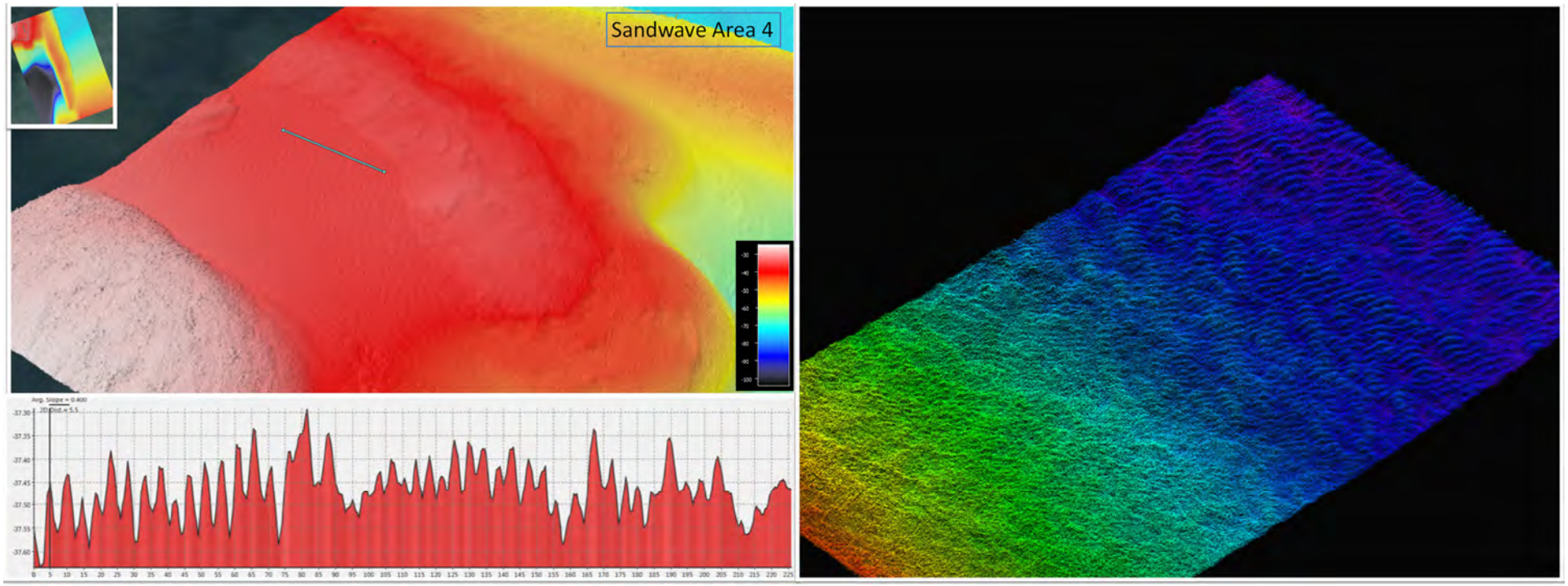
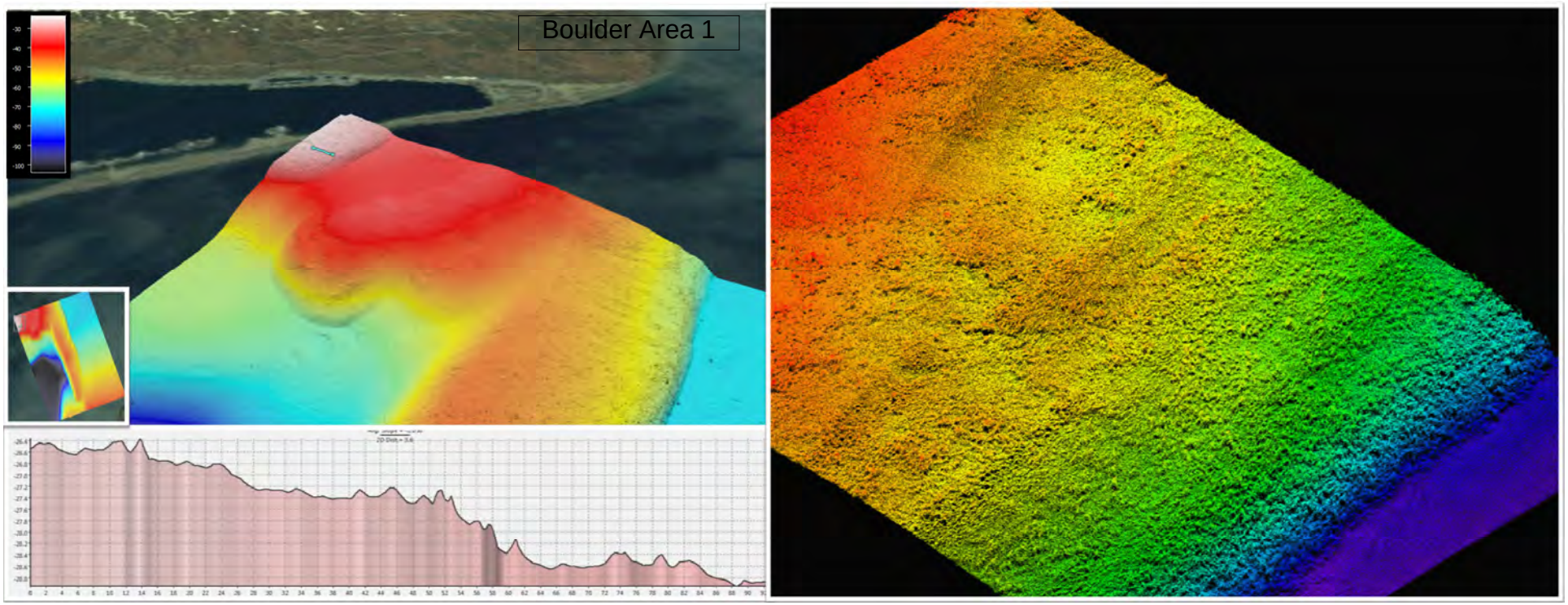
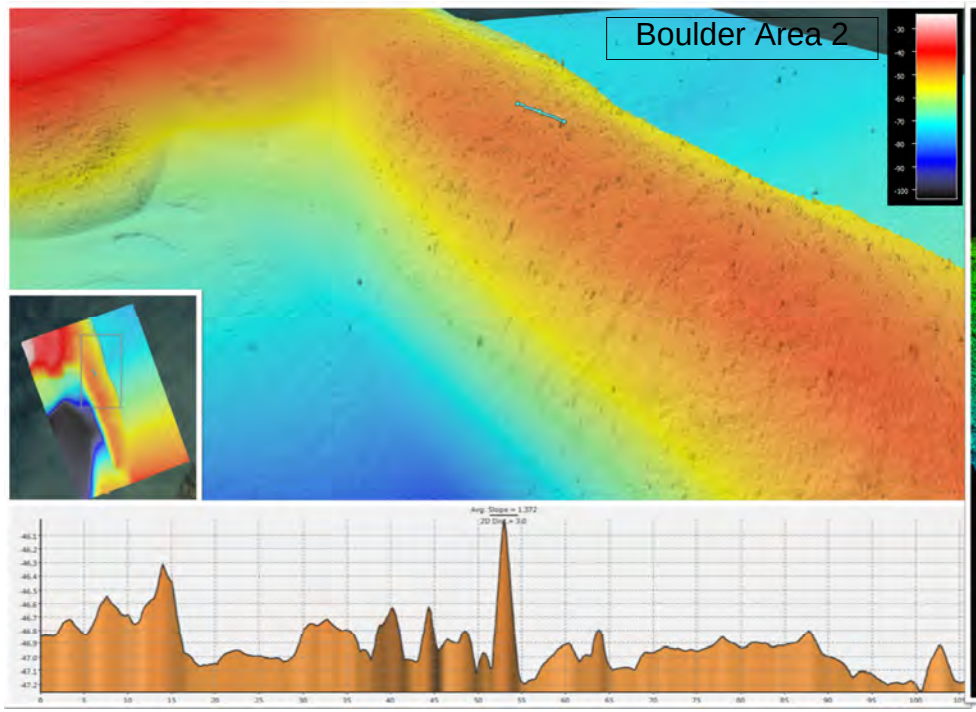
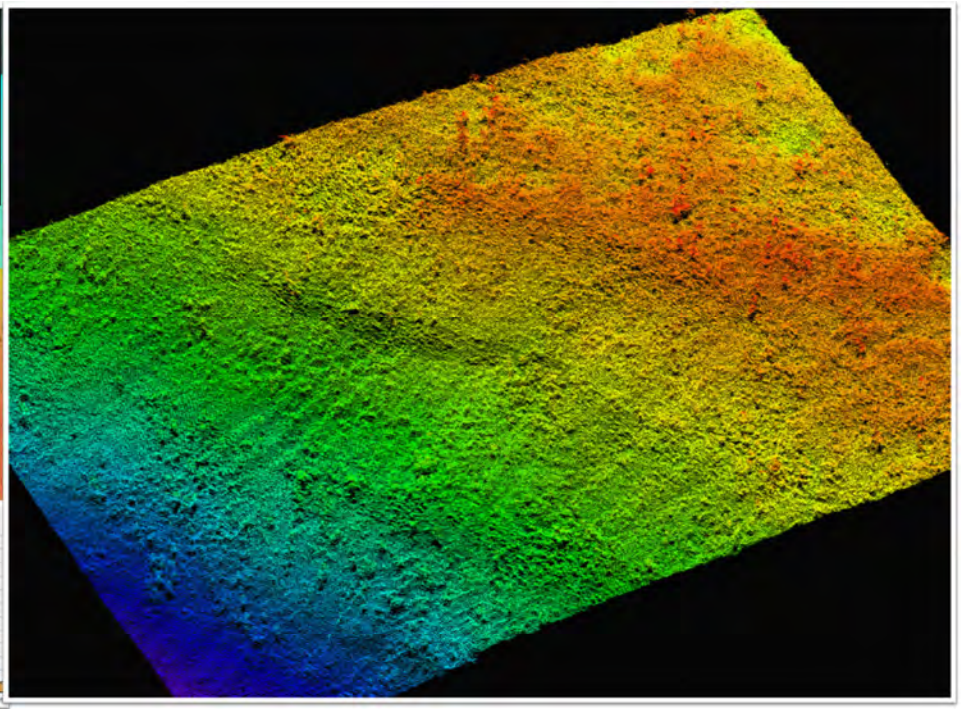

Sandwave Area 4

Surface Sediment Features

Boulder Field

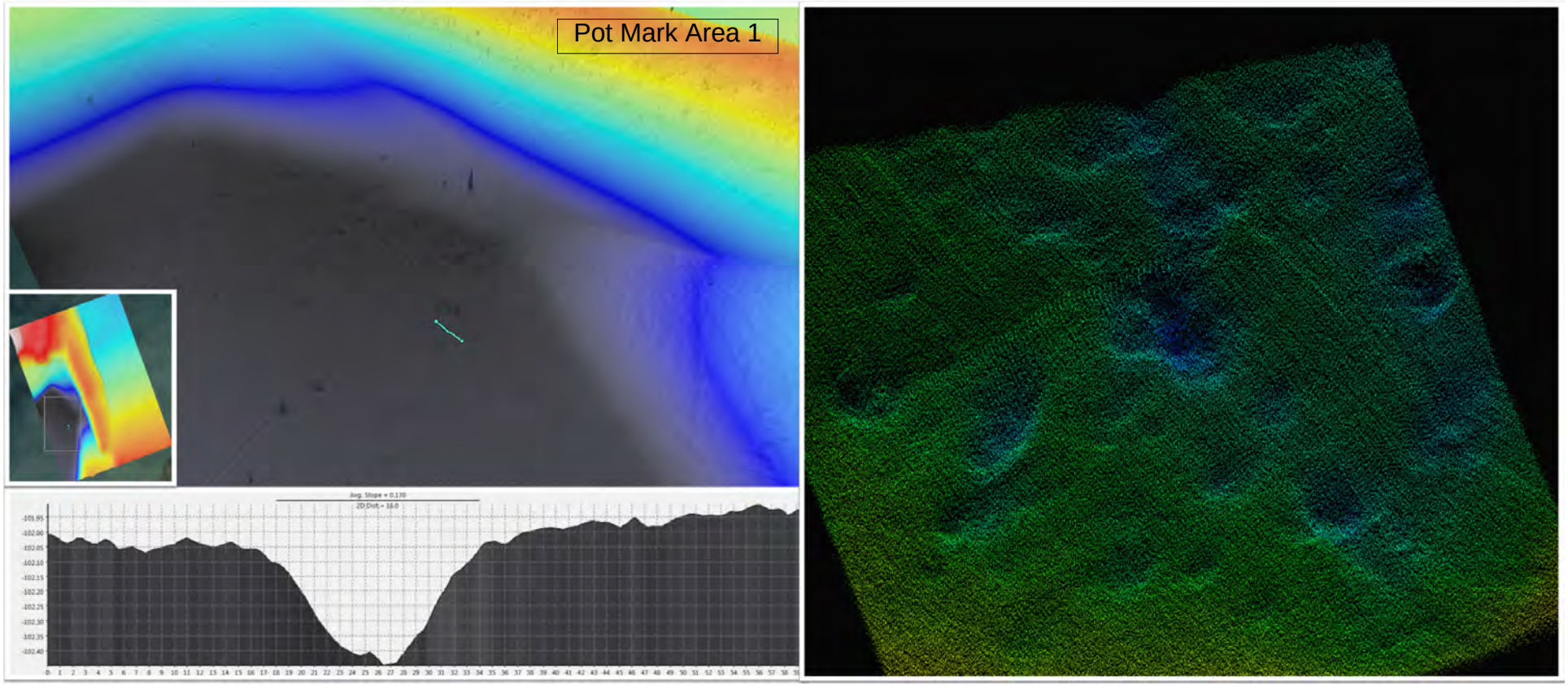

Boulder Area 1


Boulder Area 2



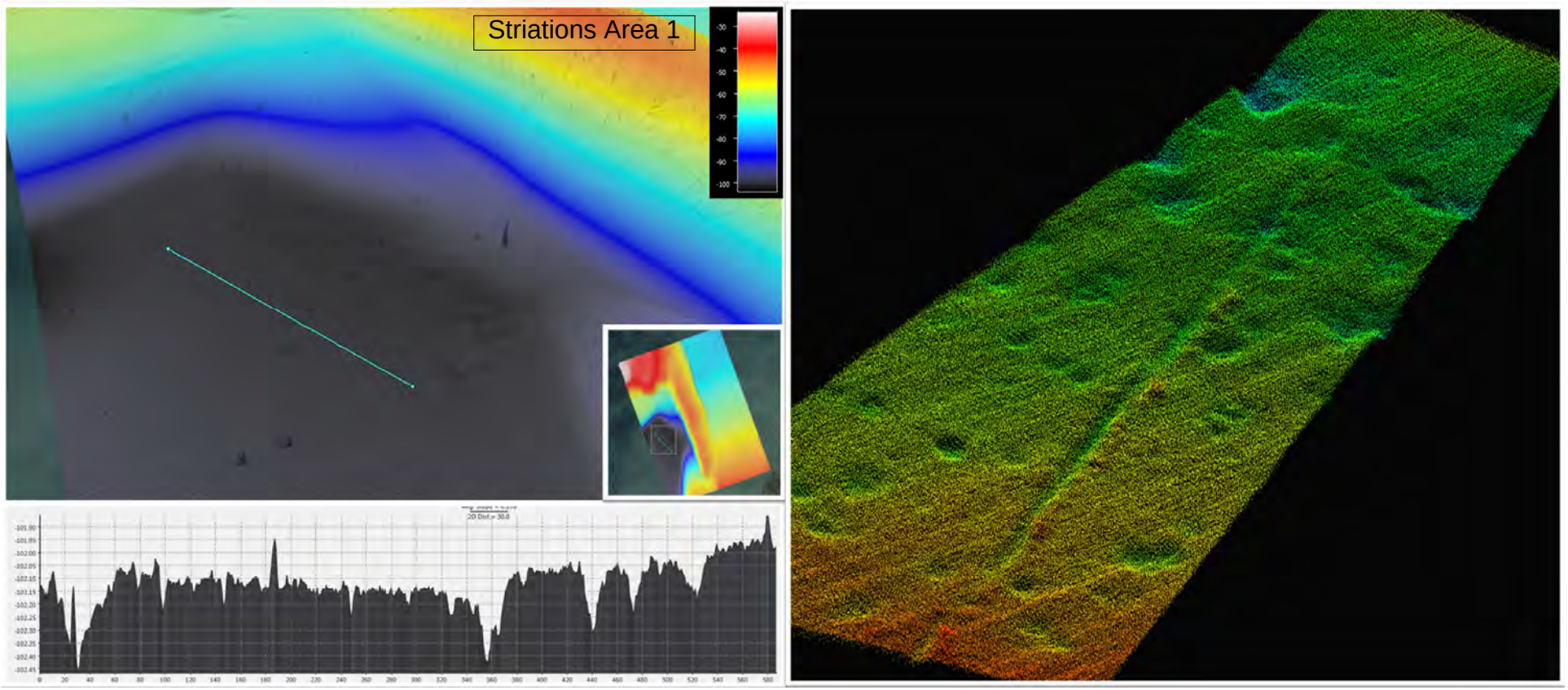
Surface Sediment Features

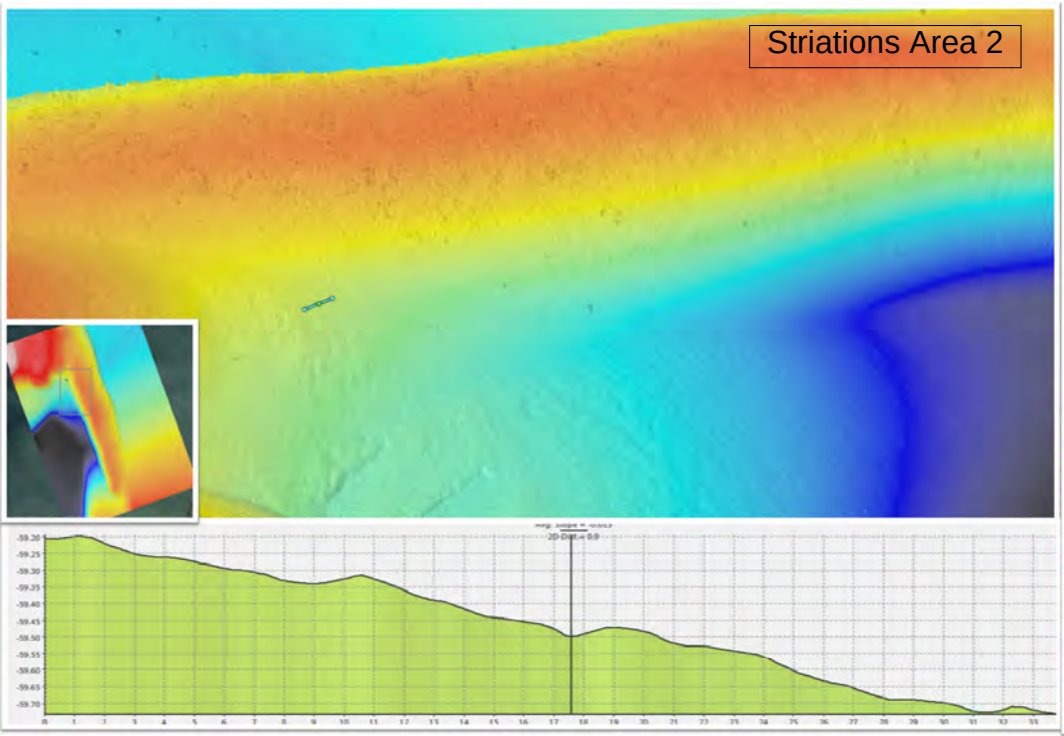
Pockmarks

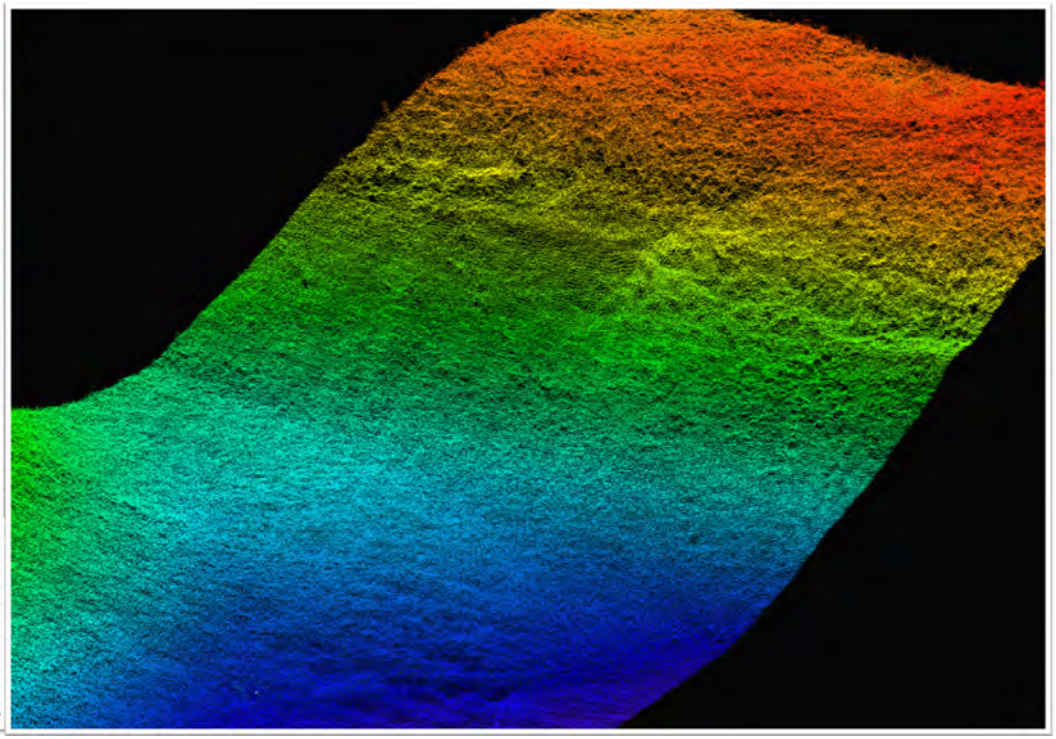

Pot Mark Area 1

Surface Sediment Features

Striations

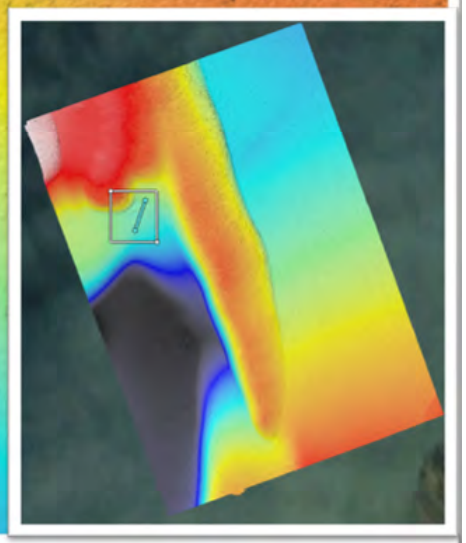

Striations Area 1

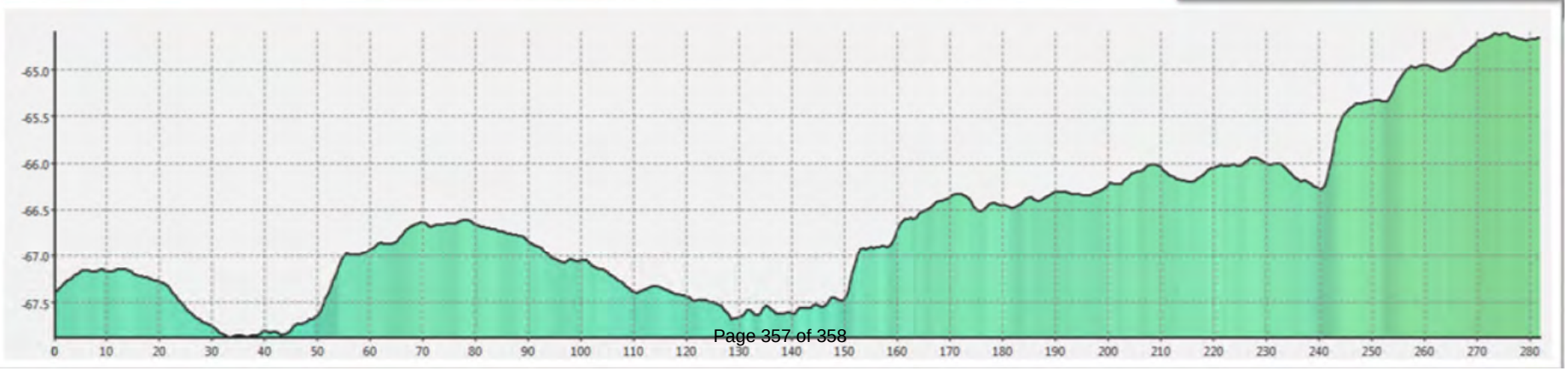

Striations Area 2



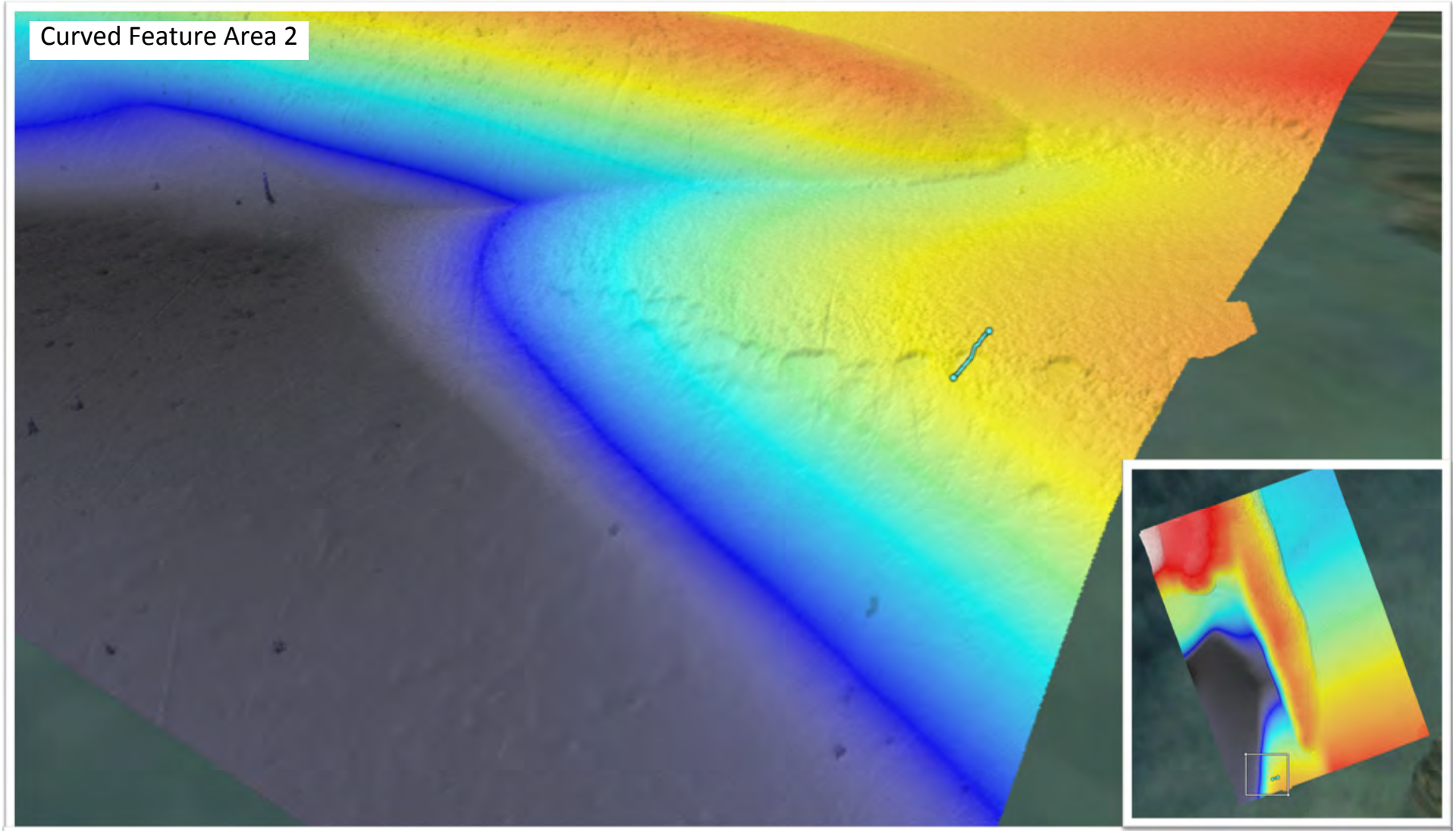
Surface Sediment Features
Curved Features

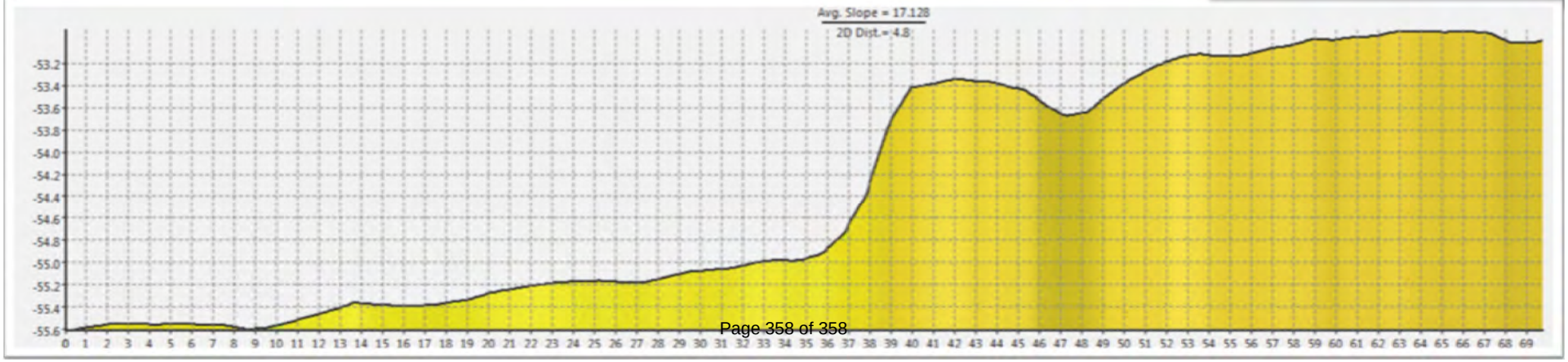
Curved Feature Area 1





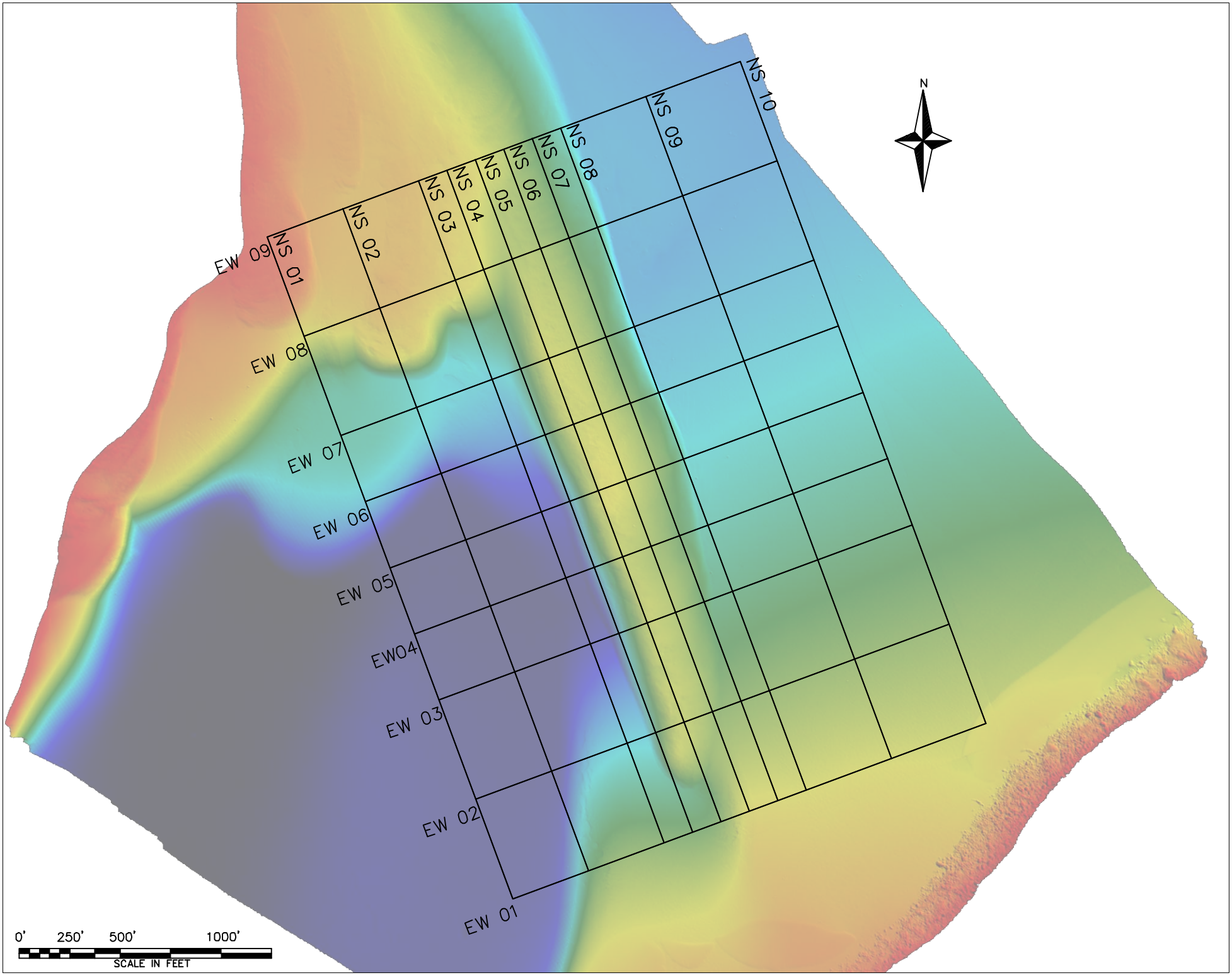
Curved Feature Area 2

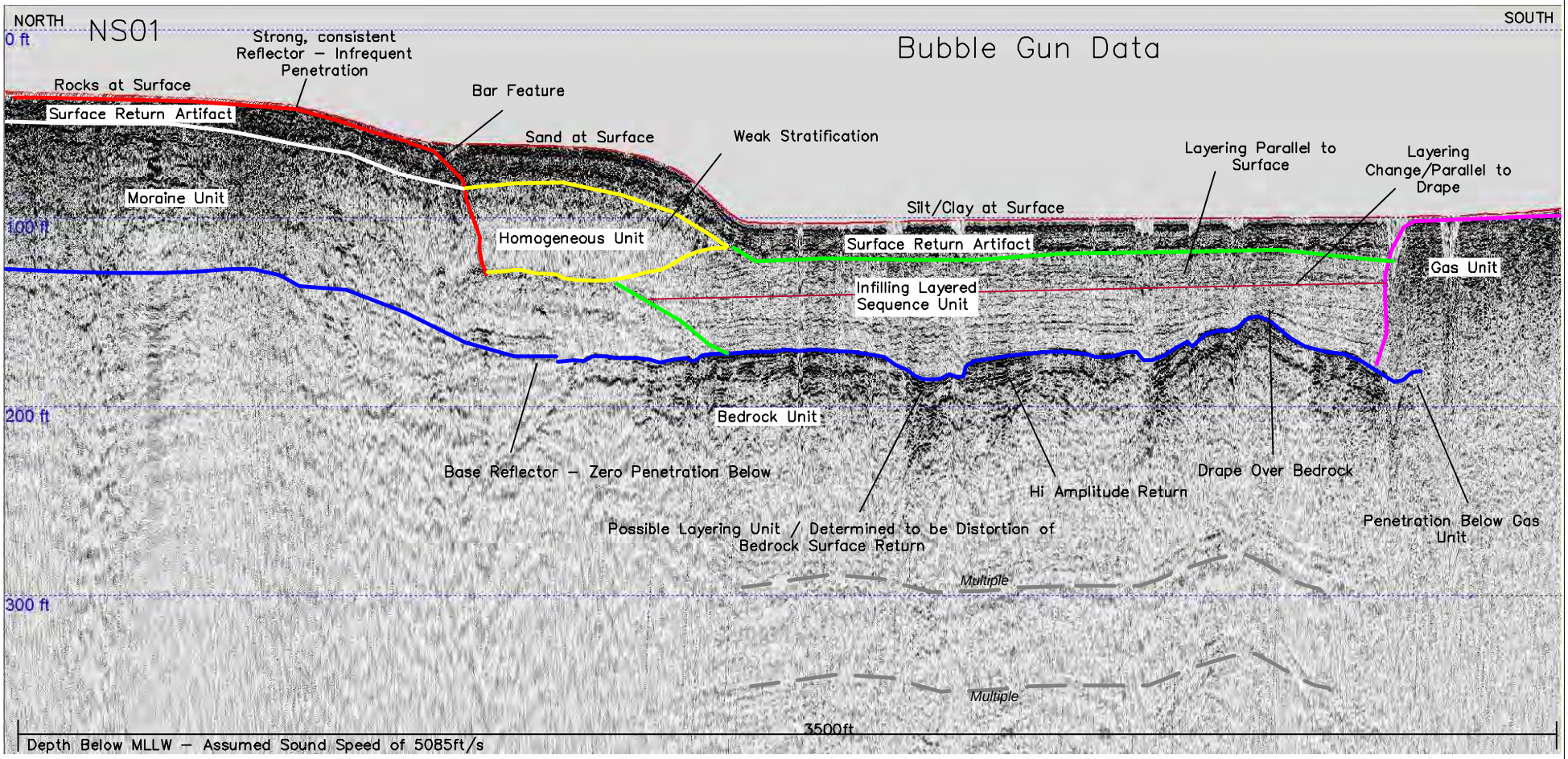


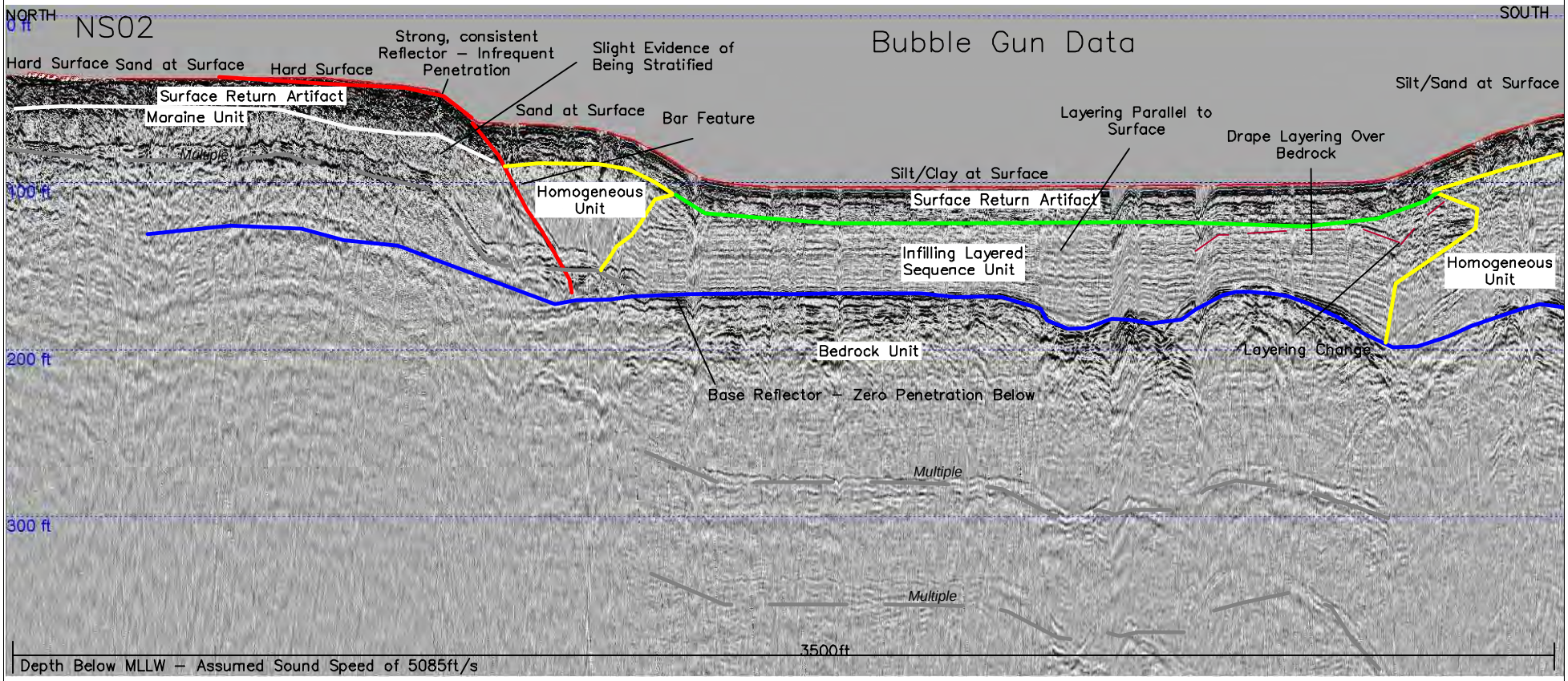


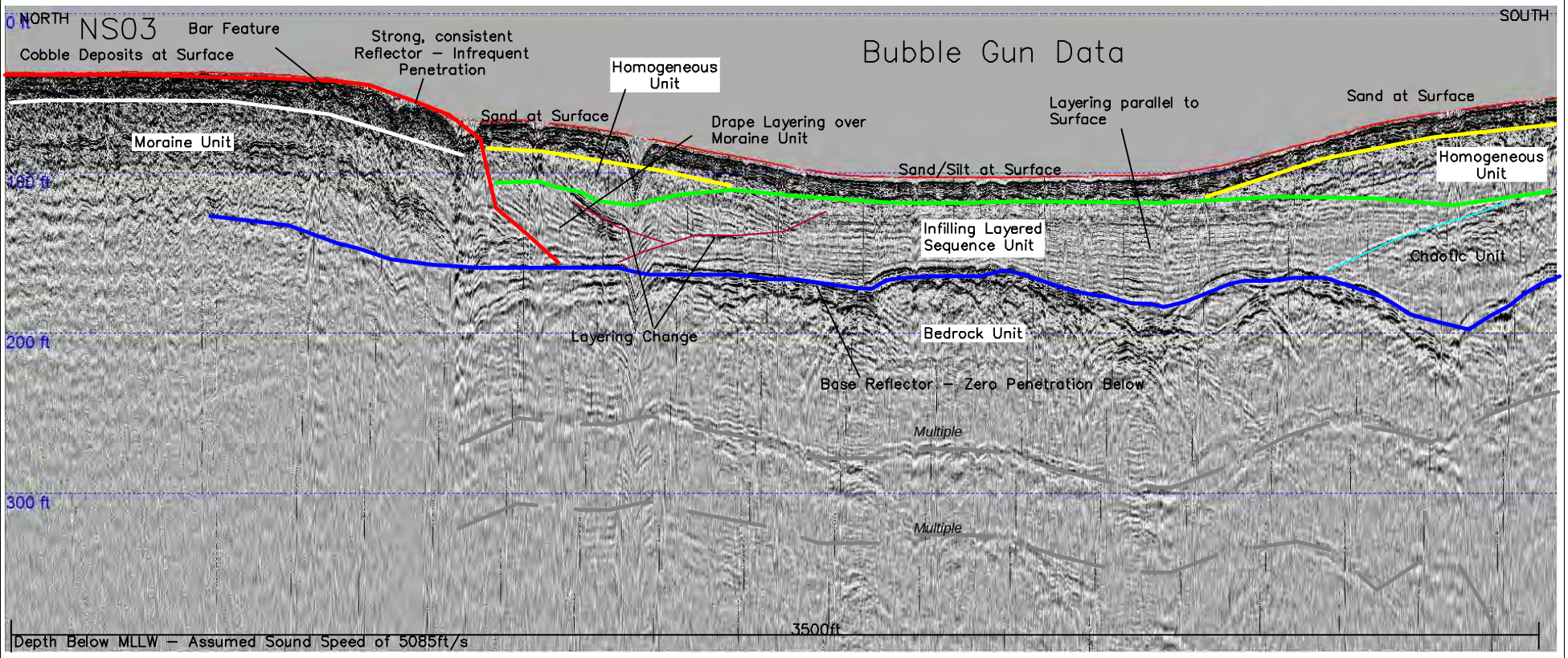
APPENDIX E - SEISMIC PROFILES

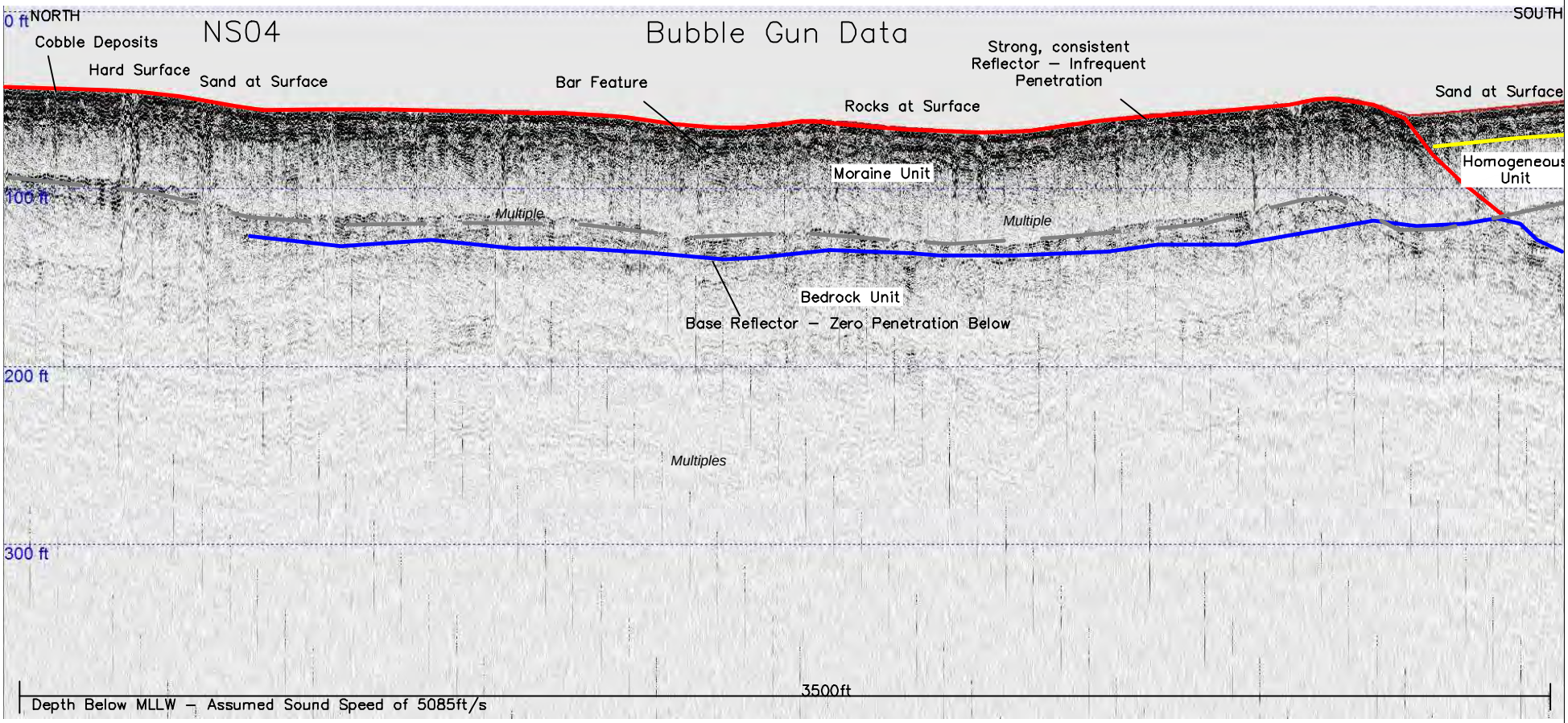
(PDF file is layer aware so interpretations can be turned off)

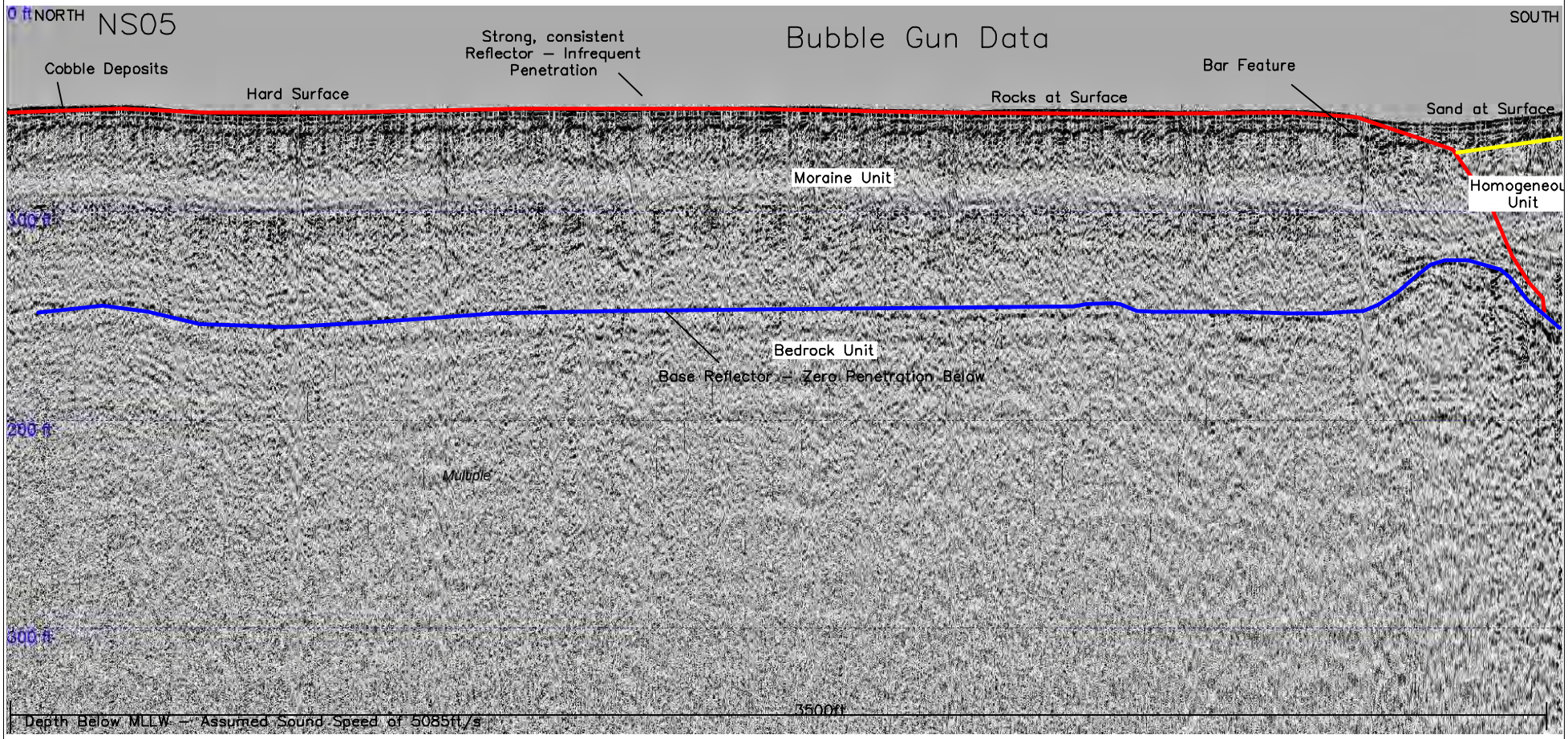

NS 01
NS 02
NS 03
NS 04
NS 05
NS 06
NS 07
NS 08
NS 09
NS 10
EW 09
EW 08
EW 07
EW 06
EW 05
EW04
EW 03
EW 02
EW 01
N
0'
250'
500'
1000'
SCALE IN FEET

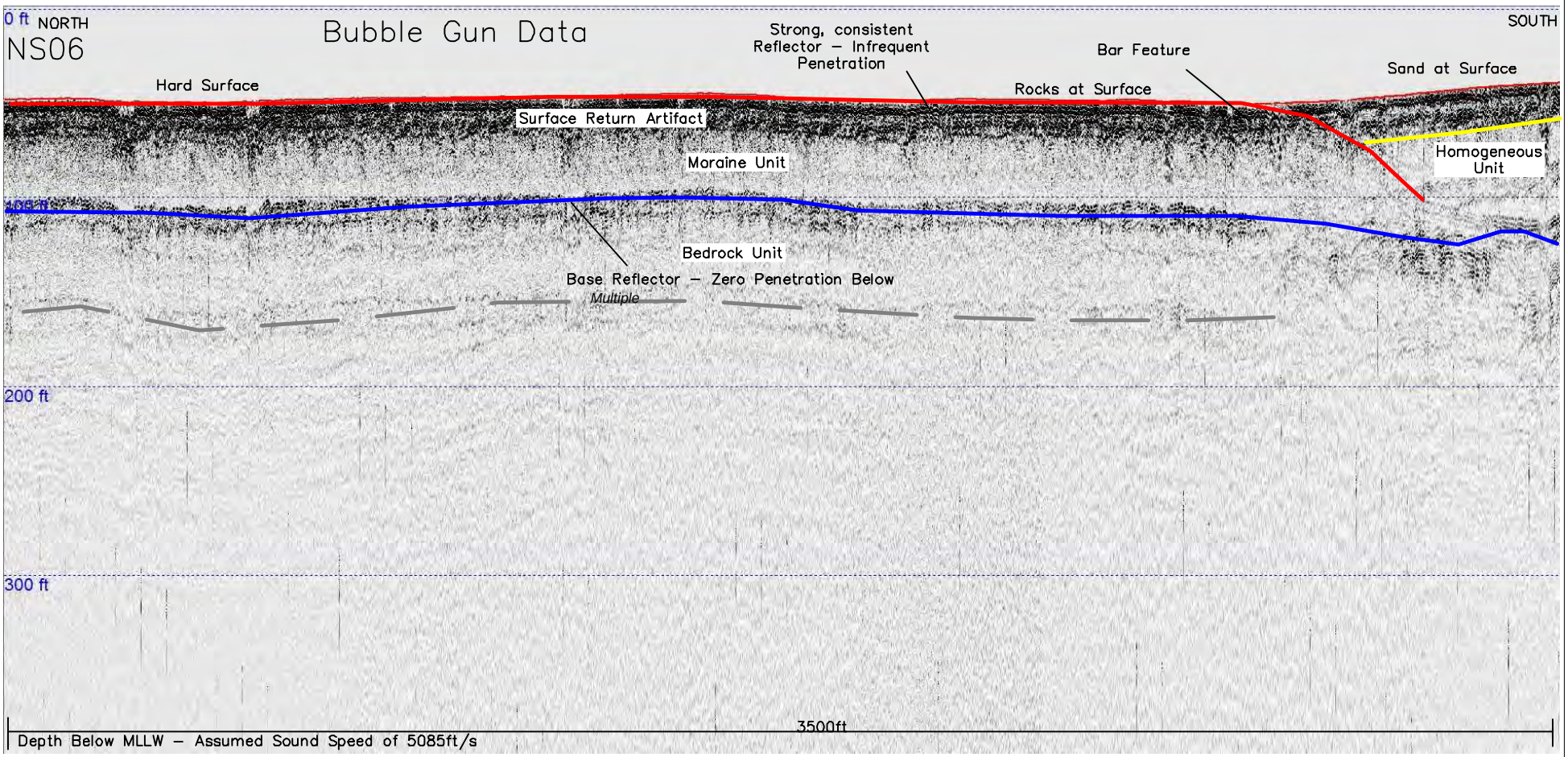

NORTH
NS01
SOUTH
Bubble Gun Data
0 ft
100 ft
200 ft
300 ft
Strong, consistent Reflector – Infrequent Penetration
Rocks at Surface
Surface Return Artifact
Bar Feature
Sand at Surface
Weak Stratification
Layering Parallel to Surface
Layering Change/Parallel to Drape
Moraine Unit
Silt/Clay at Surface
Homogeneous Unit
Surface Return Artifact
Gas Unit
Infilling Layered Sequence Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Hi Amplitude Return
Drape Over Bedrock
Possible Layering Unit / Determined to be Distortion of Bedrock Surface Return
Penetration Below Gas Unit
Multiple
Multiple
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

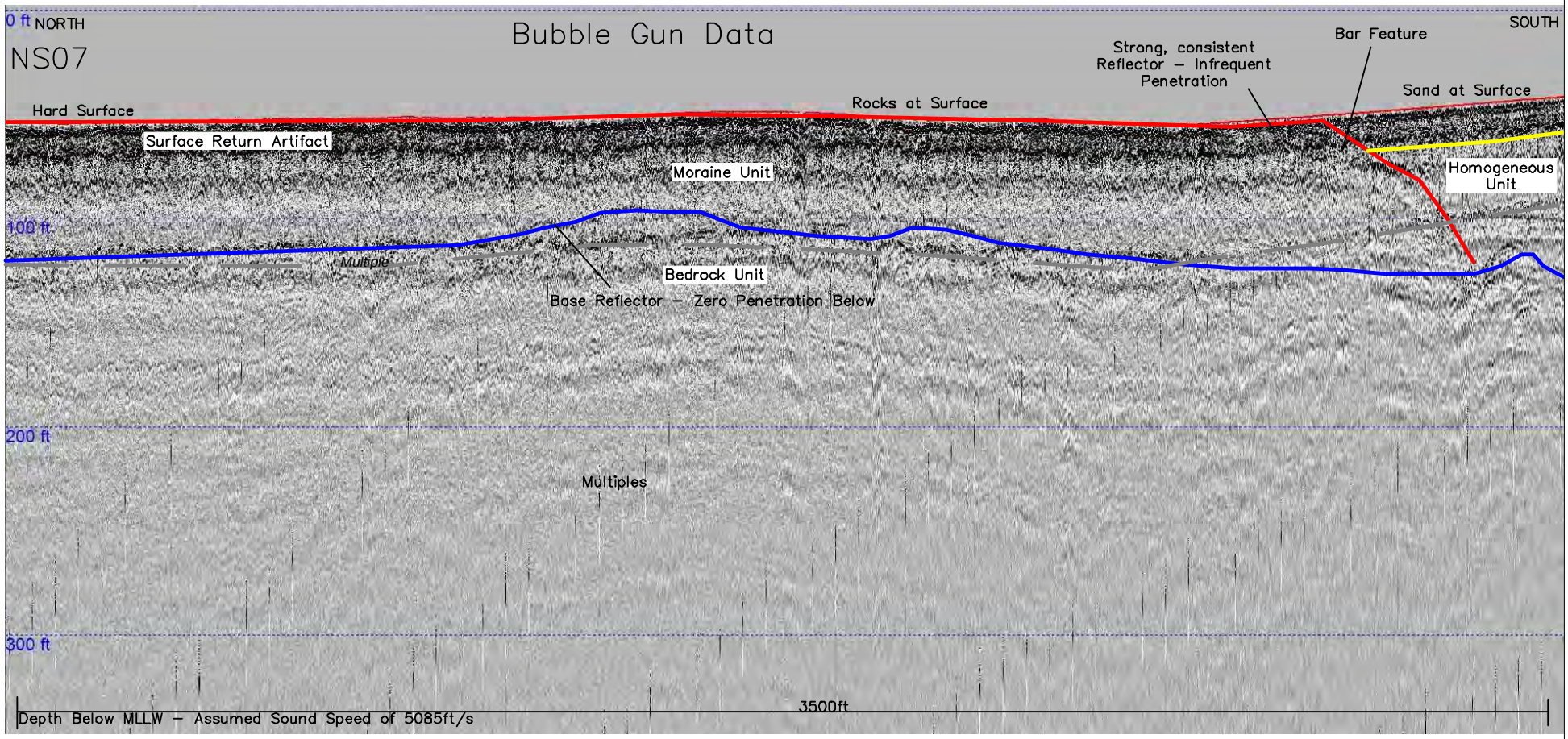

NORTH
SOUTH
NS02
Bubble Gun Data
0 ft
100 ft
200 ft
300 ft
Hard Surface Sand at Surface
Hard Surface
Strong, consistent Reflector – Infrequent Penetration
Slight Evidence of Being Stratified
Surface Return Artifact
Moraine Unit
Multiple
Sand at Surface
Bar Feature
Homogeneous Unit
Silt/Clay at Surface
Surface Return Artifact
Layering Parallel to Surface
Drape Layering Over Bedrock
Silt/Sand at Surface
Infilling Layered Sequence Unit
Homogeneous Unit
Bedrock Unit
Layering Change
Base Reflector – Zero Penetration Below
Multiple
Multiple
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

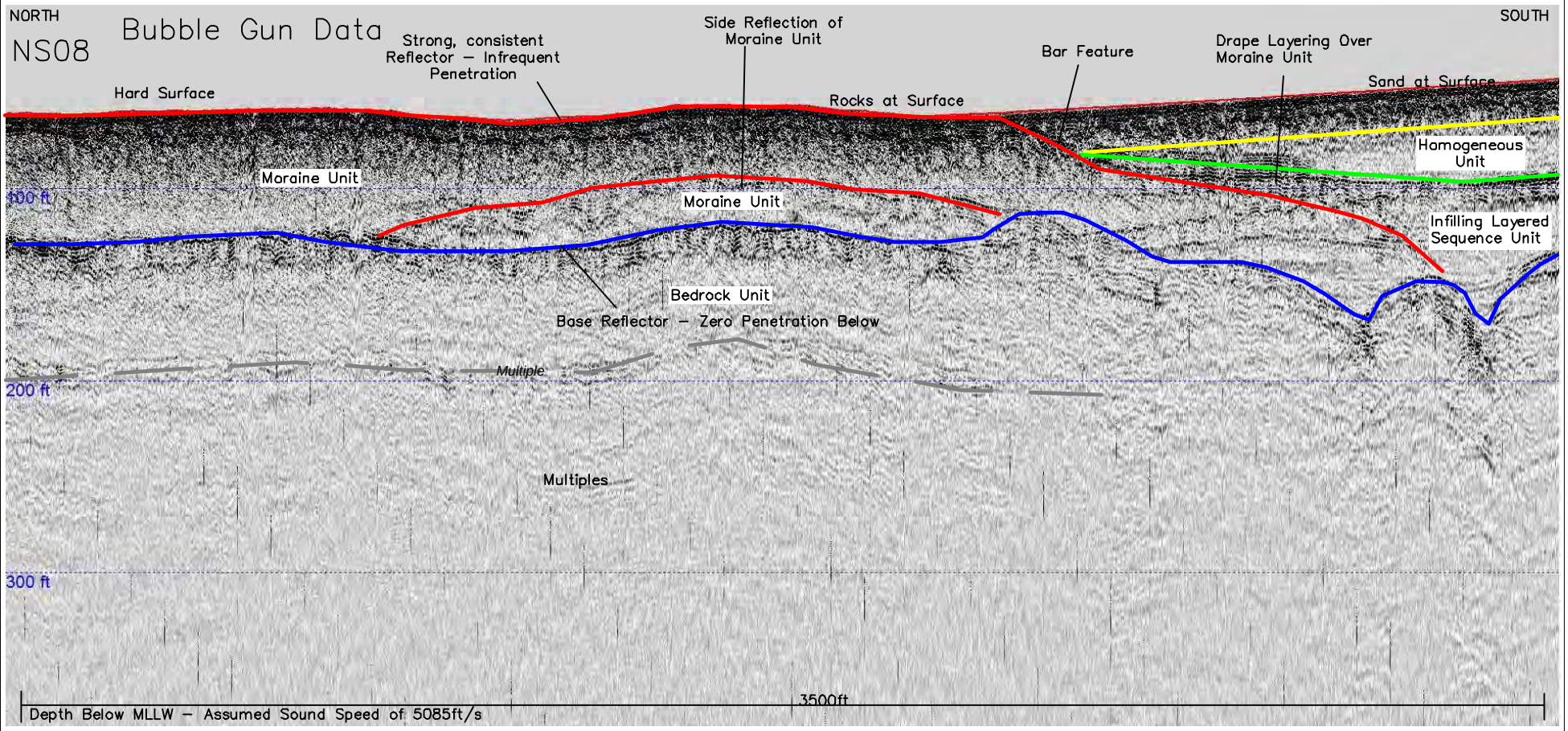

NORTH
SOUTH
NS03
Bubble Gun Data
Bar Feature
Cobble Deposits at Surface
Strong, consistent Reflector – Infrequent Penetration
Homogeneous Unit
Sand at Surface
Drape Layering over Moraine Unit
Layering parallel to Surface
Sand at Surface
Moraine Unit
Sand/Silt at Surface
Homogeneous Unit
100 ft
Infilling Layered Sequence Unit
Chaotic Unit
Layering Change
Bedrock Unit
200 ft
Base Reflector – Zero Penetration Below
Multiple
300 ft
Multiple
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

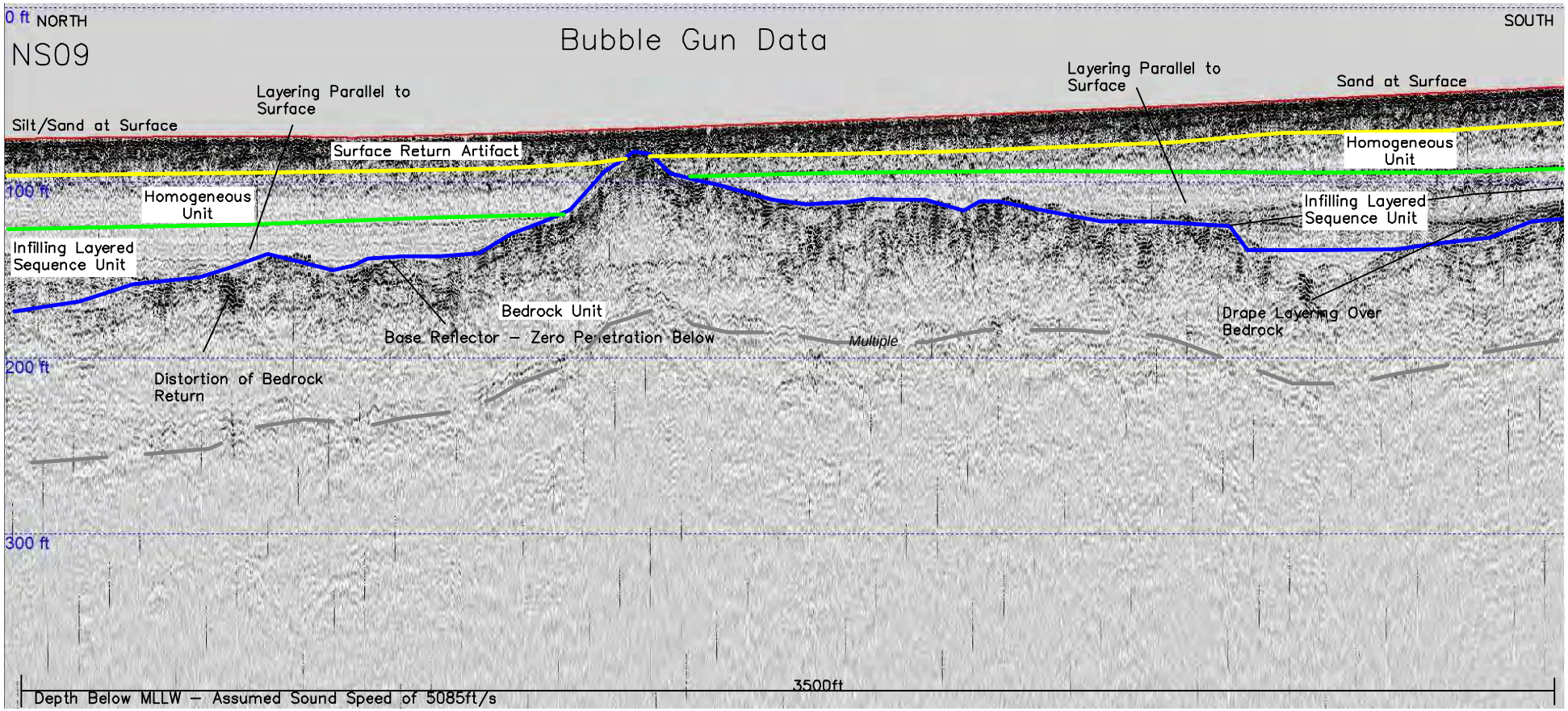

NS04
Bubble Gun Data
0 ft
NORTH
SOUTH
Cobble Deposits
Hard Surface
Sand at Surface
Bar Feature
Rocks at Surface
Strong, consistent Reflector – Infrequent Penetration
Sand at Surface
Homogeneous Unit
Moraine Unit
100 ft
Multiple
Multiple
Bedrock Unit
Base Reflector – Zero Penetration Below
200 ft
Multiples
300 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

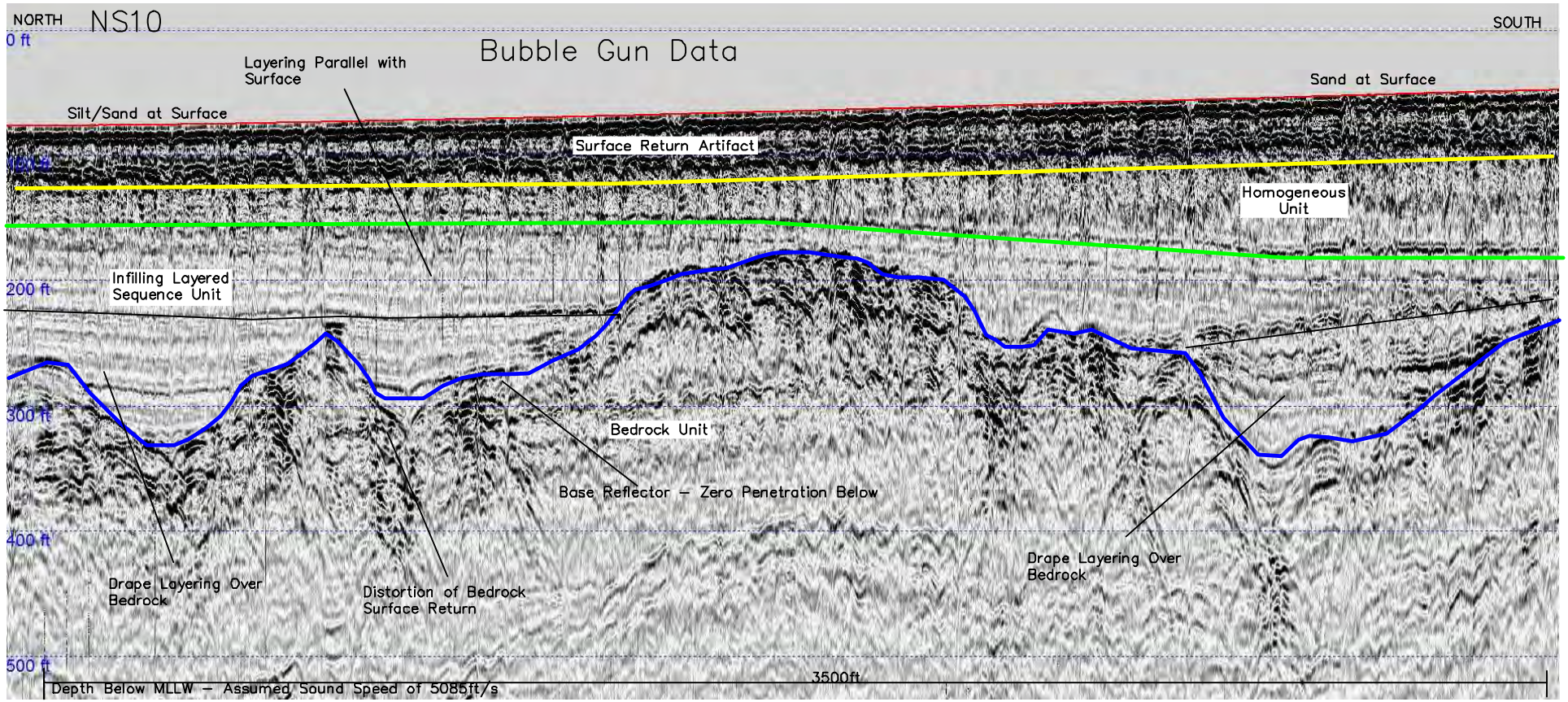

0 ft
NORTH
NS05
Bubble Gun Data
SOUTH
Cobble Deposits
Hard Surface
Strong, consistent Reflector – Infrequent Penetration
Rocks at Surface
Bar Feature
Sand at Surface
Moraine Unit
Homogeneou Unit
300 ft
Bedrock Unit
Base Reflector – Zero Penetration Below
200 ft
Multiple
300 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

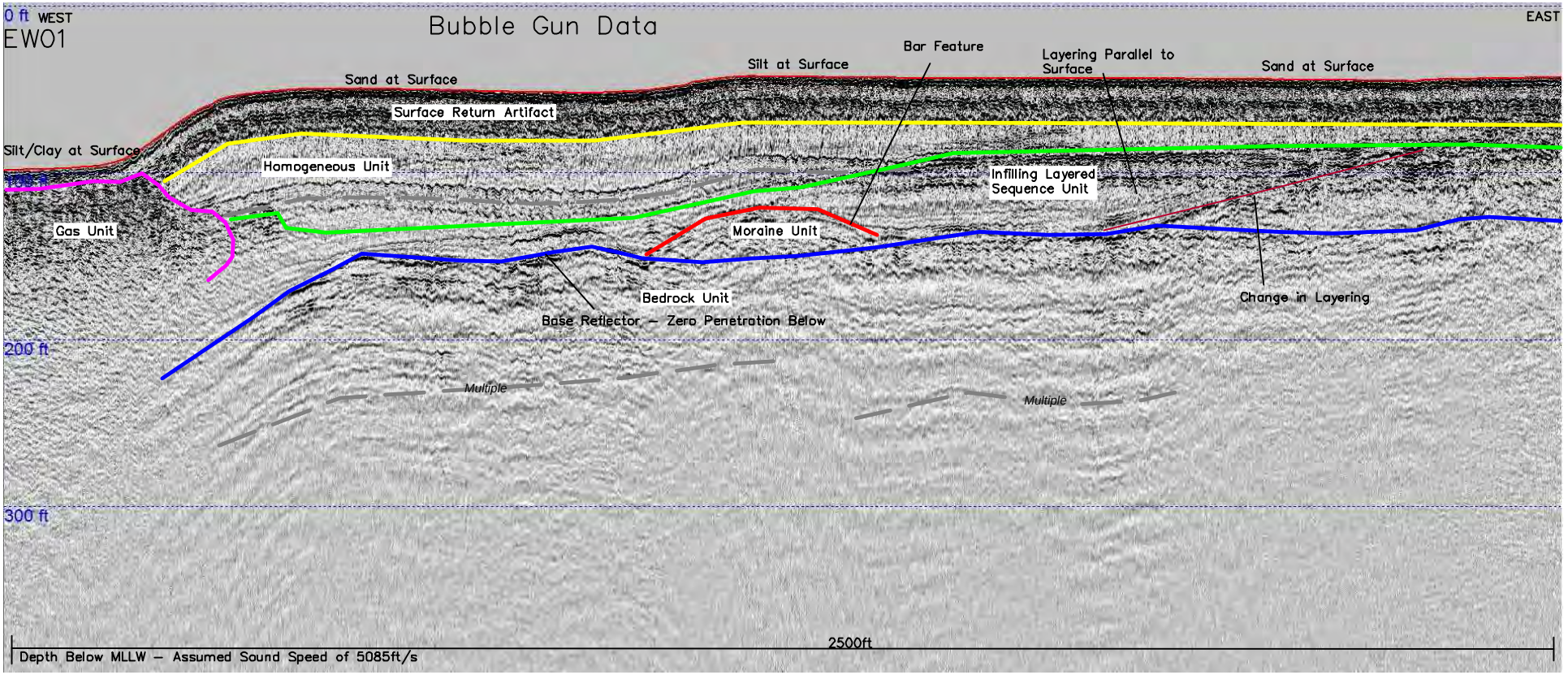

0 ft
NORTH
NS06
Bubble Gun Data
SOUTH
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Sand at Surface
Hard Surface
Rocks at Surface
Surface Return Artifact
Moraine Unit
Homogeneous Unit
100 ft
Bedrock Unit
Base Reflector – Zero Penetration Below
Multiple
200 ft
300 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

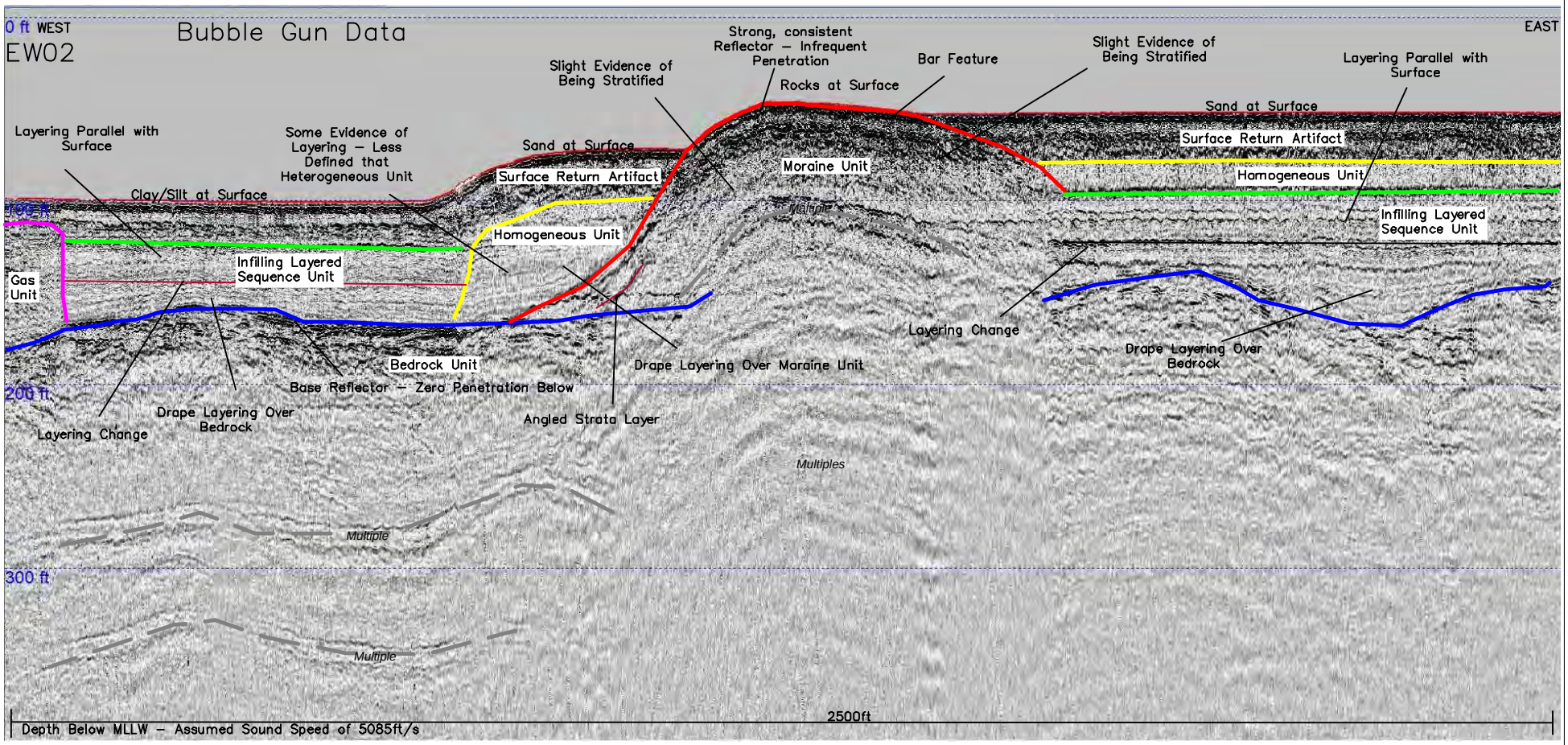

0 ft
NORTH
Bubble Gun Data
SOUTH
NS07
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Sand at Surface
Hard Surface
Rocks at Surface
Surface Return Artifact
Moraine Unit
Homogeneous Unit
100 ft
Multiple
Bedrock Unit
Base Reflector – Zero Penetration Below
200 ft
Multiples
300 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

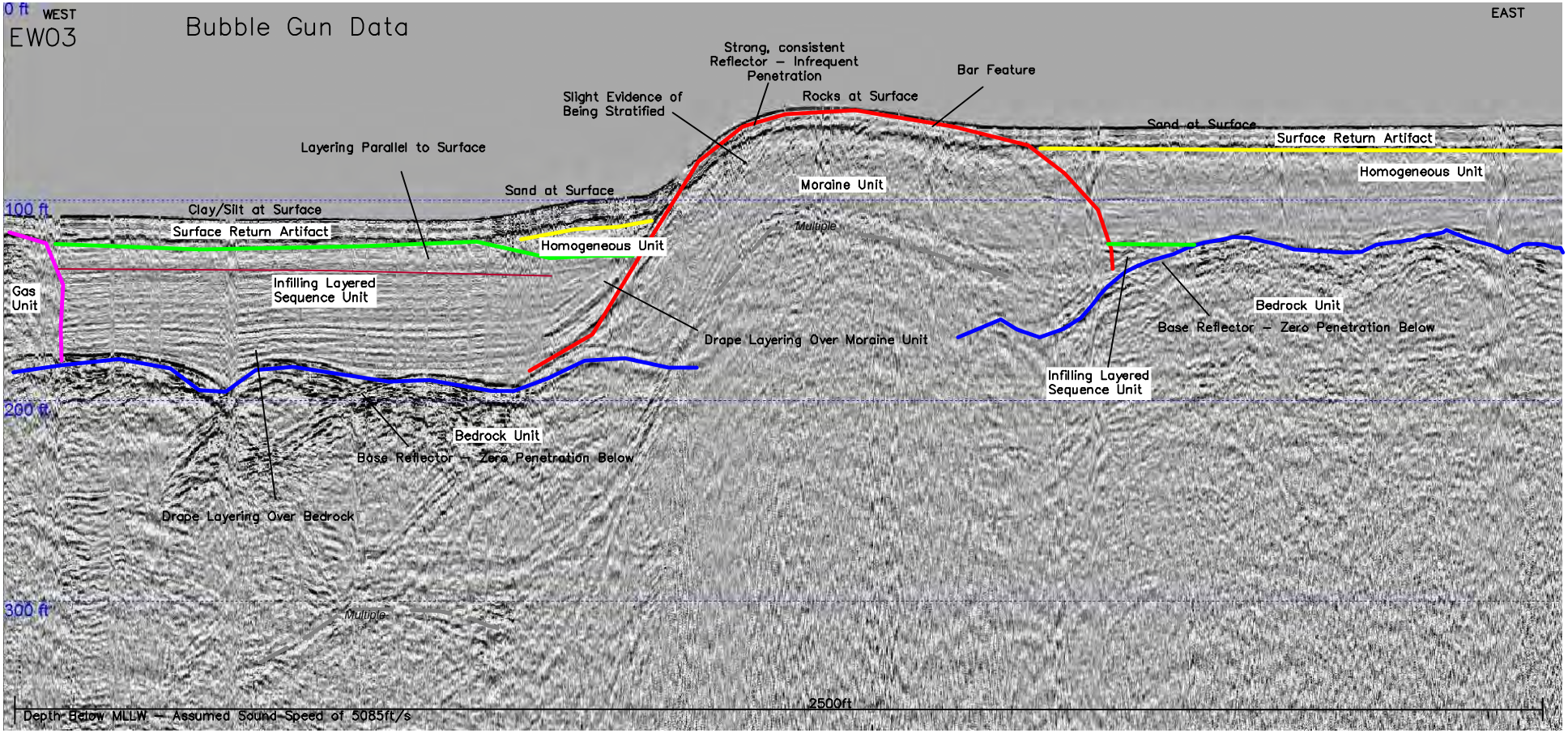

NORTH
SOUTH
NS08
Bubble Gun Data
Strong, consistent Reflector – Infrequent Penetration
Side Reflection of Moraine Unit
Bar Feature
Drape Layering Over Moraine Unit
Sand at Surface
Hard Surface
Rocks at Surface
Homogeneous Unit
Moraine Unit
Moraine Unit
100 ft
Infilling Layered Sequence Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Multiple
200 ft
Multiples
300 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

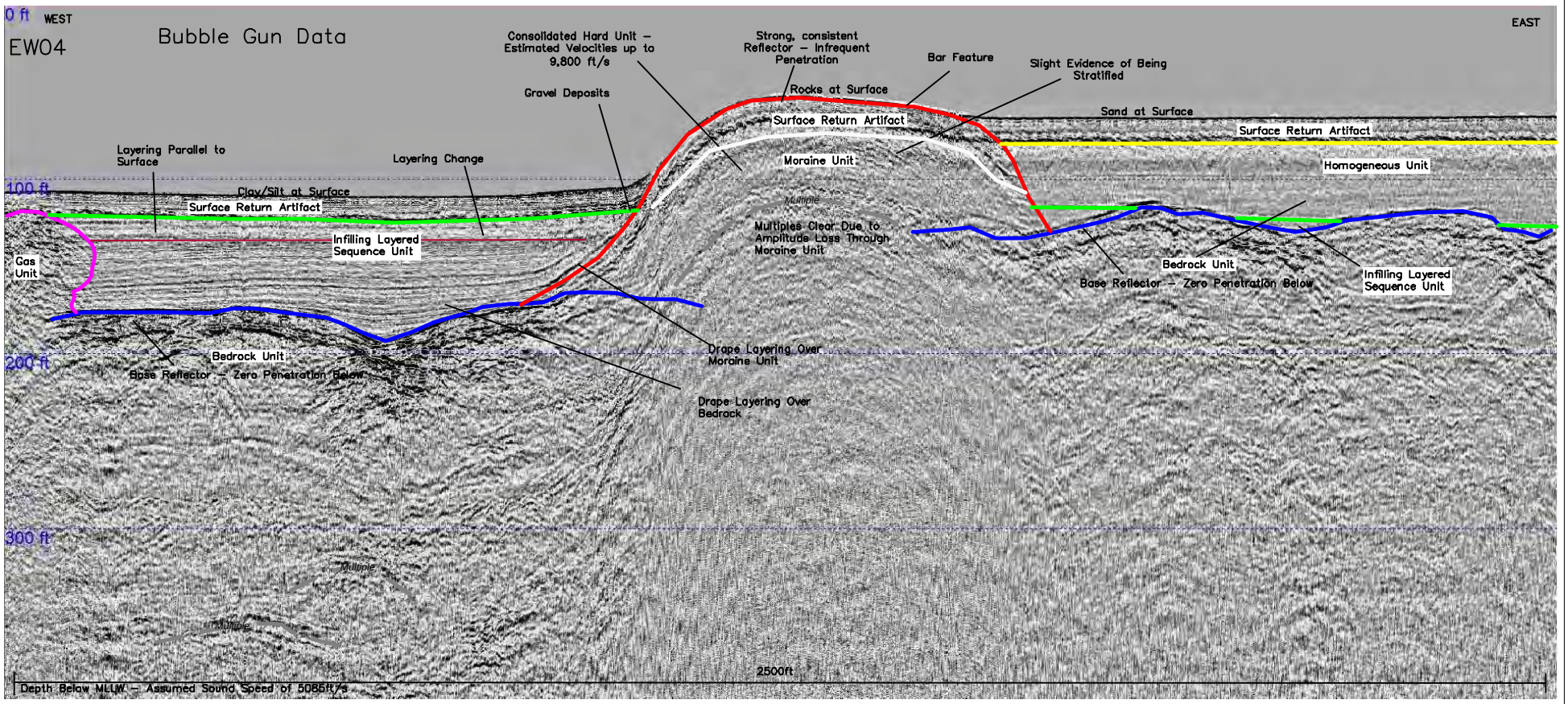

0 ft NORTH
SOUTH
NS09
Bubble Gun Data
Layering Parallel to Surface
Layering Parallel to Surface
Sand at Surface
Silt/Sand at Surface
Surface Return Artifact
Homogeneous Unit
Homogeneous Unit
100 ft
Infilling Layered Sequence Unit
Infilling Layered Sequence Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Multiple
Drape Layering Over Bedrock
200 ft
Distortion of Bedrock Return
300 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

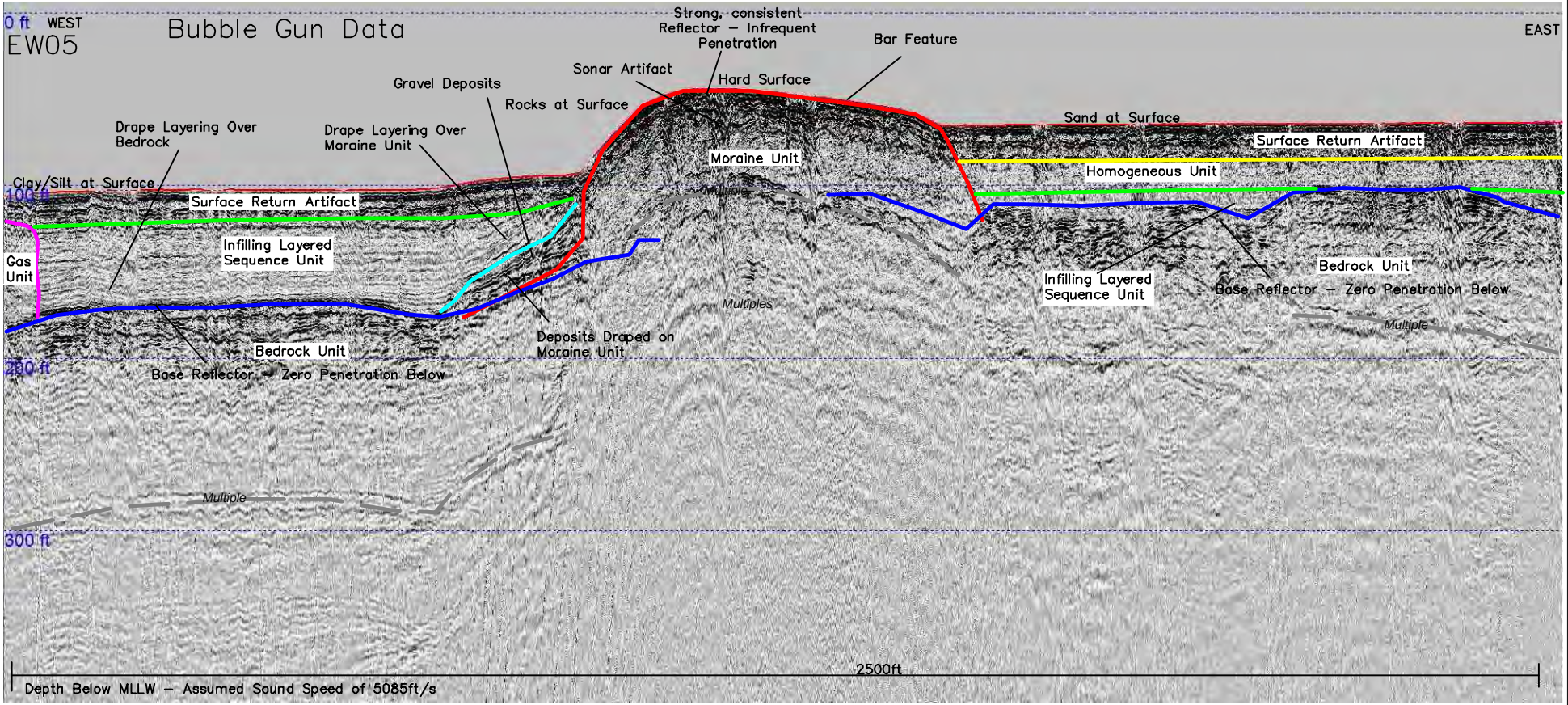

NORTH
NS10
SOUTH
Bubble Gun Data
0 ft
Layering Parallel with Surface
Silt/Sand at Surface
Sand at Surface
Surface Return Artifact
Homogeneous Unit
200 ft
Infilling Layered Sequence Unit
300 ft
Bedrock Unit
Base Reflector – Zero Penetration Below
400 ft
Drape Layering Over Bedrock
Distortion of Bedrock Surface Return
Drape Layering Over Bedrock
500 ft
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

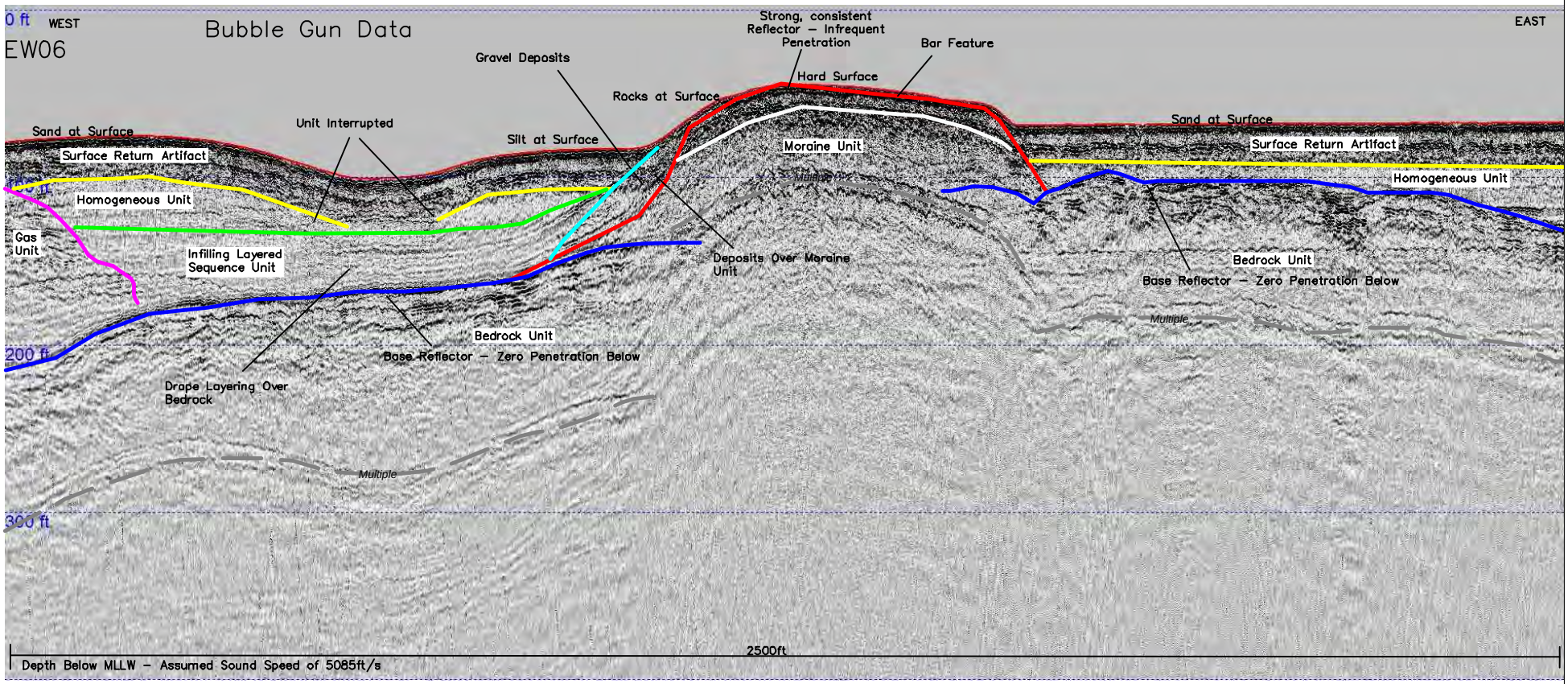

0 ft WEST
EW01
Bubble Gun Data
EAST
Sand at Surface
Surface Return Artifact
Silt at Surface
Bar Feature
Layering Parallel to Surface
Sand at Surface
Silt/Clay at Surface
Homogeneous Unit
Infilling Layered Sequence Unit
Gas Unit
Moraine Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Change in Layering
100 ft
200 ft
300 ft
Multiple
Multiple
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

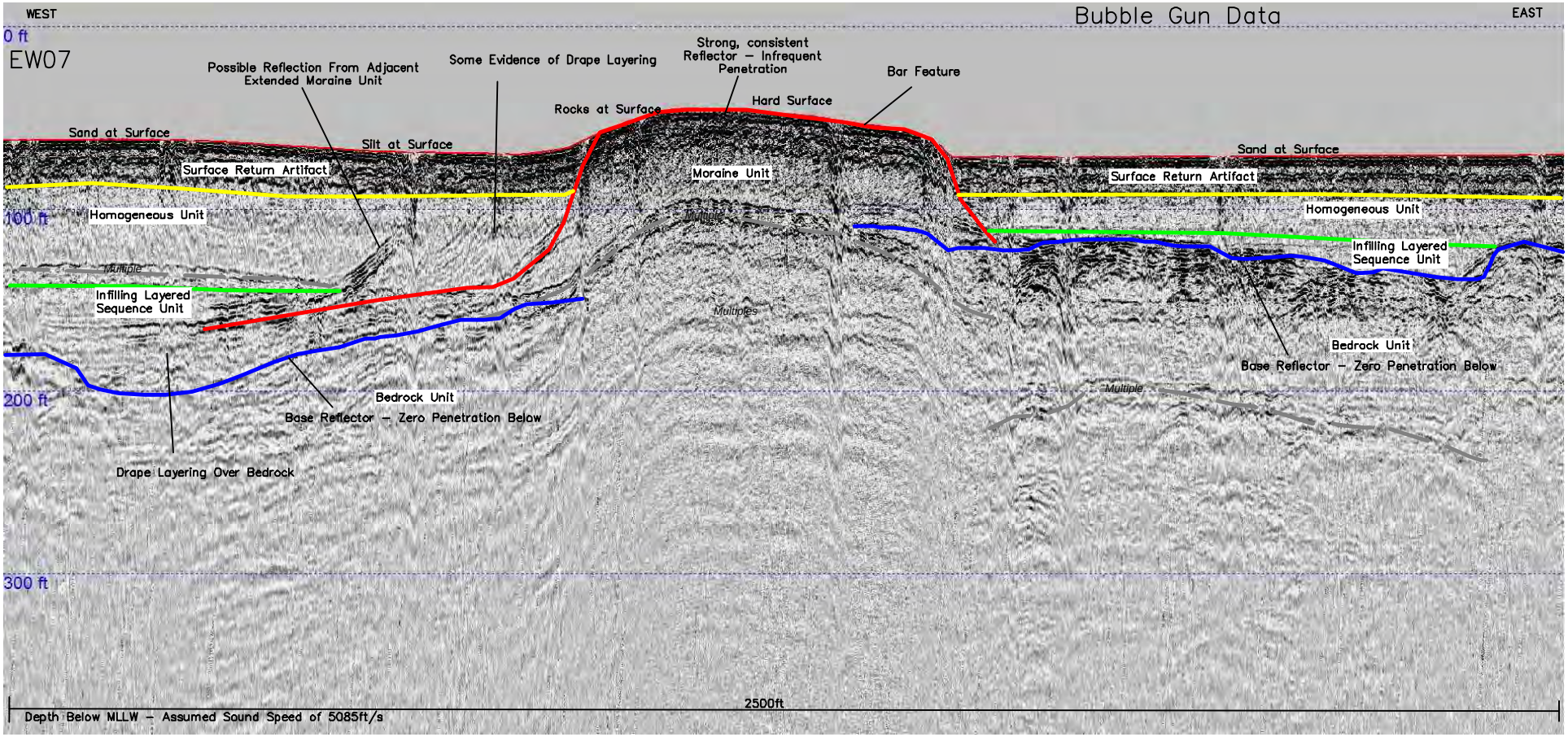

0 ft WEST
EW02
Bubble Gun Data
EAST
Strong, consistent Reflector – Infrequent Penetration
Slight Evidence of Being Stratified
Bar Feature
Slight Evidence of Being Stratified
Layering Parallel with Surface
Rocks at Surface
Sand at Surface
Layering Parallel with Surface
Some Evidence of Layering – Less Defined that Heterogeneous Unit
Sand at Surface
Surface Return Artifact
Surface Return Artifact
Moraine Unit
Clay/Silt at Surface
Homogeneous Unit
Multiple
Homogeneous Unit
100 ft
Infilling Layered Sequence Unit
Infilling Layered Sequence Unit
Gas Unit
Layering Change
Drape Layering Over Bedrock
Bedrock Unit
Drape Layering Over Moraine Unit
Base Reflector – Zero Penetration Below
200 ft
Drape Layering Over Bedrock
Layering Change
Angled Strata Layer
Multiples
Multiple
300 ft
Multiple
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

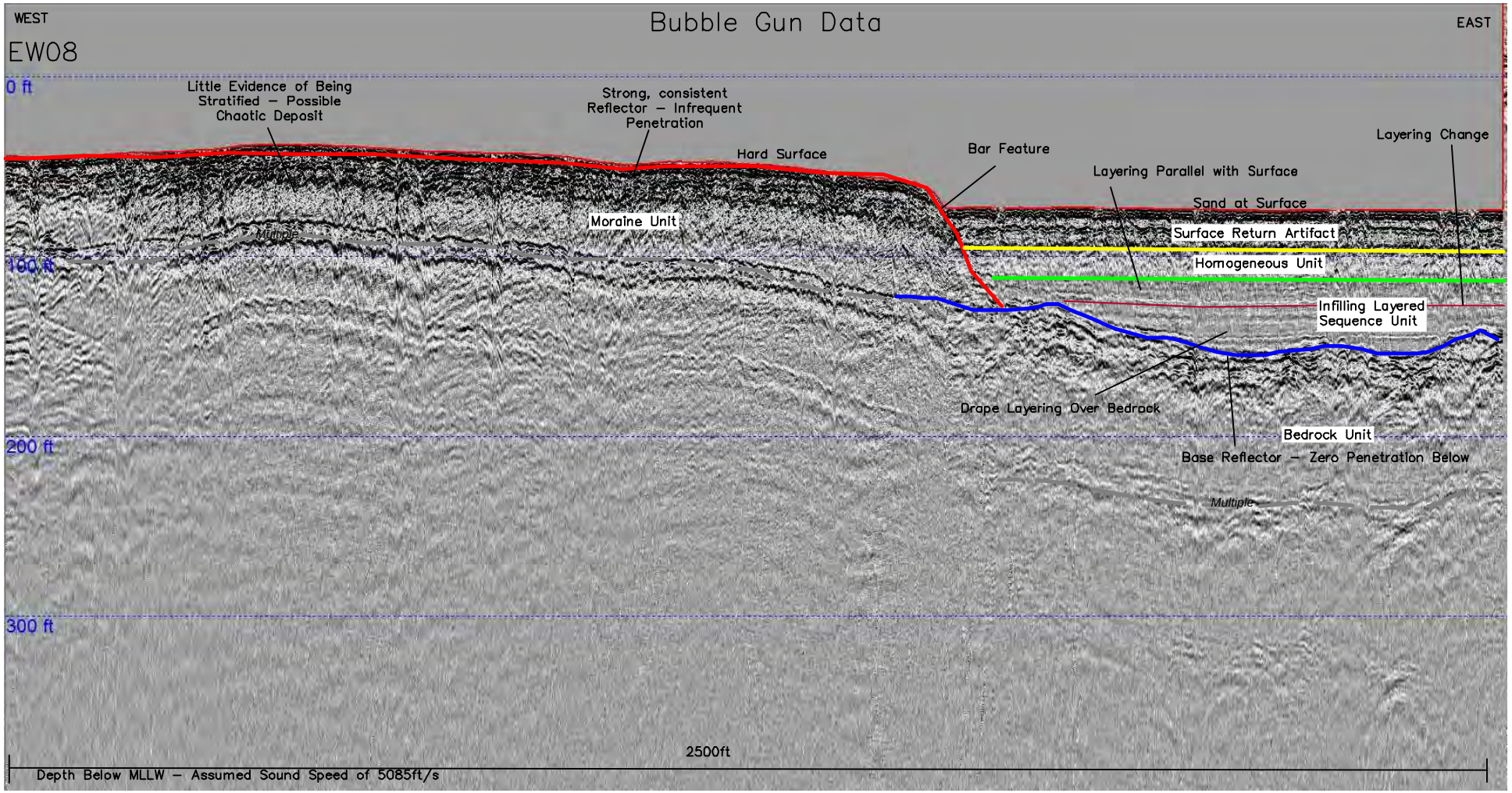

0 ft
WEST
EW03
Bubble Gun Data
EAST
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Slight Evidence of Being Stratified
Rocks at Surface
Sand at Surface
Surface Return Artifact
Layering Parallel to Surface
Sand at Surface
Moraine Unit
Homogeneous Unit
100 ft
Clay/Silt at Surface
Surface Return Artifact
Multiple
Homogeneous Unit
Gas Unit
Infilling Layered Sequence Unit
Drape Layering Over Moraine Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Infilling Layered Sequence Unit
200 ft
Bedrock Unit
Base Reflector – Zero Penetration Below
Drape Layering Over Bedrock
300 ft
Multiple
2500ft
Depth Below MLLW – Assumed Sound-Speed of 5085ft/s

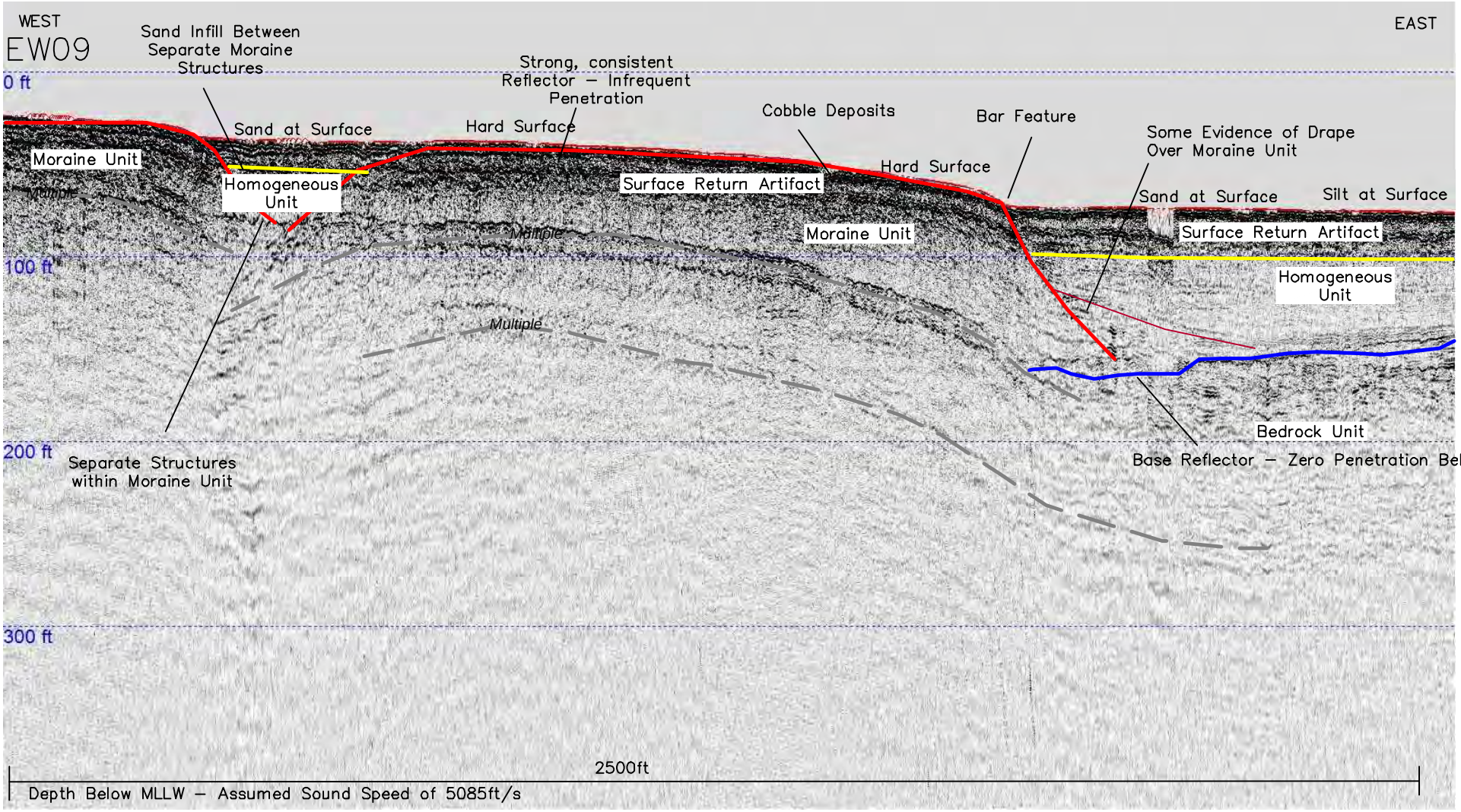

0 ft
WEST
EAST
EW04
Bubble Gun Data
Consolidated Hard Unit – Estimated Velocities up to 9,800 ft/s
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Slight Evidence of Being Stratified
Rocks at Surface
Gravel Deposits
Sand at Surface
Surface Return Artifact
Surface Return Artifact
Layering Parallel to Surface
Layering Change
Moraine Unit
Homogeneous Unit
100 ft
Clay/Silt at Surface
Surface Return Artifact
Multiple
Multiples Clear Due to Amplitude Loss Through Moraine Unit
Infilling Layered Sequence Unit
Gas Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Infilling Layered Sequence Unit
200 ft
Bedrock Unit
Base Reflector – Zero Penetration Below
Drape Layering Over Moraine Unit
Drape Layering Over Bedrock
300 ft
Multiple
Multiple
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

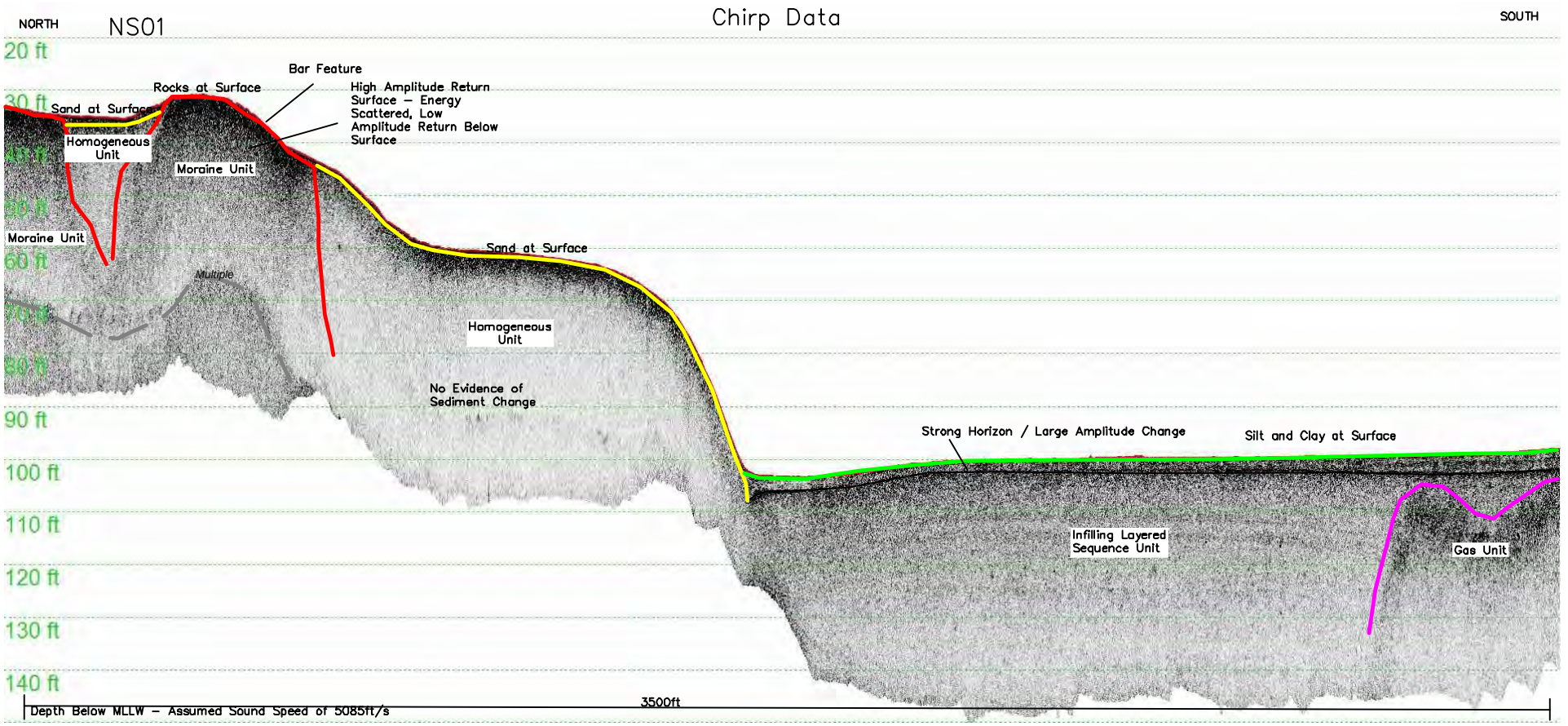

0 ft WEST
EW05
Bubble Gun Data
EAST
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Sonar Artifact
Hard Surface
Gravel Deposits
Rocks at Surface
Sand at Surface
Drape Layering Over Bedrock
Drape Layering Over Moraine Unit
Surface Return Artifact
Moraine Unit
Homogeneous Unit
Clay/Silt at Surface
100 ft
Surface Return Artifact
Infilling Layered Sequence Unit
Gas Unit
Bedrock Unit
Infilling Layered Sequence Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Multiples
Multiple
Deposits Draped on Moraine Unit
200 ft
Base Reflector – Zero Penetration Below
Multiple
300 ft
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

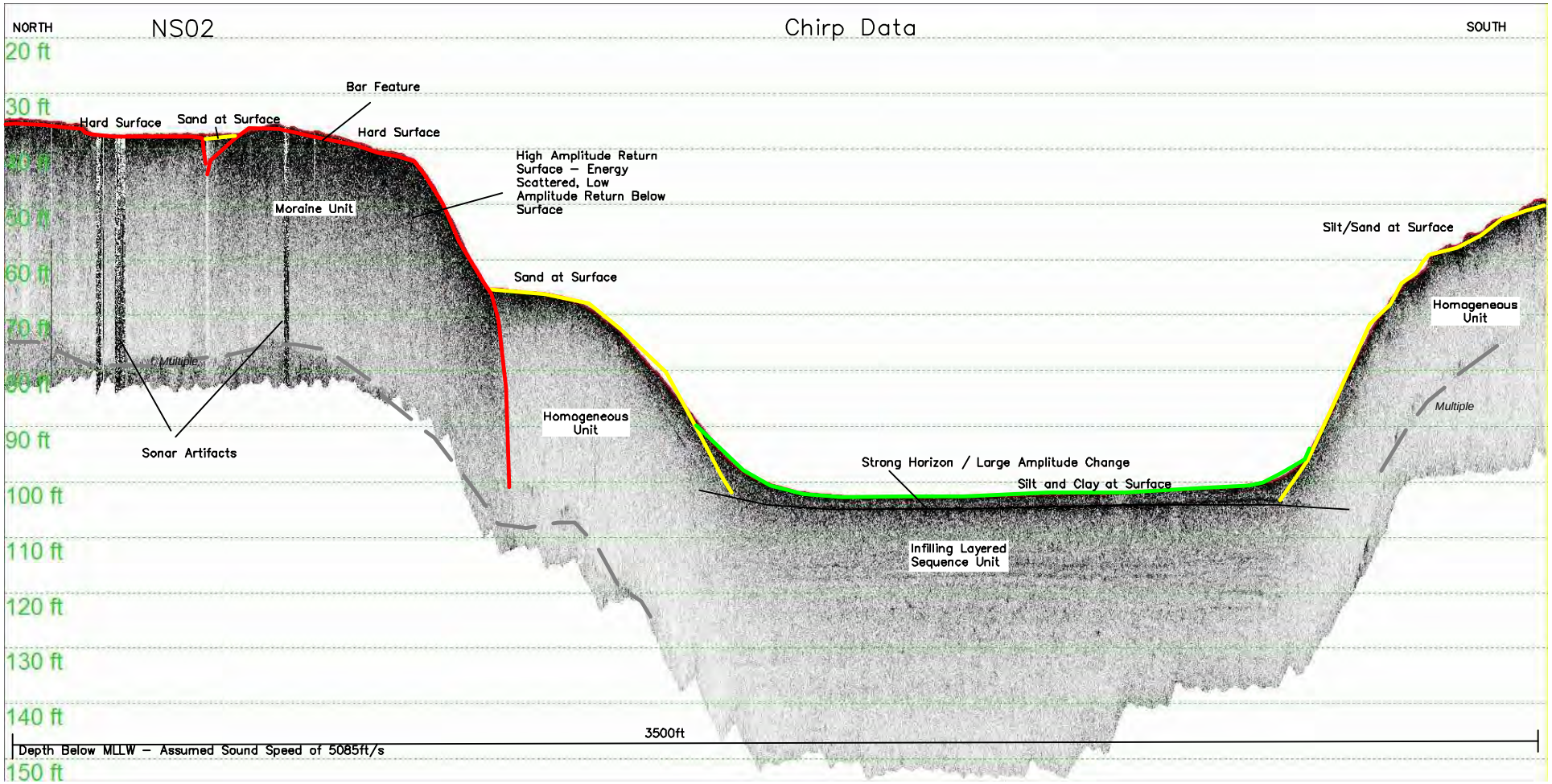

0 ft
WEST
EAST
Bubble Gun Data
EW06
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Gravel Deposits
Hard Surface
Rocks at Surface
Unit Interrupted
Sand at Surface
Silt at Surface
Moraine Unit
Sand at Surface
Surface Return Artifact
Surface Return Artifact
Homogeneous Unit
Homogeneous Unit
Gas Unit
Infilling Layered Sequence Unit
Deposits Over Moraine Unit
Bedrock Unit
Base Reflector – Zero Penetration Below
Multiple
Bedrock Unit
Base Reflector – Zero Penetration Below
200 ft
Drape Layering Over Bedrock
Multiple
300 ft
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

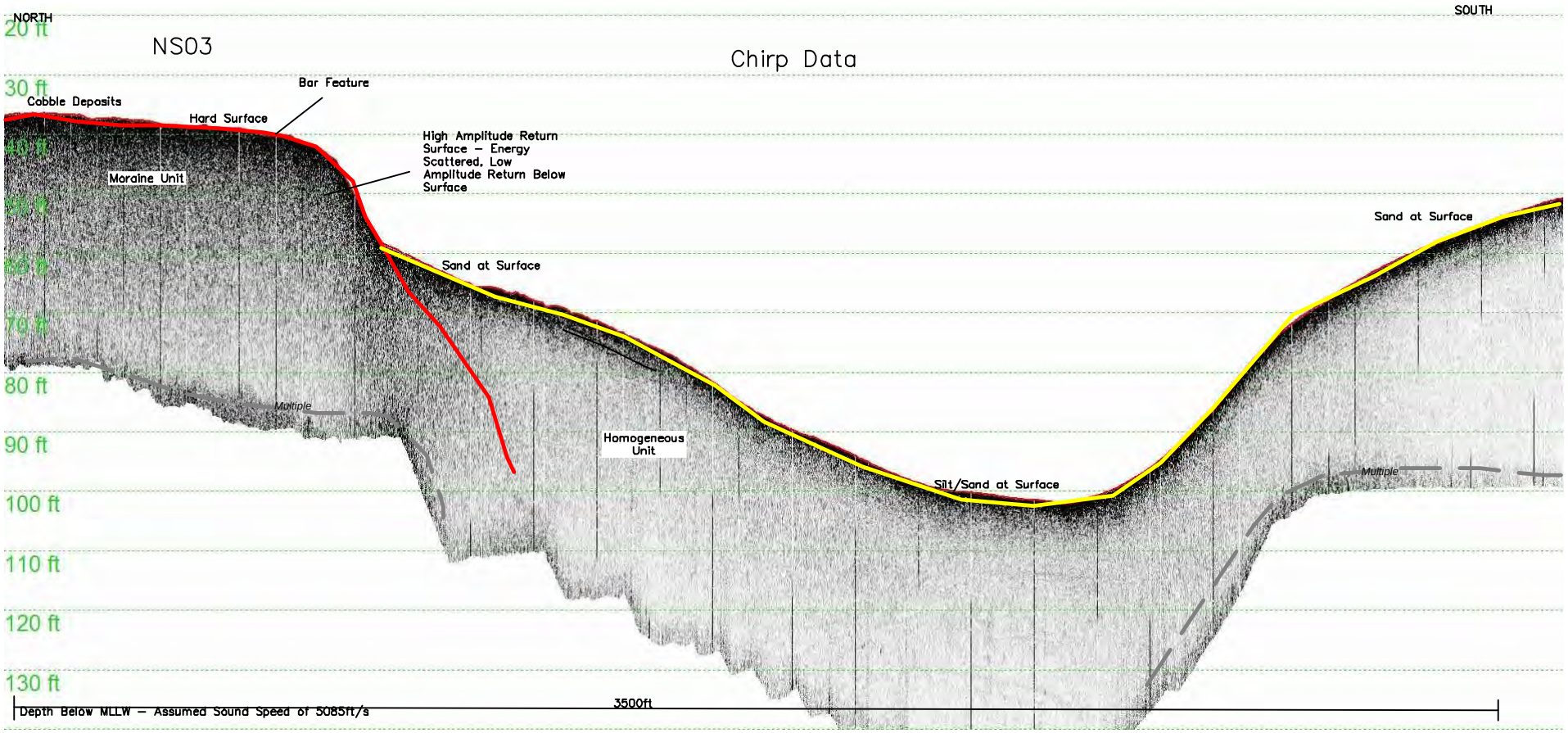

WEST
Bubble Gun Data
EAST
0 ft
EW07
Possible Reflection From Adjacent Extended Moraine Unit
Some Evidence of Drape Layering
Strong, consistent Reflector – Infrequent Penetration
Bar Feature
Rocks at Surface
Hard Surface
Sand at Surface
Silt at Surface
Surface Return Artifact
Moraine Unit
Sand at Surface
Surface Return Artifact
100 ft
Homogeneous Unit
Homogeneous Unit
Infilling Layered Sequence Unit
Infilling Layered Sequence Unit
Multiple
Multiples
Bedrock Unit
Base Reflector – Zero Penetration Below
200 ft
Bedrock Unit
Base Reflector – Zero Penetration Below
Multiple
Drape Layering Over Bedrock
300 ft
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

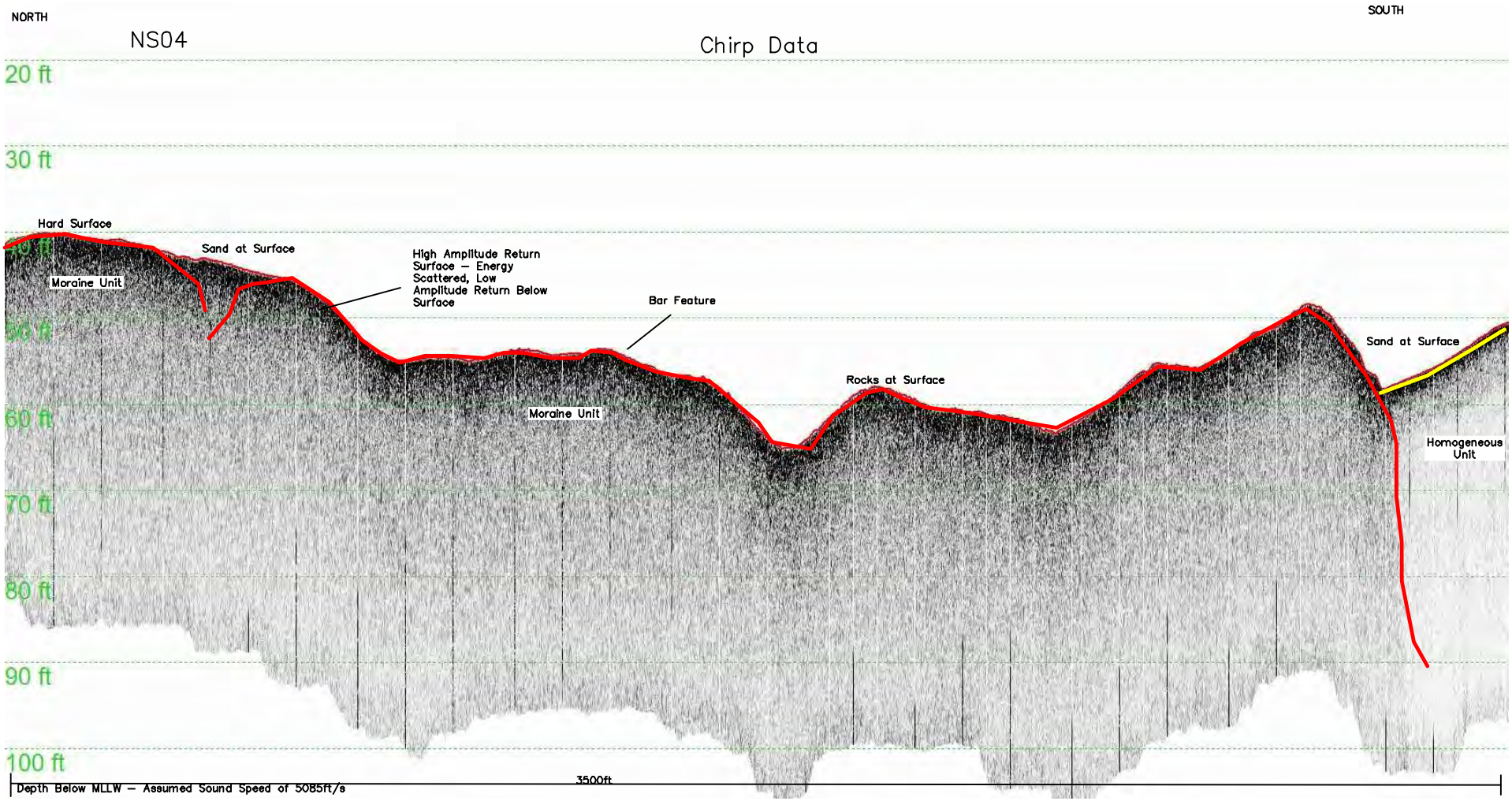

WEST
Bubble Gun Data
EAST
EW08
0 ft
Little Evidence of Being Stratified – Possible Chaotic Deposit
Strong, consistent Reflector – Infrequent Penetration
Hard Surface
Bar Feature
Layering Change
Layering Parallel with Surface
Sand at Surface
Moraine Unit
Surface Return Artifact
Multiple
100 ft
Homogeneous Unit
Infilling Layered Sequence Unit
Drape Layering Over Bedrock
Bedrock Unit
200 ft
Base Reflector – Zero Penetration Below
Multiple
300 ft
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

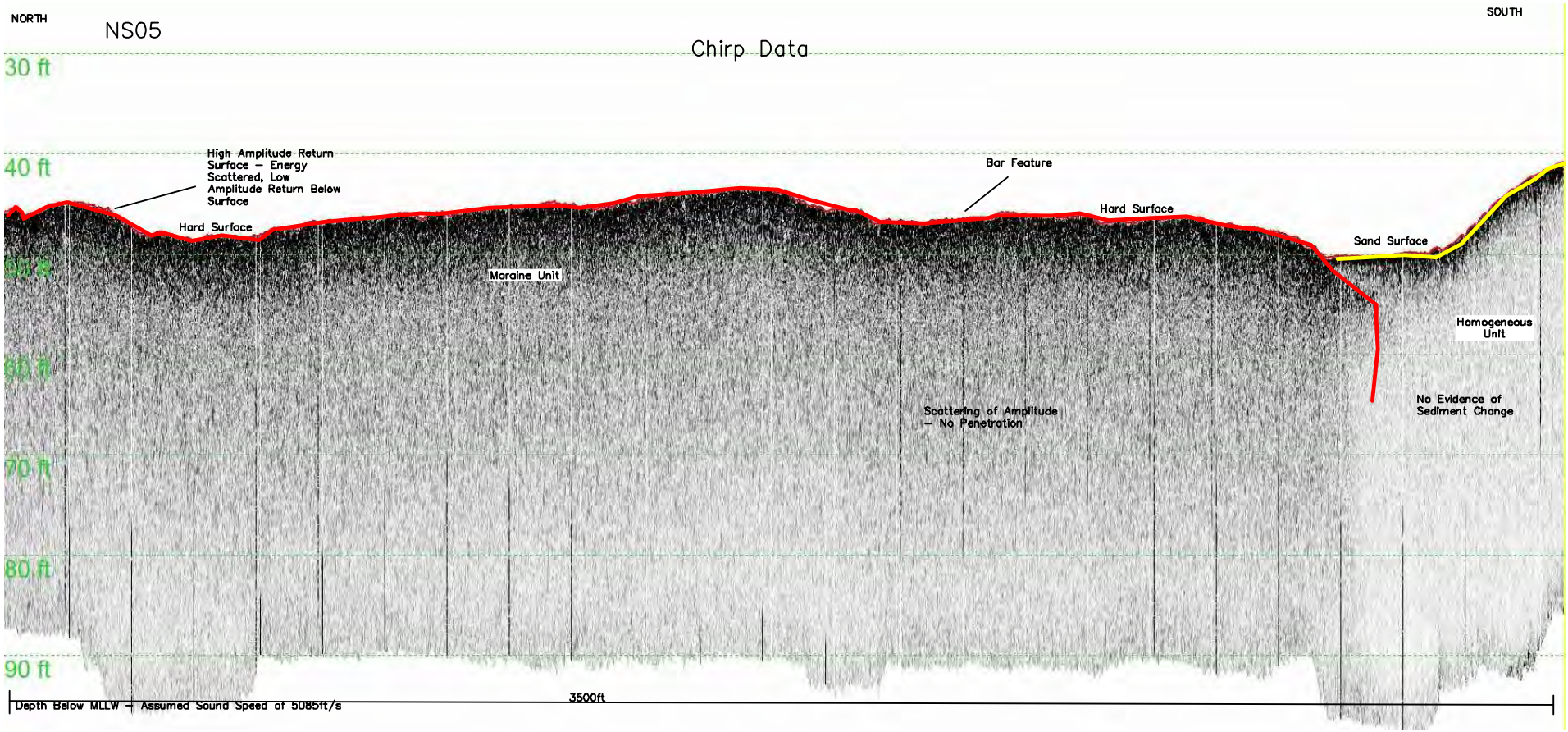

WEST
EW09
EAST
Sand Infill Between Separate Moraine Structures
Strong, consistent Reflector – Infrequent Penetration
0 ft
Sand at Surface
Hard Surface
Cobble Deposits
Bar Feature
Some Evidence of Drape Over Moraine Unit
Moraine Unit
Homogeneous Unit
Surface Return Artifact
Hard Surface
Sand at Surface
Silt at Surface
Multiple
Moraine Unit
Surface Return Artifact
100 ft
Homogeneous Unit
Multiple
Bedrock Unit
200 ft
Separate Structures within Moraine Unit
Base Reflector – Zero Penetration Bel
300 ft
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

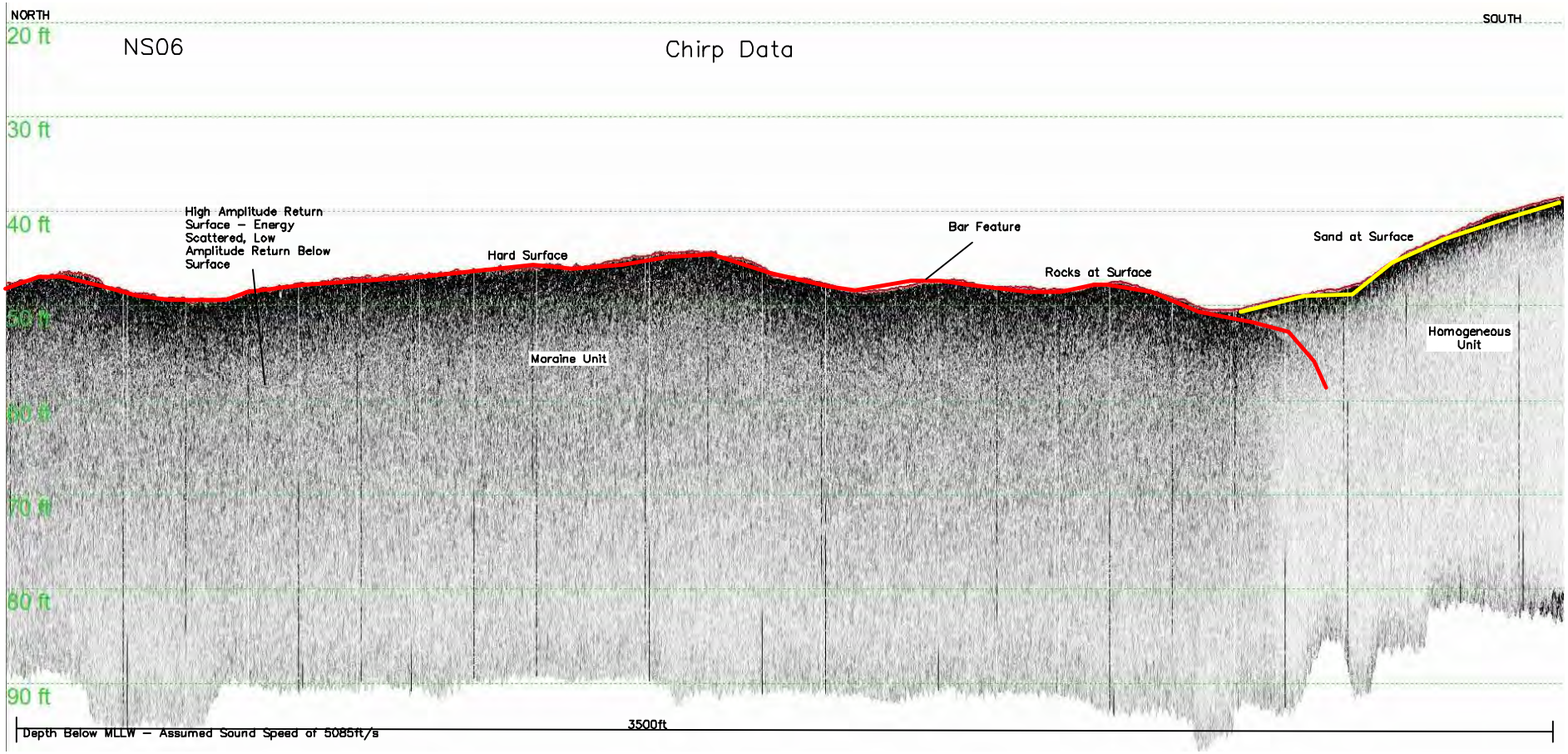

NORTH
NS01
Chirp Data
SOUTH
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
120 ft
130 ft
140 ft
Bar Feature
Rocks at Surface
High Amplitude Return
Surface – Energy
Scattered, Low
Amplitude Return Below
Surface
Sand at Surface
Homogeneous Unit
Moraine Unit
Moraine Unit
Multiple
Sand at Surface
Homogeneous Unit
No Evidence of Sediment Change
Strong Horizon / Large Amplitude Change
Silt and Clay at Surface
Infilling Layered Sequence Unit
Gas Unit
Depth Below MLLW – Assumed Sound Speed of 5085ft/s
3500ft

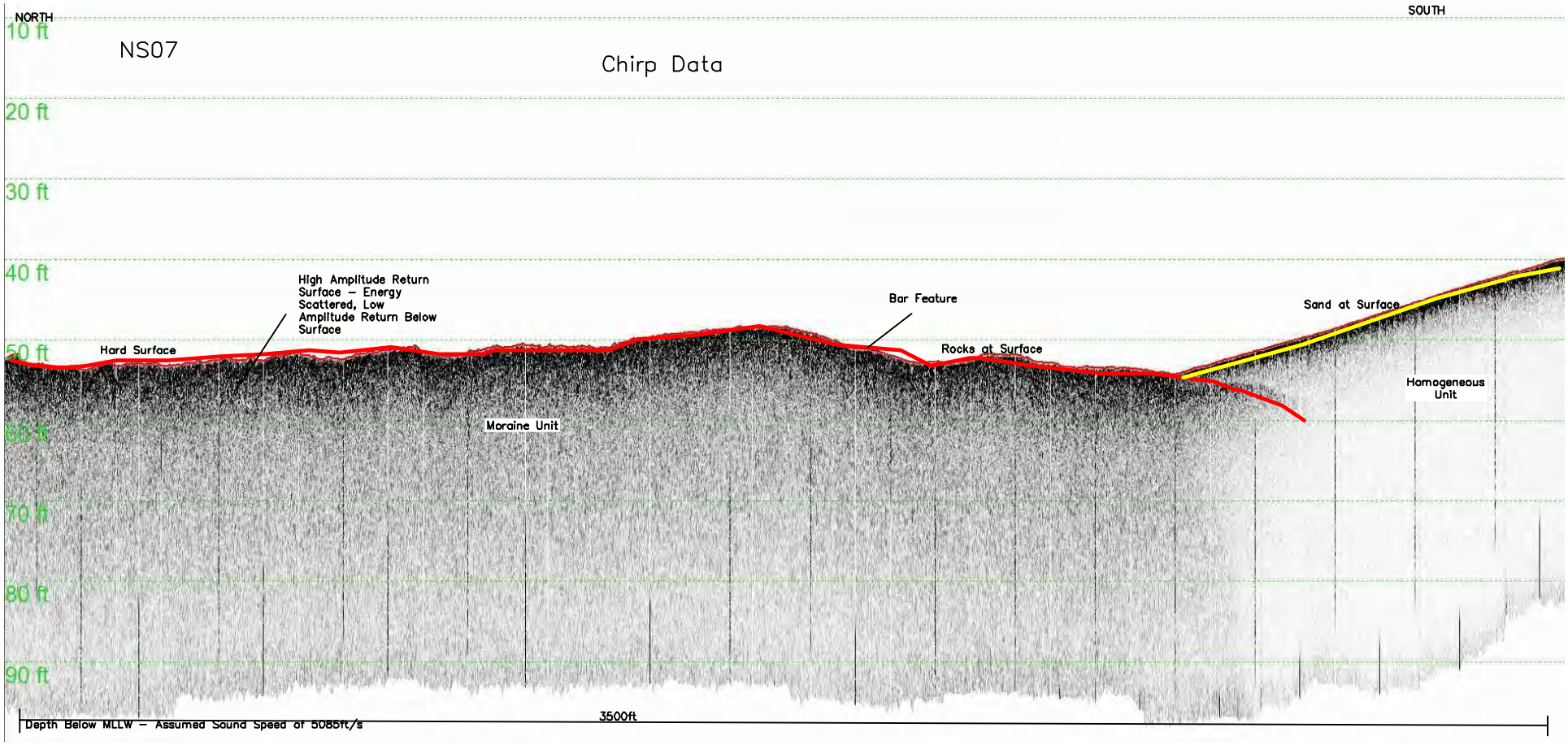

NORTH
NS02
Chirp Data
SOUTH
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
120 ft
130 ft
140 ft
150 ft
Bar Feature
Hard Surface
Sand at Surface
Hard Surface
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Moraine Unit
Sand at Surface
Silt/Sand at Surface
Homogeneous Unit
Multiple
Multiple
Homogeneous Unit
Sonar Artifacts
Strong Horizon / Large Amplitude Change
Silt and Clay at Surface
Infilling Layered Sequence Unit
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

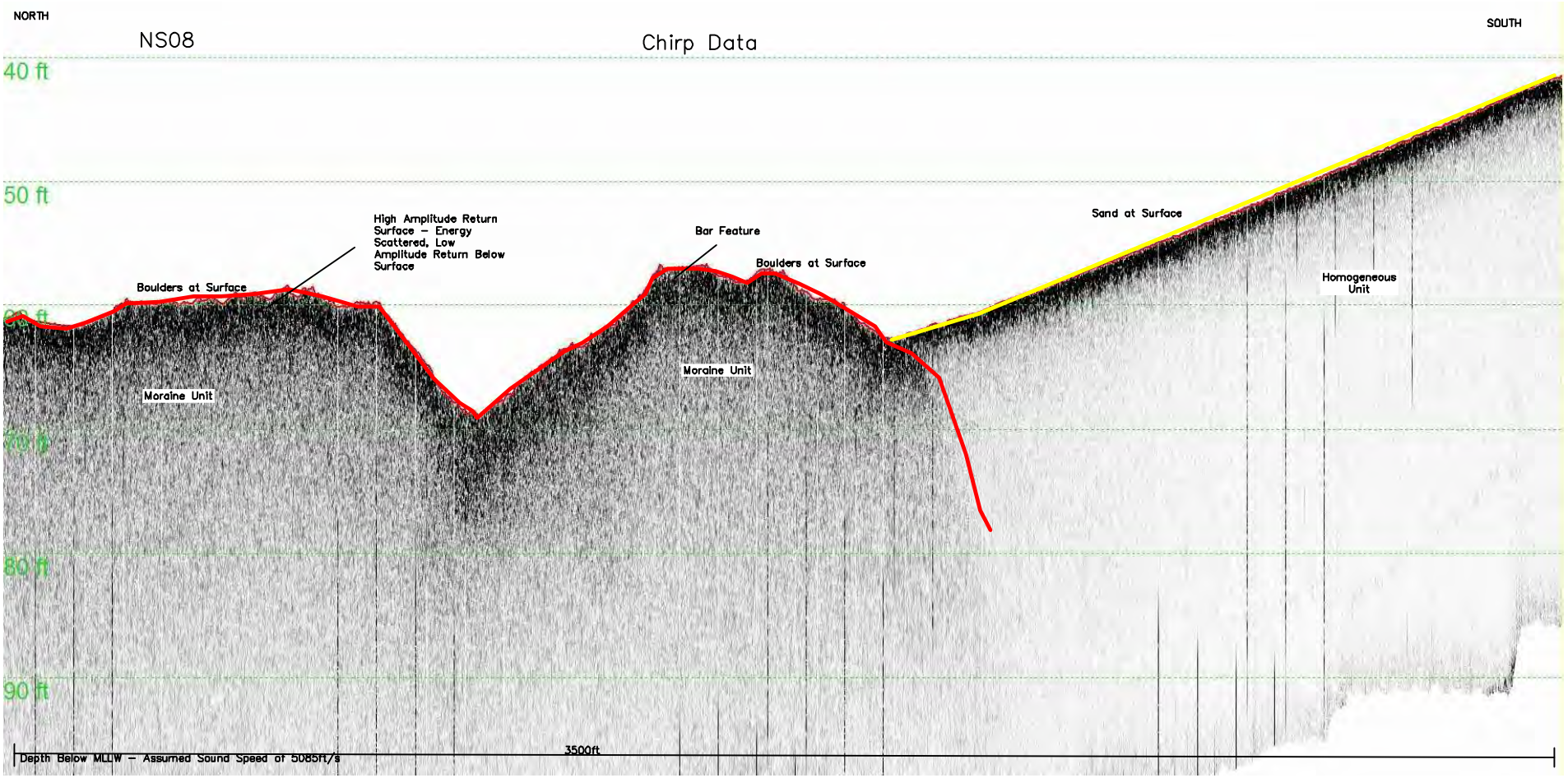

NORTH
SOUTH
NS03
Chirp Data
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
120 ft
130 ft
Cobble Deposits
Hard Surface
Bar Feature
High Amplitude Return
Surface – Energy
Scattered, Low
Amplitude Return Below
Surface
Moraine Unit
Sand at Surface
Sand at Surface
Multiple
Homogeneous
Unit
Silt/Sand at Surface
Multiple
Depth Below MLLW – Assumed Sound Speed of 5085ft/s
3500ft

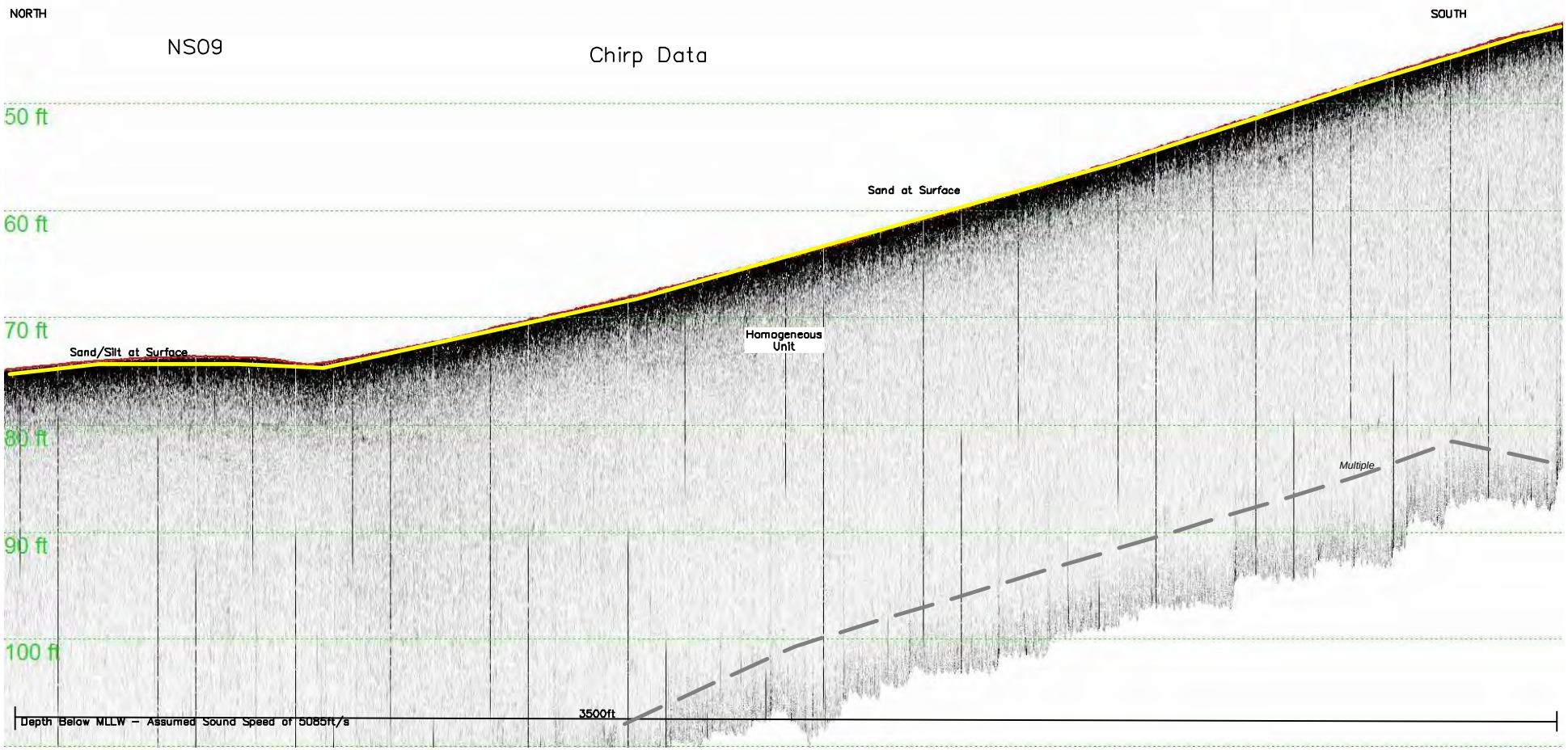

NORTH
SOUTH
NS04
Chirp Data
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
Hard Surface
Sand at Surface
Moraine Unit
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Bar Feature
Moraine Unit
Rocks at Surface
Sand at Surface
Homogeneous Unit
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

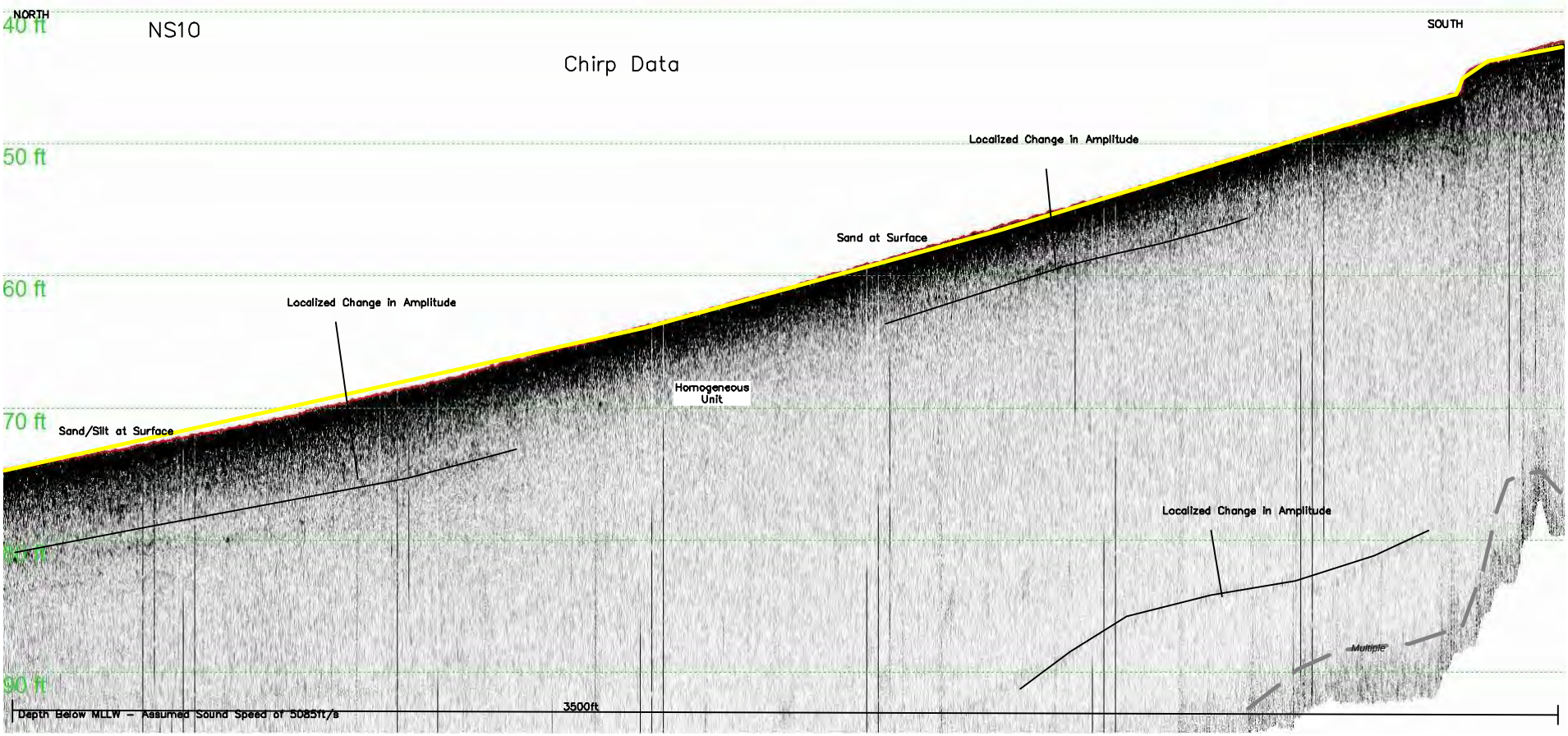

NORTH
SOUTH
NS05
Chirp Data
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Hard Surface
Moraine Unit
Bar Feature
Hard Surface
Sand Surface
Homogeneous Unit
Scattering of Amplitude – No Penetration
No Evidence of Sediment Change
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

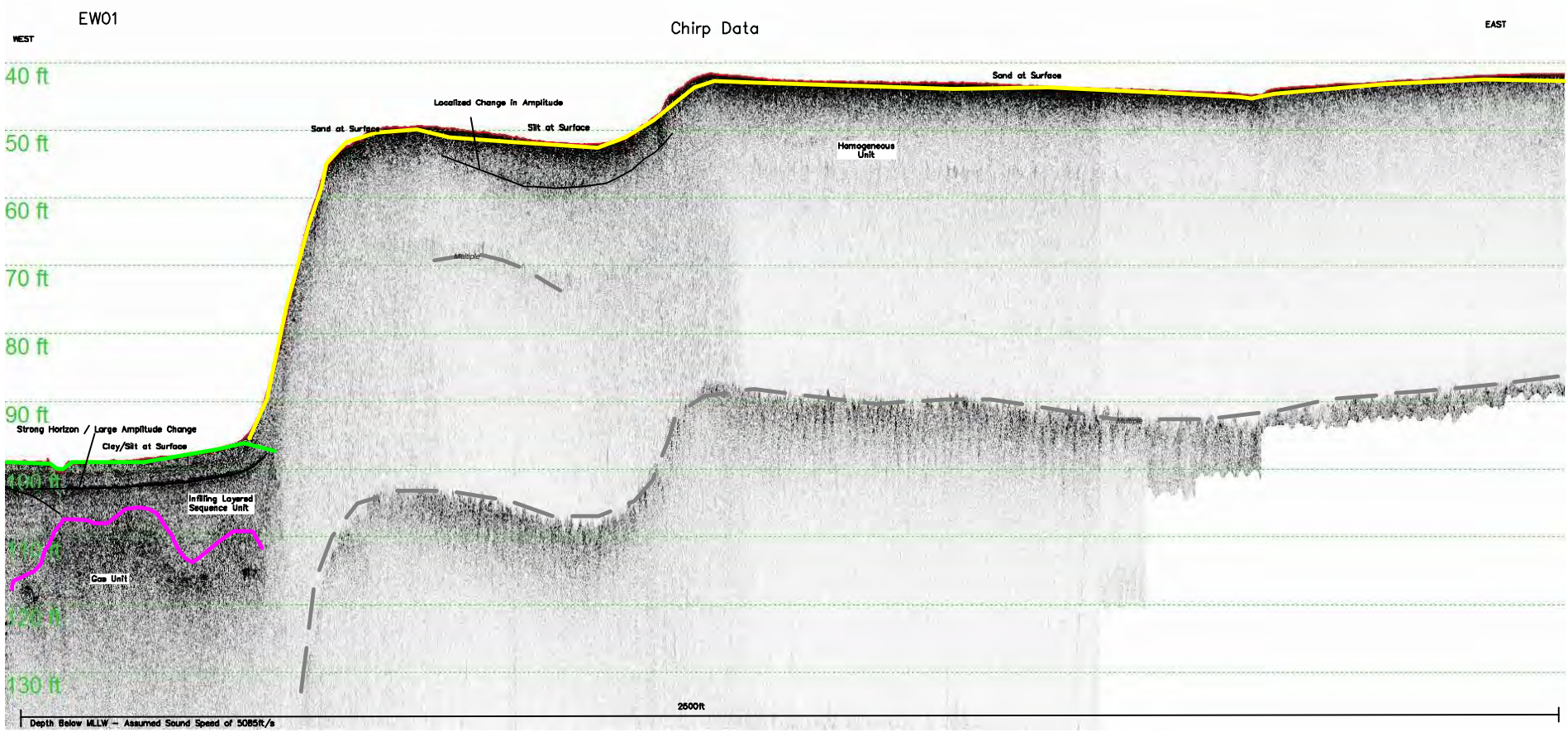

NORTH
SOUTH
NS06
Chirp Data
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Hard Surface
Moraine Unit
Bar Feature
Rocks at Surface
Sand at Surface
Homogeneous Unit
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

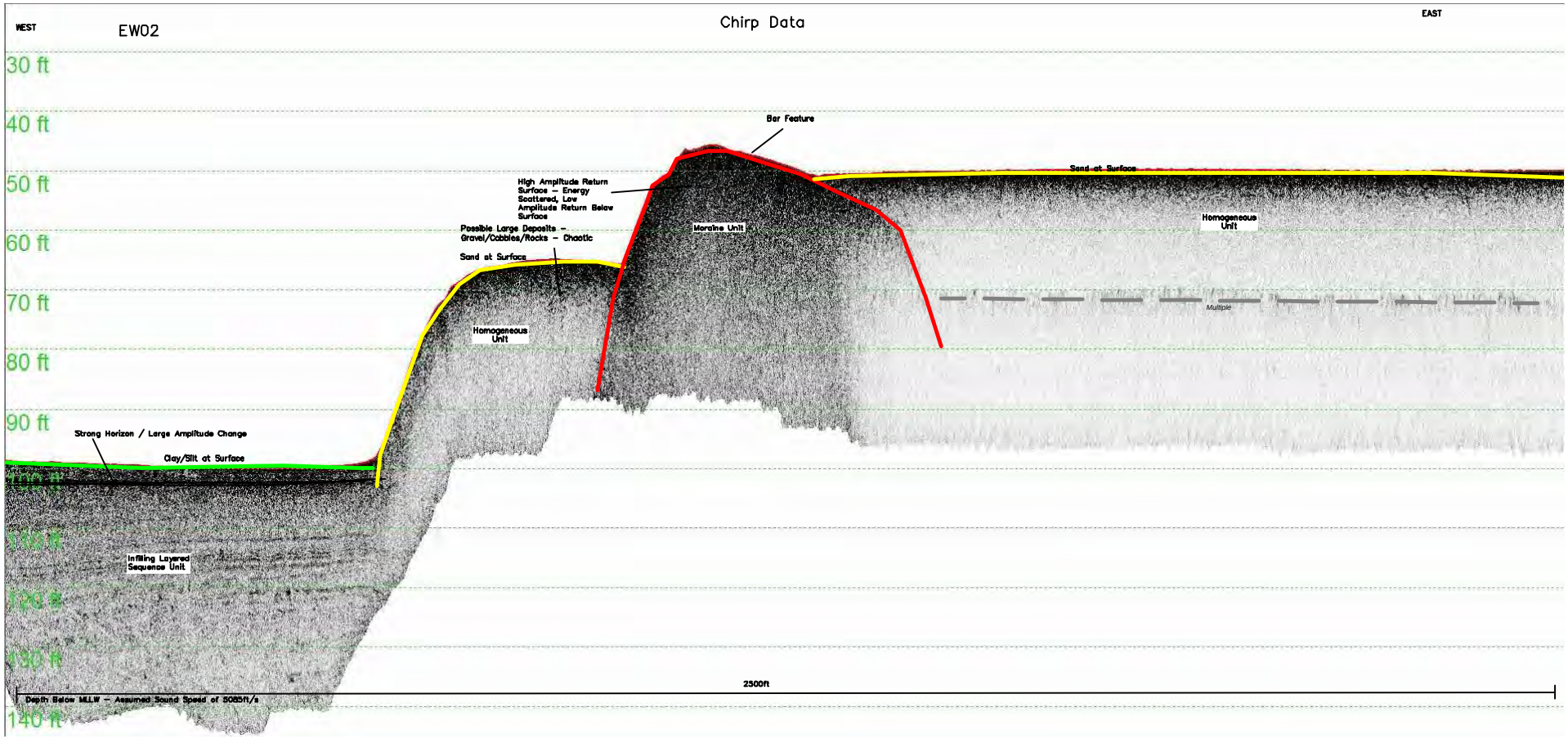

NORTH
SOUTH
NS07
Chirp Data
10 ft
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Hard Surface
Moraine Unit
Bar Feature
Rocks at Surface
Sand at Surface
Homogeneous Unit
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

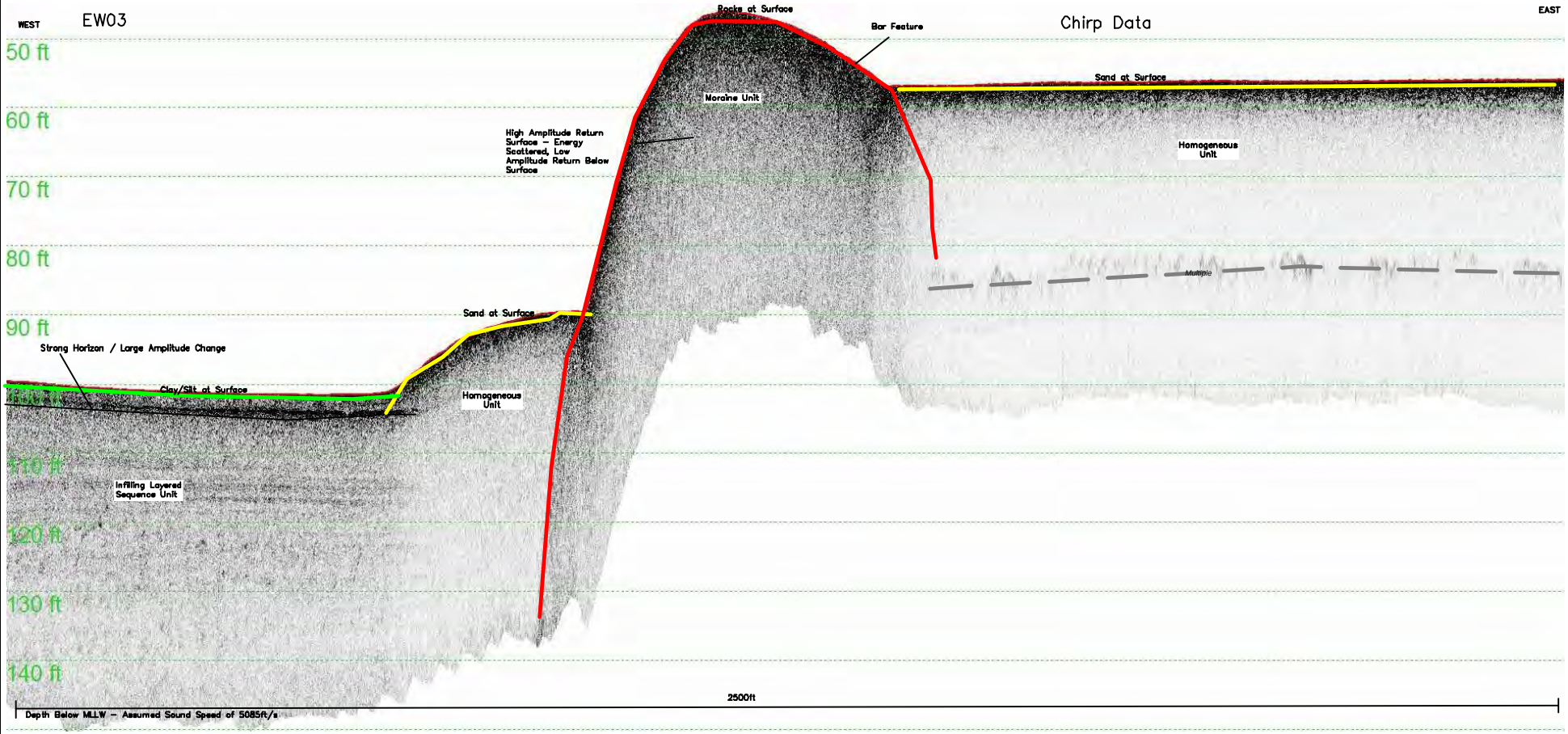

NORTH
NS08
Chirp Data
SOUTH
40 ft
50 ft
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Bar Feature
Boulders at Surface
Sand at Surface
Boulders at Surface
Homogeneous Unit
Moraine Unit
Moraine Unit
80 ft
90 ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s
3500ft

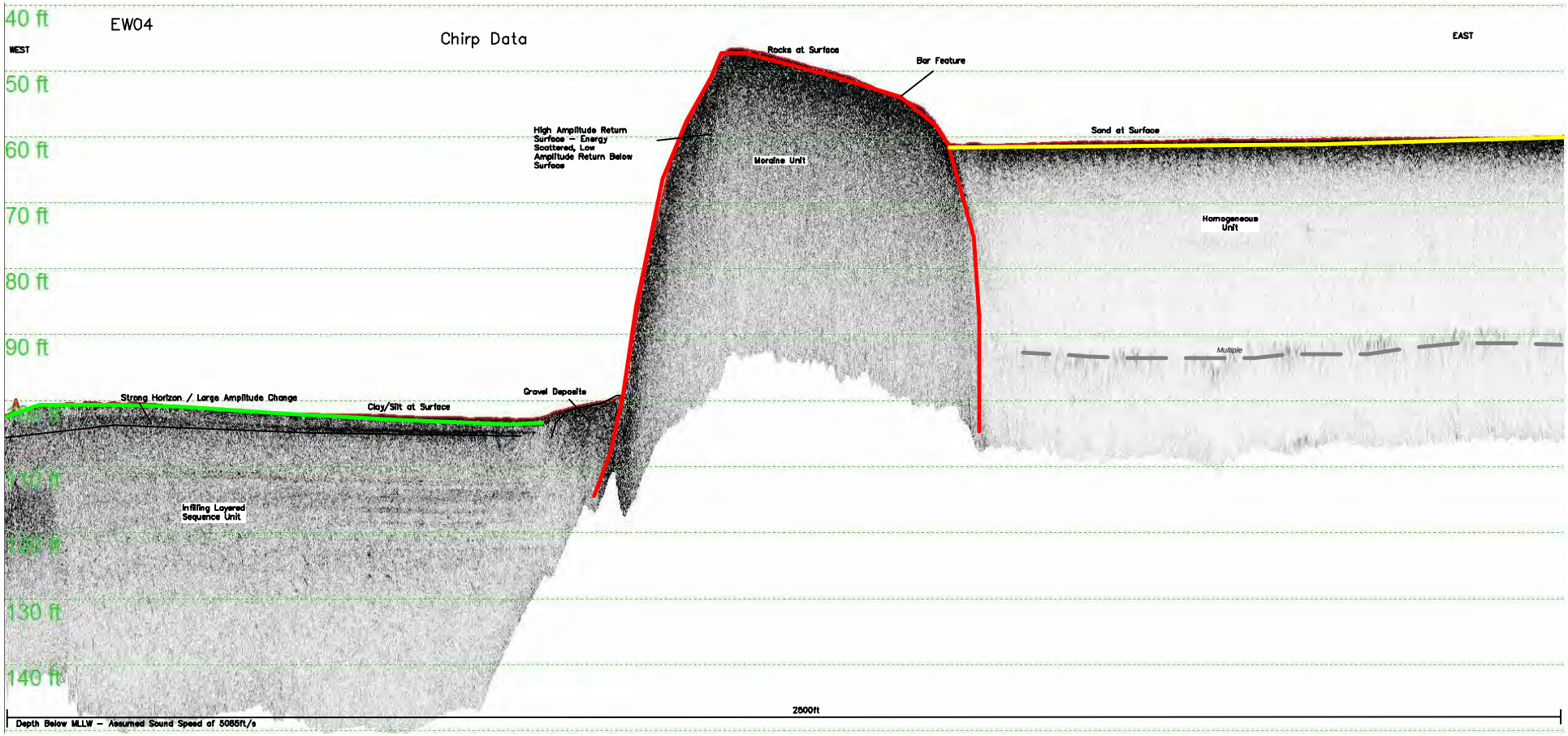

NORTH
SOUTH
NS09
Chirp Data
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
Sand at Surface
Sand/Silt at Surface
Homogeneous Unit
Multiple
3500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

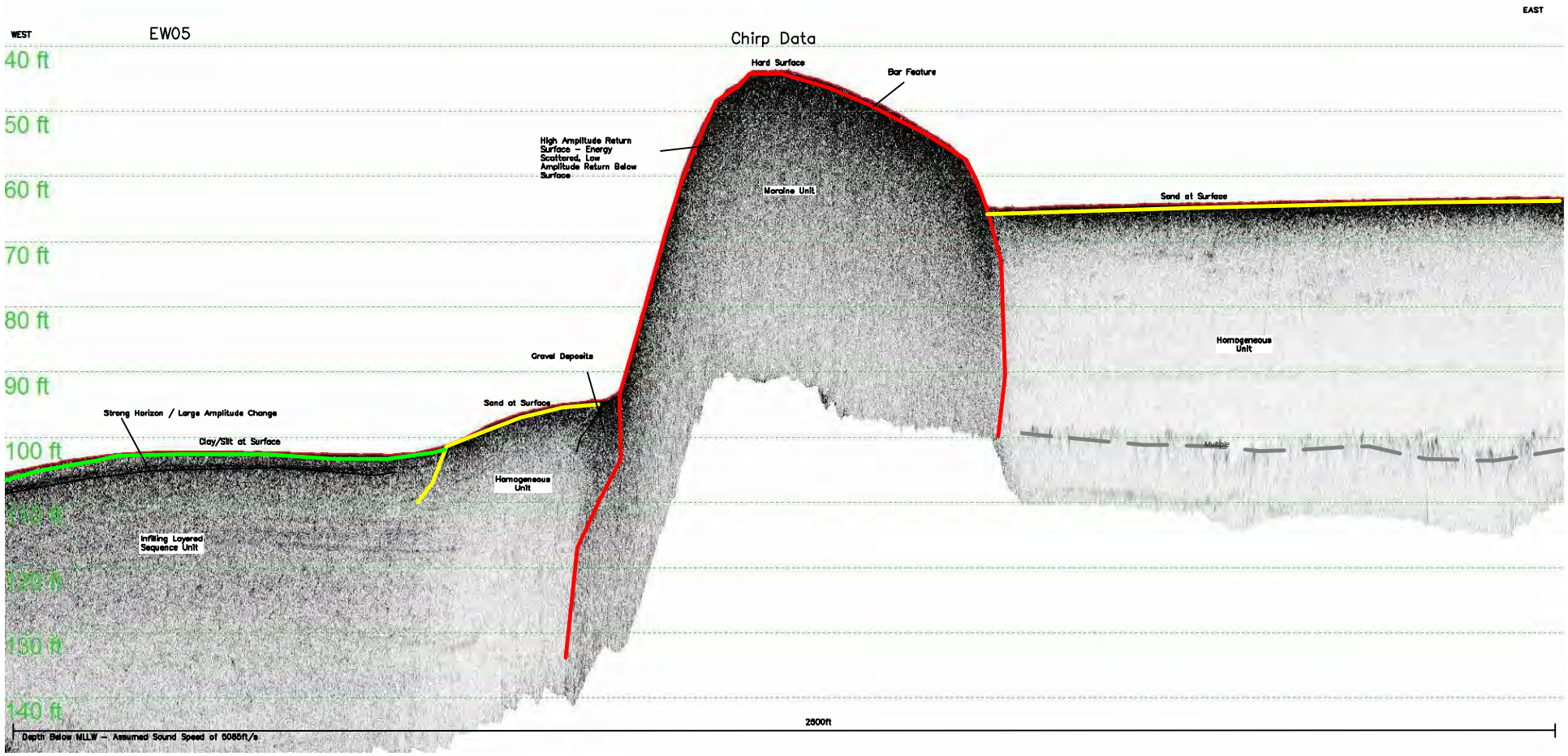

NORTH
NS10
Chirp Data
SOUTH
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
Localized Change in Amplitude
Sand at Surface
Localized Change in Amplitude
Homogeneous Unit
Sand/Silt at Surface
Localized Change in Amplitude
Multiple
Depth Below MLLW – Assumed Sound Speed of 5085ft/s
3500ft

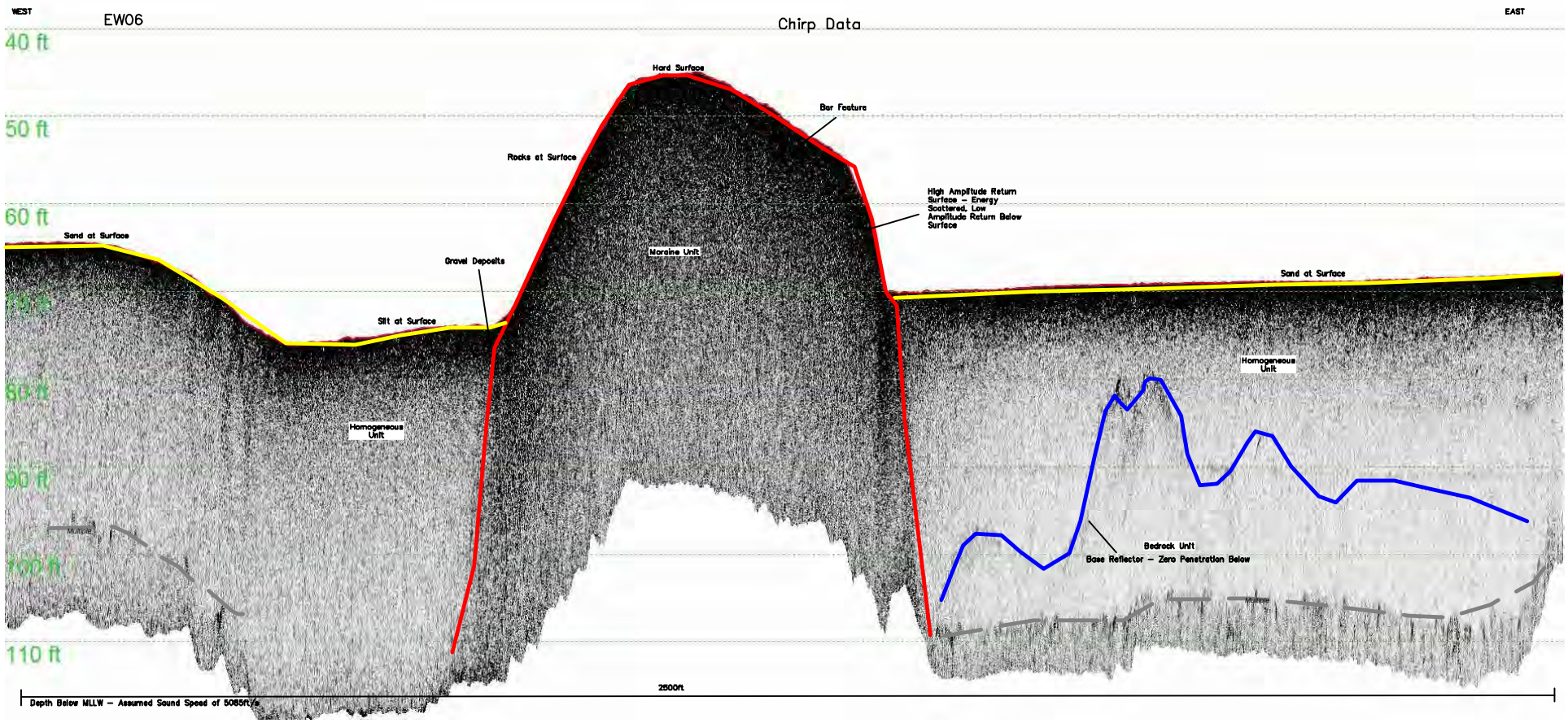

EW01
Chirp Data
WEST
EAST
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
Sand at Surface
Localized Change in Amplitude
Sand at Surface
Silt at Surface
Homogeneous Unit
Multiple
Strong Horizon / Large Amplitude Change
Clay/Silt at Surface
Infilling Layered Sequence Unit
Gas Unit
130 ft
2500ft
Depth Below MLLW -- Assumed Sound Speed of 5085ft/s

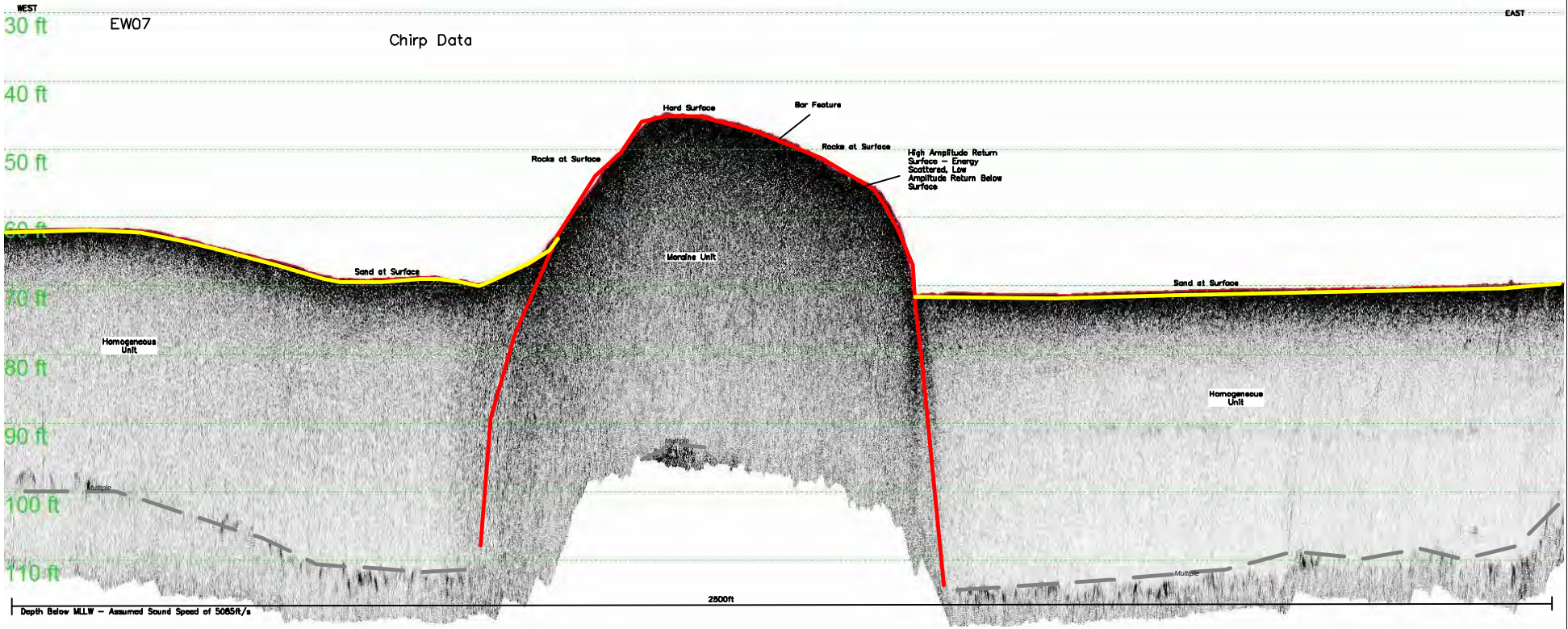

WEST
EW02
Chirp Data
EAST
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
110 ft
120 ft
130 ft
140 ft
Bar Feature
Sand at Surface
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Possible Large Deposits – Gravel/Cobbles/Rocks – Chaotic
Sand at Surface
Moraine Unit
Homogeneous Unit
Homogeneous Unit
Multiple
Strong Horizon / Large Amplitude Change
Clay/Silt at Surface
Infilling Layered Sequence Unit
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

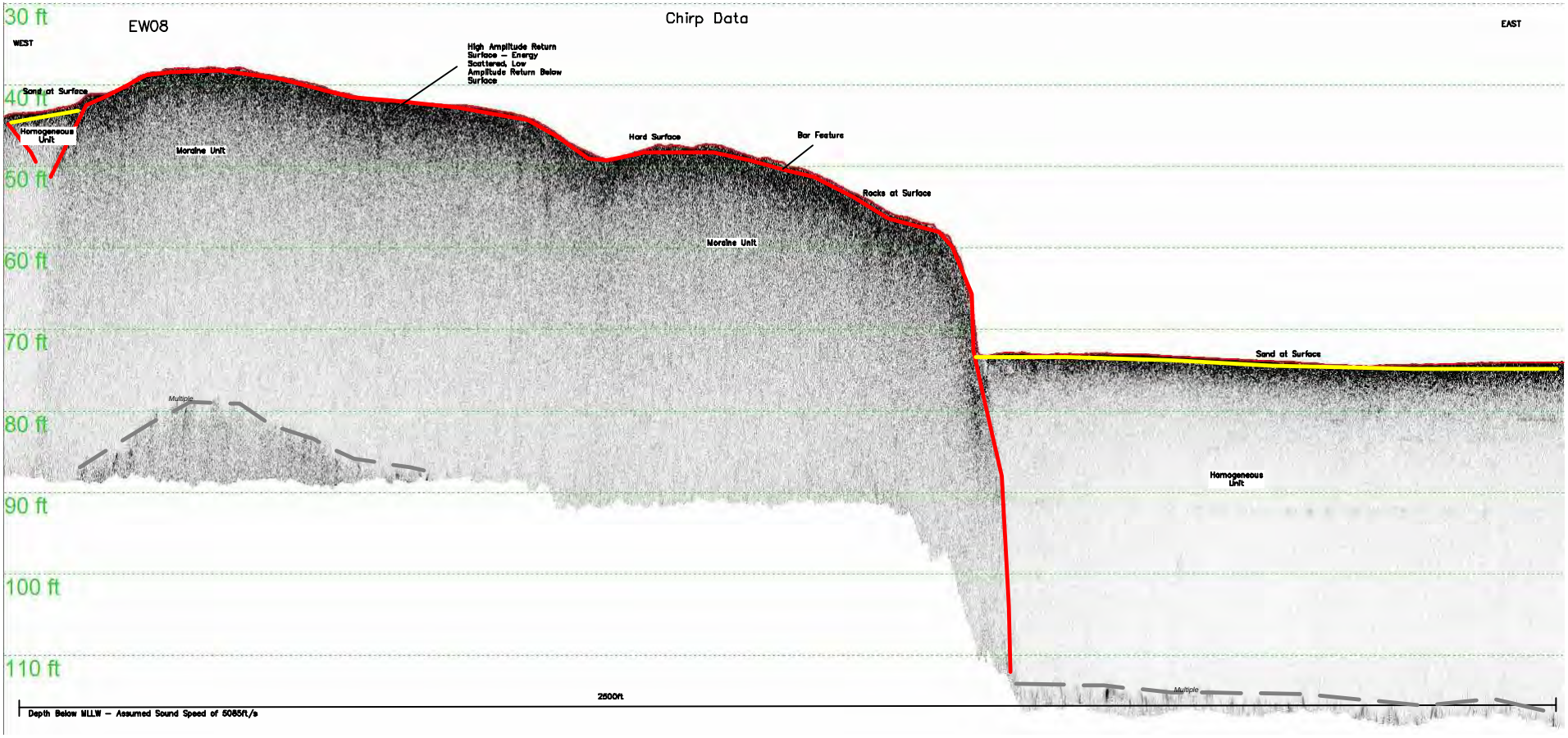

WEST
EW03
Chirp Data
EAST
50 ft
60 ft
70 ft
80 ft
90 ft
110 ft
120 ft
130 ft
140 ft
Rocks at Surface
Bar Feature
Sand at Surface
Moraine Unit
High Amplitude Return Surface - Energy Scattered, Low Amplitude Return Below Surface
Homogeneous Unit
Multiple
Sand at Surface
Strong Horizon / Large Amplitude Change
Clay/Silt at Surface
Homogeneous Unit
Infilling Layered Sequence Unit
2500ft
Depth Below MLLW - Assumed Sound Speed of 5085ft/s

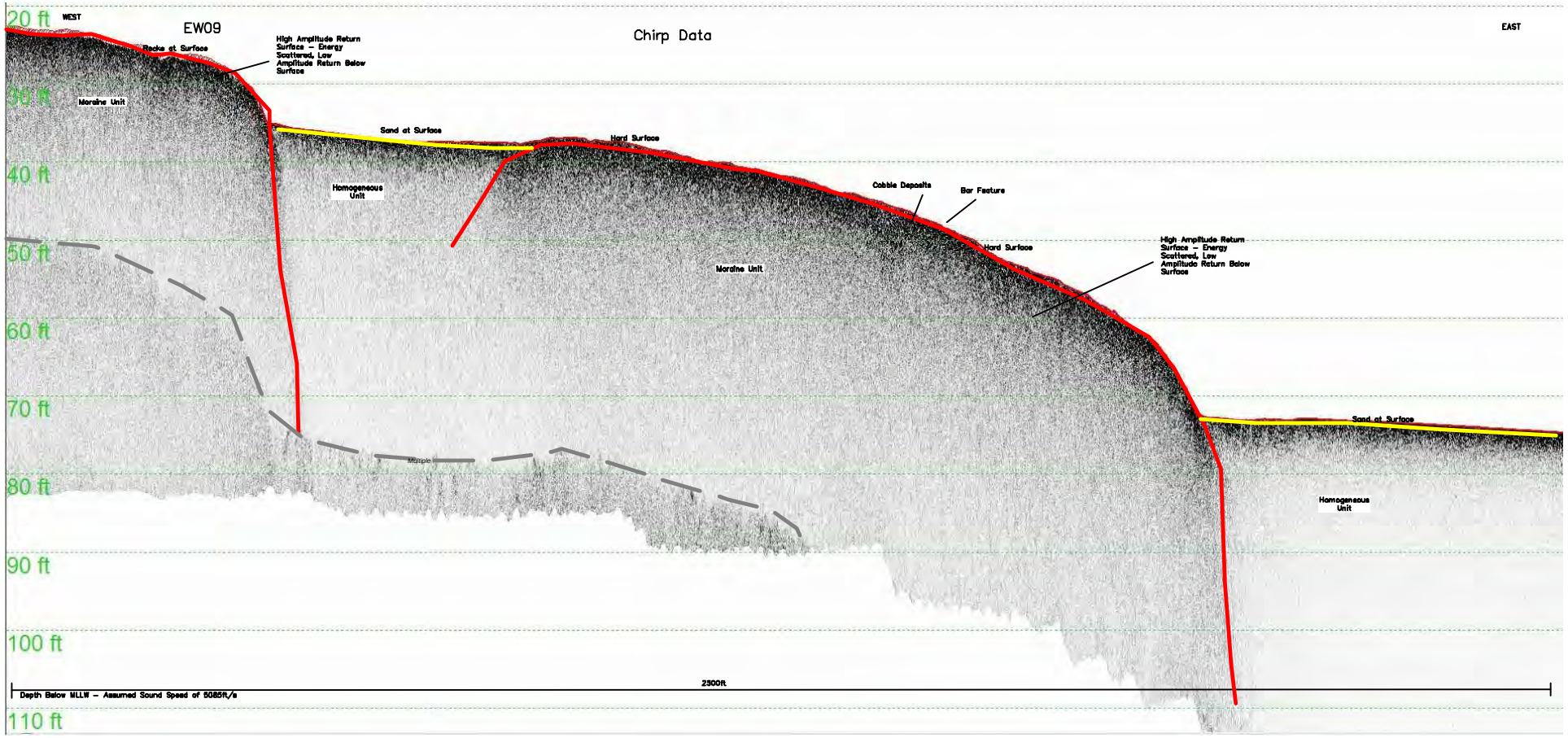

EW04
Chirp Data
WEST
EAST
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
130 ft
140 ft
Rocks at Surface
Bar Feature
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Moraine Unit
Sand at Surface
Homogeneous Unit
Multiple
Strong Horizon / Large Amplitude Change
Clay/Silt at Surface
Gravel Deposits
Infilling Layered Sequence Unit
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s


WEST
EW05
Chirp Data
EAST
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
120 ft
130 ft
140 ft
Hard Surface
Bar Feature
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Moraine Unit
Sand at Surface
Homogeneous Unit
Gravel Deposits
Sand at Surface
Strong Horizon / Large Amplitude Change
Clay/Silt at Surface
Homogeneous Unit
Infilling Layered Sequence Unit
Multiple
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s


WEST
EW06
Chirp Data
EAST
40 ft
50 ft
60 ft
110 ft
Hard Surface
Bar Feature
Rocks at Surface
High Amplitude Return Surface - Energy Scattered, Low Amplitude Return Below Surface
Sand at Surface
Gravel Deposits
Moraine Unit
Silt at Surface
Homogeneous Unit
Sand at Surface
Homogeneous Unit
Bedrock Unit
Base Reflector - Zero Penetration Below
2500ft
Depth Below MLLW - Assumed Sound Speed of 5085ft/s


WEST
EAST
EW07
Chirp Data
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
Hard Surface
Bar Feature
Rocks at Surface
Rocks at Surface
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Sand at Surface
Moraine Unit
Sand at Surface
Homogeneous Unit
Homogeneous Unit
Multiple
Multiple
Multiple
2500ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

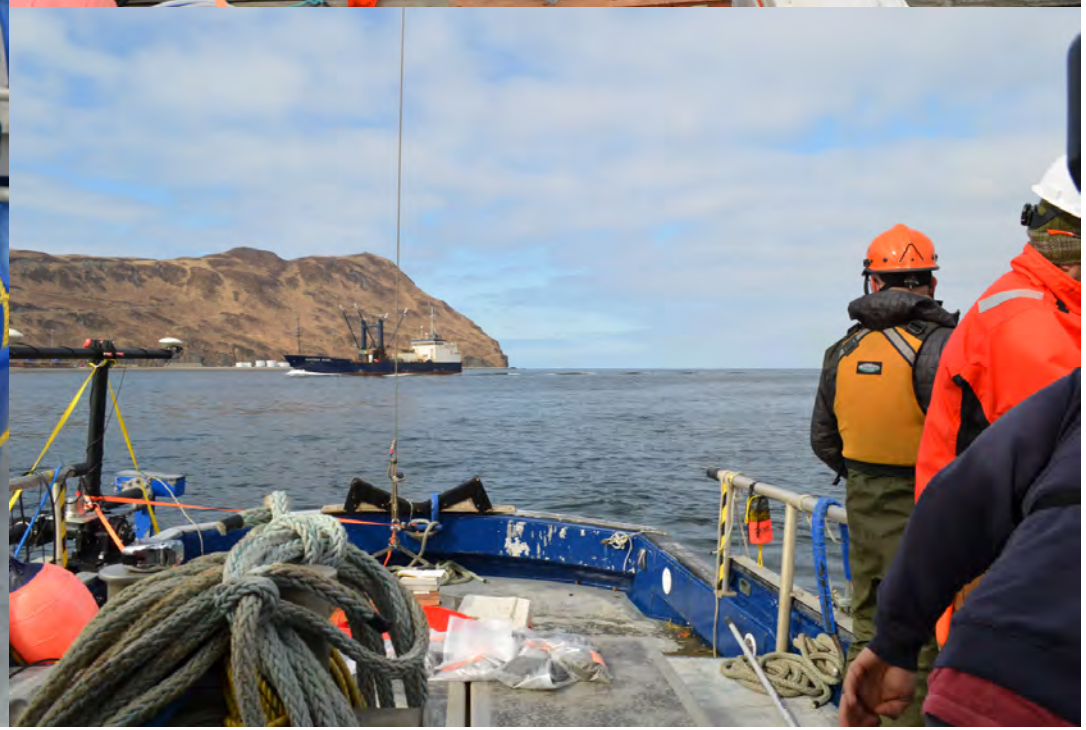

EW08
Chirp Data
WEST
EAST
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
Sand at Surface
Homogeneous Unit
Moraine Unit
High Amplitude Return Surface — Energy Scattered, Low Amplitude Return Below Surface
Hard Surface
Bar Feature
Rocks at Surface
Moraine Unit
Sand at Surface
Multiple
Homogeneous Unit
Multiple
2500ft
Depth Below MLLW — Assumed Sound Speed of 5085ft/s


EW09
Chirp Data
WEST
EAST
20 ft
30 ft
40 ft
50 ft
60 ft
70 ft
80 ft
90 ft
100 ft
110 ft
Rocks at Surface
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Moraine Unit
Sand at Surface
Hard Surface
Homogeneous Unit
Cobble Deposits
Bar Feature
Hard Surface
Moraine Unit
High Amplitude Return Surface – Energy Scattered, Low Amplitude Return Below Surface
Sand at Surface
Homogeneous Unit
Multiple
2300ft
Depth Below MLLW – Assumed Sound Speed of 5085ft/s

Appendix F

Field Photos

SEDIMENT SAMPLING – DUTCH HARBOR – APRIL 2017



MULTIBEAM OPERATIONS – DUTCH HARBOR – APRIL 2017

SURVEY VESSEL

USBL CALIBRATIONS – DUTCH HARBOR – APRIL 2017

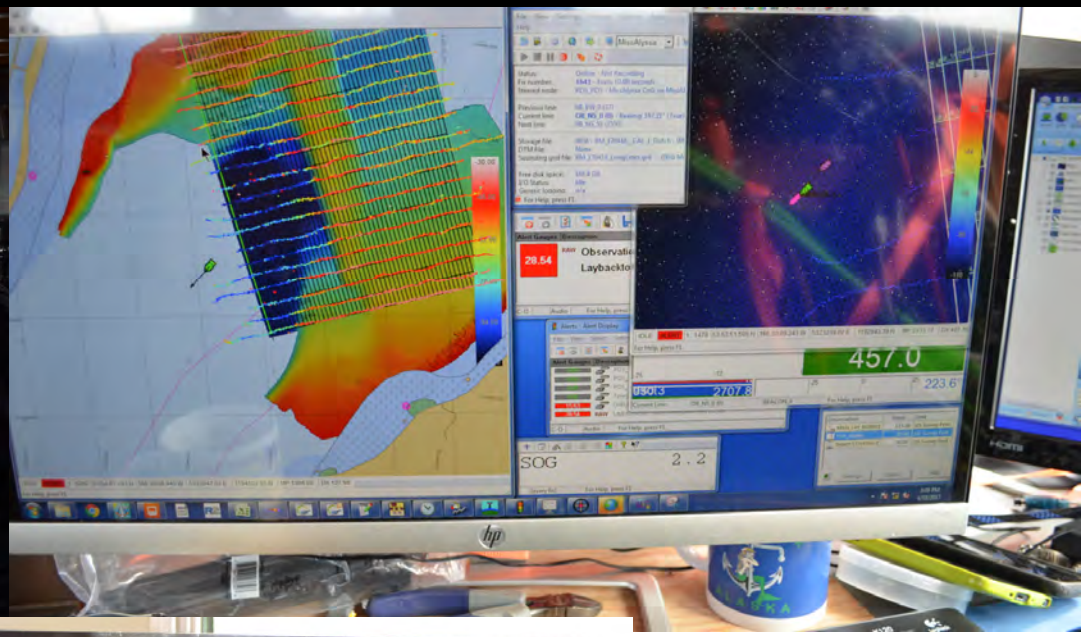
SUBBOTTOM PROFILER OPERATIONS – DUTCH HARBOR – APRIL 2017

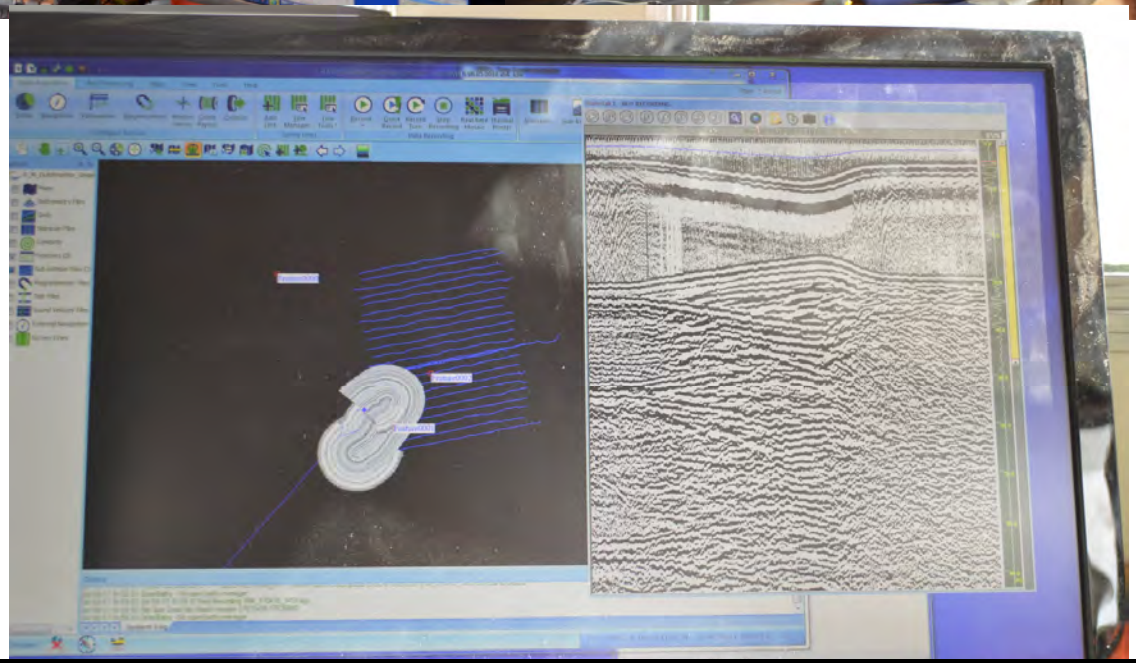
BUBBLE GUN DEPLOYMENT

SUBBOTTOM PROFILER OPERATIONS – DUTCH HARBOR – APRIL 2017

BACK DECK

SUBBOTTOM PROFILER OPERATIONS – DUTCH HARBOR – APRIL 2017





ONLINE DISPLAYS

SUBBOTTOM PROFILER OPERATIONS – DUTCH HARBOR – APRIL 2017

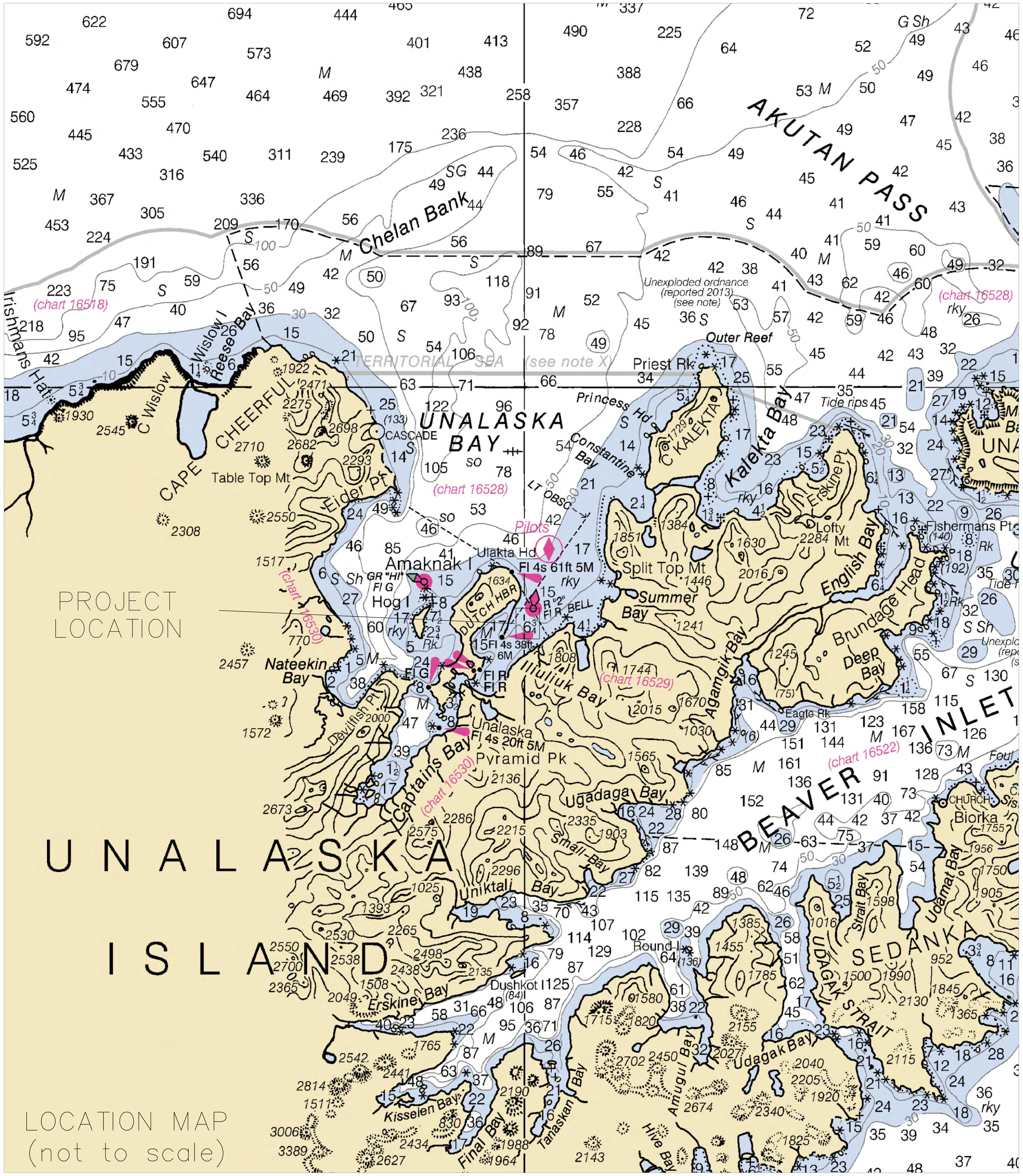
MARINE MAMMAL OBSERVER

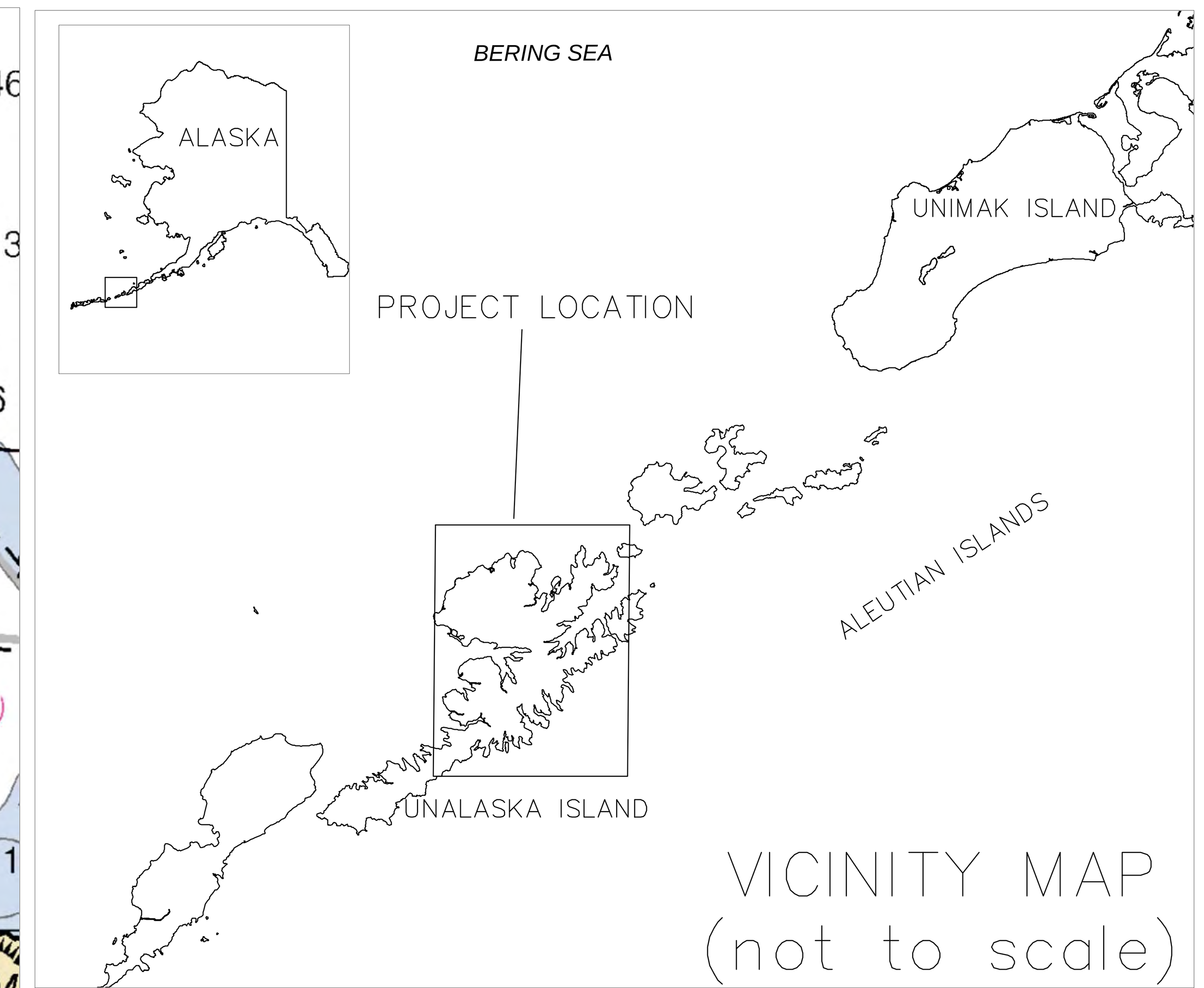
SUBBOTTOM PROFILER OPERATIONS – DUTCH HARBOR – APRIL 2017

OBJECT DETECTION SURVEY – BACK DECK

SURROUNDING ENVIRONMENT – DUTCH HARBOR – APRIL 2017

SURROUNDING ENVIRONMENT – DUTCH HARBOR – APRIL 2017





FINAL SUBMITTAL
REVISION 1
3 JULY 2017

GEOPHYSICAL SURVEY REPORT
CHANNEL NAVIGATION IMPROVEMENTS
FEASIBILITY STUDY

DUTCH HARBOR, ALASKA
VOLUME 2 OF 2
DRAWINGS
CONTRACT NO. W911KB-17-D-0001
DELIVERY ORDER NO.0005

PREPARED FOR:
U.S ARMY ENGINEER DISTRICT, ALASKA
CEPOA-EC-G DOUG BLISS
2204 TALLEY AVE
JBER, AK 99506

PREPARED BY:
R&M CONSULTANTS, INC.
9101 VANGUARD DRIVE
ANCHORAGE, AK 99507

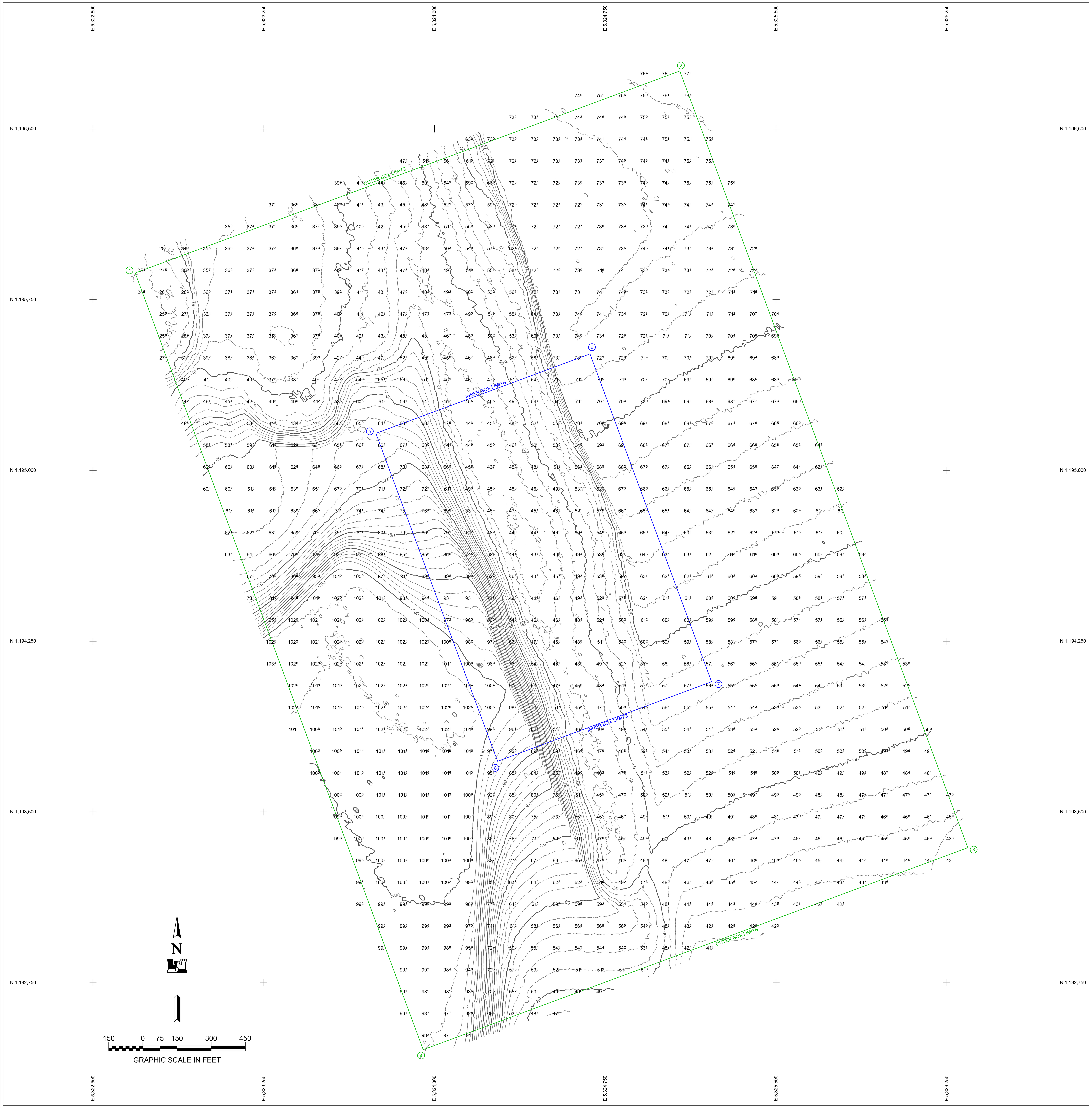
IN ASSOCIATION WITH:
ETRAC, INC.
617 S. KNIK GOOSE BAY RD. SUITE C
WASILLA, AK 99654

LIST OF DRAWINGS	SHEET NUMBER
COVER PAGE	- SHEET 1
BATHYMETRIC SURVEY:CONTOURS & SOUNDINGS	- SHEET 2
BATHYMETRIC SURVEY:CONTOURS & COLOR RELIEF	- SHEET 3
GEOPHYSICAL SURVEY: SEDIMENT CLASSIFICATION MAP	- SHEET 4
GEOPHYSICAL SURVEY: DETECTED OBJECTS - ALL	- SHEET 5
GEOPHYSICAL SURVEY: DETECTED OBJECTS - FERROUS	- SHEET 6
GEOPHYSICAL SURVEY: STRATIFICATION OVERVIEW & PROFILE LINES	- SHEET 7
GEOPHYSICAL SURVEY: SUB-SURFACE PROFILES	- SHEET 8
GEOPHYSICAL SURVEY: SUB-SURFACE PROFILES	- SHEET 9
GEOPHYSICAL SURVEY: SUB-SURFACE PROFILES	- SHEET 10
GEOPHYSICAL SURVEY: SUB-SURFACE PROFILES	- SHEET 11
GEOPHYSICAL SURVEY: SUB-SURFACE PROFILES	- SHEET 12
TABLES	- SHEET 13

US Army Corps of Engineers
ALASKA DISTRICT

UNALASKA, ALASKA
DUTCH HARBOR GEOPHYSICAL INVESTIGATION
NAVIGATION IMPROVEMENTS FEASIBILITY STUDY
APRIL 10 - MAY 10, 2017

SHEET IDENTIFICATION
5-UAK-92-07-11
Sheet 1 of 13



NOTES

1. PRIMARY PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 10, NAD83, (2011)(2010.00), IN US SURVEY FEET BASED ON A FULLY CONSTRAINED STATIC GPS NETWORK HOLDING THE PUBLISHED NAD83 2010.00 EPOCH VALUES OF NGS CORS STATIONS: "SANDPOINT_AK2004 CORS ARP" (PID DL7635); "COLD BAY WAAS 8 CORS ARP" (PID DL6500); "SANAKISLNDAK2007 CORS ARP" (PID DM7493).

   LOCAL PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 10, NAD83, IN US SURVEY FEET HOLDING "946 2620 TIDAL 19" AS N 1,183,685.03', E 5,317,889.75' AND "946 2620 M" AS N 1,184,129.99', E 5,317,058.52'.

2. VERTICAL CONTROL IS MEAN LOWER LOW WATER (MLLW=0.0 FT), BASED ON THE NOAA/NOS TIDAL BENCH MARK LIST "9462620 UNALASKA, DUTCH HARBOR, ALASKA", PUBLISHED 10/24/2011. THIS TIDAL DATUM IS BASED ON THE 1983-2001 TIDAL EPOCH AND IS REFERENCED BY HOLDING NOAA/NOS TIDAL BENCH MARK "946 2620 TIDAL 19" (VM#11816) AS 16.43 FT AND NOS TIDAL BENCHMARK "946 2620 M" (VM#11821) AS 10.97 FT.
3. VERTICAL TIES TO THE NATIONAL SPATIAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD88 (GEOID 12B) ELEVATIONS HOLDING NOAA/USACE TIDAL BENCHMARK "946 2620 TIDAL 19" (PID BBBB51) AS 16.68 FT.
4. SOUNDINGS ARE IN US SURVEY FEET AND ARE MINUS UNLESS OTHERWISE INDICATED.
5. BATHYMETRY WAS COLLECTED APRIL 12-14, 2017. SOUNDINGS WERE COLLECTED USING AN R2SONIC 2024 MULTIBEAM ECHOSOUNDER OPERATING AT 400 KHZ. SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH AN AML BASE X-2 SOUND VELOCITY PROBE. POSITIONING AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV OCEANMASTER V5 SYSTEM. BATHYMETRIC DATA WAS COLLECTED AND PROCESSED USING QINSY 8.1 AND QIMERA 1.5 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS VERIFIED USING DIFFERENTIAL LEVELING TECHNIQUES.
6. SUB-SURFACE STRATIGRAPHY AND OBJECT DETECTION DATA WAS COLLECTED USING AN EDGETECH 3200 HIGH-PENETRATION CHIRP SUB-BOTTOM PROFILER WITH A 216S TOWFISH. ADDITIONAL SUB-SURFACE STRATIGRAPHY DATA WAS COLLECTED USING A HEGGS MARINE HMS-620 SEISMIC REFLECTION PROFILER.
7. SURFACE AND SUB-SURFACE FERROUS OBJECT DETECTION WAS CONDUCTED USING A GEOMETRICS G-882 TVG MARINE TRANSVERSE GRADIOMETER.
8. THIS DRAWING INDICATES GENERAL CONDITIONS AT THE TIME OF THE SURVEY.
9. MAP SOUNDINGS ARE BINNED AT 96 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BIASED SOUNDINGS.

PROJECT LIMITS

CORNER#	NORTHING	EASTING
1	1,195,866.93	5,322,684.94
2	1,196,754.36	5,325,077.08
3	1,193,343.37	5,326,342.48
4	1,192,455.94	5,323,950.33

PROJECT LIMITS

CORNER#	NORTHING	EASTING
5	1,195,162.87	5,323,742.78
6	1,195,511.64	5,324,682.92
7	1,194,071.59	5,325,217.14
8	1,193,722.82	5,324,277.00

SURVEY CONTROL DATA

STATION	NORTHING	EASTING	MLLW	DESCRIPTION
2620M 1982	1,184,129.99	5,317,058.52	10.97	NOS SBC
NO. 19 1973	1,183,685.03	5,317,889.75	16.43	USCGS SBC (BENCH MARK)
SPIT	1,195,075.49	5,321,164.49	23.97	PERM BASE APC

STATE OF ALASKA 49TH GREGORY W. GIBSON No. LS14824 REGISTERED PROFESSIONAL LAND SURVEYOR

THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE OVERSIGHT OF AN ACSM/THSOA CERTIFIED HYDROGRAPHER

David R. Neff C.H. (275)

BATHYMETRIC SURVEY CONTOURS & SOUNDINGS

US Army Corps of Engineers ®
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001
CONTRACTOR R&M CONSULTANTS
CITY ANCHORAGE STATE ALASKA
Recommended: PRIME CONTRACTOR
Approved: CHIEF GEOMATICS SECTION
Date: 7/3/2017

REVISION	DATE	DESCRIPTION	BY	APPVD

REVISION	DATE	DESCRIPTION	BY	APPVD

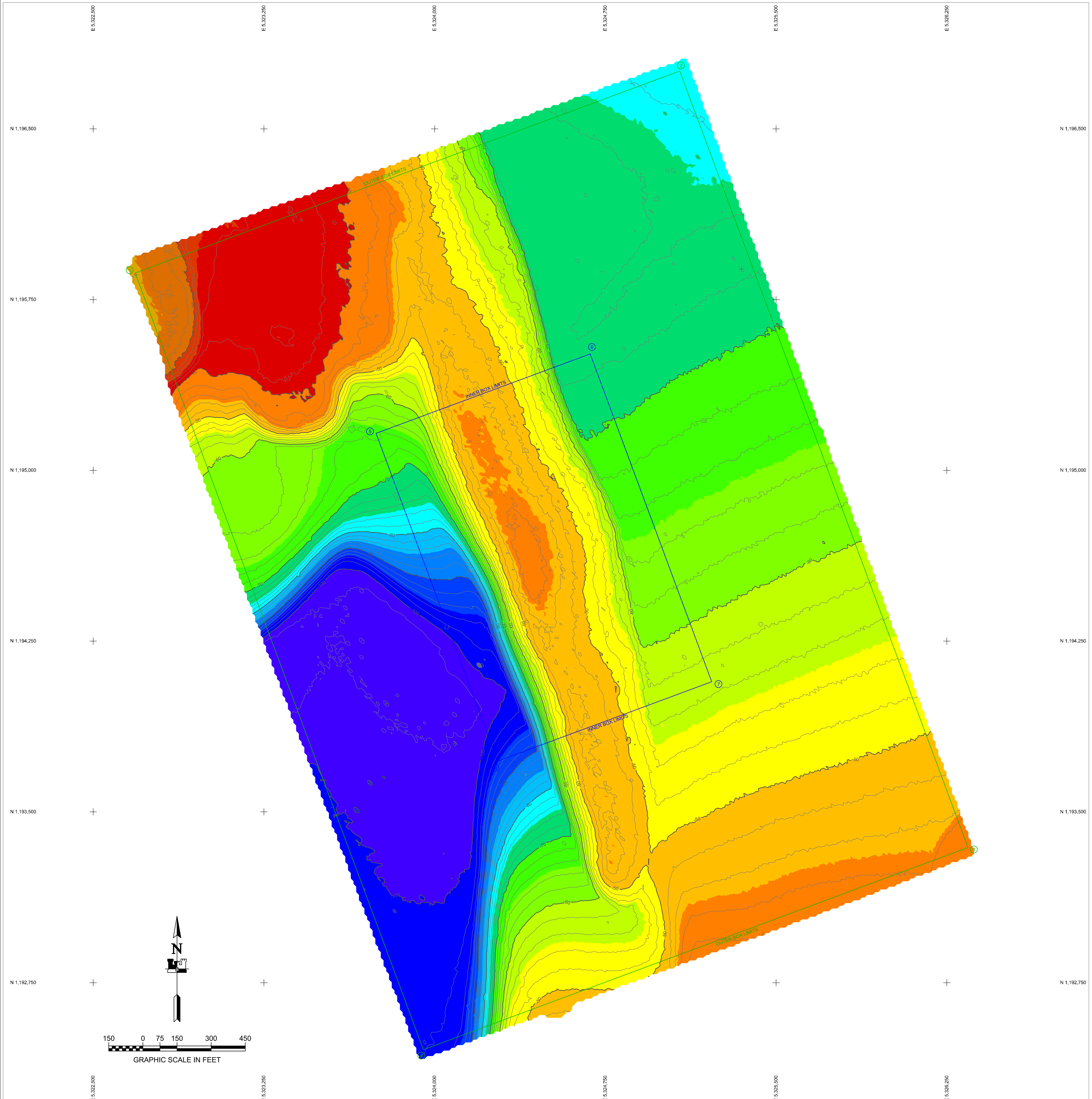
U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
P.O. BOX 6898
JBER, ALASKA 99506-0898

eTrac Inc.
617 S Knik-Goose Bay Rd, Suite C
Wasilla, AK 99654

SURVEYED BY: Gregory W. Gibson
DRAWN BY: GWG
CHECKED BY:
APPROVED BY:
SCALE: 1" = 150'
PLOT DATE: 7/3/2017
SIZE: ANSI E
FILE NAME: 403749-VH01.DWG
DATE: 3 July 2017
UPC: 403749
CONTRACT NO.: W911KB-17-D-0001
JOB NO.: 0417

UNALASKA, ALASKA
DUTCH HARBOR GEOPHYSICAL INVESTIGATION
NAVIGATION IMPROVEMENTS FEASIBILITY STUDY
APRIL 10 - MAY 10, 2017

SHEET IDENTIFICATION
5-UAK-92-07-11
Sheet 2 of 13



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   LOCAL PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 10, NAD83, IN US SURVEY FEET HOLDING "946 2620 TIDAL 19" AS N 1,183,685.03', E 5,317,889.75' AND "946 2620 M" AS N 1,184,129.99', E 5,317,058.52'.

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3. VERTICAL TIES TO THE NATIONAL SPATIAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD88 (GEOID 12B) ELEVATIONS HOLDING NOAA/USACE TIDAL BENCHMARK "946 2620 TIDAL 19" (PID BBBB51) AS 16.68 FT.
4. SOUNDINGS ARE IN US SURVEY FEET AND ARE MINUS UNLESS OTHERWISE INDICATED.
5. BATHYMETRY WAS COLLECTED APRIL 12-14, 2017. SOUNDINGS WERE COLLECTED USING AN R2SONIC 2024 MULTIBEAM ECHOSOUNDER OPERATING AT 400 KHZ. SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH AN AML BASE X-2 SOUND VELOCITY PROBE. POSITIONING AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV OCEANMASTER V5 SYSTEM. BATHYMETRIC DATA WAS COLLECTED AND PROCESSED USING QINSY 8.1 AND QIMERA 1.5 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS VERIFIED USING DIFFERENTIAL LEVELING TECHNIQUES.
6. SUB-SURFACE STRATIGRAPHY AND OBJECT DETECTION DATA WAS COLLECTED USING AN EDGETECH 3200 HIGH-PENETRATION CHIRP SUB-BOTTOM PROFILER WITH A 216S TOWFISH. ADDITIONAL SUB-SURFACE STRATIGRAPHY DATA WAS COLLECTED USING A HEGGS MARINE HMS-620 SEISMIC REFLECTION PROFILER.
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9. MAP SOUNDINGS ARE BINNED AT 96 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BIASED SOUNDINGS.

PROJECT LIMITS

CORNER#	NORTHING	EASTING
1	1,195,866.93	5,322,684.94
2	1,196,754.36	5,325,077.08
3	1,193,343.37	5,326,342.48
4	1,192,455.94	5,323,950.33

PROJECT LIMITS

CORNER#	NORTHING	EASTING
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SPIT	1,195,075.49	5,321,164.49	23.97	PERM BASE APC

ELEVATION COLOR LEGEND

#	MIN. ELEV.	MAX. ELEV.	COLOR
1	-110.0	-105.0	
2	-105.0	-100.0	
3	-100.0	-95.0	
4	-95.0	-90.0	
5	-90.0	-85.0	
6	-85.0	-80.0	
7	-80.0	-75.0	
8	-75.0	-70.0	
9	-70.0	-65.0	
10	-65.0	-60.0	
11	-60.0	-55.0	
12	-55.0	-50.0	
13	-50.0	-45.0	
14	-45.0	-40.0	
15	-40.0	-35.0	
16	-35.0	-30.0	
17	-30.0	-25.0	
18	-25.0	-20.0	

STATE OF ALASKA 49TH GREGORY W. GIBSON No. LS14824 REGISTERED PROFESSIONAL LAND SURVEYOR

THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE OVERSIGHT OF AN ACSM/THSOA CERTIFIED HYDROGRAPHER

David R. Neff C.H. (275)

BATHYMETRIC SURVEY
CONTOURS & COLOR RELIEF

US Army Corps of Engineers ® ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001
CONTRACTOR R&M CONSULTANTS
CITY ANCHORAGE STATE ALASKA
Recommended: PRIME CONTRACTOR
Approved: CHIEF GEOMATICS SECTION
Date: 7/3/2017

REVISION	DATE	DESCRIPTION	BY	APPV'D

REVISION	DATE	DESCRIPTION	BY	APPV'D

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
P.O. BOX 6898
JBER, ALASKA 99506-0898

eTrac Inc.
617 S Knik-Goose Bay Rd, Suite C
Wasilla, AK 99654

SURVEYED BY: Gregory W. Gibson
DRAWN BY: GWG
CHECKED BY:
APPROVED BY:
SCALE: 1" = 150'
SIZE: ANSI E
DATE: 3 JULY 2017
UPC: 403749
CONTRACT NO.: W911KB-17-D-0001
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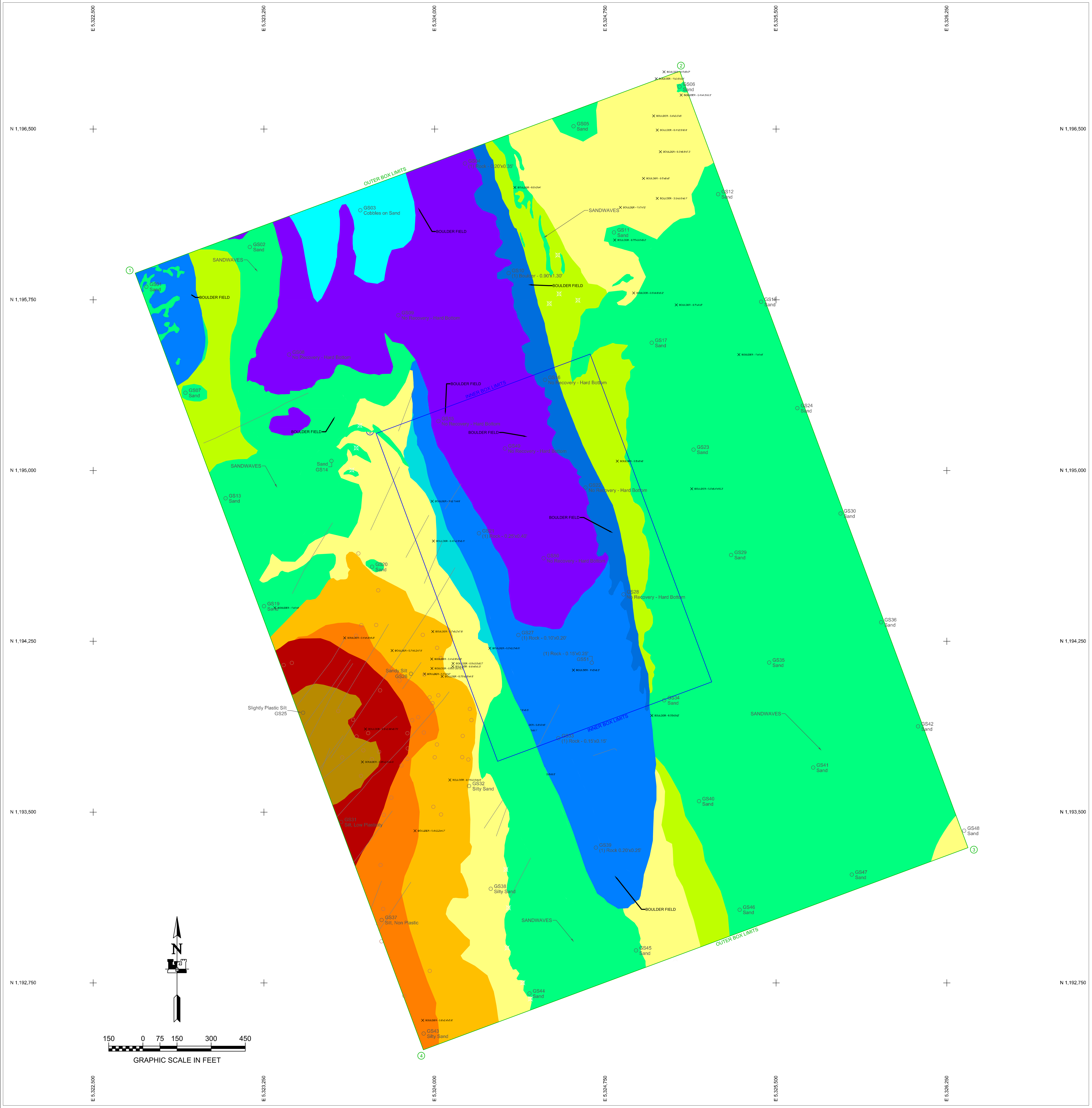

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SEDIMENT CLASSIFICATION COLOR LEGEND

Bottom Material	COLOR
Hard Bottom	
Boulder (0.90'-1.30')	
Rock (0.10'-0.40')	
Cobbles on Sand	
Gravelly Sand	
Sand	
Sand with Silt	
Silty Sand	
Sandy Silt	
Silt	
Slightly Plastic Silt	
Clay with Silt	

- Grab Sample
- Striation Features
- Boulder Identified in Multibeam Echosounder Data
- Pockmark
- Sediment Feature with Scarp

STATE OF ALASKA 49TH GREGORY W. GIBSON No. LS14824 REGISTERED PROFESSIONAL LAND SURVEYOR

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David R. Neff C.H. (275)

GEOPHYSICAL SURVEY SEDIMENT CLASSIFICATION MAP

US Army Corps of Engineers
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001
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CITY ANCHORAGE STATE ALASKA
Recommended: PRIME CONTRACTOR
Approved: CHIEF GEOMATICS SECTION
Date: 7/3/2017

REVISION | DATE | DESCRIPTION | BY | APPVD

DATE: 3 July 2017
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JOB NO.: 0417
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ALASKA DISTRICT
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JBER, ALASKA 99506-0898

eTrac Inc.
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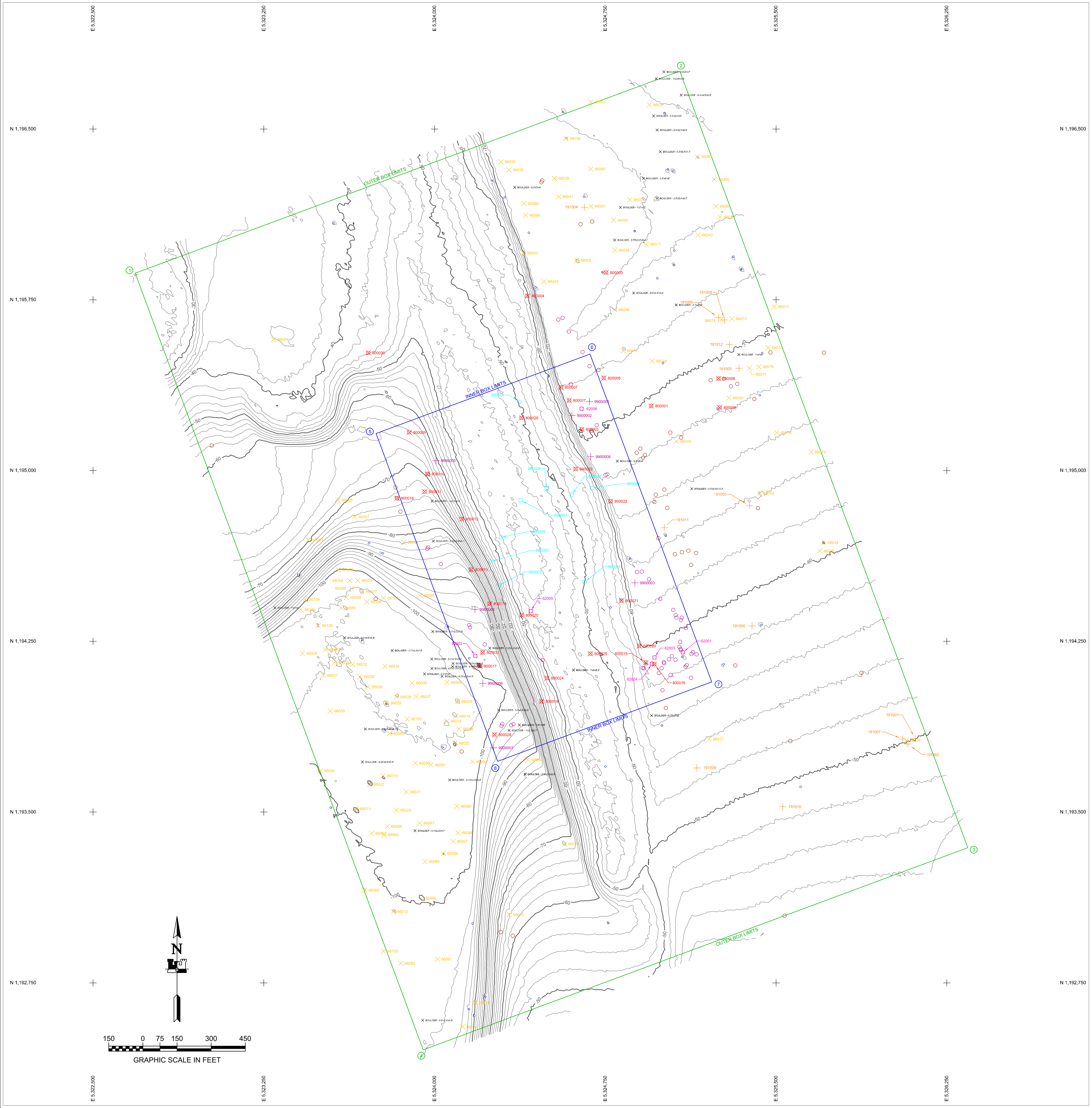

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- Multibeam Detected Unknown Surface Object with Ferrous Return
- Chirp Detected Unknown Subsurface Object with Ferrous Return
- Ferrous Return Not Detected by Chirp or Multibeam Echosounder
- Multibeam Detected Unknown Surface Object Non Ferrous
- Multibeam Detected Unknown Surface Object in Outer Survey Area
- Chirp Detected Subsurface Object in Outer Survey Area - Non natural Object
- Chirp Detected Subsurface Object in Inner Survey Area Non Ferrous - Likely Boulder
- Chirp Detected Subsurface Object Outer Survey Area - Likely Boulder
- Crab Pot
- Tire

STATE OF ALASKA 49TH GREGORY W. GIBSON No. LS14824 REGISTERED PROFESSIONAL LAND SURVEYOR

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David R. Neff C.H. (275)

GEOPHYSICAL SURVEY DETECTED OBJECTS - ALL

US Army Corps of Engineers
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
P.O. BOX 6898
JBER, ALASKA 99506-0898

eTrac Inc.
617 S Knik-Goose Bay Rd, Suite C
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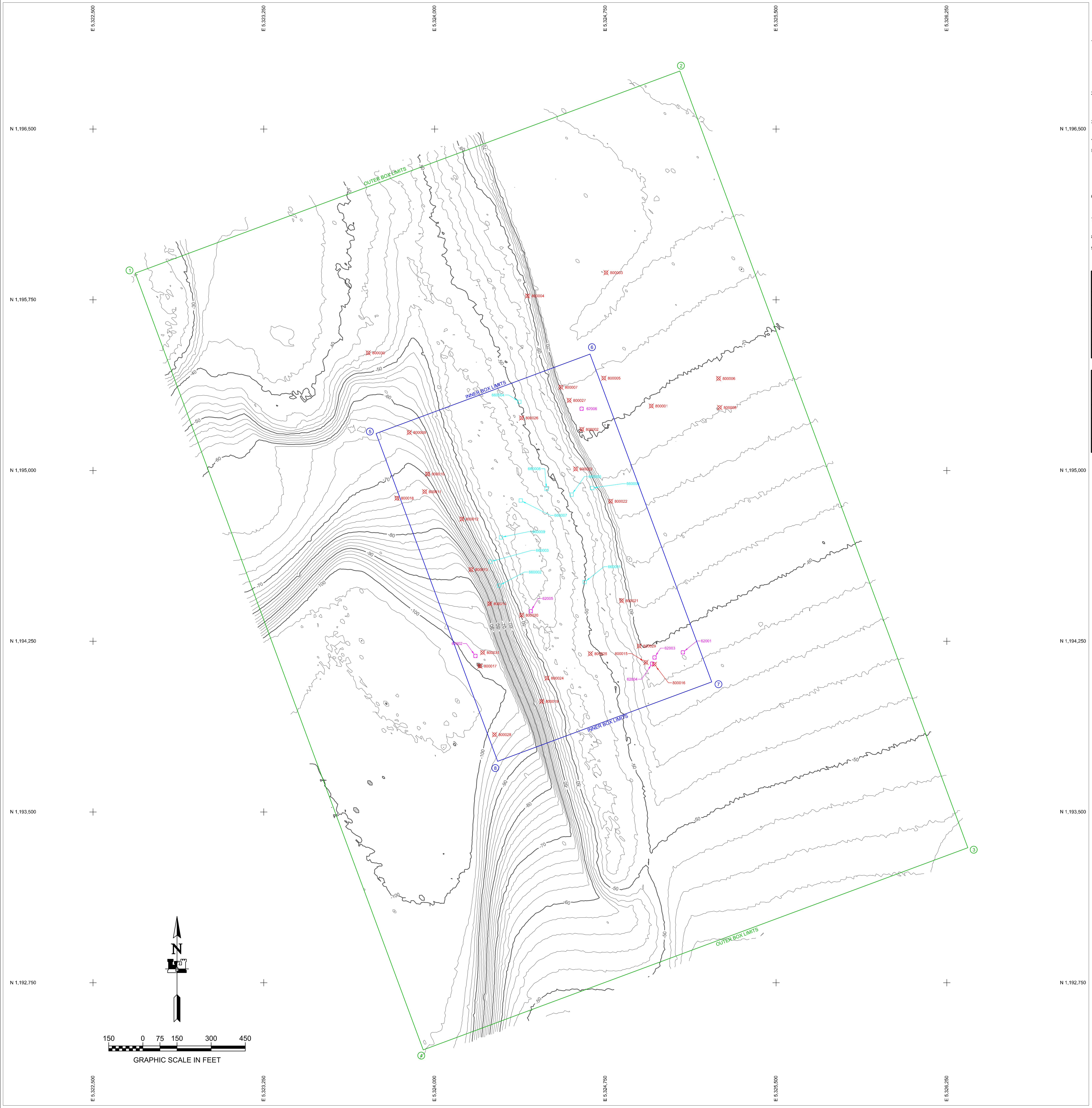

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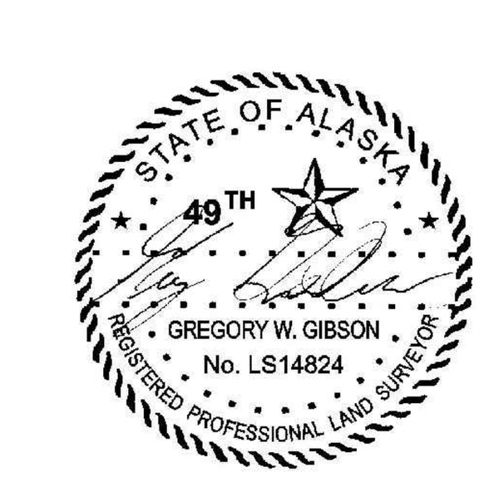

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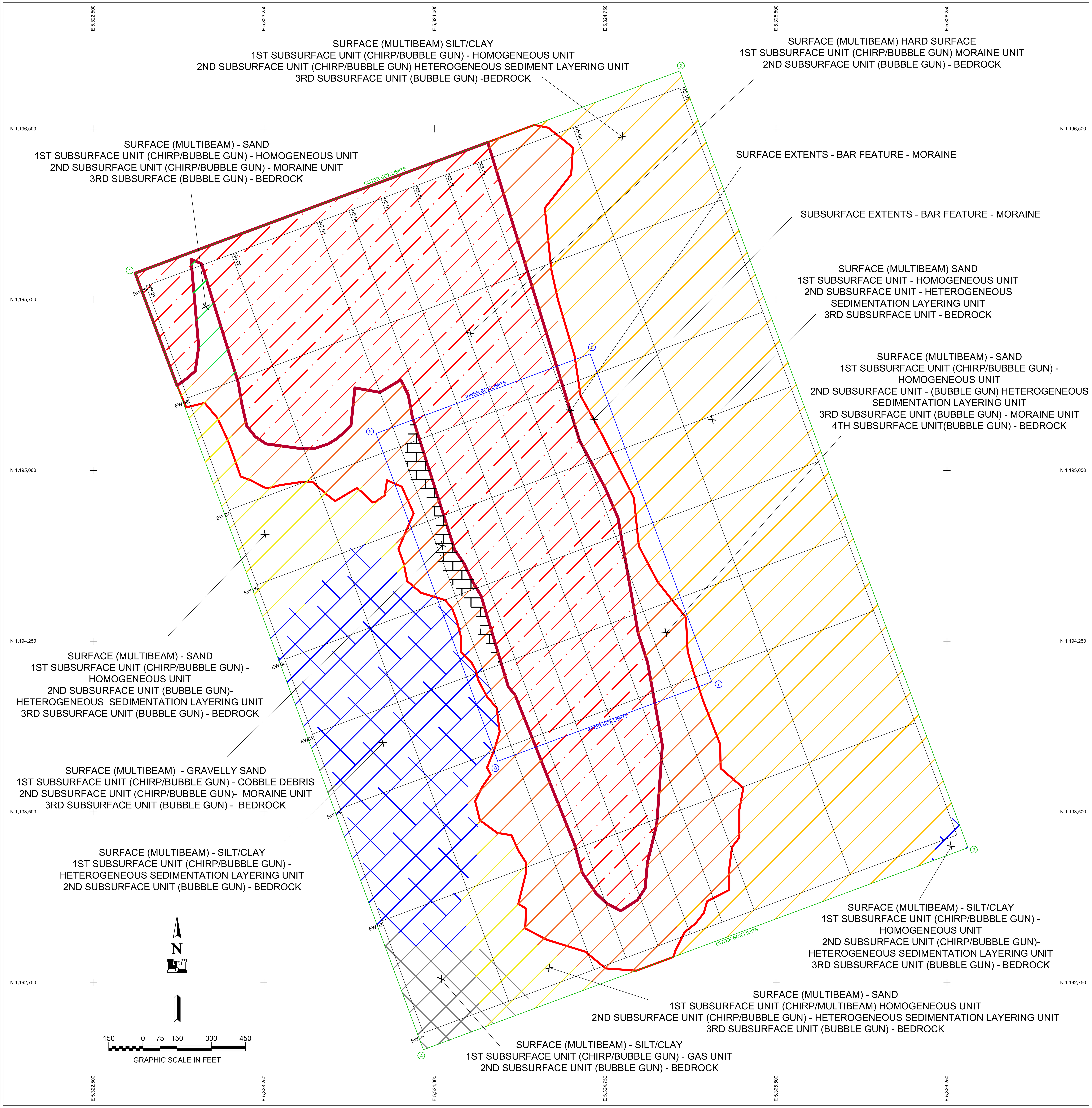

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PROJECT LIMITS

CORNER#	NORTHING	EASTING
1	1,195,866.93	5,322,684.94
2	1,196,754.36	5,325,077.08
3	1,193,343.37	5,326,342.48
4	1,192,455.94	5,323,950.33

PROJECT LIMITS

CORNER#	NORTHING	EASTING
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STATION	NORTHING	EASTING	MLLW	DESCRIPTION
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SPIT	1,195,075.49	5,321,164.49	23.97	PERM BASE APC

DESCRIPTION DETAILS

In order of vertical layer stating at surface and working down
(Multibeam) The system with which the unit was detected

Extents of the bar feature or moraine unit at the sea floor surface

Extents of the bar feature or moraine unit below the seafloor surface

Area with stratification
SURFACE - HARD SURFACE
1ST SUBSURFACE UNIT - MORAINE UNIT
2ND SUBSURFACE UNIT - BEDROCK

Area with stratification
SURFACE - SAND
1ST SUBSURFACE UNIT - HOMOGENEOUS UNIT
2ND SUBSURFACE UNIT - HETEROGENEOUS SEDIMENTATION LAYERING UNIT
3RD SUBSURFACE UNIT - MORAINE UNIT
4TH SUBSURFACE UNIT - BEDROCK

Area with stratification
SURFACE - SAND
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Area with stratification
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3RD SUBSURFACE -BEDROCK

Area with stratification
SURFACE - SILT/CLAY
1ST SUBSURFACE UNIT - HETEROGENEOUS SEDIMENT LAYERING UNIT
2ND SUBSURFACE UNIT - BEDROCK

Area with stratification
SURFACE - SAND AND COBBLES
1ST SUBSURFACE UNIT - COBBLE DEBRIS
2ND SUBSURFACE UNIT - MORAINE UNIT
3RD SUBSURFACE UNIT - BEDROCK

Area with stratification
SURFACE - SILT/CLAY
1ST SUBSURFACE UNIT - GAS UNIT
2ND SUBSURFACE UNIT - BEDROCK

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David R. Neff C.H. (275)

GREGORY W. GIBSON No. LS14824

GEOPHYSICAL SURVEY STRATIFICATION OVERVIEW & PROFILE LINES

US Army Corps of Engineers ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001

U.S. ARMY CORPS OF ENGINEERS ALASKA DISTRICT

eTrac Inc. 617 S Knik-Goose Bay Rd, Suite C Wasilla, AK 99654

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NAVIGATION IMPROVEMENTS FEASIBILITY STUDY
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SHEET IDENTIFICATION
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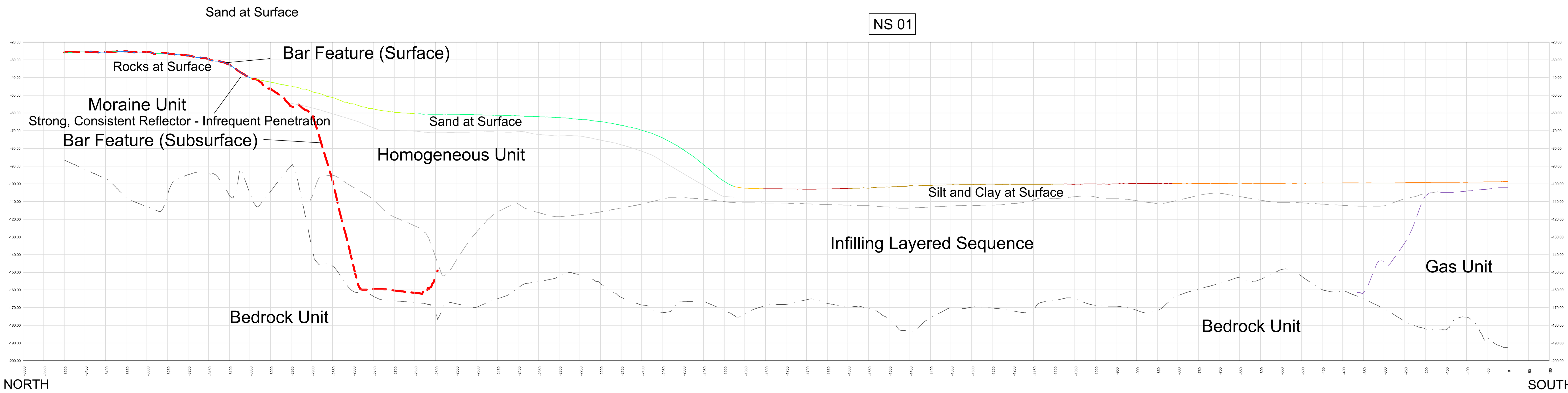

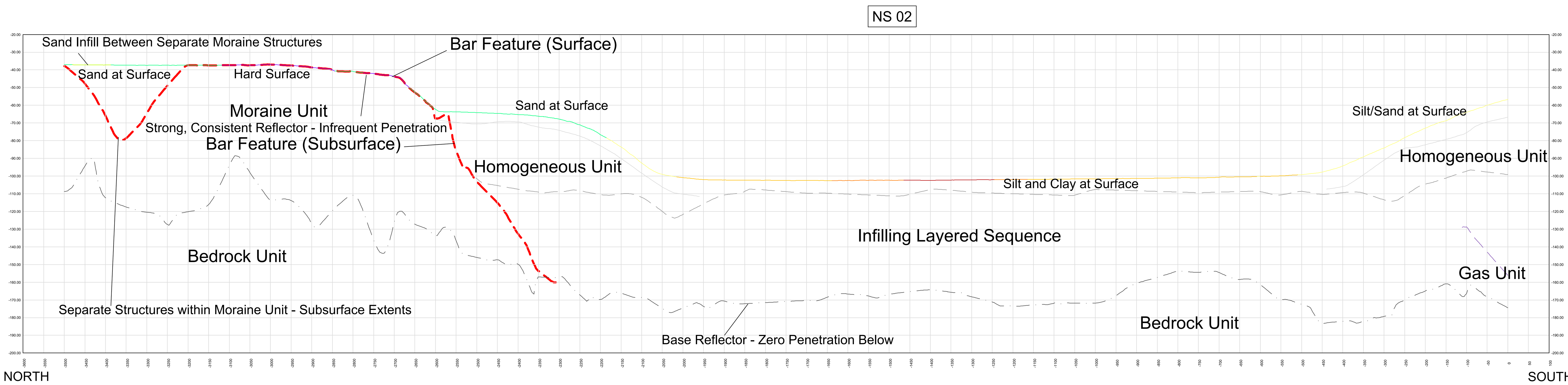

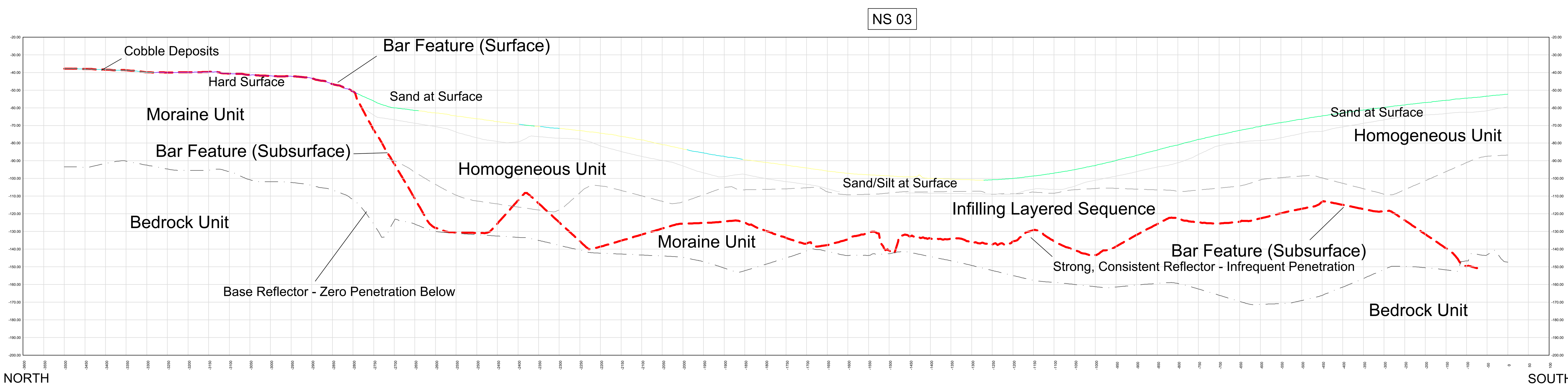

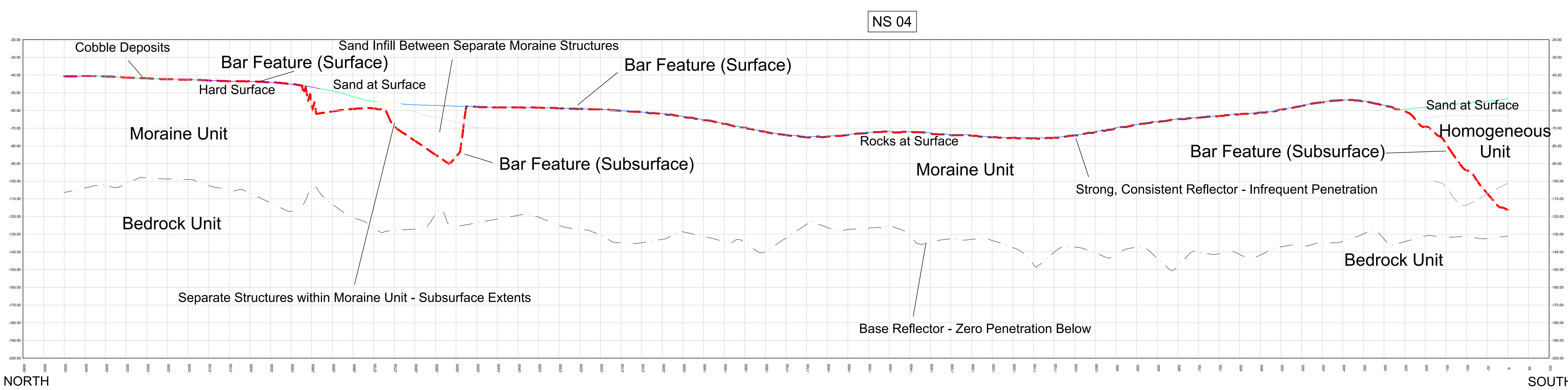

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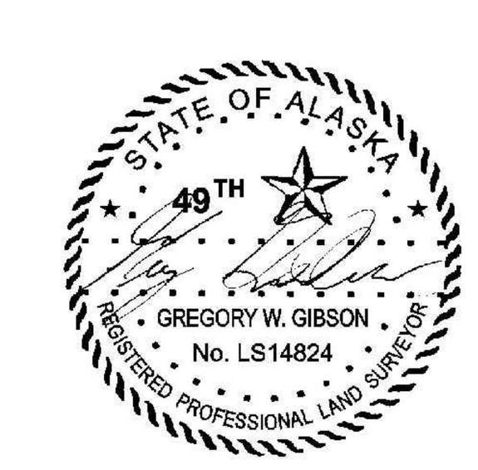

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GEOPHYSICAL SURVEY SUB-SURFACE PROFILES

US Army Corps of Engineers
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001

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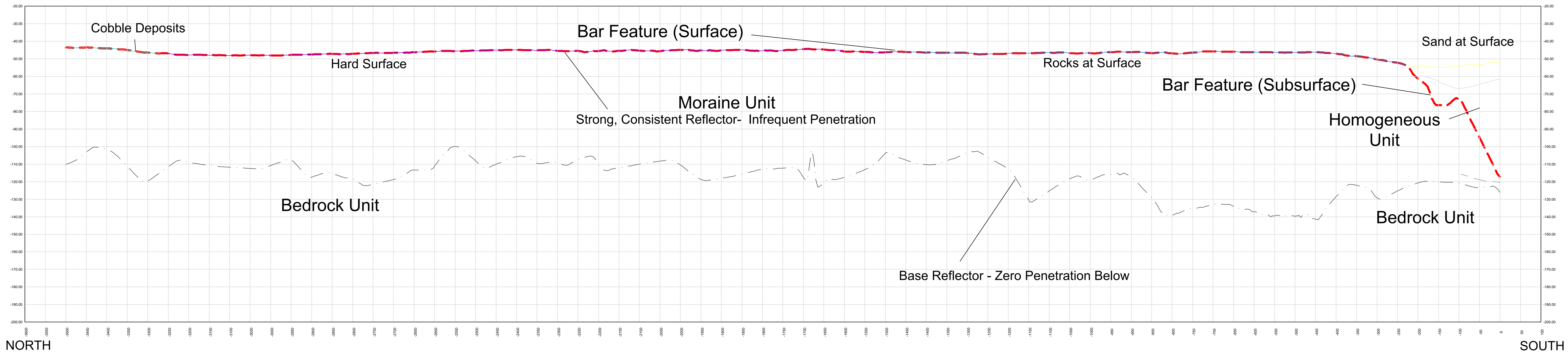
NS 05



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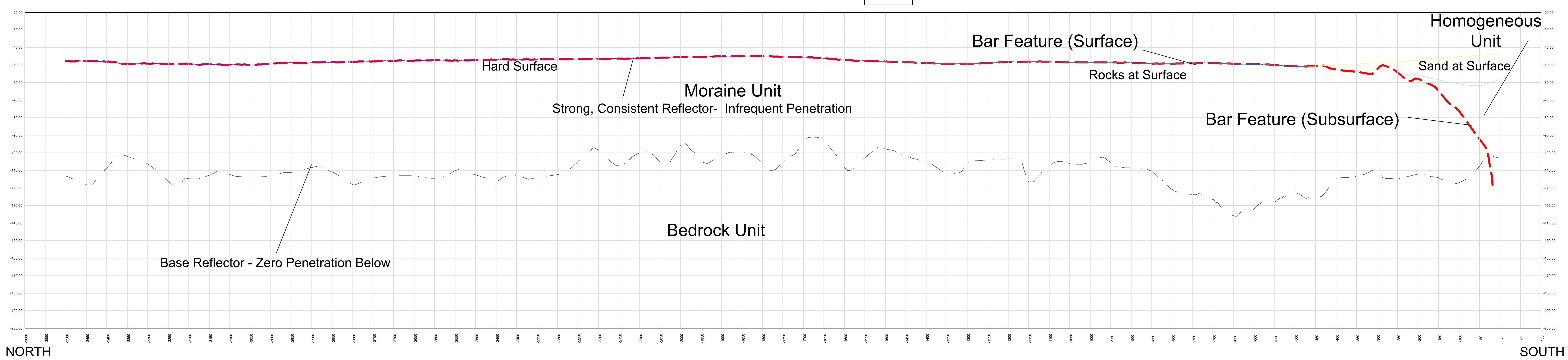

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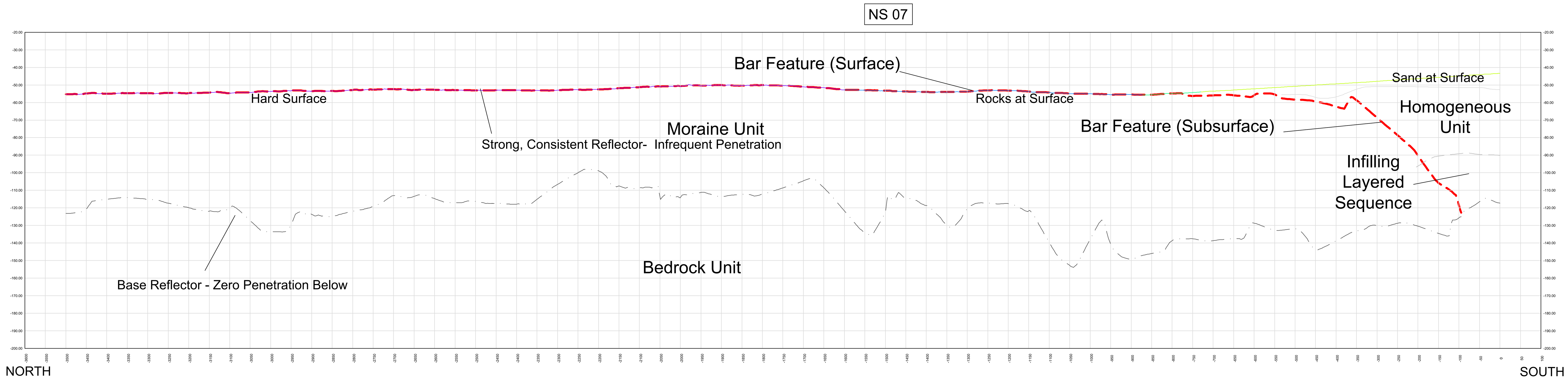

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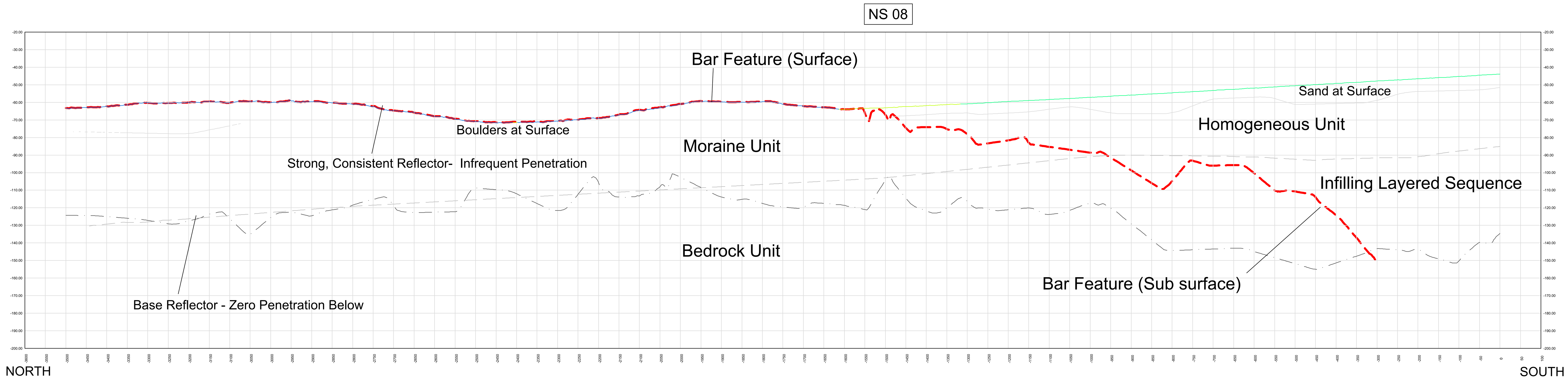

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GEOPHYSICAL SURVEY
SUB-SURFACE PROFILES

US Army Corps of Engineers
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001

REVISION | DATE | DESCRIPTION | BY | APPR

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
P.O. BOX 6898
JBER, ALASKA 99506-0898

eTrac Inc.
617 S Knik-Goose Bay Rd, Suite C
Wasilla, AK 99654

SURVEYED BY: Gregory W. Gibson | DRAWN BY: GWG | CHECKED BY: | APPROVED BY: | SCALE: 1" = 150' | SIZE: ANSI E | FILE NAME: 403749-VH01.DWG | PLOT DATE: 7/3/2017 | DATE: 3 July 2017 | UPC: 403749 | CONTRACT NO.: W911KB-17-D-0001 | JOB NO.: 0417

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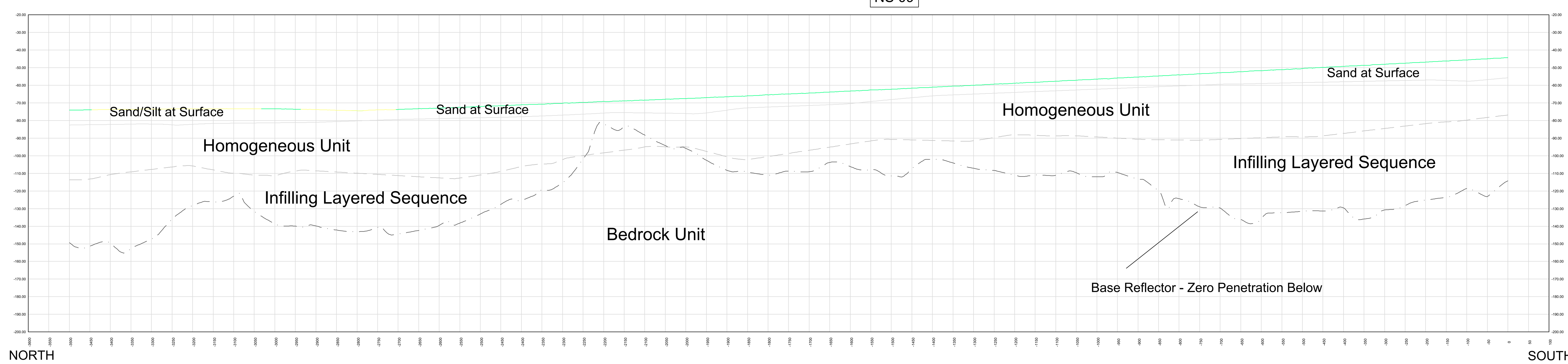

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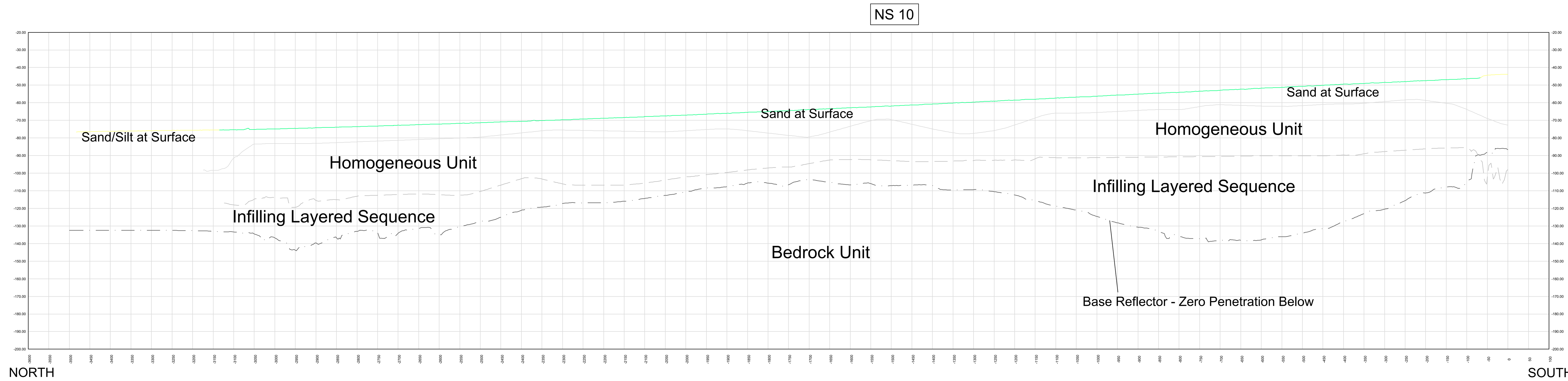

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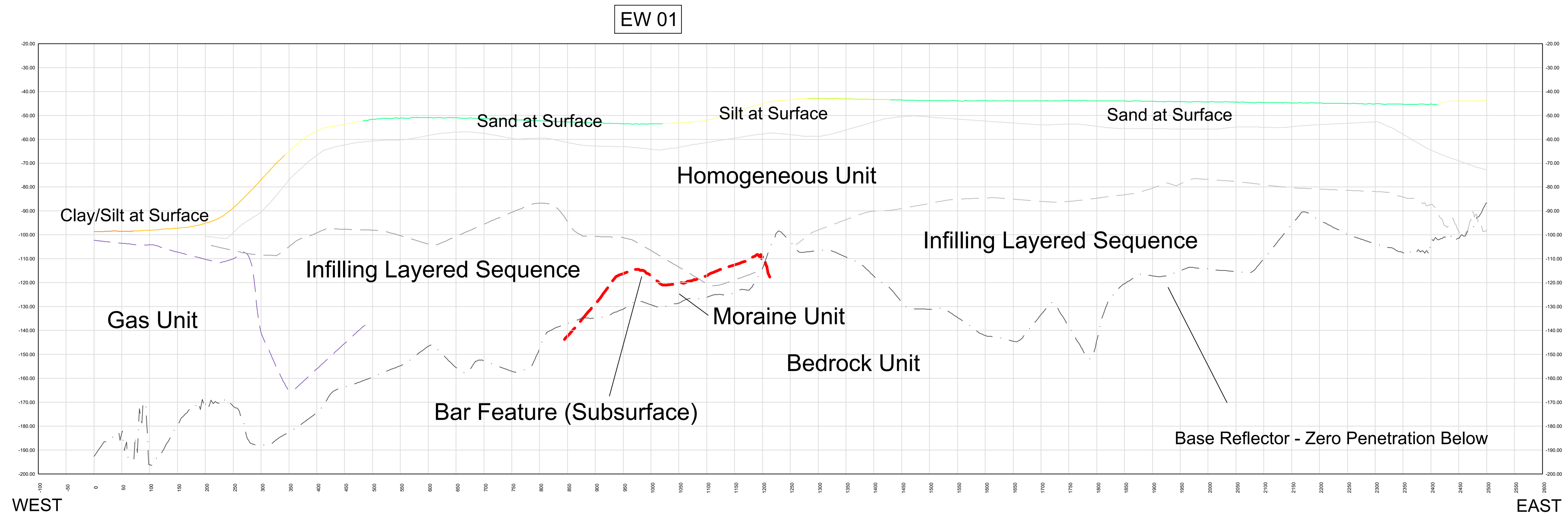

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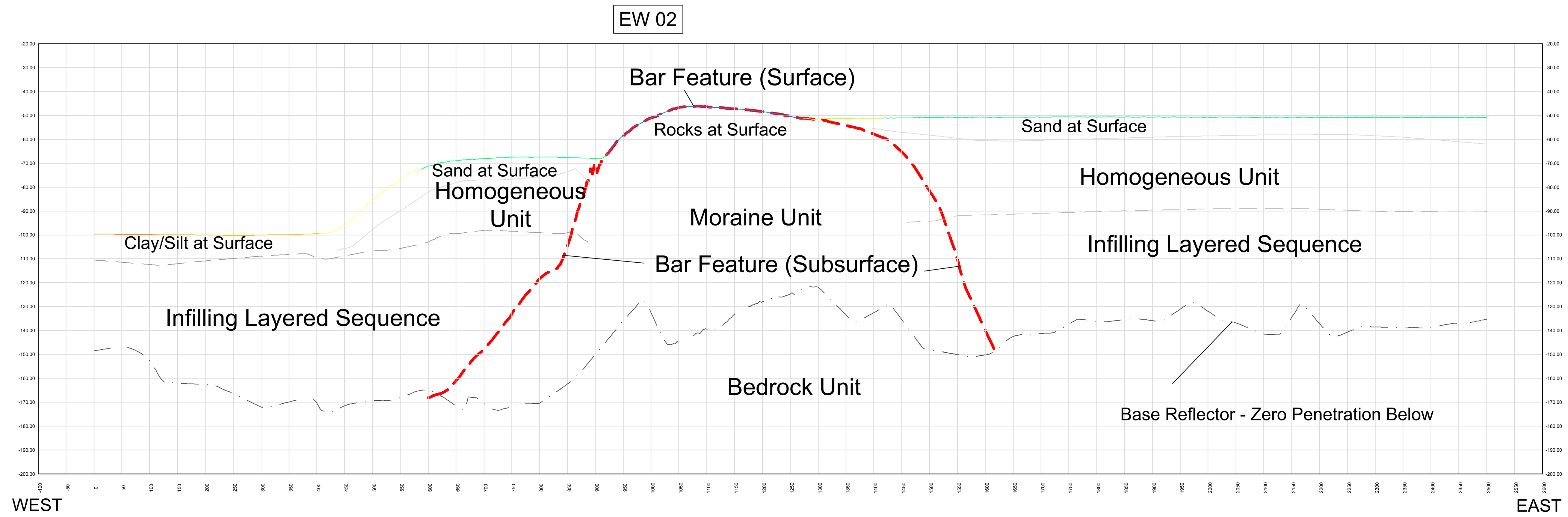

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NO. 19 1973	1,183,685.03	5,317,889.75	16.43	USCGS SBC (BENCH MARK)
SPIT	1,195,075.49	5,321,164.49	23.97	PERM BASE APC

SEA FLOOR SURFACE TYPES

- CLAY WITH SILT AT SURFACE
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- SILT AT SURFACE
- SANDY SILT AT SURFACE
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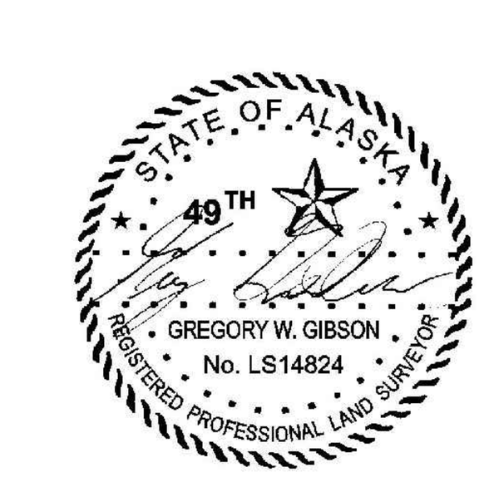

THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE OVERSIGHT OF AN ACSM/THSOA CERTIFIED HYDROGRAPHER

David R. Neff C.H. (275)

GEOPHYSICAL SURVEY SUB-SURFACE PROFILES

US Army Corps of Engineers
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
P.O. BOX 6898
JBER, ALASKA 99506-0898

eTrac Inc.
617 S Knik-Goose Bay Rd, Suite C
Wasilla, AK 99654

SURVEYED BY: Gregory W. Gibson		DATE: 3 July 2017	
DRAWN BY: GWG	CHECKED BY:	UPC: 403749	
APPROVED BY:		CONTRACT NO.: W911KB-17-D-0001	
SCALE: 1" = 150'	PLOT DATE: 7/3/2017	JOB NO.: 0417	
SIZE: ANSI E	FILE NAME: 403749-VH01.DWG		

UNALASKA, ALASKA
DUTCH HARBOR GEOPHYSICAL INVESTIGATION
NAVIGATION IMPROVEMENTS FEASIBILITY STUDY
APRIL 10 - MAY 10, 2017

SHEET IDENTIFICATION
5-UAK-92-07-11

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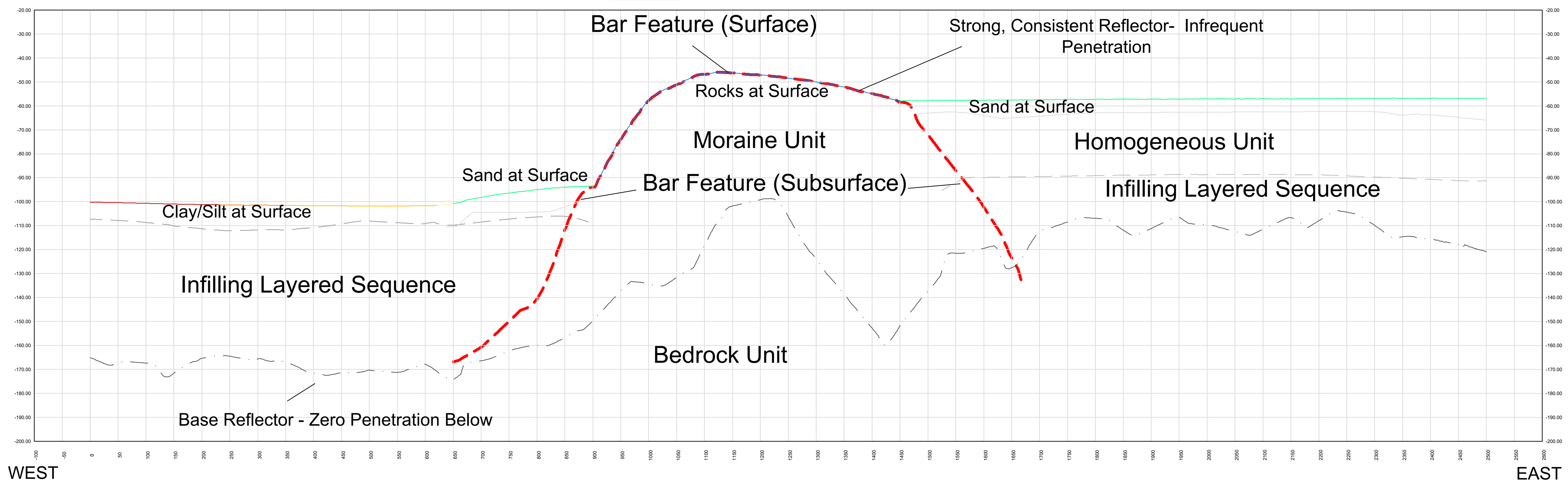
EW 03



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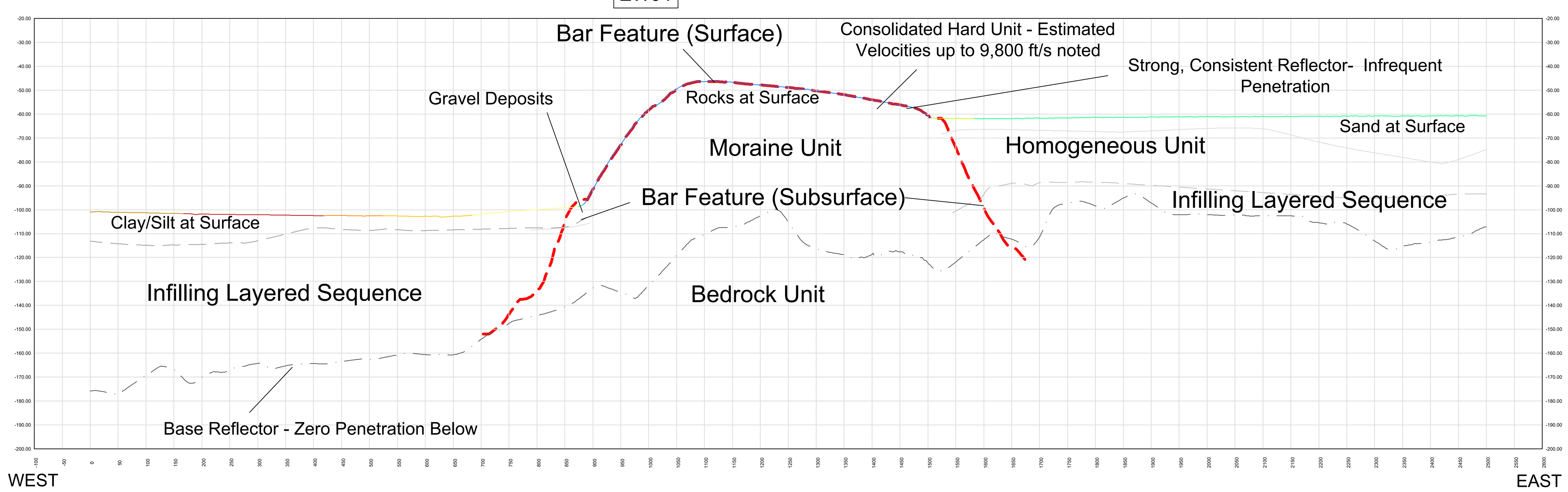

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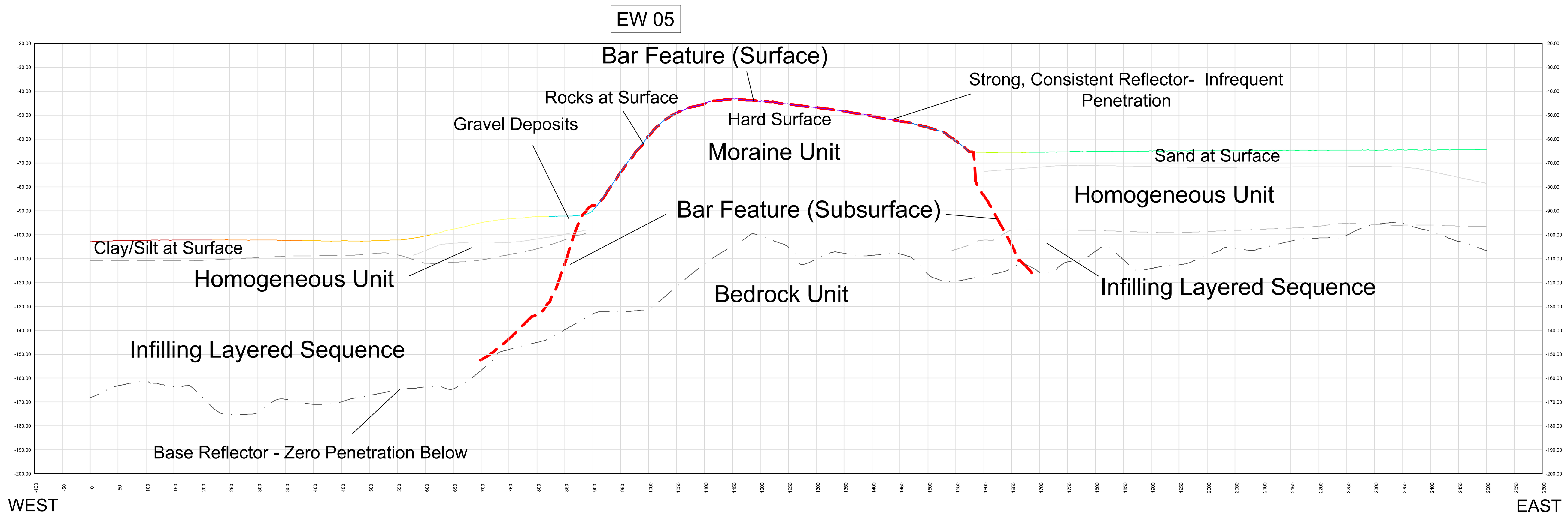

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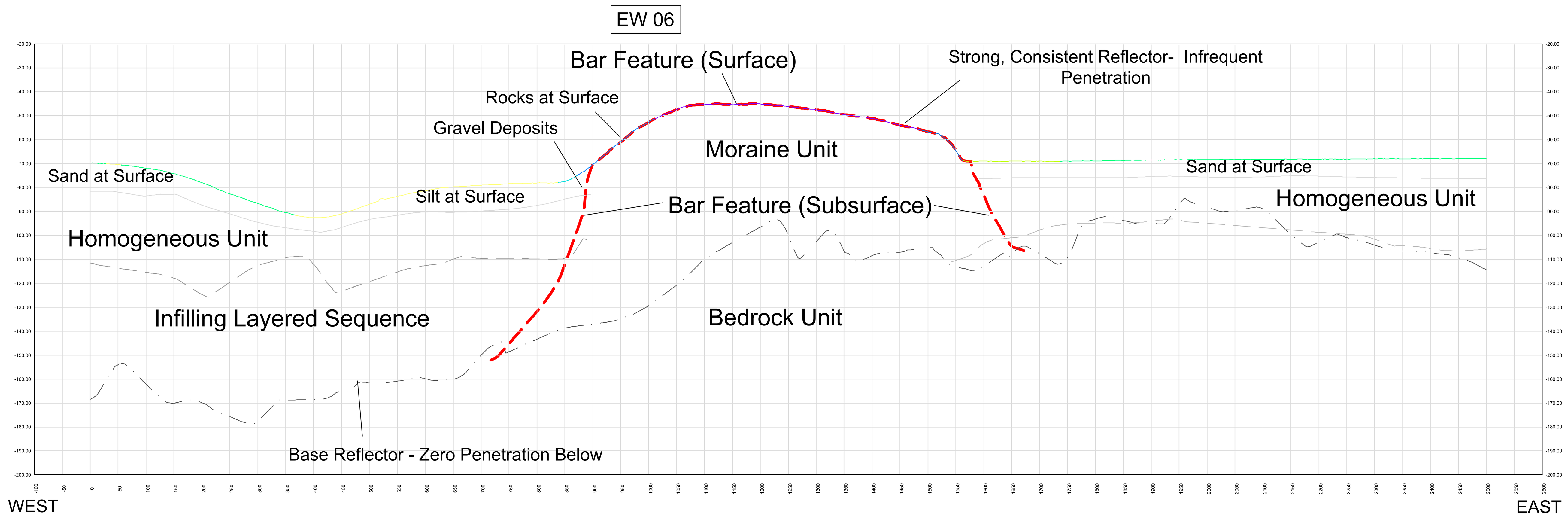

NOTES

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3. VERTICAL TIES TO THE NATIONAL SPATIAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD88 (GEOID 12B) ELEVATIONS HOLDING NOAA/USACE TIDAL BENCHMARK "946 2620 TIDAL 19" (PID BBBB51) AS 16.68 FT.
4. SOUNDINGS ARE IN US SURVEY FEET AND ARE MINUS UNLESS OTHERWISE INDICATED.
5. BATHYMETRY WAS COLLECTED APRIL 12-14, 2017. SOUNDINGS WERE COLLECTED USING AN R2SONIC 2024 MULTIBEAM ECHOSOUNDER OPERATING AT 400 KHZ. SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH AN AML BASE X-2 SOUND VELOCITY PROBE. POSITIONING AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV OCEANMASTER V5 SYSTEM. BATHYMETRIC DATA WAS COLLECTED AND PROCESSED USING QINSY 8.1 AND QIMERA 1.5 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS VERIFIED USING DIFFERENTIAL LEVELING TECHNIQUES.
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9. MAP SOUNDINGS ARE BINNED AT 96 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BIASED SOUNDINGS.

PROJECT LIMITS

CORNER#	NORTHING	EASTING
1	1,195,866.93	5,322,684.94
2	1,196,754.36	5,325,077.08
3	1,193,343.37	5,326,342.48
4	1,192,455.94	5,323,950.33

PROJECT LIMITS

CORNER#	NORTHING	EASTING
5	1,195,162.87	5,323,742.78
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SUB-SURFACE PROFILES

US Army Corps of Engineers
ALASKA DISTRICT

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SURVEYED BY: Gregory W. Gibson			DATE: 3 July 2017
DRAWN BY: GWG	CHECKED BY:		UPC: 403749
APPROVED BY:			CONTRACT NO.: W911KB-17-D-0001
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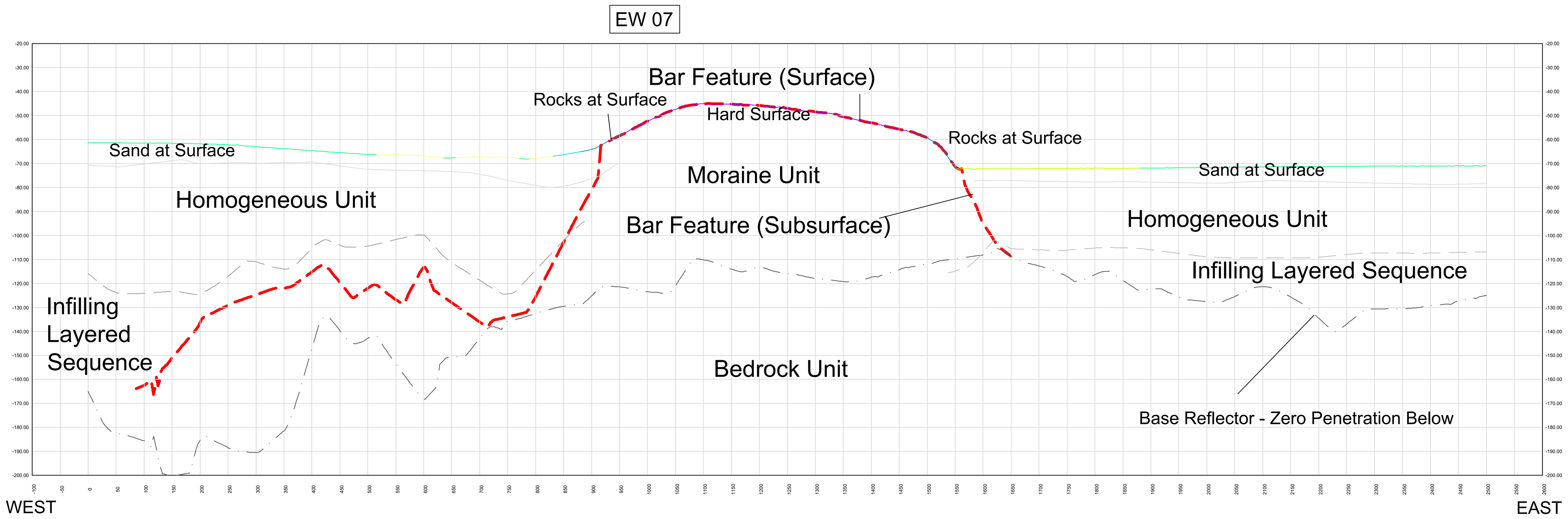
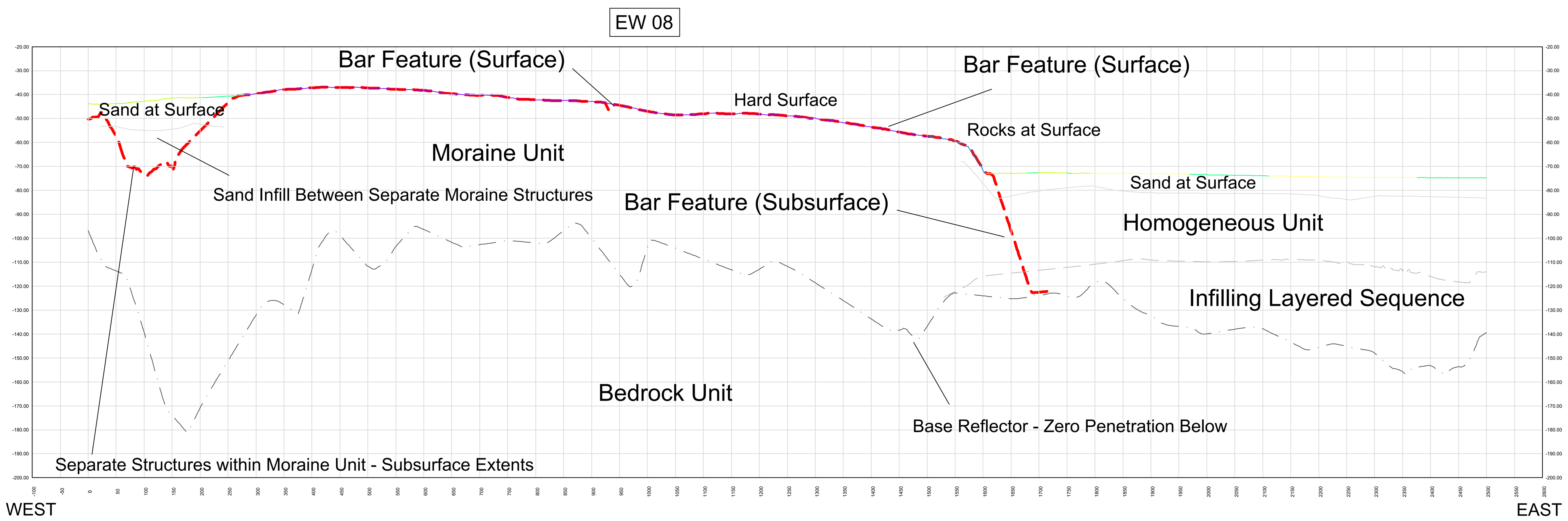
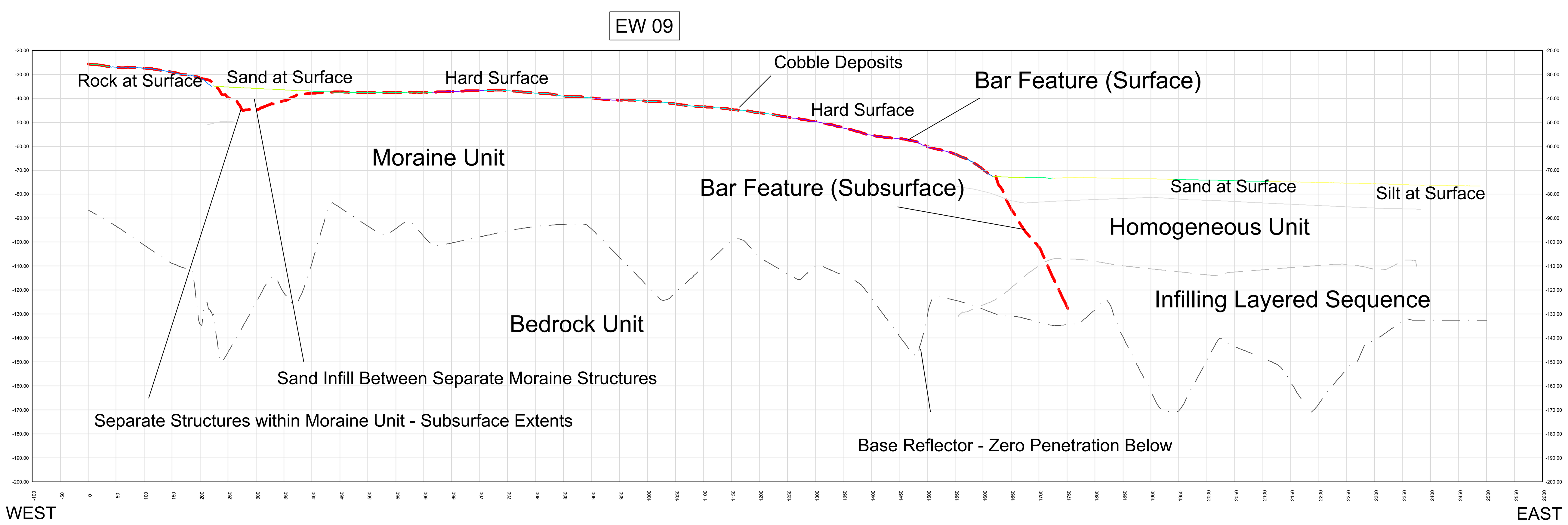
Sheet 11 of 13







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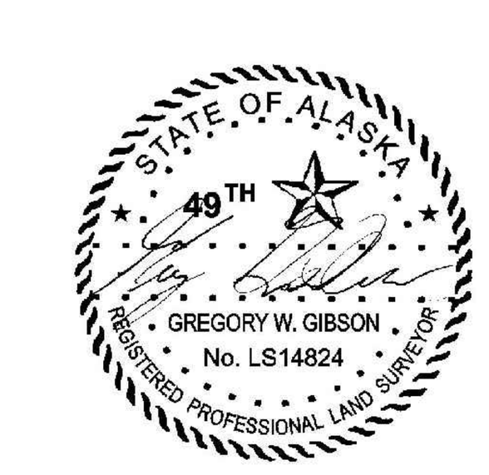

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SUB-SURFACE PROFILES

US Army Corps of Engineers ®
ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001

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SURVEYED BY: Gregory W. Gibson
DRAWN BY: GWG
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UNALASKA, ALASKA
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APRIL 10 - MAY 10, 2017

SHEET IDENTIFICATION
5-UAK-92-07-11
Sheet 12 of 13

SEDIMENT SAMPLES

ID	NORTHING	EASTING	CLASSIFICATION
GS14	1,195,042.0	5,323,547.0	SAND
GS15	1,195,217.0	5,324,017.0	NO RECOVERY - HARD BOTTOM
GS16	1,195,398.0	5,324,485.0	NO RECOVERY - HARD BOTTOM
GS01	1,195,807.0	5,322,734.0	SAND
GS17	1,195,560.9	5,324,953.7	SAND
GS18	1,195,740.8	5,325,434.3	SAND
GS19	1,194,404.0	5,323,251.0	SAND
GS20	1,194,577.0	5,323,726.0	SAND
GS21	1,194,724.0	5,324,195.0	(1) ROCK - 0.25'X0.40'
GS02	1,195,982.0	5,323,189.0	SAND
GS03	1,196,143.0	5,323,674.0	COBBLES ON SAND
GS04	1,196,348.4	5,324,133.9	(1) ROCK - 0.20'X0.35'
GS05	1,196,512.2	5,324,610.6	SAND
GS06	1,196,685.8	5,325,076.3	SAND
GS07	1,195,341.0	5,322,906.0	SAND
GS08	1,195,509.0	5,323,361.0	NO RECOVERY - HARD BOTTOM
GS09	1,195,682.0	5,323,841.0	NO RECOVERY - HARD BOTTOM
GS10	1,195,867.3	5,324,325.4	(1) BOULDER - 0.90'X1.30'
GS11	1,196,045.2	5,324,788.4	SAND
GS12	1,196,213.8	5,325,245.6	SAND
GS13	1,194,878.0	5,323,082.0	SAND
GS22	1,194,925.0	5,324,663.0	NO RECOVERY - HARD BOTTOM
GS23	1,195,091.8	5,325,138.0	SAND
GS24	1,195,274.2	5,325,593.9	SAND
GS25	1,193,936.0	5,323,423.0	SLIGHTLY PLASTIC SILT
GS26	1,194,107.0	5,323,897.0	SANDY SILT
GS27	1,194,277.0	5,324,368.0	(1) ROCK - 0.10'X0.20'
GS28	1,194,456.0	5,324,830.0	NO RECOVERY - HARD BOTTOM
GS29	1,194,629.3	5,325,302.6	SAND
GS30	1,194,811.3	5,325,783.0	SAND
GS31	1,193,456.0	5,323,590.0	SILT, LOW PLASTICITY
GS32	1,193,614.2	5,324,152.0	SILTY SAND
GS33	1,193,824.0	5,324,544.0	(1) ROCK - 0.15'X0.15'
GS34	1,193,991.0	5,325,009.0	SAND
GS35	1,194,156.6	5,325,470.1	SAND
GS36	1,194,333.5	5,325,961.7	SAND
GS37	1,193,026.0	5,323,768.0	SILT, NON PLASTIC
GS38	1,193,163.0	5,324,247.0	SILTY SAND
GS39	1,193,344.0	5,324,709.0	(1) ROCK 0.20'X0.25'
GS40	1,193,547.5	5,325,161.4	SAND
GS41	1,193,695.0	5,325,663.2	SAND
GS42	1,193,876.1	5,326,123.6	SAND
GS43	1,192,527.0	5,323,952.0	SILTY SAND
GS44	1,192,703.0	5,324,417.0	SAND
GS45	1,192,892.0	5,324,885.0	SAND
GS46	1,193,071.0	5,325,340.0	SAND
GS47	1,193,225.0	5,325,833.0	SAND
GS48	1,193,418.0	5,326,326.0	SAND
GS49	1,195,097.0	5,324,309.0	NO RECOVERY - HARD BOTTOM
GS50	1,194,615.0	5,324,479.0	NO RECOVERY - HARD BOTTOM
GS51	1,194,156.0	5,324,691.0	(1) ROCK - 0.15'X0.25'

MULTIBEAM DETECTED UNKNOWN SURFACE OBJECT NON-FERROUS

ID	NORTHING	EASTING	DEPTH (FT)	DESIGNATION
9900001	1,195,302.8	5,324,680.1	-69.6	DHG_2017_UKI_001
9900002	1,195,241.7	5,324,602.9	-69.9	DHG_2017_UKI_002
9900003	1,194,506.5	5,324,880.1	-61.9	DHG_2017_UKI_003
9900004	1,194,389.8	5,324,177.1	-93.2	DHG_2017_UKI_004
9900005	1,195,043.6	5,324,006.0	-59.5	DHG_2017_UKI_005
9900006	1,194,064.9	5,324,211.9	-98.1	DHG_2017_UKI_006
9900007	1,193,782.4	5,324,259.2	-96.2	DHG_2017_UKI_007
9900008	1,195,060.9	5,324,685.8	-68.4	DHG_2017_UKI_008

FERROUS OBJECT NOT DETECTED BY CHIRP OR MULTIBEAM

ID	NORTHING	EASTING	DESIGNATION
660001	1,194,510.2	5,324,658.9	DHG_2017_FA_001
660002	1,194,495.5	5,324,283.1	DHG_2017_FA_002
660003	1,194,600.3	5,324,245.4	DHG_2017_FA_003
660004	1,195,302.1	5,324,372.5	DHG_2017_FA_004
660005	1,194,894.4	5,324,602.0	DHG_2017_FA_005
660006	1,194,923.8	5,324,692.1	DHG_2017_FA_006
660007	1,194,868.8	5,324,378.3	DHG_2017_FA_007
660008	1,194,919.3	5,324,491.4	DHG_2017_FA_008
660009	1,194,707.1	5,324,291.4	DHG_2017_FA_009

SURFACE OBJECTS - CRAB POTS

ID	NORTHING	EASTING	DEPTH (FT)	DESIGNATION
550001	1,196,575.1	5,324,564.1	-71.6	DHG_2017_CRB_001
550002	1,196,569.3	5,325,010.5	-73.0	DHG_2017_CRB_002
550003	1,196,322.2	5,325,025.0	-72.2	DHG_2017_CRB_003
550004	1,196,315.3	5,325,047.9	-72.0	DHG_2017_CRB_004
550005	1,196,272.8	5,324,252.0	-64.1	DHG_2017_CRB_005
550006	1,196,202.0	5,324,657.2	-69.1	DHG_2017_CRB_006
550007	1,196,200.1	5,324,309.4	-69.4	DHG_2017_CRB_007
550008	1,196,084.4	5,323,556.5	-36.0	DHG_2017_CRB_008
550009	1,196,051.6	5,324,879.4	-71.6	DHG_2017_CRB_009
550010	1,196,043.9	5,324,414.9	-70.3	DHG_2017_CRB_010
550011	1,195,965.7	5,325,053.3	-72.4	DHG_2017_CRB_011
550012	1,195,939.1	5,325,312.6	-70.2	DHG_2017_CRB_012
550013	1,195,902.0	5,325,052.7	-70.0	DHG_2017_CRB_013
550014	1,195,883.0	5,325,346.9	-69.9	DHG_2017_CRB_014
550015	1,195,869.6	5,324,739.3	-71.0	DHG_2017_CRB_015
550016	1,195,844.2	5,324,978.9	-70.0	DHG_2017_CRB_016
550017	1,195,802.7	5,324,443.2	-70.4	DHG_2017_CRB_017
550018	1,195,515.6	5,325,439.2	-67.4	DHG_2017_CRB_018
550019	1,195,471.7	5,325,003.4	-68.2	DHG_2017_CRB_019
550020	1,195,414.0	5,324,500.2	-58.5	DHG_2017_CRB_020
550021	1,195,343.7	5,323,788.5	-56.8	DHG_2017_CRB_021
550022	1,195,331.1	5,325,428.5	-66.4	DHG_2017_CRB_022
550023	1,195,199.4	5,324,744.8	-67.4	DHG_2017_CRB_023
550024	1,194,713.7	5,325,015.3	-61.7	DHG_2017_CRB_024
550025	1,194,680.3	5,323,712.6	-81.8	DHG_2017_CRB_025
550026	1,194,636.1	5,323,773.2	-84.8	DHG_2017_CRB_026
550027	1,194,612.6	5,324,858.2	-61.7	DHG_2017_CRB_027
550028	1,194,541.1	5,323,402.4	-78.3	DHG_2017_CRB_028
550029	1,194,398.6	5,324,773.7	-51.1	DHG_2017_CRB_029
550030	1,194,375.4	5,324,550.9	-43.7	DHG_2017_CRB_030
550031	1,194,321.7	5,325,435.1	-57.2	DHG_2017_CRB_031
550032	1,194,314.3	5,324,058.4	-95.9	DHG_2017_CRB_032
550033	1,194,256.8	5,323,683.4	-99.6	DHG_2017_CRB_033
550034	1,194,180.9	5,325,089.0	-56.4	DHG_2017_CRB_034
550035	1,194,175.0	5,324,153.1	-97.3	DHG_2017_CRB_035
550036	1,194,149.2	5,325,269.6	-54.6	DHG_2017_CRB_036
550037	1,194,148.8	5,324,930.9	-56.6	DHG_2017_CRB_037
550038	1,193,879.7	5,324,999.2	-54.0	DHG_2017_CRB_038
550039	1,193,860.2	5,323,780.5	-99.4	DHG_2017_CRB_039
550040	1,193,784.2	5,324,033.6	-99.4	DHG_2017_CRB_040
550041	1,193,699.9	5,324,750.8	-43.5	DHG_2017_CRB_041
550042	1,193,610.5	5,325,607.9	-47.2	DHG_2017_CRB_042
550043	1,193,518.8	5,323,544.4	-97.6	DHG_2017_CRB_043
550044	1,193,012.0	5,324,763.3	-55.4	DHG_2017_CRB_044
550045	1,193,009.6	5,324,167.4	-94.4	DHG_2017_CRB_045
550046	1,192,688.6	5,324,222.8	-77.9	DHG_2017_CRB_046
550047	1,192,634.5	5,324,151.3	-90.6	DHG_2017_CRB_047
550048	1,192,605.9	5,324,175.5	-89.2	DHG_2017_CRB_048

CHIRP DETECTED SUBSURFACE OBJECT IN OUTER AREA - NON-NATURAL OBJECT

ID	NORTHING	EASTING	BURIAL (FT)	DESIGNATION
191000	1,194,317.5	5,325,394.4	6.2	DHG_2017_OSUKO_101
191001	1,193,823.5	5,326,111.2	6.2	DHG_2017_OSUKO_102
191002	1,193,798.8	5,326,078.8	1.6	DHG_2017_OSUKO_103
191003	1,194,845.3	5,325,382.9	0.6	DHG_2017_OSUKO_104
191004	1,196,156.6	5,324,657.7	2.1	DHG_2017_OSUKO_105
191005	1,195,449.4	5,325,337.4	0.8	DHG_2017_OSUKO_106
191006	1,195,671.5	5,325,247.5	1.0	DHG_2017_OSUKO_107
191007	1,193,820.8	5,326,055.5	0.6	DHG_2017_OSUKO_108
191008	1,195,661.6	5,325,273.8	0.6	DHG_2017_OSUKO_109
191009	1,193,693.7	5,325,152.2	0.6	DHG_2017_OSUKO_110
191010	1,193,523.8	5,325,529.0	0.8	DHG_2017_OSUKO_111
191011	1,194,749.1	5,325,008.7	0.8	DHG_2017_OSUKO_112
191012	1,195,553.9	5,325,295.1	0.3	DHG_2017_OSUKO_113

CHIRP DETECTED UNKNOWN SUB-SURFACE OBJECT WITH FERROUS RETURN

ID	NORTHING	EASTING	BURIAL (FT)	DESIGNATION
62001	1,194,201.1	5,325,090.4	2.3	DHG_2017_ISUKF_001
62002	1,194,185.6	5,324,179.6	3.5	DHG_2017_ISUKF_002
62003	1,194,178.6	5,324,966.4	7.2	DHG_2017_ISUKF_003
62004	1,194,151.8	5,324,955.5	5.7	DHG_2017_ISUKF_004
62005	1,194,382.1	5,324,422.6	9.6	DHG_2017_ISUKF_005
62006	1,195,271.4	5,324,645.7	2.4	DHG_2017_ISUKF_006

MULTIBEAM DETECTED UNKNOWN SURFACE OBJECT IN OUTER AREA

ID	NORTHING	EASTING	DEPTH (FT)	DESIGNATION
66001	1,196,189.2	5,324,857.5	-72.1	DHG_2017_UKO_001
66002	1,195,955.2	5,324,390.1	-67.8	DHG_2017_UKO_002
66003	1,195,923.4	5,324,624.1	-70.4	DHG_2017_UKO_003
66004	1,195,575.8	5,323,292.7	-35.1	DHG_2017_UKO_004
66005	1,195,318.5	5,325,292.9	-67.9	DHG_2017_UKO_005
66006	1,194,870.6	5,323,575.9	-66.9	DHG_2017_UKO_006
66007	1,193,371.6	5,324,081.2	-99.0	DHG_2017_UKO_007
66008	1,194,066.8	5,323,901.4	-100.4	DHG_2017_UKO_008
66009	1,193,985.6	5,324,101.9	-100.3	DHG_2017_UKO_009
66010	1,193,659.2	5,323,774.1	-96.5	DHG_2017_UKO_010
66011	1,193,360.3	5,324,569.6	-66.4	DHG_2017_UKO_011
66012	1,193,062.8	5,323,818.6	-94.8	DHG_2017_UKO_012
66013	1,193,514.3	5,323,655.2	-95.4	DHG_2017_UKO_013
66014	1,192,663.5	5,324,177.1	-88.9	DHG_2017_UKO_014
66015	1,193,049.7	5,324,327.7	-63.5	DHG_2017_UKO_015
66016	1,193,814.3	5,326,070.6	-49.1	DHG_2017_UKO_016
66017	1,193,820.3	5,325,205.2	-53.0	DHG_2017_UKO_017
66018	1,193,921.2	5,324,092.5	-97.4	DHG_2017_UKO_018
66019	1,193,899.0	5,324,053.3	-99.6	DHG_2017_UKO_019
66020	1,193,802.2	5,324,089.8	-99.7	DHG_2017_UKO_020
66021	1,193,588.5	5,323,875.7	-98.7	DHG_2017_UKO_021
66022	1,193,622.6	5,323,714.8	-94.8	DHG_2017_UKO_022
66023	1,193,508.7	5,323,832.4	-100.2	DHG_2017_UKO_023
66024	1,194,683.7	5,325,709.1	-59.6	DHG_2017_UKO_024
66025	1,194,646.7	5,325,691.7	-58.8	DHG_2017_UKO_025
66026	1,194,050.2	5,323,706.6	-100.5	DHG_2017_UKO_026
66027	1,194,007.4	5,323,919.6	-100.7	DHG_2017_UKO_027
66028	1,194,005.7	5,323,832.9	-100.3	DHG_2017_UKO_028
66029	1,193,979.1	5,323,789.4	-99.5	DHG_2017_UKO_029
66030	1,194,094.2	5,323,672.0	-100.3	DHG_2017_UKO_030
66031	1,194,100.0	5,323,510.3	-100.8	DHG_2017_UKO_031
66032	1,194,148.5	5,323,639.9	-100.8	DHG_2017_UKO_032
66033	1,194,156.0	5,323,560.4	-101.3	DHG_2017_UKO_033
66034	1,194,140.6	5,323,782.1	-101.0	DHG_2017_UKO_034
66035	1,196,356.1	5,324,291.4	-72.2	DHG_2017_UKO_035
66036	1,196,457.6	5,324,577.0	-70.8	DHG_2017_UKO_036
66037	1,196,606.2	5,324,943.5	-74.8	DHG_2017_UKO_037
66038	1,196,320.6	5,324,326.7	-71.9	DHG_2017_UKO_038
66039	1,196,283.1	5,324,526.6	-71.6	DHG_2017_UKO_039
66040	1,196,324.3	5,324,685.9	-72.7	DHG_2017_UKO_040
66041	1,196,202.7	5,324,545.1	-70.3	DHG_2017_UKO_041
66042	1,196,099.3	5,324,786.3	-70.2	DHG_2017_UKO_042
66043	1,196,034.4	5,325,157.3	-72.7	DHG_2017_UKO_043
66044	1,195,967.7	5,324,791.7	-71.4	DHG_2017_UKO_044
66045	1,195,830.5	5,324,480.4	-71.9	DHG_2017_UKO_045
66046	1,195,706.6	5,324,791.5	-70.7	DHG_2017_UKO_046
66047	1,195,526.7	5,324,827.9	-68.7	DHG_2017_UKO_047
66048	1,195,481.0	5,324,956.1	-69.4	DHG_2017_UKO_048
66049	1,195,128.5	5,325,061.9	-66.0	DHG_2017_UKO_049
66050	1,194,900.9	5,325,428.0	-63.7	DHG_2017_UKO_050
66051	1,194,694.8	5,323,446.4	-67.6	DHG_2017_UKO_051
66052	1,194,684.3	5,323,864.0	-79.1	DHG_2017_UKO_052
66053	1,194,517.4	5,323,662.0	-98.0	DHG_2017_UKO_053
66054	1,194,516.8	5,323,627.1	-94.5	DHG_2017_UKO_054
66055	1,194,451.4	5,323,935.3	-91.9	DHG_2017_UKO_055
66056	1,194,396.6	5,323,589.2	-101.4	DHG_2017_UKO_056
66057	1,194,212.9	5,323,520.7	-100.4	DHG_2017_UKO_057
66058	1,194,197.4	5,323,419.9	-101.5	DHG_2017_UKO_058
66059	1,193,944.0	5,323,541.5	-100.7	DHG_2017_UKO_059
66060	1,193,844.6	5,323,802.4	-99.6	DHG_2017_UKO_060
66061	1,193,406.8	5,323,722.5	-99.3	DHG_2017_UKO_061
66062	1,193,400.8	5,323,779.0	-99.6	DHG_2017_UKO_062
66063	1,196,619.2	5,324,685.7	-73.3	DHG_2017_UKO_063
66064	1,196,379.4	5,325,155.1	-72.3	DHG_2017_UKO_064
66065	1,196,278.9	5,325,229.3	-73.9	DHG_2017_UKO_065
66066	1,196,172.0	5,324,392.3	-72.0	DHG_2017_UKO_066
66067	1,196,160.9	5,324,686.5	-71.8	DHG_2017_UKO_067
66068	1,196,121.0	5,324,399.6	-71.9	DHG_2017_UKO_068
66069	1,196,160.5	5,325,235.6	-74.0	DHG_2017_UKO_069
66070	1,196,113.8	5,325,254.1	-73.2	DHG_2017_UKO_070
66071	1,195,994.1	5,324,930.5	-73.5	DHG_2017_UKO_071
66072	1,195,719.6	5,325,491.7	-70.2	DHG_2017_UKO_072
66073	1,195,667.0	5,325,306.0	-70.5	DHG_2017_UKO_073
66074	1,195,663.2	5,325,260.3	-70.0	DHG_2017_UKO_074
66075	1,195,539.7	5,325,464.6	-68.4	DHG_2017_UKO_075
66076	1,195,456.1	5,325,425.3	-68.4	DHG_2017_UKO_076
66077	1,195,449.2	5,325,383.0	-67.9	DHG_2017_UKO_077

MULTIBEAM DETECTED UNKNOWN SURFACE OBJECT IN OUTER AREA

ID	NORTHING	EASTING	DEPTH (FT)	DESIGNATION
66078	1,195,166.4	5,325,503.5	-64.1	DHG_2017_UKO_078
66079	1,195,081.3	5,325,653.5	-64.2	DHG_2017_UKO_079
66080	1,193,121.2	5,323,943.2	-98.0	DHG_2017_UKO_080
66081	1,192,853.8	5,324,012.4	-98.3	DHG_2017_UKO_081
66082	1,192,836.0	5,323,850.7	-99.3	DHG_2017_UKO_082
66083	1,193,157.1	5,323,692.4	-97.4	DHG_2017_UKO_083
66084	1,193,283.6	5,323,957.8	-100.4	DHG_2017_UKO_084
66085	1,193,318.2	5,324,038.3	-99.4	DHG_2017_UKO_085
66086	1,193,409.3	5,324,102.8	-100.6	DHG_2017_UKO_086
66087	1,193,451.4	5,323,934.8	-100.5	DHG_2017_UKO_087
66088	1,193,437.1	5,323,792.5	-100.3	DHG_2017_UKO_088
66089	1,193,525.2	5,324,097.6	-100.6	DHG_2017_UKO_089
66090	1,193,729.5	5,324,409.8	-88.8	DHG_2017_UKO_090
66091	1,193,707.1	5,323,984.5	-100.8	DHG_2017_UKO_091
66092	1,193,721.8	5,324,165.9	-101.1	DHG_2017_UKO_092
66093	1,193,714.5	5,323,915.0	-100.9	DHG_2017_UKO_093
66094	1,193,680.8	5,323,497.8	-97.8	DHG_2017_UKO_094
66095	1,194,069.1	5,324,054.3	-102.3	DHG_2017_UKO_095
66096	1,193,865.1	5,324,106.8	-102.0	DHG_2017_UKO_096
66097	1,194,797.0	5,323,649.2	-73.9	DHG_2017_UKO_097
66098	1,194,482.7	5,323,636.8	-101.6	DHG_2017_UKO_098
66099	1,194,442.5	5,323,612.7	-101.5	DHG_2017_UKO_099
66100	1,193,908.9	5,323,880.5	-101.9	DHG_2017_UKO_100
66101	1,192,557.0	5,324,122.5	-95.4	DHG_2017_UKO_101
66102	1,192,889.6	5,323,775.4	-98.9	DHG_2017_UKO_102
66103	1,194,564.2	5,323,577.8	-99.6	DHG_2017_UKO_103
66104	1,194,433.8	5,323,431.8	-98.4	DHG_2017_UKO_104
66105	1,194,389.4	5,323,412.2	-100.4	DHG_2017_UKO_105
66106	1,194,319.2	5,323,489.0	-101.2	DHG_2017_UKO_106
66107	1,194,468.1	5,323,681.8	-101.4	DHG_2017_UKO_107
66108	1,194,423.0	5,323,702.3	-102.0	DHG_2017_UKO_108
66109	1,194,439.5	5,323,776.1	-101.5	DHG_2017_UKO_109

MULTIBEAM DETECTED UNKNOWN SURFACE OBJECT WITH FERROUS RETURN

ID	NORTHING	EASTING	DEPTH (FT)	DESIGNATION
800001	1,195,283.4	5,324,951.8	-69.0	DHG_2017_UKF_001
800002	1,195,180.9	5,324,646.6	-67.7	DHG_2017_UKF_002
800003	1,195,869.0	5,324,753.4	-72.6	DHG_2017_UKF_003
800004	1,195,767.4	5,324,408.6	-55.1	DHG_2017_UKF_004
800005	1,195,405.9	5,324,743.2	-70.4	DHG_2017_UKF_005
800006	1,195,404.0	5,325,247.4	-67.6	DHG_2017_UKF_006
800007	1,195,365.6	5,324,554.9	-70.6	DHG_2017_UKF_007
800008	1,195,276.5	5,325,252.2	-65.4	DHG_2017_UKF_008
800009	1,195,167.3	5,323,888.9	-63.3	DHG_2017_UKF_009
800010	1,194,984.8	5,323,969.3	-66.0	DHG_2017_UKF_010
800011	1,194,907.1	5,323,956.5	-71.0	DHG_2017_UKF_011
800012	1,194,787.0	5,324,119.3	-60.1	DHG_2017_UKF_012
800013	1,194,564.9	5,324,160.5	-81.0	DHG_2017_UKF_013
800014	1,194,415.3	5,324,241.7	-79.9	DHG_2017_UKF_014
800015	1,194,157.4	5,324,928.2	-57.9	DHG_2017_UKF_015
800016	1,194,149.0	5,324,965.2	-58.1	DHG_2017_UKF_016
800017	1,194,141.1	5,324,199.3	-84.3	DHG_2017_UKF_017
800018	1,194,878.9	5,323,835.0	-70.1	DHG_2017_UKF_018
800019	1,193,986.1	5,324,470.3	-60.7	DHG_2017_UKF_019
800020	1,194,364.5	5,324,382.1	-47.7	DHG_2017_UKF_020
800021	1,194,428.2	5,324,821.5	-55.0	DHG_2017_UKF_021
800022	1,194,865.1	5,324,773.1	-66.6	DHG_2017_UKF_022
800023	1,195,007.0	5,324,619.6	-53.3	DHG_2017_UKF_023
800024	1,194,088.2	5,324,493.9	-49.9	DHG_2017_UKF_024
800025	1,194,195.6	5,324,684.6	-49.2	DHG_2017_UKF_025
800026	1,195,231.2	5,324,382.1	-48.9	DHG_2017_UKF_026
800027	1,195,307.9	5,324,591.1	-70.3	DHG_2017_UKF_027
800028	1,193,840.2	5,324,263.4	-96.3	DHG_2017_UKF_028
800029	1,194,229.0	5,324,898.9	-58.9	DHG_2017_UKF_029
800030	1,195,516.9	5,323,708.7	-42.9	DHG_2017_UKF_030
800031	1,194,200.7	5,324,211.4	-97.1	DHG_2017_UKF_031

SURFACE OBJECTS - TIRE

ID	NORTHING	EASTING	DEPTH (FT)	DESIGNATION
710001	1,193,636.0	5,323,565.5	-100.0	DHG_2017_TR_001
710002	1,193,460.2	5,323,629.0	-99.3	DHG_2017_TR_002
710003	1,196,111.3	5,324,932.1	-72.8	DHG_2017_TR_003
710004	1,195,356.4	5,323,693.7	-58.1	DHG_2017_TR_004

NOTES

1. PRIMARY PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 10, NAD83, (2011)(2010.00), IN US SURVEY FEET BASED ON A FULLY CONSTRAINED STATIC GPS NETWORK HOLDING THE PUBLISHED NAD83 2010.00 EPOCH VALUES OF NGS CORS STATIONS: "SANDPOINT_AK2004 CORS ARP" (PID DL7635); "COLD BAY WAAS 8 CORS ARP" (PID DL6500); "SANAKISLNDAK2007 CORS ARP" (PID DM7493).

   LOCAL PROJECT HORIZONTAL CONTROL IS ALASKA STATE PLANE, ZONE 10, NAD83, IN US SURVEY FEET HOLDING "946 2620 TIDAL 19" AS N 1,183,685.03', E 5,317,889.75' AND "946 2620 M" AS N 1,184,129.99', E 5,317,058.52'.

2. VERTICAL CONTROL IS MEAN LOWER LOW WATER (MLLW=0.0 FT), BASED ON THE NOAA/NOS TIDAL BENCH MARK LIST "9462620 UNALASKA, DUTCH HARBOR, ALASKA", PUBLISHED 10/24/2011. THIS TIDAL DATUM IS BASED ON THE 1983-2001 TIDAL EPOCH AND IS REFERENCED BY HOLDING NOAA/NOS TIDAL BENCH MARK "946 2620 TIDAL 19" (VM#11816) AS 16.43 FT AND NOS TIDAL BENCHMARK "946 2620 M" (VM#11821) AS 10.97 FT.
3. VERTICAL TIES TO THE NATIONAL SPATIAL REFERENCE SYSTEM ARE BASED ON PUBLISHED NAVD88 (GEOID 12B) ELEVATIONS HOLDING NOAA/USACE TIDAL BENCHMARK "946 2620 TIDAL 19" (PID BBBB51) AS 16.68 FT.
4. SOUNDINGS ARE IN US SURVEY FEET AND ARE MINUS UNLESS OTHERWISE INDICATED.
5. BATHYMETRY WAS COLLECTED APRIL 12-14, 2017. SOUNDINGS WERE COLLECTED USING AN R2SONIC 2024 MULTIBEAM ECHOSOUNDER OPERATING AT 400 KHZ. SOUND VELOCITY THROUGH THE WATER COLUMN WAS DETERMINED WITH AN AML BASE X-2 SOUND VELOCITY PROBE. POSITIONING AND VESSEL ORIENTATION WERE MEASURED USING AN APPLANIX POSMV OCEANMASTER V5 SYSTEM. BATHYMETRIC DATA WAS COLLECTED AND PROCESSED USING QINSY 8.1 AND QIMERA 1.5 SOFTWARE. HORIZONTAL CONTROL WAS SURVEYED USING STATIC GNSS EQUIPMENT AND TECHNIQUES. VERTICAL CONTROL WAS VERIFIED USING DIFFERENTIAL LEVELING TECHNIQUES.
6. SUB-SURFACE STRATIGRAPHY AND OBJECT DETECTION DATA WAS COLLECTED USING AN EDGETECH 3200 HIGH-PENETRATION CHIRP SUB-BOTTOM PROFILER WITH A 216S TOWFISH. ADDITIONAL SUB-SURFACE STRATIGRAPHY DATA WAS COLLECTED USING A HEGGS MARINE HMS-620 SEISMIC REFLECTION PROFILER.
7. SURFACE AND SUB-SURFACE FERROUS OBJECT DETECTION WAS CONDUCTED USING A GEOMETRICS G-882 TVG MARINE TRANSVERSE GRADIOMETER.
8. THIS DRAWING INDICATES GENERAL CONDITIONS AT THE TIME OF THE SURVEY.
9. MAP SOUNDINGS ARE BINNED AT 96 FEET AND ARE SHOAL BIASED. CONTOURS ARE BASED ON 12 FEET BINNED SHOAL-BIASED SOUNDINGS.

PROJECT LIMITS

CORNER#	NORTHING	EASTING
1	1,195,866.93	5,322,684.94
2	1,196,754.36	5,325,077.08
3	1,193,343.37	5,326,342.48
4	1,192,455.94	5,323,950.33

PROJECT LIMITS

CORNER#	NORTHING	EASTING
5	1,195,162.87	5,323,742.78
6	1,195,511.64	5,324,682.92
7	1,194,071.59	5,325,217.14
8	1,193,722.82	5,324,277.00

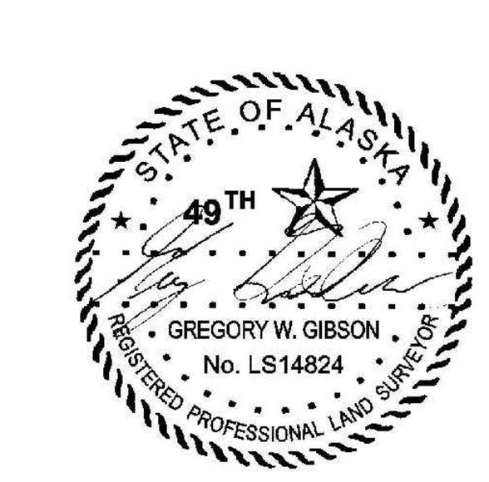
SURVEY CONTROL DATA

STATION	NORTHING	EASTING	MLLW	DESCRIPTION
2620M 1982	1,184,129.99	5,317,058.52	10.97	NOS SBC
NO. 19 1973	1,183,685.03	5,317,889.75	16.43	USCGS SBC (BENCH MARK)
SPIT	1,195,075.49	5,321,164.49	23.97	PERM BASE APC

Project ID — Year of Survey — Object Type — Unique ID Number

DHG_2017_UKF_001

UKF – unknown surface object with ferrous return
UKI – unknown surface object non ferrous Inner Box
UKO – unknown surface object non ferrous Outer Box
ISUKF – Inner Box subsurface unknown object with ferrous return
ISUKNF - Inner Box subsurface unknown object non ferrous
OSUK - Outer Box subsurface unknown likely rock
OSUKO - Outer Box subsurface unknown object
FA- ferrous object with no other surface or subsurface detection



THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE OVERSIGHT OF AN ACSM/THSOA CERTIFIED HYDROGRAPHER

David R. Neff C.H. (275)

TABLES

US Army Corps of Engineers ® ALASKA DISTRICT

CONTRACT NO. W911KB-17-D-0001
CONTRACTOR R&M CONSULTANTS
CITY ANCHORAGE STATE ALASKA
Recommended: PRIME CONTRACTOR
Approved: CHIEF GEOMATICS SECTION
Date: 05/23/2017

REVISION	DATE	DESCRIPTION	BY	APPVD

U.S. ARMY CORPS OF ENGINEERS
ALASKA DISTRICT
P.O. BOX 6898
JBER, ALASKA 99506-0898

eTrac Inc.
617 S Knik-Goose Bay Rd, Suite C
Wasilla, AK 99654

SURVEYED BY: Gregory W. Gibson
DRAWN BY: GWG
CHECKED BY:
APPROVED BY:
SCALE: 1" = 150'
SIZE: ANSI E
PLOT DATE: 05/23/2017
FILE NAME: 403749-VH01.DWG
DATE: 3 July 2017
UPC: 403479
CONTRACT NO.: W911KB-17-D-0001
JOB NO.: 0417

UNALASKA, ALASKA
DUTCH HARBOR GEOPHYSICAL INVESTIGATION
NAVIGATION IMPROVEMENTS FEASIBILITY STUDY
APRIL 10 - MAY 10, 2017

SHEET IDENTIFICATION
5-UAK-92-07-11
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