SHANNON & WILSON

MEMORANDUM

DATE: June 3, 2022

PROJECT: South Coast Slide Study

PROJ. #: 106381-009

SUBJECT: Technical Memorandum #4 – Slide Area Alternative Analysis and Mitigation Concepts

INTRODUCTION

Shannon & Wilson, Inc. (Shannon & Wilson) developed conceptual geologic cross-sections, performed landslide interpretation, and developed mitigation concepts for each of the 13 landslides based on our review of existing information (including InSAR and LiDAR data) and site reconnaissance. The geotechnical services Shannon & Wilson completed to develop the mitigation concepts at each landslide site include the following:

- Develop up to two (2) conceptual geologic cross-sections along the critical section(s) of each landslide;
- Perform landslide interpretation for each landslide area;
- Perform slope stability back-calculations to estimate soil residual shear strength along the shear planes, and to evaluate the landslide critical condition and their failure mechanisms;
- Perform slope stability mitigation analyses to evaluate the performance of a variety of mitigation alternatives;
- Prepare preliminary mitigation concept plans; and
- Provide planning level opinions of probable cost for slide mitigation.

This memo presents our conceptual geologic-cross sections showing the estimated failure plane location(s), site plans showing the locations of existing subsurface explorations and preliminary landslide boundaries based on our review of existing data including LiDAR and InSAR data, landslide interpretations, the results of our back calculation and conceptual mitigation slope stability analyses, and our mitigation alternative concept plans and associated opinions of probable cost.

CONCEPTUAL GEOLOGIC CROSS SECTIONS

Preliminary landslide boundaries for each slide are shown on the Site and Exploration Plans in Attachment A and were generated using a combination of existing information, observations made during the recent site reconnaissance performed by Shannon & Wilson, and LiDAR and InSAR data analysis.

Up to two conceptual geologic cross sections were developed for each slide based on the existing information, site reconnaissance, and LiDAR and InSAR data analysis. The location of each cross section is shown on the Site and Exploration Plans in Attachment A and the Conceptual Geologic Cross Sections are also included in Attachment A.

Our conceptual back calculation slope stability analyses were performed using an assumed high groundwater level based on the existing information. The assumed groundwater level for back calculation analysis is shown on each Conceptual Geologic Cross Section.

LANDSLIDE FAILURE SURFACE INTERPRETATION

The subsurface failure planes (shear planes) of the landslides were interpreted based on our review of existing information including inclinometer data, our site reconnaissance, and our LiDAR and InSAR data analysis. The locations and orientations of the assumed shear planes for each slide are shown on the Conceptual Geologic Cross Sections.

Our interpretation of the landslide failure surface mechanism(s) for each slide are summarized in Table 1, attached to this memo. Common failure mechanisms for the 13 slides along US 101 are shallow groundwater within the slide mass, coastal erosion of the slide toe, or a combination of shallow groundwater and coastal erosion.

Average landslide displacement rates along each shear plane were characterized by considering the displacement versus time data from the available inclinometer data. Rates of shear plane displacement calculated from inclinometer data were calculated over the entire inclinometer monitoring period and therefore may not be representative of maximum displacement rates. We also considered overall landslide displacement rates obtained from InSAR data (both L-Band and C-Band frequencies). Displacement rates were measured within SkyGeo’s viewer by tracing a line along the southbound shoulder of US 101 within our interpreted slide boundary over the entire monitoring period (March 19, 2016 to May 24, 2020 for L-Band data and May 23, 2015 to December 31, 2021 for C-Band data). We provided both an average rate, considering all data points along the line within the slide boundary, as well as a maximum displacement rate. Shear plane displacement rates are summarized in Table 1, attached to this memo.

BACK CALCULATION ANALYSES

The initial phase of our conceptual slope stability analysis included back calculation to evaluate the residual shear strength along the assumed failure plane(s) of the landslides under static conditions. Back calculation is an iterative process where the strength properties of a given soil material are adjusted to obtain an expected result. In this case, the residual friction angle of the shear plane was adjusted until a factor of safety (FS) of 1.0 was obtained for the failure mass. Conceptual slope stability analyses were performed using the computer program SLOPE/W Version 11.0.1.21429 (Geo-Slope International, 2021). This program employs limit equilibrium methods. The Morgenstern-Price slope stability analysis method was used for irregular surface failure mechanisms.

The residual shear strength calculated from the back calculation analysis methodology described above is particularly sensitive to the orientation of the assumed shear plane, groundwater level, and the surface topography. It is necessary to base the back calculation analysis on quality data in order to achieve the most accurate residual shear strength. If there is insufficient existing data, the back calculation results are not likely to be representative of the landslide at failure (i.e. FS = 1.0). Therefore, we only performed back calculation analyses at landslide sites with sufficient existing data (i.e. inclinometer and piezometer data) to determine the location of the shear plane(s) and groundwater level. The landslide sites we performed back calculation analyses on are: Retz Creek South, Coal Point, Arizona North, Arizona Inn, and Christmas Tree (Frankfort North). The remaining landslide sites lacked sufficient data to accurately define the shear plane(s) and groundwater level to a degree at which back calculation analyses are justified.

The location and orientation of the assumed shear planes are shown on the Conceptual Geologic Cross Sections. Back calculation analyses were performed using an assumed high groundwater level which is shown on each Conceptual Geologic Cross Section.

Using an FS that represents a failed slope condition (i.e., on the order of 1.0 or slightly less), a friction angle along the assumed shear plane, φ_r, was calculated in our computer model. The conceptual back-calculation slope stability analyses for the Retz Creek South, Coal Point, Arizona North, Arizona Inn, and Christmas Tree slides are presented in Attachment B.

CONCEPTUAL LANDSLIDE MITIGATIONS

We evaluated several conceptual landslide mitigation alternatives for each slide based on the provided existing information, our site reconnaissance, LiDAR and InSAR data analysis, and conceptual landslide slope stability analyses. The conceptual mitigation alternatives were developed to protect the US 101 roadway within the slide limits and reduce the frequency of roadway maintenance and lane closures due to landslide movements. Mitigation alternatives were not developed for shear planes or portions of the slides that do not affect US 101. The conceptual landslide slope stability analyses are sensitive to the residual shear strength along the shear plane(s). Therefore, we only performed conceptual landslide slope stability analyses for the slides that we performed back calculation analyses on and had sufficient existing data to justify a reasonably accurate back calculated residual friction angle.

According to the ODOT GDM (ODOT, 2018), Chapter 7, landslide mitigation design should provide a minimum slope stability FS of 1.25 under static conditions. Typically, the larger the landslide the more expensive the mitigation design will be to provide a slope stability FS of 1.25. Many of the 13 landslides in the South Coast Slide Study project have deep-seated shear planes and/or large aerial extents and a small increase in slope stability FS coincides with a large increase in mitigation cost. ODOT may not have the funds to construct a particular mitigation alternative that achieves FS of 1.25, however may be able to fund a mitigation project that achieves a FS of 1.1. Therefore, we performed sensitivity analyses varying the mitigation design to evaluate the impact on slope stability FS. The mitigation alternatives presented herein achieved FS varying between 1.03 and 1.4. The higher the FS that a particular mitigation alternative achieves, the less the landslide movement and subsequent roadway maintenance will be over the design life of the mitigation. In other words, more funds spent up front to mitigate a landslide will result in less funds spent over the design life of the mitigation for roadway maintenance due to landslide movements. In addition, the more expensive mitigation alternatives typically have a longer design life.

The conceptual mitigation slope stability analyses for the Retz Creek South, Coal Point, Arizona North, Arizona Inn, and Christmas Tree slides are presented in Attachment C and the results are summarized in Exhibits 1 through 5 in the following sections. Conceptual landslide mitigation alternatives for each landslide are summarized in Table 1, attached to this memo.

A "geotechnical priority list" was created assigning a priority of "low", "medium", or "high" to each interpreted shear plane within each landslide. The "geotechnical priority" for each shear plane was determined based on the slide's potential to affect US 101, the severity of the slide activity as determined by inclinometer and InSAR displacement rates, frequency of US 101 maintenance and closures due to slide activity, and the estimated level of effort to mitigate the landslide. The geotechnical priority list may be used to prioritize which landslides should be mitigated first given limited funds. Geotechnical priorities are summarized in Table 1.

The following subsections present the mitigation alternatives considered for each slide, our preferred mitigation alternative, and the results of our conceptual mitigation slope stability analyses.

Retz Creek South

We considered a drilled stone column shear key, a soldier pile tieback wall, and horizontal drains as potential mitigation alternatives for the Retz Creek South landslide. Mitigation Concept Plans for the shear key and soldier pile tieback wall alternatives are included in Attachment D, Figures D1 to D3.

The conceptual stone column shear key alternative consists of drilled stone columns constructed just downslope of US 101 southbound, spaced in a triangular grid pattern to intercept shear planes #1 and #2. Due to the relatively slow rate of movement along the shear plane, low potential to impact US 101, and additional cost to mitigate, the drilled stone columns do not intercept shear plane #3. The conceptual slope stability analyses show that FS equal to 1.06 and 1.11 are obtained along shear planes #1 and #2, respectively, by extending the stone columns a minimum of 5-feet below the shear planes. Our conceptual analysis for the shear key indicated that the proposed shear key would have a minimum base width of 25 feet. A level drilling platform would be necessary for construction therefore we assumed an approximate 10-foot-deep cut from roadway grade down to a drilling platform, leaving at least 20 to 25 feet of roadway width accessible for one-way traffic during construction. The length of drilled stone columns will be approximately 45 feet to intercept shear plane #1, and approximately 70 feet to intercept both shear planes #1 and #2. We assumed a stone column diameter of 5 feet installed in an equilateral triangle pattern so that the edge-to-edge spacing between the stone columns is 1-foot. After drilling and installing the stone columns, the temporary excavation would be backfilled with stone embankment material. The shear key should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual drilled stone column shear key length for the Retz Creek Slide is approximately 950 feet.

Although the drilled stone column shear key alternative is preferred due to cost, we conceptually evaluated a soldier pile tieback retaining wall alternative. The conceptual location for the soldier pile tieback retaining wall is along the southbound shoulder of US 101 within the slide limits. The intent of the retaining wall is to protect US 101 only and would be designed assuming the downslope slide mass will continue moving. Based on the depth to shear plane #1, the conceptual retaining wall height is approximately 35 feet.

Although the retaining wall lagging and tiebacks would not extend down to shear planes #2 and #3, the tiebacks and soldier piles would be embedded beyond both shear planes and would provide an increase in the FS along both shear planes. The soldier piles should be embedded a minimum of 10 feet beyond the deepest slide plane into rock, resulting in approximately 115-foot-long piles. We anticipate three rows of tiebacks extending a minimum of 20 feet beyond the deepest slide plane into rock, resulting in approximately 140-foot-long tiebacks. The retaining wall should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual retaining wall length is approximately 950 feet.

Horizontal drains were considered for a mitigation alternative, however based on our assumed high groundwater level, dewatering would have a minimal effect on the FS of the higher priority shear planes #1 and #2. Horizontal drains could be a feasible alternative to mitigate shear plane #3 however, in our opinion, mitigation of this shear plane is a low priority and not likely justifiable due to cost.

Exhibit 1: Retz Creek South Drilled Stone Column Shear Key Conceptual Mitigation Slope Stability Analysis Results

Shear Plane	Existing FS	Improved FS	Percent (%) FS Increase
1	1.017	1.060	4.2%
2	1.030	1.114	8.2%

Coal Point

We considered horizontal drains, trench drains, and a drilled stone column shear key as potential mitigation alternatives for the Coal Point landslide. Due to the relatively slow rate of movement along the shear plane and additional cost to mitigate, mitigation alternatives were not designed to improve the FS along shear plane #3, although the horizontal and trench drain alternatives do provide some increase in the FS. In addition, shear plane #4 has low potential to impact US 101 therefore mitigation alternatives were not designed to improve its FS either. Mitigation Concept Plans for the above alternatives are included in Attachment D, Figures D4 to D9.

The conceptual horizontal drain alternative slope stability analysis shows that the FS presented in Exhibit 2 are obtained by installing two tiers of horizontal drains. For the uppermost horizontal drain tier installed from the northbound shoulder of US 101, we assumed a parallel configuration of drains spaced at 50-foot centers, approximately 300 feet long each. For the horizontal drain tier downslope from US 101, we assumed four arrays of drains with 10 drains in each array and each drain is approximately 400 feet long. Therefore, the total lineal footage of horizontal drains is approximately 22,000 feet. Without a site-specific exploration program including test drains, the effectiveness of horizontal drains at the site is uncertain. Therefore, we performed slope stability analyses assuming the drains are functioning with 100 percent and 50 percent efficiency.

The conceptual trench drain alternative slope stability analysis shows that the FS presented in Exhibit 2 are obtained by constructing three rows of 25-foot-deep trench drains perpendicular to the slope. The three rows will be all be connected near the slide margins by additional trench drains running downslope to transport the collected water to anchored slope pipes. The entire trench drain system will remain within the slide extents to limit potential for slide movements that may interrupt the drain network. The total lineal footage of trench drains is approximately 4,500 feet.

The conceptual stone column shear key alternative consists of constructing drilled stone columns just downslope of US 101 southbound, spaced in a triangular grid pattern that extend a minimum of 5 feet below shear plane #2. We assume that the proposed shear key would have a minimum base width of approximately 25 feet. A level drilling platform would be necessary for construction therefore we assumed an approximate 10-foot-deep cut from roadway grade down to a drilling platform, leaving at least 20 to 25 feet of roadway width accessible for one-way traffic during construction. The length of drilled stone columns will be approximately 70 feet to intercept shear planes #1 and #2. We assumed a stone column diameter of 5 feet installed in an equilateral triangle pattern so that the edge-to-edge spacing between the stone columns is 1-foot. After drilling and installing the stone columns, the temporary excavation would be backfilled with stone embankment material. The shear key should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual drilled stone column shear key length for the Coal Point slide is approximately 1,300 feet.

In our opinion, due to the relatively shallow groundwater throughout the slide mass and depth to slide plane, a dewatering mitigation alternative, specifically horizontal drains, will be the most efficient and economical form of mitigation and therefore the preferred alternative. The drilled stone column shear key alternative is technically feasible but not preferred due to cost.

Exhibit 2: Coal Point Dewatering Conceptual Mitigation Slope Stability Analysis Results

Shear Plane	Existing FS	Trench Drains		Horizontal Drains (50% Efficiency)		Horizontal Drains (100% Efficiency)	
		Improved FS	Percent (%) FS Increase	Improved FS	Percent (%) FS Increase	Improved FS	Percent (%) FS Increase
1	1.012	1.087	7.4%	1.248	23.3%	1.248	23.3%
2	1.027	1.095	6.6%	1.258	22.5%	1.411	37.4%
3	1.022	1.039	1.7%	1.083	6.0%	1.141	11.6%

North Brush Creek Hump

A slide mitigation consisting of a shear key with buttress was constructed at the North Brush Creek Hump slide in 2011. We therefore considered increasing the depth of the existing shear key with drilled stone columns to intercept shear planes #1 and #2. We also considered horizontal drains and enlarging the entire existing shear key with buttress as potential mitigation alternatives for the North Brush Creek Hump slide. Due to the lack of observed of movement along the interpreted shear plane, additional cost to mitigate, and low potential to impact US 101, mitigation alternatives were not designed to improve the FS along shear plane #3. Mitigation Concept Plans for the drilled stone column shear key alternative are included in Attachment D, Figures D10 to D11.

The conceptual stone column shear key alternative consists of constructing drilled stone columns within the footprint of the existing shear key, spaced in a triangular grid pattern, that extend a minimum of 5 feet below shear plane #2. We assume that the proposed shear key would have a minimum base width of approximately 20 feet and be constructed far enough into the existing slope to avoid interacting with the heel drain within the existing shear key. The length of drilled stone columns will be approximately 45 feet to intercept shear planes #1 and #2. We assumed a stone column diameter of 5 feet installed in an equilateral triangle pattern so that the edge-to-edge spacing between the stone columns is 1-foot. The shear key should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual drilled stone column shear key length for the North Brush Creek Hump slide is approximately 480 feet.

In our opinion, extending the shear key depth with drilled stone columns is the preferred mitigation alternative. Insufficient groundwater data is available at the site to make a conclusion regarding the efficiency of horizontal drains. Enlarging the existing shear key with buttress may increase the FS but will there is a high risk that the slope above US 101 will be de-stabilized during excavation for the larger shear key and buttress.

Brush Creek

We considered shear piles, realignment of US 101 away from the head of the slide, and a rock excavation to reduce the driving force of the slide as potential mitigation alternatives for the Brush Creek slide. Mitigation Concept Plans for the shear piles are included in Attachment D, Figures D12 to D13.

The conceptual location for the shear piles is along the southbound shoulder of US 101 within the slide limits. The intent of the shear piles is to protect US 101 during slide movement and should be designed assuming the downslope slide mass will continue moving. Lagging between the piles and tiebacks may need to be installed if slide movement starts to expose the piles. The shear piles should be embedded a minimum of 25 feet beyond the shear plane, resulting in approximately 50-foot-long piles. We assumed 2.5-foot-diameter drilled-in piles spaced 6 feet on-center. The shear piles should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual length of shear pile extents is approximately 250 feet.

In our opinion, the shear piles are the most economic and technically preferred mitigation alternative. Excavating the "hump" of material between US 101 and the ocean will reduce the driving forces on the slide and improve the FS but will be environmentally difficult to permit and may be more expensive than shear piles. Relocating US 101 away from the head of the slide will require a rock cut upslope of the current alignment, within a rock slope that is known for producing rockfall. Excavating further into the same formation could expose the realigned highway to additional rockfall events.

Arizona North

We considered horizontal drains and a drilled stone column shear key as potential mitigation alternatives for the Arizona North slide. Due to the relatively slow rate of movement along the shear plane and additional cost to mitigate, mitigation alternatives were not designed to improve the FS along shear plane #3, although the horizontal drain alternative does provide some increase in the FS. Mitigation Concept Plans for the horizontal drains are included in Attachment D, Figures D14 to D15.

The conceptual horizontal drain alternative slope stability analysis shows that the FS presented in Exhibit 3 are obtained by installing three tiers of horizontal drains with a trench drain near the toe of the slide. For the uppermost horizontal drain tier installed from the northbound shoulder of US 101, we assumed a parallel configuration of drains spaced at 50-foot centers, approximately 300 feet long each. For the middle horizontal drain tier installed approximately 300 feet downslope from US 101, we assumed four arrays of drains with 10 drains in each array, and each drain is approximately 400 feet long. For the lowermost horizontal drain tier installed approximately 500 feet downslope from US 101, we assumed six arrays of drains with six drains in each array, and each drain is approximately 250 feet long. Therefore, the total lineal footage of horizontal drains is approximately 32,500 feet. In addition, a 20-foot-deep trench drain constructed perpendicular to the slope is considered near the toe of the slide about 200 feet upslope from the coastline. The trench drain will run downslope at the slide lateral margins and transport the collected water to anchored slope pipes. The trench drain system will remain within the slide extents to limit potential for slide movements that may interrupt the drain network.

The total lineal footage of trench drain is approximately 1,400 feet. Without a site-specific exploration program including test drains, the effectiveness of horizontal drains at the site is uncertain. Therefore, we performed slope stability analyses assuming the horizontal drains are functioning with 100 percent and 50 percent efficiency.

A drilled stone column shear key alternative was also considered as a potential mitigation alternative. However, due to the large slide area and depth to shear planes, it was determined the shear key would not be cost-effective. In our opinion, due to the shallow groundwater throughout the slide mass, a dewatering mitigation alternative, specifically horizontal drains, will be the most efficient and economical form of mitigation and therefore the preferred alternative.

Exhibit 3: Arizona North Horizontal Drain Conceptual Mitigation Slope Stability Analysis Results

Shear Plane	Existing FS	Horizontal Drains (50% Efficiency)		Horizontal Drains (100% Efficiency)	
		Improved FS	Percent (%) FS Increase	Improved FS	Percent (%) FS Increase
1	0.986	1.074	8.9%	1.074	8.9%
2	1.030	1.064	3.3%	1.069	3.8%
3	1.006	1.033	2.7%	1.065	5.9%

Arizona Inn

We considered horizontal drains and a drilled stone column shear key as potential mitigation alternatives for the Arizona Inn slide. Shear plane #1 has low potential to impact US 101 therefore mitigation alternatives were not designed to improve its FS. Mitigation Concept Plans for the horizontal drains are included in Attachment D, Figures D16 to D18.

The conceptual horizontal drain alternative slope stability analysis shows that the FS presented in Exhibit 4 are obtained by installing four tiers and three tiers of horizontal drains at the northern and southern sections of the Arizona Inn slide, respectively. We separated Arizona Inn into two slide segments defined by the cross sections AI1-AI1’ (northern part) and AI2-AI2’ (southern part). In 1997, a 20-foot diameter drainage shaft was installed approximately 100 feet downslope from US 101 in the southern portion of Arizona Inn (AI2-AI2’). Horizontal drains were installed from the drainage shaft targeting an approximate 500-foot radius surrounding the drainage shaft. For our analysis and conceptual mitigation plans, we assume this drainage shaft and associated horizontal drains are still functioning. As part of the 1997 mitigation, horizontal drains were also installed upslope of US 101 in the southern portion of Arizona Inn. Our conceptual horizontal drain plan in this portion of the slide is intended to supplement/replace these existing drains. We understand no existing slide mitigations have been implemented in the northern portion of Arizona Inn (AI1-AI1′).

Within the northern section of Arizona Inn, for the uppermost horizontal drain tier installed from the Old Pacific Highland Drive (old US 101 highway), we assumed two arrays of drains with 10 drains in each array, and each drain is approximately 500 feet long. For the horizontal drain tier installed from the northbound shoulder of US 101, we assume a parallel configuration of drains spaced at 50-foot centers, approximately 400 feet long each. For the horizontal drain tier installed approximately 100 feet downslope from US 101, we assumed three arrays of drains with 10 drains in each array, and each drain is approximately 550 feet long. For the lowermost horizontal drain tier installed approximately 300 feet downslope from US 101, we assumed six arrays of drains with six drains in each array, and each drain is approximately 300 feet long. Therefore, the total lineal footage of horizontal drains within the northern section of Arizona Inn is approximately 38,000 feet.

Within the southern section of Arizona Inn, for the uppermost horizontal drain tier installed from the Old Pacific Highland Drive, we assumed three arrays of drains with 10 drains in each array, and each drain is approximately 700 feet long. For the horizontal drain tier installed from the northbound shoulder of US 101, we assume a parallel configuration of drains spaced at 50-foot centers, approximately 600 feet long each. For the horizontal drain tier installed approximately 100 feet downslope from US 101, we assumed two arrays of drains with 10 drains in each array, and each drain is approximately 700 feet long. Therefore, the total lineal footage of horizontal drains within the southern section of Arizona Inn is approximately 45,000 feet.

Without a site-specific exploration program including test drains, the effectiveness of horizontal drains at the site is uncertain. Therefore, we performed slope stability analyses assuming the drains are functioning with 100 percent and 50 percent efficiency.

A drilled stone column shear key alternative was also considered as a potential mitigation alternative. However, due to the large slide area and depth to shear plane, it was determined the shear key would not be cost-effective. In our opinion, due to the shallow groundwater throughout the slide mass, a dewatering mitigation alternative, specifically horizontal drains, will be the most efficient and economical form of mitigation and therefore the preferred alternative.

Exhibit 4: Arizona Inn Horizontal Drain Conceptual Mitigation Slope Stability Analysis Results (Cross-Section AI2-**AI2'**)

Shear Plane	Existing FS	Horizontal Drains (50% Efficiency)		Horizontal Drains (100% Efficiency)	
		Improved FS	Percent (%) FS Increase	Improved FS	Percent (%) FS Increase
2	1.013	1.060	4.6%	1.091	7.7%

Frankport North (Christmas Tree)

We considered a soldier pile tieback retaining wall, a shear key buttress, and highway realignment as potential mitigation alternatives for the Frankport North (Christmas Tree) slide. Mitigation Concept Plans for the soldier pile tieback retaining wall are included in Attachment D, Figures D19 to D20.

The conceptual location for the soldier pile tieback retaining wall is along the southbound shoulder of US 101 within the slide limits. The intent of the retaining wall is to protect US 101 only and would be designed assuming the downslope slide mass will continue moving. Based on the depth to shear plane, the conceptual retaining wall height is approximately 15 feet. The soldier piles should be embedded a minimum of 20 feet beyond the slide plane into rock, resulting in approximately 35-foot-long piles. We anticipate two rows of tiebacks extending a minimum of 20 feet beyond the slide plane into rock, resulting in approximately 30-foot-long tiebacks. The retaining wall should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual retaining wall length is approximately 400 feet. We performed a conceptual slope stability analysis to determine the approximate tieback load to necessary to achieve a FS of 1.25, as summarized in Exhibit 5.

Exhibit 5: Frankport North (Christmas Tree) Soldier Pile Tieback Wall Conceptual Mitigation Slope Stability Analysis Results

Target FS	Tieback Load per linear foot of wall (kip/ft)	Approximate Tieback Load (kips) [1]
1.25	7.9	50

1 Assumes soldier piles are spaced 6-feet on-center.

A shear key with buttress and highway realignment alternatives were also considered as potential mitigation alternatives. Based on the existing surficial and anticipated bedrock topography, the shear key would require a very deep excavation adjacent to US 101 in order to embed the shear key beyond the slide plane. Realignment of the highway away from the head of the slide would result in an upslope cut, potentially exposing the highway to additional slope failures. There is a documented cut slope failure upslope of US 101 just south of the Christmas Tree slide. In our opinion, due to the relatively shallow bedrock and shear plane below US 101, a soldier pile tieback wall is the preferred mitigation alternative.

Sisters Rock Sink

We considered horizontal drains, trench drains, a drilled stone column shear key, a soldier pile tieback wall, US 101 realignment, and use of lightweight fill as potential mitigation alternatives for the Sisters Rock Sink slide. Due to the relatively slow rate of movement along the shear plane and additional cost to mitigate, mitigation alternatives were not designed to improve the FS along shear plane #2 (larger slide area shown on the site plan), although the horizontal and trench drain alternatives would provide some increase in the FS where they are implemented within the slide mass. Mitigation Concept Plans for horizontal drains and trench drains are included in Attachment D, Figures D21 to D24.

The conceptual horizontal drain alternative includes installing three tiers of horizontal drains. For the uppermost horizontal drain tier installed from the northbound shoulder of US 101, we assumed a parallel configuration of drains spaced at 50-foot centers, approximately 150 feet long each. For the horizontal drain tier immediately downslope from US 101, we assumed one array of drains with six drains and each drain is approximately 300 feet long. For the third horizontal drain tier approximately 150 feet downslope from US 101, we assumed two arrays of drains with six drains in each array and each drain is approximately 250 feet long. Therefore, the total lineal footage of horizontal drains is approximately 6,000 feet.

The conceptual trench drain alternative includes constructing two rows of 25-foot-deep trench drains perpendicular to the slope. The uppermost trench will be constructed immediately upslope from US 101. The two rows will be all be connected near the slide margins by trench drains running downslope to transport the collected water to anchored slope pipes. The trench drain system will remain within the slide extents to limit potential for slide movements that may interrupt the drain network. The total lineal footage of trench drains is approximately 1,500 feet.

A soldier pile tieback wall, drilled stone column shear key, roadway realignment, and excavation and replacement of the roadway embankment with lightweight fill were also considered as potential mitigation alternatives. Based on the depth to shear plane below US 101, the soldier pile tieback wall height would be on the order of 35 to 40 feet and would require approximately 150-foot-long tiebacks to adequately extend past the slide plane. This large of a retaining wall will be very expensive to construct. A drilled stone column shear key may not be stable if the slide mass above shear plane #1 continues movement downslope. Realignment of the highway away from the head of the slide would result in an upslope cut, potentially exposing the highway to additional slope failures. There is a documented cut slope failure upslope of US 101 near the Sisters Rock Sink slide. Excavating the roadway embankment material and replacing with lightweight fill has been considered by ODOT in the past, however the ratio of replaced material compared to the entire driving mass above the shear plane may not be sufficient to induce any meaningful increase in the FS. In our opinion, due to the shallow groundwater throughout the slide mass, a dewatering mitigation alternative, specifically trench drains, will be the most efficient and economical form of mitigation and therefore the preferred alternative.

Frankport South

We considered trench drains, horizontal drains, and a drilled stone column shear key as potential mitigation alternatives for the Frankport South slide. Due to the relatively slow rate of movement along the shear planes and additional cost to mitigate, mitigation alternatives were not designed to improve the FS along shear planes #2 and #3, although the horizontal and trench drain alternatives would provide some increase in the FS. Mitigation Concept Plans for horizontal drains and trench drains are included in Attachment D, Figures D25 to D28.

The conceptual horizontal drain alternative includes installing three tiers of horizontal drains. For the uppermost horizontal drain tier installed from the northbound shoulder of US 101, we assumed a parallel configuration of drains spaced at 50-foot centers, approximately 150 feet long each. For the horizontal drain tier approximately 100 feet downslope from US 101, we assumed three arrays of drains with six drains in each array and each drain is approximately 250 feet long. For the third horizontal drain tier approximately 250 feet downslope from US 101, we assumed four arrays of drains with six drains in each array and each drain is approximately 300 feet long. Therefore, the total lineal footage of horizontal drains is approximately 12,000 feet.

The conceptual trench drain alternative includes constructing three rows of 25-foot-deep trench drains perpendicular to the slope. We assumed the uppermost row will be constructed along the northbound shoulder of US 101, and the other two rows will be constructed approximately 50 feet and 250 feet downslope from US 101. The three rows will all be connected near the slide margins by trench drains running downslope to transport the collected water to anchored slope pipes. The trench drain system will remain within the slide extents to limit potential for slide movements that may interrupt the drain network. The total lineal footage of trench drains is approximately 3,500 feet.

A drilled stone column shear key was also considered as a potential mitigation alternative however it may not be stable if the slide mass above shear plane #1 continues movement downslope. In our opinion, due to the shallow groundwater throughout the slide mass, a dewatering mitigation alternative, specifically trench drains, will be the most efficient and economical form of mitigation and therefore the preferred alternative.

Woodroof Creek

We considered a soldier pile tieback wall, horizontal drains, and a culvert extension with fill placement as potential mitigation alternatives for the Woodroof Creek slide. Mitigation Concept Plans for a solider pile tieback wall and horizontal drains are included in Attachment D, Figures D29 to D32.

The conceptual location for the soldier pile tieback retaining wall is along the southbound shoulder of US 101 within the slide limits. The intent of the retaining wall is to protect US 101 only and would be designed assuming the downslope slide mass will continue moving. Based on the depth to the shear plane, the conceptual retaining wall height is approximately 30 feet. The soldier piles should be embedded a minimum of 20 feet beyond the slide plane into rock, resulting in approximately 50-foot-long piles. We anticipate three rows of tiebacks extending a minimum of 20 feet beyond the slide plane into rock, resulting in approximately 50-foot-long tiebacks. The retaining wall should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual retaining wall length is approximately 400 feet.

The conceptual horizontal drain alternative includes installing three tiers of horizontal drains. For the uppermost horizontal drain tier installed from the existing access road located approximately 100 feet downslope from US 101, we assumed a parallel configuration of drains spaced at 50-foot centers, approximately 100 feet long each. For the horizontal drain tier approximately 150 feet downslope from US 101, we assumed three arrays of drains with six drains in each array and each drain is approximately 120 feet long. For the third horizontal drain tier approximately 300 feet downslope from US 101, we assumed three arrays of drains with six drains in each array and each drain is approximately 170 feet long. Therefore, the total lineal footage of horizontal drains is approximately 6,000 feet.

Woodroof Creek runs perpendicular to the toe of the slide, from a culvert at the toe of the US 101 embankment into the Pacific Ocean. We considered extending the culvert through the slide area to reduce erosion at the toe of the slide and backfilling around the extended culvert to act as a buttress. However, we understand this alternative will be environmentally difficult to permit. In our opinion, with the current data available, a soldier pile tieback wall is the preferred mitigation alternative. Horizontal drains may be more cost-effective however given the lack of existing subsurface data it is unclear if they will be effective in improving the FS of the slide.

Eighty Acres

We considered a shear key, extending the length and depth of the existing trench drain, and a soldier pile tieback retaining wall as potential mitigation alternatives for the Eighty Acres slide. Mitigation Concept Plans for a shear key and trench drain extension are included in Attachment D, Figures D33 to D34.

The shear key conceptual alternative consists of constructing a shear key downslope of US 101 along the southbound shoulder that extends a minimum of 5 feet below the slide plane. We assume that the proposed shear key would have a minimum base width of approximately 15 feet, a height of approximately 40 feet, and a top width of approximately 80 feet. An approximate 40-foot-deep cut from roadway grade down to the base of the shear key is required, leaving at least 25 feet of roadway width accessible for one-way traffic during construction. The shear key should extend a minimum of 50 feet past the landslide extents. Therefore, the conceptual shear key length is approximately 400 feet.

A French Drain was installed in 2015 immediately upslope from the head scarp, along the US 101 northbound shoulder ditch line to a depth up to 13 feet below the ground surface. Since its installation, the frequency of roadway maintenance required within the Eighty Acres slide has decreased. Therefore, we considered extending the drain depth to approximately 25 feet below the ground surface and extending the drain to envelope the entire slide extents as a potential mitigation alternative. The total lineal footage of the proposed trench drain improvements is approximately 1,000 feet.

A soldier pile tieback wall is also a feasible mitigation alternative however is less cost effective than the shear key and trench drain extension mitigation alternatives. Based on the assumed groundwater level within the slide limits, lowering the groundwater level further with a deeper trench drain may provide minimal FS improvement. Therefore, in our opinion, the shear key is the preferred mitigation alternative.

Burnt Hill

We considered a drilled stone column shear key, trench drains or horizontal drains, and a highway realignment with a soldier pile tieback wall as potential mitigation alternatives for the Burnt Hill slide. Mitigation Concept Plans for the drilled stone column shear key are included in Attachment D, Figures D35 to D36.

The conceptual drilled stone column shear key alternative consists of constructing drilled stone columns just downslope of US 101 southbound, spaced in a triangular grid pattern that extend a minimum of 5 feet below the shear plane. We assume that the proposed shear key would have a minimum base width of approximately 25 feet. A level drilling platform would be necessary for construction therefore we assumed an approximate 10-foot-deep cut from roadway grade down to a drilling platform, leaving at least 20 to 25 feet of roadway width accessible for one-way traffic during construction. The length of drilled stone columns will be approximately 70 feet to intercept the shear plane. We assumed a stone column diameter of 5 feet installed in an equilateral triangle pattern so that the edge-to-edge spacing between the stone columns is 1-foot. After drilling and installing the stone columns, the temporary excavation would be backfilled with stone embankment material. The shear key should extend a minimum of 50 feet beyond the landslide extents. Therefore, the conceptual drilled stone column shear key length for the Burnt Hill slide is approximately 900 feet.

Trench drains or horizontal drains were also considered as potential mitigation alternatives for the slide, however insufficient groundwater data is available to draw a meaningful conclusion on their effectiveness. A soldier pile tieback wall was also considered, however due to the depth of shear plane below US 101, the retaining wall would be very expensive to construct. Therefore, in our opinion, the drilled stone column shear key is the preferred mitigation alternative.

Hooskanaden

We considered the following as conceptual mitigation alternatives for the Hooskanaden slide: (1) a material stockpile located outside of the slide limits which could be used to restore the roadway prism and quickly re-open US 101 following a slide event, (2) a material stockpile located near the toe of slide which would also act as a buttress, (3) a material stockpile at the toe of the slide with a drilled stone column shear key to intercept the slide plane, (4) a stone column interceptor trench, (5) large diameter drilled shaft shear piles, and (6) a large rip rap jetty protecting the toe from coastal erosion. Mitigation Concept Plans for alternatives #2, 3, 4, and 6 are included in Attachment D, Figures D37 to D41.

Due to the size of the Hooskanaden slide, typical landslide mitigation measures are not feasible due to the extreme cost that would be associated with them. Therefore, we generally considered alternatives that would either assist in reducing the rate of ground movement or assist ODOT in repairing the roadway quickly after a slide event.

In our opinion, stockpiling approximately 20,000 cubic yards of material at a nearby stockpile site, outside of the slide limits, is the preferred mitigation alternative. The 20,000 cubic yards of material was estimated based on an ODOT Region 3 scoping effort in 2019, to use after a slide event in order to rebuild the roadway prism. Stockpiling material on the toe of the slide as a "buttress" instead of outside the landslide boundaries could provide a small increase in FS however not enough to justify the environmental permitting effort that may be required. Secant stone columns acting as a deep interceptor trench, drilled approximately 100 feet upslope of US 101, could lower the groundwater locally by up to 80 feet, however the zone of impact is still relatively small compared to the entire slide mass and may not have enough impact on the FS to justify the project cost. Approximately 200,000 cubic yards of rip rap material was estimated by ODOT Region 3 to protect the toe against coastal erosion and reduce the rate of slide movement. However, the impact on the landslide movement may not justify the project cost and significant environmental permitting effort.

Large diameter drilled shaft shear piles penetrating beyond the shear plane have also been considered and evaluated by ODOT Region 3 in 2019. In order to obtain a satisfactory FS of 1.25, ODOT estimated a project cost of $135 million. We also considered constructing a 100-foot wide, 70-foot deep, and 1,700-foot-long drilled stone column shear key at the toe of the slide with a material stockpile of 20,000 cubic yards overlying it. Both of the above mitigation alternatives will increase the FS however are not preferred due to cost, and in the case of the drilled stone column alternative, significant environmental permitting effort.

CONCEPTUAL SLIDE MITIGATION COSTS

Based on our mitigation design concepts presented in Attachment D, we have provided opinions of probable cost for construction of the mitigation alternatives. Assumed unit costs and our opinions of probable cost are provided in Exhibits 6 and 7, respectively. The costs include contractor mobilization but do not include clearing and grubbing, traffic control, temporary erosion control, pavement reconstruction, contractor sampling and testing, surveying and staking, temporary shoring, or final design and construction monitoring fees.

Exhibit 6: Assumed Units Costs for Slide Mitigation Construction

Item	Assumed Unit Cost Range	Mobilization	Notes
Drilled Stone Columns (5-foot-diameter)	$200 to $250 per foot column length	$200,000	Includes drilling and aggregate material
Horizontal Drains	$50 to $70 per foot drain length	10% of cost[1]	Includes steel casing, drill pads, earthwork, collection pipes
Trench Drains (25-foot-deep, 3-foot-wide)	$225 to $250 per foot trench length	10% of cost[1]	Includes rock, fabric, excavation, pipe
Shear Key (Stone Embankment Material)	$70 to $80 per cubic yard	10% of cost[1]	Includes rock, fabric, excavation
Shear Pile (30-inch-diameter with steel H-pile)	$450 to $500 per foot pile length	$200,000	Includes drilling, concrete, steel pile
Soldier Pile Tieback Wall (No permanent concrete facing)	$350 to $400 per square foot exposed wall area	$200,000	Includes drilling, concrete, steel pile, tiebacks, lagging

1 Refers to total construction cost

Exhibit 7: Opinions of Probable Cost for Slide Mitigation Construction

Slide	Mitigation Concept	Cost
Retz Creek South	Drilled Stone Column Shear Key (mitigate Slide Plane #1 only)	$7.3M to $9.1M
	Drilled Stone Column Shear Key (mitigate Slide Planes #1 and #2)	$11.3M to $14.0M
	Solider Pile Tieback Wall	$11.8M to $13.5M
Coal Point	Horizontal Drains (preferred)	$1.2M to $1.7M
	Trench Drains	$1.1M to $1.2M
	Drilled Stone Column Shear Key	$15.4M to $19.2M
North Brush Creek Hump	Drilled Stone Column Shear Key (extend existing shear key depth)	$3.1M to $3.8M
Brush Creek	Shear Piles	$1.1M to $1.3M
Arizona North	Horizontal Drains	$2.1M to $2.9M
Arizona Inn	Horizontal Drains	$4.6M to $6.4M
Frankport North (Christmas Tree)	Solider Pile Tieback Wall	$2.3M to $2.6M
Sisters Rock Sink	Trench Drains (preferred)	$370K to $415K
	Horizontal Drains	$330K to $465K
Frankport South	Trench Drains (preferred)	$865K to $965K
	Horizontal Drains	$660K to $925K
Woodroof Creek	Soldier Pile Tieback Wall (preferred)	$4.4M to $5.0M
	Horizontal Drains	$330K to $465K
80 Acres	Shear Key (preferred)	$1.7M to $1.9M
	Trench Drain (extend existing trench drain)	$250K to $275K
Burnt Hill	Drilled Stone Column Shear Key	$10.7M to $13.3M
Hooskanaden	Off-Site Stockpile (preferred)	$350,000
	On-Site Stockpile at Toe of Slide	$700,000
	On-Site Stockpile with Drilled Stone Column Shear Key at Toe	$90,000,000
	Drilled Stone Column Interceptor Trench	$12,500,000
	Drilled Shaft Shear Piles	$135,000,000
	Rip Rap Jetty for Toe Protection	$10,500,000

Our opinions of probable cost do not include any price escalation that may occur if the construction does not occur for several years and should not be used by contractors to prepare bids. We have no control over the cost of labor, materials, equipment, or work furnished by others; the contractor’s actual or proposed construction methods or pricing; competitive bidding; or market conditions. We do not guarantee that proposals, bids, or actual construction cost will be similar to our opinions of probable cost. Shannon & Wilson is not a construction cost estimator or contractor. Our opinion of probable cost should not be considered equivalent to the nature and extent of services a construction cost estimator or contractor would provide.

REFERENCES

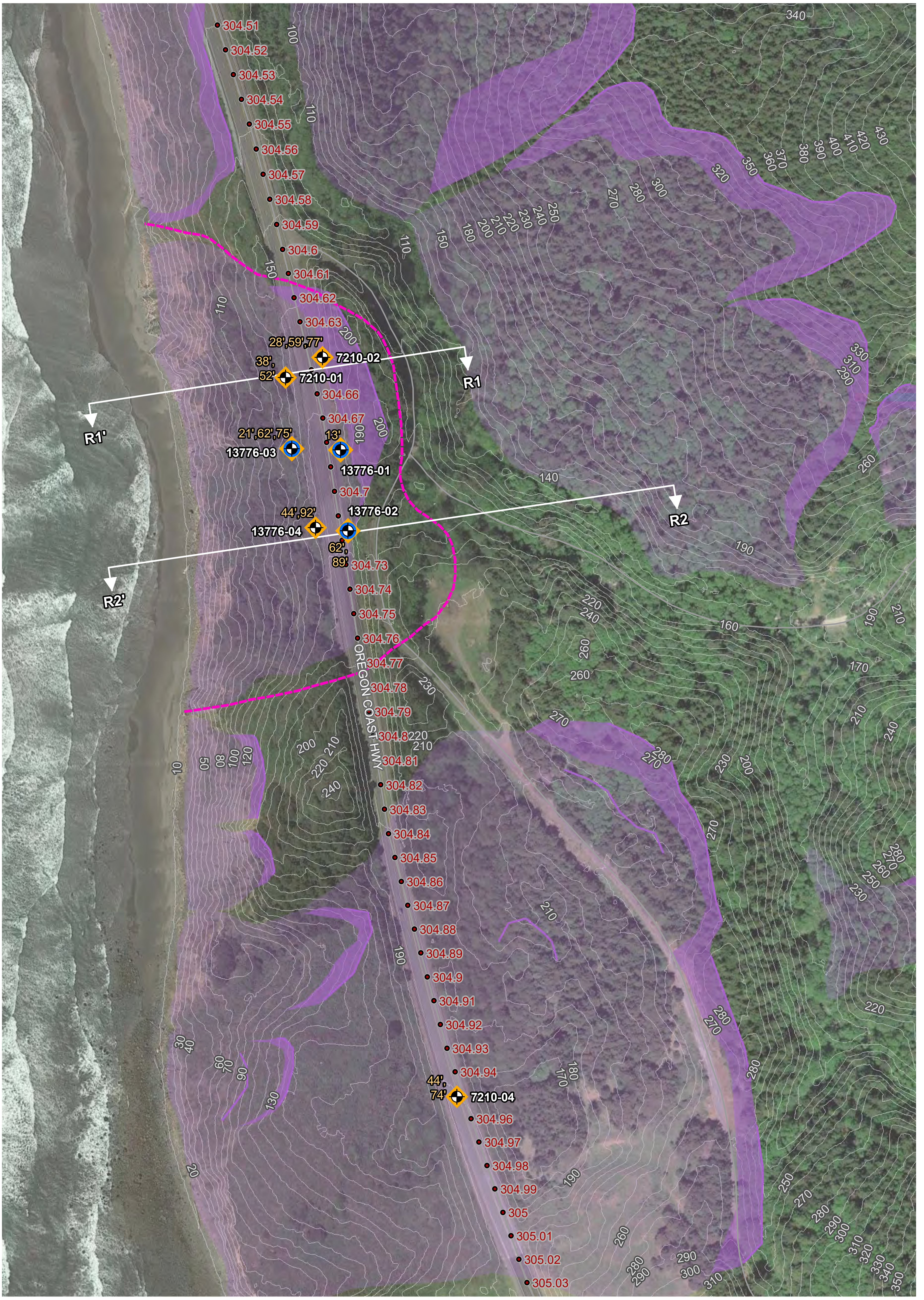
Geo-Slope International, 2021, GeoStudio 2021 R2 SLOPE/W, version 11.0.1.21429: Calgary, Alberta.

ODOT, 2018, Geotechnical Design Manual: Salem, Oregon, available: https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Geotech-Manual.aspx.

ATTACHMENT A

SITE AND EXPLORATION PLANS & CONCEPTUAL GEOLOGIC CROSS SECTIONS

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan1SRetz_10.7.mxd Date: 5/11/2022 Login: AEH



LEGEND

13'	Approximate Location of Boring with Inclinometer and Shear Plane Depth
13'	Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
R1 R1'	Designation and Location of Conceptual Subsurface Cross Section
	Interpreted Slide Extents
	Mapped Slide Scarp
	Mapped Slide Scarp
	Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

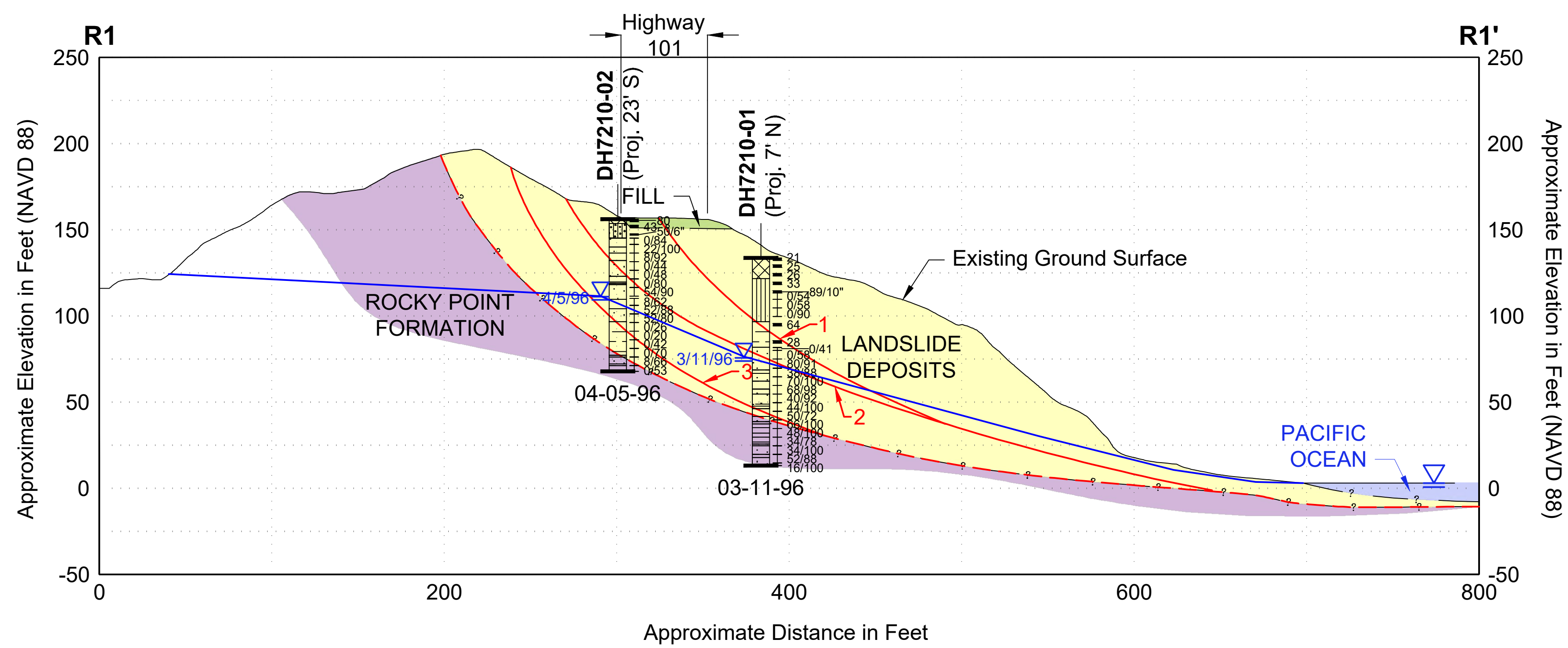
SITE AND EXPLORATION PLAN
RETZ CREEK SOUTH

May 2022 106381

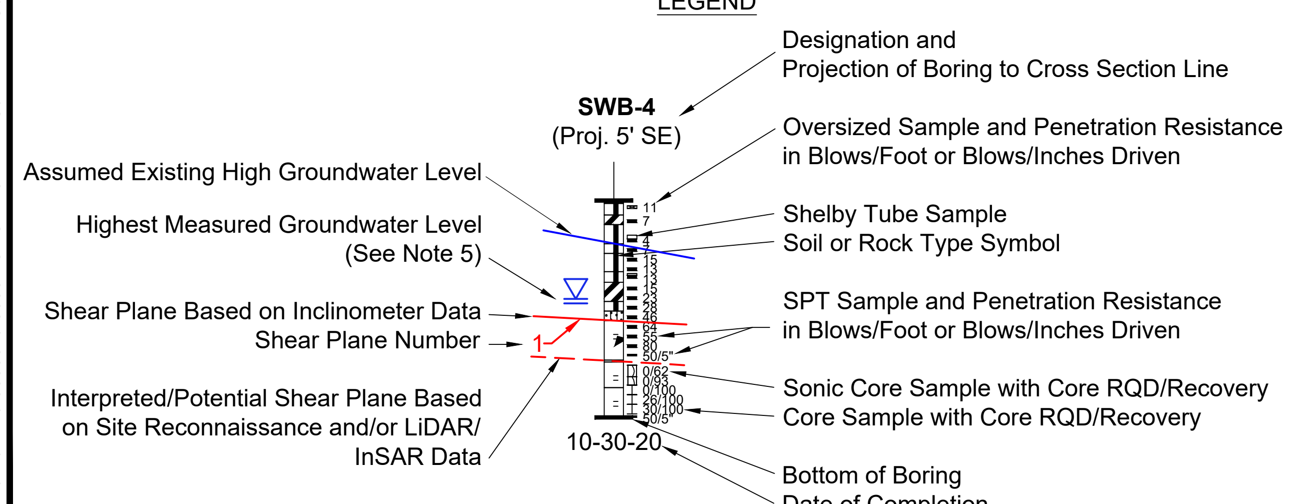
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A1

FIG. A1



LEGEND



0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A1 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

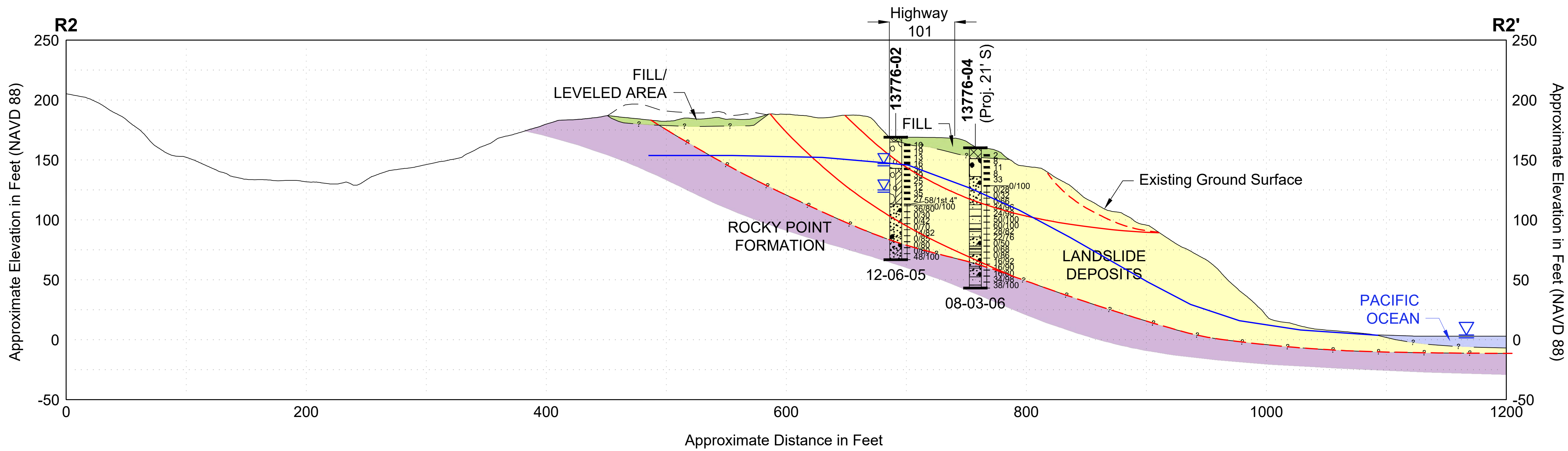
CONCEPTUAL GEOLOGIC CROSS SECTION R1-R1' RETZ CREEK SOUTH

May 2022 106381

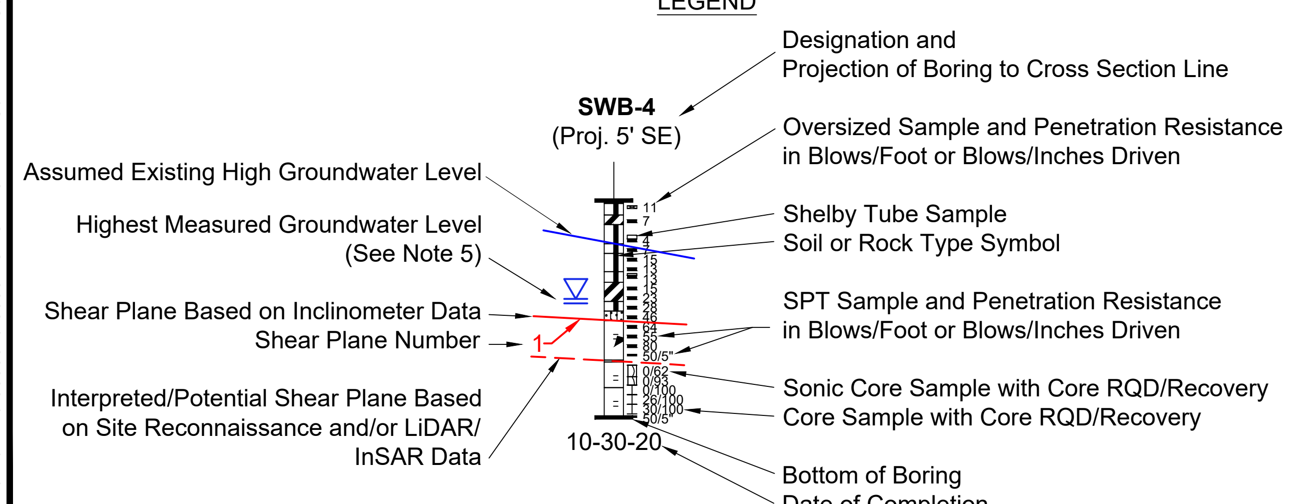
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

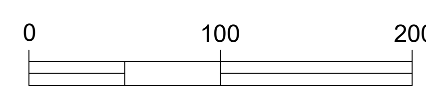
FIG. A2

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND





Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A1 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION R2-R2' RETZ CREEK SOUTH

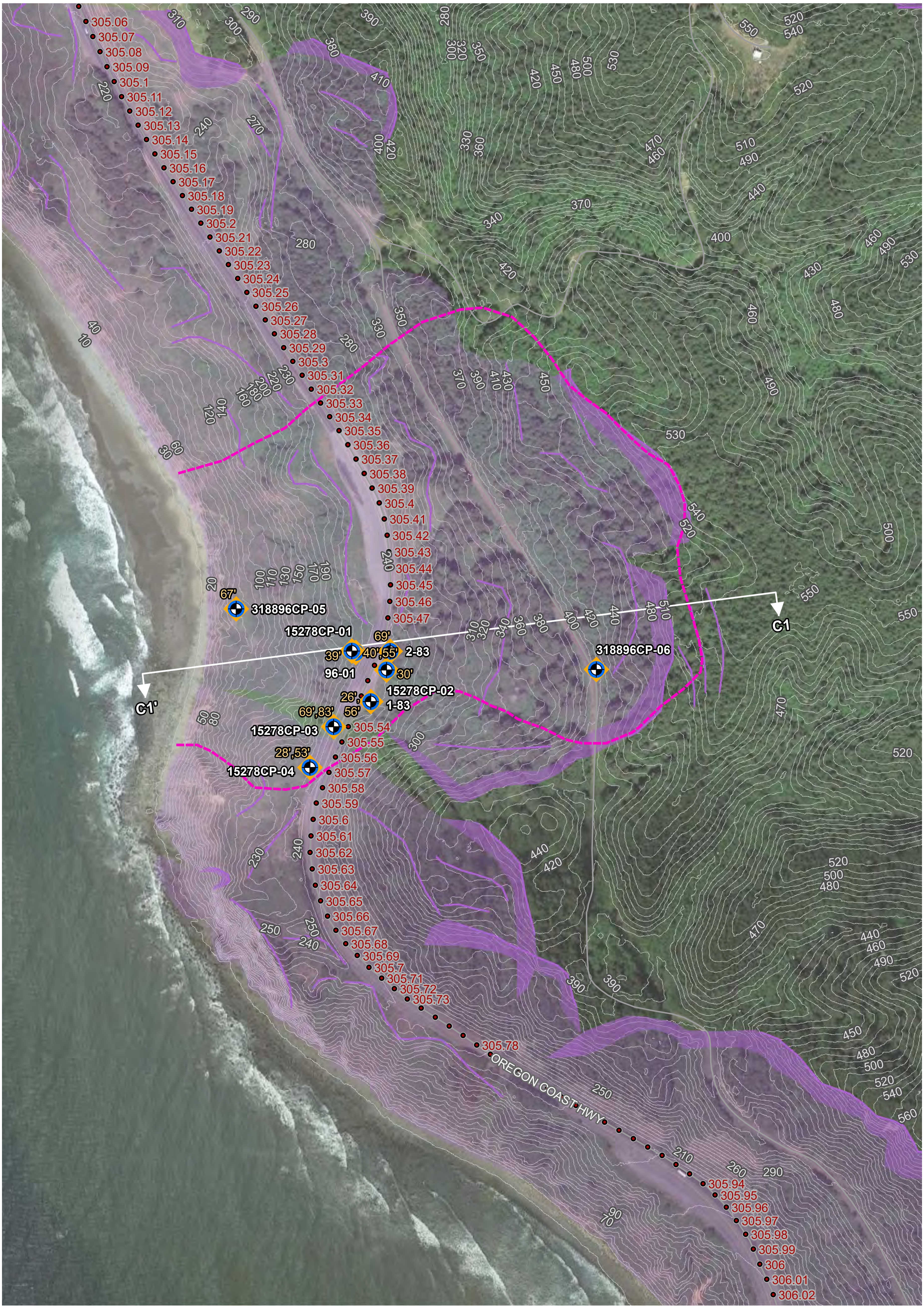
May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A3

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan2Coal_10.7.mxd Date: 5/11/2022 Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer

R1 R1' Designation and Location of Conceptual Subsurface Cross Section

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

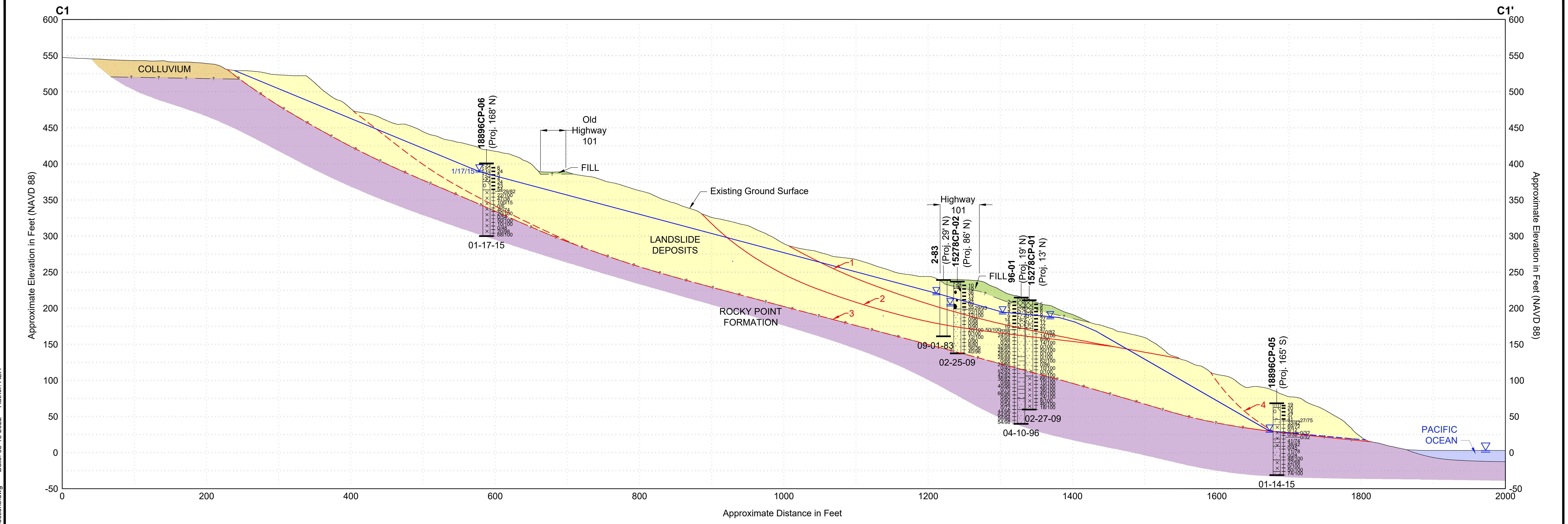
SITE AND EXPLORATION PLAN
COAL POINT

May 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A4

FIG. A4

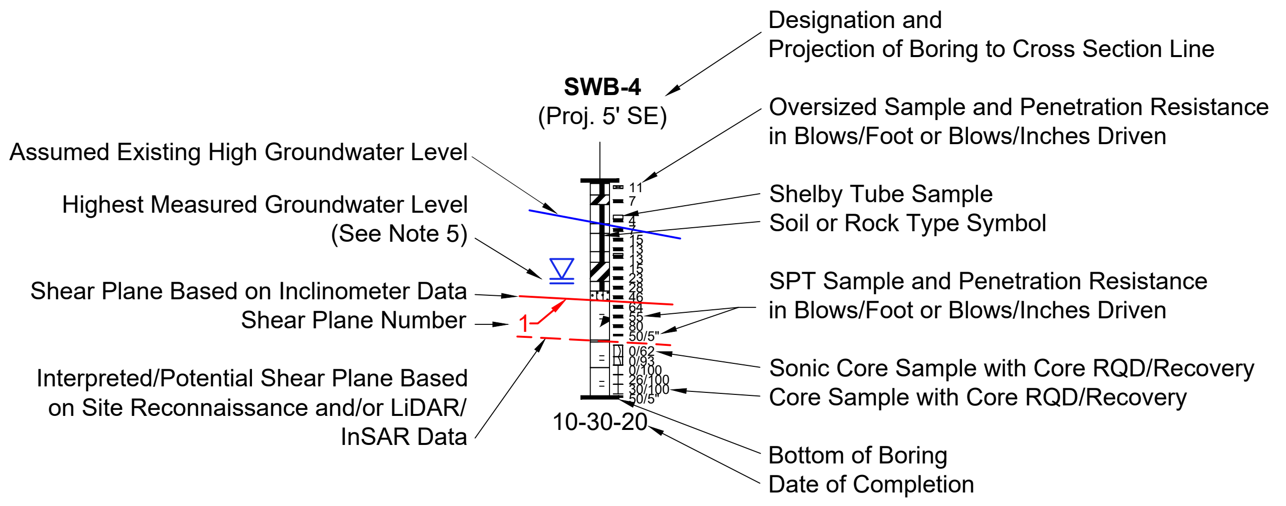


0 100 200

Scale in Feet

No Vertical Exaggeration

LEGEND



NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A4 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION C1-C1' COAL POINT

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A5

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan3NBrush_10.7.mxd Date: 5/11/2022 Login: AEH

LEGEND

- Approximate Location of Boring
- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- Approximate Location of Boring with Piezometer
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400
Scale in Feet

NOTES
1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

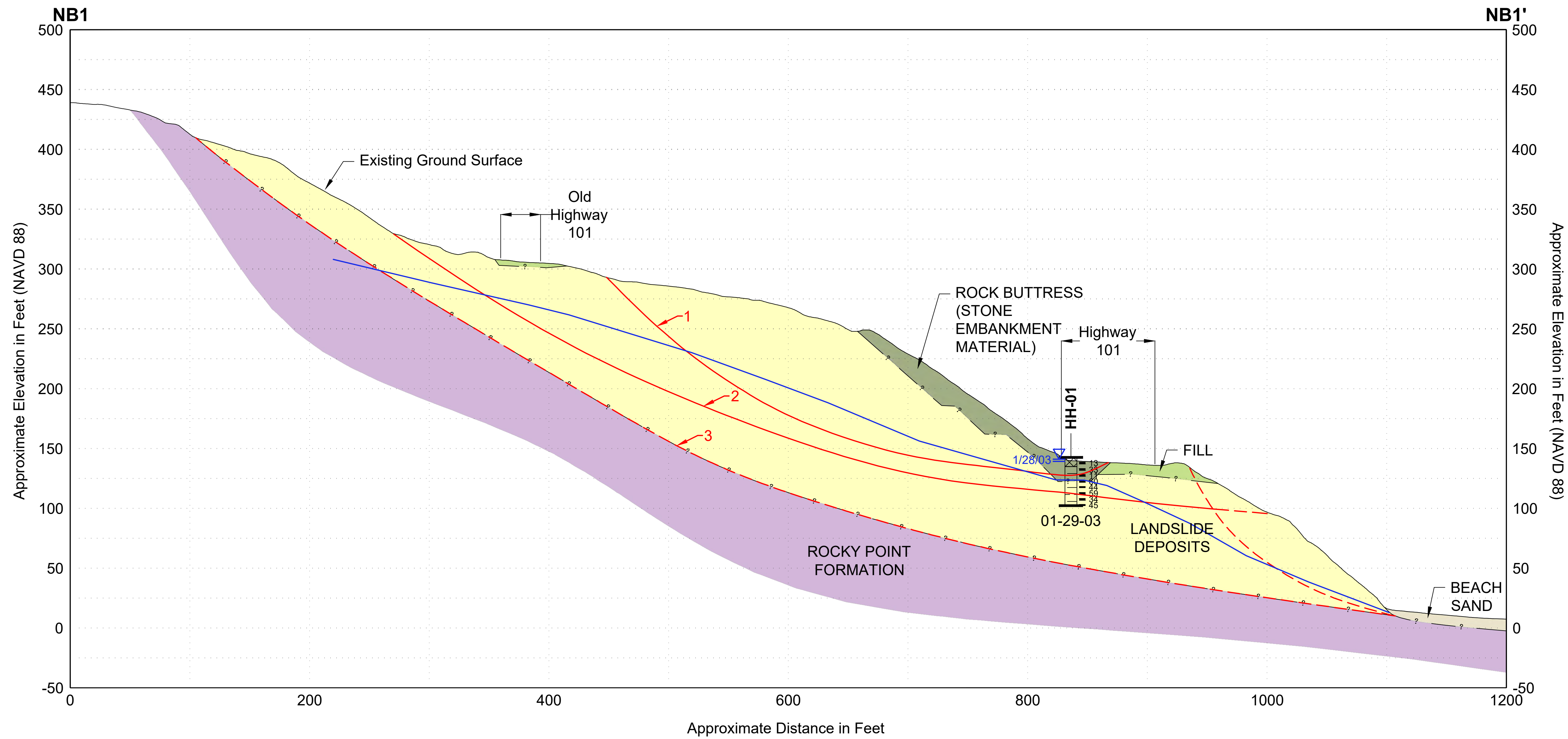
SITE AND EXPLORATION PLAN
NORTH BRUSH CREEK HUMP

May 2022 106381

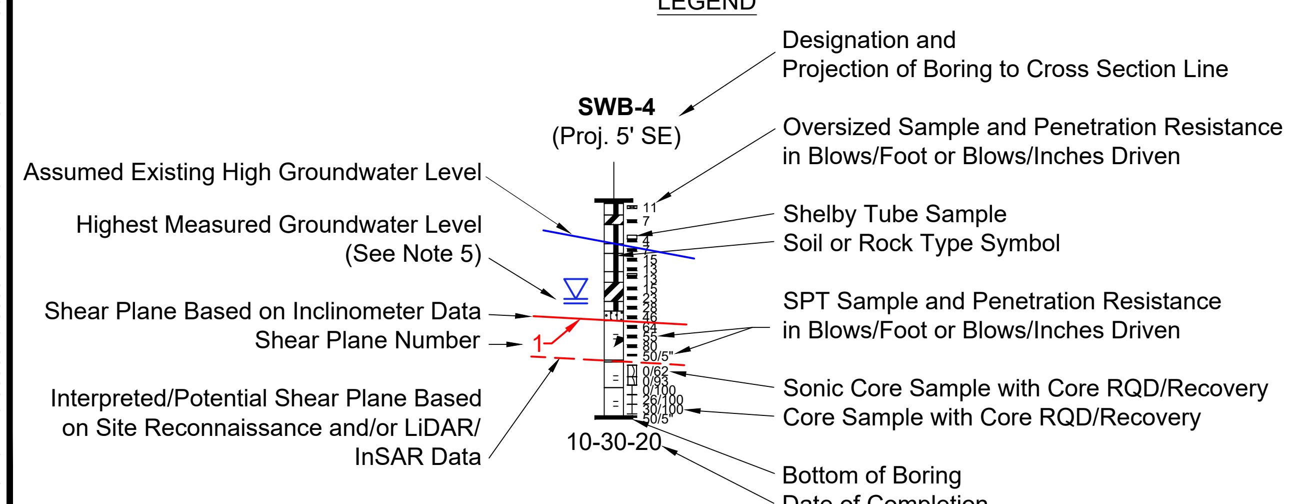
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

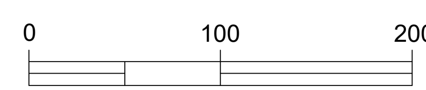
FIG. A6

FIG. A6



LEGEND





Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A6 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION NB1-NB1' NORTH BRUSH CREEK HUMP

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A7

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan4Brush_10.7.mxd   Date: 5/11/2022   Login: AEH

LEGEND

- Approximate Location of Boring
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

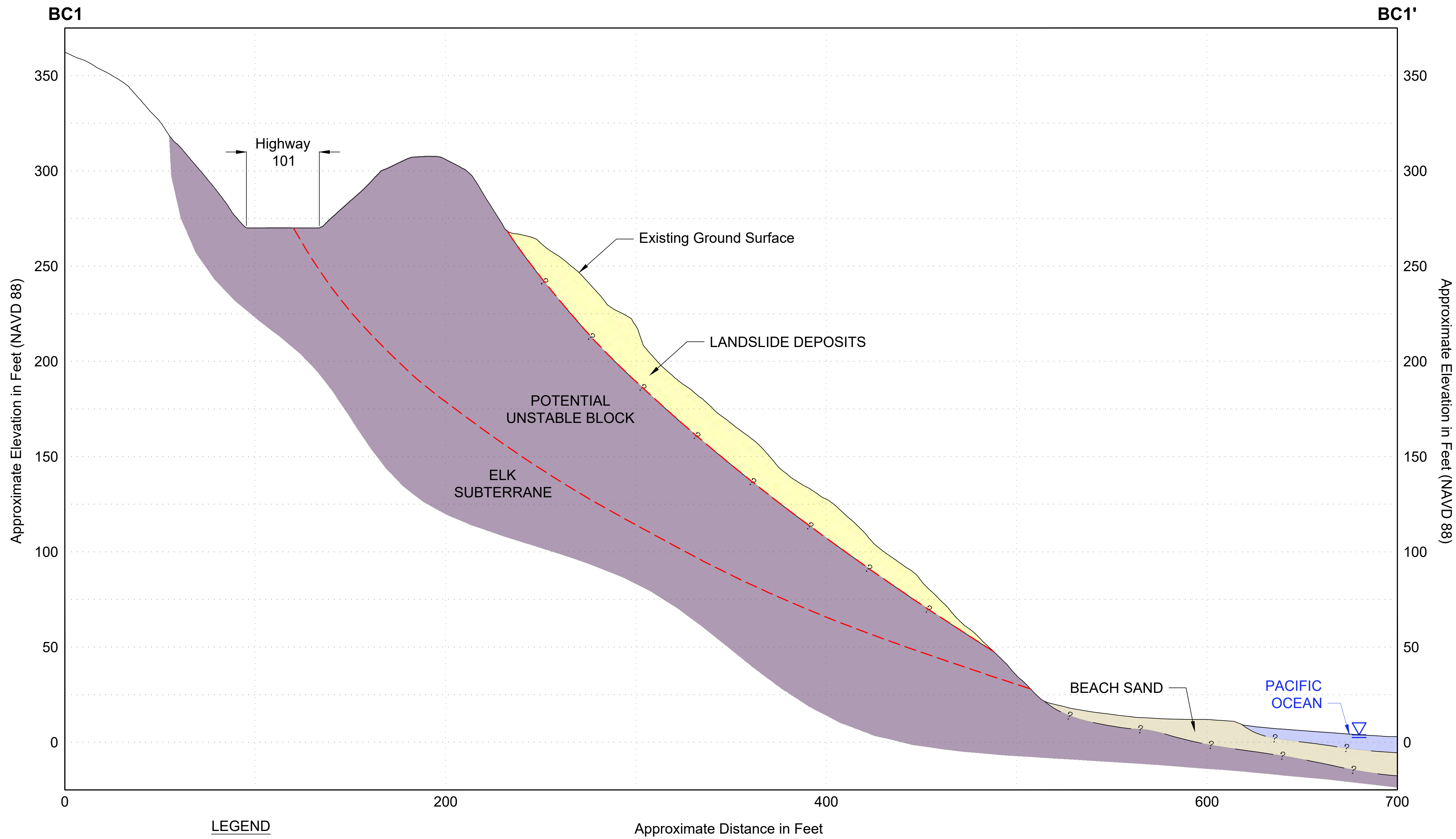
SITE AND EXPLORATION PLAN
BRUSH CREEK

May 2022   106381

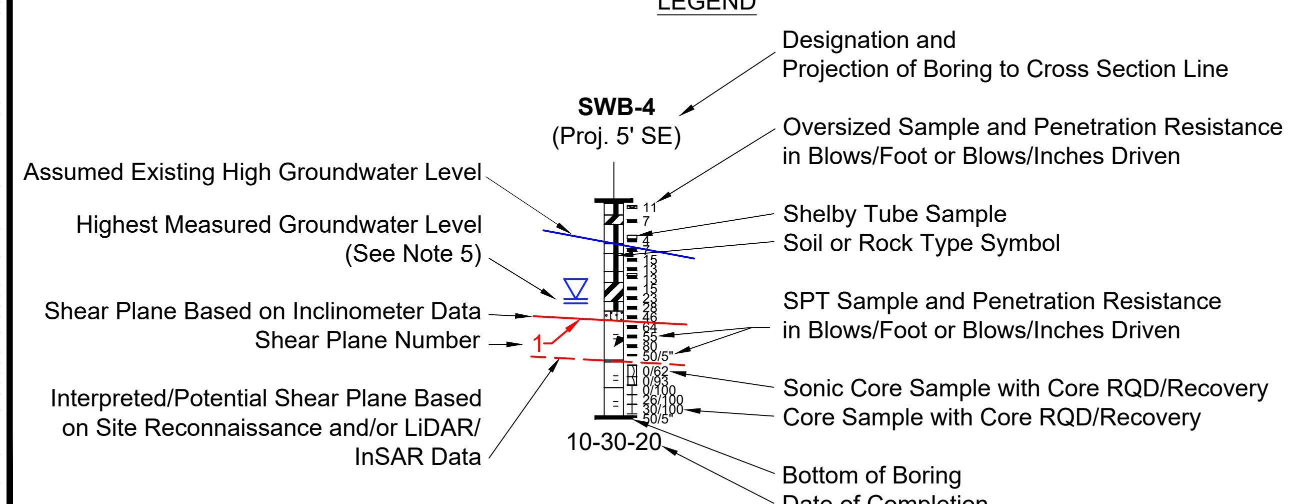
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A8

FIG. A8



LEGEND



0 60 120

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A8 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION BC1-BC1' BRUSH CREEK

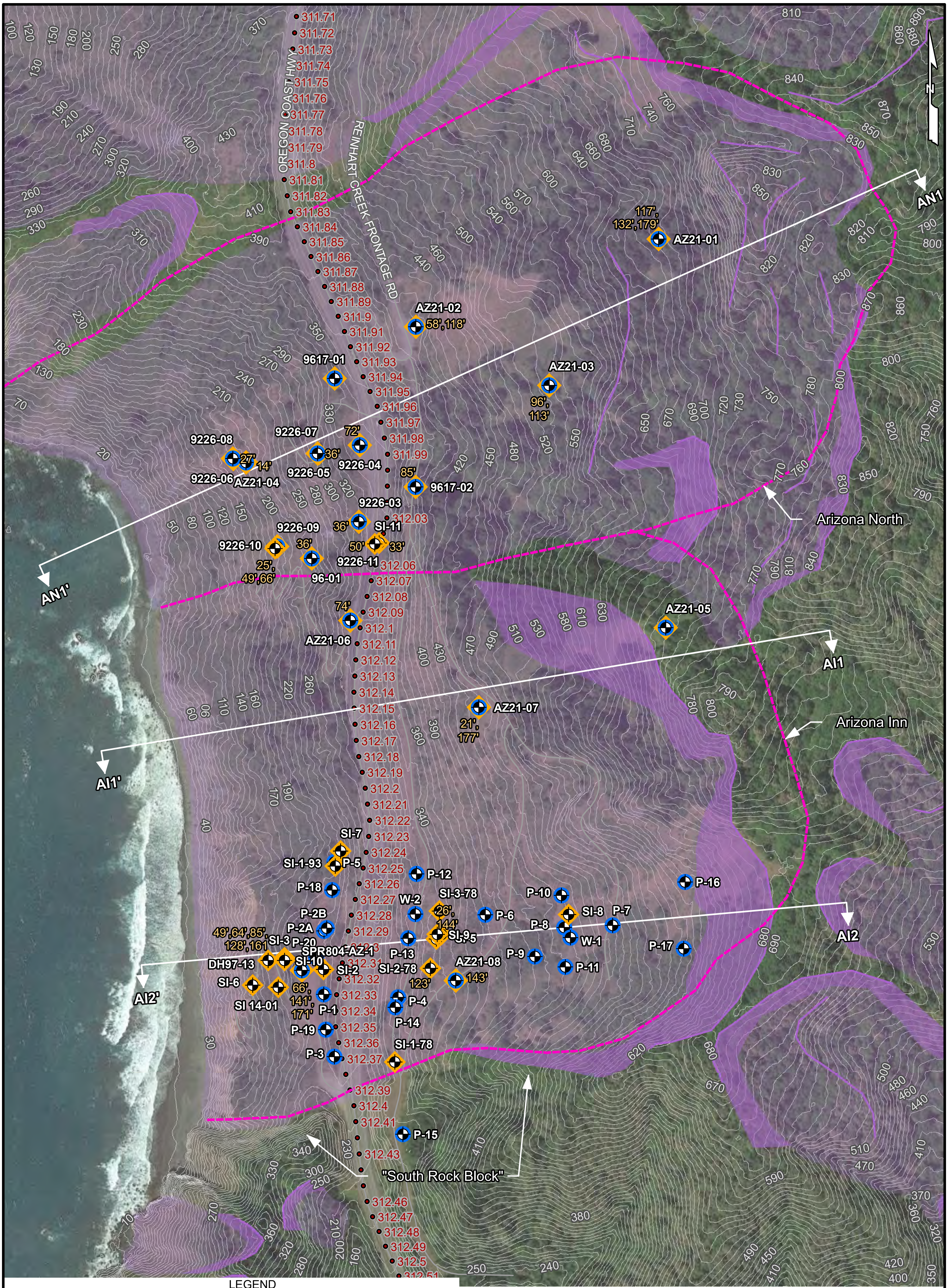
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A9

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan5_6AZ_10.7.mxd Date: 5/11/2022 Login: AEH



LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- Approximate Location of Boring with Piezometer
- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

SITE AND EXPLORATION PLAN ARIZONA INN COMPLEX

May 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A10

FIG. A10

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A10 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

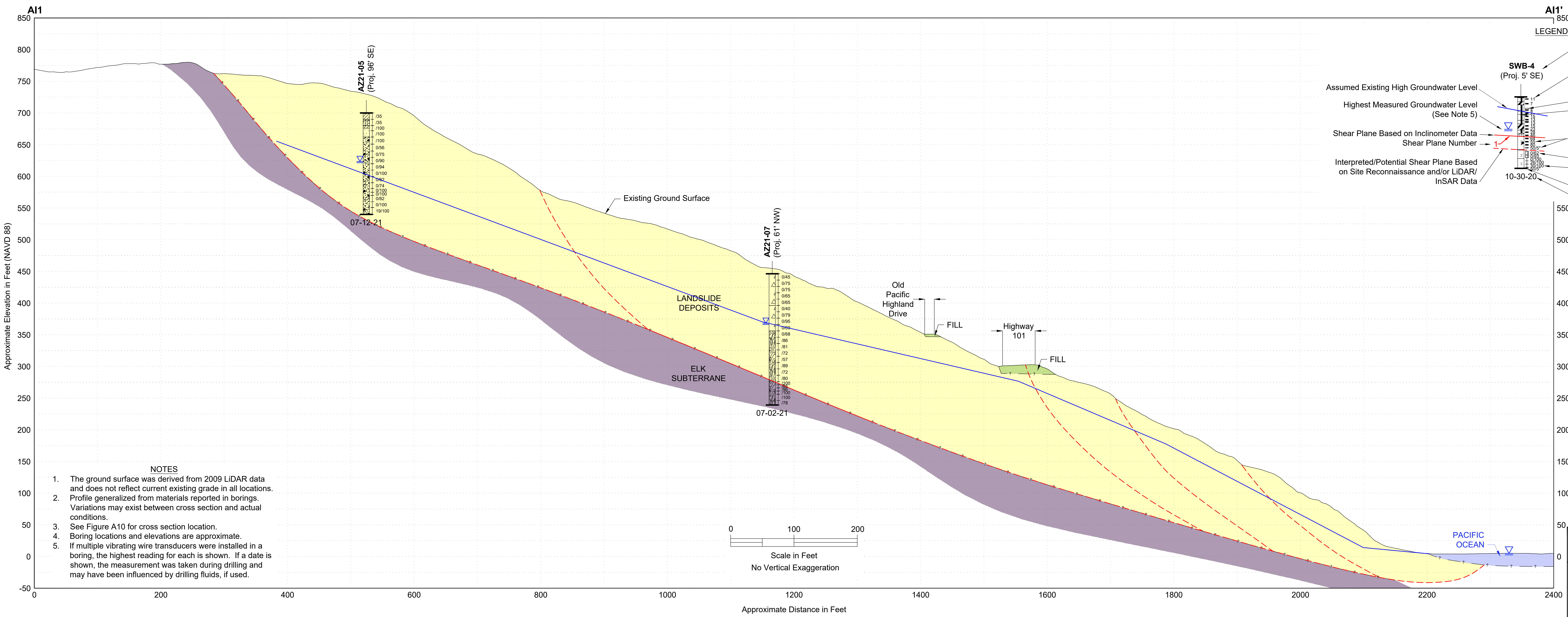
CONCEPTUAL GEOLOGIC CROSS SECTION AN1-AN1' ARIZONA INN COMPLEX

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A11

File: I:\EP\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-25-2022 Author: AEH



NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A10 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION AI1-AI1' ARIZONA INN COMPLEX

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A12

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A10 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

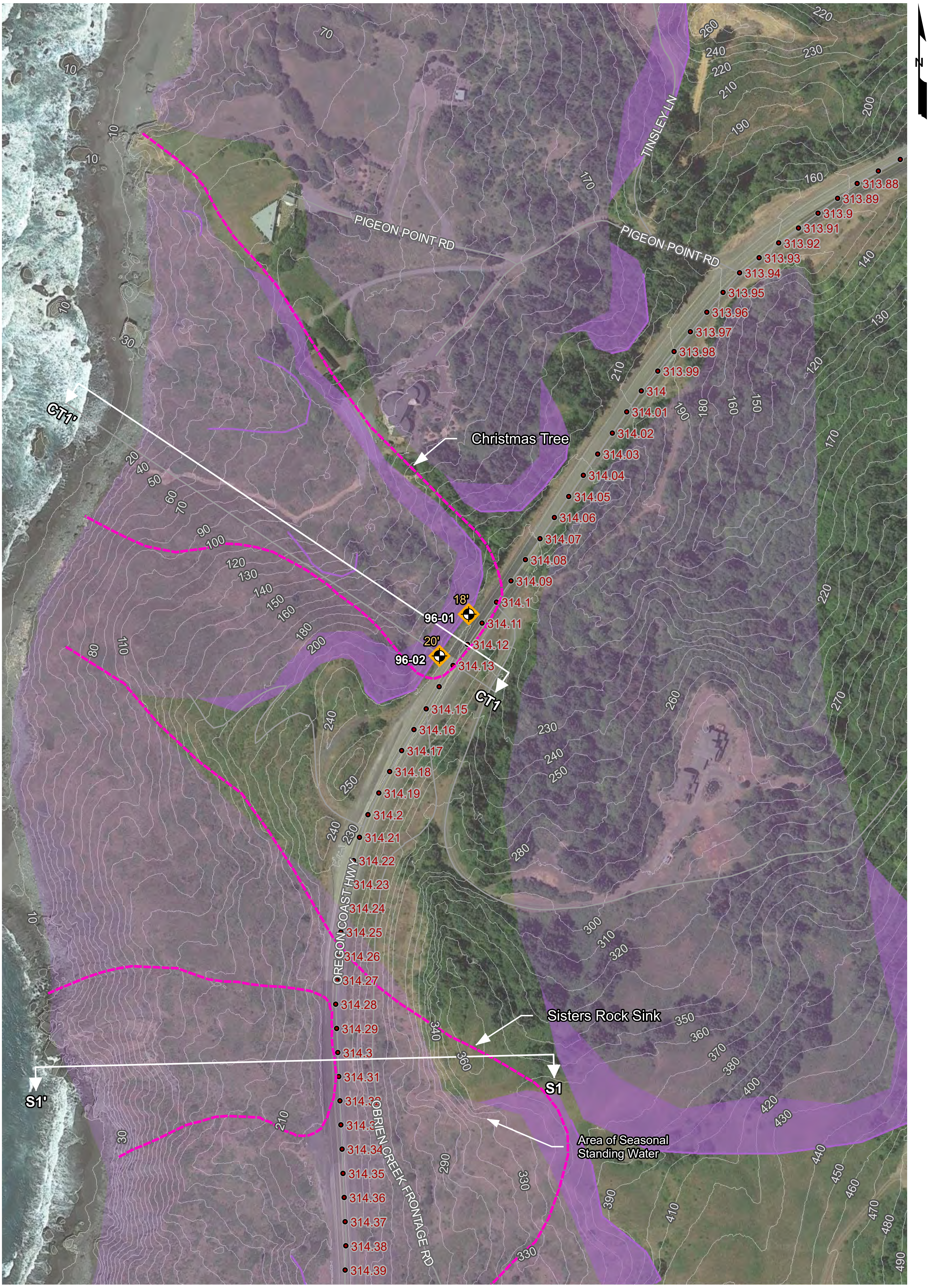
CONCEPTUAL GEOLOGIC CROSS SECTION AI2-AI2'
ARIZONA INN COMPLEX

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A13

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-25-2022 Author: AEH



LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

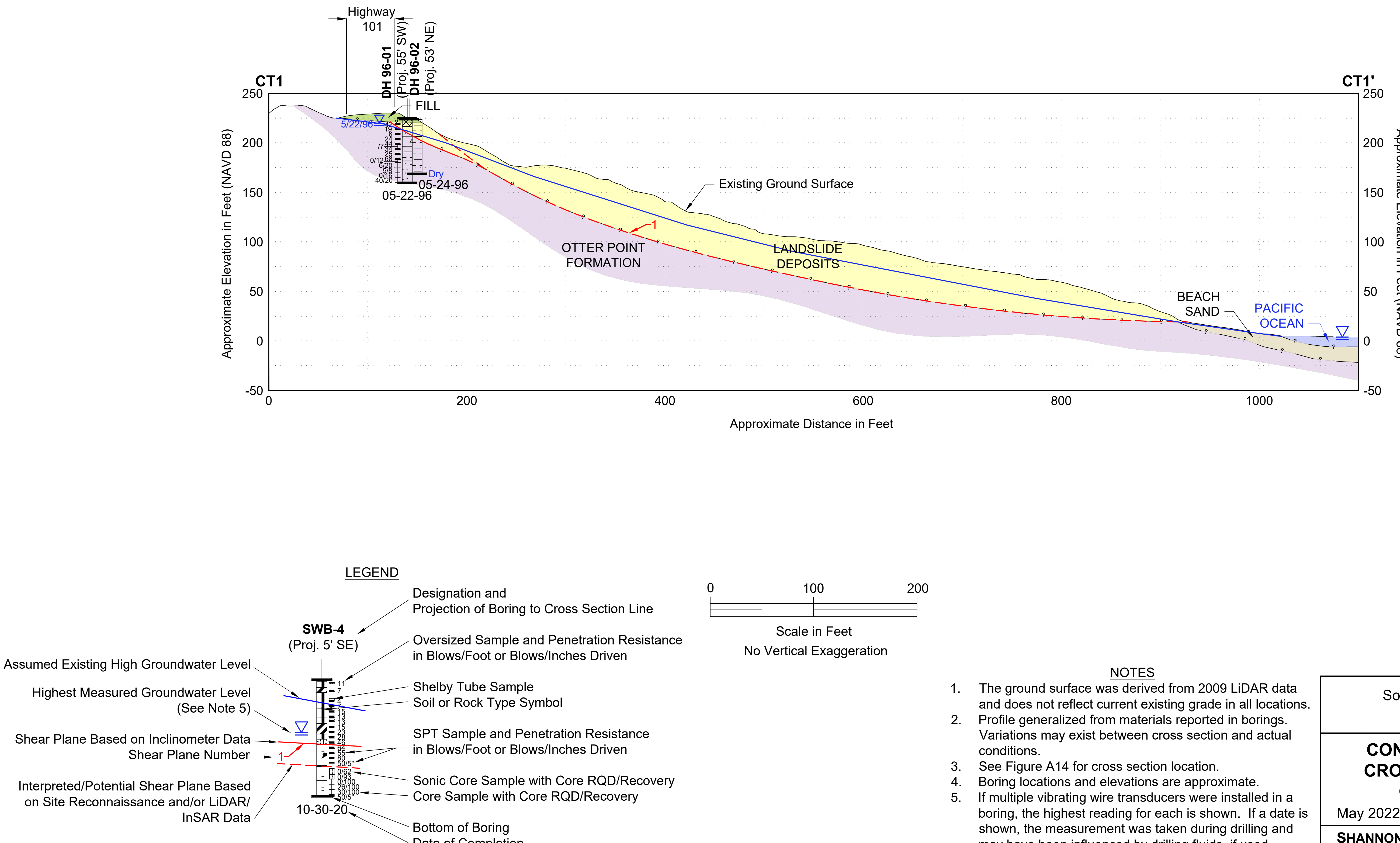
SITE AND EXPLORATION PLAN CHRISTMAS TREE (FRANKPORT NORTH)

May 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A14

FIG. A14



NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A14 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

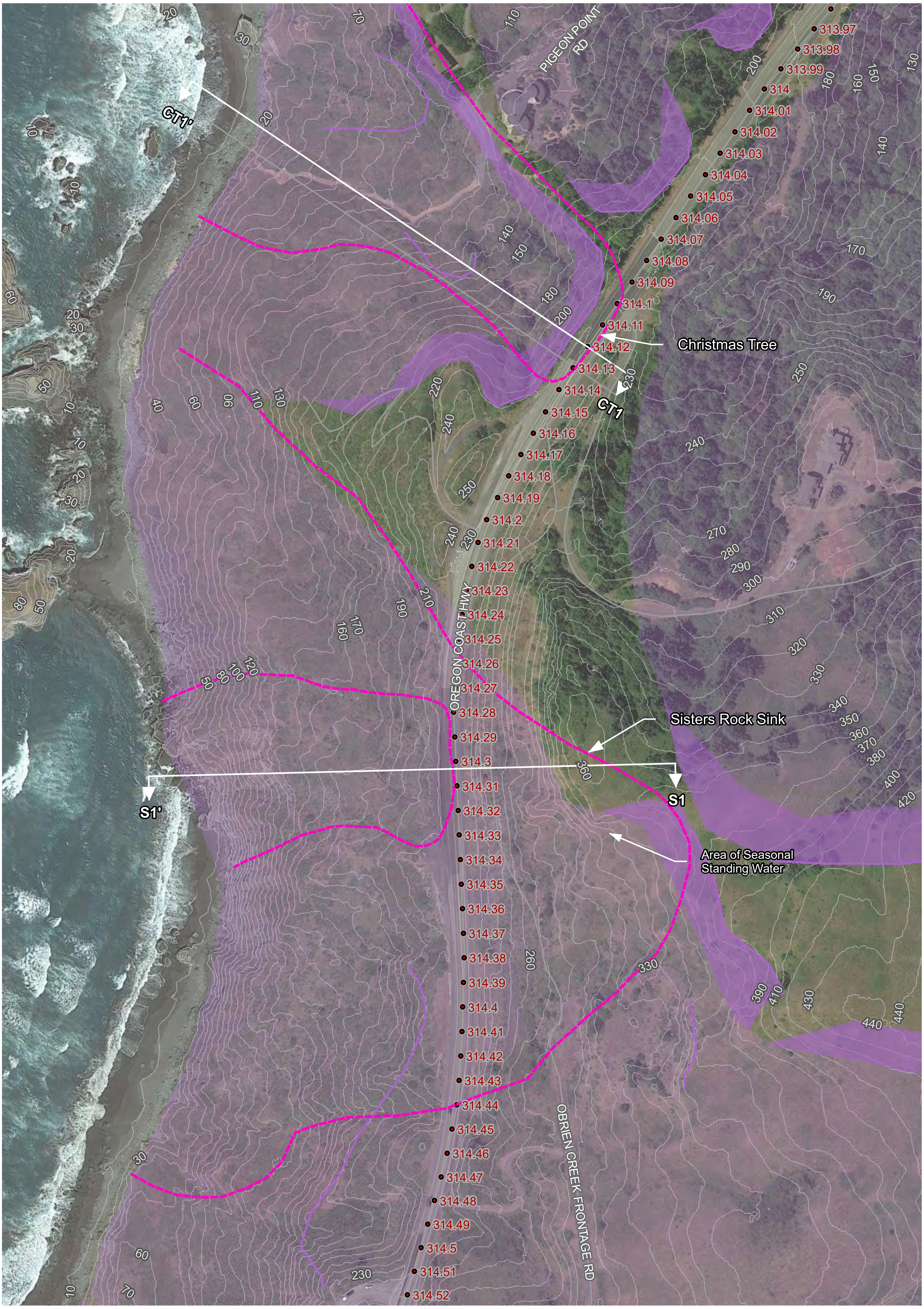
CONCEPTUAL GEOLOGIC CROSS SECTION CT1-CT1' CHRISTMAS TREE

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A15

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND

- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

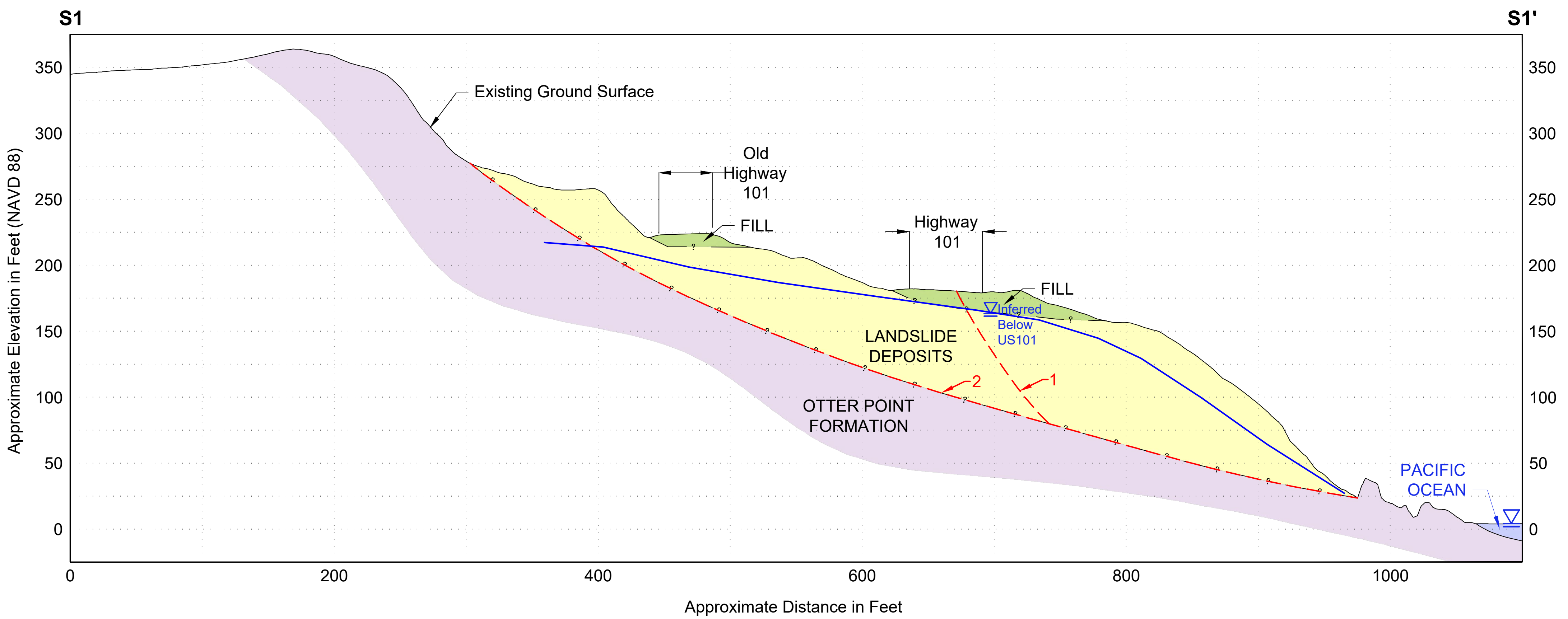
SITE AND EXPLORATION PLAN
SISTERS ROCK SINK

May 2022 106381

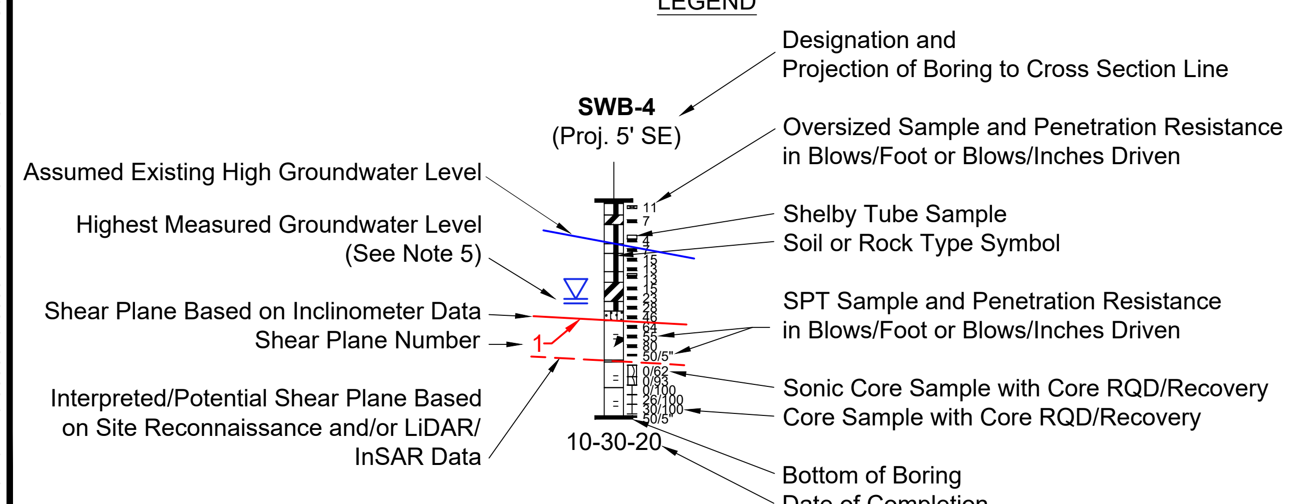
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A16

FIG. A16



LEGEND



0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A16 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION S1-S1' SISTERS ROCK SINK

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A17

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

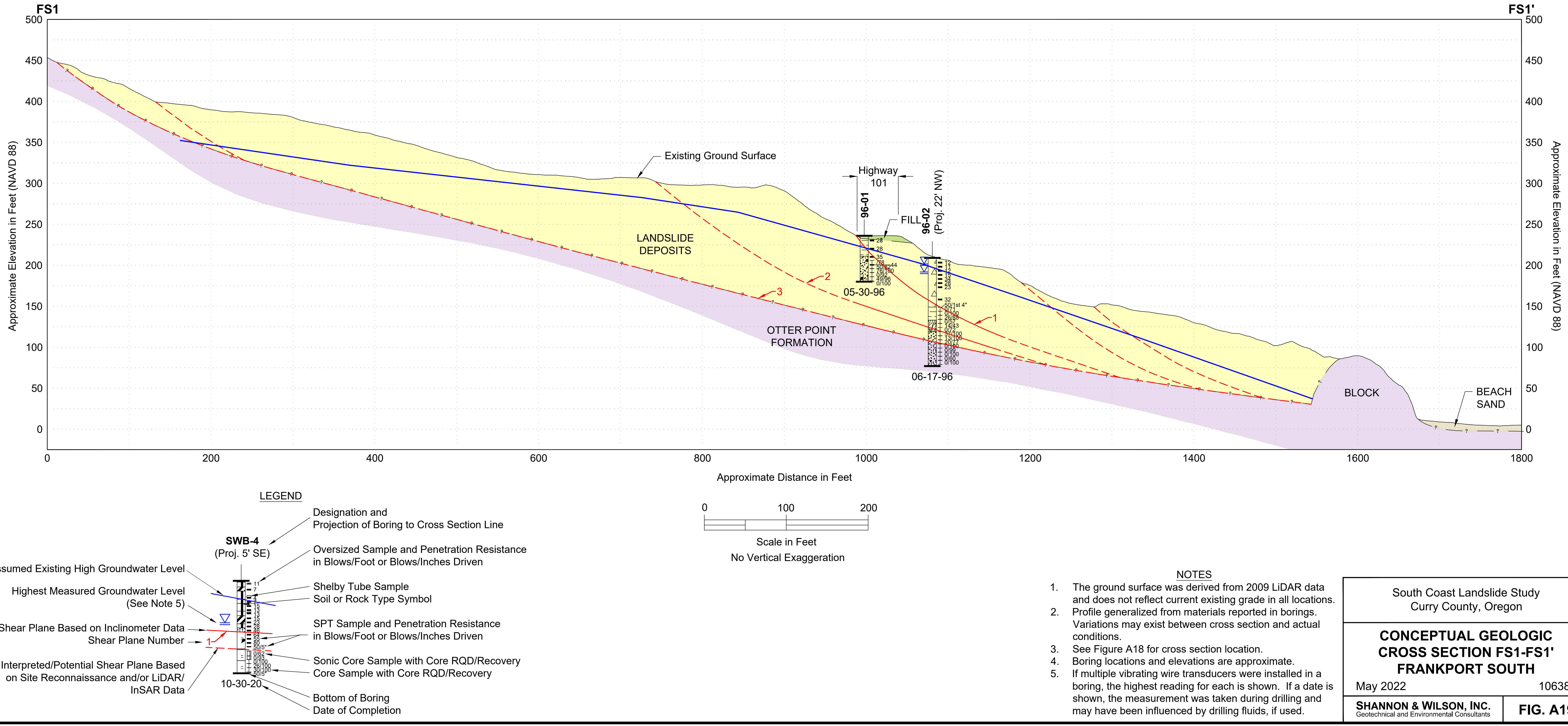
SITE AND EXPLORATION PLAN
FRANKPORT SOUTH

May 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A18

FIG. A18



LEGEND

- SWB-4 (Proj. 5' SE): Designation and Projection of Boring to Cross Section Line
- Assumed Existing High Groundwater Level
- Highest Measured Groundwater Level (See Note 5)
- Shear Plane Based on Inclinometer Data
- Shear Plane Number
- Interpreted/Potential Shear Plane Based on Site Reconnaissance and/or LiDAR/InSAR Data
- Oversized Sample and Penetration Resistance in Blows/Foot or Blows/Inches Driven
- Shelby Tube Sample
- Soil or Rock Type Symbol
- SPT Sample and Penetration Resistance in Blows/Foot or Blows/Inches Driven
- Sonic Core Sample with Core RQD/Recovery
- Core Sample with Core RQD/Recovery
- 10-30-20: Bottom of Boring, Date of Completion

Scale in Feet: 0, 100, 200
No Vertical Exaggeration

NOTES
1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A18 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION FS1-FS1' FRANKPORT SOUTH

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A19

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan10Woodroof_10.7.mxd Date: 5/11/2022 Login: AEH

LEGEND

- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits
- R1 R1' Designation and Location of Conceptual Subsurface Cross Section

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

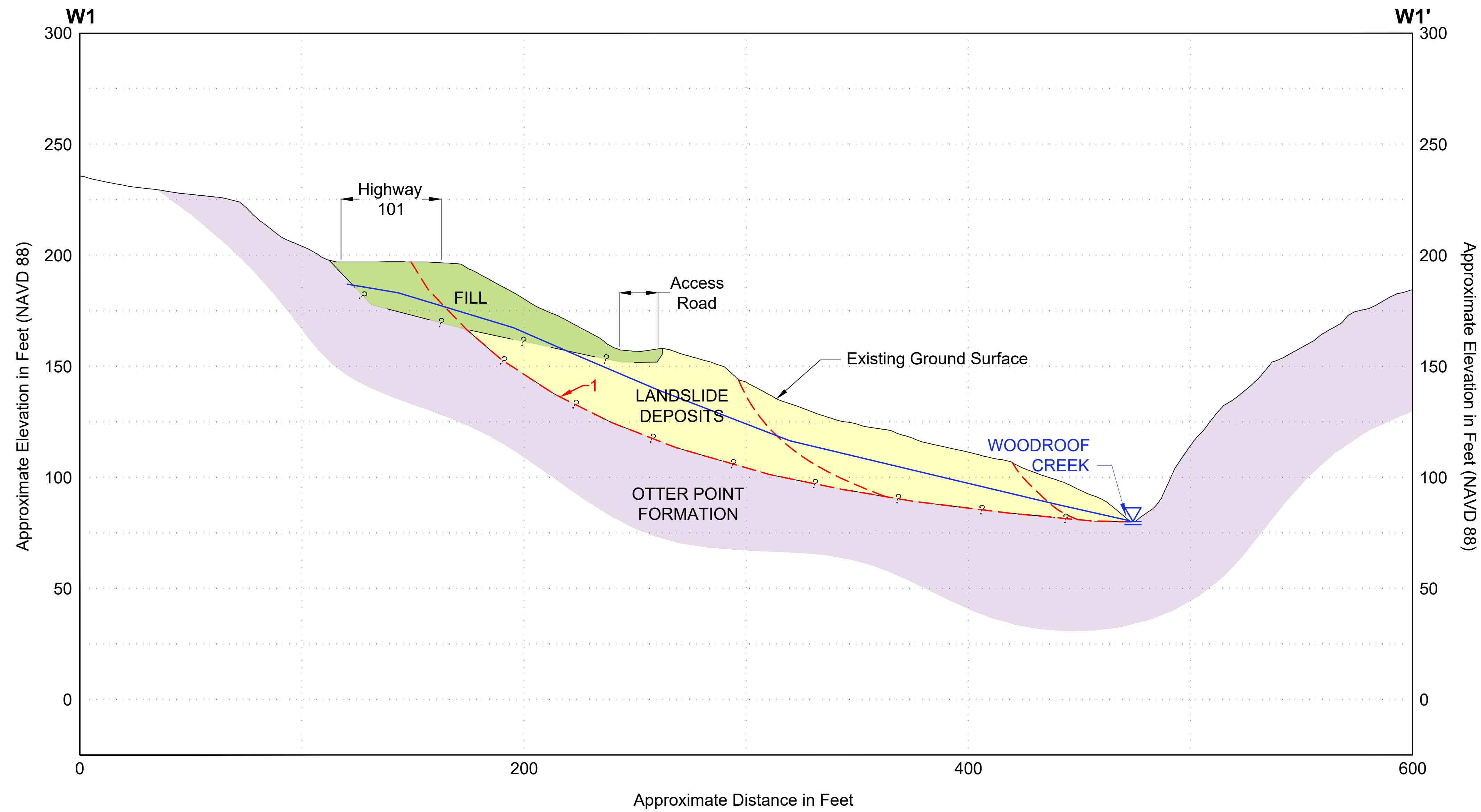
SITE AND EXPLORATION PLAN
WOODROOF CREEK

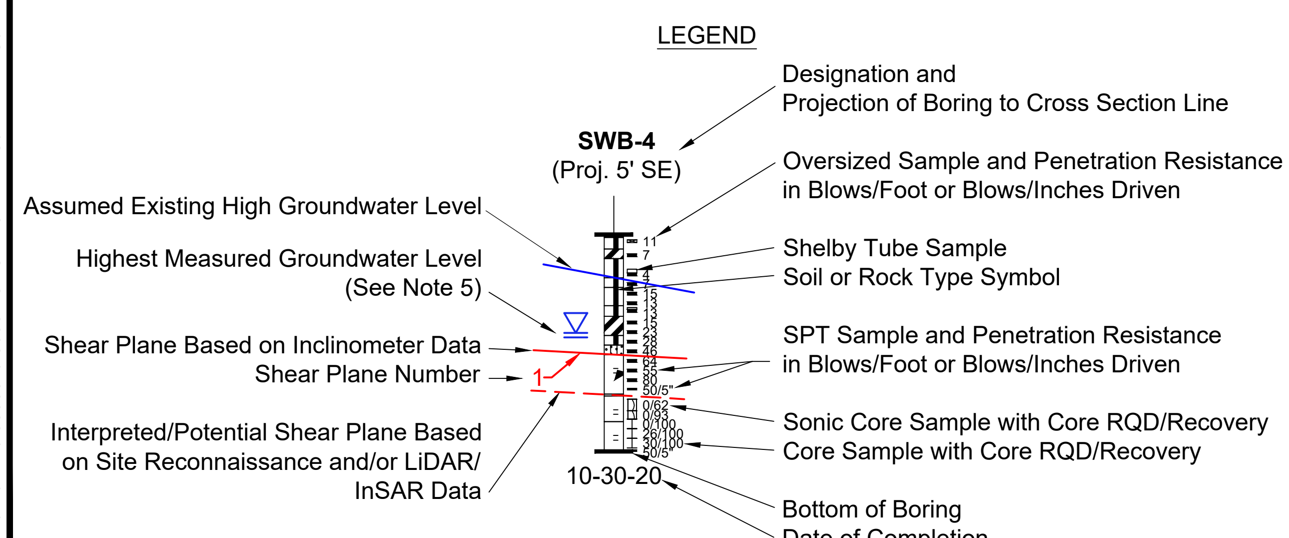
May 2022 106381

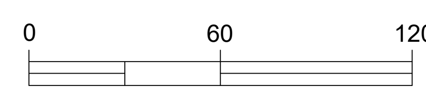
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A20

FIG. A20







Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A20 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION W1-W1' WOODROOF CREEK

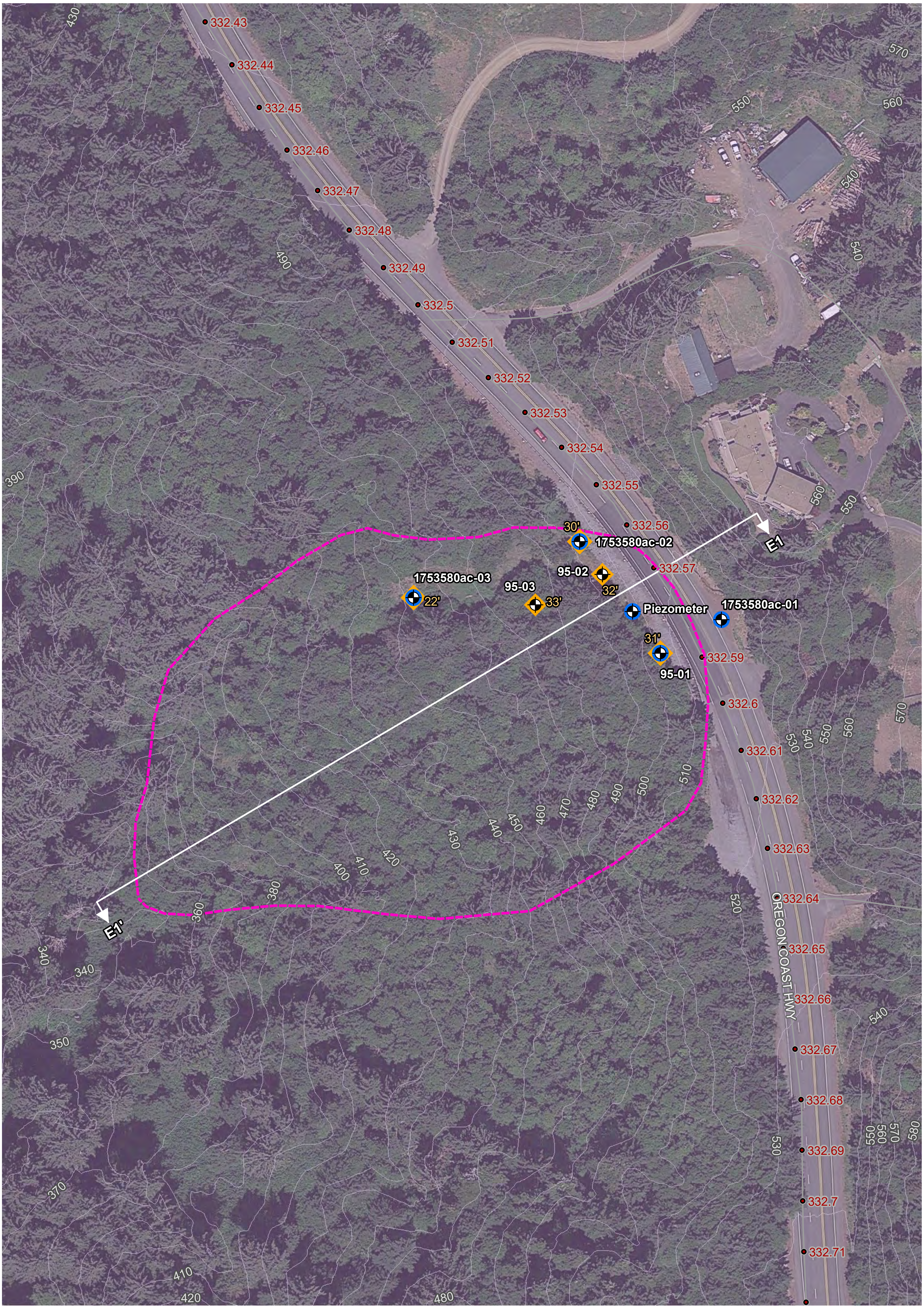
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A21

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan11EightyAcres_10.7.mxd Date: 5/11/2022 Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer and Shear Plane Depth

Approximate Location of Boring with Piezometer

13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer

R1 R1' Designation and Location of Conceptual Subsurface Cross Section

Interpreted Slide Extents

Mapped Landslide Deposits

0 50 100 200
Scale in Feet

NOTES
1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

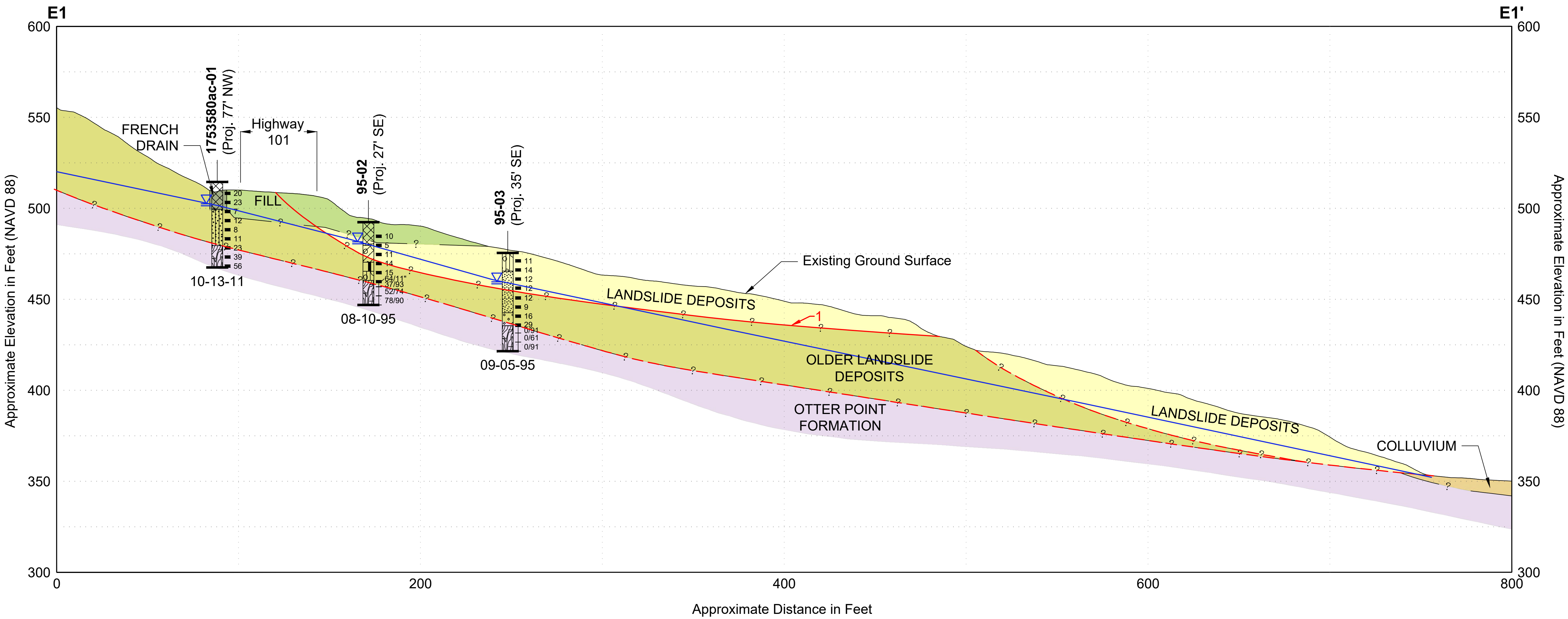
SITE AND EXPLORATION PLAN
EIGHTY ACRES

May 2022 106381

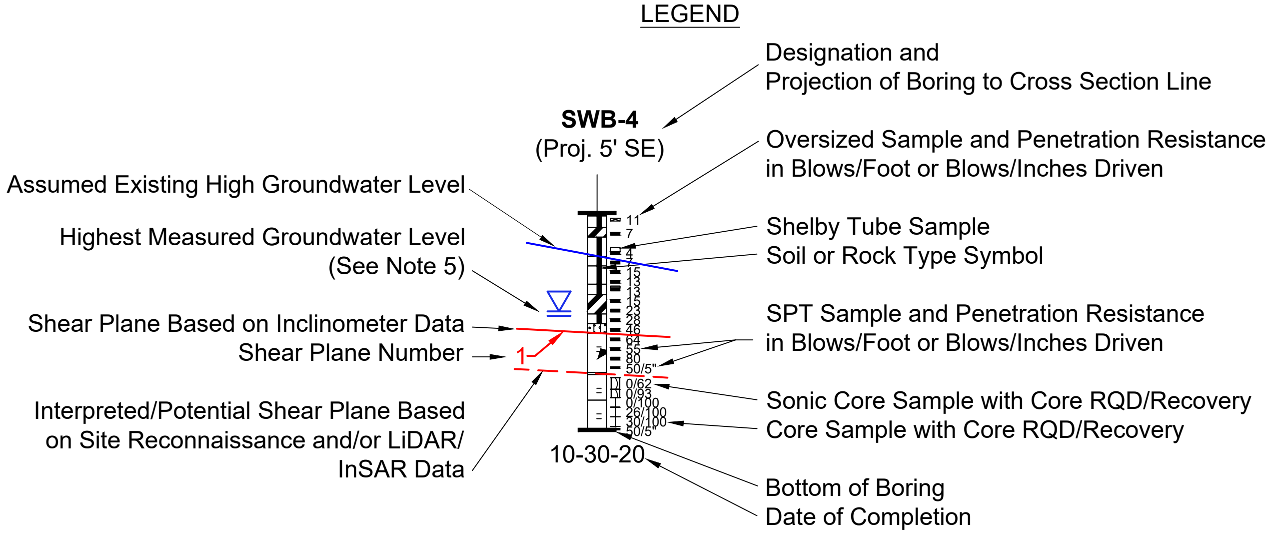
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A22

FIG. A22



LEGEND



0 60 120

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A22 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION E1-E1' EIGHTY ACRES

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A23

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

LEGEND

Approximate Location of Boring

R1 R1' Designation and Location of Conceptual Subsurface Cross Section

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

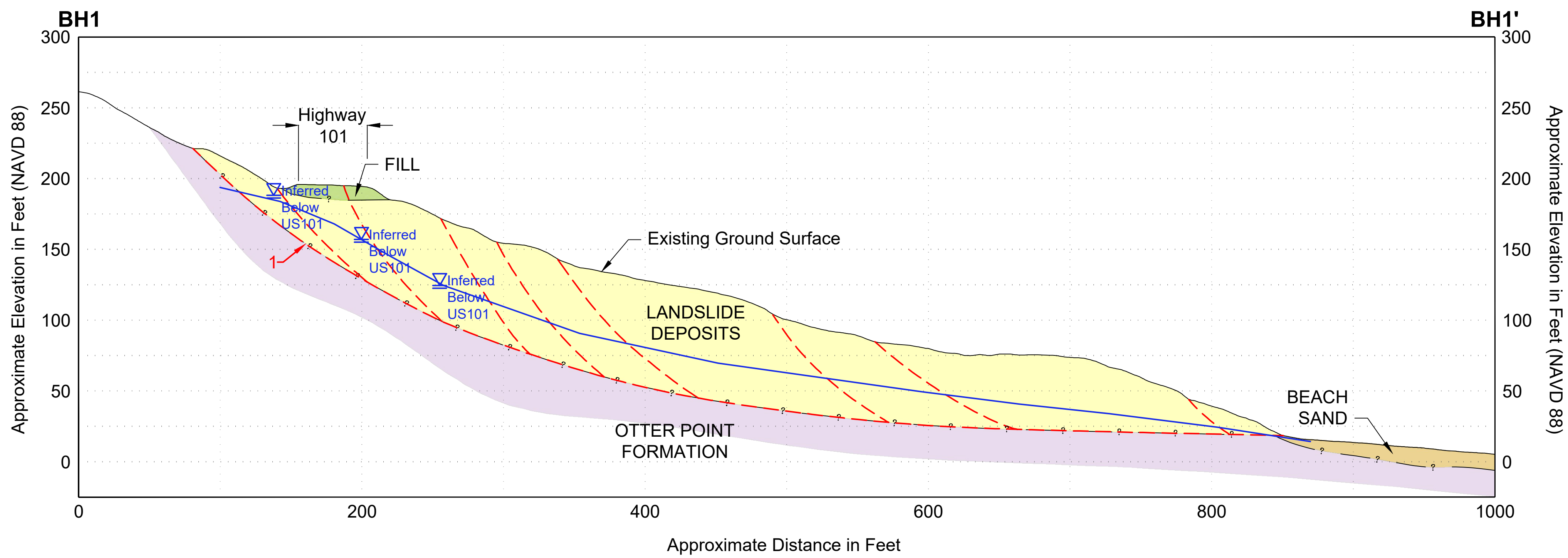
SITE AND EXPLORATION PLAN
BURNT HILL

May 2022 106381

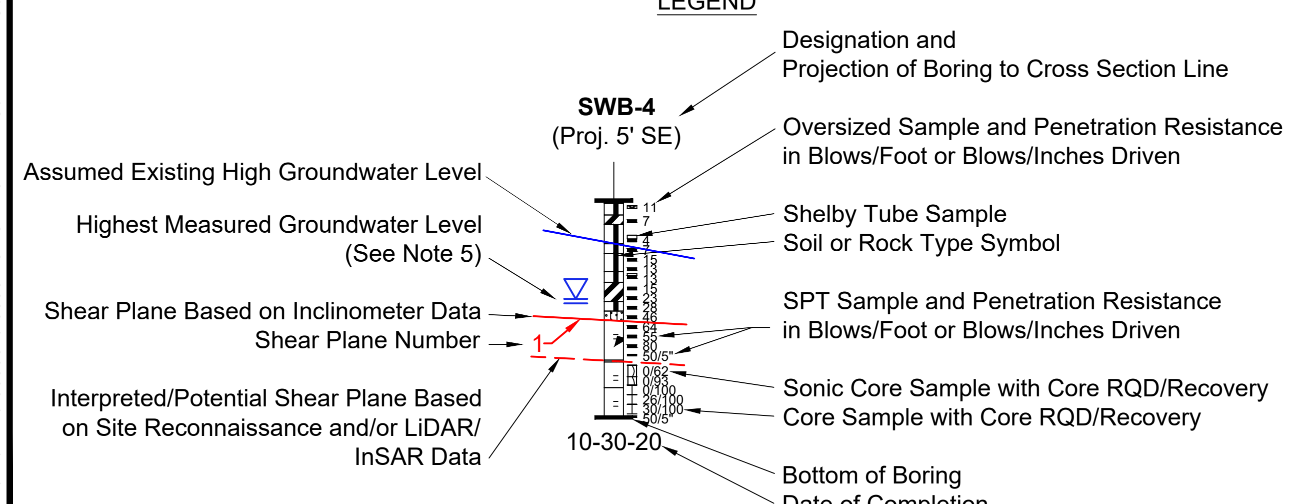
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

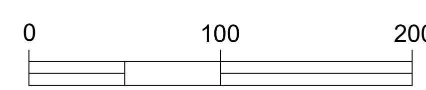
FIG. A24

FIG. A24



LEGEND





Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A24 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION BH1-BH1' BURNT HILL

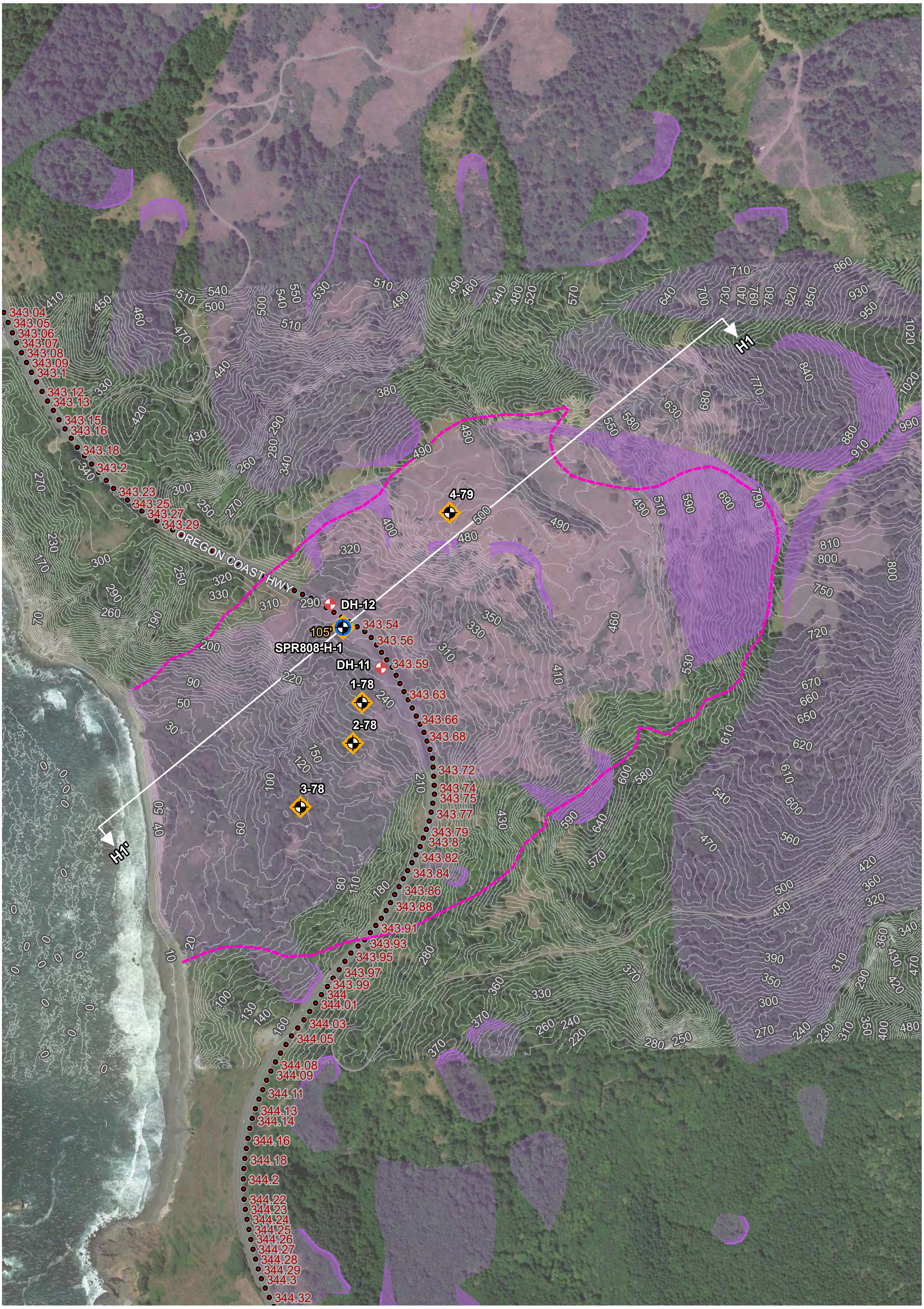
May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A25

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan13Hooskanaden_10.7.mxd Date: 5/11/2022 Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer and Shear Plane Depth

13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer

Approximate Location of Boring (Missing Data)

R1 R1' Designation and Location of Conceptual Subsurface Cross Section

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 250 500 1,000

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

SITE AND EXPLORATION PLAN
HOOSKANADEN

May 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. A26

FIG. A26

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A26 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION H1-H1' HOOSKANADEN

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

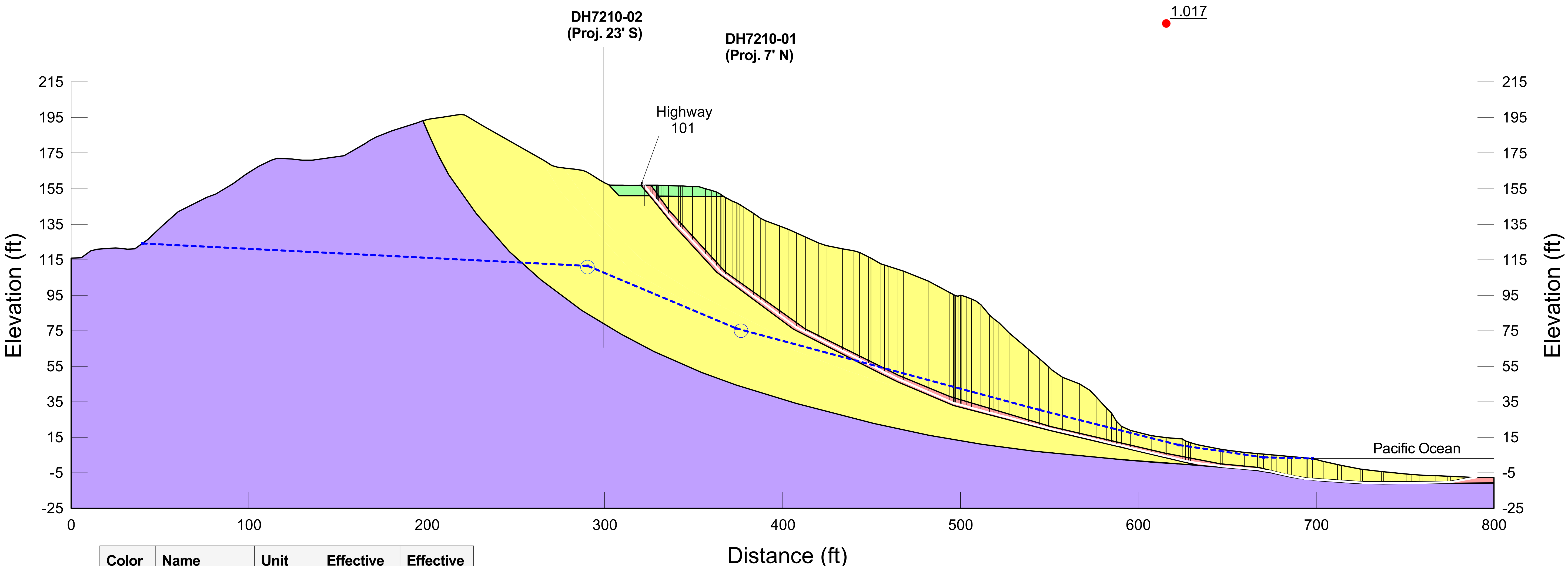
FIG. A27

Date: 05-18-2022 Author: AEH

SHANNON & WILSON

ATTACHMENT B

CONCEPTUAL SLOPE STABILITY BACK CALCULATION ANALYSES



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(green)	Existing Fill	120	0	30
(yellow)	Landslide Deposits	130	0	30
(purple)	Rocky Point Formation	140		
(pink)	Slide Plane 1	130	0	25

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

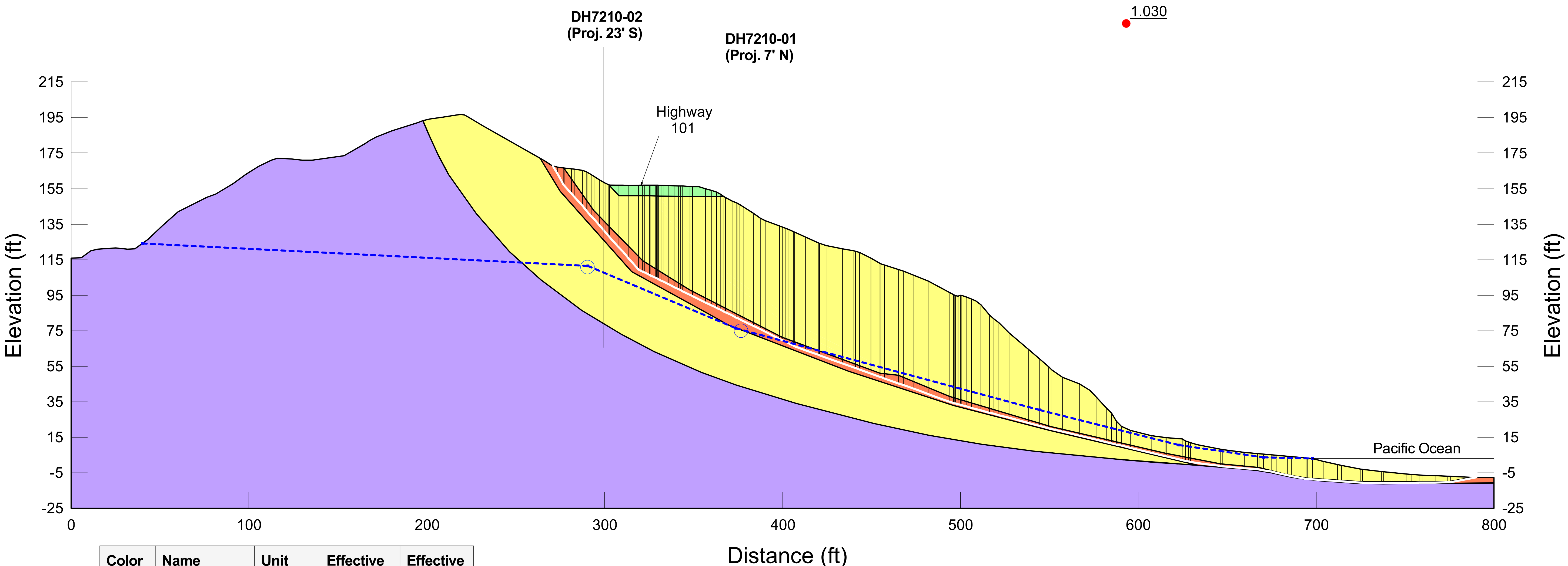
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
RETZ CREEK SOUTH R1-R1' NO. 1
BACK CALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B1



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(green)	Existing Fill	120	0	30
(yellow)	Landslide Deposits	130	0	30
(purple)	Rocky Point Formation	140		
(orange)	Slide Plane 2	130	0	23

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

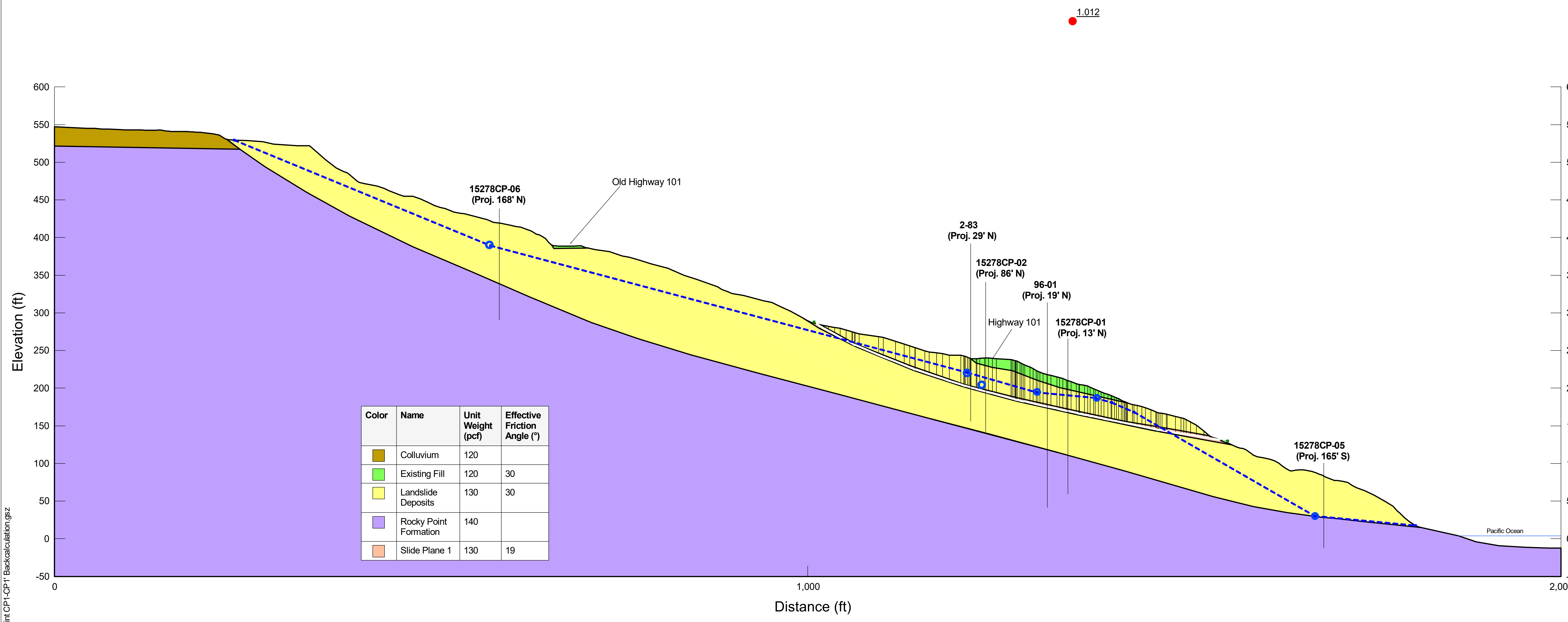
GLOBAL STABILITY ANALYSIS
RETZ CREEK SOUTH R1-R1' NO. 2
BACK CALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B2

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Retz Creek South R1-R1' Backcalculation.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 1	130	19

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Coal Point CP1-CP1' Backcalculation.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

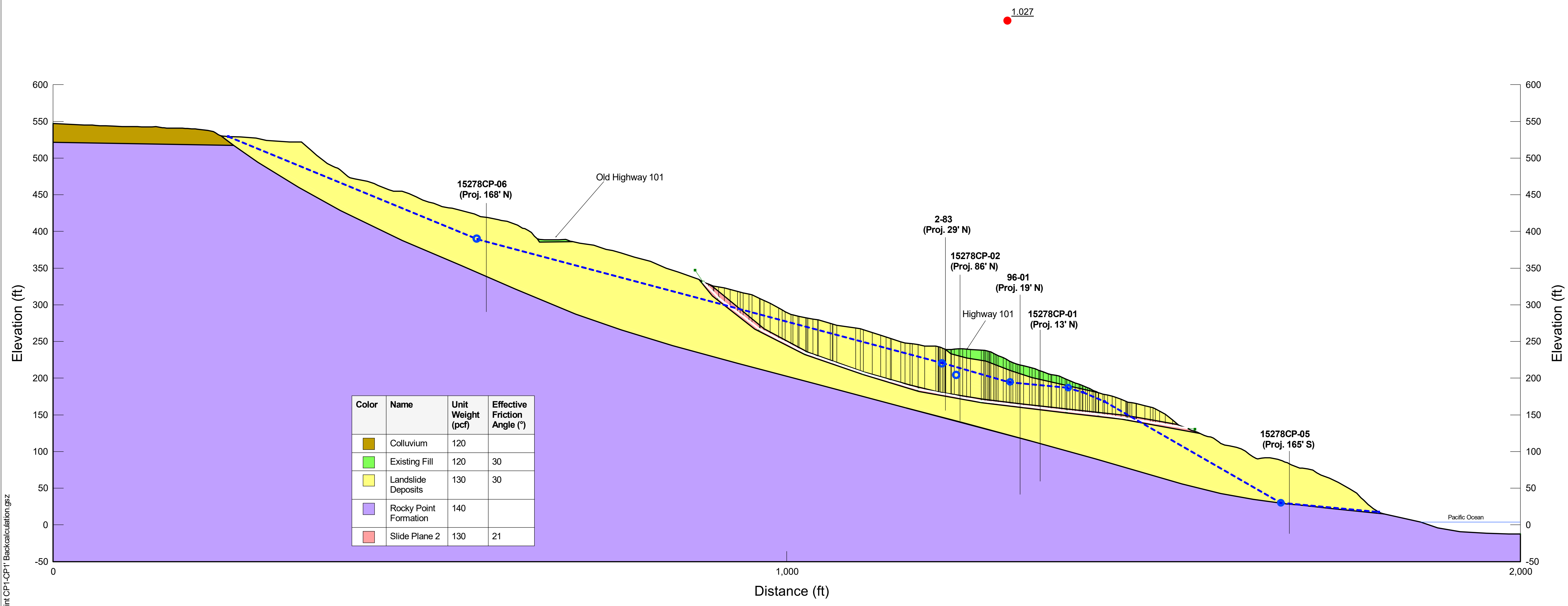
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1' NO. 1
BACK CALCULATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B3



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 2	130	21

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

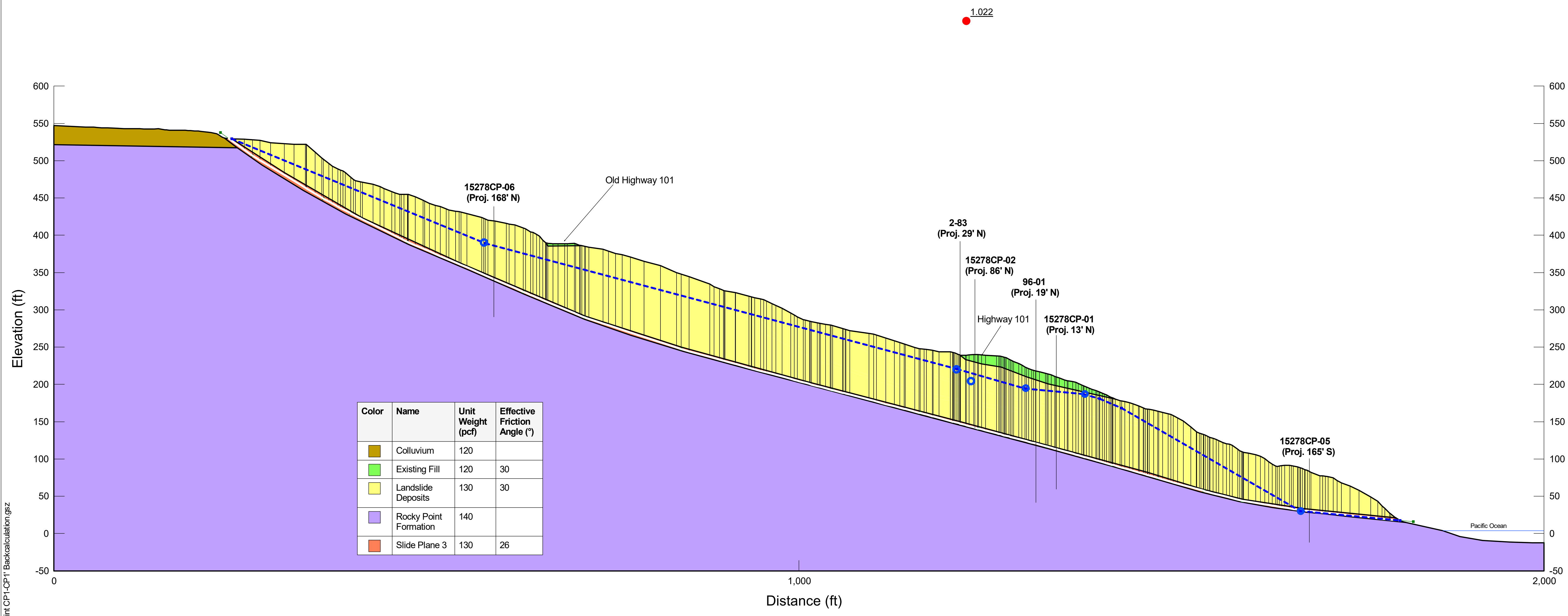
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1' NO. 2
BACK CALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B4



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 3	130	26

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

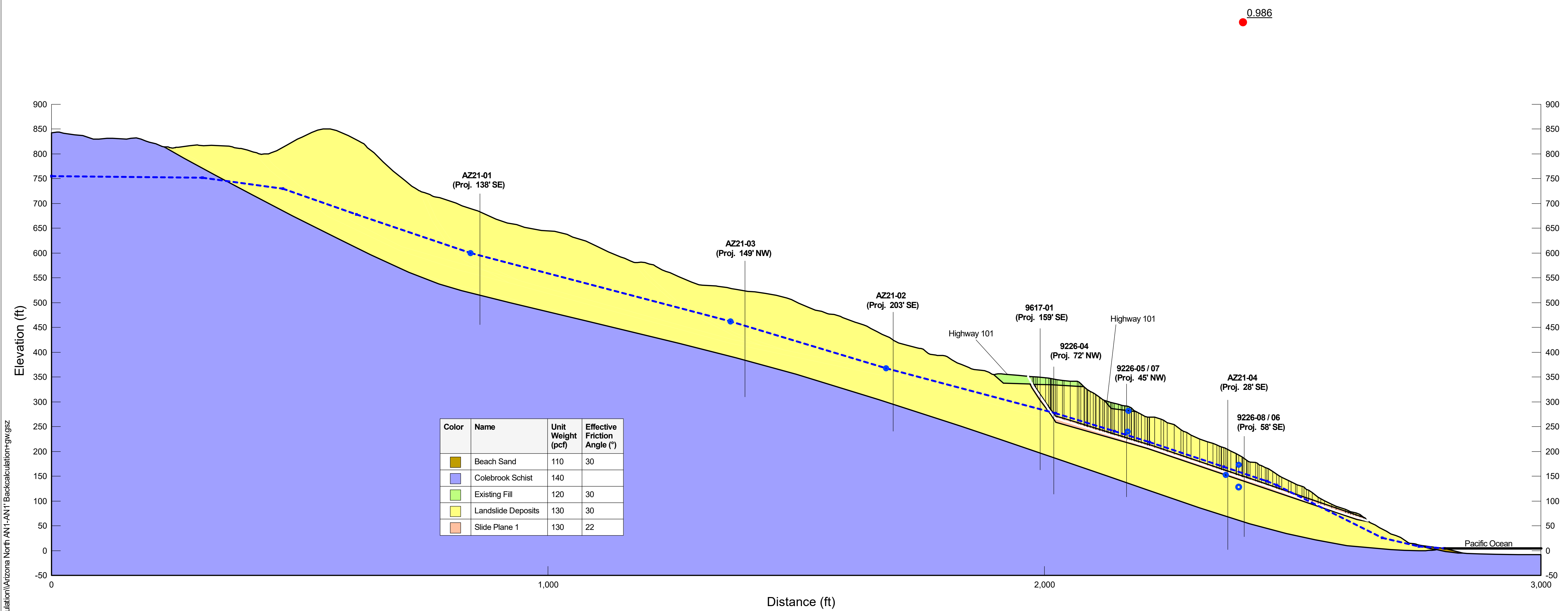
GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1' NO. 3
BACK CALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B5

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Coal Point CP1-CP1' Backcalculation.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 1	130	22

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Arizona North AN1-AN1' Backcalculation+gw.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

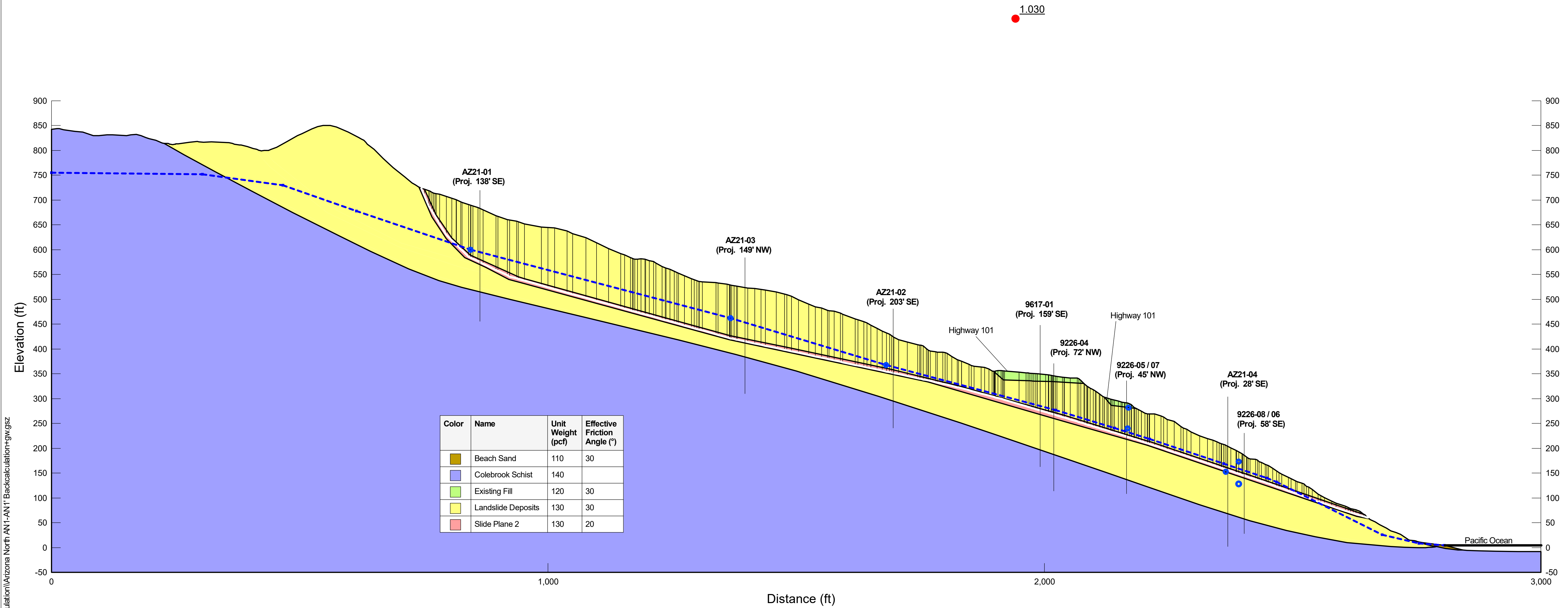
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS ARIZONA NORTH AN1-AN1' NO. 1 BACKCALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B6



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 2	130	20

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Arizona North AN1-AN1' Backcalculation+gw.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

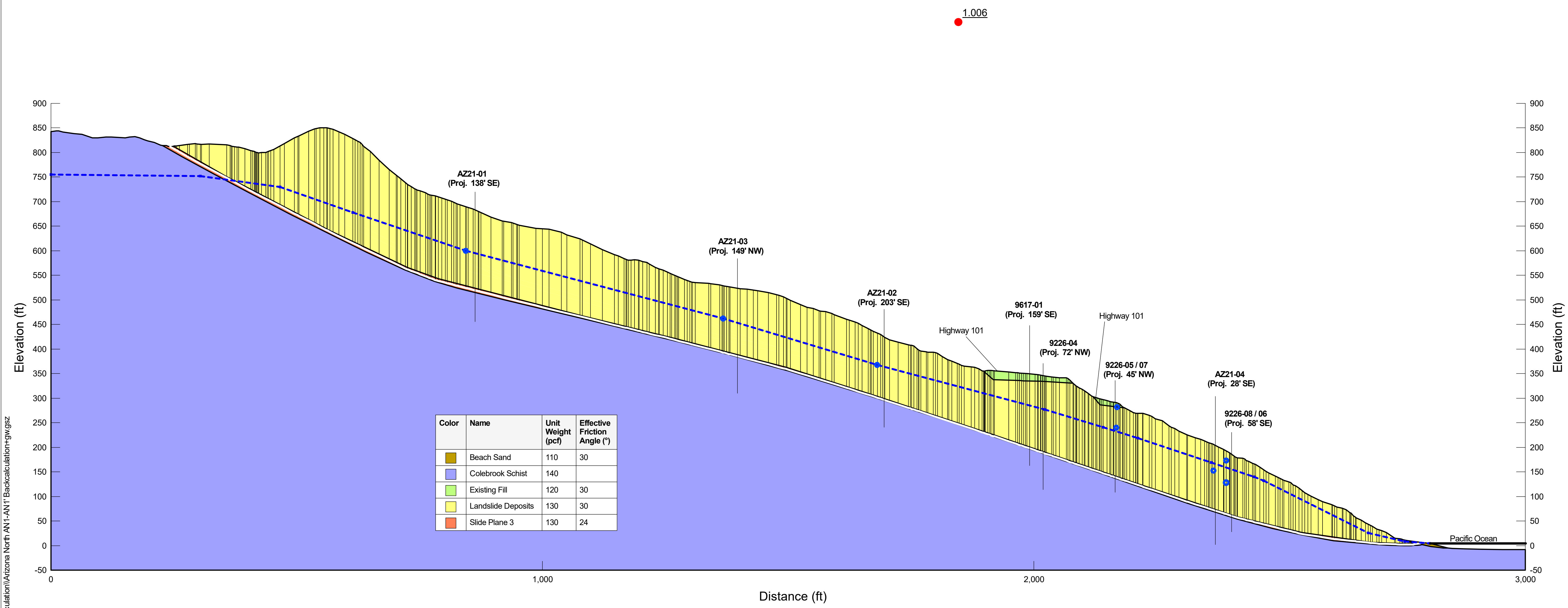
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1' NO. 2
BACKCALCULATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B7



I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Arizona North AN1-AN1' Backcalculation+gw.gsz

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

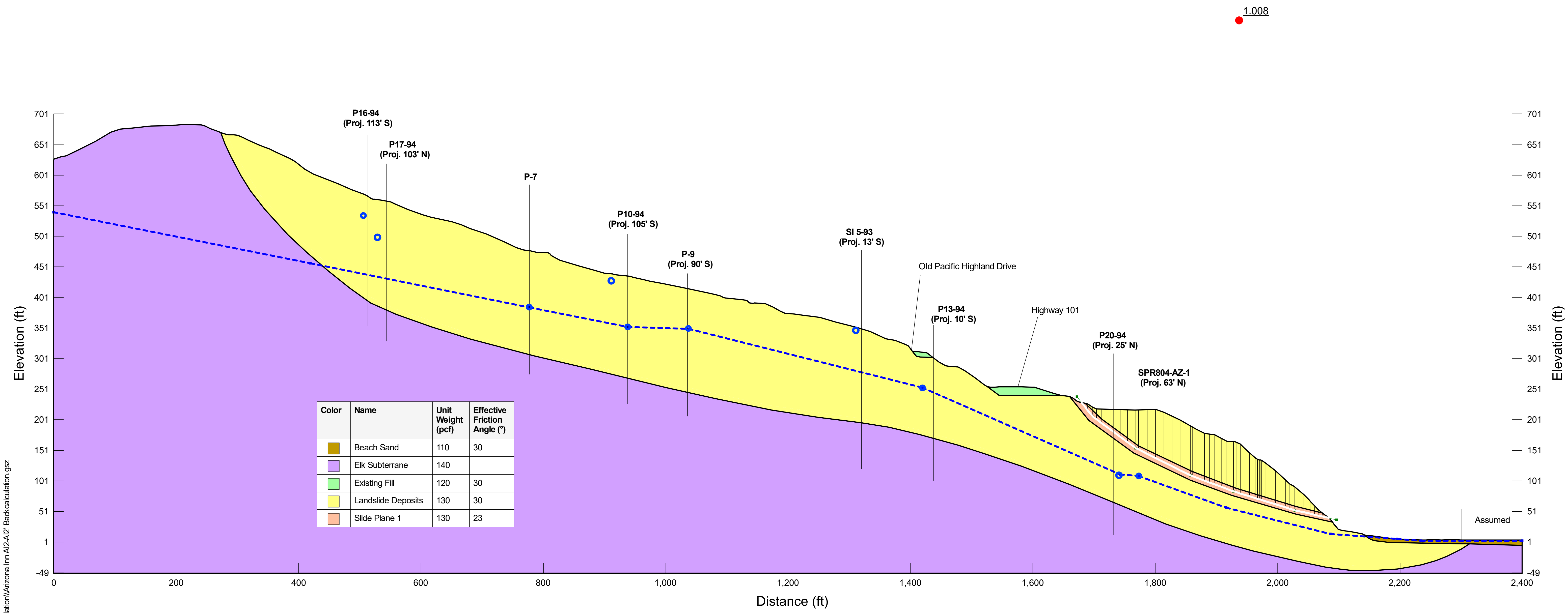
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1' NO. 3
BACKCALCULATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B8



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Elk Subterrane	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 1	130	23

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

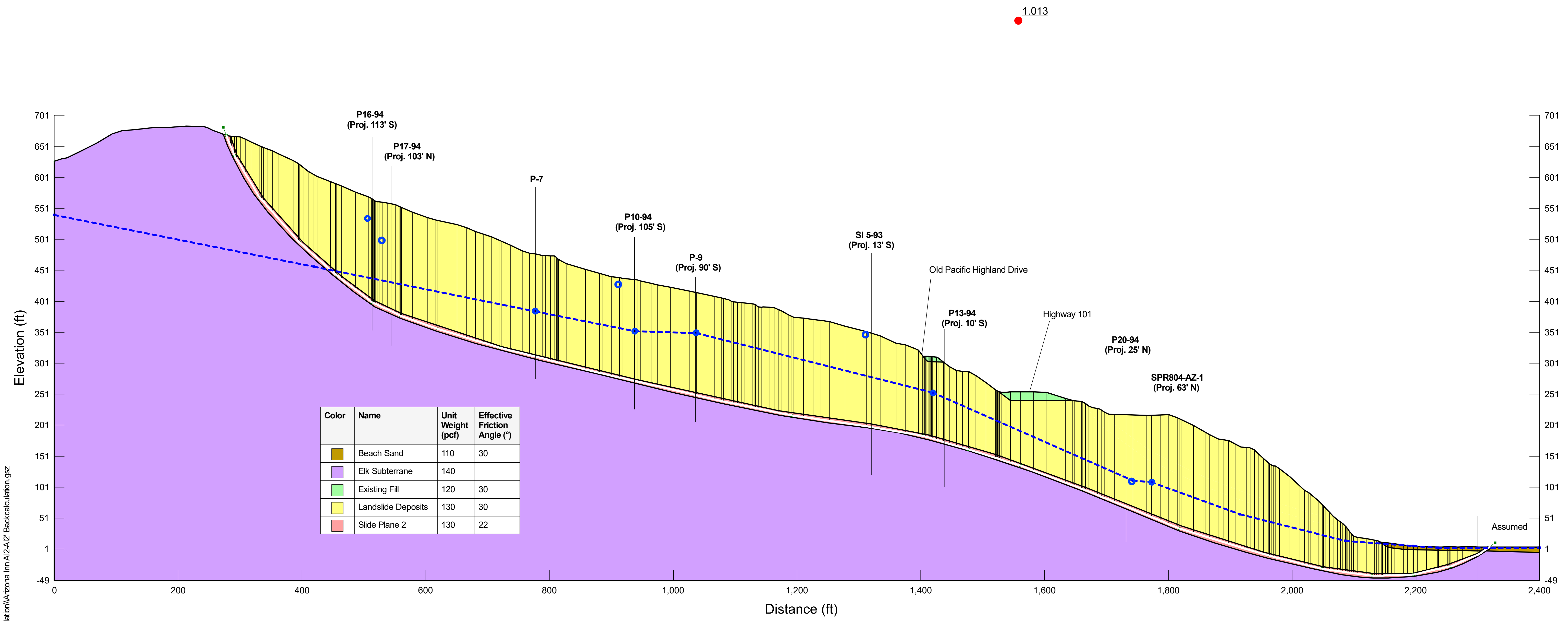
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA INN AI2-AI2' NO. 1
BACK CALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B9



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Elk Subterrane	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 2	130	22

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

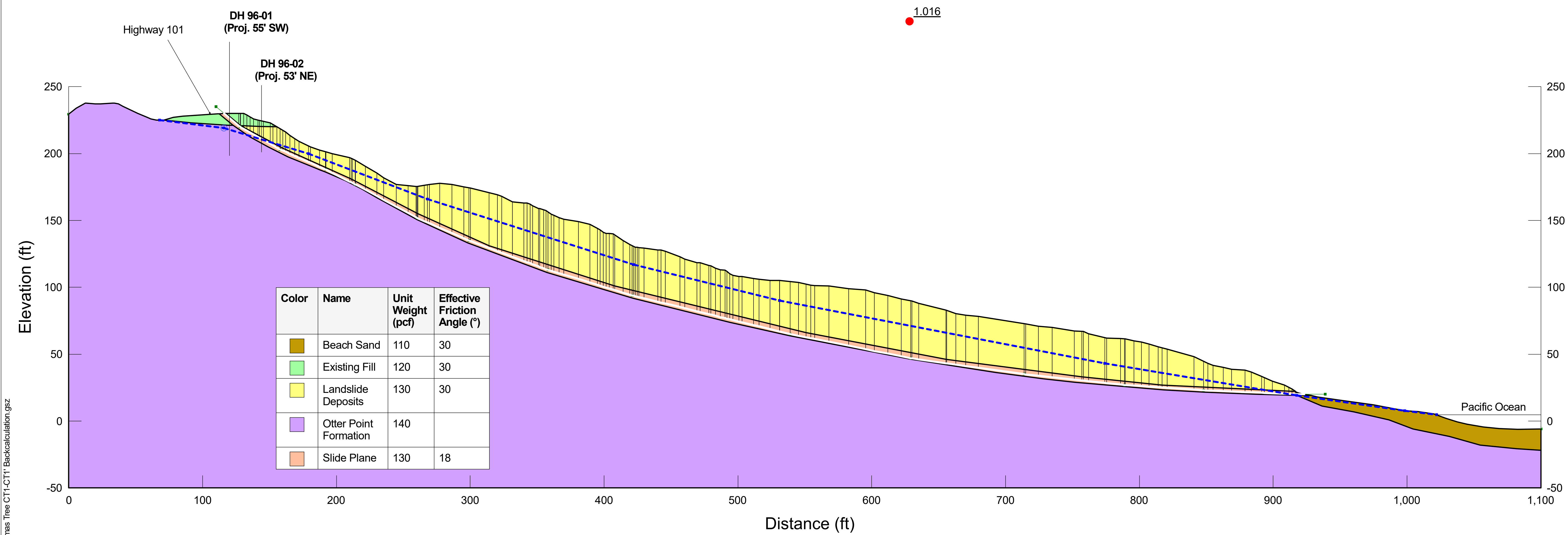
GLOBAL STABILITY ANALYSIS
ARIZONA INN AI2-AI2' NO. 2
BACK CALCULATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B10

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Arizona Inn AI2-AI2' Backcalculation.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Existing Fill	120	30
	Landslide Deposits	130	30
	Otter Point Formation	140	
	Slide Plane	130	18

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
CHRISTMAS TREE CT1-CT1'
BACK CALCULATION ANALYSIS

April 2022 | 106381

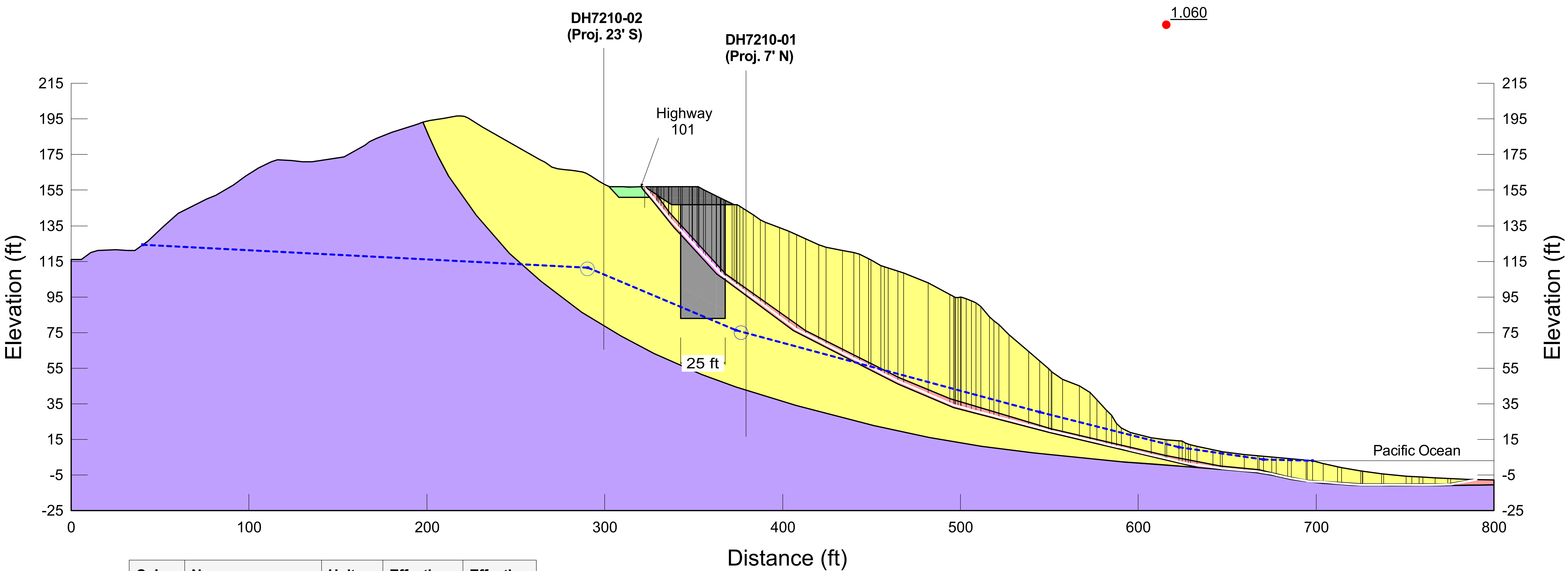
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. B11

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Backcalculation\Christmas Tree CT1-CT1' Backcalculation.gsz

ATTACHMENT C

CONCEPTUAL MITIGATION SLOPE STABILITY ANALYSES



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Existing Fill	120	0	30
	Landslide Deposits	130	0	30
	Stone Column	135	0	50
	Stone Column (SP1)	135	0	41
	Rocky Point Formation	140		
	Slide Plane 1	130	0	25
	Stone Embankment Material	135	0	38

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

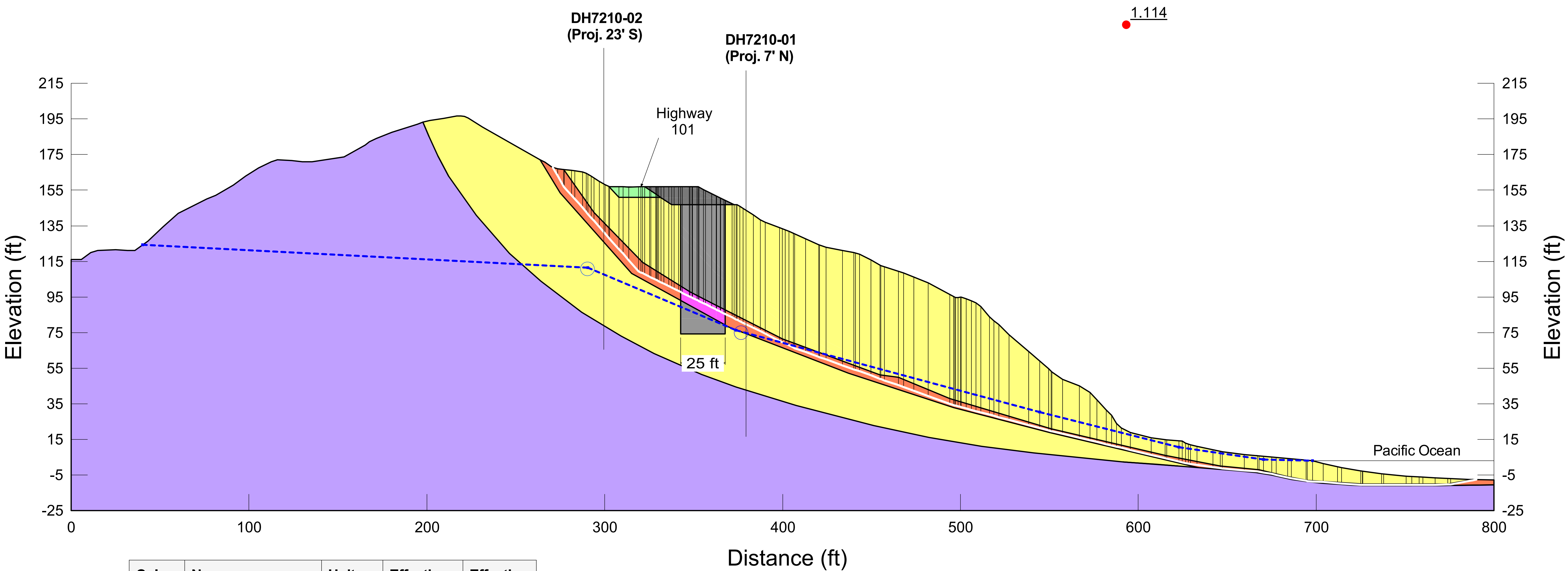
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
RETZ CREEK SOUTH R1-R1'
MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C1



Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
(light green)	Existing Fill	120	0	30
(yellow)	Landslide Deposits	130	0	30
(gray)	Stone Column	135	0	50
(magenta)	Stone Column (SP2)	135	0	40
(purple)	Rocky Point Formation	140		
(orange)	Slide Plane 2	130	0	23
(dark gray)	Stone Embankment Material	135	0	38

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

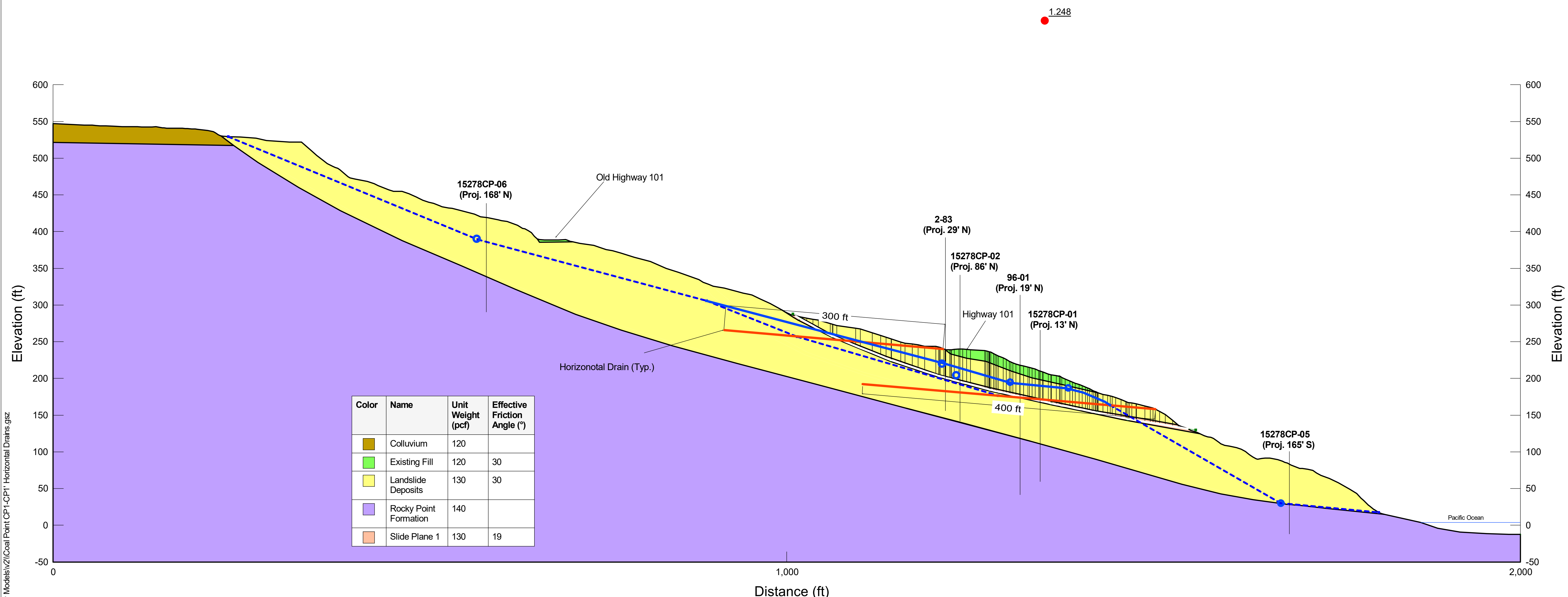
GLOBAL STABILITY ANALYSIS
RETZ CREEK SOUTH R1-R1'
MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C2

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Retz Creek South R1-R1' Shear Key Mitigation.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 1	130	19

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Horizontal Drains.gsz

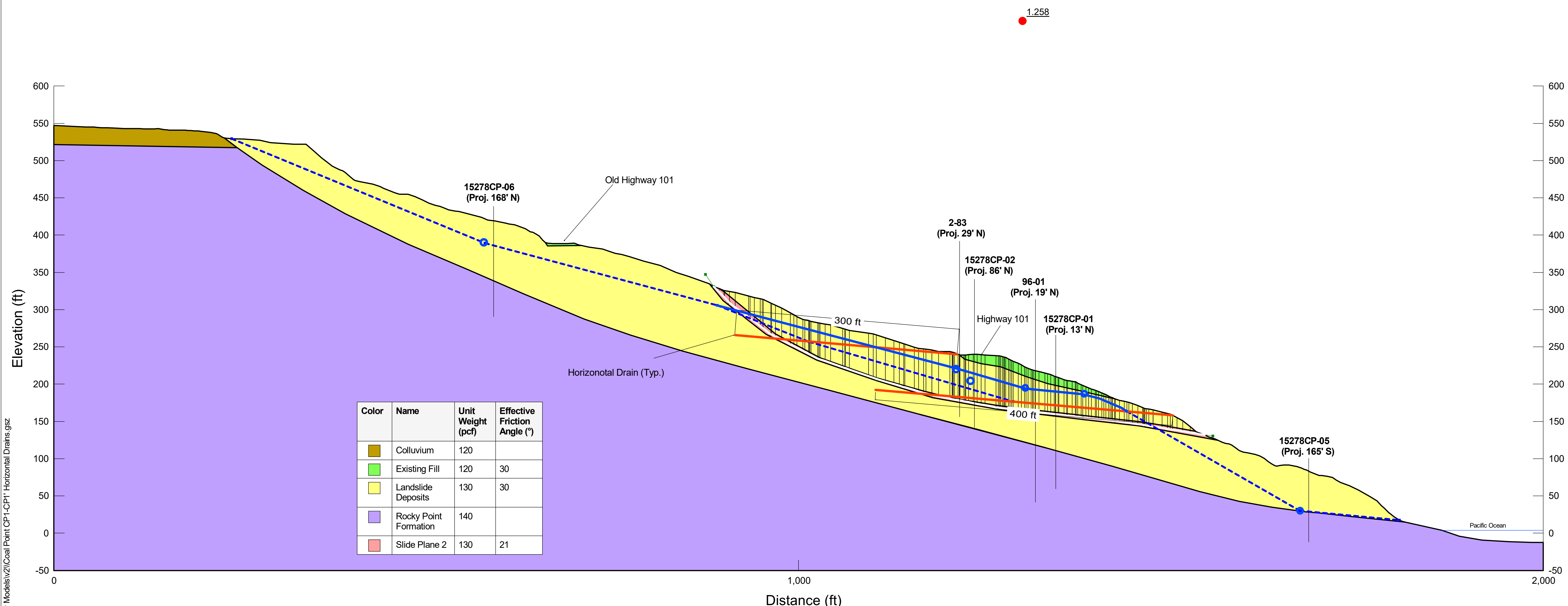
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
50% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C3



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 2	130	21

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Horizontal Drains.gsz

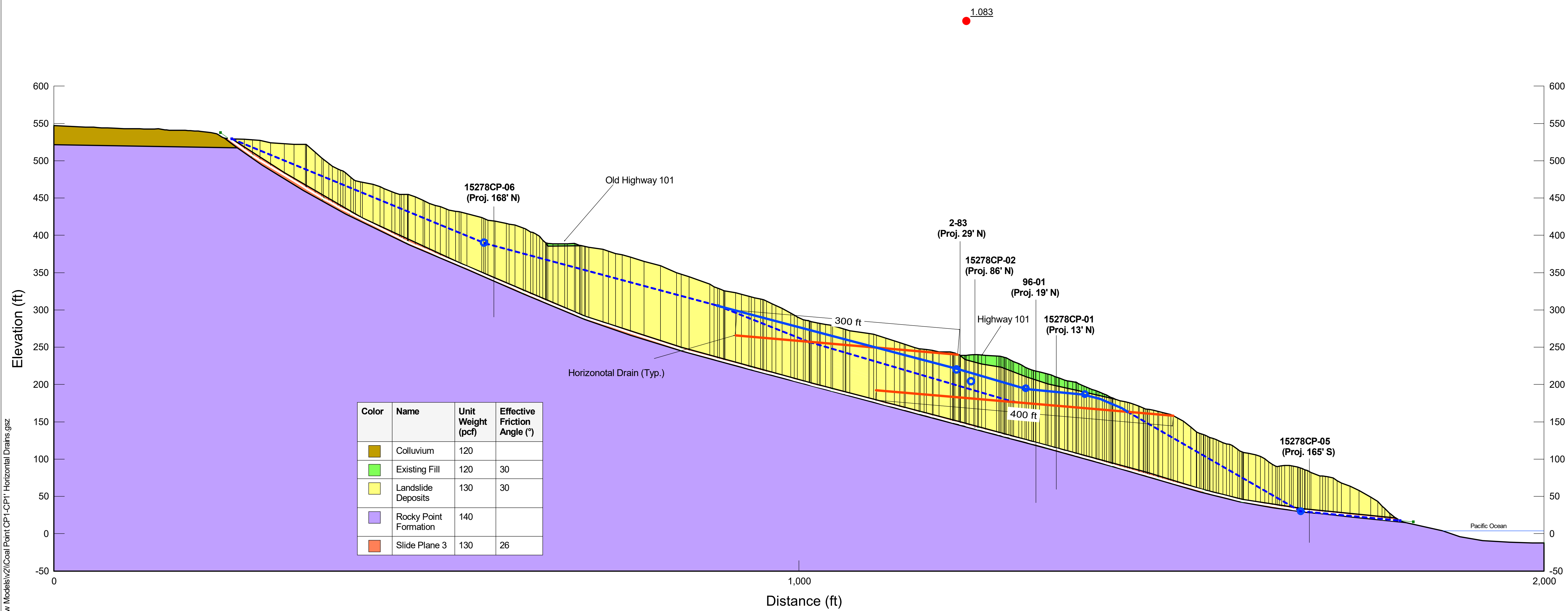
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
50% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C4



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 3	130	26

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

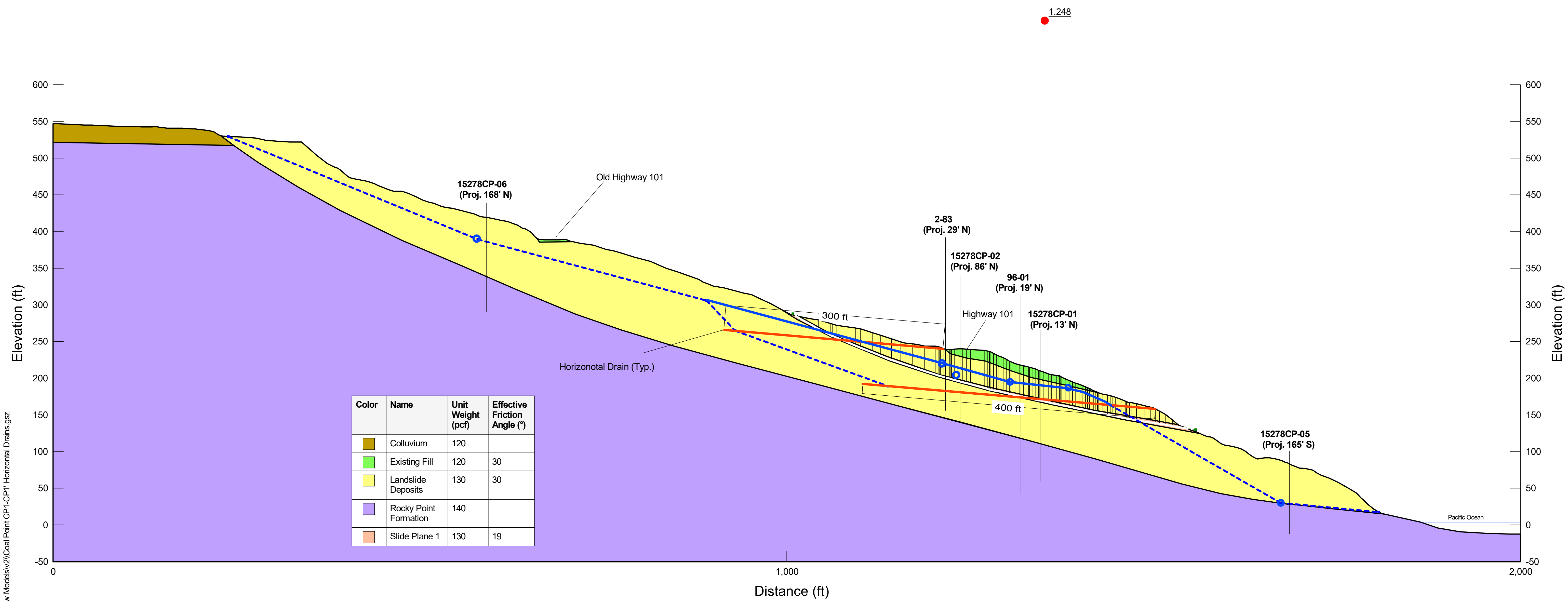
GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
50% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C5

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\\Coal Point CP1-CP1' Horizontal Drains.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 1	130	19

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Horizontal Drains.gsz

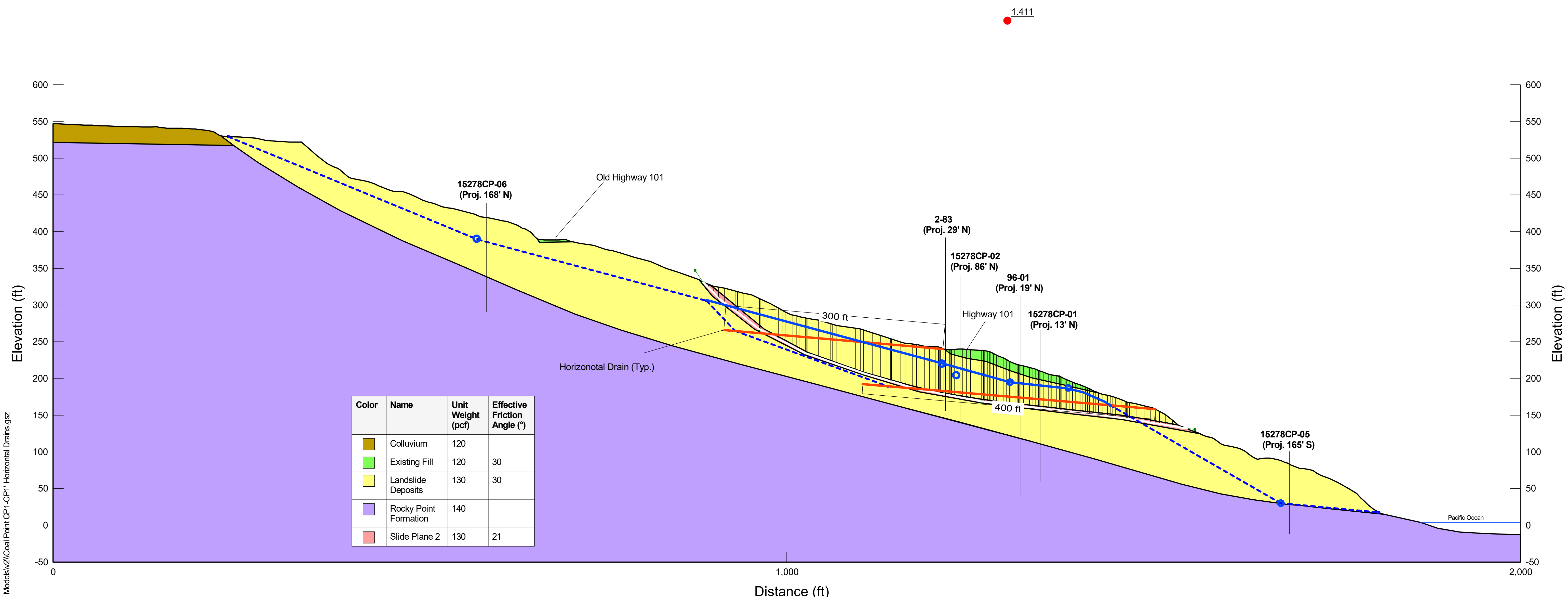
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
100% MITIGATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C6



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 2	130	21

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

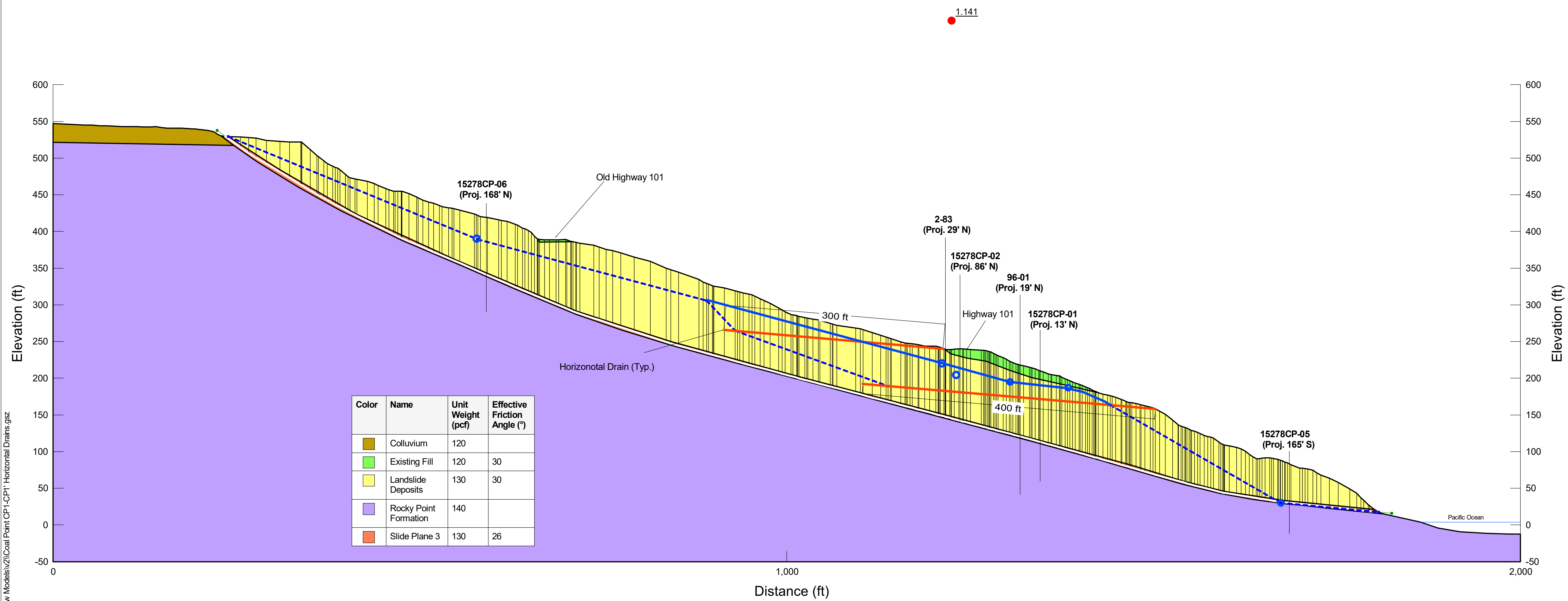
GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
100% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C7

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Horizontal Drains.gsz



NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

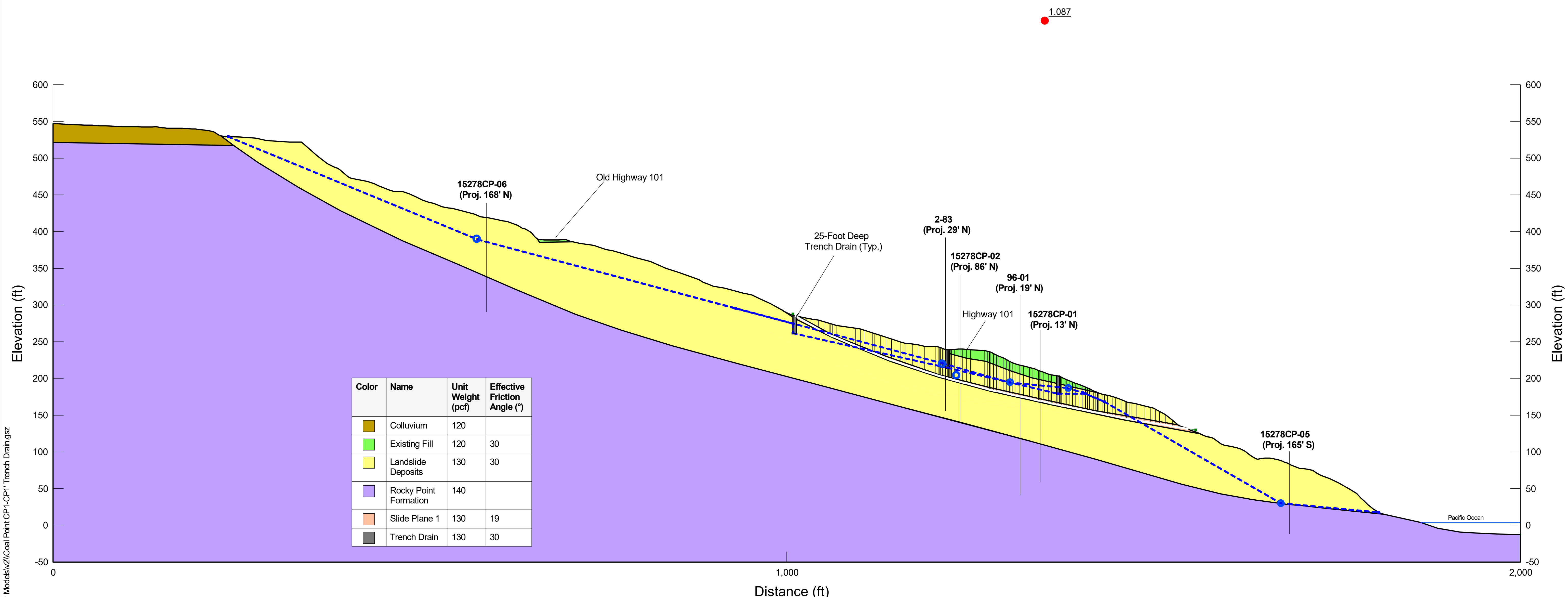
GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
100% MITIGATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C8

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Horizontal Drains.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 1	130	19
	Trench Drain	130	30

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Trench Drain.gsz

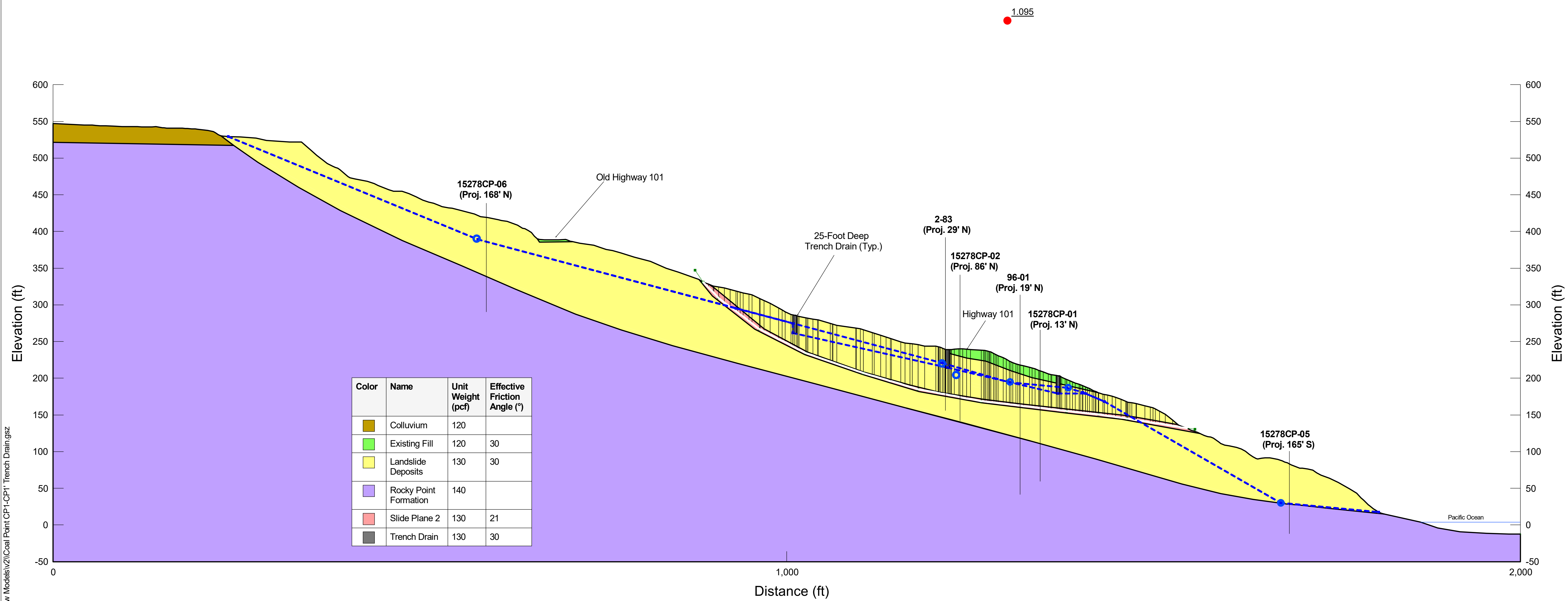
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C9



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 2	130	21
	Trench Drain	130	30

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

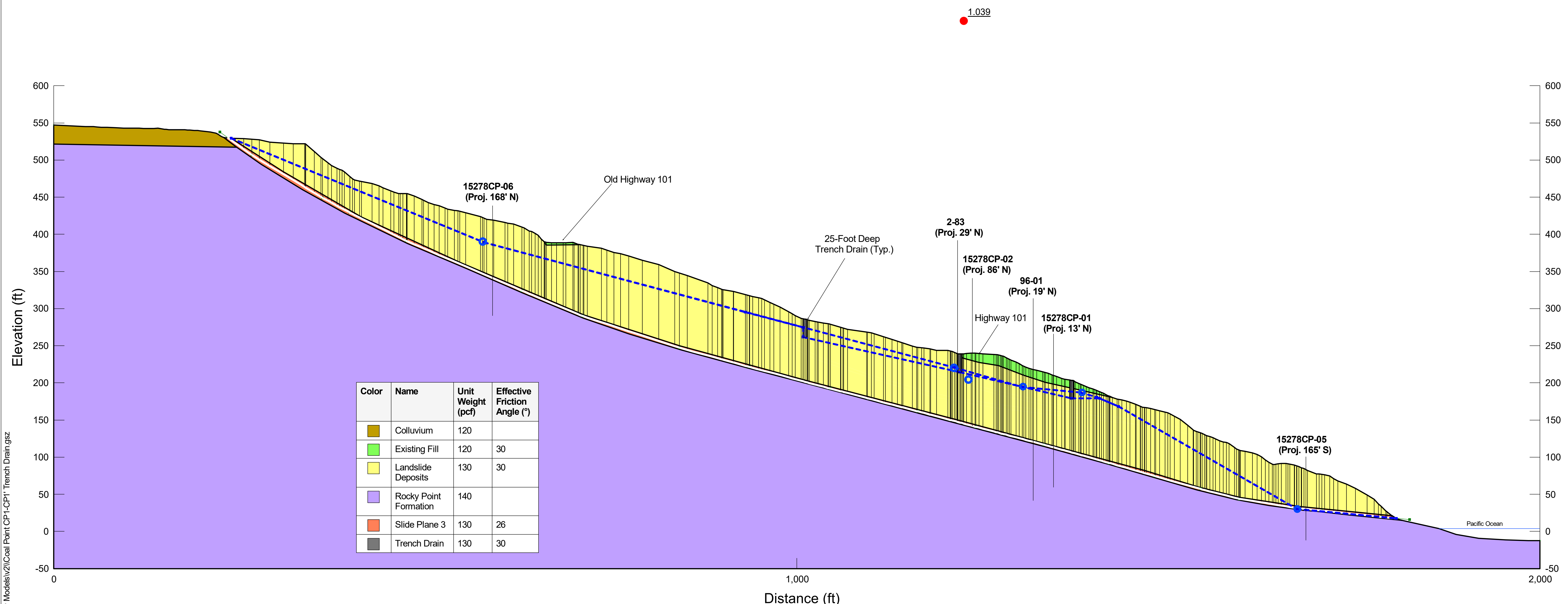
GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C10

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Trench Drain.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Colluvium	120	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Rocky Point Formation	140	
	Slide Plane 3	130	26
	Trench Drain	130	30

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Coal Point CP1-CP1' Trench Drain.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

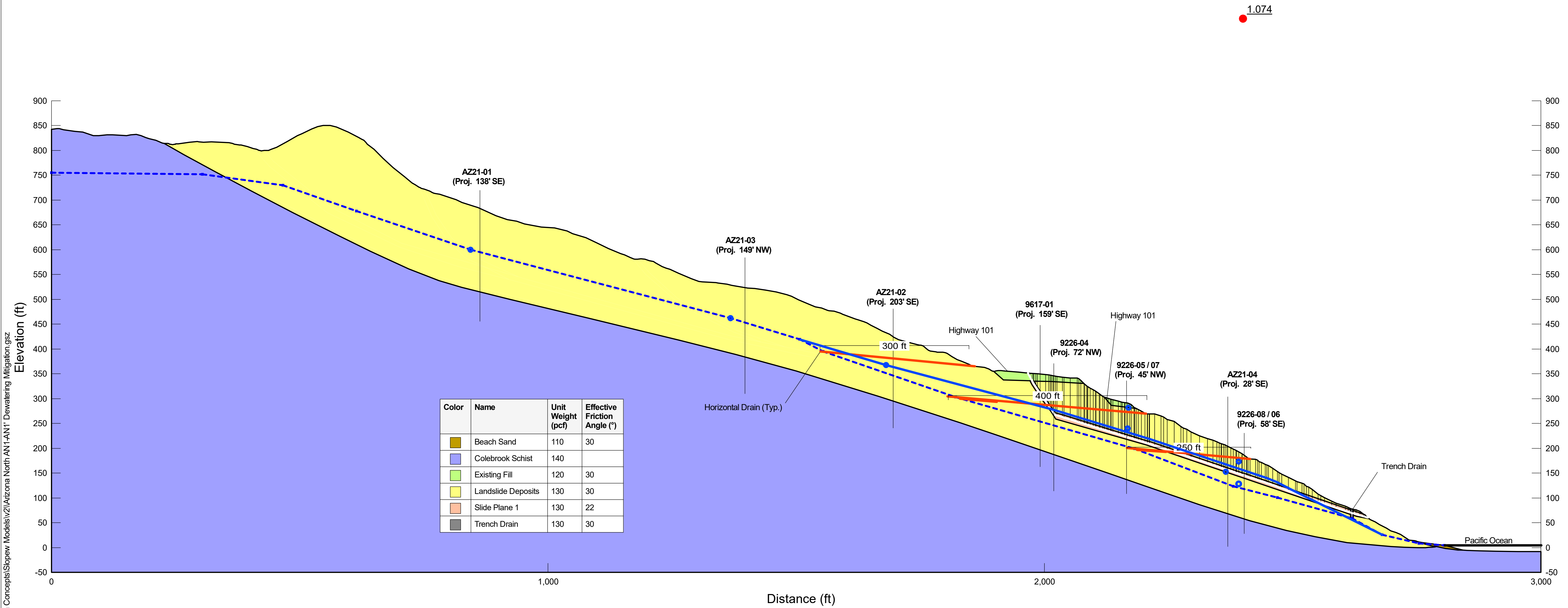
GLOBAL STABILITY ANALYSIS
COAL POINT CP1-CP1'
MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C11

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona North AN1-AN1' Dewatering Mitigation.gsz



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 1	130	22
	Trench Drain	130	30

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

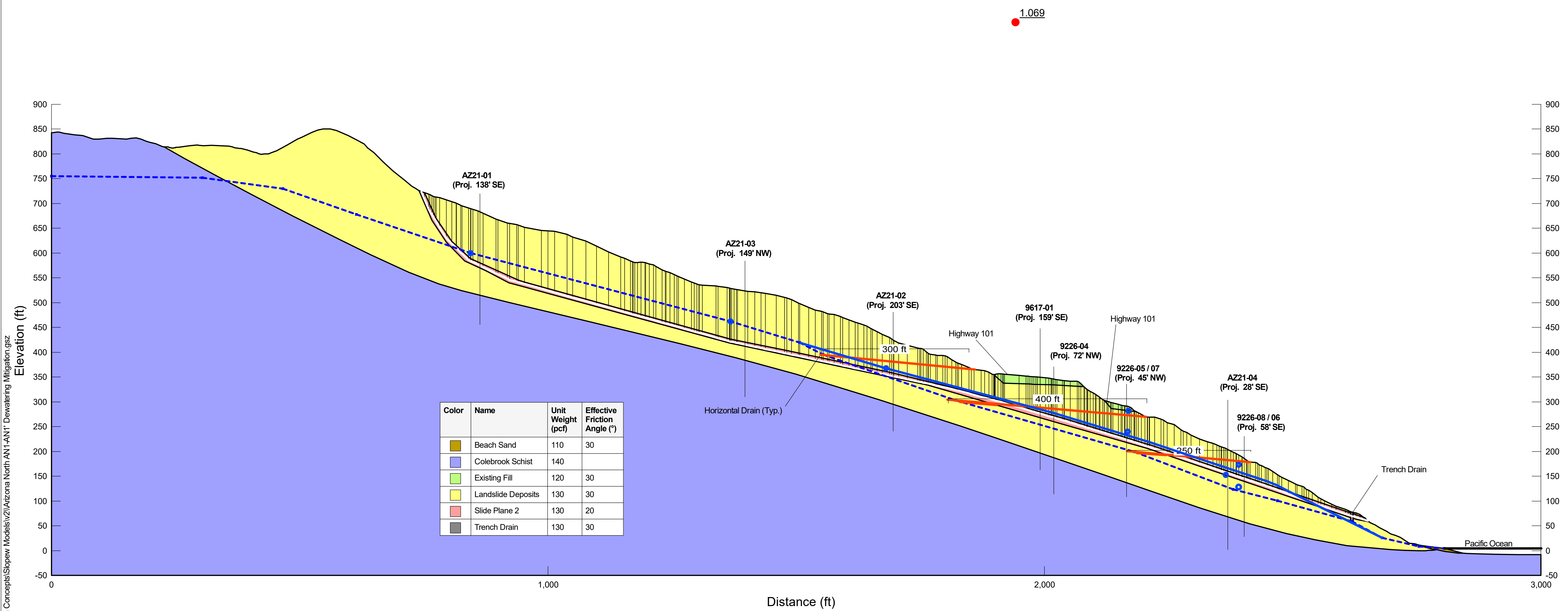
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1'
100% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C12



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 2	130	20
	Trench Drain	130	30

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona North AN1-AN1' Dewatering Mitigation.gsz

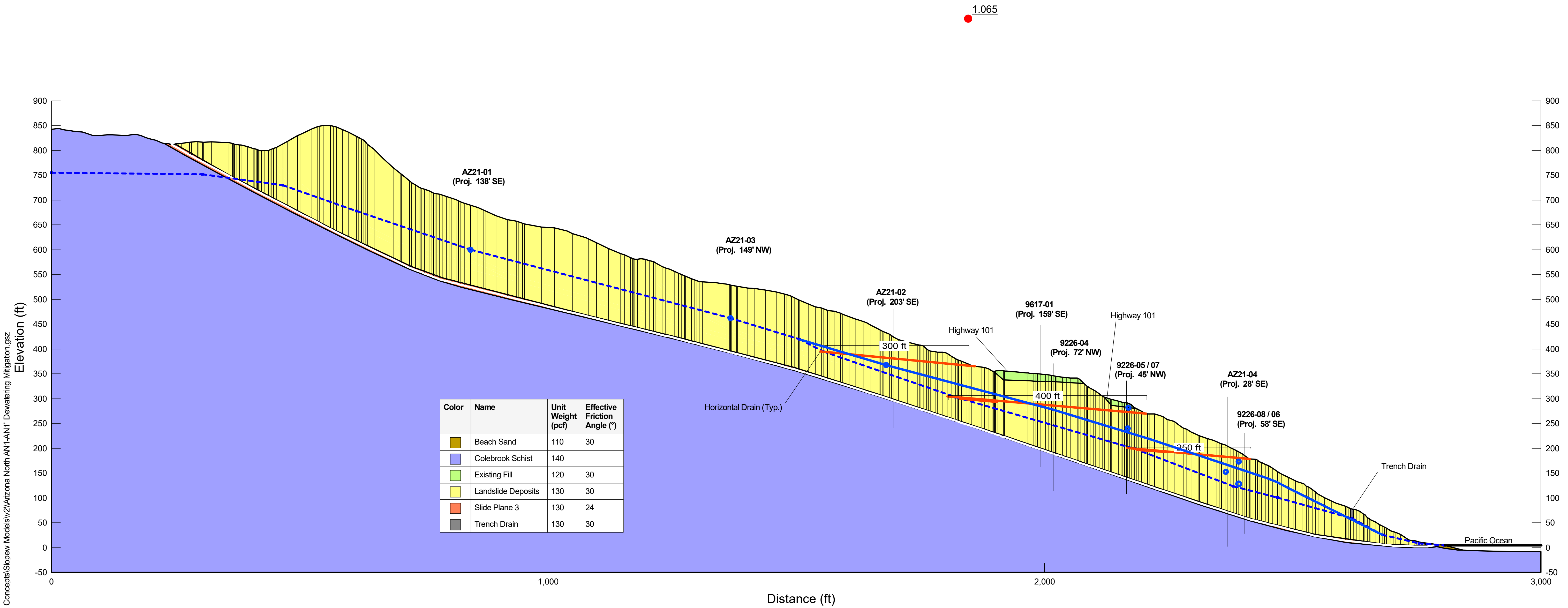
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1'
100% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C13



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 3	130	24
	Trench Drain	130	30

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona North AN1-AN1' Dewatering Mitigation.gsz

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

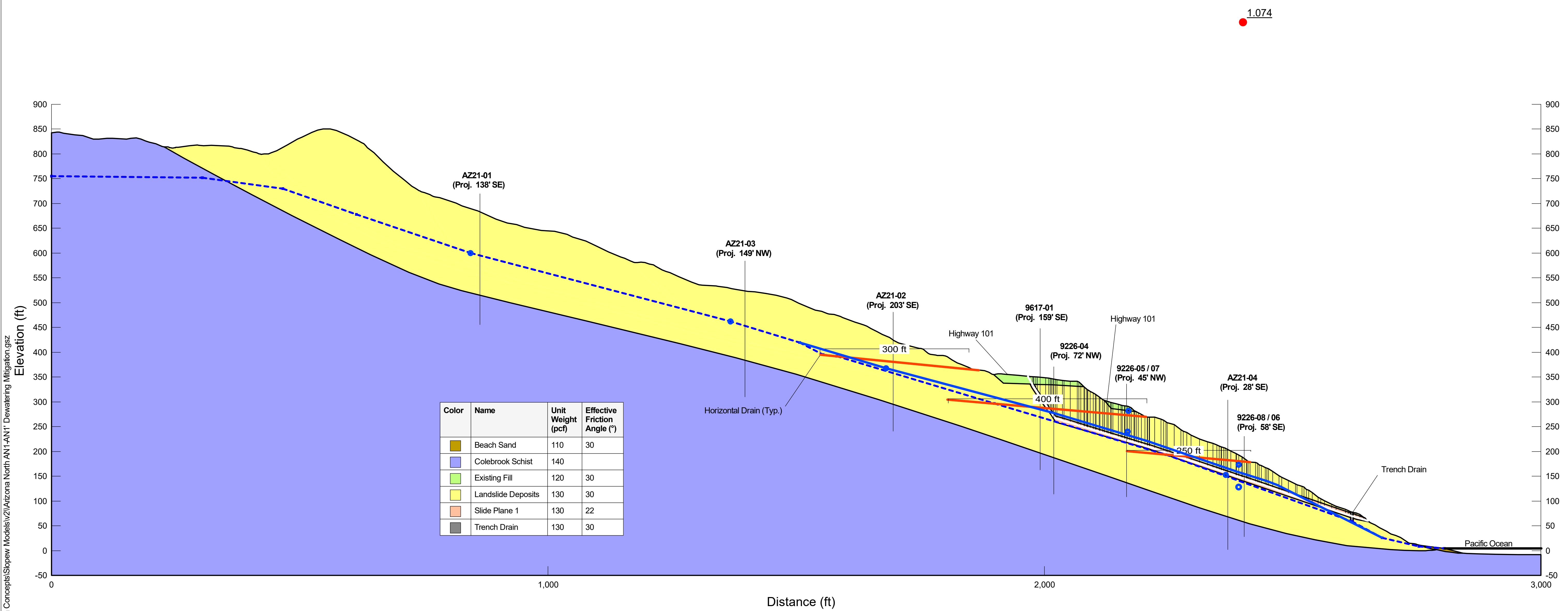
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1'
100% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C14



I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona North AN1-AN1' Dewatering Mitigation.gsz

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

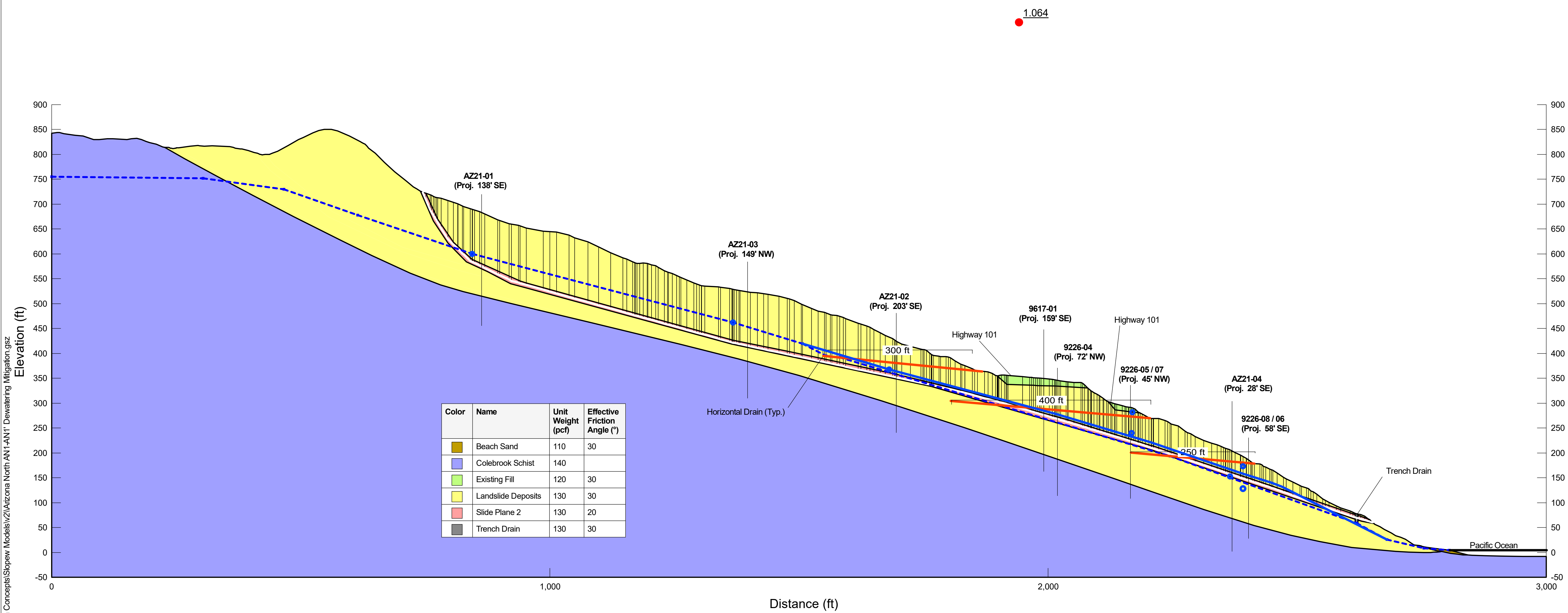
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1'
50% MITIGATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C15



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 2	130	20
	Trench Drain	130	30

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona North AN1-AN1' Dewatering Mitigation.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

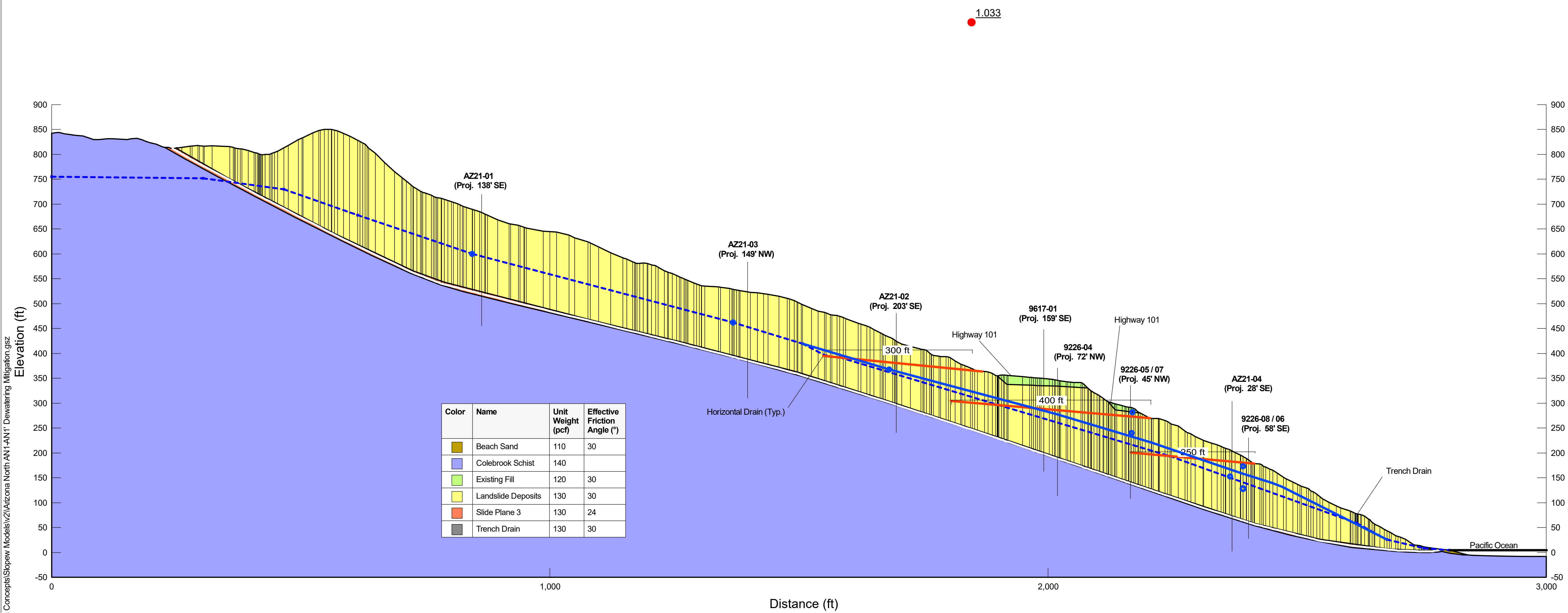
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1'
50% MITIGATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C16



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Colebrook Schist	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 3	130	24
	Trench Drain	130	30

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona North AN1-AN1' Dewatering Mitigation.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

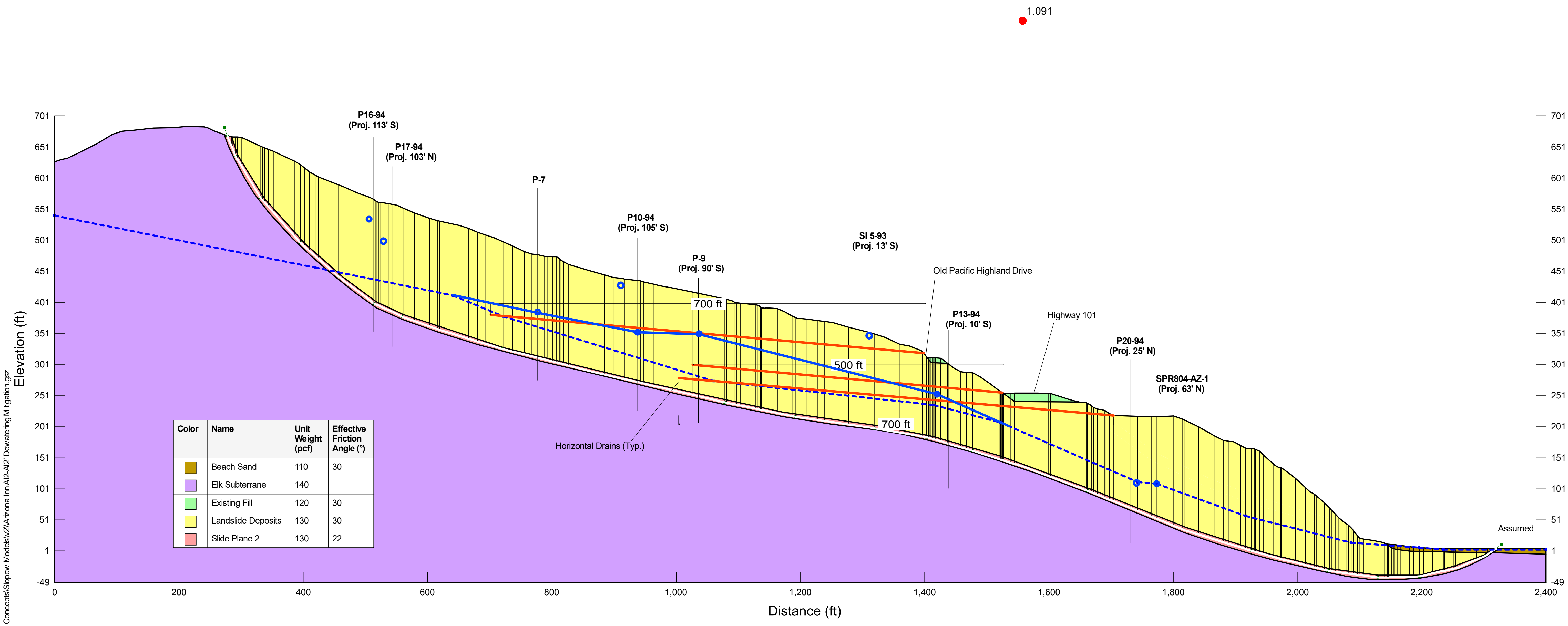
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA NORTH AN1-AN1'
50% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C17



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Elk Subterrane	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 2	130	22

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona Inn AI2-AI2' Dewatering Mitigation.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

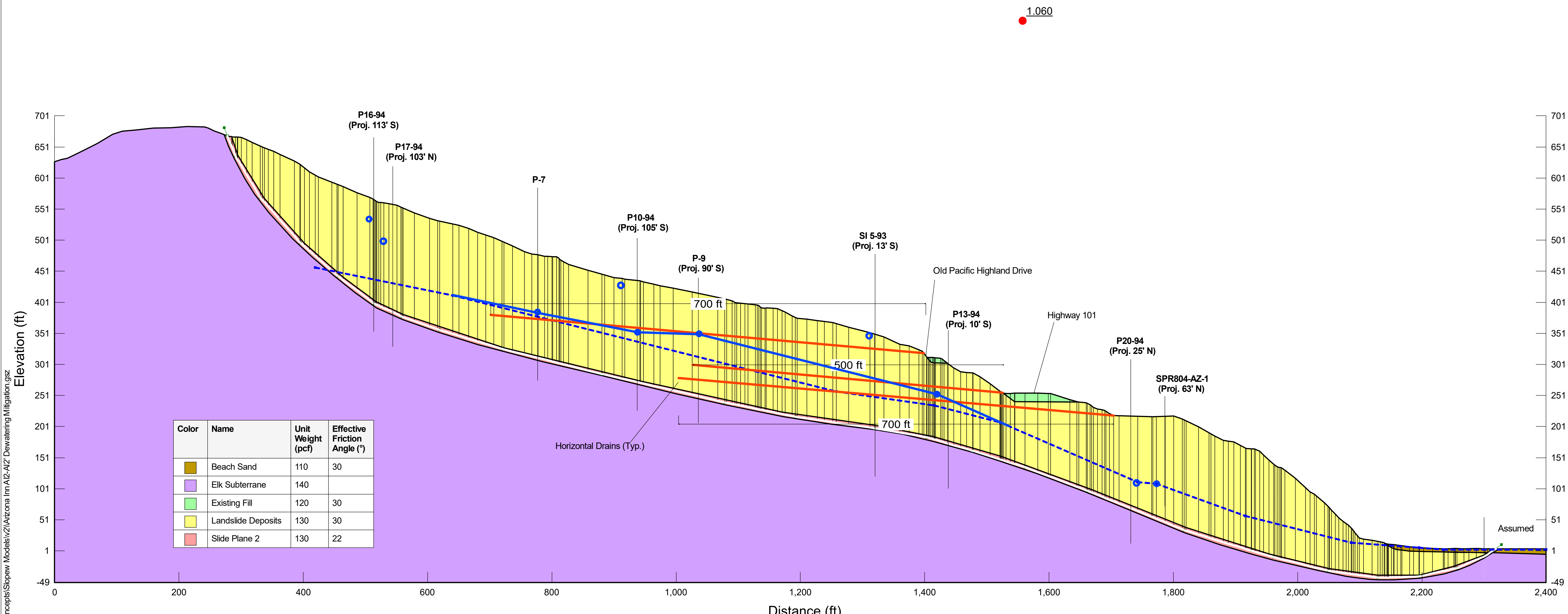
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA INN AI2-AI2'
100% MITIGATION ANALYSIS

April 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C18



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Elk Subterrane	140	
	Existing Fill	120	30
	Landslide Deposits	130	30
	Slide Plane 2	130	22

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\v2\Arizona Inn AI2-AI2' Dewatering Mitigation.gsz

NOTES

1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

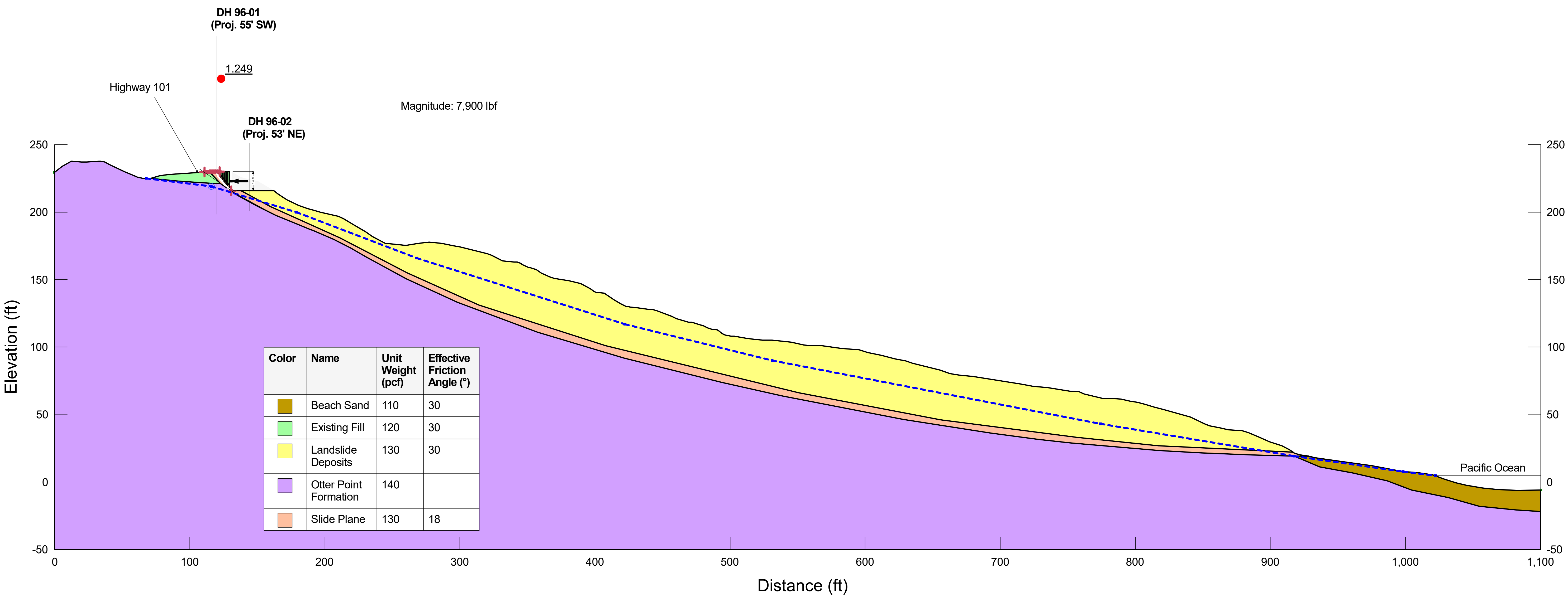
South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
ARIZONA INN AI2-AI2'
50% MITIGATION ANALYSIS

April 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C19



Color	Name	Unit Weight (pcf)	Effective Friction Angle (°)
	Beach Sand	110	30
	Existing Fill	120	30
	Landslide Deposits	130	30
	Otter Point Formation	140	
	Slide Plane	130	18

NOTES
1. Failure surface estimated using the fully specified surface criteria and the Morgenstern and Price (1965) analysis method.

South Coast Landslide Study
Curry County, Oregon

GLOBAL STABILITY ANALYSIS
CHRISTMAS TREE CT1-CT1'
SOLDIER PILE WALL ANALYSIS

April 2022 106381

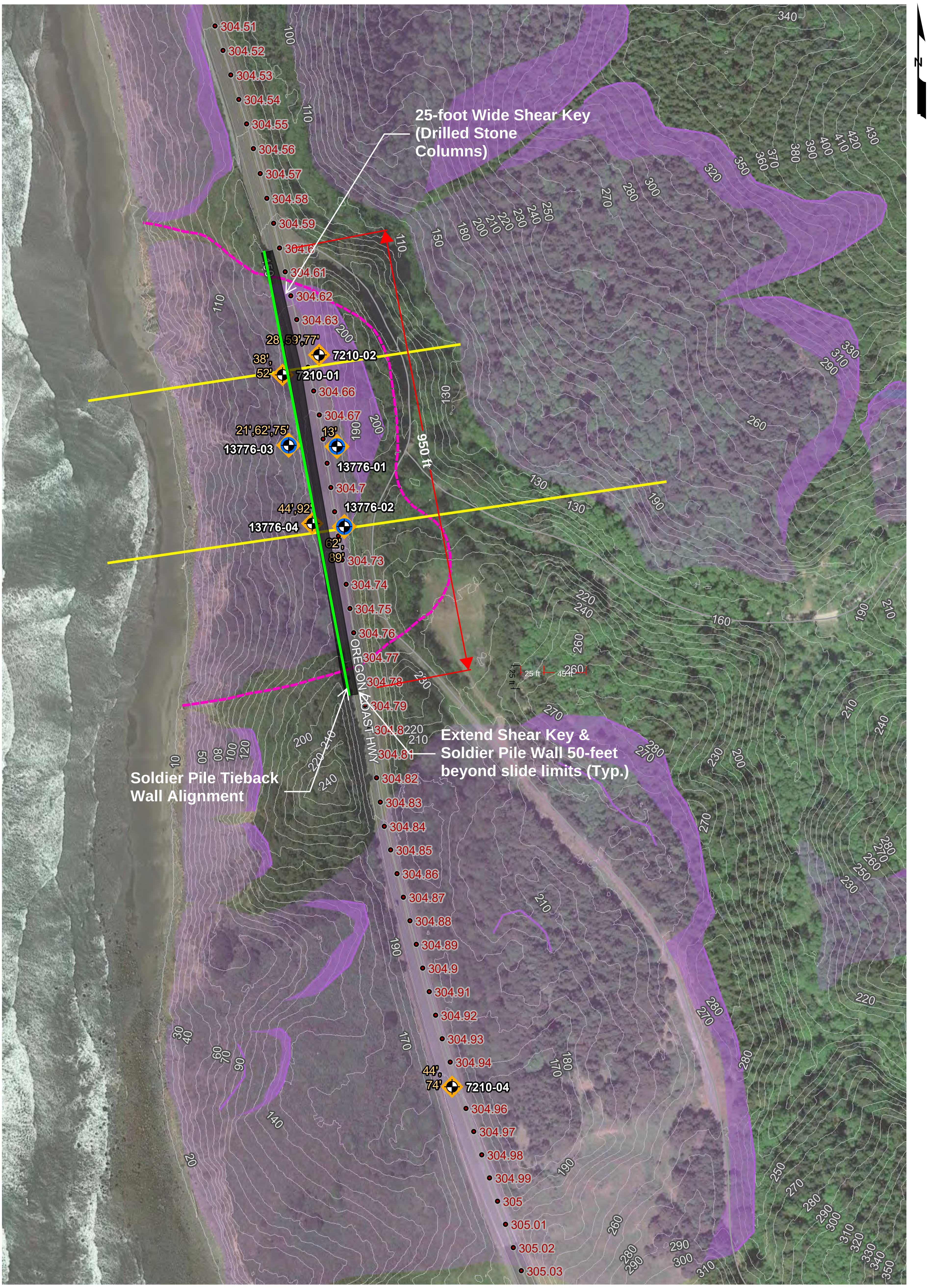
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. C20

I:\EF\PDX\106000s\106381 ODOT R3 South C\Analysis\Mitigation Concepts\Slopew Models\Christmas Tree CT1-CT1' Soldier Pile Mitigation.gsz

ATTACHMENT D

LANDSLIDE MITIGATION CONCEPT PLANS



LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

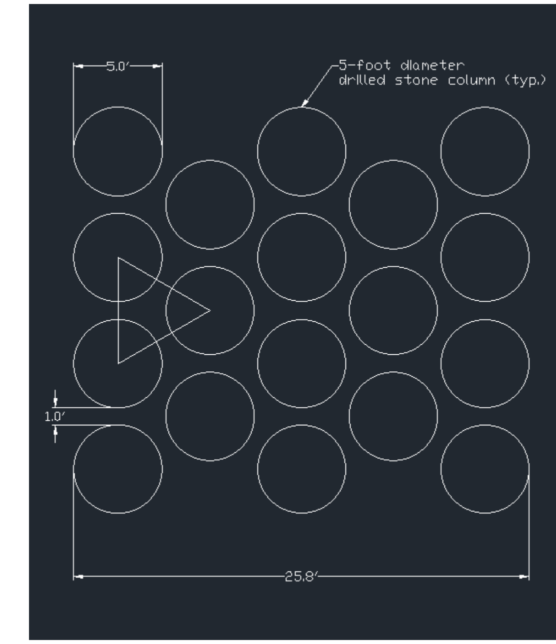
SITE AND EXPLORATION PLAN
RETZ CREEK SOUTH

April 2022 106381

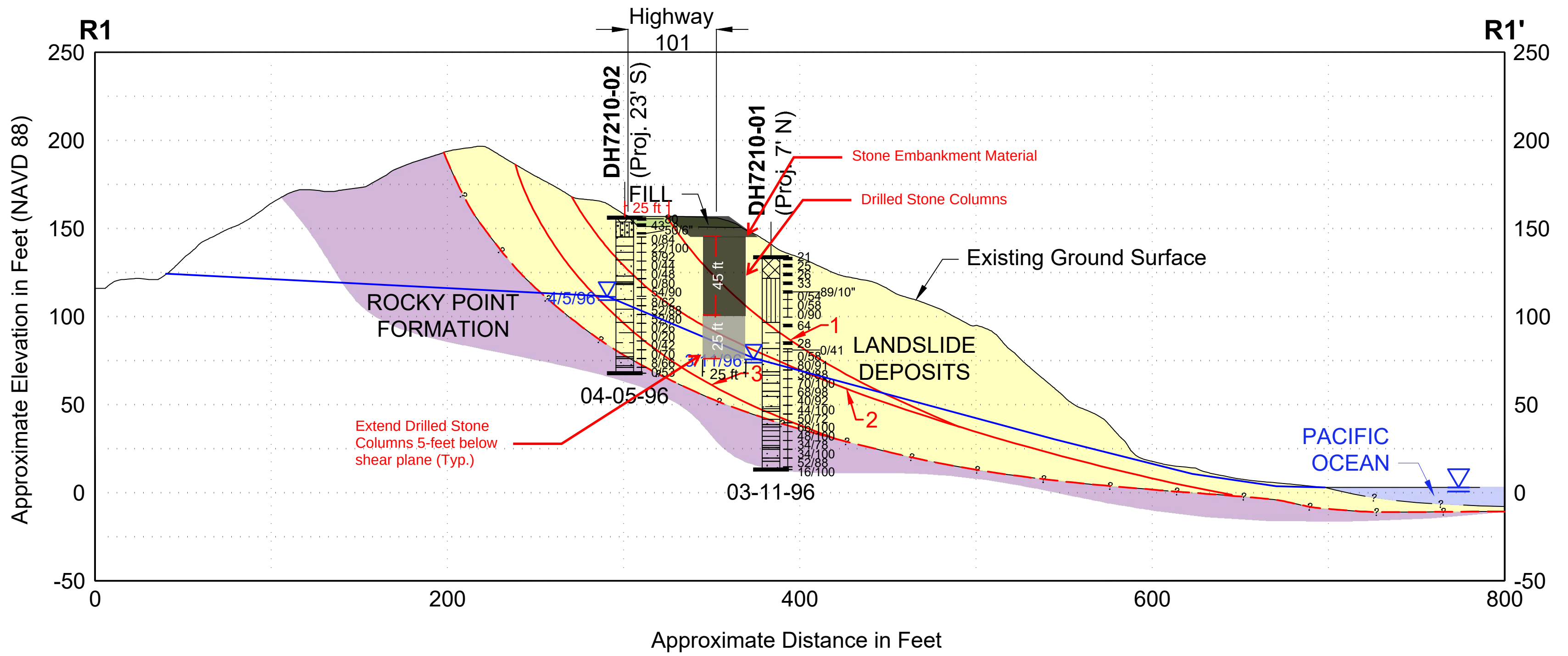
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D1

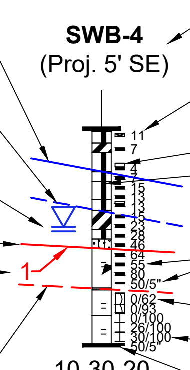
FIG. 1



5-foot diameter columns spaced 1-foot apart in equilateral triangle pattern



LEGEND



- Assumed Existing High Groundwater Level
- Anticipated Post-Mitigation Groundwater Level
- Highest Measured Groundwater Level (See Note 5)
- Shear Plane Based on Inclinometer Data
- Shear Plane Number
- Interpreted/Potential Shear Plane Based on Site Reconnaissance and/or LiDAR/InSAR Data
- Designation and Projection of Boring to Cross Section Line
- Oversized Sample and Penetration Resistance in Blows/Foot or Blows/Inches Driven
- Shelby Tube Sample
- Soil or Rock Type Symbol
- SPT Sample and Penetration Resistance in Blows/Foot or Blows/Inches Driven
- Sonic Core Sample with Core RQD/Recovery
- Core Sample with Core RQD/Recovery
- Bottom of Boring
- Date of Completion

0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A1 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

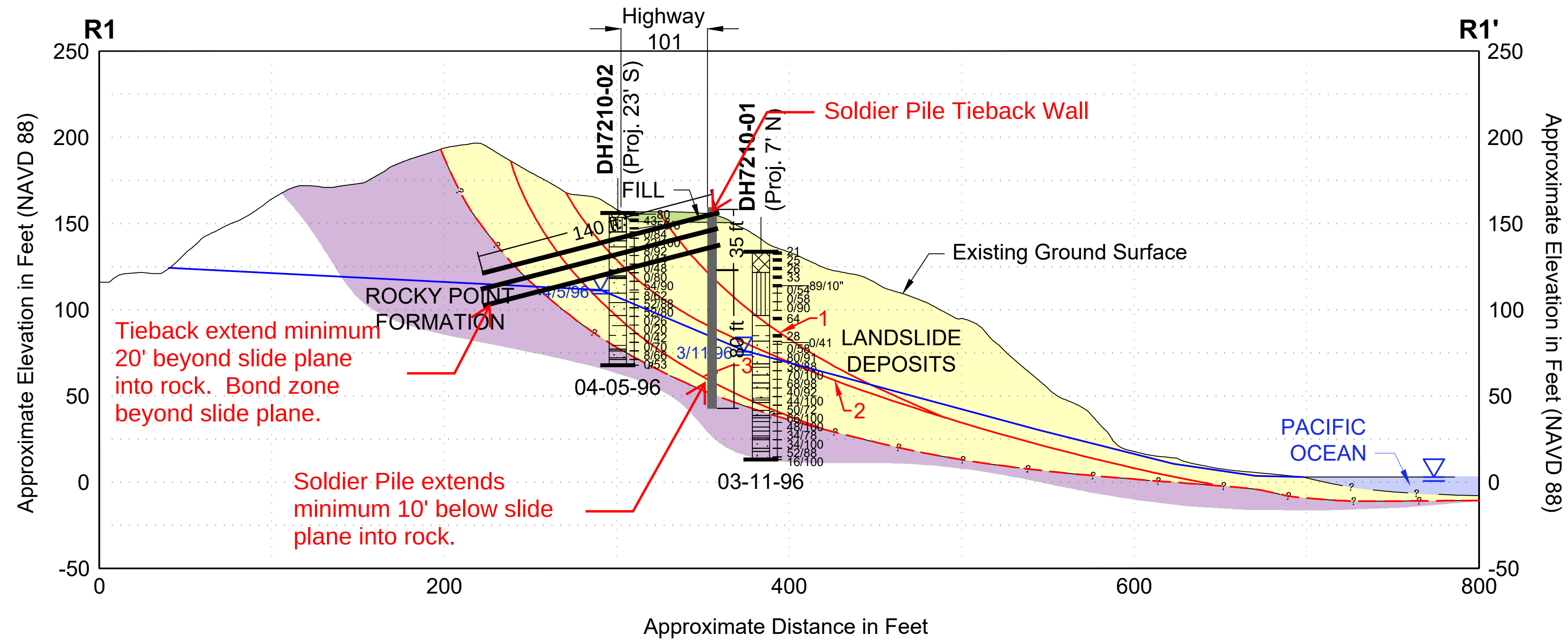
South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION R1-R1' RETZ CREEK SOUTH

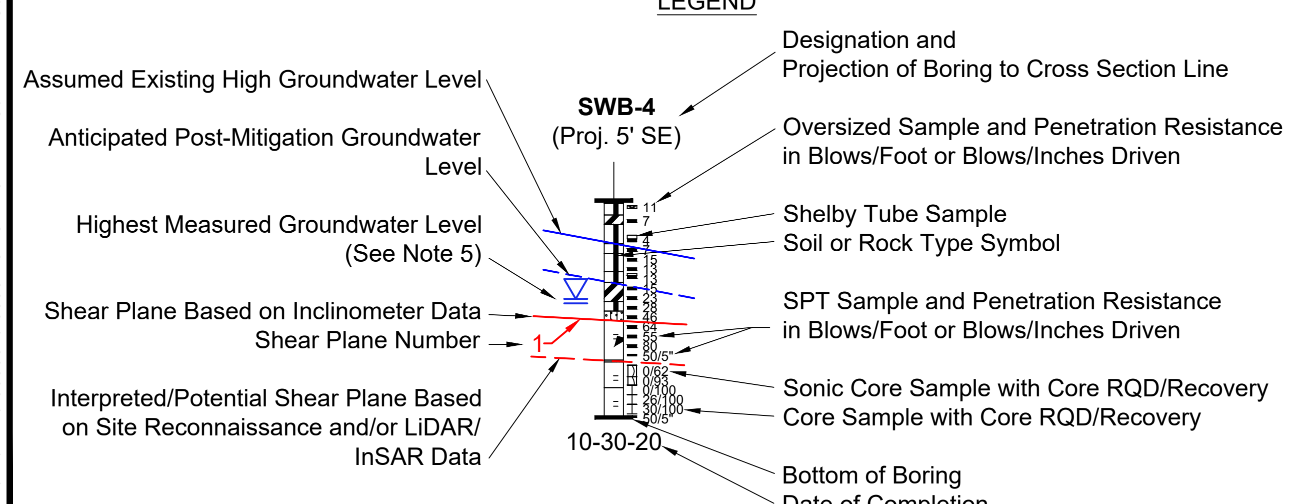
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D2



LEGEND



0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A1 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION R1-R1' RETZ CREEK SOUTH

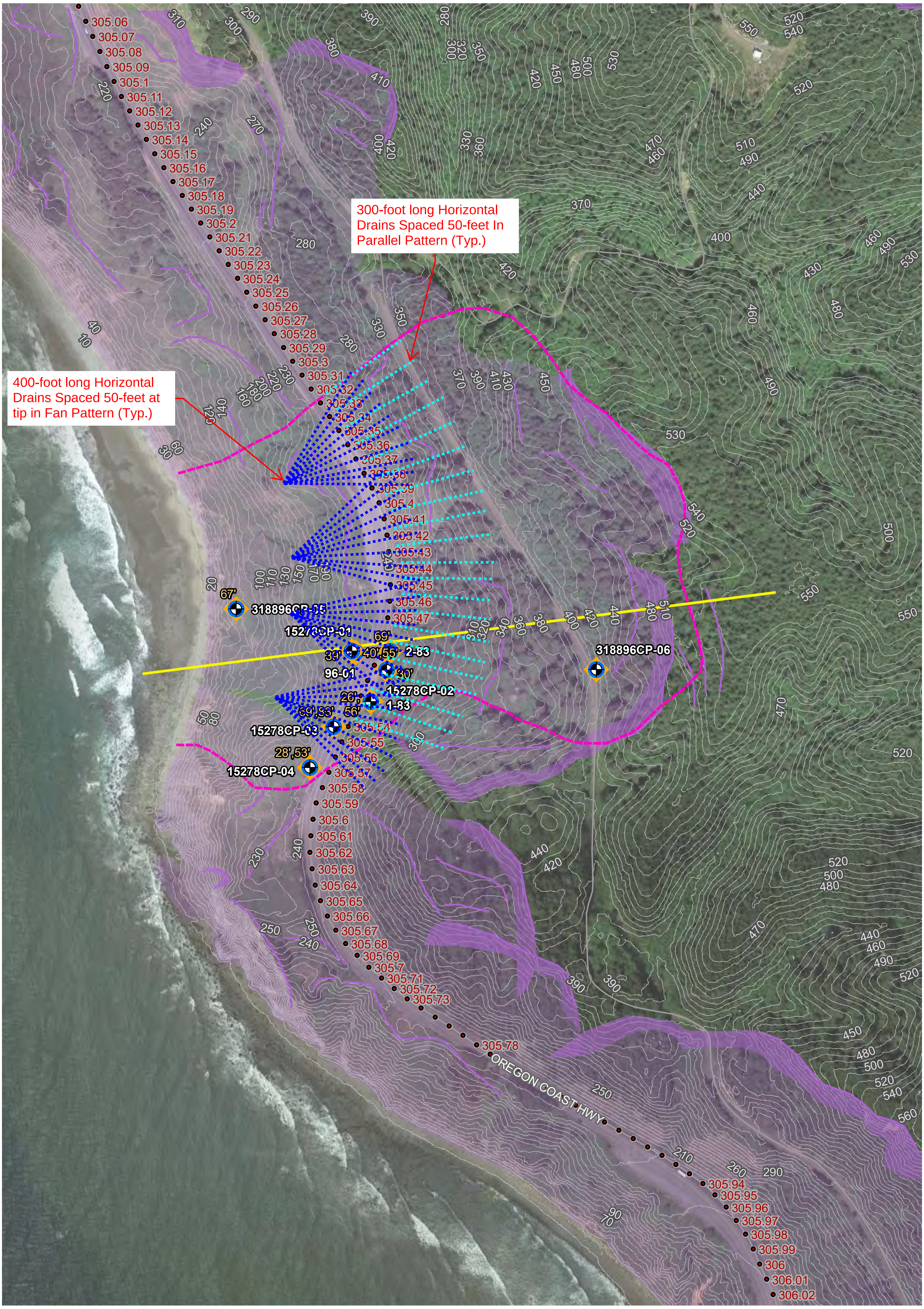
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D3

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan2Coal_10.7.mxd   Date: 3/24/2022   Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

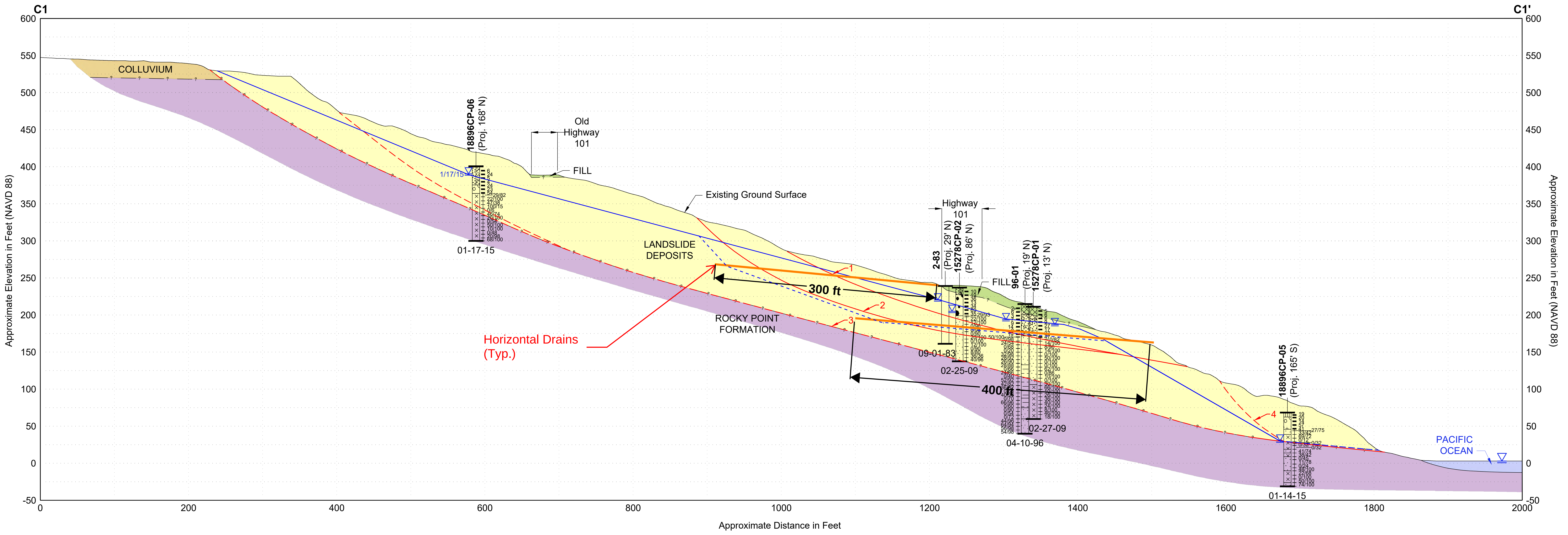
SITE AND EXPLORATION PLAN
COAL POINT

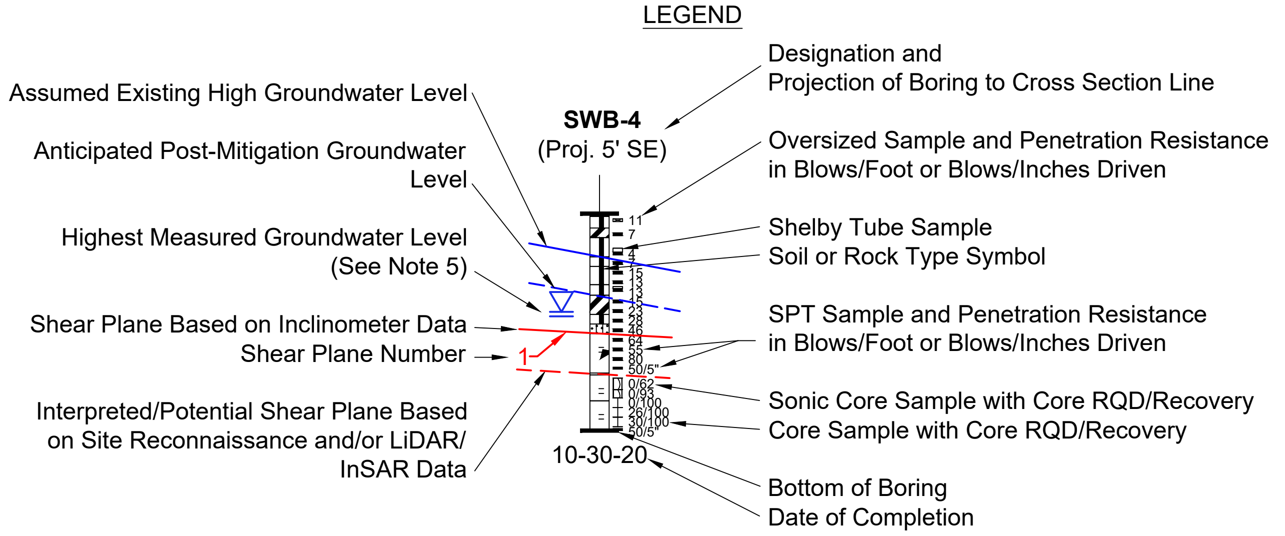
April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D4

FIG. 1





Scale in Feet: 0 – 100 – 200

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A4 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

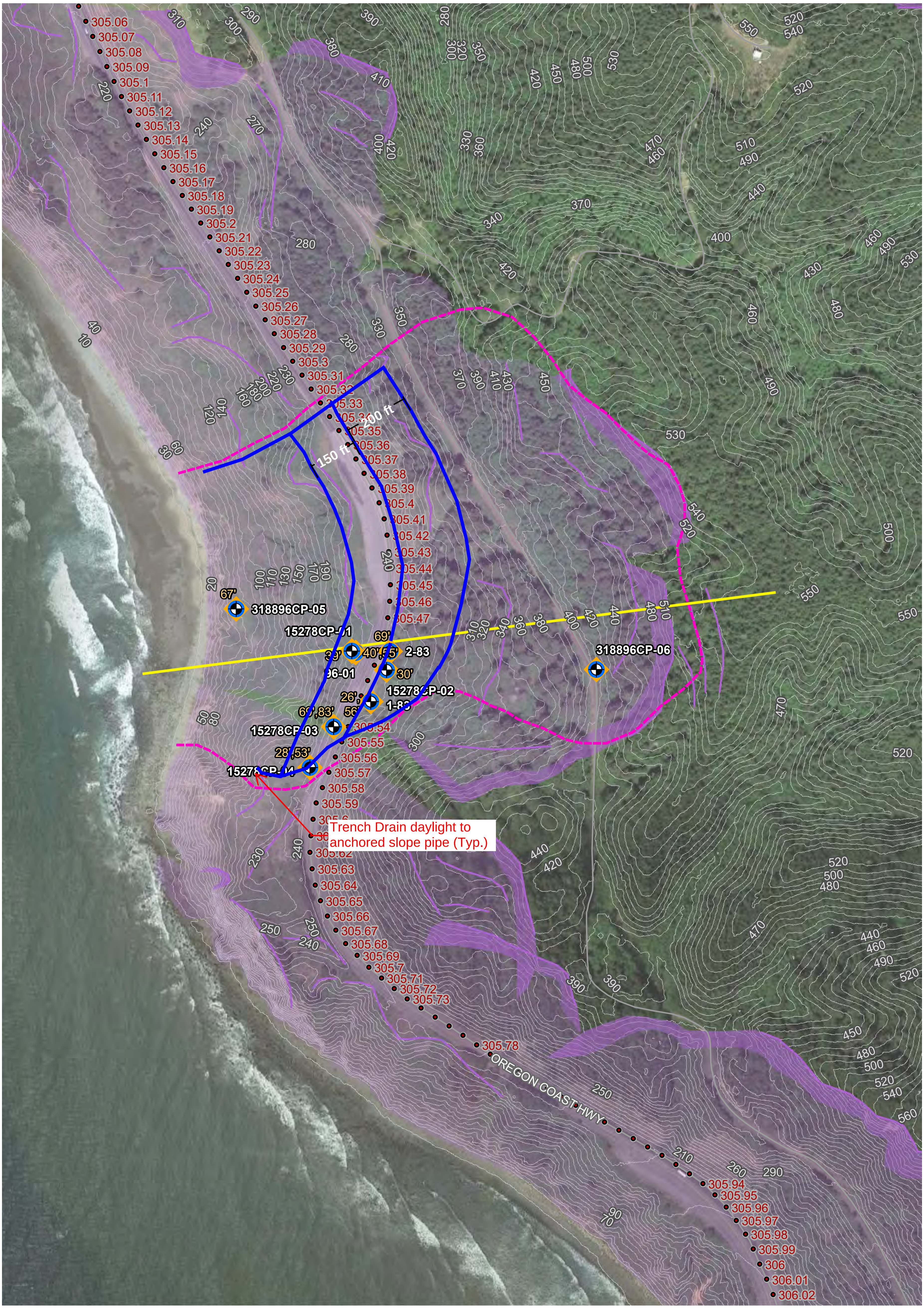
CONCEPTUAL GEOLOGIC CROSS SECTION C1-C1' COAL POINT

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D5

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND

- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

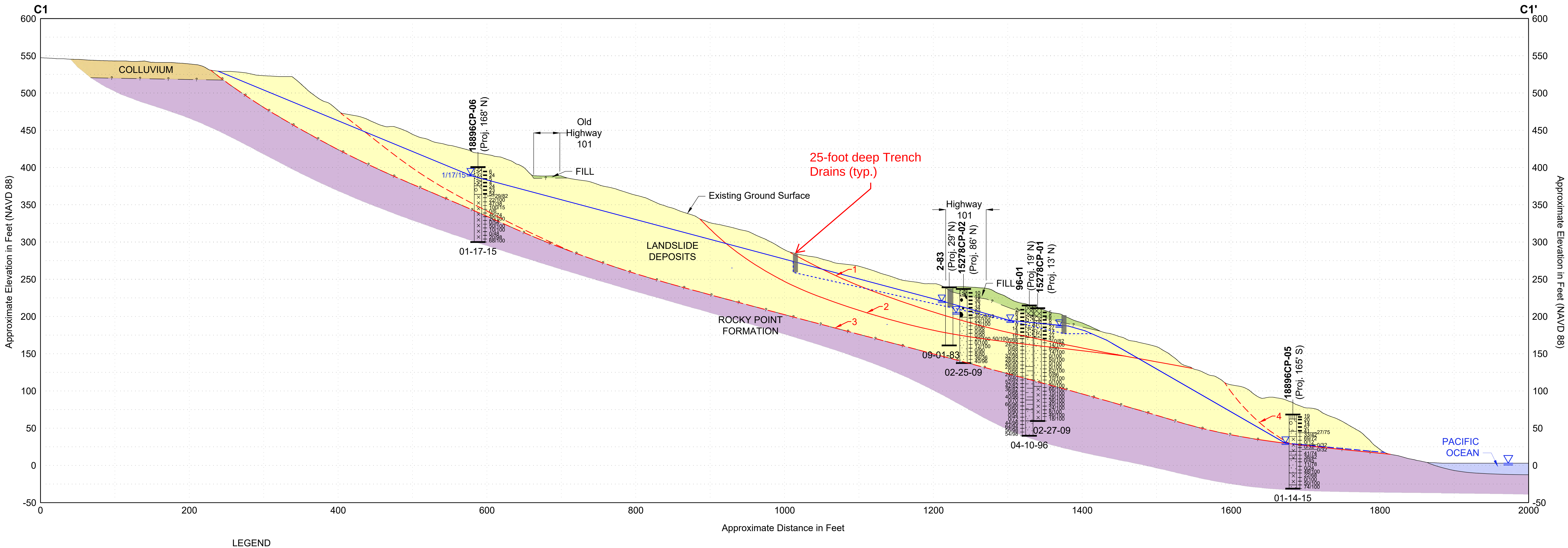
SITE AND EXPLORATION PLAN
COAL POINT

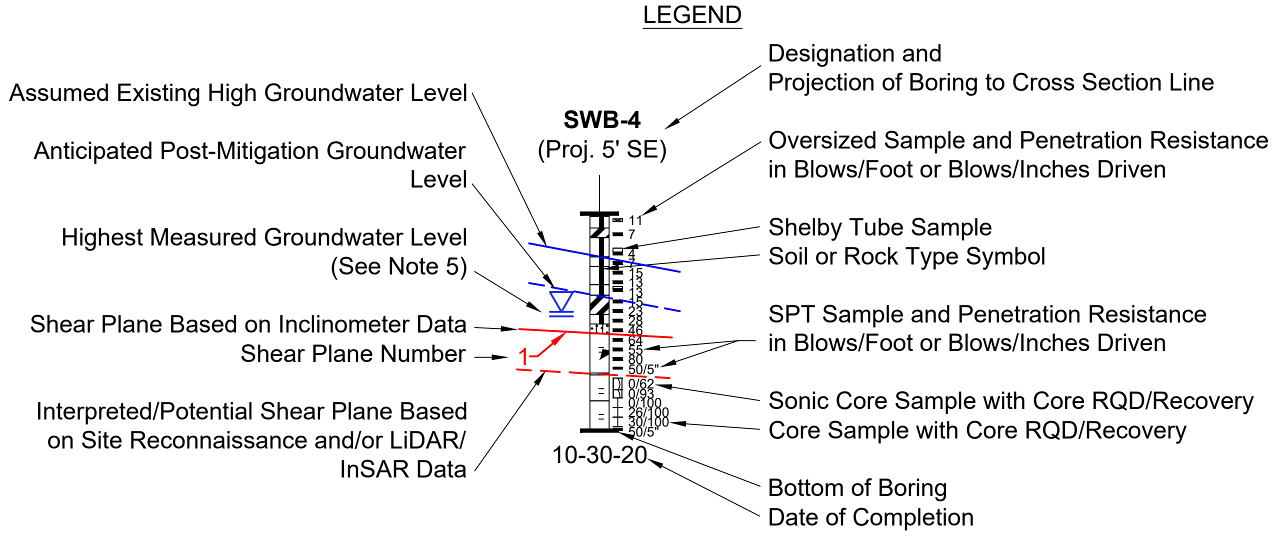
April 2022 106381

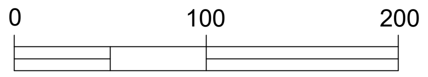
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D6

FIG. 1







No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A4 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION C1-C1' COAL POINT

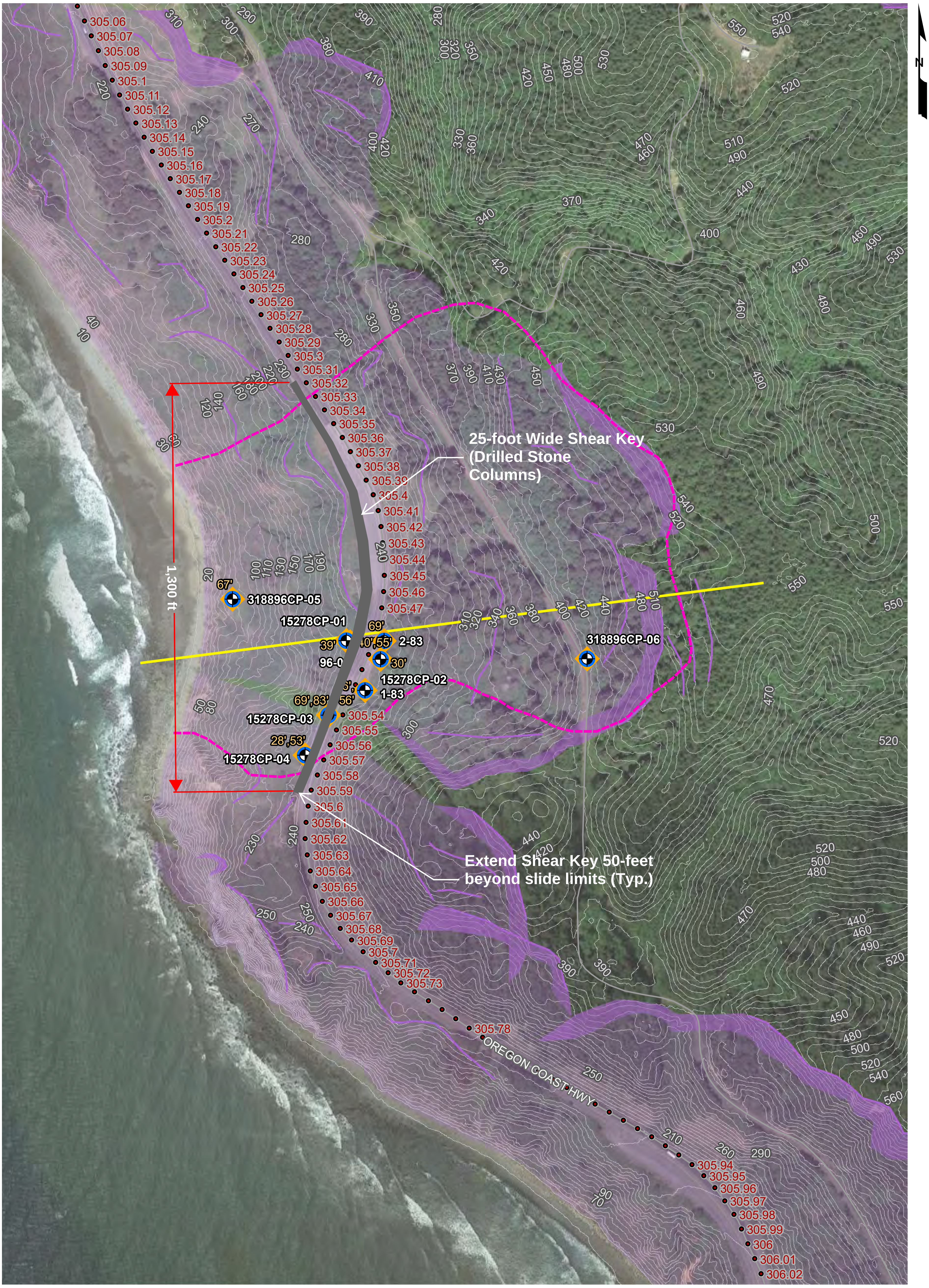
May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D7

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan2Coal_10.7.mxd   Date: 3/24/2022   Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

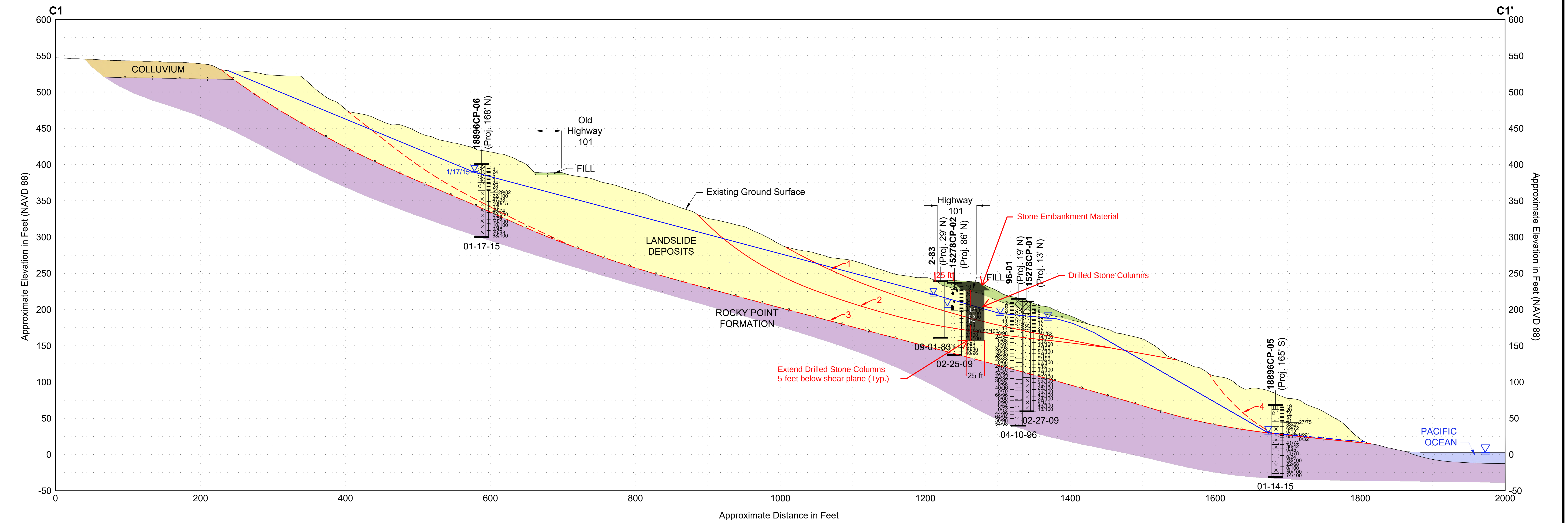
SITE AND EXPLORATION PLAN
COAL POINT

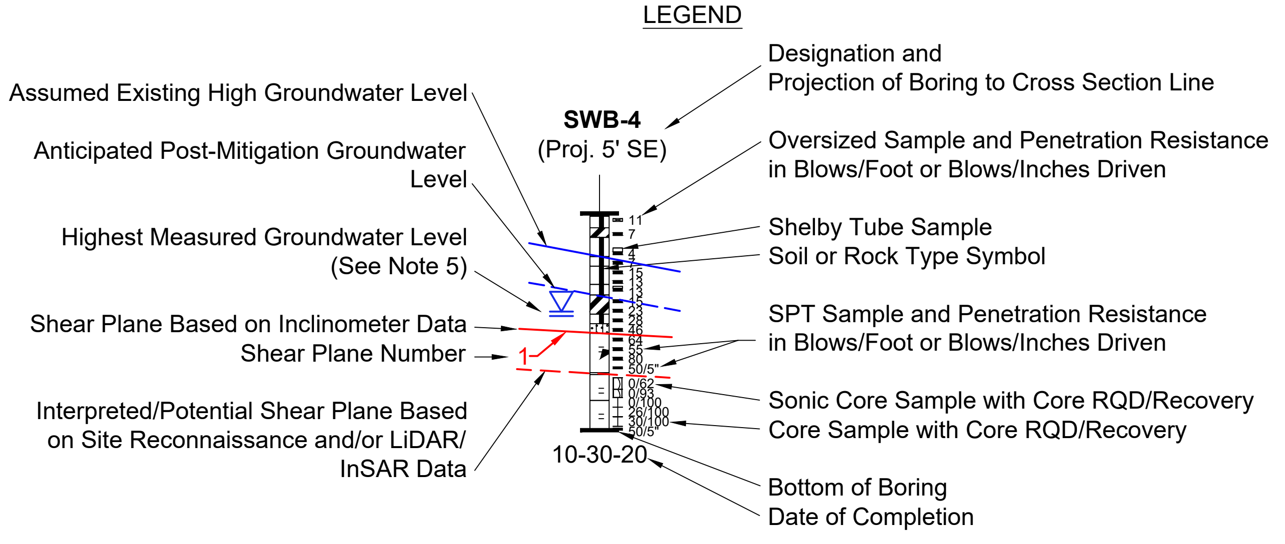
April 2022 | 106381

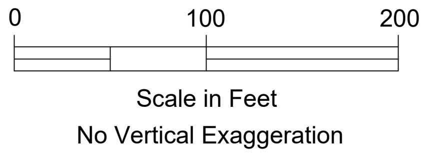
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D8

FIG. 1







NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A4 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

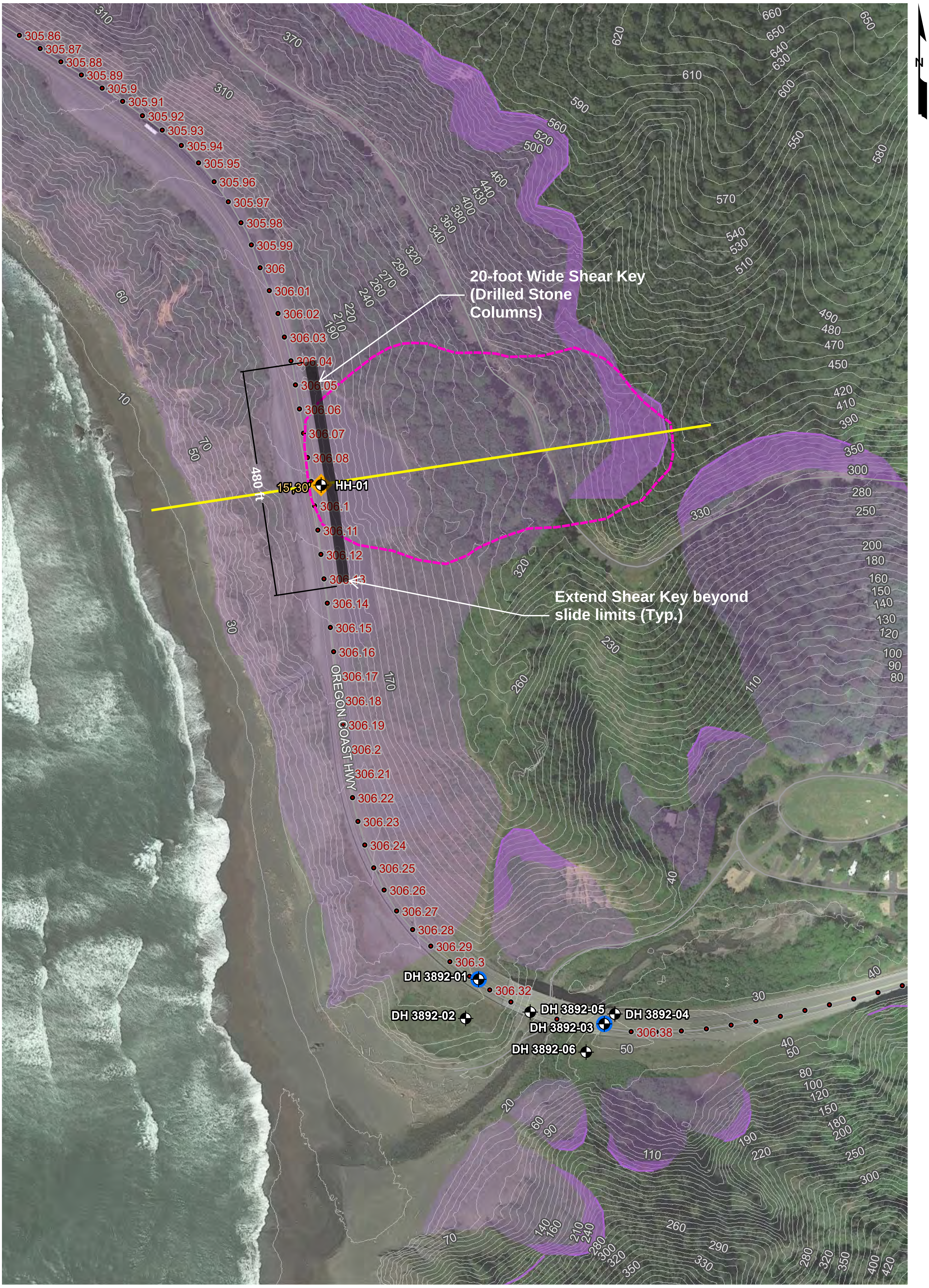
CONCEPTUAL GEOLOGIC CROSS SECTION C1-C1' COAL POINT

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D9

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan3NBrush_10.7.mxd Date: 3/24/2022 Login: AEH



LEGEND

- Approximate Location of Boring
- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- Approximate Location of Boring with Piezometer
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

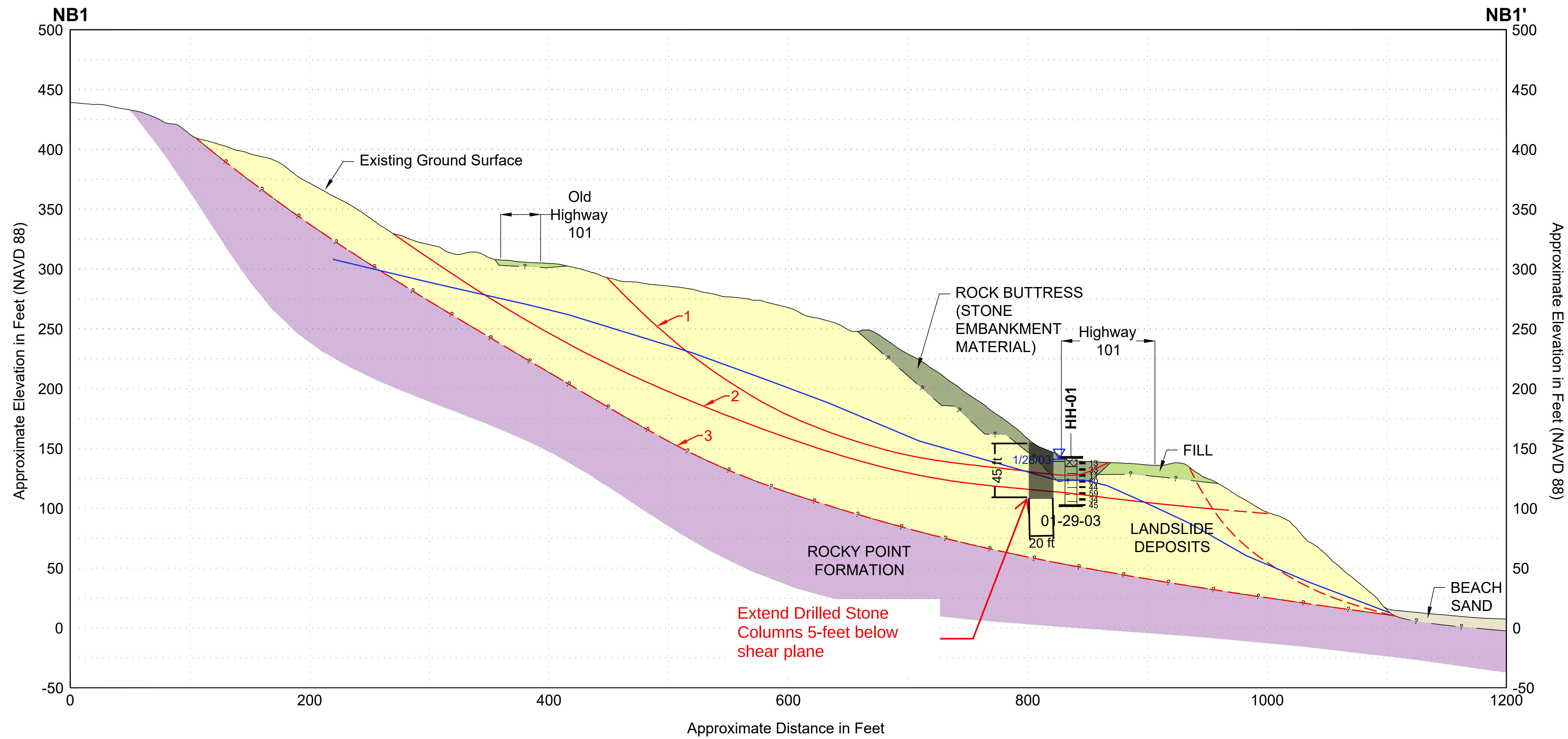
SITE AND EXPLORATION PLAN
NORTH BRUSH CREEK HUMP

April 2022 106381

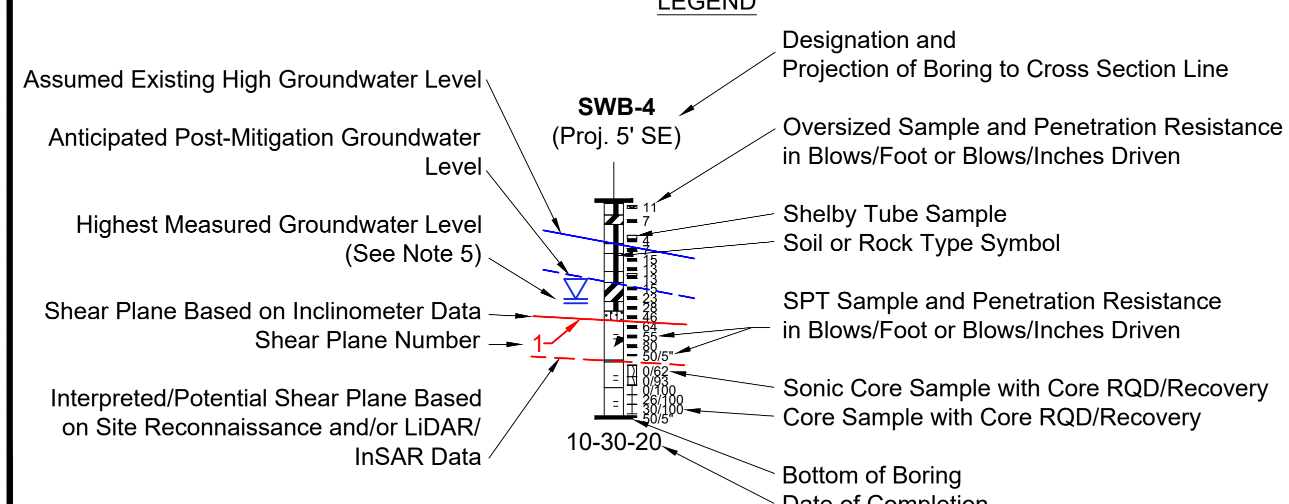
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

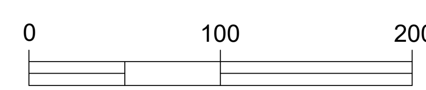
FIG. D10

FIG. 1



LEGEND





Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A6 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION NB1-NB1' NORTH BRUSH CREEK HUMP

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D11

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan4Brush_10.7.mxd Date: 3/24/2022 Login: AEH

LEGEND

- Approximate Location of Boring
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

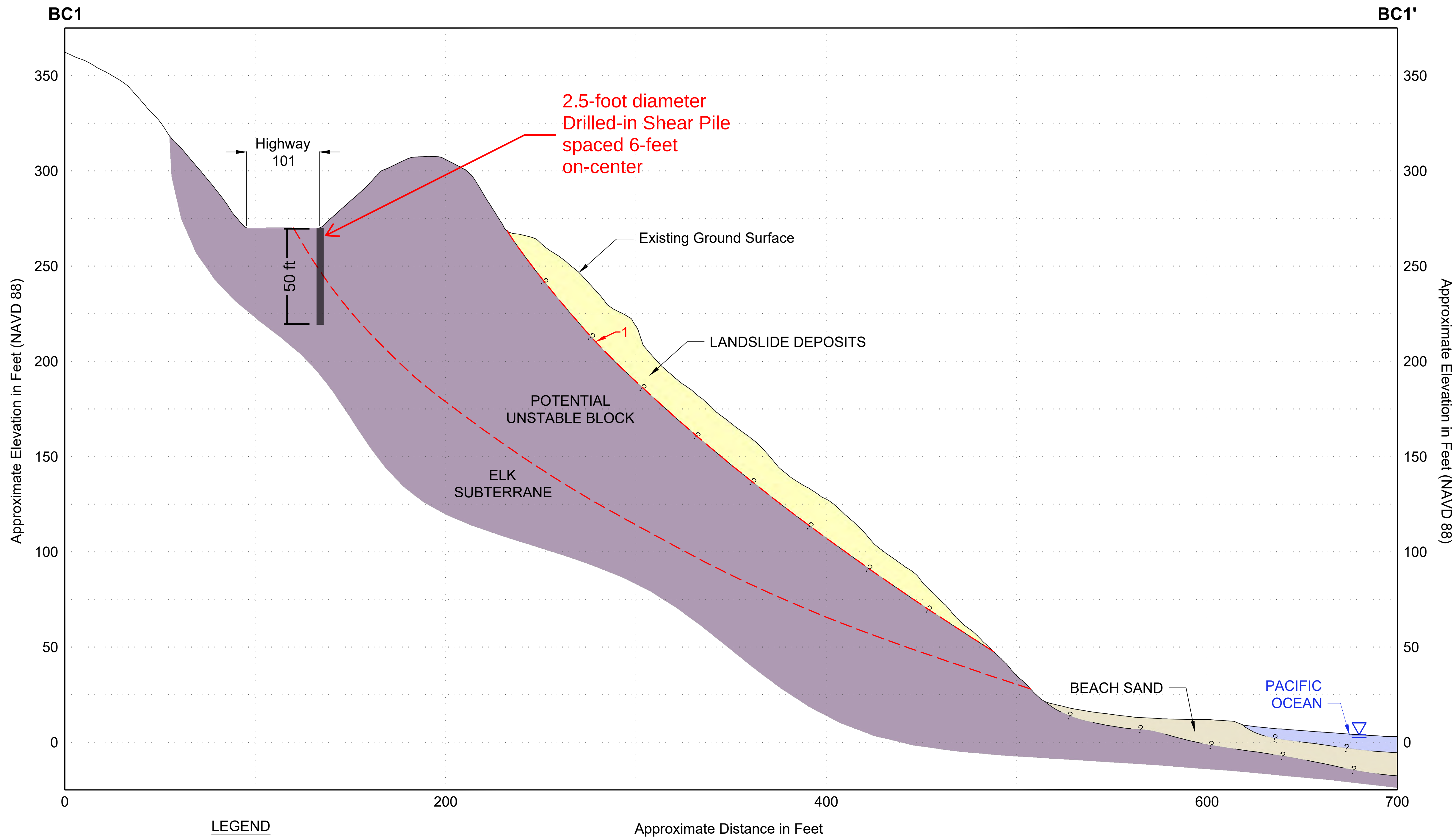
SITE AND EXPLORATION PLAN
BRUSH CREEK

April 2022 106381

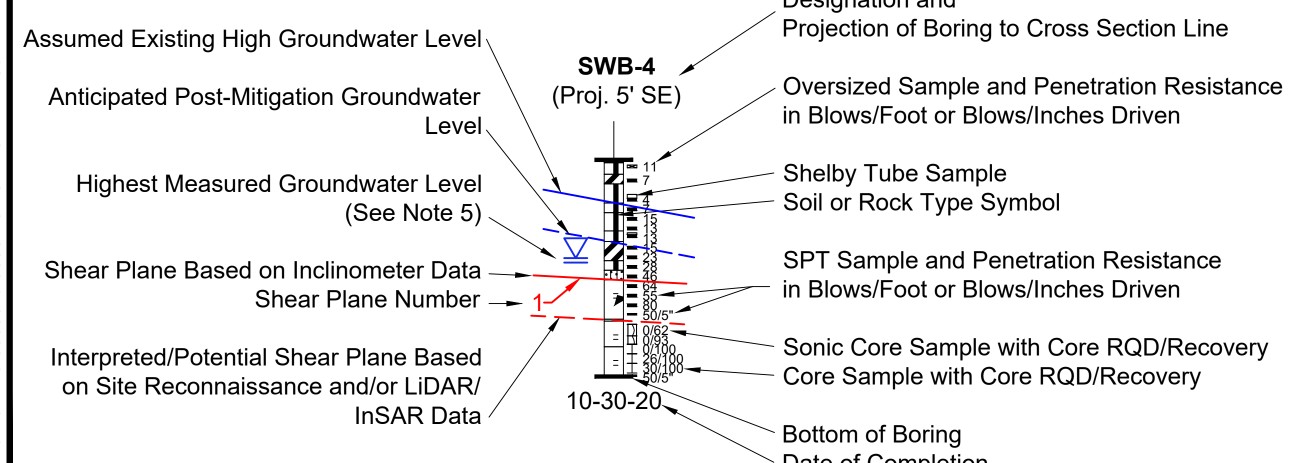
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D12

FIG. 1



LEGEND



0 60 120

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A8 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION BC1-BC1' BRUSH CREEK

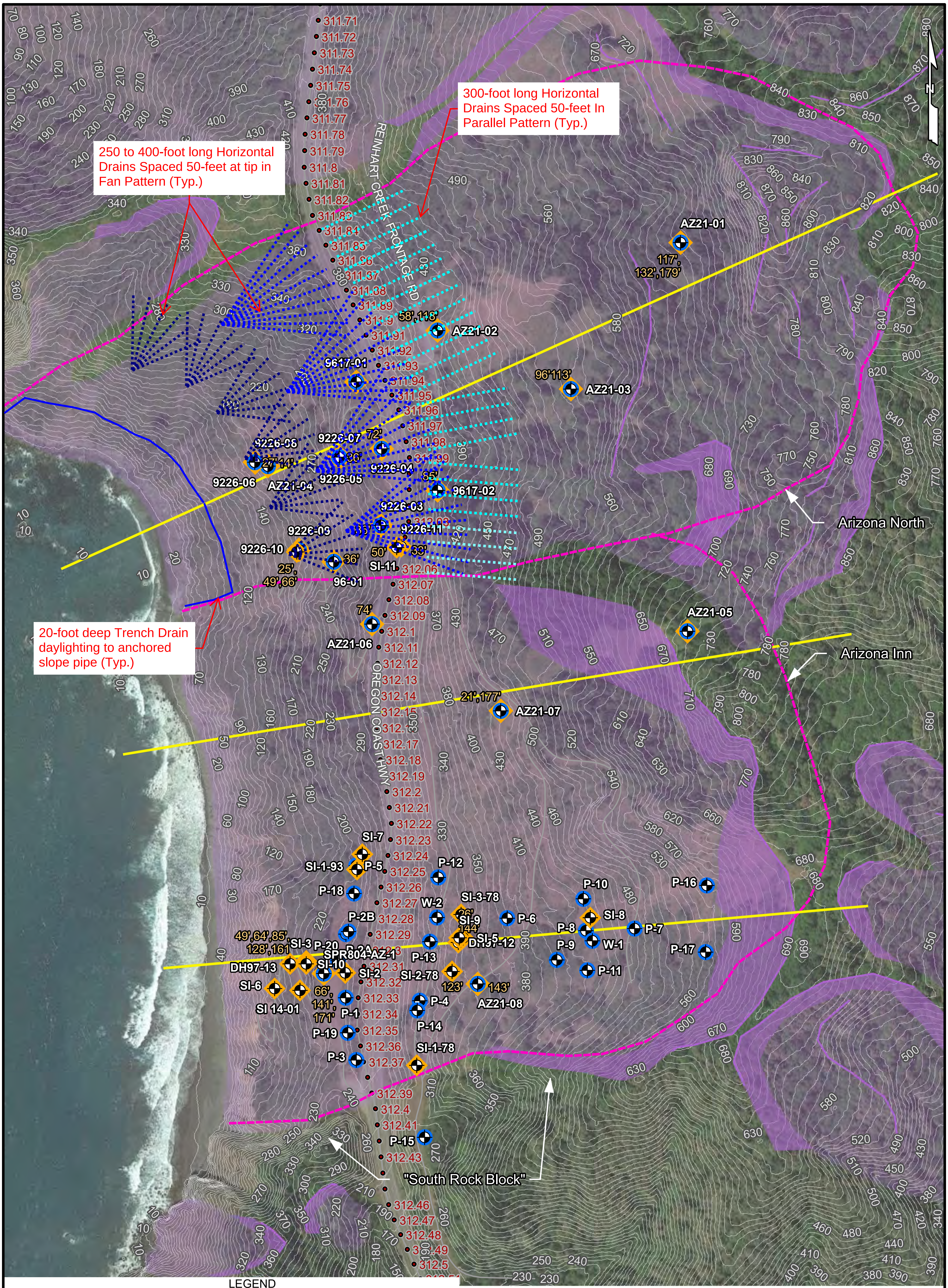
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D13

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan5_6AZ_10.7.mxd Date: 4/1/2022 Login: AEH



LEGEND

- Approximate Location of Boring with Inclinometer and Shear Plane Depth
- Approximate Location of Boring with Piezometer
- Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

SITE AND EXPLORATION PLAN ARIZONA INN COMPLEX

April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D14

FIG. 1

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A10 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION AN1-AN1' ARIZONA INN COMPLEX

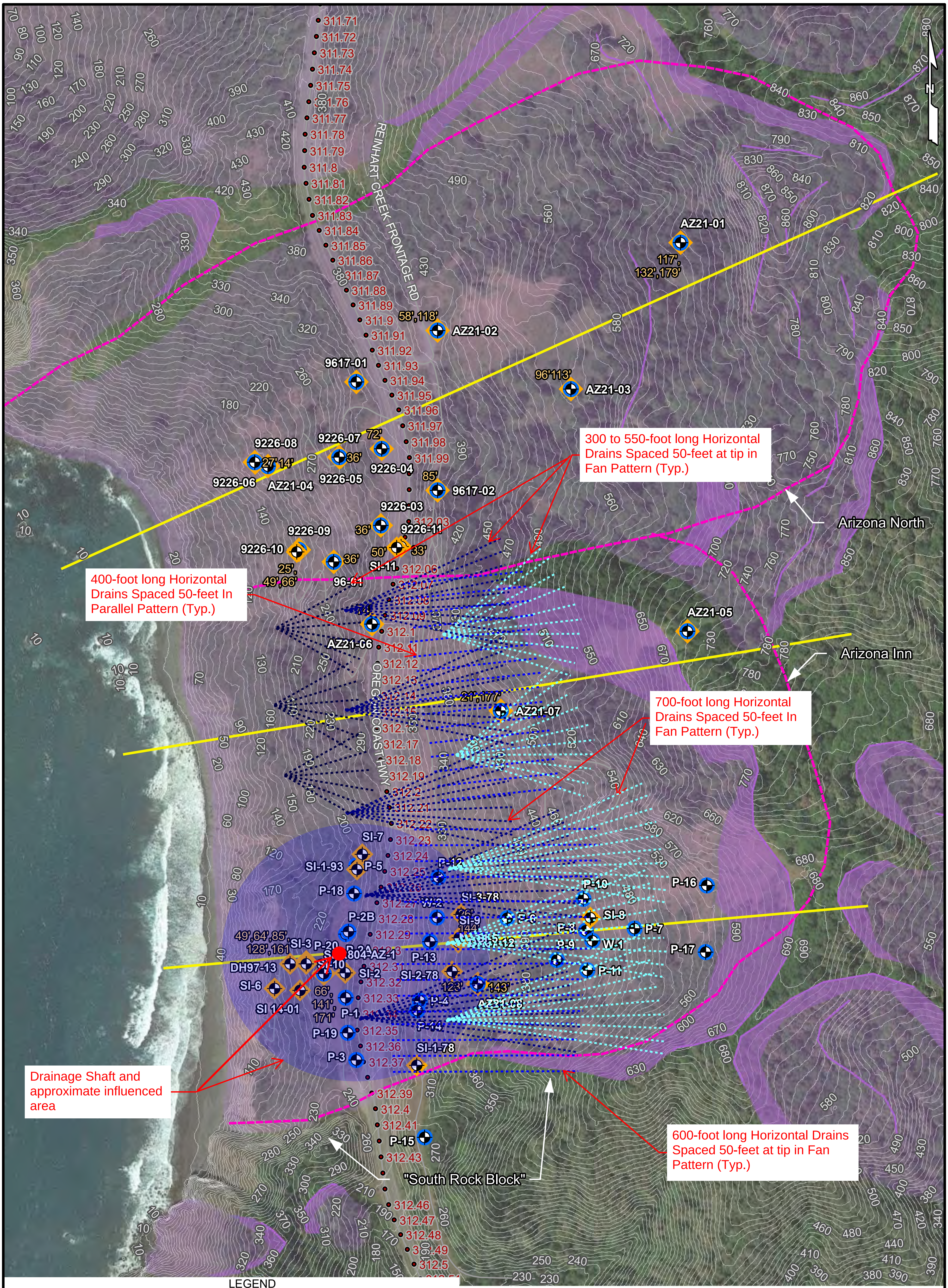
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D15

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan5_6AZ_10.7.mxd Date: 4/1/2022 Login: AEH



LEGEND

- Approximate Location of Boring with Inclinometer and Shear Plane Depth (13')
- Approximate Location of Boring with Piezometer
- Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer (13')
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

SITE AND EXPLORATION PLAN
ARIZONA INN COMPLEX

April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D16

FIG. 1

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A10 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION AI1-AI1' ARIZONA INN COMPLEX

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D17

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A10 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION AI2-AI2' ARIZONA INN COMPLEX

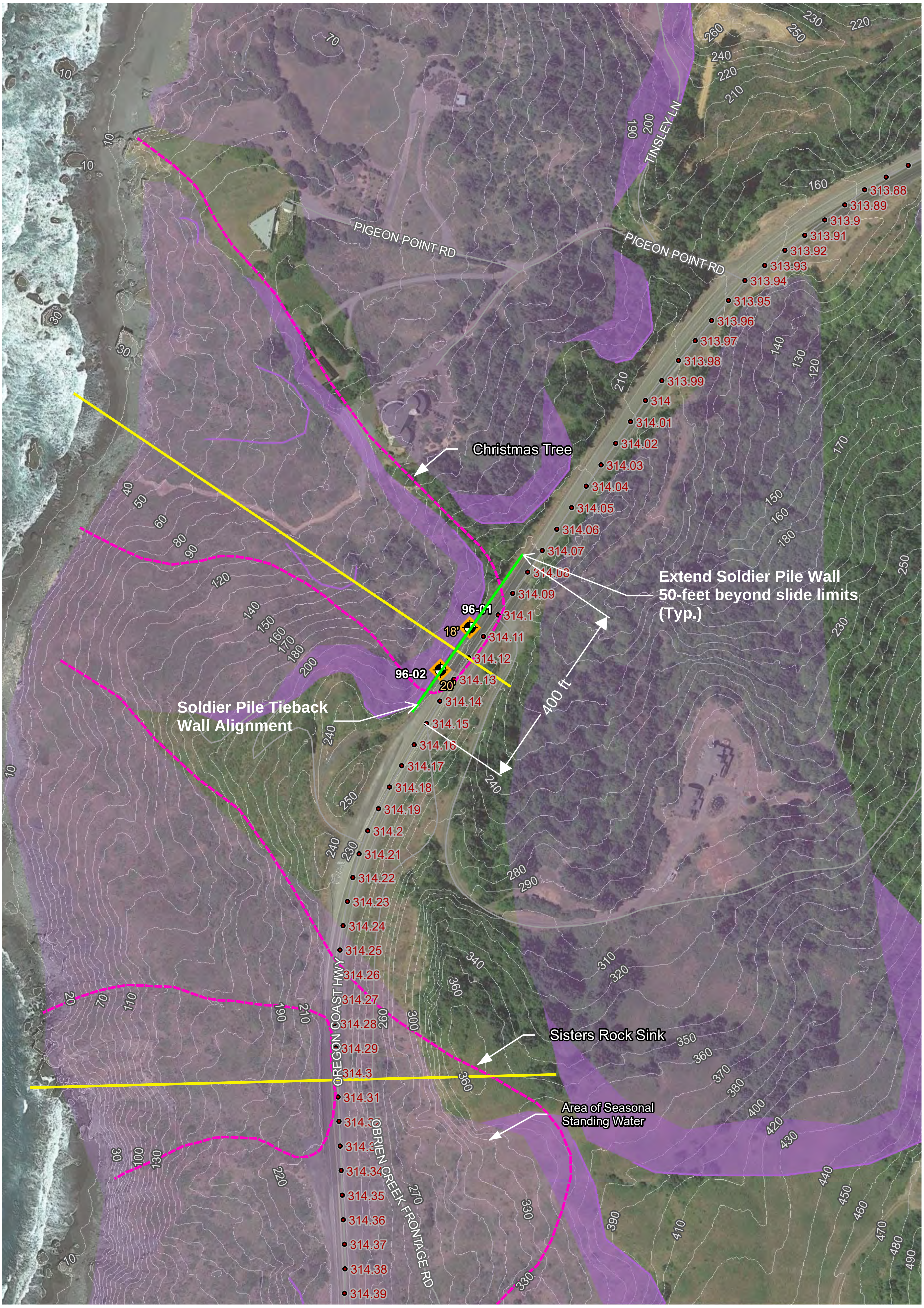
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D18

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan7FrankportN_10.7.mxd Date: 3/31/2022 Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer and Shear Plane Depth

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

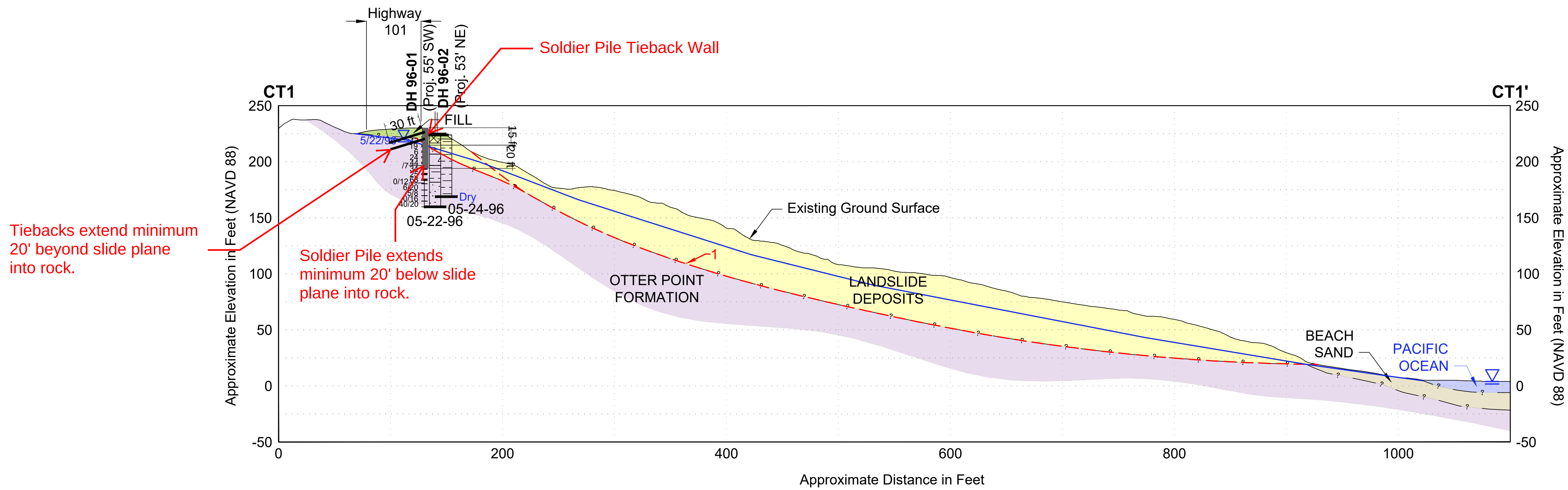
SITE AND EXPLORATION PLAN CHRISTMAS TREE (FRANKPORT NORTH)

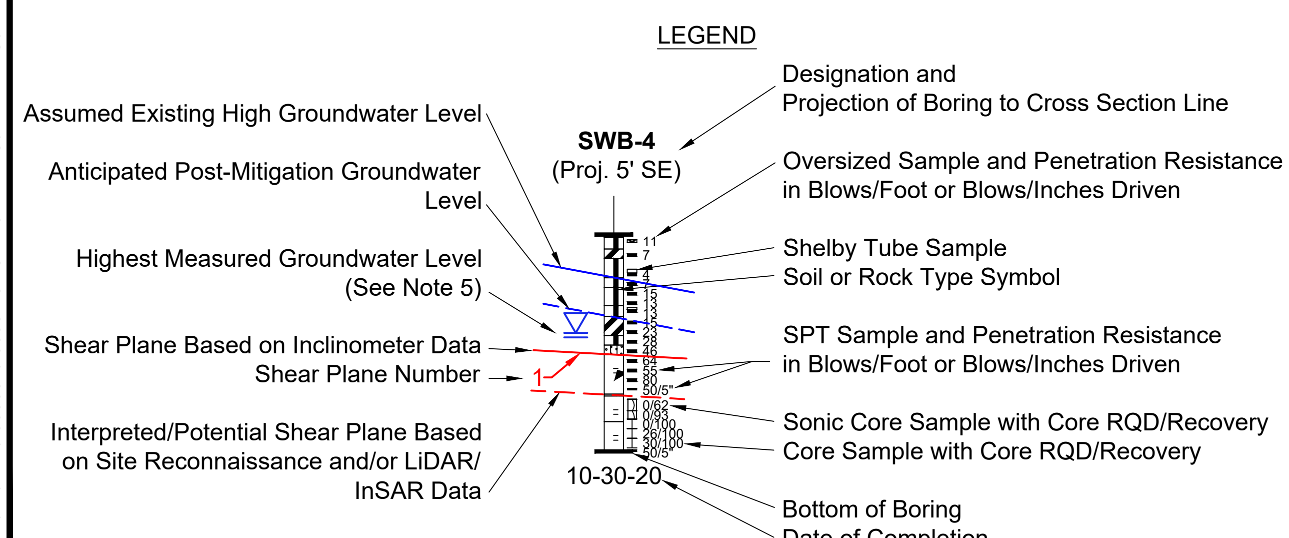
April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D19

FIG. 1





0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A14 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION CT1-CT1' CHRISTMAS TREE

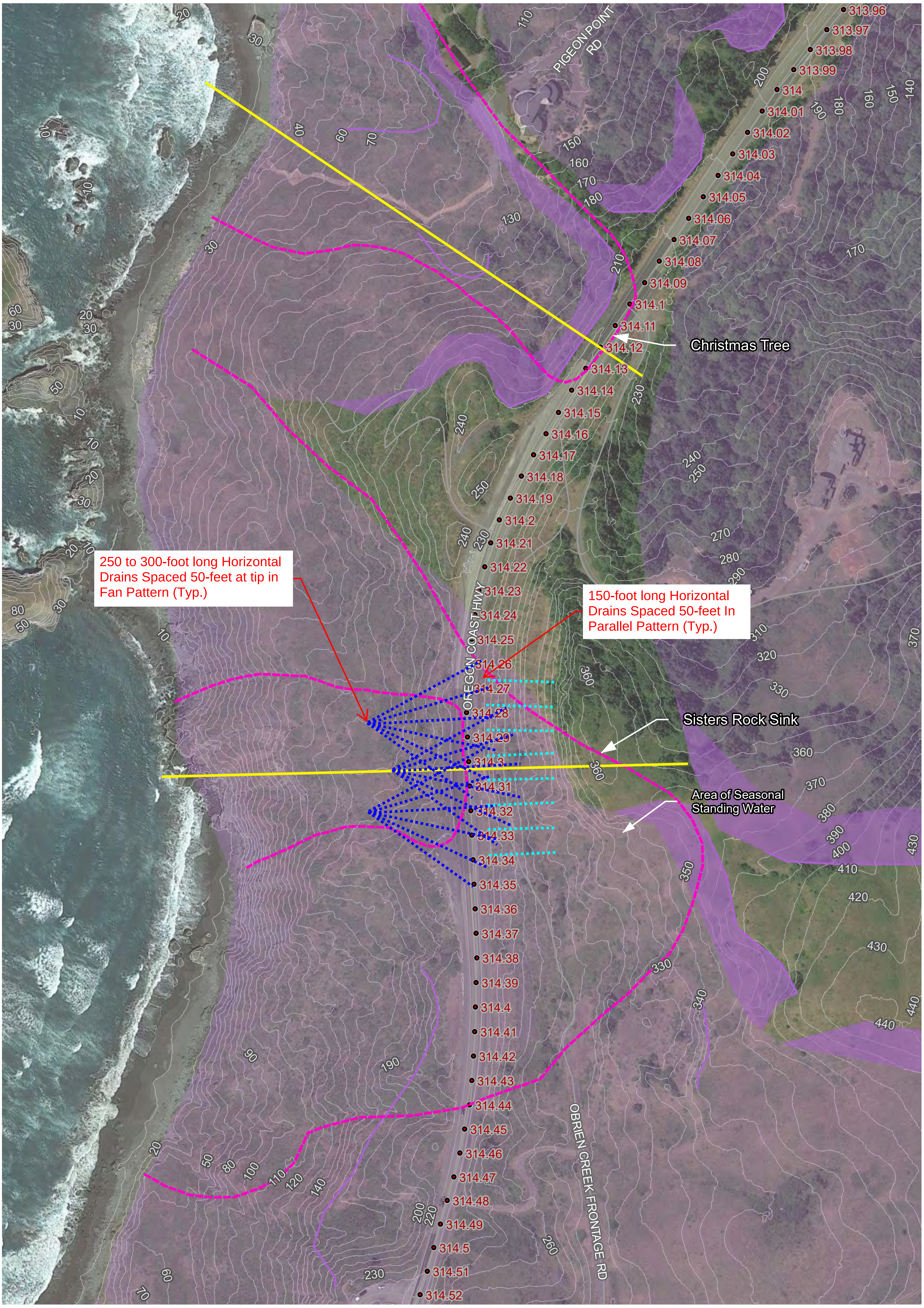
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D20

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan8SistersRk_10.7.mxd Date: 3/31/2022 Login: AEH



LEGEND
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400
Scale in Feet

NOTES
1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

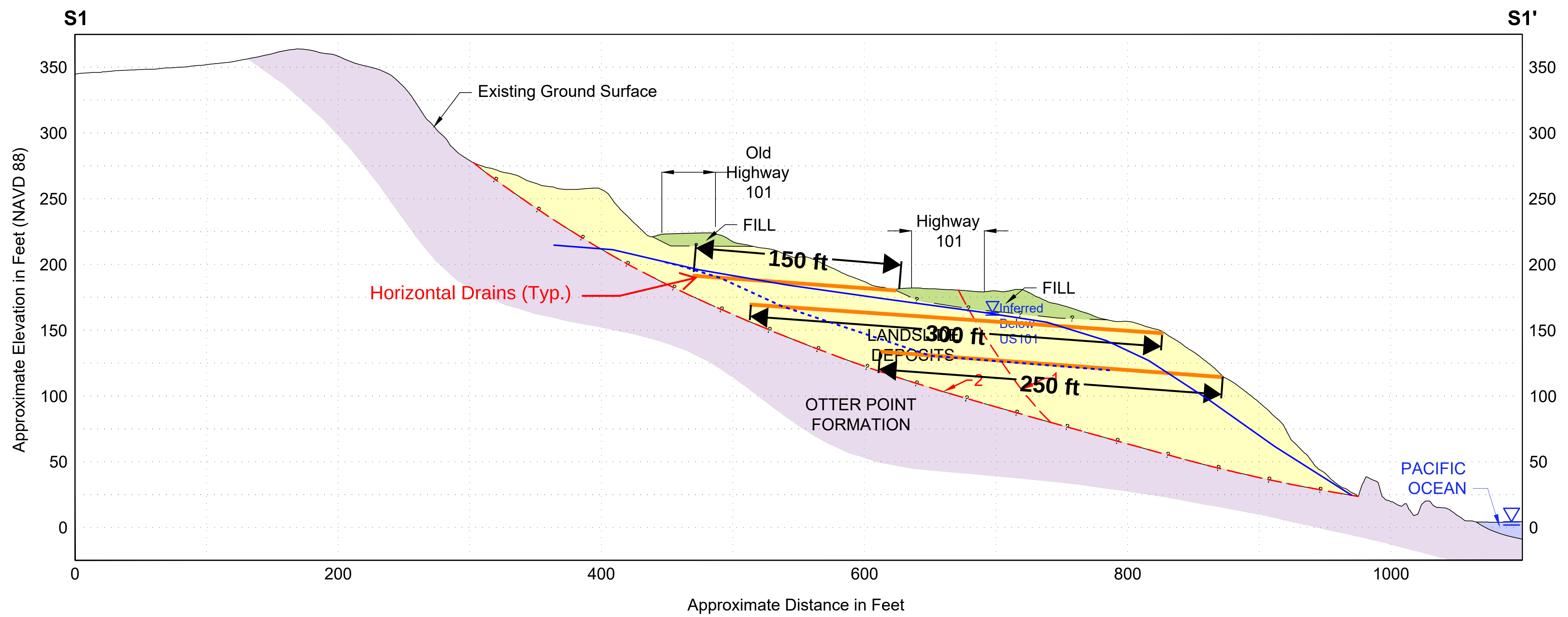
SITE AND EXPLORATION PLAN
SISTERS ROCK SINK

April 2022 | 106381

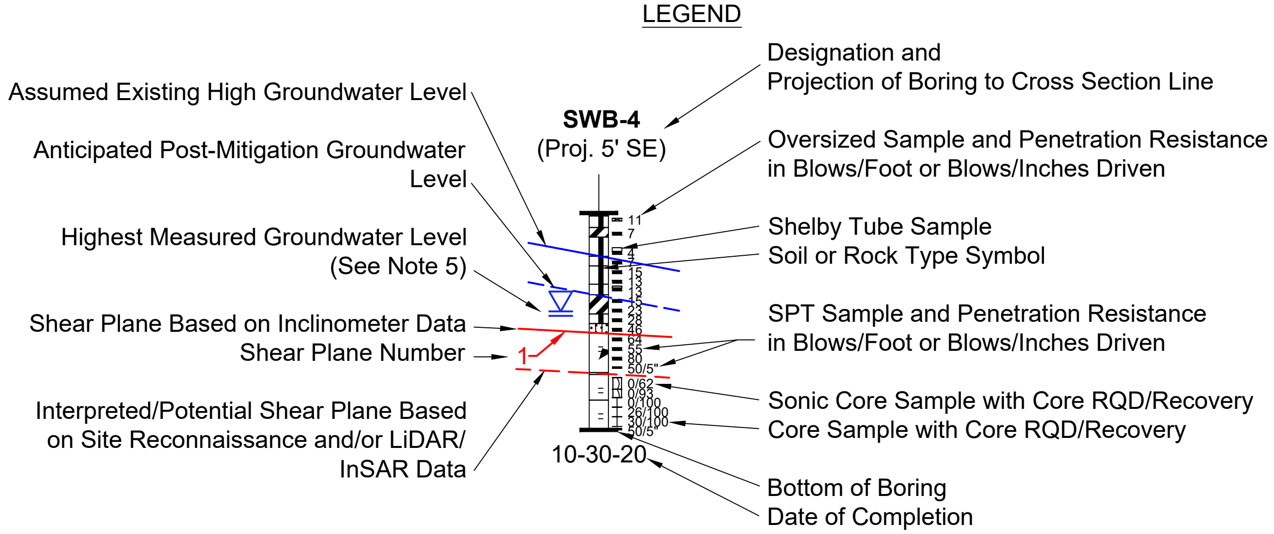
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D21

FIG. 1



LEGEND



0 100 200

Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A16 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

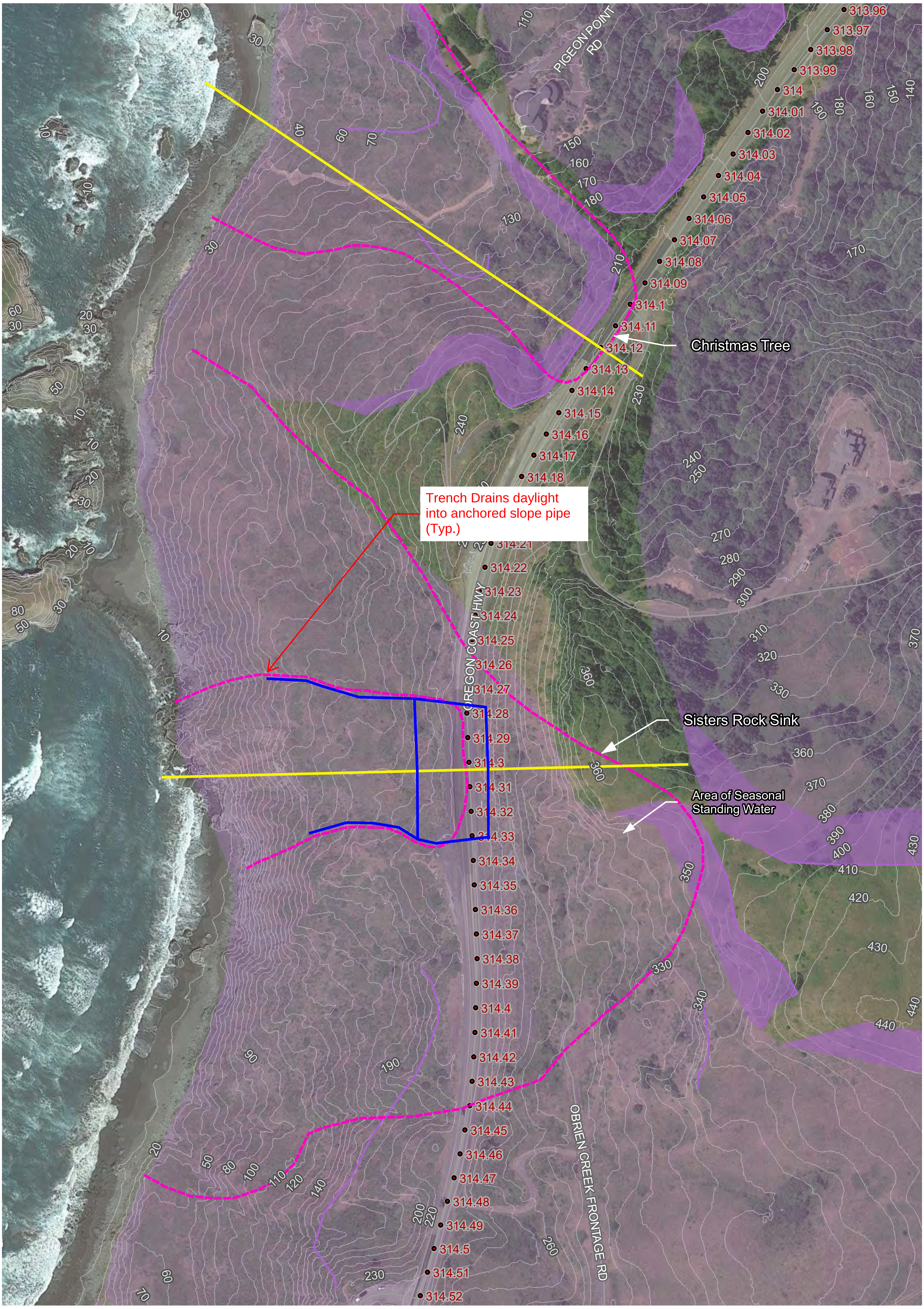
CONCEPTUAL GEOLOGIC CROSS SECTION S1-S1' SISTERS ROCK SINK

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D22

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND

- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

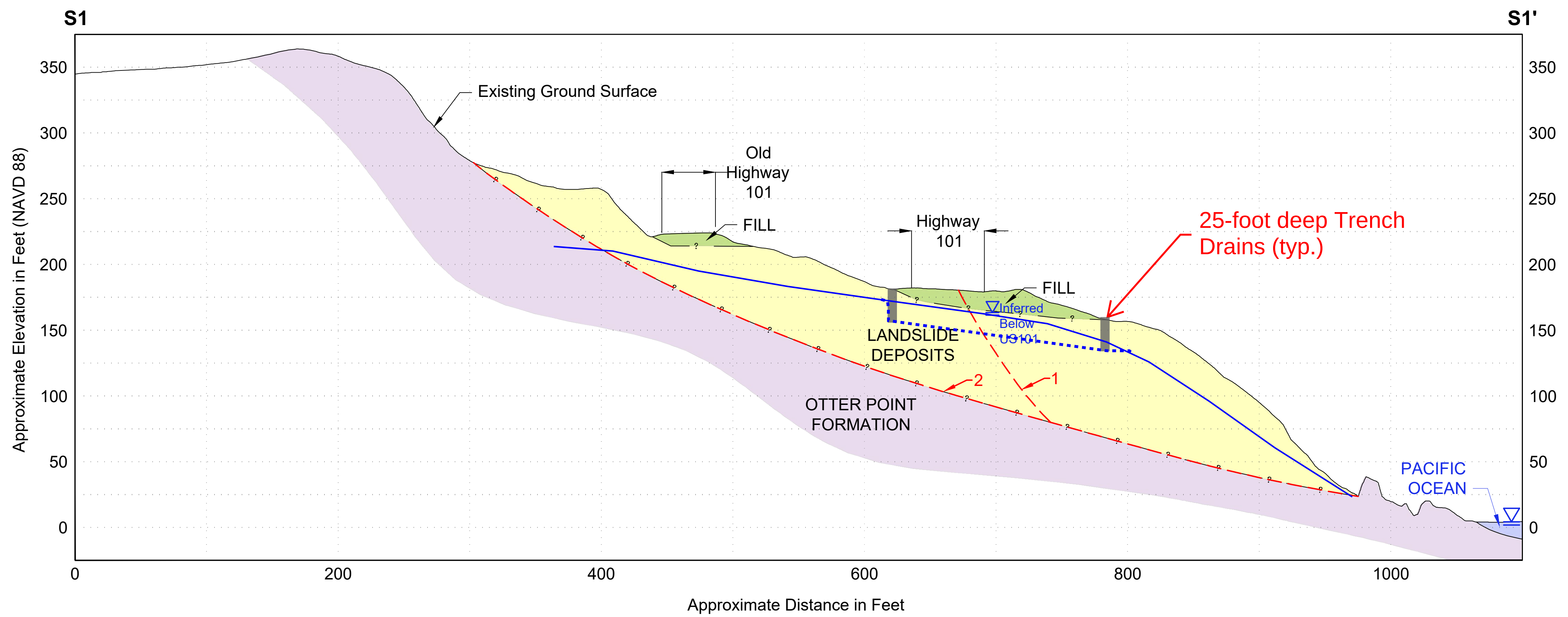
SITE AND EXPLORATION PLAN
SISTERS ROCK SINK

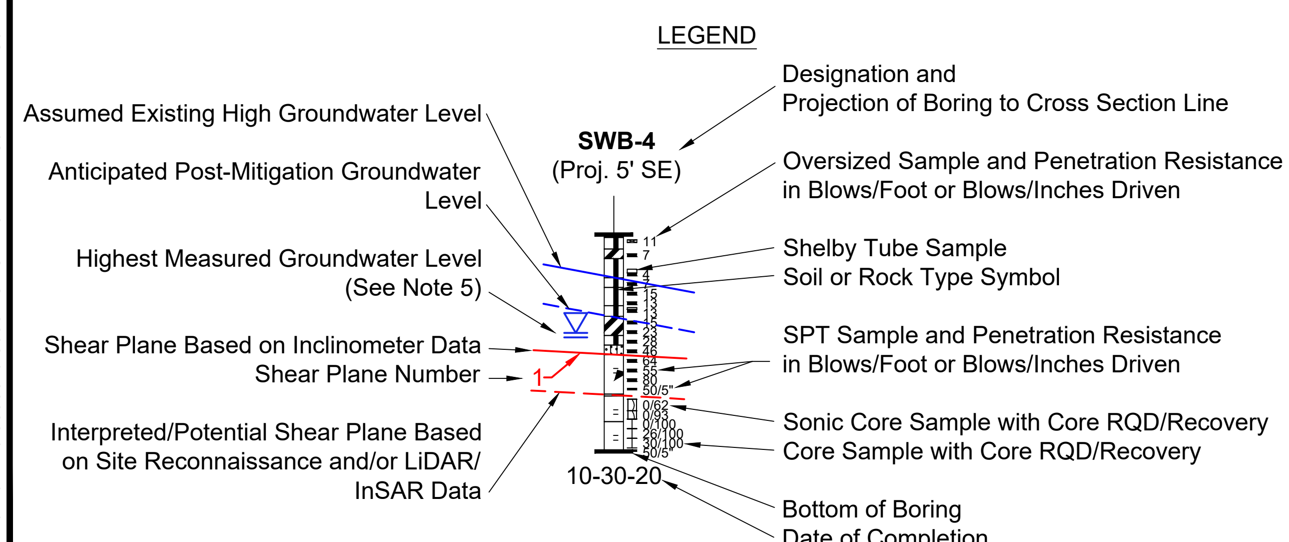
April 2022 106381

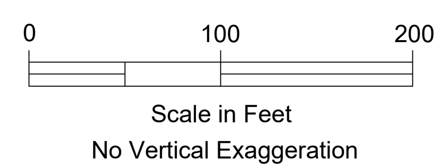
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D23

FIG. 1







NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A16 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION S1-S1' SISTERS ROCK SINK

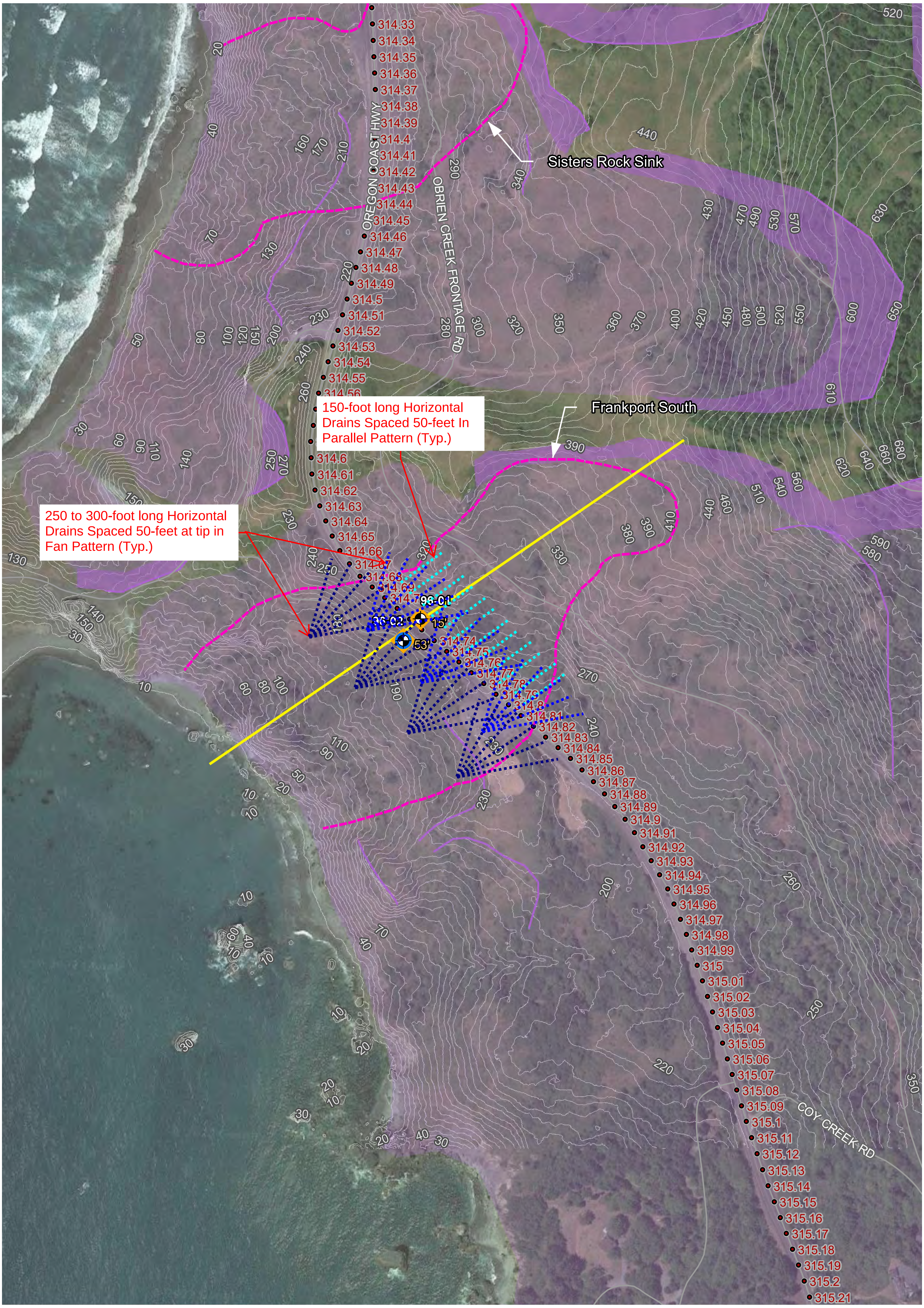
May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D24

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan9FrankportS_10.7.mxd Date: 3/24/2022 Login: AEH



LEGEND

13' Approximate Location of Boring with Inclinometer and Shear Plane Depth

13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer

Interpreted Slide Extents

Mapped Slide Scarp

Mapped Slide Scarp

Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

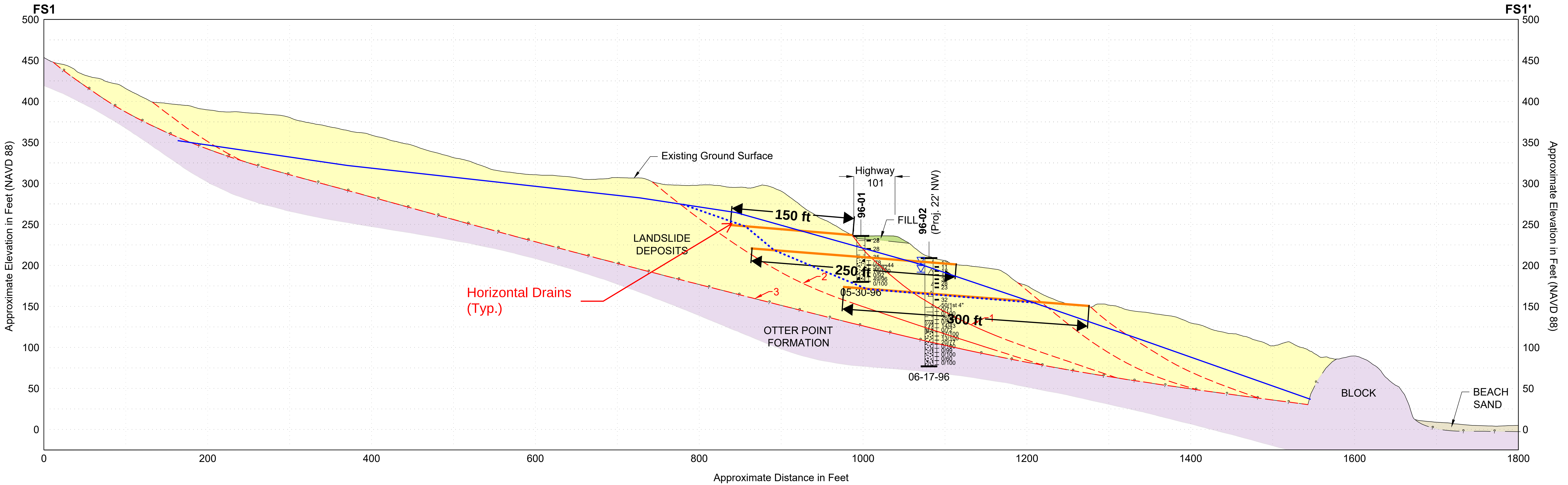
SITE AND EXPLORATION PLAN
FRANKPORT SOUTH

April 2022 106381

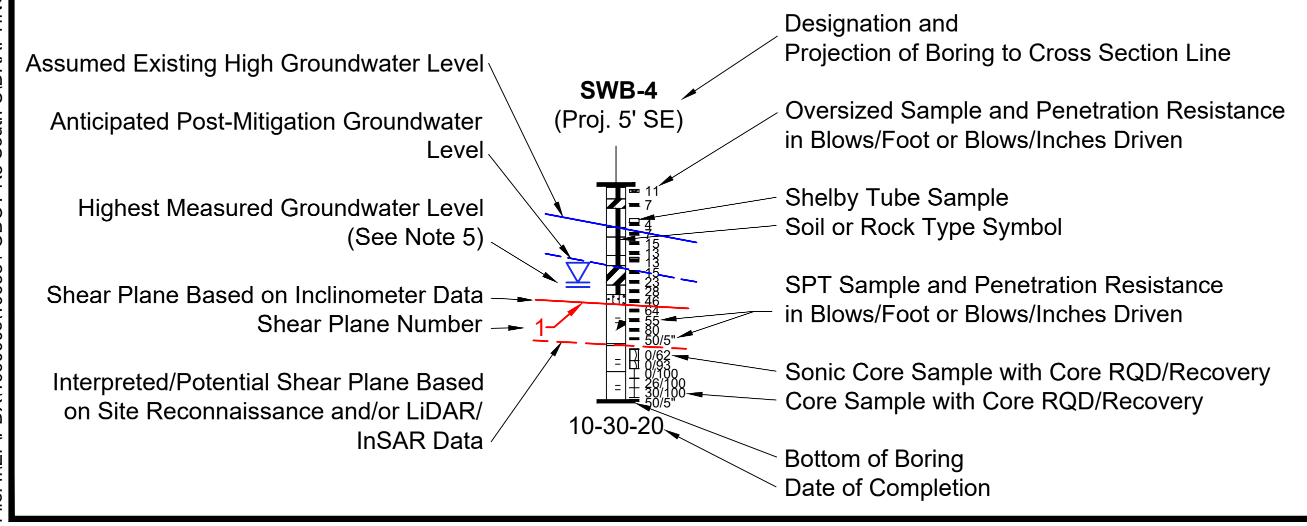
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D25

FIG. 1



LEGEND



0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A18 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

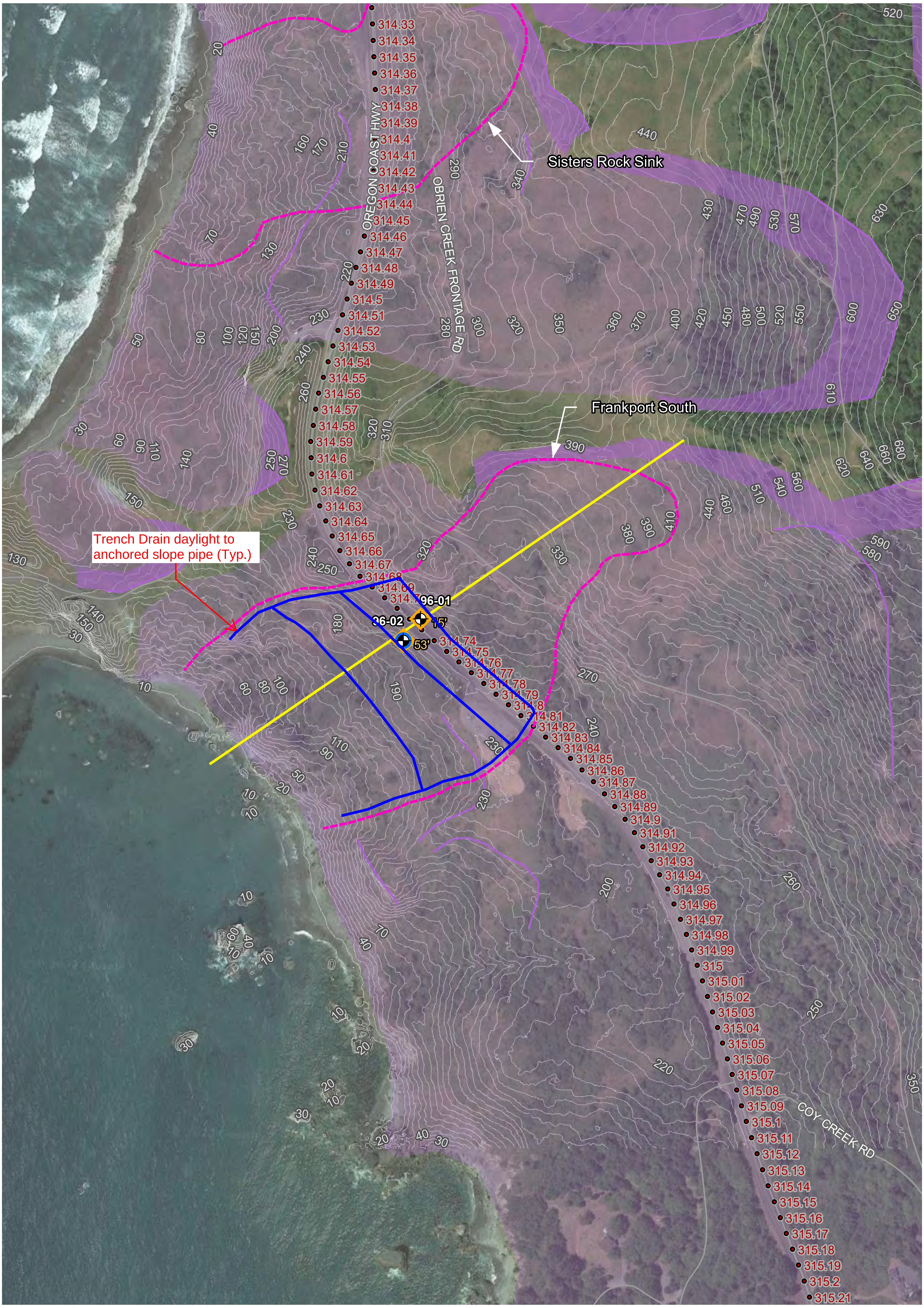
CONCEPTUAL GEOLOGIC CROSS SECTION FS1-FS1' FRANKPORT SOUTH

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D26

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 150 300 600

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

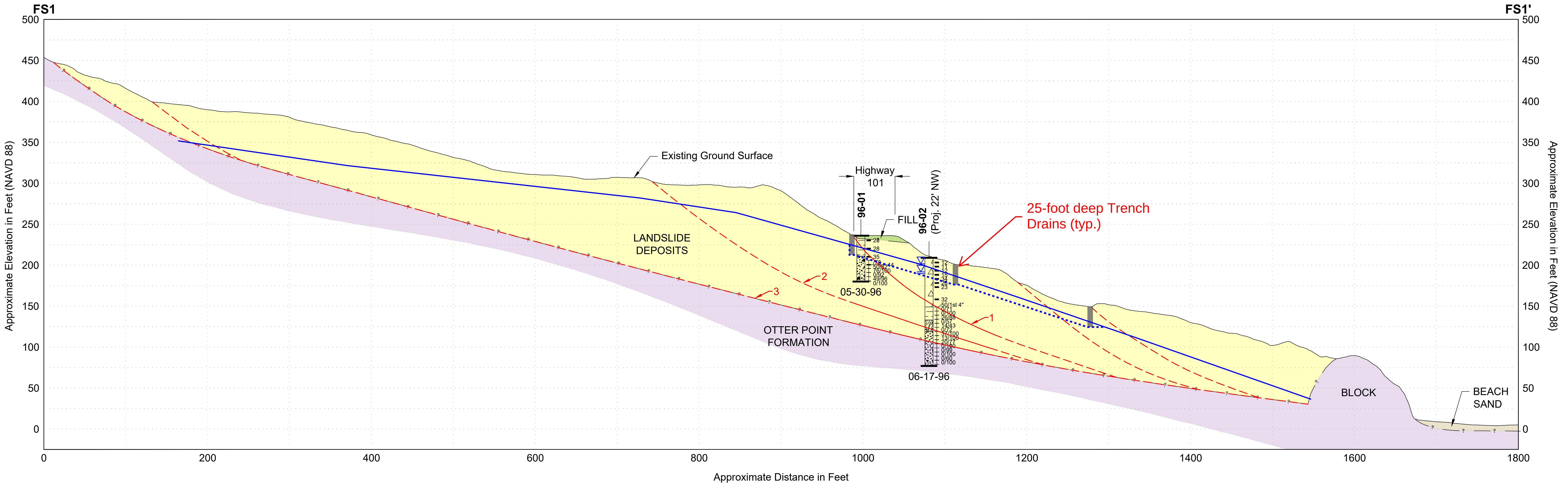
SITE AND EXPLORATION PLAN
FRANKPORT SOUTH

April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D27

FIG. 1



LEGEND

- Assumed Existing High Groundwater Level
- Anticipated Post-Mitigation Groundwater Level
- Highest Measured Groundwater Level (See Note 5)
- Shear Plane Based on Inclinometer Data
- Shear Plane Number
- Interpreted/Potential Shear Plane Based on Site Reconnaissance and/or LiDAR/InSAR Data
- SWB-4 (Proj. 5' SE) — Designation and Projection of Boring to Cross Section Line
- Oversized Sample and Penetration Resistance in Blows/Foot or Blows/Inches Driven
- Shelby Tube Sample
- Soil or Rock Type Symbol
- SPT Sample and Penetration Resistance in Blows/Foot or Blows/Inches Driven
- Sonic Core Sample with Core RQD/Recovery
- Core Sample with Core RQD/Recovery
- Bottom of Boring
- 10-30-20 — Date of Completion

0 100 200

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A18 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION FS1-FS1' FRANKPORT SOUTH

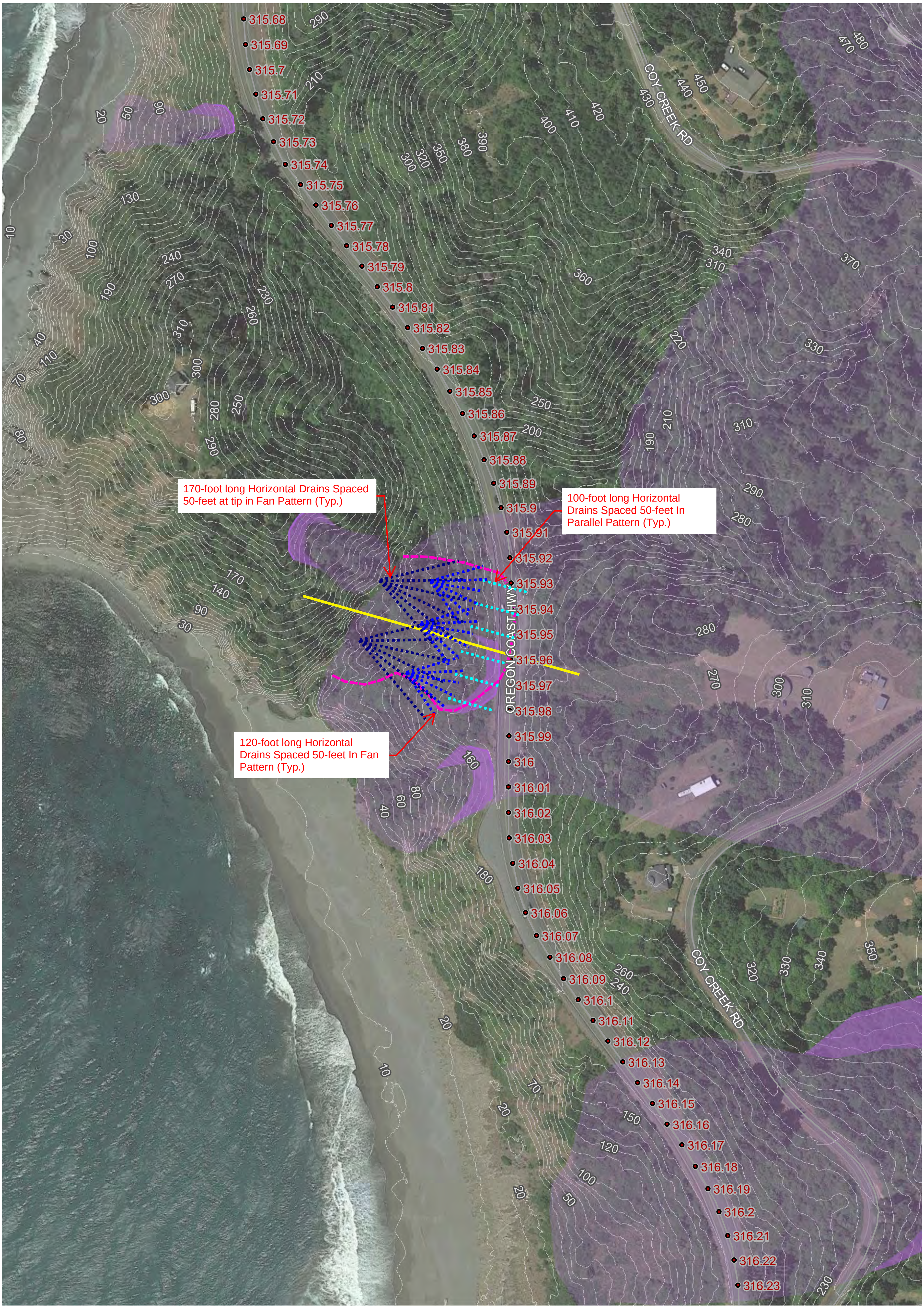
May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D28

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan10Woodroof_10.7.mxd Date: 3/24/2022 Login: AEH



LEGEND

- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Hillshade created from 2009 LiDAR data obtained through DOGAMI.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Displacement rate points from InSAR data downloaded from SkyGeo on December 3, 2021. Only points with quality of 0.3 or higher are shown.

South Coast Landslide Study
Curry County, Oregon

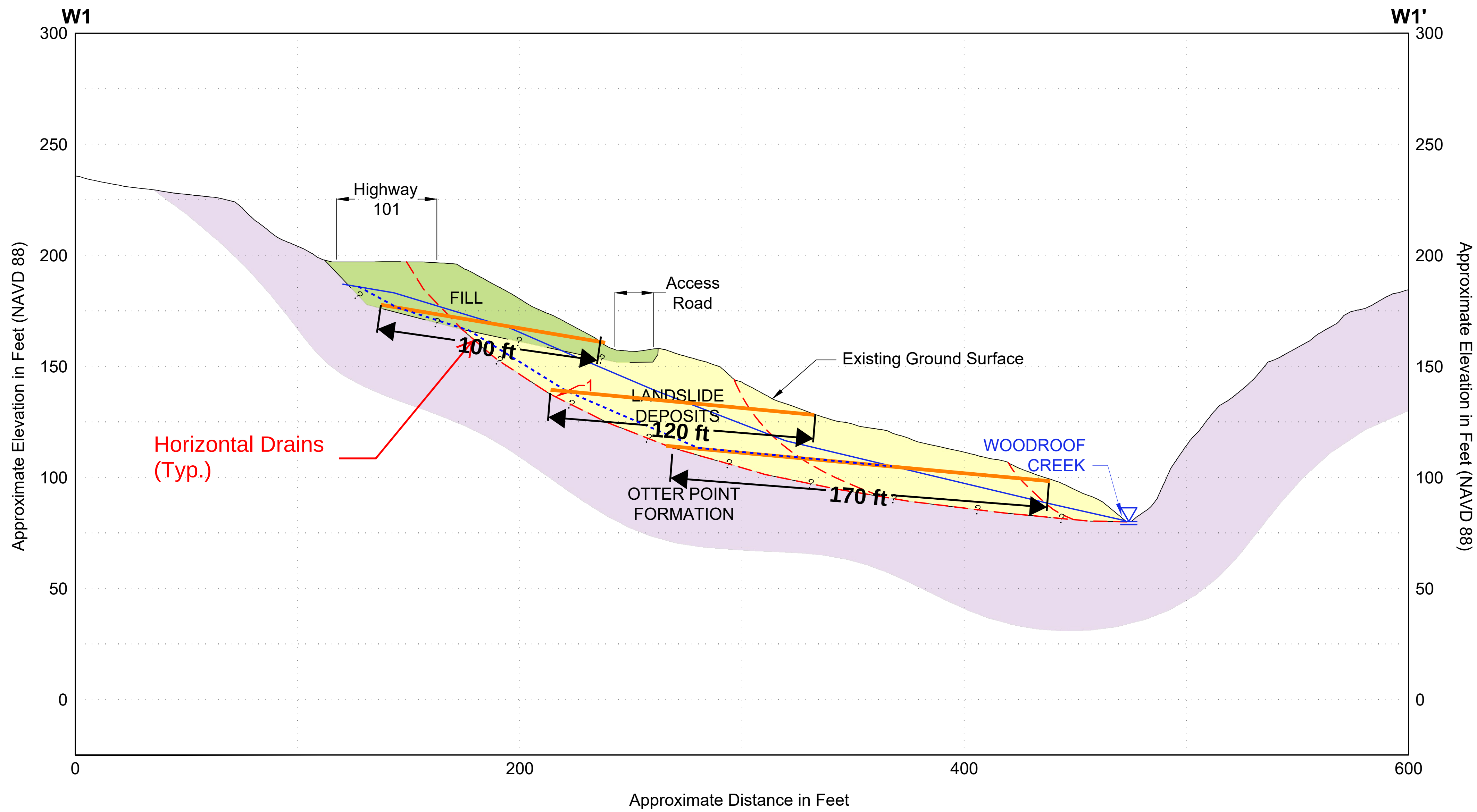
SITE AND EXPLORATION PLAN
WOODROOF CREEK

April 2022 106381

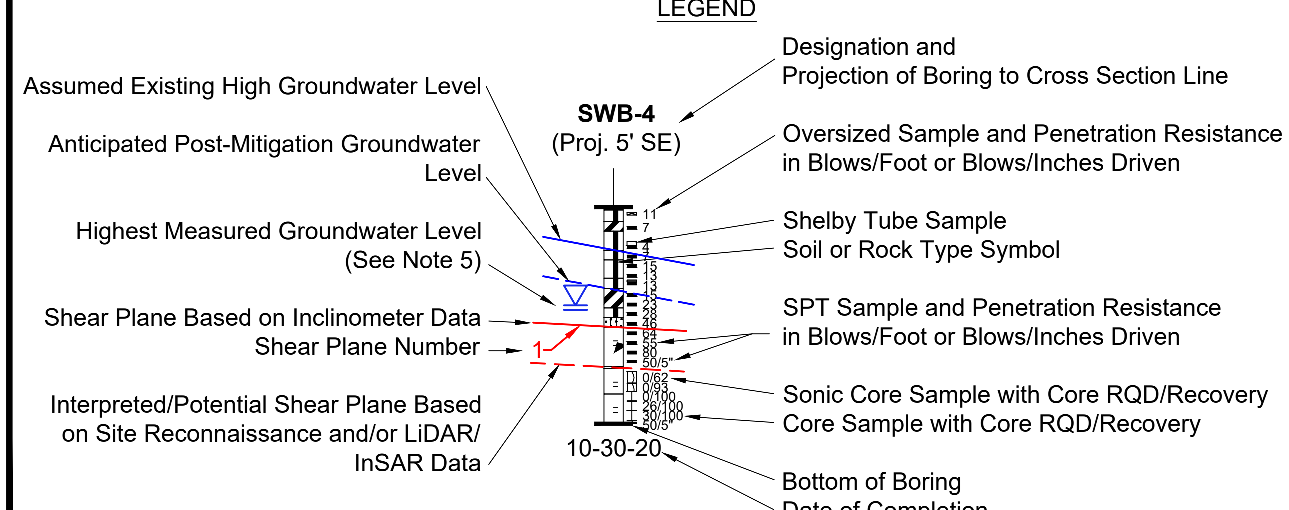
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D29

FIG. 2



LEGEND



0 60 120

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A20 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION W1-W1' WOODROOF CREEK

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D30

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan10Woodroof_10.7.mxd Date: 3/24/2022 Login: AEH

LEGEND

- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Hillshade created from 2009 LiDAR data obtained through DOGAMI.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Displacement rate points from InSAR data downloaded from SkyGeo on December 3, 2021. Only points with quality of 0.3 or higher are shown.

South Coast Landslide Study
Curry County, Oregon

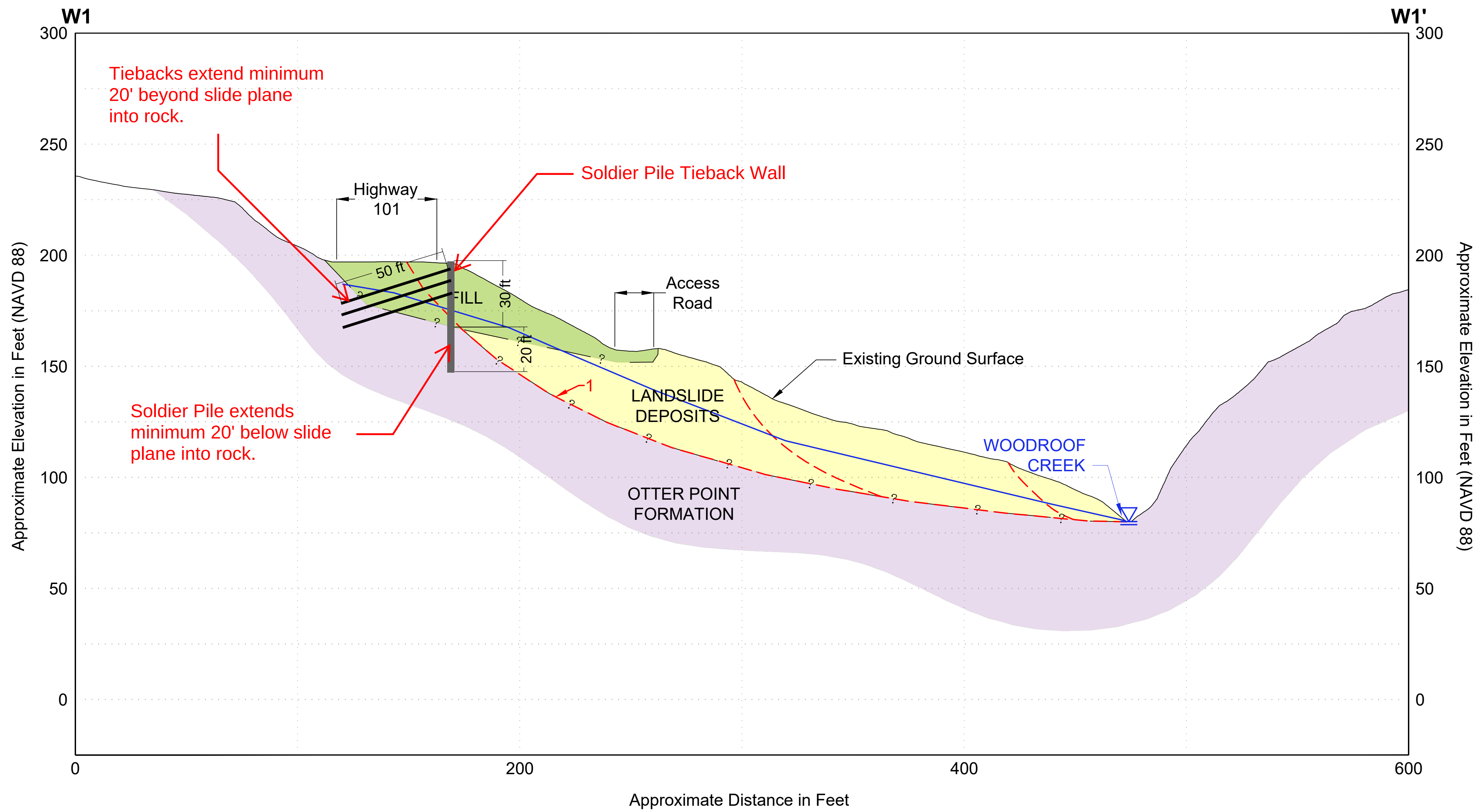
SITE AND EXPLORATION PLAN
WOODROOF CREEK

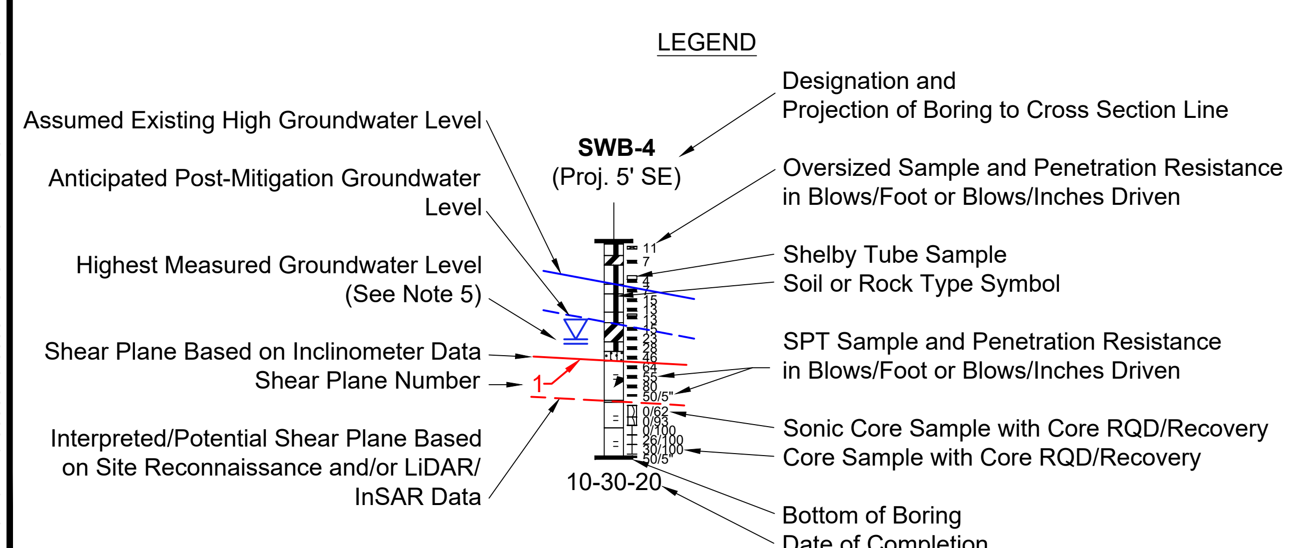
April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D31

FIG. 2





0 60 120

Scale in Feet

No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A20 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

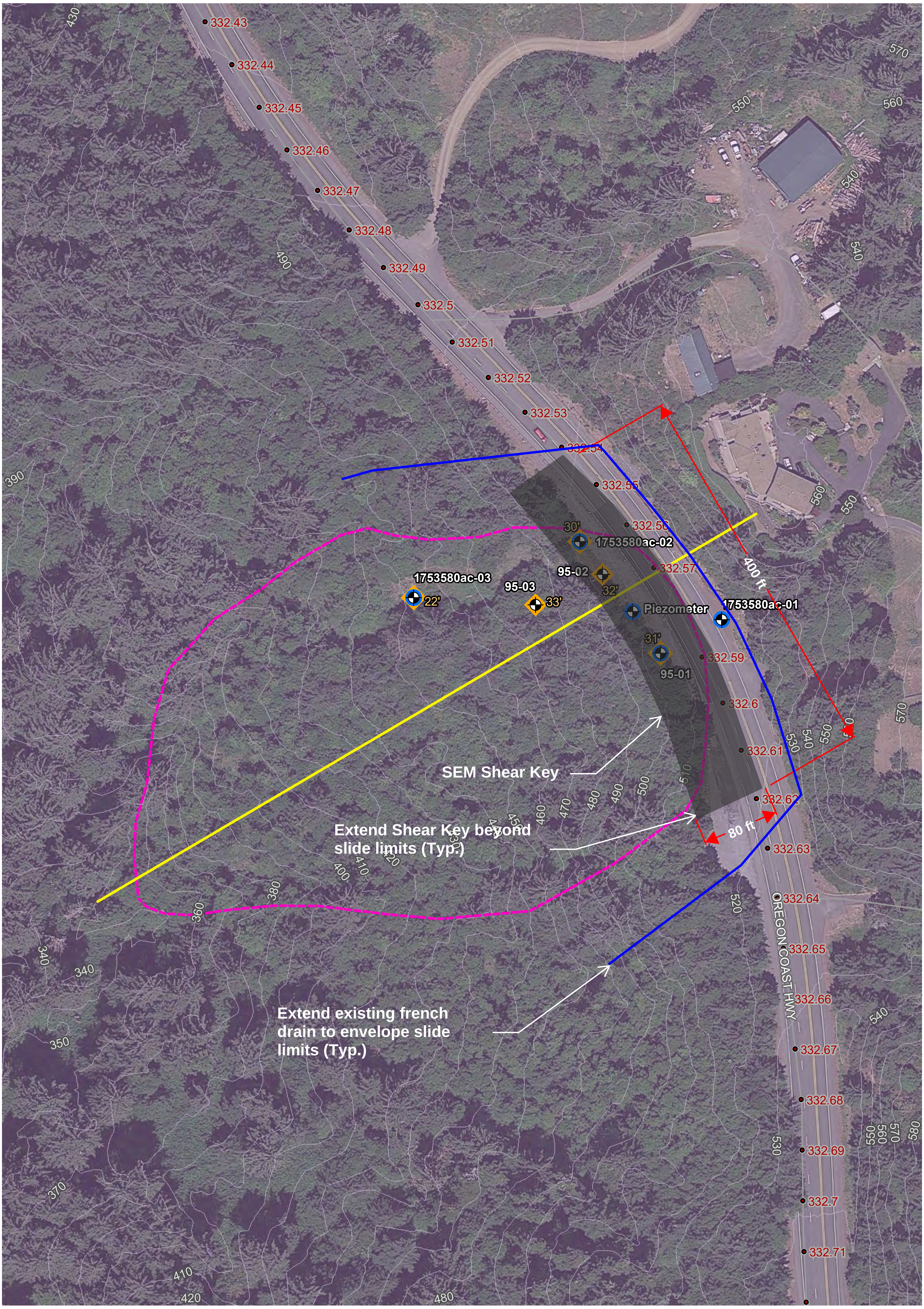
CONCEPTUAL GEOLOGIC CROSS SECTION W1-W1' WOODROOF CREEK

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D32

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- Approximate Location of Boring with Piezometer
- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- Interpreted Slide Extents
- Mapped Landslide Deposits

0 50 100 200

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

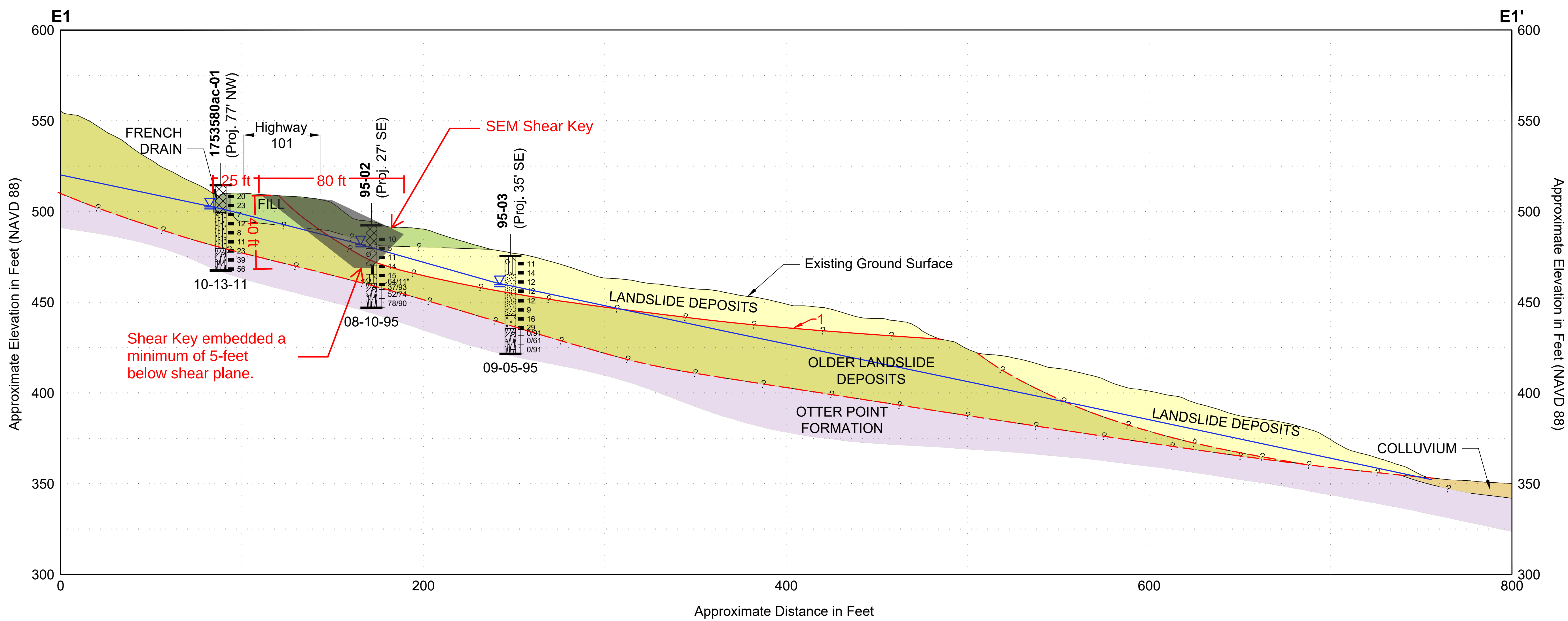
SITE AND EXPLORATION PLAN
EIGHTY ACRES

April 2022 106381

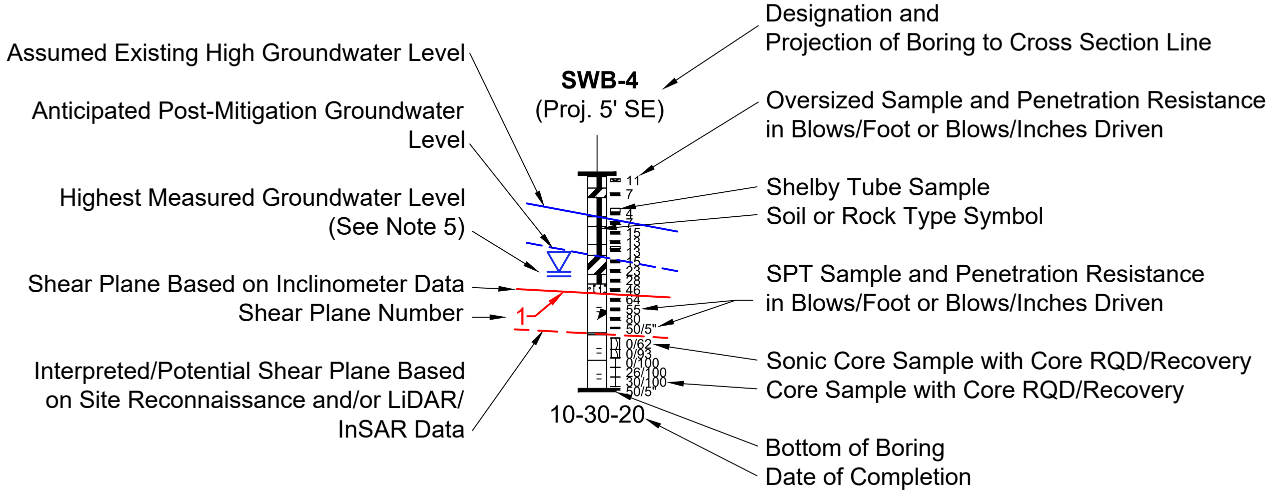
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

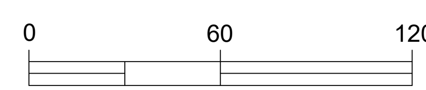
FIG. D33

FIG. 1



LEGEND





Scale in Feet
No Vertical Exaggeration

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A22 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION E1-E1' EIGHTY ACRES

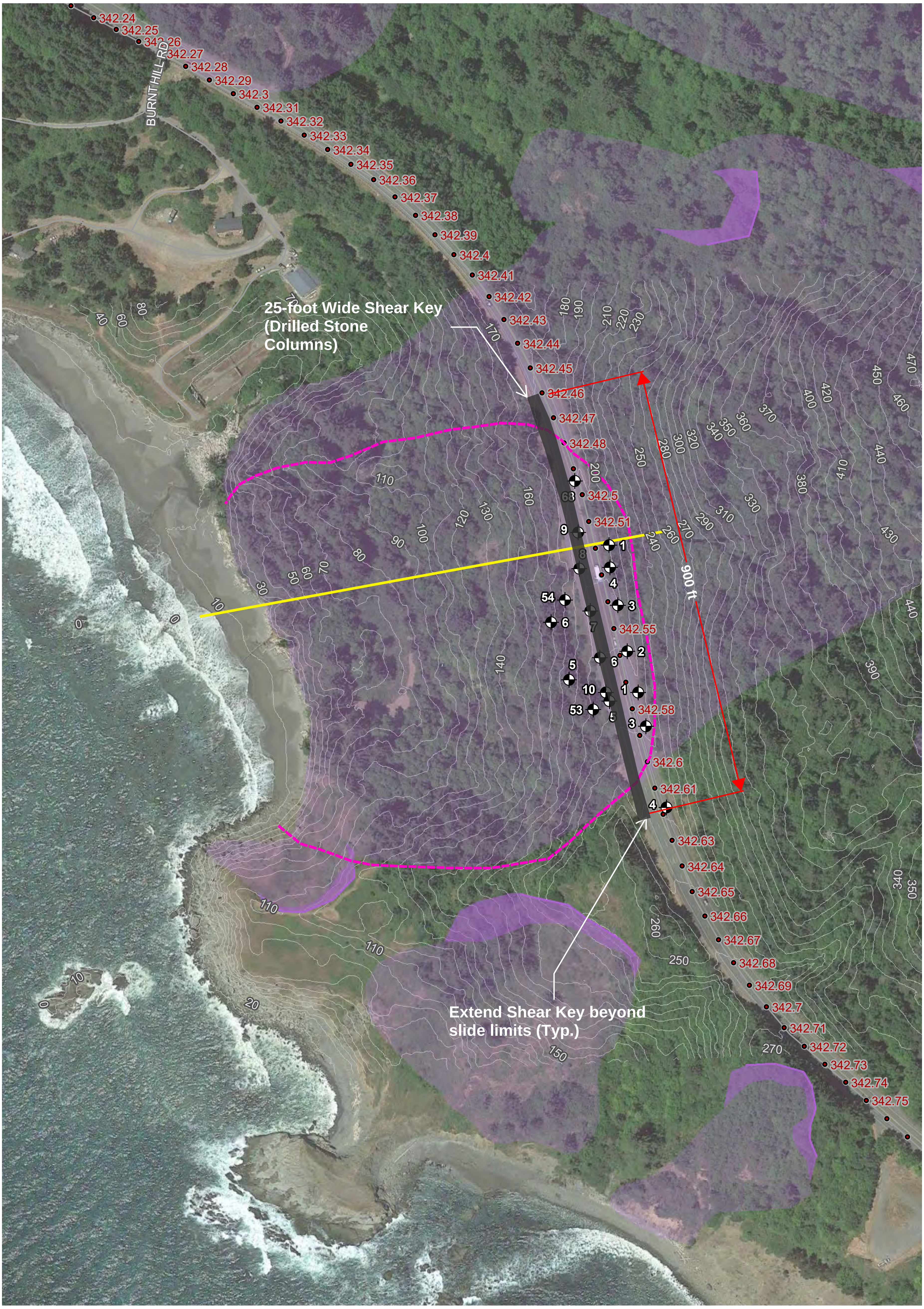
May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D34

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

Filename: T:\Projects\PDX\106000s\106381_ODOT R3 South C\Avmxd\SitePlan12Burnt_10.7.mxd Date: 3/25/2022 Login: AEH



LEGEND

- Approximate Location of Boring
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 100 200 400

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.
3. Contours created from 2009 LiDAR data obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

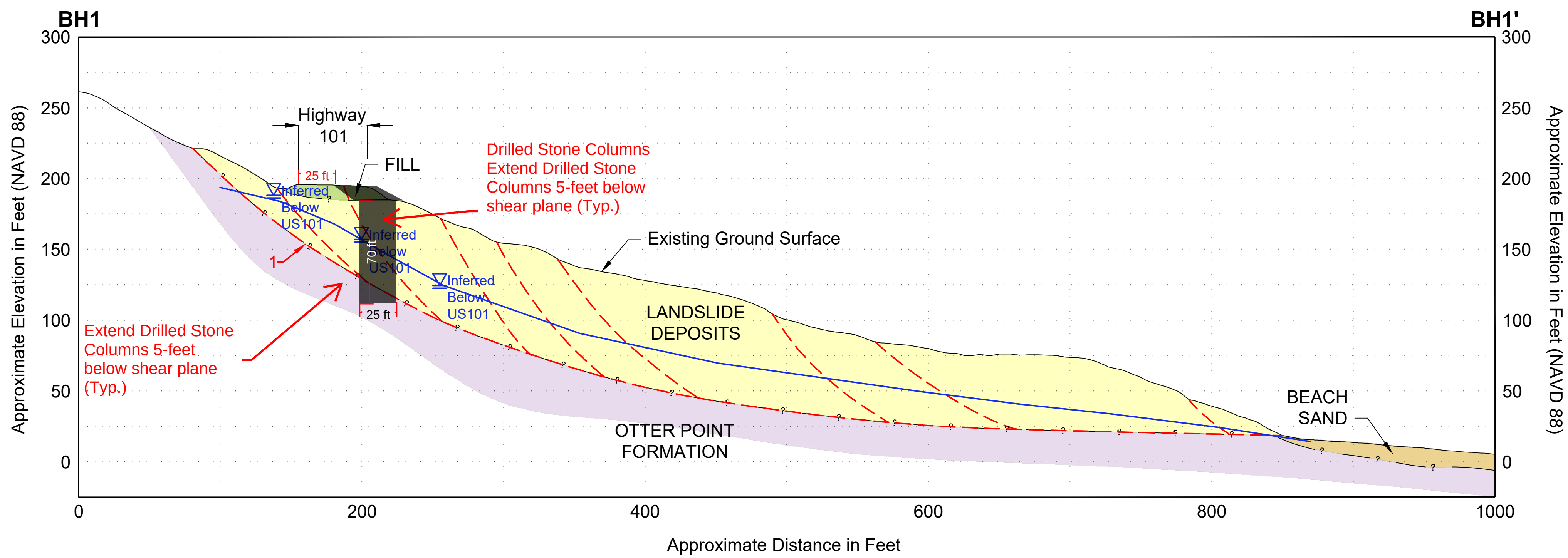
SITE AND EXPLORATION PLAN
BURNT HILL

April 2022 106381

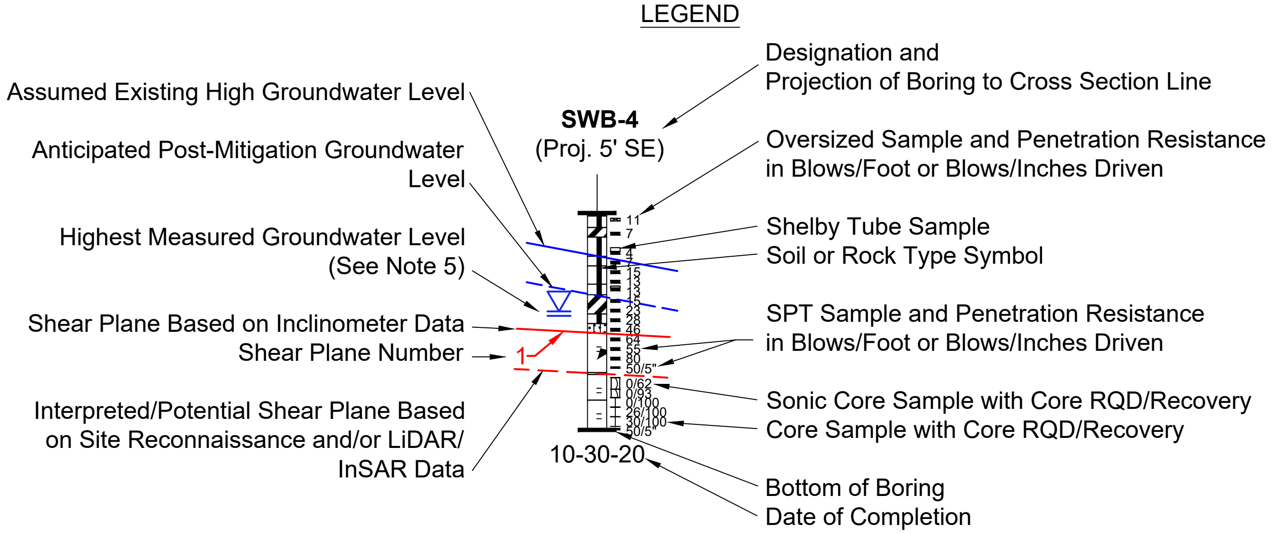
SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

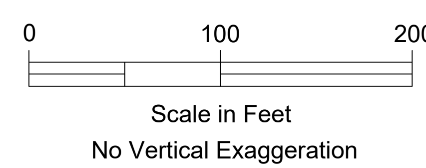
FIG. D35

FIG. 1



LEGEND





NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A24 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

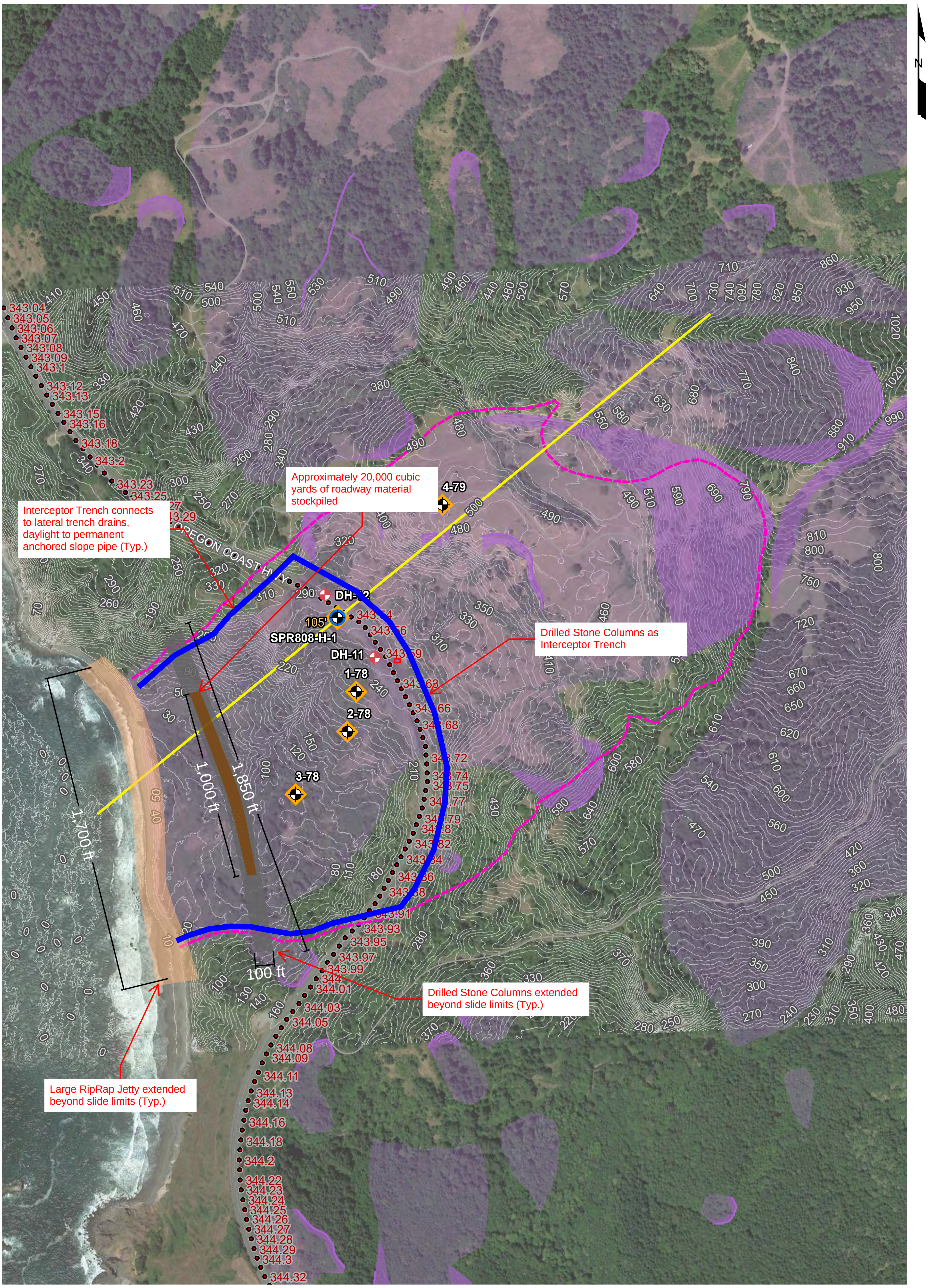
CONCEPTUAL GEOLOGIC CROSS SECTION BH1-BH1' BURNT HILL

May 2022 | 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D36

File: I:\EF\PDX\106000s\106381 ODOT R3 South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH



LEGEND

- 13' Approximate Location of Boring with Inclinometer and Shear Plane Depth
- 13' Approximate Location of Boring with Inclinometer, Shear Plane Depth, and Piezometer
- Approximate Location of Boring (Missing Data)
- Interpreted Slide Extents
- Mapped Slide Scarp
- Mapped Slide Scarp
- Mapped Landslide Deposits

0 250 500 1,000

Scale in Feet

NOTES

1. Hillshade created from 2009 LiDAR data obtained through DOGAMI.
2. Mapped slide features from SLIDO-4.2, obtained through DOGAMI.

South Coast Landslide Study
Curry County, Oregon

SITE AND EXPLORATION PLAN HOOSKANADEN

April 2022 106381

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. D37

FIG. 3

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION H1-H1' HOOSKANADEN

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D38

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A26 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION H1-H1' HOOSKANADEN

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D39

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A26 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION H1-H1' HOOSKANADEN

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D40

South C\DRAFTING\Sections.dwg Date: 05-18-2022 Author: AEH

NOTES

1. The ground surface was derived from 2009 LiDAR data and does not reflect current existing grade in all locations.
2. Profile generalized from materials reported in borings. Variations may exist between cross section and actual conditions.
3. See Figure A26 for cross section location.
4. Boring locations and elevations are approximate.
5. If multiple vibrating wire transducers were installed in a boring, the highest reading for each is shown. If a date is shown, the measurement was taken during drilling and may have been influenced by drilling fluids, if used.

South Coast Landslide Study
Curry County, Oregon

CONCEPTUAL GEOLOGIC CROSS SECTION H1-H1' HOOSKANADEN

May 2022 106381

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. D41