APPENDIX E

Geophysics Report

GEOPHYSICAL INVESTIGATION REPORT

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

FOR

SEGALE PROPERTIES, LLC
TUKWILA, WASHINGTON

AUGUST 30, 2022

PHILIP H. DUOOS
GEOPHYSICAL CONSULTANT

August 30, 2022 Our Ref.: 1389-21

Segale Properties, LLC
5811 Segale Park Drive C
Tukwila, Washington 98188
Attention: Mr. Mark Segale

Report: Geophysical Investigation
Cumberland Property
King County, Washington

Dear Mr. Segale:

This letter report contains the results of the geophysical investigation performed at the Cumberland Property for Segale Properties, LLC (Segale). Electrical resistivity imaging (ERI) and seismic refraction surveys were performed to better determine subsurface conditions such as the depth and configuration of the bedrock surface, and also to better understand the aggregate resources available. A description of the geophysical methods is attached (Attachments A, B-1 and B-2). ERI field work was performed during the period of November 10 – 22, 2021, and the seismic surveying was performed from December 6, 2021 to January 7, 2022. Draft results were provided to you periodically upon completion of the field work.

Figure 1 is a general overview map showing the approximate locations of the geophysical lines, borings, and other reference features of the area. The general locations of the geophysical lines were placed in areas of interest determined by Associated Earth Sciences, Inc. (AESI). **Figures 2-1** through **2-7** show the surveyed locations of the numerous shot holes and borings. These locations were surveyed by the Segale surveying crew concurrently with the geophysical field work and afterwards. The survey locations of the shot holes and borings provided by Segale were incorporated by AESI personnel into the existing map of the site which has Lidar contour data, roads and other features. AESI personnel incorporated the geophysical lines into the figures based on my field notes. I referenced the geophysical lines in the field to the shot holes and nearby borings using a tape measure. Locations of the geophysical lines shown on Figures 2-1 through 2-7 are approximate and accurate to within 20 feet due to the relatively small scale of the figures.

FIELD METHODOLOGY

The geophysical lines in the field were oriented along alignments previously cleared through the brush by Segale. Seismic shot locations were located by myself along these alignments, and were then surveyed by Segale land surveyors. I used a hand level to measure the relative elevation changes between the ERI stations and they were referenced to each of the shot locations with a surveyed elevation. Hand level elevations are estimated to be within one foot for most of the station locations.

ERI Field Methodology

The ERI survey was performed using a Syscal 72 Channel Resistivity Meter. The ERI arrays were laid out in a relatively straight line using several long electrical cables. The cables have connections that are spaced 10 meters (32.8 feet) apart, and have a total of 72 connections for each ERI array. The electrode locations were marked with wire pin flags for referencing the station locations to the surveyed shot locations, and to obtain relative hand level elevations for each station.

ERI electrodes (16-inch long steel spikes) were then pounded into the ground at 10-meter intervals along each line, connected to the cable, and salt-water poured on the ground at each location to help provide good electrical contact with the earth. The electrical resistance was then checked at each of the electrodes by the instrument. If the resistance was high, more electrodes were added in the proximity of the original electrode (within 2 feet) and wired together with the original electrode to provide a better connection of the electrical signal to the earth.

As was anticipated, in many areas the electrodes were driven into coarse-grained materials (gravels and cobbles) that provided a high electrical resistance to the electrical current, in spite of numerous additional electrodes. Loose, coarse-grained sediments of gravel and cobbles have large void spaces which prevented good electrical connection with the earth in some cases. Surface conditions providing for the best ERI data had finer-grained materials such as topsoil, silt and sand mixed in with the gravel and cobbles; which provided for better electrical contact between the electrodes and the earth.

Along most of the ERI lines these poor-quality electrodes were sporadic and did not impact the data interpretation greatly. The ERI array uses a variety of electrode combinations to measure the apparent resistivity at similar distances and depths which provides overlap and redundancy of the data which limits the effects of a few poor-quality electrodes.

For each of the ERI arrays (72 electrodes) data was collected using a total of 1999 combinations of electrode pairs, providing 1999 data points at various distances and depths along each line. On Lines ERI-1 and ERI-8, 1323 pairs and 1386 pairs, respectively, provided useful data (about 67 percent) due to the larger expanses of coarse-grained materials where the data was too poor to be interpreted. For the remaining six lines, 86 to 99 percent of the electrode pairs provided useful data.

Another source of poor ERI data was due to the instrument itself, which created some interference in the middle of four of the eight ERI profiles. The instrument, located at the center of each ERI line (near station 1165'), induced extraneous electrical energy that was transferred into the ground. Precautions were taken to prevent this including placing the equipment on tarps, rubber mats and plastic crates to keep the equipment up from the ground. In my opinion, the very wet conditions during most of the ERI surveying contributed to the interference in spite of the precautions taken. The interpretation of the resistivity data accounted for the effects of the localized interference.

Poor data was observed at the far end of the last four ERI lines that were performed. This noisy data was initially thought to be due to poor soil conditions. However, after the resistivity instrument was returned to the rental company it was determined that some channels at the far end of the array were malfunctioning. The field tests performed prior to each line could not detect these problems, which were only detected using specialized testing equipment specific to the instrument. Portions of ERI Lines 1, 2, 3 and 8 were impacted by the malfunctioning instrument. The shaded areas of questionable data between stations 2000' and 2300' at the far end of these lines are due primarily to the instrument malfunctioning. The interpretation of other portions of these four lines was not adversely affected due to the bad channels.

<u>Seismic Field Methodology</u>

A 48-channel Geometrics Geode seismograph with 20-foot geophone spacing cables (940-foot long line) was used for the seismic survey. The geophones were placed in the ground by tapping them into firm soil with a small hammer. In most areas there was loose soil or gravel and a shallow hole (one foot deep or less) was dug with hand tools to reach firmer ground.

Prior to the seismic surveys, Segale crews excavated six to seven holes along each seismic line and placed cardboard tubes extending about 4 feet deep into the ground to be used as seismic shot locations. Small explosive charges (1 to 3 pounds of Kinestick binary explosives) were used in each hole as the seismic energy source. Mr. Jerry Wallace (Wallace Technical Blasting) from Woodland, WA provided the blasting materials and performed all of the blasting work on the project.

The seismic survey was designed to obtain information to about 200 feet deep. In some areas of the property depths of about 280 feet were obtained, while in other locations the interpretation was difficult at 150 to 200 feet deep due to steeply inclined bedrock surfaces (see Attachment B-2).

<u>Blast Monitoring of Seismic Shots</u>

Although no issues were anticipated given the relatively small explosive charges used for the project, an Instantel Blastmate Sound and Vibration monitor was used to measure the effects of the blasting activities. Air overpressure measurements for the blasting were made using a linear scale microphone which measured frequencies between 2 Hz and 250 Hz. The measurements are expressed as "linear" scale decibels (dBL).

The State of Washington regulatory limit for air overpressure due to blasting measured with a 2-Hz response monitor is 133 dBL at nearby structures. This air overpressure limit is to prevent damage to buildings (such as broken windows). The effects of the blasting were minimal, with an air overpressure level of 131.2 dBL recorded only 31 feet from a 3-pound explosive charge in a shot hole. At a distance of 640 feet an air overpressure level of 114.8 was recorded.

The air overpressure level decreases about 6 dBL for every doubling of the distance from the source. The nearest structure to any of the shot holes was over 1,000 feet away. At this distance the air overpressure, based on the monitoring data in the vicinity of the blasting, would have been about 111 dBL which is below the regulatory limit.

Most of the air overpressure from typical explosions has frequencies less than the threshold of human hearing, which is about 20 Hz. The dominant frequencies observed with the 3-pound seismic charges were generally in the range of 10 to 24 Hz. Therefore, the audible portion of the air overpressure (expressed as dBA) is much less than the level measured with the linear microphone required for blast monitoring. For a linear scale air overpressure intensity of 111 dBL (maximum intensity at 1000 feet from a shot hole), the audible intensity would be about 77 dBA (less than a sink garbage disposal).

In King County, typical audible construction noises are not limited by their intensity but by the work hours. All of the seismic shots were performed between the hours of 9 am to 5 pm which is the time frame allowed for impact equipment such as pile drivers. For comparison, a pile driver at a distance of 20 feet would have an approximate audible intensity of 120 dBA.

Ground vibration levels were also recorded, and are measured in terms of peak particle velocity in units of inches/second. At distances greater than 500 feet the vibrations from the 3-pound charges were below 0.08 in/sec, well below the typical recommended limit of 0.5 in/sec to prevent minor cracking of plaster walls in residential structures.

GEOPHYSICAL INTERPRETATION RESULTS

ERI Results

The results of the ERI resistivity survey provided information on the depth to bedrock at the site as well as delineating areas with increased thicknesses of probable coarser-grained overburden deposits such as gravel. The ERI method is used to map subsurface strata with contrasting resistivity properties, such as coarse-grained (sand and gravel) deposits versus fine-grained (silt and clay) deposits. This is typically a good method for obtaining information within non-lithified deposits. Resistivity values may also be lower in areas with water saturation, however, the primary factor is the grain size of the material rather than moisture content. The Puget Group rock in this area also has a low electrical resistivity which helps distinguish it from the coarser overlying materials. The rock may not be distinguishable from sediment high in silt and finer grained materials if they are laying directly on top of the rock.

The near-surface materials have fairly high electrical resistivity values (generally above 1,900 ohm-meters) and are typical of coarse-grained materials such as gravel deposits. The low resistivity values (generally below about 300 to 500 ohm-meters) are interpreted to indicate bedrock and are based on resistivity values of Puget Group rock from nearby sites and correlation to many of the nearby borings at this site. Intermediate values between about 500 to 1,900 ohm-meters are interpreted to correlate to sandy materials and silty gravel deposits. The above resistivity values correlate generally well with the boring logs and the seismic interpretation throughout the site property. These are general ranges of resistivity values, and a material can have a wide range of values due to density, water content and other variations.

Seismic Refraction Results

The seismic refraction survey helped to provide additional information on the depth to bedrock. The seismic method measures the velocity of seismic waves through the subsurface, which is primarily a function of the density of the soil or rock. The Puget Group rock in this area provided a good velocity contrast with the normally consolidated overlying sand and gravels.

The bedrock velocities range from 8,400 to 9,800 feet per second for all of the seismic lines on the site property. These velocities are typical of other site investigations in the area where Puget Group sandstone and siltstone have been confirmed with borings. The normally consolidated recessional sand and gravel materials above the bedrock have velocities ranging from 4,000 to 5,500 feet per second and are also typical of these deposits.

At this site there is the possibility that a "thin layer" of higher velocity material will not be observed if it is laying directly above the bedrock (see Attachment B-1 for a description of the "thin layer problem"). On Profile E-4, near seismic line SL 4-2, Boring EB-7W encountered a layer of dense, glacially consolidated sediment at a depth of 151 feet. The seismic data in this area indicates a seismic velocity of 7,200 feet per second for this material. This layer was observable in this area due to it being fairly thick with a moderately high velocity and having its surface located well above the bedrock surface. There is an interpreted buried bedrock valley in this area. No bedrock surface was interpreted from the geophysical data, and no bedrock was encountered in Boring EB-7W which was drilled to a depth of 245 feet.

This dense layer will not be detected with the seismic refraction method where it is relatively "thin" due to the physics of the method as discussed in Attachment B-1. The term "thin layer" is relative. With the observed velocities of the bedrock and the moderately consolidated sand and gravel material at this site, a "thin" layer of dense material (7,200 feet per second) would need to be about 60 feet thick if the bedrock was at about 150 feet deep in order for it to be observed.

The presence of an undetected high velocity "thin layer" would make the interpreted depth to rock shallower than the actual depth to rock. Additionally, the 7,200 feet per second velocity is very similar to the lower range of the bedrock velocity (8,400 feet per second) making distinguishing between the two layers difficult.

In some areas of the site the denser sediments observed in the borings may have seismic velocities similar to the overlying materials which would make the denser sediments difficult to detect. For example, the seismic data in the vicinity of the interpreted bedrock channel on Profile E-5 was analyzed for a possible higher velocity layer that may indicate the dense sediments observed in Boring EB-1W. The changes in seismic layer velocities at depth were not as distinct as observed in Profile E-4 and a confident interpretation of the seismic data to indicate denser sediments could not be made. The seismic method has difficulties resolving overburden materials with relatively similar velocities, and which also may be very complex in their range of depths and distribution. The seismic method was used at this site to primarily provide information on the depth to bedrock.

While these limitations of the seismic method were foreseen at this site due to knowledge of the regional geology and the results of previous borings at the site, the seismic interpreted depths to rock correlate generally well with the results of the nearby borings, and are also in general agreement with the resistivity interpretation results. However, while the seismic depths are similar in configuration to the resistivity depths, along many of the profiles the interpreted depth to bedrock using the ERI data is deeper than the seismic interpretation. The ERI depths are often 20 to 30 feet deeper than the seismic interpretation, and up to about 50 feet deeper in some areas. These areas with the deeper ERI interpreted depths may indicate areas with a thin layer of dense sediment, and the ERI interpretation to the top of rock may be more accurate.

Steeply sloping bedrock surfaces can also be difficult to resolve using the seismic refraction method, and are better delineated using the ERI method. On steep bedrock slopes the seismic energy will not be refracted back to the geophones at the ground surface from all of the source locations. This becomes more of a problem when a possible narrow bedrock channel is present, where the signals from all of the various source locations do not refract back towards the ground surface. Attachment B-1 discusses the critical angle of incidence and shows two figures with horizontal layering and the seismic wave paths. Attachment B-2 shows the seismic wave paths when the velocity layer slopes greater than the critical angle of incidence.

INTERPRETATION PROFILES

The results of the geophysical surveys are provided on Profiles E-1 through E-8. Each of the profiles usually show one long ERI array and the two to three related seismic lines. The profiles show the color contours of the model resistivity data and a pink dashed line which indicates the interpreted depth to rock based on the resistivity model. The resistivity contour values are representative of the various overburden materials. In general, higher resistivities indicate coarser-grained deposits, and lower resistivity values indicate deposits with more finer-grained materials.

The seismic interpreted depth to rock is shown on the profile by the open diamond symbols. The seismic interpretation results in a distinct layer which shows the estimated model surface of the top of bedrock rather than a contour model that the resistivity data provides. There are numerous variables that can affect the seismic model interpretation including gradual changes in wave velocities due to changes in density and material composition that are not observed in the data.

Distances along the profiles are in feet, with 0' referenced to the start of each ERI line. Elevations are also in feet, and a natural scale is used for the profiles. The locations and bedrock elevations from nearby borings are shown on the profiles in red, and nearby seismic interpreted rock elevations from nearby seismic lines are shown in blue. For borings and seismic results some distance away from the profile, the ground surface elevations are also shown. The locations and ground surface elevations of the shot hole locations and borings were surveyed by the Segale survey crew. The geophysical station locations on the profiles are accurate to two feet in relation to the shot hole locations.

The confidence levels of the interpreted depths to bedrock along each profile are shown on Table 1. High levels are where the interpreted results for the ERI and seismic data are similar, and/or where they correlate well with nearby borings or the results from nearby geophysical lines. Moderately high levels indicate more confidence in the data but without strong correlation with other data. Moderate levels indicate fair confidence, and in the case of the seismic data it indicates where the seismic interpretation follows the same general shape as the ERI interpretation, but the seismic interpretation is shallower than the ERI interpretation. This may indicate a thin layer of denser sediments above the bedrock that the seismic is not able to detect, which would make the seismic interpretation shallower. The confidence of the ERI interpretation is greater in these areas. Areas with low confidence are in areas with poor data, or have very poor correlation with the other geophysical results and/or boring results. The column labelled "None" indicates no ERI resistivity data interpreted because of very poor data quality. On the profiles these locations are indicated by the shaded areas. Portions of the line indicated as "N/A" indicates that it is beyond the length of the array, that bedrock is deeper than the design of the array, or, for the seismic interpretation, in an area with a buried bedrock valley with steeply sloping bedrock surfaces.

<u>Profile E-1: ERI-1, SL 1-1 and SL 1-2</u>

Profile E-1 is located in the western portion of the project site and runs SW to NE. Profile E-1 shows the resistivity model data from Line ERI-1 and depth to rock from seismic lines SL 1-1 and SL 1-2 that were located both adjacent and parallel to Line ERI-1 (see map, Figure 2-1). Two borings (EB-4W and B-4) are located close to Profile E-1. Boring EB-4W is located near station 308' near the west end of the profile and penetrated a sequence of gravel from the surface to about elevation 711 feet (about 80 feet deep), which correlates well with the 1,900 ohm-meter resistivity contour. Boring EB-4W indicates that below the gravel is a layer of sand and then silty gravel deposits to about elevation 638 feet (about 153 feet deep) where bedrock was encountered. Boring B-4 is located near station 1135' and encountered 75 feet of mostly gravel (to elevation 715 feet). No bedrock was encountered in Boring B-4. The resistivity data near Boring B-4 indicates higher values (greater than 1,900 ohm-meters) for the entire depth of the boring which correlates well to the gravel deposits observed in the boring.

The interpreted depth to bedrock from both the ERI and seismic data is somewhat shallower than the depth to bedrock encountered in Boring EB-4W. However, the overall form of the top of bedrock surface is interpreted to be generally representative of the rock surface along Profile E-1. The ERI based interpretation of depth to bedrock diverges from the seismic data near station 1400'. The seismic data is interpreted to provide a better estimate of depth to rock from station 1400' to the east end of SL 1-2 than the ERI data. Areas with questionable ERI data are shown as a hachured shaded pattern on Profile E-1.

ERI data acquisition east of station 1600' was affected by ground conditions associated with the hard gravel road along the profile alignment. Surface resistance tests indicated poor ground conditions, and numerous electrodes were added in multiple attempts to lower surface resistance to electrical current flow. However, high surface resistance was still encountered and the ERI data east of station 1600' is not considered in the interpretation of the subsurface conditions. An area of poor ERI data was also encountered near station 1165' in the middle of the profile but does not affect the interpretation of depth to bedrock. The approximate depth to bedrock to the east of station 1400' is best represented by the seismic data.

Profile E-2: ERI-2, SL 2-1 and SL 2-2

Profile E-2 heads to the north from Line ERI-1 and shows the resistivity model data from Line ERI-2 and depth to rock from seismic lines SL 2-1 and SL 2-2 that were located both adjacent and parallel to Line ERI-2 (see map, Figure 2-2).

Boring EB-6W is located about 300 feet west of station 1340', and encountered mostly gravel to about elevation 702 feet (124 feet deep) where bedrock was encountered. The gravel deposits are glacially consolidated below elevation 743 feet (83 feet deep). The interpreted depth to rock based on both the ERI data and seismic data correlates well with the boring results.

The seismic interpreted rock elevation from Profile E-1 is shown on the left side of Profile E-2 by the blue "X". Profile E-2 has similar results to E-1 with regard to the model resistivities and general ranges in depth to rock. The seismic interpreted depth to rock at the north end of E-2 is interpreted to be shallowing to the north, and ties in well with the intersecting crossline of seismic line SL 2-3.

ERI data interference is apparent near the middle of the line due to extraneous energy from the instrument, and the poor resistivity data at the far north end is due to an instrument malfunction.

Profile SL 2-3

Seismic line SL 2-3 was oriented generally southeast to northwest to provide information between Profile E-2 and Profile E-3 farther to the west (see map, Figure 2-2). No resistivity data was recorded along the short seismic alignment.

The interpreted bedrock surface has a generally similar elevation along the profile, while the ground surface slopes down to the northwest. The seismic results at the southeast end of SL 2-3 correlate well with the results from SL 2-2. At the northwest end of SL 2-3 there is good correlation with the interpreted results along Profile E-3 (line ERI-3 and SL 3-1) where rock has an interpreted depth of about 25 feet.

Profile E-3: ERI-3 and SL 3-1

Profile E-3 runs south to north along the western edge of the property, and is east of the Green River Gorge which has exposed bedrock in this area. Profile E-3 shows the resistivity model data from Line ERI-3 and depth to rock from seismic line SL 3-1 located along the north end of line ERI-3. Profile E-3 is interpreted to have relatively shallow bedrock along most of the line

At the south end of seismic line SL 3-1 (near station 1375') both the ERI and seismic data correlate well with the interpreted depth to rock observed on nearby seismic line SL 2-3. Near the north end of the line there is an isolated bedrock outcrop knob that is about 250 feet to the east of the line, and centered at about station 2000', which correlates well with the interpreted shallow depth to rock in this area.

Near the south end of the Profile E-3 at station 200', the deeper depth to rock interpreted from the ERI data correlates reasonably well with the results observed at Boring EB-6W located to the south of the line.

The north end of the ERI profile has a short section of questionable resistivity data due to an instrument malfunction.

Profile E-4: ERI-4, SL 4-1 and SL 4-2

Profile E-4 is oriented west to east and runs across the northern edge of the large surface depression (glacial kettle) east of the powerlines that run north-south through the property (see map, Figure 2-4). Line ERI-4 runs in a straight line west to east. Seismic line SL 4-1 is along the same alignment as the western half of the ERI line. The west end of seismic line SL 4-2 is at the east end of SL 4-1, and then heads to the northeast away from the ERI line. The east end of SL 4-2 is about 400 feet north of Line ERI-4. Boring EB-7W is located 35 feet northwest (perpendicular from SL 4-2) at about station SL 4-2, 1508'. The location of the boring was measured with a tape measure, and its relative elevation obtained using a hand level and referenced to a nearby shot location survey stake.

Boring EB-7W penetrated a sequence of mostly gravel from the surface to about elevation 694 feet (about 151 feet deep) where it encountered dense sediments of primarily sand and then gravel at greater depths near the bottom of the boring, which is at about elevation 600 feet (245 feet deep). No bedrock was encountered at Boring EB-7W.

The ERI interpretation near Boring EB-7W indicates a deep and relatively narrow valley in the bedrock with steeply sloping sides. The top of the bedrock surface was not observed in the center of this buried valley and is interpreted to be at least 300 feet deep. The steep slopes of this valley prevented the seismic refraction method from providing reliable information on the bedrock surface. However, the top of the thick layer of dense, glacially consolidated sediment was observed in the seismic data (velocity layer of about 7,200 fps) and correlates well with Boring EB-7W.

To the west of the interpreted bedrock valley, the seismic interpreted depth to rock is shallower than the ERI interpreted depth to rock, which may indicate that a thin layer of dense sediment, not detected by the seismic method, overlays the bedrock in this area. There is a higher confidence in the deeper depth to rock interpreted from the ERI data in this area. Both methods provide similar depths to rock at the west end of the profile that are consistent with the bedrock depth observed in Boring B-3 farther to the west. Boring B-3 encountered bedrock at a depth of 93.5 feet. The interpreted bedrock depth on Profile E-4 at station 200' is about 120 feet deep. At the east end of Profile E-4 the bedrock surface interpreted from the seismic data correlates well with the seismic interpretation from Profile E-5 which is about 350 feet to the north.

The ERI data is questionable at depth in the area between stations 1300' and 1850' due to naturally occurring coarse gravel and cobbles at the surface which provided for poor electrode contact with the earth, and therefore limited the flow of electrical current in this area.

<u>Profile E-5: ERI-5, SL 5-1, SL 5-2 and SL 5-3</u>

Profile E-5 is oriented west to east and lies to the north and east of Profile E-4 (see map, Figure 2-5). The ERI data shows a thinner layer of high resistivity materials than was observed on Profile E-4, which seems to correlate well with the thinner layer of poorly graded gravels in Boring EB-1W (0 to 30 feet deep) located near station 1085'. Below 30 feet deep, Boring EB-1W indicates gravel and sand mixed with silt, which seems to correlate with the moderate resistivity values (500 to 1,200 ohm-meters, green contours). The discrete zone of higher resistivities (yellow contours) to the east of the boring is due to interference from the instrument located at the center of the array. Boring EB-1W extended to elevation 655 feet (175 feet deep) and did not encounter bedrock. The bedrock surface interpreted from the seismic and resistivity data indicates bedrock at about elevation 605 feet (about 225 feet deep) near the boring.

The interpreted seismic depths are fairly deep in the middle portion of the profile and are near the maximum depth penetration. The area with no interpreted seismic data between stations 800' and 1100' is due to the great depth to rock, and the probable steep slope of the bedrock surface near station 800' as indicated by the ERI resistivity data.

The interpreted depth to rock at the west end of SL 5-1 correlates well with the rock at the east end of SL 4-2 farther to the southwest. Near the east end of SL 5-3 the depth to rock is very close to the depth interpreted on seismic line SL 6-1.

<u>Profile E-6-7: ERI-6 and ERI-7; SL 6-1, SL 6-2, SL 7-1 and SL 7-2</u>

Profile E-6-7 is located in the northeast portion of the site and is a combination of Line ERI-7 (to the southeast) and ERI-6 (to the northwest), as well as four seismic arrays oriented along the same alignment (see map, Figure 2-6). This profile crosses near the east end of SL 5-3 at station E-6-7, 2115'. The ERI data along this line indicates a relatively thin layer of high resistivity materials near the ground surface (probable poorly sorted gravel as observed in Boring B-2). Boring B-2 is located near station 640' and is about 150 feet southwest of the line and encountered bedrock at about elevation 798 feet (about 50.5 feet deep). The interpreted rock surface at station 640' is at about elevation 765 feet (about 85 feet deep).

The interpreted bedrock surface is relatively horizontal in the southern half of the profile and ranges from about elevation 800 feet at the southeast end to about elevation 750 feet near the middle of the profile at station 2250'. Near station 2250' the interpreted rock surface slopes down to the northwest, and the toe of the rock slope near station 3000' is interpreted to be at about elevation 600 feet based on the ERI resistivity data. The interpreted top of rock based on the seismic data is deeper than the resistivity interpretation, but is questionable due to the relatively great depth which is at or beyond the depth capability of the seismic array design.

A thick sequence of materials in this northern portion of the line with moderate resistivity values (300 to 1,200 ohm-meters, green contours) and seismic velocities in the range of 4,000 to 5,500 feet per second may indicate that these materials are normally consolidated recessional deposits with sand and silty gravel.

<u>Profile E-8: ERI-8, SL 8-1, SL 8-2, and SL 8-3</u>

Profile E-8 is at the southwest portion of the property and runs south to north (see map, Figure 2-7). Three seismic lines (SL 8-1, 8-2 and 8-3) are also located along this alignment. The north end of the profile is located near Boring B-5 which is about 100 feet to the east of the geophysical line. The seismic interpretation correlates well with the boring results. Boring B-5 encountered mostly gravel and then relatively shallow rock observed at about elevation 773 feet (about 33.5 feet deep). Boring 21M is an older boring located near the south end of the line at about station -400 and about 175 feet to the west. This boring encountered mostly gravel and then bedrock at about elevation 757 feet (about 82 feet deep) which also correlates well with the seismic interpretation results.

The bedrock depths observed in borings EB-2W (to the south of the profile) and EB-3W (west of about station 1420') are shown on Profile E-8, and they also correlate fairly well with the geophysical results, although they are much farther away from the profile.

The resistivity data seems to indicate mostly higher resistivity materials (probable poorly graded gravel) above the bedrock surface. Interference from the ERI instrument in the middle of the array is observed, and questionable resistivity data between stations 1400' and 1650' is believed to be due to naturally occurring dry, loose gravel with cobbles at the ground surface. At the north end of the line the questionable resistivity data is due to an instrument malfunction.

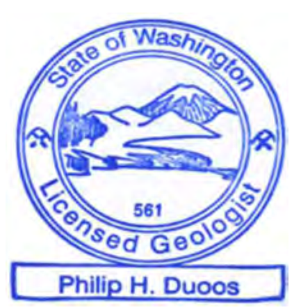
CONCLUSIONS

The use of electrical resistivity imaging and seismic refraction methods at this site provides valuable information to assist in the development of the site. Although the geophysical results agree well in general with the borehole information, these results are interpretive in nature and represent a best estimate of subsurface conditions considering the limitations of the geophysical methods employed. Because of the many variables in any type of geophysical investigation and variable subsurface conditions, engineering design plans should not be made based solely on geophysical results. Review of this information by a geologist who is familiar with this area will also provide valuable insight into the geophysical interpretation results. Only direct observations using test pits, borings or other means can ultimately characterize subsurface conditions, using the geophysical results as a guide.

Please feel free to contact me if you have any questions or comments regarding this information, or if you require further assistance. I appreciated the opportunity to work with you on this project.

Respectfully submitted,

Philip H. Duoos
Geophysical Consultant
WA Licensed Geologist # 561



Attachments

LIST OF ATTACHMENTS

ATTACHMENT A

ELECTRICAL RESISTIVITY IMAGING DESCRIPTION

Electrical resistivity imaging (ERI) uses DC Resistivity techniques to measure changes in the electrical properties of the subsurface. This technique employs a series of electrodes in a straight line. A DC current is induced into the ground through the two current electrodes, and the potential difference measured between the two potential electrodes. As the electrode spacing is increased, resistivity data (ohm-meters) is obtained from greater depths. For final interpretation, the apparent resistivity values are plotted against electrode spacing, and is then interpreted using computer-assisted modeling.

Factors which may decrease subsurface resistivities include higher moisture content, greater amounts of finer materials, increased clay and/or silt content, soil contamination and/or ground water contamination.

Several factors can affect the effectiveness of the ERI resistivity method. The presence of coarse-grained materials at the ground surface can prevent good electrical connection with the electrodes and limit the amount of electrical current into the earth. The proximity of cultural features such as underground utilities, fences, reinforced concrete and other metal structures can interfere with the resistivity data. The results are also dependent on the size, depth, and resistivity contrast of the target. While the accuracy of the interpretation depends on site-specific conditions, geophysical methods in general provide an accuracy of +/- 10%.

ATTACHMENT B-1

SEISMIC REFRACTION METHODOLOGY

Overview

The seismic refraction method is used to evaluate numerous subsurface conditions; including depth to and strength (rippability) of rock and general subsurface stratigraphy.

The seismic refraction method uses an induced shock wave. As the shock wave propagates through the earth, it is affected by the materials through which it passes. Geophones placed on the ground surface record the ground motion caused by the resultant wave. A seismograph measures the time required for the resultant wave to arrive at each geophone. These geophones are located at selected distances from the wave source. Analysis of the data (travel times and distances) provides seismic velocities of subsurface material and depths to significant velocity interfaces.

Geologic conditions yielding higher seismic velocities include increased amounts of water, clay, cobbles, and rock fragments, greater compaction of overburden materials, and greater competency of rock. Several factors can affect the effectiveness of the seismic method including the proximity of cultural interferences (such as powerlines and traffic noise), surface conditions (such as loose soil), the size and depth of the target, and the seismic wave velocity contrast between stratigraphic units. Seismic velocities must increase with depth for a reliable interpretation of the data.

Calculations

The description of the travel of seismic refraction waves through the earth uses the same equation that describes the refraction of light: Snell's Law. The following is a brief summary of the basic theory for a simple two-layer geologic model as discussed by Redpath (Redpath, 1973).

Snell's Law is stated as:

$$\frac{SIN\alpha}{SIN\beta} = \frac{V_1}{V_2}$$

and at the critical angle of incidence for a refracted seismic wave (β=90°), it becomes:

$$SIN\alpha = \frac{V_1}{V_2}$$

where V_1 and V_2 are the seismic wave velocities for the upper and lower layers, respectively.

The seismic refraction method measures the amount of time it takes the seismic energy to travel from the energy source to the geophones placed along the ground surface. The arrival time for the seismic wave at each geophone is plotted corresponding to the distance of the geophone from the energy source, creating a time-distance graph (Figure 1).

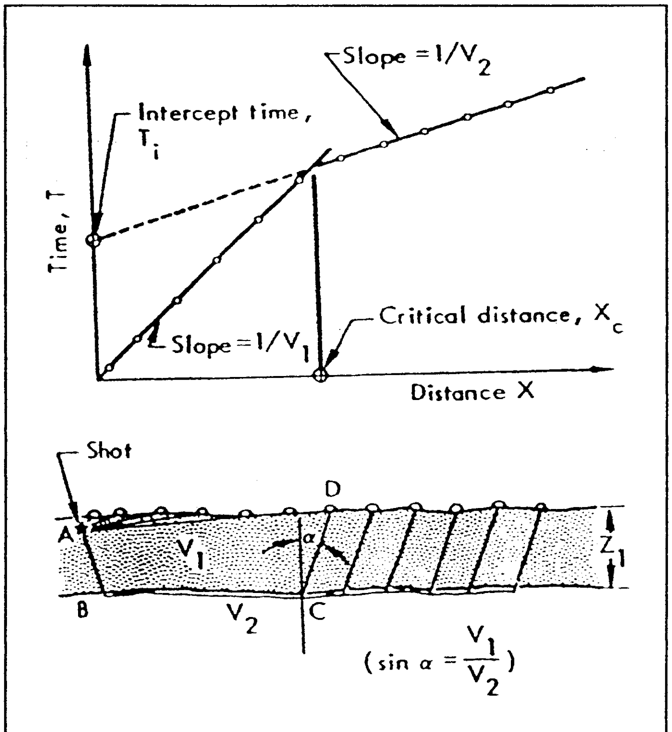


Figure 1: Two-layer geologic model and associated time-distance graph (Redpath, 1973).

The time required for the energy to reach the geophones near the source (direct wave arrivals) is based only on the seismic velocity of the energy traveling though the upper (low velocity) layer. At a certain distance from the source, called the critical distance, the first seismic waves to reach the geophones will be those that have refracted from a deeper, higher velocity layer. Although these waves have traveled a greater distance than the direct waves, they have traveled at a greater velocity over most of their path, and thus arrive before the slower direct arrivals to the geophones farther from the source. Successively deeper layers with higher velocities affect the time-distance graph in a similar manner

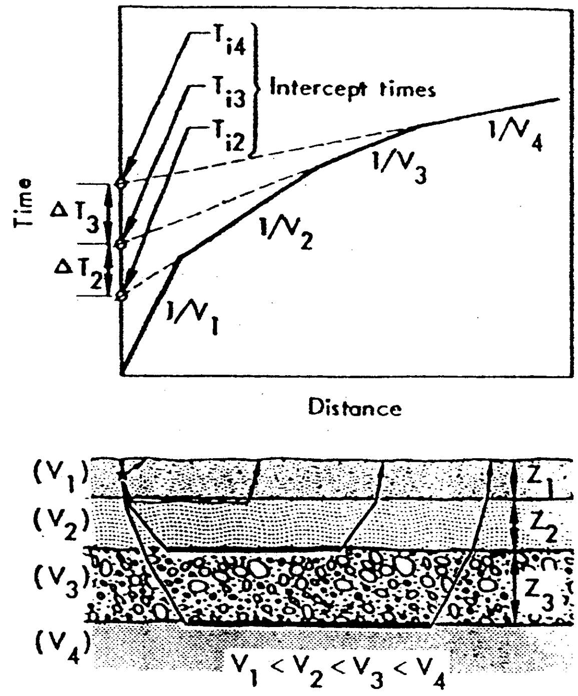


Figure 2: Multiple layer geologic model and associated time-distance graph (Redpath, 1973).

Using the time-distance graph, the velocities of the layers can be calculated (based on the slope of the arrival times), and the layer thicknesses can be calculated using the intercept times. The equation used in the time-intercept method to determine thicknesses is:

$$Z_1 = \frac{T_i V_1}{2COS(SIN^{-1} V_1 / V_2)} + \frac{\text{SHOT DEPTH}}{2};$$

Figure 2 is a sketch of a multiple layer case and the corresponding time distance curve showing the intercept times.

For more complex geologic models, as is usually observed, additional energy source locations are required at both ends of a seismic line as was done for this survey. The layer velocities are calculated using the data from all of the time-distance curves (delay-time method).

Limitations

Two types of geologic conditions can cause a *hidden zone* problem. One type of hidden zone is a layer with a lower velocity than the layer above it. Energy approaching the layer at the critical angle will pass through the layer, and will not be refracted back to the surface until it encounters a deeper layer with a higher velocity, so no first arrivals are observed from the low-velocity layer. The presence of an unknown low-velocity layer will cause the calculated depths to be greater than the actual depths.

The other type of hidden zone is a layer with a greater velocity than the layer above it, but one that is too thin and/or does not have a large enough velocity contrast. The effect of a thin layer will cause the calculated depths to be shallower than the actual depths.

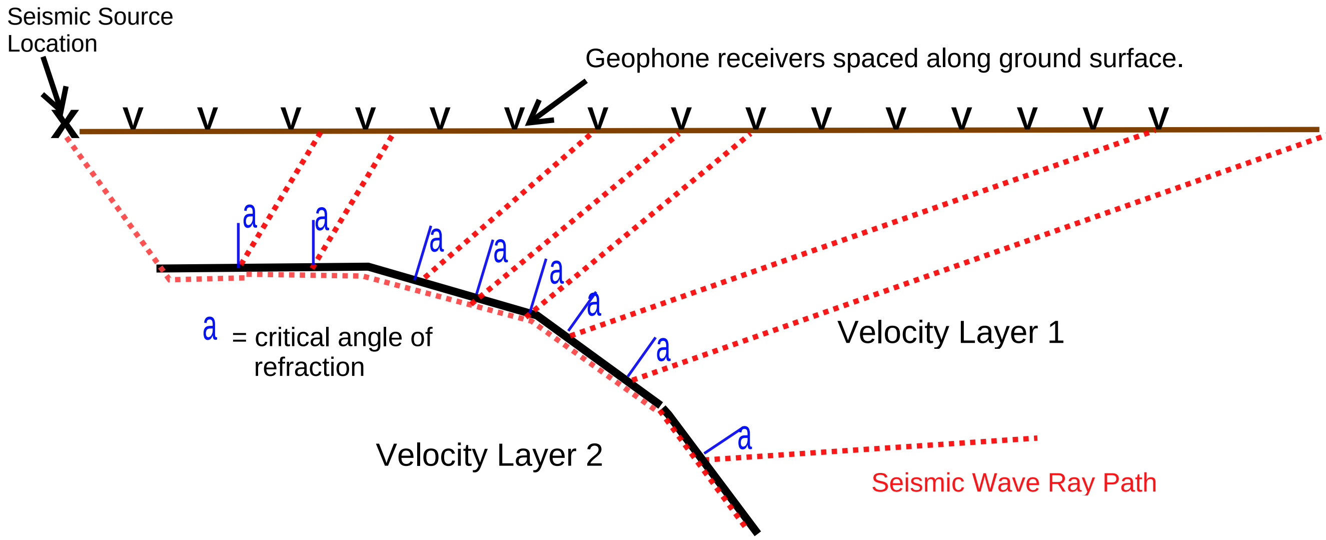
In areas with hidden zones, the amount of error can be determined based on direct observations (such as test pits or boreholes), and can be compensated for over the rest of the seismic lines.

References

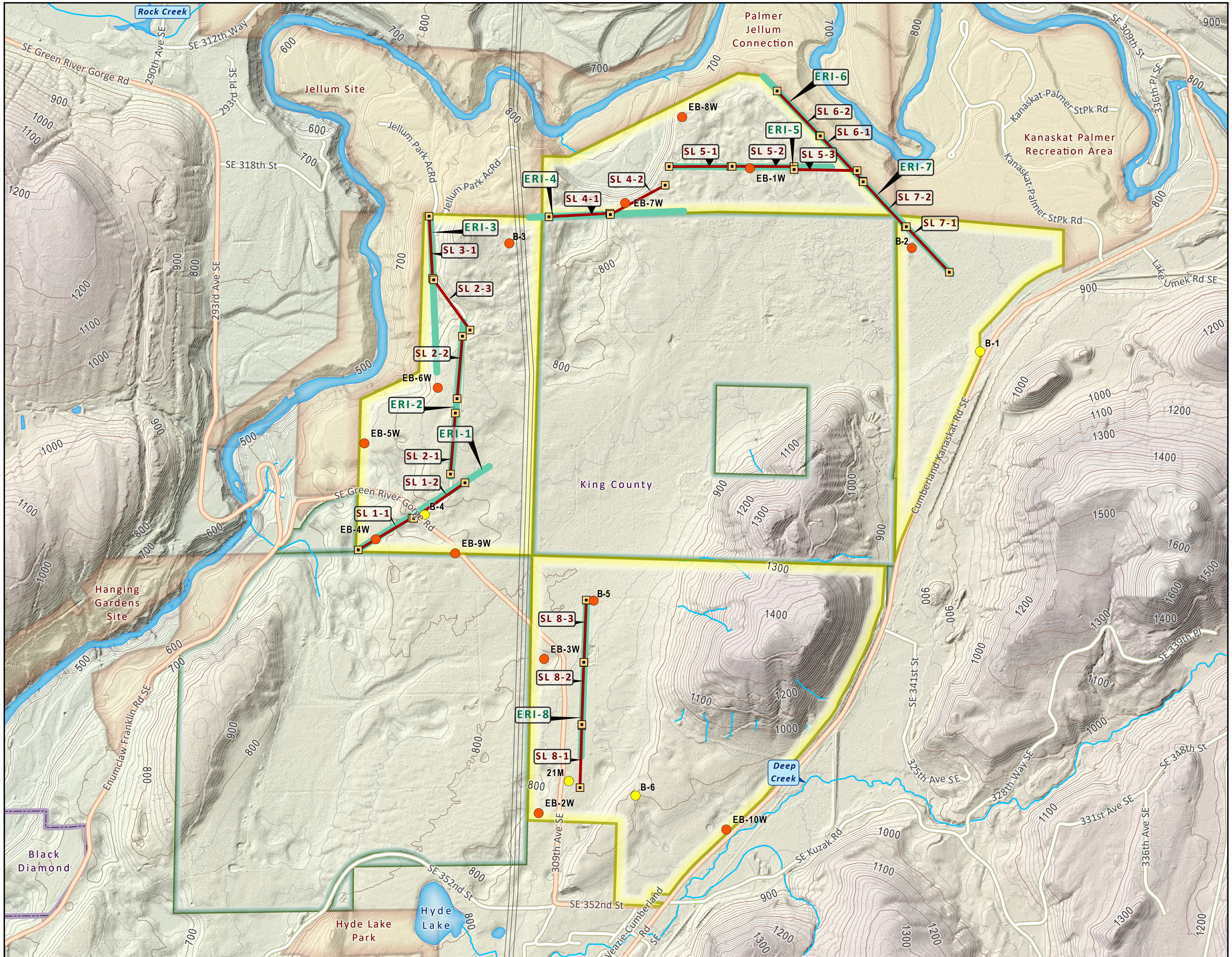
Redpath, Bruce B. (1973). "Seismic Refraction Exploration for Engineering Site Investigations." *Tech. Report E-73-4*, U.S. Army Engineer Waterways Experiment Station Explosive Excavation Research Laboratory, Livermore, CA

Attachment B-2

Seismic Refraction Wave Path Angles



The figure shows the effect of a steeply sloping velocity layer. Seismic waves are refracted from the Velocity Layer 2 surface at the critical angle (a). For steeply sloping interfaces the ray path will not be refracted back to the geophones at the ground surface. The length of the geophone array will also be a factor in detecting the refracted energy.



LEGEND

SITE

DOWNHOLE GEOPHYSICS

EXPLORATION BORING BY OTHER

SEISMIC LINE START AND END

GEOPHYSICAL SURVEY LINE

SEISMIC REFRACTION

ELECTRICAL RESISTIVITY IMAGING

CITY BOUNDARY

PARK

WADNR MANAGED PROPERTY

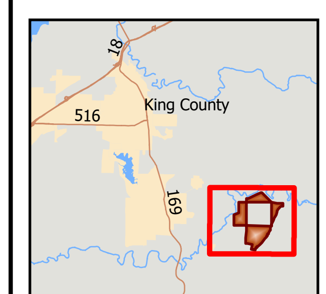
TRANSMISSION LINE

CONTOUR 100 FT

CONTOUR 20 FT

DATA SOURCES / REFERENCES:
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



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FEET

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

Philip H. Duoos
Geophysical Consultant

GEOPHYSICAL EXPLORATION OVERVIEW

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	1

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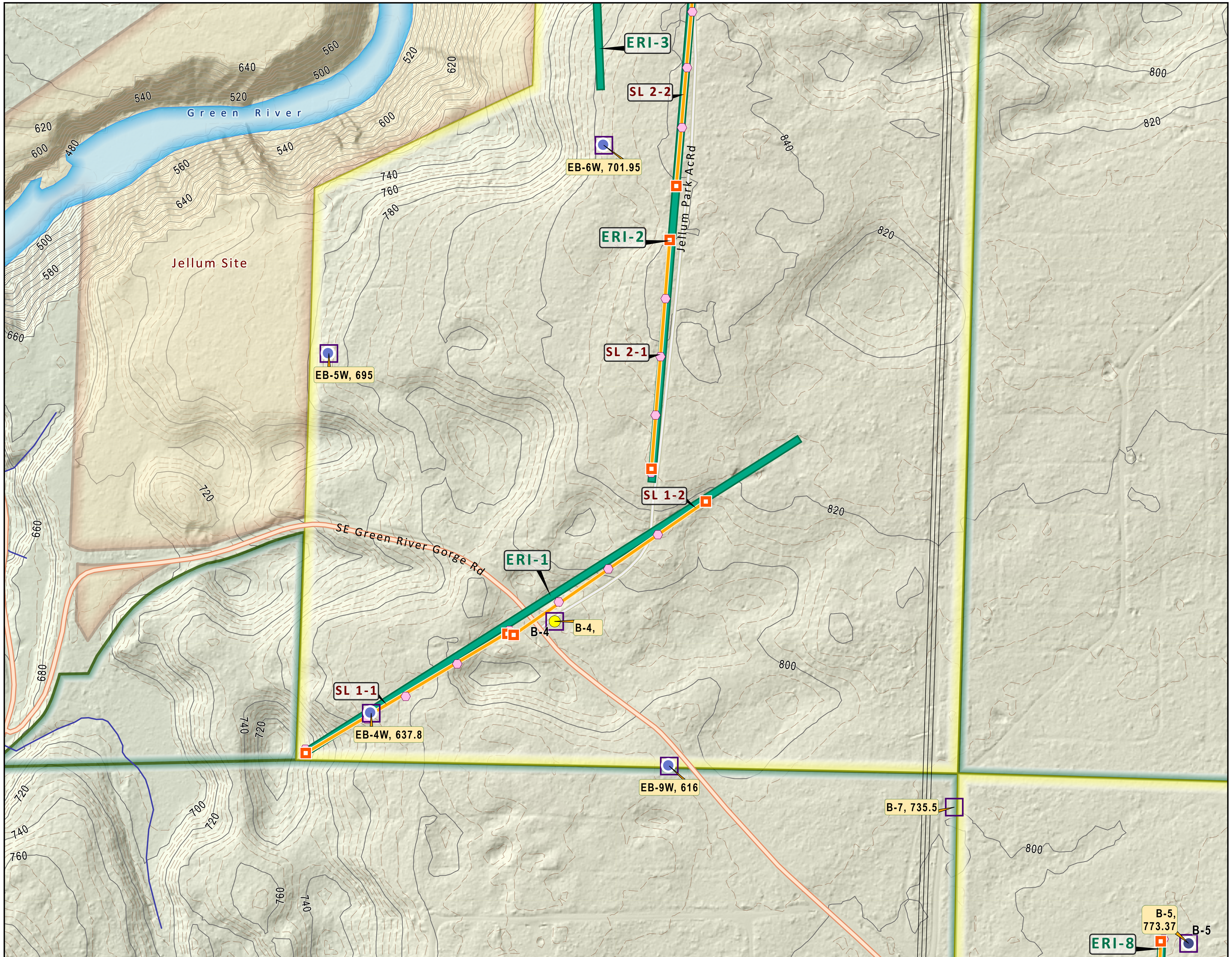


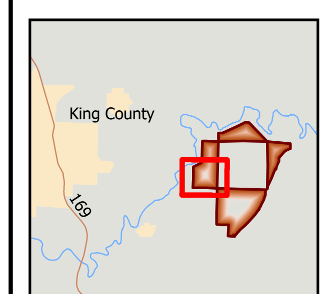
SITE
DOWNHOLE GEOPHYSICS
EXPLORATION BORING
BEDROCK ELEVATION FROM EXPLORATION
SHOT FLAG LOCATION
SEISMIC LINE START AND END

GEOPHYSICAL SURVEY LINE
SEISMIC REFRACTION
ELECTRICAL RESISITIVITY IMAGING
PARK
WADNR MANAGED PROPERTY
TRANSMISSION LINE
CONTOUR 20 FT
CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



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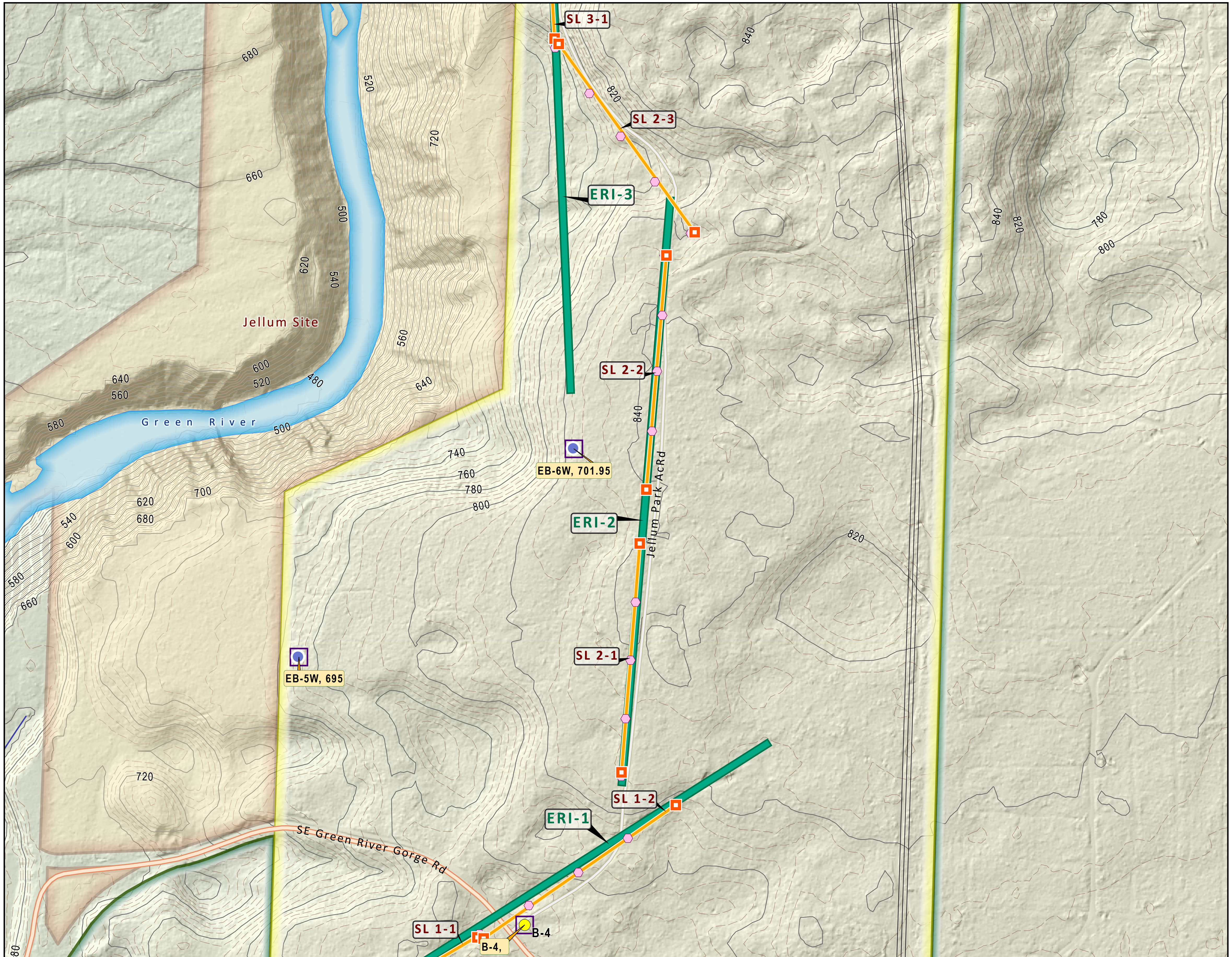
FEET

Philip H. Duoos Geophysical Consultant

GEOPHYSICAL SURVEY LINES ERI-1 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-1

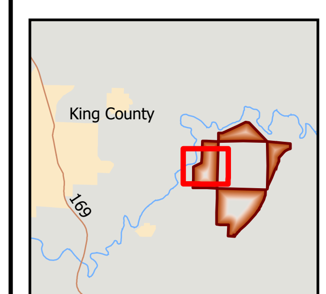


SITE
DOWNHOLE GEOPHYSICS
EXPLORATION BORING
BEDROCK ELEVATION FROM EXPLORATION
SHOT FLAG LOCATION
SEISMIC LINE START AND END
GEOPHYSICAL SURVEY LINE
SEISMIC REFRACTION
ELECTRICAL RESISTIVITY IMAGING
PARK
WADNR MANAGED PROPERTY
TRANSMISSION LINE
CONTOUR 20 FT
CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



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FEET

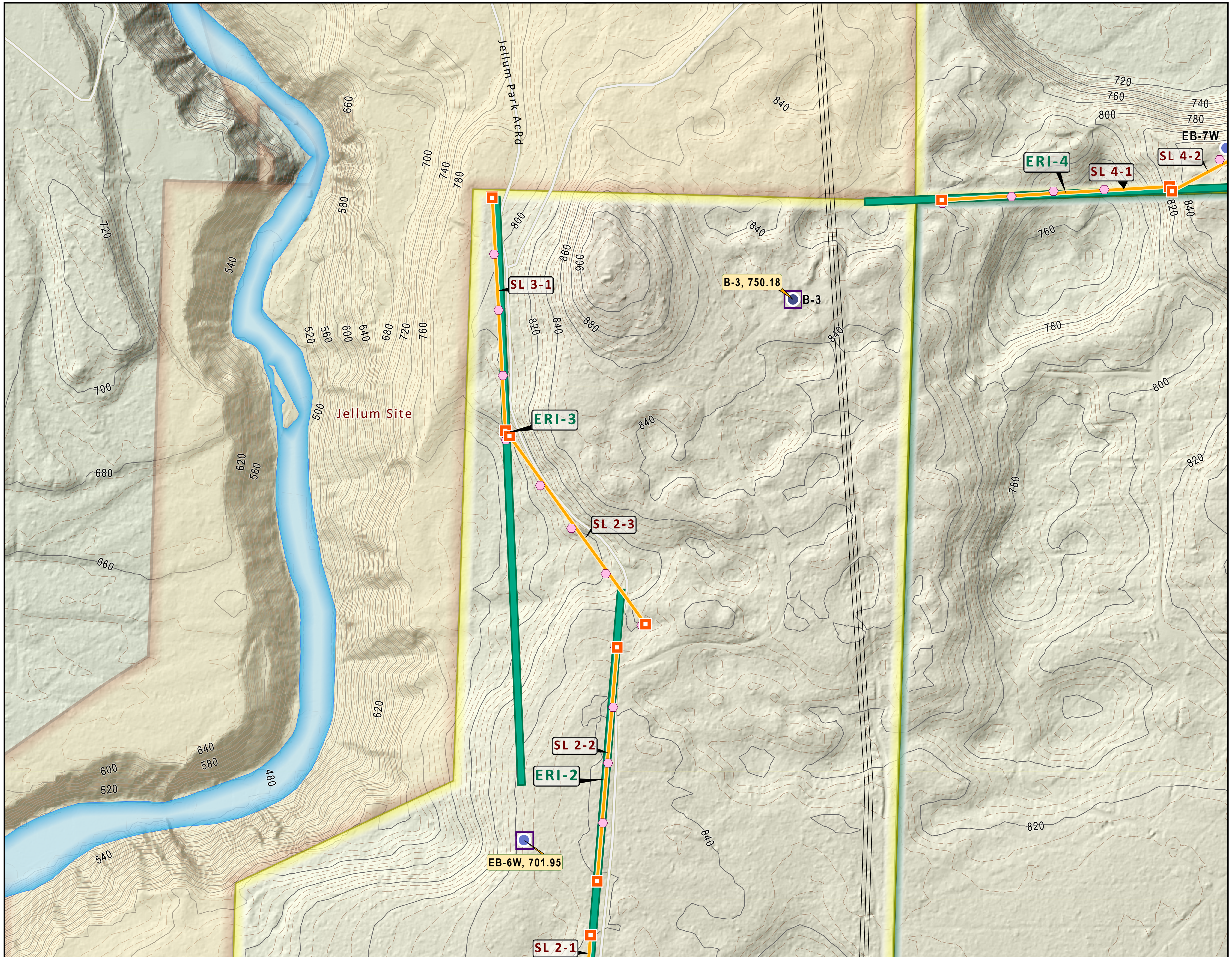
BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

Philip H. Duoos
Geophysical Consultant

GEOPHYSICAL SURVEY LINES
ERI-2 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-2

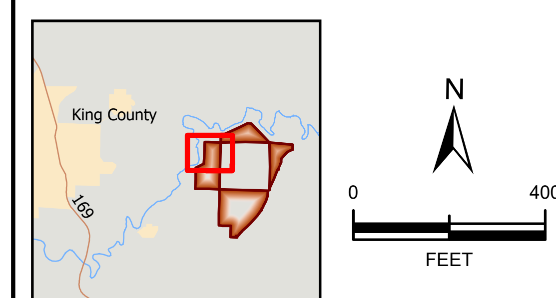


SITE
DOWNHOLE GEOPHYSICS
BEDROCK ELEVATION FROM EXPLORATION
SHOT FLAG LOCATION
SEISMIC LINE START AND END
GEOPHYSICAL SURVEY LINE
SEISMIC REFRACTION
ELECTRICAL RESISTIVITY IMAGING
PARK
WADNR MANAGED PROPERTY
TRANSMISSION LINE
CONTOUR 20 FT
CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

Philip H. Duoos
Geophysical Consultant

GEOPHYSICAL SURVEY LINES
ERI-3 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-3

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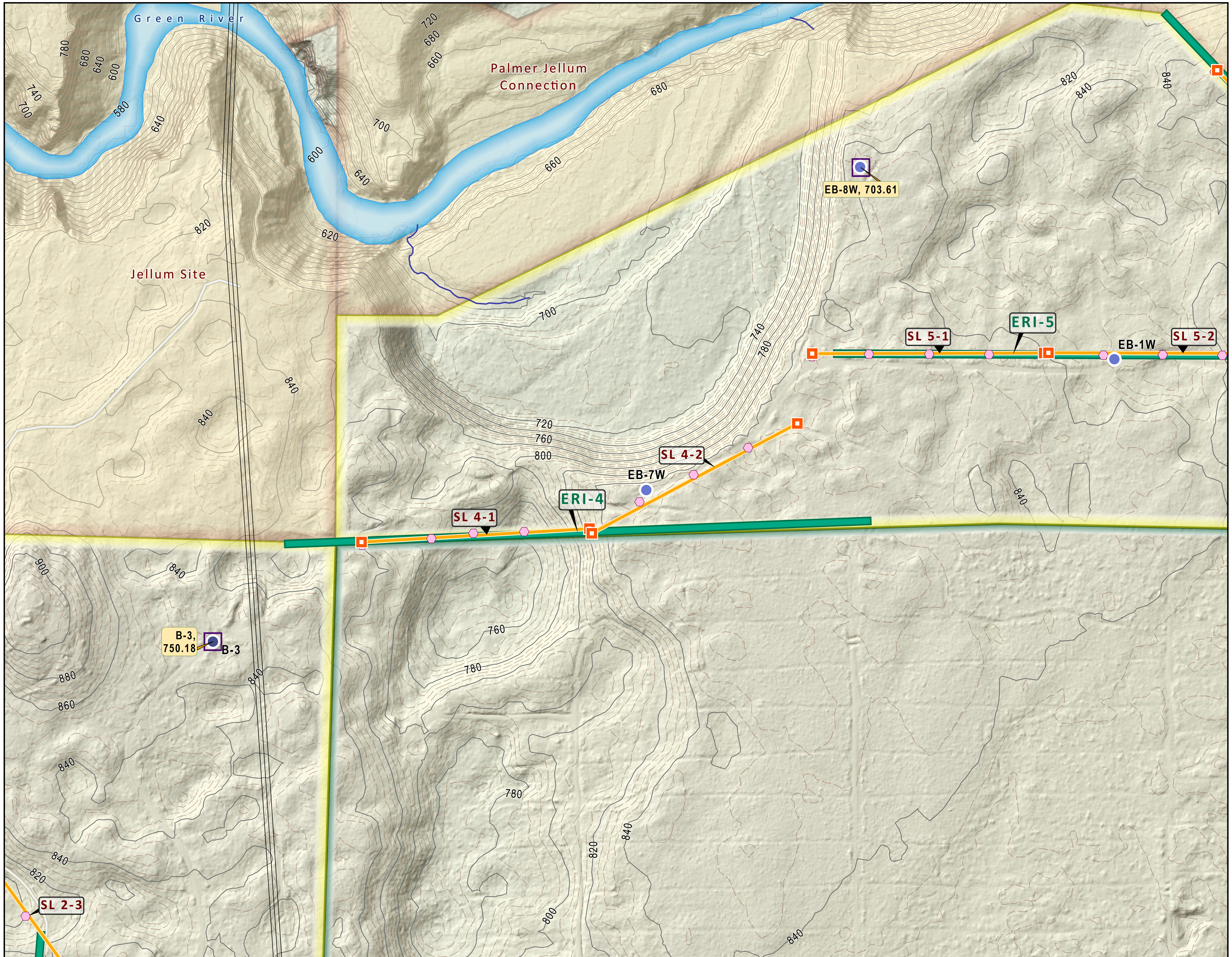
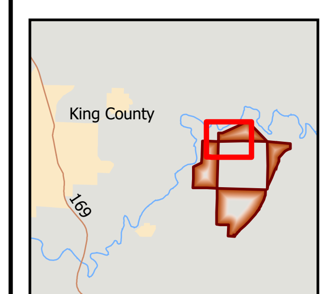


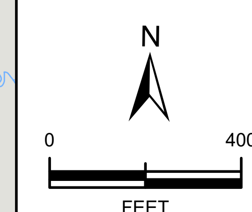
SITE
DOWNHOLE GEOPHYSICS
BEDROCK ELEVATION FROM EXPLORATION
SHOT FLAG LOCATION
SEISMIC LINE START AND END
GEOPHYSICAL SURVEY LINE
SEISMIC REFRACTION
ELECTRICAL RESISITIVITY IMAGING
PARK
WADNR MANAGED PROPERTY
TRANSMISSION LINE
CONTOUR 20 FT
CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE





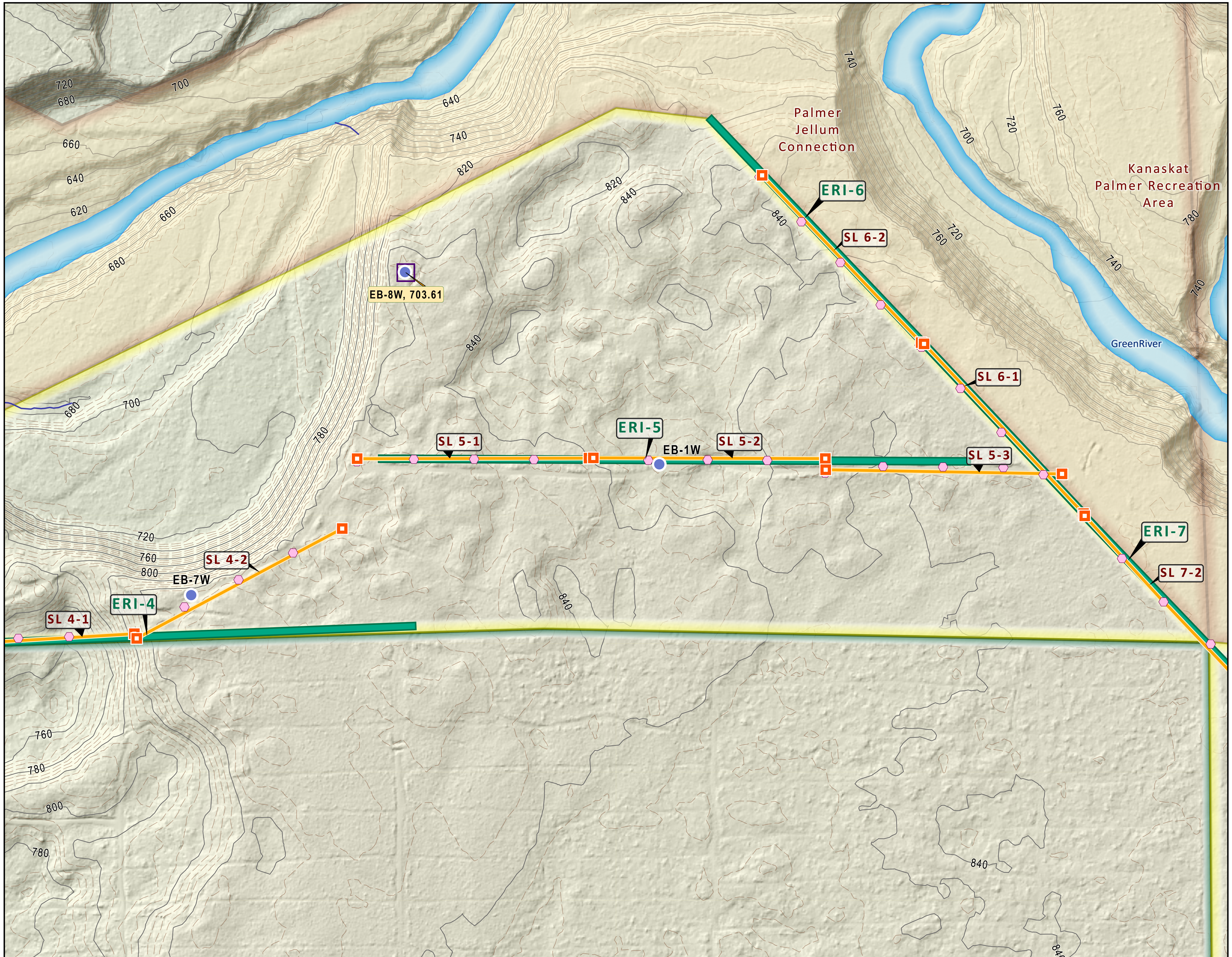
BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

Philip H. Duoos
Geophysical Consultant

GEOPHYSICAL SURVEY LINES
ERI-4 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-4

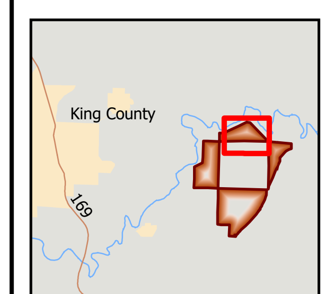


SITE
DOWNHOLE GEOPHYSICS
BEDROCK ELEVATION FROM EXPLORATION
SHOT FLAG LOCATION
SEISMIC LINE START AND END
GEOPHYSICAL SURVEY LINE
SEISMIC REFRACTION
ELECTRICAL RESISITIVITY IMAGING
PARK
WADNR MANAGED PROPERTY
CONTOUR 20 FT
CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



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Philip H. Duoos
Geophysical Consultant

GEOPHYSICAL SURVEY LINES
ERI-5, 6 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-5

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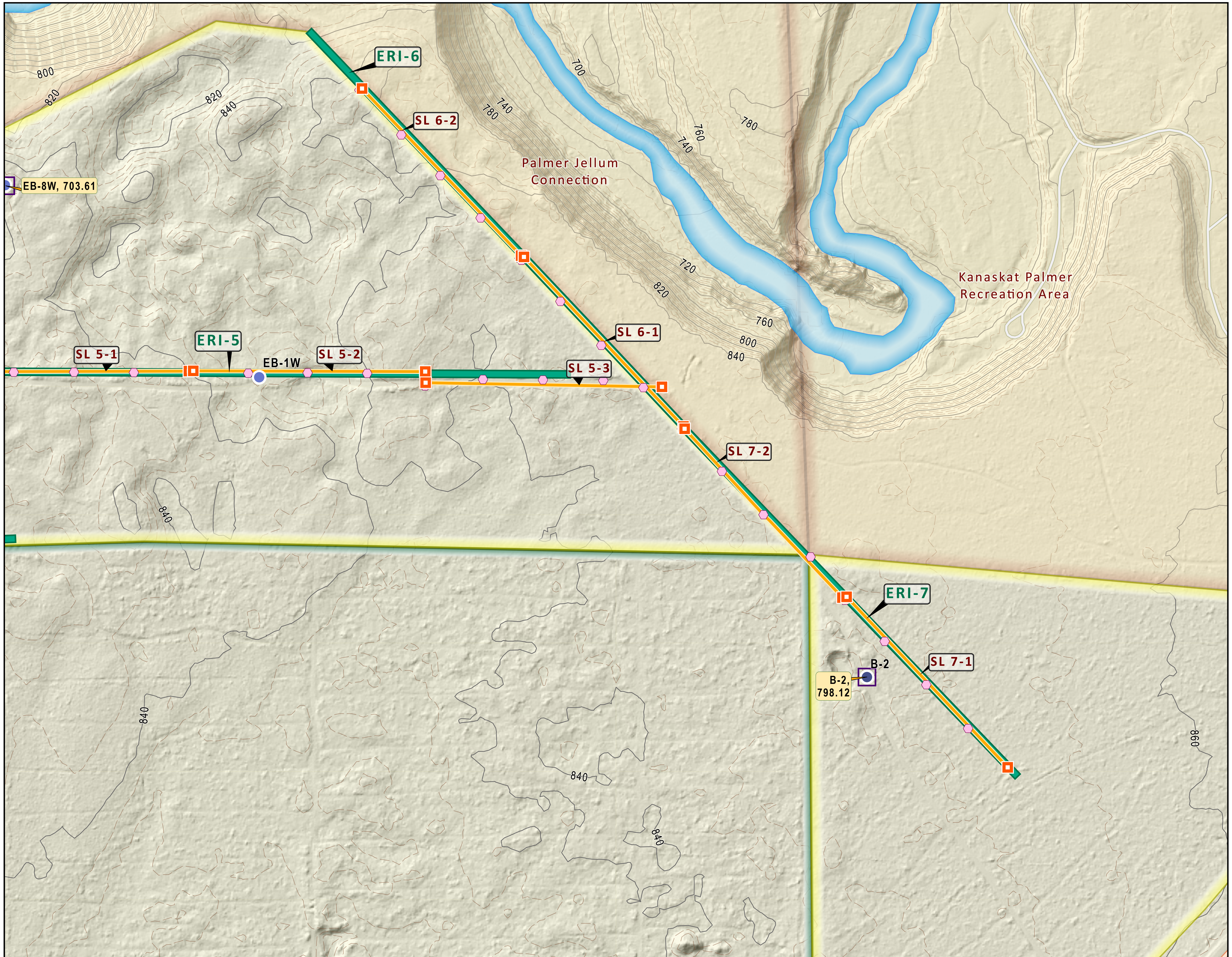
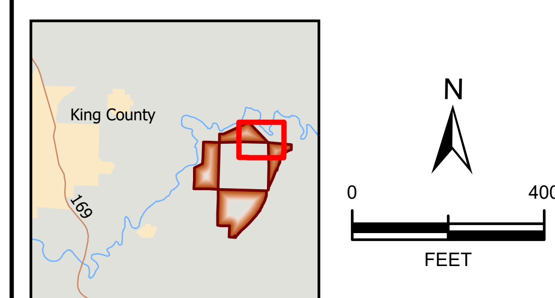


SITE
DOWNHOLE GEOPHYSICS
BEDROCK ELEVATION FROM EXPLORATION
SHOT FLAG LOCATION
SEISMIC LINE START AND END
GEOPHYSICAL SURVEY LINE
SEISMIC REFRACTION
ELECTRICAL RESISITIVITY IMAGING
PARK
WADNR MANAGED PROPERTY
CONTOUR 20 FT
CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

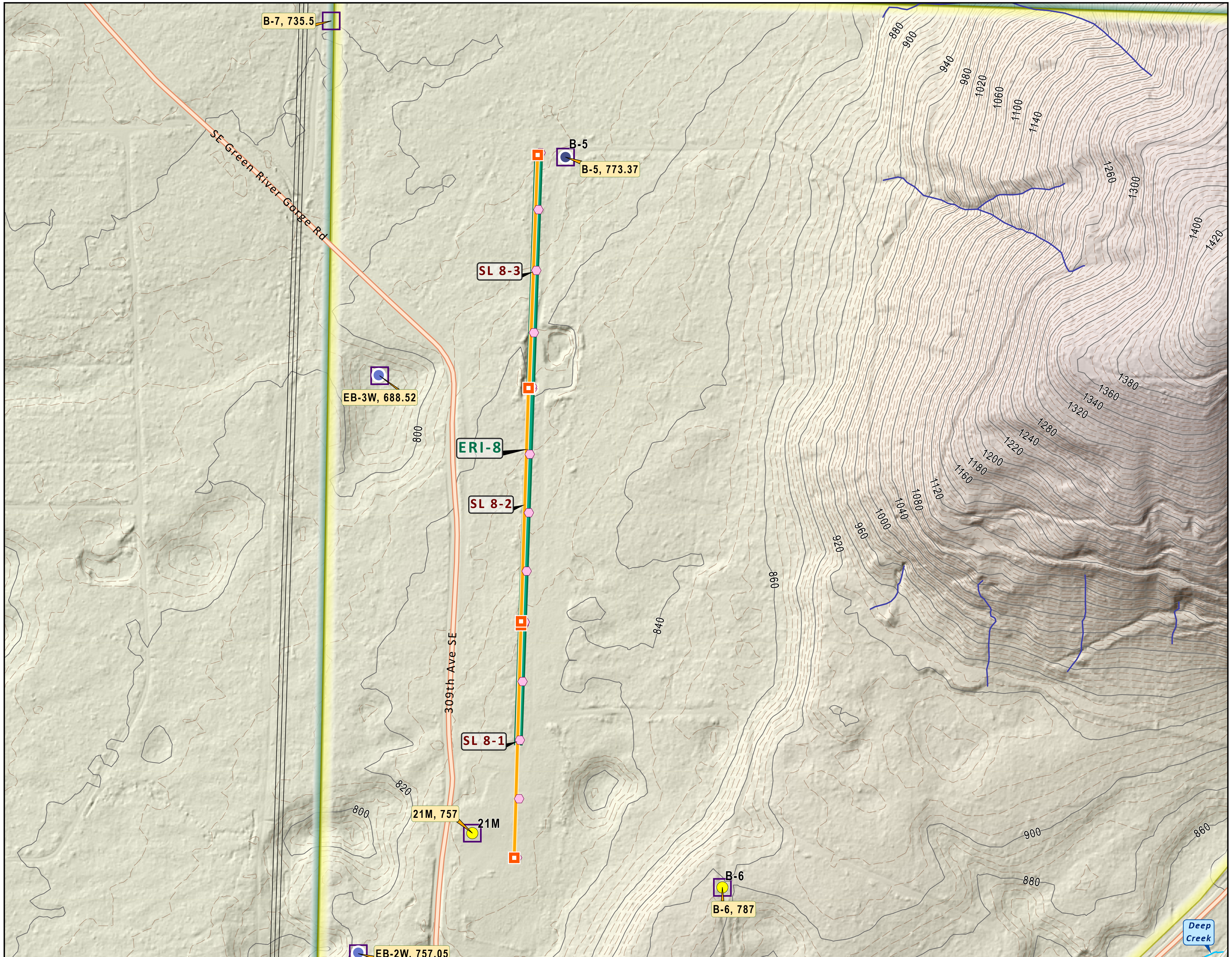


Philip H. Duoos
Geophysical Consultant

GEOPHYSICAL SURVEY LINES
ERI-6, 7 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-6



- SITE
- DOWNHOLE GEOPHYSICS
- EXPLORATION BORING
- BEDROCK ELEVATION FROM EXPLORATION
- SHOT FLAG LOCATION
- SEISMIC LINE START AND END

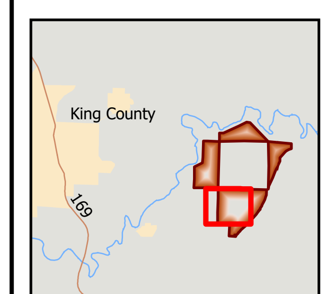
GEOPHYSICAL SURVEY LINE

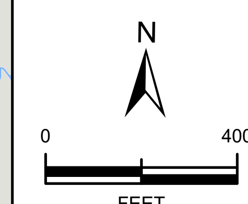
- SEISMIC REFRACTION
- ELECTRICAL RESISTIVITY IMAGING
- WADNR MANAGED PROPERTY
- TRANSMISSION LINE
- CONTOUR 20 FT
- CONTOUR 5 FT

NOTE: GEOPHYSICAL LINES ACCURATE TO WITHIN 20'.
SHOT FLAGS ARE SURVEYED

DATA SOURCES / REFERENCES:
SEISMIC: PHIL DUOOS, GEOPHYSICAL CONSULTANT
SURVEY DATA: SEGALE
PSLC: KING COUNTY 2016 LIDAR, 3' PIXEL FLOWN 3/16
CONTOURS FROM LIDAR
KING CO: STREETS, PARCELS, 4/22

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE





BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

Philip H. Duoos Geophysical Consultant

GEOPHYSICAL SURVEY LINES ERI-8 AREA

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

PROJ NO.	DATE:	FIGURE:
20200367H001	6/22	2-7

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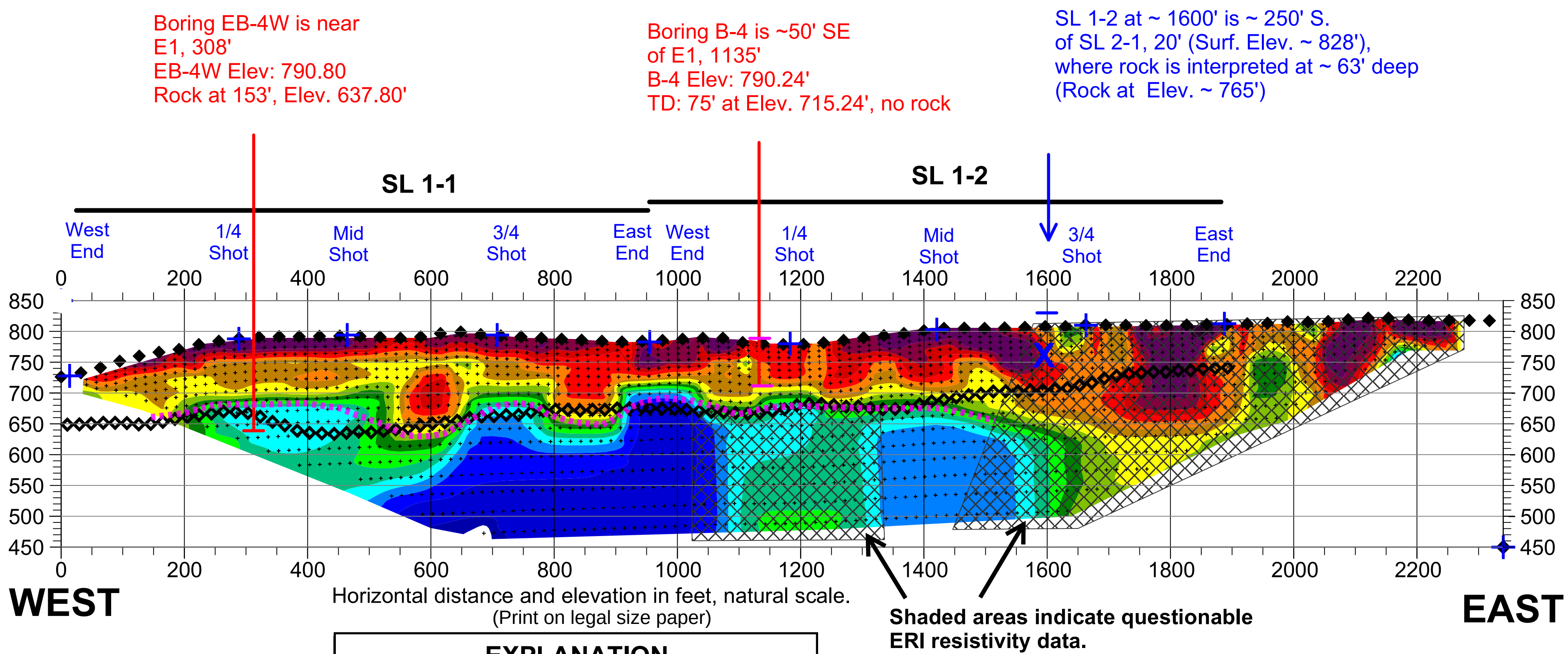
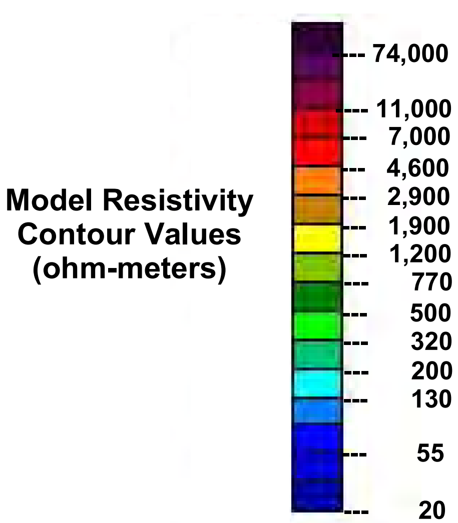




EXPLANATION

◆	ERI Resistivity Station Location at Ground Surface
+	ERI Data Model Point
······	ERI Interpreted Top of Rock
◇	Seismic Interpreted Top of Rock
+	Seismic Shot Location, locations also shown on Figure 2-1.
X	Seismic interpreted top of rock from nearby seismic lines.

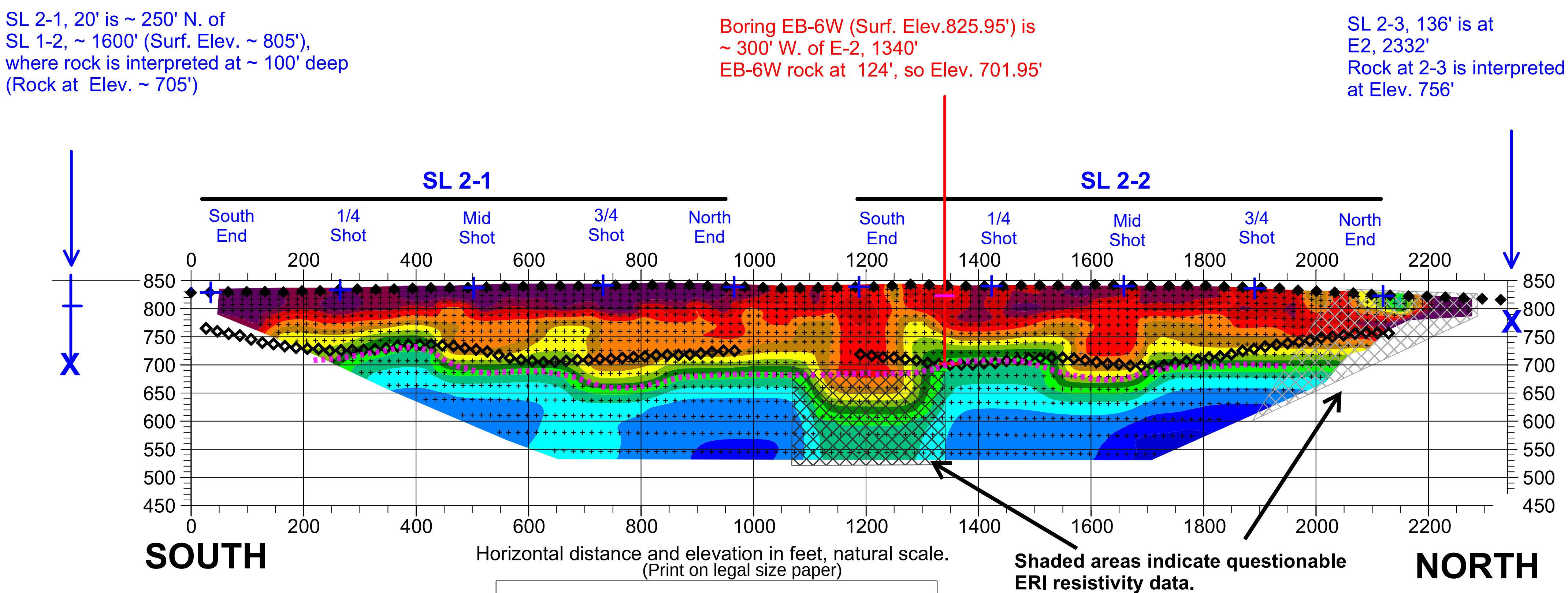
Approximate ground surface elevations were obtained for each ERI Resistivity station using a hand level and referenced to the numerous shot location stakes located by land surveyors with Segale Properties.

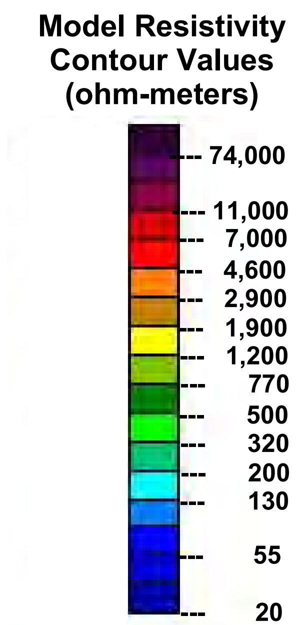
RESISTIVITY LINE ERI-1
SEISMIC LINES SL 1-1 SL 1-2

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022

Profile E-1





EXPLANATION

- ◆ ERI Resistivity Station Location at Ground Surface
- + ERI Data Model Point
- ERI Interpreted Top of Rock
- ◇ Seismic Interpreted Top of Rock
- + Seismic Shot Location, locations also shown on Figure 2-2.
- X Seismic interpreted top of rock from nearby seismic lines.

Approximate ground surface elevations were obtained for each ERI Resistivity station using a hand level and referenced to the numerous shot location stakes located by land surveyors with Segale Properties.

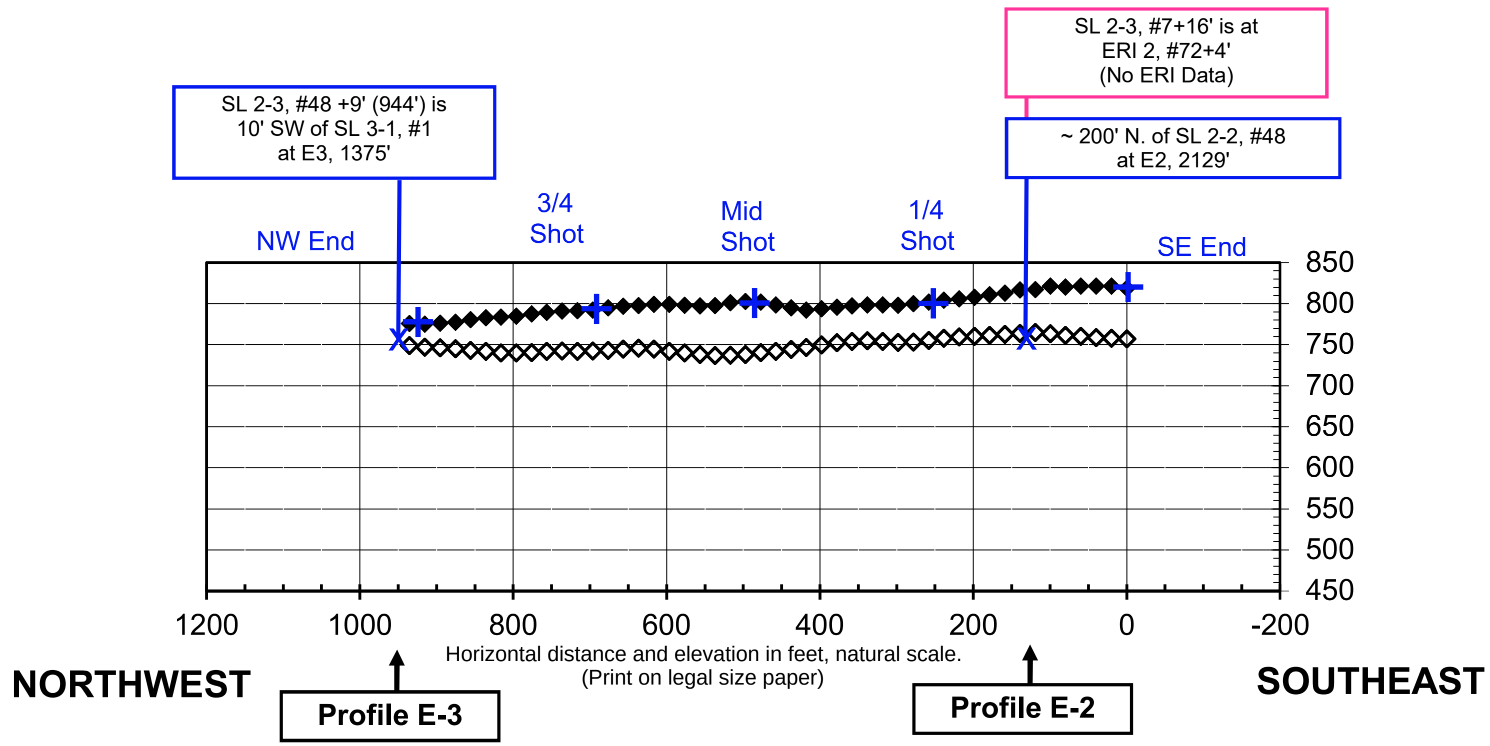
RESISTIVITY LINE ERI-2

SEISMIC LINES SL 2-1 & SL 2-2

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022

Profile E-2



EXPLANATION

◆ Seismic geophone location at ground surface

◇ Seismic Interpreted Top of Rock

\+ Seismic Shot Location, locations also shown on Map 2

X Interpreted top of rock from nearby seismic lines.

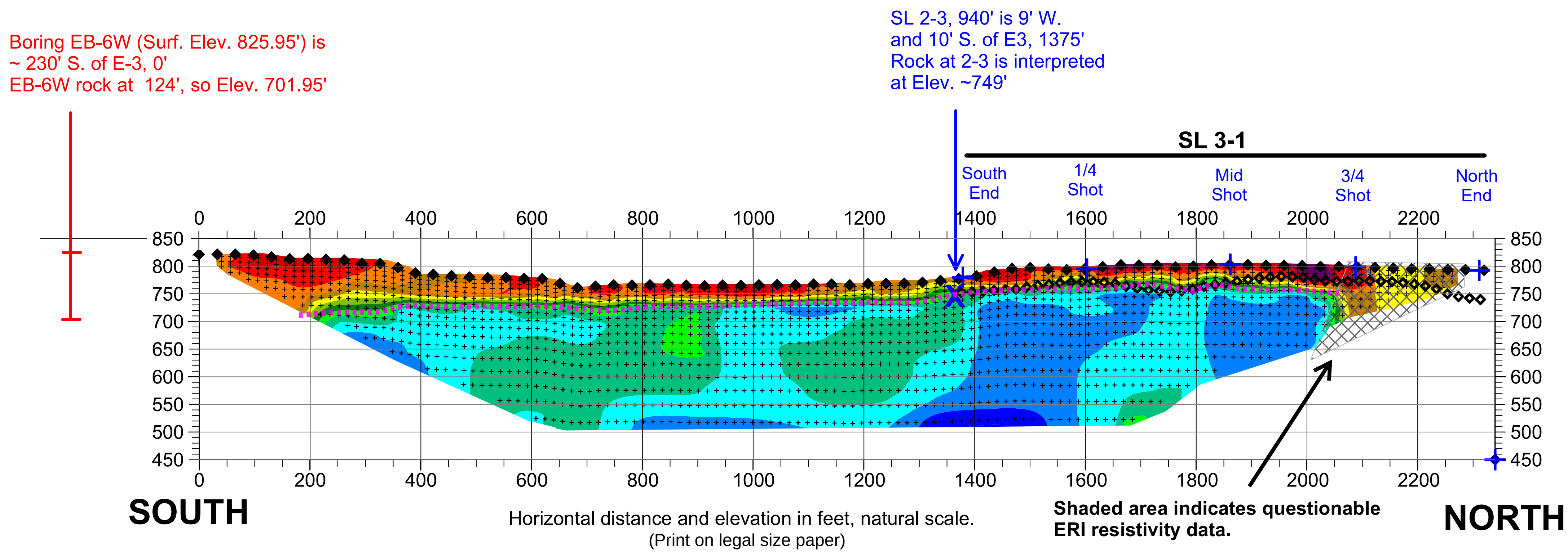
No ERI Resistivity data recorded along this short line.

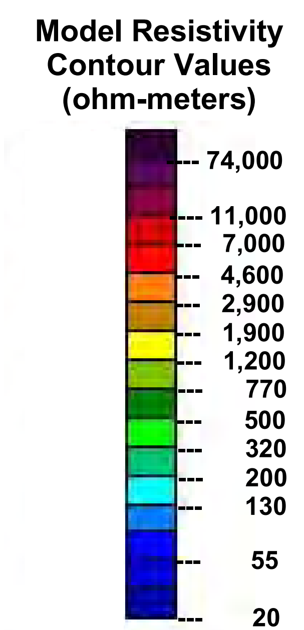
Approximate ground surface elevaions were obtained for each geophone locaion using a hand level and refererenced to the numerous shot location stakes located by land surveyors with Segale Properties.

SEISMIC PROFILE, SL 2-3
Cumberland Site
King County, Washington

Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022

Profile SL 2-3





EXPLANATION

- ◆ ERI Resistivity Station Location at Ground Surface
- + ERI Data Model Point
- ······ ERI Interpreted Top of Rock
- ◇ Seismic Interpreted Top of Rock
- + Seismic Shot Location, locations also shown on Figure 2-3.
- X Seismic interpreted top of rock from nearby seismic lines.

Approximate ground surface elevations were obtained for each ERI Resistivity station using a hand level and referenced to the numerous shot location stakes located by land surveyors with Segale Properties.

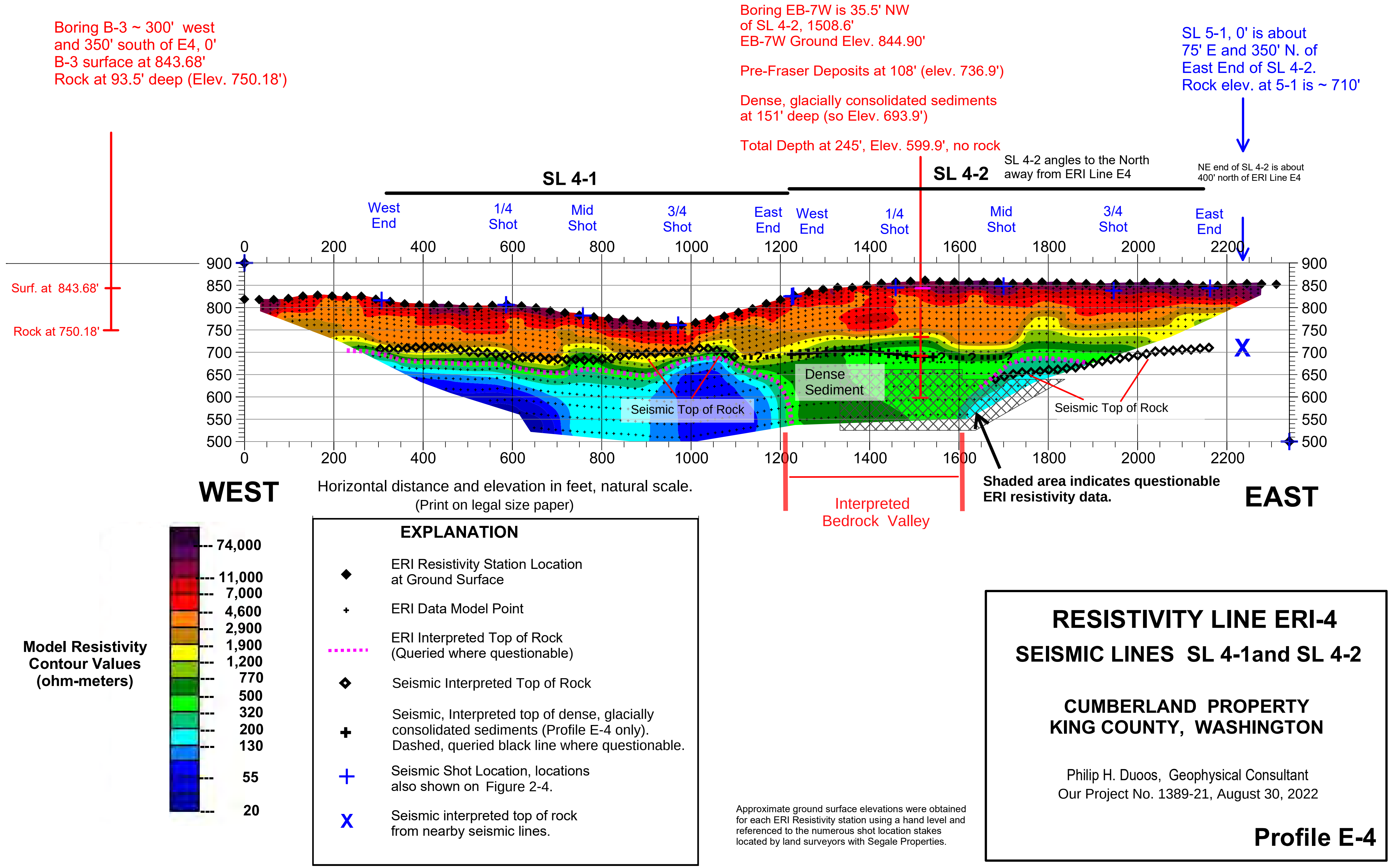
RESISTIVITY LINE ERI-3

SEISMIC LINE SL 3-1

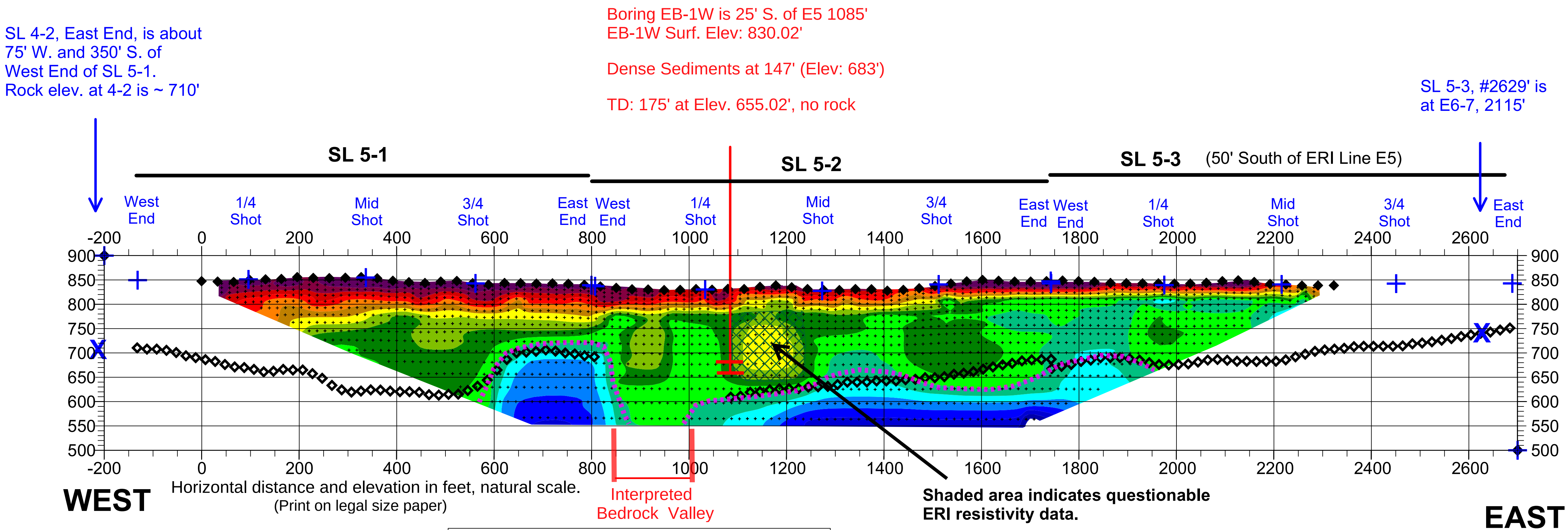
CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

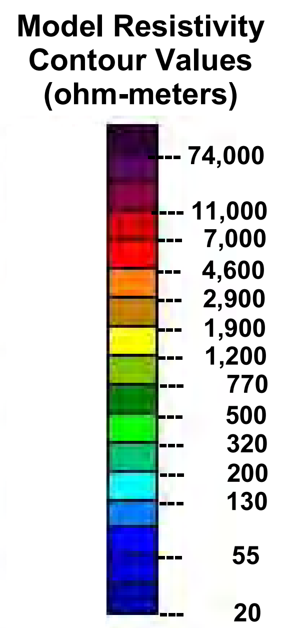
Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022

Profile E-3



Boring B-3 ~ 300' west
and 350' south of E4, 0'
B-3 surface at 843.68'
Rock at 93.5' deep (Elev. 750.18')
Surf. at 843.68'
Rock at 750.18'
Boring EB-7W is 35.5' NW
of SL 4-2, 1508.6'
EB-7W Ground Elev. 844.90'
Pre-Fraser Deposits at 108' (elev. 736.9')
Dense, glacially consolidated sediments
at 151' deep (so Elev. 693.9')
Total Depth at 245', Elev. 599.9', no rock
SL 5-1, 0' is about
75' E and 350' N. of
East End of SL 4-2.
Rock elev. at 5-1 is ~ 710'
SL 4-1
SL 4-2
SL 4-2 angles to the North
away from ERI Line E4
NE end of SL 4-2 is about
400' north of ERI Line E4
West End
1/4 Shot
Mid Shot
3/4 Shot
East End
West End
1/4 Shot
Mid Shot
3/4 Shot
East End
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
900
850
800
750
700
650
600
550
500
Dense Sediment
Seismic Top of Rock
Seismic Top of Rock
X
WEST
EAST
Horizontal distance and elevation in feet, natural scale.
(Print on legal size paper)
Interpreted
Bedrock Valley
Shaded area indicates questionable
ERI resistivity data.
Model Resistivity
Contour Values
(ohm-meters)
74,000
11,000
7,000
4,600
2,900
1,900
1,200
770
500
320
200
130
55
20
EXPLANATION
ERI Resistivity Station Location
at Ground Surface
ERI Data Model Point
ERI Interpreted Top of Rock
(Queried where questionable)
Seismic Interpreted Top of Rock
Seismic, Interpreted top of dense, glacially
consolidated sediments (Profile E-4 only).
Dashed, queried black line where questionable.
Seismic Shot Location, locations
also shown on Figure 2-4.
Seismic interpreted top of rock
from nearby seismic lines.
Approximate ground surface elevations were obtained
for each ERI Resistivity station using a hand level and
referenced to the numerous shot location stakes
located by land surveyors with Segale Properties.
RESISTIVITY LINE ERI-4
SEISMIC LINES SL 4-1and SL 4-2
CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON
Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022
Profile E-4





EXPLANATION

- ◆ ERI Resistivity Station Location at Ground Surface
- + ERI Data Model Point
- ······· ERI Interpreted Top of Rock
- ◇ Seismic Interpreted Top of Rock
- + Seismic Shot Location, locations also shown on Figure 2-5.
- X Seismic interpreted top of rock from nearby seismic lines.

Approximate ground surface elevations were obtained for each ERI Resistivity station using a hand level and referenced to the numerous shot location stakes located by land surveyors with Segale Properties.

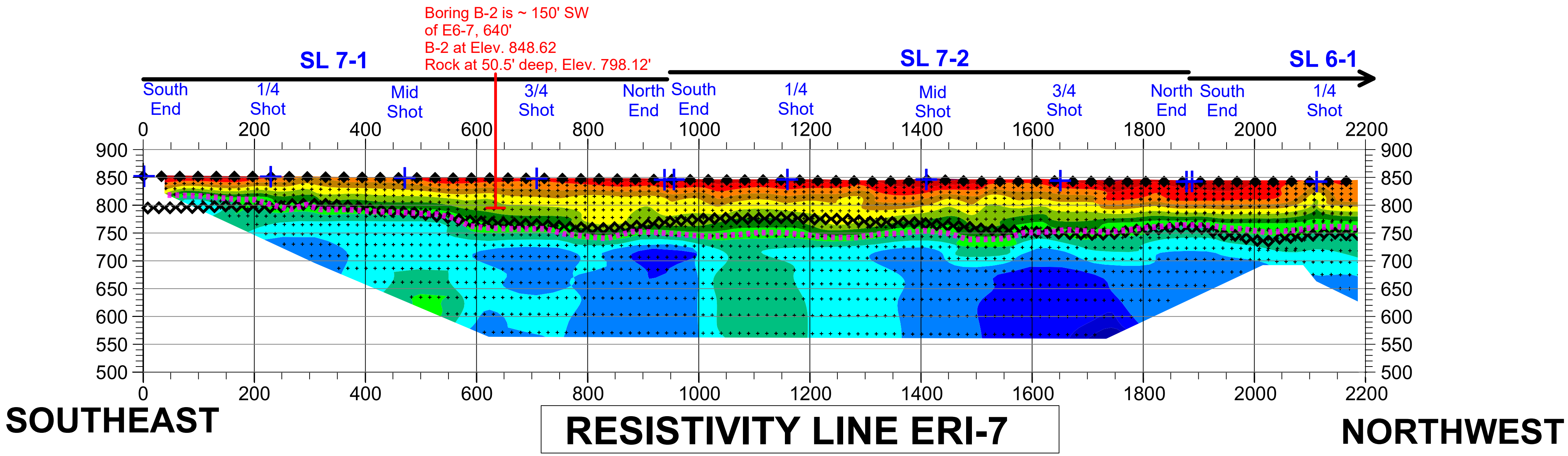
RESISTIVITY LINE ERI-5

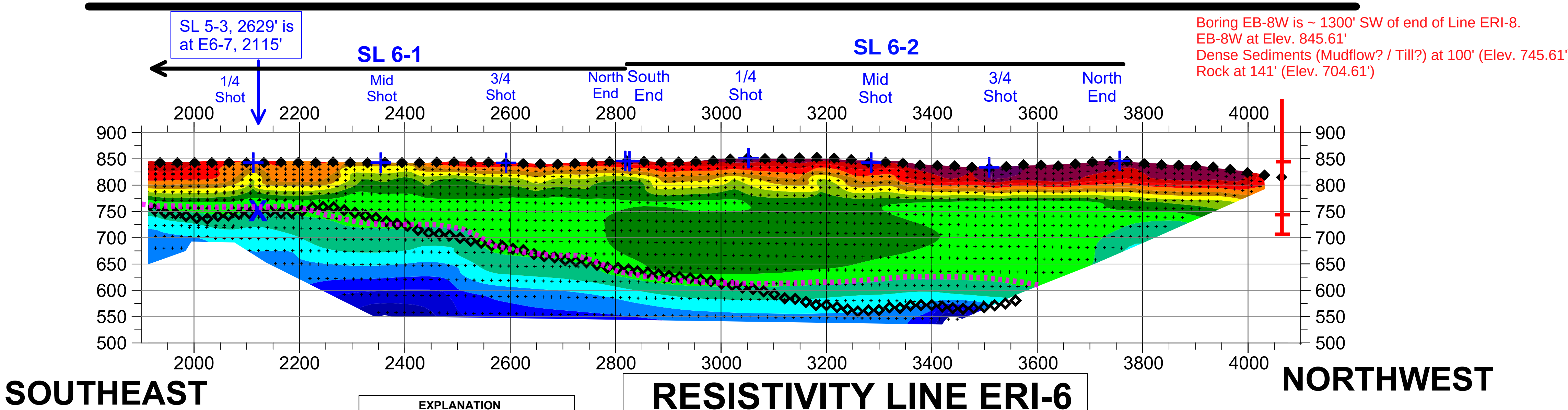
SEISMIC LINES SL 5-1, SL 5-2 & SL 5-3

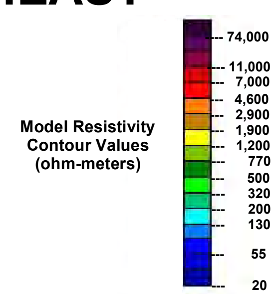
CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022

Profile E-5







EXPLANATION

- ◆ ERI Resistivity Station Location at Ground Surface
- + ERI Data Model Point
- ERI Interpreted Top of Rock
- ◇ Seismic Interpreted Top of Rock
- + Seismic Shot Location, locations also shown on Figure 2-6.
- X Seismic interpreted top of rock from nearby seismic lines.

Approximate ground surface elevations were obtained for each ERI Resistivity station using a hand level and referenced to the numerous shot location stakes located by land surveyors with Segale Properties.

Horizontal distance and elevation in feet, natural scale.
(Print on legal size paper)

Note: ERI -7 and seismic lines SL 7-1 and 7-2 are oriented properly, and are to the southeast of ERI-6 and SL 6-1 and 6-2.

RESISTIVITY LINES ERI-6 & ERI-7

SEISMIC LINES SL 6-1, SL 6-2, SL 7-1 & SL 7-2

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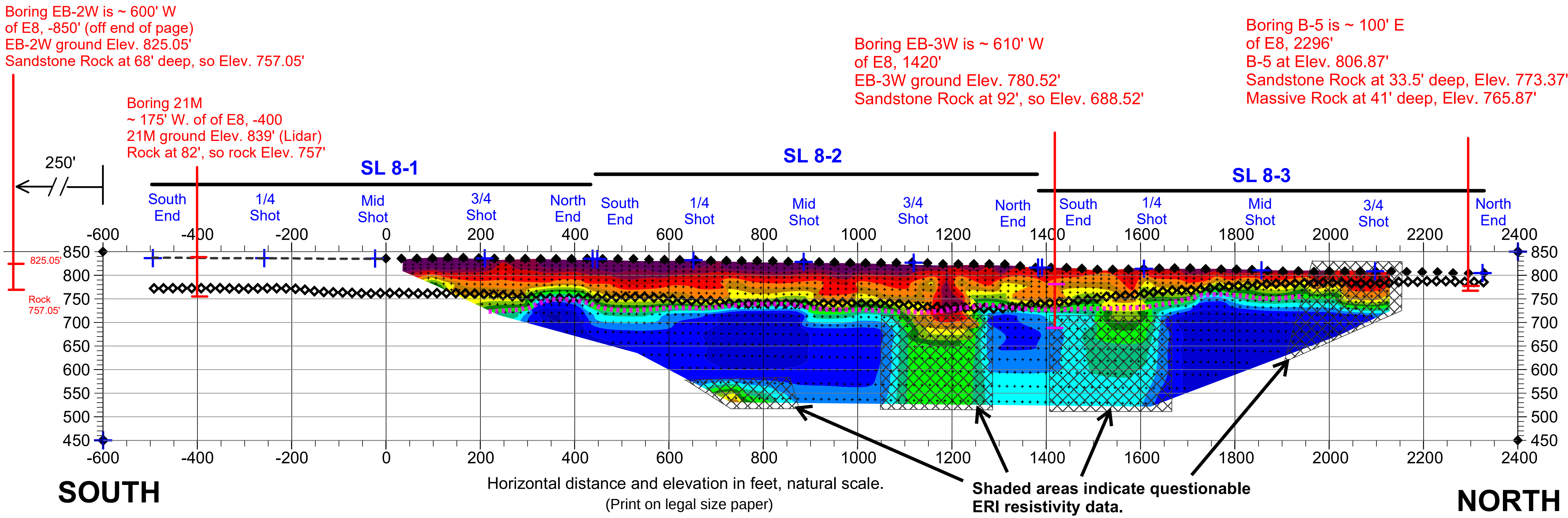
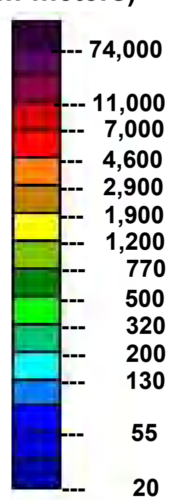
Our Project No. 1389-21, August 30, 2022

Profile E-6-7



Model Resistivity Contour Values (ohm-meters)



EXPLANATION

- ◆ ERI Resistivity Station Location at Ground Surface
- + ERI Data Model Point
- (magenta dotted line) ERI Interpreted Top of Rock
- ◇ Seismic Interpreted Top of Rock
- + Seismic Shot Location, locations also shown on Figure 2-7.
- X Seismic interpreted top of rock from nearby seismic lines.

Approximate ground surface elevations were obtained for each ERI Resistivity station using a hand level and referenced to the numerous shot location stakes located by land surveyors with Segale Properties.

RESISTIVITY LINE ERI-8

SEISMIC LINES SL 8-1, SL 8-2 & SL 8-3

CUMBERLAND PROPERTY
KING COUNTY, WASHINGTON

Philip H. Duoos, Geophysical Consultant
Our Project No. 1389-21, August 30, 2022

Profile E-8

TABLE 1

Geophysical Interpretation, Relative Confidence Levels of Bedrock Surface

LINE	ERI Resistivity						Seismic Refraction				
	High	Mod High	Mod	Low	None	N/A	High	Mod High	Mod	Low	N/A
ERI-1	1050 - 1400		150 - 250	250 - 550		0 - 150	1050 - 1400	1400 - 1900	0 - 1050		1900 - 2330
SL 1-1			650 - 800								
SL 1-2		550 - 650	900 - 1050		1500 - 2150	2150 - 2330					
		800 - 900		1400 - 1500							
ERI-2	220 - 430	430 - 1080	1080 - 1320			0 - 220	250 - 400		20 - 250		0 - 20
SL 2-1	1320 - 1480	1480 - 1700							400 - 970		970 - 1190
SL2-2	1700 - 1800		1800 - 1950		1950 - 2050	2050 - 2330			1190 - 1300		
							1300 - 1500		1500 - 1700		
							1700 - 1800		1800 - 2120		2120 - 2330
SL 2-3			**Seismic Array Only**			0 - 940	0 - 940				
ERI-3	1360 - 1850	180 - 1360				0 - 180	1360 - 1850		1850 - 2330		0 - 1360
SL 3-1			1850 - 2050		2050 - 2250	2250 - 2330					
E-4	230 - 300	300 - 1220		1590 - 1700		0 - 230			300 - 1070	1070 - 1230	0 - 300
SL 4-1			1700 - 1880			1220 - 1590		1880 - 2150	1700 - 1880	1600 - 1700	1230 - 1600
SL 4-2						1880 - 2330					2150 - 2330
E-5			830 - 890	570 - 830		-140 - 570	1100 - 1250	-140 - 800			800 - 1080
SL 5-1	1080 - 1250		1000 - 1100				1080 - 1250	1250 - 1450	1450 - 1750		
5-2, 5-3	1750 - 1950	1450 - 1750	1250 - 1450			1950 - 2690	1750 - 2690				
ERI 6-7	250 - 900		50 - 250			0-50	250 - 900	0 - 250	900 - 1600		
SL 6-1,	1600 - 1900	900 - 1600					1600 - 1900		1900 - 2550		
6-2, 7-1	2550 - 3050		1900 - 2550				2550 - 3050				
7-2			3050 - 3600			3600 - 4060				3050 - 3550	3550 - 4060
ERI-8	700 - 1420	220 - 700				-500 - 220	-500 - 0		0 - 700		
SL 8-2		1420 - 1940			1940 - 2150	2150 - 2330	700 - 1420		1420 - 2330		
8-2, 8-3											

Station distances are in feet.
High: Good correlation with ERI and Seismic and/or borings.
Mod High: More confidence in data.
Mod: Fair confidence; for seismic, shift deeper to fit ERI interpretation, thin layer

Low: Poor data
None: No ERI data due to bad signal
N/A: Not applicable, beyond length of array or bedrock too deep.