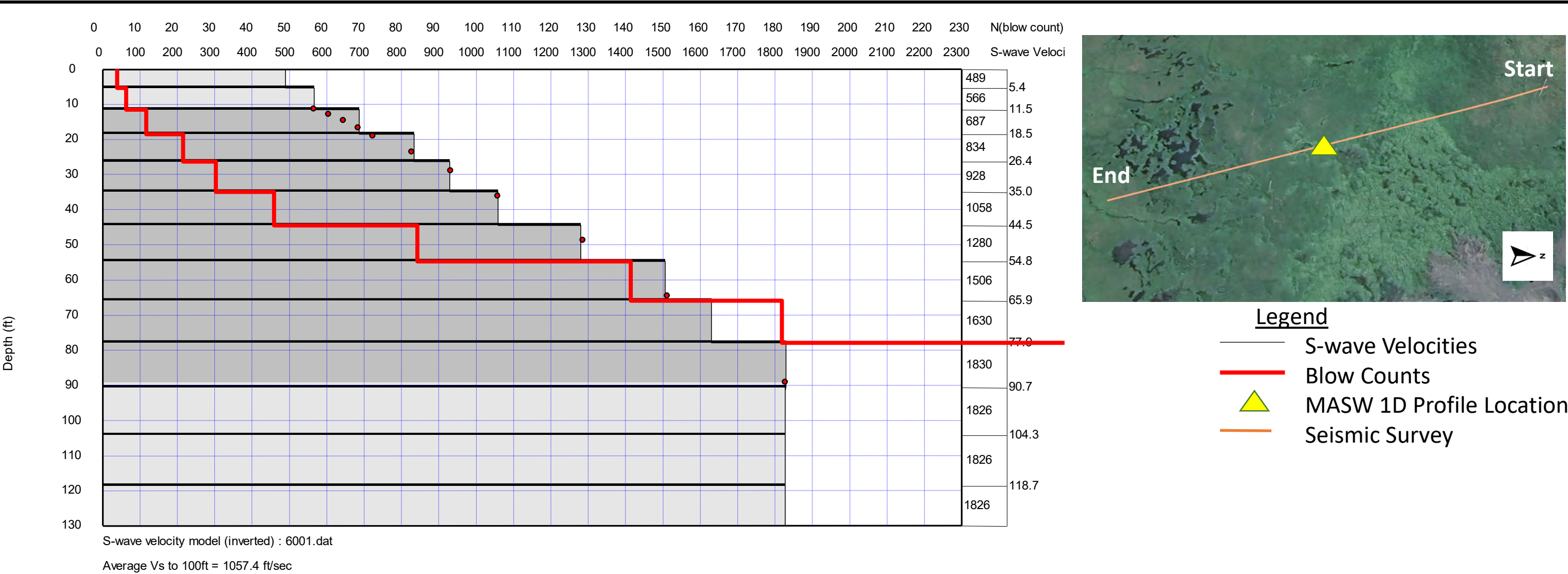


RMS Error = 5.0% after 7 Iterations

Legend  
— Seismic Survey



|                                                                                     |                                      |                                  |
|-------------------------------------------------------------------------------------|--------------------------------------|----------------------------------|
|  | Electrical Resistivity Tomography 2D |                                  |
|                                                                                     | East Sunny Point North               |                                  |
|                                                                                     | Analysis by: David Barrick           | Project: Douglas Island Crossing |
|                                                                                     | Date: February 14, 2024              | Project No.: 1138.63234.01       |



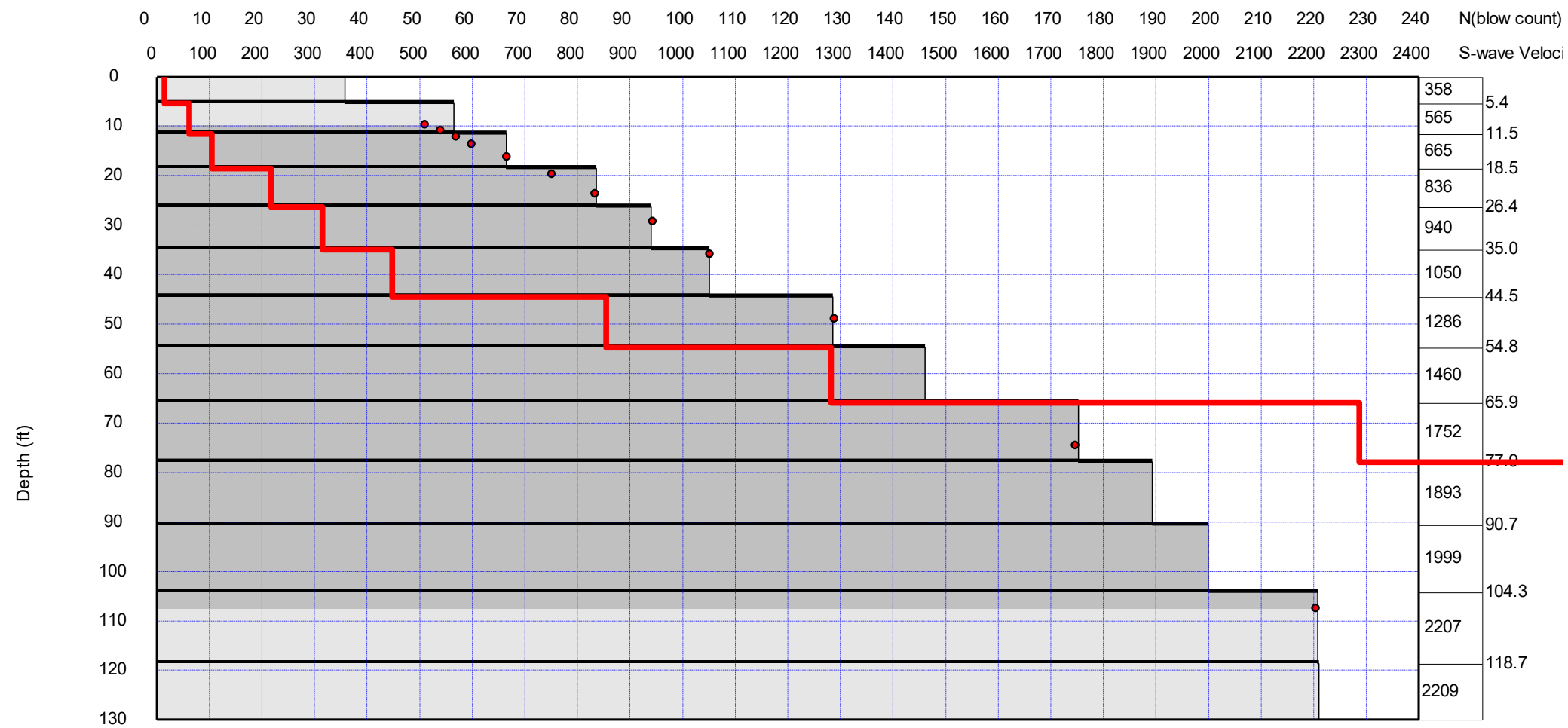
RMS Error = 4.71% after 10 Iterations

Average Vs to 100 feet = 1,057.4 ft/sec

|                                                                                     |                                                                                   |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 6001 |                                  |
|                                                                                     | East Sunny Point North                                                            |                                  |
|                                                                                     | Analysis by: David Barrick                                                        | Project: Douglas Island Crossing |
|                                                                                     | Date: February 14, 2024                                                           | Project No.: 1138.63234.01       |







S-wave velocity model (inverted) : 6015.dat

Average Vs to 100ft = 1022.1 ft/sec

RMS Error = 10.23% after 10 Iterations

Average Vs to 100 feet = 1,022.1 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 6015

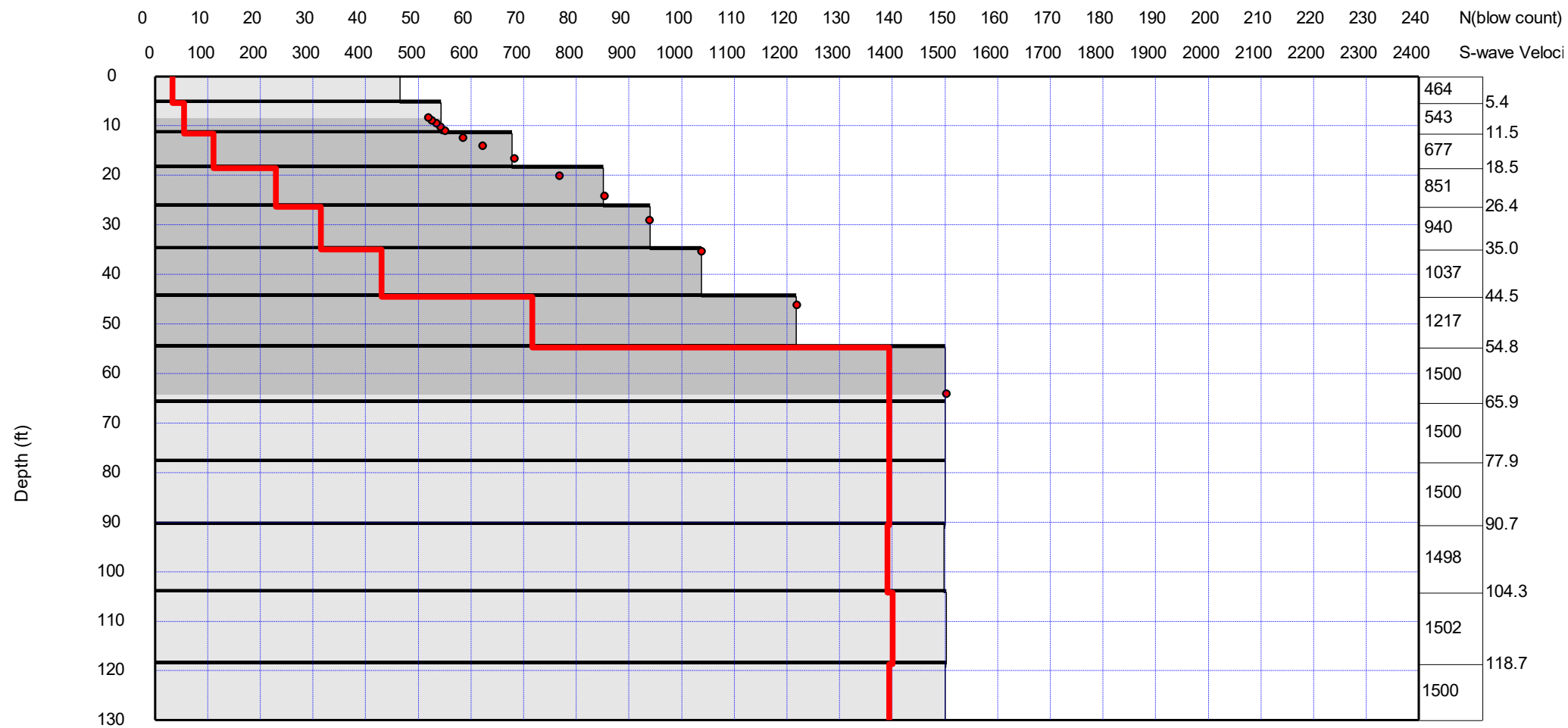
East Sunny Point North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 6016.dat

Average Vs to 100ft = 1006.5 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- MASW 1D Profile Location
- Seismic Survey

RMS Error = 4.01% after 10 Iterations

Average Vs to 100 feet = 1,006.5 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 1016

East Sunny Point North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01

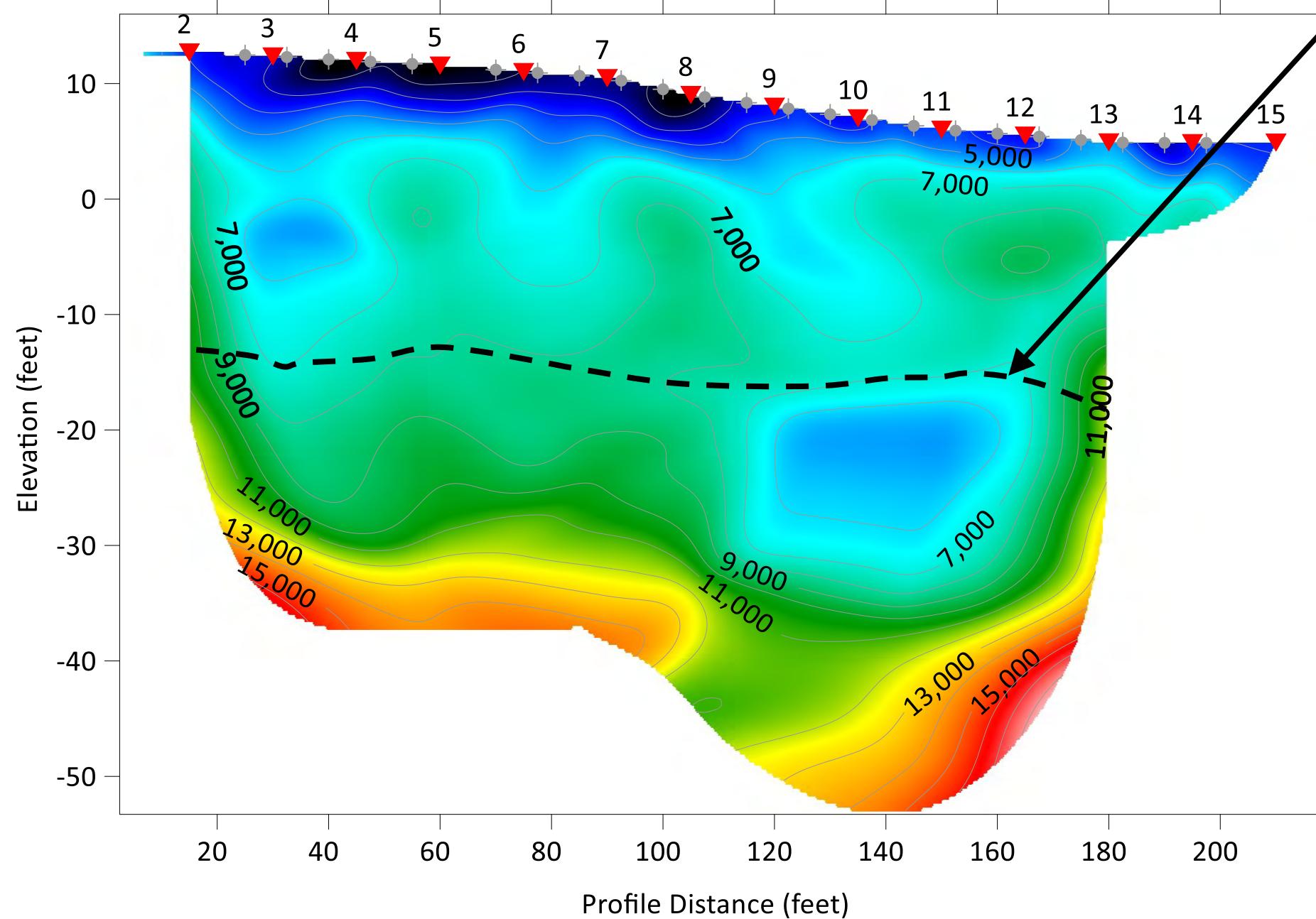
| East Sunny Point North – MASW 1D Results |                     |            |
|------------------------------------------|---------------------|------------|
| Geophysical Investigation                |                     |            |
| Shot File Number                         | Vs100 (feet/second) | Site Class |
| 6,001                                    | 1,057.4             | C          |
| 6,002                                    | 1,064.5             | C          |
| 6,015                                    | 1,022.1             | C          |
| 6,016                                    | 1,006.5             | C          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                       |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities (feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                |
| B                                                  | Rock                                      | 2,500 to 5,000                                                        |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                        |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                          |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                  |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                             |

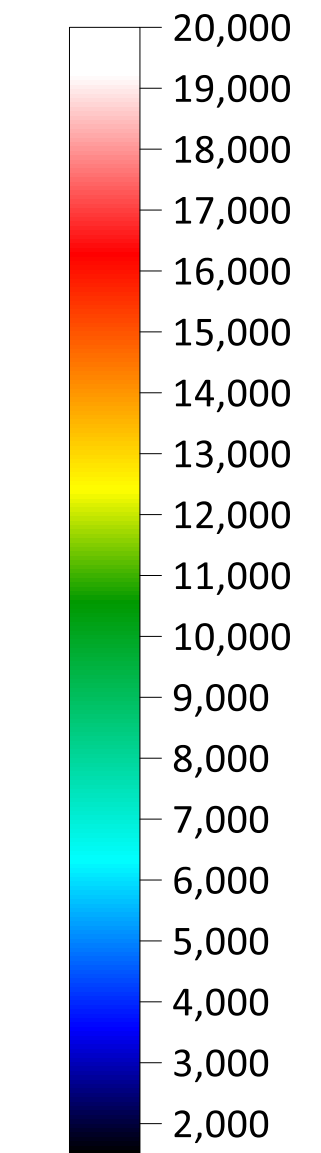
|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | East Sunny Point North                                                |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |



Sunny Point South RMS error 6.2%=0.51ms 20 WET itr. 50Hz Width 2.2% initial GRADIENT.GRD v. 4.02



Interpretive Consolidated Geomaterial



Legend

Seismic Survey



### Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities

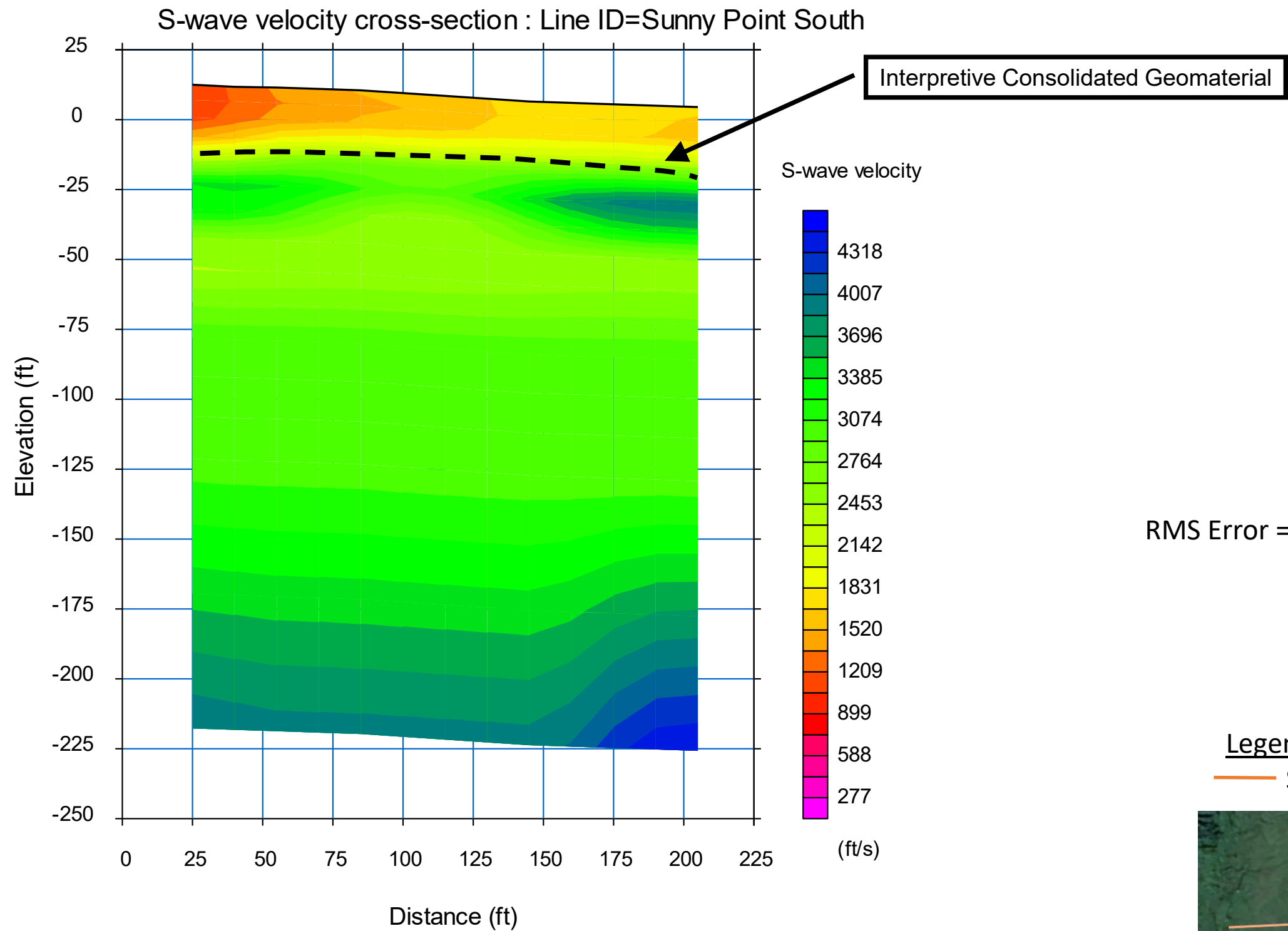
Sunny Point South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



# Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities

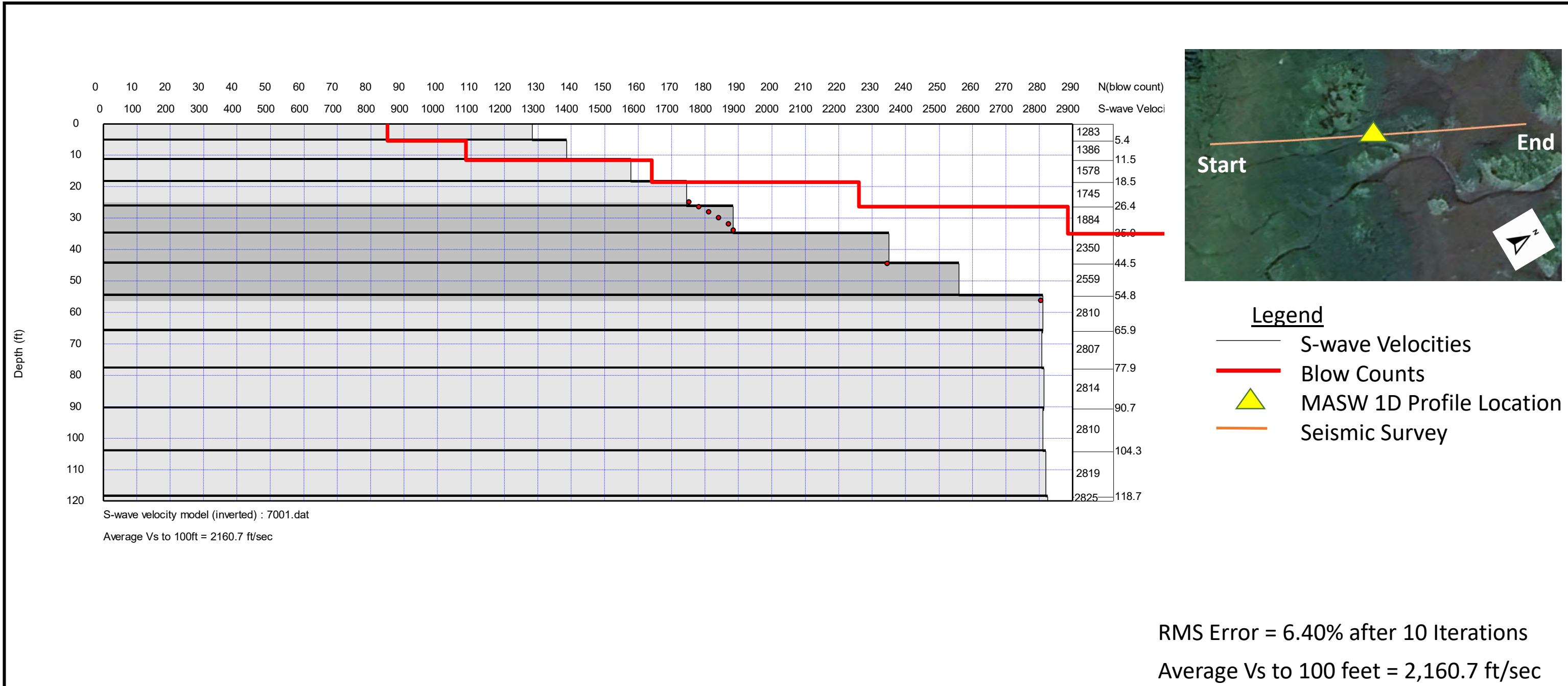
Sunny Point South

Analysis by: David Barrick

Project: Douglas Island Crossing

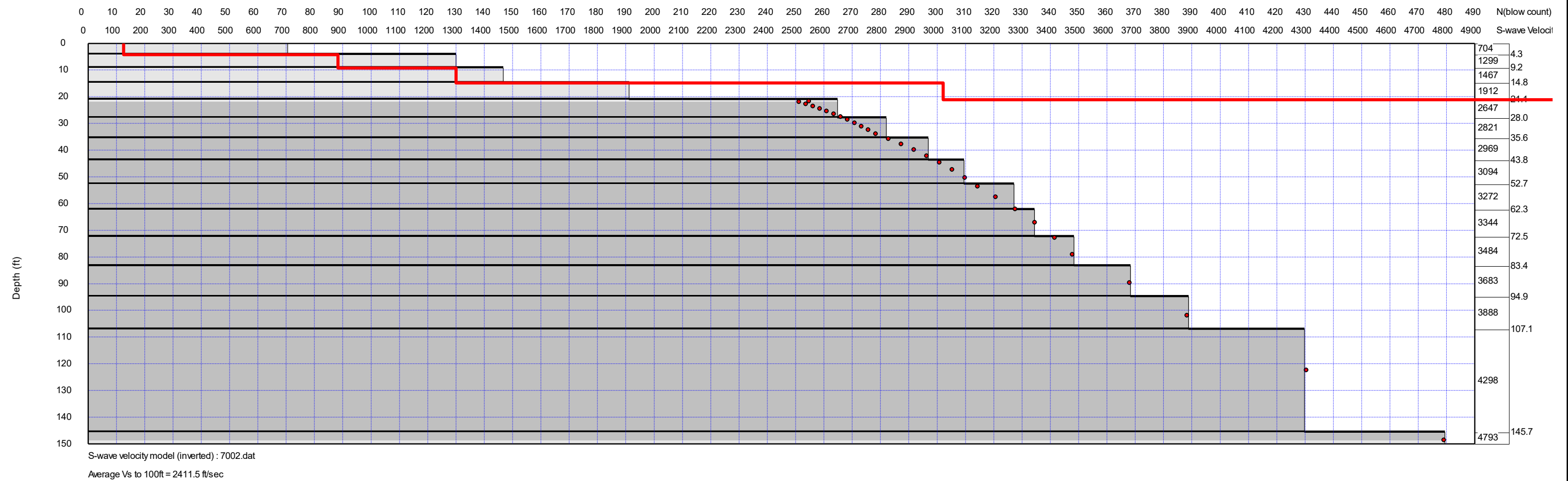
Date: February 14, 2024

Project No.: 1138.63234.01



|                                                                                     |                                                                                  |                                  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Sunny Point South – Shot 7001 |                                  |
|                                                                                     | Sunny Point South                                                                |                                  |
|                                                                                     | Analysis by: David Barrick                                                       | Project: Douglas Island Crossing |
|                                                                                     | Date: February 14, 2024                                                          | Project No.: 1138.63234.01       |





### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 4.38% after 10 Iterations  
Average Vs to 100 feet = 2,411.5 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Sunny Point South – Shot 7002

Sunny Point South

Analysis by: David Barrick

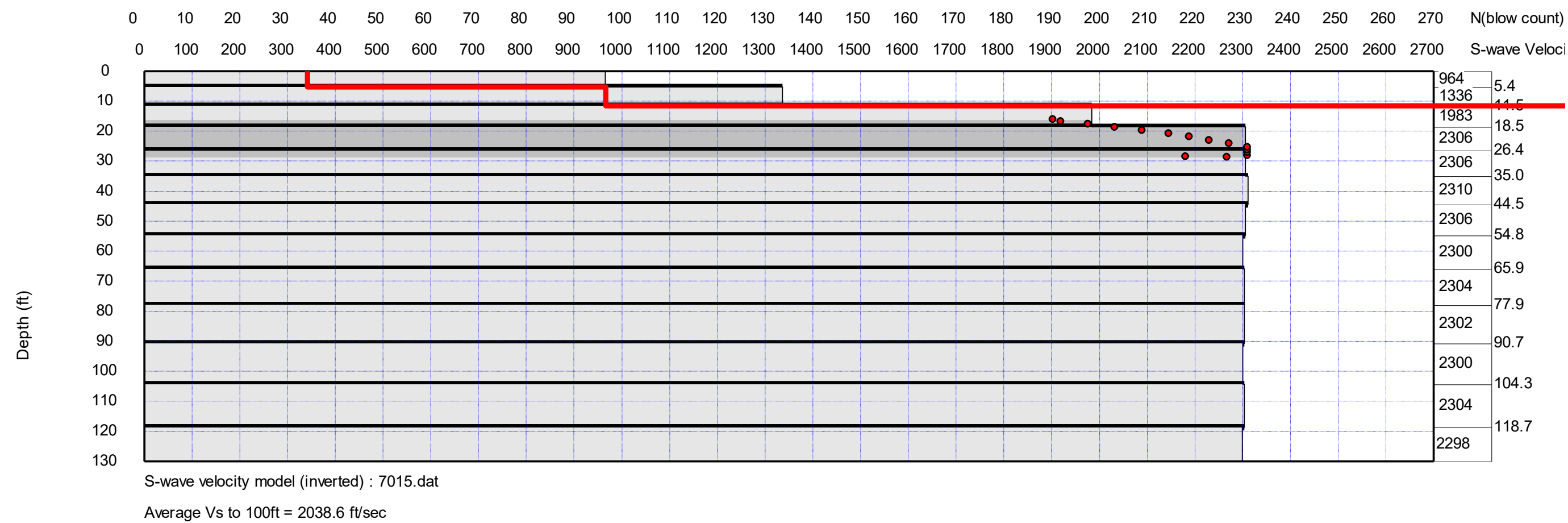
Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01

RMS Error = 3.48% after 10 Iterations  
Average Vs to 100 feet = 2,038.6 ft/sec

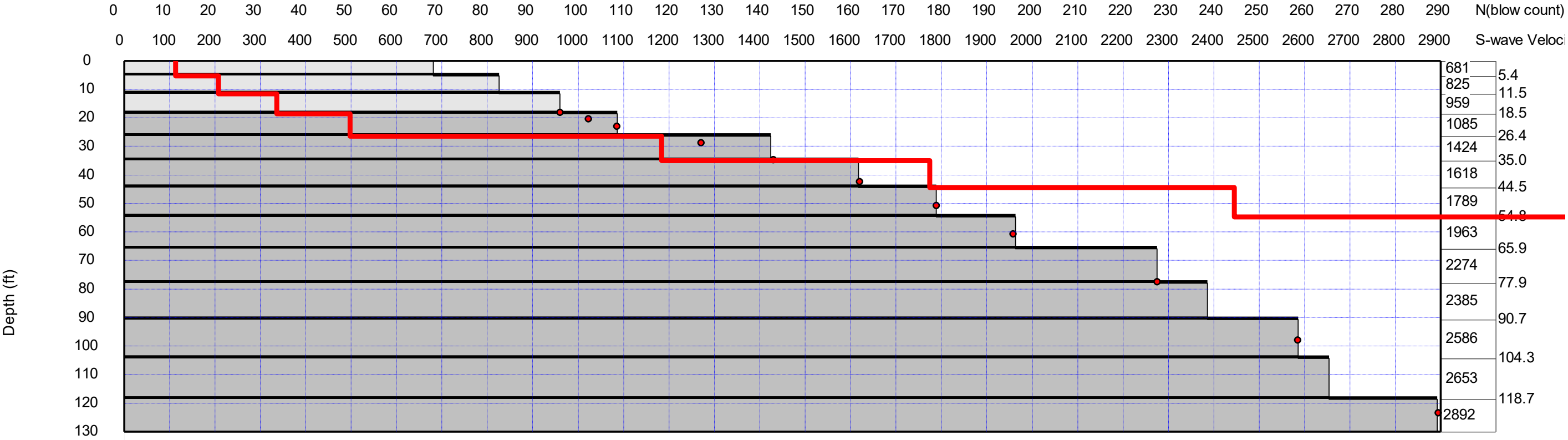
- Legend**
- S-wave Velocities
  - Blow Counts
  - MASW 1D Profile Location
  - Seismic Survey



|                                                                                  |                                  |
|----------------------------------------------------------------------------------|----------------------------------|
| Multichannel Analysis of Surface Waves (MASW) 1D – Sunny Point South – Shot 7015 |                                  |
| Sunny Point South                                                                |                                  |
| Analysis by: David Barrick                                                       | Project: Douglas Island Crossing |
| Date: February 14, 2024                                                          | Project No.: 1138.63234.01       |

RMS Error = 4.80% after 10 Iterations  
Average Vs to 100 feet = 1,482.8 ft/sec

- Legend**
- S-wave Velocities
  - Blow Counts
  - MASW 1D Profile Location
  - Seismic Survey



S-wave velocity model (inverted) : 7016.dat  
Average Vs to 100ft = 1482.8 ft/sec



|                                                                                  |                                  |
|----------------------------------------------------------------------------------|----------------------------------|
| Multichannel Analysis of Surface Waves (MASW) 1D – Sunny Point South – Shot 7016 |                                  |
| Sunny Point South                                                                |                                  |
| Analysis by: David Barrick                                                       | Project: Douglas Island Crossing |
| Date: February 14, 2024                                                          | Project No.: 1138.63234.01       |

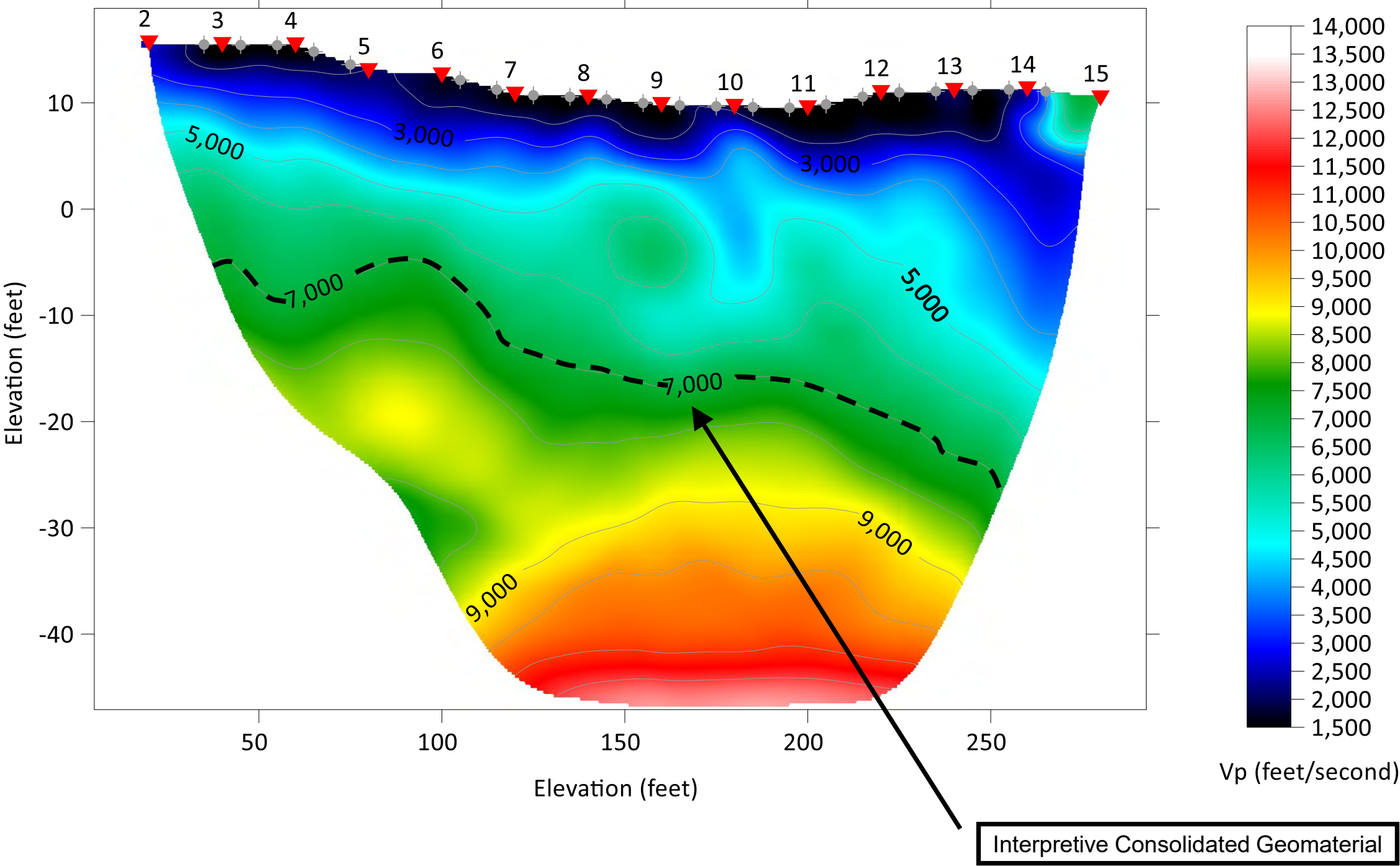


| Sunny Point South – MASW 1D Results |                     |            |
|-------------------------------------|---------------------|------------|
| Geophysical Investigation           |                     |            |
| Shot File Number                    | Vs100 (feet/second) | Site Class |
| 7,001                               | 2,160.7             | C          |
| 7,002                               | 2,411.5             | C          |
| 7,015                               | 2,038.6             | C          |
| 7,016                               | 1,482.8             | C          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                       |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities (feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                |
| B                                                  | Rock                                      | 2,500 to 5,000                                                        |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                        |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                          |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                  |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                             |

|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | Sunny Point South                                                     |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |

VanderbiltNorth RMS error 5.2%=0.86ms 20 WET itr. 50Hz Width 3.0% initial GRADIENT.GRD v. 4.02



Legend

Seismic Survey



Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities

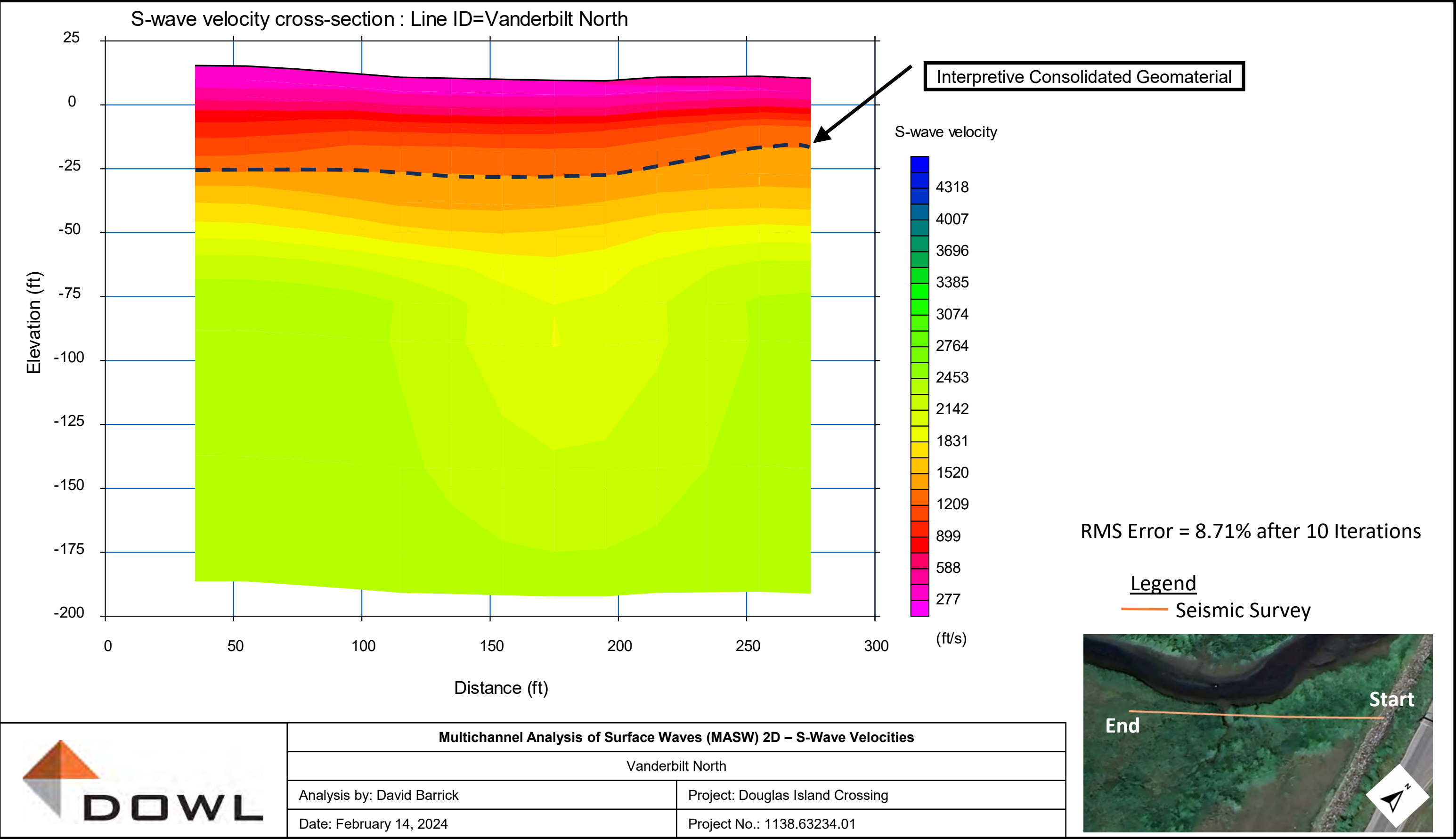
Vanderbilt North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities

Vanderbilt North

Analysis by: David Barrick

Project: Douglas Island Crossing

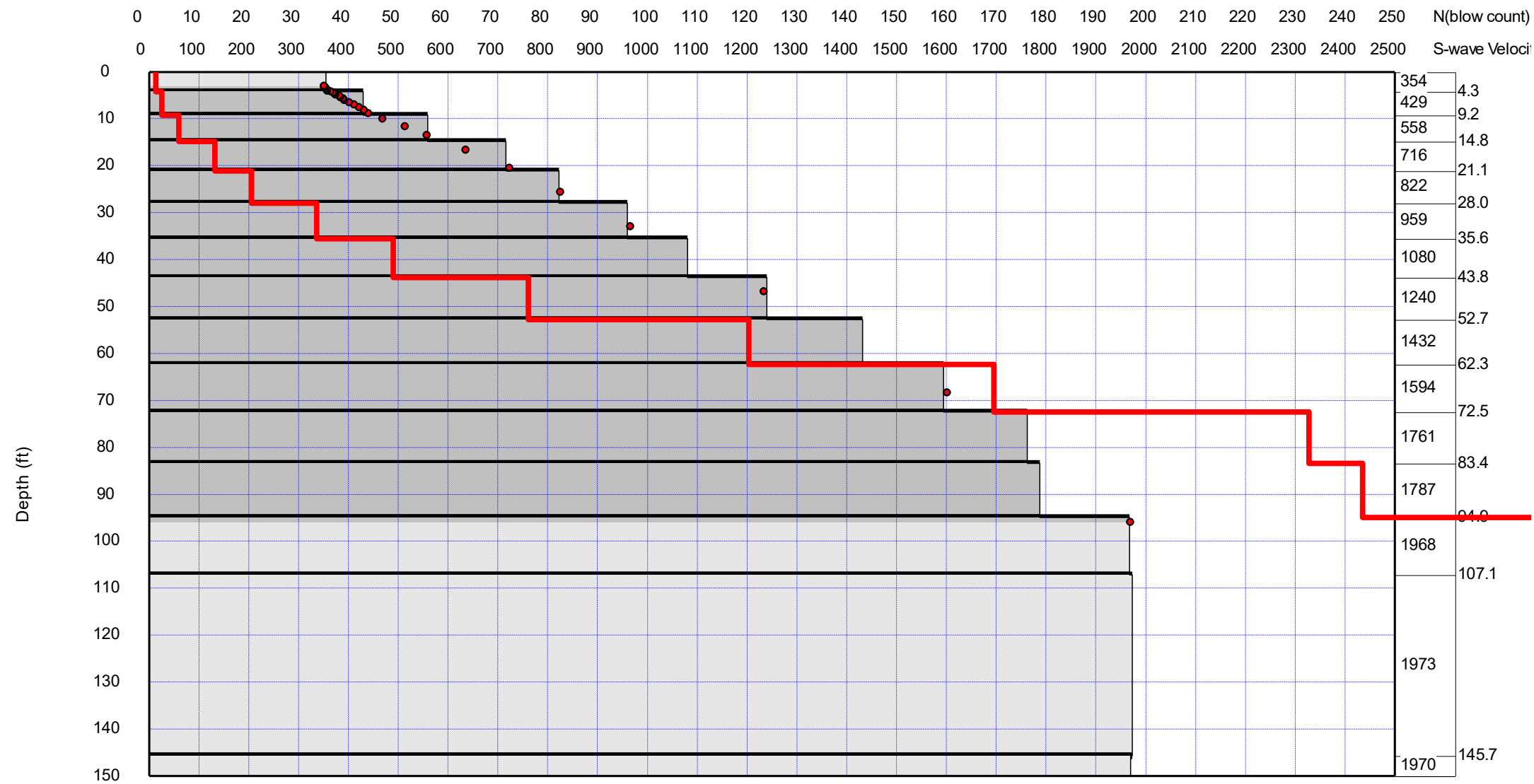
Date: February 14, 2024

Project No.: 1138.63234.01









S-wave velocity model (inverted) : 5002.dat

Average Vs to 100ft = 982.4 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 6.34% after 10 Iterations

Average Vs to 100 feet = 982.4 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Vanderbilt North – Shot 5002

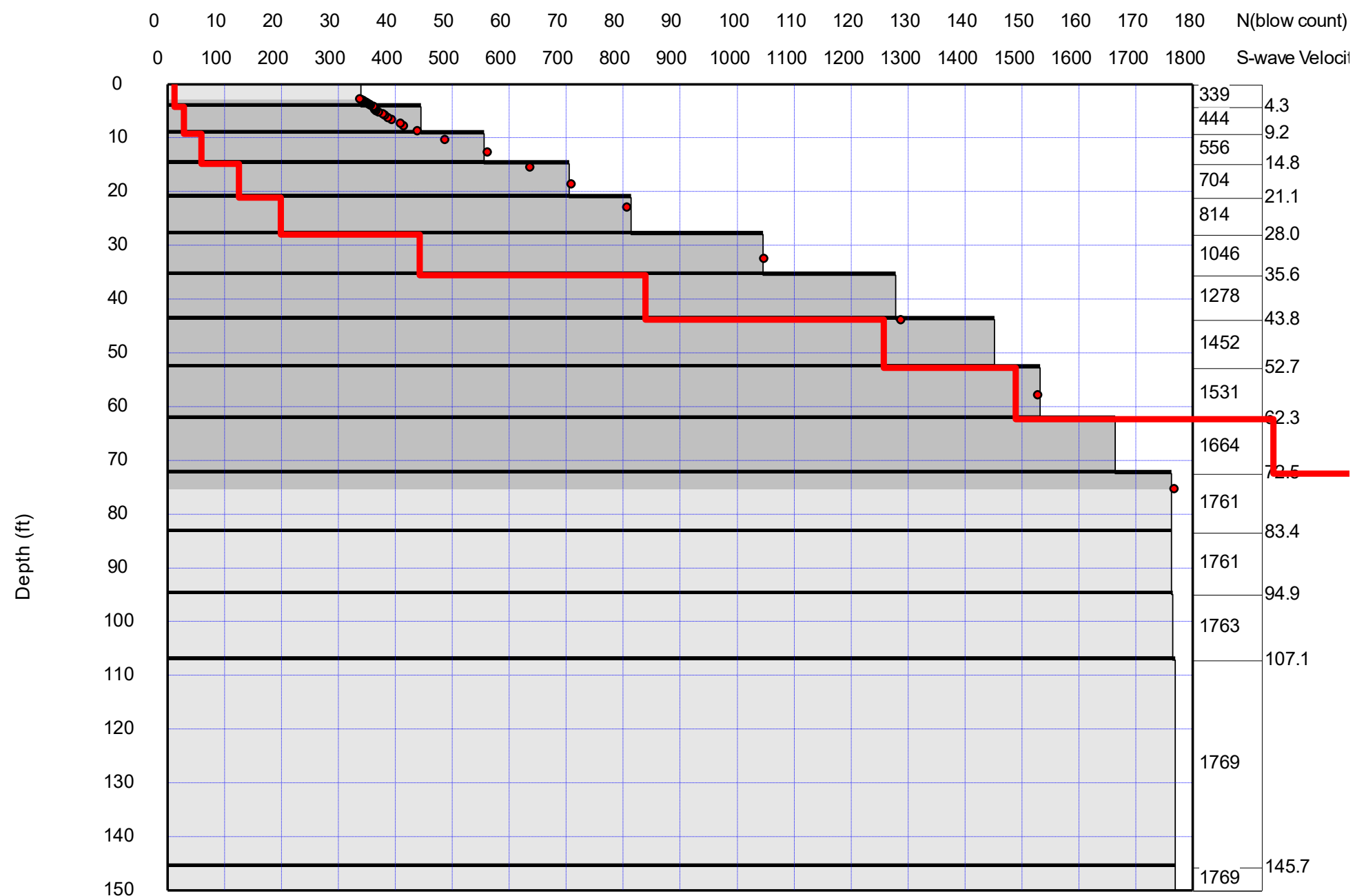
Vanderbilt North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 5015.dat

Average Vs to 100ft = 1010.0 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 8.86% after 10 Iterations

Average Vs to 100 feet = 1,010.0 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Vanderbilt North – Shot 5015

Vanderbilt North

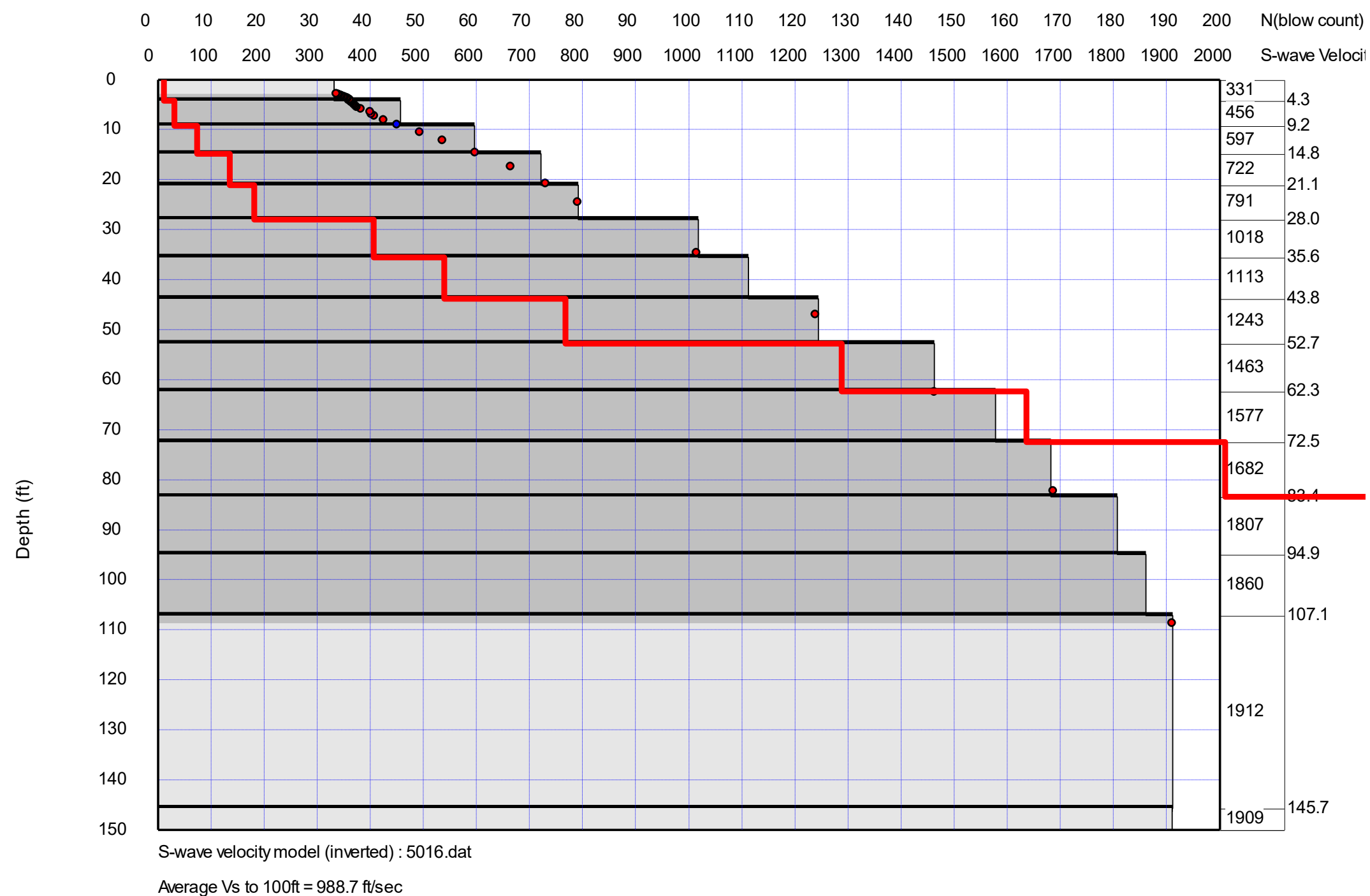
Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 6.27% after 10 Iterations  
Average Vs to 100 feet = 988.7 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Vanderbilt North – Shot 5016

Vanderbilt North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

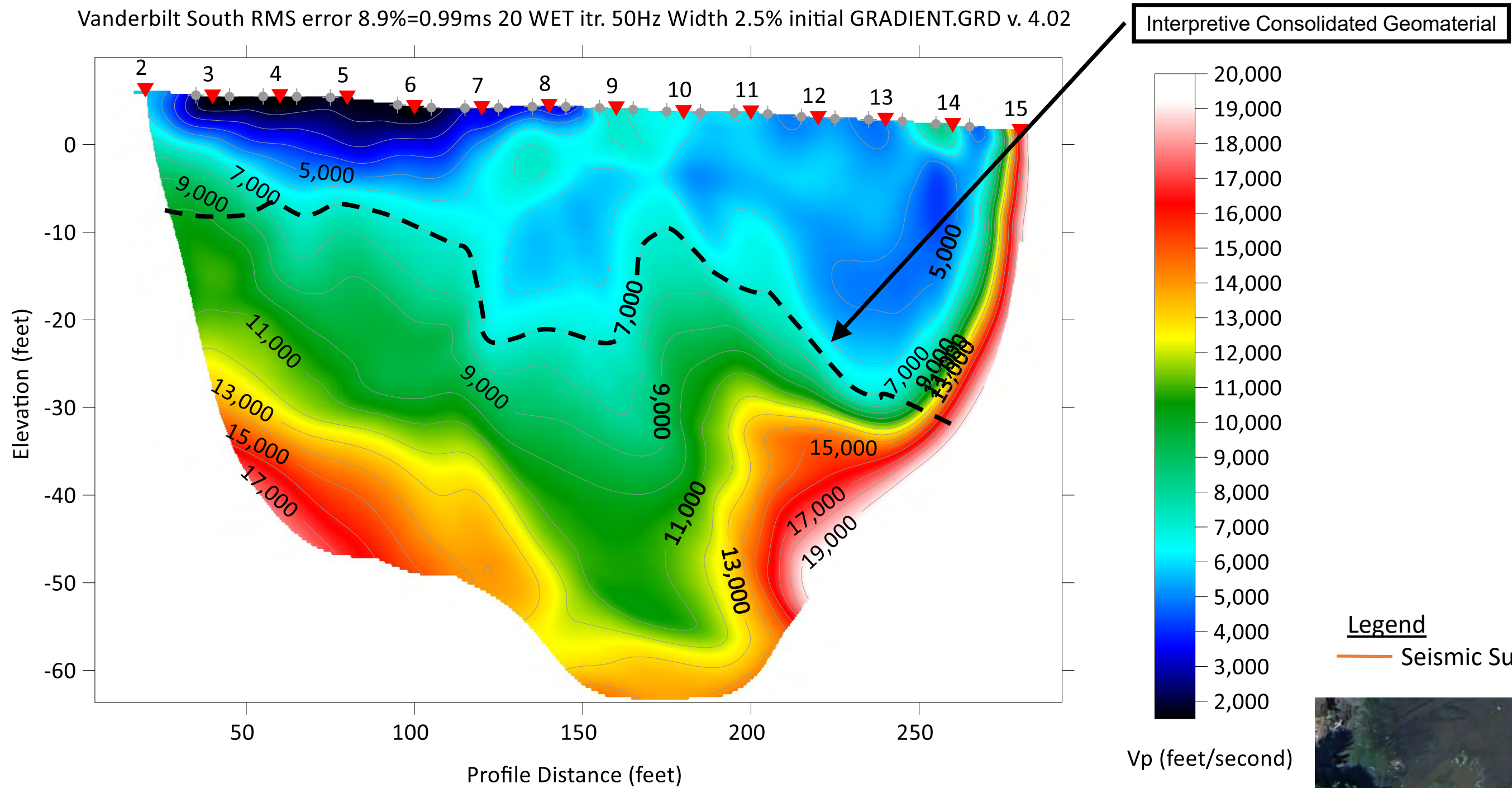
Project No.: 1138.63234.01

| Vanderbilt North – MASW 1D Results |                     |            |
|------------------------------------|---------------------|------------|
| Geophysical Investigation          |                     |            |
| Shot File Number                   | Vs100 (feet/second) | Site Class |
| 5,001                              | 952.6               | D          |
| 5,002                              | 982.4               | D          |
| 5,015                              | 1,010.0             | D          |
| 5,016                              | 988.7               | D          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                       |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities (feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                |
| B                                                  | Rock                                      | 2,500 to 5,000                                                        |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                        |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                          |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                  |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                             |

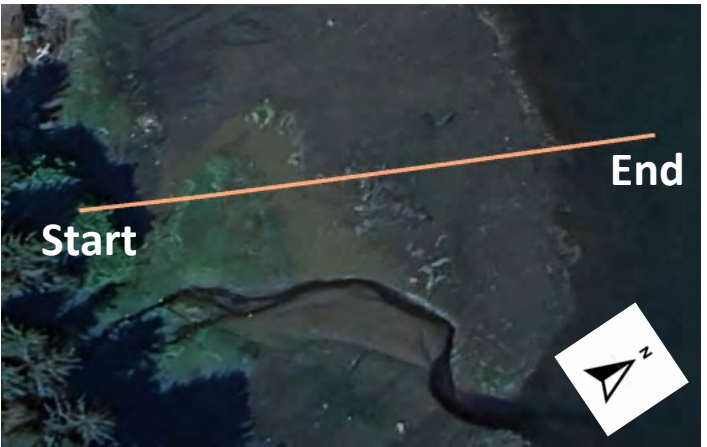
|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | Vanderbilt North                                                      |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |

Vanderbilt South RMS error 8.9%=0.99ms 20 WET itr. 50Hz Width 2.5% initial GRADIENT.GRD v. 4.02



Legend

— Seismic Survey



**Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities**

Vanderbilt South

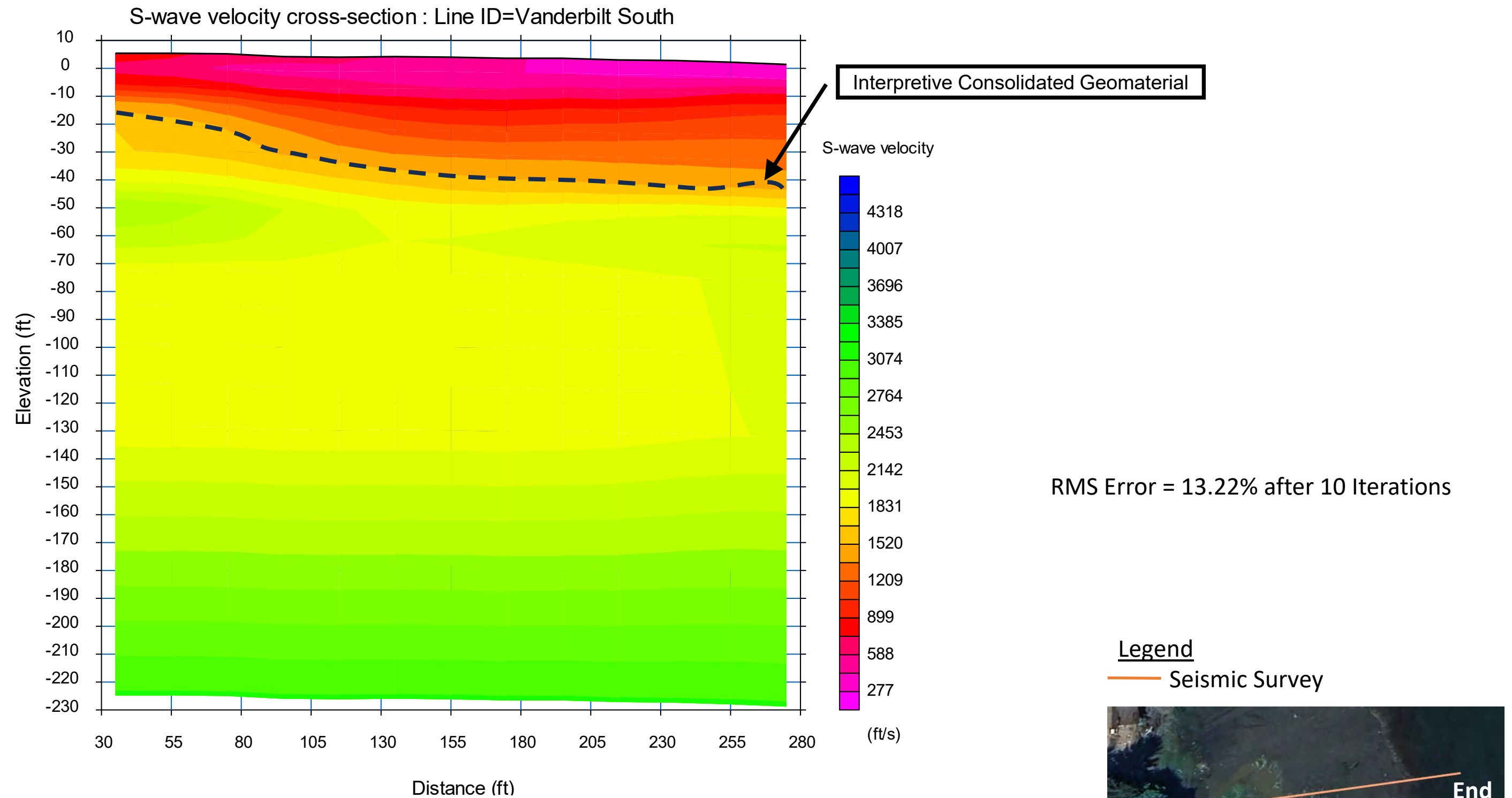
Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





# Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities

Vanderbilt South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

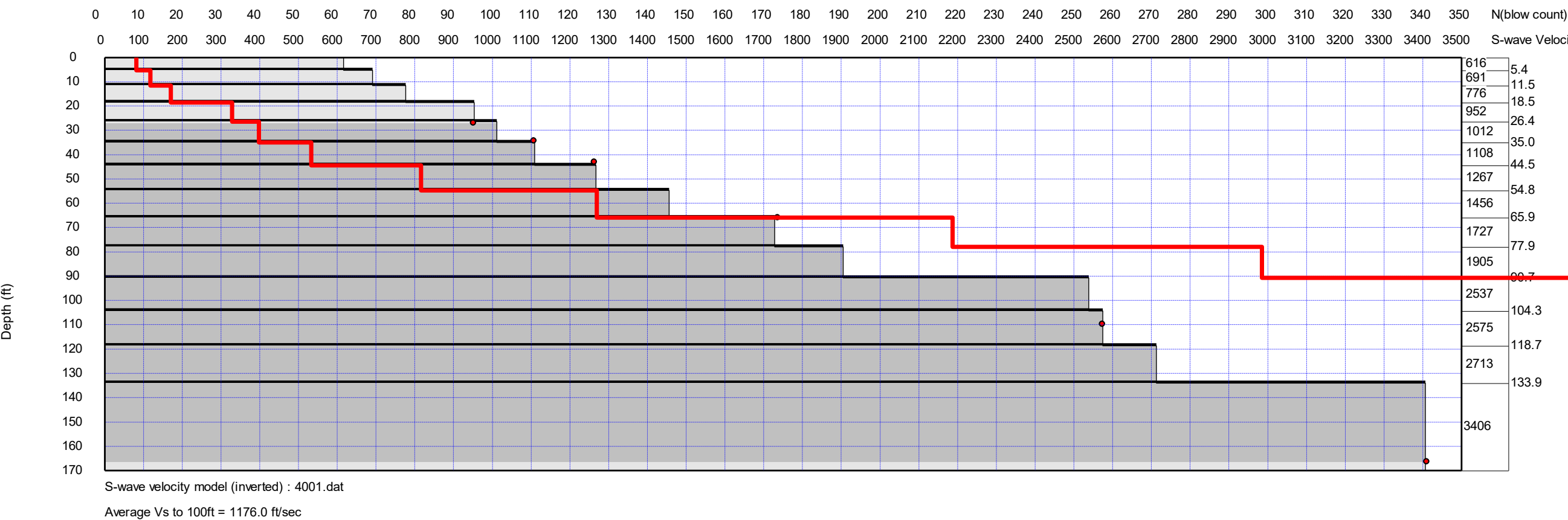
Project No.: 1138.63234.01

RMS Error = 9.56% after 10 Iterations

Average Vs to 100 feet = 1,176.0 ft/sec

Legend

- S-wave Velocities
- Blow Counts
- MASW 1D Profile Location
- Seismic Survey



Multichannel Analysis of Surface Waves (MASW) 1D – Vanderbilt South – Shot 4001

Vanderbilt South

Analysis by: David Barrick

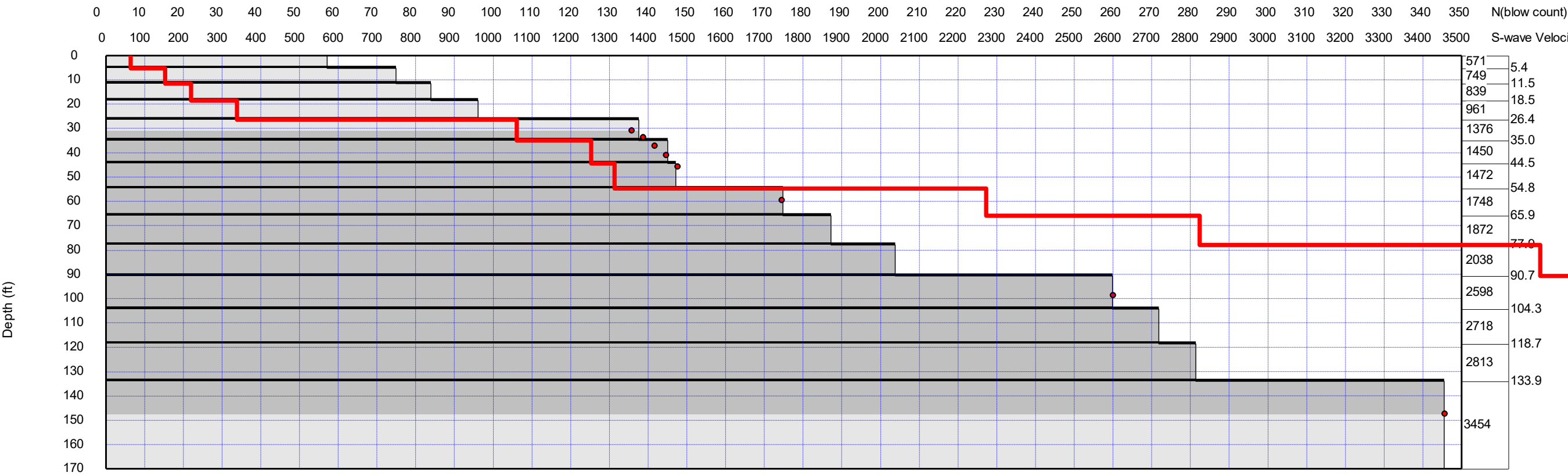
Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01

RMS Error = 6.41% after 10 Iterations  
Average Vs to 100 feet = 1,306.5 ft/sec

- Legend**
- S-wave Velocities
  - Blow Counts
  - MASW 1D Profile Location
  - Seismic Survey



S-wave velocity model (inverted) : 4002.dat

Average Vs to 100ft = 1306.5 ft/sec



**Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 4002**

Vanderbilt South

Analysis by: David Barrick

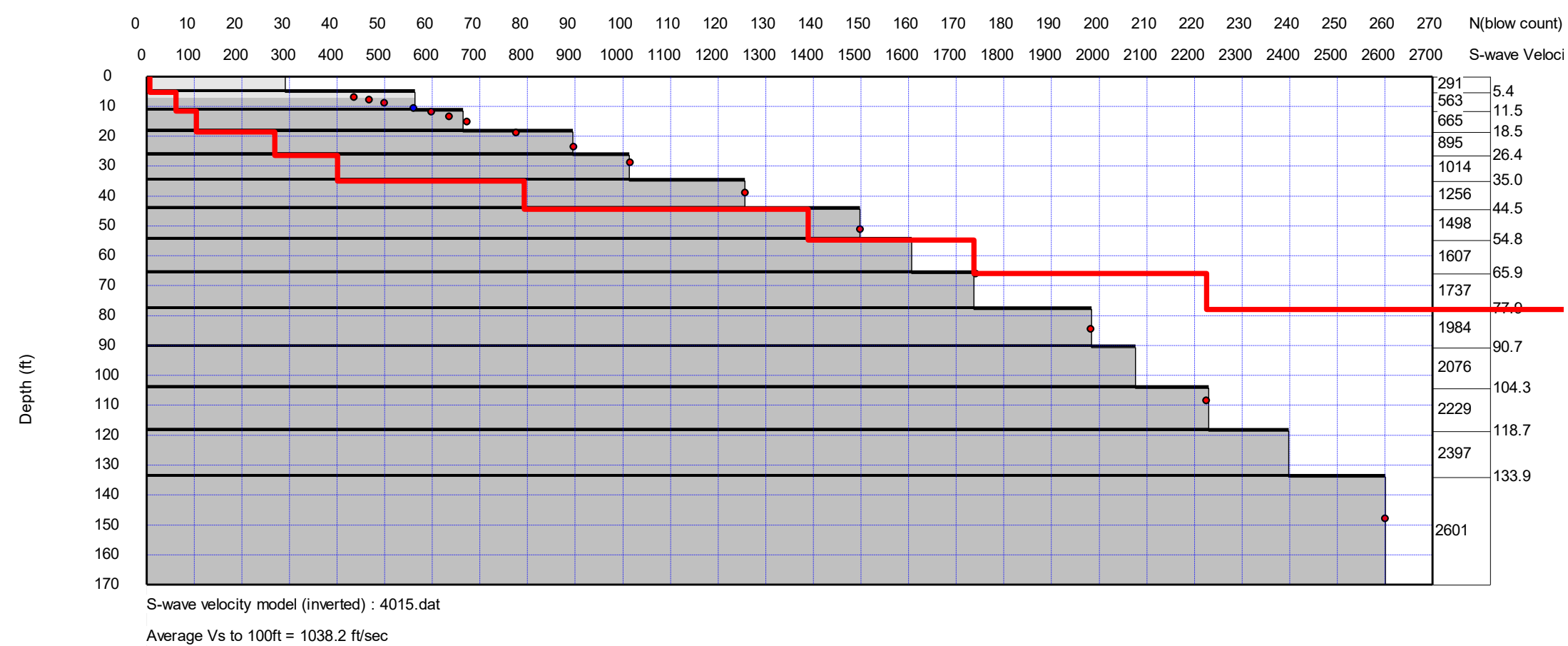
Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



RMS Error = 7.16% after 10 Iterations  
Average Vs to 100 feet = 1,038.2 ft/sec



**Legend**

- S-wave Velocities
- Blow Counts
- MASW 1D Profile Location
- Seismic Survey



**Multichannel Analysis of Surface Waves (MASW) 1D – Vanderbilt South – Shot 4015**

Vanderbilt South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

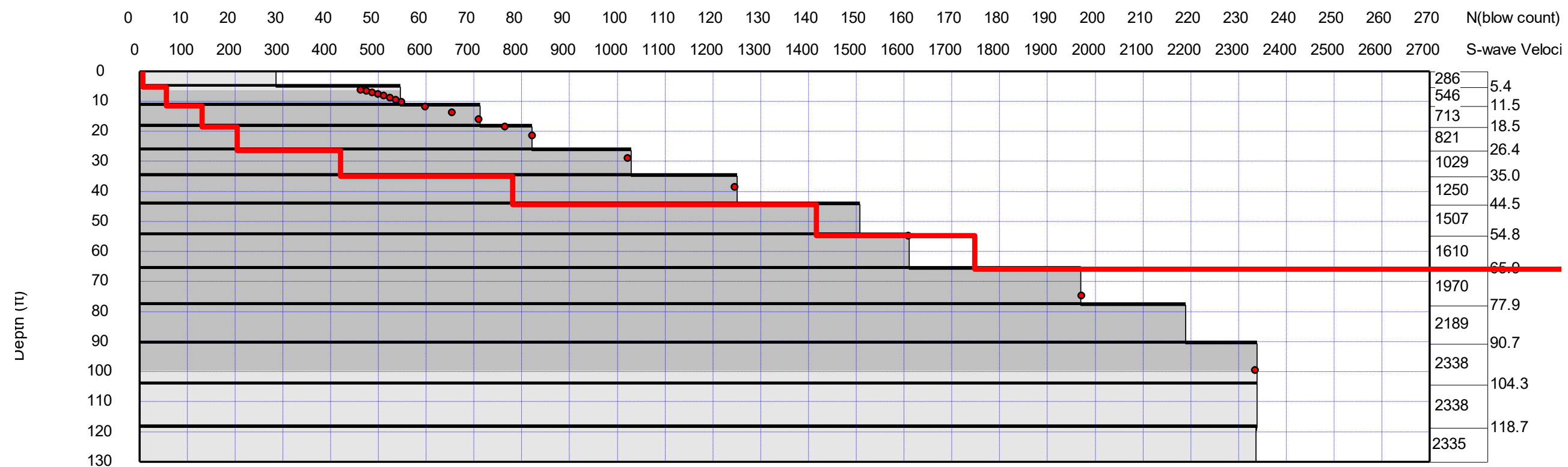
Project No.: 1138.63234.01

RMS Error = 11.78% after 10 Iterations

Average Vs to 100 feet = 1,052.8 ft/sec

### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey



S-wave velocity model (inverted) : 4016.dat

Average Vs to 100ft = 1052.8 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Vanderbilt South – Shot 4016

Vanderbilt South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01

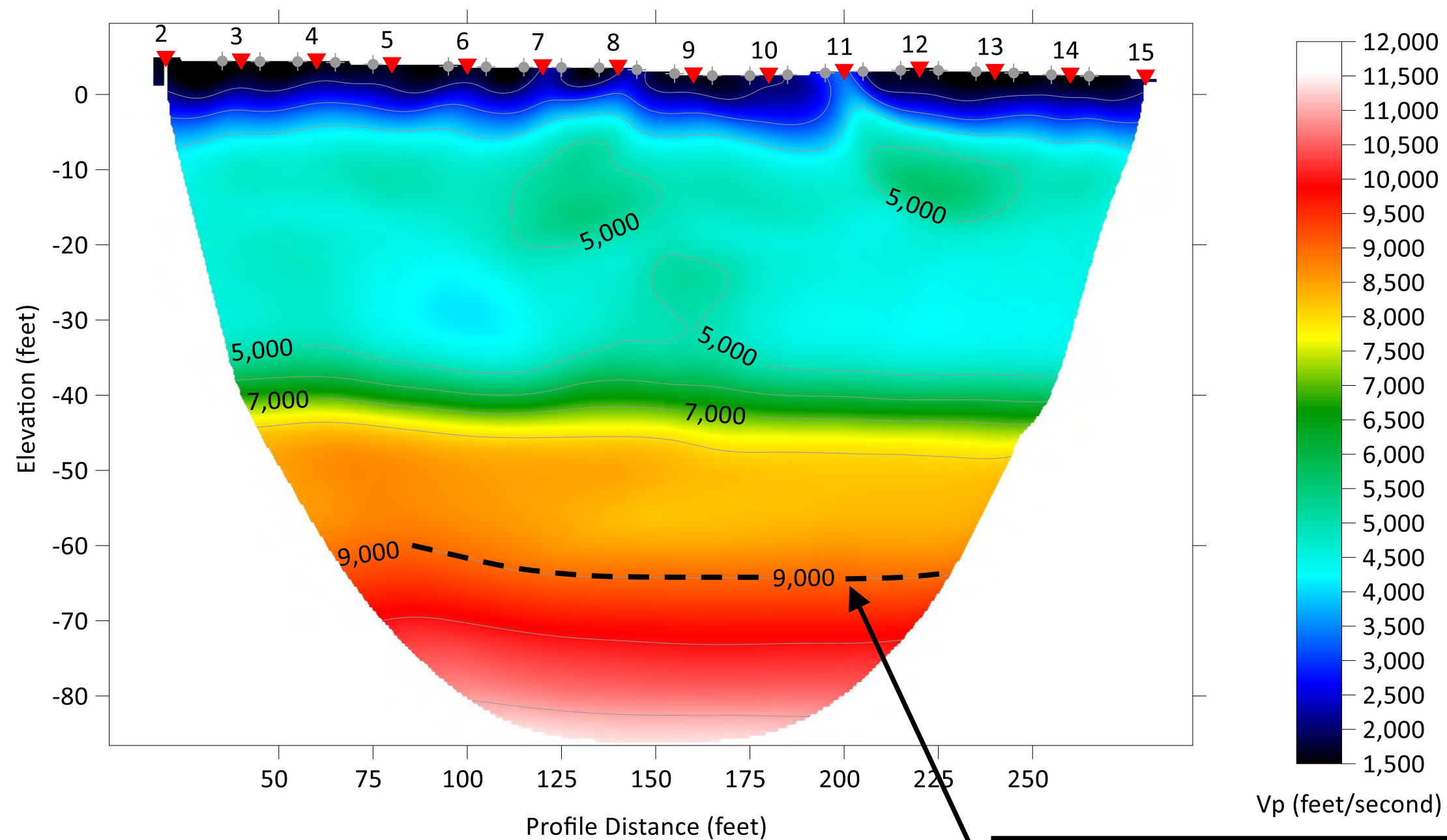
| Vanderbilt South – MASW 1D Results |                        |            |
|------------------------------------|------------------------|------------|
| Geophysical Investigation          |                        |            |
| Shot File Number                   | Vs100<br>(feet/second) | Site Class |
| 4,001                              | 1,176.0                | D          |
| 4,002                              | 1,306.5                | C          |
| 4,015                              | 1,038.2                | D          |
| 4,016                              | 1,052.8                | D          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                          |
|----------------------------------------------------|-------------------------------------------|--------------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities<br>(feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                   |
| B                                                  | Rock                                      | 2,500 to 5,000                                                           |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                           |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                             |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                     |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                                |

|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | Vanderbilt South                                                      |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |



Twin Lakes North RMS error 5.1%=1.09ms 20 WET itr. 50Hz Width 3.5% initial GRADIENT.GRD v. 4.02



Legend

— Seismic Survey



**Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities**

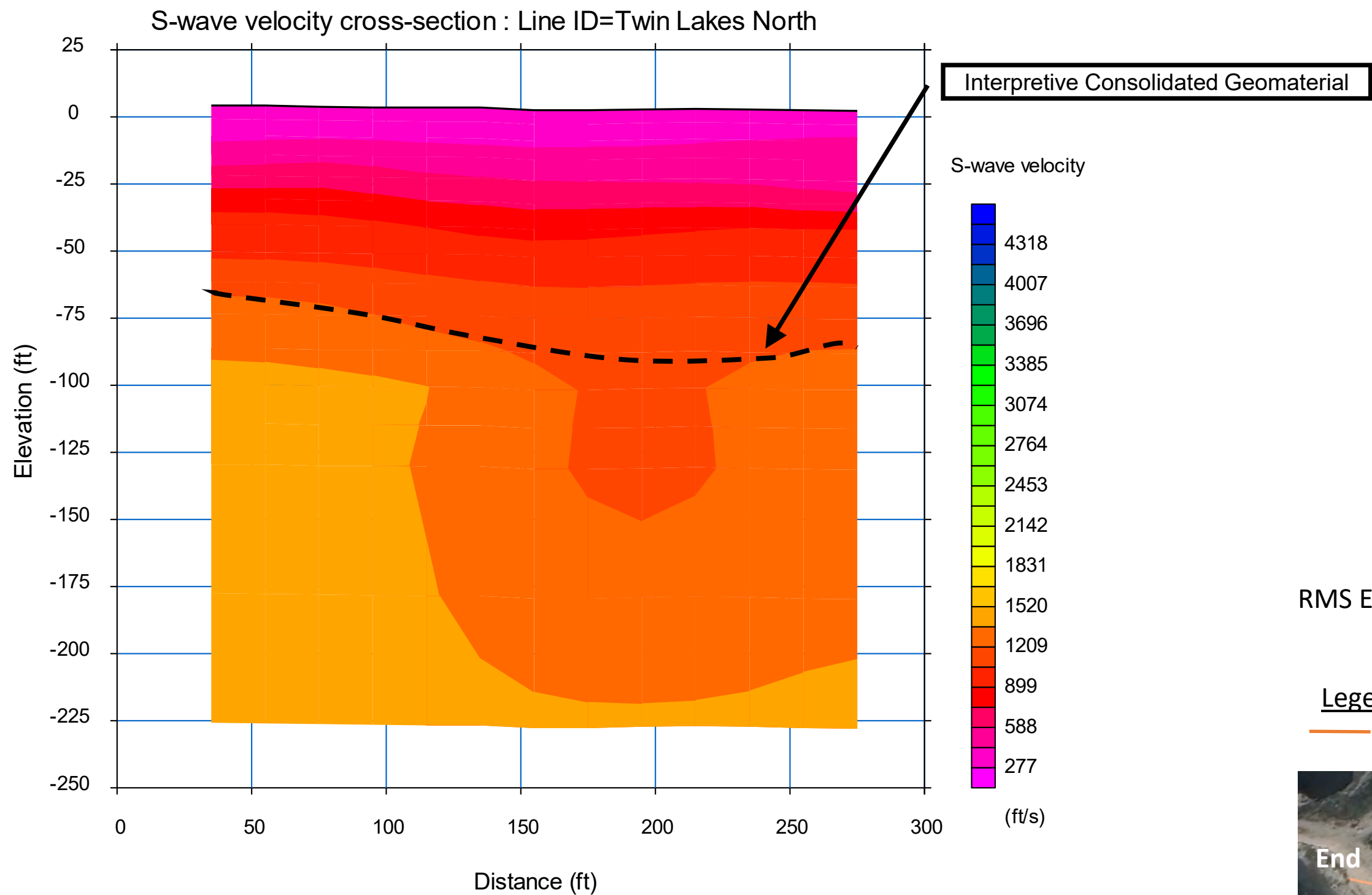
Twin Lakes North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



RMS Error = 2.98% after 10 Iterations



#### Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities

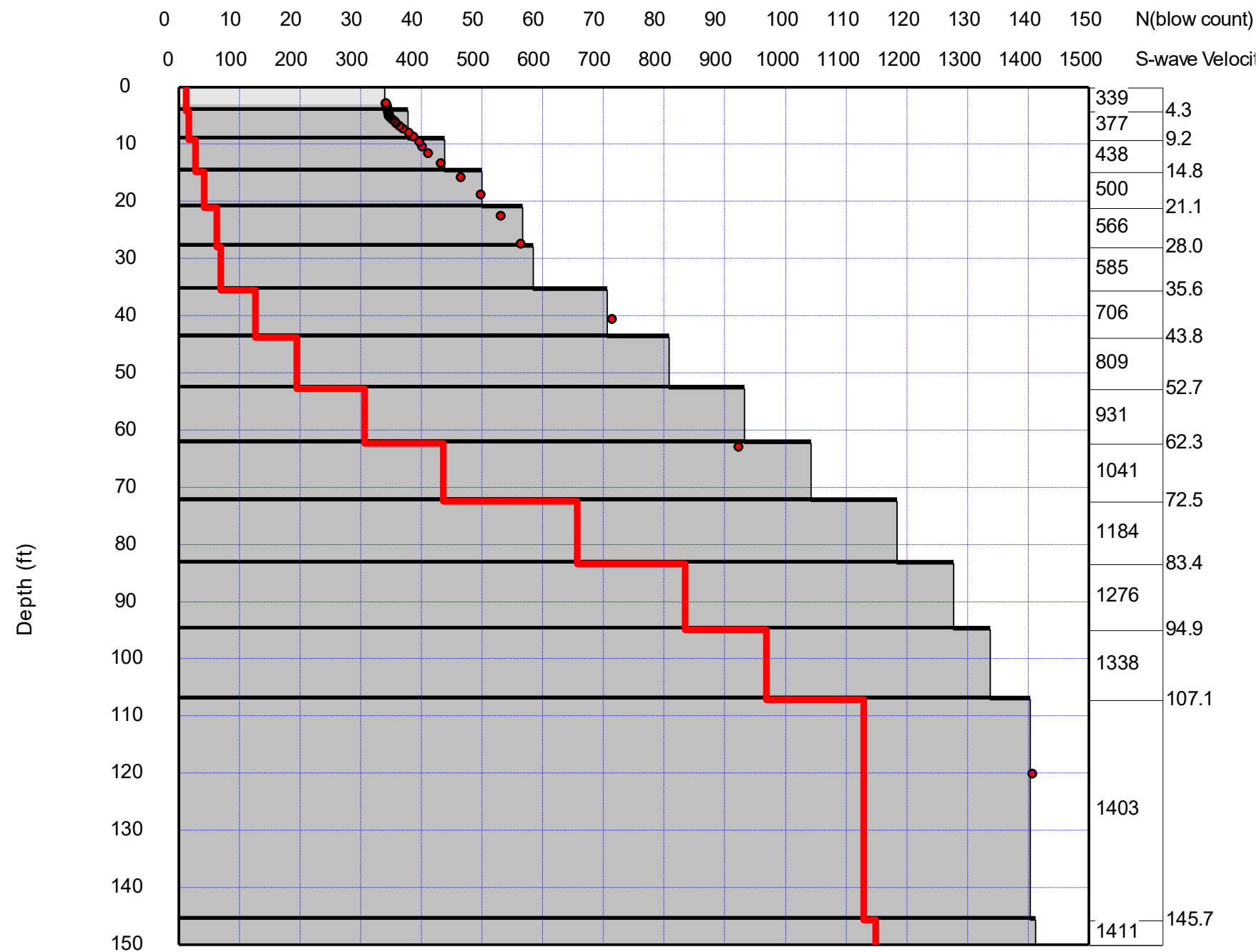
Twin Lakes North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 8001.dat

Average Vs to 100ft = 709.6 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 3.85% after 10 Iterations

Average Vs to 100 feet = 709.6 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Twin Lakes North – Shot 8001

Twin Lakes North

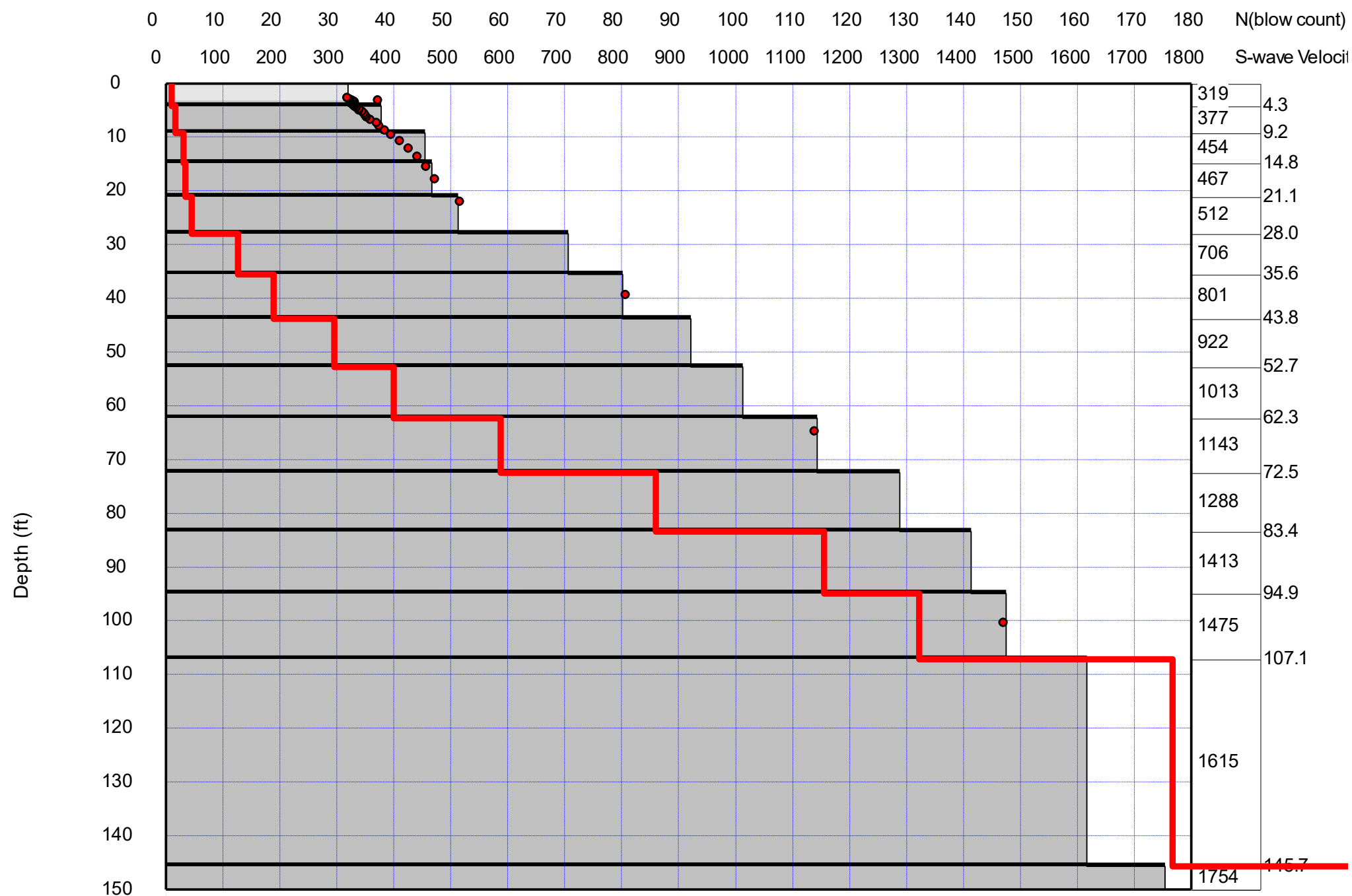
Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





S-wave velocity model (inverted) : 8002.dat

Average Vs to 100ft = 741.8 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 6.91% after 10 Iterations

Average Vs to 100 feet = 741.8 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Twin Lakes North – Shot 8002

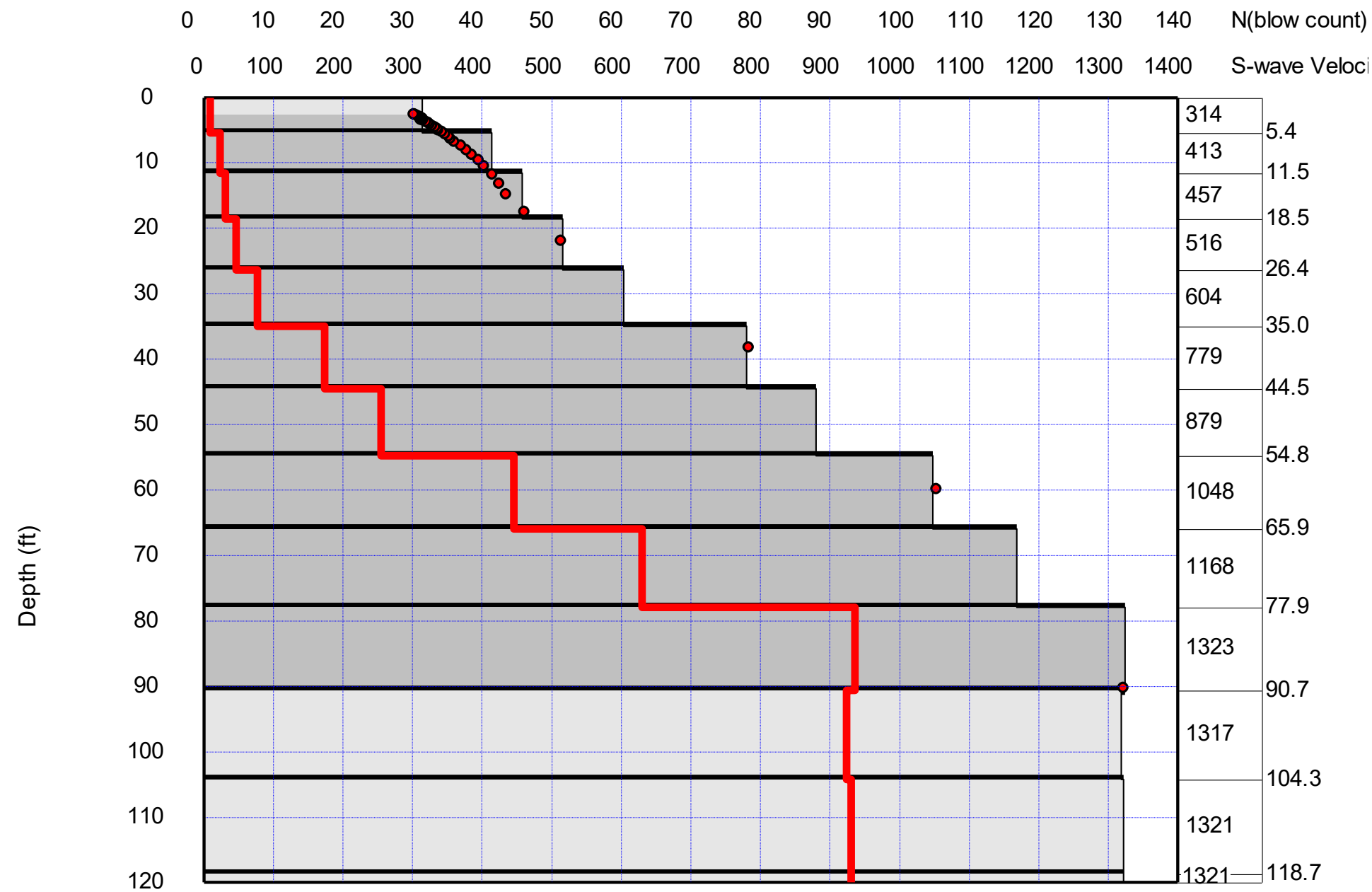
Twin Lakes North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 8015.dat

Average Vs to 100ft = 723.5 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 5.35% after 10 Iterations

Average Vs to 100 feet = 723.5 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Twin Lakes North – Shot 8015

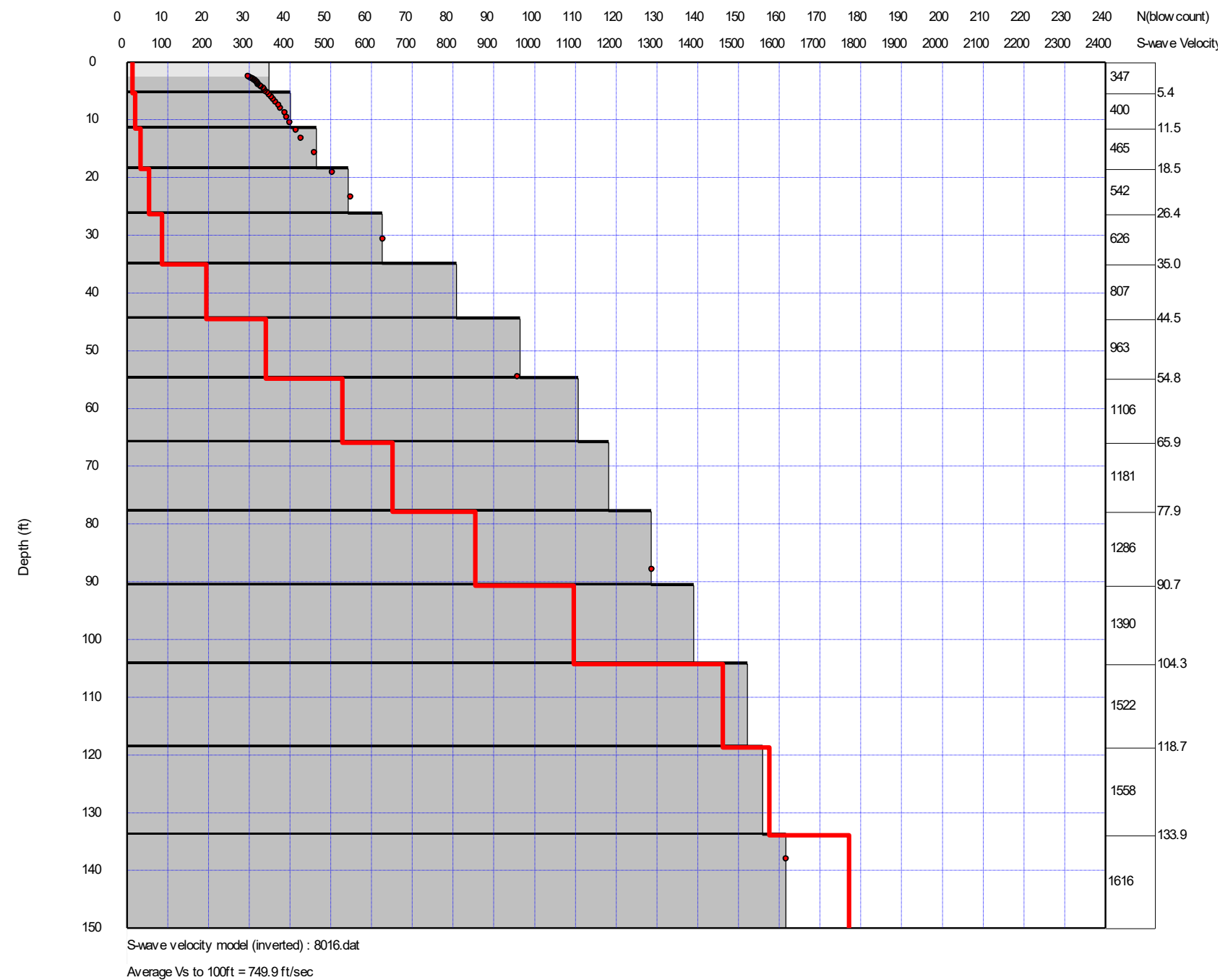
Twin Lakes North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 2.20% after 10 Iterations

Average Vs to 100 feet = 625.3 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Twin Lakes North – Shot 8016

Twin Lakes North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01

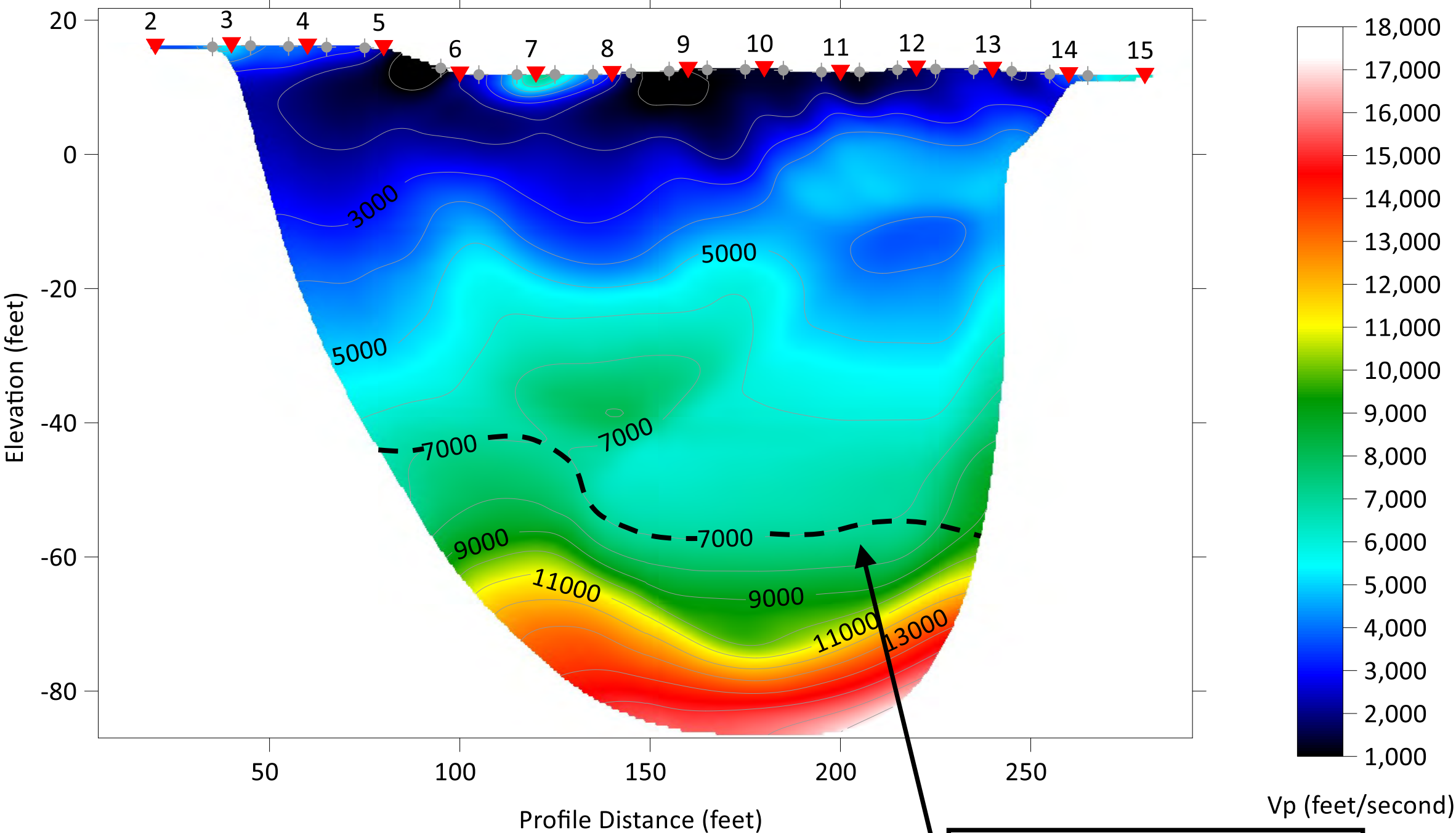


| Twin Lakes North – MASW 1D Results |                        |            |
|------------------------------------|------------------------|------------|
| Geophysical Investigation          |                        |            |
| Shot File Number                   | Vs100<br>(feet/second) | Site Class |
| 8,001                              | 709.6                  | D          |
| 8,002                              | 712.1                  | D          |
| 8,015                              | 723.5                  | D          |
| 8,016                              | 749.9                  | D          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                             |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D<br>Shear Wave Velocities<br>(feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                      |
| B                                                  | Rock                                      | 2,500 to 5,000                                                              |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                              |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                                |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                        |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                                   |

|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | Twin Lakes North                                                      |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |

SalmonCreekNorth RMS error 20.1%=4.88ms 20 WET itr. 50Hz Width 3.5% initial GRADIENT.GRD v. 4.02



Legend

— Seismic Survey



**Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities**

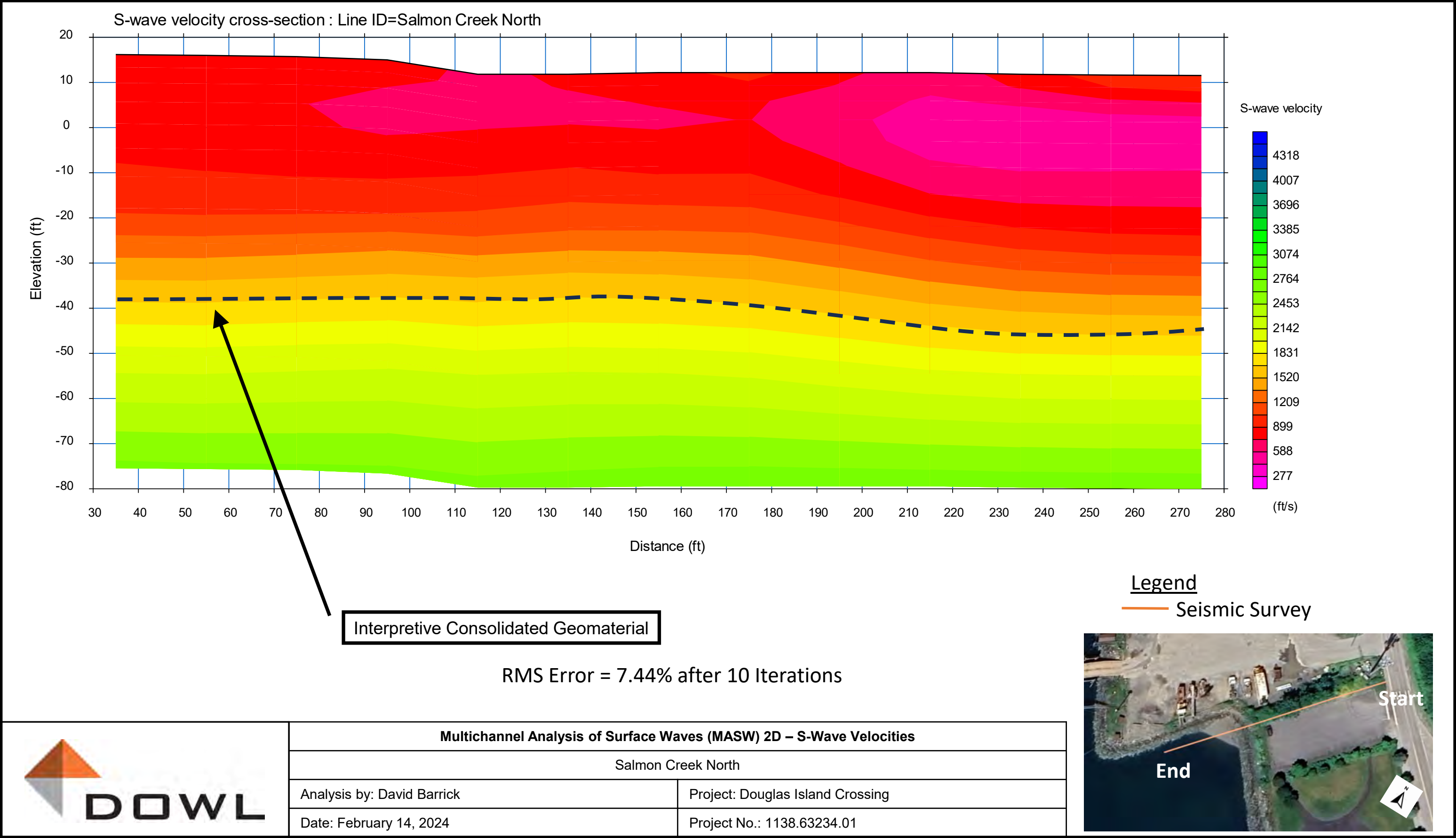
Salmon Creek North

Analysis by: David Barrick

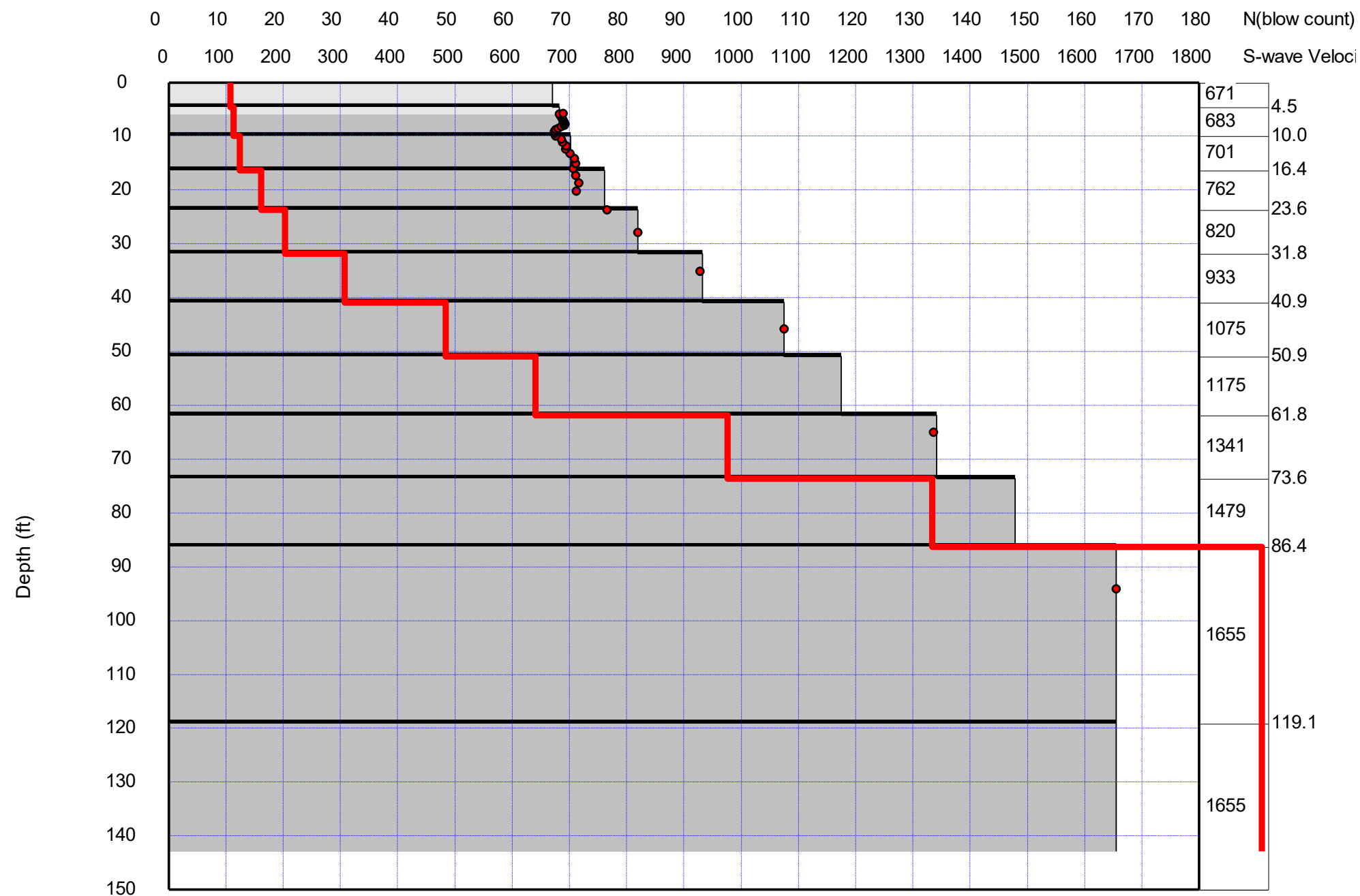
Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01







S-wave velocity model (inverted) : 1001.dat

Average Vs to 100ft = 1027.5 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- MASW 1D Profile Location
- Seismic Survey

RMS Error = 2.68% after 10 Iterations

Average Vs to 100 feet = 1,027.5 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 1001

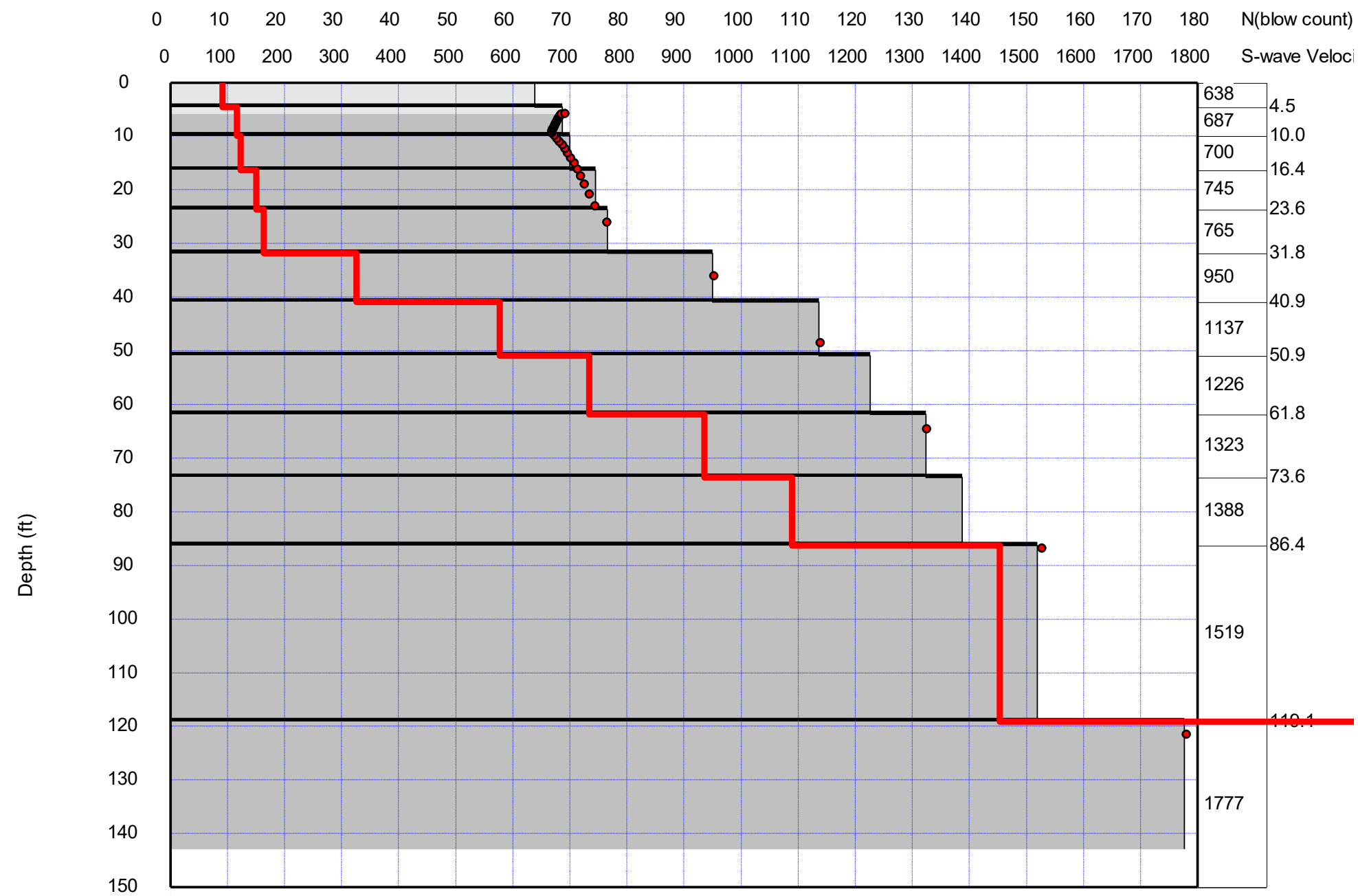
Salmon Creek North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 1002.dat

Average Vs to 100ft = 1011.0 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 2.41% after 10 Iterations

Average Vs to 100 feet = 1,011.0 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 1002

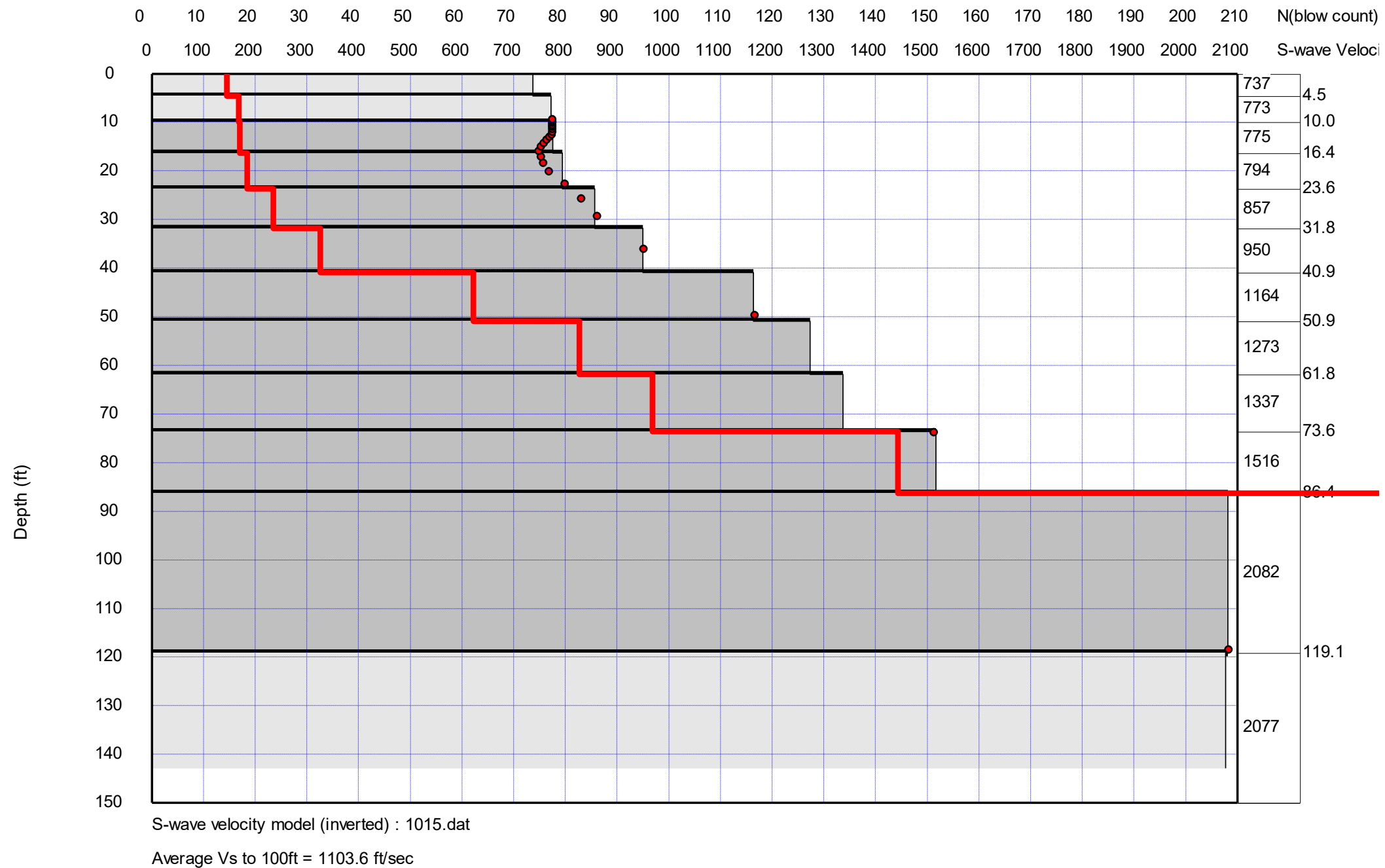
Salmon Creek North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 3.15% after 10 Iterations  
Average Vs to 100 feet = 1,103.6 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 1015

Salmon Creek North

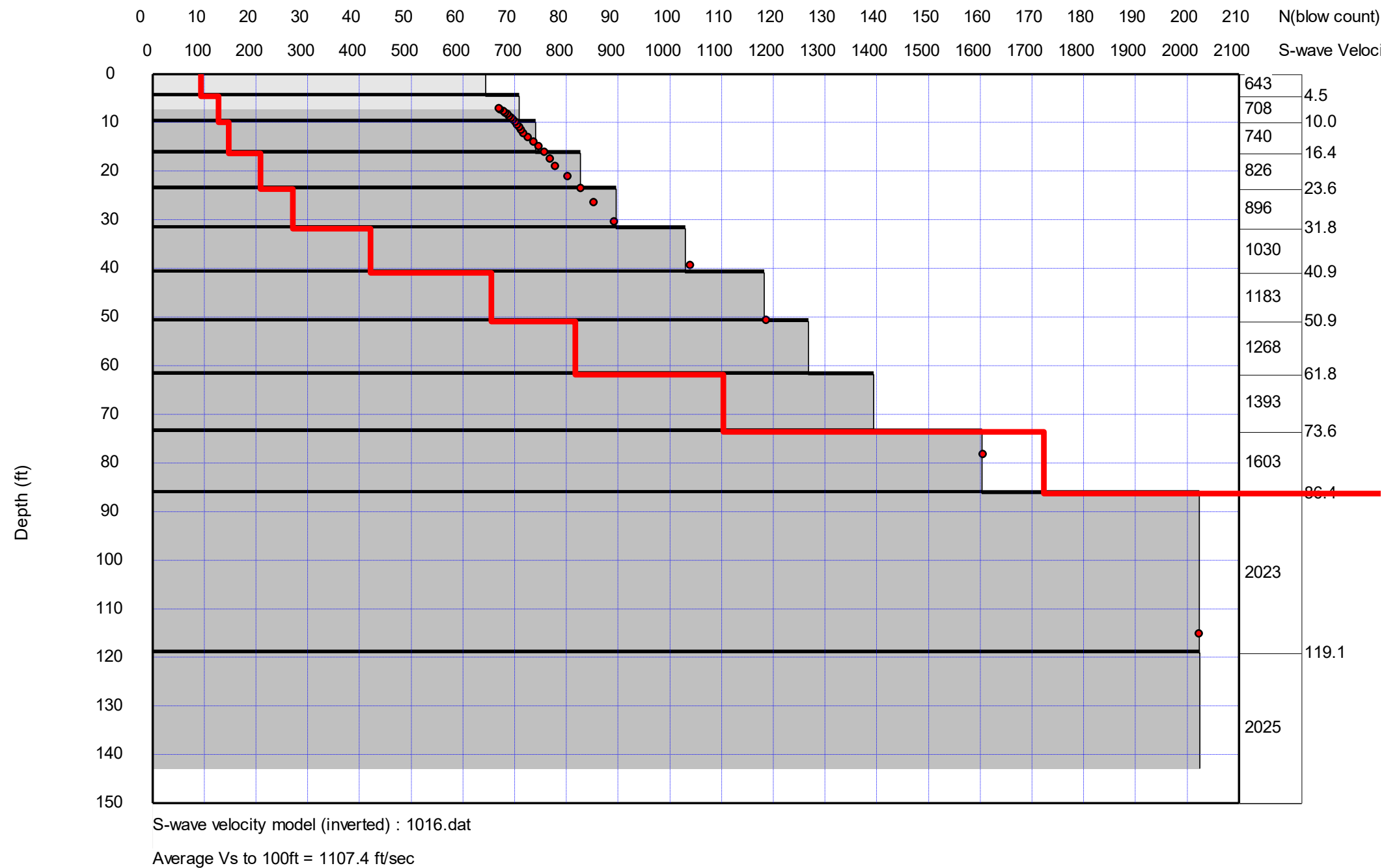
Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 4.26% after 10 Iterations

Average Vs to 100 feet = 1,107.4 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek North – Shot 1016

Salmon Creek North

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

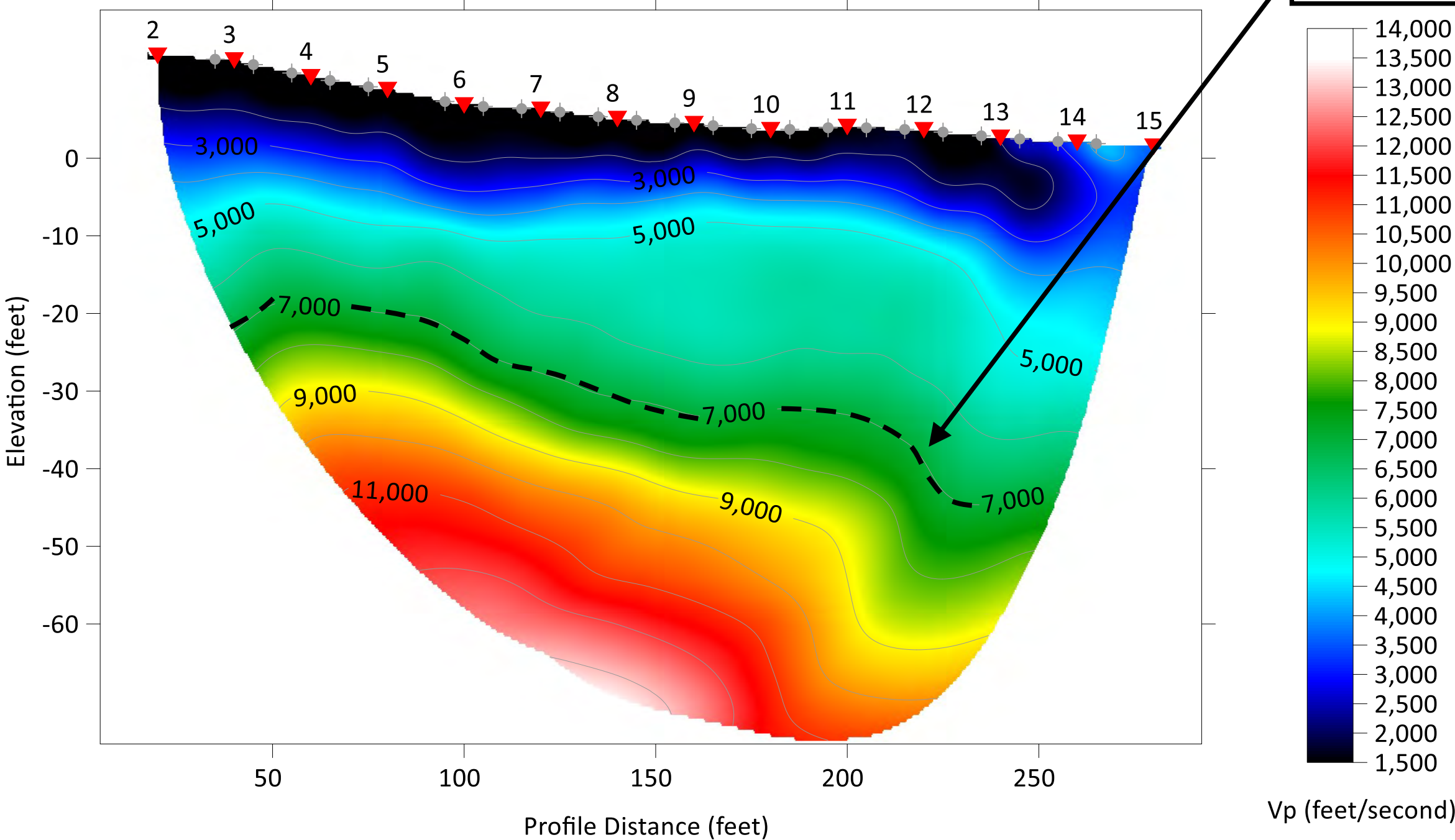
Project No.: 1138.63234.01

| Salmon Creek North – MASW 1D Results |                     |            |
|--------------------------------------|---------------------|------------|
| Geophysical Investigation            |                     |            |
| Shot File Number                     | Vs100 (feet/second) | Site Class |
| 1001                                 | 1,027.5             | D          |
| 1002                                 | 1,011.0             | D          |
| 1015                                 | 1,103.6             | D          |
| 1016                                 | 1,107.4             | D          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                       |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities (feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                |
| B                                                  | Rock                                      | 2,500 to 5,000                                                        |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                        |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                          |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                  |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                             |

|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | Salmon Creek North                                                    |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |

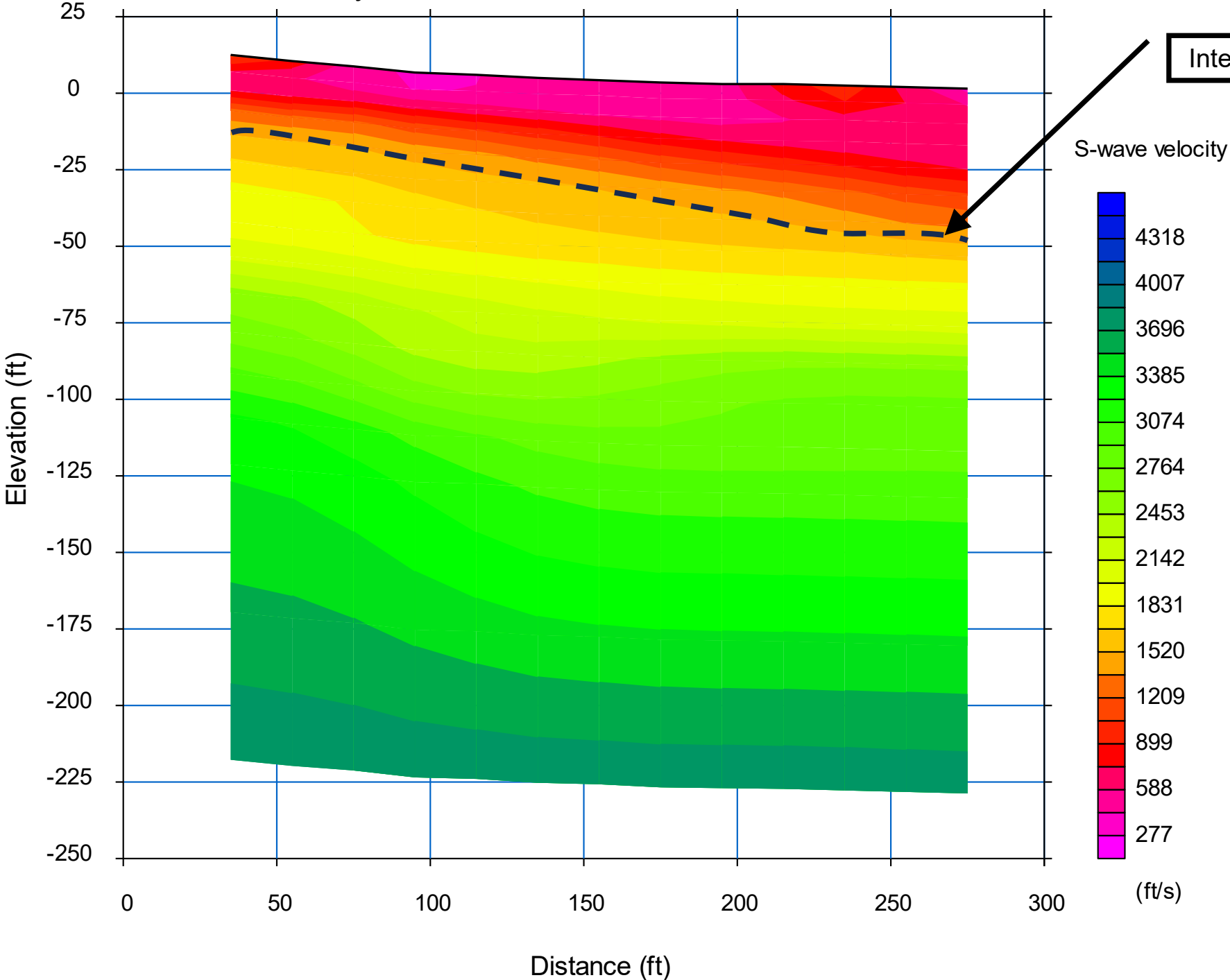
Salmon Creek South RMS error 4.1%=0.96ms 20 WET itr. 50Hz Width 3.0% initial GRADIENT.GRD v. 4.02



| Seismic Refraction Tomography (SRT) 2D – P-Wave Velocities |  |                                  |  |
|------------------------------------------------------------|--|----------------------------------|--|
| Salmon Creek South                                         |  |                                  |  |
| Analysis by: David Barrick                                 |  | Project: Douglas Island Crossing |  |
| Date: February 14, 2024                                    |  | Project No.: 1138.63234.01       |  |



S-wave velocity cross-section : Line ID=Salmon Creek South

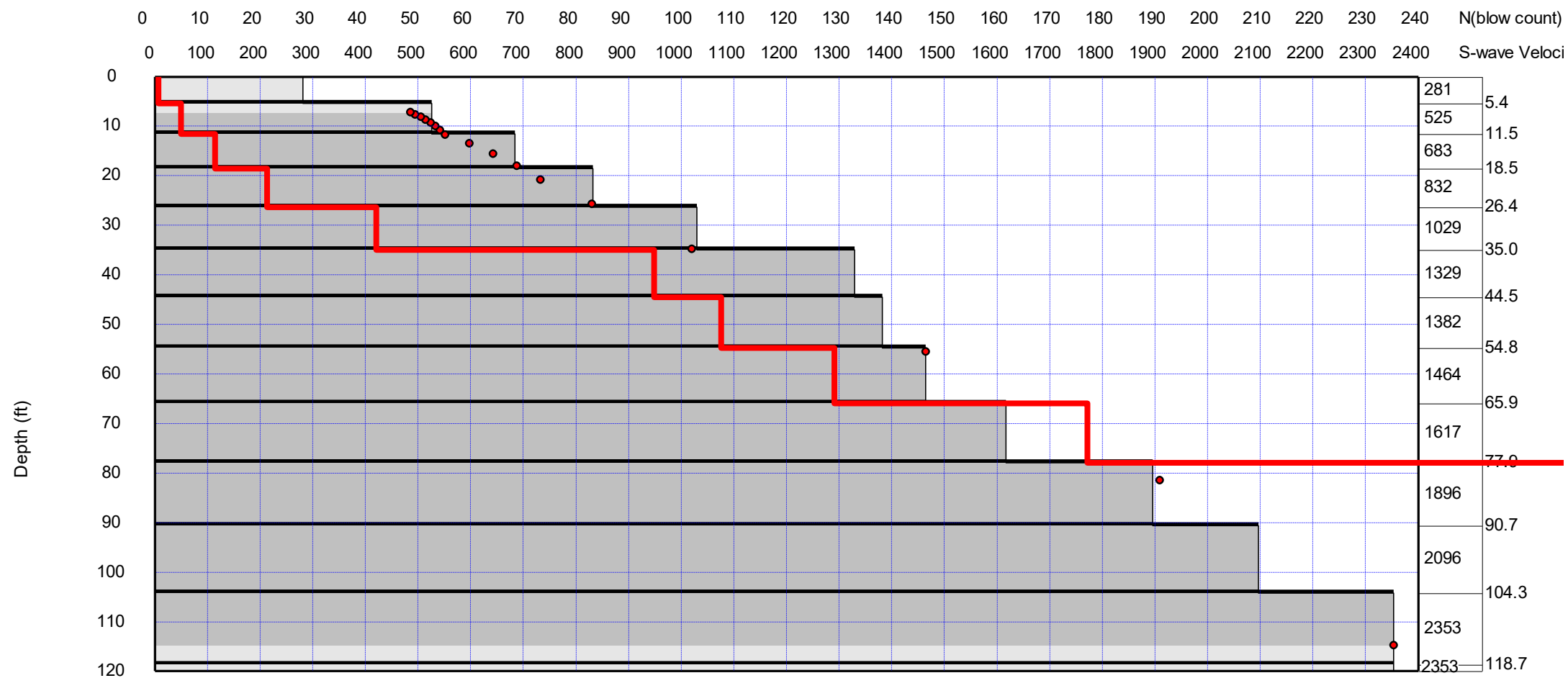


RMS Error = 10.62% after 10 Iterations

Legend  
Seismic Survey



| Multichannel Analysis of Surface Waves (MASW) 2D – S-Wave Velocities |  |                                  |  |
|----------------------------------------------------------------------|--|----------------------------------|--|
| Salmon Creek South                                                   |  |                                  |  |
| Analysis by: David Barrick                                           |  | Project: Douglas Island Crossing |  |
| Date: February 14, 2024                                              |  | Project No.: 1138.63234.01       |  |



S-wave velocity model (inverted) : 3001.dat

Average Vs to 100ft = 1004.0 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 11.85% after 10 Iterations  
Average Vs to 100 feet = 1,004.0 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek South – Shot 3001

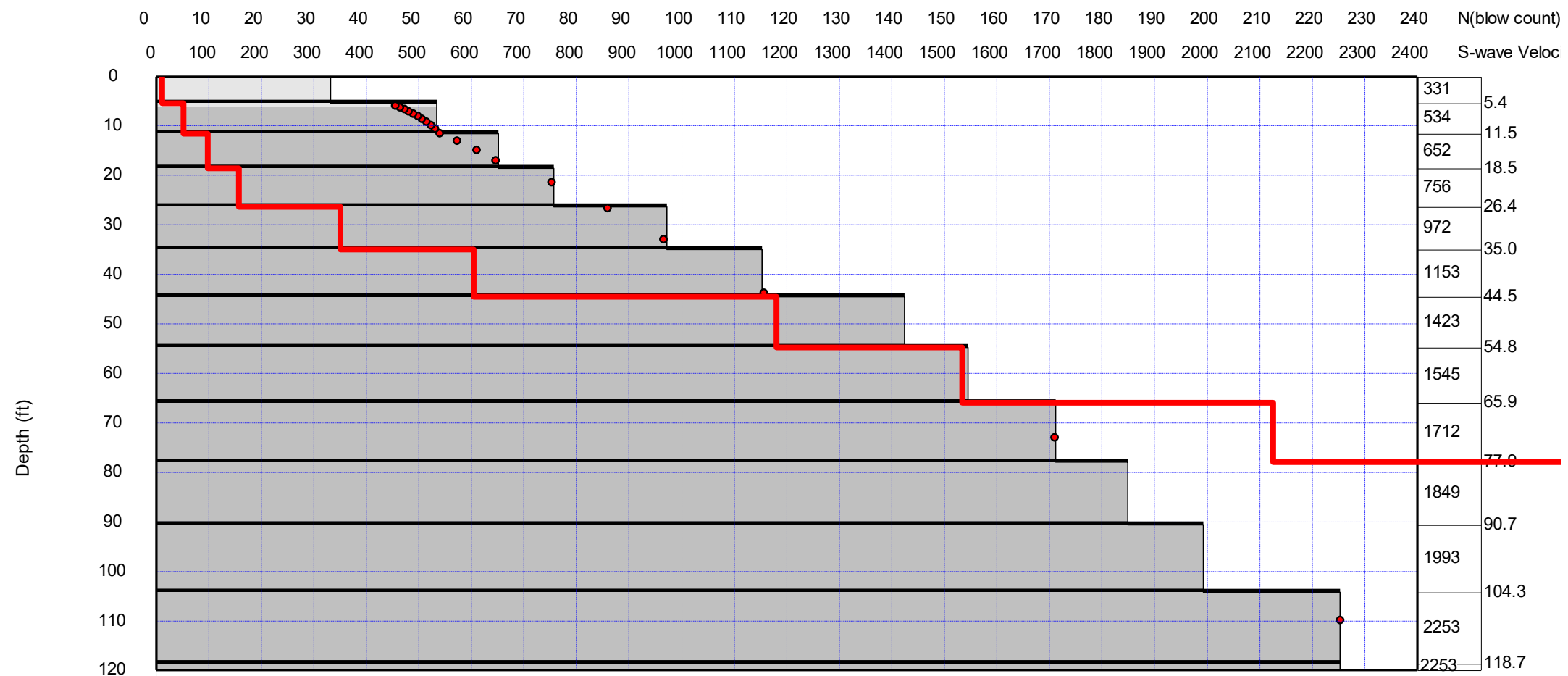
Salmon Creek South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



S-wave velocity model (inverted) : 3002.dat

Average Vs to 100ft = 1010.7 ft/sec



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 12.00% after 10 Iterations

Average Vs to 100 feet = 1,010.7 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek South – Shot 3002

Salmon Creek South

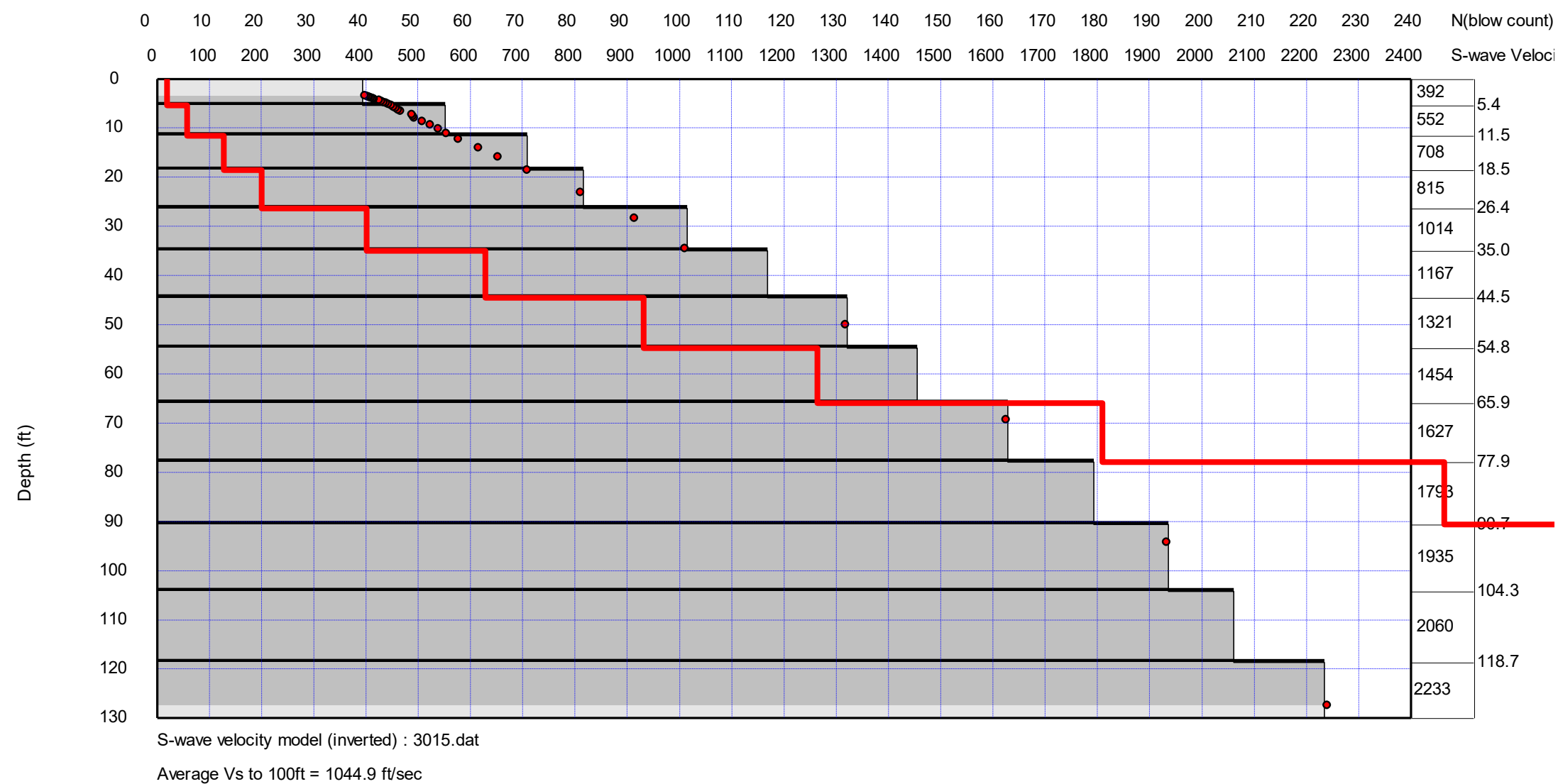
Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01





### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 6.34% after 10 Iterations

Average Vs to 100 feet = 1,044.9 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek South – Shot 3015

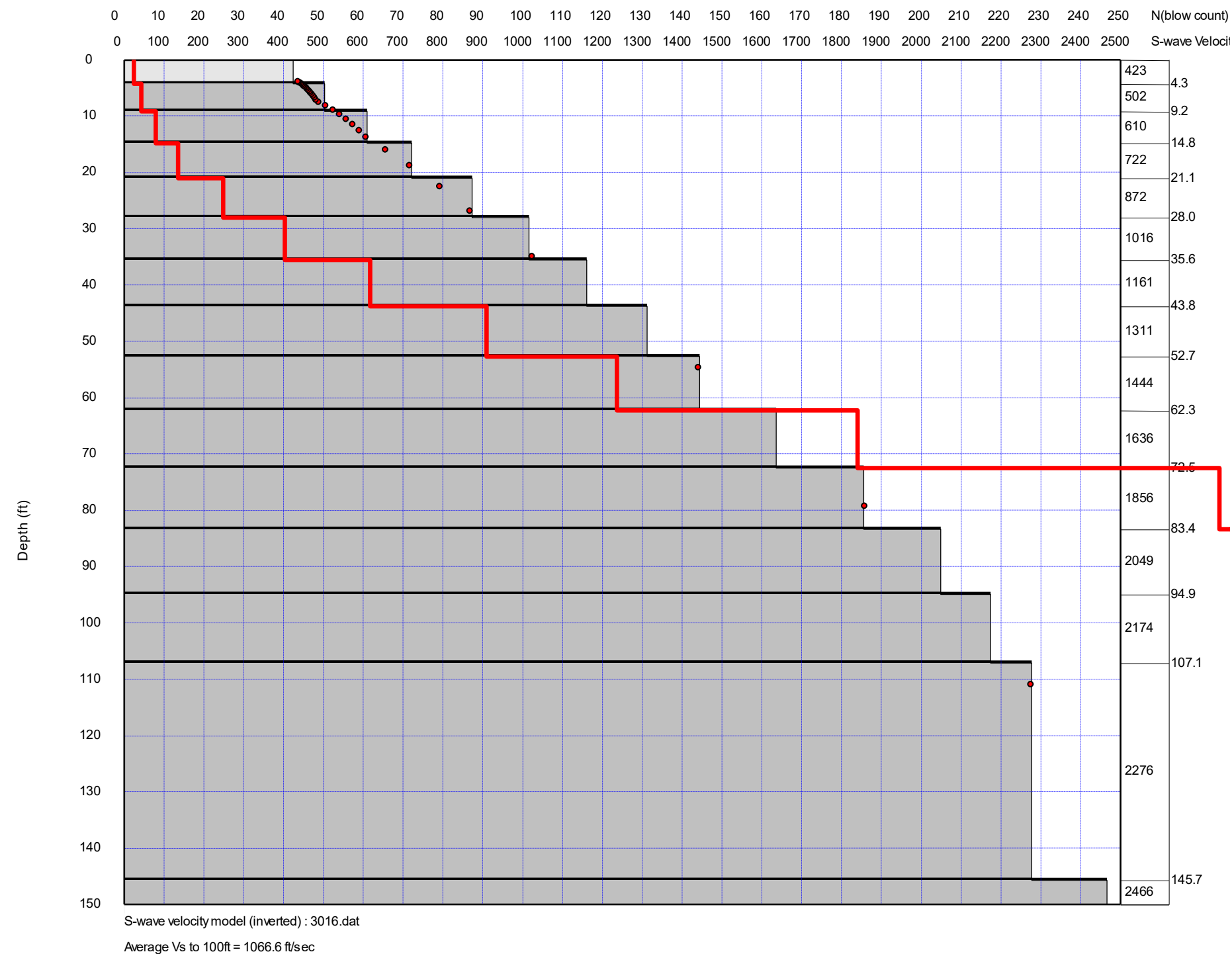
Salmon Creek South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01



### Legend

- S-wave Velocities
- Blow Counts
- ▲ MASW 1D Profile Location
- Seismic Survey

RMS Error = 5.75% after 10 Iterations

Average Vs to 100 feet = 1,066.6 ft/sec



### Multichannel Analysis of Surface Waves (MASW) 1D – Salmon Creek South – Shot 3016

Salmon Creek South

Analysis by: David Barrick

Project: Douglas Island Crossing

Date: February 14, 2024

Project No.: 1138.63234.01

| Salmon Creek South – MASW 1D Results |                     |            |
|--------------------------------------|---------------------|------------|
| Geophysical Investigation            |                     |            |
| Shot File Number                     | Vs100 (feet/second) | Site Class |
| 3,001                                | 1,004.0             | D          |
| 3,002                                | 1,010.7             | D          |
| 3,015                                | 1,044.9             | D          |
| 3,016                                | 1,066.6             | D          |

| AASHTO LRFD TABLE 3.10.3.1-1 – Site Classification |                                           |                                                                       |
|----------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------|
| Site Class                                         | Rock/Soil Type                            | Sum of Vs Calculated Using 1D Shear Wave Velocities (feet per second) |
| A                                                  | Hard Rock                                 | >5,000                                                                |
| B                                                  | Rock                                      | 2,500 to 5,000                                                        |
| C                                                  | Very Dense Soil and Soil Rock             | 1,200 to 2,500                                                        |
| D                                                  | Stiff Soil                                | 600 to 1,200                                                          |
| E                                                  | More Than 10 Feet of Soft Clay            | <600                                                                  |
| F                                                  | Soils Requiring Site Specific Evaluations | See LRFD Table 3.10.3.1-1                                             |

|                                                                                     |                                                                       |                                  |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------|
|  | Multichannel Analysis of Surface Waves (MASW) 1D – Summary of Results |                                  |
|                                                                                     | Salmon Creek South                                                    |                                  |
|                                                                                     | Analysis by: David Barrick                                            | Project: Douglas Island Crossing |
|                                                                                     | Date: June 3, 2024                                                    | Project No.: 1138.63234.01       |





# Technical Memorandum

## Visual Assessment

To: Greg Lockwood, PE., Project Manager, Alaska Department of Transportation and Public Facilities  
From: Colleen Wolfe, Landscape Architect, DOWL  
Date: February 16, 2025  
Project: Juneau Douglas North Crossing PEL Study  
Project Numbers: SFHWY00299/0003259

## PEL Study Description

The Alaska Department of Transportation and Public Facilities (DOT&PF) in cooperation with City and Borough of Juneau (CBJ) is studying a possible transportation corridor to connect Juneau with the north end of Douglas Island. A connection has been studied since the 1980s but has not progressed beyond identification and recommendation of preliminary alternative alignments. The previous studies highlighted several reasons for a north crossing:

- Congestion during peak periods on the existing Douglas Island Bridge
- Concerns about safety and emergency response in the event of a bridge closure
- The potential for residential, commercial, industrial, and port development at west Douglas Island

DOT&PF has chosen to use the Planning and Environmental Linkages (PEL) process to identify and evaluate a purpose and need (P&N) and recommend alternatives for connecting Juneau with the northern end of Douglas Island. The PEL process will provide opportunities for public input and involvement. The analyses conducted may be incorporated into a future National Environmental Policy Act (NEPA) process.

## Purpose

This memorandum is an initial step in the development of the proposed alternatives for the Juneau Douglas North Crossing PEL Study (Project Numbers: SFHWY00299/0003259). It is intended to provide a summary of visual analysis based on the methodology defined in the US Department of Transportation Federal Highway Administration's Guidelines for the Visual Impact Assessment (VIA) of Highway Projects. These guidelines provide the basis for evaluating context sensitive solutions for federal transportation projects.

The photorealistic simulations provided as a part of this technical memorandum serve to provide an approximate graphical representation of the impact on the visual resource at each crossing location. Since a VIA is usually conducted a part of compliance with NEPA, these simulations included with this technical

memorandum can be later evaluated as a part of a future environmental review process. This future assessment of visual resource impacts may include but are not limited to the following:

- Parks and recreation facilities, specifically impacts on properties protected by Section 4(f) of the Department of Transportation Act of 1966, and 6(f) of the Land and Water Conservation Act
- Historic and archaeological resources, including impacts on properties protected under Section 106 of the National Historic Preservation Act
- Other protected or iconic cultural resources such as scientific or natural areas, scenic byways, routes and vistas
- Vegetation, wildlife, ecological communities and protected landscapes, specifically impacts on wetlands, threatened and endangered species, wildlife refuges, and farmland

## Study Area

The study area boundary is shown in Figure 1. It encompasses the area where prior studies and community outreach identified potential alternative crossing locations as indicated in Figure 2.

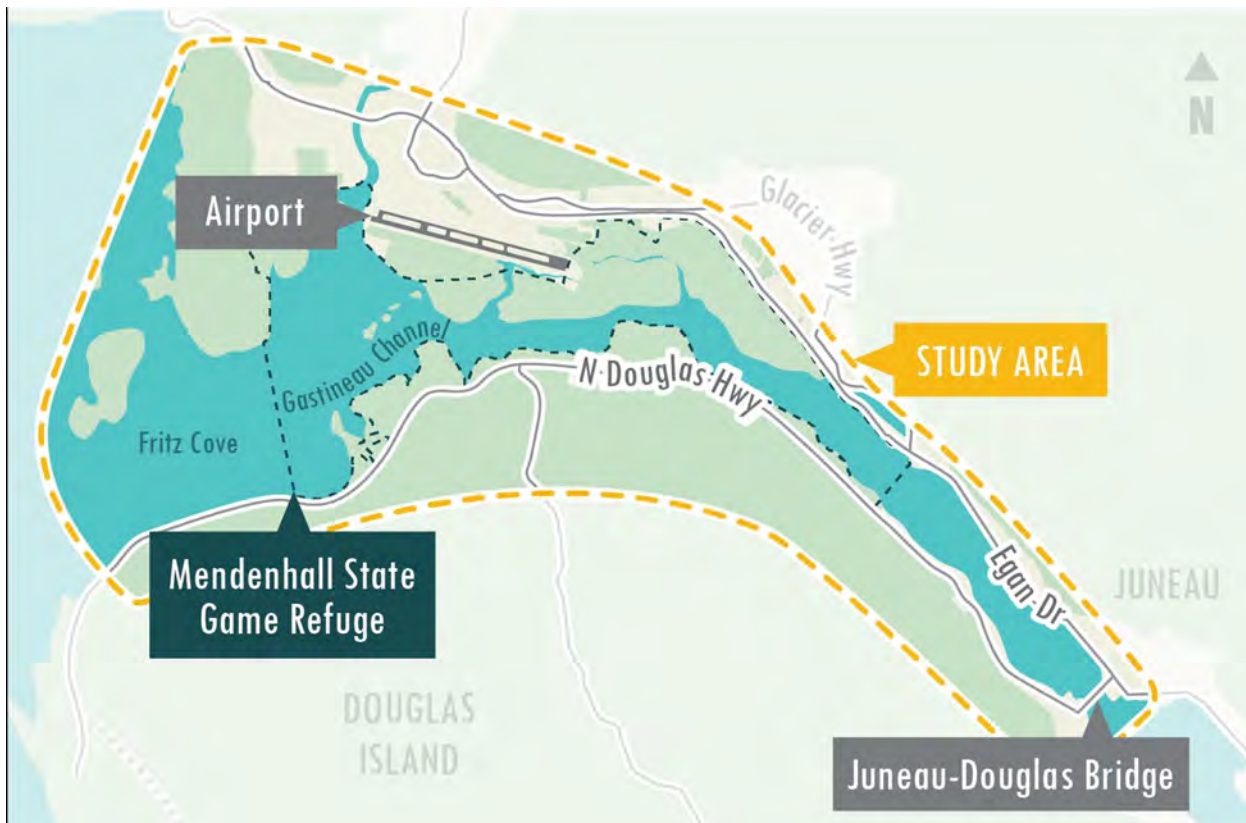


Figure 1: Study Area

Following preliminary alternative analysis, six potential crossing locations were found to meet the project Purpose and Need and were advanced to detailed alternative development and environmental screening (Figure 2). The visual analysis is intended to support the environmental screening to support the selection of alternatives recommended to advance to a NEPA review.

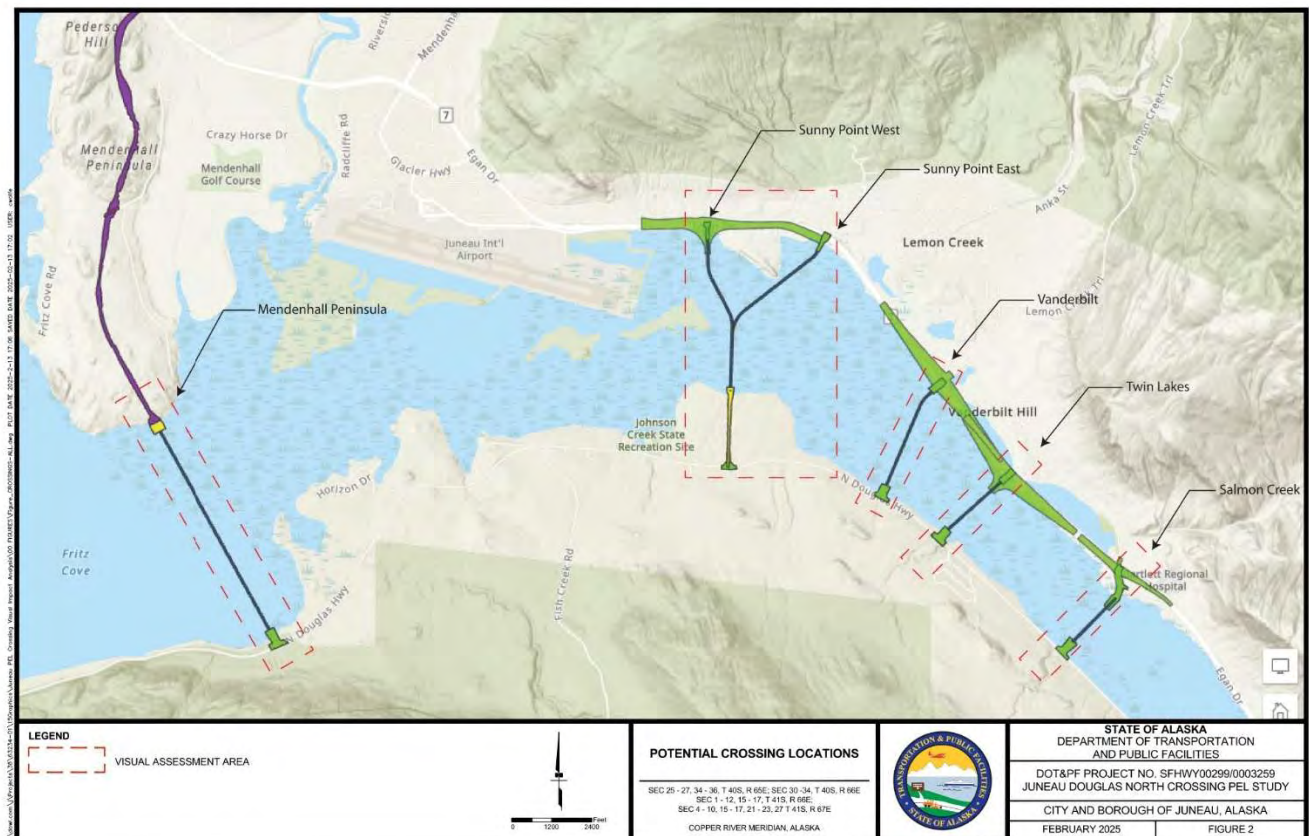


Figure 2: Potential Crossing Locations

## Data Collection Sources

Data was collected to identify existing conditions at the six potential crossing locations within the study area as indicated in Figure 2. Data collection and base mapping was derived from the following public documents or sources:

- Aerial imagery from Google Earth (2024)
- Aerial imagery from Bing Maps (2024)
- Maxar and TomTom mapping software from Google Earth and Bing Maps (2024)
- Geographic Information System (ArcGIS) mapping
- Alaska Fisheries NOAA (National Oceanic and Atmospheric Administration) Shore Zone flight data (2024)





- January 2024 field photography using a Canon 7D DSLR camera with a 55 mm lens with additional photography obtained with a Samsung S22 Ultra

## Simulation Software

The software used to generate the photo simulations include:

- ArcGIS
- Autodesk Civil 3D
- Autodesk InRoads
- Sketchup Pro
- Chaos Engine Enscape
- Adobe Illustrator
- Adobe Photoshop
- Adobe Lightroom
- Bluebeam Revu 21

## Simulation Methodology

Existing site and street imagery photographed during Juneau's summer season in 2023 was collected from the Google Earth Pro database. Based on the viewpoints and view corridors established in the Google Earth photography, winter season photography was taken by a field team in January 2024. The viewpoints in winter were established to be as close as possible to the summer photography locations so both seasons could be represented together. A Trimble TSC7 data collector connected to a Trimble R10 GNSS system was used to locate each alternative alignment. The location of each image is approximately 30 to 40 feet from the center of each potential crossing intersection alignment.

Conceptual profile designs were developed by structural engineers for each crossing location. The preliminary designs were used to model a 3D representation of each crossing structure, conveying the scale and style of each based on these conceptual alignment profiles and existing conditions. The 3D models of each crossing were constructed digitally using Sketchup Pro and Autodesk InRoads. Using the 3D software, conceptual bent and deck locations were developed for each crossing.

An existing context model was developed using data collected from ArcGis, Bing Maps and Google Earth Pro with additional information from Alaska Fisheries NOAA flight mapping. Each 3D crossing model was then inserted and scaled into the existing context model and geolocated. Additionally, background photographs were used to convey site context and to visually represent existing conditions at each crossing location. The combination of the existing context model and conceptual crossing models allows each crossing to be graphically represented from an aerial view.

Crossing simulations were further developed to include ArcGIS layers containing existing data from publicly available data sources and information in the 2022 Juneau Douglas Island North Crossing PEL Baseline Studies. From these sources, trails, general ownership, transit stops, youth services, existing bridges, Native allotments, parks, and recreation layers were added to the simulation models. Each layer of data was available

for use in XML, DWG, TIN and SHX formats. Finally, the crossing models and ArcGIS data were aligned with the State of Alaska GIS coordinate system to include existing roadways and other pertinent connection points.

To achieve photorealistic rendering attributes, SketchUp Pro with the add-on software Chaos Enscape was used to convey human-scale elements for each crossing simulation such as vehicles, buildings, roadway elements, vegetation, and other surrounding landscape features.

## List of Figures

- Figure 1: Proposed Study Area
- Figure 2: Potential Crossing Locations
- Figure 3: Mendenhall Peninsula Crossing – Existing Views
- Figure 4: Mendenhall Peninsula Crossing – Simulations North
- Figure 5: Mendenhall Peninsula Crossing – Simulations South
- Figure 6: Mendenhall Peninsula Crossing – Simulation - Perspective
- Figure 7: Mendenhall Peninsula Crossing – Simulation - Bird's Eye 1
- Figure 8: Sunny Point Crossing – Existing Views West
- Figure 9: Sunny Point Crossing – Simulations Northwest
- Figure 10: Sunny Point Crossing – Existing Views East
- Figure 11: Sunny Point Crossing – Simulations Northeast
- Figure 12: Sunny Point Crossing – Simulations South
- Figure 13: Sunny Point Crossing – Simulation – Northwest Connection Bird's Eye 1
- Figure 14: Sunny Point Crossing – Simulation – Northwest Connection Bird's Eye 2
- Figure 15: Sunny Point Crossing – Simulation – Northeast Connection Bird's Eye 1
- Figure 16: Sunny Point Crossing – Simulation – Northeast Connection Bird's Eye 2
- Figure 17: Vanderbilt Crossing – Existing Views
- Figure 18: Vanderbilt Crossing – Simulations North
- Figure 19: Vanderbilt Crossing – Simulations South
- Figure 20: Vanderbilt Crossing – Simulation Bird's Eye 1
- Figure 21: Vanderbilt Crossing – Simulation Bird's Eye 2
- Figure 22: Twin Lakes Crossing – Existing Views
- Figure 23: Twin Lakes Crossing – Simulations North
- Figure 24: Twin Lakes Crossing – Simulations South
- Figure 25: Twin Lakes Crossing – Simulation Bird's Eye 1
- Figure 26: Twin Lakes Crossing – Simulation Bird's Eye 2
- Figure 27: Salmon Creek Crossing – Existing Views
- Figure 28: Salmon Creek Crossing – Simulations North
- Figure 29: Salmon Creek Crossing – Simulations South
- Figure 30: Salmon Creek Crossing – Simulation Bird's Eye 1

- Figure 31: Salmon Creek Crossing – Simulation Bird's Eye 2

## Future Analysis

Beyond the scope of this memorandum, the photo simulations provided herein can be used to support preparation of a complete VIA which is anticipated to be performed during a NEPA review. A VIA assesses changes to the degree of visual quality as being *beneficial*, *adverse*, or *neutral* to the relationship viewers have with their visual environment. As such, the Analysis Phase\* of a VIA determines the compatibility and sensitivity of the impact as evaluated and measures the degree of impact to visual quality. During the VIA, the following may be evaluated, as defined in Chapter 6 of Guidelines for the Visual Impact Assessment of Highway Projects:

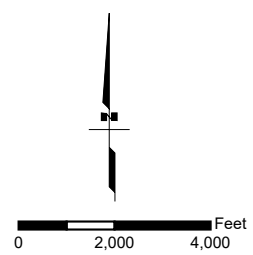
- **Compatibility of the Impact:** Defined as the ability of the environment to absorb the proposed project as a result of the project and the environment having compatible visual characters. The proposed project can be considered compatible or incompatible. By itself, compatibility of the impact should not be confused or conflated with the value of the impact.
- **Sensitivity to the Impact:** Defined by the ability of viewers to see and care about the project's impacts. The sensitivity to impact is based on viewer sensitivity to changes in the visual character of visual resources. Viewers are either sensitive or insensitive to impacts. By itself, the sensitivity of the impact should not be confused or conflated with the value of the impact.
- **Degree of the Impact:** Defined as either a beneficial, adverse, or neutral change to visual quality. A proposed project may benefit visual quality by enhancing visual resources to create better views of those resources and improve visual quality by viewers. Similarly, the project may adversely affect the visual quality by degrading visual resources or obstructing or altering desired views.

\*For complete VIA guidelines including the Analysis Phase (Chapter 6), refer to the Federal Highway Administration's *Guidelines for the Visual Impact Assessment of Highway Projects*, January 2015.





 PROPOSED STUDY AREA



### PROPOSED STUDY AREA

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. CFHWYXXXXX/XXXXXXX  
JUNEAU DOUGLAS ALTERNATIVE CORRIDOR PEL STUDY

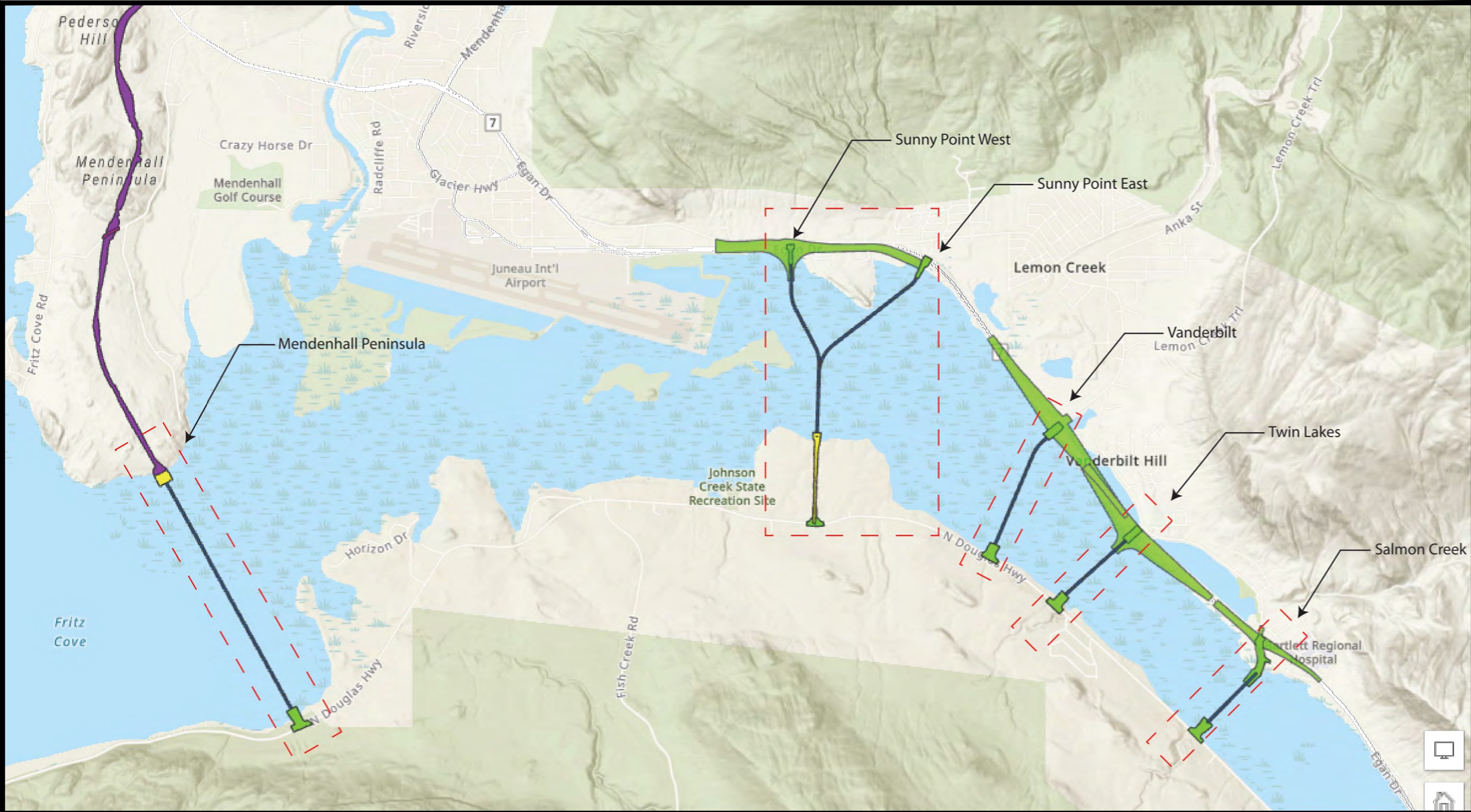
BOROUGH AND CITY OF JUNEAU, ALASKA

MARCH 11, 2022

FIGURE 1



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figure\_CROSSINGS-ALL.dwg PLOT DATE 2025-02-13 17:06 SAVED DATE 2025-02-13 17:02 USER: cwoife



**LEGEND**  
[Red dashed line] VISUAL ASSESSMENT AREA

**POTENTIAL CROSSING LOCATIONS**

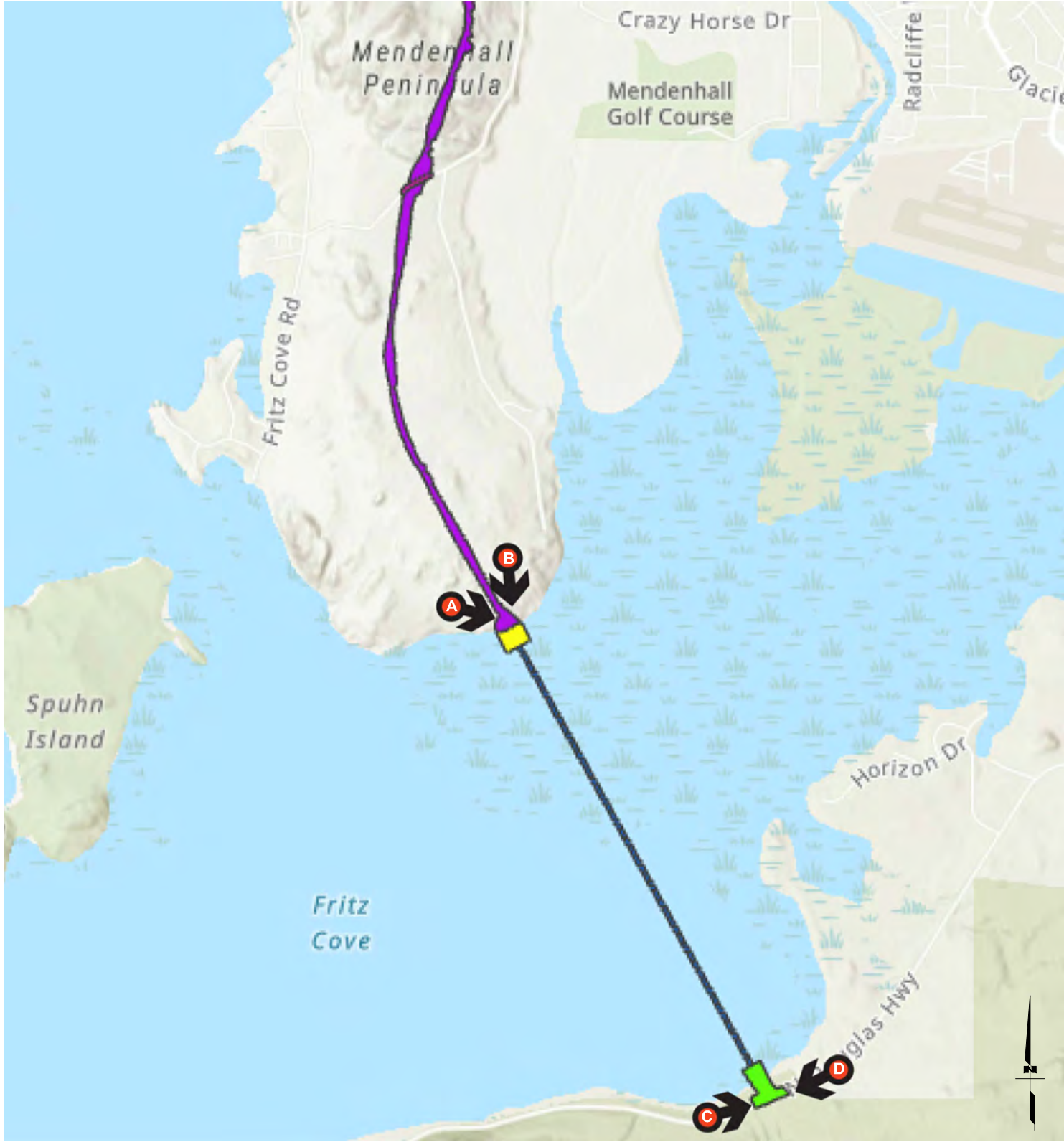
SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E  
COPPER RIVER MERIDIAN, ALASKA



| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES         |          |
|----------------------------------------------------------------------------------|----------|
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS NORTH CROSSING PEL STUDY |          |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                               |          |
| FEBRUARY 2025                                                                    | FIGURE 2 |



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_MENDENHALL.dwg PLOT DATE 2025-2-13 17:15 SAVED DATE 2024-06-27 16:27 USER: cwoife



0 1000 2000 Feet

EXISTING AERIAL VIEWS



A.  
MENDENHALL PENINSULA FACING  
SOUTHEAST (Google Earth 2023)

EXISTING SUMMER VIEWS



C.  
N. DOUGLAS HIGHWAY FACING NORTHEAST  
(Google Earth 2023)



D.  
N. DOUGLAS HIGHWAY FACING SOUTHWEST  
(Google Earth 2023)

EXISTING WINTER VIEWS



B.  
MENDENHALL PENINSULA FACING  
SOUTHWEST (Google Earth 2023)



C.  
N. DOUGLAS HIGHWAY FACING NORTHEAST  
(January 2024)

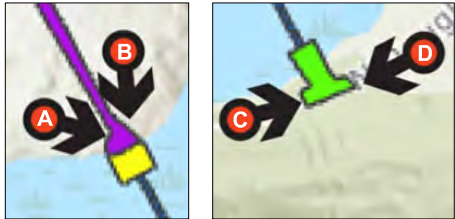


D.  
N. DOUGLAS HIGHWAY FACING SOUTHWEST  
(January 2024)



MENDENHALL PENINSULA PLAN AERIAL  
(BING MAPS)

VIEWPOINTS



MENDENHALL PENINSULA CROSSING  
EXISTING VIEWS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

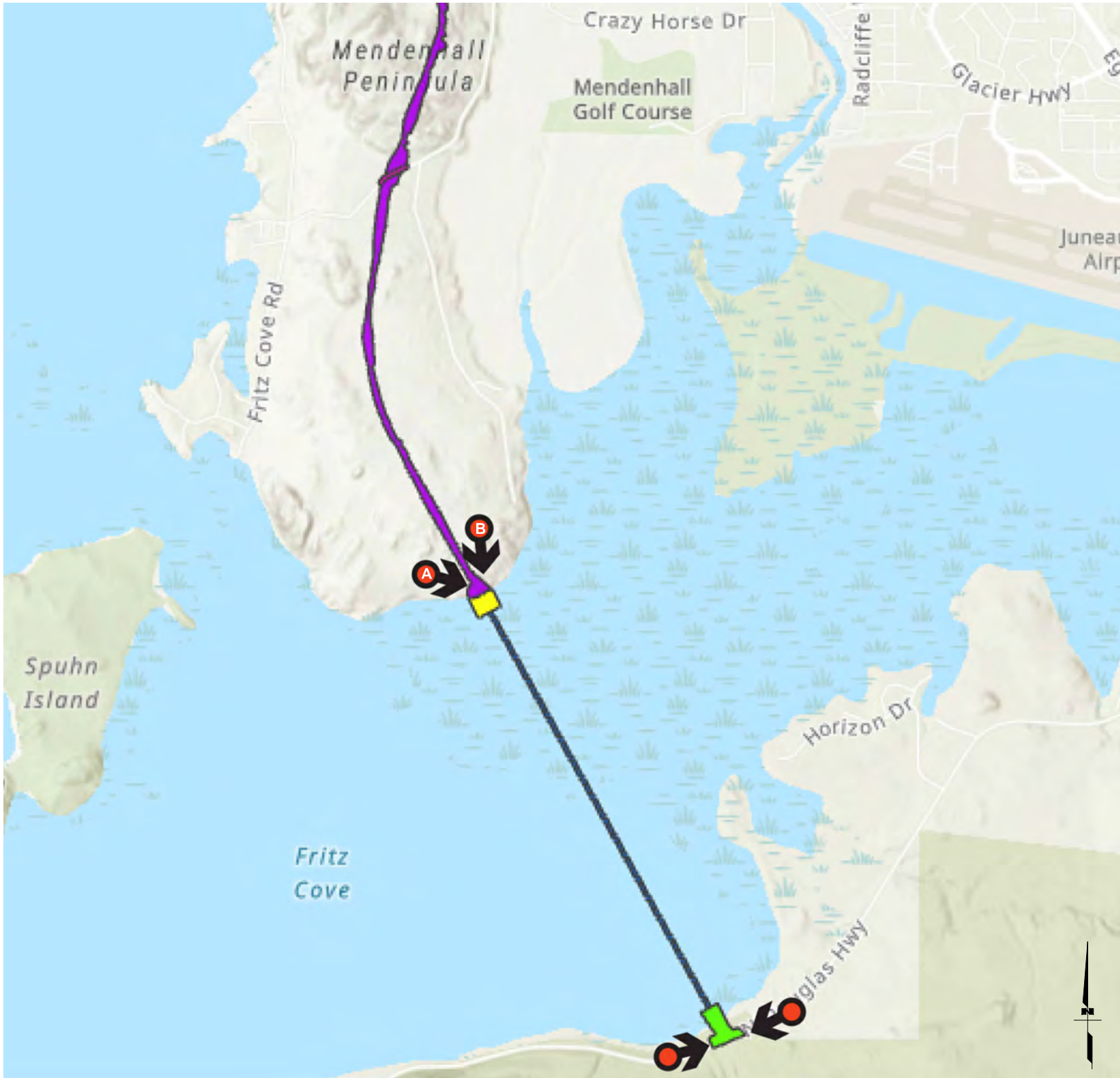
CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 3



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_MENDENHALL.dwg PLOT DATE 2025-2-13 17:17 SAVED DATE 2024-06-27 16:27 USER: cwoife



0 1000 2000 Feet

**SIMULATIONS**

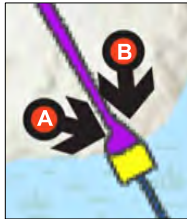


**A.** FROM MENDENHALL PENINSULA - FACING SOUTHEAST



**B.** FROM MENDENHALL PENINSULA - FACING SOUTHWEST

**VIEWPOINTS**



**MENDENHALL PENINSULA CROSSING  
SIMULATIONS**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

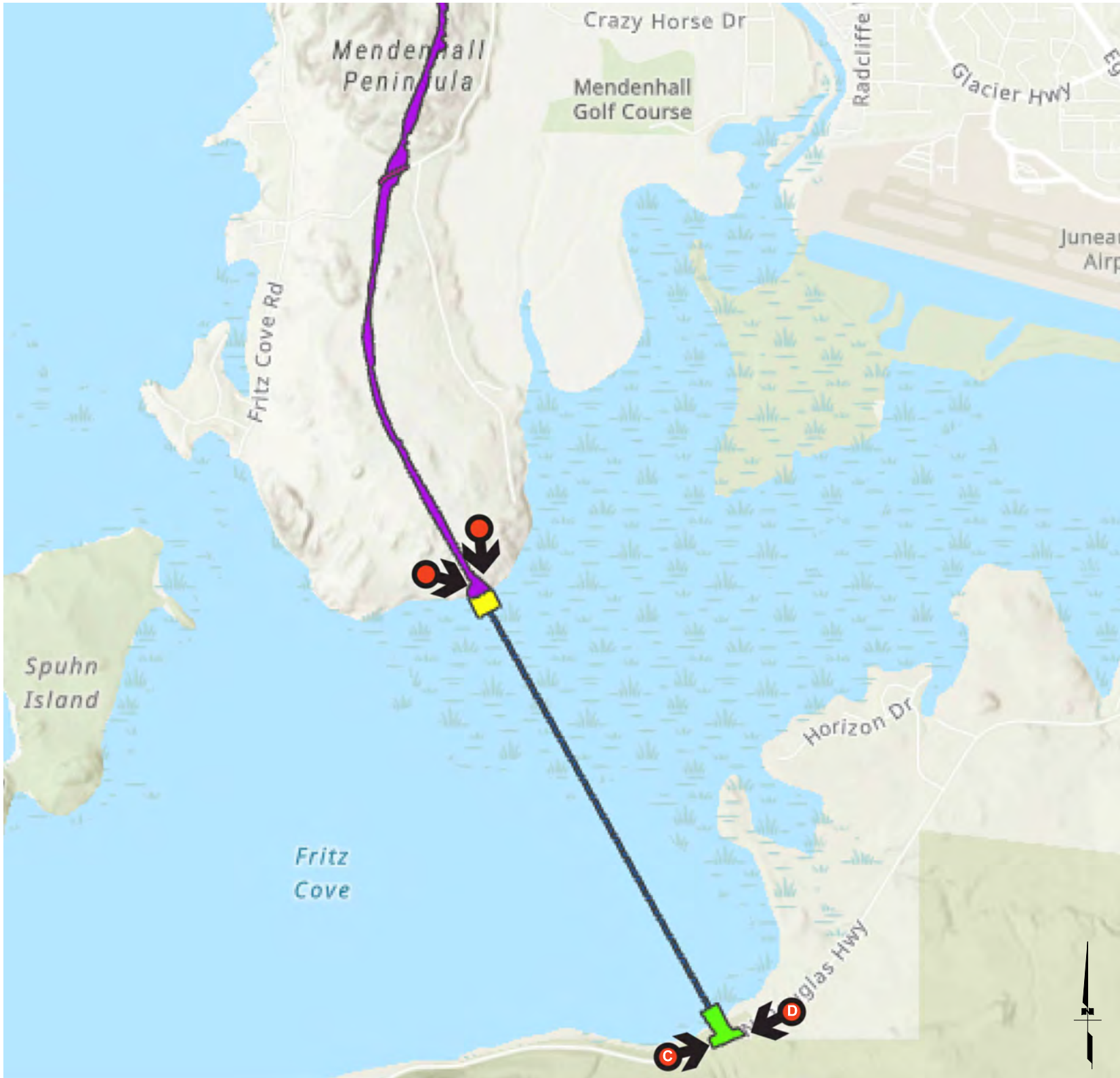
CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 4



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_MENDENHALL.dwg PLOT DATE 2025-2-13 17:17 SAVED DATE 2024-06-27 16:27 USER: cwoife



**SIMULATIONS**



**C.** NORTH DOUGLAS HIGHWAY FACING NORTHEAST



**D.** NORTH DOUGLAS HIGHWAY FACING SOUTHWEST

**VIEWPOINTS**



**MENDENHALL PENINSULA CROSSING  
SIMULATIONS**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



|                                                                                  |          |
|----------------------------------------------------------------------------------|----------|
| STATE OF ALASKA<br>DEPARTMENT OF TRANSPORTATION<br>AND PUBLIC FACILITIES         |          |
| DOT&PF PROJECT NO. SFHWY00299/0003259<br>JUNEAU DOUGLAS NORTH CROSSING PEL STUDY |          |
| CITY AND BOROUGH OF JUNEAU, ALASKA                                               |          |
| FEBRUARY 2025                                                                    | FIGURE 5 |



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\MENDENHALL.dwg PLOT DATE 2025-2-13 17:19 SAVED DATE 2024-06-27 16:27 USER: cwoife



**MENDENHALL PENINSULA CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 6



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_MENDENHALL.dwg PLOT DATE 2025-2-13 17:20 SAVED DATE 2024-06-27 16:27 USER: cwolfe



**MENDENHALL PENINSULA CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 7



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY POINT.dwg PLOT DATE 2025-2-13 17:22 SAVED DATE 2024-06-27 16:48 USER: cwoffe



EXISTING SUMMER VIEWS



A.  
EGAN DRIVE FACING EAST  
(Google Earth 2023)



B.  
EGAN DRIVE FACING WEST  
(Google Earth 2023)



C.  
N. DOUGLAS HIGHWAY FACING EAST  
(Google Earth 2023)



D.  
N. DOUGLAS HIGHWAY FACING WEST  
(Google Earth 2023)

EXISTING WINTER VIEWS



A.  
EGAN DRIVE FACING EAST  
(January 2024)



B.  
EGAN DRIVE FACING WEST  
(January 2024)

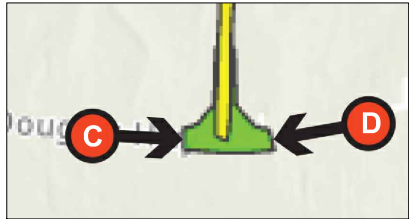
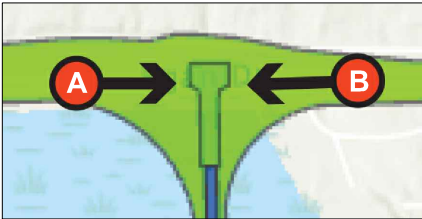


C.  
N. DOUGLAS HIGHWAY FACING EAST  
(January 2024)



D.  
N. DOUGLAS HIGHWAY FACING WEST  
(January 2024)

VIEWPOINTS



SUNNY POINT CROSSING  
EXISTING VIEWS - WEST

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 8



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY POINT.dwg PLOT DATE 2025-2-13 17:22 SAVED DATE 2024-06-27 16:48 USER: cwoife



SIMULATIONS

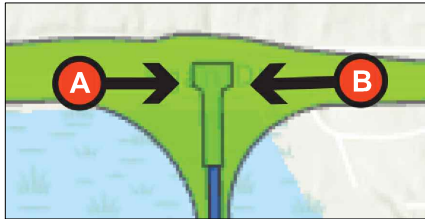


A. EGAN DRIVE FACING SOUTHEAST



B. EGAN DRIVE FACING SW

VIEWPOINTS



SUNNY POINT CROSSING  
SIMULATIONS - EGAN WEST

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 9



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY POINT.dwg PLOT DATE 2025-2-13 17:23 SAVED DATE 2024-06-27 16:48 USER: cwoife



EXISTING SUMMER VIEWS



A.  
EGAN DRIVE FACING SOUTHEAST  
(Google Earth 2023)



B.  
EGAN DRIVE FACING NORTHWEST  
(Google Earth 2023)



C.  
N. DOUGLAS HIGHWAY FACING EAST  
(Google Earth 2023)



D.  
N. DOUGLAS HIGHWAY FACING WEST  
(Google Earth 2023)

EXISTING WINTER VIEWS



A.  
EGAN DRIVE FACING SOUTHEAST  
(January 2024)



B.  
EGAN DRIVE FACING NORTHWEST  
(January 2024)

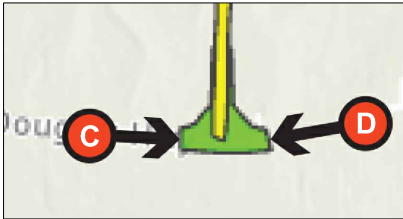
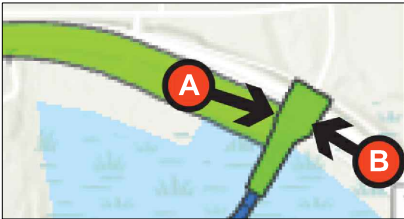


C.  
N. DOUGLAS HIGHWAY FACING EAST  
(January 2024)



D.  
N. DOUGLAS HIGHWAY FACING WEST  
(January 2024)

VIEWPOINTS



SUNNY POINT CROSSING  
EXISTING VIEWS - EAST

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 10



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY\_POINT.dwg PLOT DATE 2025-2-13 17:23 SAVED DATE 2024-06-27 16:48 USER: cwoffe



SIMULATIONS

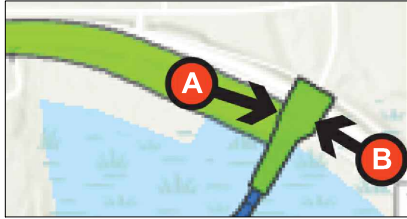


A. EGAN DRIVE FACING SOUTHEAST



B. EGAN DRIVE FACING SOUTHWEST

VIEWPOINTS



SUNNY POINT CROSSING  
SIMULATIONS - EGAN EAST

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 11



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY\_POINT.dwg PLOT DATE 2025-2-13 17:24 SAVED DATE 2024-06-27 16:48 USER: cwoffe



SIMULATIONS

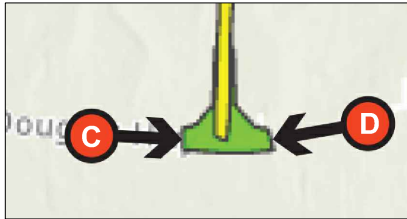


C. NORTH DOUGLAS HIGHWAY FACING EAST



D. NORTH DOUGLAS HIGHWAY FACING WEST

VIEWPOINTS



SUNNY POINT CROSSING  
SIMULATIONS - DOUGLAS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 12



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY\_POINT.dwg PLOT DATE 2025-2-13 17:24 SAVED DATE 2024-06-27 16:48 USER: cwoife



**SUNNY POINT CROSSING  
SIMULATION - WEST CONNECTION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 13



\\dow.com\Projects\38\63234-01\15Graphics\Juneau\_PEL\_Crossing\_Visual\_Impact\_Analysis\00 FIGURES\Figures\_SUNNY\_POINT.dwg PLOT DATE 2025-2-13 17:25 SAVED DATE 2024-06-27 16:48 USER: ewolfe



**SUNNY POINT CROSSING  
SIMULATION - WEST CONNECTION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 14



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY\_POINT.dwg PLOT DATE 2025-2-13 17:25 SAVED DATE 2024-06-27 16:48 USER: ewolfe



**SUNNY POINT CROSSING  
SIMULATION - EAST CONNECTION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

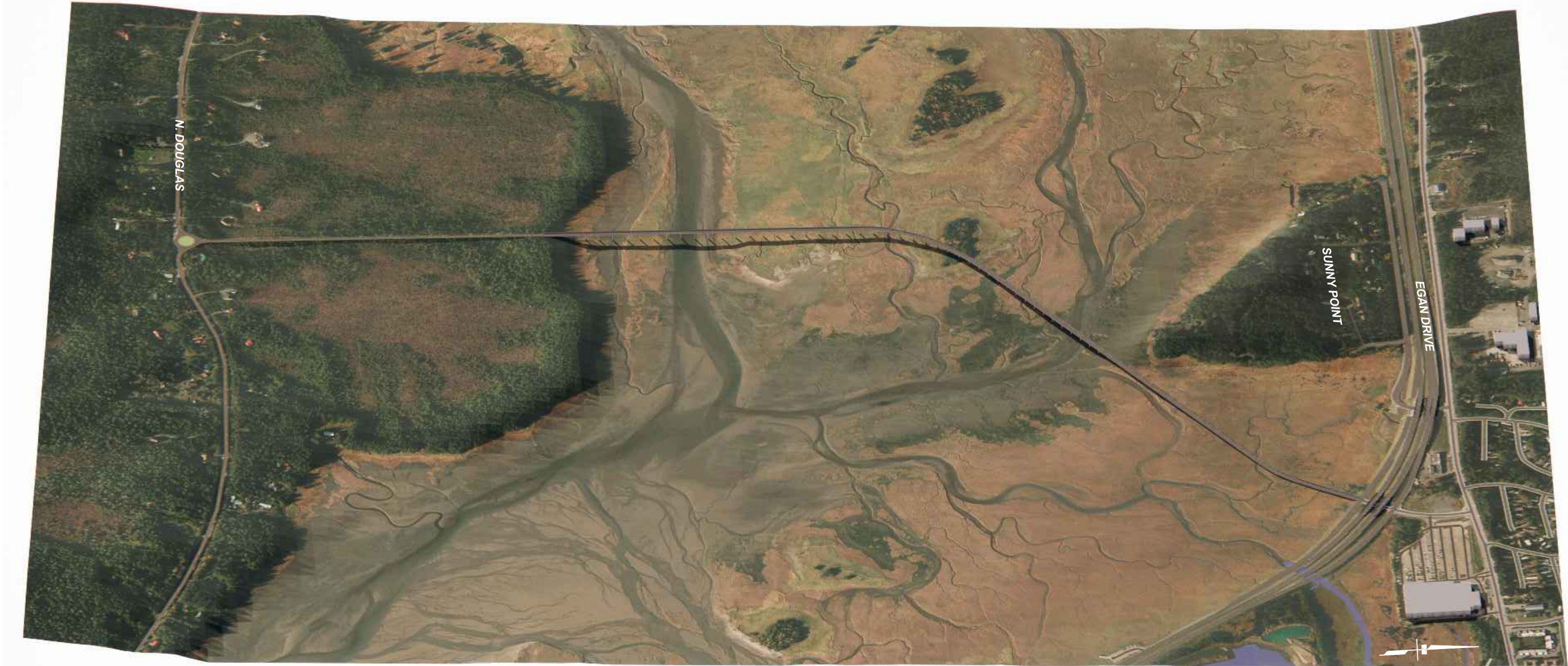
CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 15



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SUNNY\_POINT.dwg PLOT DATE 2025-2-13 17:26 SAVED DATE 2024-06-27 16:48 USER: cwoife



**SUNNY POINT CROSSING  
SIMULATION - EAST CONNECTION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

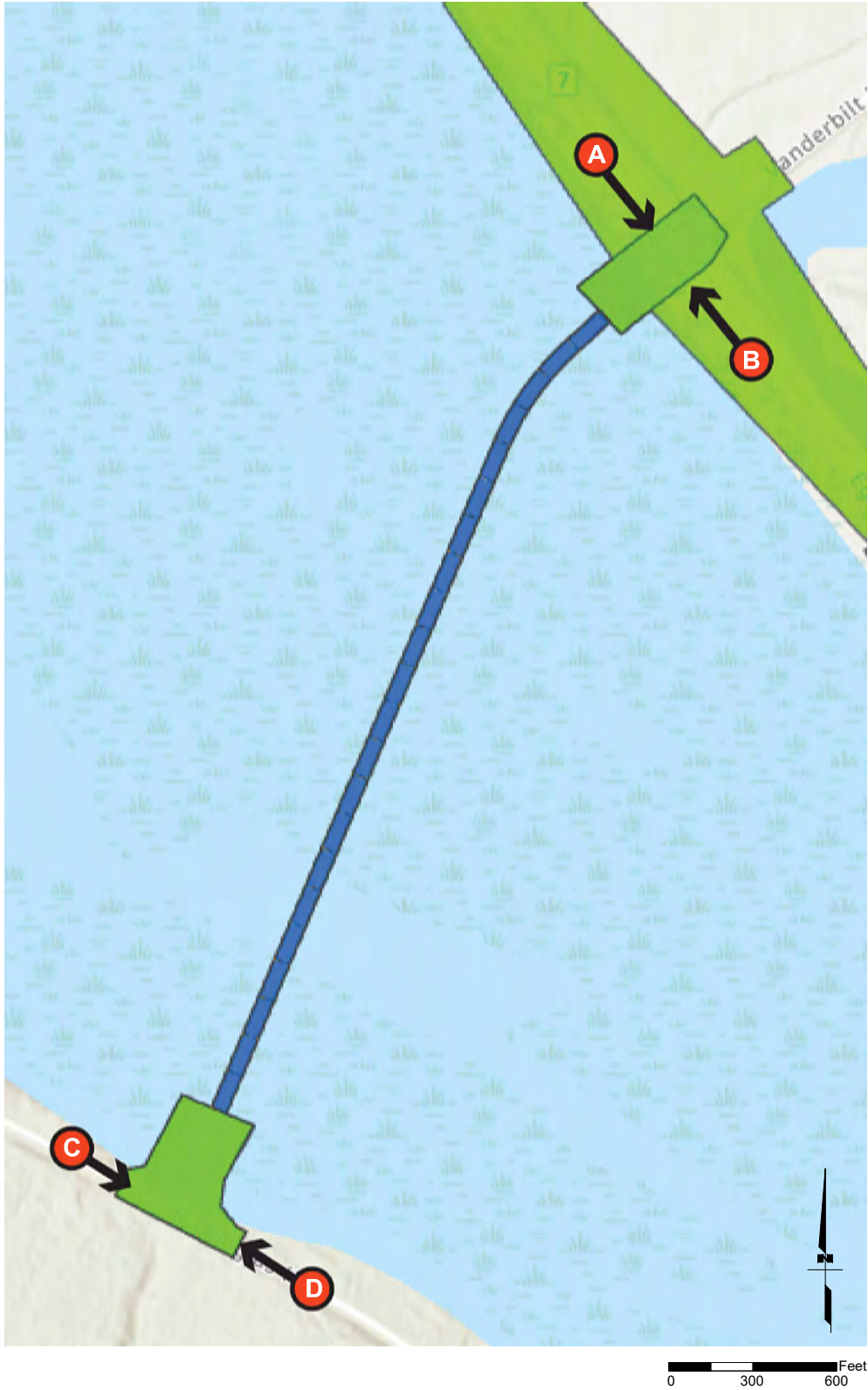
CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 16



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_VANDERBILT.dwg PLOT DATE 2025-2-13 17:30 SAVED DATE 2024-06-27 16:59 USER: cwoife



EXISTING SUMMER VIEWS



A.  
EGAN DRIVE FACING SOUTHEAST  
(Google Earth 2023)



B.  
EGAN DRIVE FACING NORTHWEST  
(Google Earth 2023)



C.  
N. DOUGLAS HIGHWAY FACING SOUTHEAST  
(Google Earth 2023)



D.  
N. DOUGLAS HIGHWAY FACING NORTHWEST  
(Google Earth 2023)

EXISTING WINTER VIEWS



A.  
EGAN DRIVE FACING SOUTHEAST  
(January 2024)



B.  
EGAN DRIVE FACING NORTHWEST  
(January 2024)

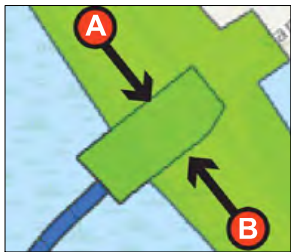
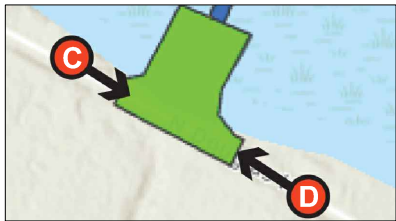


C.  
N. DOUGLAS HIGHWAY FACING SOUTHEAST  
(January 2024)



D.  
N. DOUGLAS HIGHWAY FACING NORTHWEST  
(January 2024)

VIEWPOINTS



VANDERBILT CROSSING  
EXISTING VIEWS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

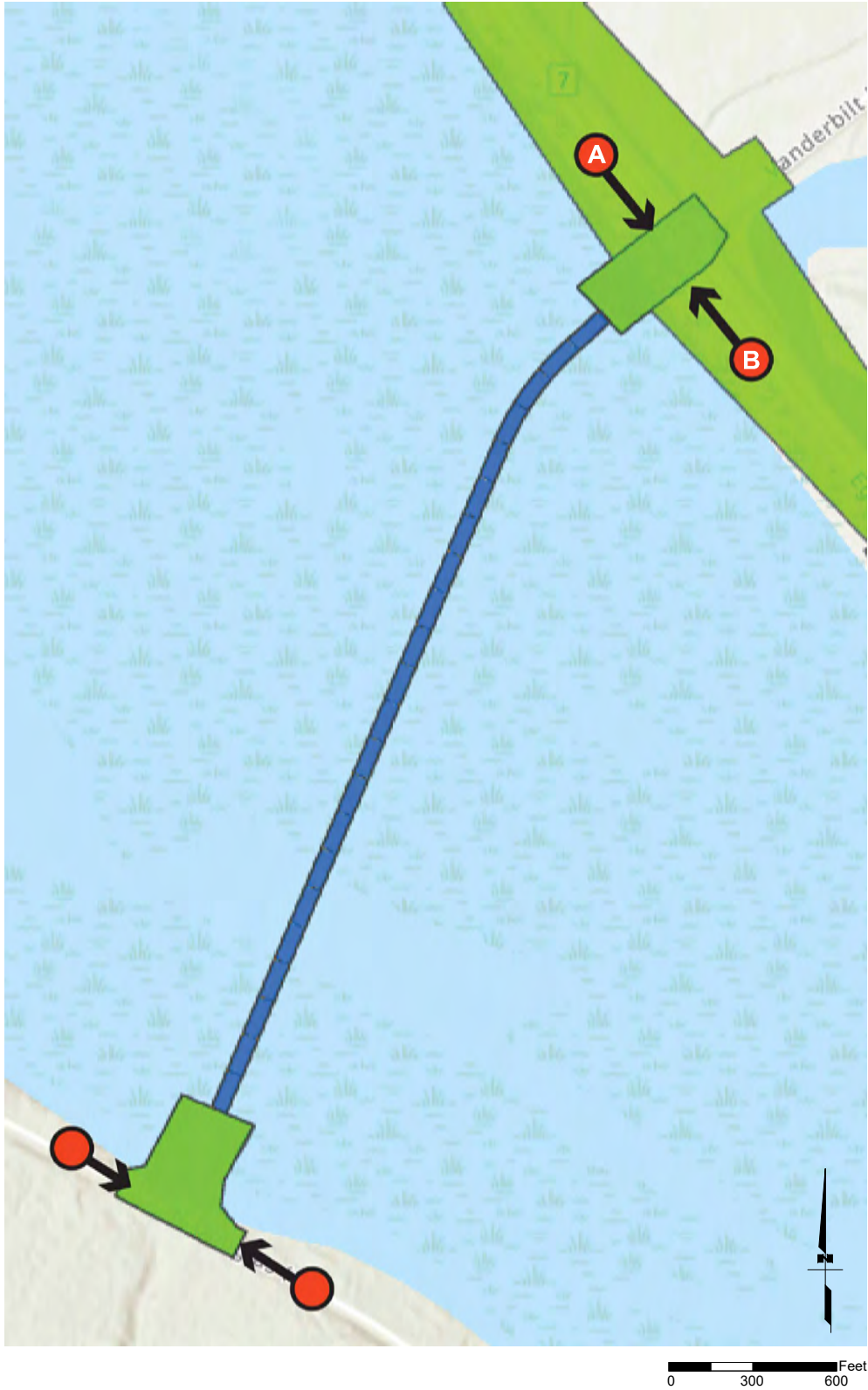
CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 17



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_VANDERBILT.dwg PLOT DATE 2025-2-13 17:30 SAVED DATE 2024-06-27 16:59 USER: cwoffe



SIMULATIONS

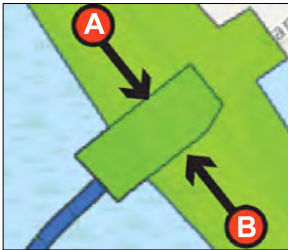


A. EGAN DRIVE FACING SOUTHEAST



B. EGAN DRIVE FACING NORTHWEST

VIEWPOINTS



VANDERBILT CROSSING  
SIMULATIONS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

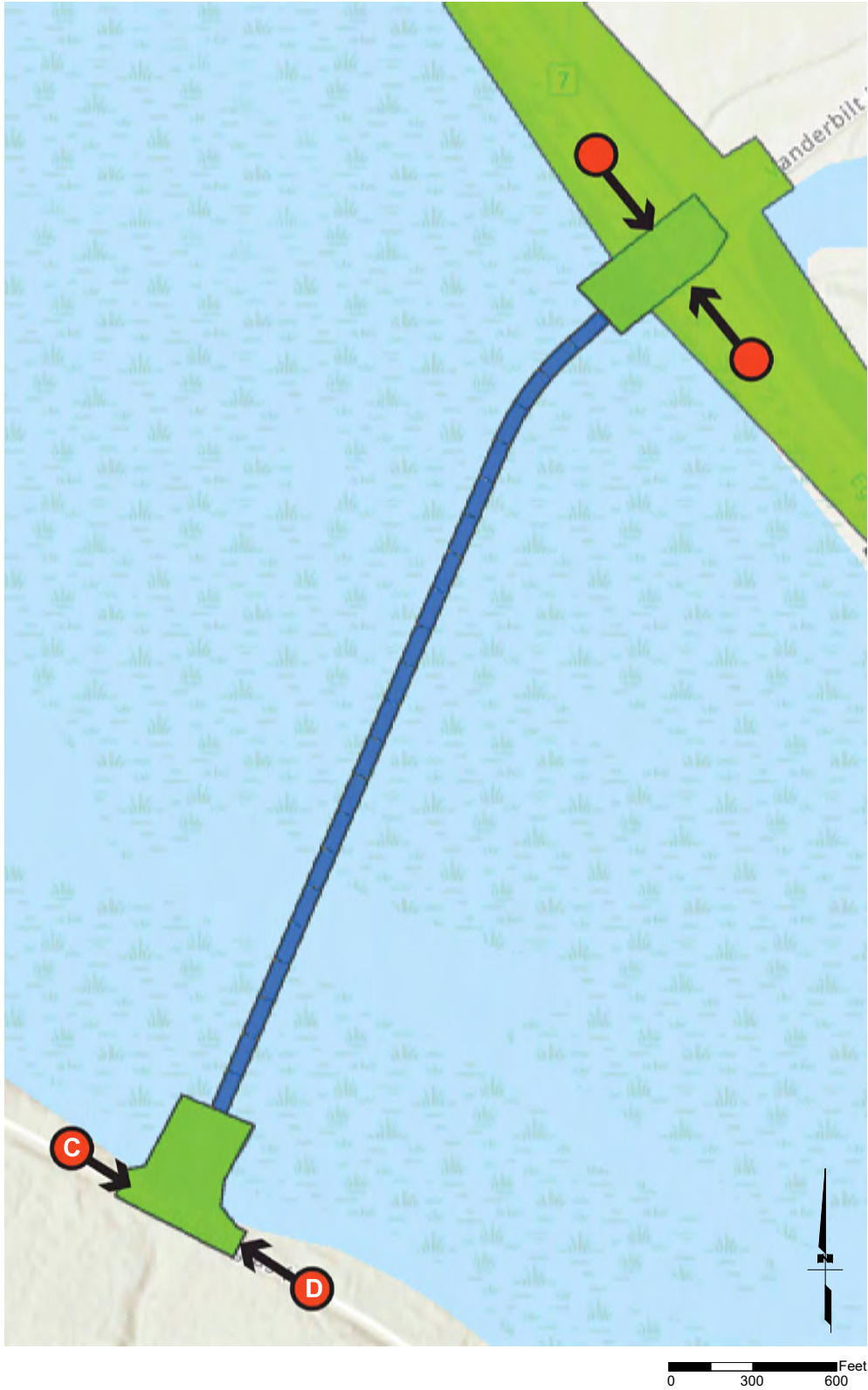
CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 18



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_VANDERBILT.dwg PLOT DATE 2025-2-13 17:32 SAVED DATE 2024-06-27 16:59 USER: cwoffe



**SIMULATIONS**

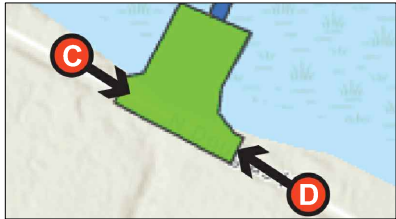


**C.** NORTH DOUGLAS HIGHWAY FACING SOUTHEAST



**D.** NORTH DOUGLAS HIGHWAY FACING NORTHWEST

**VIEWPOINTS**



**VANDERBILT CROSSING  
SIMULATIONS**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 19



\\\\dowl.com\\Projects\\38\\63234-01\\15Graphics\\Juneau PEL Crossing Visual Impact Analysis\\00 FIGURES\\Figures\_VANDERBILT.dwg PLOT DATE 2025-2-13 17:32 SAVED DATE 2024-06-27 16:59 USER: cwoite



**VANDERBILT CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 20



\\\\dow.com\\Projects\\38\\63234-01\\15Graphics\\Juneau PEL Crossing Visual Impact Analysis\\00 FIGURES\\Figures\_VANDEBILT.dwg PLOT DATE 2025-2-13 17:33 SAVED DATE 2024-06-27 16:59 USER: cwoite



**VANDERBILT CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 21



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_TWIN LAKES.dwg PLOT DATE 2025-2-13 17:35 SAVED DATE 2024-06-27 17:03 USER: cwoffe



EXISTING SUMMER VIEWS



A.  
EGAN DRIVE FACING SOUTHEAST  
(Google Earth 2023)



B.  
EGAN DRIVE FACING NORTHWEST  
(Google Earth 2023)



C.  
N. DOUGLAS HIGHWAY FACING SOUTHEAST  
(Google Earth 2023)



D.  
N. DOUGLAS HIGHWAY FACING NORTHWEST  
(Google Earth 2023)

EXISTING WINTER VIEWS



A.  
EGAN DRIVE FACING SOUTHEAST  
(January 2024)



B.  
EGAN DRIVE FACING NORTHWEST  
(January 2024)

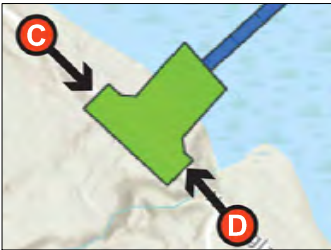
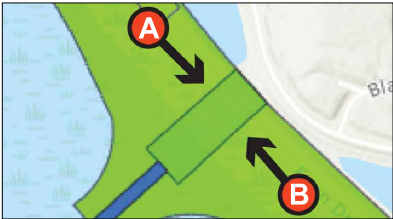


C.  
N. DOUGLAS HIGHWAY FACING SOUTHEAST  
(January 2024)



D.  
N. DOUGLAS HIGHWAY FACING NORTHWEST  
(January 2024)

VIEWPOINTS



TWIN LAKES CROSSING  
EXISTING VIEWS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 22



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_TWIN LAKES.dwg PLOT DATE 2025-2-13 17:36 SAVED DATE 2024-06-27 17:03 USER: cwoife



**SIMULATIONS**



**A.** EGAN DRIVE FACING SOUTHEAST



**B.** EGAN DRIVE FACING NORTHWEST

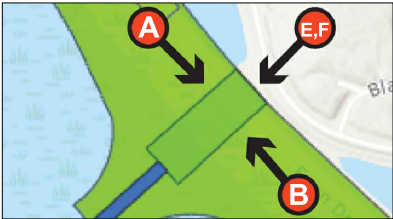


**E.** EGAN DRIVE & GLACIER HIGHWAY INTERSECTION FACING SOUTHEAST



**F.** EGAN DRIVE & GLACIER HIGHWAY INTERSECTION FACING SOUTHWEST

**VIEWPOINTS**



**TWIN LAKES CROSSING  
SIMULATIONS**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 23



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_TWIN LAKES.dwg PLOT DATE 2025-2-13 17:36 SAVED DATE 2024-06-27 17:03 USER: cwalfe



SIMULATIONS

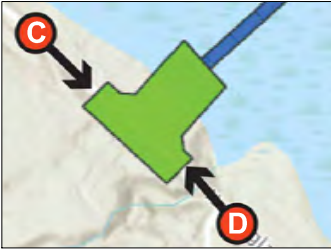


C. NORTH DOUGLAS HIGHWAY FACING SOUTHEAST



D. NORTH DOUGLAS HIGHWAY FACING NORTHWEST

VIEWPOINTS



TWIN LAKES CROSSING  
SIMULATIONS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 24



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_TWIN LAKES.dwg PLOT DATE 2025-2-13 17:37 SAVED DATE 2024-06-27 17:03 USER: cwalfe



**TWIN LAKES CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 25



\\dowl.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_TWIN LAKES.dwg PLOT DATE 2025-2-13 17:38 SAVED DATE 2024-06-27 17:03 USER: cwolfe



**TWIN LAKES CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 26



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SALMON CREEK.dwg PLOT DATE 2025-02-13 15:56 SAVED DATE 2025-02-13 15:55 USER: cwoife



EXISTING SUMMER VIEWS



A.  
CHANNEL DRIVE FACING SOUTHEAST  
(Google Earth 2023)



B.  
CHANNEL DRIVE FACING NORTHWEST  
(Google Earth 2023)



C.  
N. DOUGLAS HIGHWAY FACING SOUTHEAST  
(Google Earth 2023)



D.  
N. DOUGLAS HIGHWAY FACING NORTHWEST  
(Google Earth 2023)

EXISTING WINTER VIEWS



A.  
CHANNEL DRIVE FACING SOUTHEAST  
(January 2024)



B.  
CHANNEL DRIVE FACING NORTHWEST  
(January 2024)

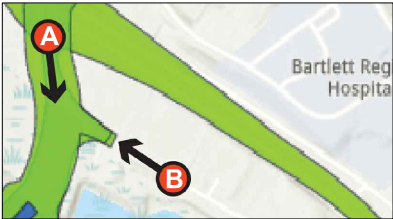


C.  
N. DOUGLAS HIGHWAY FACING SOUTHEAST  
(January 2024)



D.  
N. DOUGLAS HIGHWAY FACING NORTHWEST  
(January 2024)

VIEWPOINTS



SALMON CREEK CROSSING  
EXISTING VIEWS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 -34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 27



\\dow.com\Projects\38\63234-01\15Graphics\Juneau PEL Crossing Visual Impact Analysis\00 FIGURES\Figures\_SALMON CREEK.dwg PLOT DATE 2025-2-13 15:57 SAVED DATE 2025-02-13 15:55 USER: cwoife



**SIMULATIONS**

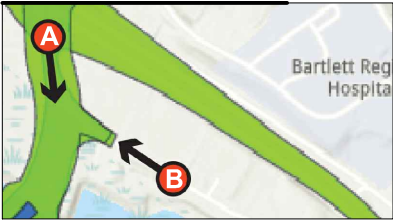


**A.** CHANNEL DRIVE FACING SOUTHEAST



**B.** CHANNEL DRIVE FACING NORTHWEST

**VIEWPOINTS**



**SALMON CREEK CROSSING  
SIMULATIONS**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

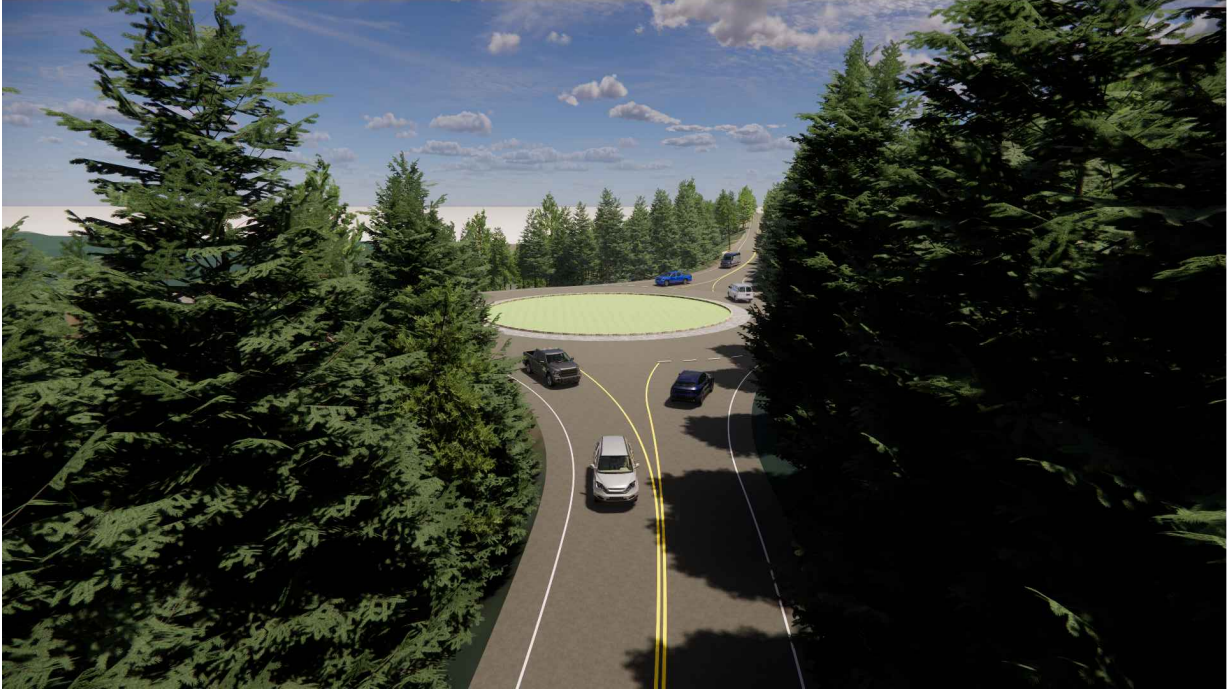
FIGURE 28



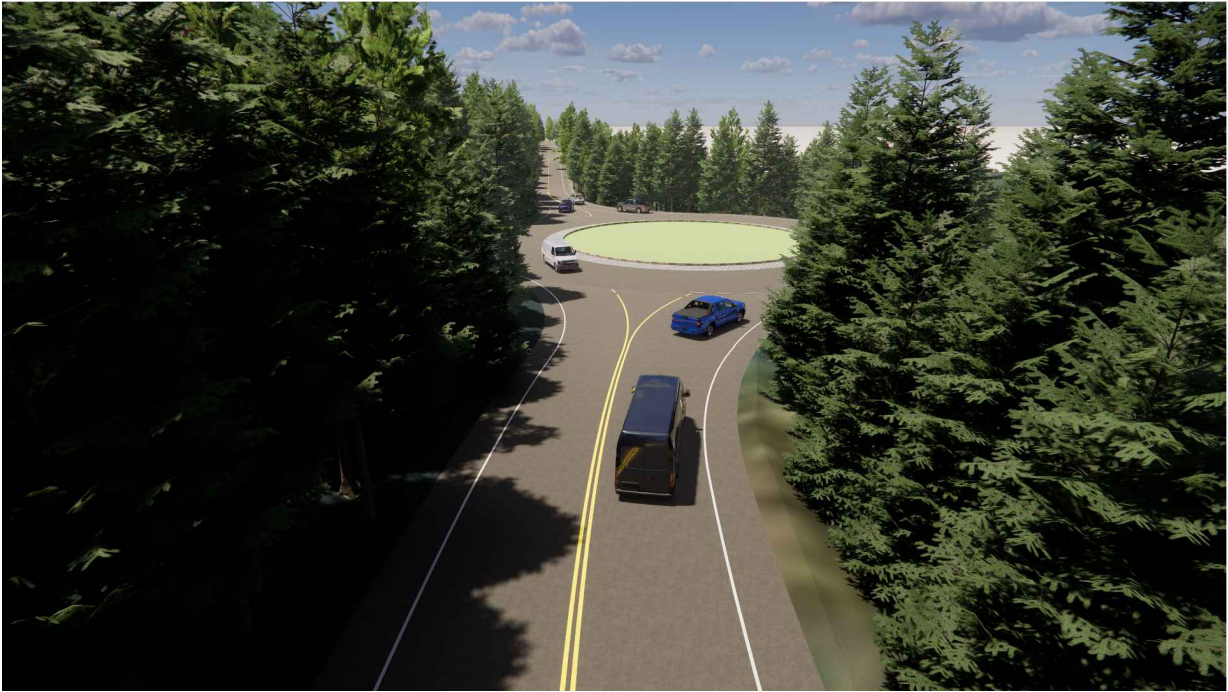
\\dow.com\Projects\38\63234-01\15Graphics\Juneau\_PEL\_Crossing\_Visual\_Impact\_Analysis\00 FIGURES\Figures\_SALMON\_CREEK.dwg PLOT DATE 2025-2-13 15:58 SAVED DATE 2025-02-13 15:55 USER: cwoife



SIMULATIONS



C. NORTH DOUGLAS HIGHWAY FACING SOUTHEAST



D. NORTH DOUGLAS HIGHWAY FACING NORTHWEST

VIEWPOINTS



SALMON CREEK CROSSING  
SIMULATIONS

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



STATE OF ALASKA  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 29



\\\\dow.com\\Projects\\38\\63234-01\\15Graphics\\Juneau PEL Crossing Visual Impact Analysis\\00 FIGURES\\Figures\_SALMON CREEK.dwg PLOT DATE 2025-02-13 15:58 SAVED DATE 2025-02-13 15:55 USER: cwoife



**SALMON CREEK CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 30



\\\\dowl.com\\Projects\\38\\63234-01\\15Graphics\\Juneau PEL Crossing Visual Impact Analysis\\00 FIGURES\\Figures\_SALMON CREEK.dwg PLOT DATE 2025-2-13 15:59 SAVED DATE 2025-02-13 15:55 USER: cwoife



**SALMON CREEK CROSSING  
SIMULATION**

SEC 25 - 27, 34 - 36, T 40S, R 65E; SEC 30 - 34, T 40S, R 66E  
SEC 1 - 12, 15 - 17, T 41S, R 66E;  
SEC 4 - 10, 15 - 17, 21 - 23, 27 T 41S, R 67E

COPPER RIVER MERIDIAN, ALASKA



**STATE OF ALASKA**  
DEPARTMENT OF TRANSPORTATION  
AND PUBLIC FACILITIES

DOT&PF PROJECT NO. SFHWY00299/0003259  
JUNEAU DOUGLAS NORTH CROSSING PEL STUDY

CITY AND BOROUGH OF JUNEAU, ALASKA

FEBRUARY 2025

FIGURE 31