Attachment 3.8

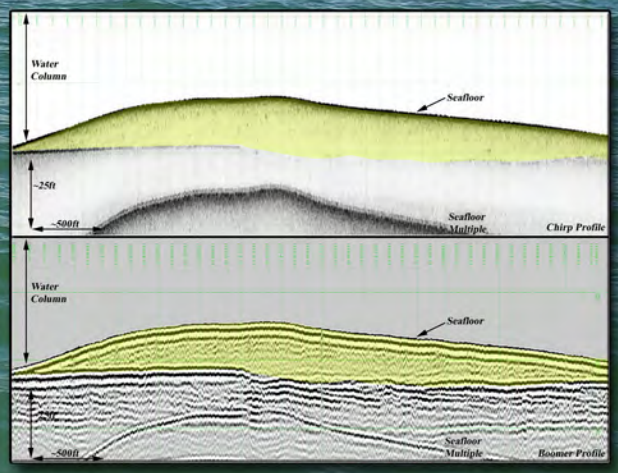
Technical Memorandum

Reconnaissance Geophysical Sand Search Surveys To Support Lee County Lovers Key Beach Nourishment Project

Gulf of Mexico, Florida

OSI Report No. 20ES002-1

25 August 2020



COASTAL ENGINEERING CONSULTANTS INC.

Prepared For:
Coastal Engineering Consultants, Inc.

Prepared By:
Ocean Surveys, Inc.

TECHNICAL MEMORANDUM

RECONNAISSANCE GEOPHYSICAL SAND SEARCH SURVEYS TO SUPPORT LEE COUNTY LOVERS KEY BEACH NOURISHMENT PROJECT GULF OF MEXICO, FLORIDA

OSI REPORT NO. 20ES002-1

Prepared For: Coastal Engineering Consultants, Inc.
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25 August 2020

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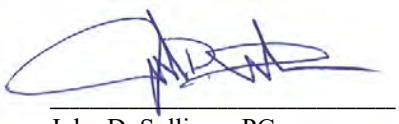
APPENDICES

Digital Appendix – Final report and Project drawing files (AutoCAD and PDF formats), subbottom profiles (jpg format), survey trackline log (PDF format) copy of the approved data collection plan and the FL 1A-32 and BOEM Authorization permits.



John D. Sullivan, PG
Manager Geophysical Surveys
OCEAN SURVEYS, INC.

TECHNICAL MEMORANDUM

RECONNAISSANCE SAND SOURCE GEOPHYSICAL SURVEY TO SUPPORT LEE COUNTY LOVERS KEY BEACH NOURISHMENT PROJECT GULF OF MEXICO, FLORIDA

1.0 INTRODUCTION

During the period 19-26 June 2020, Ocean Surveys, Inc. (OSI) performed a reconnaissance high-resolution geophysical (HRG) survey in the Gulf of Mexico in the waters offshore of Sanibel Island, Estero Island and Lovers Key, FL (Figure 1). These investigations were performed under subcontract to Coastal Engineering Consultants, Inc. (CEC) for Lee County (County), FL and were designed to assist the County in identifying offshore sediment resources and a pump-out area and pipeline corridor to support the Lovers Key Beach Nourishment Project (Project) for a 50-year period of analysis.

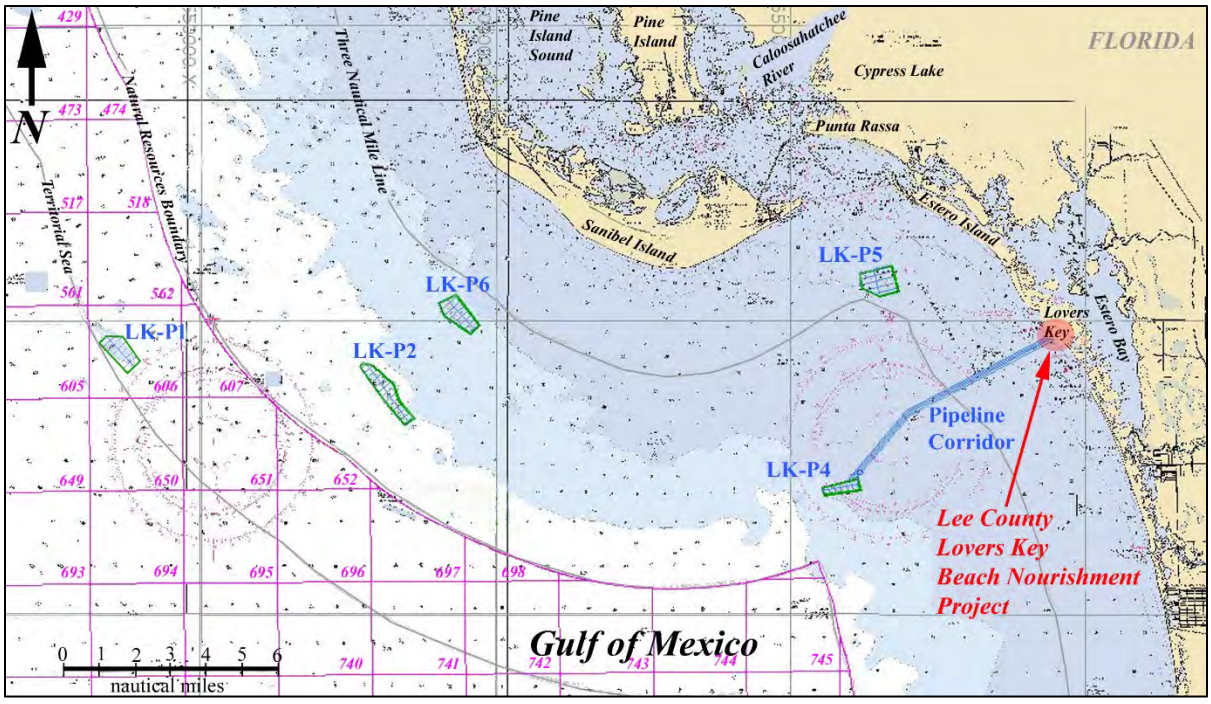


Figure 1. Location map illustrating the reconnaissance survey areas (outlined in green) and pipeline conveyance corridor investigated. Background image based on NOAA Chart No. 11426, Estero Bay to Lemon Bay. BOEM lease blocks (magenta) downloaded from BOEM's GOMR GIS Data and Maps website.

2.0 PROJECT SUMMARY

2.1 Project Background and Objectives

The County has tasked the CEC Team comprised of CEC, OSI, R.C. Goodwin and Associates (RCG&A) and American Vibracore Services (AVS) a marine division of Amdrill Inc. with conducting a sand search study to identify offshore resources in the Gulf of Mexico that can be used to re-nourish Lovers Key for the next 50 years. Based on preliminary work performed by CEC, the 50-year beach nourishment needs are on the order of 2.2 million cubic yards (mcy). To account for beach fill to overfill ratio, cut to fill losses, and borrow area cutting inefficiency factor, the proposed scope of services and budget are based upon identifying up to 4.4 mcy at the reconnaissance level; and 2.2 mcy at the detailed level.

The first step in this study included a desktop review of maps, charts, the Florida Department of Environmental Protection's (FDEP) ROSSI database and available literature sources to identify potential offshore sand target areas (TAs) to support the Project. The results of this desktop review have been reported in the form of a Technical Memorandum addressed to the County (CEC, 2020). Based on this desktop review six (6) potential sand TAs (LK-P1 to P6) were identified to evaluate their suitability. LK-P1 is in federal waters (Bureau of Ocean Energy Management (BOEM) protraction polygon NG17-04 (Charlotte Harbor) Block 606) while all other TAs are located within Florida's natural resources boundary. As described in the desktop review three of the TAs (LK-P1, P4 and P5) have been probed by others during previous sand search projects which documented the existence of a potential sand resource within their limits. The three remaining TAs (LK-P2, P3 and P6) have not been previously investigated so the CEC Team conducted a jet probe investigation as the first task in evaluating their suitability as a potential sand resource to support the Project (CEC, 2020-1).

Based on the Project jet probe investigation performed in the three potential sand TAs without historic geotechnical data, LK-P2 and LK-P6 were deemed as potential sand resources and included in a follow-up reconnaissance geophysical survey plan along with LK-P1, P4 and P5. Because jet probes found that the sediment thickness and sediment quality were less than

desirable in LK-P3, this area was eliminated as a potential Project resource with no further investigation.

This report provides a summary of the reconnaissance level geophysical surveys performed in the five remaining TAs. The survey focused on acquiring HRG data in the TAs in order to map the sand bodies and develop a follow-up reconnaissance vibratory core sampling plan to groundtruth the geophysical data interpretation and confirm the resource is Project suitable. In addition to the TAs, this report also provides summary of the reconnaissance survey work that was performed within a potential pipeline conveyance corridor proposed between LK-P4 and Lovers Key.

OSI has been subcontracted by CEC to perform all reconnaissance and detailed geophysical resource surveys in the potential borrow areas and pipeline corridors and pump-out areas proposed to support the Project. AVS has been subcontracted to acquire and analyze all Project vibratory cores and RCG&A has been subcontracted to perform all Project related cultural resource assessments.

Prior to the reconnaissance geophysical survey, OSI worked with archaeologists from RCG&A and developed a survey data collection plan (Data Collection Plan 1, 2020). The data collection plan was submitted by RCG&A to the Florida Department of State, Division of Historical Resources along with a 1A-32 permit application to perform geophysical, geotechnical, and cultural resources surveys in State waters. The Archaeological Research Permit (No. 1920.081) was issued on 5 June 2020. To conduct geophysical operations in Federal waters (prospecting for mineral resources on the outer continental shelf (OCS)) in LK-P1, OSI applied for and was granted authorization from BOEM (BOEM OCS Authorization M20-001, 11 June 2020). With permits in-hand the OSI geophysical survey team was mobilized to the site and began data acquisition on 20 June 2020.

2.2 Summary of Geophysical Survey and Equipment

The reconnaissance survey concentrated on acquiring HRG data (sounding, subbottom profiling, magnetometer, and side scan sonar imagery) within the reconnaissance level TAs and within a pipeline corridor to Lovers Key.

The proposed trackline layout within the reconnaissance level TAs consisted of a series of parallel primary survey lines (generally oriented perpendicular to the long axis of the TAs) spaced 1,000 feet (305 meters) apart and at least one cross or "tie" line oriented perpendicular to the primary lines through each site. During the field investigation several primary survey lines were extended in the borrow areas and several lines were added to the program to better map the potential resources. Trackline spacing within the proposed pipeline corridor (1,000-feet wide) to Lovers Key from LK-P4 was established at 250 feet. Tie-line spacing within the corridor varied and several survey lines were added to the program to avoid an obstruction in the base pipeline corridor. Along all tracklines, single beam depth sounding, subbottom profiling, marine magnetometer data and side scan sonar imagery were acquired simultaneously. In the TAs both a high-frequency Chirp and a lower frequency Boomer type profiler were used to acquire subbottom data. The intent was that the two instruments would provide a broad range of energy and frequency to investigate the expected variable sequence of sediments expected in the area. Boomer subbottom data were not acquired within the proposed pipeline corridor.

Survey operations were performed by a two-person OSI field crew comprised of a marine geologist/geophysicist and a vessel operator/ACSM Certified Hydrographer aboard OSI's shallow draft research vessel, *R/V Able II*. *R/V Able II* is a 26-foot fiberglass vessel equipped with a fully-enclosed cabin, dual-outboard motors, stern mounted A-frame and winch for towing subsurface gear, swing arm davit and all United State Coast Guard (USCG) safety equipment including an Automatic Information System (AIS). To comply with BOEM's OCS Authorization permit, a trained protected species observer (PSO) accompanied the survey crew on the vessel during work in LK-P1 to visually monitor an acoustic exclusion zone around the low frequency sound sources (subbottom profilers) during survey activities.

The primary equipment systems that were employed to complete the investigation are listed below:

Navigation and Positioning:

- *Applanix POS MV Global Positioning System (GPS), Orientation and Heading Sensor Operating in Network Real Time Kinematic (NRTK) mode*
- *Hydrographic Survey Products, Inc. Smart Sensor Cable Layback Measurement System*
- *HYPACK Navigation and Data Logging Computer System*

Seafloor Mapping:

- *Odom Echotrac MK III Digital Depth Sounder (200 kHz employed)*
- *Klein 3000 Digital Side Scan Sonar System (500 kHz employed)*
- *Geometrics G882 Cesium Marine Magnetometer*

Subbottom Profiling:

- *EdgeTech 3200-XS Chirp Subbottom Profiling System equipped with a SB216 Tow Vehicle (2-16 kHz)*
- *Applied Acoustics 200J high-resolution "Boomer" Subbottom Profiling System (0.5-8 kHz) interfaced with a CSP-P Seismic Energy Source and Coda DAG4G Shallow Seismic Processor/Heave Compensator/Data Logger and 10 element hydrophone streamer*

Figure 2 (upper panel) provides a photograph of the survey vessel, *R/V Able II*. Survey equipment was configured onboard the vessel to optimize data quality, reduce ambient noise and cross talk, and maximize survey efficiency. Figure 2 (lower panel) provides an illustration of the general equipment configuration used onboard the survey vessel. The single-frequency depth sounder transducer was hard mounted to the starboard side of the vessel. The side scan sonar towfish was towed from the stern with the magnetometer sensor in tandem behind. Towfish layback (side scan sonar and magnetometer) was determined by means of a digital cable counter. The side scan sonar system employed an approximate 250-foot (75-meter) sweep range. The side scan sonar and magnetometer sensors were maintained at an approximate 20-foot (6 meters) tow height above the seabed during acquisition (where depth permitted). The Chirp SB216 was towed from a davit located approximately midships on the port side of the vessel. The Boomer subbottom profiling system was towed from a spreader bar fixed to the stern A-frame and laid back approximately 30 feet. Boomer subbottom data were only acquired within the TAs.

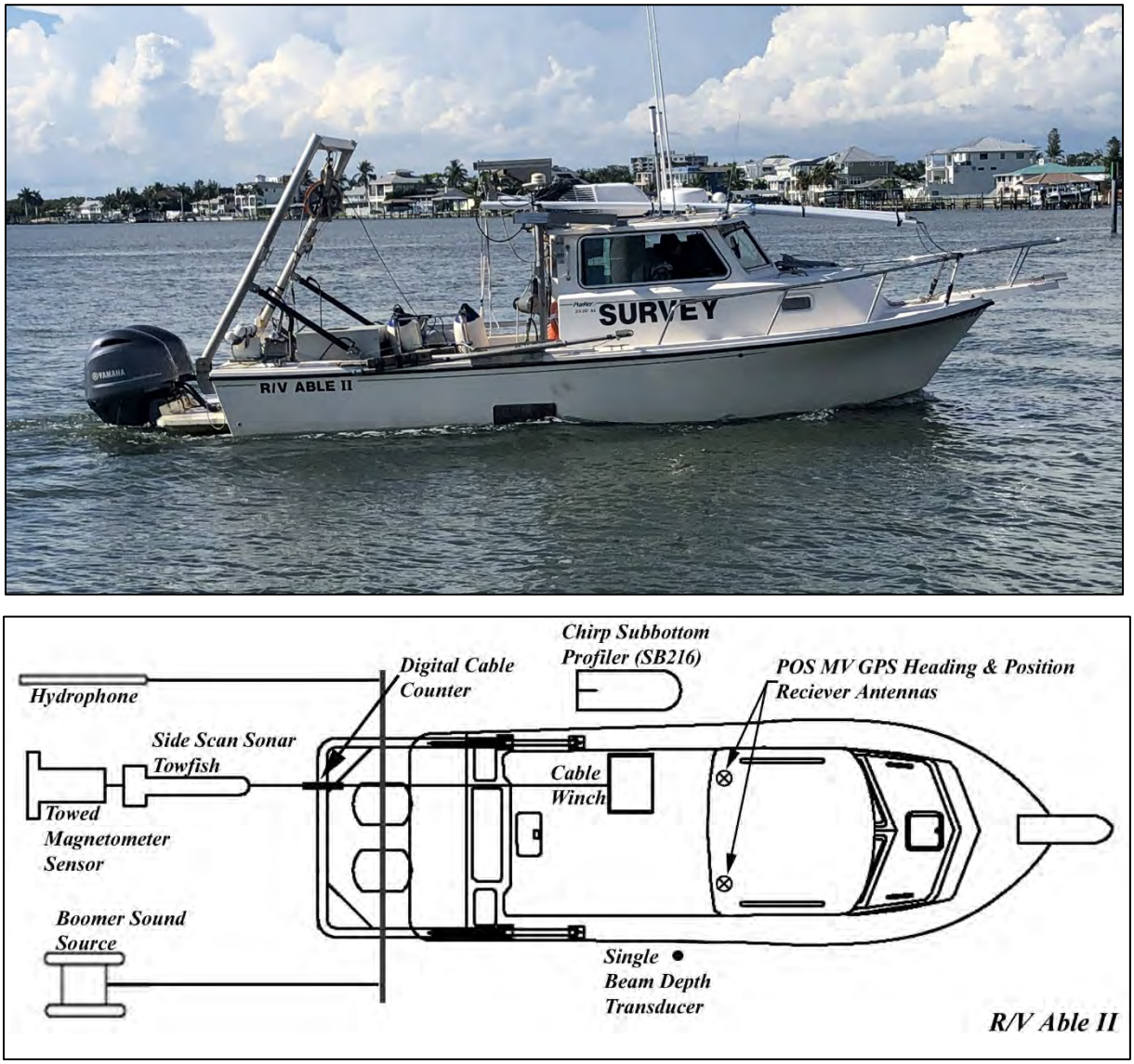


Figure 2. Survey vessel *Able II* (upper) and overview of equipment layout and general sensor configuration maintained onboard the vessel (lower). Note vessel sketch not to scale.

During the survey, vessel speed was maintained as high as possible without affecting the quality of the data, typically at 3-4 knots. Once online, no course changes were made, other than to maintain proposed trackline alignment. Survey direction and vessel speed were recorded in a detailed field line log.

2.2.1 Horizontal and Vertical Control

Project horizontal reference is Florida State Plane Coordinate System, West Zone (0902), NAD 83 in US Survey Feet. Project vertical reference is the North American Vertical Datum of 1988 (NAVD88), feet. Water depths were corrected for tidal variations and reduced to Project vertical datum based on a blended correction solution developed from predicted water level data obtained from the National Oceanic and Atmospheric Administration (NOAA) and Network Real-Time Kinematic (NRTK) water levels recorded on the survey vessel during data acquisition.

Three-dimensional (3-D) positioning of the survey vessel was accomplished utilizing an Applanix POS MV GPS interfaced with a computer running HYPACK, a PC-based navigation and data logging software package. Correctors from the Florida Department of Transportation Permanent Reference Network (FPRN) were employed resulting in nearly full time NRTK-quality 3-D positioning throughout the survey.

Prior to commencing the survey, an NRTK Global Navigation Satellite System (GNSS) rover (Trimble R10 with a TSC3 Data Collector) was employed to confirm the suitability of the FPRN correctors. The rover was used to occupy a local U.S. Army Corps of Engineers (ACOE) Online Positioning Users Service (OPUS) Shared Solution control point, "Estero 101" (PID: BBDV83). The coordinates of the ACOE control point are provided in Table 1 below.

Table 1 - Survey Control

Designation (PID)	Latitude (N)	Longitude (W)	NAVD88
ESTERO 101 (BBDV83)	29° 26' 12.15899"	-081° 55' 20.90810"	4.73'

Once the 3-D positioning accuracy of the NRTK GNSS rover was verified at the local ACOE control point, the rover was used to establish a convenient, temporary, dockside point at the Project marina against which the vessel's positioning system 3-D accuracy could be confirmed. The temporary point was set on a piling at the vessel's dock slip. Aboard the vessel, horizontal positioning was confirmed via a physical measurement between the vessel's reference point (RP) and the temporary point. The physical measurement was compared to the calculated

difference as displayed by the onboard data acquisition software and an assessment of horizontal positioning accuracy was derived. The vertical positioning accuracy of the onboard navigation system was verified as follows: A direct measurement between the respective temporary point and the water surface was used to calculate water level. The calculated water level was compared to the HYPACK-displayed "tide" value and an assessment of vertical positioning accuracy derived thus. The horizontal and vertical checks were accomplished each survey day both before and after daily operations. In all cases the vertical and horizontal checks confirmed that the onboard navigation system was operating within expected 3-D accuracy limits, i.e. sub-decimeter X, Y, Z performance.

2.2.2 Chronology of Geophysical Survey Field Operations and Acquisition Summary

In total, approximately 102 nautical miles (nm) of multi-sensor HRG survey tracklines were investigated during this task in the TAs and pipeline corridor including reruns, overruns beyond the end of the planned lines and additional survey work completed in LK-P1 and P5 to better define the potential resource and in the pipeline corridor to enable rerouting around a hazard. Table 2 provides a general chronology of the fieldwork, including vessel mobilization and demobilization.

Table 2 - General Chronology of Reconnaissance Field Investigation

Task	2020 Dates	Description
Survey crew and vessel mobilized on site	19 June	OSI vessel and crew arrive on site (Estero Island, FL), perform presurvey control work and launch survey vessel (*R/V Able II).*
Survey operations	20 June	Perform initial on-site calibration of geophysical survey equipment and acquire data within LK-P5.
Survey operations	20 June	Continue geophysical survey investigations within the federal water site, LK-P1.
Survey operations	22 June	Continue geophysical survey investigations within LK-P6 & P2.
Survey operations	22 June	Continue geophysical survey investigations within LK-P6 & P2.
Survey operations	23 June	Continue geophysical survey investigations within LK-P4 and start work in the corridor.
Survey operations	24 June	Continue geophysical survey investigations within the corridor.
Survey operations	25 June	Complete geophysical survey investigations within the corridor and acquire additional HRG data within LK-P4 & P5.
Conclude survey operations and demobilize	26 June	Pull survey vessel and prepare for overland transit. OSI vessel and crew depart site, investigation concluded.

3.0 DATA PROCESSING AND PRODUCTS

Throughout the course of the investigation, data were continually reviewed by the field team to ensure coverage and data quality. Following completion of the field investigation, the acquired data sets were more fully processed and interpreted. Table 3 lists the processing software used for each data set. Appendix 1 provides tables summarizing the magnetic anomalies and side scan sonar targets identified during the investigation along with thumbnail images for each sonar target. To aid in review, magnetic anomalies have been grouped into three classes based on amplitude [Class 1: ≤ 25 gammas, Class 2: >25 -100 gammas, Class 3: >100 gammas].

Table 3 - Data Processing Software

Data Set	Processing Software
Navigation & Hydrographic Data	HYPACK® Version 17, Single Beam Editor software, QuickSurf Version 5 digital terrain modeling software, Blue Marble's Geographics Global Mapper software package Version 13.
Side Scan Sonar Imagery	Chesapeake Technologies, Inc. SonarWiz, Version 7, side scan sonar processing software.
Magnetometer Data	HYPACK® Version 13, Single Beam Editor software.
Subbottom Profile Data	Chesapeake Technologies, Inc. SonarWiz, Version 7, subbottom processing software.

In order to expedite the review process, data products were shared with the CEC Team as soon as completed. Online meetings were conducted (between OSI and CEC) to review the preliminary findings and develop a vibratory coring plan. Once the coring plan was developed, RCG&A Project archaeologists were provided processed data to review and determine if bottom-disturbing activities (vibratory coring) might impact any potential submerged archaeological/cultural resources in the TAs.

To illustrate the results of the investigation and data analysis, nine (9) Project drawings (which include a total of thirty (30) Project drawing sheets) were constructed on ANSI B size drawing sheets (11 by 17 inches). Drawing 1 provides an overview of the reconnaissance survey TAs, Drawings 2-6 present data for each TA, and Drawings 7-9 present data for the pipeline corridor. Drawings 2-6 include sheets A-E presenting tracklines, hydrography, side scan sonar and

magnetometer results, interpreted sand thickness and represented profiles, respectively. Table 4 summarizes scales and the data presented on each drawing sheet.

Table 4 - Summary of Project Drawings

Project Drawing	Drawing Designation (scale)	Data Presented
1	Overview (1 inch = 12,000 feet)	Proposed TA(s) and pipeline corridor survey limits, survey vessel tracklines, BOEM lease blocks and charted features. USGS aerial photograph and NOAA chart of area shown in background.
2 - 6A Series	Survey Vessel Tracklines (1 inch = 1,000 feet)	Survey vessel tracklines (with events and run/line designations), historic & Project jet probe locations, proposed reconnaissance vibratory core locations and charted obstructions included as overlay. NOAA chart of area shown in background.
2 - 6B Series	Hydrography (1 inch = 1,000 feet)	One-foot depth contours (referenced to NAVD88) overlain on colorized image of modeled depth surface based on processed sounding data. Proposed reconnaissance vibratory core locations included as overlay. NOAA chart of area shown in background.
2 - 6C Series	Side Scan Sonar & Magnetic Data (1 inch = 1,000 feet)	Side scan sonar mosaic overlain by individual sonar target and magnetic anomaly locations and designations. Magnetic anomalies grouped into three Classes based on amplitude. Historic & Project jet probe locations, proposed reconnaissance vibratory core locations included as overlay. NOAA chart of area shown in background.
2 - 6D Series	Interpreted Sand Thickness (1 inch = 1,000 feet)	One-foot contours of interpreted sand thickness (based on subbottom data) overlain on colorized image of modeled thickness. Historic & Project jet probe locations, proposed reconnaissance vibratory core locations and interpreted profile sections (presented on the E sheet) included as overlay. NOAA chart of area shown in background.
2 - 6E Series	Subbottom Profiles (horizontal 1 inch = 1,000 feet, vertical 1 inch = 20 feet)	Representative chirp subbottom profile sections for the TAs, where interpreted sand thickness is highlighted in yellow. Overview of profile locations included on D version drawing sheets.
7, 8, 9	Pipeline Corridor (1 inch = 1,000 feet)	Two-panel drawing of pipeline corridor: upper panel presents survey vessel tracklines (with events and run/line designations) and one-foot depth contours (referenced to NAVD88) overlain on colorized image of modeled depth surface. The lower panel presents side scan sonar mosaic overlain by individual sonar target and magnetic anomaly locations and designations. Magnetic anomalies grouped into three Classes based on amplitude. NOAA chart of area shown in background of both panels.

All drawings are presented in full size in Appendix 2. Digital drawing files (AutoCAD and PDF formats), a copy of this report (PDF format), chirp subbottom profiles (jpg format) and a survey trackline log (PDF format) are provided in the report's digital appendix along with ASCII files containing processed soundings. Also included in the digital appendix is a copy of the approved data collection plan and the FL 1A-32 and BOEM Authorization permits. All raw digital data files acquired during the survey (HYPACK, side scan sonar, and subbottom profile) will be archived in-house.

4.0 DATA ANALYSIS AND DISCUSSION

Hydrographic, subbottom profiling and magnetometer data together with side scan sonar imagery documented current seafloor and subsurface conditions along the reconnaissance tracklines investigated within the sand TAs and pipeline corridor. The following presents a brief synopsis of conditions documented in the TAs and corridor and concludes with recommendations for geotechnical samples to be acquired during the planned follow-up reconnaissance vibratory coring investigation. Depth references are in feet relative to NAVD88. Stationing in the corridor is in feet and originates on Lovers Key.

4.1 Surface Data Review

Within the five TAs, hydrographic data were processed and contoured. LK-P1, P2 and P6 appear to have features resembling ridges exhibiting approximately 5 to 14 feet of relief from the surrounding seafloor. No ridges were identified in LK-P4 and P5. The seafloor within these areas gradually slopes offshore. Water depths in the TAs ranged from 10 feet in LK-P5 to more than 56 feet in LK-P1. The seafloor gradually slopes offshore (10 to 34 feet) in the pipeline corridor.

Side scan sonar imagery was acquired along all tracklines. Due to the wide trackline spacing of the reconnaissance survey, full sonar bottom coverage was not attained within the TAs. Near full bottom coverage was attained in the pipeline corridor. Sonar mosaics show the seafloor to

be generally featureless in most areas with no large scale bedforms. Small scale sand waves were observed in several areas but in general they were not prevalent. LK-P1, P2 and P6 contained areas of potential hardbottom exposure along their outer limits.

Side scan sonar imagery and magnetometer data were reviewed to identify features that potentially could impact the Project. No anomalies or sonar targets were identified in LK-P1. In total, 160 magnetic anomalies and 70 side scan sonar targets were identified throughout the remaining four TAs and pipeline corridor. In general, the magnetic anomalies detected were isolated, small in amplitude (Class 1, <25 gammas) and did not have a correlative side scan sonar target association. Only nine anomalies exceeded 100 gammas (Class 3). The vast majority of side scan sonar targets and anomalies were detected in LK-P5 and the corridor. Several groupings of anomalies were detected in these areas and one suspect alignment of anomalies was observed across the corridor near Sta. 33+00 (M112, M133, M81, M116 and M93). It is unclear what the alignment of anomalies is associated with as there is no side scan sonar target present or charted utility in the area.

Side scan sonar targets identified were also generally small (<10 feet in length) and exhibited only minimal relief (<3 feet of relief). Targets identified are described as either oblong or linear. None of the sonar targets identified during the reconnaissance survey appear as a recognizable manmade feature. Only two sonar targets had magnetic anomaly associations. Table 5 summaries the minimum and maximum water depths measured as well as the number of anomalies and targets identified in each area. For additional information regarding the magnetic anomalies and sonar targets identified refer to the summary tables presented in Appendix 1.

Table 5 - Summary of Depth, Anomalies and Sonar Targets

Area Designation	Minimum Water Depth[1]	Maximum Water Depth[1]	Magnetic Anomalies	Side Scan Sonar Targets
LK-P1	31	56	0	0
LK-P2	34	43	0	7
LK-P4	32	42	20	8
LK-P5	10	21	88	18
LK_P6	27	36	1	2
Pipeline Corridor	5	34	51	35

[1]Water depths in feet, referenced to NAVD88.

4.2 Subsurface Data Review

Subbottom profile data (boomer and chirp) acquired throughout the areas showed subsurface penetration and resolution of reflectors at depth. In general, the boomer subbottom profiler attained deeper penetration than the chirp system and often resolved continuous reflectors below the seabed at depth whereas the chirp system generally attained less penetration but was of higher resolution.

Subbottom profiler data were analyzed in an effort to map reflectors at the base of the surficial ridges in LK-P1, P2 and P6. Historic data suggest that nearsurface sands will be concentrated in these ridges. Reflectors at the base of the sand ridges are interpreted to represent a transition from sandy sediments overlying fragmented or a semi-lithified limestone layer. Limited probe data in these areas support this interpretation. Figure 3 presents three sections of chirp and boomer subbottom profile data acquired along the same survey lines in the LK-P1, P2 and P6 that illustrate the resolution of each subbottom profiling system and the mapping of sand. In these profiles the interpreted sand body is highlighted in yellow. Note the general restriction in subbottom penetration below the reflector marking the base of the sand. This reflector is interpreted as the upper surface of a limestone layer. In some cases, the boomer subbottom profiler attained partial penetration below this layer suggesting it may be fragmented or semi-lithified.

Subbottom profiler data acquired in LK-P4 and P5 appear more complex than in LK-P1, P2 and P6. The interpreted sand deposit does not resemble a ridge or mound type feature composed of a homogeneous deposit; instead, it appears more like an infill feature overlying an irregular possibly eroded surface. Internal reflectors within the interpreted sand body suggest that it may be a mix of various sediment types. Figure 4 presents two sections of chirp and boomer subbottom profile data acquired along the same survey line in the LK-P4 and P5 that illustrate the mapping of sand in these areas. Note the relic channel cut feature observed in LK-P5 and the deeper penetration attained by the boomer in both areas.

Throughout the five TAs, the base of the interpreted sand deposit was mapped for each survey line and cross checked by review of the intersecting tielines. Preliminary sand volume estimates were calculated for each of those areas using the shallow reflector mapped below the deposit as the base of the potential resource with a minimum of four (4) feet of sediment thickness. The results of these calculations are summarized in Table 6. It is important to note that these volume estimates are "order of magnitude" based solely on reconnaissance level geophysical data and have not been verified with direct measurements (i.e. coring results).

Table 6 - Preliminary Sand Volume Estimates based on Reconnaissance Geophysical Survey

Area Designation	Area Contained w/i Minimum 4 ft Thickness (sqft)	Total Volume w/i Minimum 4 ft Thickness Area (cyd)	Max Thickness	Average Thickness >4 ft
LK-P1	26,687,300	12,304,200	22.8	12.6
LK-P2	9,423,490	1,842,400	12.3	5.3
LK-P4	43,010,070	15,363,000	24.4	10.8
LK-P5	31,035,350	12,062,200	22.5	10.5
LK_P6	8,205,330	1,677,700	9.8	5.8

4.3 Reconnaissance Vibratory Core Recommendations

Based on the analysis of the HRG data acquired during the reconnaissance survey, fifteen (15) primary vibratory core locations and five (5) supplemental/alternate locations are proposed for the reconnaissance vibratory coring investigation to groundtruth the interpretation presented herein. Proposed core locations are based on a joint review process by OSI and CEC. The proposed vibratory cores have been strategically placed within in the TAs to sample specific subbottom reflectors and to aid in the final data interpretation, mapping, and grain size analyses of the potential sand resources. All cores proposed have been positioned away from any of the isolated anomalies or side scan sonar targets detected during the reconnaissance survey.

Table 7 provides a listing of the state plane and geographical coordinates of each of the proposed reconnaissance core locations along with water depth and recommended core length at each station. It is anticipated that the reconnaissance core program will be a dynamic investigation driven by field results. Supplemental/alternate core locations will be investigated based on

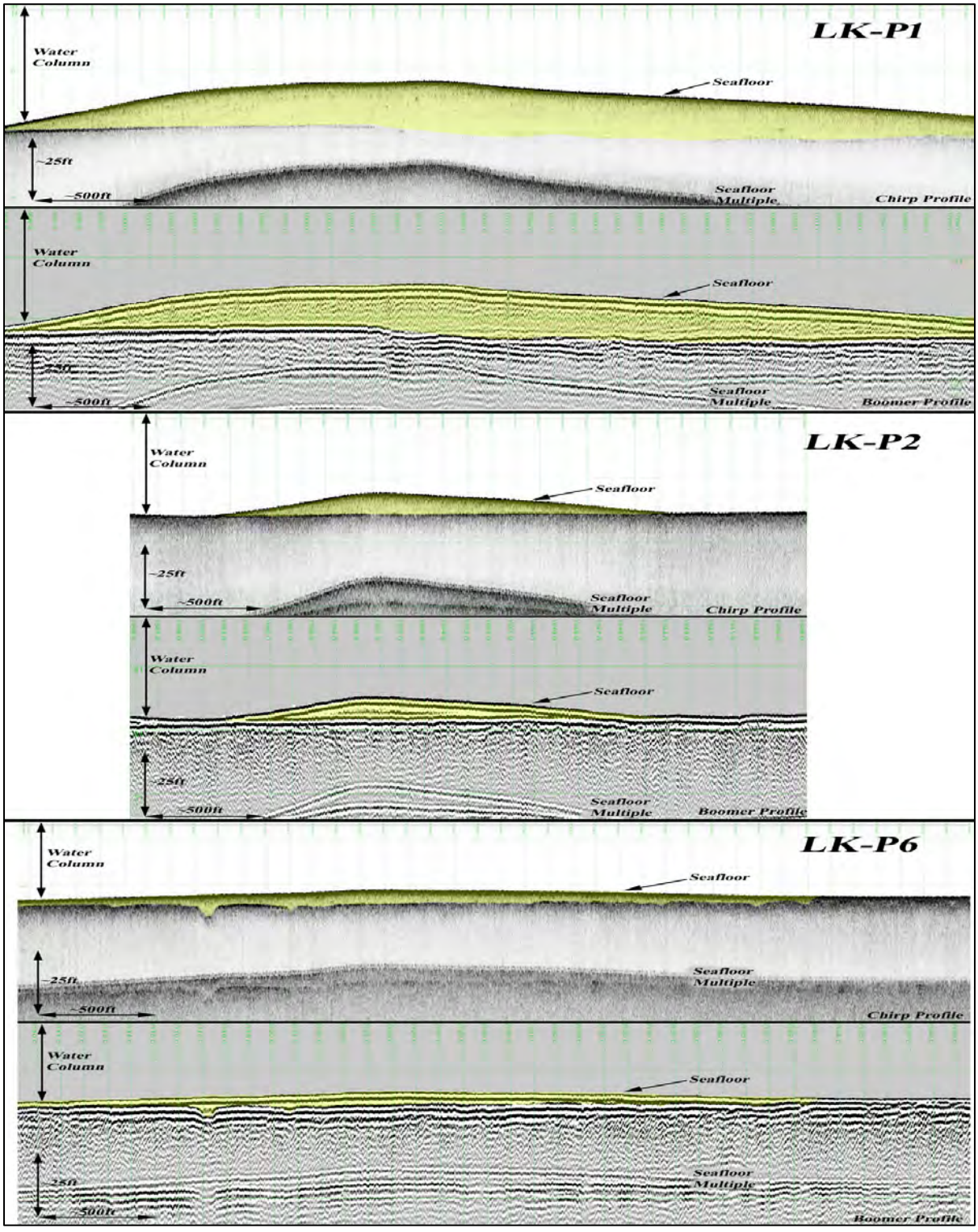


Figure 3. Chirp (upper) and boomer (lower) subbottom profiles acquired in the LK-P1, P2 and P6 illustrating the ridges identified in these TAs. Note interpreted surficial sand deposit shaded yellow and lack of subbottom penetration below the interpreted deposit. The seafloor multiple is the second reflected return of the seafloor in the profiles and does not represent a deeper reflector resolved by the systems.

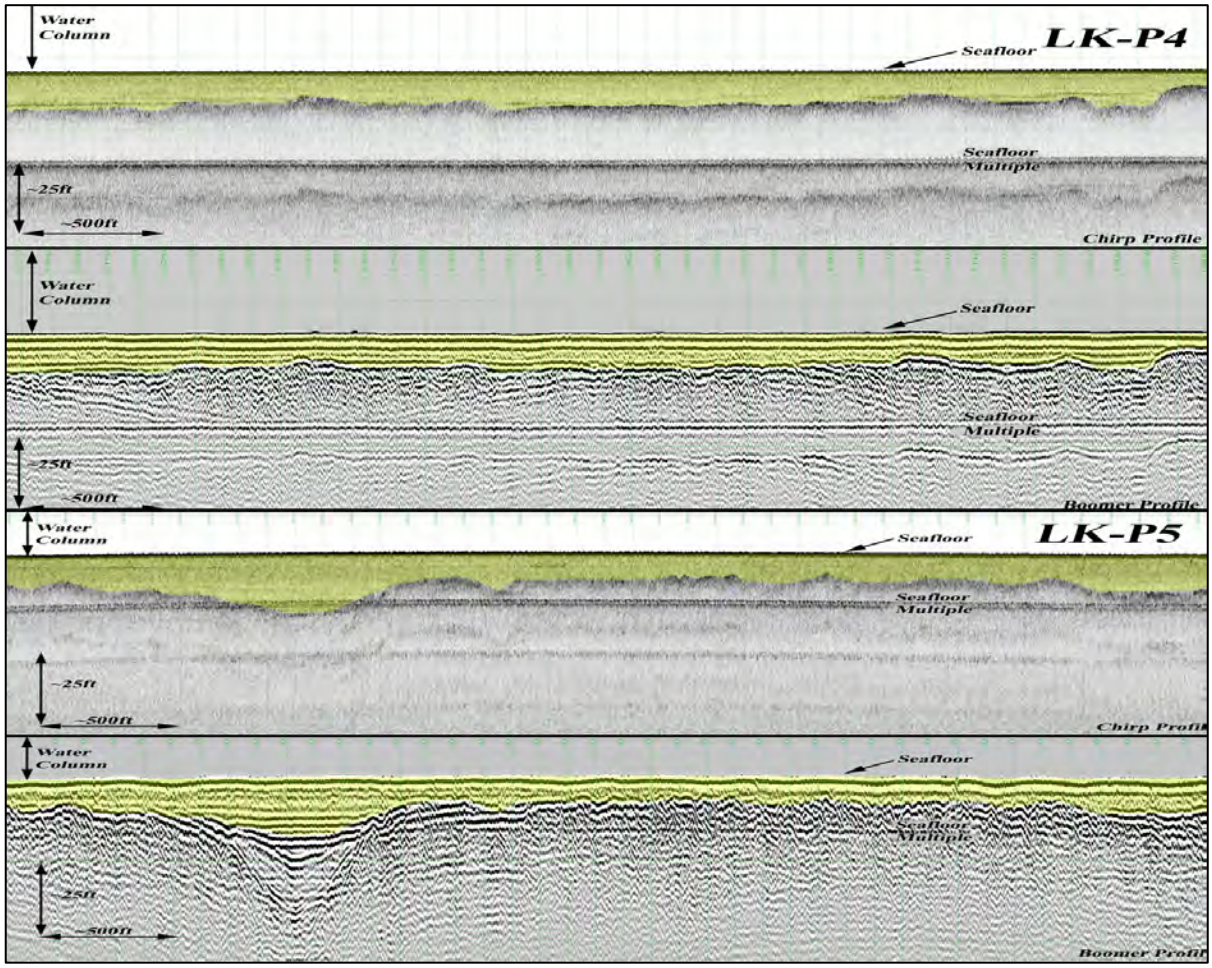


Figure 4. Chirp (upper) and boomer (lower) subbottom profiles acquired in the LK-P4 and P5 illustrating the interpreted sand deposit in these TAs. Note the slightly deeper penetration attained by the boomer system versus the chirp. The seafloor multiple is the second reflected return of the seafloor in the profiles and does not represent a deeper reflector resolved by the systems.

sediments recovered in the primary core locations. All cores in LK-P1 are planned as 20-foot length, the remaining cores are planned as 10-foot length. If time and budget permits, it is recommended that several of the cores in LK-P4 and P5 be extended to 20 feet.

RCG&A archaeologists have reviewed the geophysical data acquired in the vicinity of the proposed core locations. Appendix 3 includes copies of their geoarchaeological review letters for reconnaissance level vibratory coring ("Geoarchaeological Review of Three (3) Vibracores from Sand Target Area, LK-P1, Lee County Lovers Key Beach Nourishment Project, Gulf of Mexico, Offshore Florida", August 11, 2020 and "Geoarchaeological Review of 17 Vibracores from Four Sand Target Areas (LK-P2, LK-P4, LK-P5, and LK-P6) Lee County Lovers Key

Beach Nourishment Project, Gulf of Mexico, Offshore Florida", August 17, 2020). These letters conclude that the bottom disturbing activities associated with the acquisition of the reconnaissance vibracores will not impact any potential archaeological resources and that no historic properties that are eligible for the National Register of Historic Places were detected at the proposed sampling locations.

Following conclusion of the proposed vibratory coring program, the cores will be analyzed and sub-sampled for grain size to determine sand suitability within each core using criteria established by the Project team. Once core analysis is completed the subbottom data acquired during the current task will be re-evaluated (with respect to core findings) to update the data interpretation and to plan more detailed geophysical/cultural resource surveys and borrow area geotechnical sampling. Future survey and sampling investigations will be designed to further characterize sediments and estimate sediment volumes within the potential borrow areas.

Table 7 - Proposed Reconnaissance Vibratory Core Locations

Proposed Reconnaissance VC Designation (Recommended Core Length)[1]	Easting[2]	Northing[2]	Latitude[3]	Longitude[3]	Water Depth[4]
VC-20_1-1 (20FT)	534673	745847	26.385129	-82.371115	36.1
VC-20_1-2 (20FT)	536033	744381	26.381107	-82.366951	34.5
VC-20_1-3 (20FT)	537374	742904	26.377056	-82.362840	32.0
VC-20_2-1 (10FT)	577801	741049	26.372212	-82.239351	37.3
VC-20_2-2 (10FT)	580073	739051	26.366726	-82.232401	35.0
VC20_2-3 (10FT) *	581423	736225	26.358957	-82.228263	38.0
VC-20_6-1 (10FT)	591587	752378	26.403444	-82.197297	30.5
VC-20_6-2 (10FT)	592880	750849	26.399244	-82.193341	29.0
VC-20_6-3 (10FT) *	593705	750256	26.397616	-82.190817	31.0
VC-20_5-1 (20FT)	662787	757168	26.416756	-81.979772	15.0
VC-20_5-2 (20FT)	666580	758163	26.419492	-81.968183	14.3
VC-20_5-3 (20FT)	665232	755028	26.410868	-81.972303	16.8
VC-20_5-4 (20FT)	667591	755321	26.411673	-81.965095	17.1
VC-20_5-5 (20FT) *	665044	756737	26.415571	-81.972876	13.3
VC-20_5-6 (20FT) *	663673	755346	26.411745	-81.977065	17.6
VC-20_4-1 (20FT)	650400	717022	26.306307	-82.017604	40.1
VC-20_4-2 (20FT) *	650834	714734	26.300011	-82.016278	40.2
VC-20_4-3 (20FT)	654338	717720	26.308227	-82.005583	36.1

Proposed Reconnaissance VC Designation (Recommended Core Length)[1]	Easting[2]	Northing[2]	Latitude[3]	Longitude[3]	Water Depth[4]
VC-20_4-4 (10FT)	656882	720329	26.315405	-81.997816	33.0
VC-20_4-5 (10FT)	658664	721657	26.319060	-81.992375	33.0

[1]Proposed reconnaissance vibratory core designation. Supplemental/alternate locations identified with an asterisk *.
[2]Grid coordinates are referenced to Florida State Plane Coordinate System, West Zone (0902), NAD 83.
[3]Geographical coordinates are decimal degrees referenced to NAD 83.
[4]Water Depths are in feet and referenced to NAVD88.

5.0 REFERENCES

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APPENDIX 1

SUMMARY TABLES OF MAGNETIC ANOMALIES, SIDE SCAN SONAR TARGETS AND SIDE SCAN SONAR TARGET REPORTS

MAGNETIC ANOMALIES

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M1	668453.2	759693.8	26.423702	81.962457	M-	64	72	11	142.3		5	2	7/0
M2	667090.3	759339.8	26.422729	81.966622	M+	12	22	10	156.4		5	1	7/0
M3	666888.1	759276.3	26.422555	81.967239	M-	11	33	10	158.5		5	1	7/0
M4	666214.2	759091.8	26.422048	81.969299	Di	63	46	9	165.5		5	2	7/0
M5	665872.5	759023.9	26.421861	81.970343	M-	20	34	8	169.0		5	1	7/0
M6	665844.5	759014.3	26.421835	81.970428	M+	5	17	8	169.3		5	1	7/0
M7	665803.4	759002.1	26.421801	81.970554	M-	15	34	8	169.7		5	1	7/0
M8	665229.8	758853.3	26.421392	81.972307	M-	12	17	6	175.6		5	1	7/0
M9	665081.4	758802.2	26.421252	81.972760	M+	10	30	6	177.2		5	1	7/0
M10	664961.2	758773.6	26.421173	81.973128	M+	5	22	6	178.4		5	1	7/0
M11	664899.9	758767.4	26.421156	81.973315	M-	14	21	6	179.1		5	1	7/0
M12	664671.1	758706.5	26.420989	81.974014	Di	25	28	6	181.4		5	2	7/0
M13	664170.0	758579.6	26.420640	81.975545	Di	13	39	6	186.6		5	1	7/0
M14	663275.8	758348.8	26.420005	81.978278	Di	132	57	7	195.8		5	3	7/0
M15	661610.0	756880.4	26.415966	81.983368	Di	7	41	11	226.6		5	1	8/0
M16	665074.2	757771.7	26.418416	81.972783	M-	9	29	7	262.6		5	1	8/0
M17	665738.1	757945.3	26.418894	81.970754	Di	10	45	8	269.2		5	1	8/0
M18	665879.8	757979.9	26.418989	81.970321	M-	28	30	8	270.7		5	2	8/0
M19	666238.9	758074.9	26.419250	81.969224	M+	25	38	9	274.4		5	2	8/0
M20	667070.0	758302.9	26.419877	81.966684	Di	23	52	10	283.0		5	1	8/0
M21	667114.4	758320.9	26.419926	81.966549	M+	7	23	10	283.5		5	1	8/0
M22	667192.1	758331.4	26.419955	81.966311	M+	5	30	10	284.3		5	1	8/0
M23	667655.5	758447.4	26.420274	81.964895	M-	30	40	11	289.0		5	2	8/0
M24	667802.1	757430.6	26.417476	81.964448	M+	15	42	11	300.1		5	1	9/0

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M25	667498.5	757372.4	26.417316	81.965376	M+	18	73	10	303.2		5	1	9/0
M26	667447.8	757355.2	26.417269	81.965531	M-	24	32	10	303.7		5	1	9/0
M27	667413.2	757343.7	26.417237	81.965636	M-	133	35	10	304.1		5	3	9/0
M28	667385.0	757335.3	26.417214	81.965723	M-	102	36	10	304.4		5	3	9/0
M29	665824.1	756940.8	26.416130	81.970492	M+	9	18	8	320.5		5	1	9/0
M30	665773.7	756927.2	26.416093	81.970646	M-	26	29	8	320.9		5	2	9/0
M31	665339.4	756816.0	26.415787	81.971973	M-	16	46	8	325.5		5	1	9/0
M32	665305.3	756805.6	26.415758	81.972077	Cd	24	35	8	325.8		5	1	9/0
M33	663452.2	756330.4	26.414452	81.977740	Di	41	47	10	344.9		5	2	9/0
M34	663350.5	755264.2	26.411519	81.978051	M+	7	32	13	382.3		5	1	10/0
M35	664079.9	755455.5	26.412045	81.975822	M+	5	19	11	389.8		5	1	10/0
M36	664819.2	755641.8	26.412557	81.973563	Di	19	35	10	397.4		5	1	10/0
M38	665305.7	755767.8	26.412903	81.972077	M-	17	28	10	402.2		5	1	10/0
M39	665350.0	755780.1	26.412937	81.971942	M+	16	30	10	402.9		5	1	10/0
M40	665702.5	755875.4	26.413199	81.970865	M-	10	24	9	406.6		5	1	10/0
M41	667816.7	756415.2	26.414683	81.964404	M+	8	23	11	428.4		5	1	10/0
M42	668175.7	756509.8	26.414943	81.963307	M+	7	34	11	432.1		5	1	10/0
M43	668824.7	755647.5	26.412570	81.961325	M+	9	22	12	437.8		5	1	11/0
M44	668811.2	755644.1	26.412560	81.961366	M-	8	17	12	437.9		5	1	11/0
M45	668740.1	755621.4	26.412498	81.961584	M-	9	30	12	438.7		5	1	11/0
M46	668653.2	755591.3	26.412415	81.961849	M+	14	31	12	439.6		5	1	11/0
M47	667917.9	755413.1	26.411926	81.964096	M-	18	39	11	447.2	S37	5	1	11/0
M48	666874.2	755144.9	26.411188	81.967285	Di	42	46	11	457.9		5	2	11/0
M49	666760.8	755113.8	26.411103	81.967632	M+	5	20	11	459.2		5	1	11/0
M50	666212.3	754978.1	26.410730	81.969308	M-	7	28	11	464.8		5	1	11/0
M51	666146.1	754957.6	26.410674	81.969510	M-	26	30	11	465.5		5	2	11/0

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M52	665496.7	754787.6	26.410206	81.971494	M+	27	60	11	472.2		5	2	11/0
M53	663914.9	754381.9	26.409091	81.976327	M-	13	28	13	488.5		5	1	11/0
M54	665131.4	755422.3	26.411953	81.972610	M-	10	33	10	516.6		5	1	12/0
M55	664789.5	756786.3	26.415706	81.973653	M-	20	34	7	530.7		5	1	12/0
M56	664781.4	756830.0	26.415826	81.973678	M-	78	53	7	531.1	S30	5	2	12/0
M57	664276.2	758771.5	26.421168	81.975221	M-	5	12	6	551.2		5	1	12/0
M58	664781.5	756826.1	26.415815	81.973678	M-	149	52	7	583.9	S30	5	3	13/0
M59	664792.8	756781.9	26.415694	81.973643	M-	18	28	7	584.4		5	1	13/0
M60	665469.9	754131.5	26.408401	81.971576	M-	16	25	12	611.8		5	1	13/0
M61	666793.5	754986.8	26.410754	81.967532	Di	26	44	11	638.3		5	2	14/0
M62	666775.9	755086.8	26.411029	81.967585	Cd	29	74	11	639.3		5	2	14/0
M63	666613.7	755719.2	26.412769	81.968081	M-	9	32	10	645.8		5	1	14/0
M64	666599.1	755755.4	26.412868	81.968125	M+	7	24	10	646.2		5	1	14/0
M65	666425.9	756425.2	26.414711	81.968654	M+	9	25	9	653.1		5	1	14/0
M66	666397.2	756568.0	26.415104	81.968741	Di	36	42	9	654.5		5	2	14/0
M67	666350.2	756732.1	26.415556	81.968885	Di	95	56	8	656.2		5	2	14/0
M68	666227.2	757223.0	26.416906	81.969260	M-	7	20	8	661.3		5	1	14/0
M69	666200.7	757320.7	26.417175	81.969341	M-	42	25	8	662.3		5	2	14/0
M70	666151.0	757485.9	26.417630	81.969493	Di	63	45	8	664.0		5	2	14/0
M71	665974.9	758159.5	26.419483	81.970031	Di	52	33	7	670.9		5	2	14/0
M72	665929.9	758371.2	26.420065	81.970168	M+	5	22	7	673.2		5	1	14/0
M73	665764.7	758984.1	26.421752	81.970672	M+	6	16	7	679.5		5	1	14/0
M74	592962.0	749579.9	26.395751	82.193084	Di	46	105	15	2354.3		6	2	48/11
M75	660286.6	723766.4	26.324862	81.987422	M-	14	77	16	2630.7		4	1	55/32
M76	660306.5	722636.1	26.321753	81.987361	M-	12	71	15	2705.1		4	1	57/49
M77	660053.5	722480.5	26.321325	81.988134	M-	11	76	15	2708.1		4	1	57/49

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M78	655005.9	719480.4	26.313071	82.003544	Di	12	86	16	2781.7		4	1	58/71
M79	660040.6	722440.3	26.321214	81.988173	M+	28	80	14	2842.8		4	2	61/1
M80	660291.7	722731.5	26.322015	81.987406	M+	49	78	14	2846.6		4	2	61/1
M81	667146.8	730784.2	26.344167	81.966472	M-	17	52	15	2952.4		c	1	61/1
M82	683250.1	741194.6	26.372788	81.917279	M+	7	38	15	3175.7		c	1	63/1
M83	683379.1	741275.5	26.373010	81.916885	M+	27	58	15	3177.2		c	2	63/1
M84	692631.8	745856.2	26.385594	81.888612	Di	392	58	7	3301.7		c	3	64/4
M85	683623.6	741102.8	26.372535	81.916138	M-	9	31	18	3403.6		c	1	64/4
M86	683532.7	741055.6	26.372405	81.916416	M+	14	32	19	3404.6		c	1	64/4
M87	683475.4	741019.5	26.372306	81.916591	Di	38	47	18	3405.3		c	2	64/4
M88	683335.1	740946.9	26.372106	81.917020	Cd	300	122	18	3406.9		c	3	64/4
M89	683246.1	740901.8	26.371982	81.917292	M+	27	30	19	3407.9		c	2	64/4
M90	660193.6	723379.9	26.323799	81.987706	M-	33	78	14	3544.2		4	2	65/3
M91	664954.5	728996.9	26.339251	81.973167	M+	9	50	14	3623.7		c	1	66/3
M92	665385.0	729495.7	26.340623	81.971852	Di	37	79	14	3630.3		c	2	66/3
M93	667070.9	731490.9	26.346111	81.966703	M+	20	88	15	3656.4		c	1	66/3
M94	667322.6	731772.5	26.346885	81.965934	M-	13	81	15	3660.2		c	1	66/3
M95	673631.2	736693.8	26.360419	81.946664	M-	45	76	14	3741.7		c	2	66/3
M96	682713.3	741480.1	26.373574	81.918918	Di	30	77	17	3874.3		c	2	68/3
M97	682929.5	741594.8	26.373890	81.918257	Cd	20	117	16	3876.7		c	1	68/3
M98	690889.9	745784.3	26.385400	81.893933	M+	18	44	6	3981.7		c	1	69/3
M99	692099.5	746440.0	26.387201	81.890237	Di	10	35	3	4001.2		c	1	70/16
M100	692328.2	746128.6	26.386344	81.889539	M+	27	37	3	4005.1		c	2	70/16
M101	692414.8	746001.3	26.385993	81.889275	M-	13	28	3	4006.6		c	1	70/16
M102	692576.1	745775.6	26.385372	81.888782	M+	5	13	3	4009.4		c	1	70/16
M103	692627.1	745707.9	26.385186	81.888627	M-	6	22	5	4010.3		c	1	70/16

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M104	693676.9	746124.4	26.386329	81.885419	Di	12	18	4	4022.2		c	1	71/5
M105	693138.2	745838.2	26.385543	81.887065	M+	6	11	3	4028.3		c	1	71/5
M106	692474.4	745485.5	26.384574	81.889094	M+	128	31	4	4035.8		c	3	71/5
M107	691970.1	745221.3	26.383848	81.890635	M-	41	24	5	4041.4		c	2	71/5
M108	683592.1	740807.7	26.371723	81.916235	M-	10	39	14	4136.2		c	1	71/5
M109	668344.9	731441.1	26.345973	81.962813	M-	18	62	16	4342.2		c	1	73/5
M110	667490.9	730430.4	26.343193	81.965421	M+	26	72	16	4355.4		c	2	73/5
M111	665097.3	727609.9	26.335435	81.972732	M+	10	58	16	4392.4		c	1	73/5
M112	667227.9	730117.4	26.342332	81.966224	Di	20	56	16	4395.5		c	1	73/5
M113	660239.1	723059.2	26.322917	81.987567	M-	22	90	15	4480.9		4	1	75/2
M114	664967.0	728616.7	26.338205	81.973129	M-	18	89	13	4553.8		c	1	75/2
M115	665415.9	729149.7	26.339671	81.971758	M+	9	39	15	4560.8		c	1	75/2
M116	667108.8	731147.6	26.345166	81.966587	M-	20	72	15	4587.0		c	1	75/2
M117	683565.1	741648.3	26.374036	81.916316	M-	12	30	13	4813.6		c	1	78/2
M118	691183.8	745657.9	26.385051	81.893036	M+	15	19	8	4899.6		c	1	78/2
M119	691187.5	745660.0	26.385057	81.893024	Di	15	26	8	4899.7		c	1	78/2
M120	692704.9	746456.6	26.387245	81.888387	Di	485	53	5	4916.8		c	3	78/2
M121	693330.4	746774.3	26.388118	81.886476	M+	16	11	3	4923.8		c	1	78/2
M122	692143.2	746449.1	26.387226	81.890103	M-	5	7	3	4944.3		c	1	79/3
M123	683540.5	740492.4	26.370856	81.916393	M+	33	54	15	5024.8		c	2	80/101
M124	683500.4	740469.9	26.370794	81.916516	M+	5	25	15	5025.3		c	1	80/101
M125	681865.2	739338.9	26.367685	81.921512	Di	8	31	15	5105.2		c	1	81/102
M126	683040.2	739955.3	26.369379	81.917922	M+	8	28	16	5118.5		c	1	81/102
M127	683553.7	740223.4	26.370115	81.916354	Di	414	132	15	5124.3		c	3	81/102
M128	683704.9	740303.9	26.370337	81.915892	M+	14	27	16	5125.9		c	1	81/102
M129	683788.5	740346.5	26.370454	81.915636	M-	27	36	16	5126.9		c	2	81/102

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M130	684261.2	740312.3	26.370359	81.914193	M-	11	44	15	5201.3		c	1	82/103
M131	683863.1	740100.6	26.369777	81.915409	M+	5	54	16	5205.8		c	1	82/103
M132	683822.2	740079.4	26.369719	81.915534	Di	12	59	15	5206.3		c	1	82/103
M133	667183.9	730462.3	26.343281	81.966359	M-	22	54	13	5609.1		c	1	89/4
M134	651098.5	718644.6	26.310771	82.015471	M-	14	52	14	5925.8		4	1	93/4
M135	651090.0	718682.5	26.310875	82.015497	M-	12	53	14	5926.3		4	1	93/4
M136	651078.0	718746.8	26.311052	82.015534	M+	16	55	14	5926.8		4	1	93/4
M137	650313.5	717450.3	26.307485	82.017867	M+	57	79	14	5953.5		4	2	94/5
M138	650334.2	717322.0	26.307132	82.017804	M+	15	28	12	5954.8		4	1	94/5
M139	650340.5	717293.8	26.307054	82.017785	M+	6	32	13	5955.1		4	1	94/5
M140	650492.0	716556.4	26.305025	82.017322	Di	24	82	14	5962.6		4	1	94/5
M141	650807.7	714864.5	26.300371	82.016358	M-	33	48	14	5979.8		4	2	94/5
M142	648823.2	714649.7	26.299779	82.022415	M+	32	125	12	6128.2		4	2	96/9
M143	648853.0	714518.7	26.299418	82.022324	M+	46	62	14	6129.5		4	2	96/9
M145	653052.3	718840.7	26.311311	82.009507	M+	11	44	15	6269.0		4	1	98/12
M146	649461.8	718825.1	26.311267	82.020468	M+	8	40	16	6305.3		4	1	98/12
M147	663615.8	753282.3	26.406066	81.977242	Di	16	70	14	6329.3		5	1	99/1
M148	665327.6	753723.6	26.407279	81.972011	M-	12	53	13	6346.8		5	1	99/1
M149	666864.8	754122.4	26.408375	81.967315	M-	34	48	11	6362.7		5	2	99/1
M150	668896.2	754647.3	26.409818	81.961108	M-	16	45	11	6383.7		5	1	99/1
M151	666792.7	754986.0	26.410751	81.967534	Di	18	59	11	6408.3		5	1	100/3
M152	666771.8	755069.6	26.410981	81.967598	M-	9	28	11	6409.3		5	1	100/3
M153	666763.7	755100.4	26.411066	81.967623	M+	10	40	11	6409.5		5	1	100/3
M154	666757.1	755126.4	26.411138	81.967643	M-	8	22	12	6409.7		5	1	100/3
M155	666575.3	755795.2	26.412978	81.968198	M-	10	29	11	6416.7		5	1	100/3
M156	666342.8	756733.1	26.415558	81.968908	Di	33	62	9	6426.4		5	2	100/3

Magnetic Anomaly	Easting[1]	Northing[1]	Latitude	Longitude	Type[2]	Amplitude[3]	Duration[4]	Sensor Altitude[4]	Event	Sonar Target Correlation	Area[5]	Class[6]	Run/ Line
M157	666192.0	757317.1	26.417165	81.969368	Di	23	53	9	6432.4		5	1	100/3
M158	666147.7	757486.3	26.417631	81.969503	Di	43	51	8	6434.1		5	2	100/3
M159	666045.3	757862.8	26.418667	81.969816	M+	9	29	8	6438.0		5	1	100/3
M160	665972.8	758163.8	26.419495	81.970037	M+	31	32	8	6441.2		5	2	100/3
M161	665921.8	758371.3	26.420066	81.970193	M+	18	31	6	6443.3		5	1	100/3
M162	667474.6	757381.1	26.417340	81.965449	Cd	67	110	9	6464.4		5	2	101/2

[1]Coordinates are in feet in the FL State Plane Coordinate System, West Zone, NAD 83.
[2]M+ - positive monopole, M- - negative monopole, Di – dipole, Cd – complex dipole.
[3]Amplitude is measured in Gammas (note: 1Gamma (γ) = 1 Nanotesla (nT)
[4]Duration and Sensor Altitude are measured in feet.
[5]Area: 2 = LK-P2; 4 = LK-P4; 5 = LK-P5; 6 = LK-P6; C = Conveyance Corridor (No anomalies detected in Area LK-P1).
[6]Class 1: ≤ 25 gammas, Class 2: >25 -100 gammas, Class 3: >100 gammas.

SIDE SCAN SONAR TARGETS

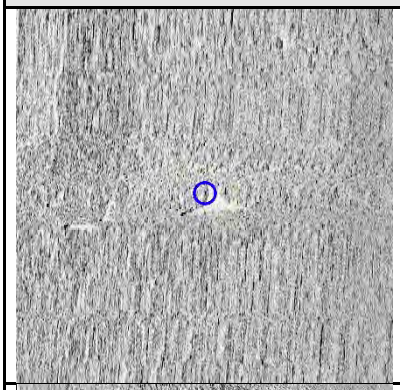
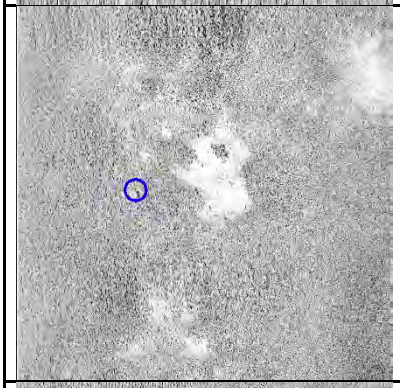
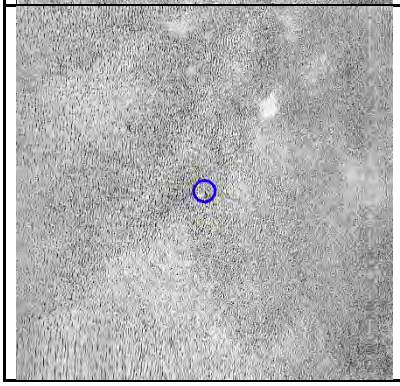
Sonar Target	Easting[1]	Northing[1]	Latitude	Longitude	Length[2]	Width[2]	Height[2]	Area[3]	Description	Magnetic Anomaly
S1	577788.1	742598.1	26.376473	82.239399	8.0	1.3	0.9	2	Oblong object	
S2	578882.1	742247.3	26.375514	82.236056	4.9	1.5	0.8	2	Oblong object	
S3	579001.6	741703.4	26.374018	82.235688	3.8	1.4	1.0	2	Oblong object	
S4	579536.7	740877.7	26.371749	82.234049	4.3	0.9	1.2	2	Oblong object	
S5	580128.7	741644.1	26.373860	82.232245	3.1	1.2	1.0	2	Oblong object	
S6	581424.2	740252.9	26.370039	82.228281	2.6	0.7	1.4	2	Oblong object	
S7	581451.2	740304.5	26.370181	82.228199	4.2	0.9	1.2	2	Oblong object	
S8	591818.7	752865.7	26.404787	82.196592	7.9	1.4	1.0	6	Oblong object	
S9	593430.4	748404.0	26.392518	82.191648	6.0	3.1	0.9	6	Oblong object	
S10	647922.6	718720.2	26.310977	82.025166	5.3	1.4	0.7	4	Group of oblong objects	
S11	648054.0	719223.7	26.312363	82.024766	102.6	25.6	3.2	4	Group of oblong objects/rocks	
S12	650190.7	718790.6	26.311172	82.018243	2.1	1.9	0.9	4	Oblong object	
S13	651343.4	716618.8	26.305197	82.014723	2.6	0.5	0.8	4	Oblong object	
S14	652580.5	717260.8	26.306964	82.010947	0.0	0.0	0.7	4	No obvious object just shadow	
S15	657821.3	719830.9	26.314035	81.994949	4.6	0.7	0.8	4	Oblong object	
S16	661096.6	756721.2	26.415528	81.984937	0.0	0.0	4.0	5	No obvious object just shadow	
S17	661164.2	755542.0	26.412284	81.984731	70.1	12.3	1.0	5	Group of oblong objects	
S18	661198.4	755601.8	26.412448	81.984626	6.5	3.2	1.9	5	Group of oblong objects	
S19	661239.4	755577.0	26.412380	81.984501	21.2	17.0	1.7	5	Oblong object	
S20	661533.7	722037.6	26.320105	81.983615	5.4	1.4	0.6	4	Oblong object	
S21	661551.1	722027.4	26.320078	81.983562	3.5	0.9	1.3	4	Oblong object	
S22	661590.9	755785.1	26.412953	81.983427	3.2	1.6	1.2	5	Two oblong objects	
S23	661846.1	756836.0	26.415844	81.982647	6.2	1.1	1.7	5	Group of oblong objects	
S24	661929.1	724421.5	26.326664	81.982407	2.1	1.8	0.7	C	Oblong object	
S25	662251.0	756966.0	26.416201	81.981410	4.2	1.2	1.1	5	Oblong object	
S26	662348.8	757119.4	26.416623	81.981111	6.4	1.1	0.9	5	Oblong object	

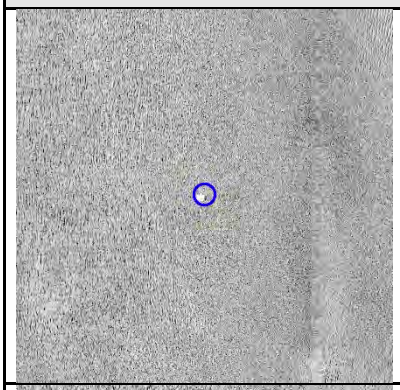
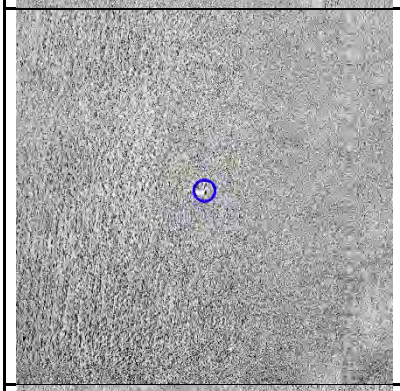
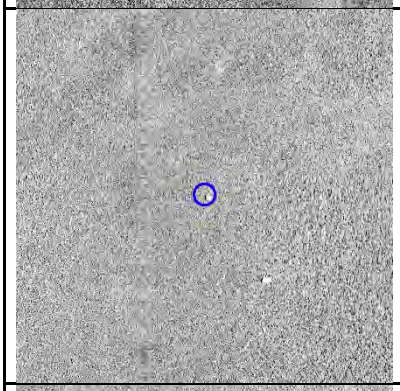
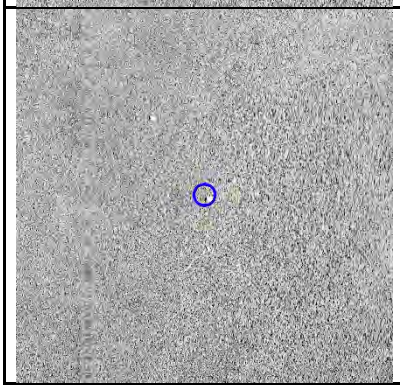
Sonar Target	Easting[1]	Northing[1]	Latitude	Longitude	Length[2]	Width[2]	Height[2]	Area[3]	Description	Magnetic Anomaly
S27	662358.1	757129.4	26.416651	81.981082	2.8	1.2	1.3	5	Oblong object	
S28	662598.0	755304.3	26.411630	81.980350	5.7	0.4	0.8	5	Oblong object	
S29	662960.7	726726.0	26.333004	81.979256	20.0	4.7	3.5	C	Oblong object	
S30	664775.7	756828.2	26.415821	81.973696	11.7	4.5	0.4	5	Oblong object	M56/M58
S31	664866.3	758563.1	26.420594	81.973418	11.3	2.8	0.8	5	Possible fish	
S32	665002.5	753717.0	26.407261	81.973005	5.9	1.7	1.4	5	Oblong object	
S33	665024.4	753545.6	26.406790	81.972938	6.0	2.0	1.3	5	Oblong object	
S34	665508.5	753845.0	26.407613	81.971459	7.9	2.9	0.3	5	Oblong object	
S35	667122.5	758386.8	26.420107	81.966524	12.1	1.1	2.4	5	No obvious object detached shadow	
S36	667686.0	757379.5	26.417336	81.964803	2.9	2.9	1.4	5	Oblong object	
S37	667916.9	755410.9	26.411920	81.964099	0.0	0.0	0.0	5	Possible target on nadir	M47
S38	681029.1	739566.9	26.368314	81.924065	7.1	2.6	1.1	C	Oblong object	
S39	681574.4	738100.8	26.364279	81.922403	16.5	1.0	1.0	C	Linear object	
S40	681592.3	738246.3	26.364679	81.922348	28.1	1.0	0.8	C	Oblong object	
S41	682632.0	741643.0	26.374023	81.919166	79.3	20.0	2.0	C	Group of oblong objects	
S42	682881.2	741691.7	26.374156	81.918405	35.0	9.7	2.8	C	Group of oblong objects	
S43	683274.9	740974.1	26.372181	81.917204	79.6	69.9	1.1	C	Group of oblong objects	
S44	683298.7	741049.9	26.372390	81.917131	6.6	6.6	0.8	C	Two oblong objects	
S45	683380.4	741082.7	26.372480	81.916881	19.7	8.4	3.2	C	Group of oblong objects	
S46	683408.5	740897.7	26.371971	81.916796	51.2	35.3	2.7	C	Group of oblong objects	
S47	683448.0	740850.2	26.371840	81.916675	47.6	13.1	4.5	C	Group of oblong objects	
S48	683493.6	741004.6	26.372265	81.916536	12.4	0.6	3.6	C	Group of oblong objects	
S49	683498.0	740945.0	26.372101	81.916522	2.5	1.4	1.0	C	Oblong object	
S50	683500.5	741222.9	26.372865	81.916514	8.5	2.7	1.6	C	Two oblong objects	
S51	683540.7	740252.3	26.370195	81.916393	37.4	5.8	0.8	C	Group of oblong objects	
S52	683558.4	740594.4	26.371136	81.916339	38.4	5.3	1.2	C	Oblong object	
S53	683598.9	740293.3	26.370308	81.916215	35.3	4.0	1.5	C	Group of oblong objects	

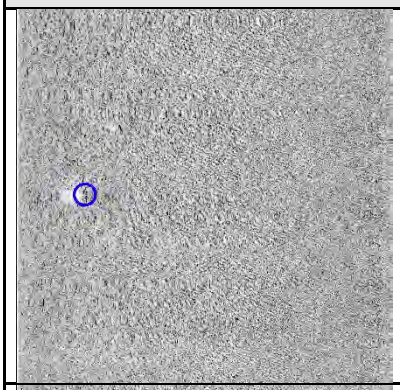
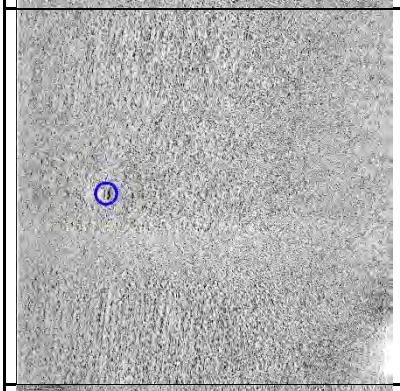
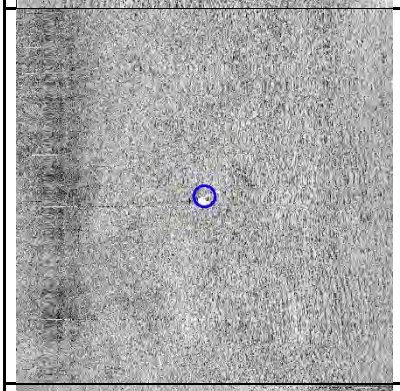
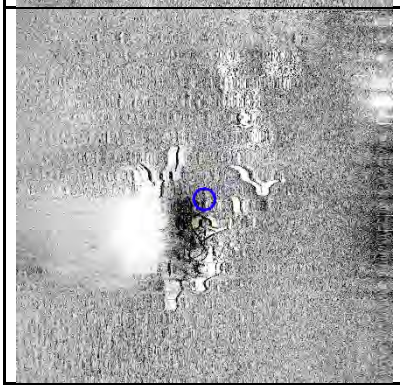
Sonar Target	Easting[1]	Northing[1]	Latitude	Longitude	Length[2]	Width[2]	Height[2]	Area[3]	Description	Magnetic Anomaly
S54	683705.1	741979.3	26.374946	81.915888	23.9	0.6	1.0	C	Linear object	
S55	683755.6	740229.5	26.370132	81.915737	34.7	10.7	4.7	C	Group of oblong objects	
S56	683757.7	741924.5	26.374795	81.915727	3.3	2.3	1.1	C	Oblong object	
S57	683914.1	740316.0	26.370369	81.915253	5.8	2.9	1.0	C	Oblong object	
S58	684066.9	740342.6	26.370443	81.914786	4.1	1.8	1.4	C	Oblong object	
S59	685277.3	740486.1	26.370835	81.911089	26.7	3.5	1.1	C	Linear object	
S60	686317.2	741174.9	26.372728	81.907911	4.6	2.1	0.8	C	Oblong object	
S61	686451.4	742470.5	26.376292	81.907498	3.0	1.6	1.2	C	Oblong object	
S62	687175.0	742039.8	26.375106	81.905289	6.3	4.4	1.5	C	Oblong object	
S63	687216.2	741983.5	26.374951	81.905164	24.7	5.2	1.7	C	Oblong object	
S64	687960.6	743252.9	26.378442	81.902887	6.0	1.0	0.6	C	Oblong object	
S65	689253.9	743982.4	26.380446	81.898935	3.3	1.5	0.6	C	Oblong object	
S66	689334.9	744529.3	26.381951	81.898686	8.9	2.1	1.2	C	Oblong object	
S67	689440.8	744345.1	26.381443	81.898363	1.6	2.2	1.4	C	Oblong object	
S68	689697.6	744393.5	26.381576	81.897578	3.3	0.7	1.2	C	Oblong object	
S69	691138.8	744824.1	26.382757	81.893175	2.8	2.1	1.5	C	Oblong object	
S70	691281.9	745528.8	26.384696	81.892736	9.6	3.2	0.9	C	Oblong object	

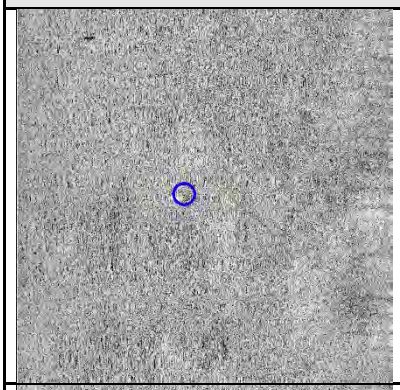
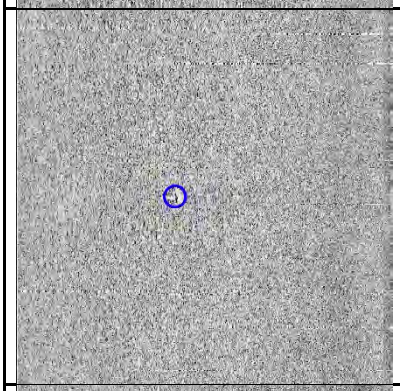
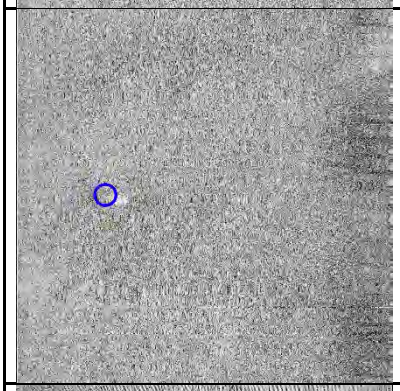
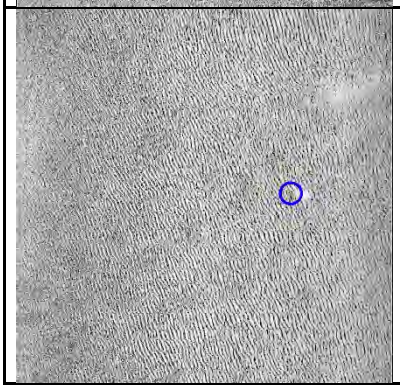
[1]Coordinates are in feet in the FL State Plane Coordinate System, West Zone, NAD 83.
[2]All measurements are in feet.
[3]Area: 2 = LK-P2; 4 = LK-P4; 5 = LK-P5; 6 = LK-P6; C = Conveyance Corridor (No anomalies detected in Area LK-P1).

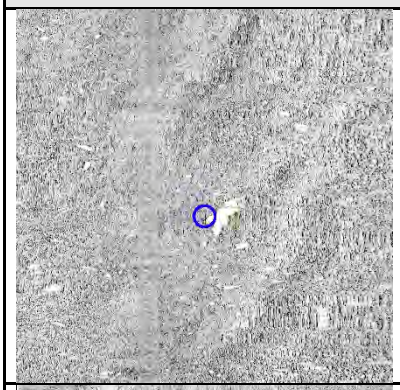
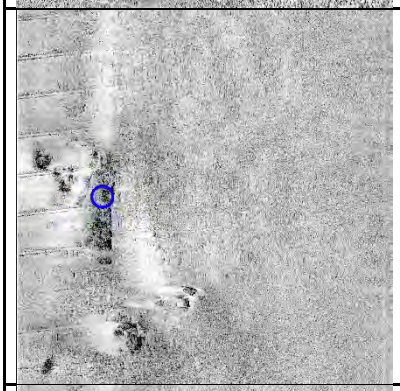
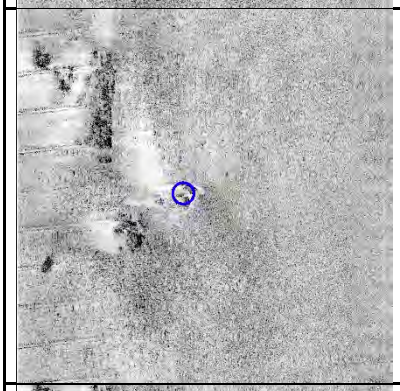
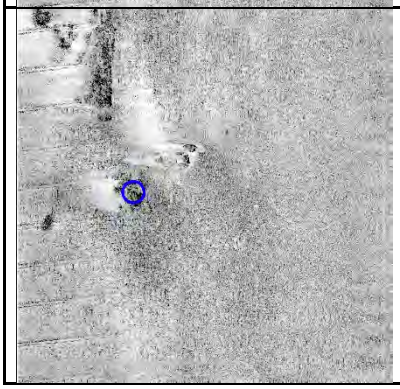
SIDE SCAN SONAR TARGET REPORTS

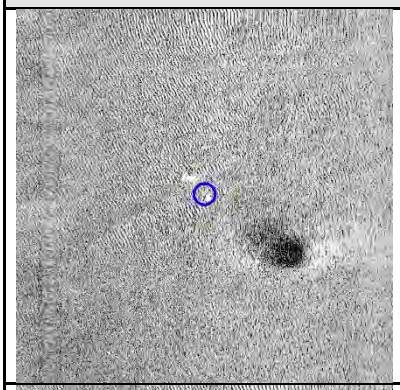
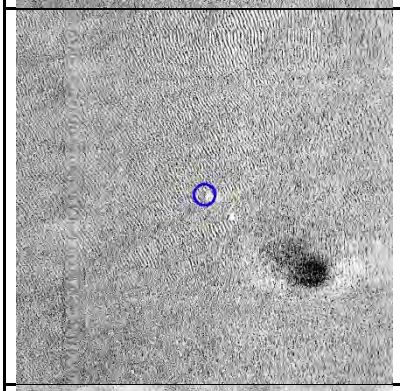
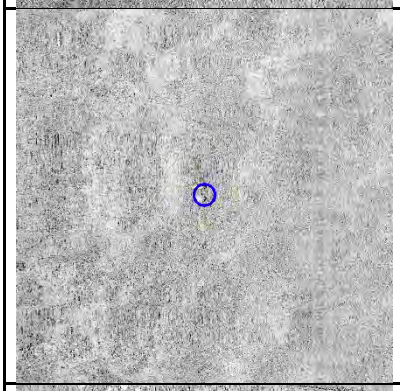
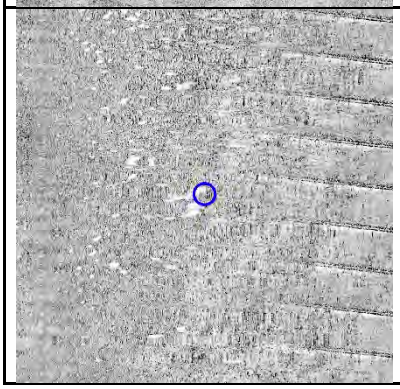
Target Image	Target Info	Description
	**S1** 26.3764730424 -82.2393993151 (WGS84) (X) 577788.09 (Y) 742598.08 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.3 US ft • Target Height: 0.9 US ft • Target Length: 8.0 US ft • Description: Oblong object
	**S2** 26.3755135050 -82.2360557881 (WGS84) (X) 578882.12 (Y) 742247.30 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.5 US ft • Target Height: 0.8 US ft • Target Length: 4.9 US ft • Description: Oblong object
	**S3** 26.3740176413 -82.2356877959 (WGS84) (X) 579001.60 (Y) 741703.37 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.4 US ft • Target Height: 1.0 US ft • Target Length: 3.8 US ft • Description: Oblong object

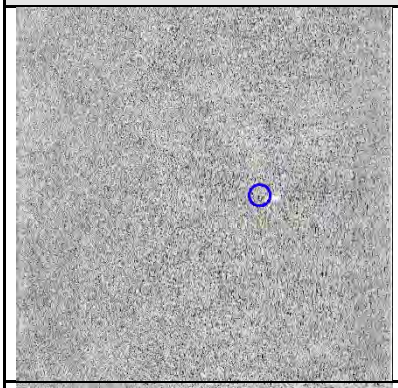
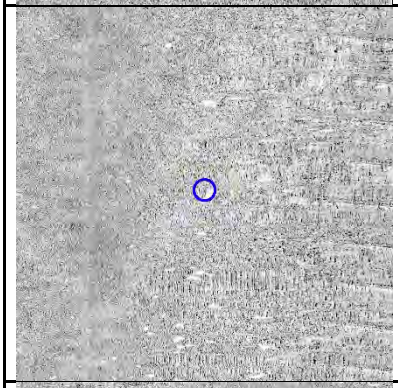
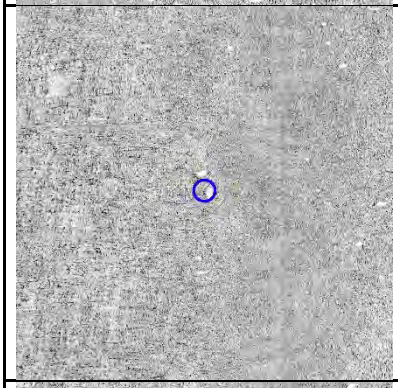
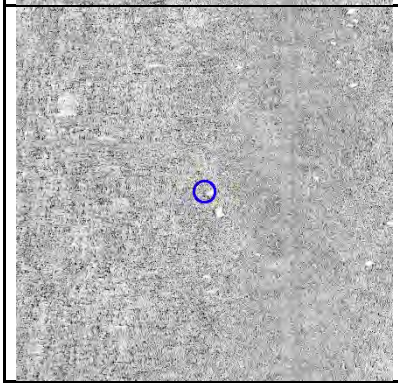
Target Image	Target Info	Description
	**S4** 26.3717486716 -82.2340489241 (WGS84) (X) 579536.68 (Y) 740877.67 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.9 US ft • Target Height: 1.2 US ft • Target Length: 4.3 US ft • Description: Oblong object
	**S5** 26.3738601258 -82.2322448891 (WGS84) (X) 580128.73 (Y) 741644.07 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.2 US ft • Target Height: 1.0 US ft • Target Length: 3.1 US ft • Description: Oblong object
	**S6** 26.3700391935 -82.2282805263 (WGS84) (X) 581424.22 (Y) 740252.93 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.7 US ft • Target Height: 1.4 US ft • Target Length: 2.6 US ft • Description: Oblong object
	**S7** 26.3701813261 -82.2281985221 (WGS84) (X) 581451.16 (Y) 740304.55 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.9 US ft • Target Height: 1.2 US ft • Target Length: 4.2 US ft • Description: Oblong object

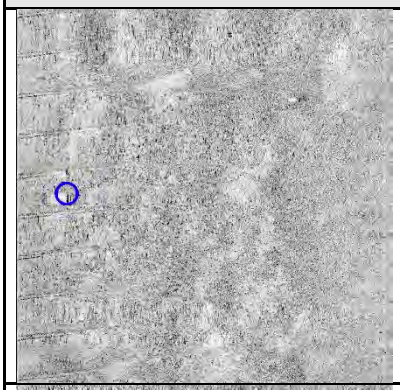
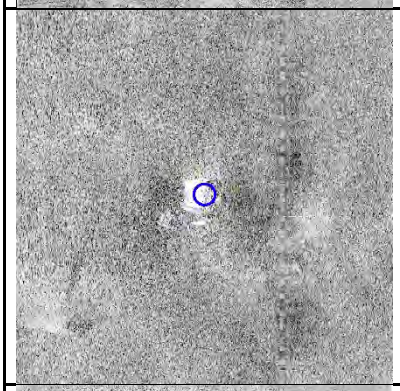
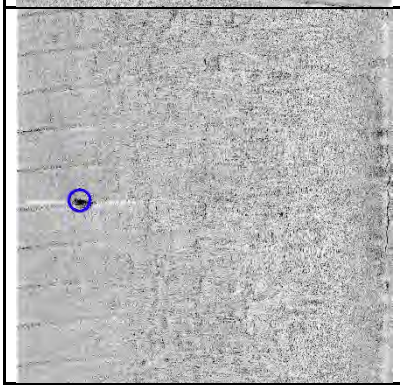
Target Image	Target Info	Description
	**S8** 26.4047866926 -82.1965924077 (WGS84) (X) 591818.67 (Y) 752865.74 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.4 US ft • Target Height: 1.0 US ft • Target Length: 7.9 US ft • Description: Oblong object
	**S9** 26.3925183510 -82.1916479493 (WGS84) (X) 593430.45 (Y) 748404.05 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 3.1 US ft • Target Height: 0.9 US ft • Target Length: 6.0 US ft • Description: Oblong object
	**S10** 26.3109773368 -82.0251664994 (WGS84) (X) 647922.61 (Y) 718720.22 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.4 US ft • Target Height: 0.7 US ft • Target Length: 5.3 US ft • Description: Group of oblong objects
	**S11** 26.3123625001 -82.0247658367 (WGS84) (X) 648053.95 (Y) 719223.67 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 25.6 US ft • Target Height: 3.2 US ft • Target Length: 102.6 US ft • Description: Group of oblong objects/rocks

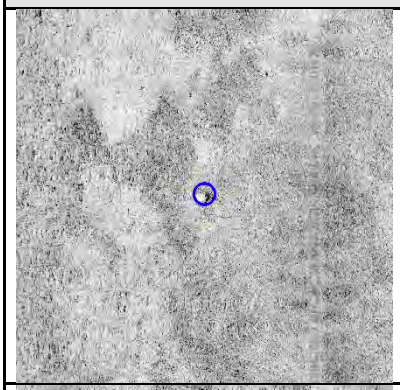
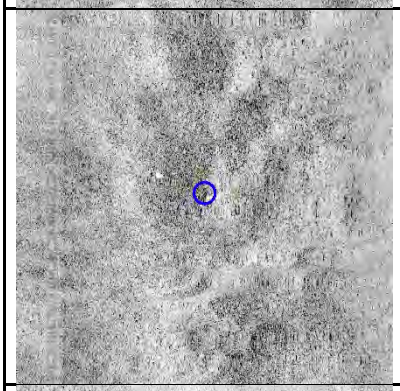
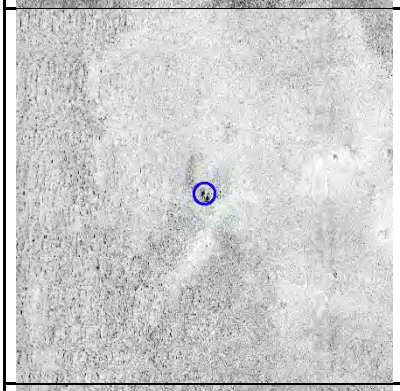
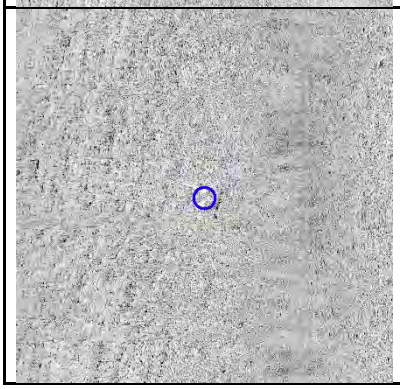
Target Image	Target Info	Description
	**S12** 26.3111718711 -82.0182426373 (WGS84) (X) 650190.74 (Y) 718790.55 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.9 US ft • Target Height: 0.9 US ft • Target Length: 2.1 US ft • Description: Oblong object
	**S13** 26.3051972074 -82.0147230809 (WGS84) (X) 651343.43 (Y) 716618.79 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.5 US ft • Target Height: 0.8 US ft • Target Length: 2.6 US ft • Description: Oblong object
	**S14** 26.3069637739 -82.0109471747 (WGS84) (X) 652580.46 (Y) 717260.76 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.0 US ft • Target Height: 0.7 US ft • Target Length: 0.0 US ft • Description: No obvious object, just shadow
	**S15** 26.3140350954 -81.9949489268 (WGS84) (X) 657821.26 (Y) 719830.86 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.7 US ft • Target Height: 0.8 US ft • Target Length: 4.6 US ft • Description: Oblong object

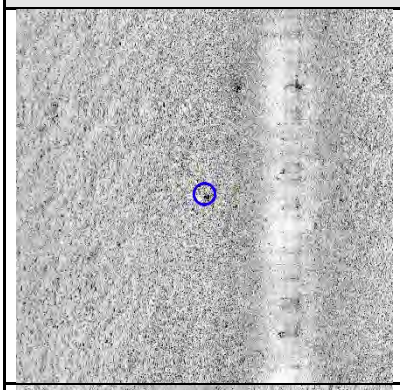
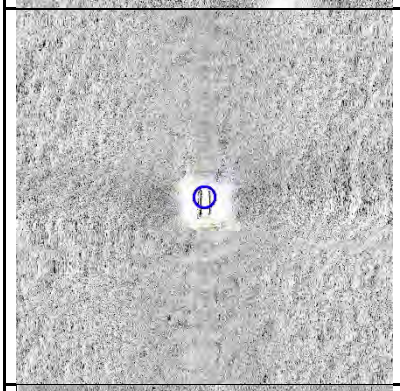
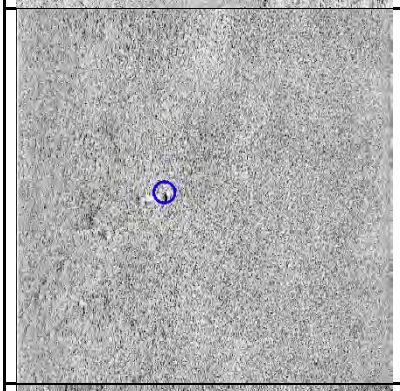
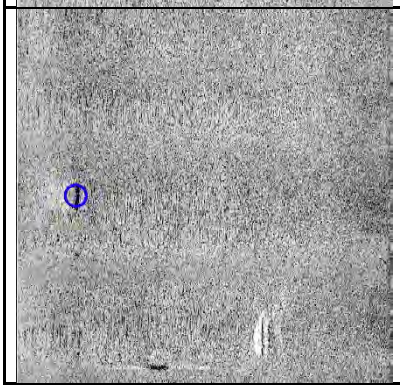
Target Image	Target Info	Description
	**S16** 26.4155281865 -81.9849370471 (WGS84) (X) 661096.56 (Y) 756721.22 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.0 US ft • Target Height: 4.0 US ft • Target Length: 0.0 US ft • Description: No obvious object, just shadow
	**S17** 26.4122839178 -81.9847307364 (WGS84) (X) 661164.22 (Y) 755542.01 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 12.3 US ft • Target Height: 1.0 US ft • Target Length: 70.1 US ft • Description: Group of oblong objects
	**S18** 26.4124484838 -81.9846262059 (WGS84) (X) 661198.43 (Y) 755601.83 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 3.2 US ft • Target Height: 1.9 US ft • Target Length: 6.5 US ft • Description: Group of oblong objects
	**S19** 26.4123801104 -81.9845011882 (WGS84) (X) 661239.35 (Y) 755576.98 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 17.0 US ft • Target Height: 1.7 US ft • Target Length: 21.2 US ft • Description: Oblong object

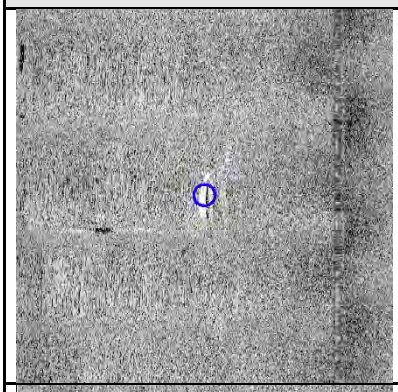
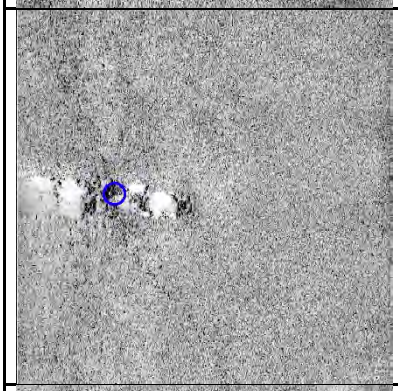
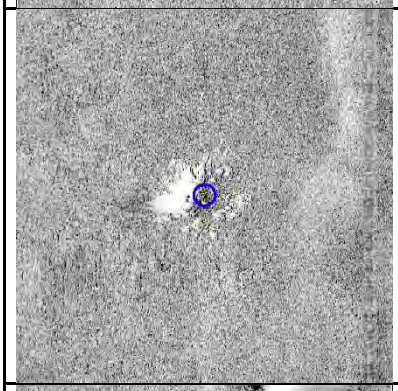
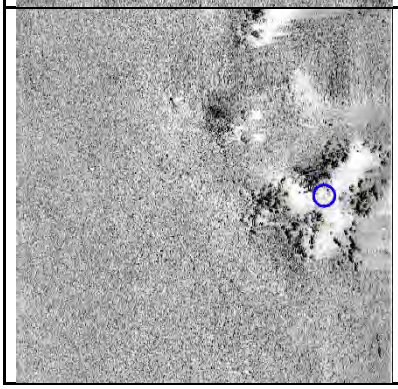
Target Image	Target Info	Description
	**S20** 26.3201054414 -81.9836147315 (WGS84) (X) 661533.74 (Y) 722037.57 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.4 US ft • Target Height: 0.6 US ft • Target Length: 5.4 US ft • Description: Oblong object
	**S21** 26.3200775281 -81.9835617601 (WGS84) (X) 661551.09 (Y) 722027.42 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.9 US ft • Target Height: 1.3 US ft • Target Length: 3.5 US ft • Description: Oblong object
	**S22** 26.4129526817 -81.9834269948 (WGS84) (X) 661590.90 (Y) 755785.14 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.6 US ft • Target Height: 1.2 US ft • Target Length: 3.2 US ft • Description: Two oblong objects
	**S23** 26.4158437230 -81.9826468936 (WGS84) (X) 661846.08 (Y) 756836.00 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.1 US ft • Target Height: 1.7 US ft • Target Length: 6.2 US ft • Description: Group of oblong objects

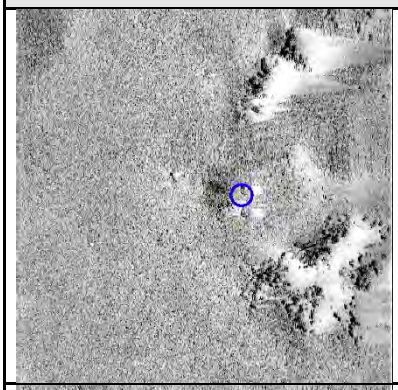
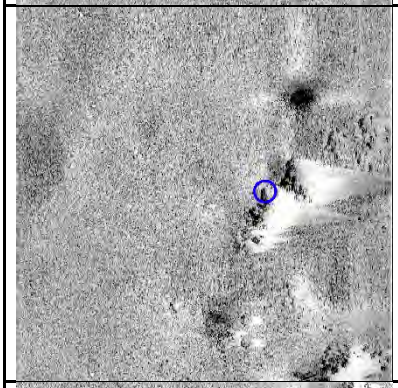
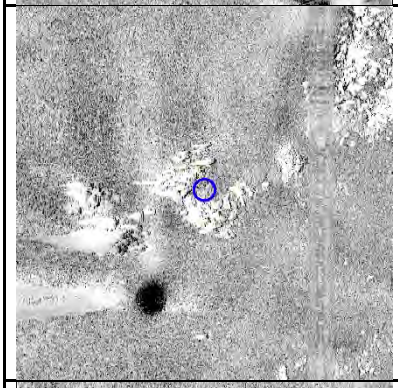
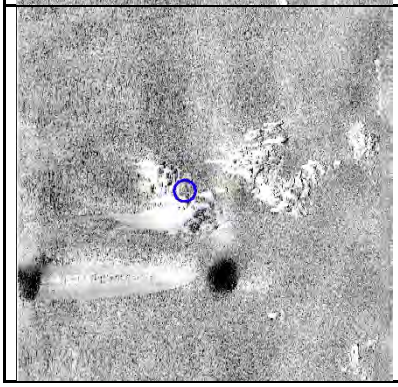
Target Image	Target Info	Description
	**S24** 26.3266641948 -81.9824068860 (WGS84) (X) 661929.05 (Y) 724421.54 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.8 US ft • Target Height: 0.7 US ft • Target Length: 2.1 US ft • Description:
	**S25** 26.4162011702 -81.9814096300 (WGS84) (X) 662251.00 (Y) 756965.98 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.2 US ft • Target Height: 1.1 US ft • Target Length: 4.2 US ft • Description: Oblong object
	**S26** 26.4166232305 -81.9811106091 (WGS84) (X) 662348.84 (Y) 757119.40 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.1 US ft • Target Height: 0.9 US ft • Target Length: 6.4 US ft • Description: Oblong object
	**S27** 26.4166506204 -81.9810822299 (WGS84) (X) 662358.13 (Y) 757129.36 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.2 US ft • Target Height: 1.3 US ft • Target Length: 2.8 US ft • Description: Oblong object

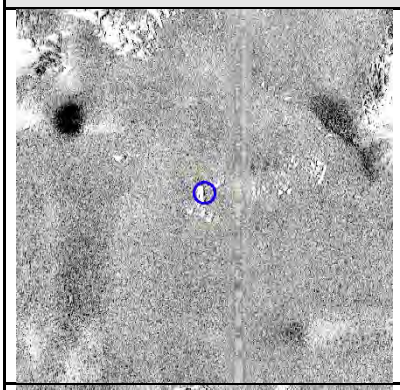
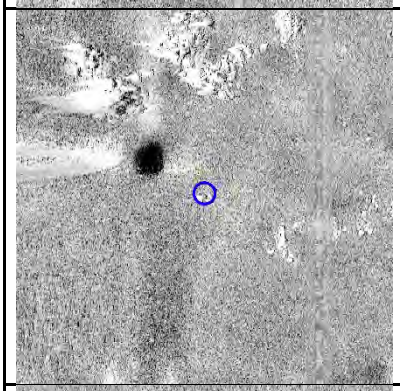
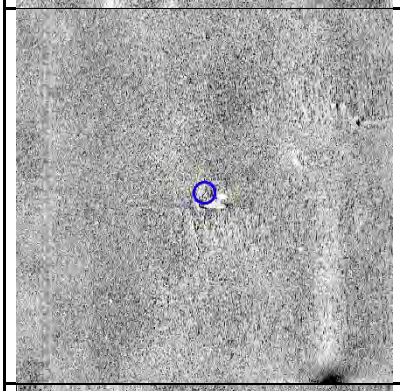
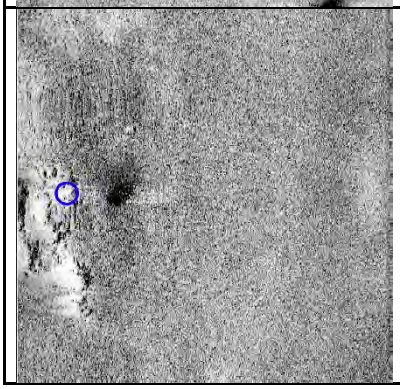
Target Image	Target Info	Description
	**S28** 26.4116295261 -81.9803500955 (WGS84) (X) 662598.02 (Y) 755304.35 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.4 US ft • Target Height: 0.8 US ft • Target Length: 5.7 US ft • Description: Oblong object
	**S29** 26.3330038015 -81.9792559390 (WGS84) (X) 662960.73 (Y) 726725.97 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 4.7 US ft • Target Height: 3.5 US ft • Target Length: 20.0 US ft • Description: Oblong object
	**S30** 26.4158208952 -81.9736957131 (WGS84) (X) 664775.67 (Y) 756828.20 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 4.5 US ft • Target Height: 0.4 US ft • Target Length: 11.7 US ft • Description: Oblong object
	**S31** 26.4205940199 -81.9734177673 (WGS84) (X) 664866.28 (Y) 758563.14 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.8 US ft • Target Height: 0.8 US ft • Target Length: 11.3 US ft • Description: Possible fish

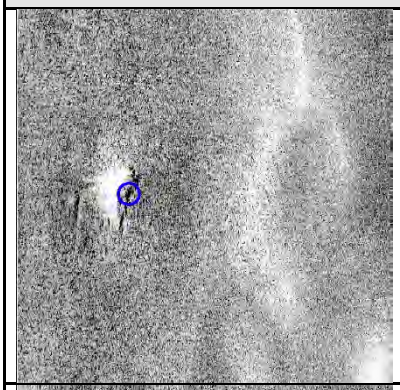
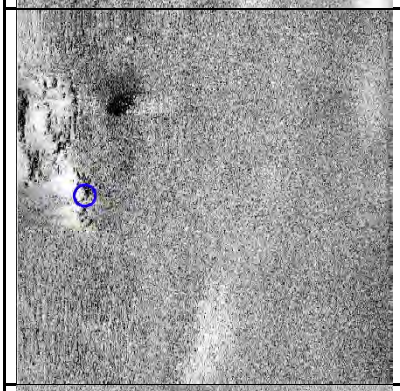
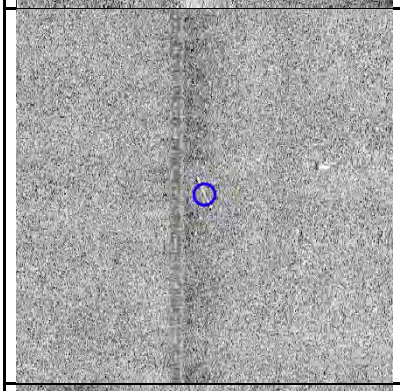
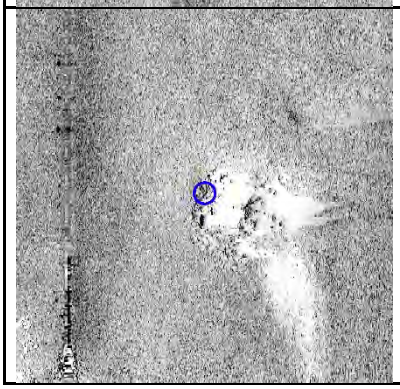
Target Image	Target Info	Description
	**S32** 26.4072612738 -81.9730047513 (WGS84) (X) 665002.47 (Y) 753717.03 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.7 US ft • Target Height: 1.4 US ft • Target Length: 5.9 US ft • Description: Oblong object
	**S33** 26.4067897041 -81.9729377604 (WGS84) (X) 665024.43 (Y) 753545.63 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.0 US ft • Target Height: 1.3 US ft • Target Length: 6.0 US ft • Description: Oblong object
	**S34** 26.4076131535 -81.9714586064 (WGS84) (X) 665508.51 (Y) 753845.04 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.9 US ft • Target Height: 0.3 US ft • Target Length: 7.9 US ft • Description: Oblong object
	**S35** 26.4201073189 -81.9665238073 (WGS84) (X) 667122.53 (Y) 758386.76 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.1 US ft • Target Height: 2.4 US ft • Target Length: 12.1 US ft • Description: No obvious object, detached shadow?

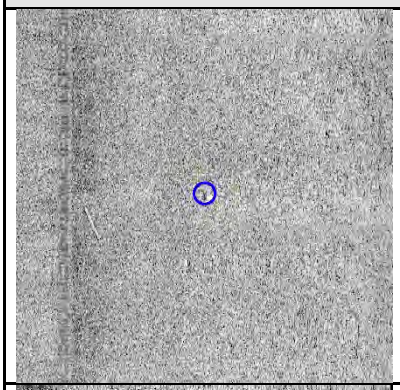
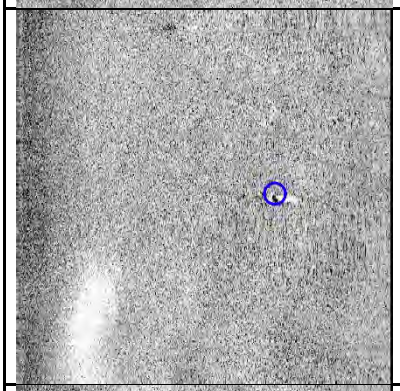
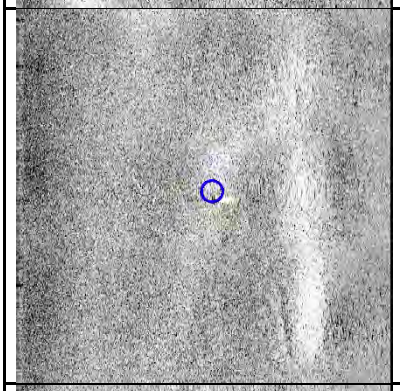
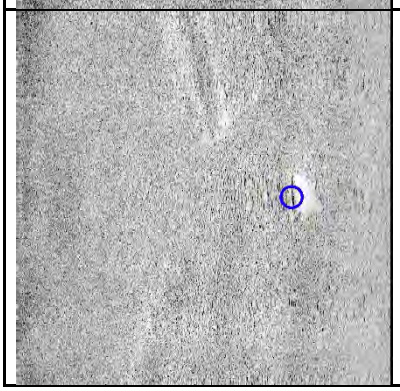
Target Image	Target Info	Description
	**S36** 26.4173358583 -81.9648030662 (WGS84) (X) 667685.95 (Y) 757379.55 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.9 US ft • Target Height: 1.4 US ft • Target Length: 2.9 US ft • Description: Oblong object
	**S37** 26.4119195426 -81.9640991989 (WGS84) (X) 667916.87 (Y) 755410.91 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.0 US ft • Target Height: 0.0 US ft • Target Length: 0.0 US ft • Description: Possible target? On nadir
	**S38** 26.3683135490 -81.9240654177 (WGS84) (X) 681029.11 (Y) 739566.89 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.6 US ft • Target Height: 1.1 US ft • Target Length: 7.1 US ft • Description: Oblong object
	**S39** 26.3642791681 -81.9224027540 (WGS84) (X) 681574.38 (Y) 738100.82 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.0 US ft • Target Height: 1.0 US ft • Target Length: 16.5 US ft • Description: Linear object

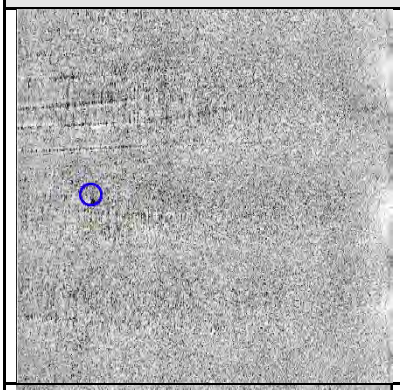
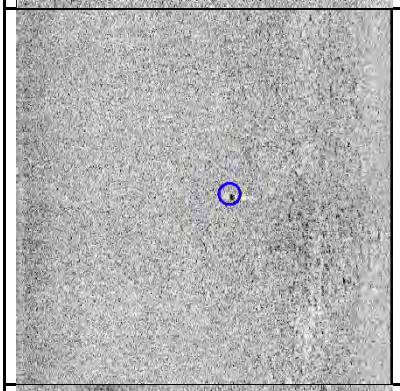
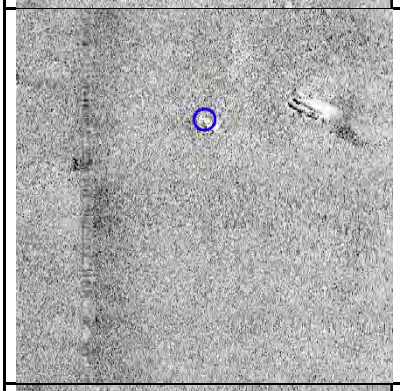
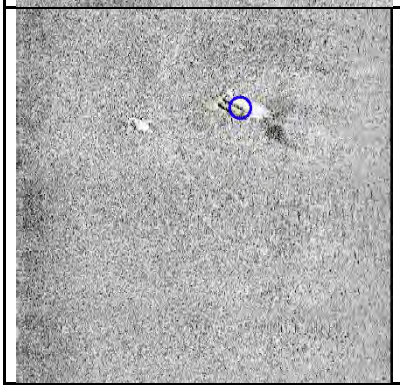
Target Image	Target Info	Description
	**S40** 26.3646794935 -81.9223478948 (WGS84) (X) 681592.26 (Y) 738246.34 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.0 US ft • Target Height: 0.8 US ft • Target Length: 28.1 US ft • Description: Oblong object
	**S41** 26.3740227996 -81.9191657977 (WGS84) (X) 682632.04 (Y) 741643.03 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 20.0 US ft • Target Height: 2.0 US ft • Target Length: 79.3 US ft • Description: Group of oblong objects
	**S42** 26.3741563385 -81.9184046498 (WGS84) (X) 682881.22 (Y) 741691.72 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 9.7 US ft • Target Height: 2.8 US ft • Target Length: 35.0 US ft • Description: Group of oblong objects
	**S43** 26.3721812627 -81.9172035066 (WGS84) (X) 683274.93 (Y) 740974.09 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 69.9 US ft • Target Height: 1.1 US ft • Target Length: 79.6 US ft • Description: Group of oblong objects

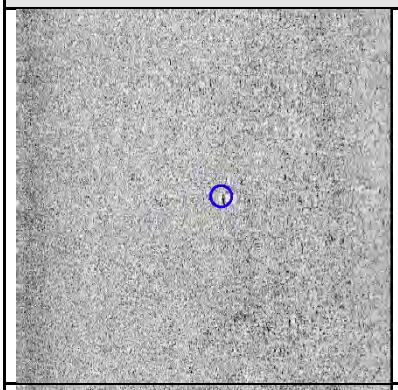
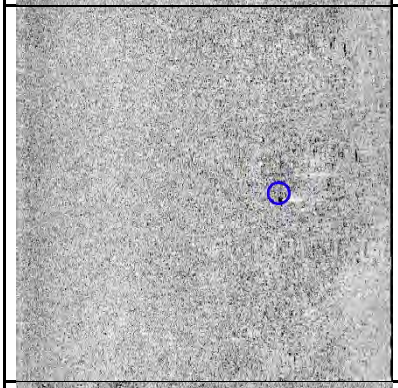
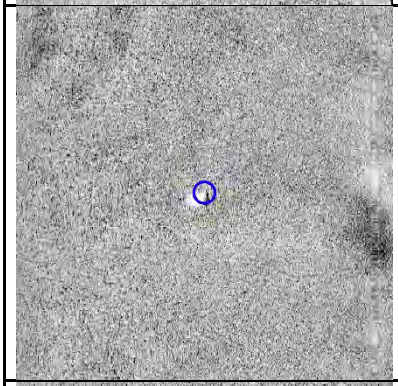
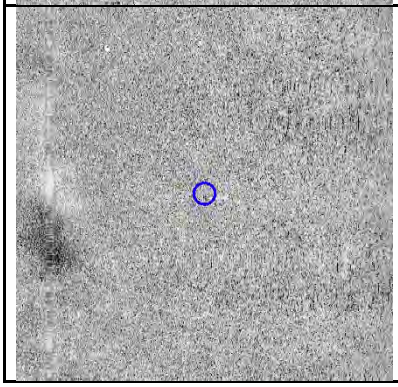
Target Image	Target Info	Description
	**S44** 26.3723898850 -81.9171306718 (WGS84) (X) 683298.73 (Y) 741049.93 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 6.6 US ft • Target Height: 0.8 US ft • Target Length: 6.6 US ft • Description: Two oblong objects
	**S45** 26.3724798791 -81.9168811949 (WGS84) (X) 683380.39 (Y) 741082.69 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 8.4 US ft • Target Height: 3.2 US ft • Target Length: 19.7 US ft • Description: Group of oblong objects
	**S46** 26.3719709757 -81.9167958314 (WGS84) (X) 683408.46 (Y) 740897.74 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 35.3 US ft • Target Height: 2.7 US ft • Target Length: 51.2 US ft • Description: Group of oblong objects
	**S47** 26.3718401448 -81.9166750998 (WGS84) (X) 683448.02 (Y) 740850.21 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 13.1 US ft • Target Height: 4.5 US ft • Target Length: 47.6 US ft • Description: Group of oblong objects

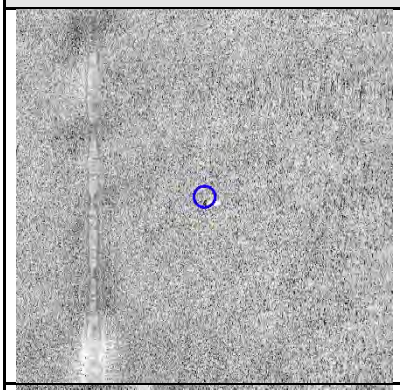
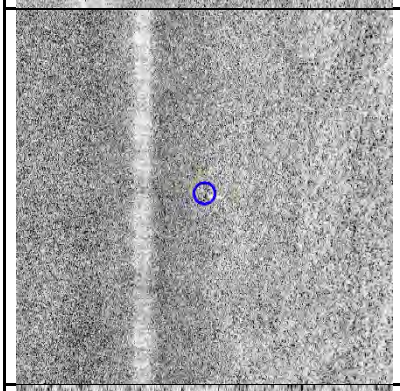
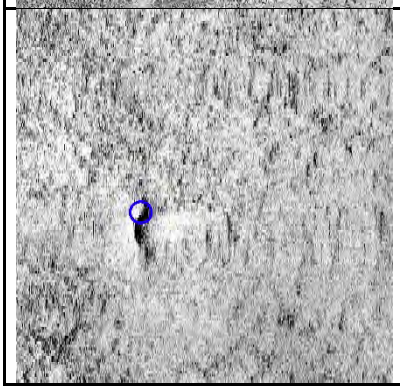
Target Image	Target Info	Description
	**S48** 26.3722647722 -81.9165355498 (WGS84) (X) 683493.61 (Y) 741004.58 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.6 US ft • Target Height: 3.6 US ft • Target Length: 12.4 US ft • Description: Group of oblong objects
	**S49** 26.3721008563 -81.9165221527 (WGS84) (X) 683498.03 (Y) 740945.00 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.4 US ft • Target Height: 1.0 US ft • Target Length: 2.5 US ft • Description: Oblong object
	**S50** 26.3728653264 -81.9165139818 (WGS84) (X) 683500.53 (Y) 741222.87 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.7 US ft • Target Height: 1.6 US ft • Target Length: 8.5 US ft • Description: Two oblong objects
	**S51** 26.3701950282 -81.9163931241 (WGS84) (X) 683540.73 (Y) 740252.31 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 5.8 US ft • Target Height: 0.8 US ft • Target Length: 37.4 US ft • Description: Group of oblong objects

Target Image	Target Info	Description
	**S52** 26.3711361895 -81.9163385870 (WGS84) (X) 683558.36 (Y) 740594.41 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 5.3 US ft • Target Height: 1.2 US ft • Target Length: 38.4 US ft • Description: Oblong object
	**S53** 26.3703075582 -81.9162154714 (WGS84) (X) 683598.87 (Y) 740293.25 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 4.0 US ft • Target Height: 1.5 US ft • Target Length: 35.3 US ft • Description: Group of oblong objects
	**S54** 26.3749461995 -81.9158876027 (WGS84) (X) 683705.12 (Y) 741979.35 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.6 US ft • Target Height: 1.0 US ft • Target Length: 23.9 US ft • Description: Linear object
	**S55** 26.3701317708 -81.9157370054 (WGS84) (X) 683755.57 (Y) 740229.46 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 10.7 US ft • Target Height: 4.7 US ft • Target Length: 34.7 US ft • Description: Group of oblong objects

Target Image	Target Info	Description
	**S56** 26.3747951525 -81.9157271879 (WGS84) (X) 683757.67 (Y) 741924.48 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.3 US ft • Target Height: 1.1 US ft • Target Length: 3.3 US ft • Description: Oblong object
	**S57** 26.3703694757 -81.9152525584 (WGS84) (X) 683914.12 (Y) 740315.96 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.9 US ft • Target Height: 1.0 US ft • Target Length: 5.8 US ft • Description: Oblong object
	**S58** 26.3704425179 -81.9147860277 (WGS84) (X) 684066.86 (Y) 740342.61 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.8 US ft • Target Height: 1.4 US ft • Target Length: 4.1 US ft • Description: Oblong object
	**S59** 26.3708349285 -81.9110887792 (WGS84) (X) 685277.29 (Y) 740486.06 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 3.5 US ft • Target Height: 1.1 US ft • Target Length: 26.7 US ft • Description: Linear object

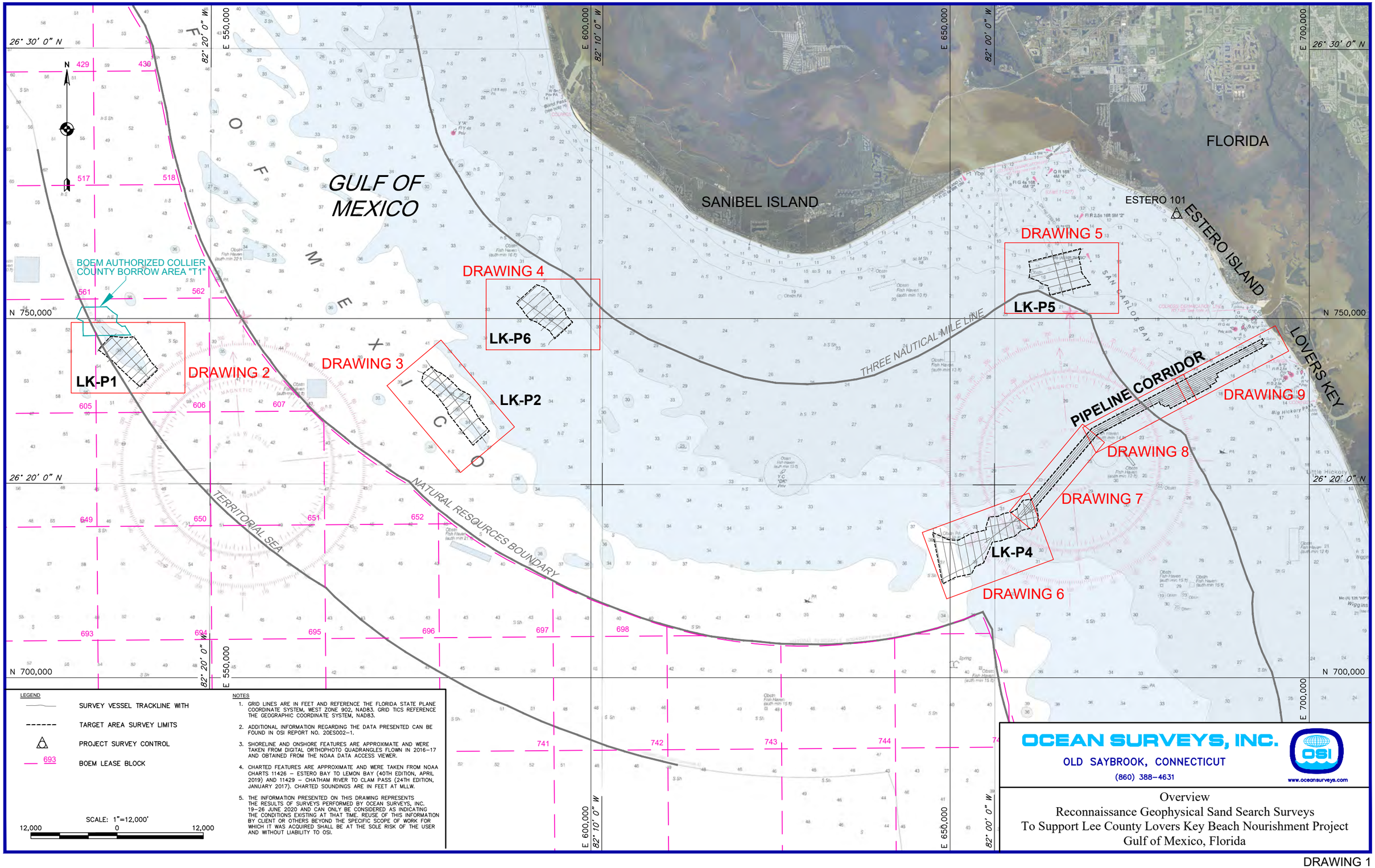
Target Image	Target Info	Description
	**S60** 26.3727280385 -81.9079112255 (WGS84) (X) 686317.17 (Y) 741174.89 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.1 US ft • Target Height: 0.8 US ft • Target Length: 4.6 US ft • Description: Oblong object
	**S61** 26.3762922840 -81.9074983351 (WGS84) (X) 686451.42 (Y) 742470.50 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.6 US ft • Target Height: 1.2 US ft • Target Length: 3.0 US ft • Description: Oblong object
	**S62** 26.3751059832 -81.9052892129 (WGS84) (X) 687175.00 (Y) 742039.83 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 4.4 US ft • Target Height: 1.5 US ft • Target Length: 6.3 US ft • Description: Oblong object
	**S63** 26.3749509056 -81.9051635634 (WGS84) (X) 687216.18 (Y) 741983.49 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 5.2 US ft • Target Height: 1.7 US ft • Target Length: 24.7 US ft • Description: Oblong object

Target Image	Target Info	Description
	**S64** 26.3784417691 -81.9028867974 (WGS84) (X) 687960.63 (Y) 743252.89 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.0 US ft • Target Height: 0.6 US ft • Target Length: 6.0 US ft • Description: Oblong object
	**S65** 26.3804460809 -81.8989347968 (WGS84) (X) 689253.91 (Y) 743982.40 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 1.5 US ft • Target Height: 0.6 US ft • Target Length: 3.3 US ft • Description: Oblong object
	**S66** 26.3819505708 -81.8986860215 (WGS84) (X) 689334.93 (Y) 744529.31 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.1 US ft • Target Height: 1.2 US ft • Target Length: 8.9 US ft • Description: Oblong object
	**S67** 26.3814434151 -81.8983632142 (WGS84) (X) 689440.76 (Y) 744345.06 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.2 US ft • Target Height: 1.4 US ft • Target Length: 1.6 US ft • Description: Oblong object

Target Image	Target Info	Description
	**S68** 26.3815762675 -81.8975784736 (WGS84) (X) 689697.63 (Y) 744393.55 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 0.7 US ft • Target Height: 1.2 US ft • Target Length: 3.3 US ft • Description: Oblong object
	**S69** 26.3827574809 -81.8931753051 (WGS84) (X) 691138.79 (Y) 744824.06 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 2.1 US ft • Target Height: 1.5 US ft • Target Length: 2.8 US ft • Description: Oblong object
	**S70** 26.3846960088 -81.8927362642 (WGS84) (X) 691281.94 (Y) 745528.79 (Projected Coordinates)	**Dimensions and attributes** • Target Width: 3.2 US ft • Target Height: 0.9 US ft • Target Length: 9.6 US ft • Description: Oblong object

APPENDIX 2

PROJECT DRAWINGS



LEGEND

- SURVEY VESSEL TRACKLINE WITH
- TARGET AREA SURVEY LIMITS
- PROJECT SURVEY CONTROL
- 693 BOEM LEASE BLOCK

SCALE: 1"=12,000'

12,000 0 12,000

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
3. SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2016-17 AND OBTAINED FROM THE NOAA DATA ACCESS VIEWER.
4. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHARTS 11426 – ESTERO BAY TO LEMON BAY (40TH EDITION, APRIL 2019) AND 11429 – CHATHAM RIVER TO CLAM PASS (24TH EDITION, JANUARY 2017). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
5. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19-26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

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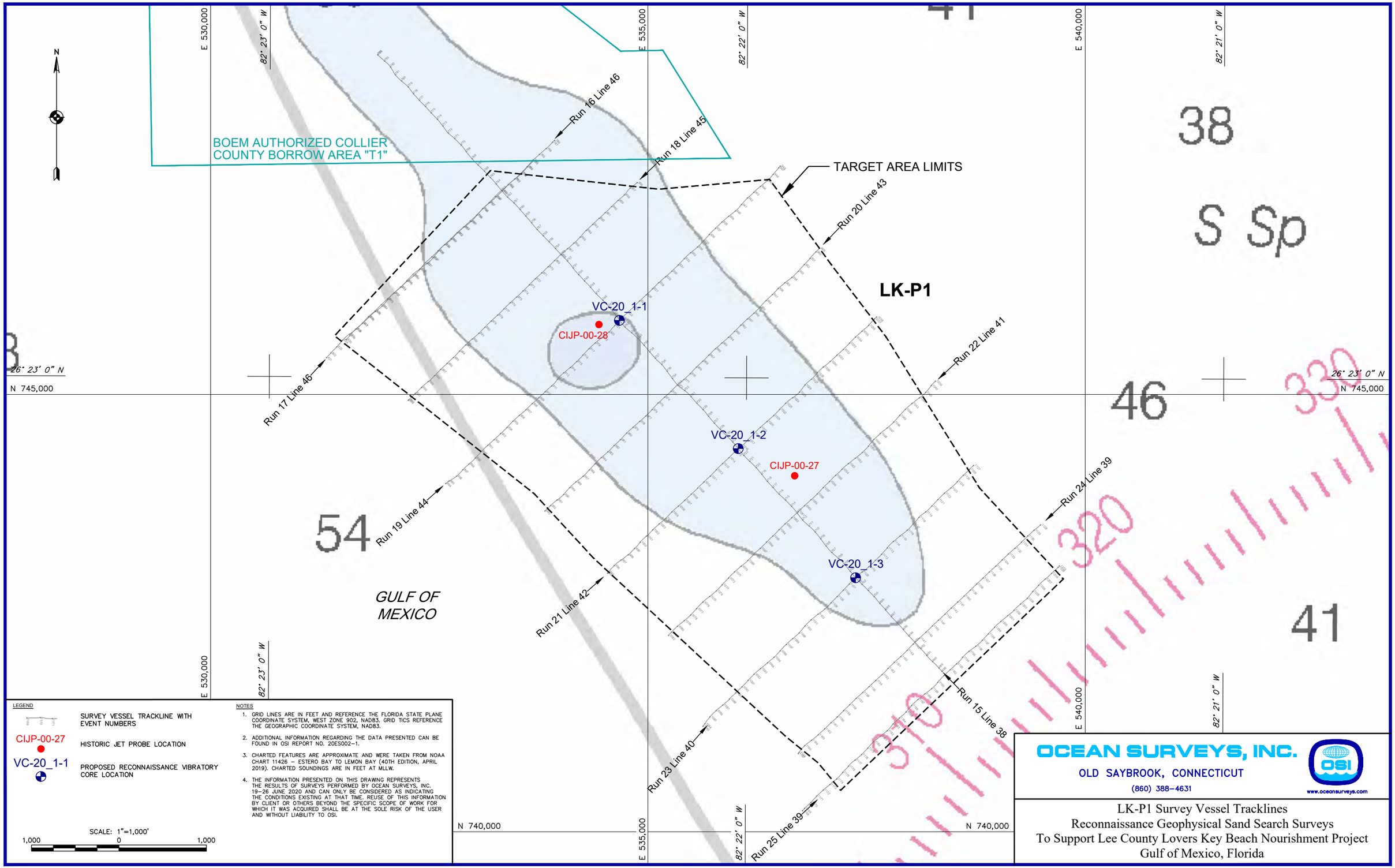
Overview
Reconnaissance Geophysical Sand Search Surveys
To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 1



LEGEND

SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS

CIJP-00-27 — HISTORIC JET PROBE LOCATION

VC-20_1-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002–1.
3. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHART 11426 – ESTERO BAY TO LEMON BAY (40TH EDITION, APRIL 2019). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
4. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19–26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

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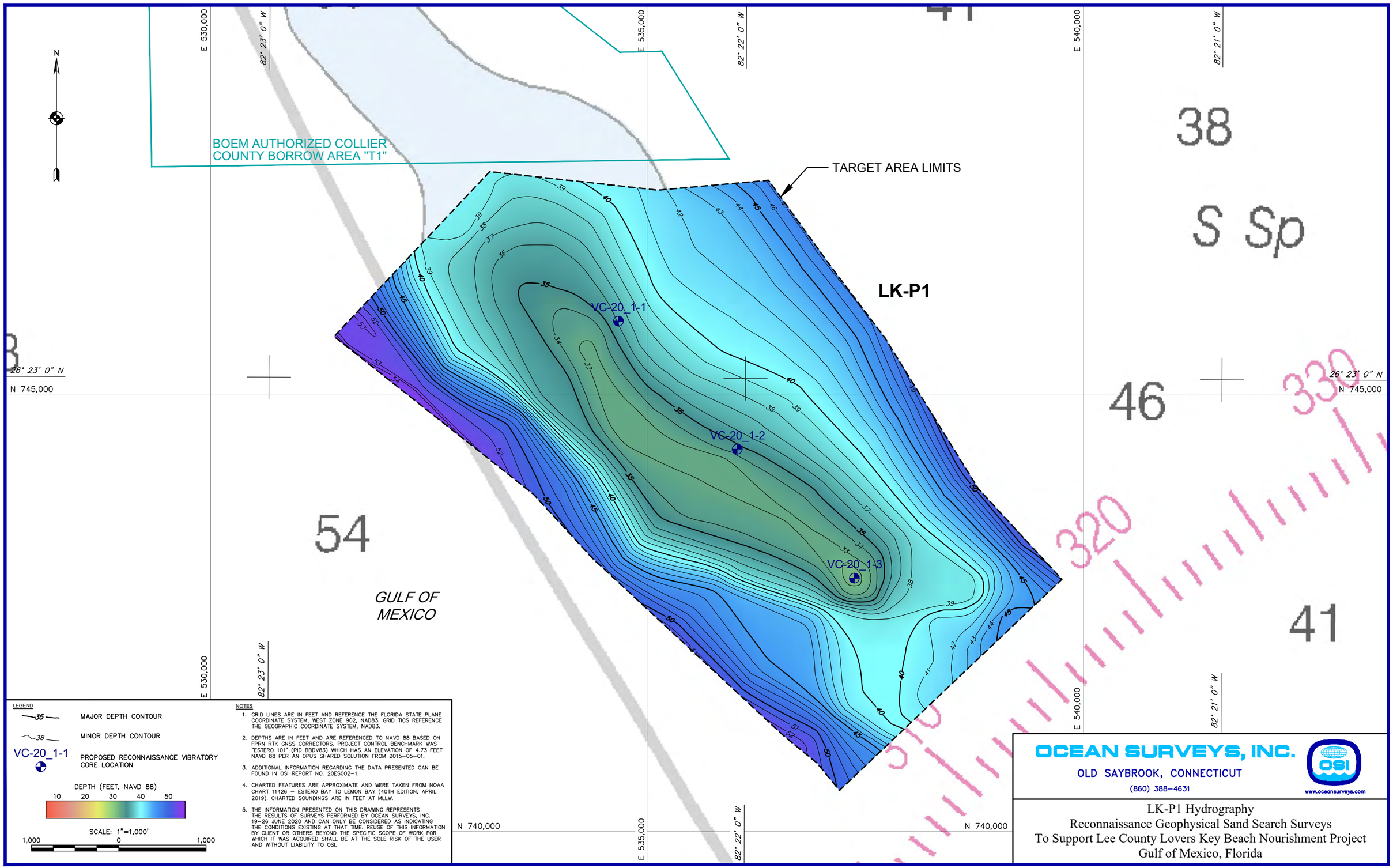
LK-P1 Survey Vessel Tracklines
Reconnaissance Geophysical Sand Search Surveys
To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 2A



LEGEND

- MAJOR DEPTH CONTOUR
- MINOR DEPTH CONTOUR
- VC-20_1-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

DEPTH (FEET, NAVD 88)
10 20 30 40 50

SCALE: 1"=1,000'
1,000 0 1,000

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. DEPTHS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON FPRN RTK GNSS CORRECTORS. PROJECT CONTROL BENCHMARK WAS "ESTERO 101" (PID BBDV83) WHICH HAS AN ELEVATION OF 4.73 FEET NAVD 88 PER AN OPUS SHARED SOLUTION FROM 2015-05-01.
3. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
4. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHART 11426 – ESTERO BAY TO LEMON BAY (40TH EDITION, APRIL 2019). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
5. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19-26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

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LK-P1 Hydrography
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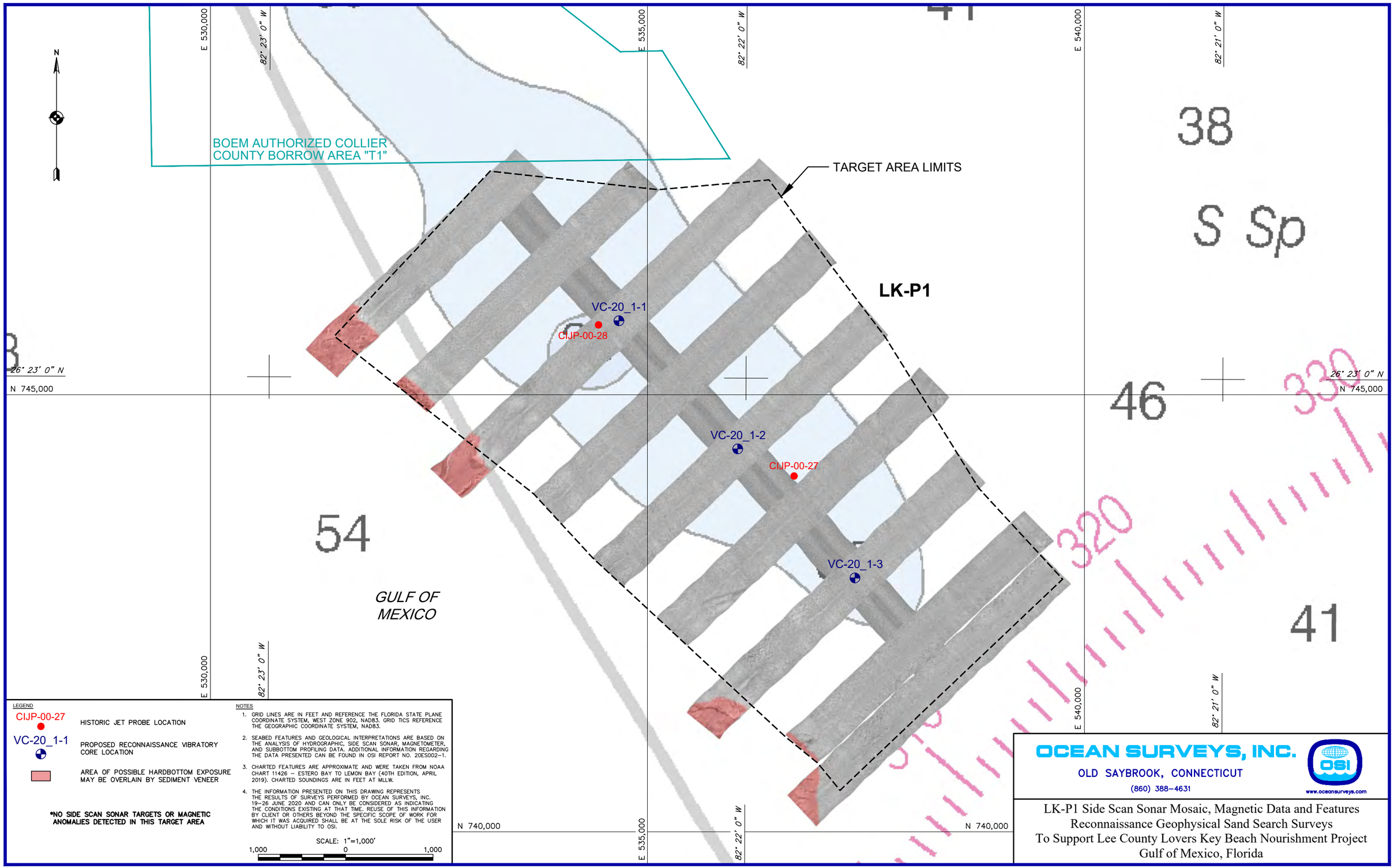
Gulf of Mexico, Florida

DRAWING 2B



LEGEND

CIJP-00-27 — HISTORIC JET PROBE LOCATION

VC-20_1-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

AREA OF POSSIBLE HARDBOTTOM EXPOSURE MAY BE OVERLAIN BY SEDIMENT VENEER

***NO SIDE SCAN SONAR TARGETS OR MAGNETIC ANOMALIES DETECTED IN THIS TARGET AREA**

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. SEABED FEATURES AND GEOLOGICAL INTERPRETATIONS ARE BASED ON THE ANALYSIS OF HYDROGRAPHIC, SIDE SCAN SONAR, MAGNETOMETER, AND SUBBOTTOM PROFILING DATA. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
3. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHART 11426 – ESTERO BAY TO LEMON BAY (40TH EDITION, APRIL 2019). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
4. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19–26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

SCALE: 1"=1,000'

1,000 0 1,000

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LK-P1 Side Scan Sonar Mosaic, Magnetic Data and Features
Reconnaissance Geophysical Sand Search Surveys
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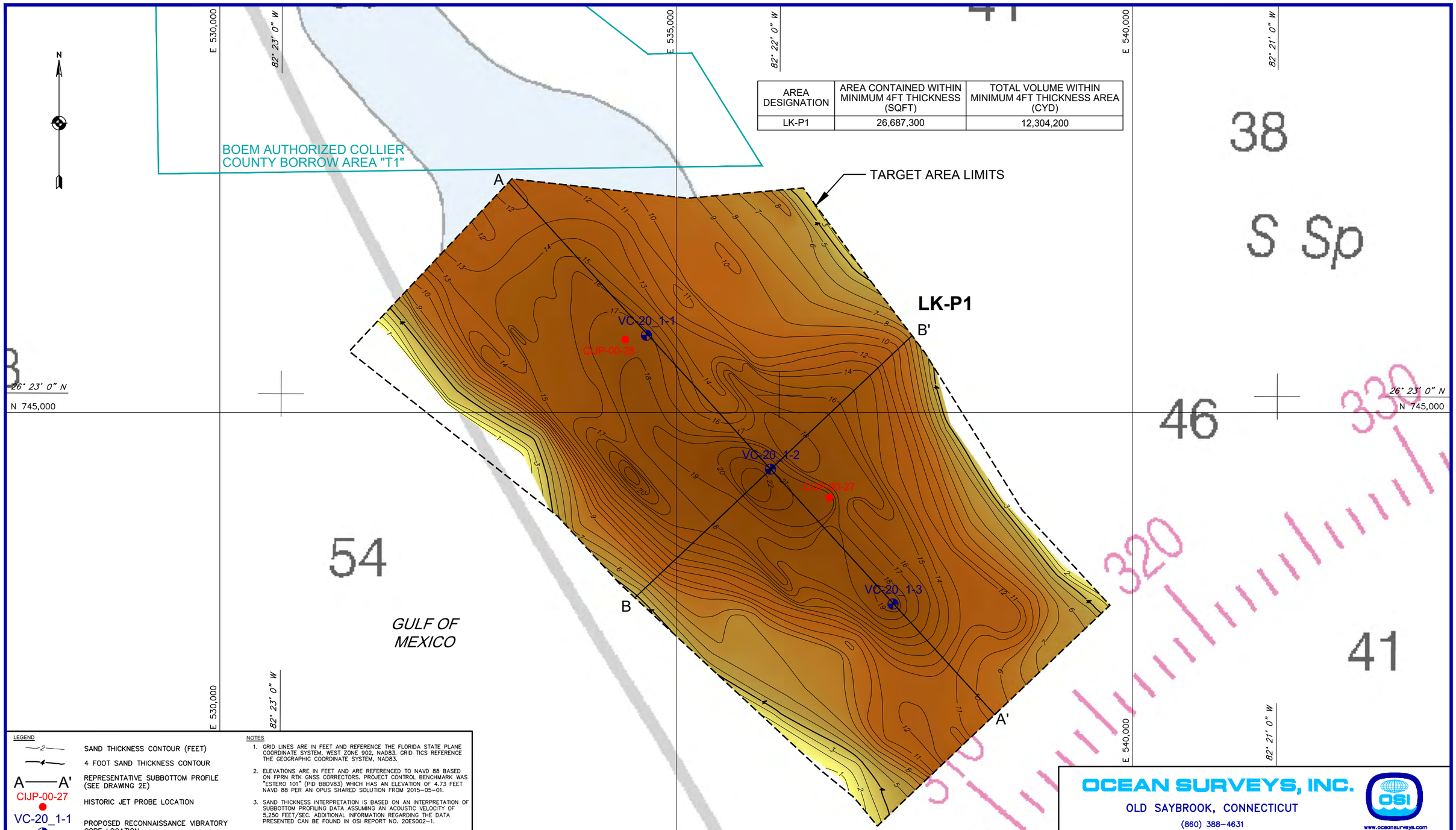
Gulf of Mexico, Florida

DRAWING 2C

AREA DESIGNATION	AREA CONTAINED WITHIN MINIMUM 4FT THICKNESS (SQFT)	TOTAL VOLUME WITHIN MINIMUM 4FT THICKNESS AREA (CYD)
LK-P1	26,687,300	12,304,200



LEGEND

- SAND THICKNESS CONTOUR (FEET)
- 4 FOOT SAND THICKNESS CONTOUR
- A——A' REPRESENTATIVE SUBBOTTOM PROFILE (SEE DRAWING 2E)
- CIJP-00-27 HISTORIC JET PROBE LOCATION
- VC-20_1-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS (FEET)

1 5 10 15 20 24

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON FPRN RTK GNSS CORRECTORS. PROJECT CONTROL BENCHMARK WAS "ESTERO 101" (PID BBDVB3) WHICH HAS AN ELEVATION OF 4.73 FEET NAVD 88 PER AN OPUS SHARED SOLUTION FROM 2015-05-01.
3. SAND THICKNESS INTERPRETATION IS BASED ON AN INTERPRETATION OF SUBBOTTOM PROFILING DATA ASSUMING AN ACOUSTIC VELOCITY OF 5,250 FEET/SEC. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
4. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHART 11426 – ESTERO BAY TO LEMON BAY (40TH EDITION, APRIL 2019). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
5. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19–26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

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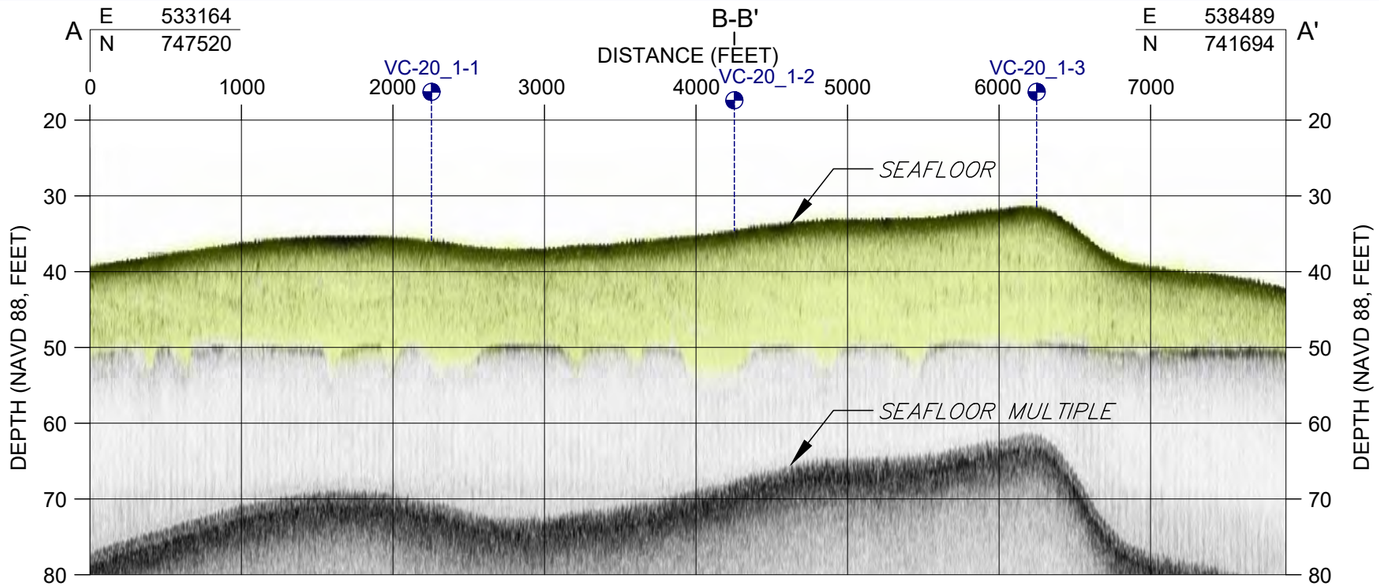
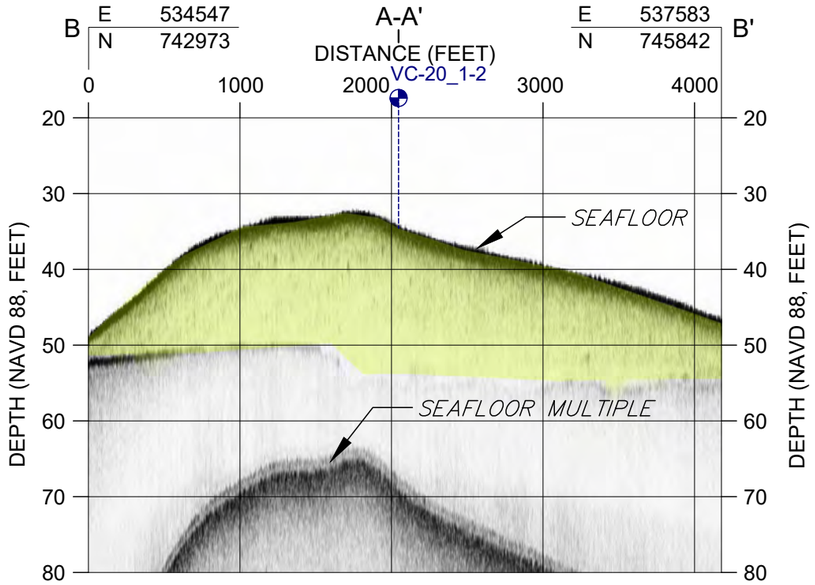
LK-P1 Interpreted Sand Thickness
Reconnaissance Geophysical Sand Search Surveys
To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 2D





LEGEND

VC-20_1-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

1. GRID LABELS ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83.
2. DEPTHS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON FPRN RTK GNSS CORRECTORS. PROJECT CONTROL BENCHMARK WAS "ESTERO 101" (PID BBDV83) WHICH HAS AN ELEVATION OF 4.73 FEET NAVD 88 PER AN OPUS SHARED SOLUTION FROM 2015-05-01.
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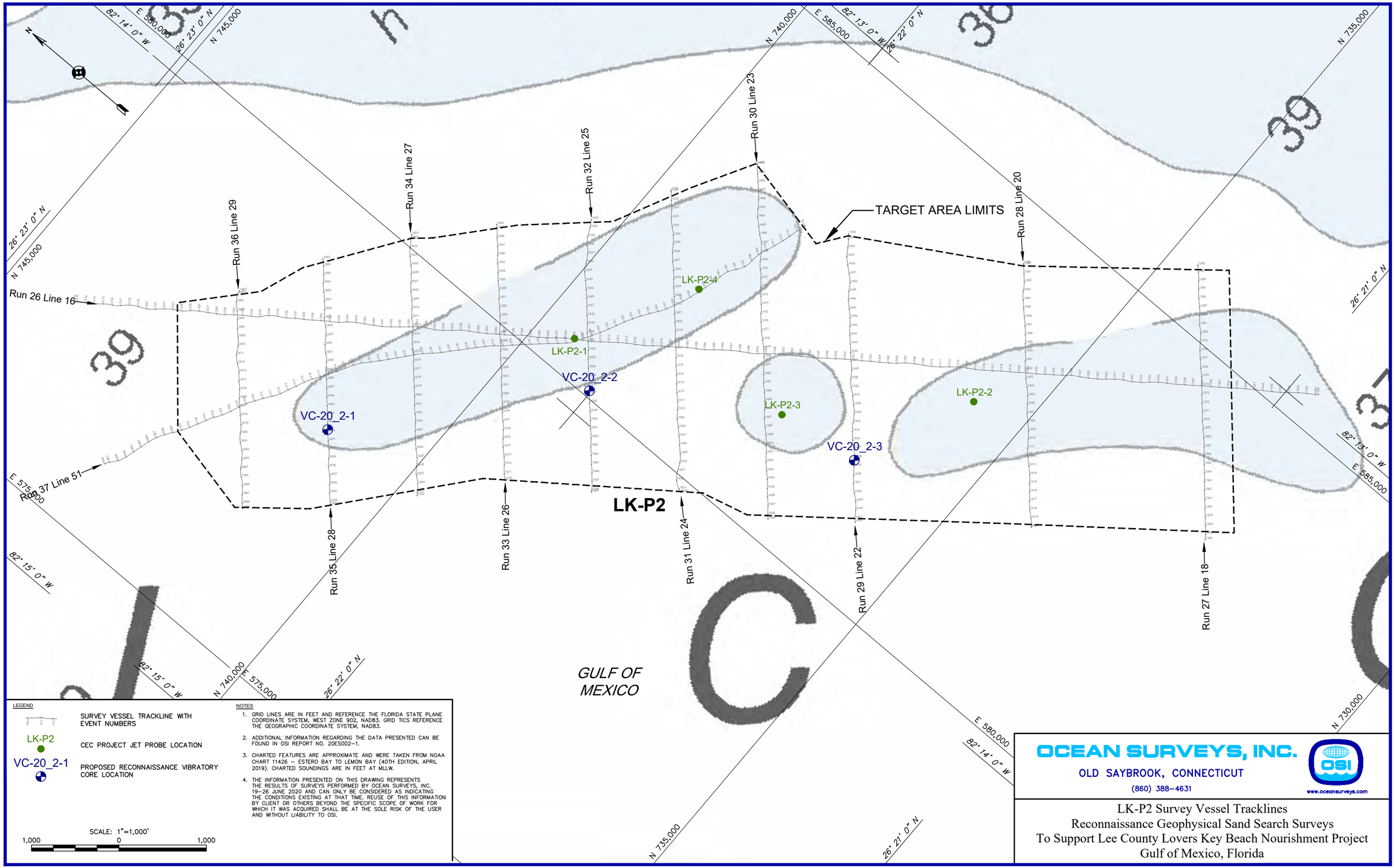
DRAWING 2E



LEGEND

SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS

LK-P2 — CEC PROJECT JET PROBE LOCATION

VC-20_2-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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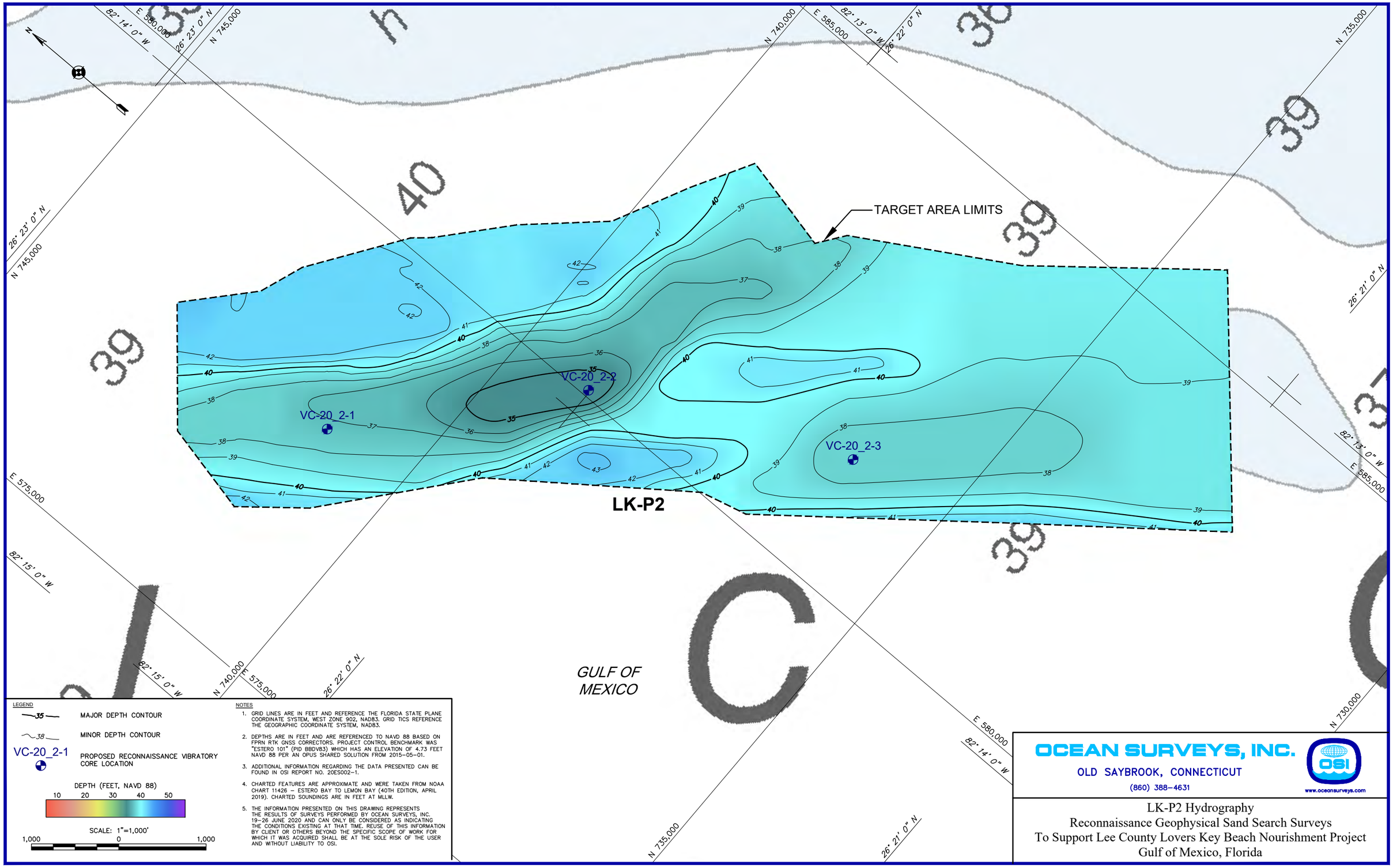
DRAWING 3A



LEGEND

35 — MAJOR DEPTH CONTOUR

38 — MINOR DEPTH CONTOUR

VC-20_2-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

DEPTH (FEET, NAVD 88)

10 20 30 40 50

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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LK-P2 Hydrography
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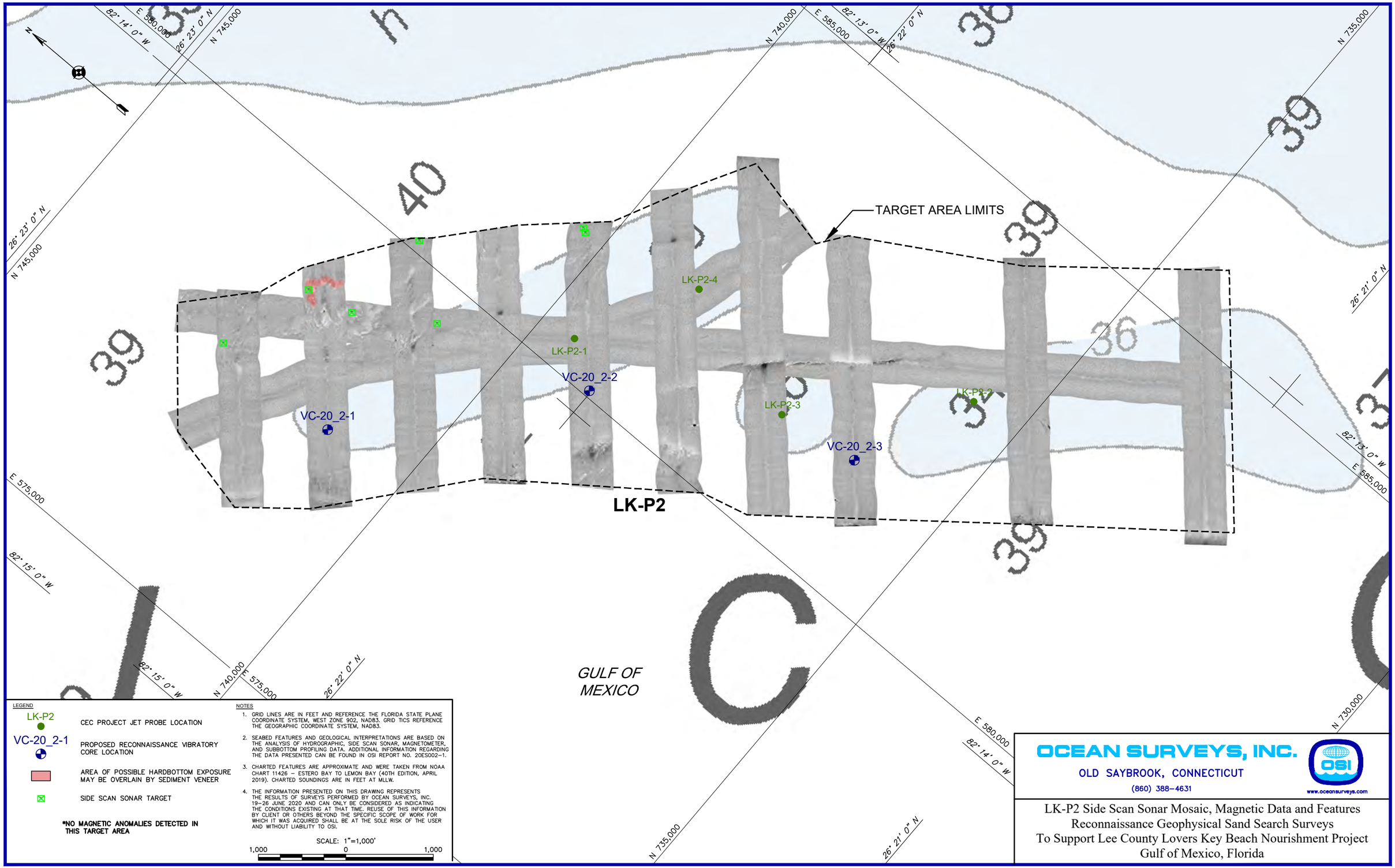
DRAWING 3B



LEGEND

LK-P2 — CEC PROJECT JET PROBE LOCATION

VC-20_2-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

AREA OF POSSIBLE HARDBOTTOM EXPOSURE MAY BE OVERLAIN BY SEDIMENT VENEER

SIDE SCAN SONAR TARGET

***NO MAGNETIC ANOMALIES DETECTED IN THIS TARGET AREA**

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. SEABED FEATURES AND GEOLOGICAL INTERPRETATIONS ARE BASED ON THE ANALYSIS OF HYDROGRAPHIC, SIDE SCAN SONAR, MAGNETOMETER, AND SUBBOTTOM PROFILING DATA. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
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SCALE: 1"=1,000'

1,000 0 1,000

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LK-P2 Side Scan Sonar Mosaic, Magnetic Data and Features
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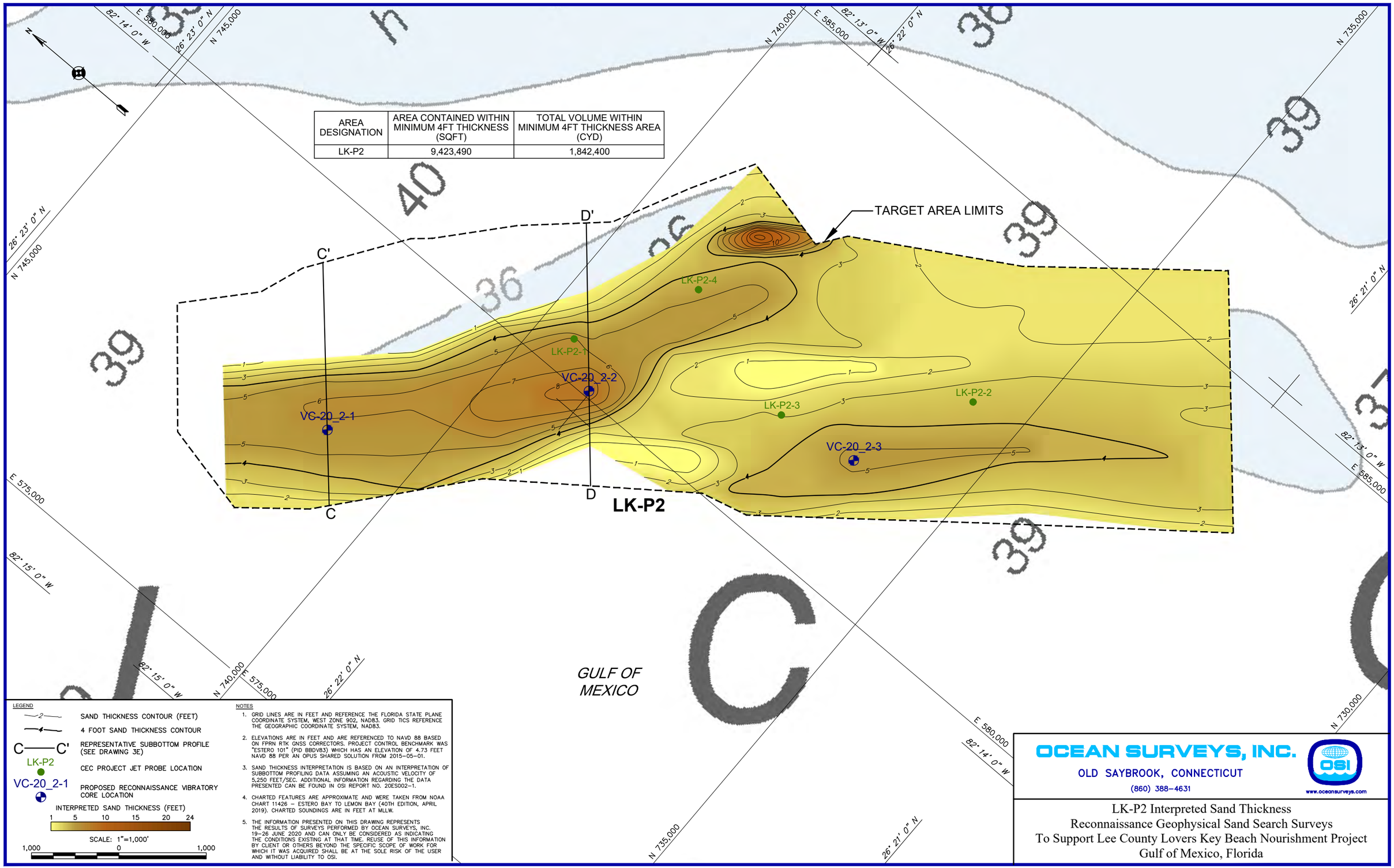
DRAWING 3C

AREA DESIGNATION	AREA CONTAINED WITHIN MINIMUM 4FT THICKNESS (SQFT)	TOTAL VOLUME WITHIN MINIMUM 4FT THICKNESS AREA (CYD)
LK-P2	9,423,490	1,842,400



LEGEND

- SAND THICKNESS CONTOUR (FEET)
- 4 FOOT SAND THICKNESS CONTOUR
- C——C' REPRESENTATIVE SUBBOTTOM PROFILE (SEE DRAWING 3E)
- LK-P2 CEC PROJECT JET PROBE LOCATION
- VC-20_2-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS (FEET)

1 5 10 15 20 24

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
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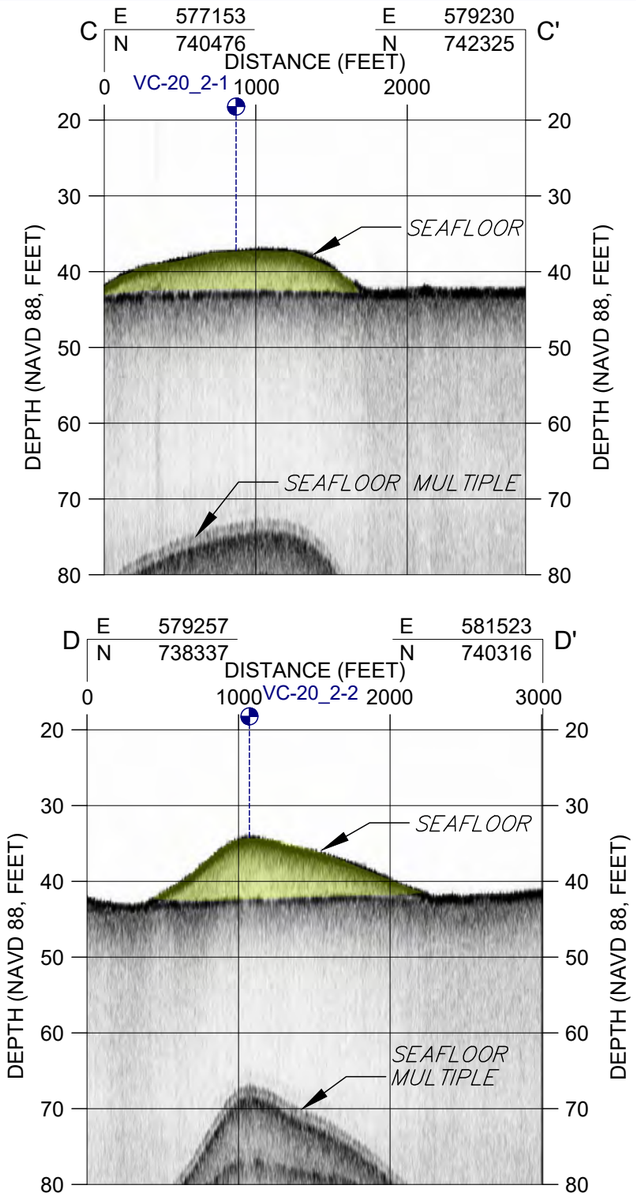
DRAWING 3D



LEGEND

VC-20_2-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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LK-P2 Representative Subbottom Profiles
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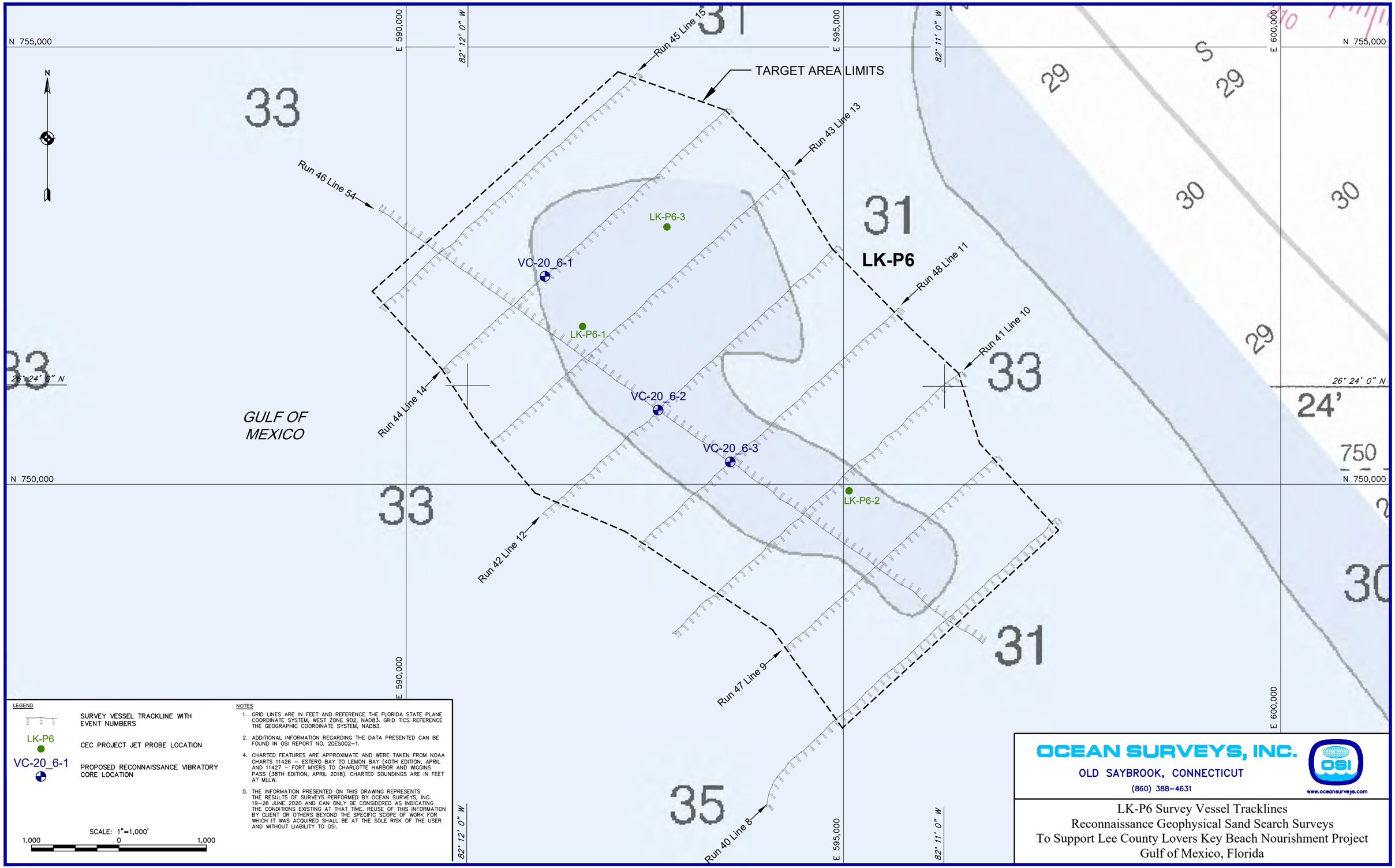
Gulf of Mexico, Florida

DRAWING 3E



LEGEND

LK-P6 — SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS

LK-P6 — CEC PROJECT JET PROBE LOCATION

VC-20_6-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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LK-P6 Survey Vessel Tracklines
Reconnaissance Geophysical Sand Search Surveys
To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 4A

TARGET AREA LIMITS

VC-20_6-1

VC-20_6-2

VC-20_6-3

LK-P6

GULF OF MEXICO

N 755,000

N 750,000

E 590,000

E 595,000

E 600,000

82° 12' 0" W

82° 11' 0" W

26° 24' 0" N

LEGEND

35 MAJOR DEPTH CONTOUR

38 MINOR DEPTH CONTOUR

VC-20_6-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

DEPTH (FEET, NAVD 88)

10 20 30 40 50

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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Gulf of Mexico, Florida

DRAWING 4B

N 755,000

E 590,000

82° 12' 0" W

E 595,000

82° 11' 0" W

E 600,000

N 755,000

TARGET AREA LIMITS

LK-P6-3

VC-20_6-1

LK-P6

LK-P6-1

VC-20_6-2

VC-20_6-3

LK-P6-2

26° 24' 0" N

GULF OF MEXICO

N 750,000

E 590,000

82° 12' 0" W

E 595,000

82° 11' 0" W

E 600,000

N 750,000

LEGEND

LK-P6 — CEC PROJECT JET PROBE LOCATION

VC-20_6-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

AREA OF POSSIBLE HARDBOTTOM EXPOSURE MAY BE OVERLAIN BY SEDIMENT VENEER

SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION

CLASS 1: ≤ 25 GAMMAS

CLASS 2: > 25–100 GAMMAS

CLASS 3: > 100 GAMMAS

NOTES

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SCALE: 1"=1,000'

1,000 0 1,000

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DRAWING 4C

AREA DESIGNATION	AREA CONTAINED WITHIN MINIMUM 4FT THICKNESS (SQFT)	TOTAL VOLUME WITHIN MINIMUM 4FT THICKNESS AREA (CYD)
LK-P6	8,205,330	1,677,700

TARGET AREA LIMITS

LK-P6

LK-P6-1
LK-P6-2
LK-P6-3
VC-20_6-1
VC-20_6-2
VC-20_6-3

GULF OF MEXICO

N 755,000
N 750,000
E 590,000
E 595,000
E 600,000
82° 12' 0" W
82° 11' 0" W
26° 24' 0" N

LEGEND

- SAND THICKNESS CONTOUR (FEET)
- 4 FOOT SAND THICKNESS CONTOUR
- E——E' REPRESENTATIVE SUBBOTTOM PROFILE (SEE DRAWING 4E)
- LK-P6 CEC PROJECT JET PROBE LOCATION
- VC-20_6-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS (FEET)
1 5 10 15 20 24

SCALE: 1"=1,000'
1,000 0 1,000

NOTES

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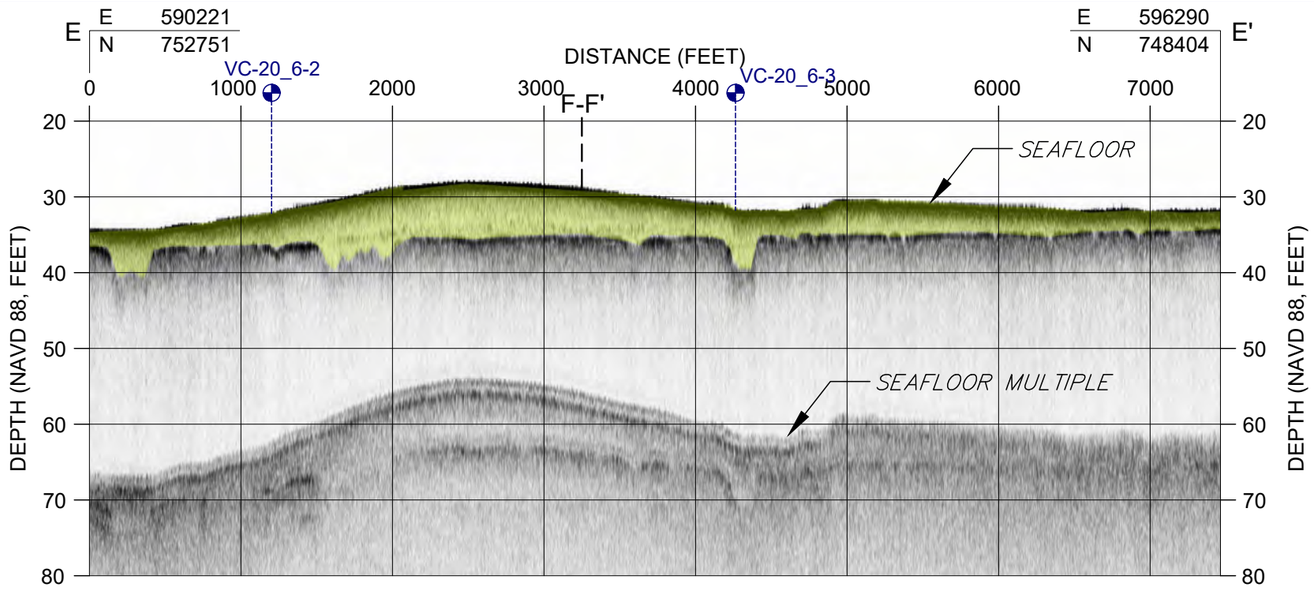
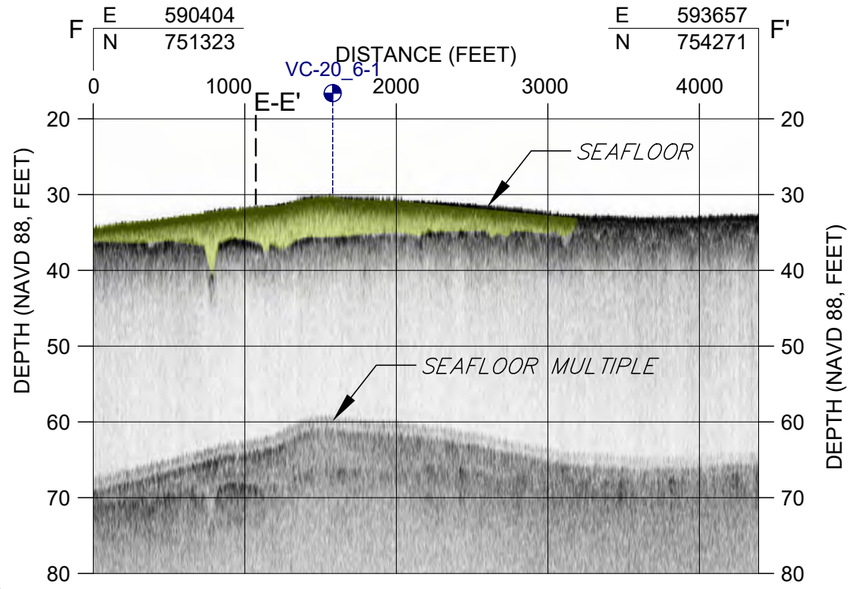
DRAWING 4D





LEGEND

VC-20_6-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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Gulf of Mexico, Florida

DRAWING 4E

N 760,000 | E 660,000 | 81° 59' 0" W | E 665,000 | 81° 58' 0" W | E 670,000 | 81° 57' 0" W | N 760,000

N 755,000 | E 660,000 | 81° 59' 0" W | E 665,000 | 81° 58' 0" W | E 670,000 | 81° 57' 0" W | N 755,000

26° 25' 0" N

26° 24' 0" N

Run 13 Line 0

Run 7 Line 0

Mo (A) 16ft 7M "SC"

GULF OF MEXICO

TARGET AREA LIMITS

VC-20_5-2

EST-JP26

Run 101 Line 2
Run 9 Line 0

VC-20_5-1

VC-20_5-5

LK-P5

Run 8 Line 0

Run 11 Line 0

VC-20_5-6

VC-20_5-4

VC-20_5-3

Obstn

Run 10 Line 0

Run 99 Line 1

Run 12 Line 0

Run 100 Line 3
Run 14 Line 0

MAGNETIC

LEGEND

SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS

EST-JP26 — HISTORIC JET PROBE LOCATION

VC-20_5-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
3. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHART 11427 – FORT MYERS TO CHARLOTTE HARBOR AND WIGGINS PASS (38TH EDITION, APRIL 2018). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
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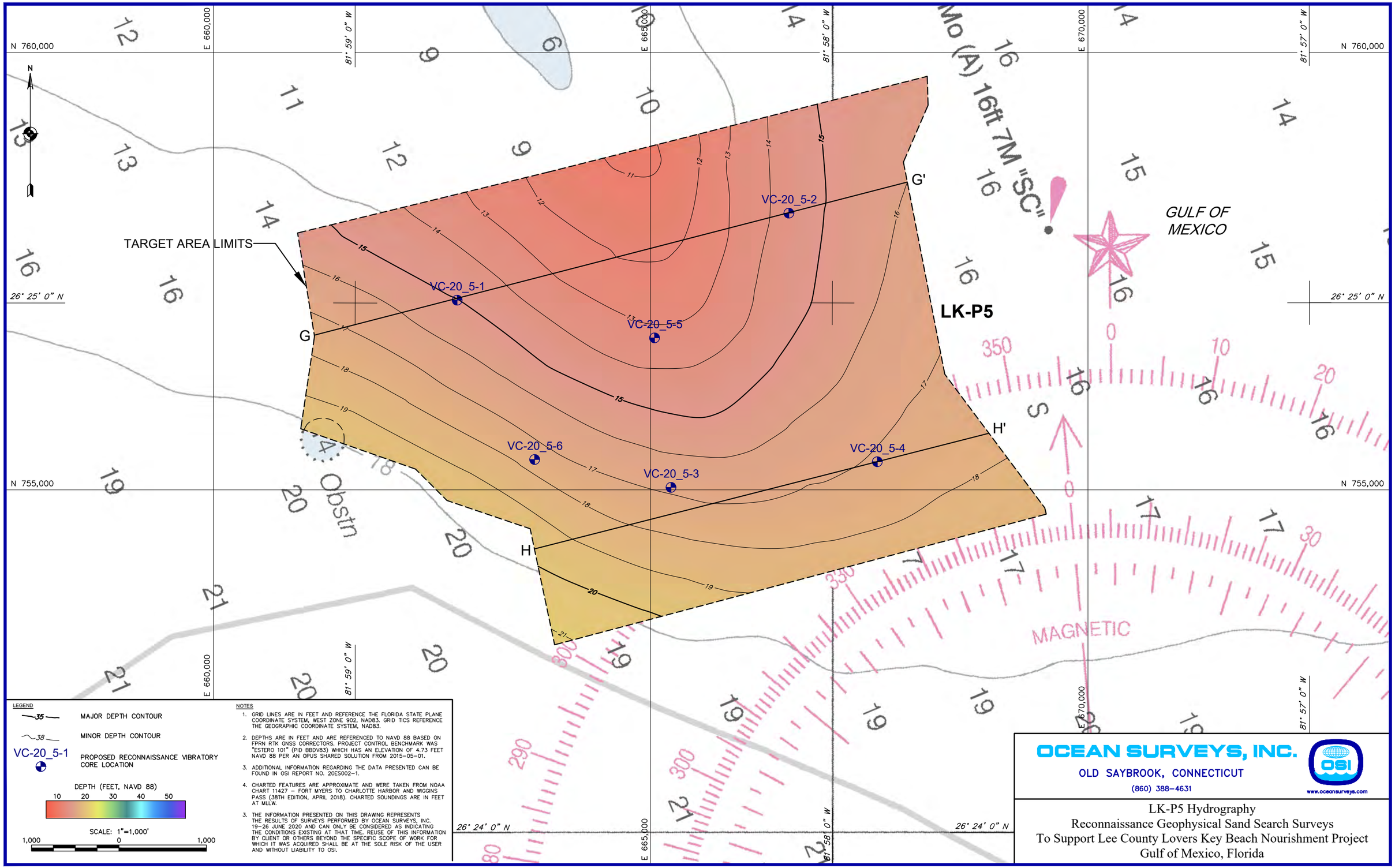
Gulf of Mexico, Florida

DRAWING 5A



LEGEND

- MAJOR DEPTH CONTOUR
- MINOR DEPTH CONTOUR
- VC-20_5-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

DEPTH (FEET, NAVD 88)

10 20 30 40 50

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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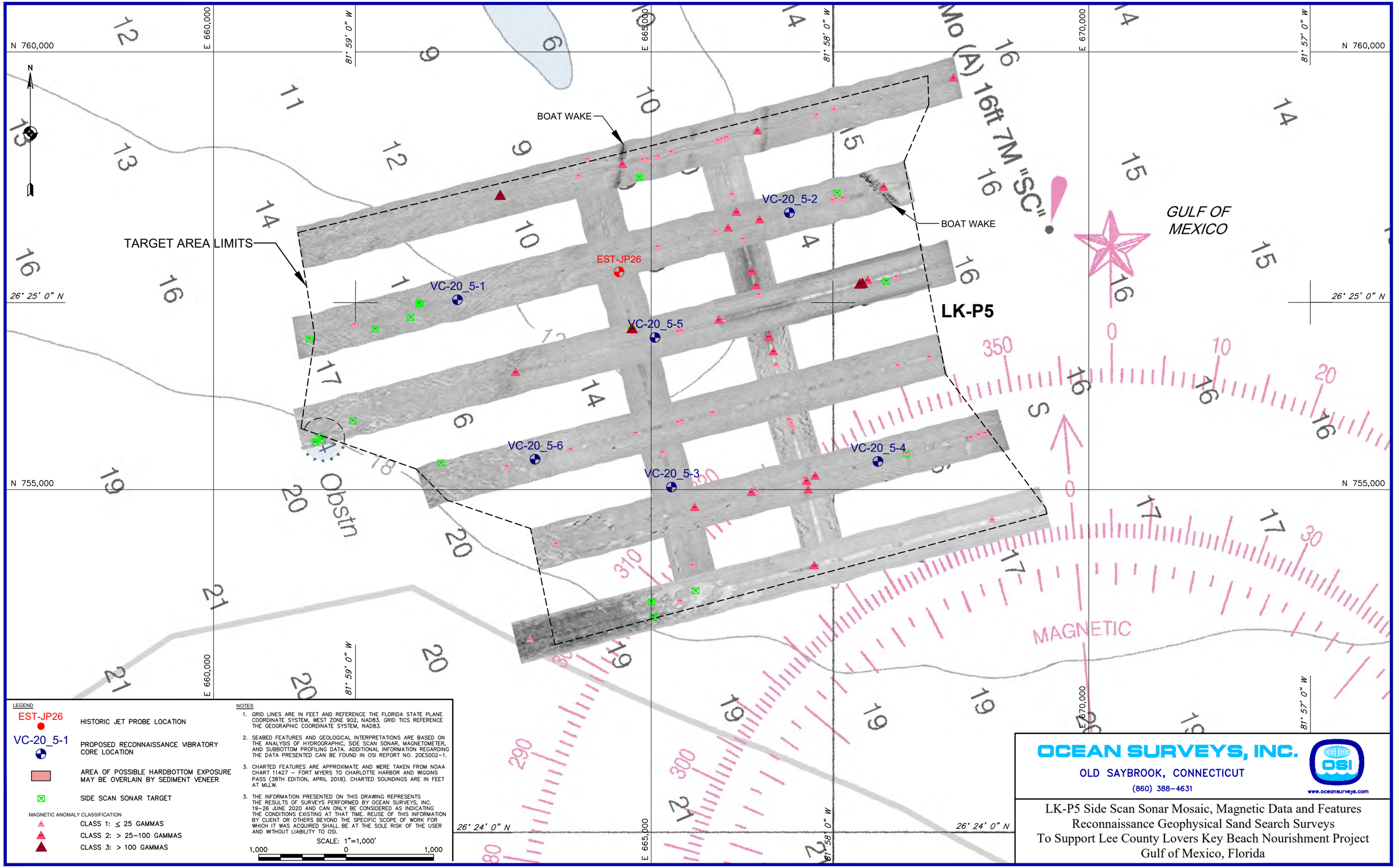
DRAWING 5B



LEGEND

EST-JP26 — HISTORIC JET PROBE LOCATION

VC-20_5-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

AREA OF POSSIBLE HARDBOTTOM EXPOSURE MAY BE OVERLAIN BY SEDIMENT VENEER

SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION

CLASS 1: ≤ 25 GAMMAS

CLASS 2: > 25–100 GAMMAS

CLASS 3: > 100 GAMMAS

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
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SCALE: 1"=1,000'

1,000 0 1,000

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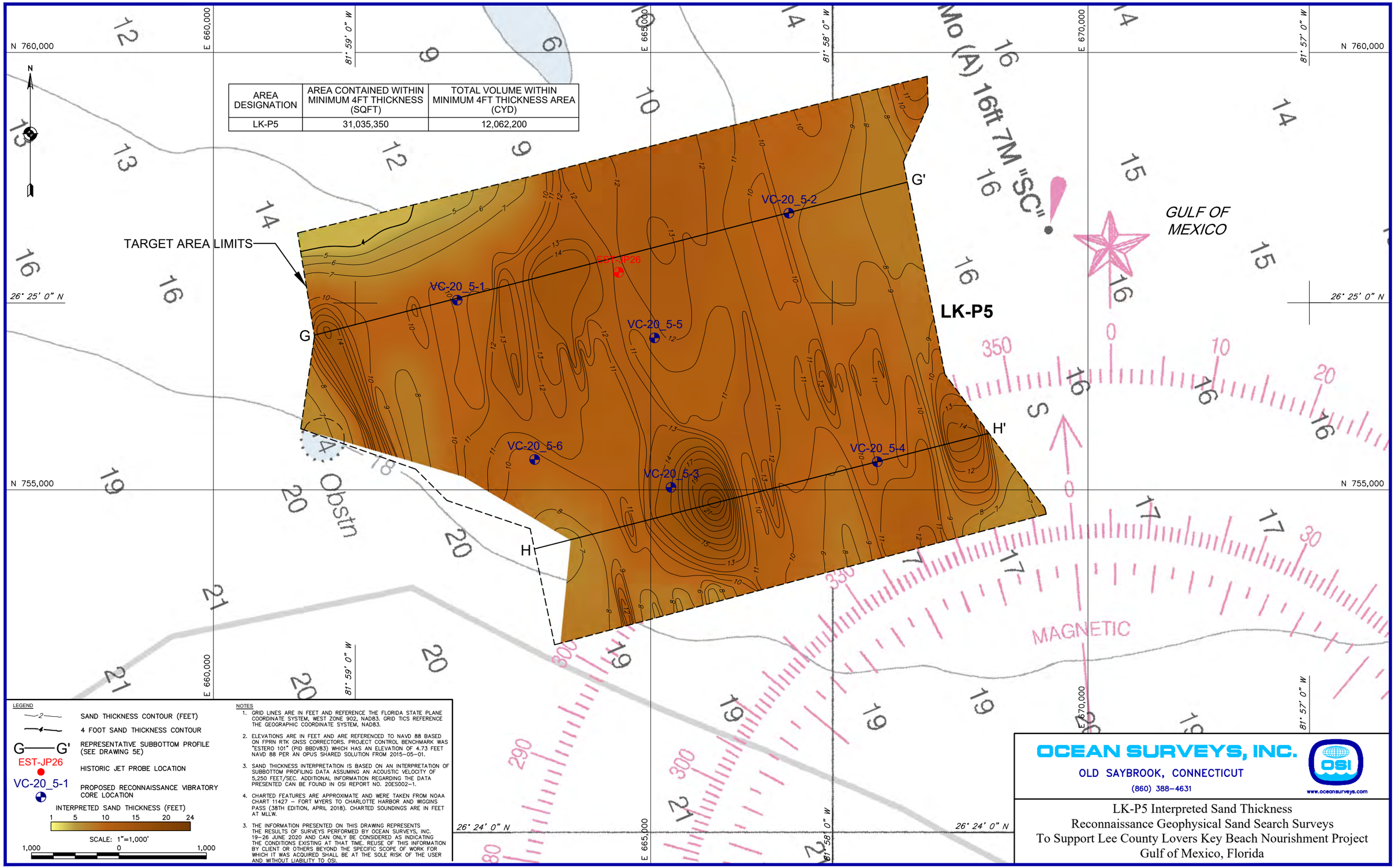
DRAWING 5C

AREA DESIGNATION	AREA CONTAINED WITHIN MINIMUM 4FT THICKNESS (SQFT)	TOTAL VOLUME WITHIN MINIMUM 4FT THICKNESS AREA (CYD)
LK-P5	31,035,350	12,062,200



LEGEND

- SAND THICKNESS CONTOUR (FEET)
- 4 FOOT SAND THICKNESS CONTOUR
- G——G' REPRESENTATIVE SUBBOTTOM PROFILE (SEE DRAWING 5E)
- EST-JP26 HISTORIC JET PROBE LOCATION
- VC-20_5-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS (FEET)

1 5 10 15 20 24

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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3. SAND THICKNESS INTERPRETATION IS BASED ON AN INTERPRETATION OF SUBBOTTOM PROFILING DATA ASSUMING AN ACOUSTIC VELOCITY OF 5,250 FEET/SEC. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
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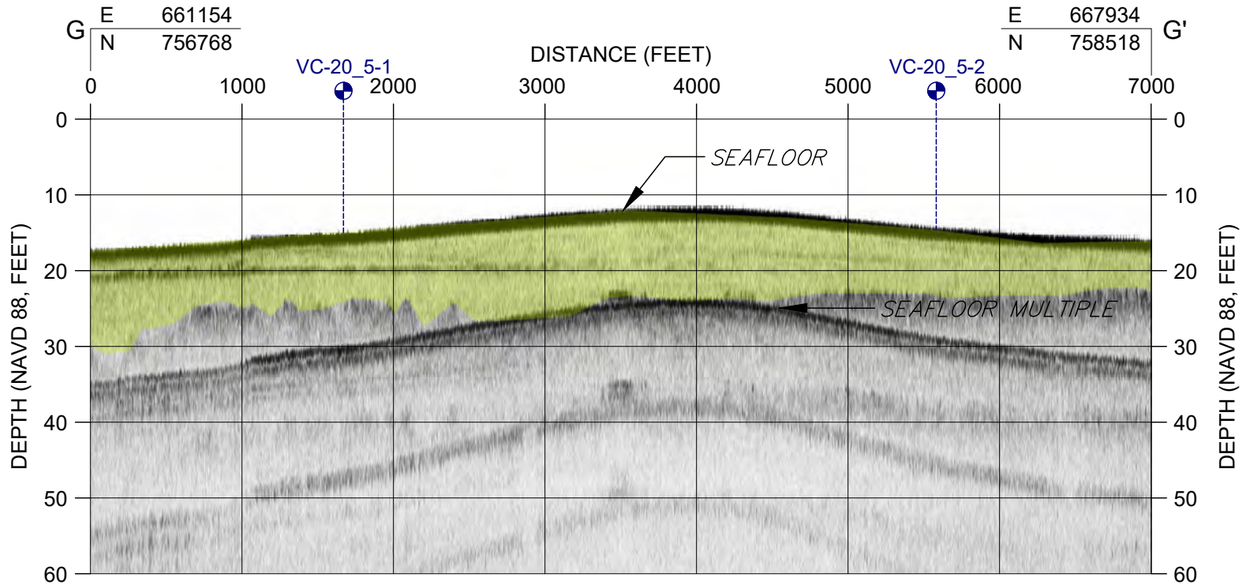
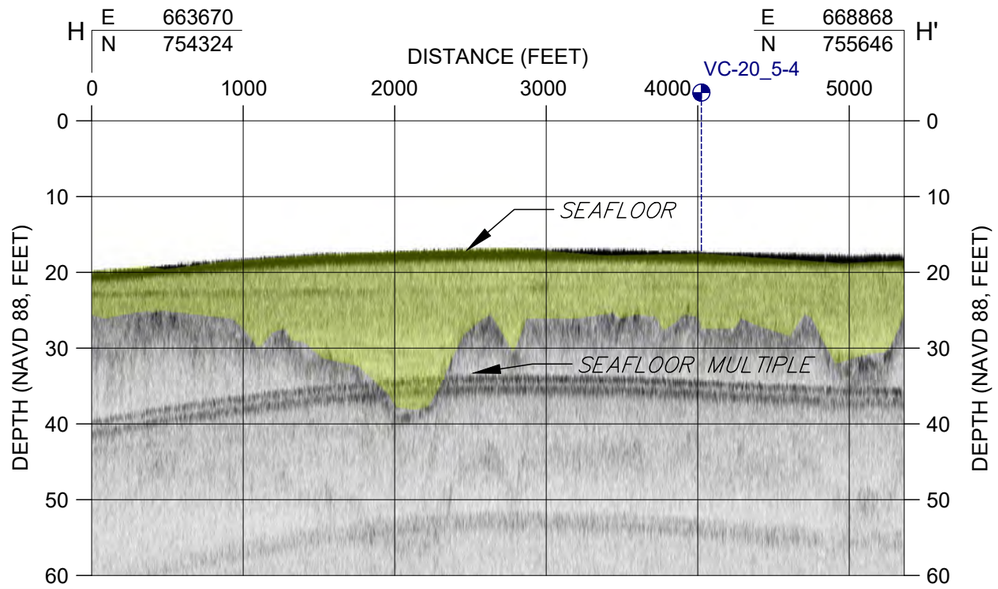
DRAWING 5D





LEGEND

VC-20_5-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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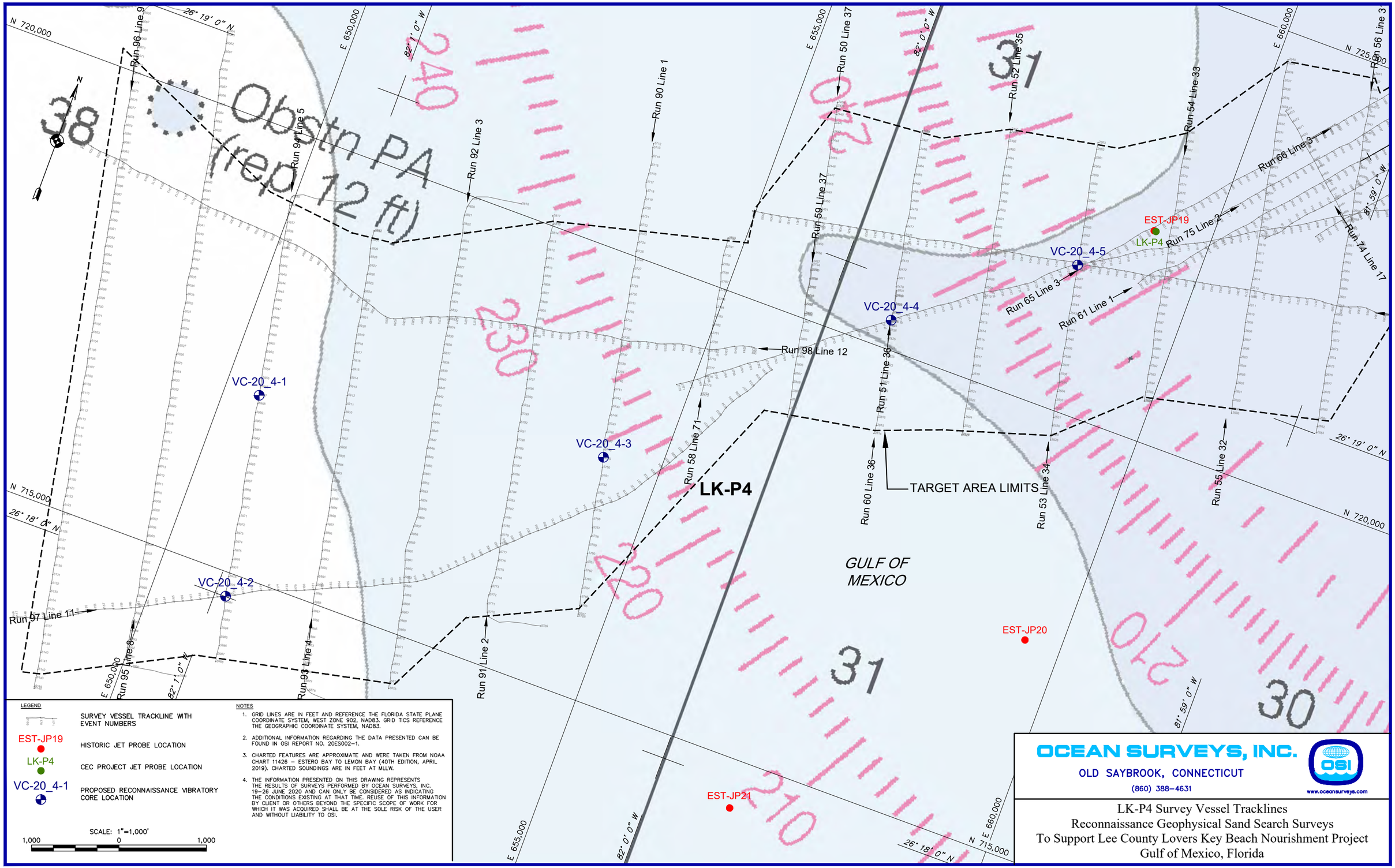
DRAWING 5E



LEGEND

- SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS
- EST-JP19 — HISTORIC JET PROBE LOCATION
- LK-P4 — CEC PROJECT JET PROBE LOCATION
- VC-20_4-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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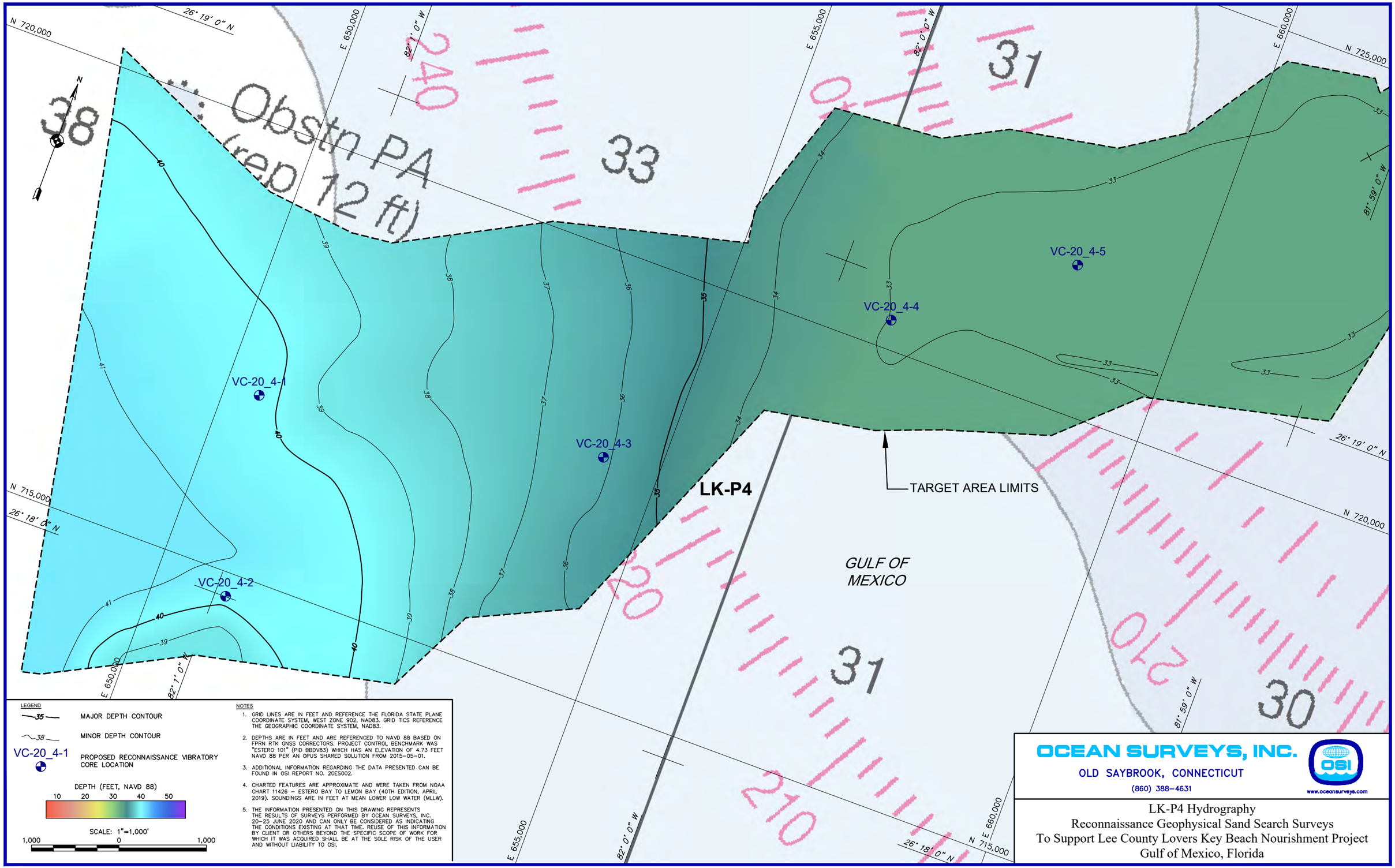
DRAWING 6A



LEGEND

35 MAJOR DEPTH CONTOUR

38 MINOR DEPTH CONTOUR

VC-20_4-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

DEPTH (FEET, NAVD 88)

10 20 30 40 50

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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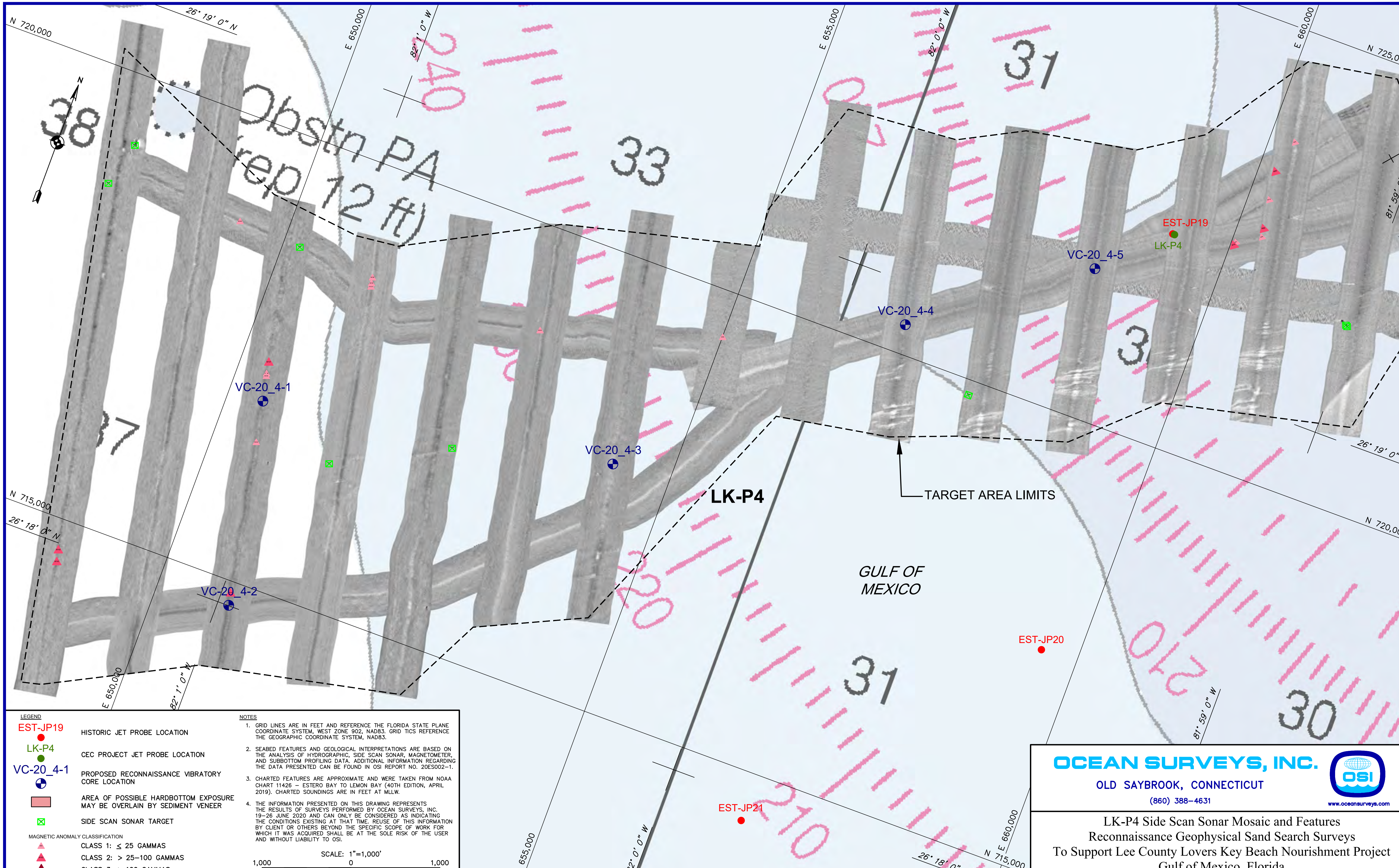
DRAWING 6B



LEGEND

EST-JP19	HISTORIC JET PROBE LOCATION
LK-P4	CEC PROJECT JET PROBE LOCATION
VC-20_4-1	PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION
	AREA OF POSSIBLE HARDBOTTOM EXPOSURE MAY BE OVERLAIN BY SEDIMENT VENEER
	SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION

- CLASS 1: ≤ 25 GAMMAS
- CLASS 2: > 25–100 GAMMAS
- CLASS 3: > 100 GAMMAS

NOTES

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SCALE: 1"=1,000'

1,000 0 1,000

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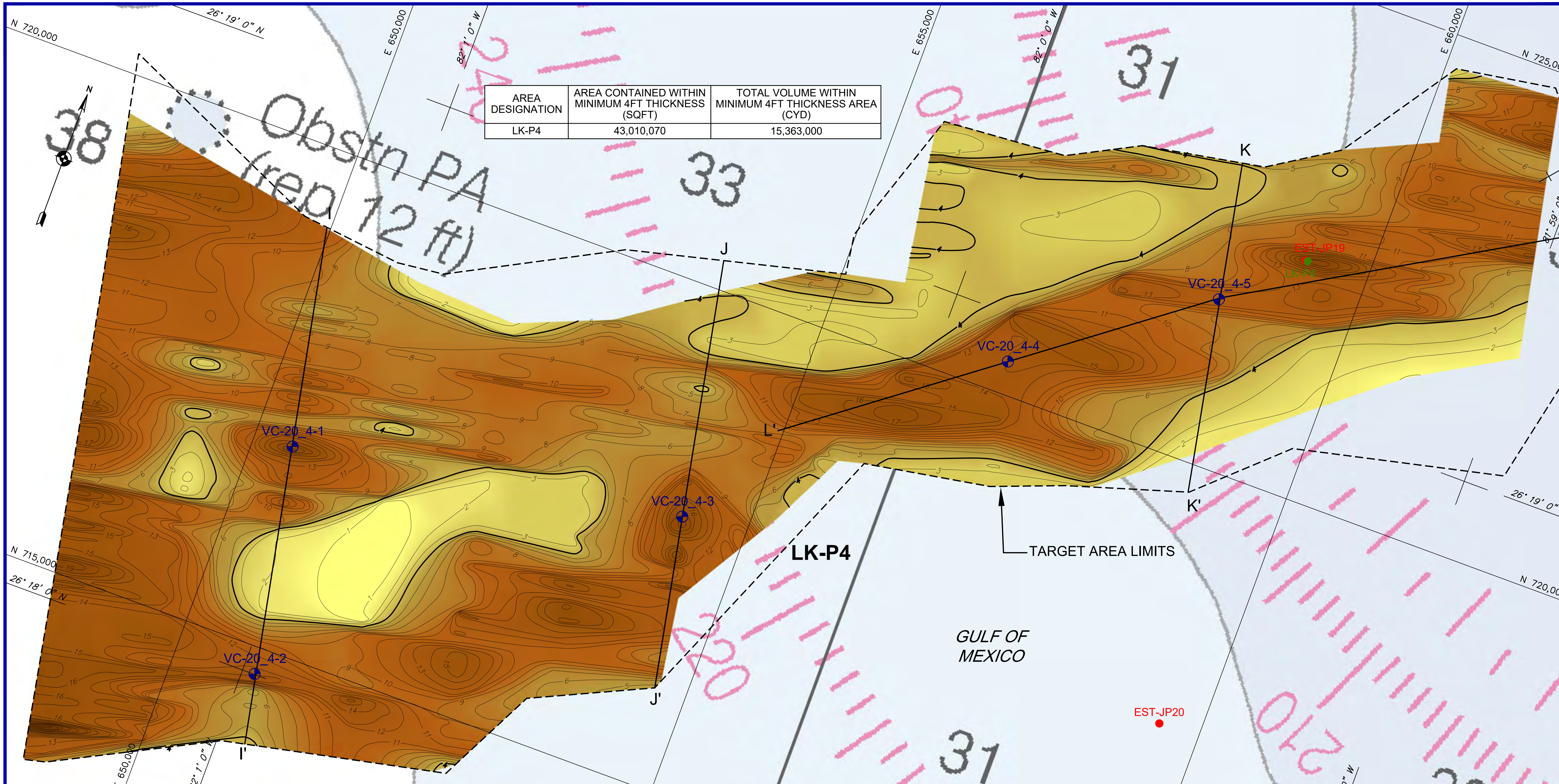
DRAWING 6C

AREA DESIGNATION	AREA CONTAINED WITHIN MINIMUM 4FT THICKNESS (SQFT)	TOTAL VOLUME WITHIN MINIMUM 4FT THICKNESS AREA (CYD)
LK-P4	43,010,070	15,363,000



LEGEND

- SAND THICKNESS CONTOUR (FEET)
- 4 FOOT SAND THICKNESS CONTOUR
- I —— I' REPRESENTATIVE SUBBOTTOM PROFILE (SEE DRAWING 6E)
- EST-JP19 HISTORIC JET PROBE LOCATION
- LK-P4 CEC PROJECT JET PROBE LOCATION
- VC-20_4-1 PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS (FEET)
1 5 10 15 20 24

SCALE: 1"=1,000'
1,000 0 1,000

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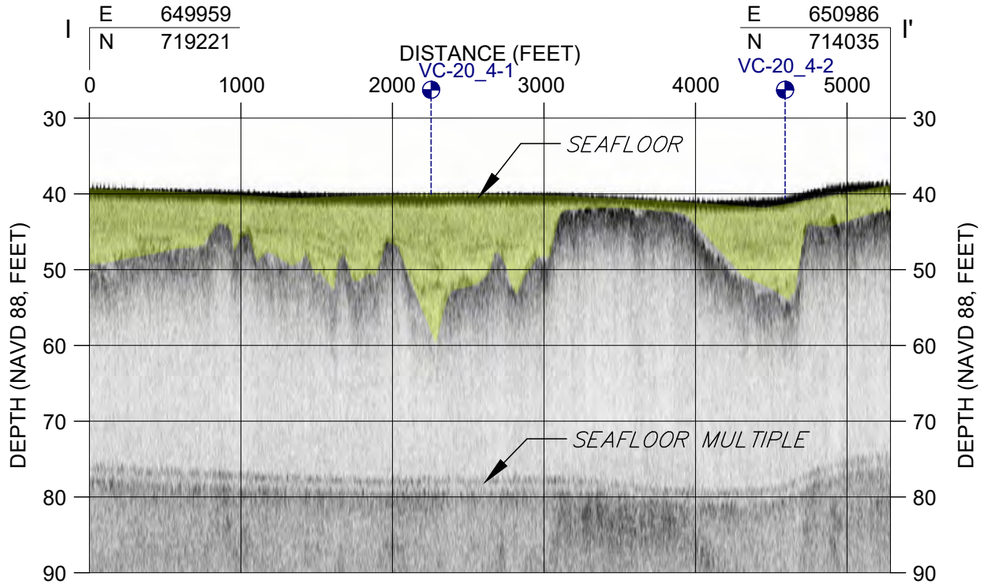
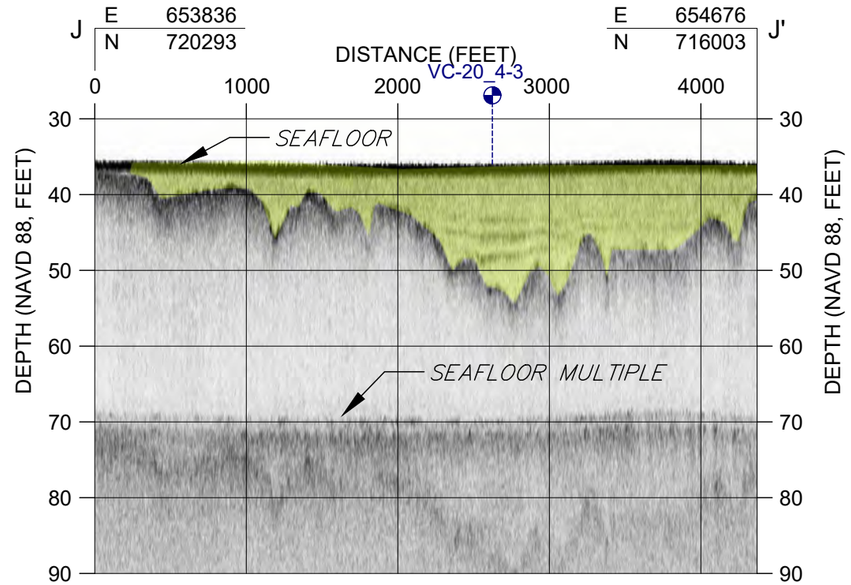
DRAWING 6D





LEGEND

VC-20_4-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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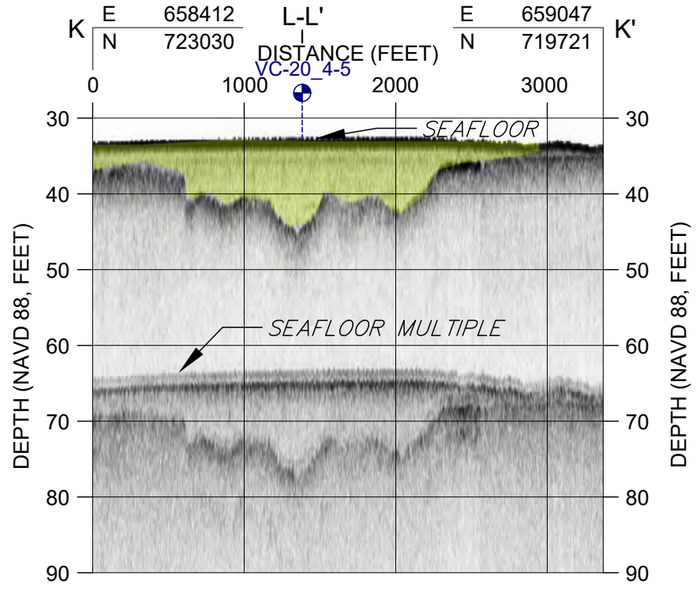

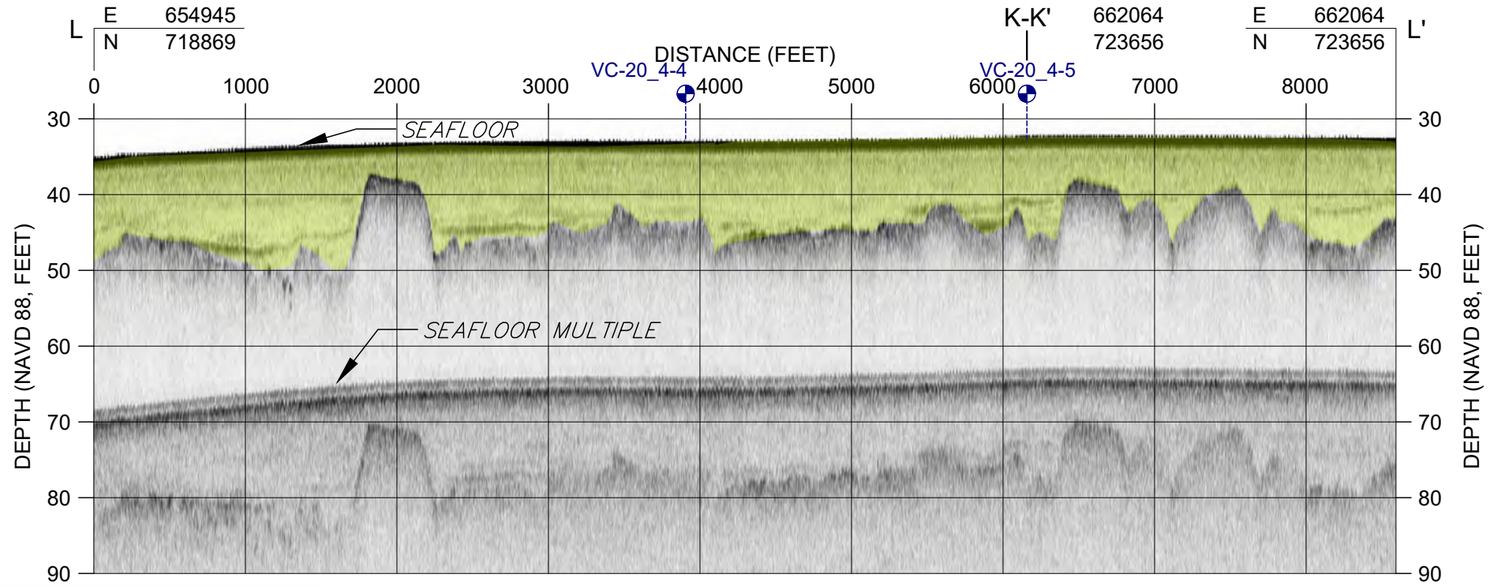

LEGEND

VC-20_4-1 — PROPOSED RECONNAISSANCE VIBRATORY CORE LOCATION

INTERPRETED SAND THICKNESS

SCALE: 1"=1,000'

1,000 0 1,000

NOTES

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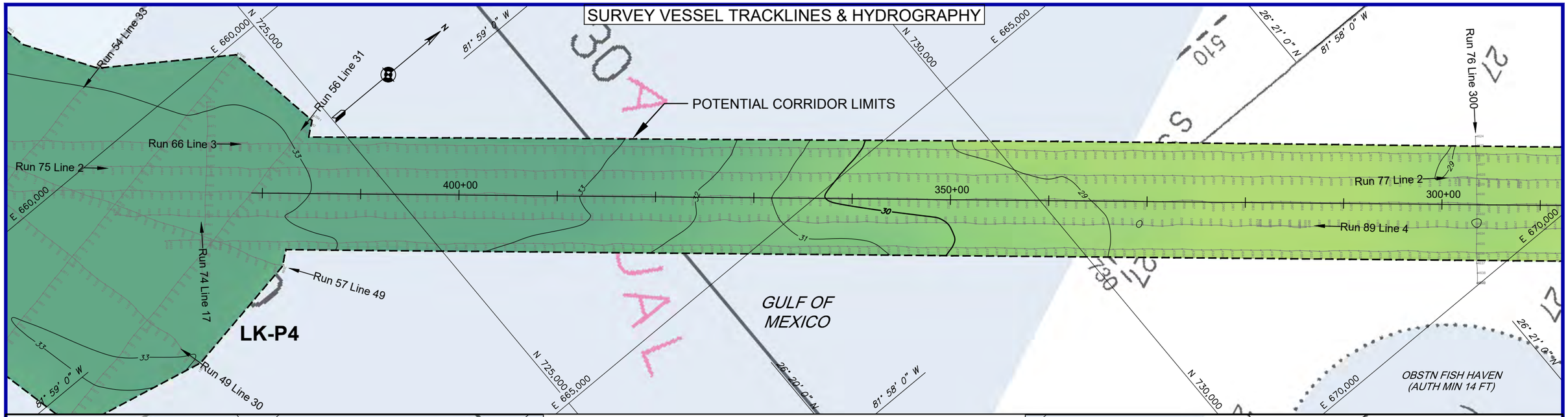
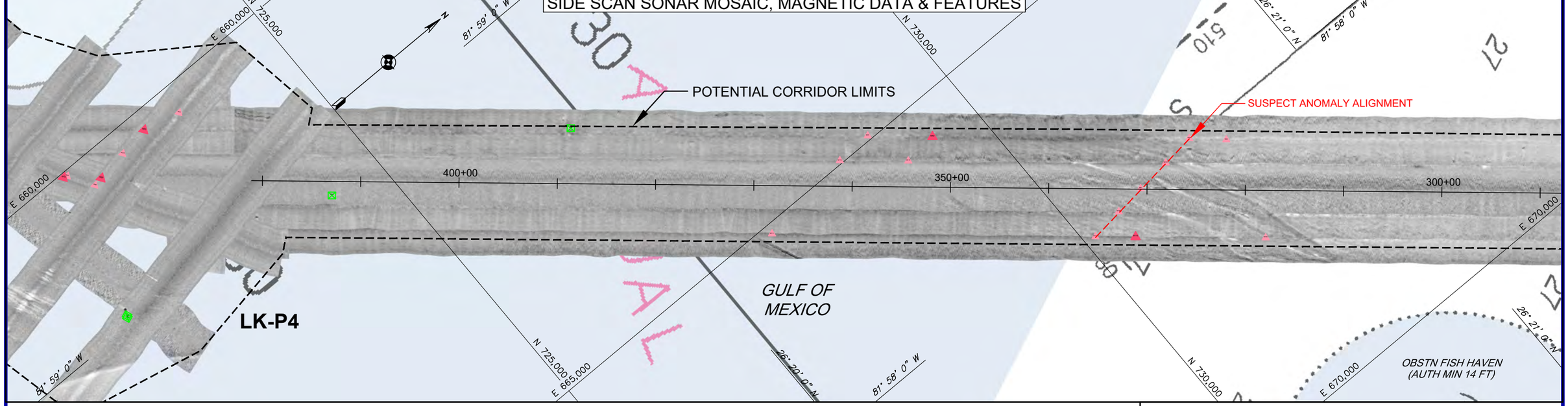
DRAWING 6E-2

SURVEY VESSEL TRACKLINES & HYDROGRAPHY



SIDE SCAN SONAR MOSAIC, MAGNETIC DATA & FEATURES



LEGEND

- SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS
- 35 — MAJOR DEPTH CONTOUR
- 38 — MINOR DEPTH CONTOUR
- SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION

- CLASS 1: ≤ 25 GAMMAS
- CLASS 2: > 25–100 GAMMAS
- CLASS 3: > 100 GAMMAS

50+00 — PIPELINE CORRIDOR CENTERLINE WITH 5000 FT STATIONING

DEPTH (FEET, NAVD 88)

10 20 30 40 50

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. DEPTHS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON FPRN RTK GNSS CORRECTORS. PROJECT CONTROL BENCHMARK WAS "ESTERO 101" (PID BBDV83) WHICH HAS AN ELEVATION OF 4.73 FEET NAVD 88 PER AN OPUS SHARED SOLUTION FROM 2015-05-01.
3. SEABED FEATURES AND GEOLOGICAL INTERPRETATIONS ARE BASED ON THE ANALYSIS OF HYDROGRAPHIC, SIDE SCAN SONAR, MAGNETOMETER, AND SUBBOTTOM PROFILING DATA. ADDITIONAL INFORMATION REGARDING THE DATA PRESENTED CAN BE FOUND IN OSI REPORT NO. 20ES002-1.
4. CHARTED FEATURES ARE APPROXIMATE AND WERE TAKEN FROM NOAA CHARTS 11426 – ESTERO BAY TO LEMON BAY (40TH EDITION, APRIL AND 11427 – FORT MYERS TO CHARLOTTE HARBOR AND WIGGINS PASS (38TH EDITION, APRIL 2018). CHARTED SOUNDINGS ARE IN FEET AT MLLW.
5. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19–26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

SCALE: 1"=1,000'

1,000 0 1,000

OCEAN SURVEYS, INC.

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Pipeline Corridor Survey
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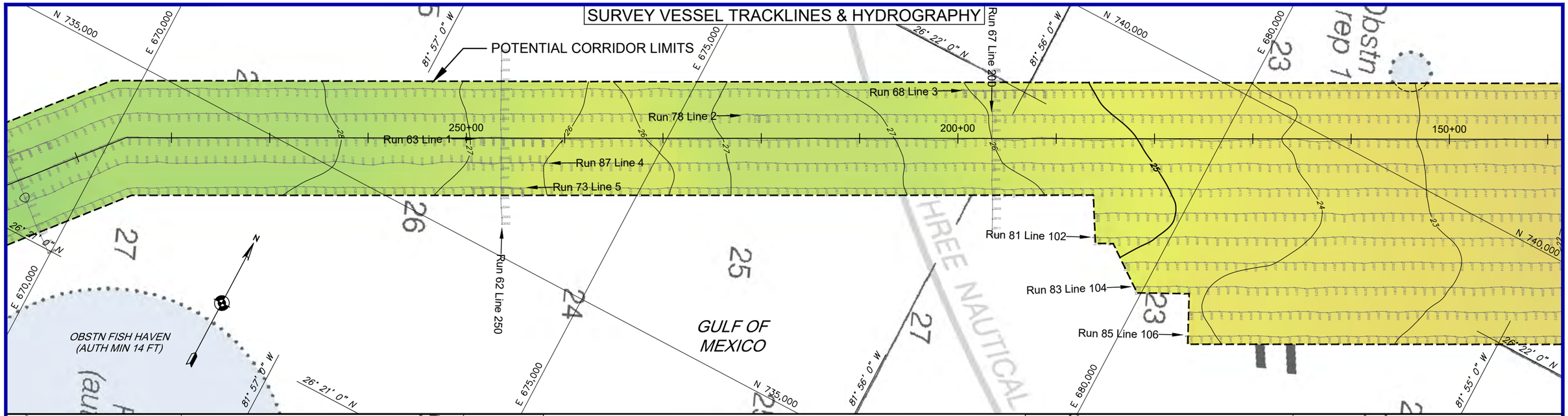
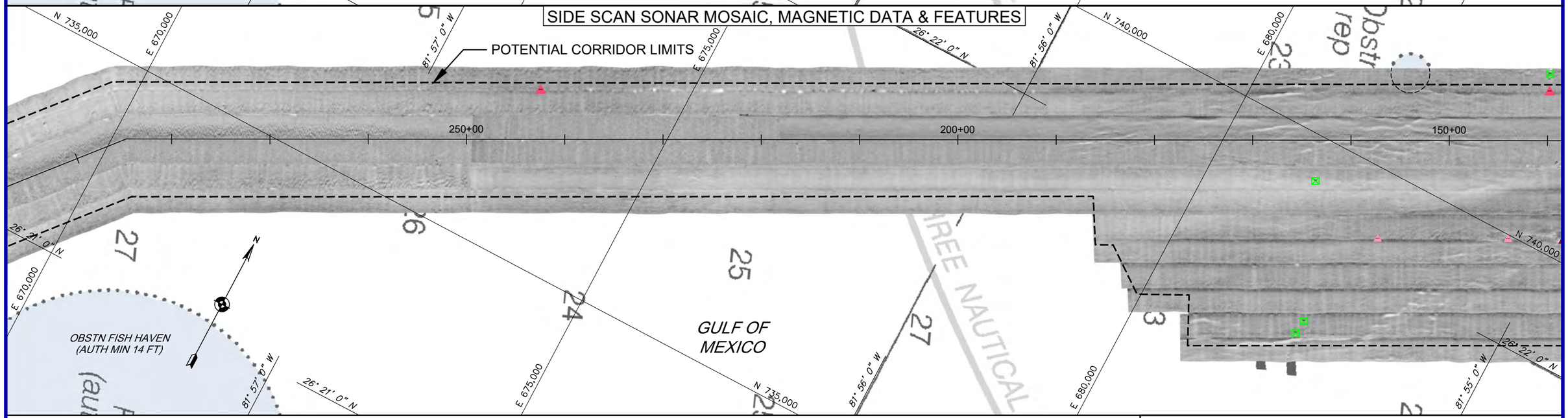
To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 7

SURVEY VESSEL TRACKLINES & HYDROGRAPHY



SIDE SCAN SONAR MOSAIC, MAGNETIC DATA & FEATURES



LEGEND

- SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS
- 35 — MAJOR DEPTH CONTOUR
- 38 — MINOR DEPTH CONTOUR
- SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION

- CLASS 1: ≤ 25 GAMMAS
- CLASS 2: > 25–100 GAMMAS
- CLASS 3: > 100 GAMMAS

50+00 — PIPELINE CORRIDOR CENTERLINE WITH 5000 FT STATIONING

DEPTH (FEET, NAVD 88)
10 20 30 40 50

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
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5. THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. 19–26 JUNE 2020 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

SCALE: 1"=1,000'
1,000 0 1,000

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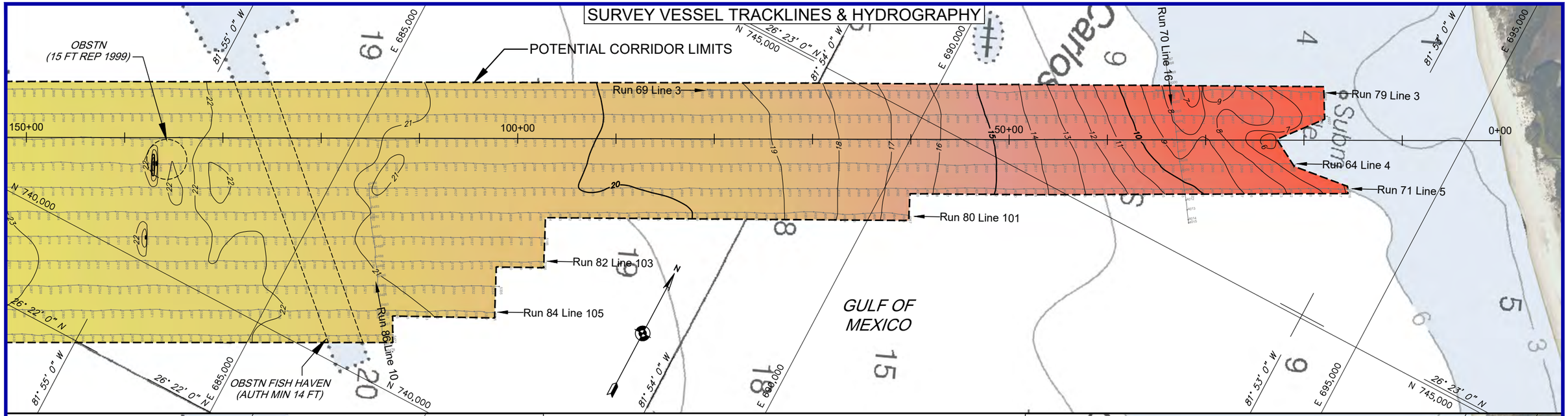
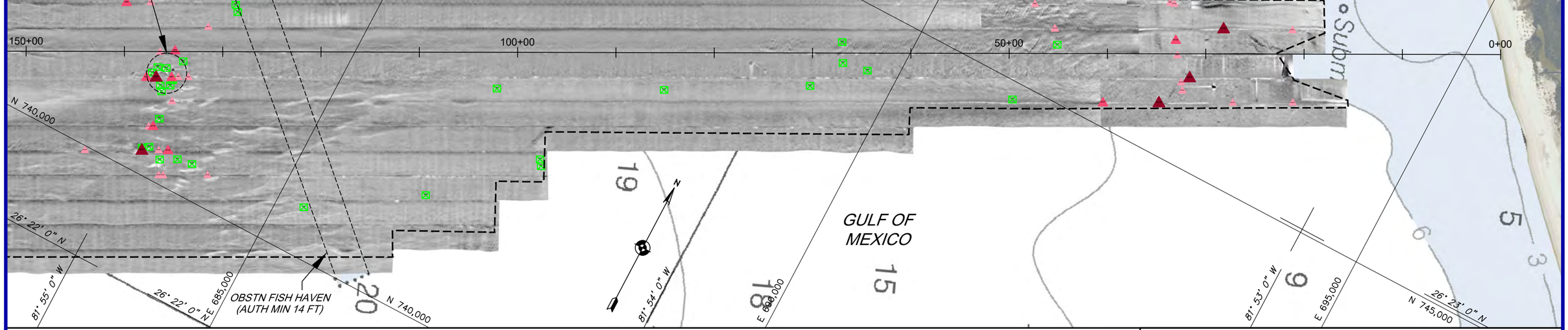
Mosaic & Features, Reconnaissance Geophysical Sand Search Surveys
To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 8

SURVEY VESSEL TRACKLINES & HYDROGRAPHY



SIDE SCAN SONAR MOSAIC, MAGNETIC DATA & FEATURES



LEGEND

- SURVEY VESSEL TRACKLINE WITH EVENT NUMBERS
- 35 — MAJOR DEPTH CONTOUR
- 38 — MINOR DEPTH CONTOUR
- SIDE SCAN SONAR TARGET

MAGNETIC ANOMALY CLASSIFICATION

- CLASS 1: ≤ 25 GAMMAS
- CLASS 2: > 25–100 GAMMAS
- CLASS 3: > 100 GAMMAS

50+00 PIPELINE CORRIDOR CENTERLINE WITH 5000 FT STATIONING

DEPTH (FEET, NAVD 88)

10 20 30 40 50

NOTES

1. GRID LINES ARE IN FEET AND REFERENCE THE FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE 902, NAD83. GRID TICS REFERENCE THE GEOGRAPHIC COORDINATE SYSTEM, NAD83.
2. DEPTHS ARE IN FEET AND ARE REFERENCED TO NAVD 88 BASED ON FPRN RTK GNSS CORRECTORS. PROJECT CONTROL BENCHMARK WAS "ESTERO 101" (PID BBDV83) WHICH HAS AN ELEVATION OF 4.73 FEET NAVD 88 PER AN OPUS SHARED SOLUTION FROM 2015-05-01.
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SCALE: 1"=1,000'

1,000 0 1,000

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To Support Lee County Lovers Key Beach Nourishment Project
Gulf of Mexico, Florida

DRAWING 9

APPENDIX 3

RCG&A GEOARCHAEOLOGICAL REVIEW LETTERS FOR RECONASISANCE VIBRACORES

August 11, 2020

Dr. Vadim Alymov, Ph.D.
Coastal Modeler
Coastal Engineering Consultants, Inc.
3106 South Horseshoe Drive
Naples, Florida 34104

RE: Geoarchaeological Review of Three (3) Vibracores from Sand Target Area, LK-P1, Lee County Lovers Key Beach Nourishment Project, Gulf of Mexico, Offshore Florida

Dear Dr. Alymov:

This report provides the results of cultural resources analyses of three (3) geotechnical sampling locations surveyed by Ocean Surveys, Inc. (OSI) within sand target area, LK-P1, to support a geotechnical site investigation of the proposed Lee County Lovers Key Beach Nourishment Project, Gulf of Mexico, Offshore Florida. The proposed sand target area, LK-P1, is located approximately 13 nautical miles (nm) (24 kilometers [km]) southwest of Sanibel Island, Florida. The work was performed under subcontract to Coastal Engineering Consultants, Inc. (CECI) for Lee County.

American Vibracore Services (AVS), a marine division of Amdrill Inc., will perform the reconnaissance-level vibracores (VCs) in the proposed sand target area, LK-P1 to ground-truth the results of the geophysical survey data and to provide data to develop sediment thickness and volume estimates for the proposed borrow areas (OSI 2020). AVS will utilize M/V *Thunderforce*, an 85-foot (ft) (25.9-meter [m]) coring vessel with a 33-ft (10-m) stern mounted A-frame. Sediment sampling will be accomplished using a pneumatic vibracore machine with 3-inch (7.6 centimeter [cm]) outside diameter polycarbonate tubes. Sampling operations will be conducted to the maximum target depth below the seabed or to refusal. Penetrometer data collection will be recorded to verify VC refusal. Refusal is defined as the sampling barrel having a penetration rate of less than 0.2 ft (6 cm) over a 2-minute period. If refusal is encountered, AVS will offset up to 20 ft (6 m) and conduct at least two additional sampling attempts. Each location where refusal is encountered will be recorded. Visual monitoring of the acoustic exclusion zone will be conducted by a trained protected species observer approved by the National Marine Fisheries. During the vibracoring operations, AVS will operate *Thunderforce* in "live boat" mode. Therefore, impact to the sea floor will be limited to the footprint of the vibratory corer, which will be confined to within the analytical area.

OSI conducted the high-resolution geophysical (HRG) survey operations aboard R/V *Able II*, a shallow draft 26-foot research vessel equipped with dual outboard motors, a fully enclosed cabin, A-frame, swing arm davit, winches, and all United States Coast Guard (USCG) safety equipment including an Automatic Information System (AIS). The reconnaissance HRG survey, which included the acquisition of single beam depth soundings, side scan sonar imagery, marine magnetometer, and sub-bottom profile data on

the OCS within LK-P1, was accomplished in a single work day (21 June 2020). In total, 8.3 nm (15.3 km) of HRG tracklines were investigated in the LK-P1 area (OSI 2020).

A Qualified Marine Archaeologist reviewed and interpreted the HRG reconnaissance data processed by OSI, within a 50 ft (15 m) radius analytical area centered on each of the three (3) proposed geotechnical locations to support a planned reconnaissance geotechnical sediment sampling program (Table 1; Appendix 1). The reviewed data included at minimum two (2) perpendicular lines of survey data that captured each of the proposed locations. This review focused on identification of any potential submerged cultural resources and buried, preserved paleolandforms through geophysical investigations.

High-resolution side scan sonar imagery was recorded throughout the survey area and viewed as georeferenced mosaicked files (Appendix 1). No sonar contacts representing significant cultural resources were identified within the analytical areas.

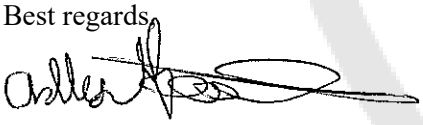
OSI utilized a Geometrics G882 Cesium Marine Magnetometer to collect magnetic data along each survey trackline. Magnetic anomalies were interpreted using magnetic total field data, and by observing their characteristics in terms of amplitude, duration, magnetic signature, and spatial distribution (Appendix 1). No magnetic anomalies representing significant cultural resources were identified within the analytical areas.

Seismic data were collected and interpreted along each survey line associated with the geotechnical locations (Appendix 2). All seismic data were reviewed to their full vertical extent. The geotechnical locations were also reviewed with respect to the ground model and interpreted horizons. Analyses of the seismic data suggest that the geotechnical samples will not impact any submerged and buried landforms with the potential to contain preserved archaeological resources.

The analyses considered all portions of the seafloor within the limits of bottom-disturbing activities as they pertain to the proposed sampling locations (Table 1; Appendix 1 and 2). Based on the current data, if the proposed geotechnical sampling activities are contained within the established analytical areas (Table 1), no potential archaeological resources will be affected by these activities. No historic properties that are eligible for the National Register of Historic Places were detected at the proposed sampling locations.

If you have questions, please do not hesitate to contact us.

Best regards,



Ashley Himmelstein, M.A.
Nautical Archaeologist

Table 1. Vibratory core locations.

Proposed RECON VC Designation (Core Length)	Easting[1]	Northing[1]	Latitude[2]	Longitude[2]	Water Depth[3]
VC-20_1-1 (20-FT)	534673.43	745846.58	26.385129	-82.371115	36.1 (11 m)
VC-20_1-2 (20-FT)	536032.52	744380.78	26.381107	-82.366951	34.5 (10.5 m)
VC-20_1-3 (20FT)	537374.40	742904.34	26.377056	-82.362840	32.0 (9.7 m)

[1]Grid Coordinates are referenced to Florida State Plane Coordinate System, West Zone (0902), NAD 83.

[2]Geographical coordinates are decimal degrees referenced to NAD 83.

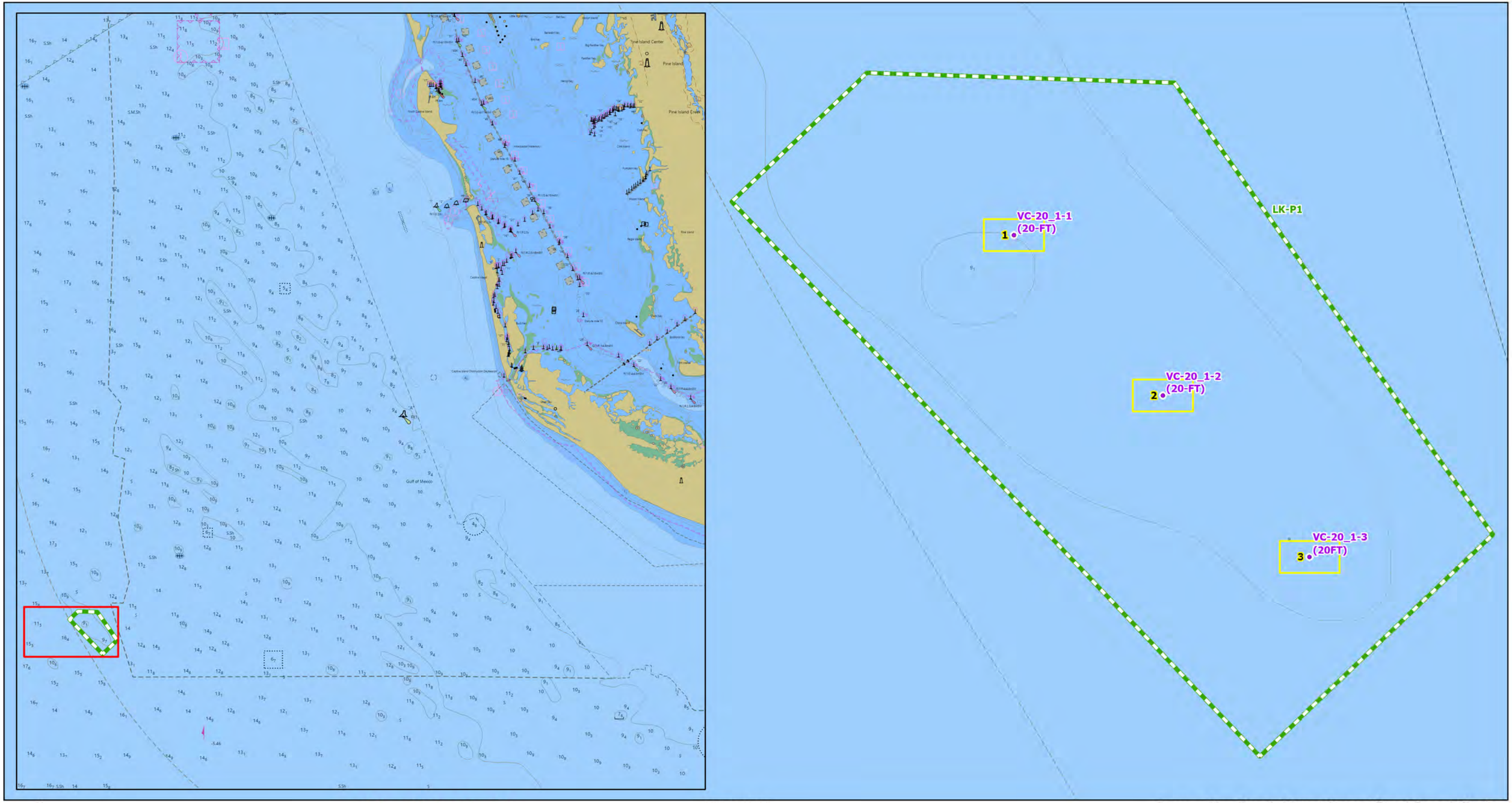
[3]Water Depths are in feet and referenced to NAVD88

References

Ocean Surveys, Inc (OSI)

2020 *Survey Report – OCS Authorization M20-001, Reconnaissance Level HRG Survey to Support Lee County Florida, Gulf of Mexico, Florida*. Submitted to the Bureau of Ocean Energy Management MS 881A-Data Acquisition and Special Projects Unit, New Orleans, LA 70123

APPENDIX 1
ARCHAEOLOGICAL RESOURCES MAPS



N
W E
S
GRID NORTH

MSR: 1:10,000
SRS: NAD 1983 STATEPLANE FLORIDA WEST FIPS 0902 FEET

0 100 200 300 400
METERS
0 500 1,000 1,500 2,000
FEET

Privileged & Confidential

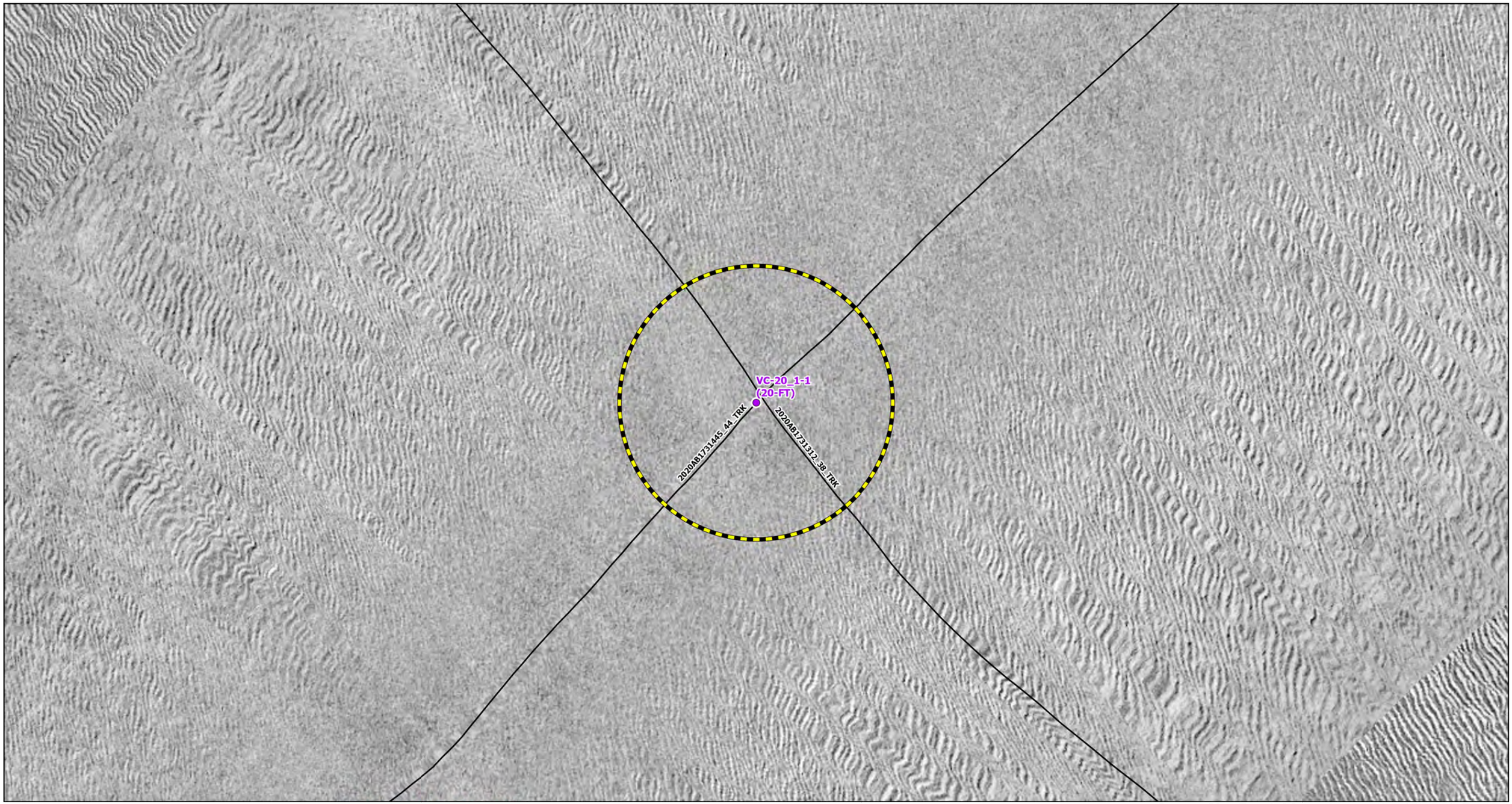
WMS: NOAA ENC

- PROPOSED VIBRACORE
- MAP SHEET EXTENT
- BORROW AREA

Lovers Key Beach Nourishment Sand Search Project
Lee County, Florida
Geotechnical Clearance: LK-P1

Index Map

R. Christopher Goodwin & Associates, Inc.
NAUTICAL DIVISION
MARINE ARCHAEOLOGY FROM STEM TO STERN
WWW.RCGOODWIN.COM | KMAY, 8.11.2020



Privileged & Confidential

N
W E
S
Grid North

MSR: 1:400
SRS: NAD 1983 StatePlane Florida West FIPS 0902 Feet

0 5 10 15 20 Meters

0 25 50 75 100 Feet

Side Scan Sonar Mosaic (0.5ft, 2020)

- Proposed Vibracore
- Magnetic Anomaly
- Side Scan Sonar Contact
- Trackline
- Analytic Area

Lovers Key Beach Nourishment Sand Search Project

Lee County, Florida

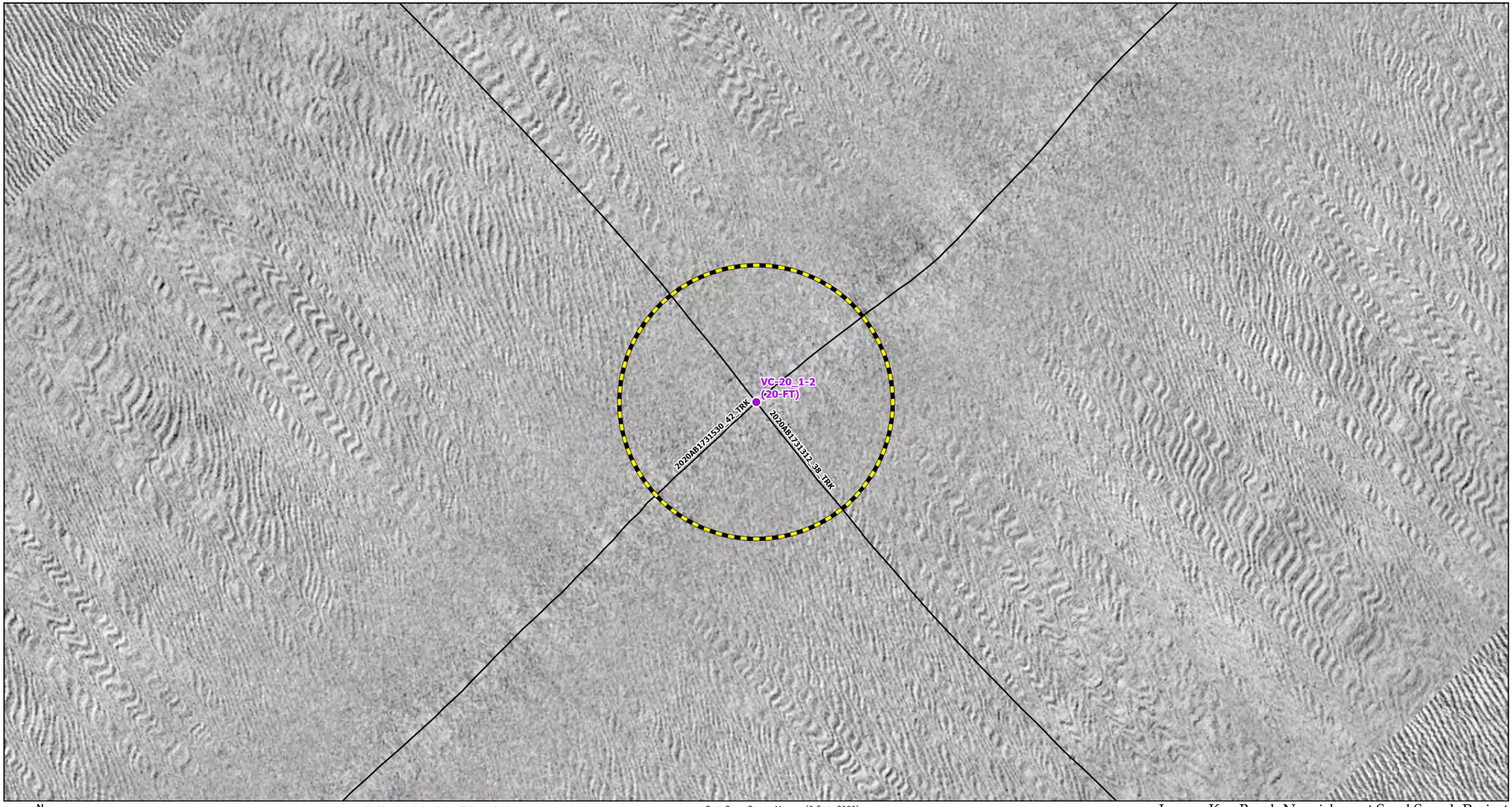
Geotechnical Clearance: LK-P1

Geotechnical Location: VC-20_1-1 (20-ft)

Map: 1

R. Christopher Goodwin & Associates, Inc.
NAUTICAL DIVISION
MARINE ARCHAEOLOGY FROM STEM TO STERN

www.rcgoodwin.com | kmay, 8.11.2020



Privileged & Confidential

N
W E
S
GRID NORTH

MSR: 1:400
SRS: NAD 1983 STATEPLANE FLORIDA WEST FIPS 0902 FEET

0 5 10 15 20 METERS
0 25 50 75 100 FEET

SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

PROPOSED VIBRACORE
MAGNETIC ANOMALY
SIDE SCAN SONAR CONTACT
TRACKLINE
ANALYTIC AREA

Lovers Key Beach Nourishment Sand Search Project

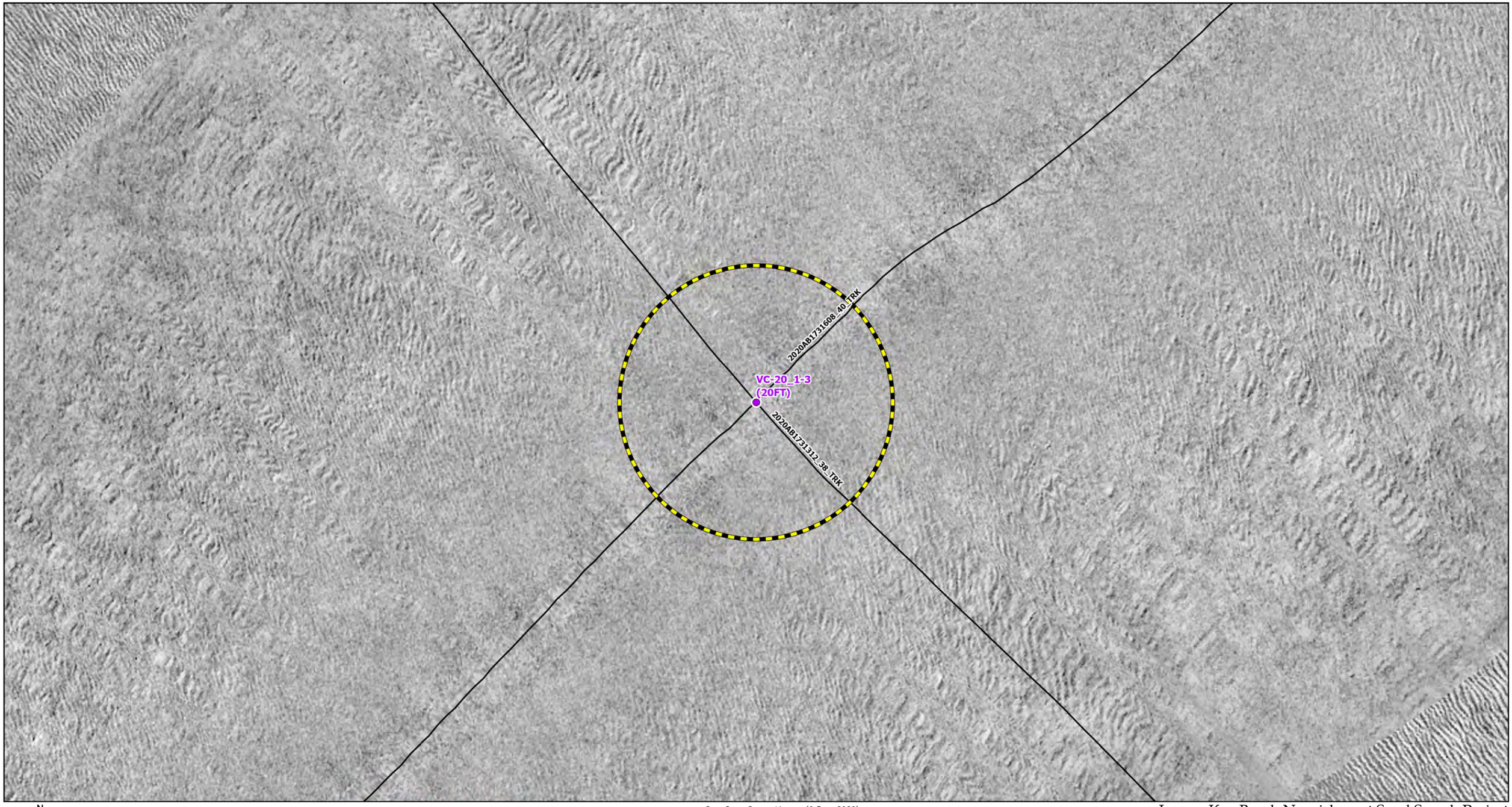
Lee County, Florida

Geotechnical Clearance: LK-P1

Geotechnical Location: VC-20_1-2 (20-ft)

Map: 2

R. Christopher Goodwin & Associates, Inc.
NAUTICAL DIVISION
MARINE ARCHAEOLOGY FROM STEM TO STERN
WWW.RCGOODWIN.COM | KMAY, 8.11.2020



Privileged & Confidential

N
W E
S
Grid North

MSR: 1:400
SRS: NAD 1983 StatePlane Florida West FIPS 0902 Feet

0 5 10 15 20 Meters
0 25 50 75 100 Feet

Side Scan Sonar Mosaic (0.5ft, 2020)

- Proposed Vibracore
- Magnetic Anomaly
- Side Scan Sonar Contact
- Trackline
- Analytic Area

Lovers Key Beach Nourishment Sand Search Project

Lee County, Florida

Geotechnical Clearance: LK-P1

Geotechnical Location: VC-20_1-3 (20-ft)

Map: 3

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NAUTICAL DIVISION
MARINE ARCHAEOLOGY FROM STEM TO STERN
www.rcgoodwin.com | kmay, 8.11.2020

APPENDIX 2
SUB-BOTTOM PROFILE IMAGES

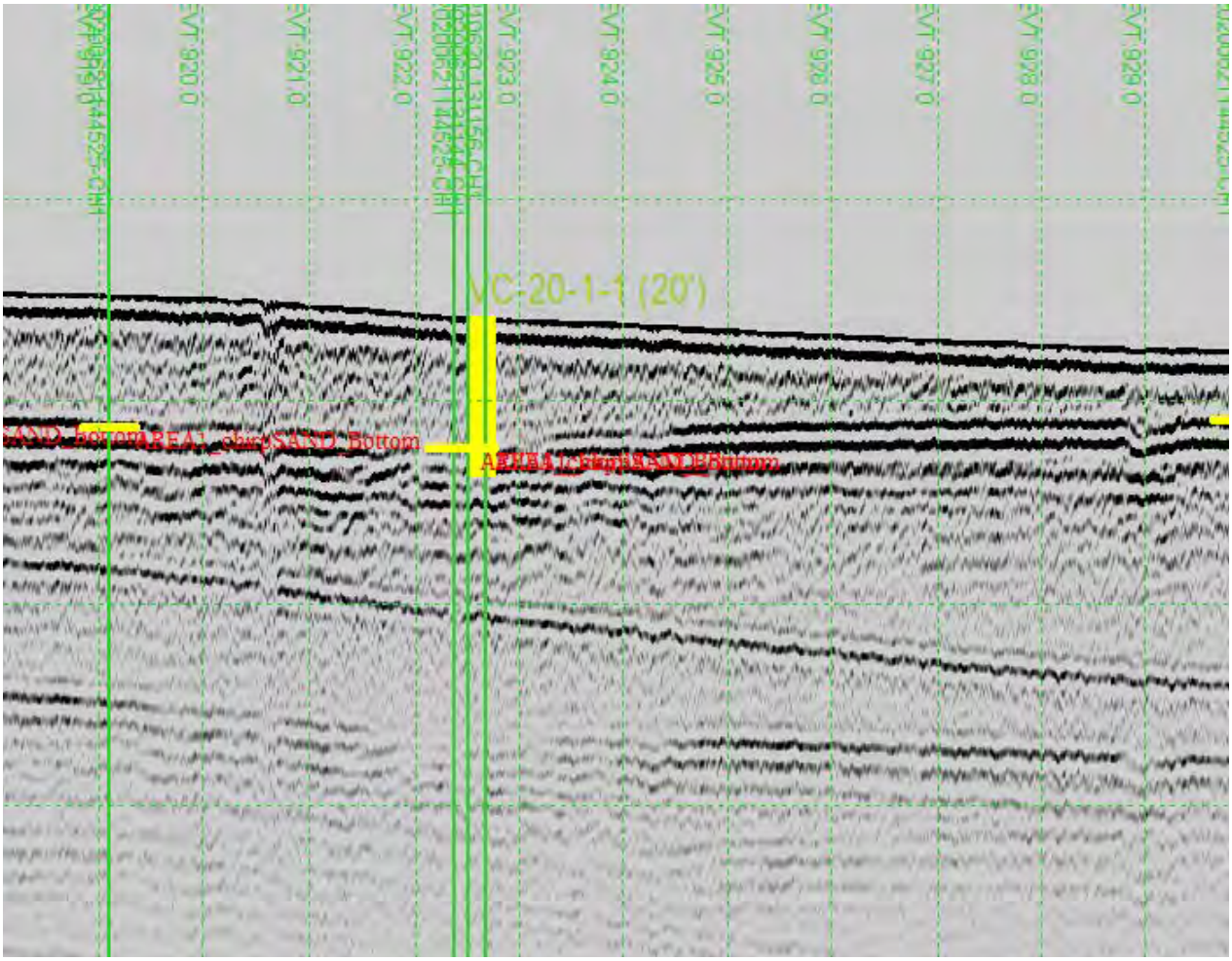


Figure 1: Boomer data of proposed geotechnical core location VC-20_1-1. The vertical yellow line represents the core's location and the maximum depth it could reach (20 feet [6 m]). Horizontal dotted green lines mark every 25ft (7.6 m) of depth.

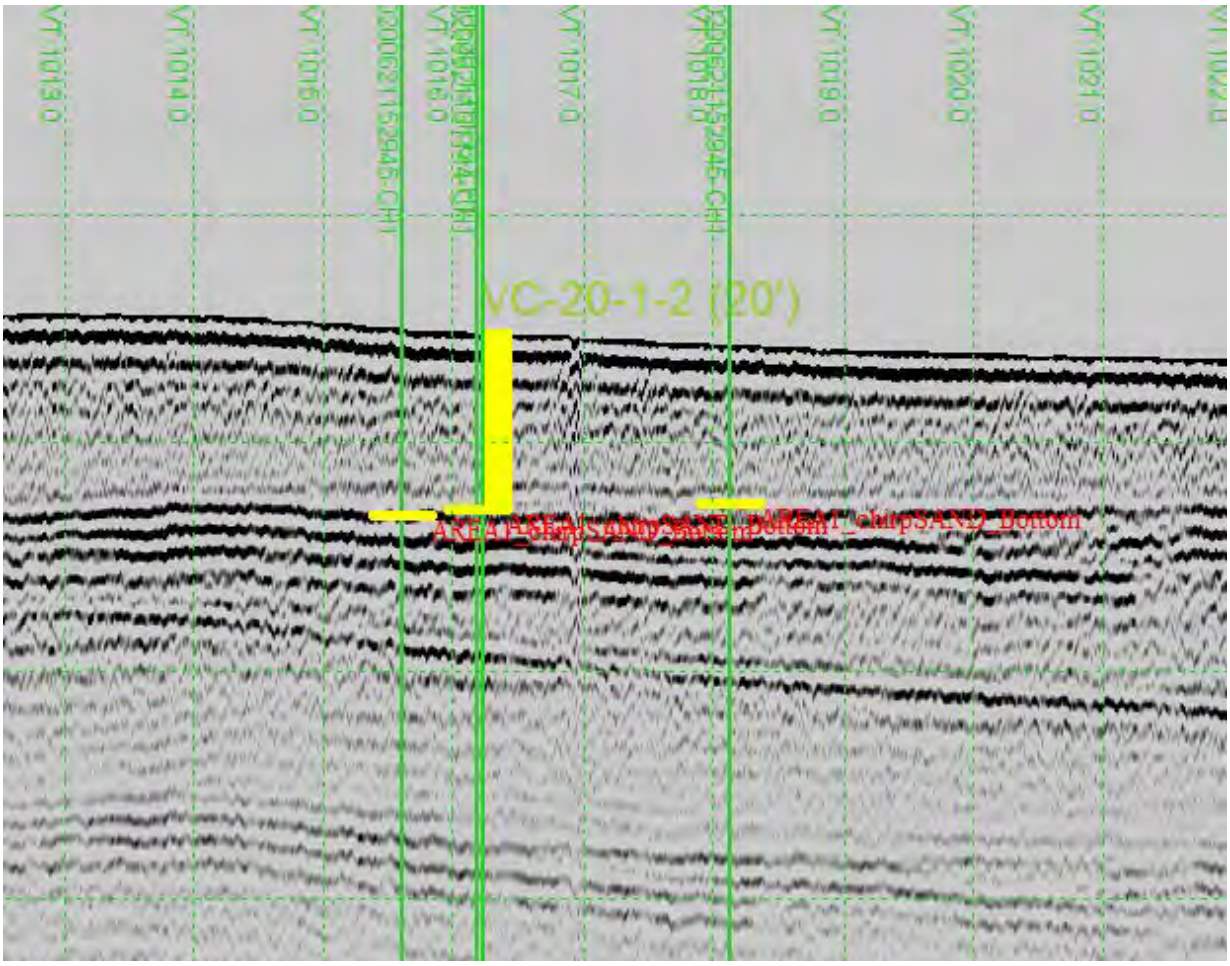


Figure 2: Boomer data of proposed geotechnical core location VC-20_1-2. The vertical yellow line represents the core's location and the maximum depth it could reach (20 feet [6 m]). Horizontal dotted green lines mark every 25ft (7.6 m) of depth.

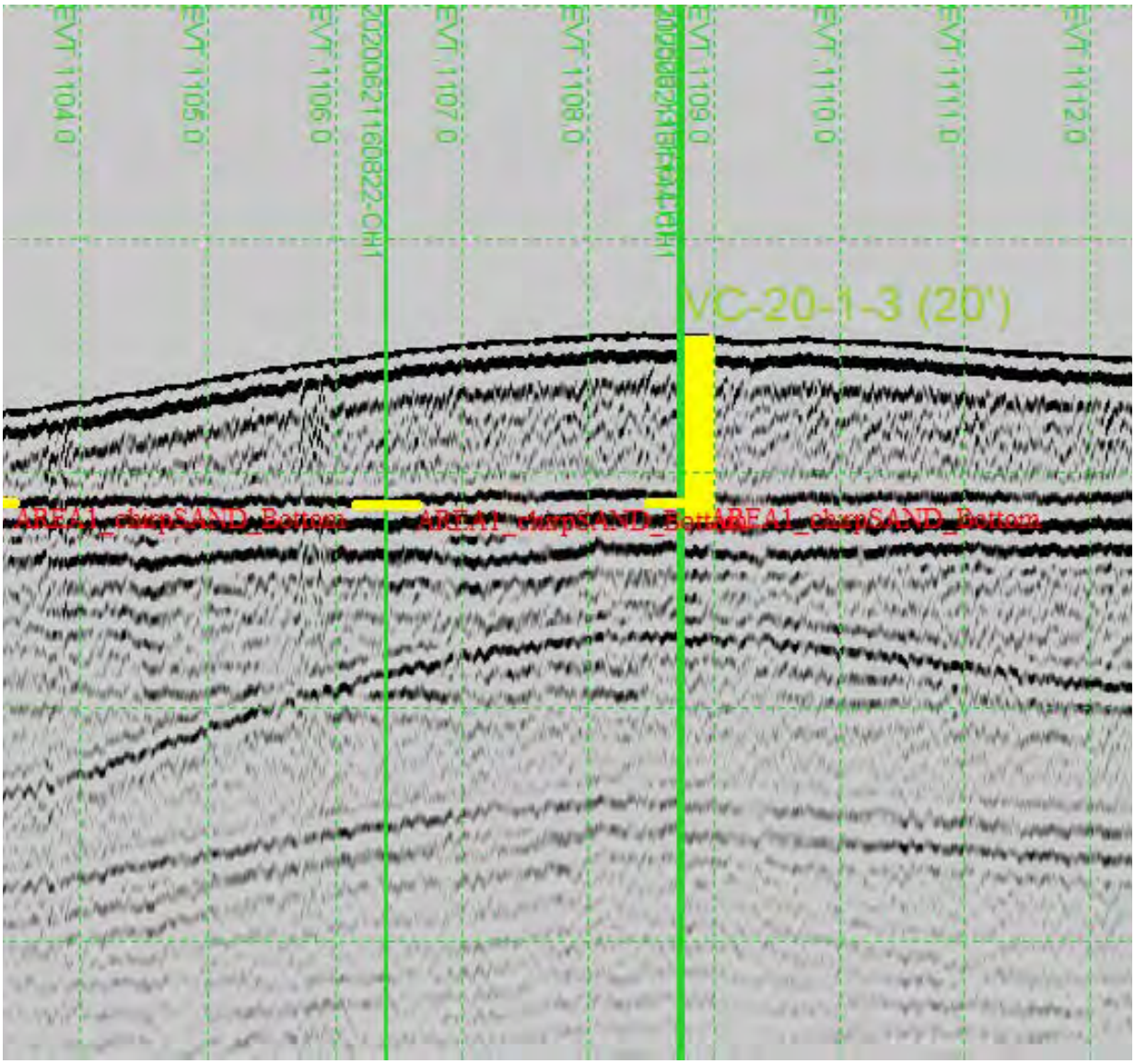


Figure 3:Boomer data of proposed geotechnical core location VC-20_1-3. The vertical yellow line represents the core's location and the maximum depth it could reach (20 feet [6 m]). Horizontal dotted green lines mark every 25ft (7.6 m) of depth.

August 17, 2020

Dr. Vadim Alymov, Ph.D.
Coastal Modeler
Coastal Engineering Consultants, Inc.
3106 South Horseshoe Drive
Naples, Florida 34104

RE: Geoarchaeological Review of 17 Vibracores from Four Sand Target Areas (LK-P2, LK-P4, LK-P5, and LK-P6), Lee County Lovers Key Beach Nourishment Project, Gulf of Mexico, Offshore Florida

Dear Dr. Alymov:

This report provides the results of cultural resources analyses of 17 geotechnical sampling locations surveyed by Ocean Surveys, Inc. (OSI) within the four sand target areas LK-P2, LK-P4, LK-P5, and LK-P6, to support a geotechnical site investigation of the proposed Lee County Lovers Key Beach Nourishment Project, Gulf of Mexico, Offshore Florida. The proposed sand target areas are located 2.6 to 16.9 nautical miles (nm) (4.8 to 31.4 kilometers [km]) southwest of Sanibel Island, Florida. The work was performed under subcontract to Coastal Engineering Consultants, Inc. (CECI) for Lee County.

American Vibracore Services (AVS), a marine division of Amdrill Inc., will perform the reconnaissance-level vibracores (VCs) in the proposed sand target areas to ground-truth the results of the geophysical survey data and to provide data to develop sediment thickness and volume estimates for the proposed borrow areas (OSI 2020). AVS will utilize M/V *Thunderforce*, an 85-foot (ft) (25.9-meter [m]) coring vessel with a 33-ft (10-m) stern mounted A-frame. Sediment sampling will be accomplished using a pneumatic vibracore machine with 3-inch (7.6 centimeter [cm]) outside diameter polycarbonate tubes. Sampling operations will be conducted to the maximum target depth below the seabed or to refusal. Penetrometer data collection will be recorded to verify VC refusal. Refusal is defined as the sampling barrel having a penetration rate of less than 0.2 ft (6 cm) over a 2-minute period. If refusal is encountered, AVS will offset up to 20 ft (6 m) and conduct at least two additional sampling attempts. Each location where refusal is encountered will be recorded. Visual monitoring of the acoustic exclusion zone will be conducted by a trained protected species observer approved by the National Marine Fisheries. During the vibracoring operations, AVS will operate *Thunderforce* in "live boat" mode. Therefore, impact to the sea floor will be limited to the footprint of the vibratory corer, which will be confined to within the analytical area.

OSI conducted the high-resolution geophysical (HRG) survey operations aboard R/V *Able II*, a shallow draft 26-foot research vessel equipped with dual outboard motors, a fully enclosed cabin, A-frame, swing arm davit, winches, and all United States Coast Guard (USCG) safety equipment including an Automatic Information System (AIS). The reconnaissance HRG survey, which included the acquisition of single beam depth soundings, side scan sonar imagery, marine magnetometer, and sub-bottom profile data on the OCS within LK-P2, LK-P4, LK-P5, and LK-P6 was carried put between June 19, 2020, and June 26, 2020. In total, 93.7 nm (173.5km) of HRG tracklines were investigated in survey areas (OSI 2020).

A Qualified Marine Archaeologist reviewed and interpreted the HRG reconnaissance data processed by OSI, within a 50 ft (15 m) radius analytical area centered on each of the 17 proposed geotechnical locations to support a planned reconnaissance geotechnical sediment sampling program (Table 1; Appendix 1). The reviewed data included at minimum two (2) perpendicular lines of survey data that captured each of the proposed locations. This review focused on identification of any potential submerged cultural resources and buried, preserved paleolandforms through geophysical investigations.

High-resolution side scan sonar imagery was recorded throughout the survey area and viewed as georeferenced mosaicked files (Appendix 1). No sonar contacts representing significant cultural resources were identified within the analytical areas.

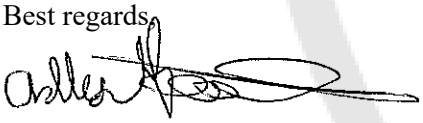
OSI utilized a Geometrics G882 Cesium Marine Magnetometer to collect magnetic data along each survey trackline. Magnetic anomalies were interpreted using magnetic total field data, and by observing their characteristics in terms of amplitude, duration, magnetic signature, and spatial distribution (Appendix 1). No magnetic anomalies representing significant cultural resources were identified within the analytical areas.

Seismic data were collected and interpreted along each survey line associated with the geotechnical locations (Appendix 2). All seismic data were reviewed to their full vertical extent. The geotechnical locations were also reviewed with respect to the ground model and interpreted horizons. Analyses of the seismic data suggest that the geotechnical samples will not impact any submerged and buried landforms with the potential to contain preserved archaeological resources.

The analyses considered all portions of the seafloor within the limits of bottom-disturbing activities as they pertain to the proposed sampling locations (Table 1; Appendix 1 and 2). Based on the current data, if the proposed geotechnical sampling activities are contained within the established analytical areas (Table 1), no potential archaeological resources will be affected by these activities. No historic properties that are eligible for the National Register of Historic Places were detected at the proposed sampling locations.

If you have questions, please do not hesitate to contact us.

Best regards,



Ashley Himmelstein, M.A.
Nautical Archaeologist

Table 1. Vibratory core locations.

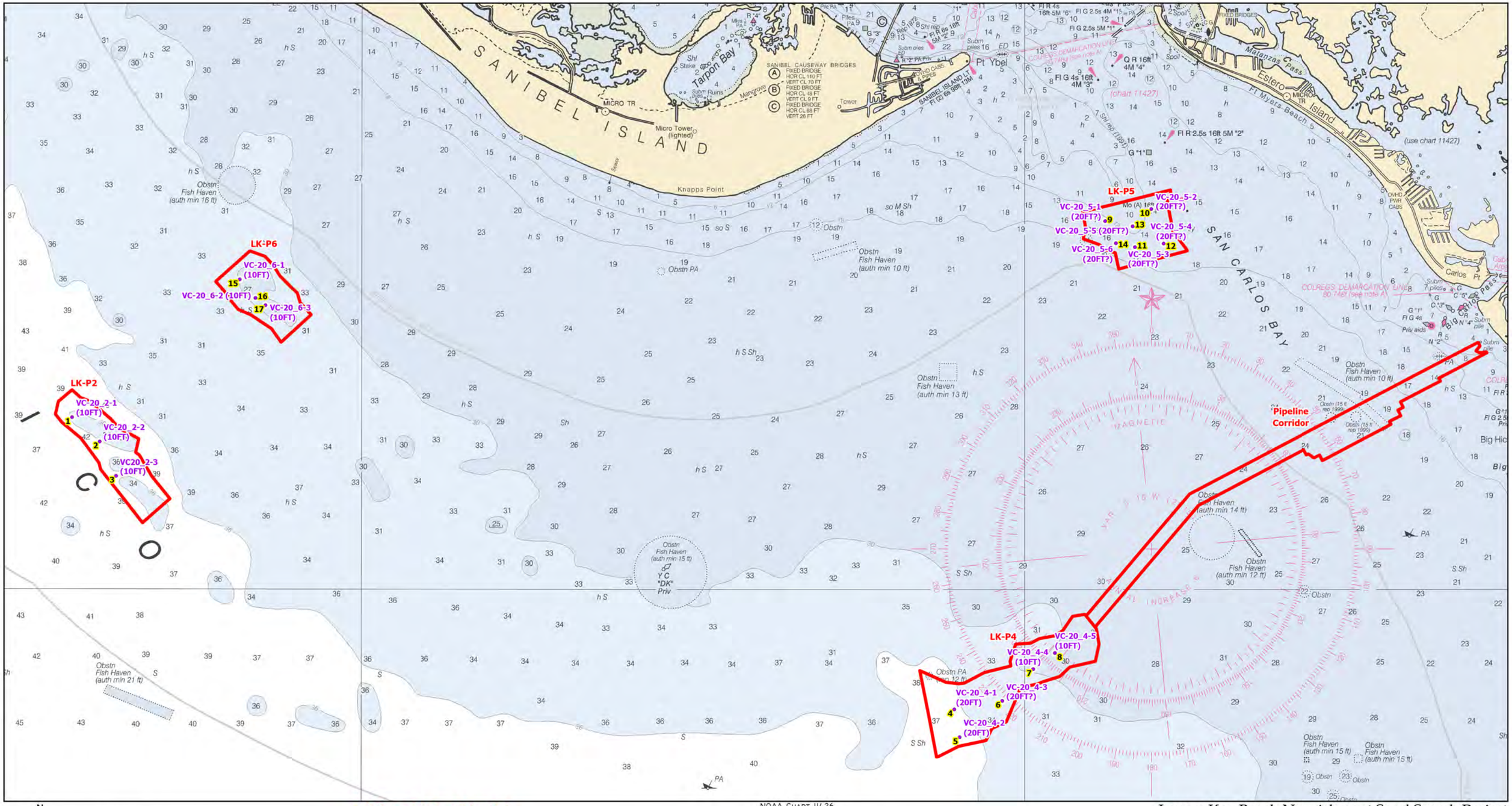
Proposed Reconnaissance VC Designation (Recommended Core Length)[1]	Sand Target Areas	Easting[2]	Northing[2]	Latitude[3]	Longitude[3]	Water Depth[4]
VC-20_2-1 (10FT)	LK-P2	577801.19	741049.42	26.372212	-82.239351	37.3
VC-20_2-2 (10FT)	LK-P2	580072.81	739050.98	26.366726	-82.232401	35.0
VC20_2-3 (10FT) *	LK-P2	581422.68	736224.84	26.358957	-82.228263	38.0
VC-20_4-1 (20FT)	LK-P4	650399.64	717022.33	26.306307	-82.017604	40.1
VC-20_4-2 (20FT) *	LK-P4	650833.76	714733.75	26.300011	-82.016278	40.2
VC-20_4-3 (20FT)	LK-P4	654337.78	717719.87	26.308227	-82.005583	36.1
VC-20_4-4 (10FT)	LK-P4	656882.23	720328.73	26.315405	-81.997816	33.0
VC-20_4-5 (10FT)	LK-P4	658664.44	721657.33	26.319060	-81.992375	33.0
VC-20_5-1 (20FT)	LK-P5	662786.91	757167.91	26.416756	-81.979772	15.0
VC-20_5-2 (20FT)	LK-P5	666579.52	758163.1	26.419492	-81.968183	14.3
VC-20_5-3 (20FT)	LK-P5	665231.89	755027.96	26.410868	-81.972303	16.8
VC-20_5-4 (20FT)	LK-P5	667590.95	755321.12	26.411673	-81.965095	17.1
VC-20_5-5 (20FT) *	LK-P5	665043.979	756737.272	26.415571	-81.972876	13.3
VC-20_5-6 (20FT) *	LK-P5	663673.13	755346.34	26.411745	-81.977065	17.6
VC-20_6-1 (10FT)	LK-P6	591587.44	752378.15	26.403444	-82.197297	30.5
VC-20_6-2 (10FT)	LK-P6	592880.05	750849.42	26.399244	-82.193341	29.0
VC-20_6-3 (10FT) *	LK-P6	593705.09	750256.44	26.397616	-82.190817	31.0

[1]Proposed reconnaissance vibratory core designation. Supplemental/alternate locations identified with an asterisk *.
[2]Grid coordinates are referenced to Florida State Plane Coordinate System, West Zone (0902), NAD 83.
[3]Geographical coordinates are decimal degrees referenced to NAD 83.
[4]Water Depths are in feet and referenced to NAVD88.

References

Ocean Surveys, Inc (OSI)
2020 *Survey Report – OCS Authorization M20-001, Reconnaissance Level HRG Survey to Support Lee County Florida, Gulf of Mexico, Florida*. Submitted to the Bureau of Ocean Energy Management MS 881A-Data Acquisition and Special Projects Unit, New Orleans, LA 70123

APPENDIX 1
ARCHAEOLOGICAL RESOURCES MAPS



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NOAA Chart 11426

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0 1 2 3 4 Miles

- Proposed Vibracore (and Map Number Label)
- Borrow Areas and Pipeline Corridor

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Lee County, Florida

Geotechnical Clearance

Index Map

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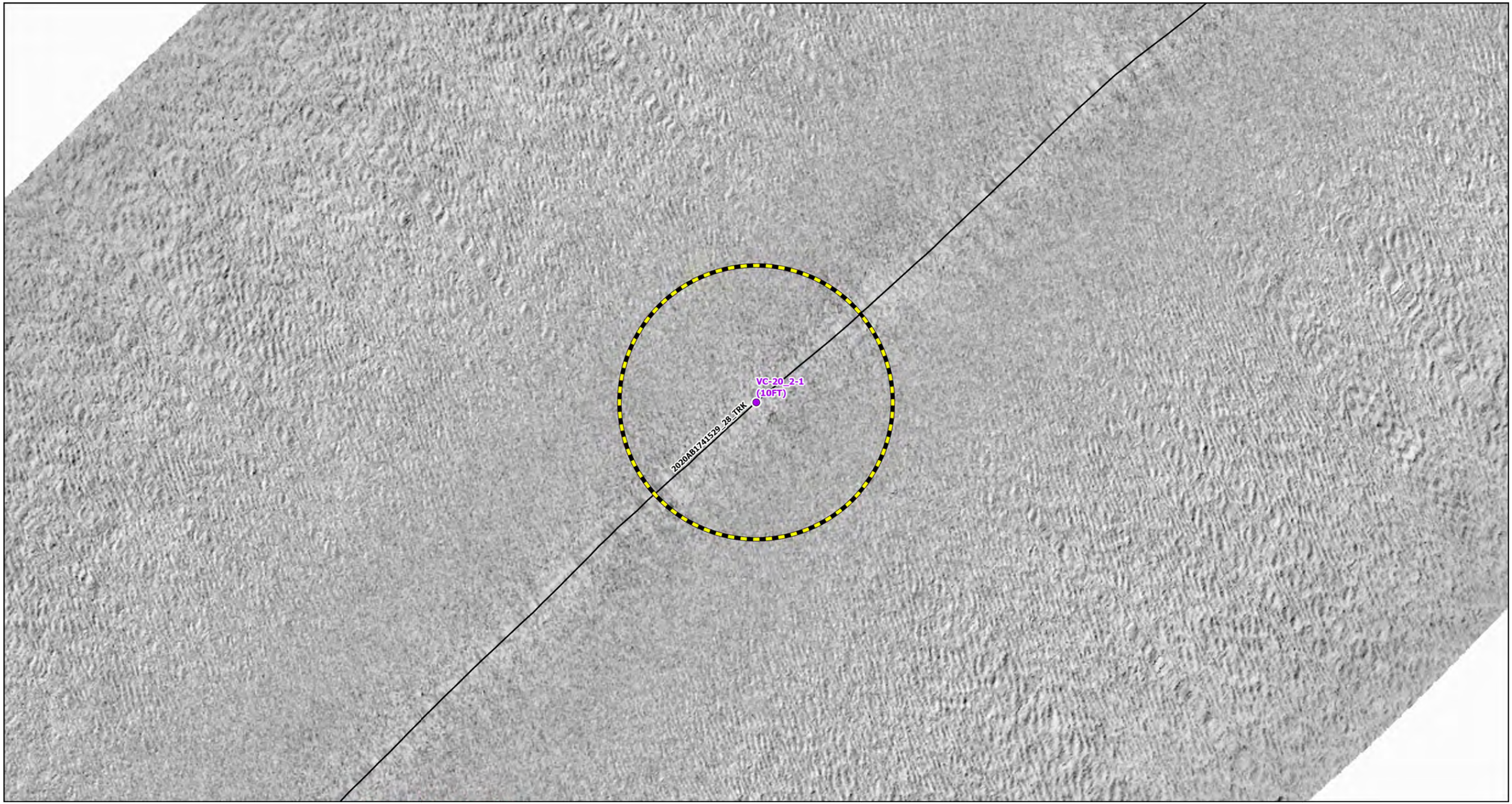

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Side Scan Sonar Mosaic (0.5ft, 2020)

- Proposed Vibracore
- Magnetic Anomaly
- Side Scan Sonar Contact
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Geotechnical Location: VC-20_2-1 (10FT)

Map: 1

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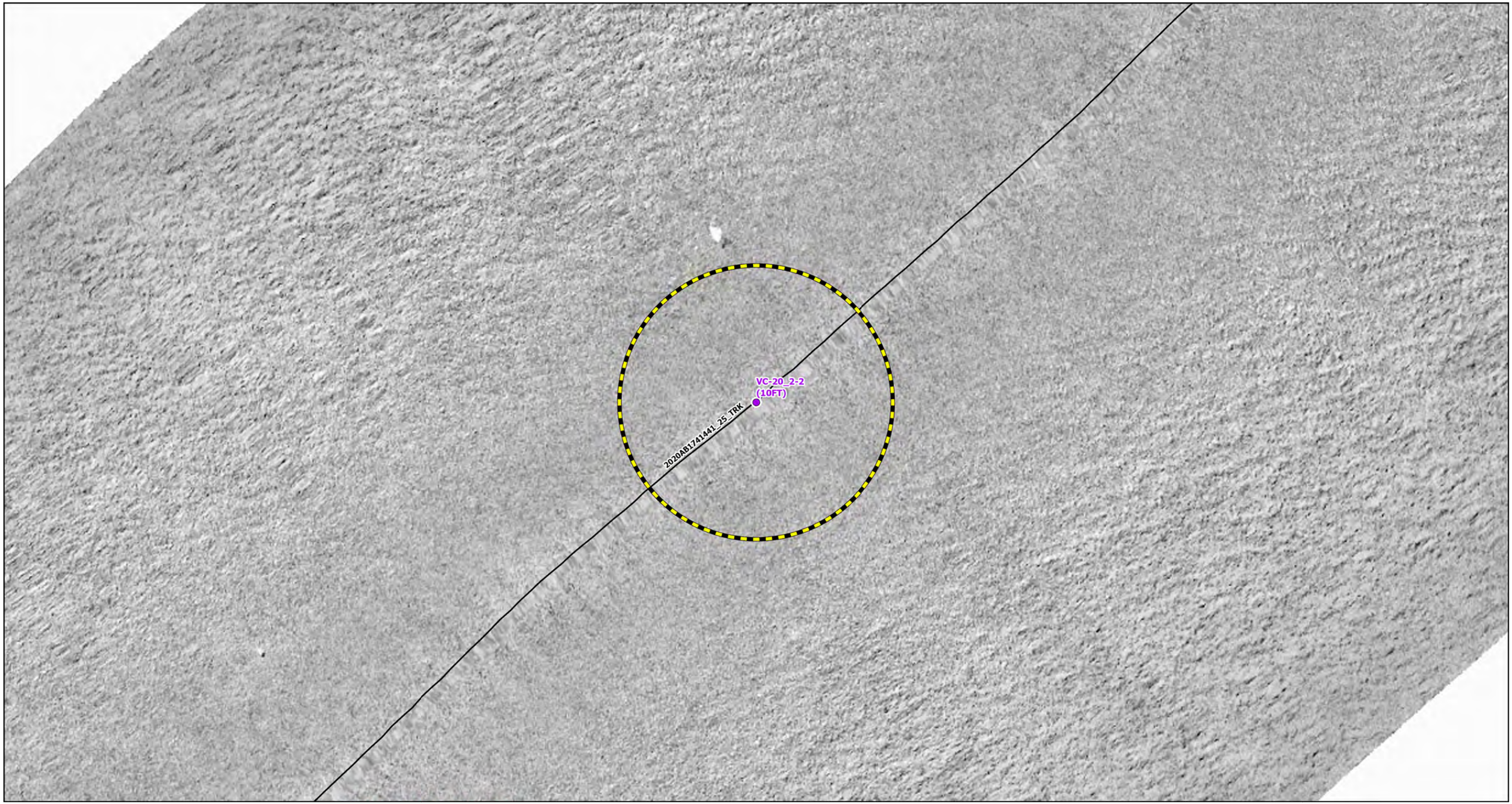

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
- ANALYTIC AREA

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Geotechnical Location: VC-20_2-2 (10FT)

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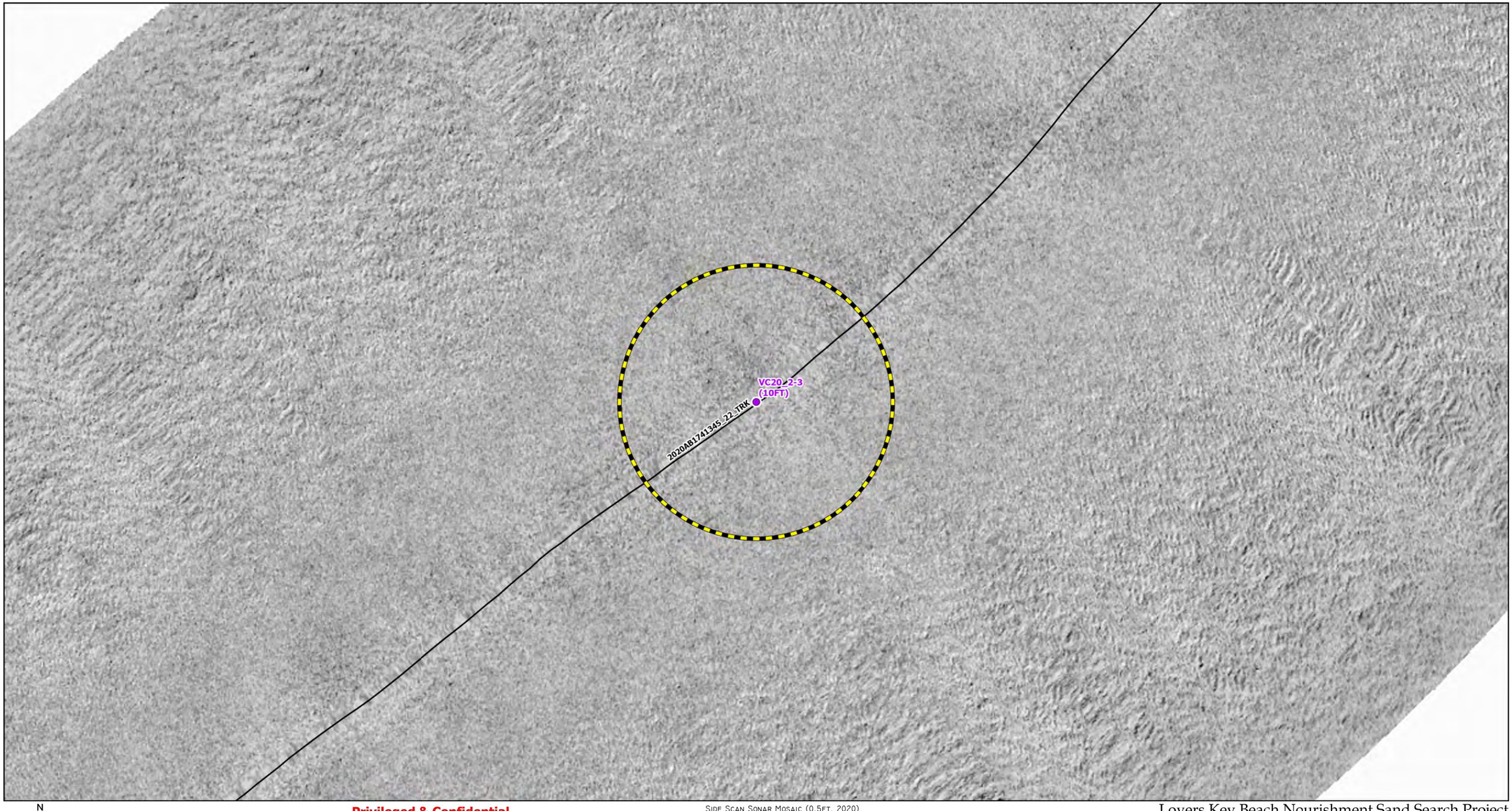

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
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Map: 3

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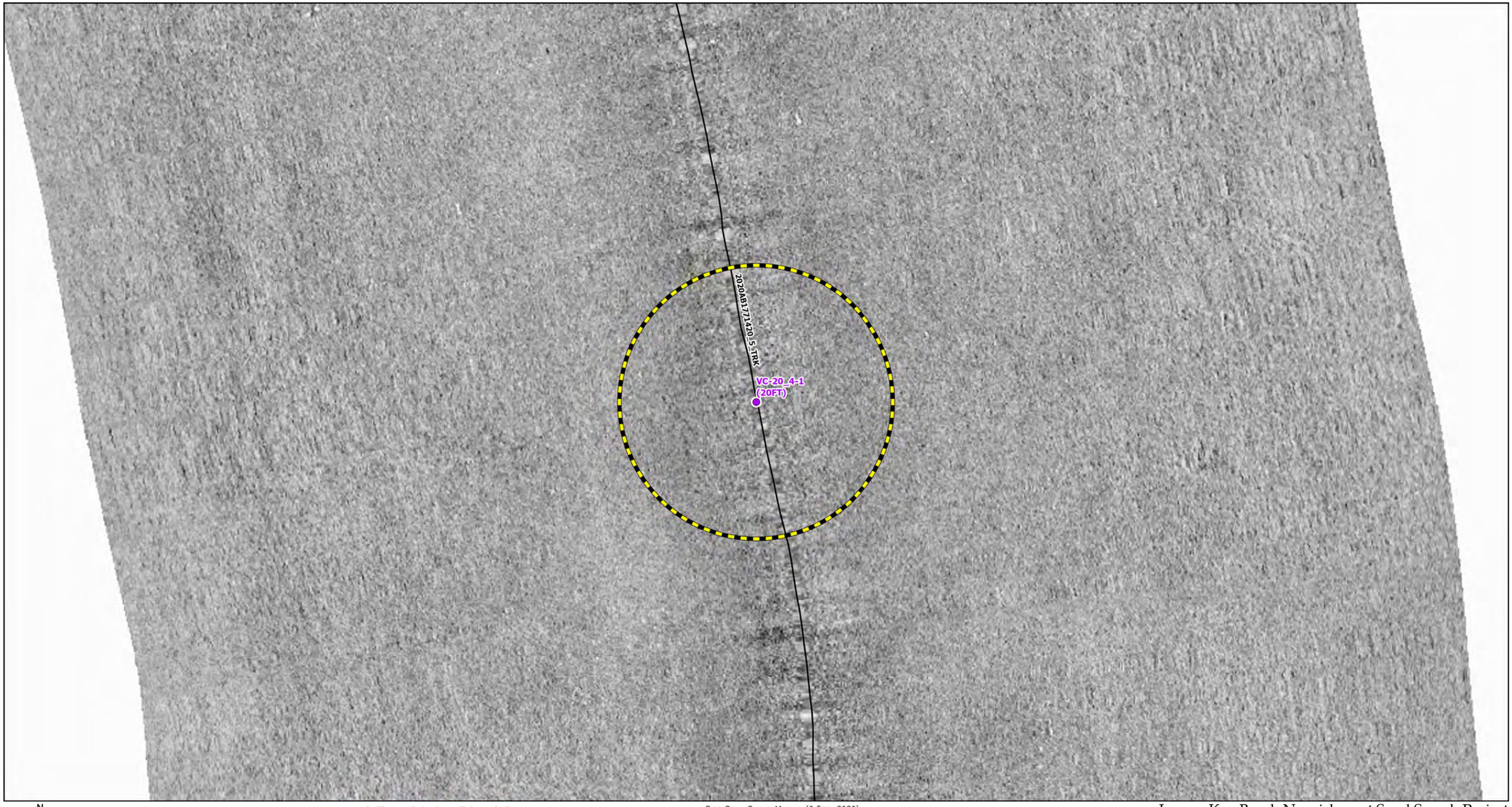

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Side Scan Sonar Mosaic (0.5ft, 2020)

- Proposed Vibracore
- Magnetic Anomaly
- Side Scan Sonar Contact
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- Analytic Area

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Lee County, Florida

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Geotechnical Location: VC-20_4-1 (20FT)

Map: 4

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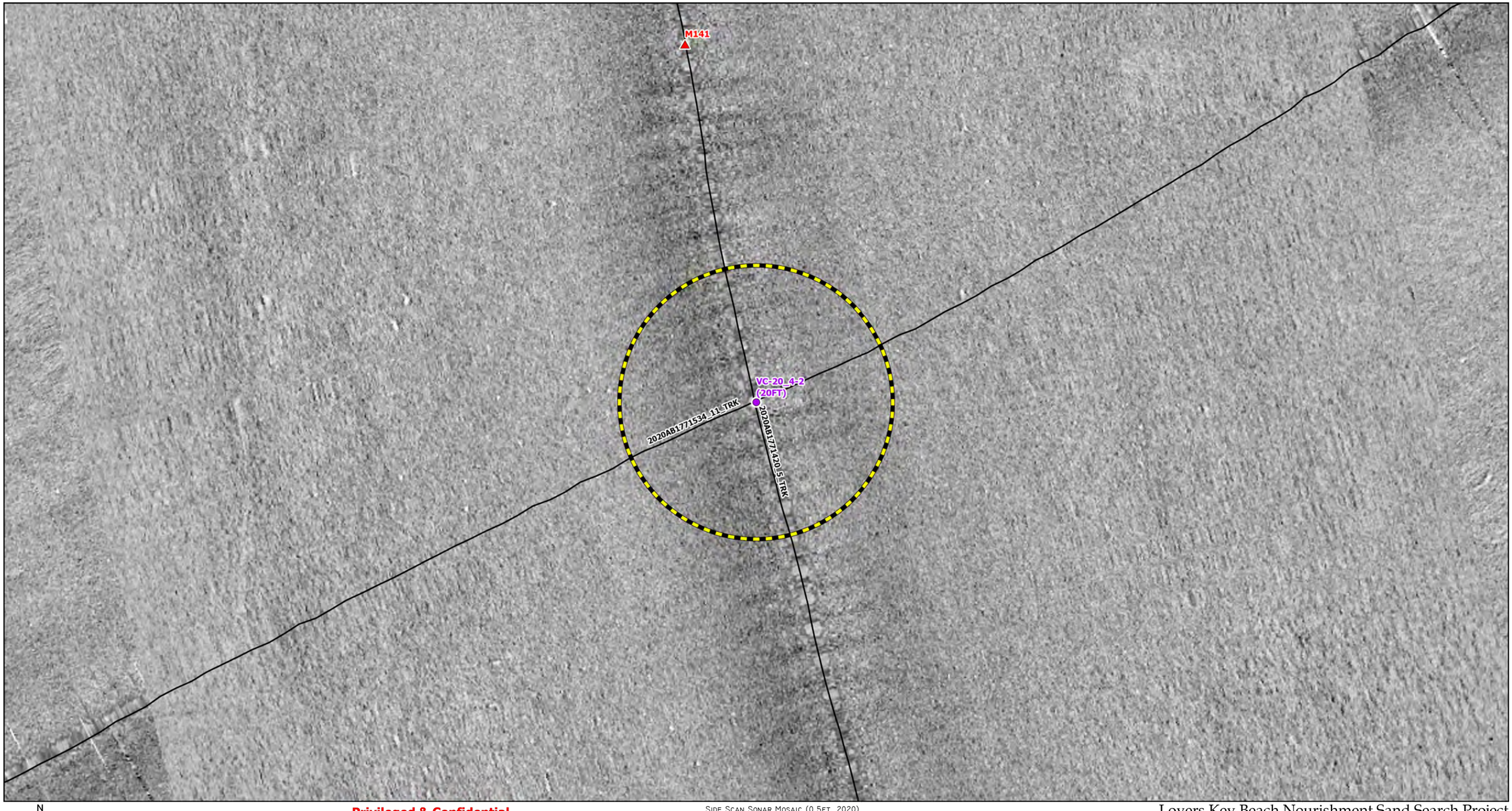

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
- ANALYTIC AREA

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Geotechnical Location: VC-20_4-2 (20FT)
Map: 5

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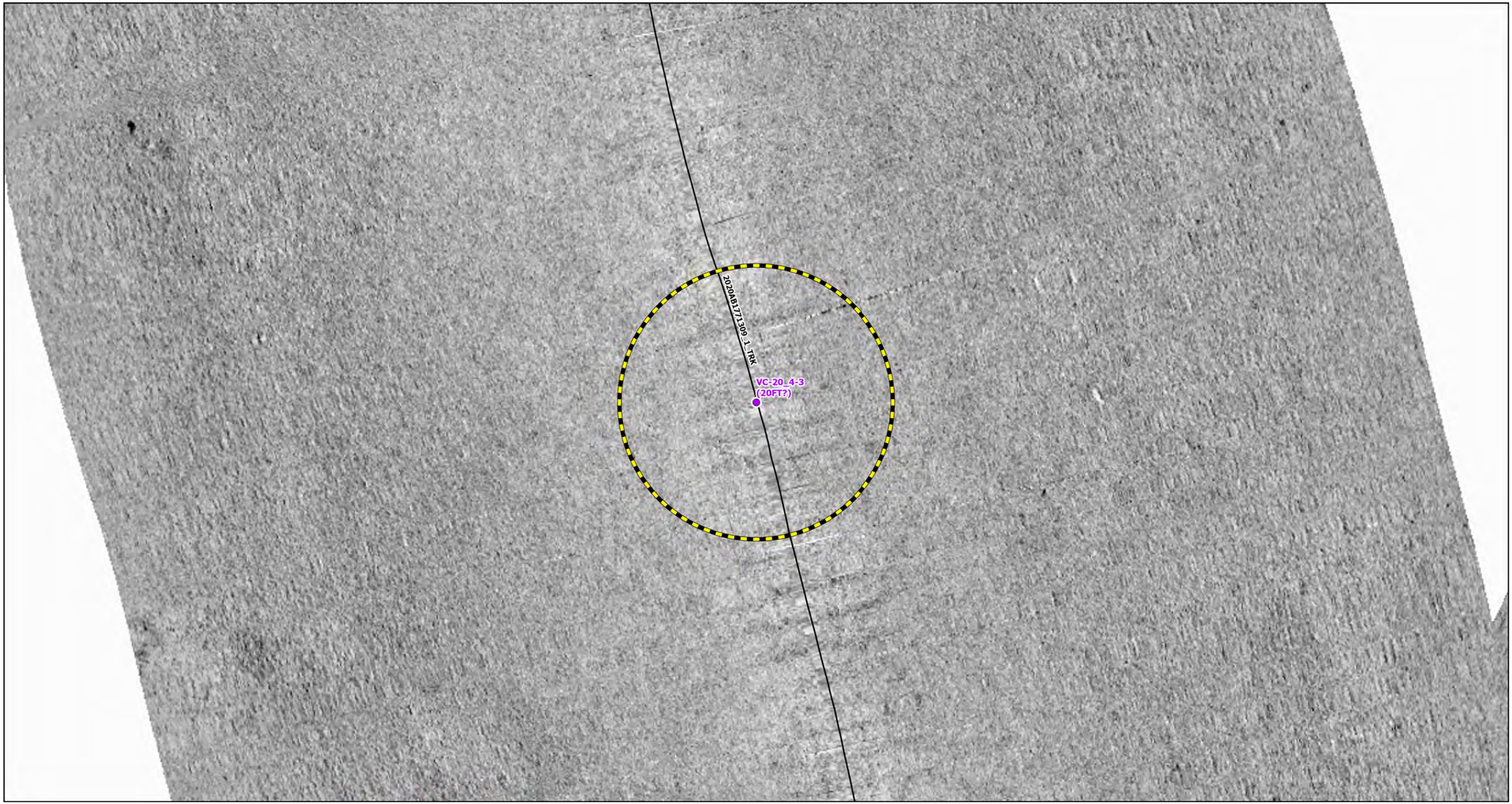

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Side Scan Sonar Mosaic (0.5ft, 2020)

Proposed Vibracore
Magnetic Anomaly
Side Scan Sonar Contact
Trackline
Analytic Area

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Lee County, Florida

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Geotechnical Location: VC-20_4-3 (20FT?)

Map: 6

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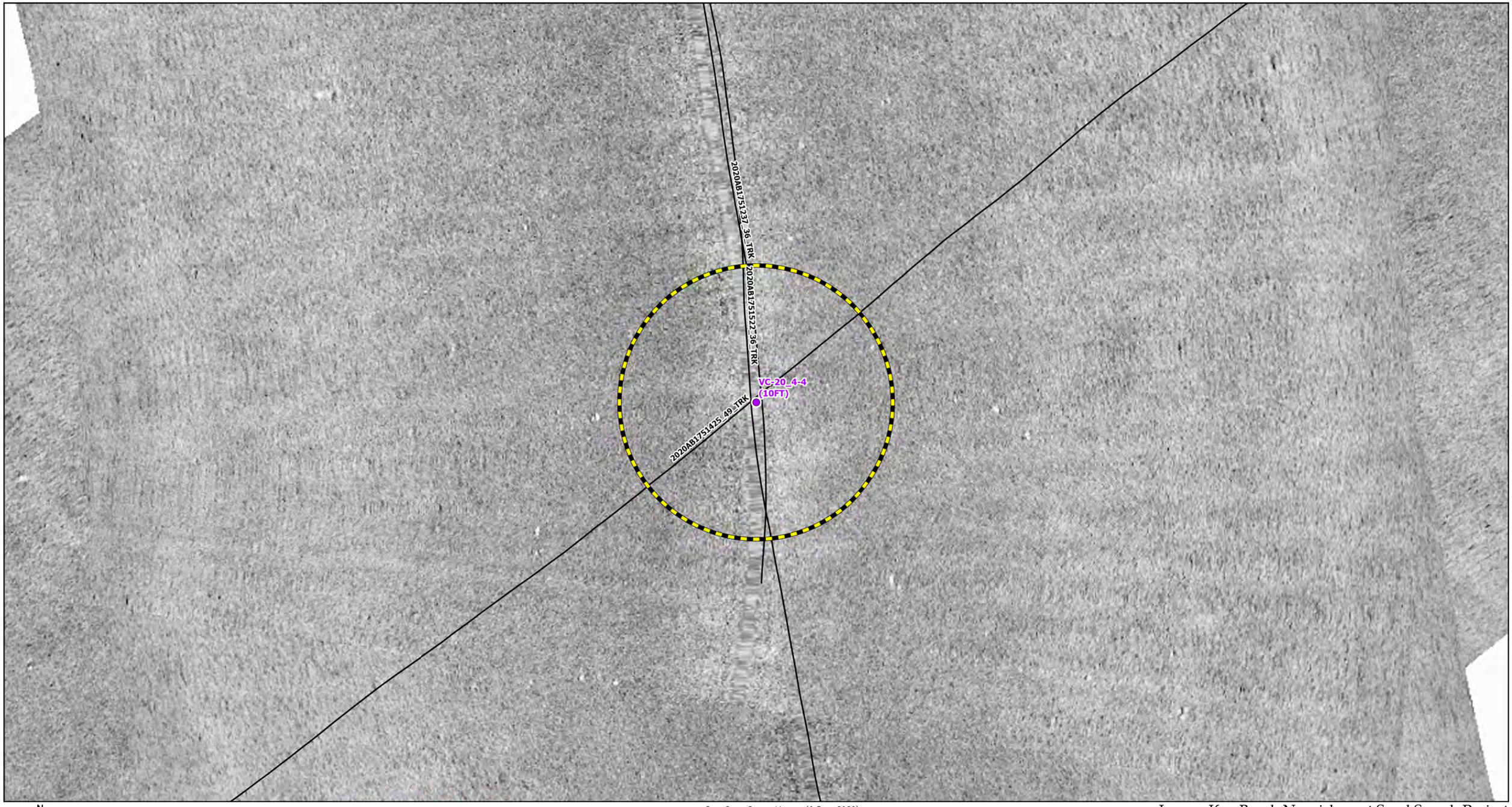

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
- ANALYTIC AREA

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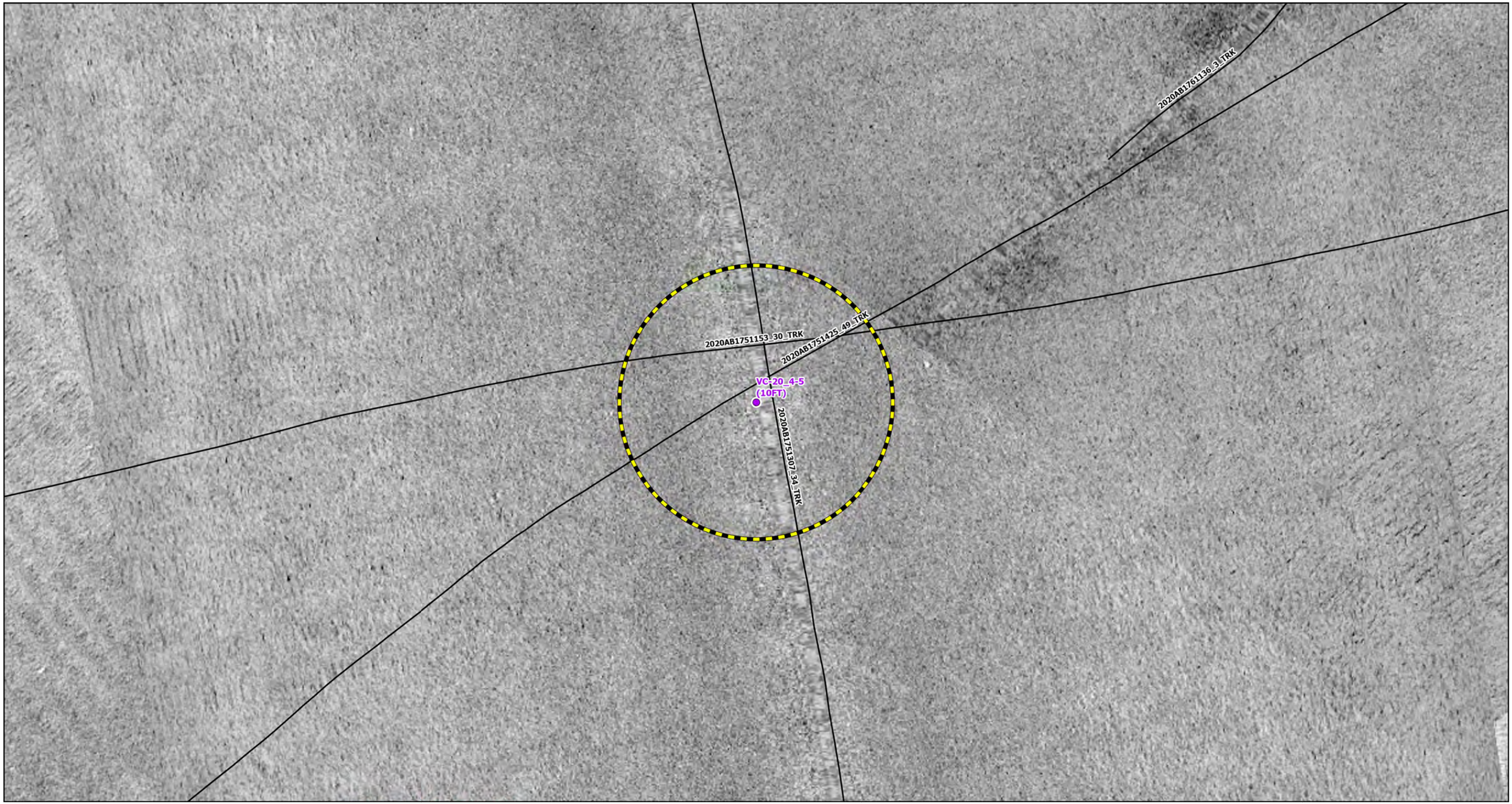

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

PROPOSED VIBRACORE
MAGNETIC ANOMALY
SIDE SCAN SONAR CONTACT
TRACKLINE
ANALYTIC AREA

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Geotechnical Clearance
Geotechnical Location: VC-20_4-5 (10FT)
Map: 8

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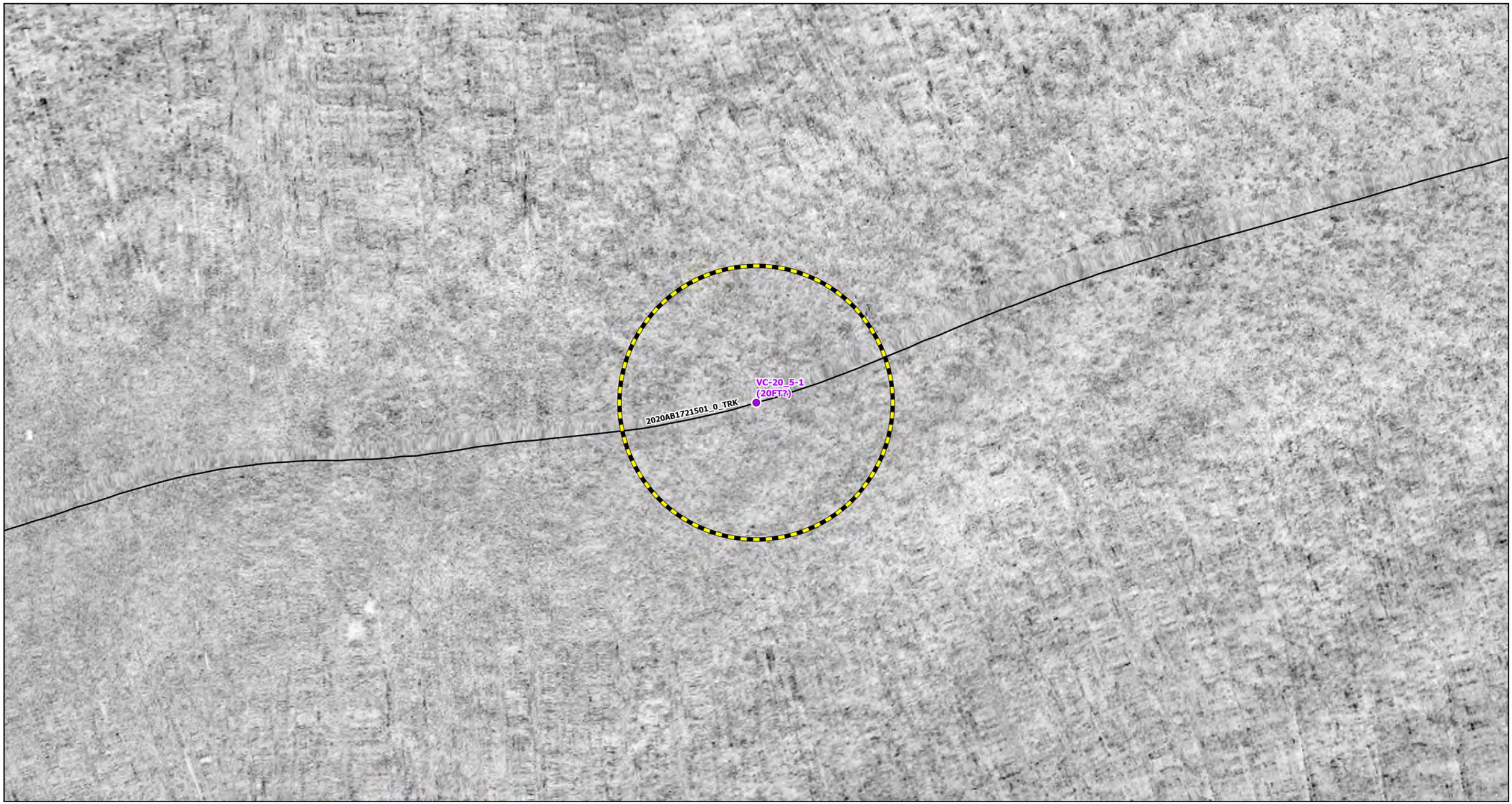

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
- ANALYTIC AREA

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Lee County, Florida

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Geotechnical Location: VC-20_5-1 (20FT?)

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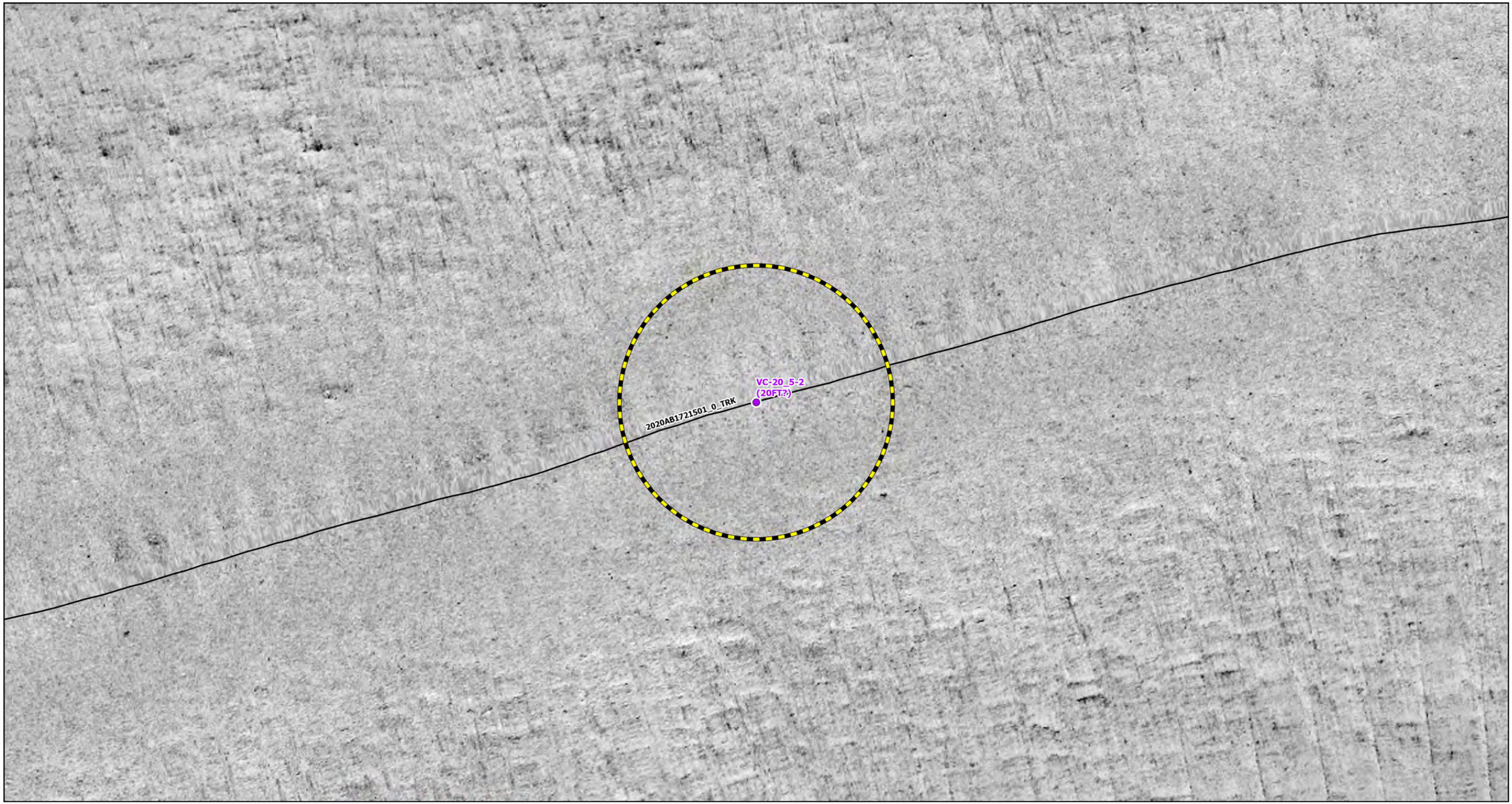

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

PROPOSED VIBRACORE
MAGNETIC ANOMALY
SIDE SCAN SONAR CONTACT
TRACKLINE
ANALYTIC AREA

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Lee County, Florida
Geotechnical Clearance
Geotechnical Location: VC-20_5-2 (20FT?)
Map: 10

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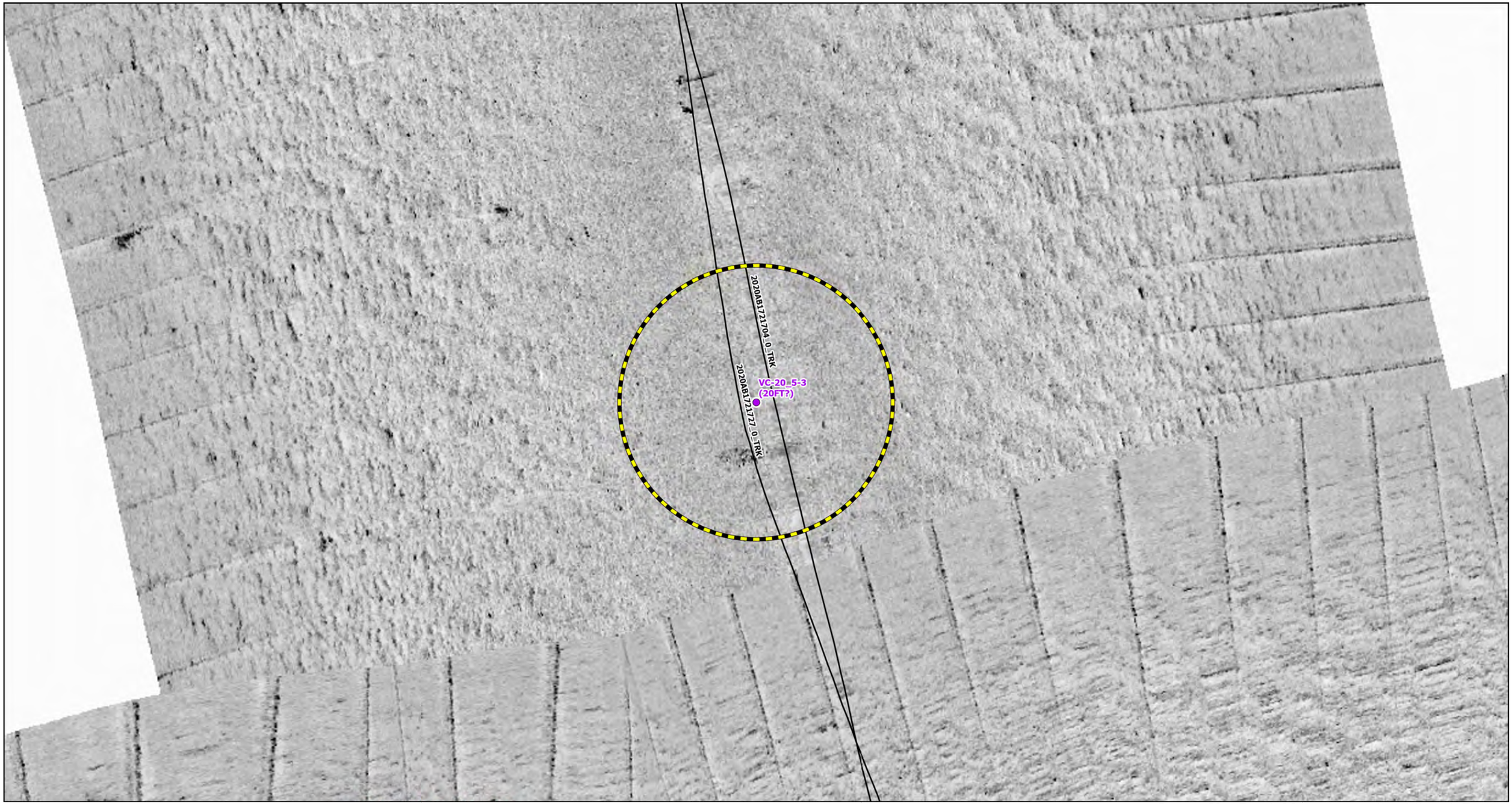

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
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Map: 11

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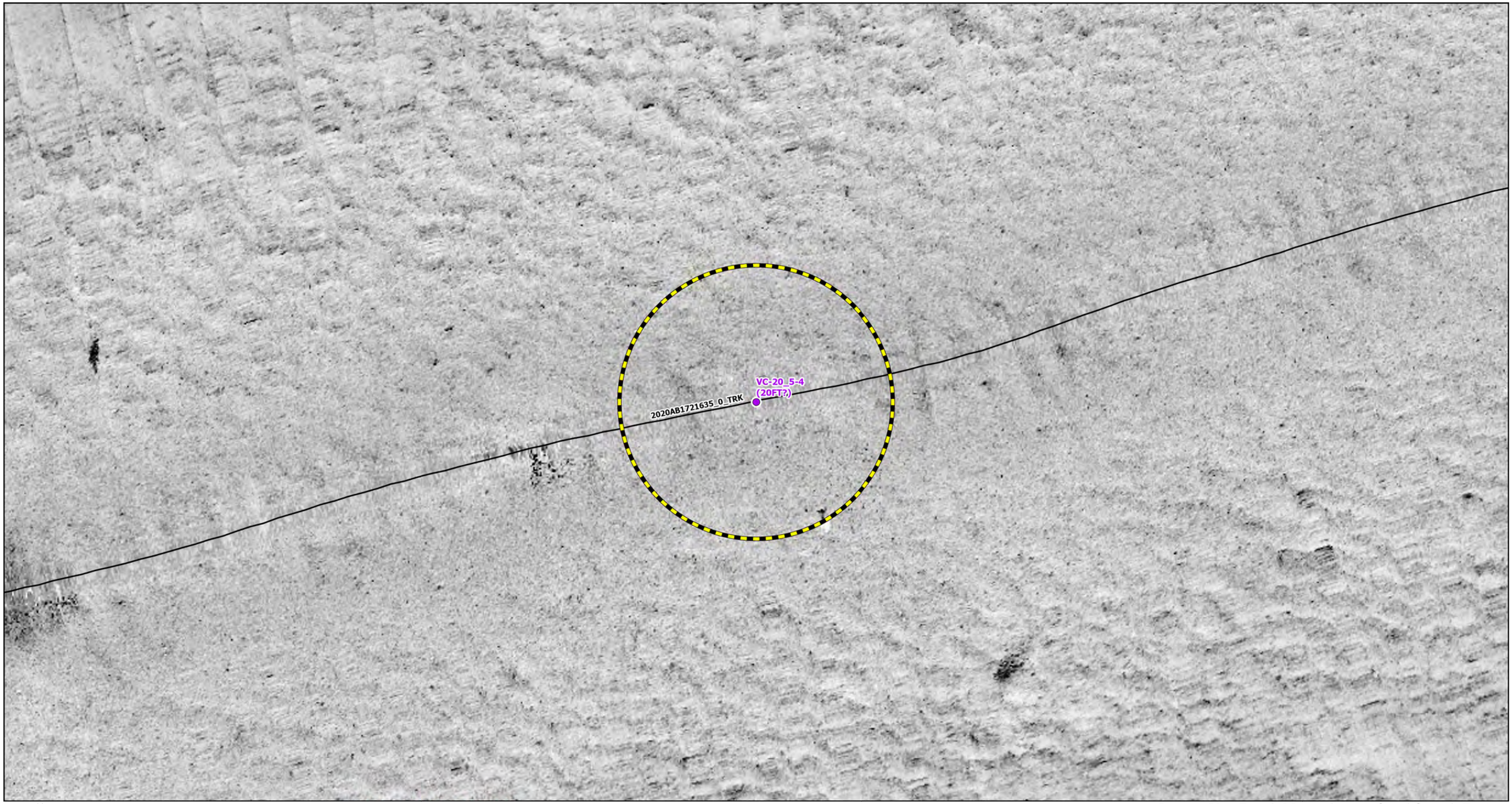

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
- ANALYTIC AREA

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Geotechnical Clearance

Geotechnical Location: VC-20_5-4 (20FT?)

Map: 12

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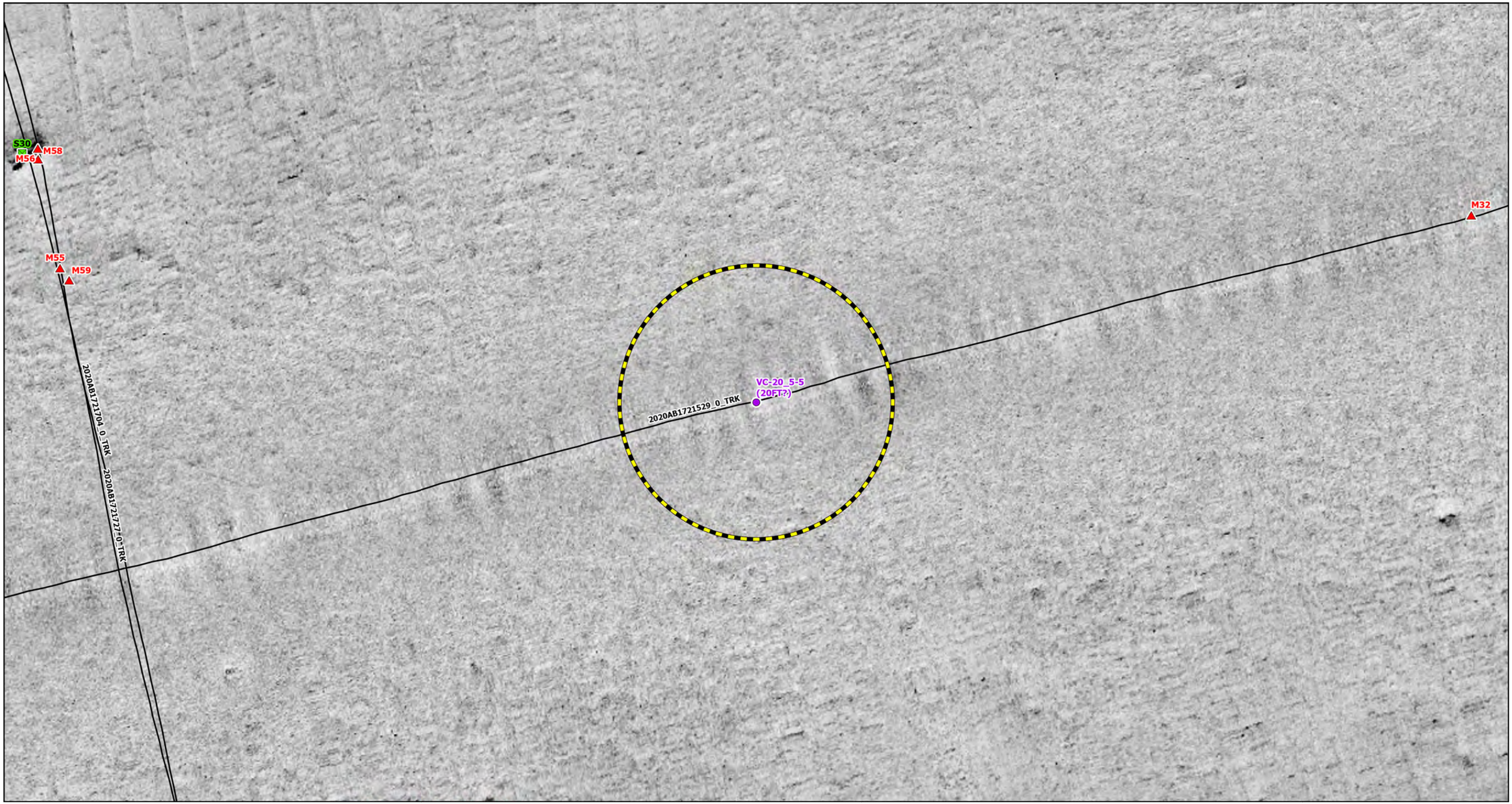

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Side Scan Sonar Mosaic (0.5ft, 2020)

- Proposed Vibracore
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Geotechnical Clearance

Geotechnical Location: VC-20_5-5 (20FT?)

Map: 13

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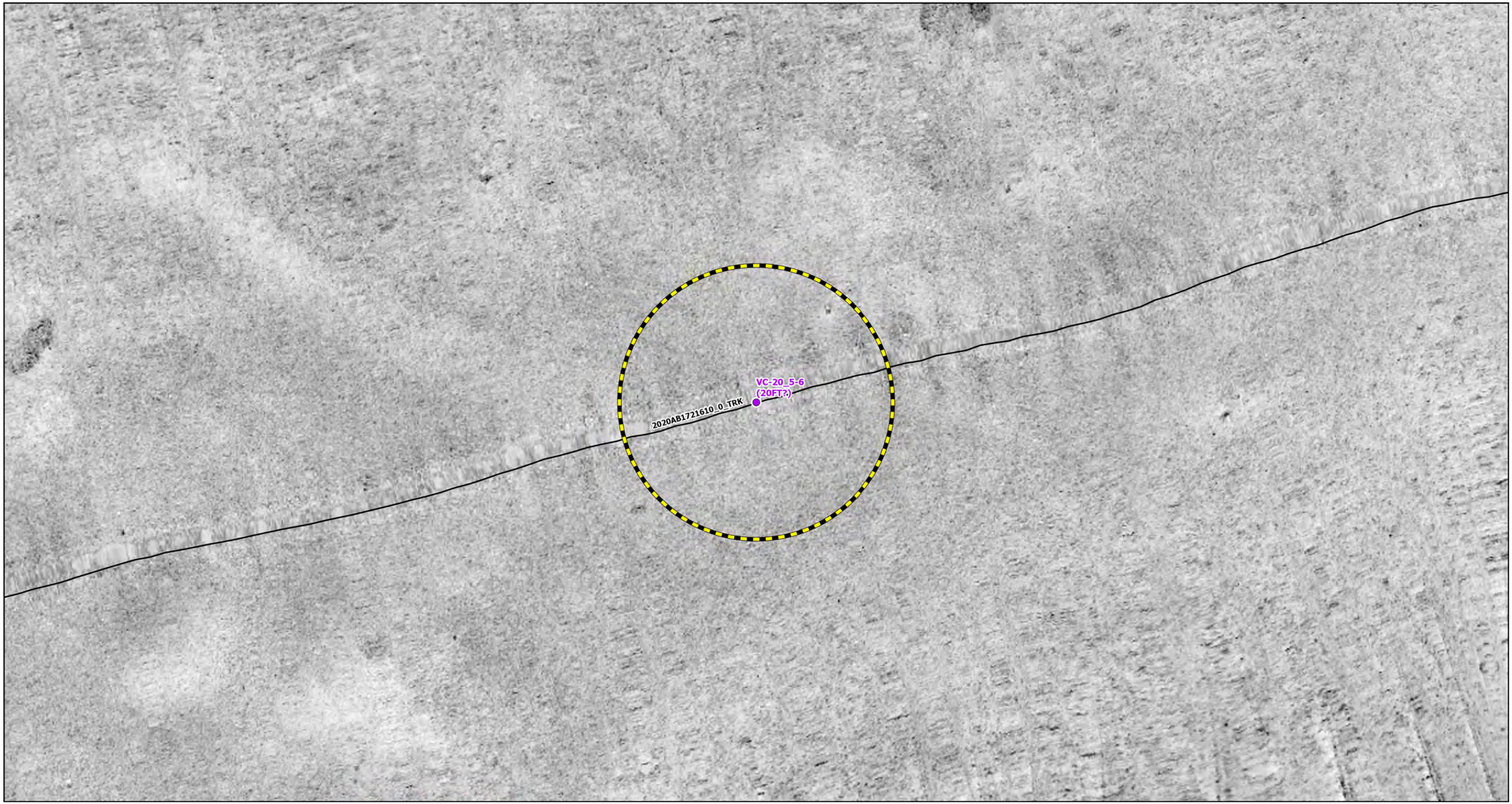

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
- ANALYTIC AREA

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Geotechnical Clearance

Geotechnical Location: VC-20_5-6 (20FT?)

Map: 14

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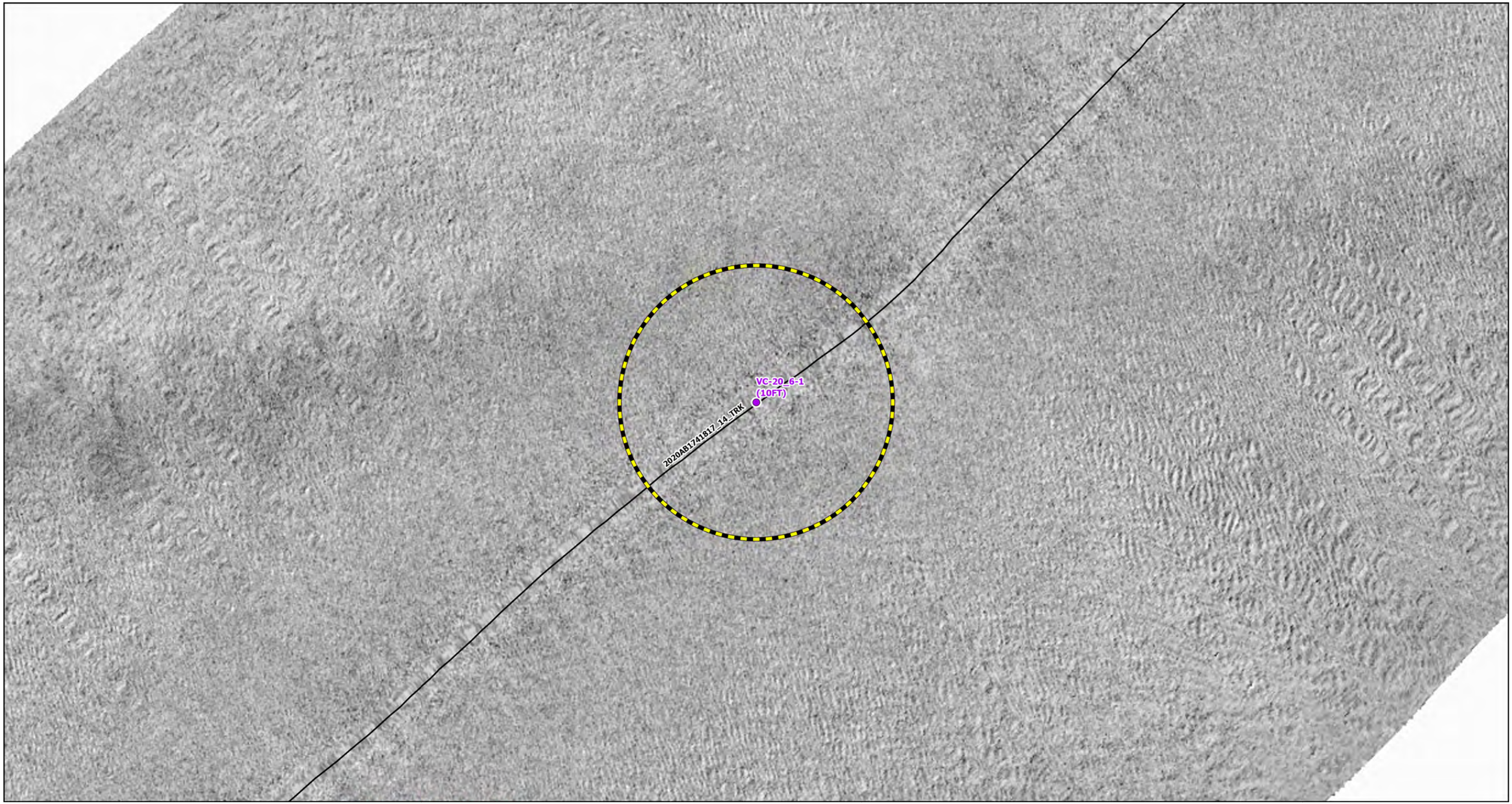

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SIDE SCAN SONAR MOSAIC (0.5FT, 2020)

- PROPOSED VIBRACORE
- MAGNETIC ANOMALY
- SIDE SCAN SONAR CONTACT
- TRACKLINE
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Geotechnical Clearance

Geotechnical Location: VC-20_6-1 (10FT)

Map: 15

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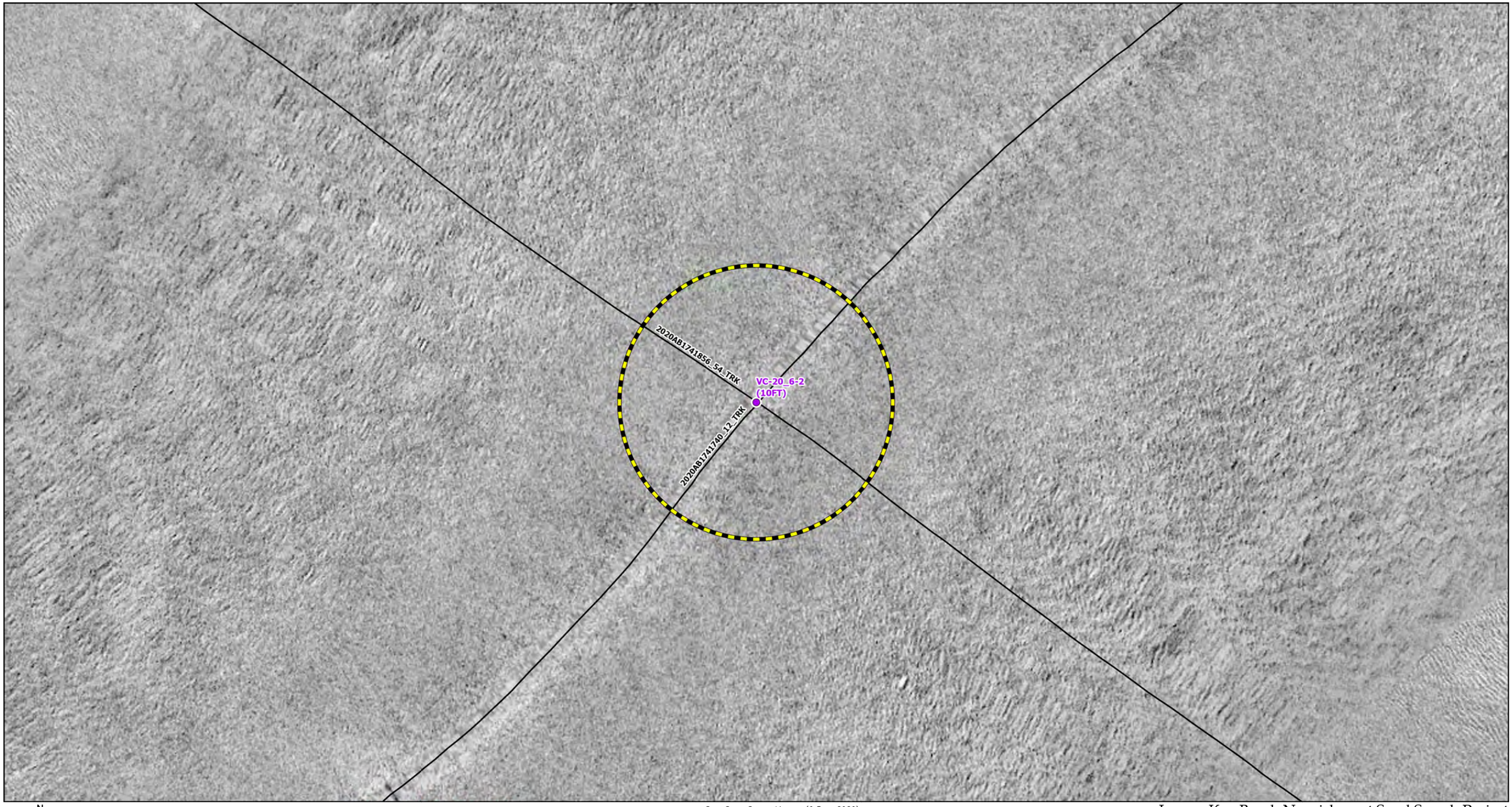

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Side Scan Sonar Mosaic (0.5ft, 2020)

- Proposed Vibracore
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Geotechnical Clearance

Geotechnical Location: VC-20_6-2 (10FT)

Map: 16

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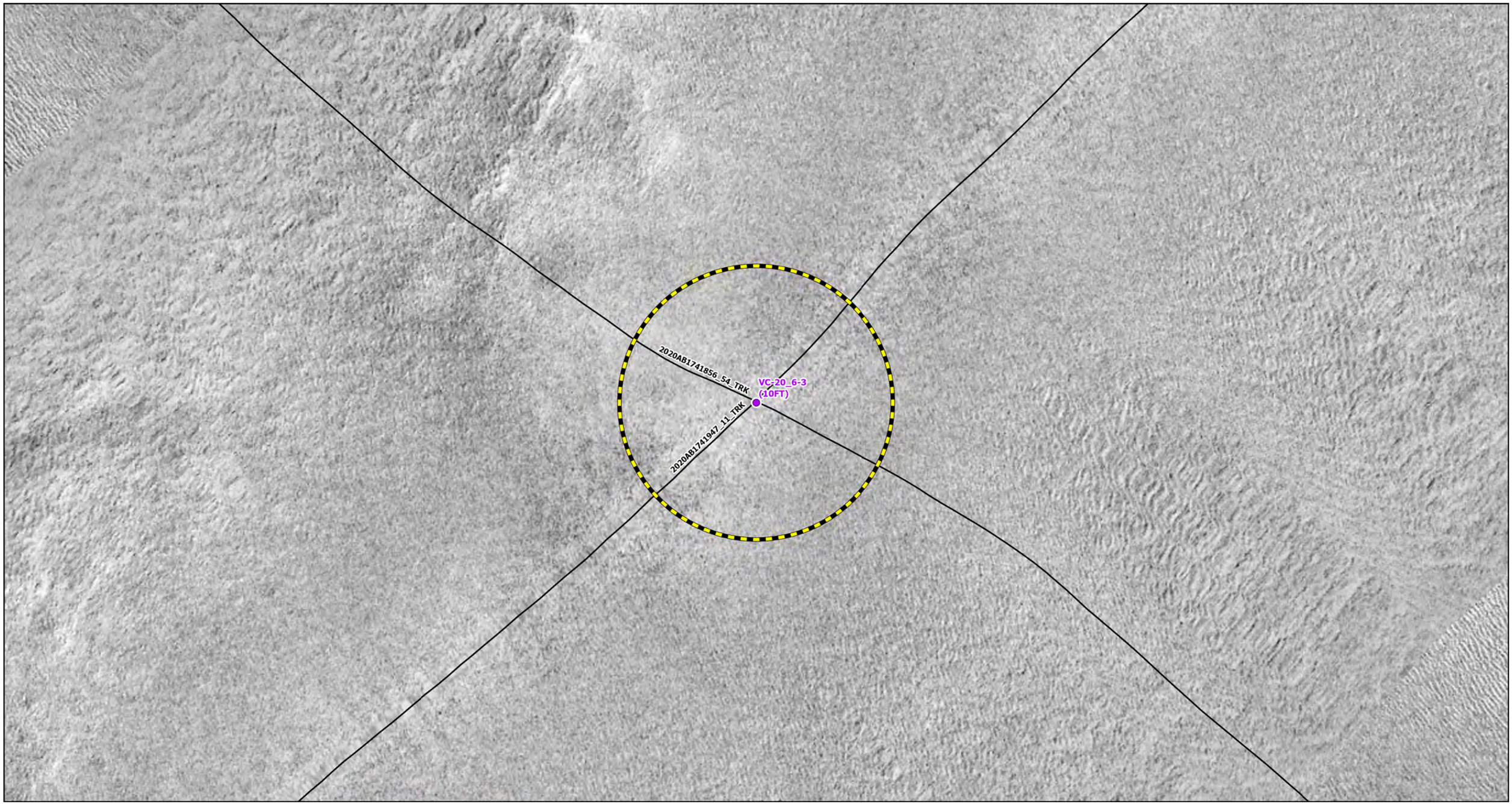

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Side Scan Sonar Mosaic (0.5ft, 2020)

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Geotechnical Location: VC-20_6-3 (10FT)

Map: 17

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APPENDIX 2
SUB-BOTTOM PROFILE IMAGES

LK-P2
Boomer Data

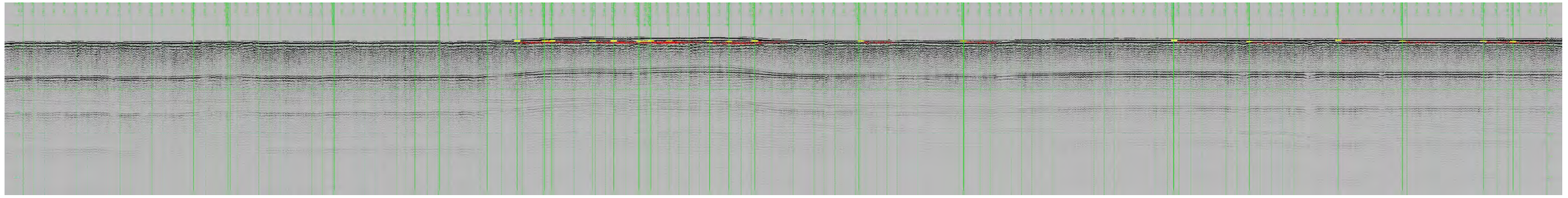

Figure 1: Boomer data showing core locations along seismic profile 220620.121233-CH1

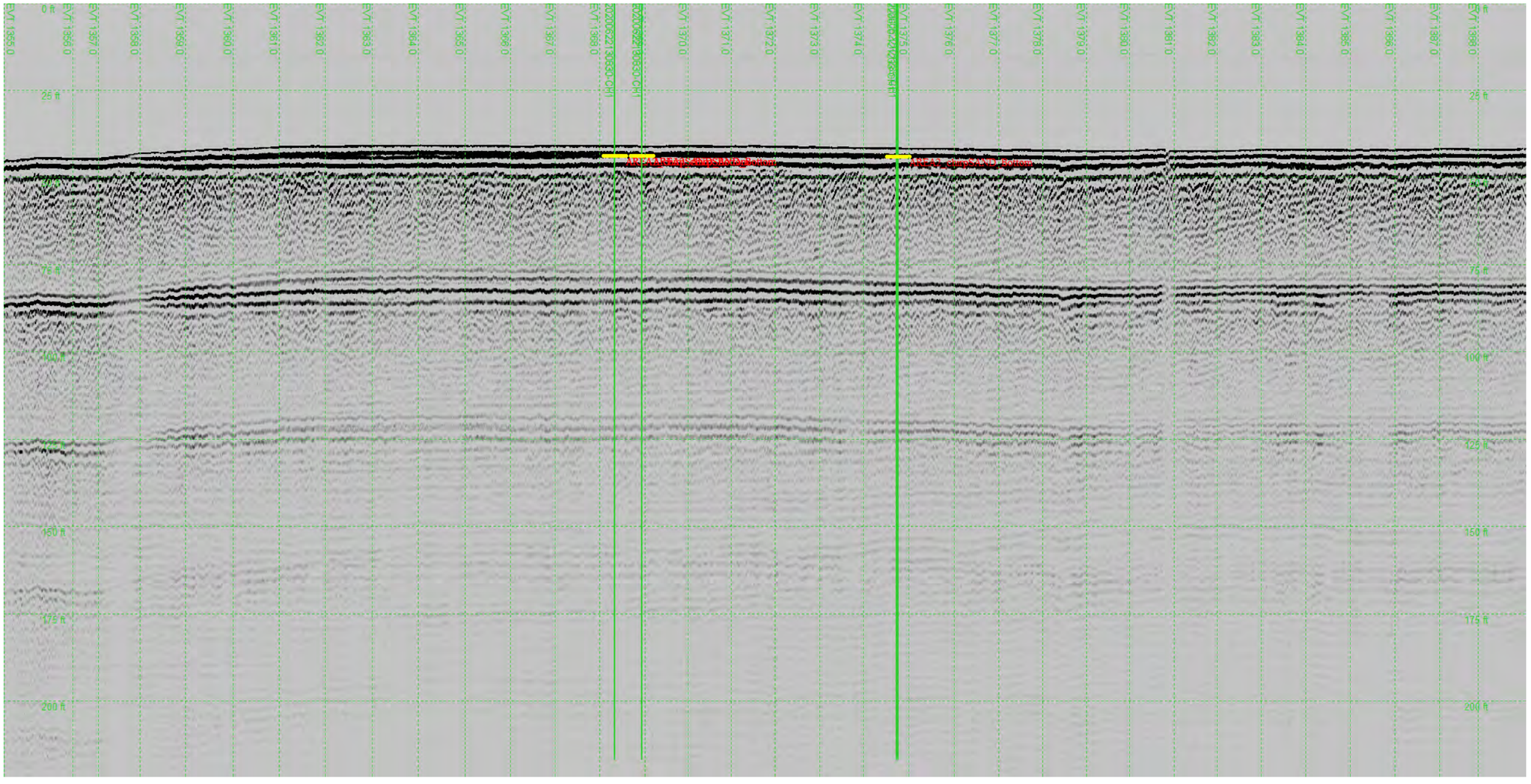

Figure 2: Boomer data showing core locations along seismic profile 220620.130817-CH1

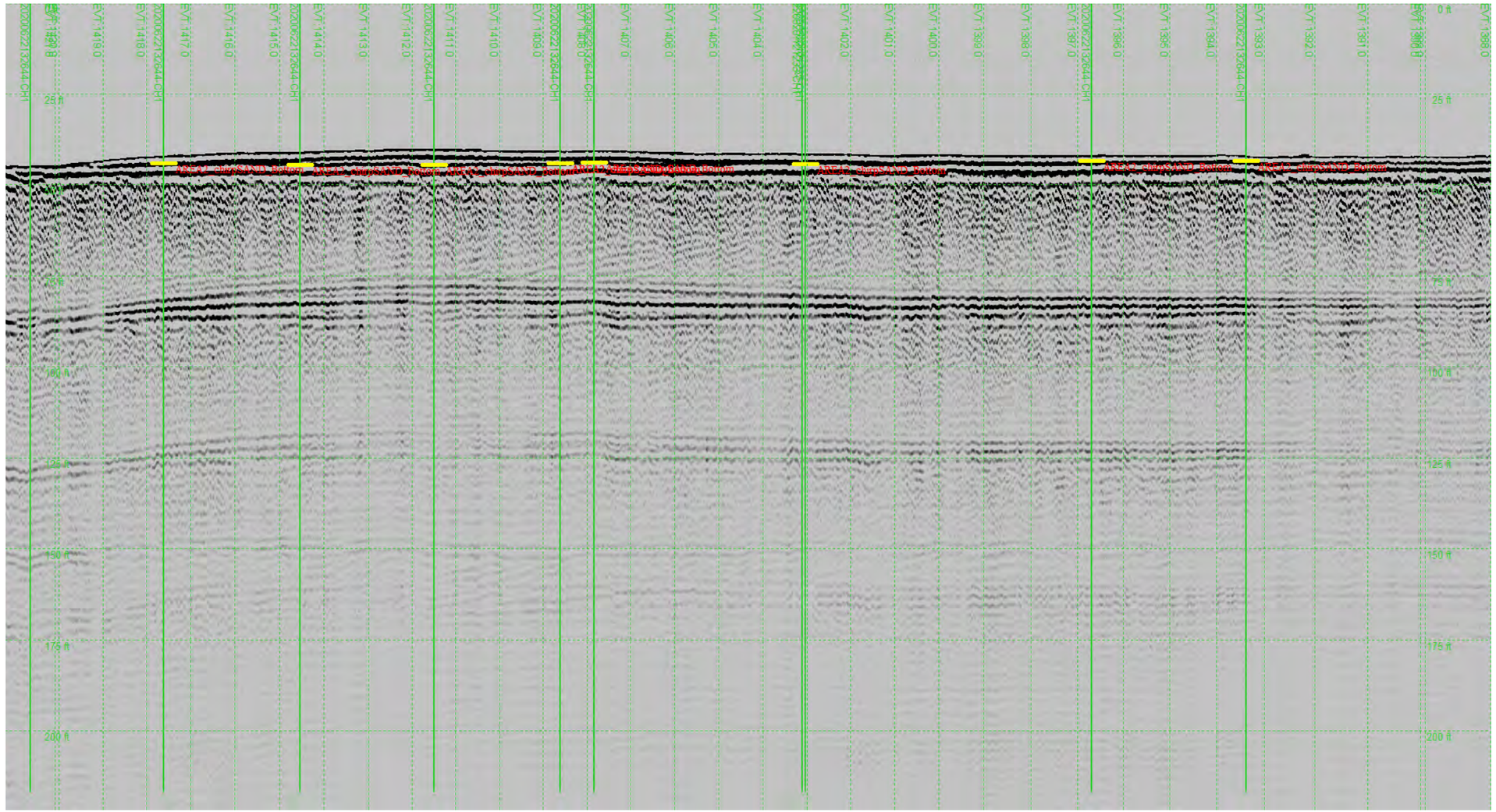

Figure 3: Boomer data showing core locations along seismic profile 220620.132633-CH1

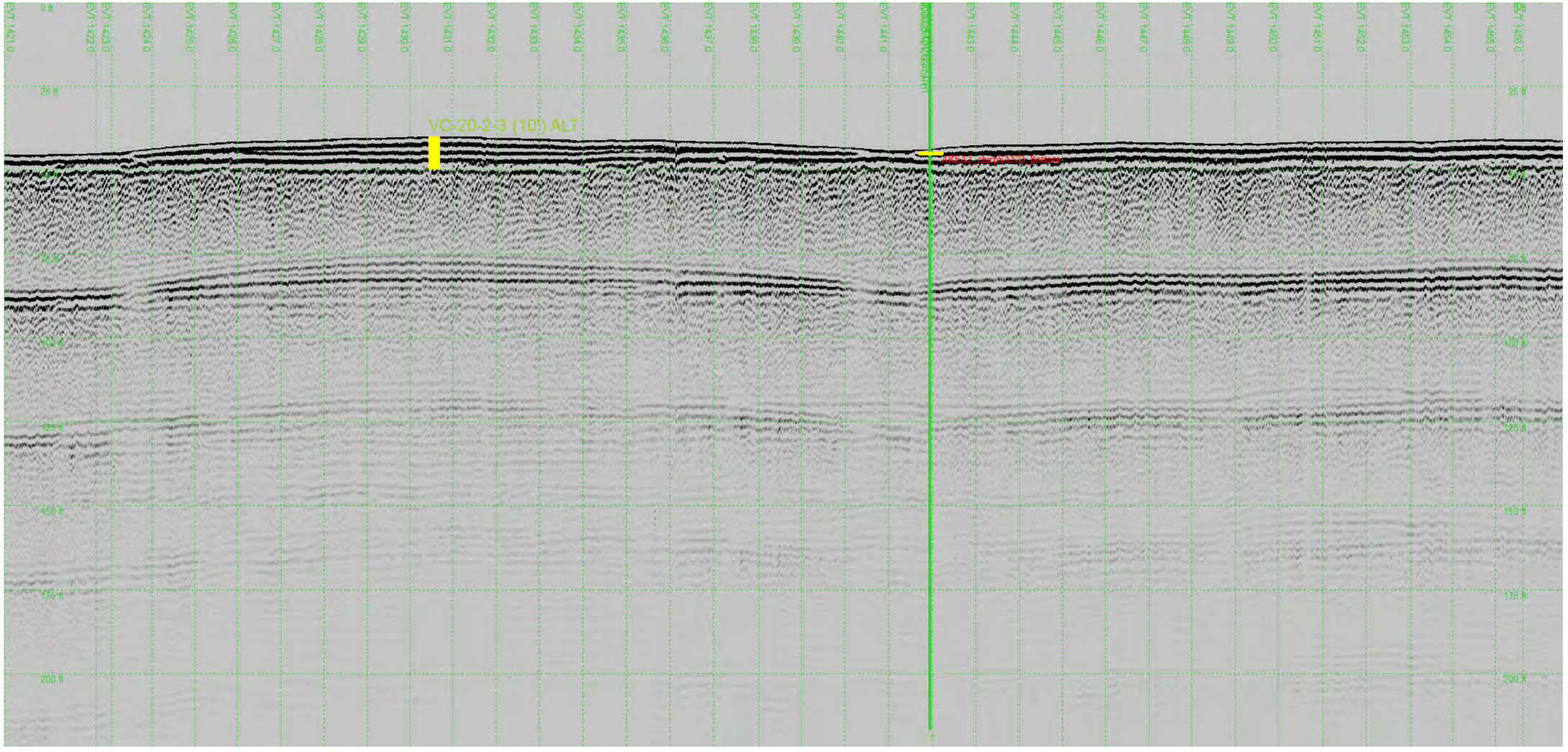

Figure 4: Boomer data showing core locations along seismic profile 220620.134433-CH1

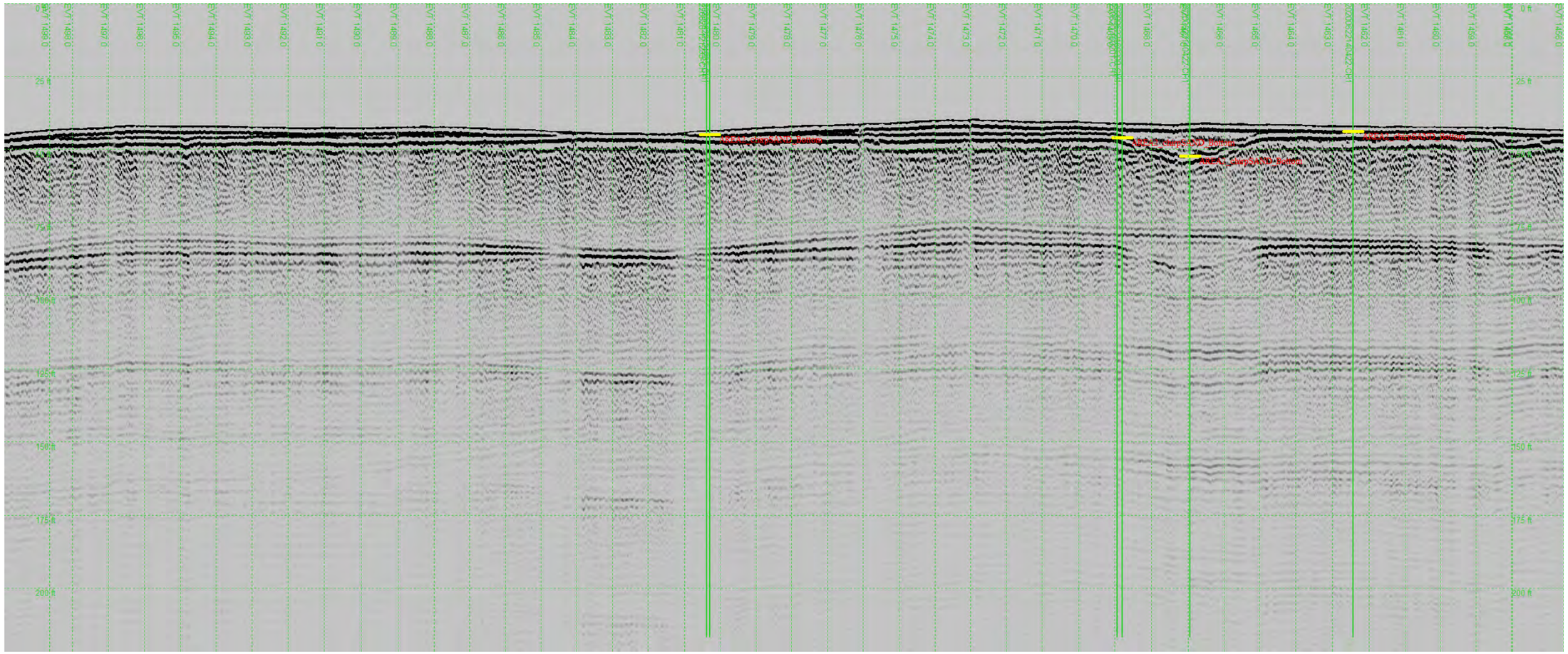

Figure 5: Boomer data showing core locations along seismic profile 220620.140414-CH1

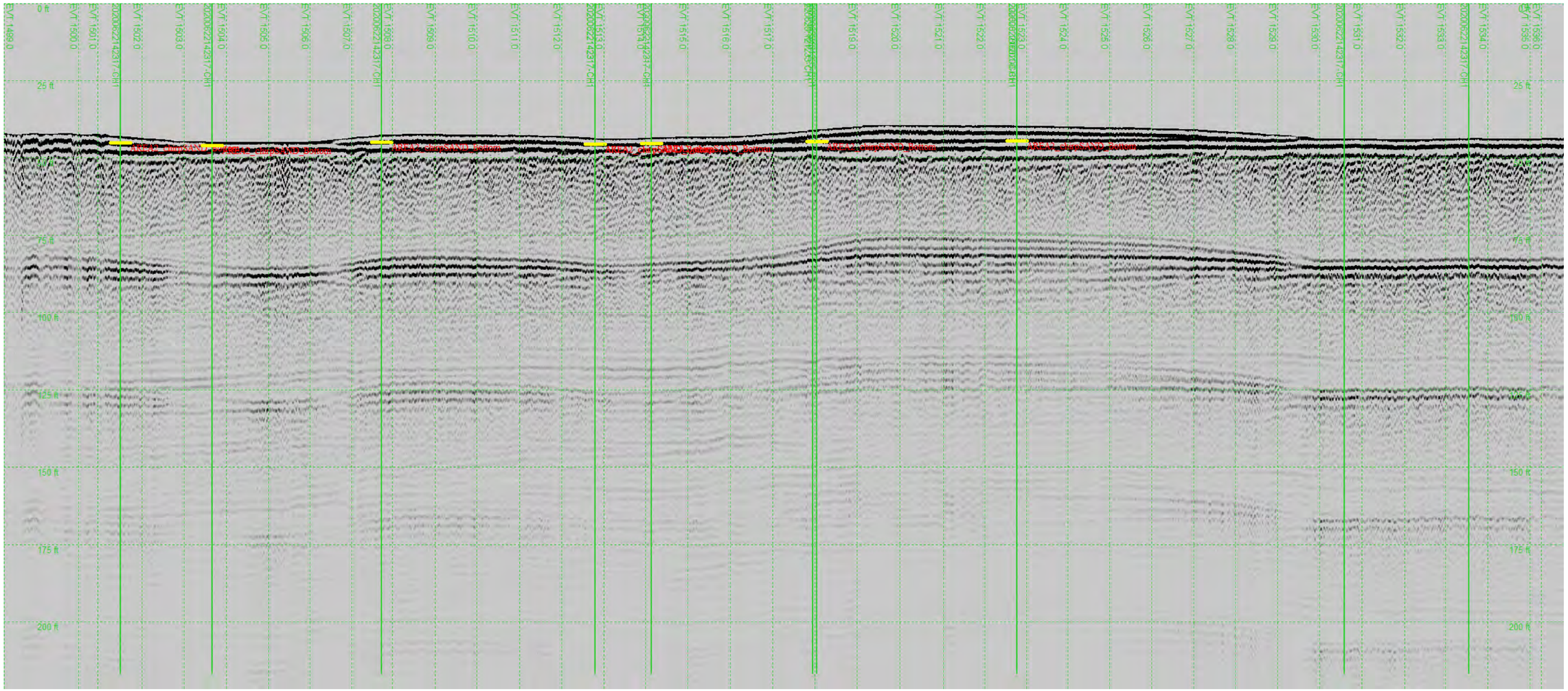

Figure 6: Boomer data showing core locations along seismic profile 220620.142300-CH1

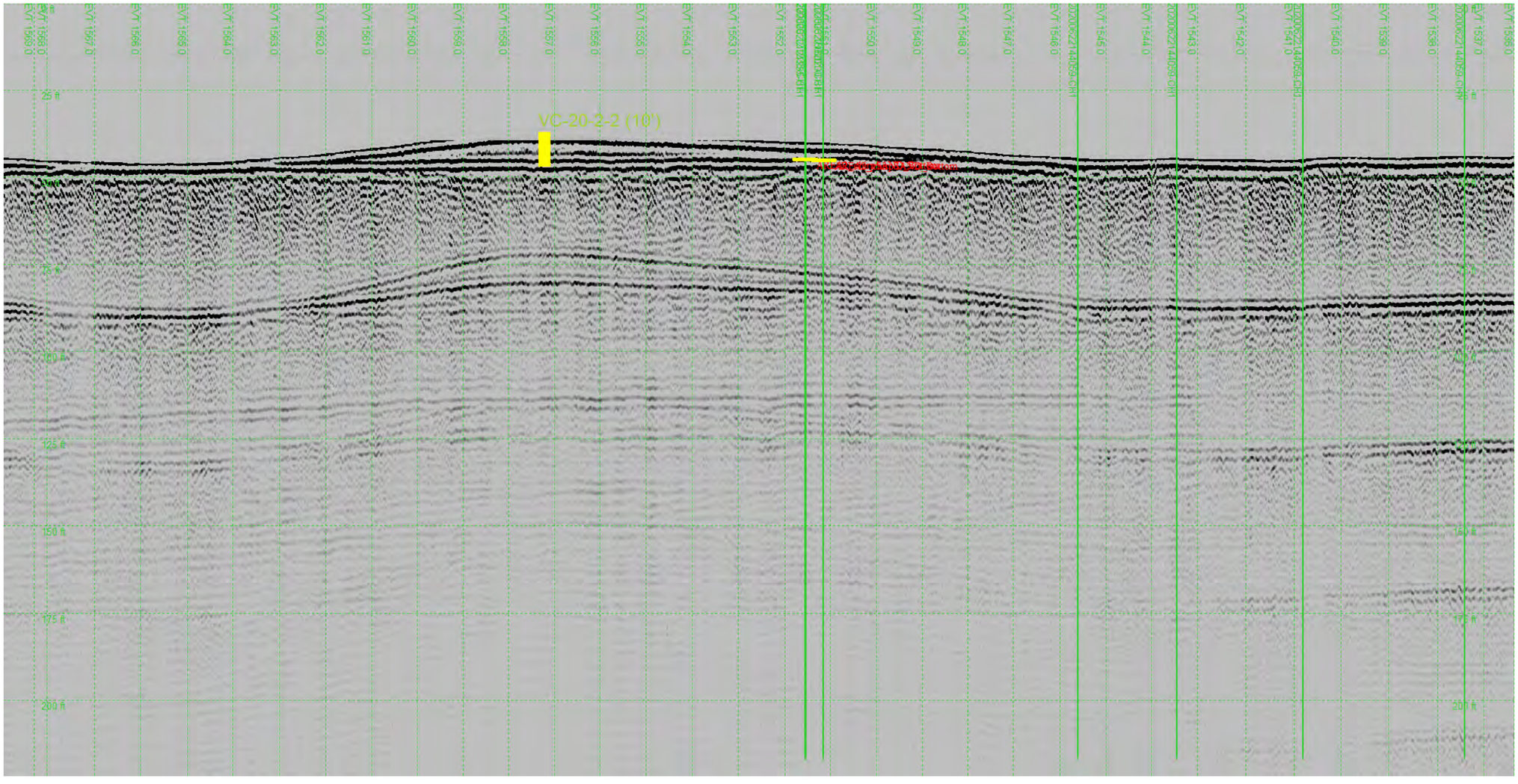

Figure 7: Boomer data showing core locations along seismic profile 220620.144057-CH1

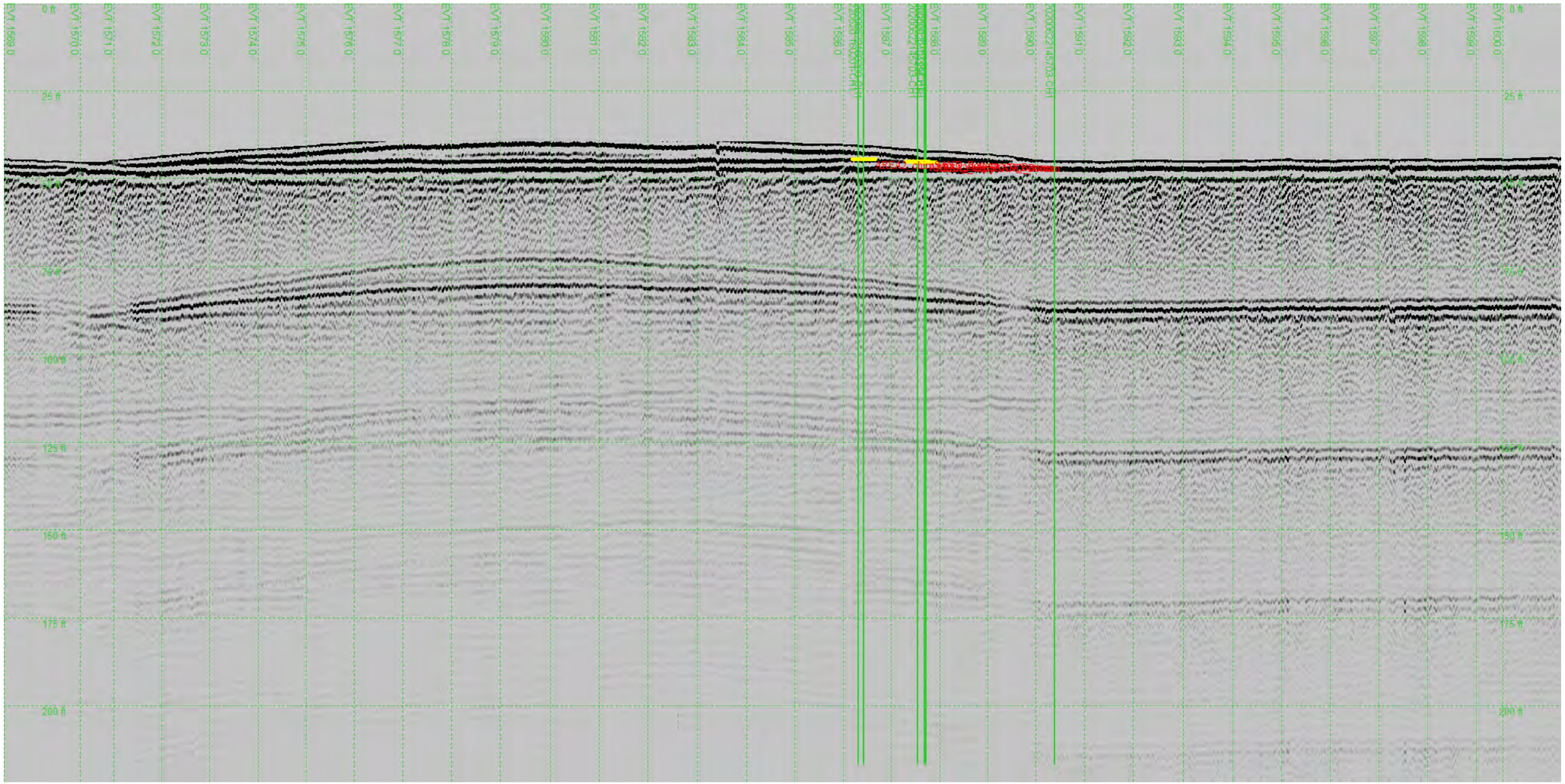

Figure 8: Boomer data showing core locations along seismic profile 220620.145641-CH1

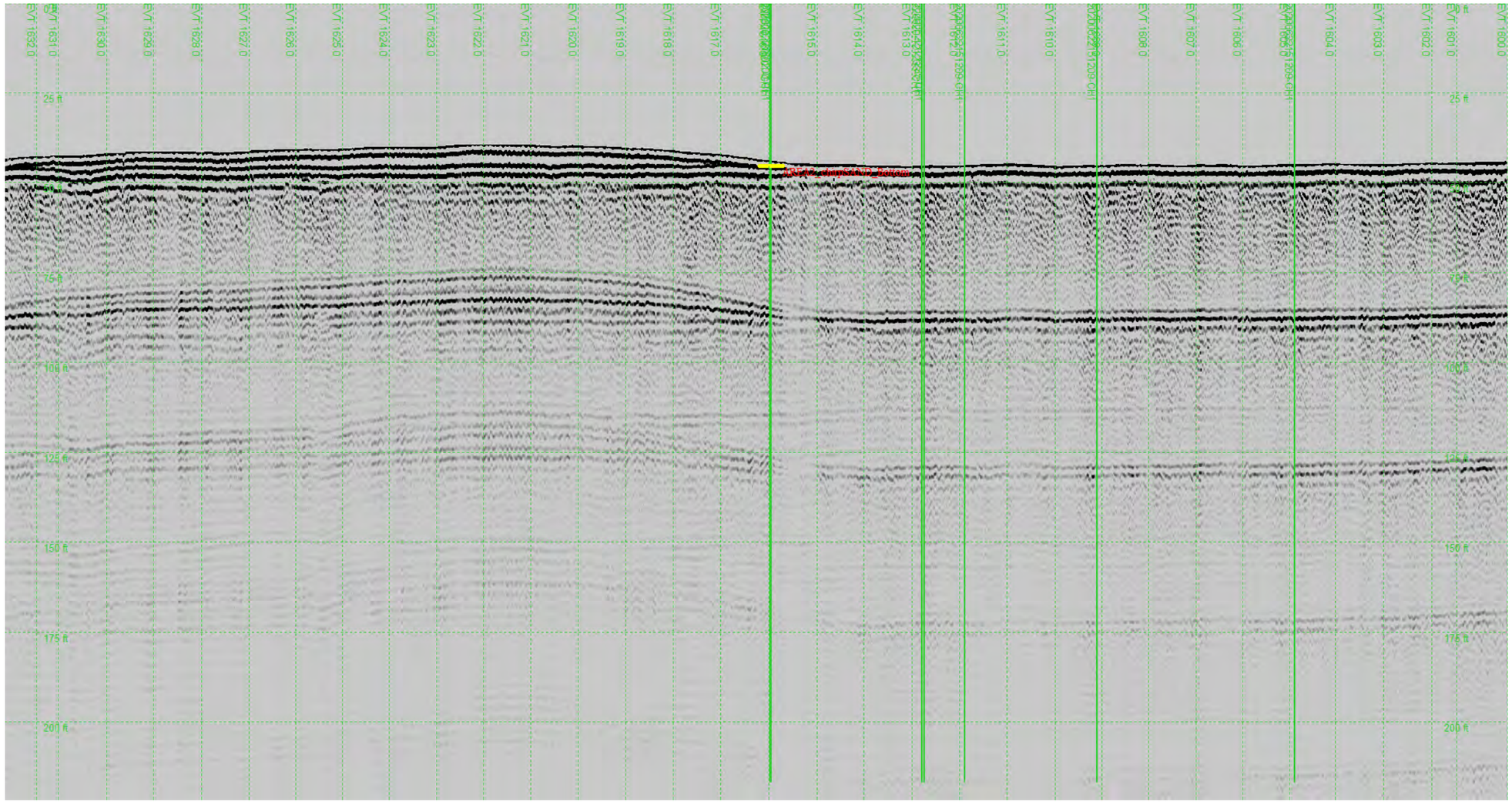

Figure 9: Boomer data showing core locations along seismic profile 220620.151207-CH1

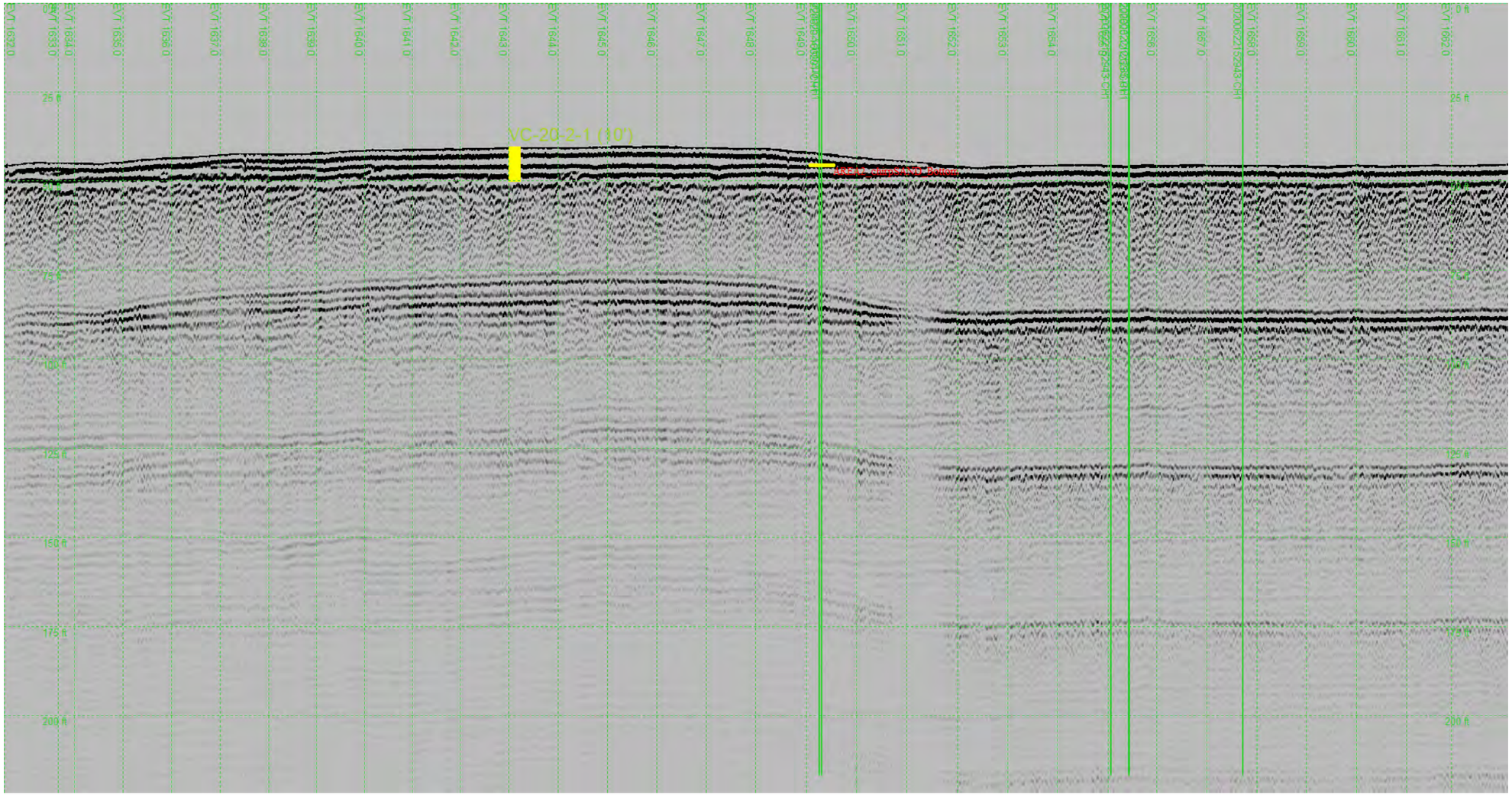

Figure 10: Boomer data showing core locations along seismic profile 220620.152934-CH1

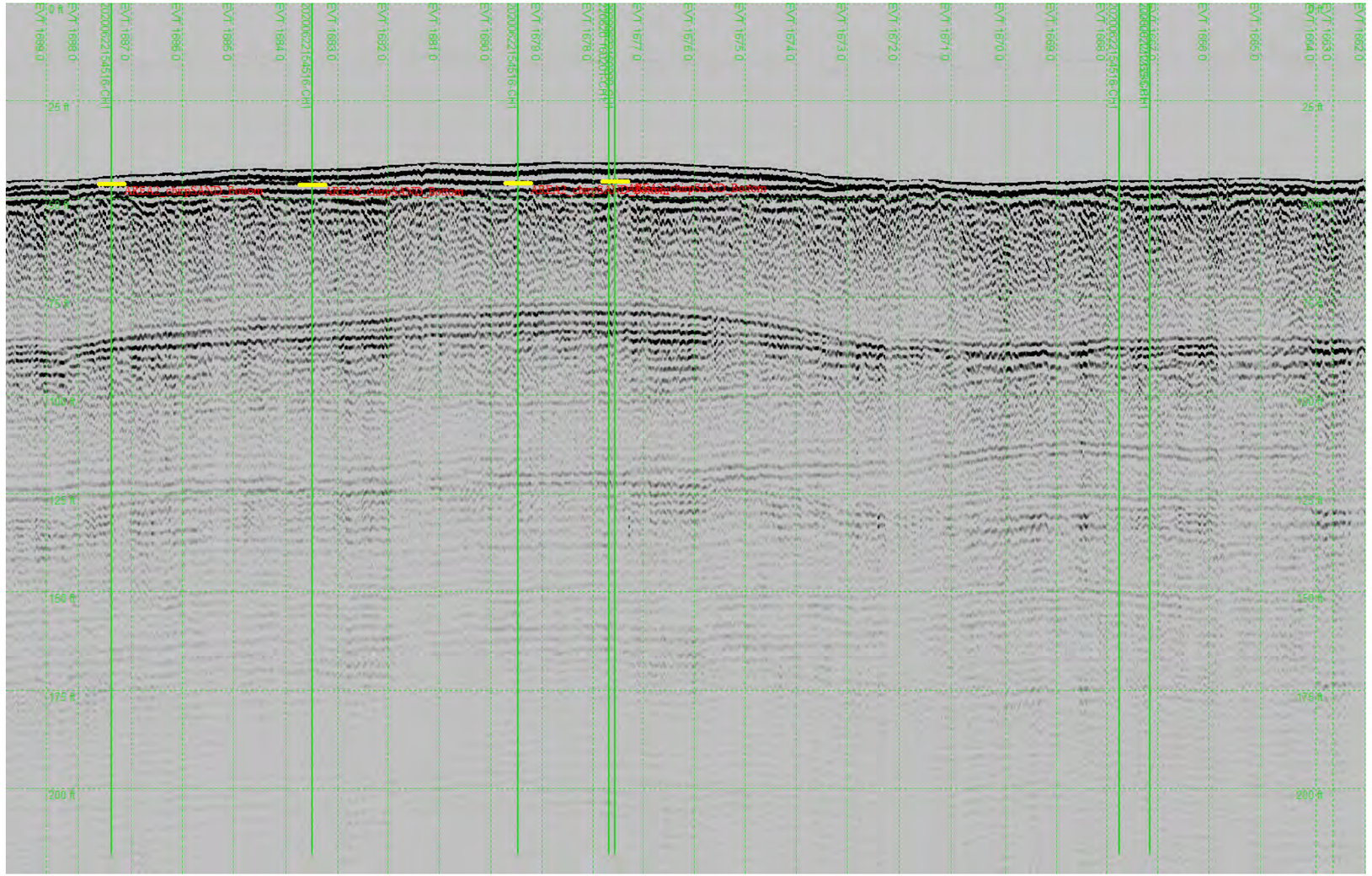

Figure 11: Boomer data showing core locations along seismic profile 220620.154516-CH1

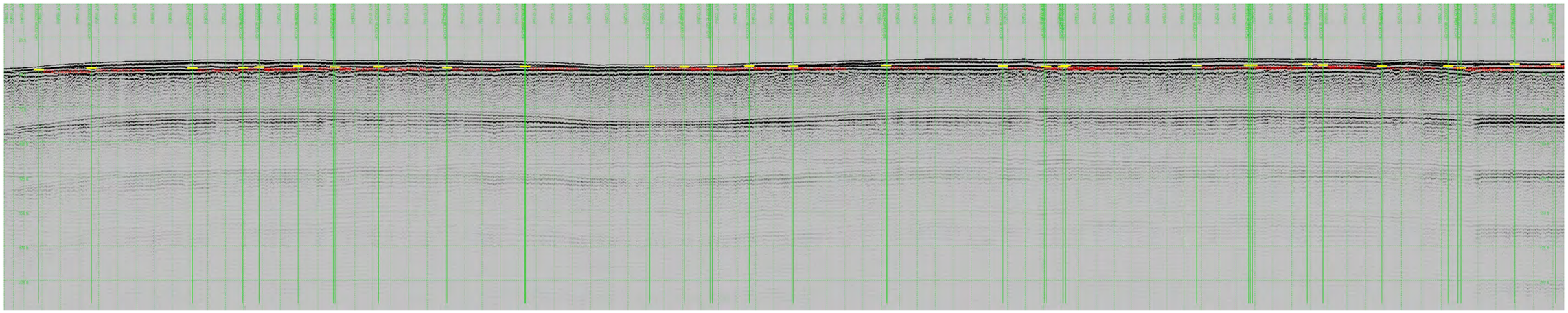

Figure 12: Boomer data showing core locations along seismic profile 220620.160201-CH1

LK-P2
CHIRP data

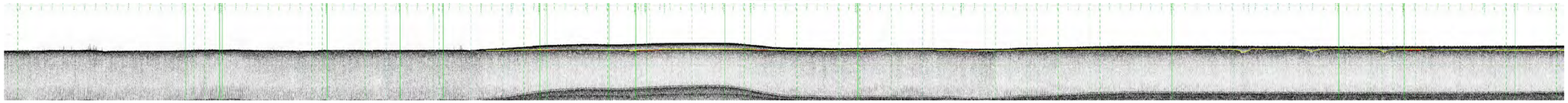

Figure 13: CHIRP data showing core locations along seismic profile 20200622121235-CH1

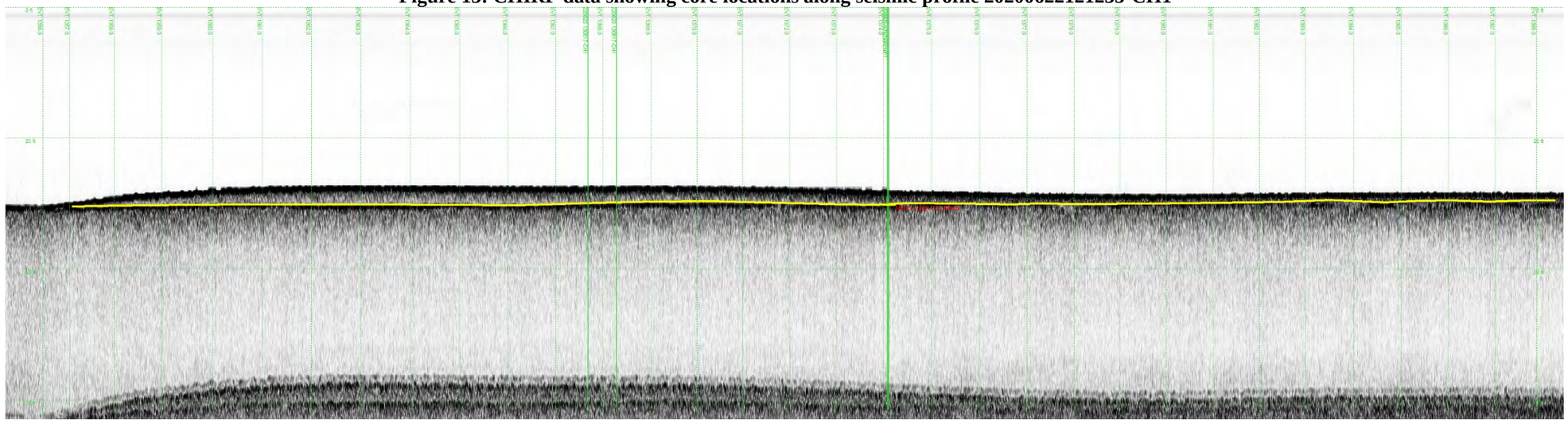

Figure 14: CHIRP data showing core locations along seismic profile 20200622130830-CH1

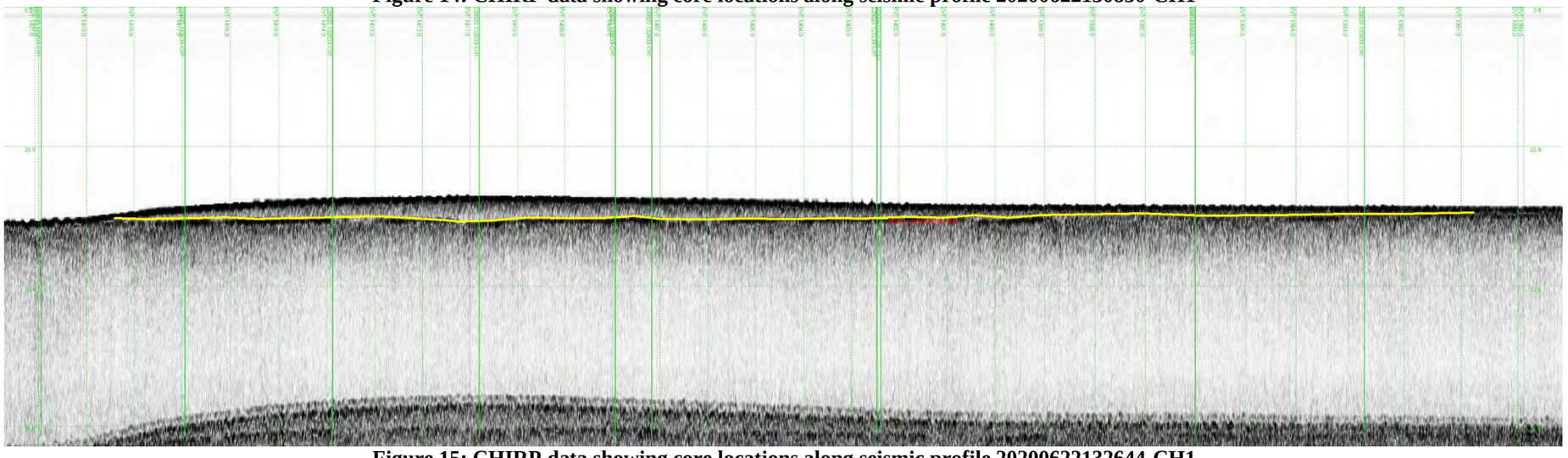

Figure 15: CHIRP data showing core locations along seismic profile 20200622132644-CH1

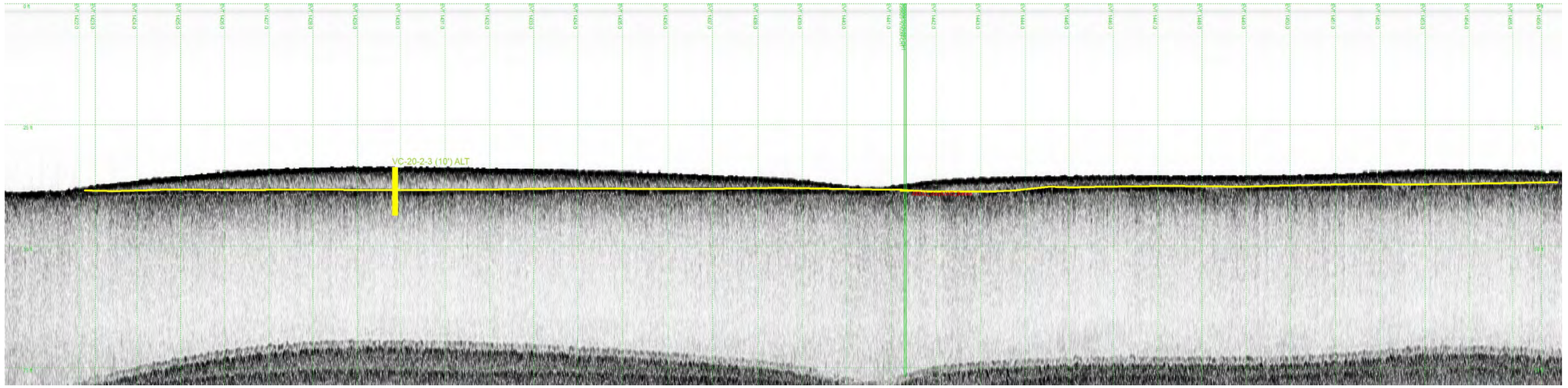

Figure 16: CHIRP data showing core locations along seismic profile 20200622134439-CH1

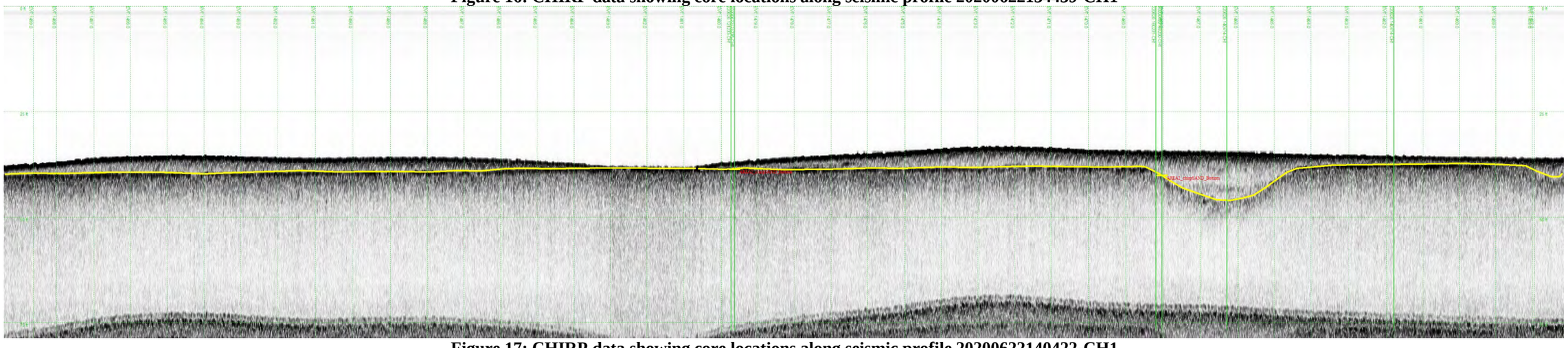

Figure 17: CHIRP data showing core locations along seismic profile 20200622140422-CH1

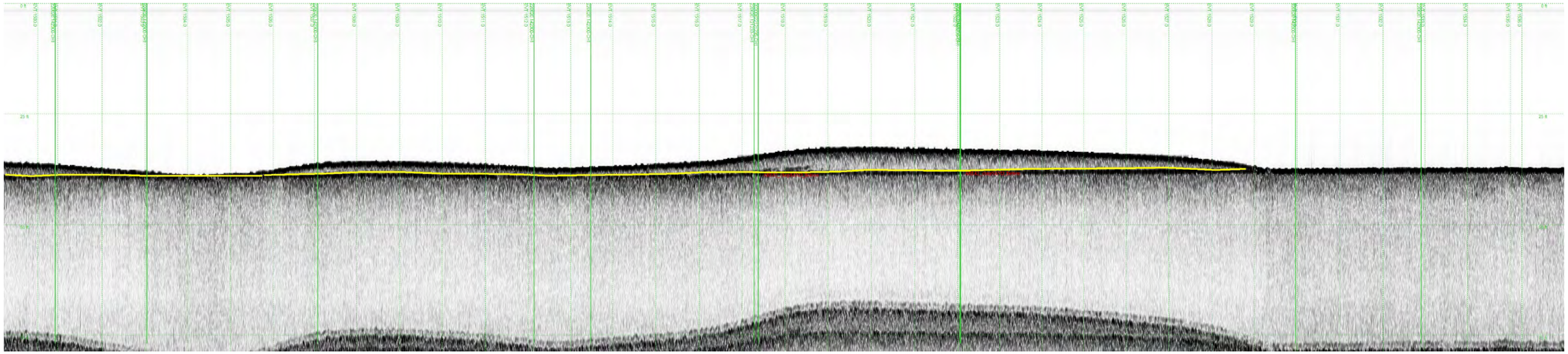

Figure 18: CHIRP data showing core locations along seismic profile 20200622142317-CH1

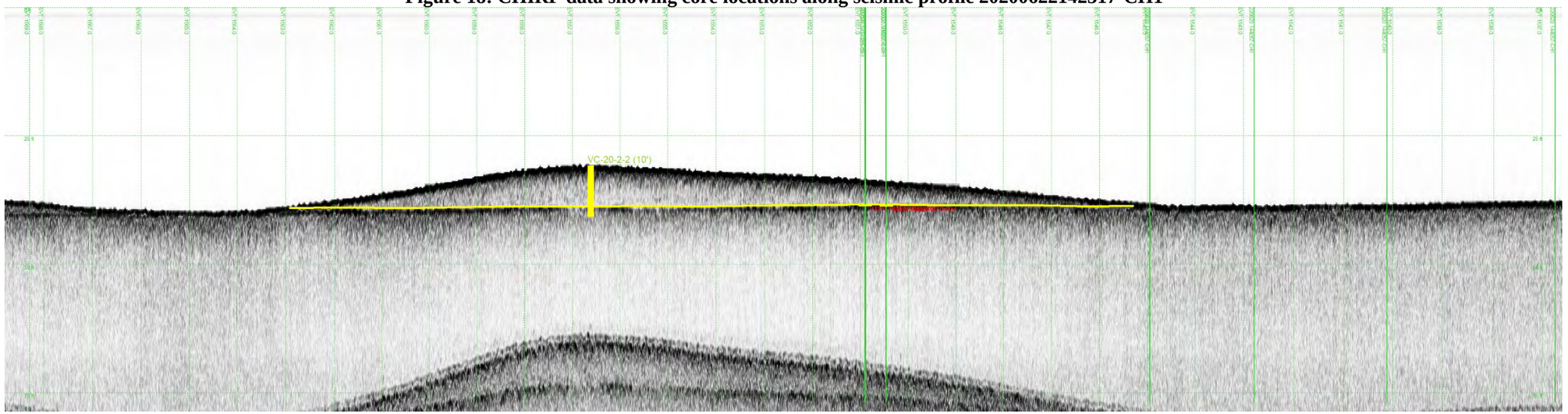

Figure 19: CHIRP data showing core locations along seismic profile 20200622144059-CH1

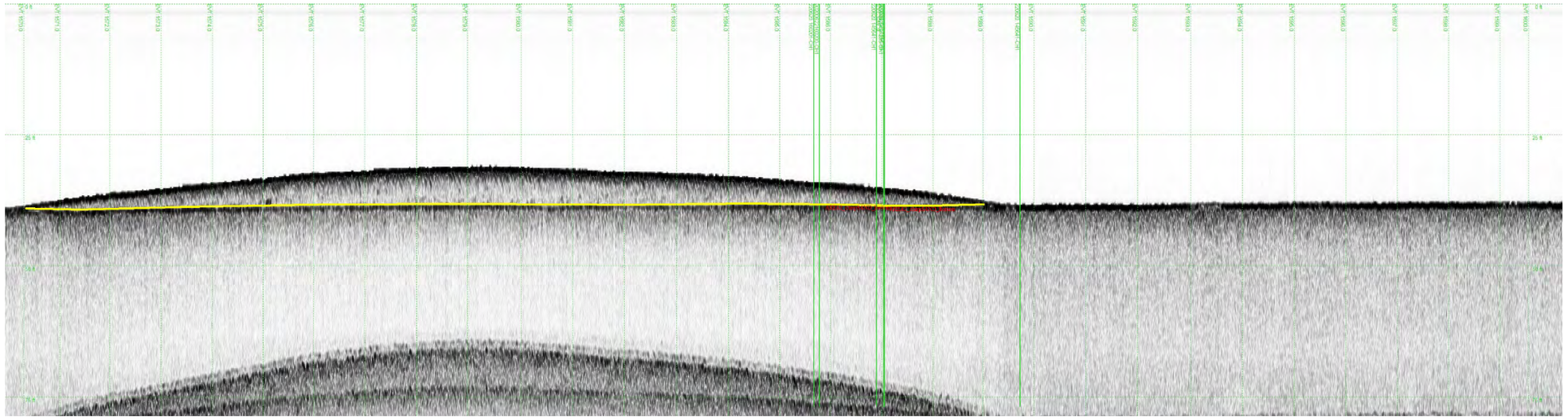

Figure 20: CHIRP data showing core locations along seismic profile 20200622145703-CH1

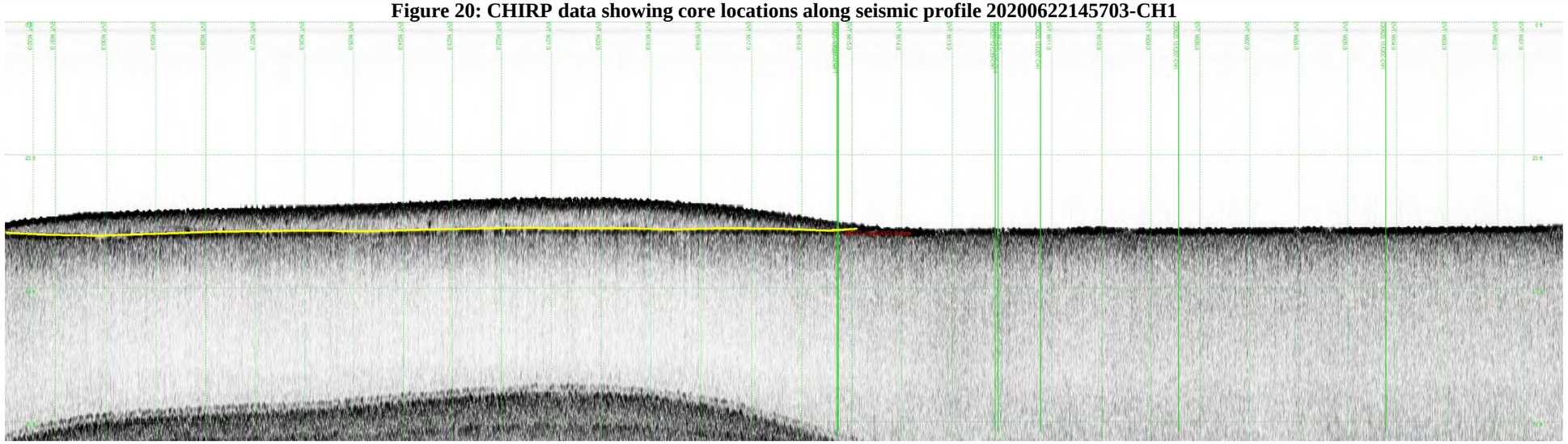

Figure 21: CHIRP data showing core locations along seismic profile 20200622151209-CH1

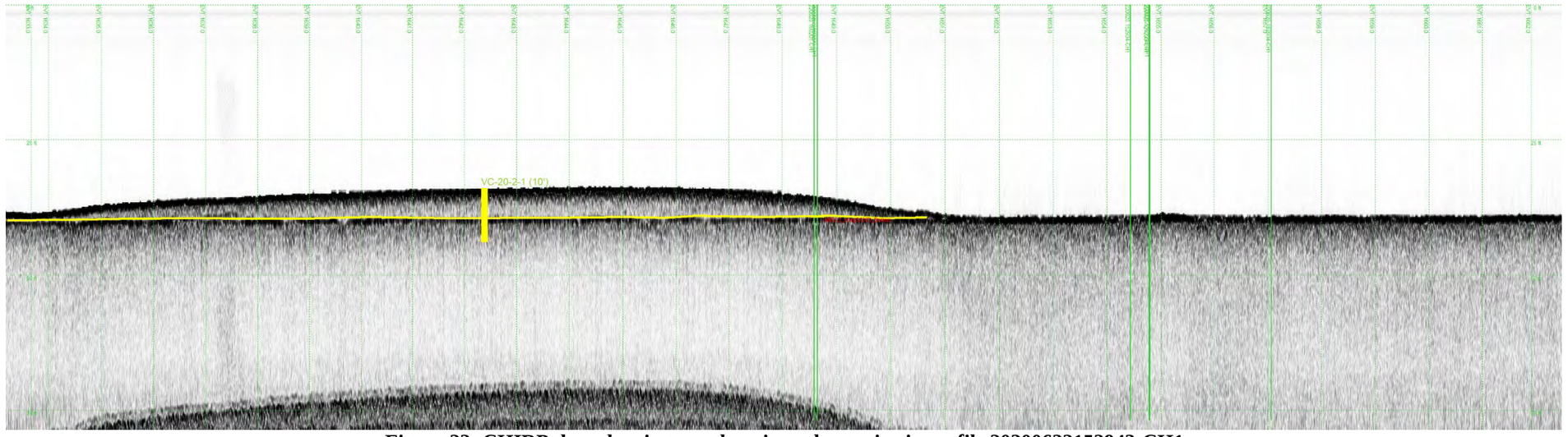

Figure 22: CHIRP data showing core locations along seismic profile 20200622152943-CH1

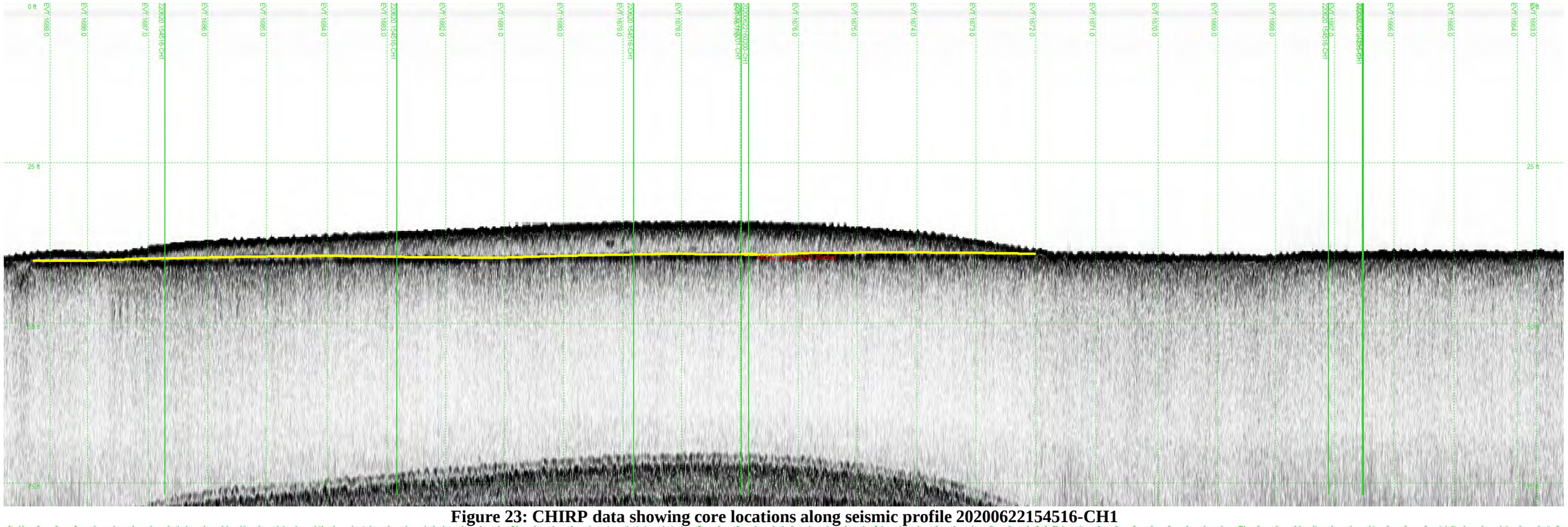

Figure 23: CHIRP data showing core locations along seismic profile 20200622154516-CH1

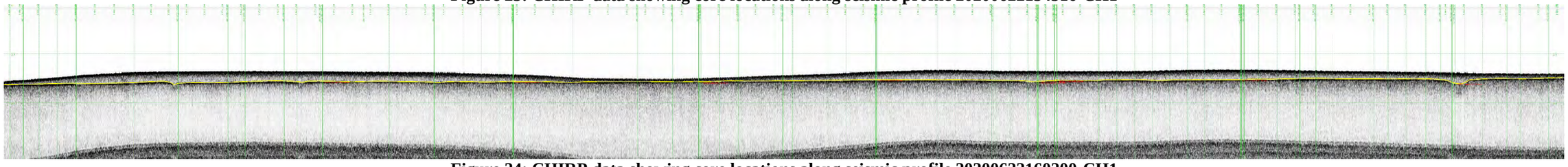

Figure 24: CHIRP data showing core locations along seismic profile 20200622160200-CH1

LK-P4
Boomer data

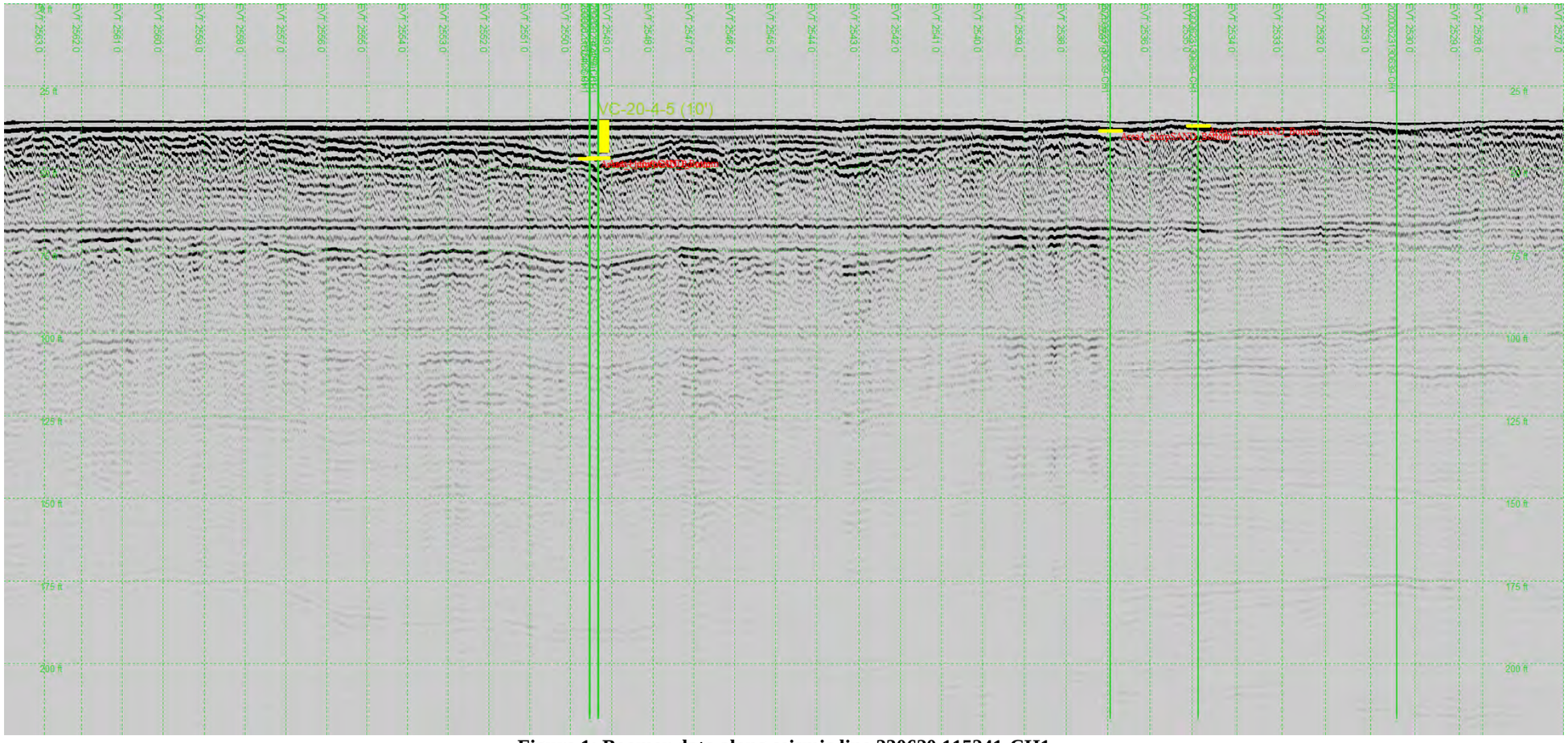

Figure 1: Boomer data along seismic line 230620.115241-CH1

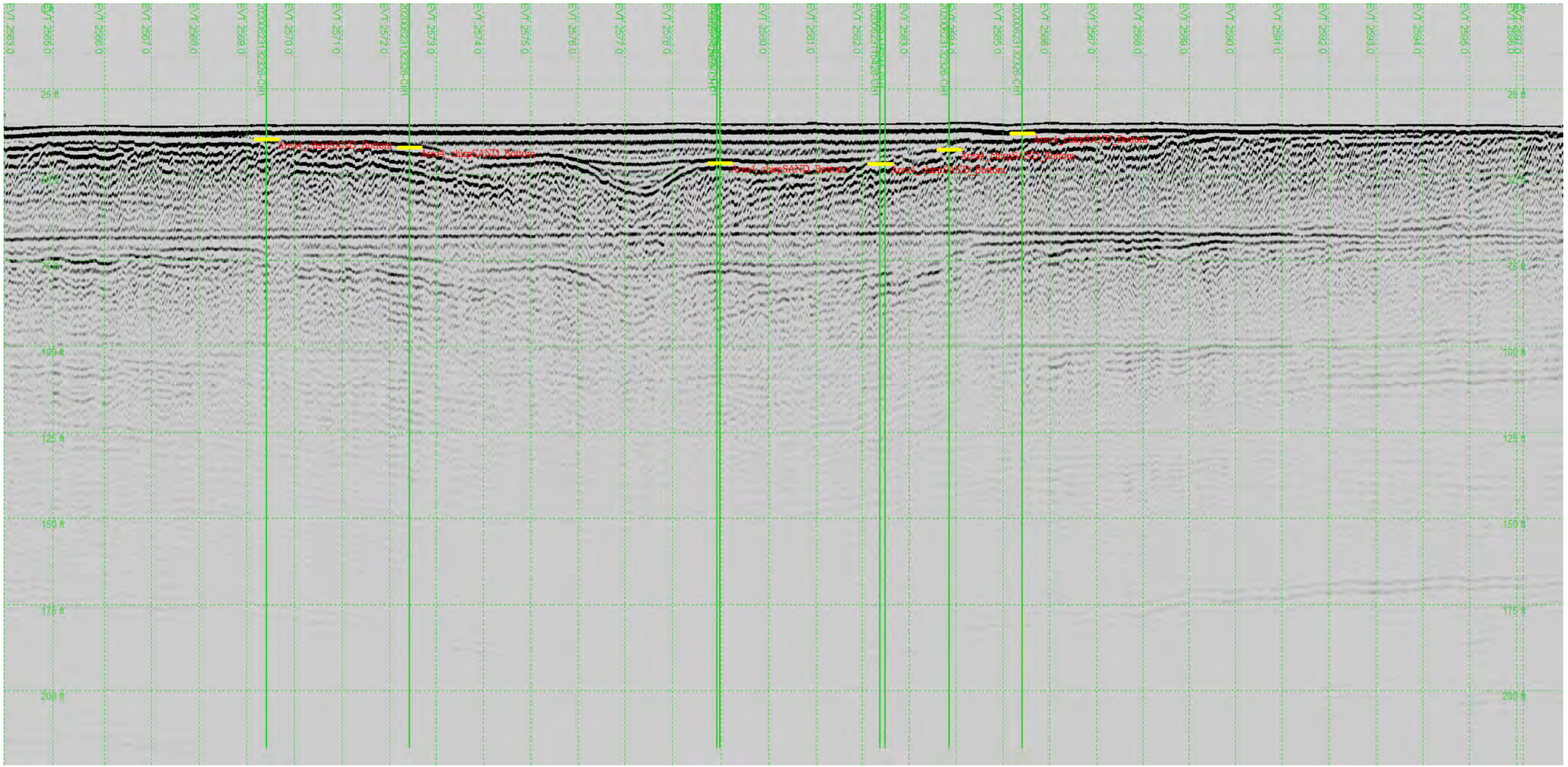

Figure 2: Boomer data along seismic line 230620.122345-CH1

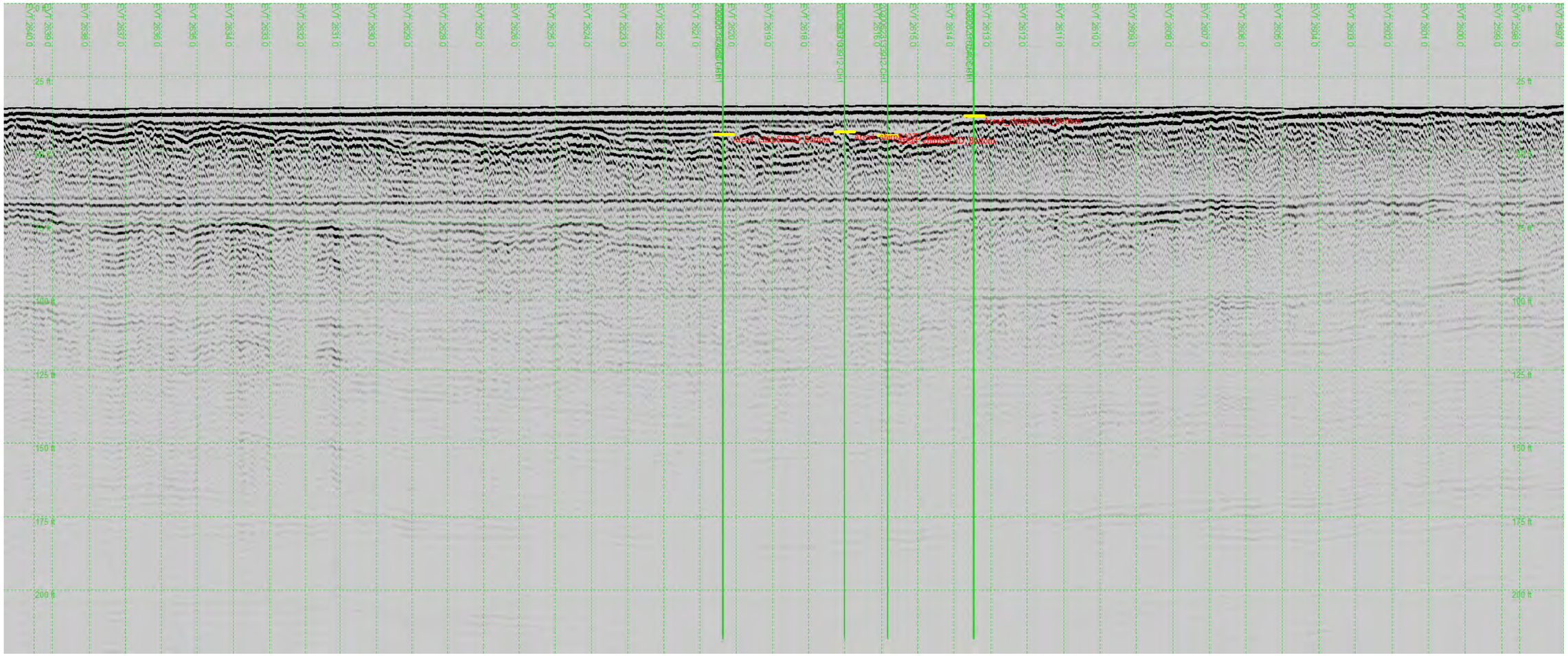

Figure 3: Boomer data along seismic line 230620.123649-CH1

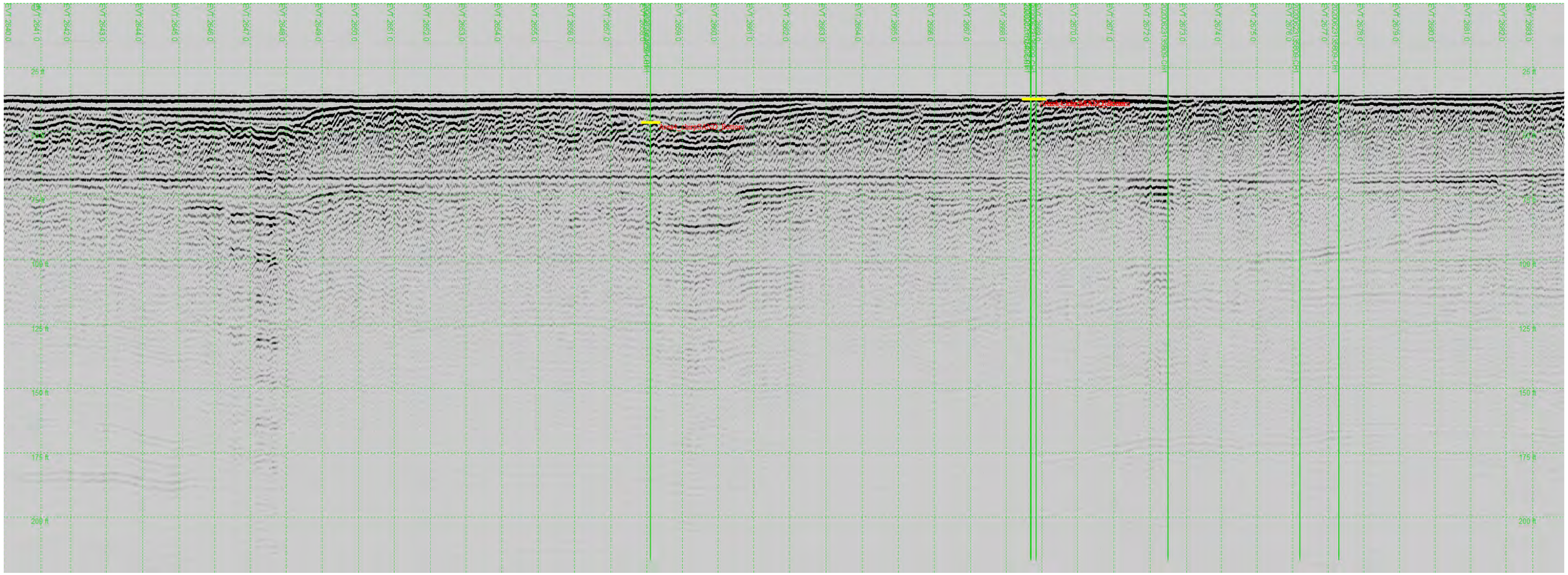

Figure 4: Boomer data along seismic line 230620.125013-CH1

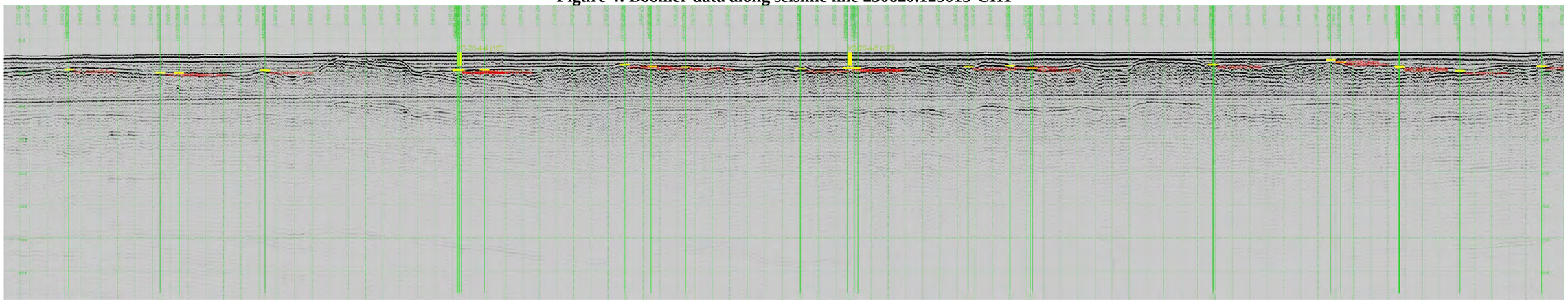

Figure 5: Boomer data along seismic line 230620.130628-CH1

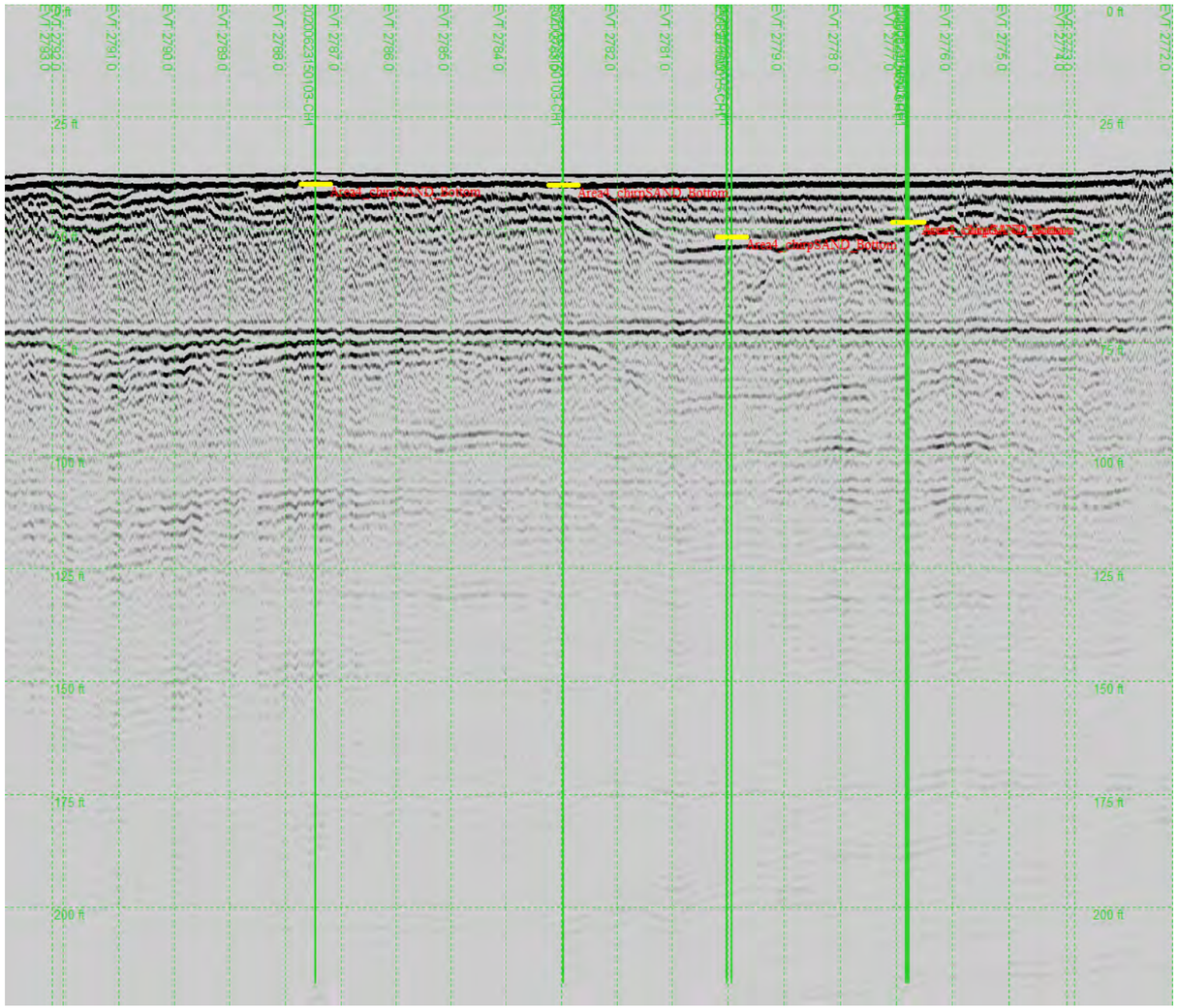

Figure 6: Boomer data along seismic line 230620.132315-CH1

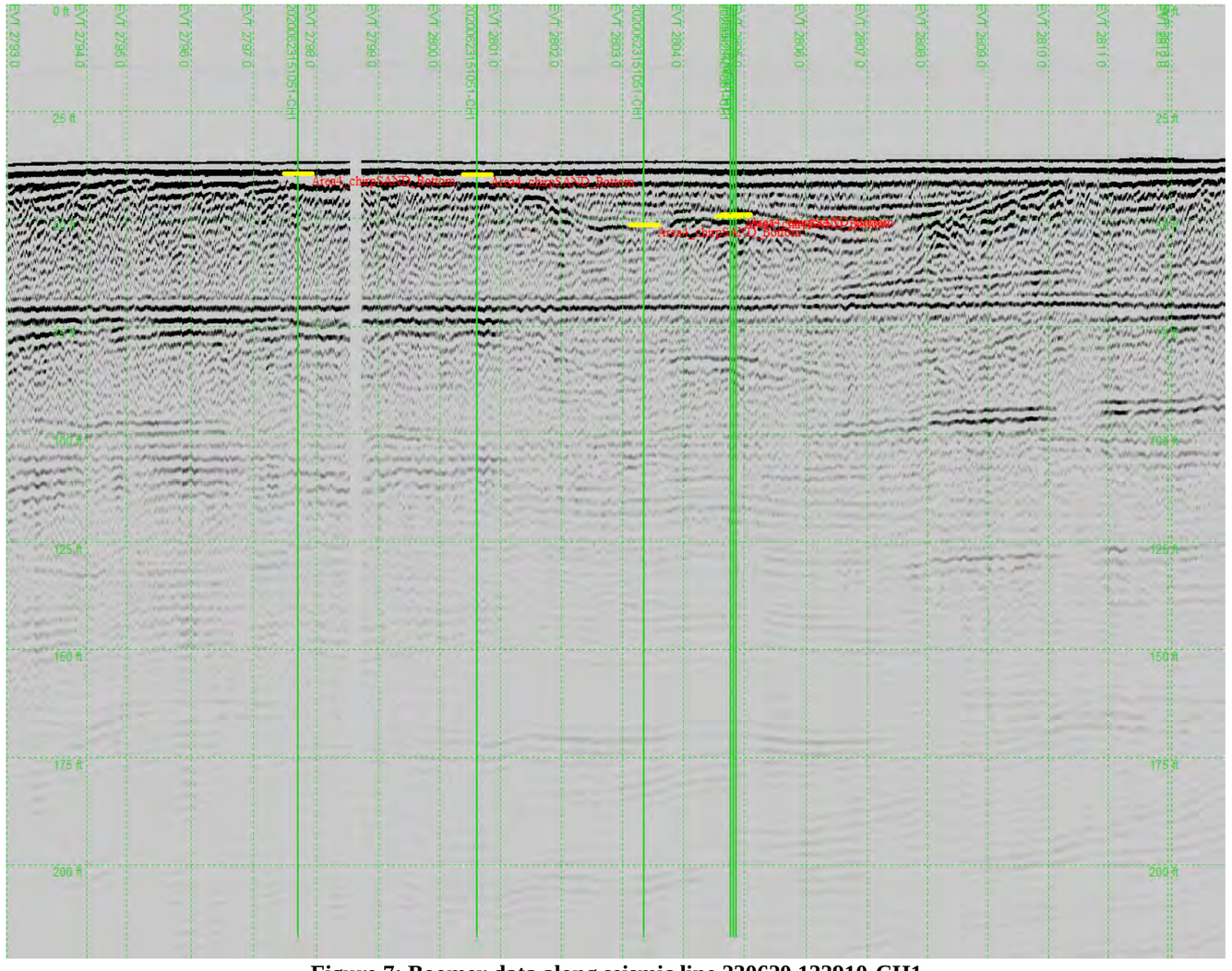

Figure 7: Boomer data along seismic line 230620.133910-CH1

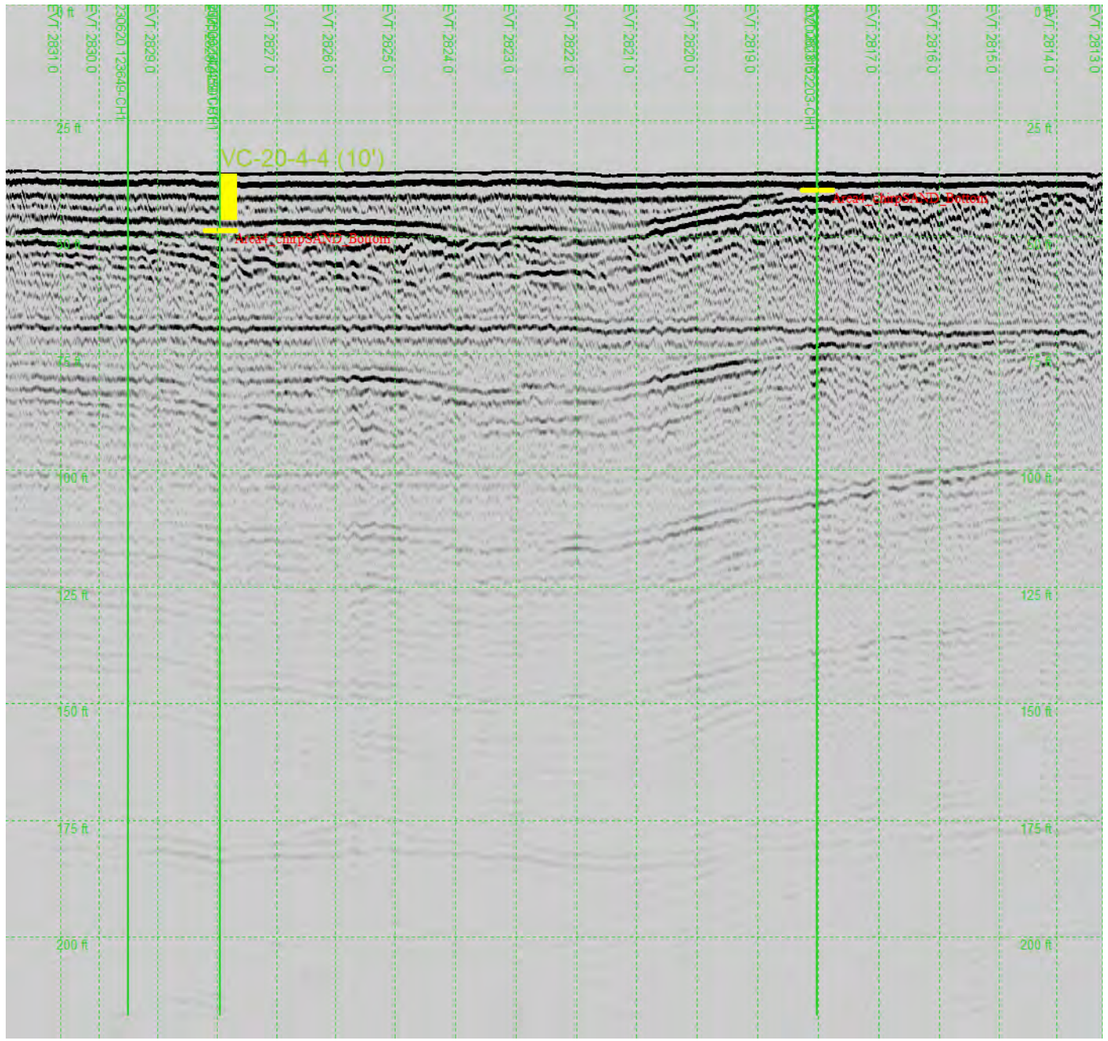

Figure 8: Boomer data along seismic line 230620.135757-CH1

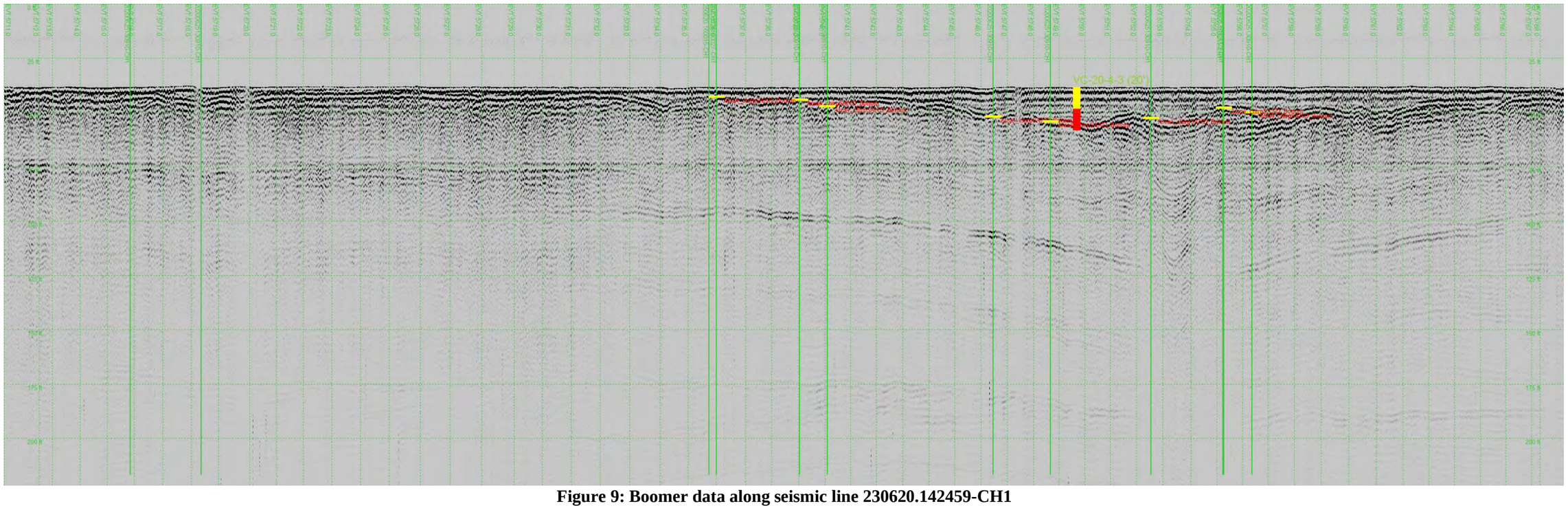

Figure 9: Boomer data along seismic line 230620.142459-CH1

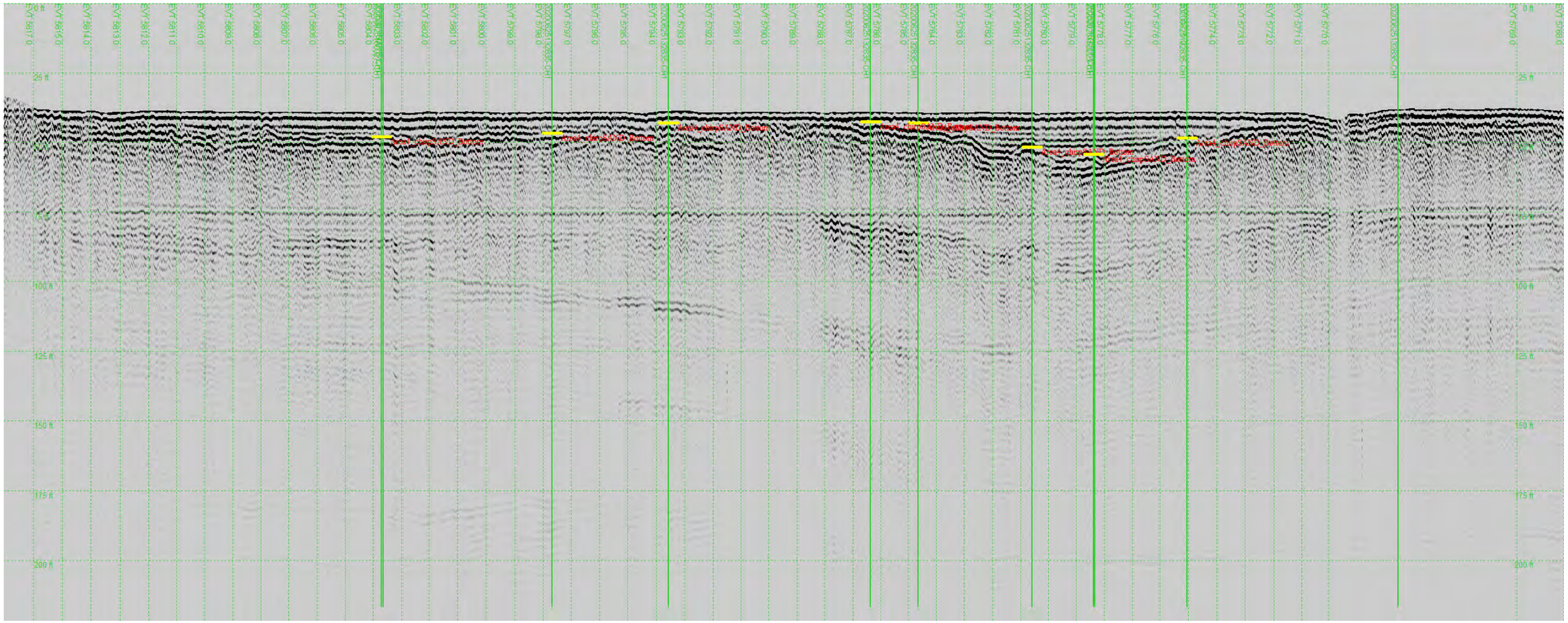

Figure 10: Boomer data along seismic line 230620.150057-CH1

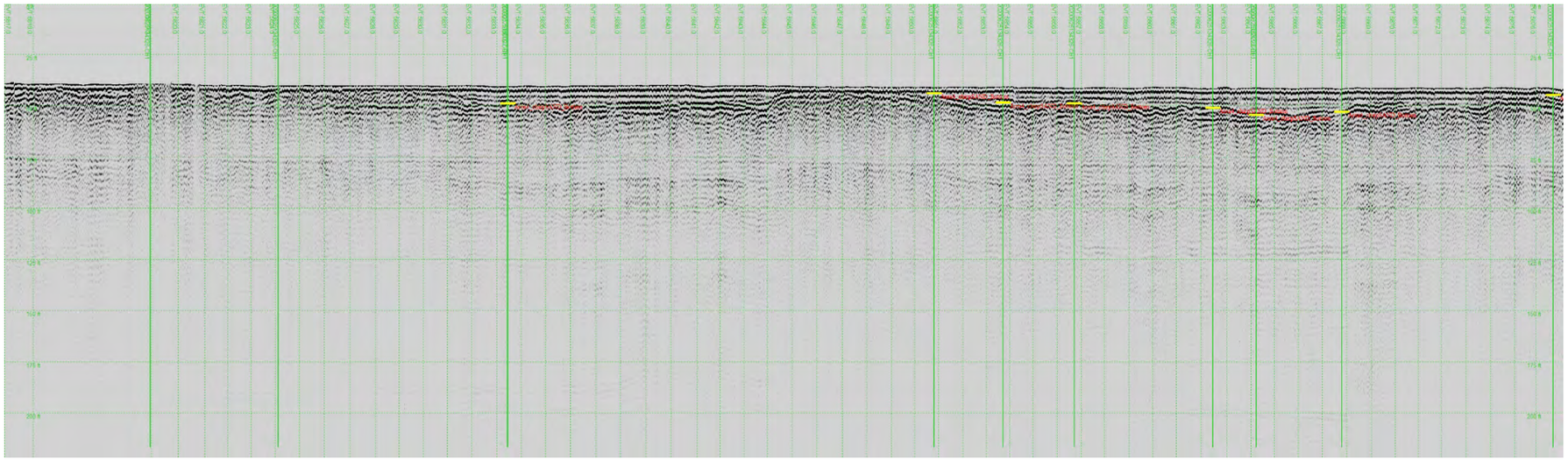

Figure 11: Boomer data along seismic line 230620.151034-CH1

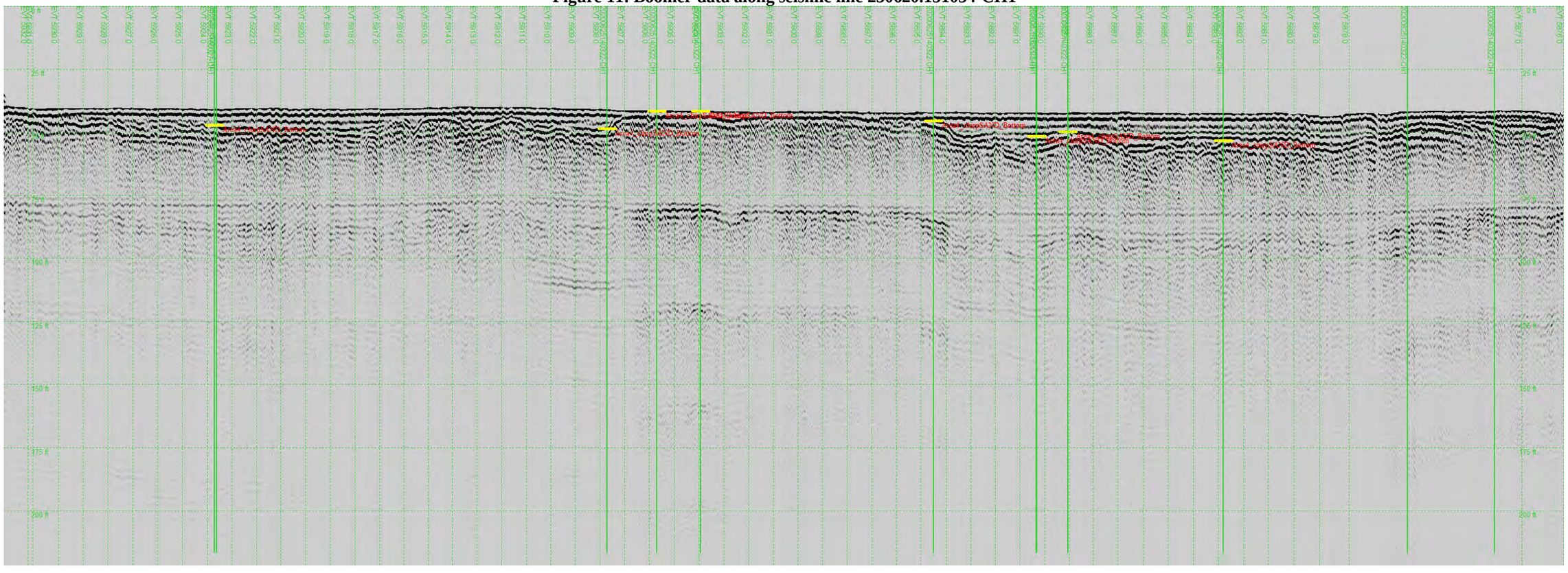

Figure 12: Boomer data along seismic line 230620.152200-CH1

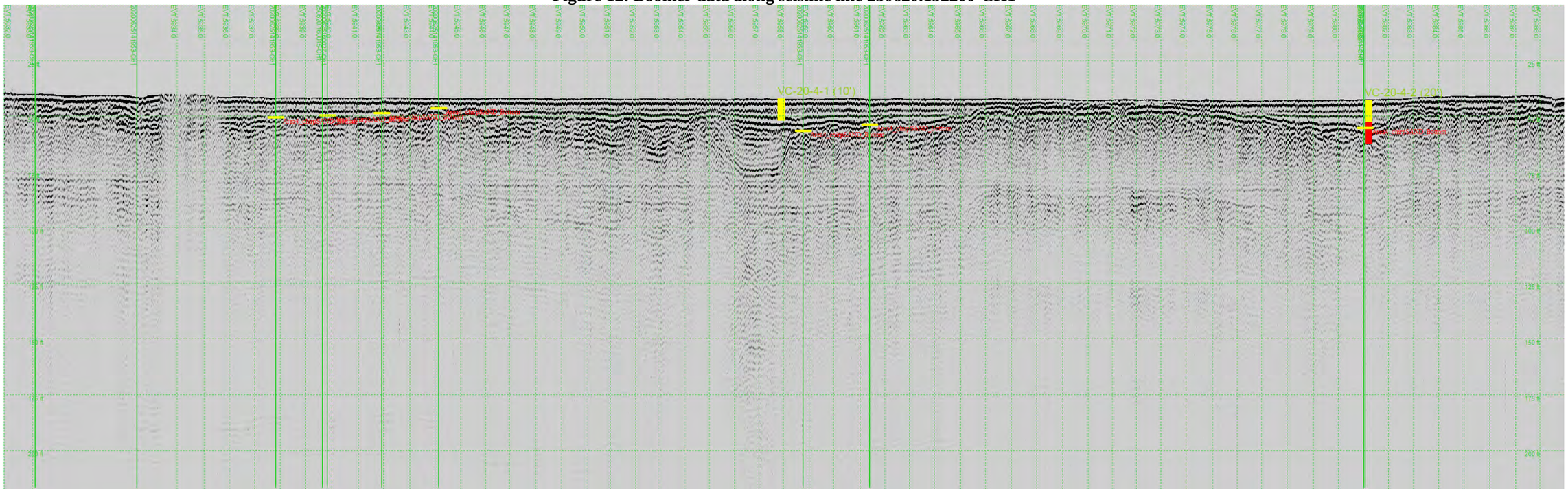

Figure 13: Boomer data along seismic line 250620.130906-CH1

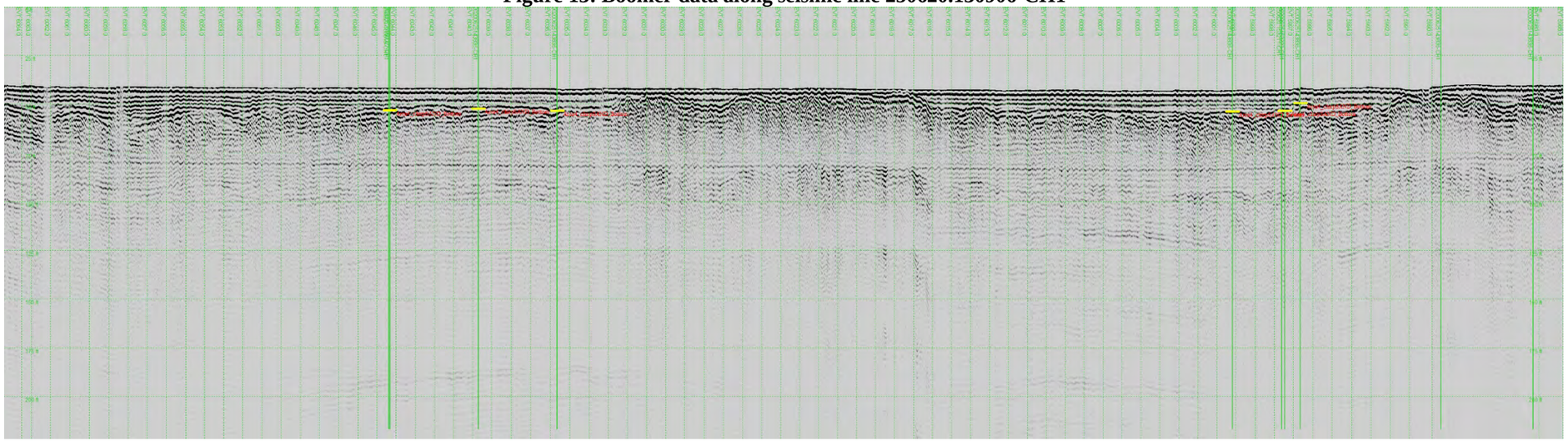

Figure 14: Boomer data along seismic line 250620.132822-CH1

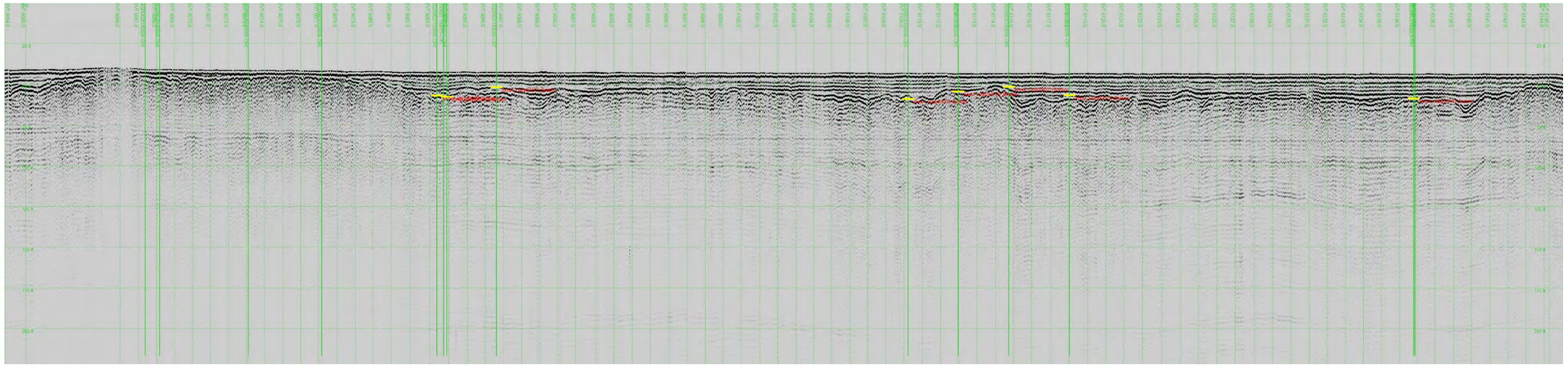

Figure 15: Boomer data along seismic line 250620.134313-CH1

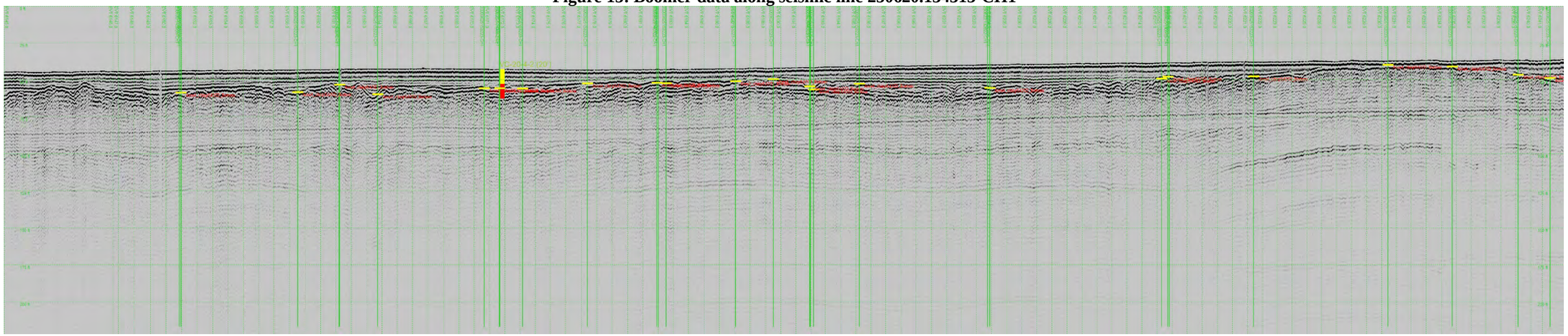

Figure 16: Boomer data along seismic line 250620.140308-CH1

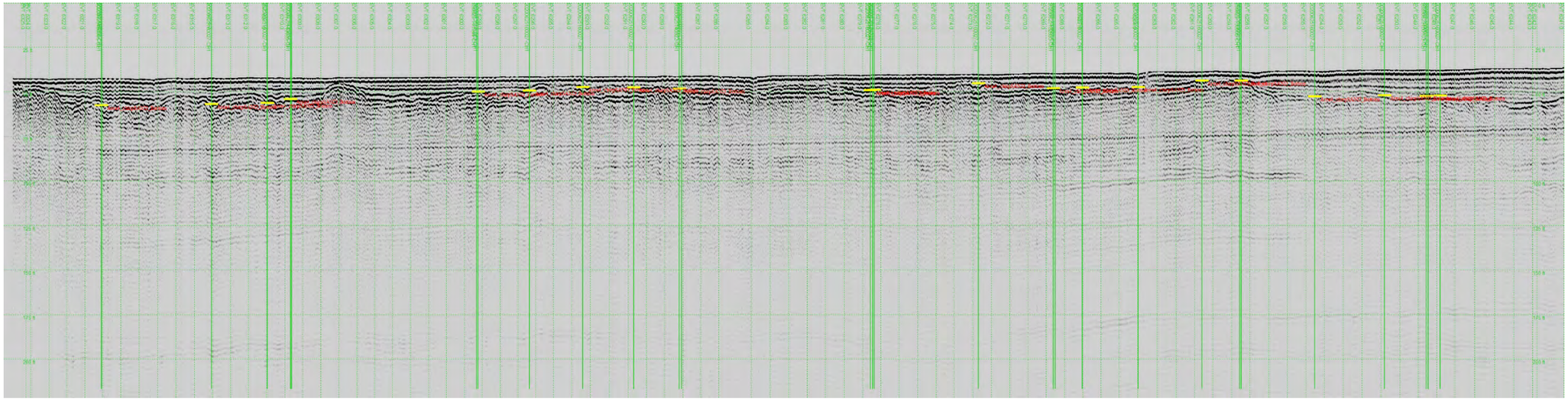

Figure 17: Boomer data along seismic line 250620.141944-CH1

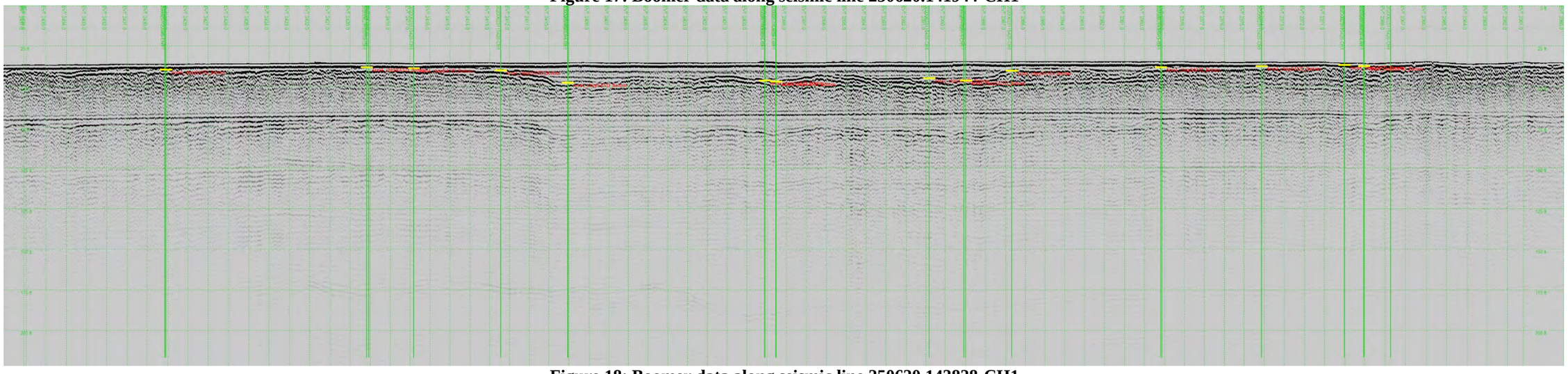

Figure 18: Boomer data along seismic line 250620.143828-CH1

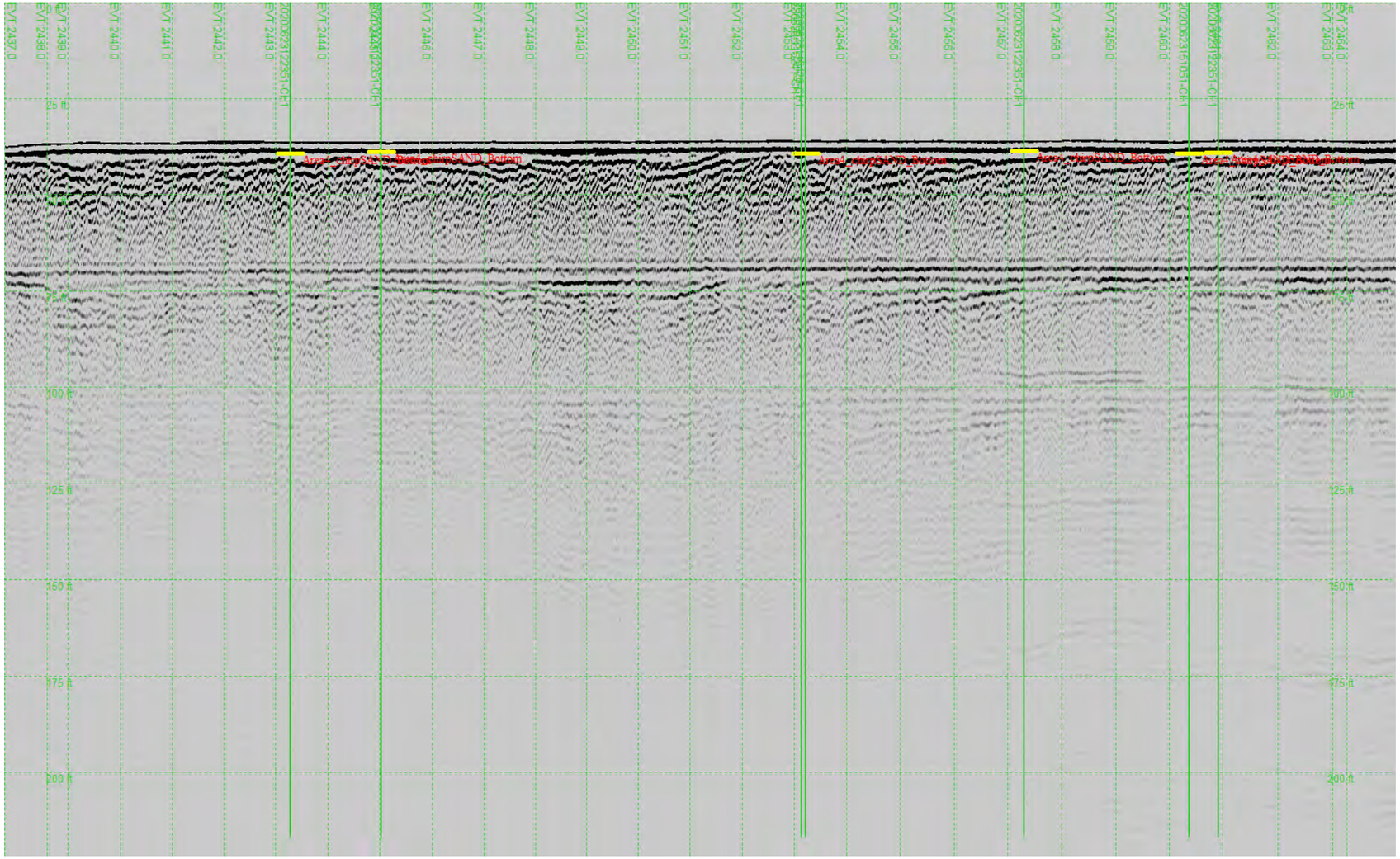

Figure 19: Boomer data along seismic line 250620.145958-CH1

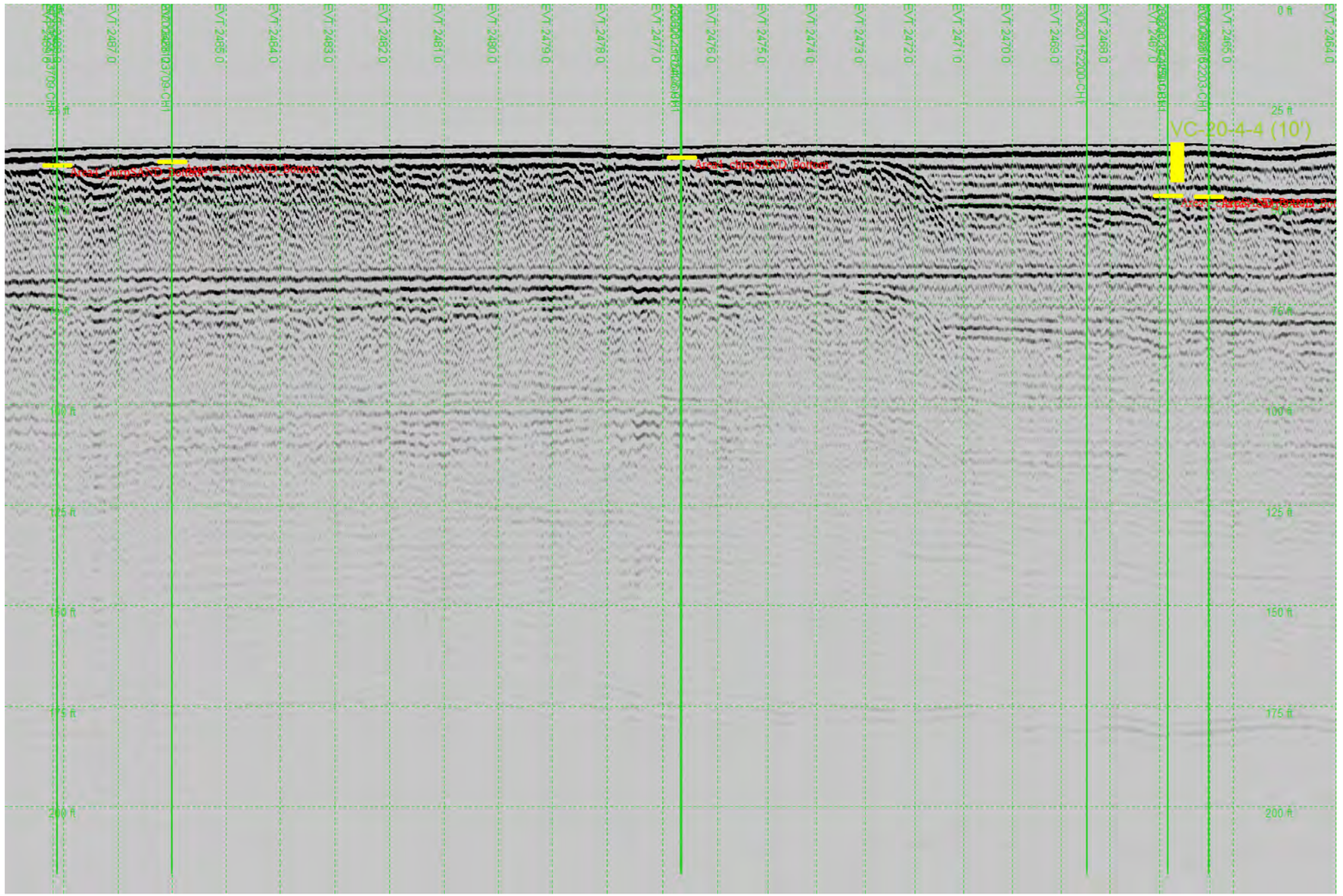

Figure 20: Boomer data along seismic line 250620.153211-CH1

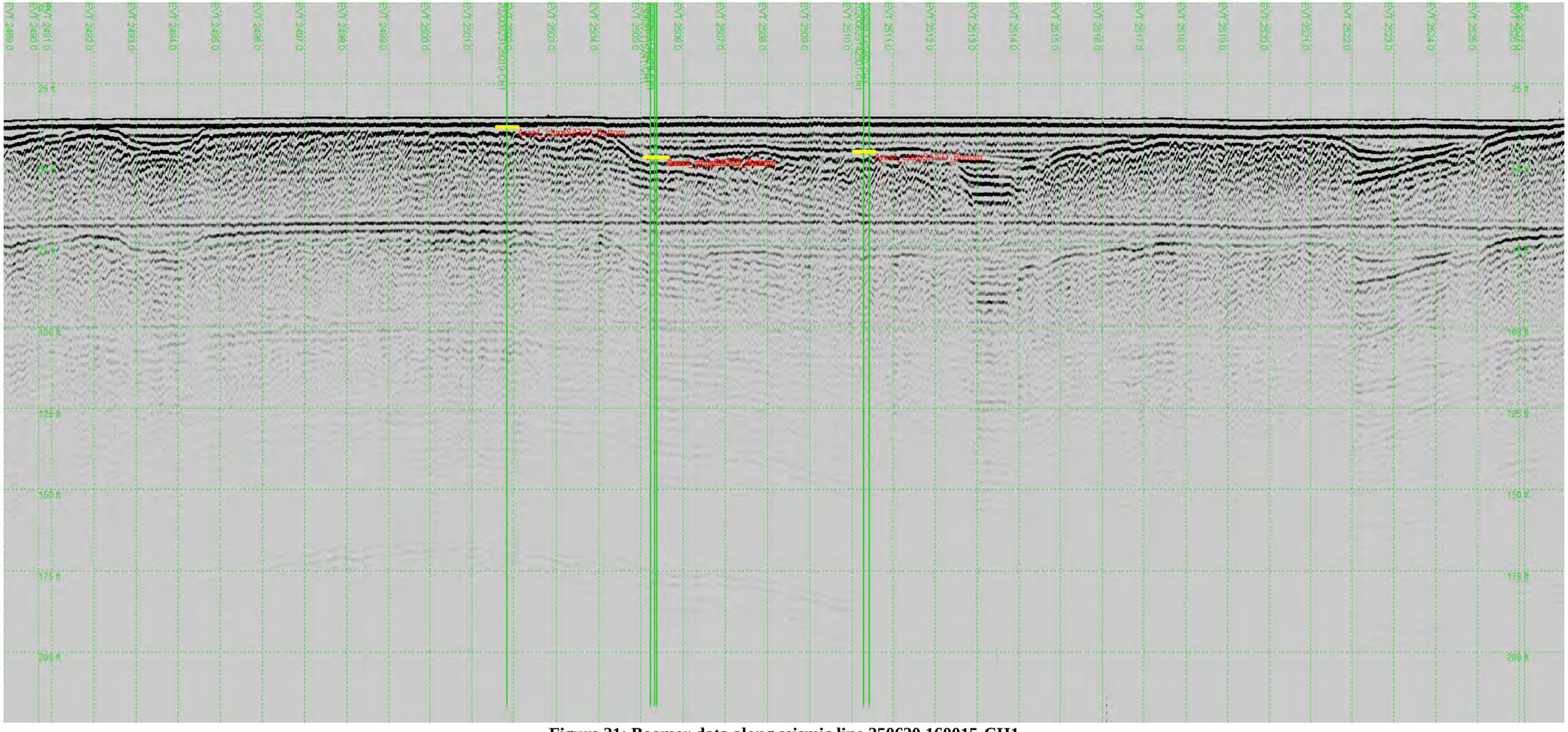

Figure 21: Boomer data along seismic line 250620.160015-CH1

LK-P4
CHIRP Data

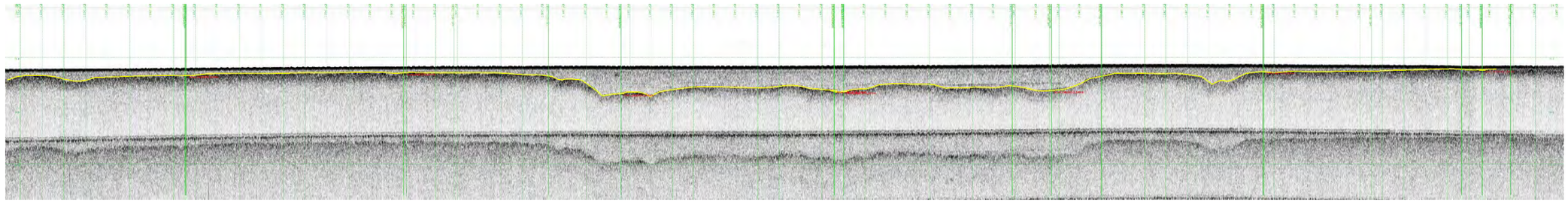

Figure 22: CHIRP data along seismic line 20200623115426-CH1

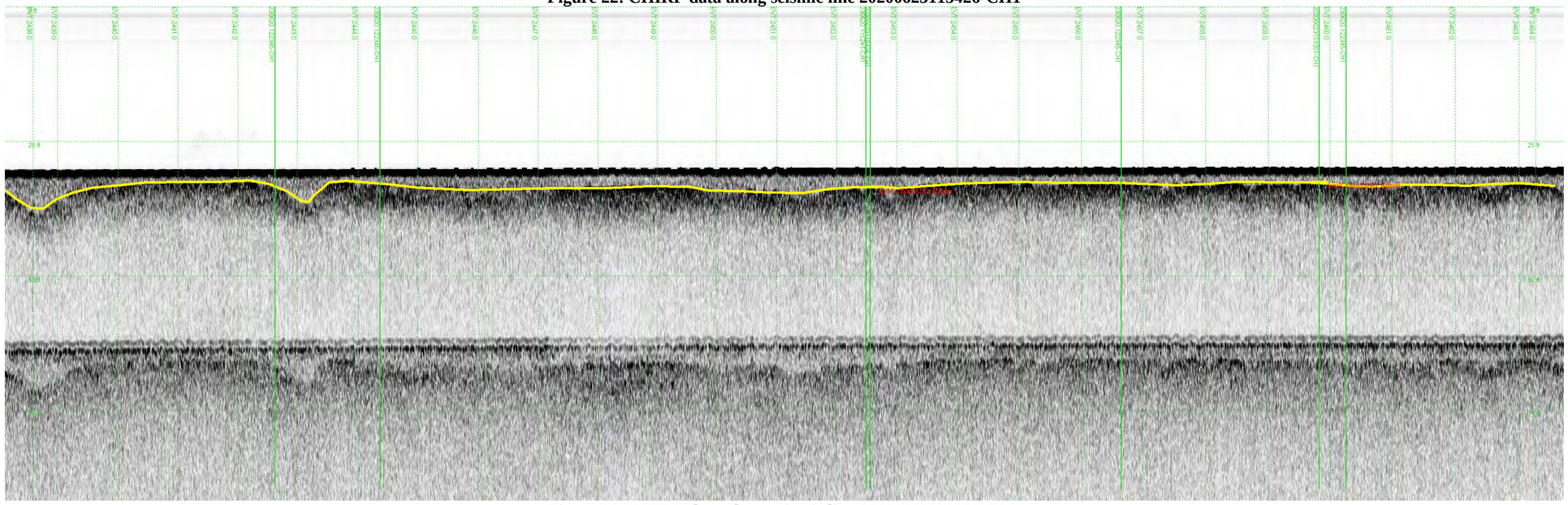

Figure 23: CHIRP data along seismic line 20200623122351-CH1

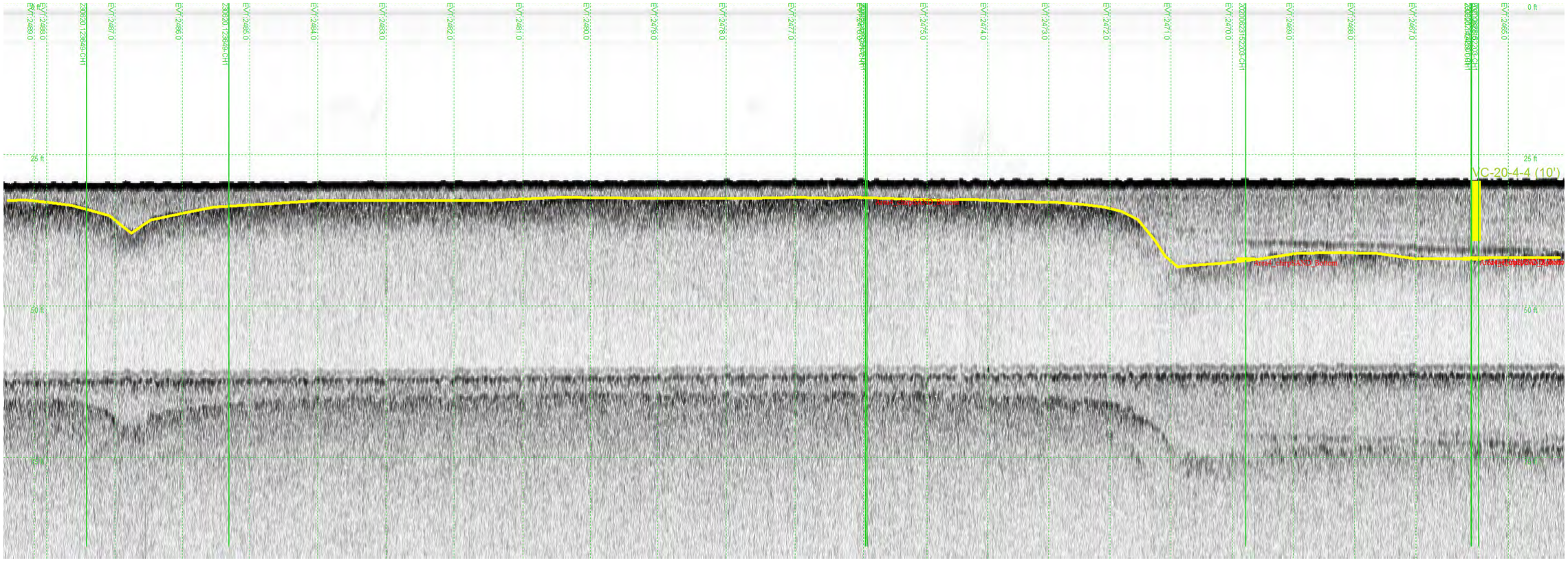

Figure 24: CHIRP data along seismic line 20200623123709-CH1

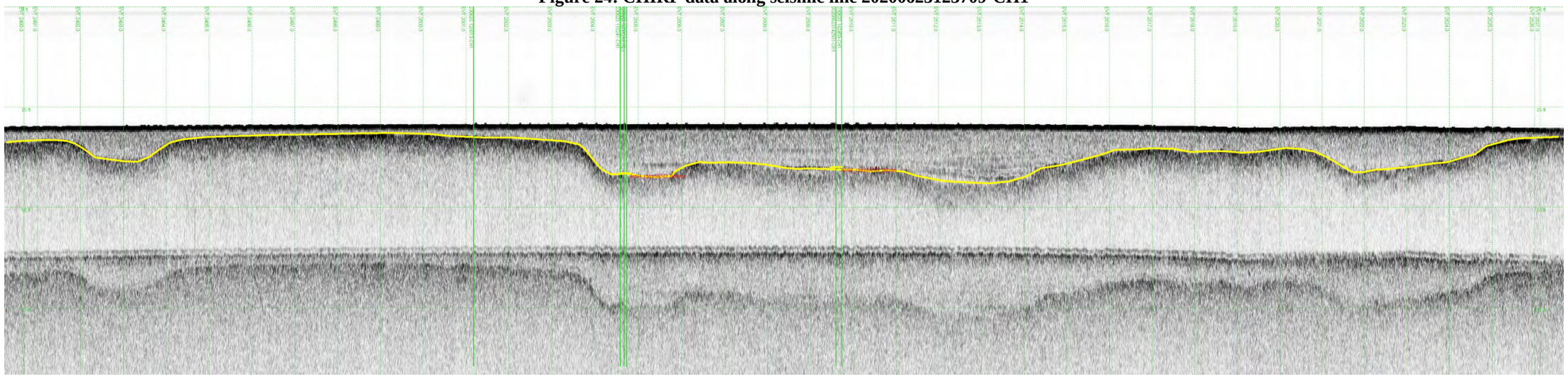

Figure 25: CHIRP data along seismic line 20200623125019-CH1

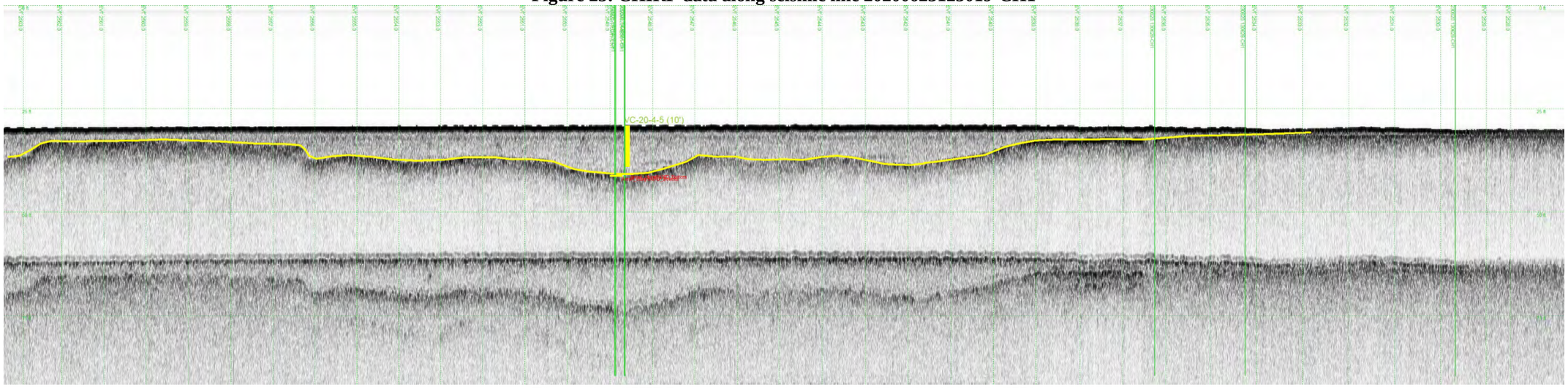

Figure 26: CHIRP data along seismic line 20200623130639-CH1

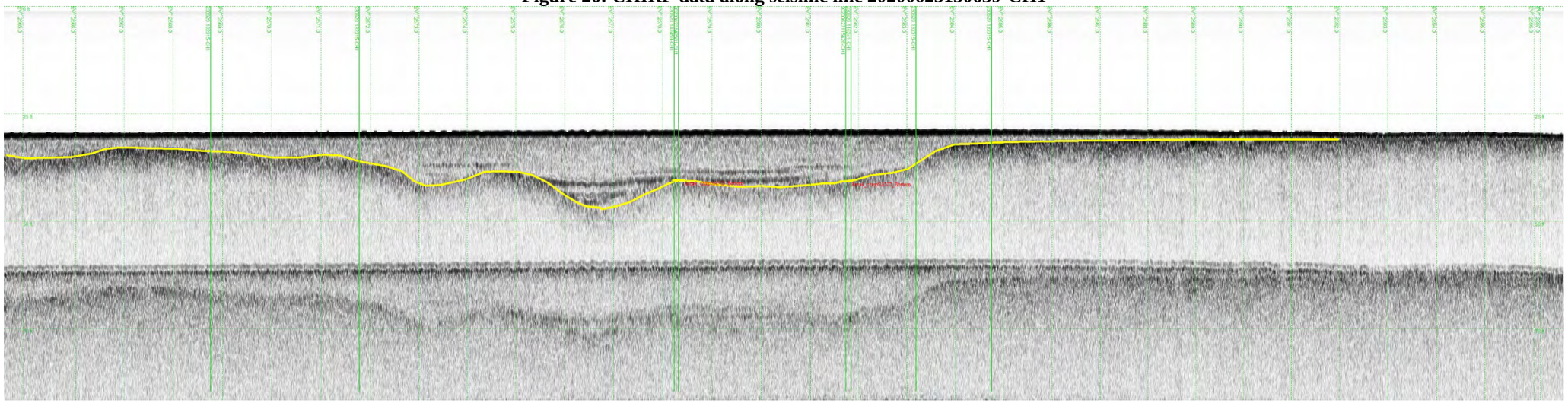

Figure 27: CHIRP data along seismic line 20200623132326-CH1

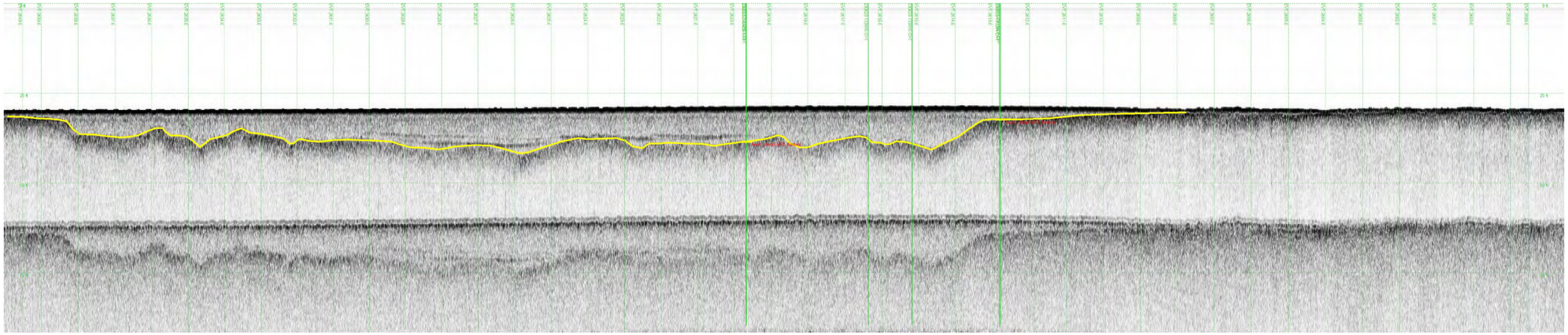

Figure 28: CHIRP data along seismic line 20200623133912-CH1

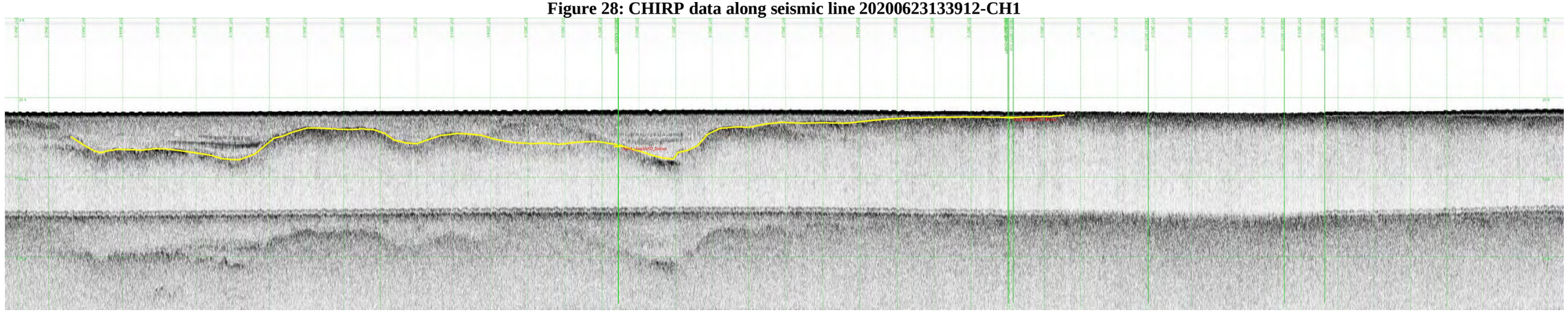

Figure 29: CHIRP data along seismic line 20200623135809-CH1

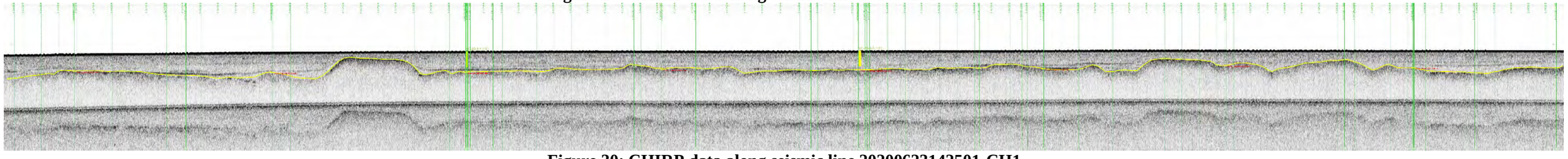

Figure 30: CHIRP data along seismic line 20200623142501-CH1

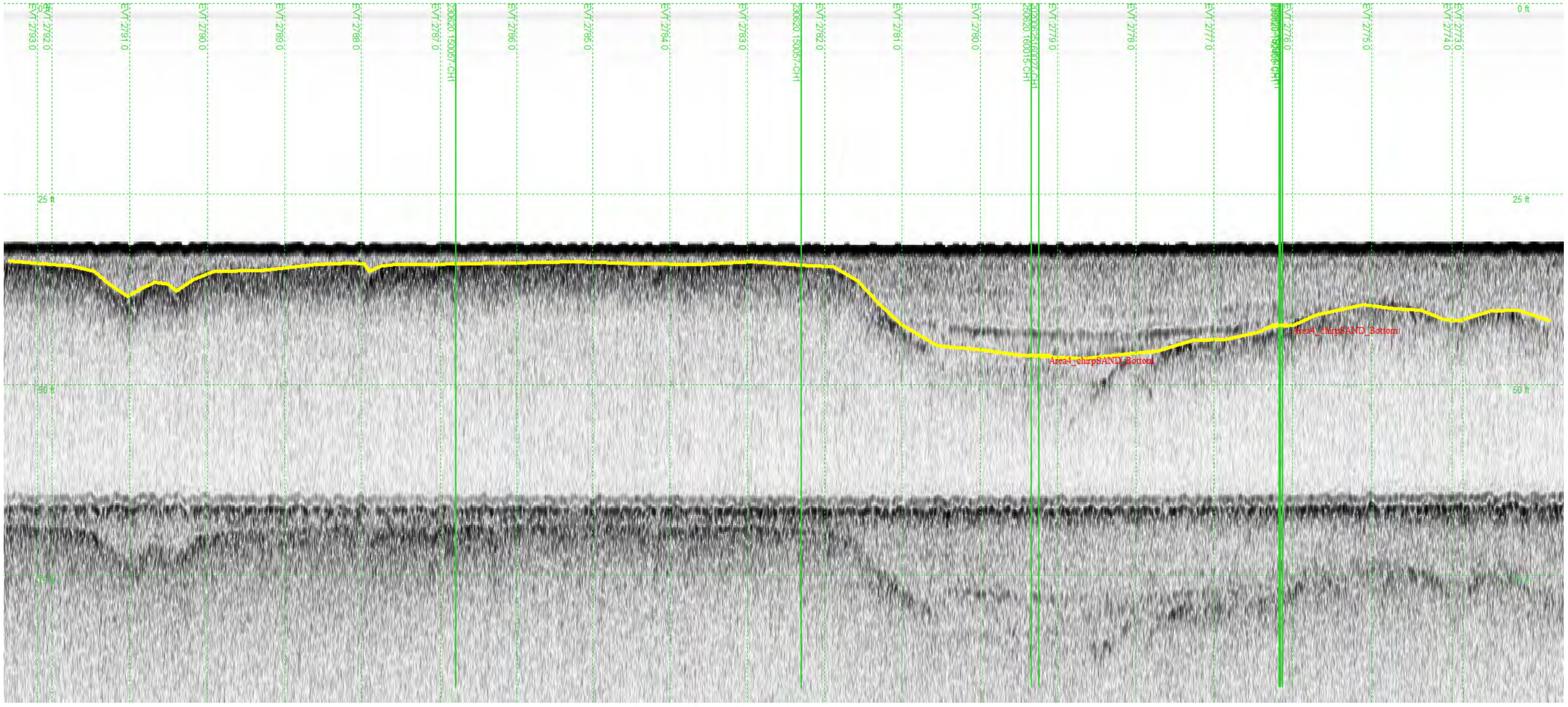

Figure 31: CHIRP data along seismic line 20200623150103-CH1

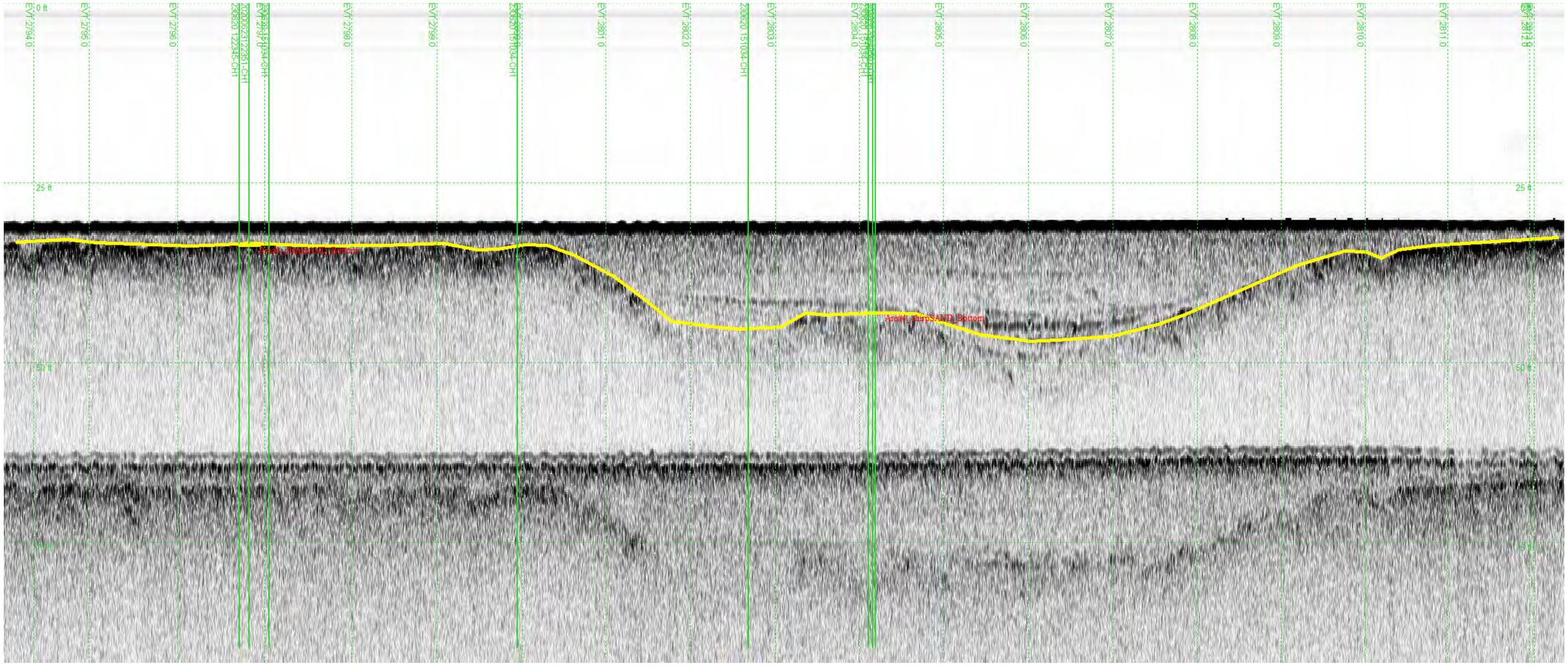

Figure 32: CHIRP data along seismic line 20200623151051-CH1

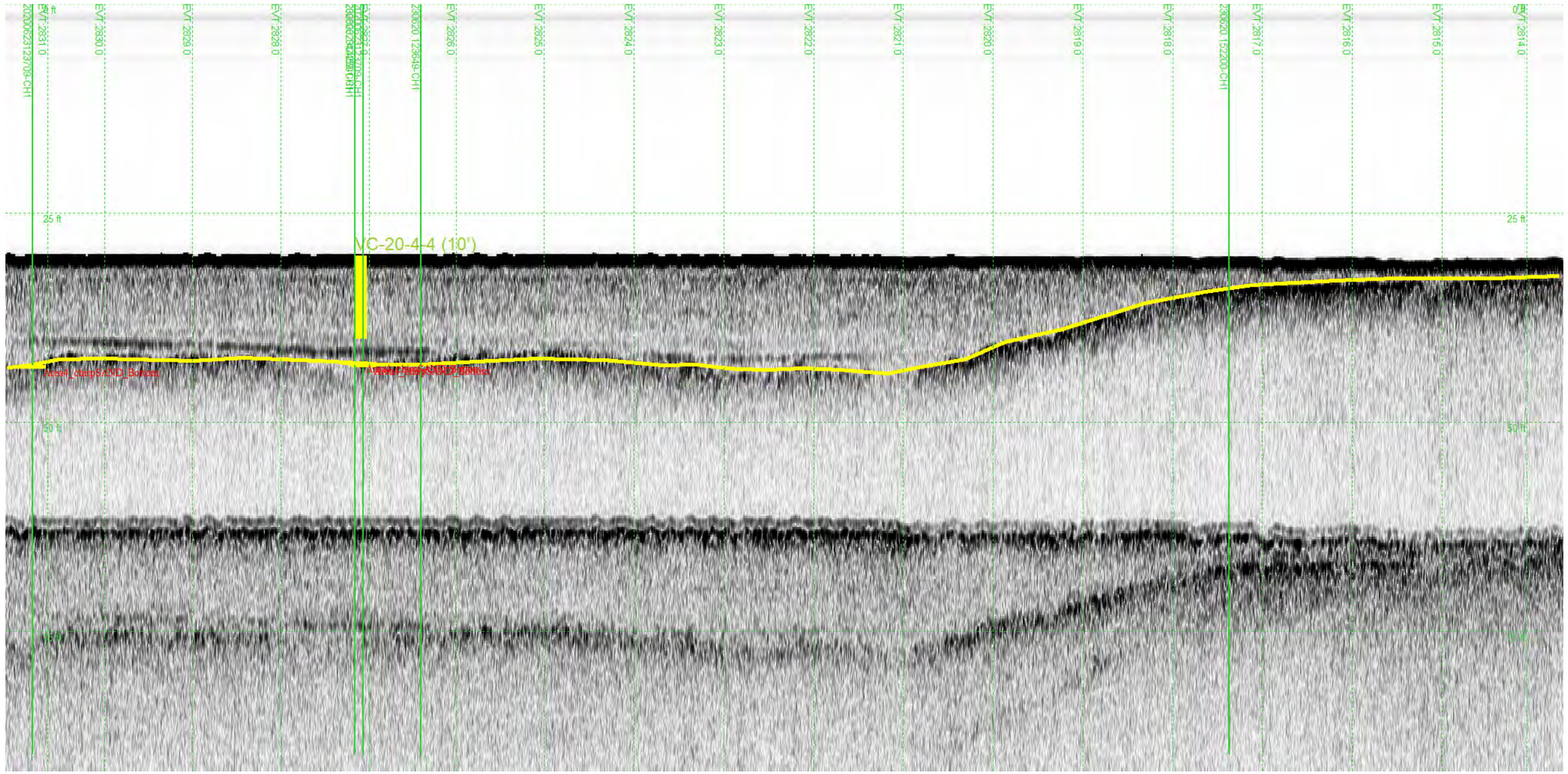

Figure 33: CHIRP data along seismic line 20200623152203-CH1

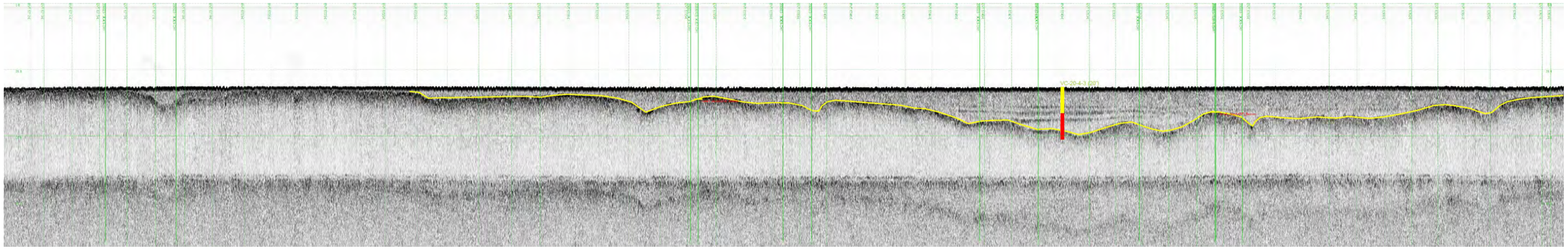

Figure 34: CHIRP data along seismic line 20200625130910-CH1

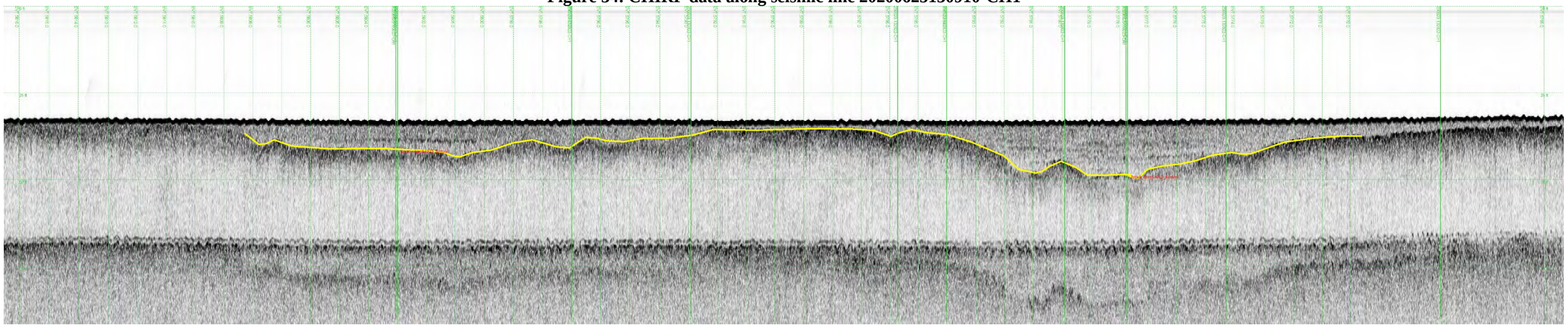

Figure 35: CHIRP data along seismic line 20200625132835-CH1

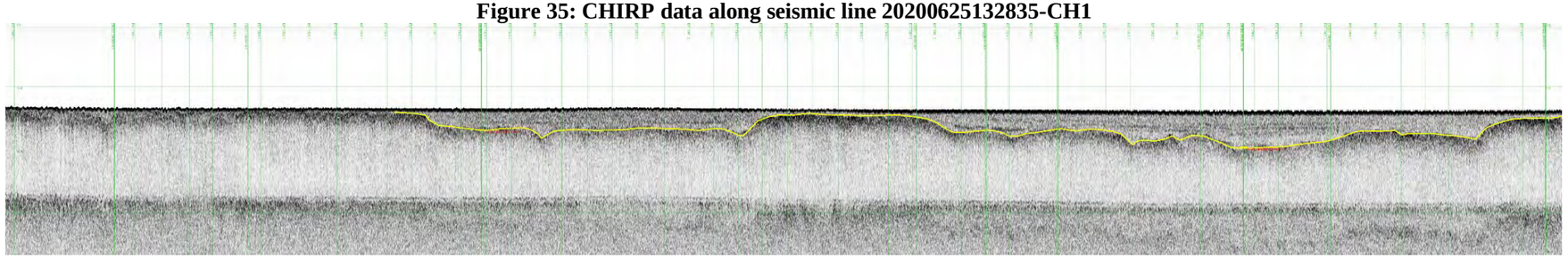

Figure 36: CHIRP data along seismic line 20200625134326-CH1

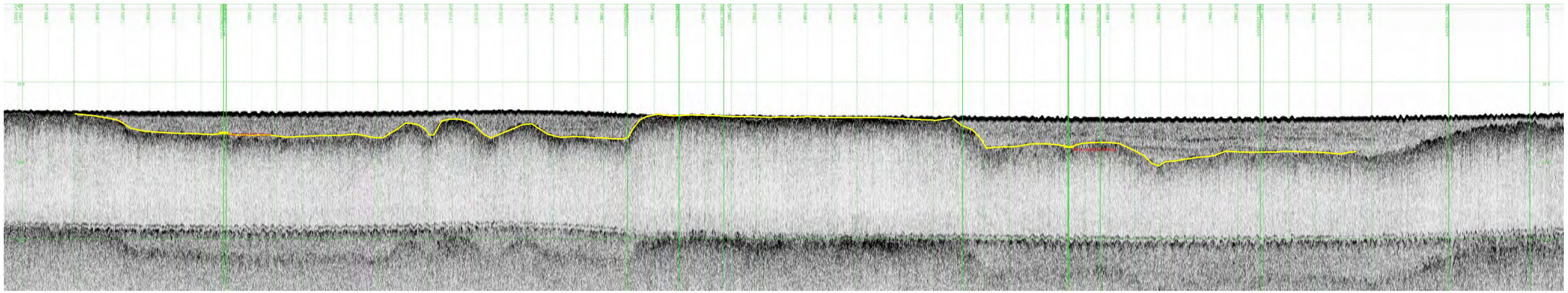

Figure 37: CHIRP data along seismic line 20200625140322-CH1

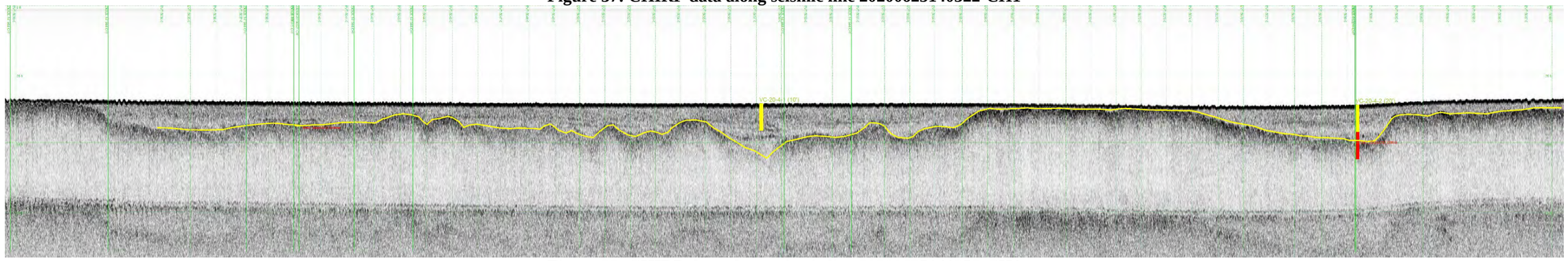

Figure 38: CHIRP data along seismic line 20200625141953-CH1

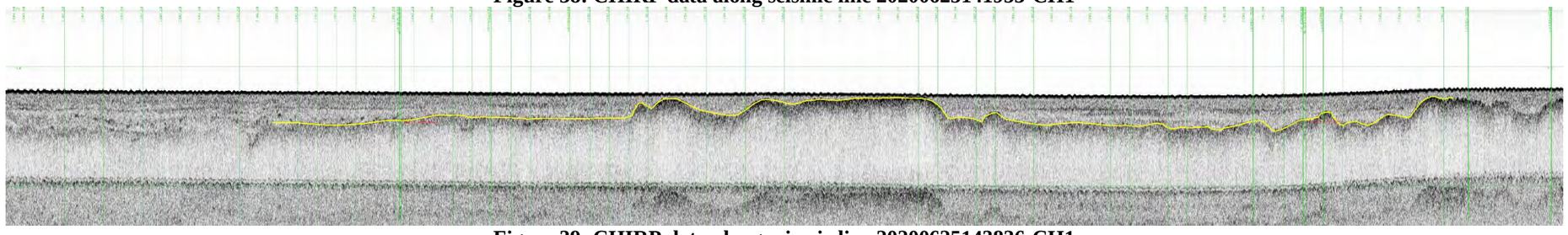

Figure 39: CHIRP data along seismic line 20200625143836-CH1

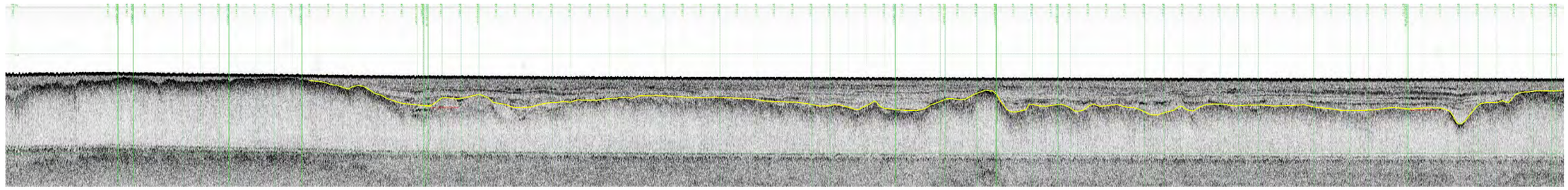

Figure 40: CHIRP data along seismic line 20200625150006-CH1

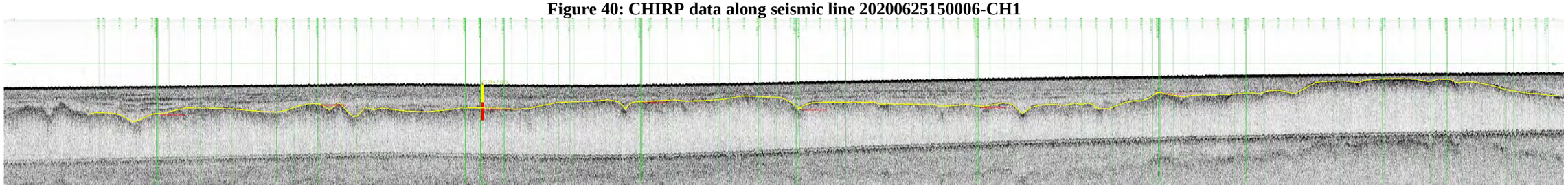

Figure 41: CHIRP data along seismic line 20200625153223-CH1

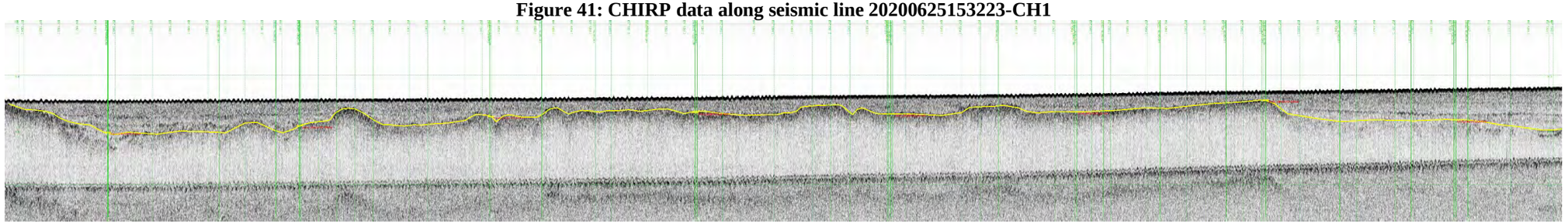

Figure 42: CHIRP data along seismic line 20200625160027-CH1

LK-P5
Boomer data

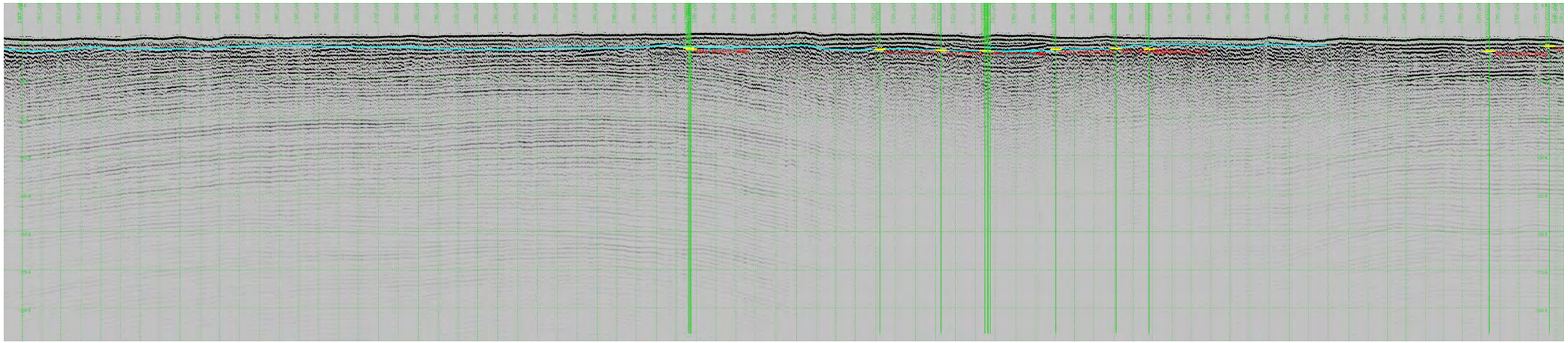

Figure 1: Boomer data along seismic line 200620.142810-CH1

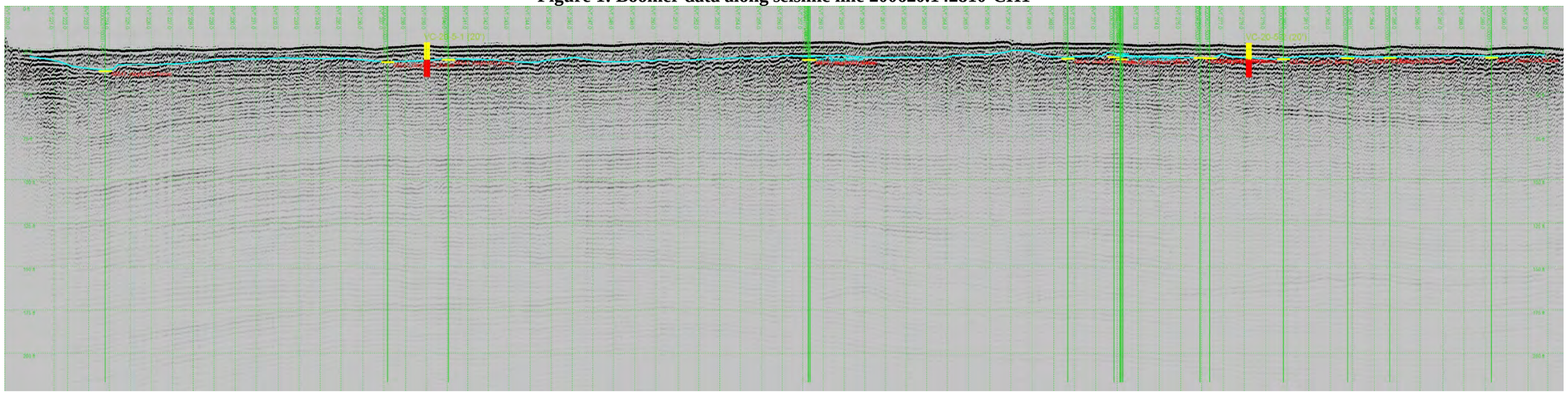

Figure 2: Boomer data along seismic line 200620.150033-CH1

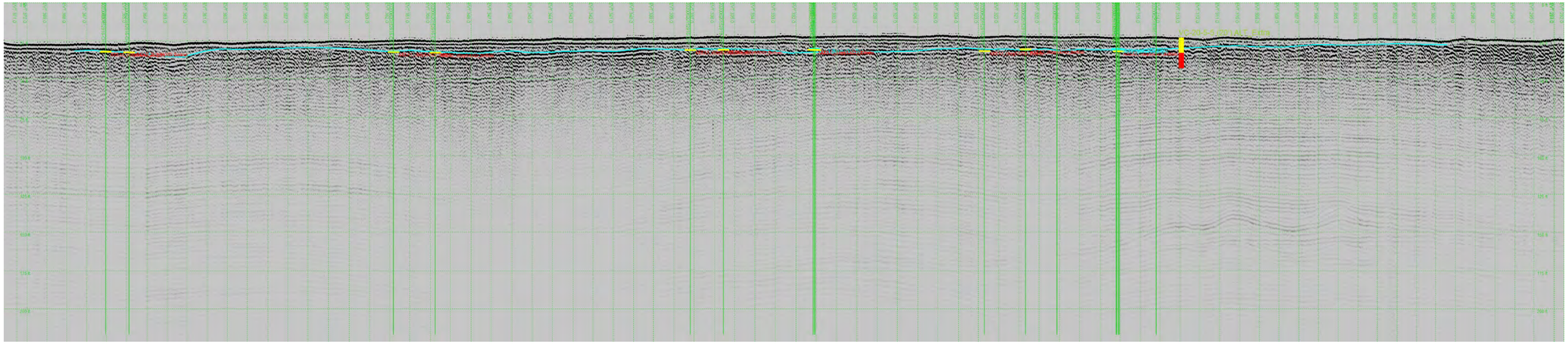

Figure 3: Boomer data along seismic line 200620.152925-CH1

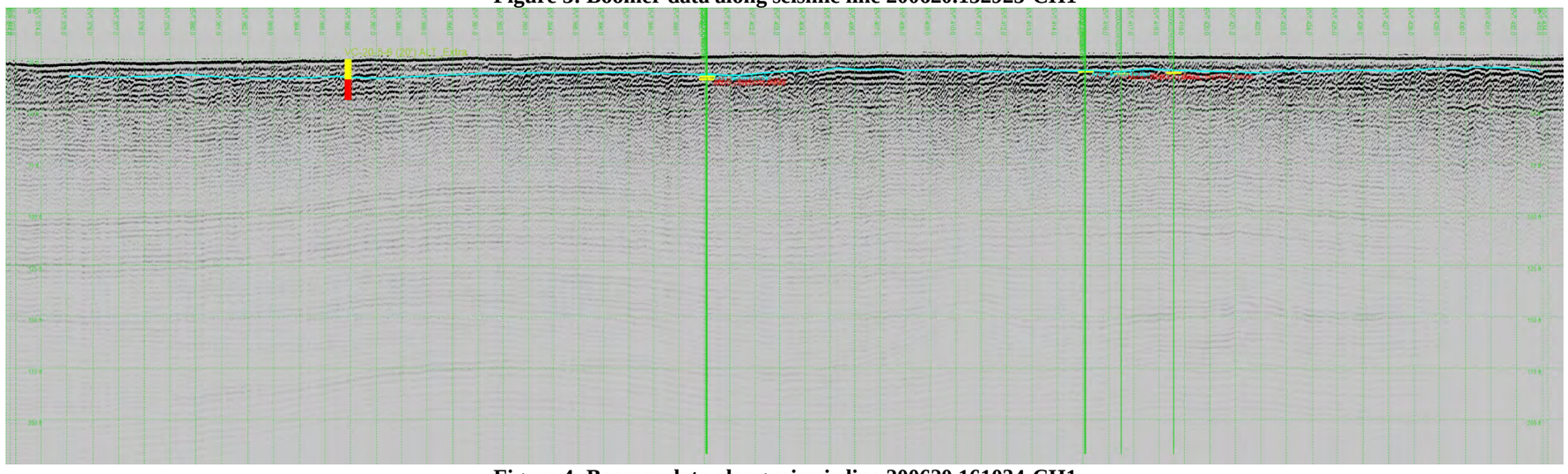

Figure 4: Boomer data along seismic line 200620.161034-CH1

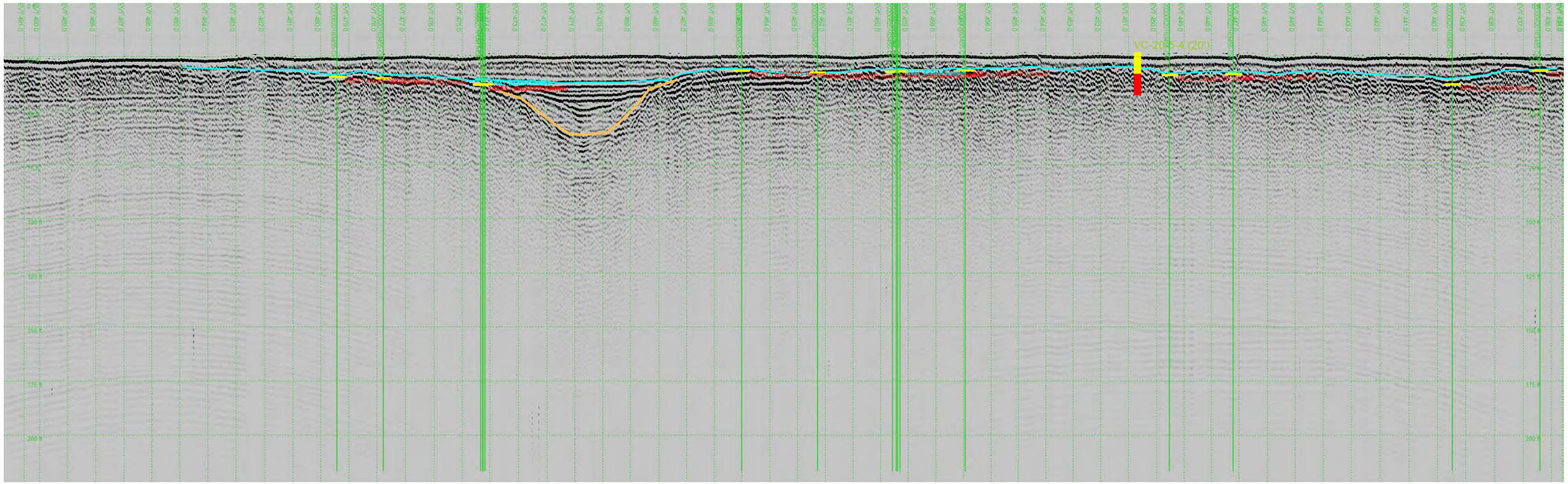

Figure 5: Boomer data along seismic line 200620.163508-CH1

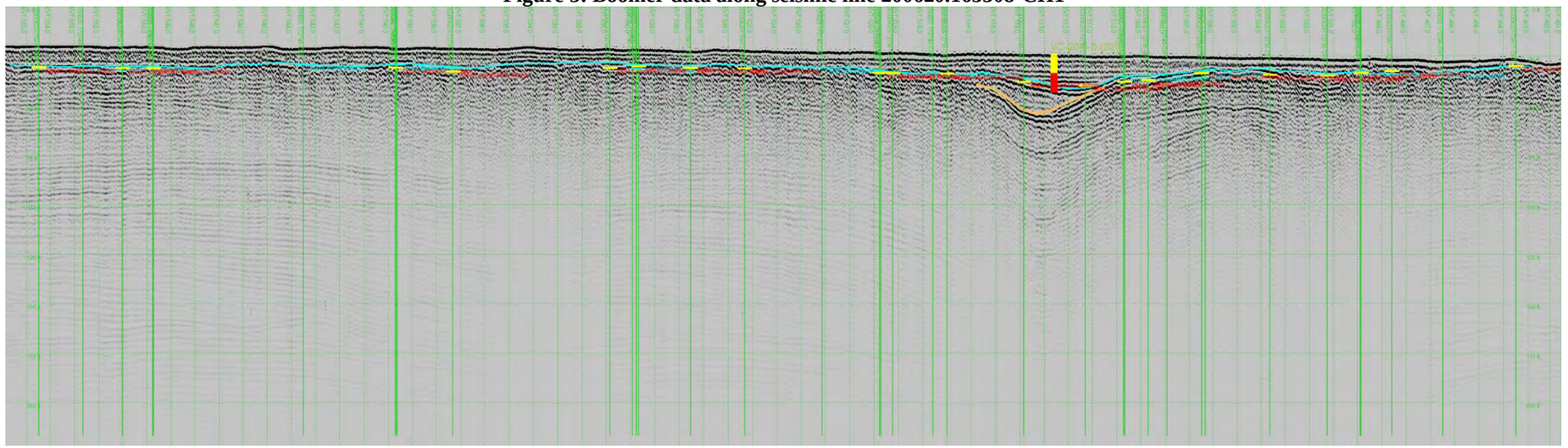

Figure 6: Boomer data along seismic line 200620.170415-CH1

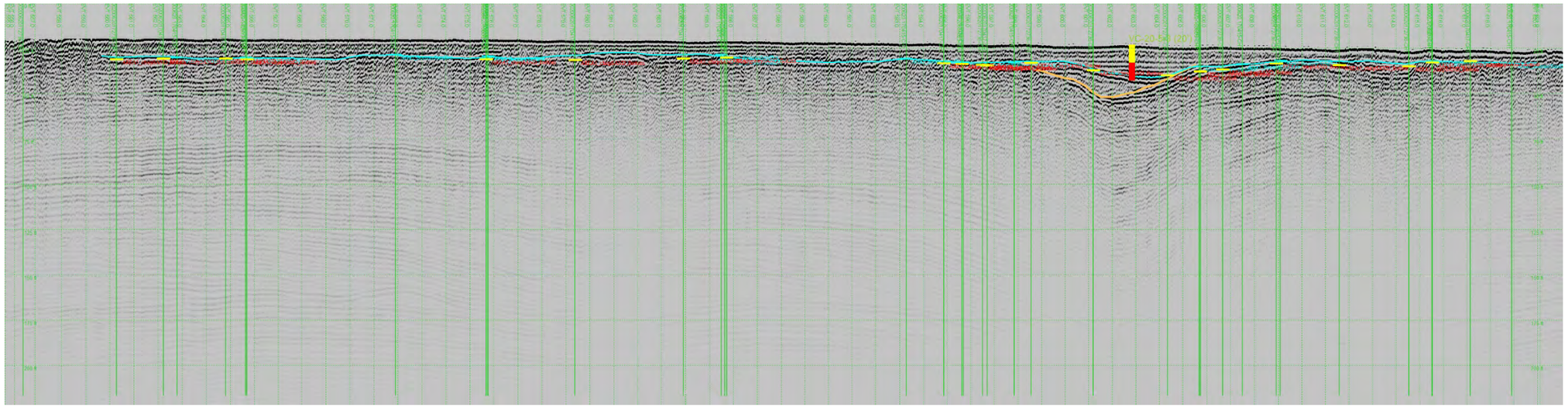

Figure 7: Boomer data along seismic line 200620.172746-CH1

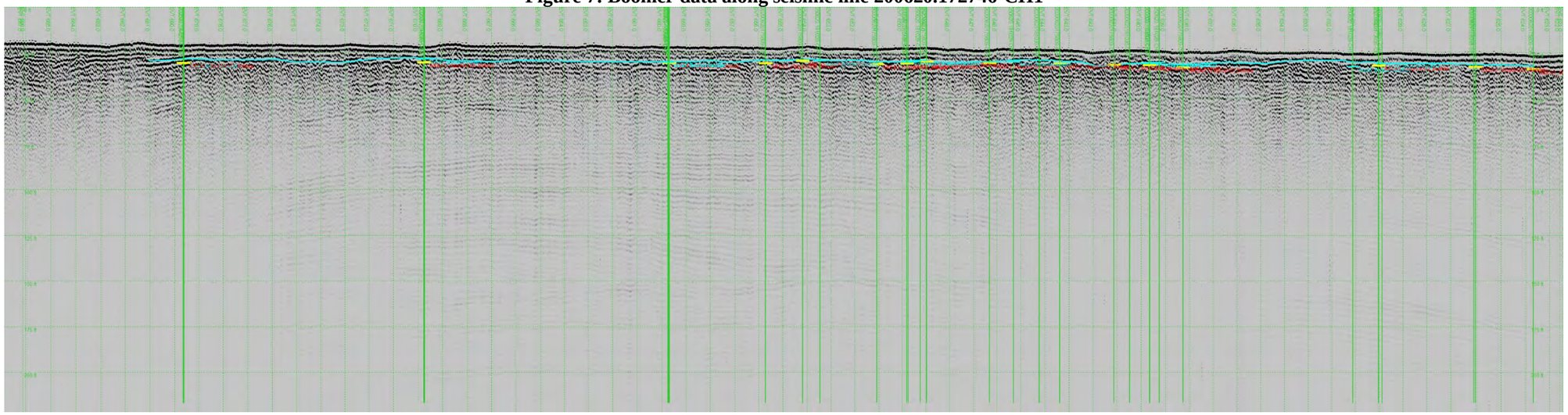

Figure 8: Boomer data along seismic line 200620.175824-CH1

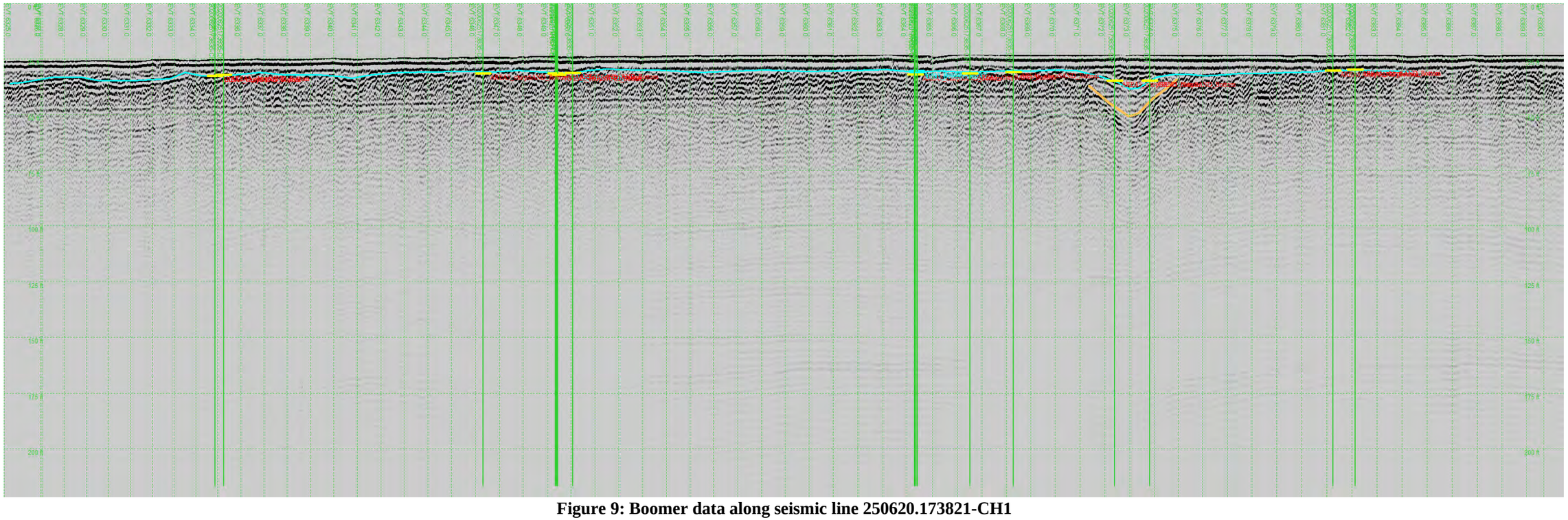

Figure 9: Boomer data along seismic line 250620.173821-CH1

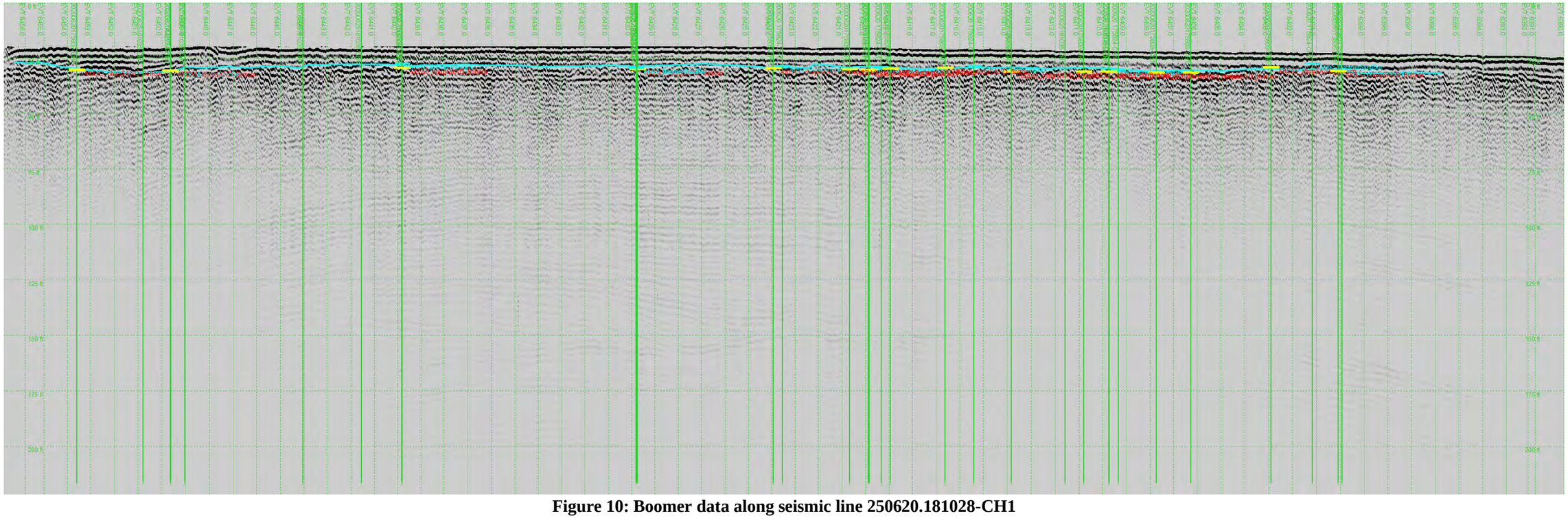

Figure 10: Boomer data along seismic line 250620.181028-CH1

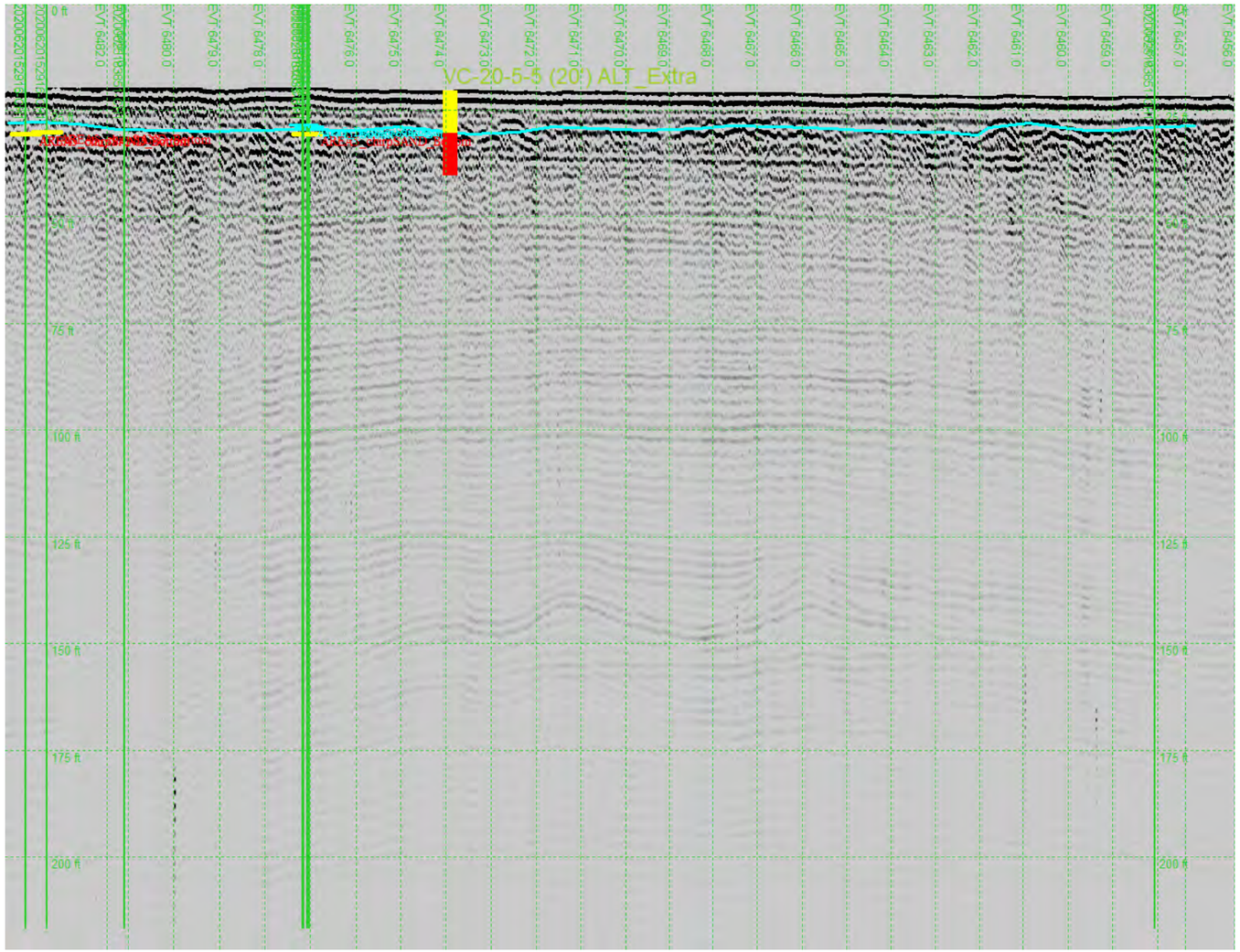

Figure 11: Boomer data along seismic line 250620.183849-CH1

LK-P5
CHIRP Data

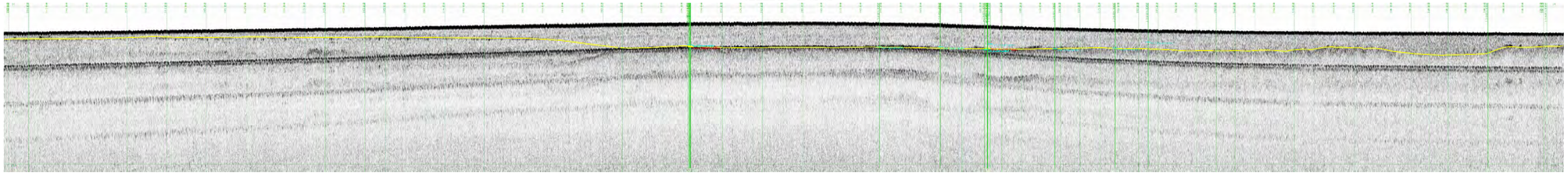

Figure 12: CHIRP data along seismic line 20200620142754-CH1

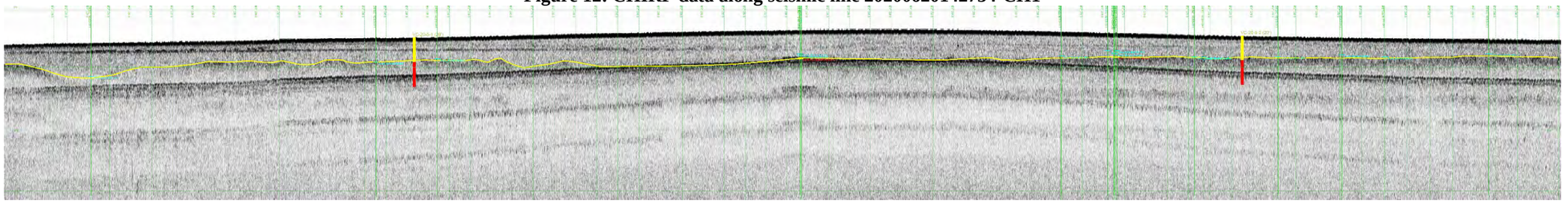

Figure 13: CHIRP data along seismic line 20200620150031-CH1

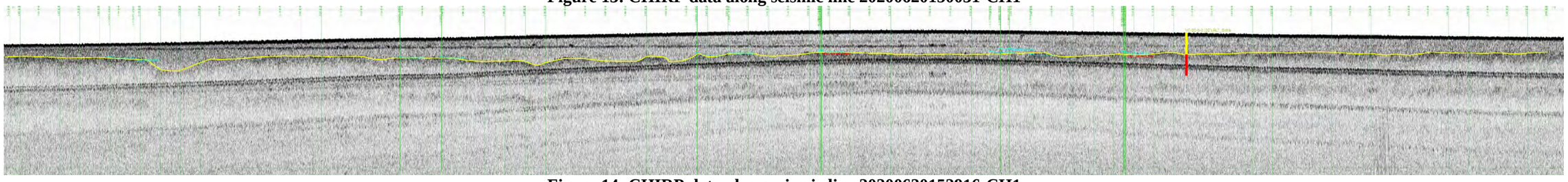

Figure 14: CHIRP data along seismic line 20200620152916-CH1

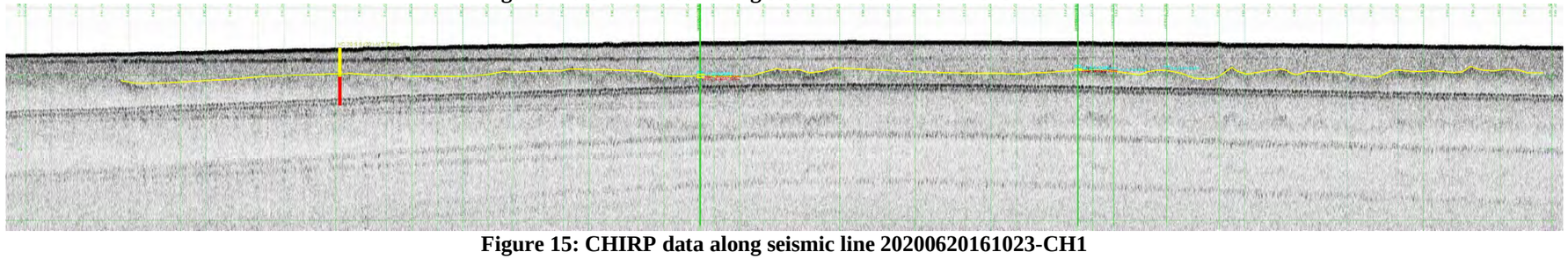

Figure 15: CHIRP data along seismic line 20200620161023-CH1

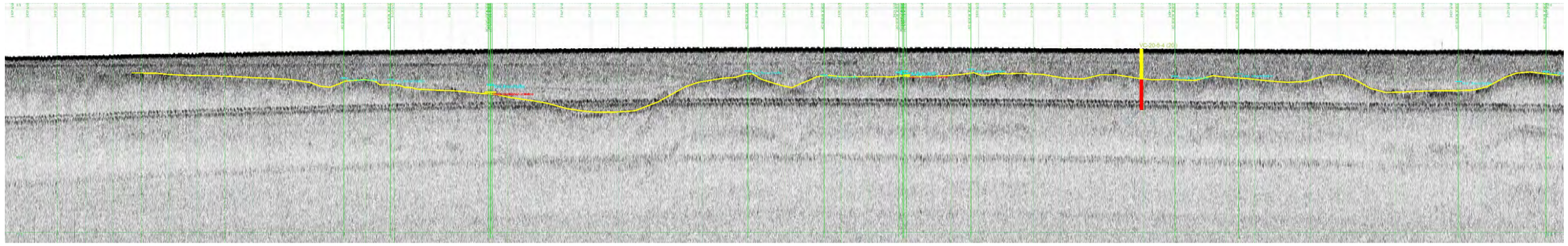

Figure 16: CHIRP data along seismic line 20200620163455-CH1

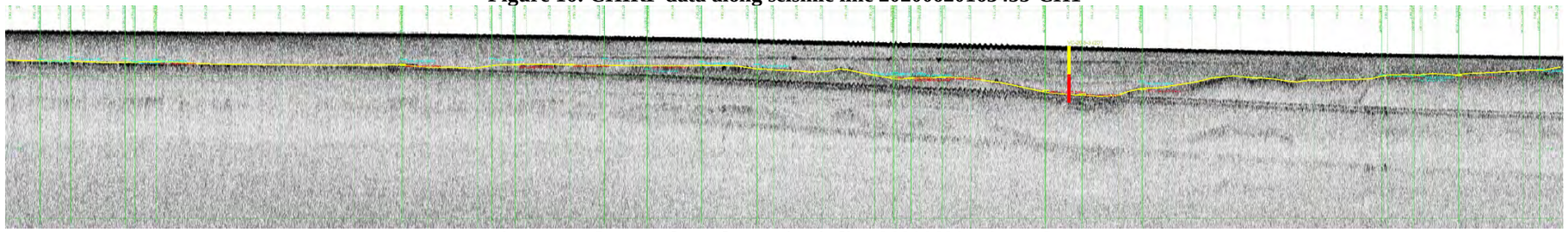

Figure 17: CHIRP data along seismic line 20200620170417-CH1

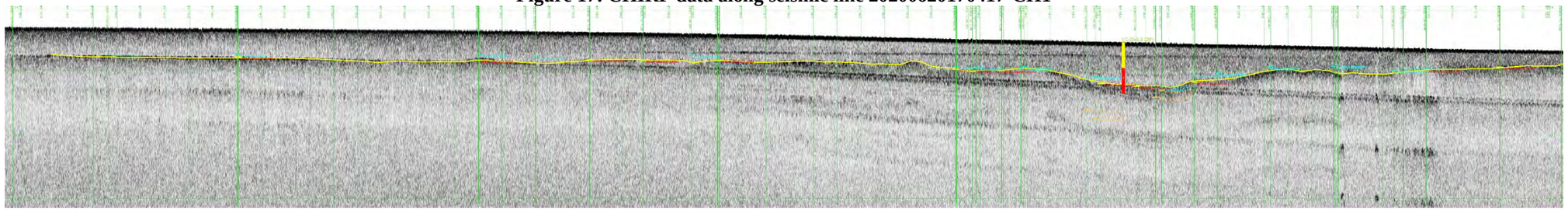

Figure 18: CHIRP data along seismic line 20200620172736-CH1

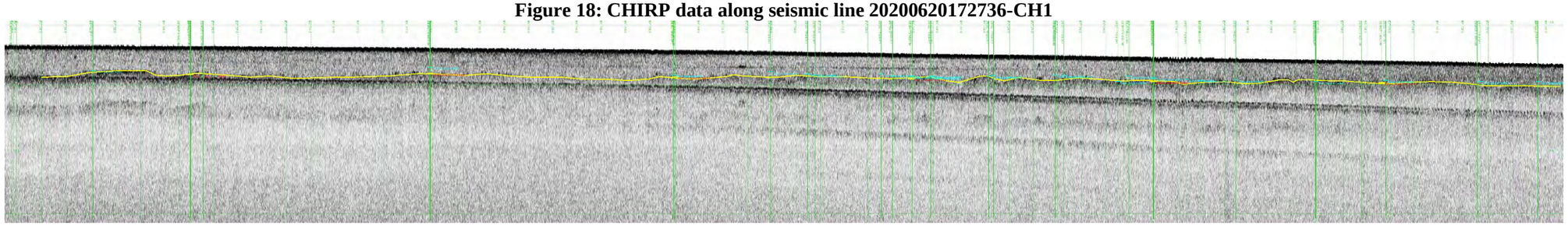

Figure 19: CHIRP data along seismic line 20200620175809-CH1

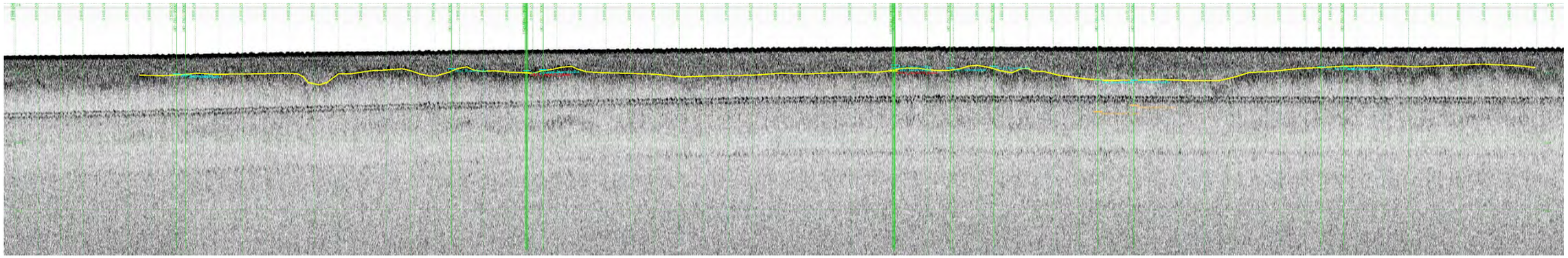

Figure 20: CHIRP data along seismic line 20200625173835-CH1

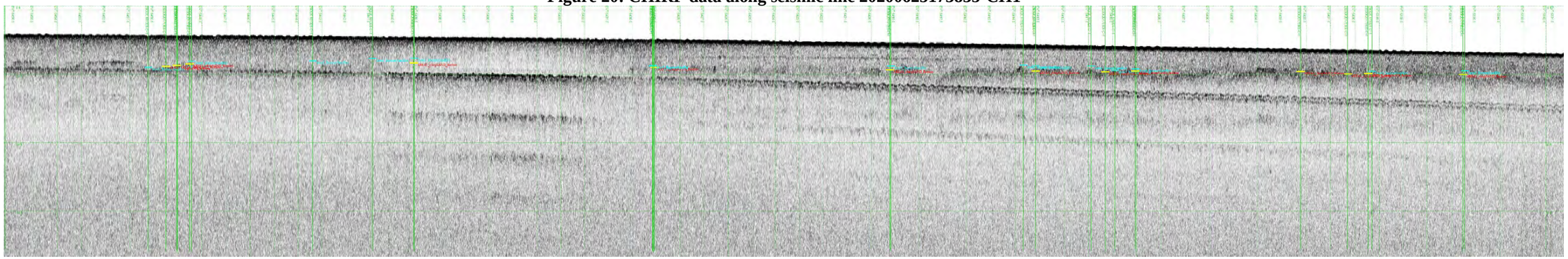

Figure 21: CHIRP data along seismic line 20200625181035-CH1

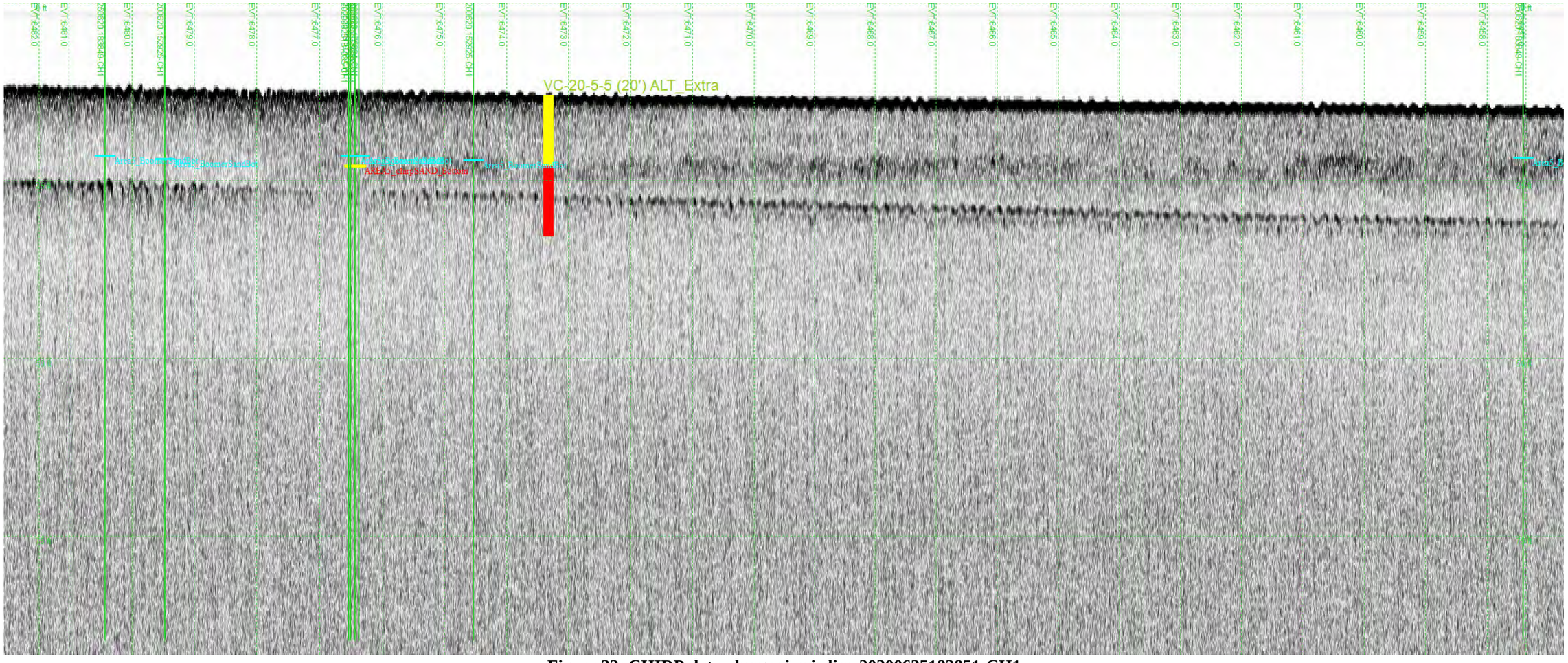

Figure 22: CHIRP data along seismic line 20200625183851-CH1

LK-P6
Boomer data

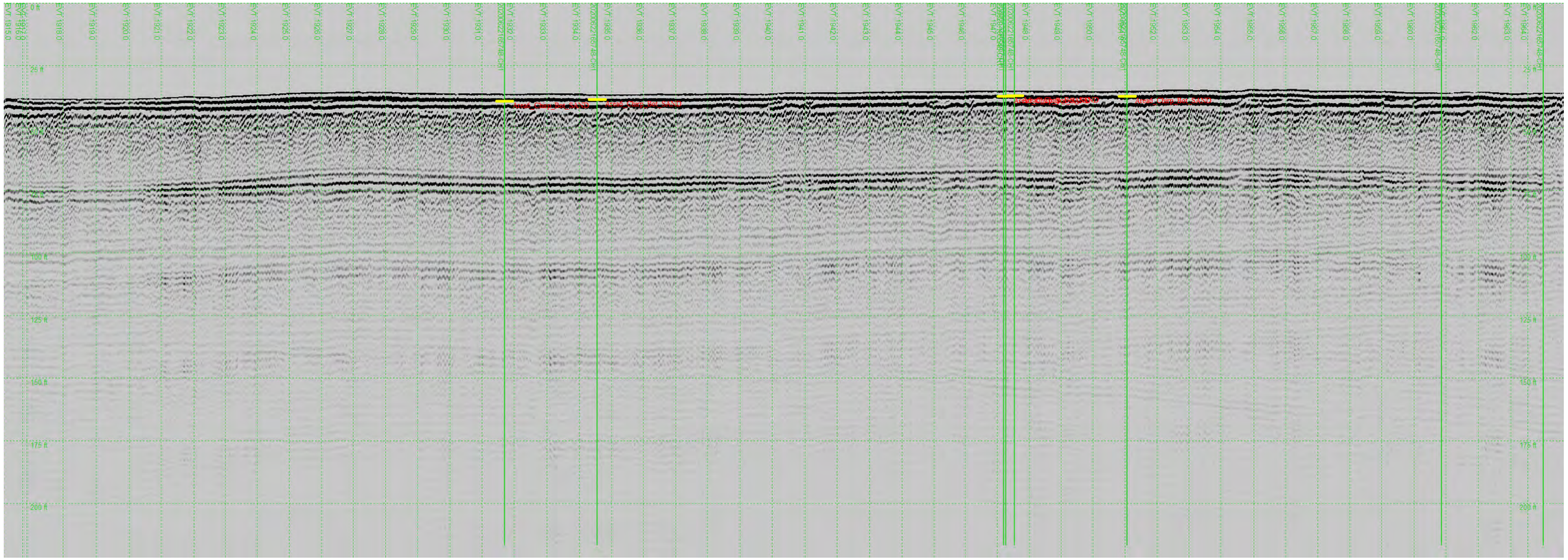

Figure 1: Boomer data along seismic line 220620.165758-CH1

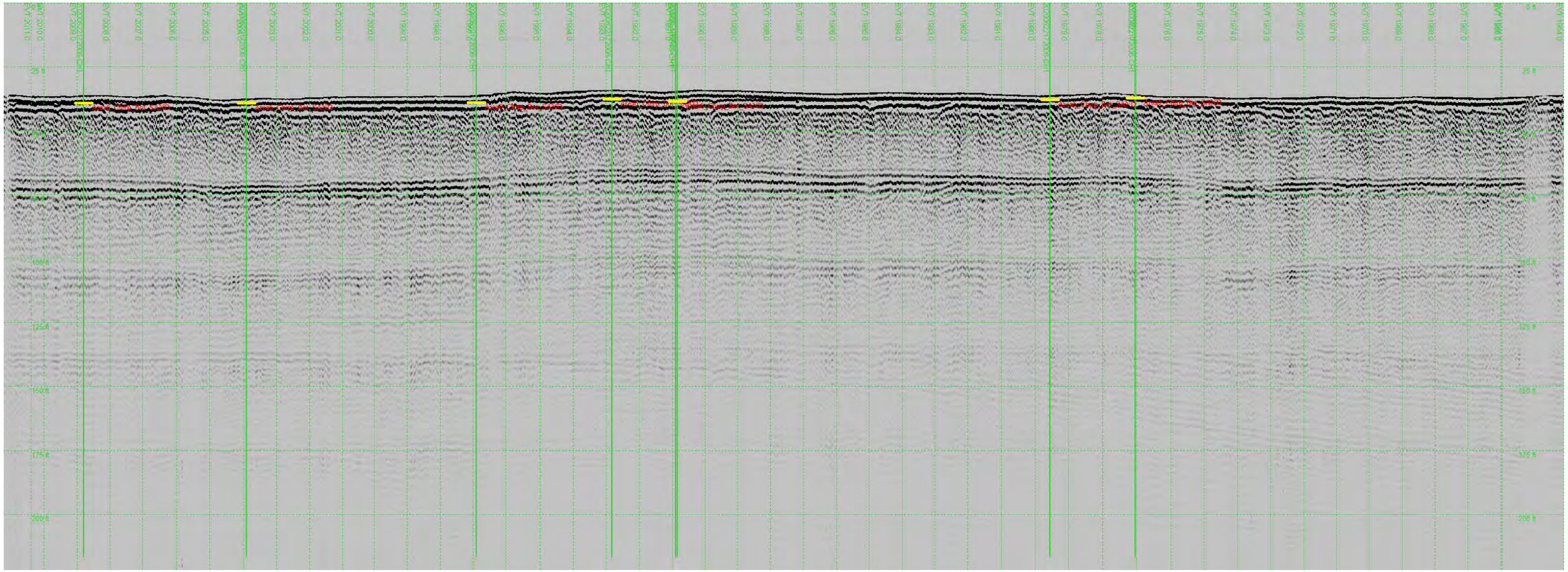

Figure 2: Boomer data along seismic line 220620.171954-CH1

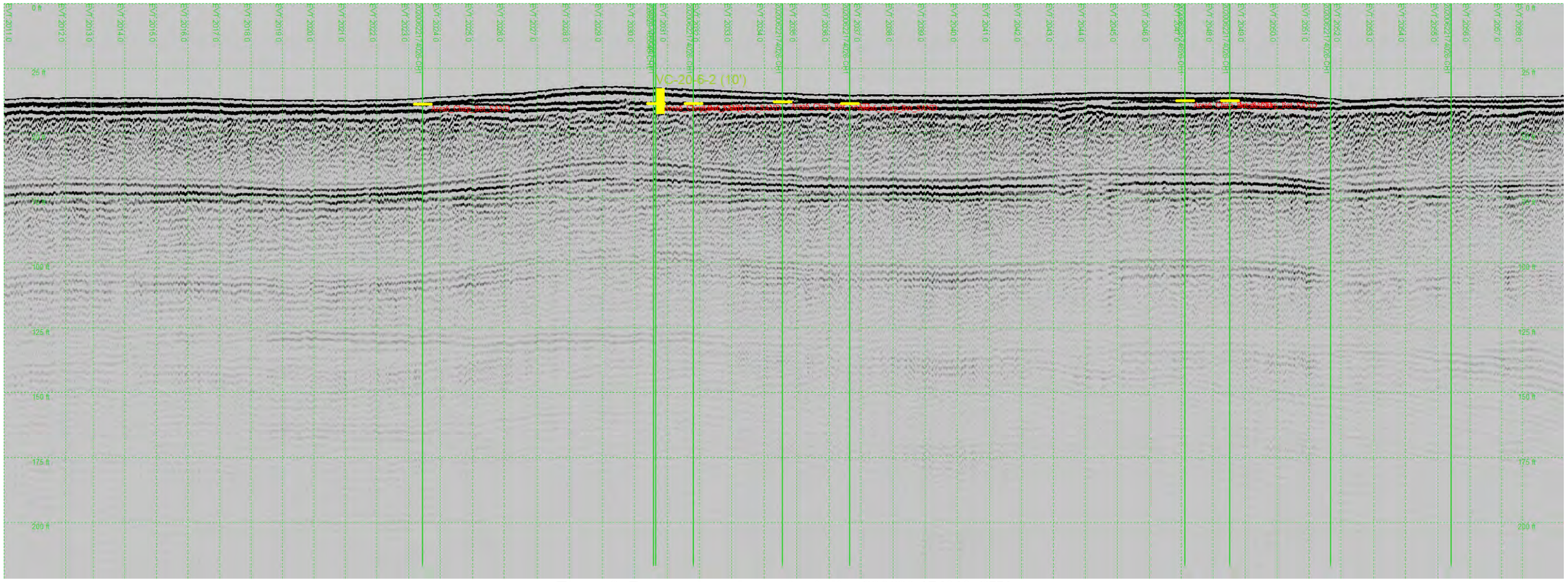

Figure 3: Boomer data along seismic line 220620.174019-CH1

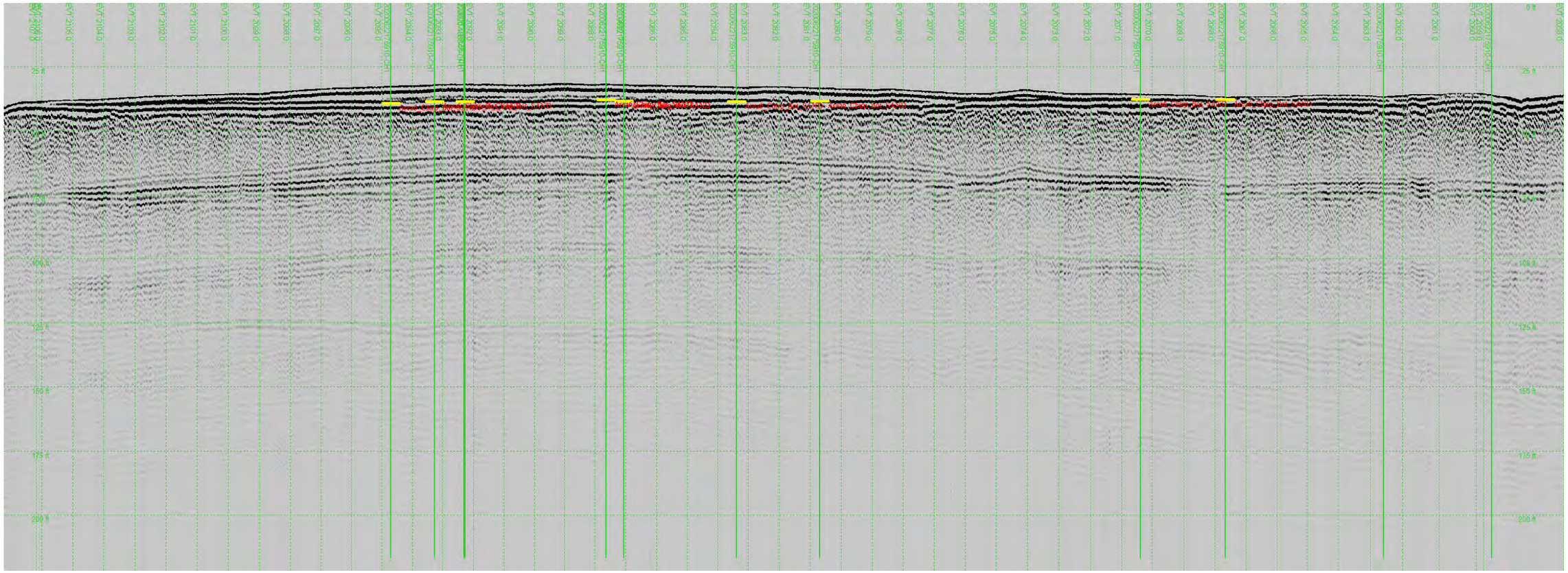

Figure 4: Boomer data along seismic line 220620.175906-CH1

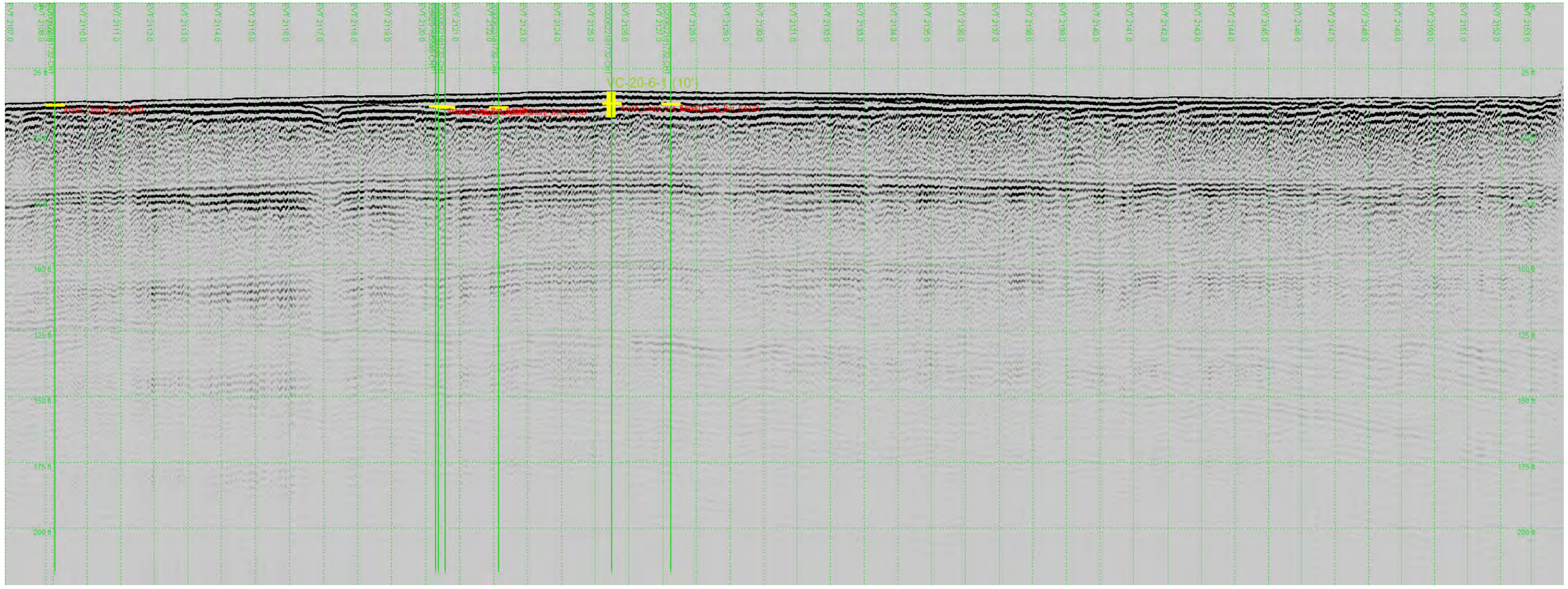

Figure 5: Boomer data along seismic line 220620.181726-CH1

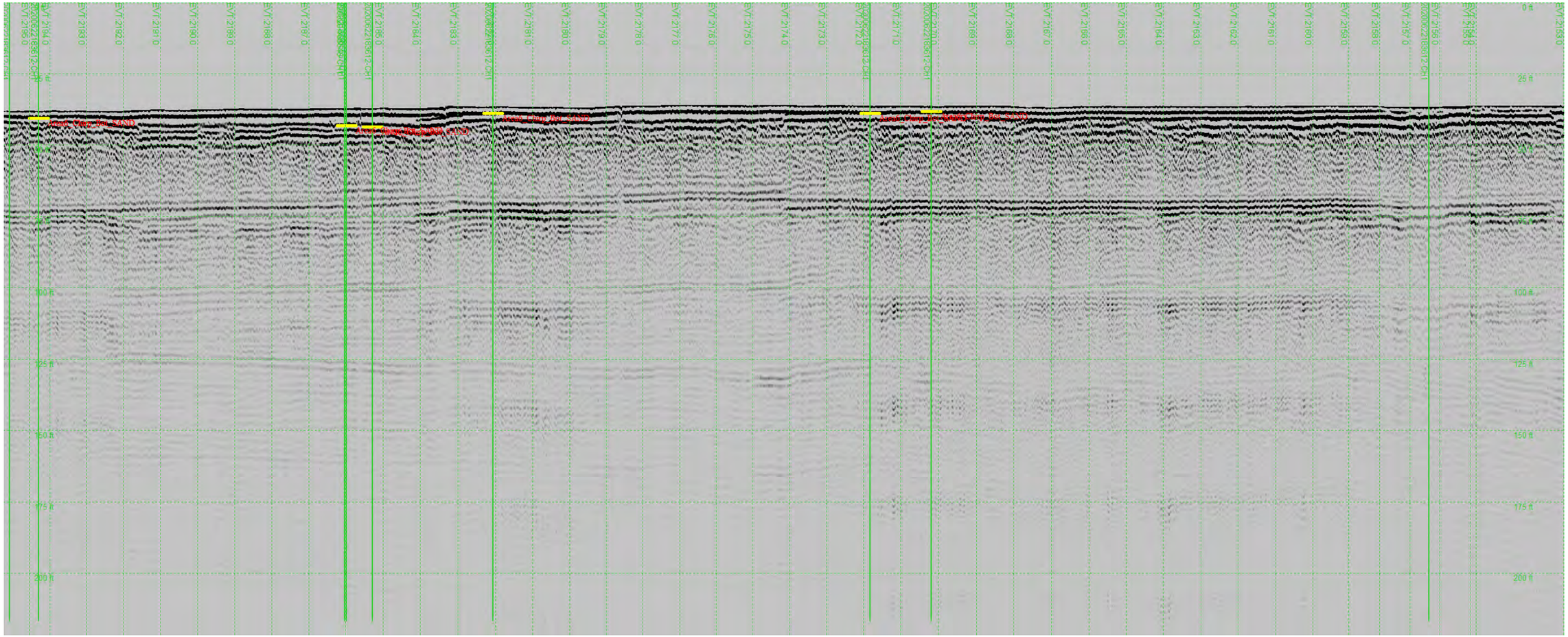

Figure 6: Boomer data along seismic line 220620.183549-CH1

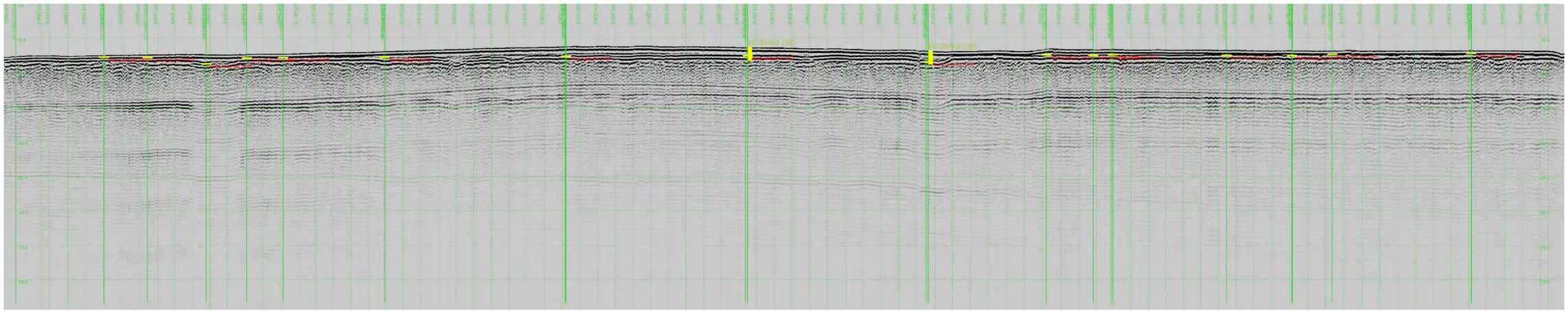

Figure 7: Boomer data along seismic line 220620.185548-CH1

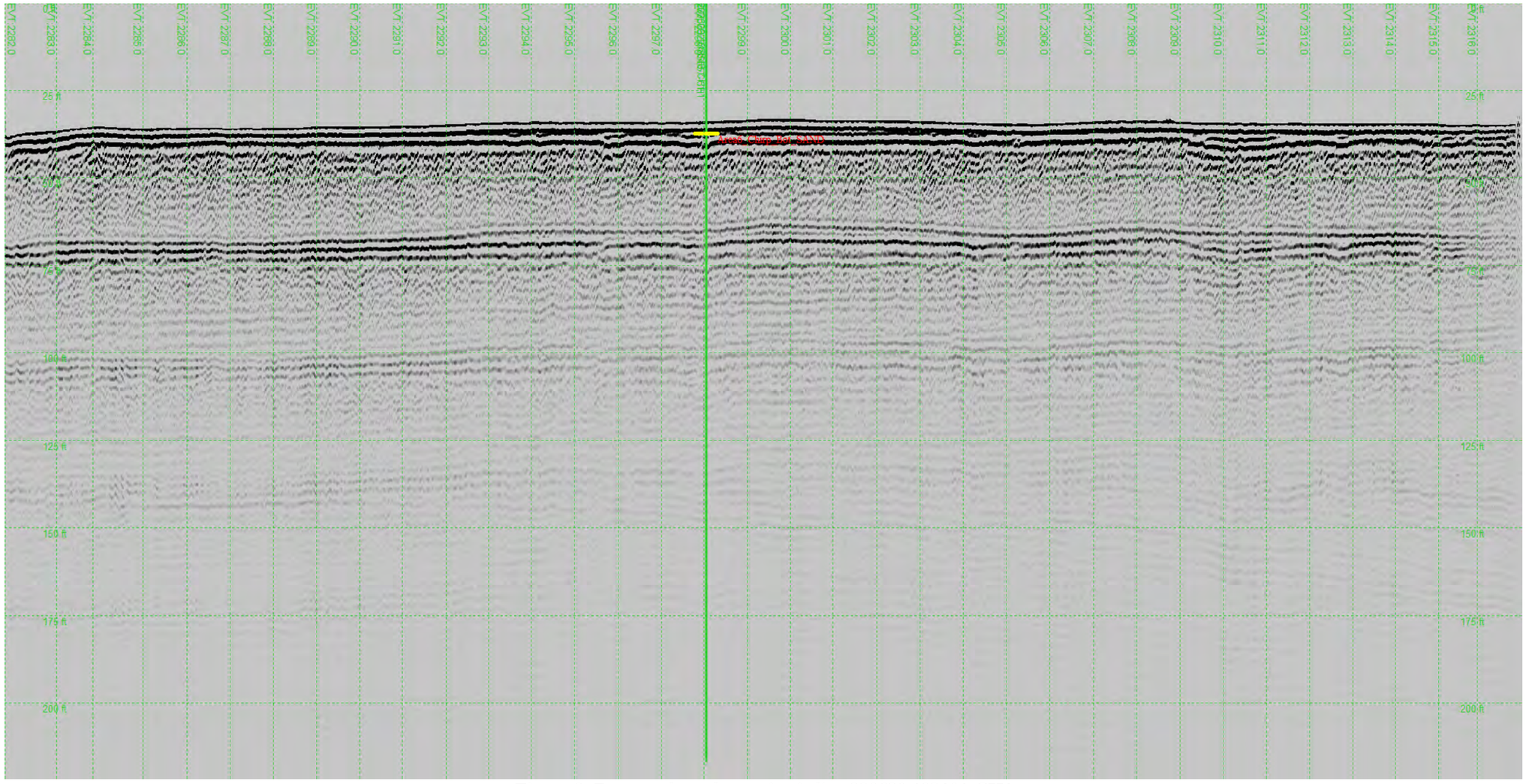

Figure 8: Boomer data along seismic line 220620.193101-CH1

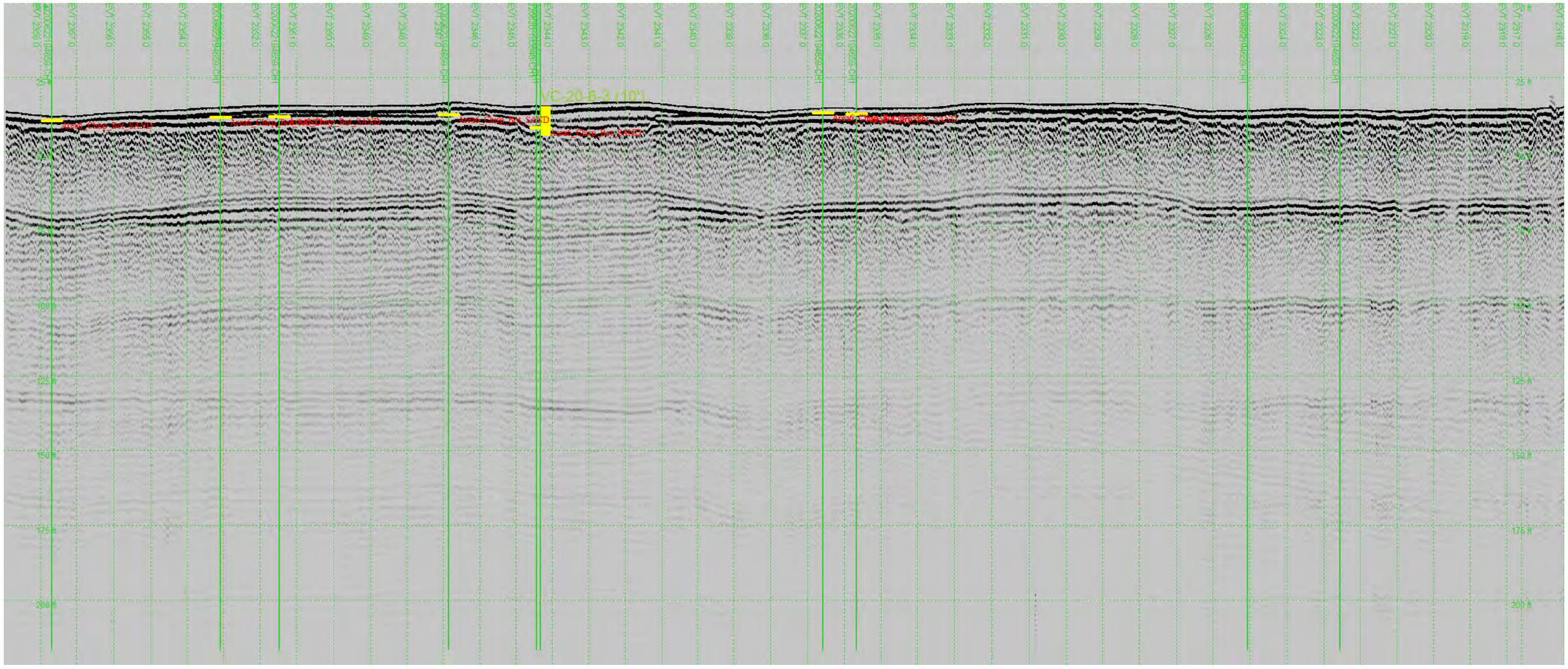

Figure 9: Boomer data along seismic line 220620.194654-CH1

LK-P6
CHIRP Data

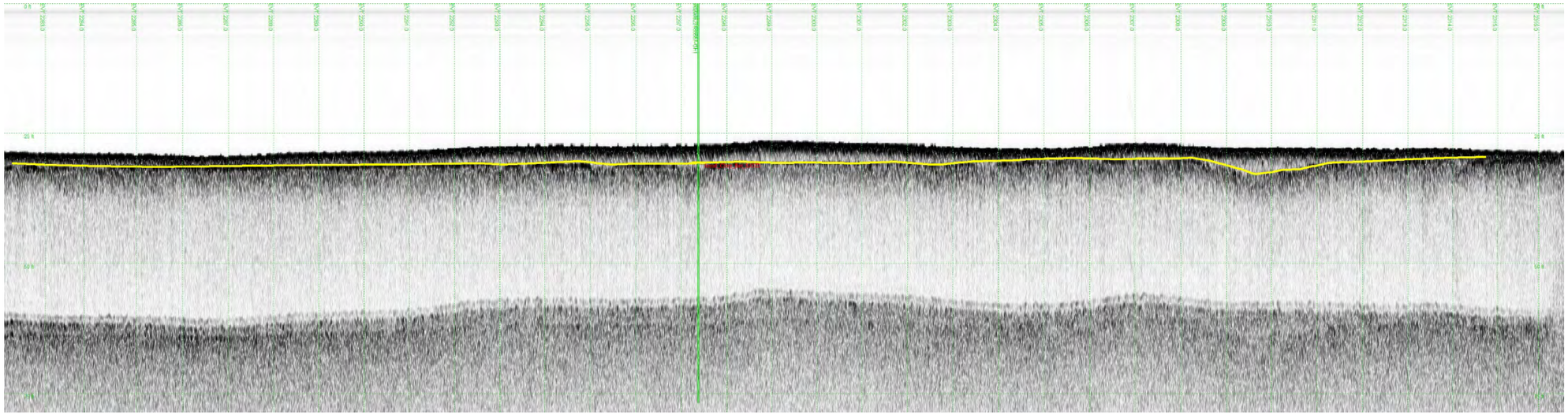

Figure 10: CHIRP data along seismic line 20200622165748-CH1

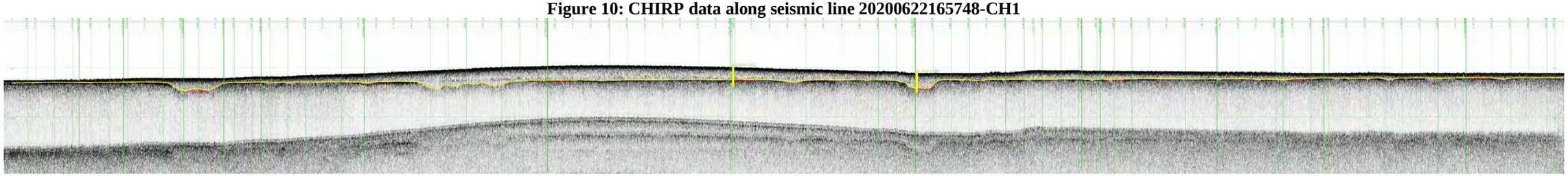

Figure 11: CHIRP data along seismic line 20200622172006-CH1

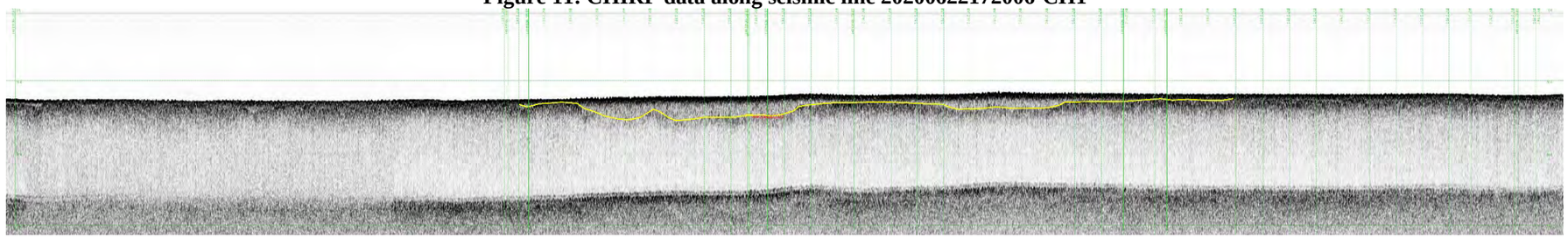

Figure 12: CHIRP data along seismic line 20200622174026-CH1

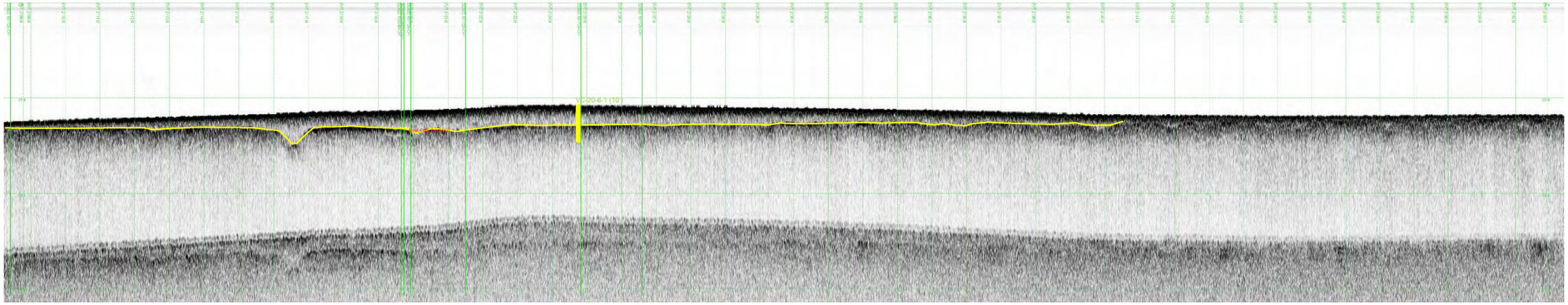

Figure 13: CHIRP data along seismic line 20200622175910-CH1

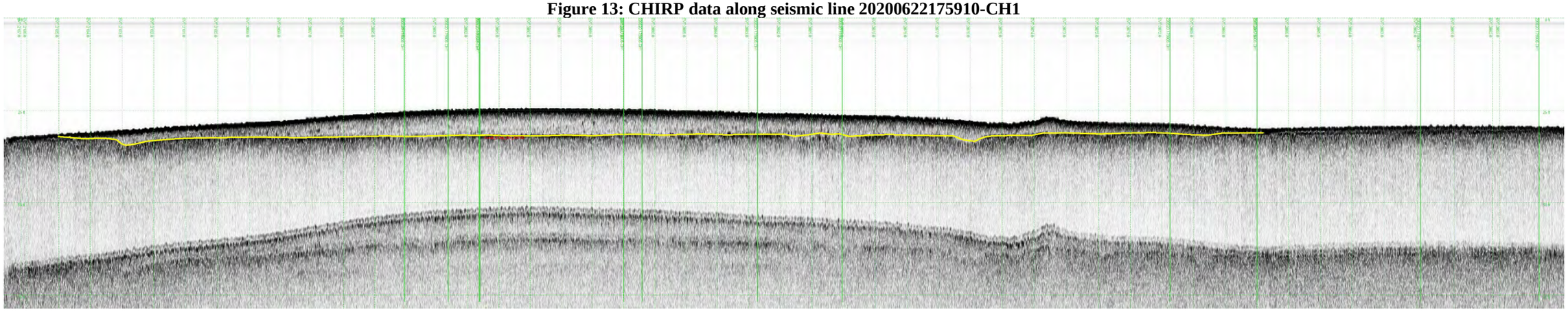

Figure 14: CHIRP data along seismic line 20200622181732-CH1

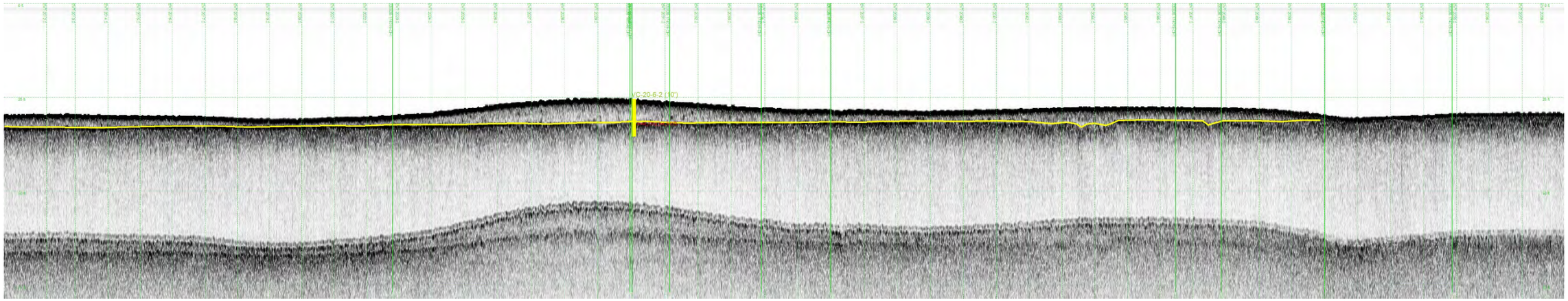

Figure 15: CHIRP data along seismic line 20200622183612-CH1

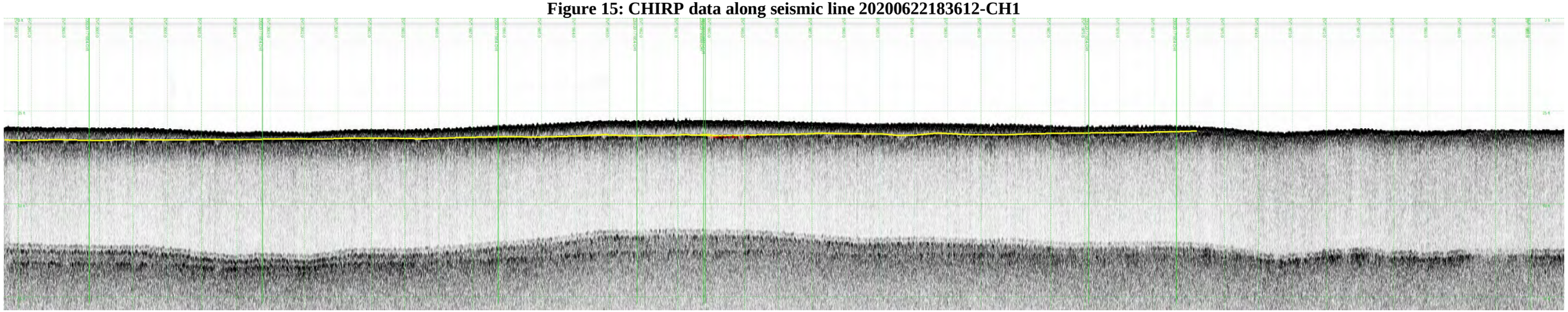

Figure 16: CHIRP data along seismic line 20200622185557-CH1

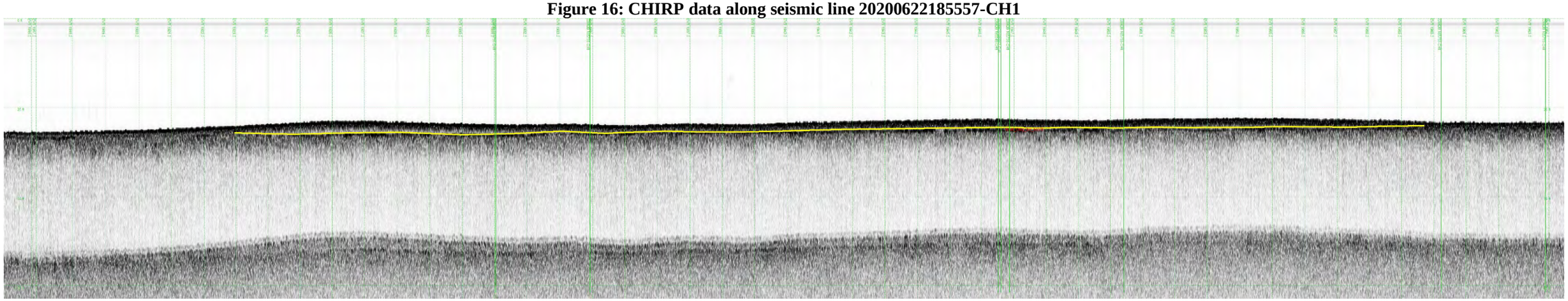

Figure 17: CHIRP data along seismic line 20200622193059-CH1

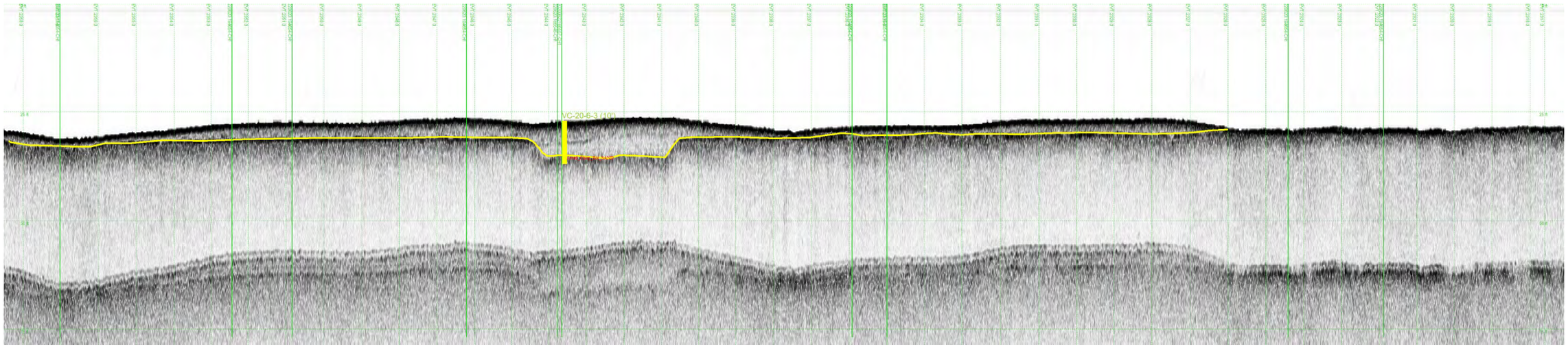

Figure 18: CHIRP data along seismic line 20200622194659-CH1