

HISTORIC AREA REMEDIATION SITE (HARS)

SPRING 2012

Prepared for:

United States Army Corps of Engineers
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1.0 Introduction

As part of Rogers Surveying's Indefinite Delivery Contract with The United States Army Corps of Engineers. Rogers Surveying was tasked with surveying the HARS (Historic Area Remediation Site). The HARS, which was re-designated as a remediation site in September 1977 was formerly known as the Mud Dump Site (MDS), and was used for the deposit of sediments dredged from the New York / New Jersey Harbor Estuary. The remediation consists of placing a one-meter "cap" layer of uncontaminated dredged material on top of the existing surface sediments within the nine Priority Remediation Areas (PRA's) of the HARS.

2.0 Objective

The primary objective of this task order is to obtain current high-accuracy multibeam bathymetry of the site, to be used in the monitoring and planning of dredge placement. The site limits being bounded by North latitude of 40° 23.323, a South latitude of 40° 21.498' and East longitude of 73° 50.591, a West longitude of 73° 53.794'. The total survey coverage area being approximately 6 square miles. (Figure 2.0-1). Rogers Surveying was given a scope of work and proceeded to perform survey operations on 5/17/12 (Table 2.0-1).

3.0 Procedure

The survey data was collected utilizing multibeam technology, and collected in accordance with The U.S. Army Corps of Engineers Manual 1110-2-1003. All survey data was collected with the survey vessel "Red Rogers" (Table 3.0-1). The "Red Rogers" is a 36' long catamaran with a beam of 12' that has berthing for 2. Survey operations were run when fuel, weather and crew staffing permitted. The vessel is equipped with a *RESON* 7101 multibeam sonar. Vessel motion corrections are supplied by an *APPLANIX* 320 (POS/MV), Differential GPS corrections are supplied by a *TRIMBLE* Pro-Beacon receiver, and when available RTK corrections provided to the POS/MV with the addition of a USB cellular modem. Speed of sound profiles are recorded thru the water column with a *SEABIRD* SBE19 Plus CTD profiler V2 (Table 3.0-1).

A seabed mounted water pressure gauge was installed at latitude N 40 °22' 38.9677" and longitude W 73° 50' 54.9287". It was anchored in approximately 40' of water (Figures 3.0-1 and 3.0-2). An acoustic release system was incorporated for retrieval of the tide gauge. The gauge was preset to record data for 60 seconds every 6 minutes. The Real Time Kinematic GPS, which augmented the POS/MV position also provided real time water levels. The RTK and VRS corrections were provided via a cellular Internet GPS Network operated by NYDOT.

Figure 2.0-1
Historic Area Restoration Site (HARS).

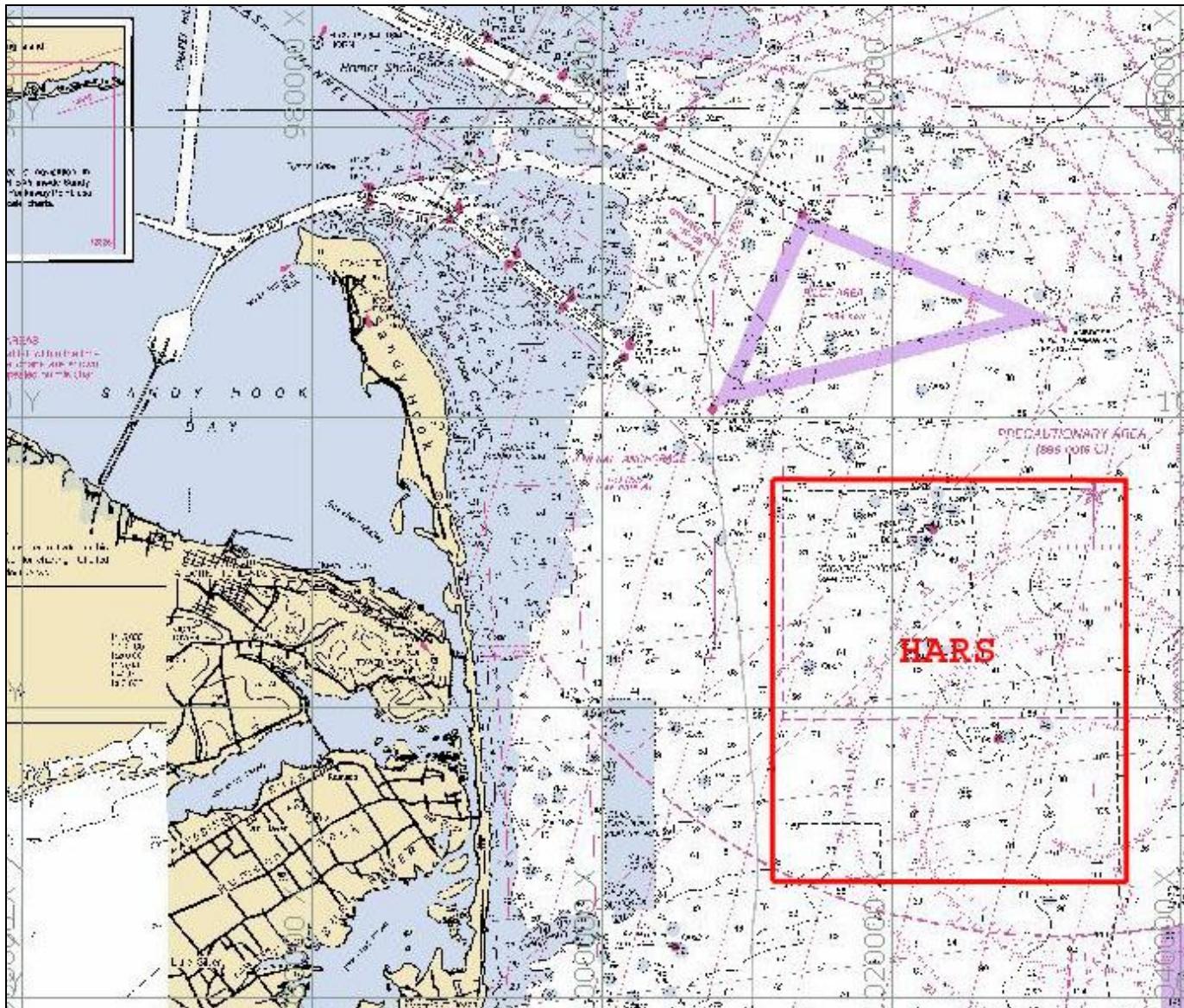


Table 2.0-1

Summary of survey operations on board survey vessel Red Rogers for the Spring 2012 multibeam survey at the HARS.

Table 3.0-1
Equipment used during the Spring 2012 multibeam survey at the HARS.

System	Model	*Accuracy
Multibeam	Reson Seabat 7101 (150/210 deg) 240 kHz, beam width 1.5 degree along and across track, 101 horizontal beams.	4 cm Nadir, 5 cm 45 degrees, 1.25 range resolution.
Position		
Differential GPS	Trimble Pro Beacon	3-5 meters DGPS USCG, 3 meters DGPS WAAS
Inertial Navigation System	TSS POS M/V 320 Motion (HPR) & Heading	Roll Pitch 0.02 (1 sigma DGPS, 2 sigma RTK) Heave 5cm or 5% 20 seconds or less Heading 0.02 (1 sigma) Position 0.5 - 2m (DGPS), 0.02 - 0.10 (RTK) Velocity 0.03 m/s horizontal
Data Acquisition and Navigation	Hypack 2009a Hysweep Survey Running on a Super Logic computer, with dual Aptec Raid removable disk drives .	
Sound Velocity	SeaBird SBE 19plusV2	
Tide Gauges		
Submersible Pressure Gauge	Valeport Midas WLR (Deployed at HARS)	Range -5 to +35 deg (C). +/-0.01 deg (C)

Survey Vessel	
M/V Red Rogers	LOA= 36', Beam= 10', Draft= 2.5, Max Speed 25kts
Propulsion	Twin Volvo KAD 44P-C Turbo Diesel Engines with DPE Stern Drives
Power	Onan 6.5 kilowatt Generator with UPS & DC power supplies



R/V *Red Roger*

Figure 3.0-1
Attaching Acoustic Release Buoy to Submersible Tide Gauge



Figure 3.0-2

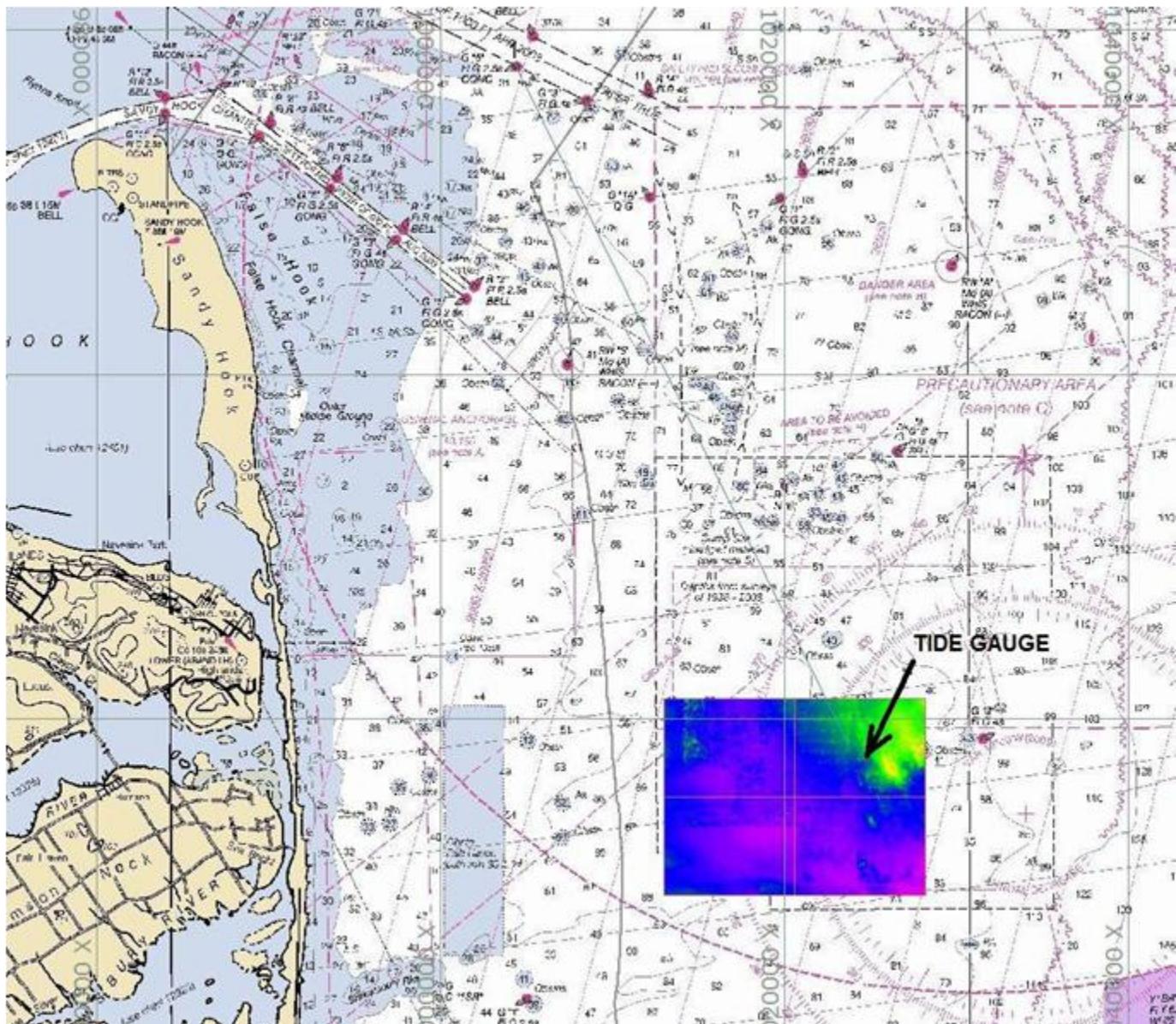


Figure 3.1-1
Portion of NGS Data Sheet for survey control disk KV0233 used at Elizabeth Marina.

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KV0233 DESIGNATION - PBM 65 33 USE
KV0233 PID - KV0233
KV0233 STATE/COUNTY- NJ/UNION
KV0233 USGS QUAD - ELIZABETH (1995)
KV0233
KV0233 *CURRENT SURVEY CONTROL
KV0233
KV0233* NAD 83(1986) - 40 39 07. (N) 074 11 11. (W) SCALED
KV0233* NAVD 88 - 7.441 (meters) 24.41 (feet) ADJUSTED
KV0233
KV0233 GEOID HEIGHT- -32.35 (meters) GEOID09
KV0233 DYNAMIC HT - 7.438 (meters) 24.40 (feet) COMP
KV0233 MODELED GRAV- 980,222.8 (mgal) NAVD 88
KV0233
KV0233 VERT ORDER - FIRST CLASS II

```

Figure 4.1-1
Sandy Hook Tidal Station information, used during the Spring 2012 multibeam survey at the HARS.

Sandy Hook, NJ
Station ID: 8531680

Station Information

Latitude: 40° 28.0' N **Mean Range:** 4.70 ft.

Longitude: 74° 0.6' W **Diurnal Range:** 5.22 ft.

Established: Jan 7 1910

Present Installation: Sep 26 1989

NOAA Chart #: 12327

Time Meridian: 75



Click image for larger image.

Minimum Water Level:
-4.71 ft. below [MLLW](#)
(02/02/1976)

Maximum Water Level:
4.86 ft. above [MHHW](#)
(09/12/1960)

[Click HERE for Drawing](#)
(Not for navigational use)

Data Types Available:

- Primary Water Level
- Backup Water Level
- Wind
- Air Temperature
- Water Temperature
- Barometric Pressure
- Conductivity

[Station and Bench Mark Drawing](#)

[Station Location Chartlet](#)

[Click HERE for Map](#)
(Not for navigational use)

3.1 Data Acquisition

The survey vessel *Red Rogers* is permanently berthed in Elizabeth, New Jersey. The voyage from the vessels homeport to the HARS is approximately 1.5 hours. Prior to multibeam survey operations a float test was performed to confirm that the RTK GPS tide reading from the POS M/V on the survey vessel agreed with the tide board at the dock at Elizabeth Marina, which had previously been referenced to National Geodetic Survey (NGS) disk KV0233 (Figure 3.1-1). This having been done the survey vessel transited to the HARS for commencement of multibeam data collection at the HARS site.

Once at the HARS the initial task was to lower the multibeam transducer head and perform a sound velocity profile (SVP). The information from the SVP was used to provide the Reson 7101 multibeam processor with a sound velocity surface value used for beam steerage. In addition the sound velocity profile was used in the Hypack data acquisition and processing software to correct for speed of sound through the water column to be applied to the multibeam data.

Having performed and applied the SVP correction, multibeam data collection began. Survey lines were run in a general North-South direction with cross check lines (see Section 5.0) being run in an East-West direction.

Constant monitoring of the Reson 7101 screen and adjustment of range, transmit/ receive power settings were made if required to accurately map and encompass the swath width needed. The swath width was set to 60 deg. either side of nadir (center beam of multibeam) and lines were run to provide a 60% swath data coverage. In addition to monitoring the Reson 7101, it was also necessary to monitor the Hypack navigation software, which provided quality information on GPS and inertial navigation sensors, motion reference unit sensor and the multibeam data from the Reson 7101.

3.2 Sound Velocity Profiles

Sound velocity profiles were taken during the course of the survey using a SeaBird SBE 19plus Version 2 CTD. Casts were obtained before, during and after each survey period. During survey operations casts were taken not less than three hours apart and at opposite ends of the days survey area, to account for any spatial water column speed of sound changes. The SeaBird SBE 19plus was last calibrated by the manufacturer and is periodically checked against our Odom Digibar Pro velocity profiler. A total of 26 SVP casts were taken over the course of the multibeam survey (Table 3.2-0). Plots of all SVP casts are shown in Figures 3.2-1 to 3.2-65.

3.3 Survey Line Report

Multibeam survey lines were run in a North-South direction primarily to best facilitate vessel operation under wave and current conditions at the time of the survey. Table 3.3-1 lists survey line start times with location and direction run.

Table 3.2-0

Sound Velocity Profiles (SVP's) taken during the Spring 2012 multibeam survey at the HARS

Date	Time	CTD File #	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
			Easting	Northing			
05/17/12	12:20	0517_1622	1027428	75651	72	40 22 27.1708	73 50 42.1258
05/17/12	14:35	0517_1837	1034837	81298	61	40 23 22.9784	73 50 51.4318
05/17/12	16:33	0517_2035	1024277	75291	78	40 22 23.6594	73 51 22.8473
05/17/12	17:38	0517_2136	1025273	80903	106	40 23 19.1039	73 51 9.8563
05/18/12	10:19	0518_1420	1021206	80029		40 23 10.528	73 52 2.4375
05/18/12	12:35	0518_1634	1022663	74908	76	40 22 19.9008	73 51 43.7031
05/18/12	14:15	0518_1802	1023922	80692		40 23 17.0356	73 51 27.3207
05/18/12	14:29	0518_1829	1020540	81071		40 23 20.8346	73 52 11.0131
05/18/12	16:06	0518_2006	1024363	79976		40 23 9.9516	73 51 21.639
05/24/12	9:51	0524_1351	1018174	81063		40 23 20.7911	73 52 41.5973
05/24/12	12:06	0524_1606	1015848	75269		40 22 23.5692	73 53 11.7525
05/24/12	13:51	0524_1751	1014485	81230	69	40 23 22.4904	73 53 29.2597
05/24/12	15:14	0524_1914	1014477	79118	71	40 23 1.6218	73 53 29.4055
05/25/12	9:48	0525_1348	1027302	75516		40 22 25.8319	73 50 43.7647
05/25/12	12:01	0525_1601	1025616	69547	79	40 21 26.8833	73 51 5.6707
05/25/12	13:48	0525_1748	1023973	75351	73	40 22 24.2599	73 51 26.7807
05/25/12	15:33	0525_1933	1021499	69569	73	40 21 27.1679	73 51 58.8496
05/29/12	10:53	0529_1453	1021479	75044	80	40 22 21.2651	73 51 59.0000
05/29/12	12:58	0529_1658	1019703	69596	73	40 21 27.4599	73 52 22.0506
05/29/12	14:09	0529_1809	1018742	75586		40 22 26.6649	73 52 34.3548
06/07/12	8:59	0607_1259	1018712	75184		40 22 22.6876	73 52 34.7514
06/07/12	11:19	0607_1519	1016924	69537	71	40 21 26.9108	73 52 57.9530
06/07/12	13:15	0607_1715	1014477	75349	73	40 22 24.3707	73 53 29.4679
06/07/12	14:49	0607_1849	1014787	70124	70	40 21 32.7423	73 53 25.5408

Table 3.3-1
Multibeam Survey Lines run during the Spring 2012 multibeam survey at the HARS

LINE #	DATE	TIME	LAT	LONG	DIRECTION
000_1228	5/17/12	12:28	40 22.402845 N	073 50.534875 W	North
000_1240	5/17/12	12:40	40 23.357851 N	073 50.560713 W	South
000_1251	5/17/12	12:51	40 22.40439 N	073 50.61724 W	North
000_1302	5/17/12	13:02	40 23.360796 N	073 50.620624 W	South
000_1313	5/17/12	13:13	40 22.403075 N	073 50.703354 W	North
000_1324	5/17/12	13:24	40 23.355174 N	073 50.697407 W	South
000_1336	5/17/12	13:36	40 22.404628 N	073 50.793207 W	North
000_1347	5/17/12	13:47	40 23.35956 N	073 50.764805 W	South
000_1357	5/17/12	13:57	40 22.404738 N	073 50.875574 W	North
000_1407	5/17/12	14:07	40 23.358228 N	073 50.839706 W	East (Cross-Line)
000_1417	5/17/12	14:17	40 22.447806 N	073 50.963462 W	North
000_1424	5/17/12	14:24	40 22.401993 N	073 50.965437 W	South
000_1439	5/17/12	14:39	40 23.364037 N	073 50.901483 W	North
002_1453	5/17/12	14:53	40 22.394964 N	073 51.064668 W	South
003_1504	5/17/12	15:04	40 23.359843 N	073 50.978263 W	North
001_1515	5/17/12	15:15	40 22.406513 N	073 51.13765 W	East (Cross-Line)
002_1526	5/17/12	15:26	40 23.359927 N	073 51.041926 W	South
003_1538	5/17/12	15:38	40 22.402328 N	073 51.223771 W	North
001_1549	5/17/12	15:49	40 23.364312 N	073 51.111196 W	South
002_1600	5/17/12	16:00	40 22.405298 N	073 51.308005 W	North
003_1611	5/17/12	16:11	40 23.36155 N	073 51.189845 W	South
001_1624	5/17/12	16:24	40 22.435478 N	073 51.397796 W	North
002_1635	5/17/12	16:35	40 22.402576 N	073 51.42033 W	South
003_1646	5/17/12	16:46	40 23.365938 N	073 51.262861 W	North
001_1657	5/17/12	16:57	40 22.406953 N	073 51.485841 W	South
002_1709	5/17/12	17:09	40 23.355994 N	073 51.324673 W	North
003_1721	5/17/12	17:21	40 22.408498 N	073 51.577566 W	East (Cross-Line)
001_1733	5/17/12	17:33	40 23.310299 N	073 51.420265 W	South
002_1029	5/18/12	10:29	40 23.350752 N	073 52.16606 W	South
003_1039	5/18/12	10:39	40 22.413341 N	073 52.129783 W	North
001_1049	5/18/12	10:49	40 23.357951 N	073 52.089824 W	South
002_1059	5/18/12	10:59	40 22.413242 N	073 52.044055 W	North
003_1110	5/18/12	11:10	40 23.357851 N	073 52.004073 W	South
001_1120	5/18/12	11:20	40 22.412588 N	073 51.958582 W	North
002_1131	5/18/12	11:31	40 23.360617 N	073 51.921179 W	South
003_1142	5/18/12	11:42	40 22.407056 N	073 51.871978 W	North

001A1153	5/18/12	11:53	40 23.348561 N	073 51.828886 W	South
002_1203	5/18/12	12:03	40 22.406955 N	073 51.786782 W	North
003_1214	5/18/12	12:14	40 23.316964 N	073 51.742315 W	West (Cross-Line)
002_1220	5/18/12	12:17	40 23.366938 N	073 51.757834 W	South
003_1236	5/18/12	12:20	40 23.343543 N	073 52.182542 W	North
001_1246	5/18/12	12:36	40 22.403598 N	073 51.704433 W	South
002_1256	5/18/12	12:46	40 23.360317 N	073 51.669793 W	North
003_1306	5/18/12	12:56	40 22.408918 N	073 51.613547 W	South
001_1314	5/18/12	13:06	40 23.356961 N	073 51.590263 W	North
002_1323	5/18/12	13:14	40 22.592352 N	073 51.533642 W	South
003_1331	5/18/12	13:23	40 23.360129 N	073 51.516403 W	North
001_1339	5/18/12	13:31	40 23.355695 N	073 51.443979 W	South
002_1346	5/18/12	13:39	40 22.746376 N	073 51.382792 W	North
003_1353	5/18/12	13:46	40 23.316521 N	073 51.38157 W	West (Cross-Line)
001_1405	5/18/12	13:53	40 23.278528 N	073 51.394434 W	South
002_1411	5/18/12	14:05	40 22.776695 N	073 51.311725 W	North
003_1416	5/18/12	14:11	40 23.120948 N	073 51.306719 W	South
001_1421	5/18/12	14:16	40 22.939556 N	073 51.24844 W	West (Cross-Line)
003_1435	5/18/12	14:21	40 23.356561 N	073 52.176352 W	South
001_1444	5/18/12	14:35	40 22.403569 N	073 52.219801 W	North
002_1455	5/18/12	14:44	40 23.36206 N	073 52.252023 W	South
003A1504	5/18/12	14:45	40 22.408212 N	073 52.319041 W	North
001_1516	5/18/12	15:04	40 23.358764 N	073 52.343893 W	South
002_1524	5/18/12	15:16	40 22.403784 N	073 52.41237 W	North
003_1536	5/18/12	15:24	40 23.361122 N	073 52.426861 W	South
001_1545	5/18/12	15:36	40 22.402763 N	073 52.514582 W	North
002_1556	5/18/12	15:45	40 23.356692 N	073 52.520212 W	South
003_1608	5/18/12	15:56	40 22.403994 N	073 52.604939 W	North
001_1619	5/18/12	16:08	40 23.322796 N	073 52.604728 W	East (Cross-Line)
002_1005	5/24/12	10:05	40 23.362477 N	073 52.631325 W	South
003_1014	5/24/12	10:14	40 22.405254 N	073 52.72344 W	North
001_1025	5/24/12	10:25	40 23.364836 N	073 52.718739 W	South
002_1034	5/24/12	10:34	40 22.403101 N	073 52.831578 W	North
003_1044	5/24/12	10:44	40 23.372877 N	073 52.823922 W	South
001_1054	5/24/12	10:54	40 22.400946 N	073 52.938236 W	North
002_1104	5/24/12	11:04	40 23.365049 N	073 52.923207 W	South
003_1114	5/24/12	11:14	40 22.40558 N	073 53.038956 W	North
001_1125	5/24/12	11:25	40 23.37082 N	073 53.026912 W	South
002_1135	5/24/12	11:35	40 22.405683 N	073 53.141165 W	North

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003_1146	5/24/12	11:46	40 23.309727 N	073 53.111471 W	East (Cross-Line)
001_1151	5/24/12	11:51	40 23.317123 N	073 52.597332 W	North
002_1154	5/24/12	11:54	40 23.365232 N	073 53.102486 W	South
003_1209	5/24/12	12:09	40 22.398991 N	073 53.24783 W	North
001_1220	5/24/12	12:20	40 23.372141 N	073 53.21508 W	South
002_1230	5/24/12	12:30	40 22.412679 N	073 53.34261 W	North
003_1240	5/24/12	12:40	40 23.366556 N	073 53.29658 W	South
001_1250	5/24/12	12:50	40 22.403711 N	073 53.441872 W	North
002_1301	5/24/12	13:01	40 23.372297 N	073 53.375099 W	South
003_1310	5/24/12	13:10	40 22.404936 N	073 53.539636 W	North
001_1321	5/24/12	13:21	40 23.365586 N	073 53.46549 W	South
002_1331	5/24/12	13:31	40 22.403893 N	073 53.635922 W	North
003_1342	5/24/12	13:42	40 23.319211 N	073 53.544092 W	East (Cross-Line)
001_1353	5/24/12	13:53	40 23.366799 N	073 53.549943 W	South
002_1405	5/24/12	14:05	40 22.40057 N	073 53.717398 W	North
003_1419	5/24/12	14:19	40 23.365743 N	073 53.632917 W	South
001_1431	5/24/12	14:31	40 22.407442 N	073 53.80034 W	North
002_1443	5/24/12	14:43	40 23.364689 N	073 53.718854 W	South
003_1453	5/24/12	14:53	40 22.720136 N	073 53.807265 W	North
001_1501	5/24/12	15:01	40 23.363636 N	073 53.806273 W	South
002_1508	5/24/12	15:08	40 23.028311 N	073 53.829013 W	East (Cross-Line)
003_1521	5/24/12	15:21	40 23.116796 N	073 52.785859 W	North
002_0958	5/25/12	09:58	40 22.414434 N	073 50.564648 W	South
003_1007	5/25/12	10:07	40 21.461913 N	073 50.613376 W	North
001_1018	5/25/12	10:18	40 22.420716 N	073 50.635401 W	South
002_1028	5/25/12	10:28	40 21.466692 N	073 50.716459 W	North
003_1038	5/25/12	10:38	40 22.420842 N	073 50.728409 W	South
001_1048	5/25/12	10:48	40 21.469945 N	073 50.835718 W	North
002_1059	5/25/12	10:59	40 22.42097 N	073 50.82344 W	South
003_1159	5/25/12	11:59	40 21.466987 N	073 50.936797 W	East (Cross-Line)
001_1119	5/25/12	11:19	40 22.421083 N	073 50.908361 W	North
002_1129	5/25/12	11:29	40 21.464026 N	073 51.037876 W	South
003_1141	5/25/12	11:41	40 22.371717 N	073 50.999458 W	North
001_1147	5/25/12	11:47	40 22.289692 N	073 50.949095 W	North
002_1149	5/25/12	11:49	40 22.306651 N	073 50.910641 W	South
003_1150	5/25/12	11:50	40 22.422749 N	073 50.999344 W	North
001_1204	5/25/12	12:04	40 21.462616 N	073 51.142995 W	South
002_1215	5/25/12	12:15	40 22.425973 N	073 51.100434 W	North
003_1224	5/25/12	12:24	40 21.468916 N	073 51.231925 W	North

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001_1235	5/25/12	12:35	40 22.422992 N	073 51.187383 W	South
002_1245	5/25/12	12:45	40 21.464402 N	073 51.330986 W	North
003_1256	5/25/12	12:56	40 22.429294 N	073 51.278357 W	North
001_1305	5/25/12	13:05	40 21.469179 N	073 51.440135 W	South
002_1316	5/25/12	13:16	40 22.423236 N	073 51.379467 W	North
003_1326	5/25/12	13:26	40 21.467752 N	073 51.537167 W	South
001_1327	5/25/12	13:27	40 22.375391 N	073 51.45438 W	East (Cross-Line)
002_1341	5/25/12	13:41	40 22.323758 N	073 50.983391 W	North
001_1350	5/25/12	13:50	40 22.414079 N	073 51.476539 W	South
002_1401	5/25/12	14:01	40 21.466317 N	073 51.628136 W	North
003_1413	5/25/12	14:13	40 22.424991 N	073 51.547284 W	South
001_1424	5/25/12	14:24	40 21.463347 N	073 51.729215 W	North
002_1436	5/25/12	14:36	40 22.425115 N	073 51.64838 W	South
003_1447	5/25/12	14:47	40 21.469644 N	073 51.822189 W	North
001_1459	5/25/12	14:59	40 22.426786 N	073 51.751496 W	East (Cross-Line)
002_1509	5/25/12	15:09	40 21.468222 N	073 51.927307 W	South
003_1521	5/25/12	15:21	40 22.420704 N	073 51.838451 W	North
001A1535	5/25/12	15:35	40 21.4699 N	073 52.040505 W	South
002_1547	5/25/12	15:47	40 22.391439 N	073 51.937585 W	North
002_1100	5/29/12	11:00	40 22.422775 N	073 51.950351 W	South
003_1111	5/29/12	11:11	40 21.460972 N	073 52.122376 W	North
001_1122	5/29/12	11:22	40 22.431006 N	073 52.033885 W	South
002_1133	5/29/12	11:33	40 21.487767 N	073 52.186111 W	North
003_1143	5/29/12	11:43	40 22.424164 N	073 52.146313 W	South
001_1148	5/29/12	11:48	40 22.132585 N	073 52.183339 W	East (Cross-Line)
002_1154	5/29/12	11:54	40 22.428856 N	073 52.185801 W	South
003_1206	5/29/12	12:06	40 21.462252 N	073 52.225648 W	North
001_1217	5/29/12	12:17	40 22.433593 N	073 52.264785 W	South
002_1231	5/29/12	13:31	40 21.460015 N	073 52.303108 W	North
003_1241	5/29/12	12:41	40 22.430203 N	073 52.349862 W	South
001_1301	5/29/12	13:01	40 21.462447 N	073 52.400303 W	North
002_1312	5/29/12	13:12	40 22.434966 N	073 52.454672 W	North
003_1326	5/29/12	13:26	40 21.45789 N	073 52.482324 W	South
001_1337	5/29/12	13:37	40 22.435077 N	073 52.556452 W	North
002_1351	5/29/12	13:51	40 21.463787 N	073 52.562807 W	South
001_1401	5/29/12	14:01	40 22.375892 N	073 52.620364 W	East (Cross-Line)
002_0909	6/7/12	09:09	40 22.414923 N	073 52.590391 W	South
003_0919	6/7/12	09:19	40 21.459213 N	073 52.592152 W	North
001_0931	6/7/12	09:31	40 22.426847 N	073 52.652384 W	South

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002_0941	6/7/12	09:41	40 21.466408 N	073 52.666539 W	North
003_0953	6/7/12	09:53	40 22.424578 N	073 52.748511 W	South
001_1003	6/7/12	10:03	40 21.464138 N	073 52.762643 W	North
002A1015	6/7/12	10:15	40 22.424685 N	073 52.850835 W	South
003_1024	6/7/12	10:24	40 21.466616 N	073 52.864939 W	North
001_1036	6/7/12	10:36	40 22.424791 N	073 52.953159 W	South
002_1046	6/7/12	10:46	40 21.488069 N	073 52.970301 W	North
003_1059	6/7/12	10:59	40 22.365595 N	073 53.043183 W	East (Cross-Line)
002_1107	6/7/12	11:07	40 22.427254 N	073 53.043076 W	South
003_1122	6/7/12	11:22	40 21.462023 N	073 53.010647 W	North
001_1134	6/7/12	11:34	40 22.424985 N	073 53.145405 W	South
002_1144	6/7/12	11:44	40 21.46212 N	073 53.106746 W	North
003_1157	6/7/12	11:57	40 22.425087 N	073 53.247729 W	South
001_1207	6/7/12	12:07	40 21.455099 N	073 53.199758 W	North
002_1219	6/7/12	12:19	40 22.427549 N	073 53.340747 W	South
003_1229	6/7/12	12:29	40 21.462323 N	073 53.311346 W	North
001_1240	6/7/12	12:40	40 22.427644 N	073 53.439971 W	South
002_1251	6/7/12	12:51	40 21.462415 N	073 53.407446 W	North
003_1305	6/7/12	13:05	40 22.380294 N	073 53.523767 W	East (Cross-Line)
001_1319	6/7/12	13:19	40 22.427753 N	073 53.554698 W	North
002_1331	6/7/12	13:31	40 21.46013 N	073 53.497349 W	North
003_1334	6/7/12	13:34	40 21.571566 N	073 53.472368 W	South
001_1337	6/7/12	13:37	40 21.469694 N	073 53.581034 W	North
002_1348	6/7/12	13:48	40 22.430202 N	073 53.638414 W	South
002_1358	6/7/12	13:58	40 21.462669 N	073 53.677145 W	North
001_1409	6/7/12	14:09	40 22.427913 N	073 53.728339 W	South
002_1419	6/7/12	14:19	40 21.465111 N	073 53.754641 W	North
003_1430	6/7/12	14:30	40 22.427984 N	073 53.805858 W	South
001_1443	6/7/12	14:43	40 21.498368 N	073 53.81659 W	East (Cross-Line)

Figure 3.2-1
SVP 051712_1622 taken during the Spring 2012 multibeam survey at the HARS.

1502.13 0.176
1501.93 0.619

CTD PROFILE # 051712 1622

1501.74 1.062
1501.55 1.565
1501.3 2.093
1500.97 2.666

1500.65 3.209
1500.45 3.721
1500.32 4.264
1500.18 4.86
1499.99 5.491
1499.65 6.13
1499.08 6.765
1498.12 7.398
1497.01 8.06
1496.27 8.749
1495.49 9.47
1494.39 10.19
1493.49 10.88
1492.78 11.58
1492.17 12.31
1491.26 13.05
1490.49 13.78
1489.91 14.52
1489.56 15.22
1489.39 15.96
1489.25 16.69
1489.12 17.41
1489.03 18.12
1488.96 18.79
1488.91 19.44
1488.86 20.08
1488.82 20.58
1488.73 20.77

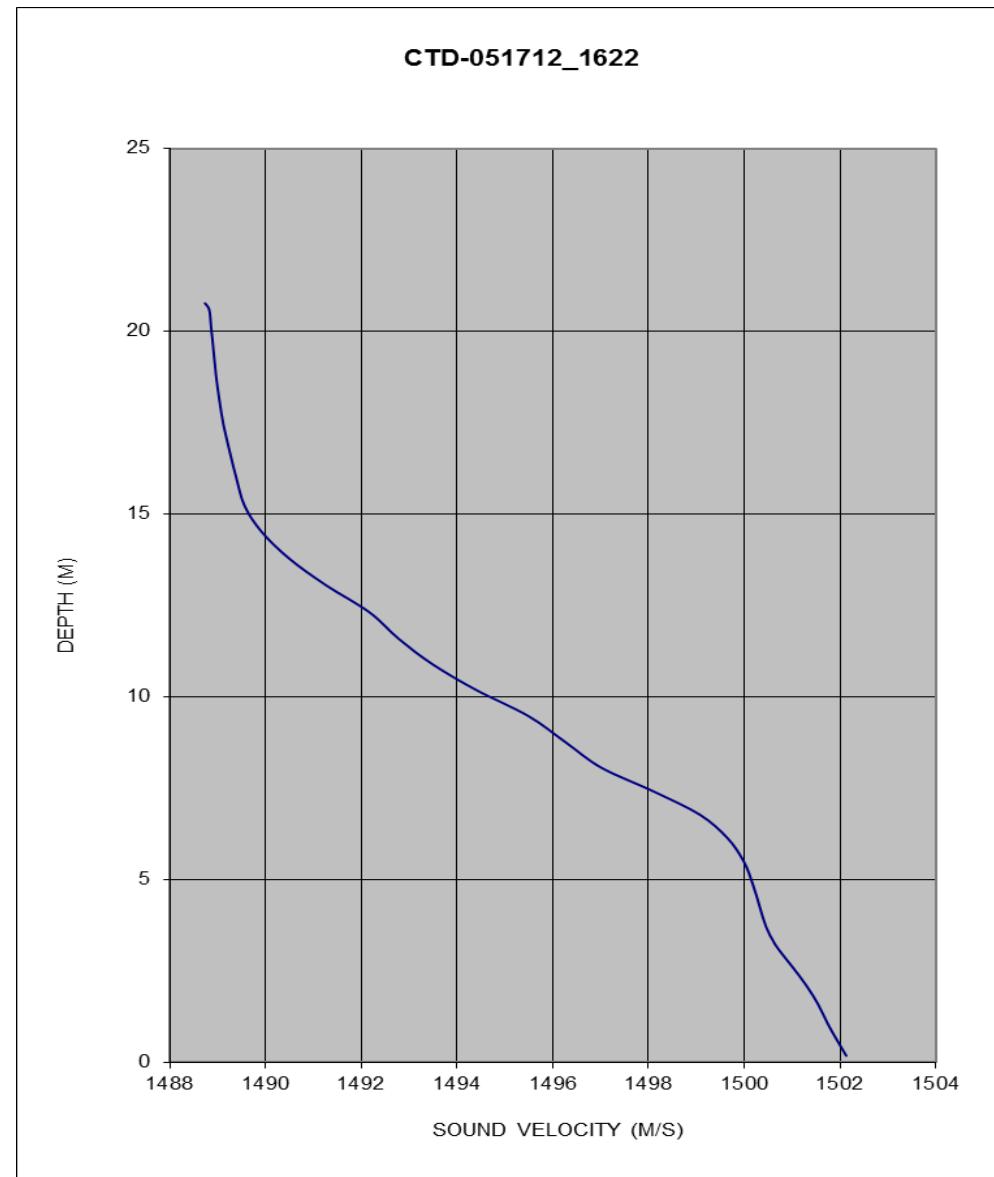


Figure 3.2-2
SVP 051712_1837 taken during the Spring 2012 multibeam survey at the HARS.

1506.74 0.118
1506.04 0.422

CTD PROFILE # 051712_1837

		Date	Time	NAD83 NY LI (Feet)	Water Depth	Latitude	Longitude
				Easting	Northing	Feet	N W
1505.4	0.775	05/17/12	18:37	1026698	81298	57	40 23 22.9784 73 50 51.4318
1503.81	1.674						

1503.21 2.135
1502.72 2.596
1502.08 3.105
1501.33 3.64
1500.87 4.18
1500.58 4.726
1500.38 5.261
1500.14 5.779
1499.66 6.261
1498.47 6.772
1496.61 7.3
1495.3 7.885
1494.62 8.468
1494.31 9.093
1494.1 9.704
1493.38 10.32
1492.16 10.96
1490.97 11.6
1490.11 12.24
1489.64 12.93
1489.43 13.65
1489.34 14.33
1489.33 14.98
1489.31 15.64
1489.29 16.31
1489.29 16.97
1489.52 17.3
1489.41 17.33
1489.27 17.33

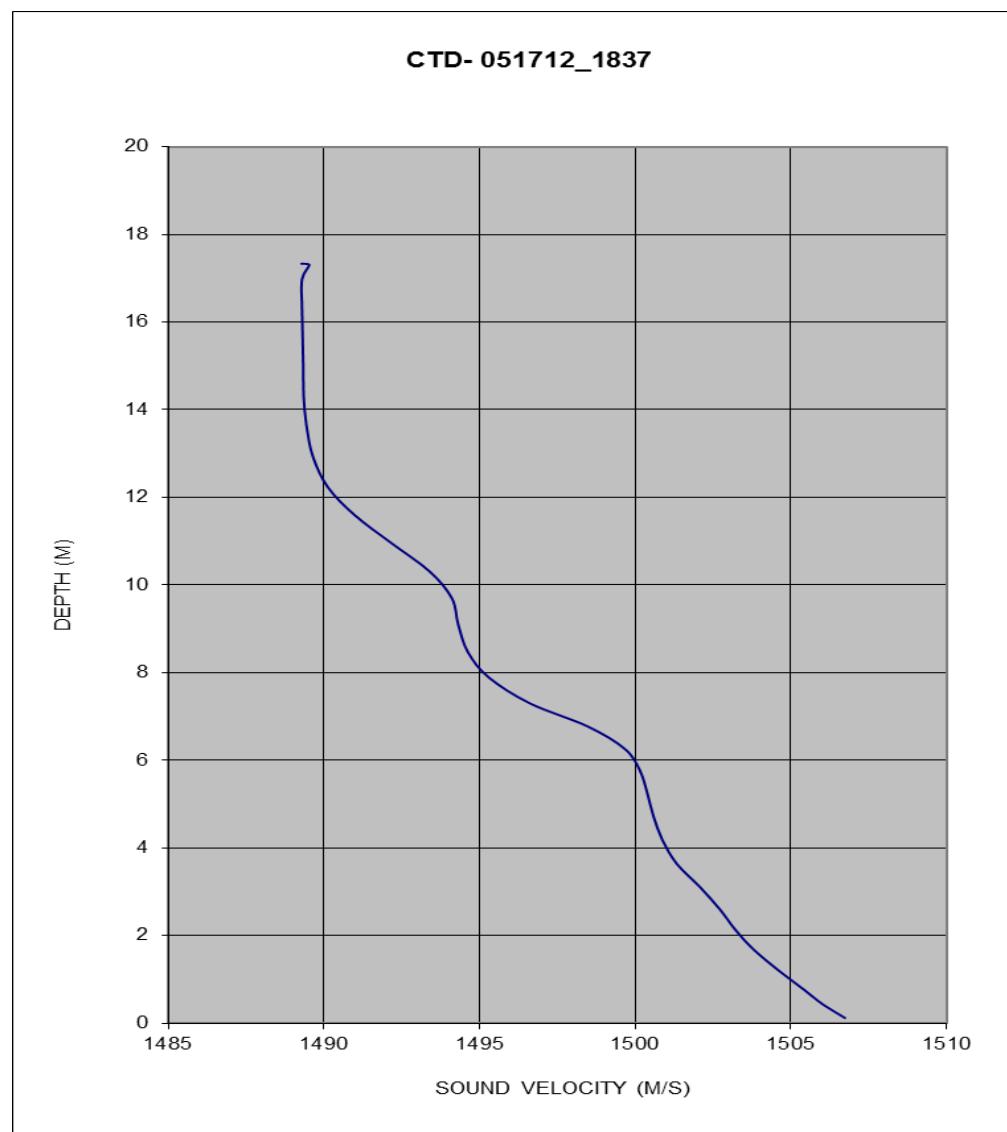


Figure 3.2-3
SVP 051712_2035 taken during the Spring 2012 multibeam survey at the HARS.

1506.19	0.275
1505.36	0.616
1504.92	0.937
1504.38	1.221
1504	1.535
1503.59	1.827

CTD PROFILE # 051712_2035

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
		Easting	Northing	Feet	N 40 22 23.6594	W 73 51 22.8473
05/17/12	20:35	1024277	75291	74		

1502.87	2.228
1502.2	2.699
1501.76	3.204
1501.39	3.759
1501.02	4.335
1500.68	4.929
1500.47	5.532
1500.32	6.121
1500.11	6.717
1499.82	7.358
1499.55	8
1499.01	8.641
1496.86	9.295
1494.25	9.94
1492.75	10.57
1492.07	11.2
1491.51	11.81
1490.95	12.45
1490.55	13.1
1490.27	13.74
1490.02	14.38
1489.69	15.06
1489.2	15.75
1488.79	16.44
1488.56	17.1
1488.42	17.78
1488.23	18.5
1488.12	19.18

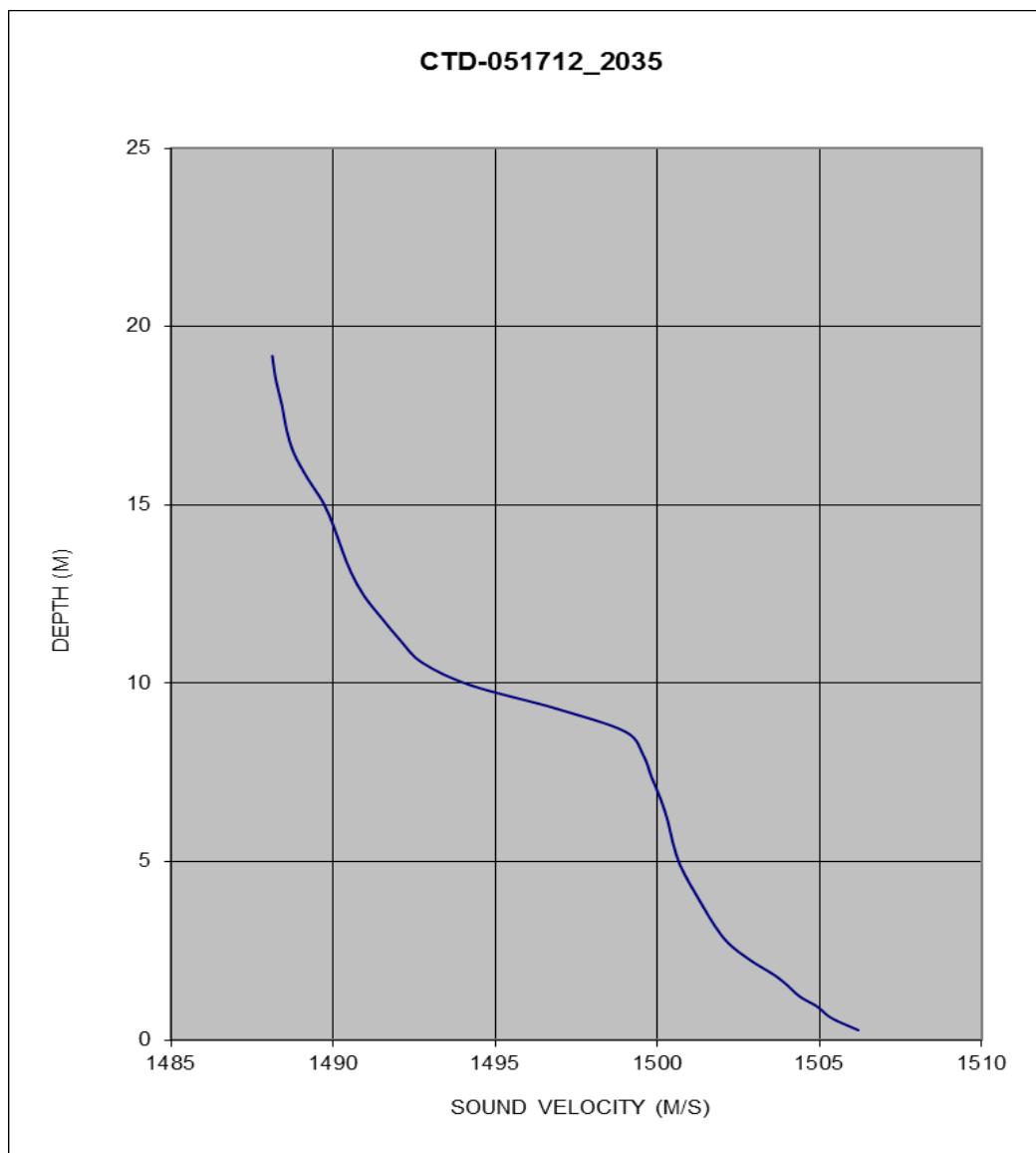


Figure 3.2-4
SVP 051712_2136 taken during the Spring 2012 multibeam survey at the HARS.

1507.28	0.01
1506.13	0.336
1505.33	0.666
1504.41	1.085
1503.47	1.557
1502.46	2.083
1501.7	2.627
1501.27	3.174
1500.91	3.756
1500.59	4.353
1500.37	4.959
1500.22	5.565
1500.1	6.212
1500.01	6.858
1499.86	7.509
1499.23	8.161
1497.49	8.79
1494.88	9.408
1492.86	10.01
1491.05	10.6
1489.88	11.17
1489.38	11.75
1489.15	12.35
1488.98	13
1488.83	13.67
1488.74	14.35
1488.71	15.04
1488.68	15.75
1488.59	16.46
1488.55	17.19
1488.55	17.85
1488.55	18.09
1488.57	18.14
1488.61	18.16

CTD PROFILE # 051712_2136

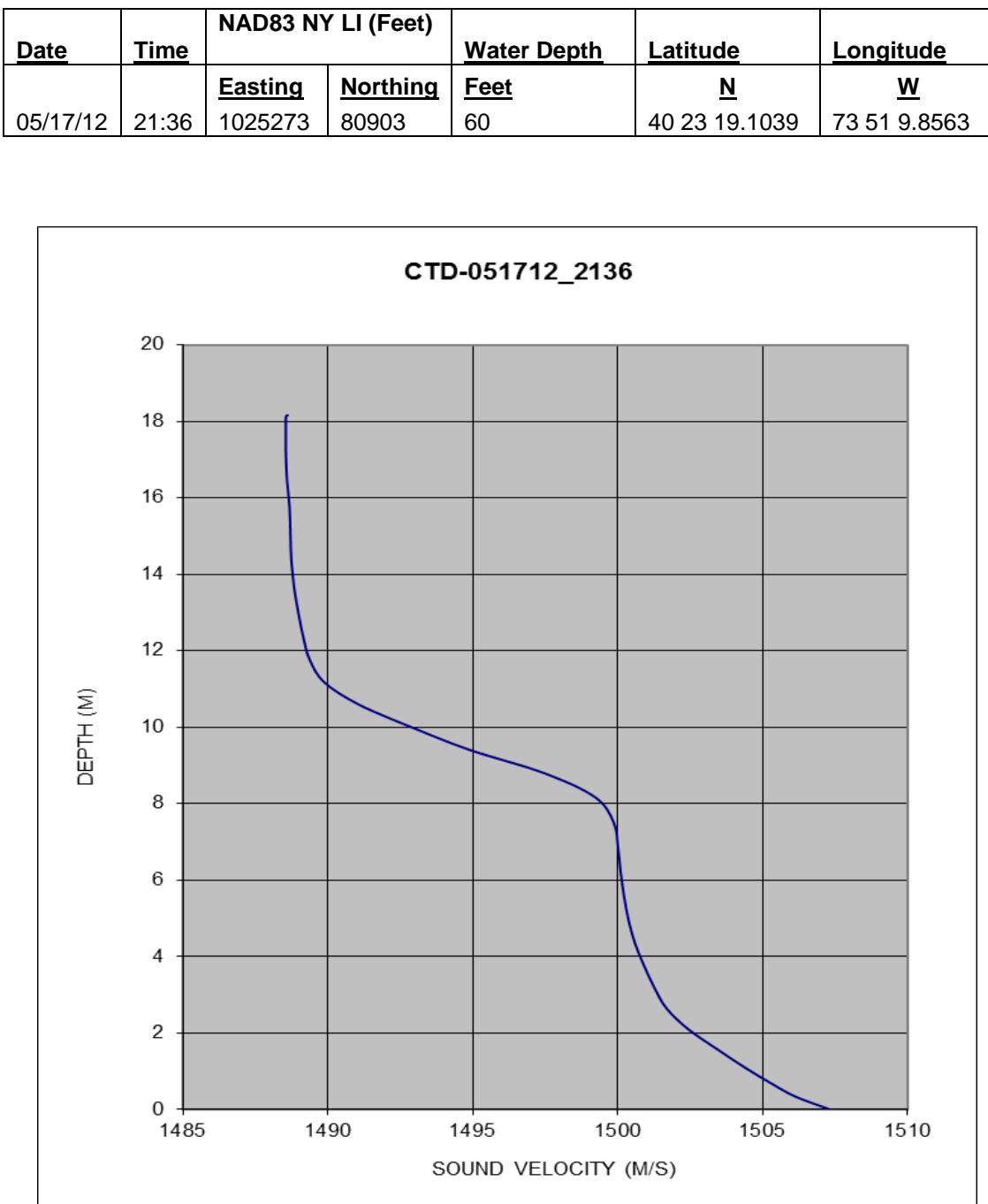


Figure 3.2-5

SVP 051812_1420 taken during the Spring 2012 multibeam survey at the HARS.

1503.21 0.202

CTD PROFILE # 051812_1420

1502.96 0.599

1502.85 0.998

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude		
		Easting	Northing	Feet	N	W		
1502.72	1.949	05/18/12	14:20	1021206	80029	62	40 23 10.528	73 52 2.4375

1502.52 2.258

1502.4 2.525

1502.37 2.758

1502.37 3.013

1502.36 3.35

1502.36 3.812

1502.13 4.333

1501.91 4.865

1501.87 5.353

1501.88 5.845

1501.83 6.377

1501.41 6.936

1501.03 7.511

1500.6 8.105

1499.59 8.688

1498.23 9.279

1497.19 9.902

1496.2 10.47

1495.02 11.04

1493.46 11.65

1491.72 12.23

1490.37 12.79

1489.6 13.39

1489.29 14.01

1489.16 14.66

1489.07 15.3

1489.01 15.94

1488.95 16.6

1488.9 17.25

1488.88 17.91

1488.86 18.53

1488.85 19.03

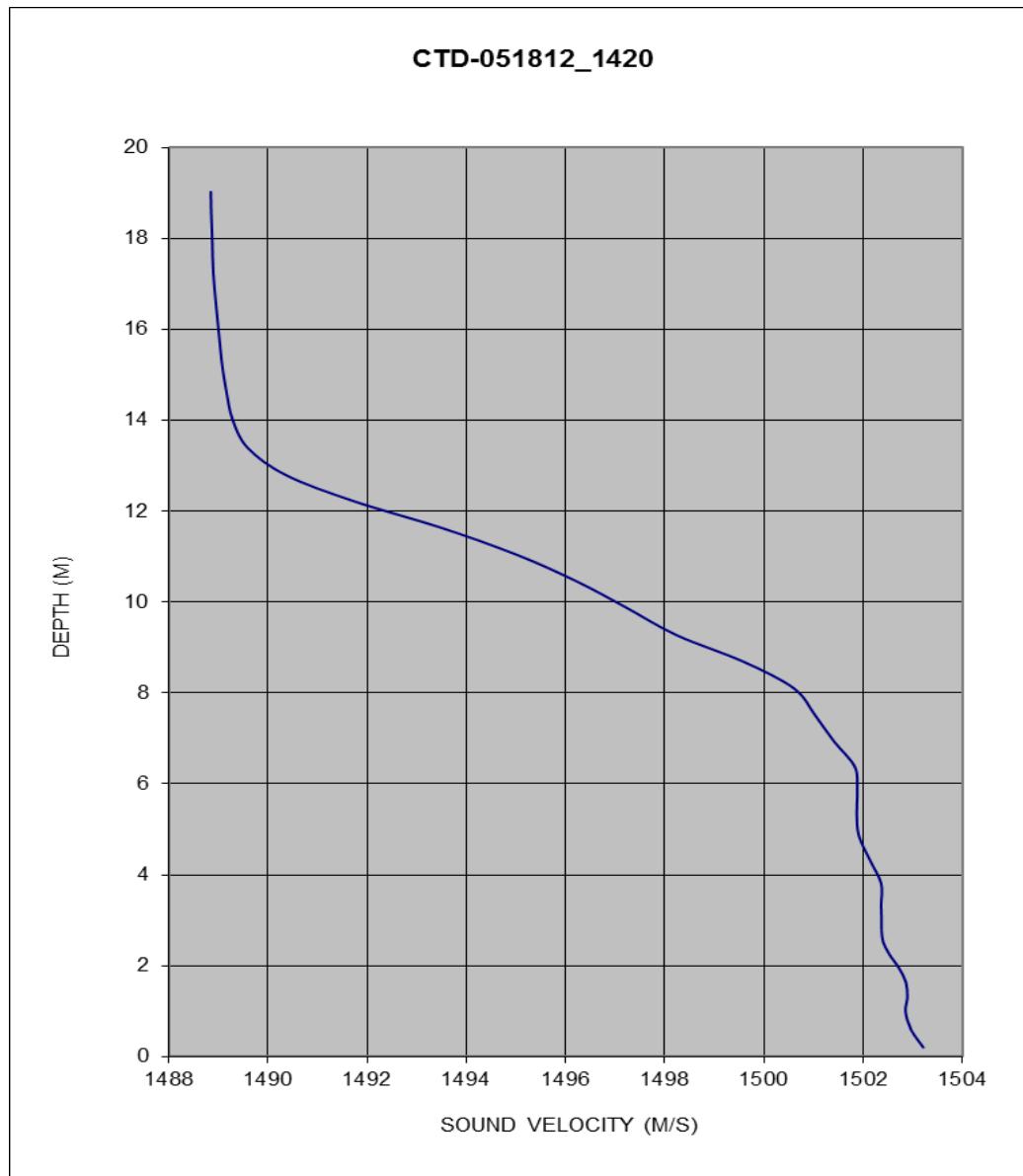


Figure 3.2-6
SVP 051812_1634 taken during the Spring 2012 multibeam survey at the HARS

1504.08	0.098
1503.95	0.293
1504.1	0.499
1503.91	0.687
1503.41	1.019
1502.78	1.444
1502.3	1.891
1501.95	2.351
1501.73	2.785
1501.64	3.199
1501.57	3.63
1501.48	4.079
1501.56	4.531
1501.65	4.992
1501.94	5.47
1502.02	5.996
1501.99	6.542
1501.71	7.119
1501.35	7.696
1500.89	8.271
1500.51	8.858
1499.65	9.441
1498.16	10.02
1496.73	10.58
1495.44	11.18
1494.1	11.78
1492.8	12.4
1491.72	13.02
1490.57	13.66
1489.68	14.32
1489.25	14.97
1489.08	15.61
1488.99	16.27
1488.96	16.93
1488.94	17.55
1488.92	18.18
1488.88	18.83
1488.86	19.52
1488.85	20.21
1488.85	20.88
1488.85	21.55
1488.86	22.21
1488.87	22.65
1488.87	22.67
1488.88	22.69

CTD PROFILE # 051812_1634

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
		Easting	Northing	Feet	N	W
05/18/12	14:20	1022663	74908	74	40 22 19.9008	73 51 43.7031

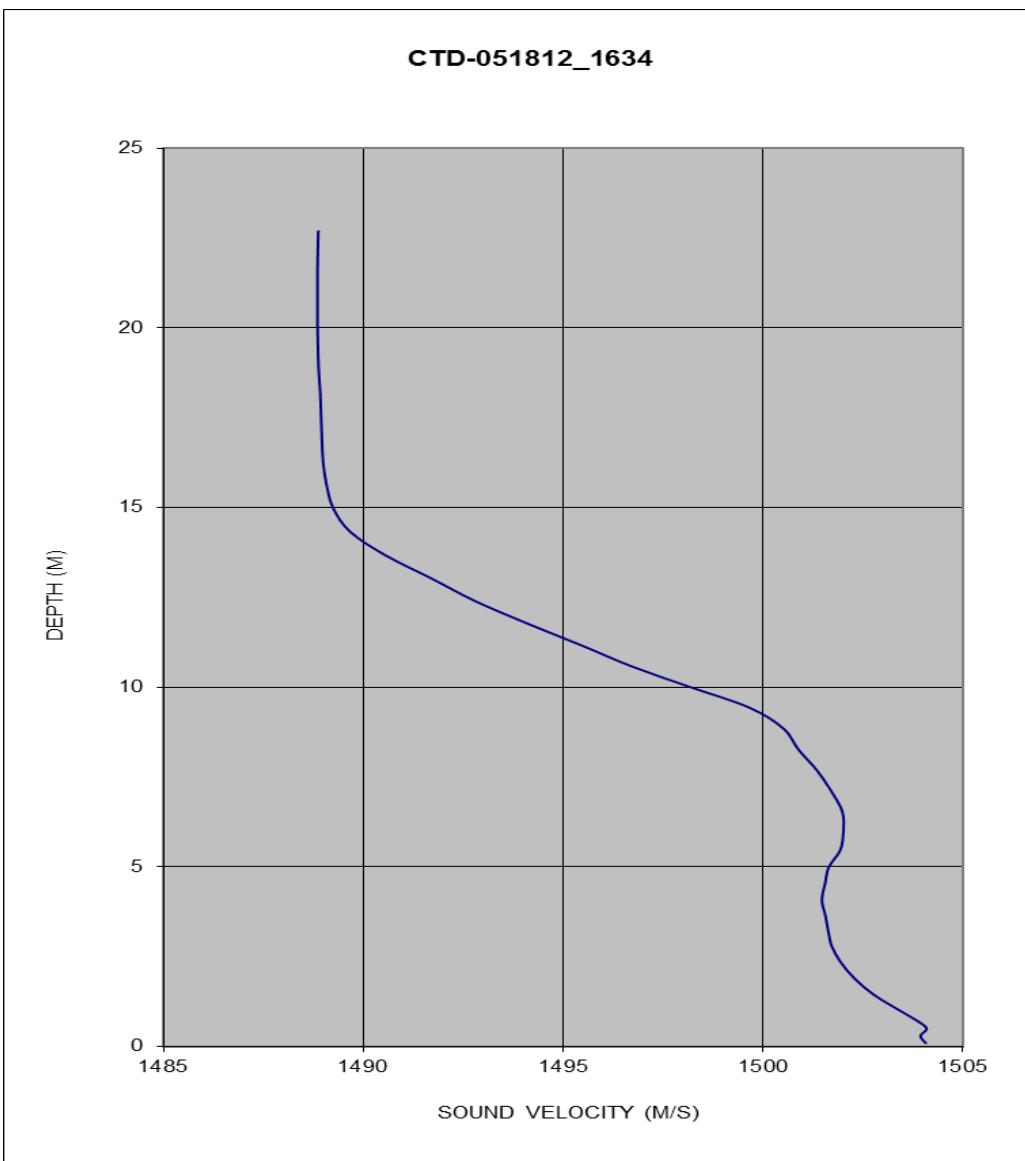


Figure 3.2-7
SVP 051812_1802 taken during the Spring 2012 multibeam survey at the HARS

1504.85	0.031
1504.81	0.316
1504.75	0.716
1504.57	1.207
1504.43	1.731
1504.4	2.057
1504.18	2.508
1503.93	3.079
1503.42	3.701
1502.68	4.365
1502.13	5.049
1501.79	5.727
1501.62	6.415
1501.43	7.095
1501.27	7.785
1501.12	8.484
1500.55	9.19
1499.6	9.914
1498.03	10.63
1495.33	11.34
1492.68	12.02
1490.94	12.67
1490.03	13.34
1489.59	14.02
1489.38	14.69
1489.29	15.38
1489.22	16.03
1489.18	16.73
1489.14	17.42
1489.11	17.7
1489.11	17.73
1489.13	17.76
1489.15	17.8
1489.15	17.85
1489.15	17.85
1488.92	18.18
1488.88	18.83
1488.86	19.52
1488.85	20.21
1488.85	20.88
1488.85	21.55
1488.86	22.21
1488.87	22.65
1488.87	22.67
1488.88	22.69

CTD PROFILE # 051812_1802

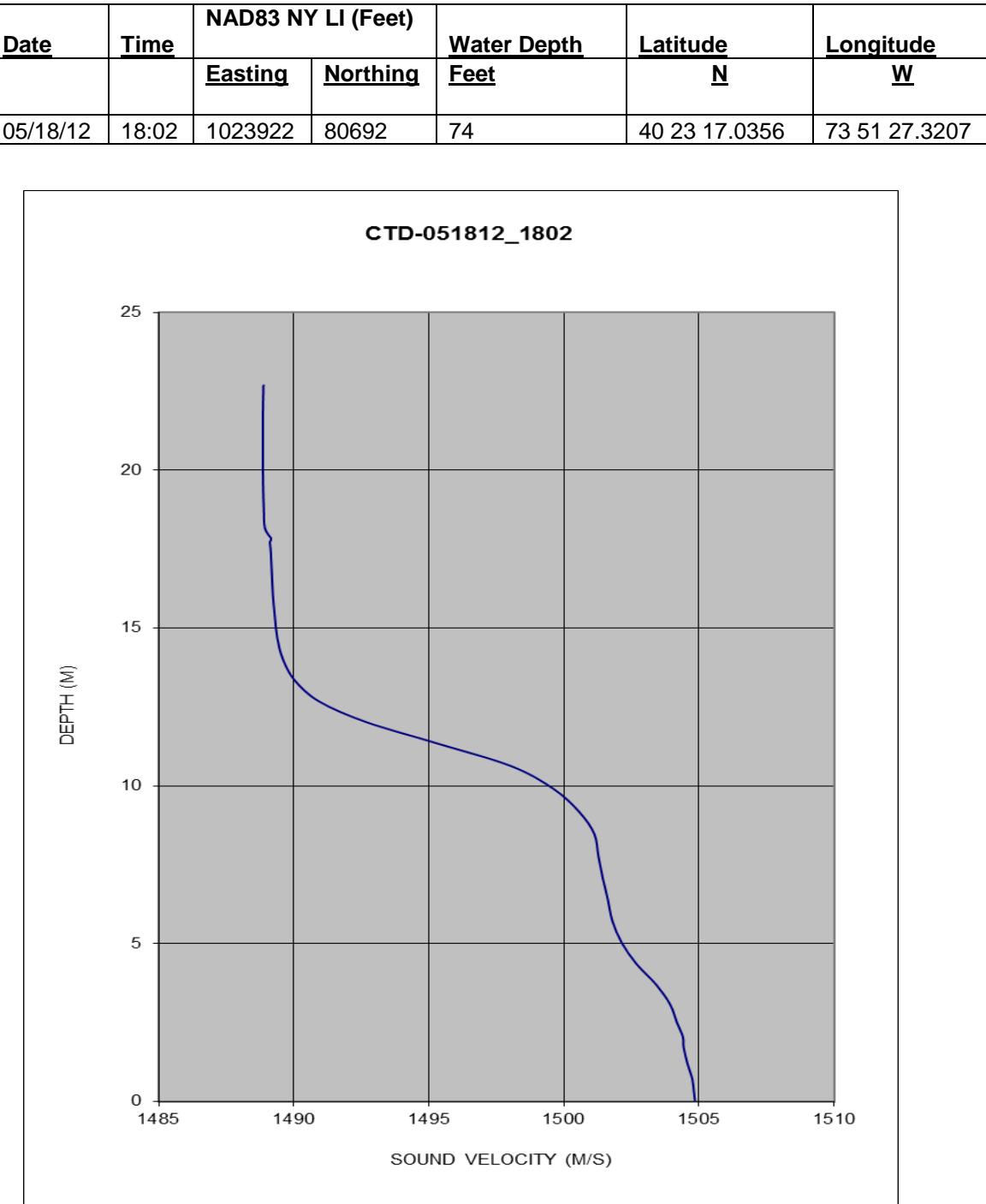


Figure 3.2-8

SVP 051812_1829 taken during the Spring 2012 multibeam survey at the HARS

CTD PROFILE # 051812 1829

1504.09	0.38
1504.1	0.719

1504.04	0.984

1503.99	1.294
1504	1.612

1504.13	1.947

1504.22	2.049

1504.35	2.166

1504.26	2.575

1504.08	3.112

1503.67	3.577

1503.4	4.061

1503.51	4.652

1503.07	5.271

1502.56	5.908

1502.1	6.535

1501.61	7.176

1501	7.808

1500.33	8.426

1499.18	9.016

1497.06	9.636

1494.75	10.23

1493.02	10.82

1491.95	11.41

1491.3	12

1490.57	12.61

1489.99	13.26

1489.64	13.87

1489.5	14.45

1489.41	15.05

1489.35	15.66

1489.29	16.29

1489.22	16.92

1489.18	17.58

1489.17	18.19

1489.1	18.79

1489.04	19.33

1489.02	19.47

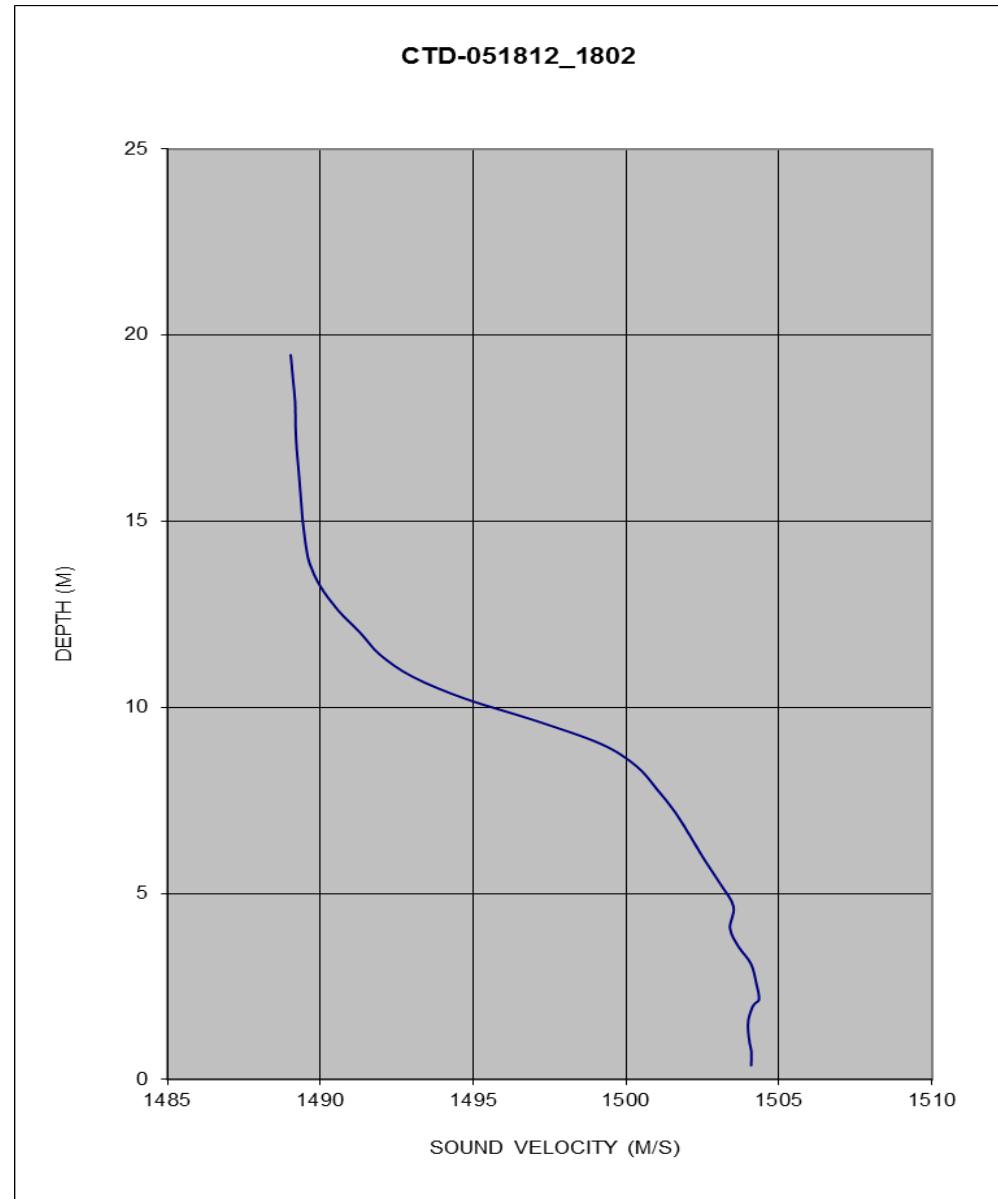


Figure 3.2-9
SVP 051812_2006 taken during the Spring 2012 multibeam survey at the HARS

1500.69 0.172
1501.14 0.528

CTD PROFILE # 051812_2006

Date	Time	NAD83 NY LI (Feet)	Water Depth	Latitude	Longitude	
		Easting	Northing	Feet	N	W
1502.64	1.014	1024363	79976	77	40 23 9.9516	73 51 21.639
1503.27	2.06					
1503.32	3.051					
1502.58	3.558					
1502.23	4.046					
1502.08	4.56					
1501.99	5.091					
1501.89	5.628					
1501.97	6.195					
1502.09	6.781					
1501.82	7.381					
1500.88	7.996					
1498.54	8.608					
1494.71	9.23					
1491.79	9.847					
1490.34	10.47					
1489.71	11.1					
1489.42	11.74					
1489.28	12.37					
1489.2	13					
1489.12	13.63					
1489.02	14.28					
1488.91	14.93					
1488.82	15.57					
1488.78	16.2					
1488.76	16.83					
1488.74	17.45					
1488.73	18.07					
1488.73	18.72					
1488.74	19.35					
1488.77	19.94					
1488.78	20.53					
1488.73	21.14					
1488.68	21.76					
1488.66	22.35					
1488.66	22.93					
1488.66	23.36					
1488.66	23.42					

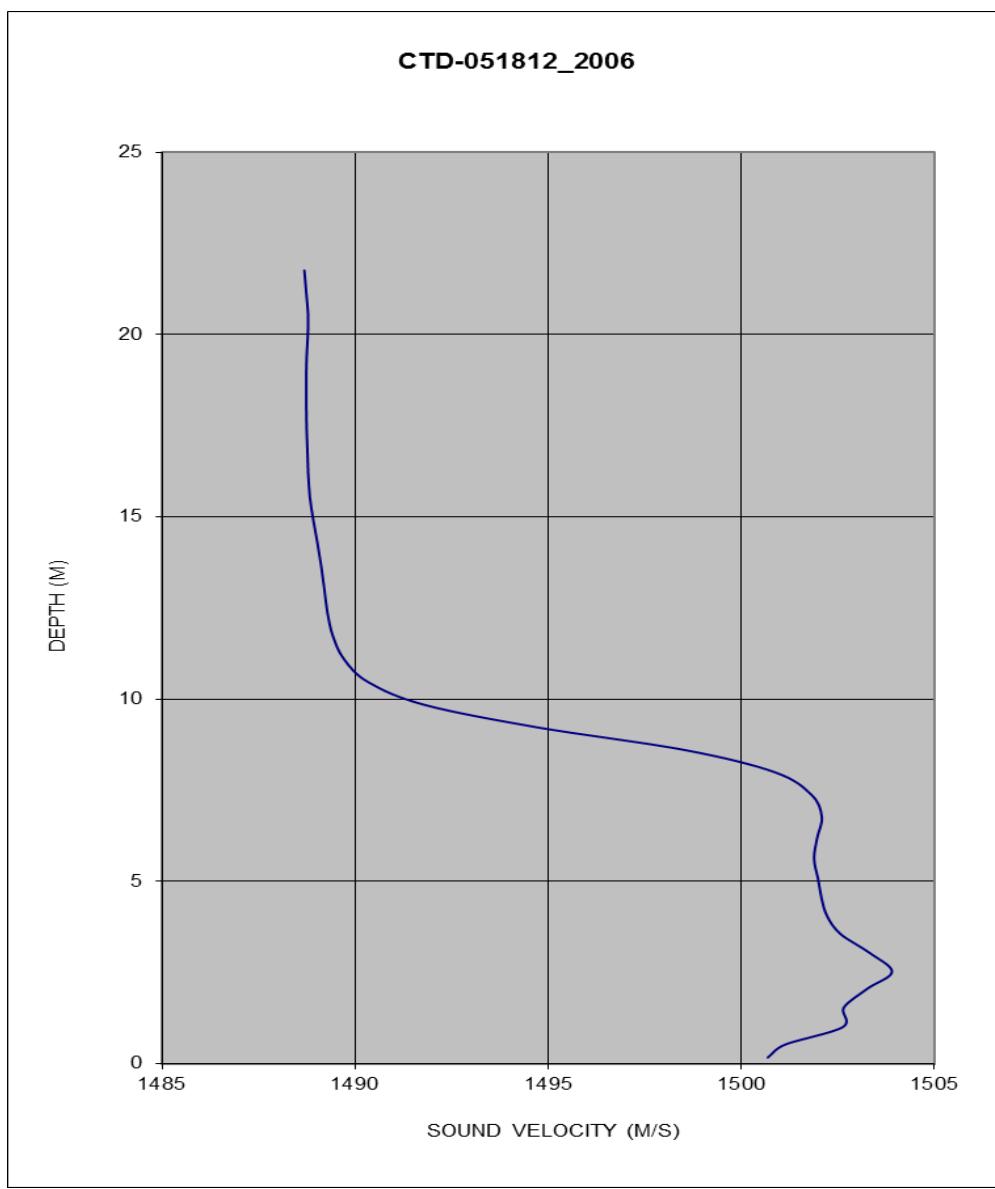


Figure 3.2-10
SVP 052412_1351 taken during the Spring 2012 multibeam survey at the HARS

1505.78	0.071
1505.88	0.247
1505.75	0.685
1505.74	1
1505.73	1.354
1505.93	1.642
1506.32	2.054
1506.46	2.424
1506.51	2.748
1506.49	3.009
1506.64	3.384
1506.86	3.809
1507.01	4.273
1506.71	5.223
1506.57	5.623
1506.37	6.025
1505.27	6.917
1504.95	7.388
1504.69	8.407
1504.64	8.88
1504.6	9.367
1504.58	10.29
1504.55	10.79
1504.52	11.28
1504.54	11.72
1504.55	12.08
1504.54	12.5
1504.53	12.89
1504.53	13.27
1504.44	14.19
1504.34	14.69
1504.21	15.15
1504.03	15.57
1503.84	16.18
1503.77	16.64
1503.6	17.02
1503.4	17.44
1503.12	17.9
1502.62	18.32
1501.56	19.16
1500.91	19.98
1500.14	20.4
1498.93	20.9
1497.79	21.39
1496.77	21.82
1496.04	22.26
1495.63	22.72
1495.73	23.02
1496.11	23.07

CTD PROFILE # 052412_1351

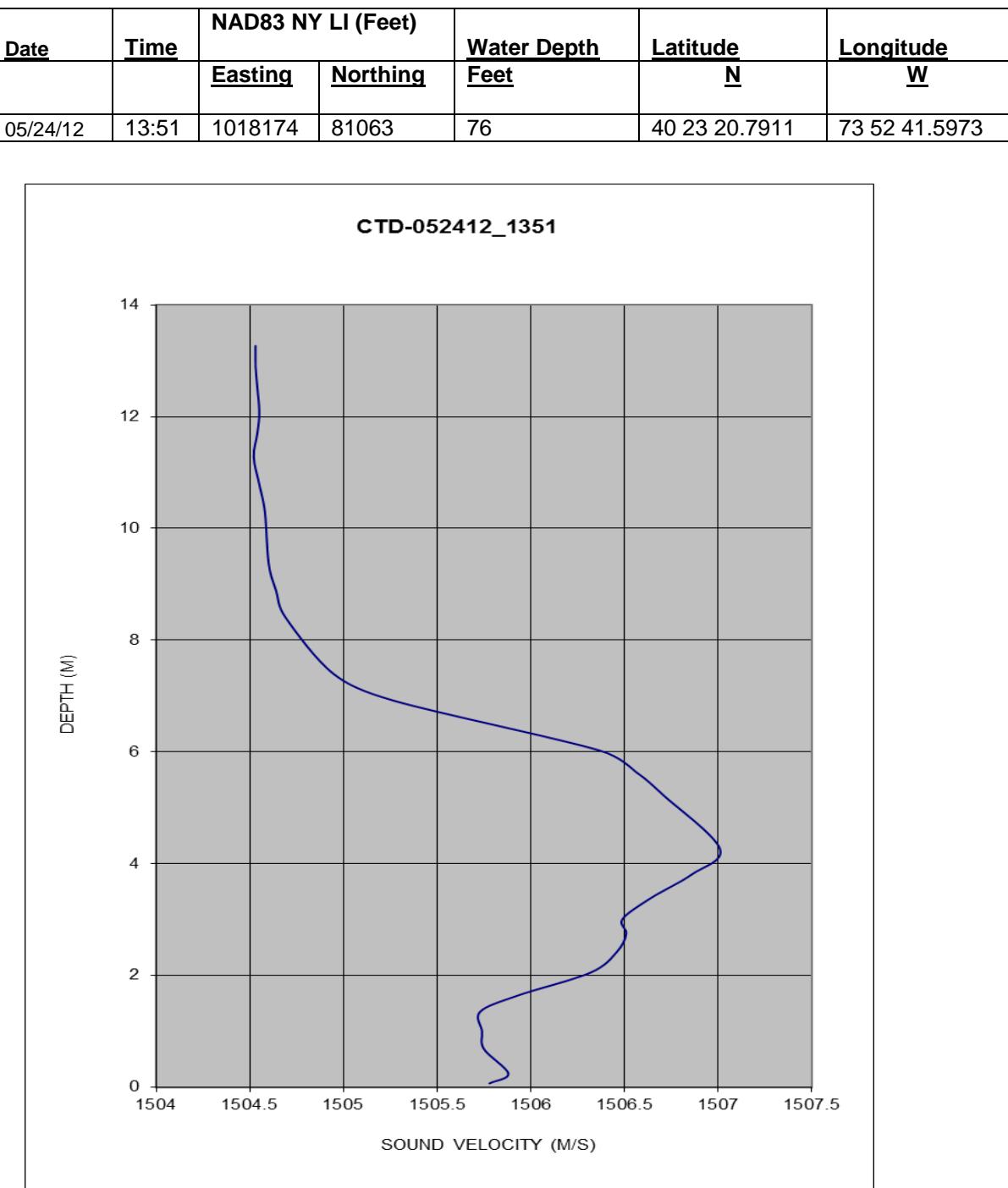


Figure 3.2-11
SVP 052412_1606 taken during the Spring 2012 multibeam survey at the HARS

1507.2 0.234

CTD PROFILE # 052412_1606

1507.13 0.68

1507.12 1.138

	<u>Date</u>	<u>Time</u>	NAD83 NY LI (Feet)		<u>Water Depth</u>	<u>Latitude</u>	<u>Longitude</u>
			<u>Easting</u>	<u>Northing</u>			
1507.13	1.555				Feet	N	W
1507.19	2.012						
1507.21	2.532	05/24/12 13:51	1015848	75269	75	40 22 23.5692	73 53 11.7525

1507.09 3.108

1506.95 3.738

1506.81 4.387

1506.52 5.036

1506.16 5.674

1505.76 6.322

1505.43 6.974

1505.19 7.64

1505.02 8.3

1504.96 8.947

1504.95 9.614

1504.94 10.3

1504.97 10.96

1505.02 11.6

1504.96 12.23

1504.57 12.87

1504.32 13.5

1504.16 14.12

1503.84 14.77

1503.48 15.42

1503.15 16.08

1502.57 16.74

1502 17.43

1501.71 18.12

1501.36 18.81

1500.88 19.49

1500.19 20.19

1498.95 20.88

1497.63 21.55

1496.65 22.22

1496.15 22.77

1496.19 22.84

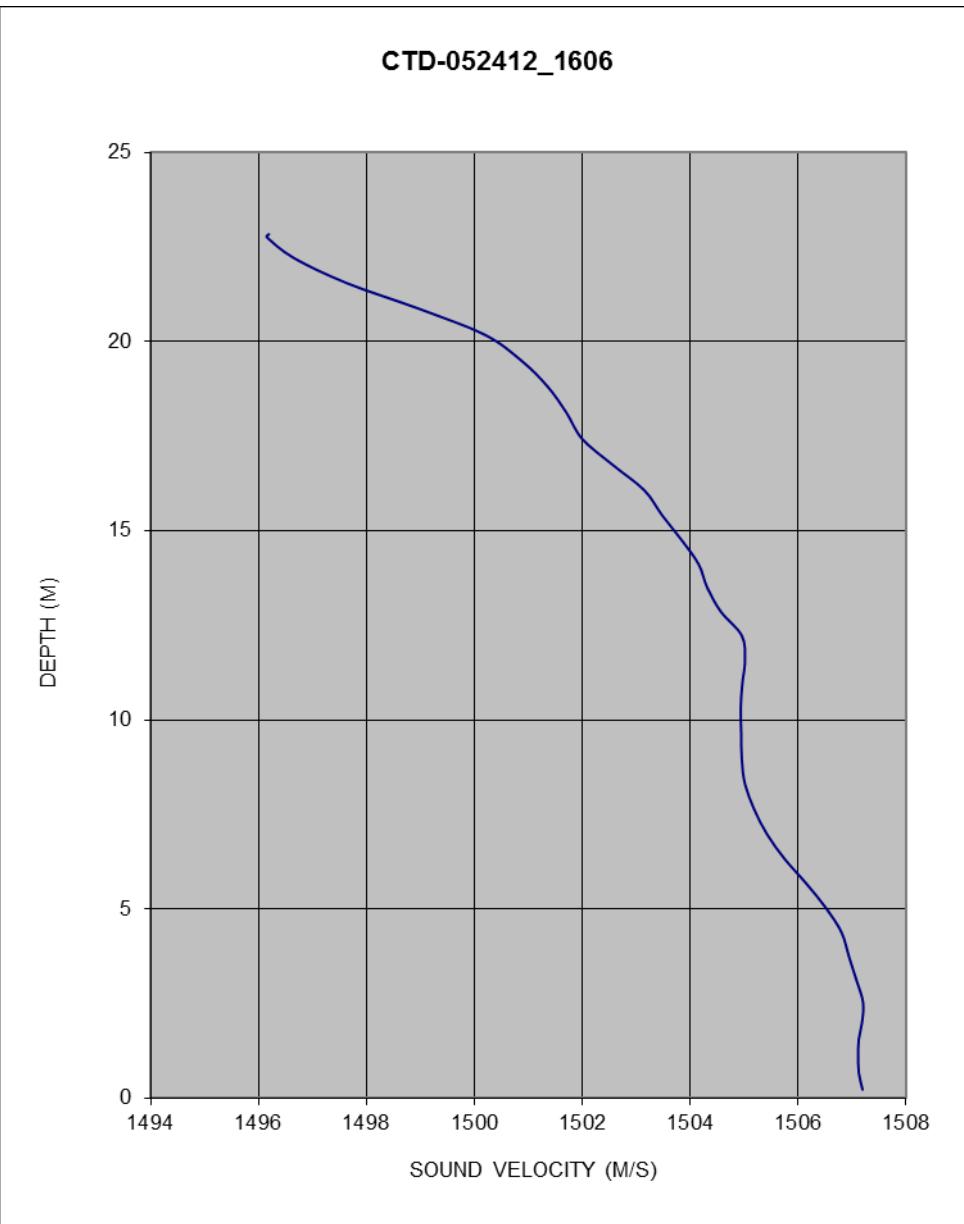


Figure 3.2-12
SVP 052412_1751 taken during the Spring 2012 multibeam survey at the HARS

1507.76 0.343

CTD PROFILE # 052412_1751

1507.74 0.627

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude		
	Date	Time	Easting	Northing	Feet	N	W	
1507.73	1.004							
1507.73	1.502							
1507.68	2.08							
1507.6	2.701	05/24/12	17:51	1014485	81230	64	40 23 22.4904	73 53 29.2597

1507.55 3.278

1507.47 3.886

1507.25 4.525

1506.92 5.139

1506.35 5.76

1505.9 6.406

1505.59 7.075

1505.31 7.754

1505.17 8.445

1505.15 9.109

1505.16 9.726

1505.16 10.38

1505.18 11.05

1504.93 11.72

1504.67 12.37

1504.33 13.01

1503.79 13.6

1503.35 14.23

1503.12 14.89

1502.98 15.55

1502.84 16.19

1502.65 16.86

1502.53 17.5

1502.47 18.15

1502.32 18.8

1502.13 19.35

1502.06 19.48

1502.06 19.53

1502.07 19.55

1502.07 19.55

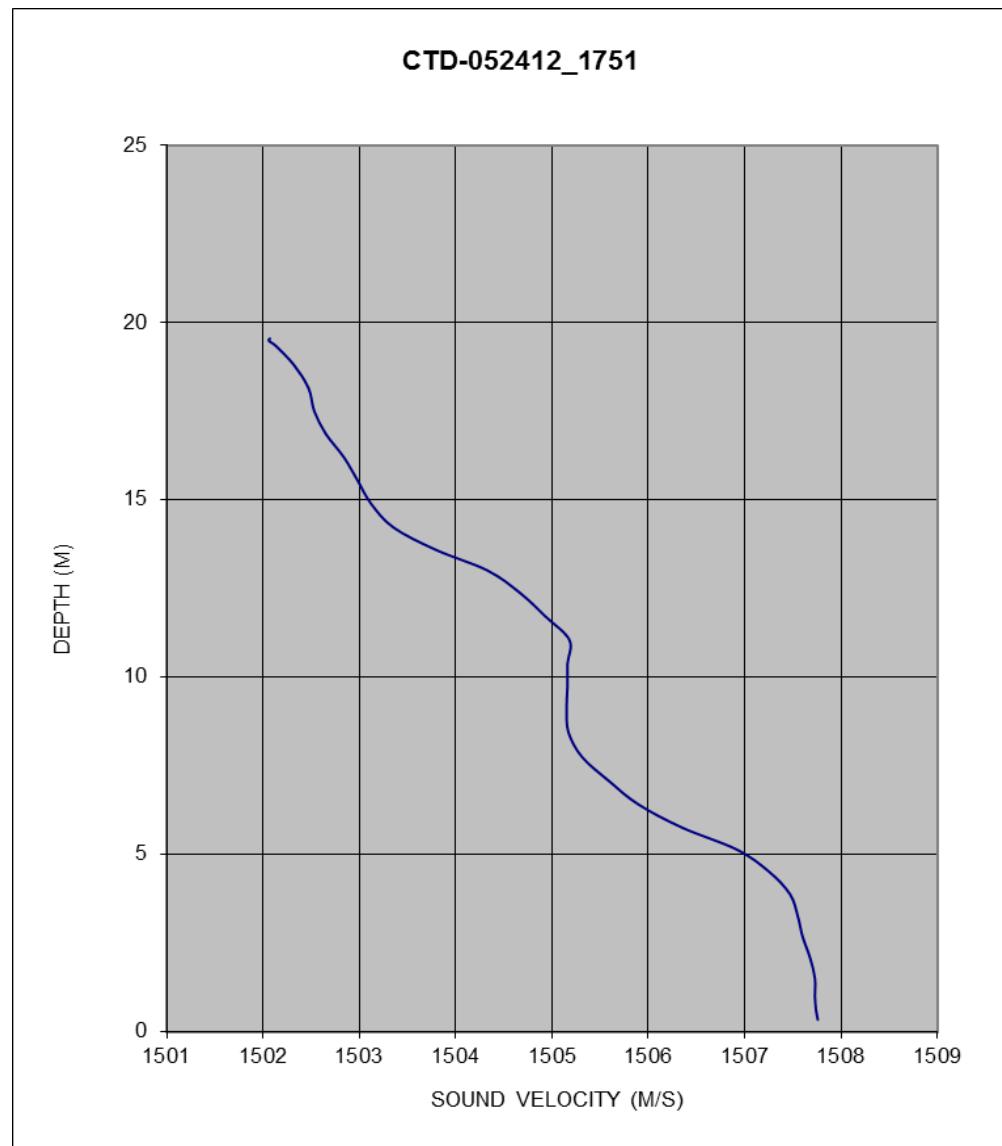


Figure 3.2-13
SVP 052412_1914 taken during the Spring 2012 multibeam survey at the HARS

1507.35 0.214

CTD PROFILE # 052412_1914

1507.25 0.513

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude	
		Easting	Northing	Feet	N	W	
1507.14	05/24/12	17:51	1014477	79118	68	40 23 1.6218	73 53 29.4055

1507.14 2.585

1507.13 3.152

1507.12 3.749

1507.17 4.396

1507.27 5.061

1507.28 5.738

1507.12 6.398

1506.88 7.043

1506.65 7.728

1506.5 8.423

1506.33 9.128

1505.89 9.827

1505.34 10.5

1504.86 11.18

1504.2 11.86

1503.41 12.54

1502.71 13.2

1502.26 13.87

1502.04 14.54

1501.92 15.22

1501.83 15.9

1501.75 16.58

1501.69 17.29

1501.58 18.01

1501.38 18.74

1501.2 19.46

1501 20.16

1500.66 20.74

1500.3 20.86

1500.22 20.87

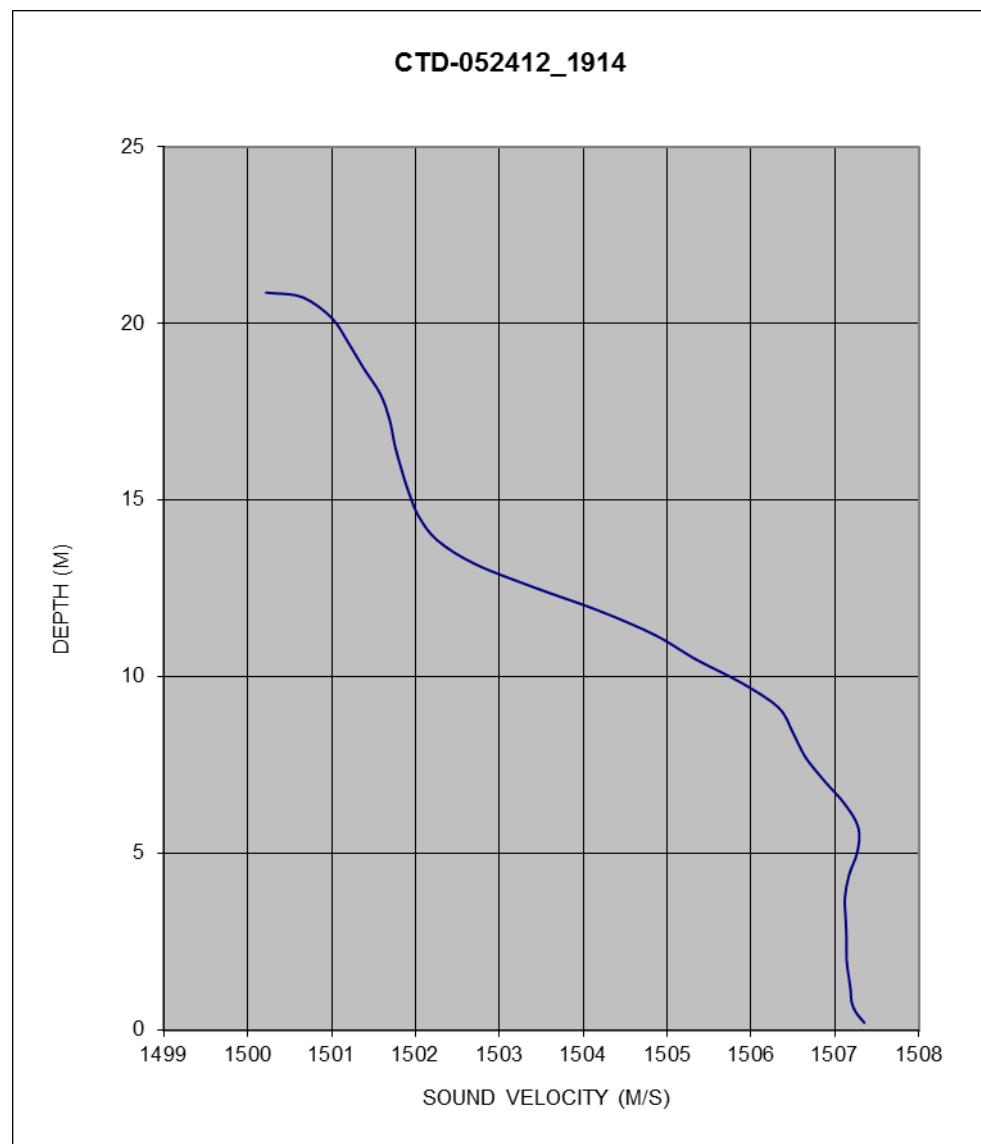


Figure 3.2-14
SVP 052512_1348 taken during the Spring 2012 multibeam survey at the HARS

1508.26 0.187
 1508.16 0.467

CTD PROFILE # 052512_1348

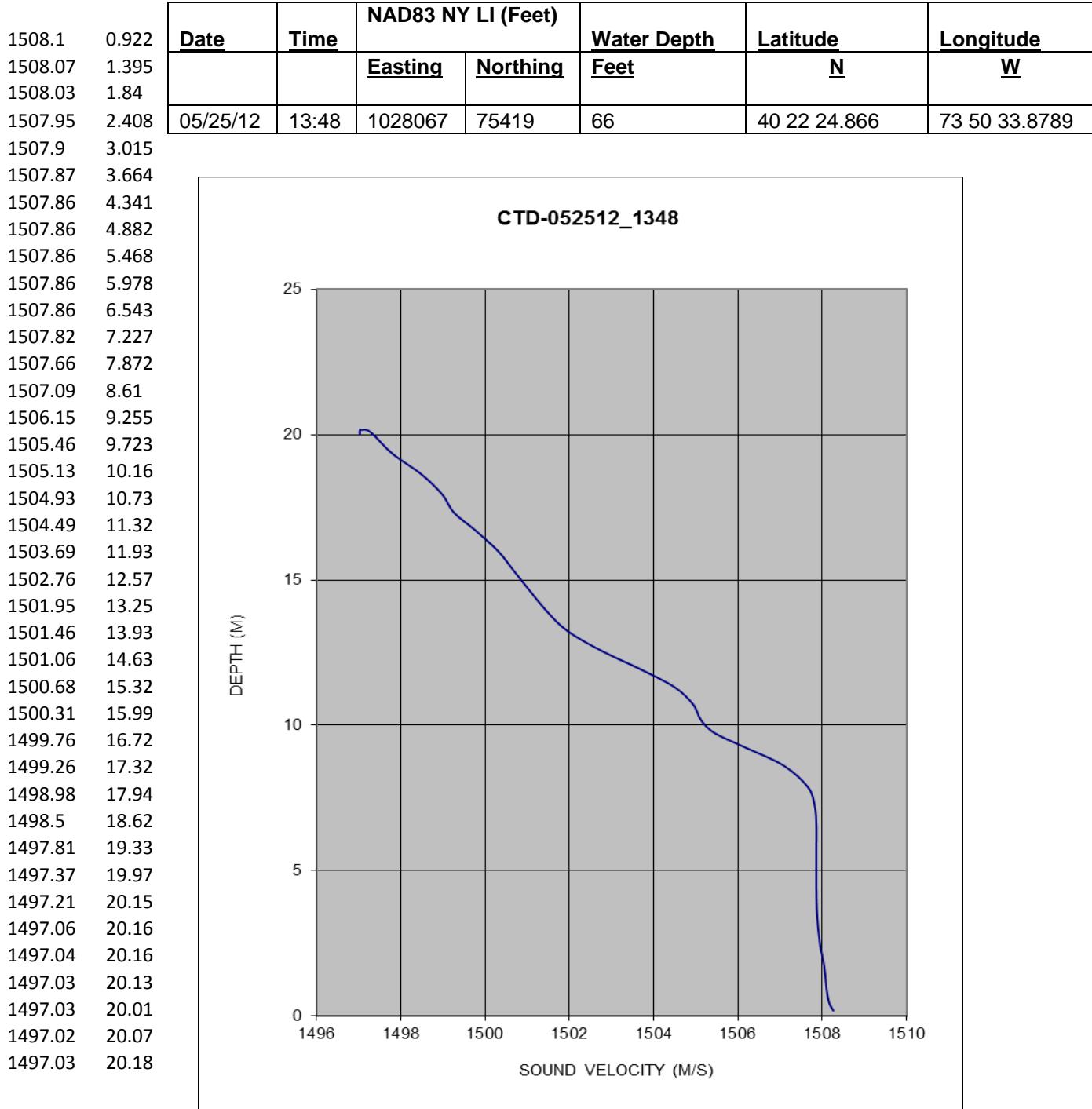


Figure 3.2-15
SVP 052512_1601 taken during the Spring 2012 multibeam survey at the HARS

1508.91 0.23
1508.87 0.407

CTD PROFILE # 052512_1601

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude		
		Easting	Northing	Feet	N	W		
1508.78	0.666							
1508.73	1.032							
1508.68	1.418							
1508.62	1.757	05/25/12	13:48	1025616	69547	77	40 21 26.8833	73 51 5.6707
1508.52	2.097							
1508.42	2.475							
1508.37	2.924							
1508.33	3.393							
1508.3	3.894							
1508.25	4.5							
1508.19	5.135							
1508.11	5.755							
1508.02	6.436							
1507.98	7.132							
1507.98	7.819							
1507.98	8.526							
1507.97	9.228							
1507.97	9.897							
1507.95	10.62							
1507.87	11.35							
1507.71	12.06							
1507.02	12.78							
1505.71	13.52							
1504.71	14.27							
1504.22	15.03							
1503.38	15.77							
1502.06	16.5							
1500.97	17.24							
1500	17.94							
1499.39	18.63							
1498.74	19.37							
1498.09	20.1							
1497.55	20.74							
1497.18	21.37							
1497.02	21.97							
1496.94	22.65							
1496.86	23.23							
1496.79	23.31							
1496.79	23.31							
1496.82	23.31							

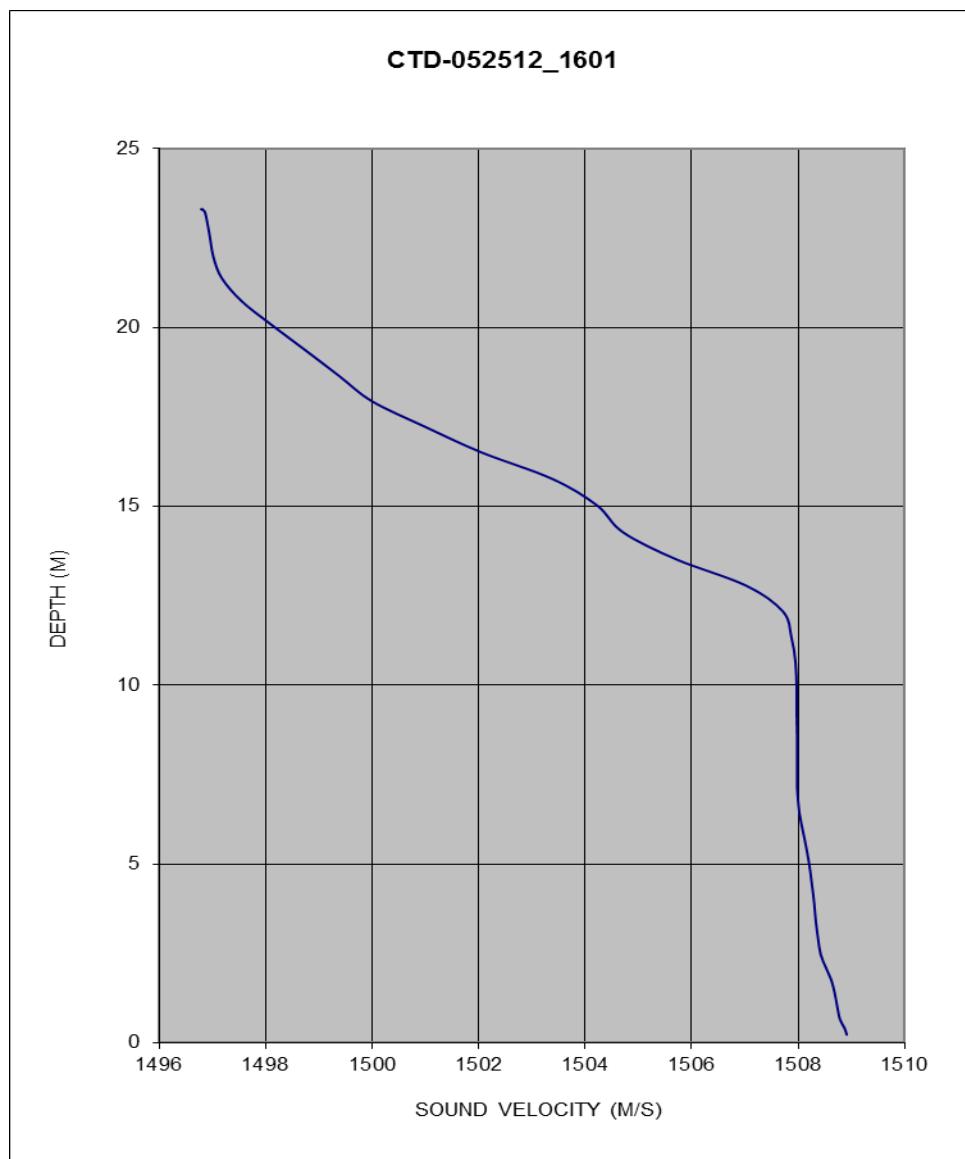


Figure 3.2-16
SVP 052512_1748 taken during the Spring 2012 multibeam survey at the HARS

1510.94 0.006
1510.27 0.341

CTD PROFILE # 052512_1748

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
		Easting	Northing	Feet	N	W
1509.84	0.714					
1509.58	1.179					
1509.39	1.639					
1509.21	2.052	05/25/12	17:48	1023973	75351	72
1509.04	2.478				40 22 24.2599	73 51 26.7807
1508.88	3					
1508.68	3.584					
1508.53	4.209					
1508.4	4.855					
1508.32	5.472					
1508.27	6.086					
1508.24	6.709					
1508.23	7.205					
1508.22	7.631					
1508.16	8.185					
1508.1	8.821					
1508.06	9.47					
1508.01	10.11					
1507.83	10.76					
1507.31	11.43					
1506.32	12.06					
1505.2	12.66					
1504.34	13.28					
1503.87	13.88					
1503.11	14.51					
1501.87	15.16					
1500.83	15.82					
1500.28	16.45					
1500.05	17.07					
1499.9	17.62					
1499.77	18.15					
1499.62	18.69					
1499.53	19.28					
1499.51	19.87					
1499.49	20.37					
1499.49	20.9					
1499.5	21.47					
1499.52	21.97					
1499.53	22.05					

CTD-052512_1748

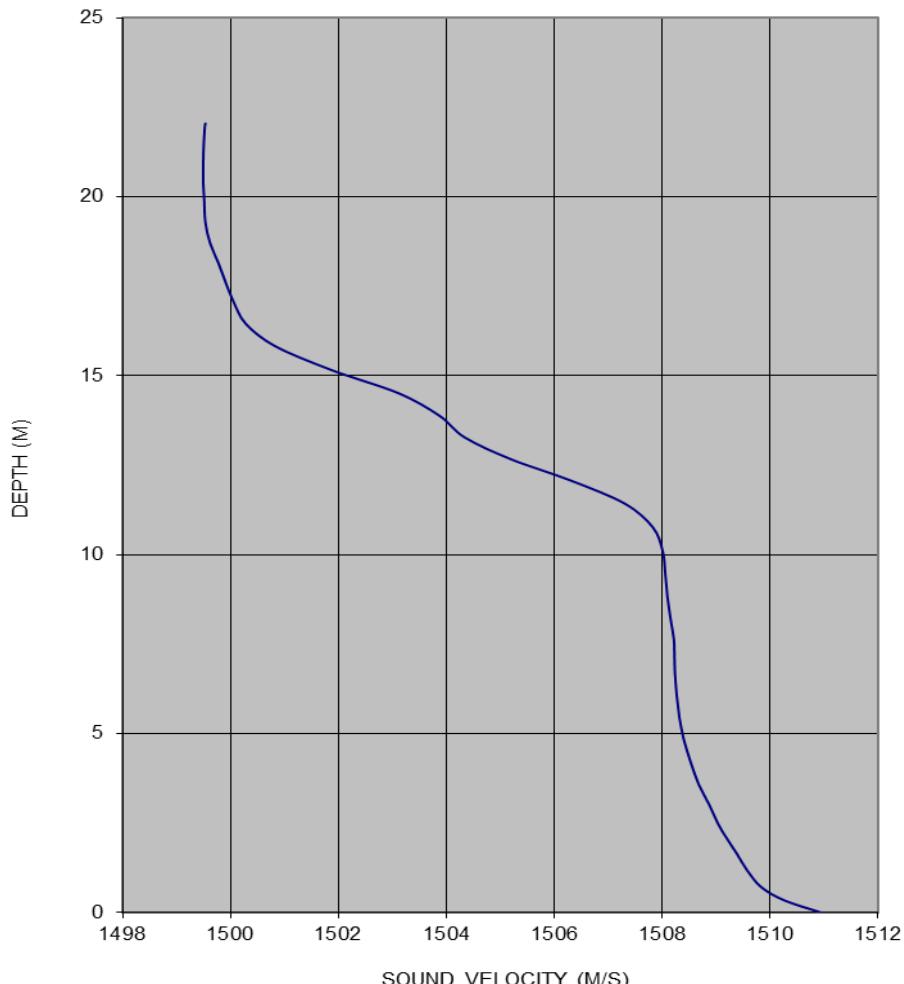


Figure 3.2-17
SVP 052512_1933 taken during the Spring 2012 multibeam survey at the HARS

1510.89	0.13
1511.07	0.177
1510.81	0.458
1510.02	0.888
1509.4	1.339
1508.9	1.85
1508.56	2.499
1508.38	3.181
1508.29	3.859
1508.22	4.568
1508.17	5.302
1508.14	6.043
1508.13	6.773
1508.08	7.298
1507.96	7.664
1507.43	8.137
1505.98	8.703
1504.36	9.253
1503.55	9.845
1503.08	10.55
1502.75	11.26
1502.54	11.96
1502.32	12.69
1502.15	13.4
1502.07	14.12
1501.89	14.9
1501.61	15.64
1501.34	16.38
1501.13	17.11
1500.91	17.87
1500.6	18.62
1500.28	19.33
1500.13	20.04
1500.07	20.78
1500.05	21.3
1500.05	21.35
1500.07	21.37
1500.09	21.39
1500.09	21.4
1500.1	21.41

CTD PROFILE # 052512_1933

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
Date	Time	Easting	Northing	Feet	N	W
05/25/12	19:33	1021499	69569	70	40 21 27.1679	73 51 58.8496

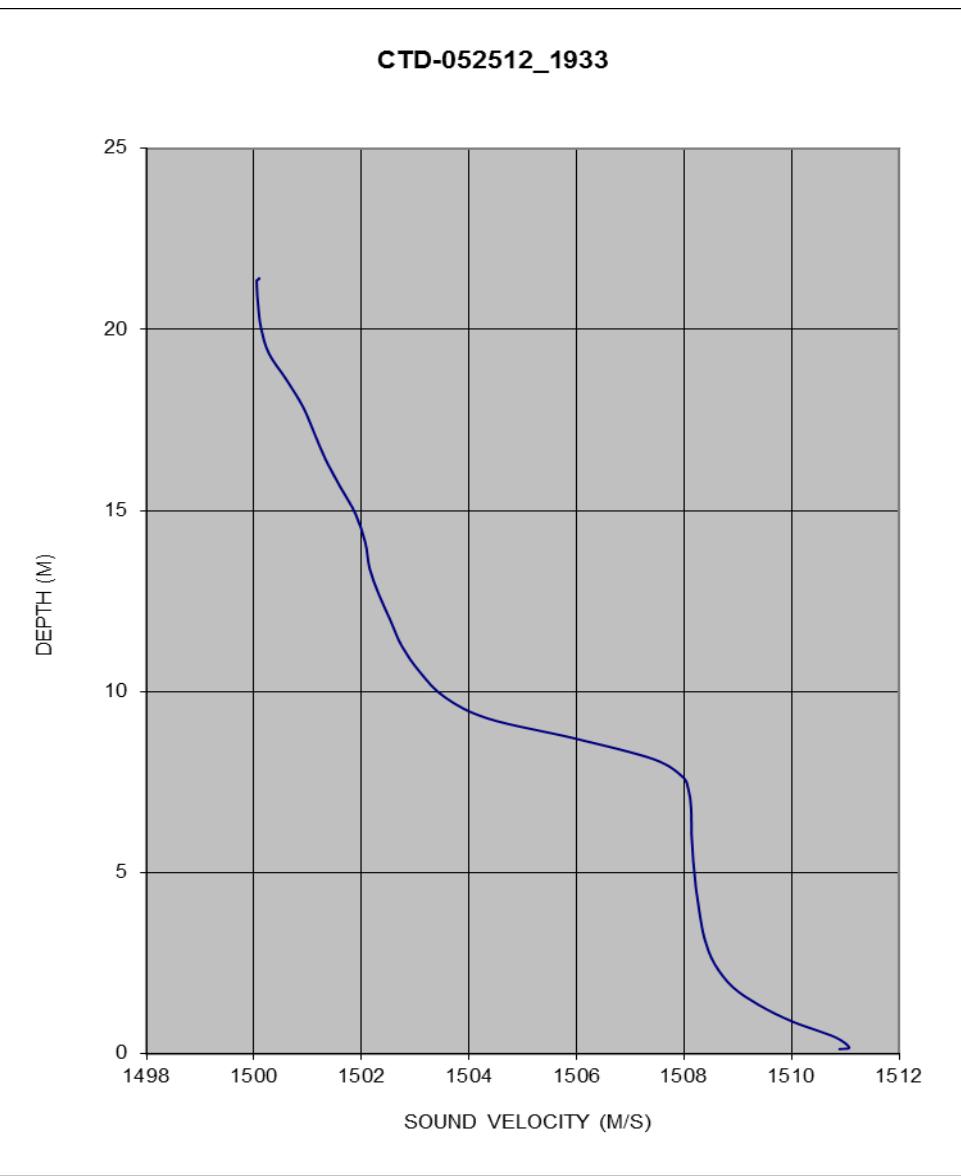


Figure 3.2-18
SVP 052912_1453 taken during the Spring 2012 multibeam survey at the HARS

1513.81	0.059
1513.39	0.483
1512.95	0.898
1512.15	1.281
1511.76	1.83
1511.79	2.384
1512.48	2.868
1512.3	3.326
1512.49	3.86
1512.97	4.517
1513.02	4.943
1511.95	5.443
1511.09	6.006
1509.83	6.47
1508.93	7.07
1508.23	7.62
1507.87	8.154
1507.76	8.799
1507.71	9.458
1507.62	9.999
1507.54	10.6
1507.39	11.19
1506.95	11.64
1506.16	12.21
1505.21	12.76
1504.67	13.3
1504.4	13.77
1504.26	14.26
1504.15	14.88
1504.04	15.44
1503.56	16.01
1502.73	16.64
1502.25	17.24
1502.02	17.63
1501.82	18.13
1501.5	18.79
1501	19.45
1500.07	20.14
1499.05	20.78
1498.02	21.22
1497.25	21.69
1496.69	22.26
1496.37	22.74
1496.21	23.16
1496.11	23.25
1496.14	23.26
1496.22	23.27

CTD PROFILE # 052912_1453

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
		Easting	Northing	Feet	N	W
05/29/12	14:53	1021479	75044	70	40 22 21.2651	73 51 59

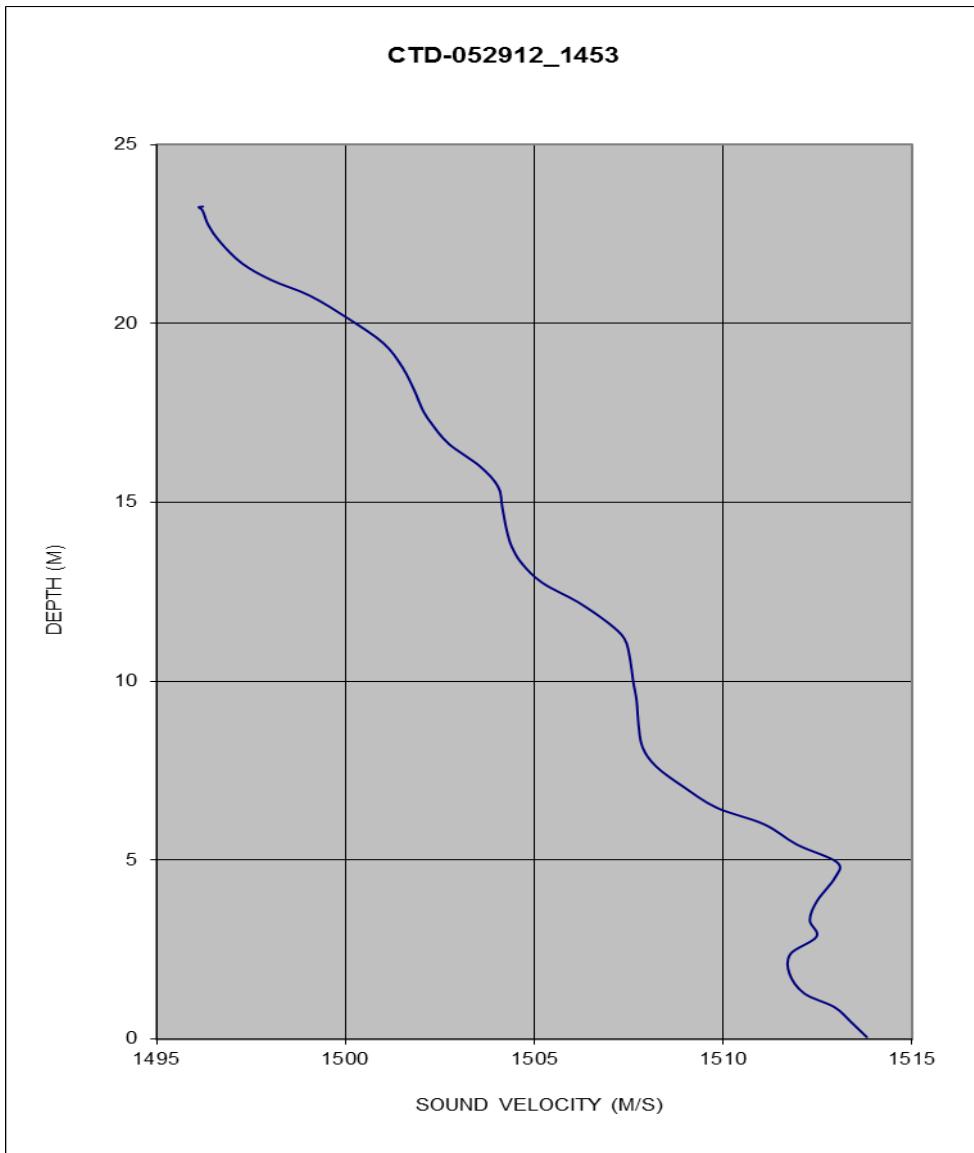


Figure 3.2-19
SVP 052912_1658 taken during the Spring 2012 multibeam survey at the HARS

1515.23	0.219
1515.2	0.788
1513.54	1.316
1512.42	1.687
1512.32	2.057
1512.97	2.498
1513.58	3.09
1514.24	3.649
1514.05	4.063
1513.47	4.602
1512.55	5.168
1511.75	5.666
1511.02	6.181
1510.3	6.68
1509.62	7.243
1509.15	7.798
1508.85	8.347
1508.62	8.943
1508.25	9.453
1507.9	9.996
1507.6	10.6
1507.36	11.16
1507.15	11.69
1506.97	12.26
1506.76	12.8
1506.13	13.33
1504.64	13.93
1502.6	14.57
1501.31	15.2
1500.75	15.77
1500.36	16.34
1500.12	16.92
1499.56	17.54
1498.59	18.16
1497.85	18.77
1497.56	19.39
1497.36	20
1496.83	20.6
1496.08	20.84

CTD PROFILE # 052912_1658

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
		Easting	Northing	Feet	N	W
1512.97	2.498	05/29/12	16:58	1019703	69596	73 52 22.0506

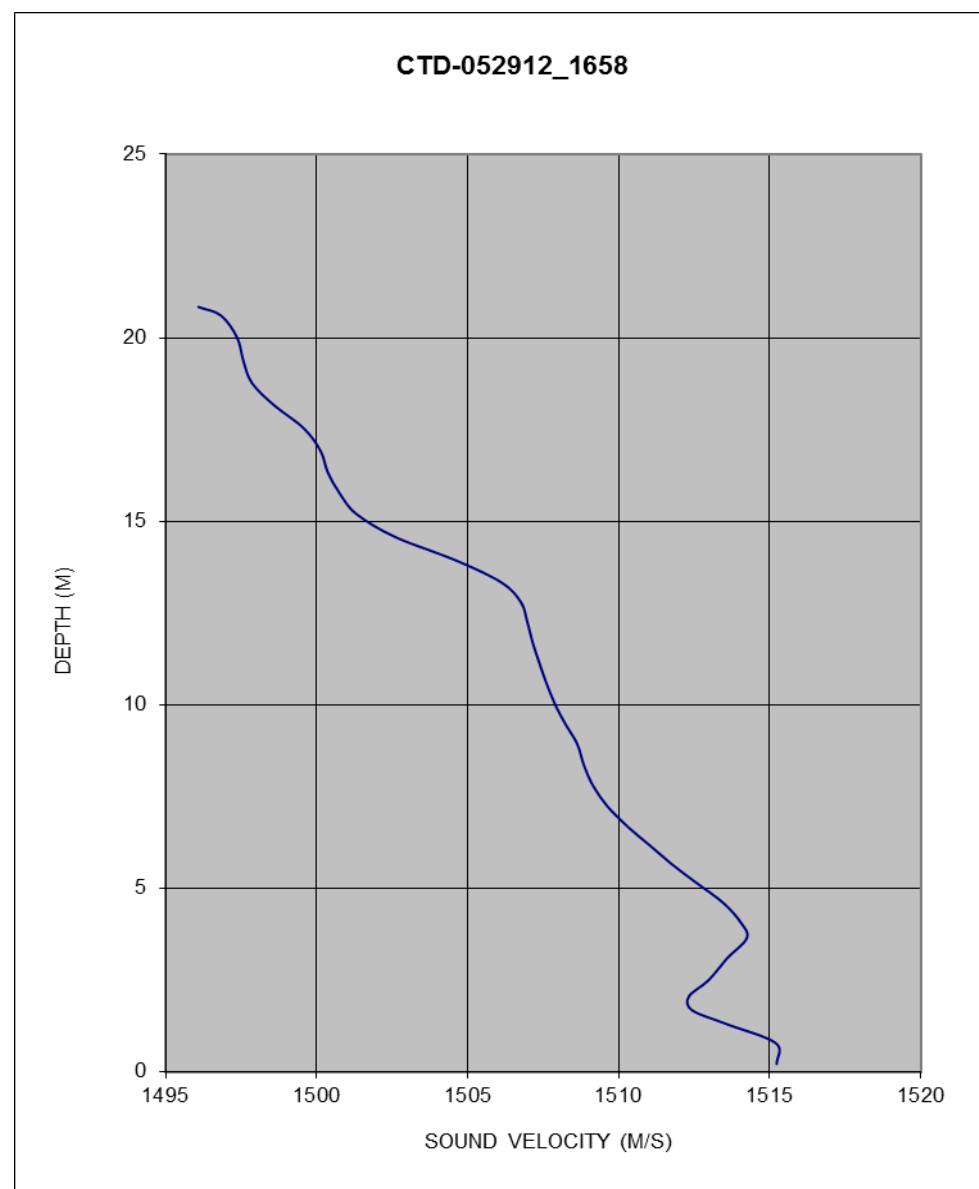


Figure 3.2-20
SVP 052912_1809 taken during the Spring 2012 multibeam survey at the HARS

1514.05 0.298

CTD PROFILE # 052912_1809

1514.01 0.921

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude		
		Easting	Northing	Feet	N	W		
1513.19	1.561	05/29/12	18:09	1018742	75586	73	40 22 26.6649	73 52 34.3548

1513.18 4.015

1512.9 4.693

1511.86 5.291

1510.93 5.902

1510.45 6.553

1510.28 7.203

1510.4 7.879

1510.43 8.544

1510.3 9.213

1509.88 9.88

1508.93 10.53

1507.81 11.21

1507.09 11.89

1506.61 12.58

1505.73 13.28

1504.29 13.95

1502.58 14.63

1501.68 15.31

1501.22 15.99

1500.55 16.67

1499.45 17.35

1498.25 18.03

1497.3 18.71

1496.64 19.39

1496.2 20.07

1495.87 20.75

1495.68 21.42

1495.55 22.06

1495.45 22.7

1495.4 23.16

1495.37 23.21

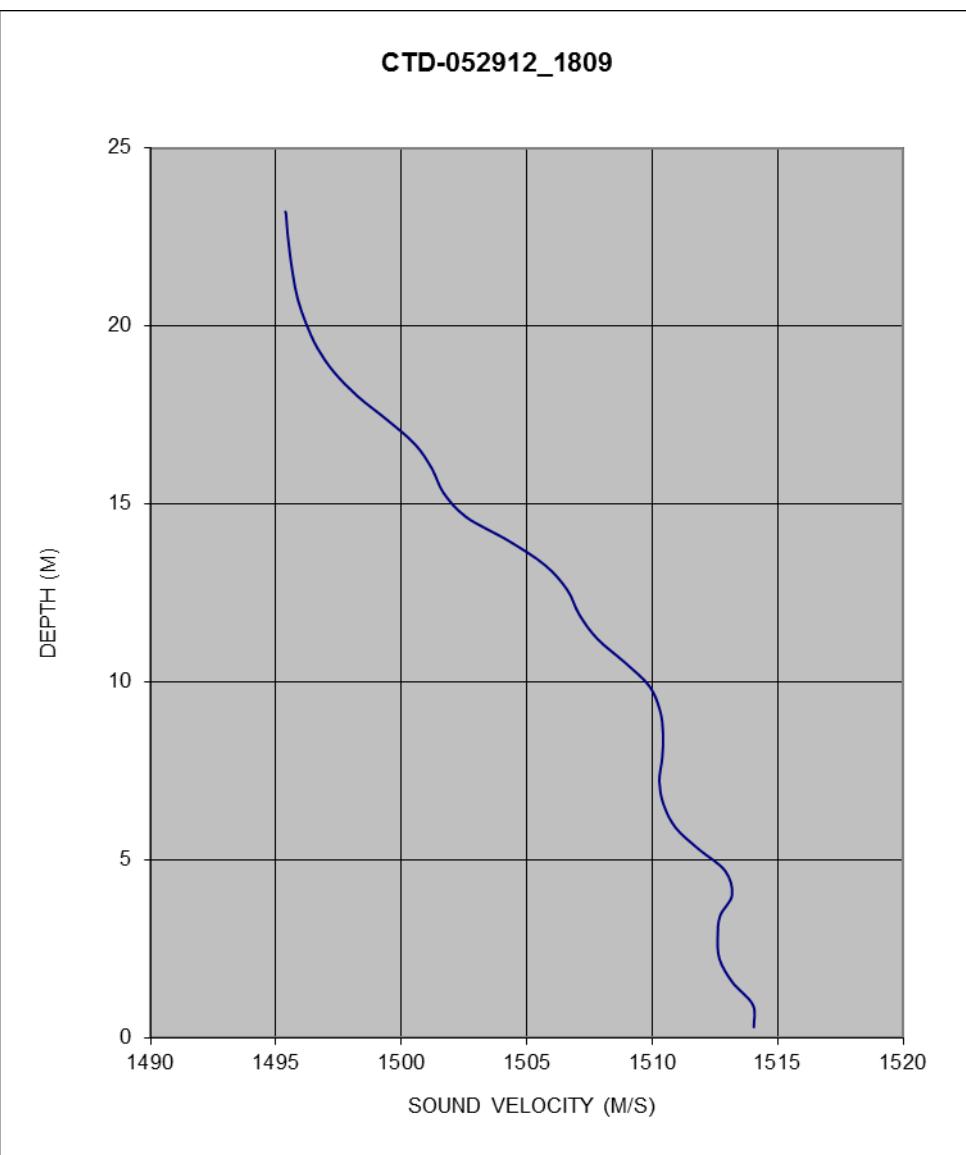


Figure 3.2-21
SVP 060712_1259 taken during the Spring 2012 multibeam survey at the HARS

1510.34	0.055
1510.03	0.418
1509.83	1.762
1509.87	2.323
1509.97	2.906
1510.15	3.52
1510.41	4.112
1510.48	4.722
1510.51	5.348
1510.32	5.938
1510.05	6.562
1509.83	7.186
1509.67	7.784
1509.46	8.256
1509.19	9.124
1508.99	9.54
1508.86	9.977
1508.77	10.48
1508.7	10.84
1508.63	11.75
1508.58	12.11
1508.6	12.56
1508.46	13.32
1508.3	13.81
1508.17	14.1
1507.89	14.87
1507.78	15.36
1507.7	15.77
1507.61	16.69
1507.48	17.04
1506.75	17.74
1506.08	18.17
1505.7	18.47
1505.41	18.82
1505.16	19.25
1504.84	19.51
1504.62	19.81
1504.51	20.29
1504.42	20.72
1504.34	21.53
1504.33	21.91
1504.33	22.27
1504.35	22.71
1504.4	23.21
1504.44	23.6

CTD PROFILE # 060712_1259



Figure 3.2-22
SVP 060712_1519 taken during the Spring 2012 multibeam survey at the HARS

1510.17 0.238

CTD PROFILE # 060712_1519

1509.87 0.585

1509.66 0.982

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
Date	Time	Easting	Northing	Feet	N	W
06/07/12	15:19	1016924	69537	65	40 21 26.9108	73 52 57.953

1509.81 2.891

1509.99 3.352

1510.2 3.922

1510.29 4.281

1510.48 4.696

1510.59 5.314

1510.52 5.924

1510.44 6.556

1510.35 7.165

1510.15 7.807

1509.81 8.469

1509.47 9.13

1509.24 9.813

1509.16 10.43

1509.16 10.98

1509.14 11.52

1509.12 12.13

1508.99 12.7

1508.75 13.19

1508.5 13.78

1508.27 14.38

1508.11 14.98

1507.78 15.6

1507.1 16.25

1506.41 16.9

1505.97 17.53

1505.6 18.19

1505.39 18.86

1505.28 19.52

1505.23 19.79

1505.22 19.81

1505.23 19.82

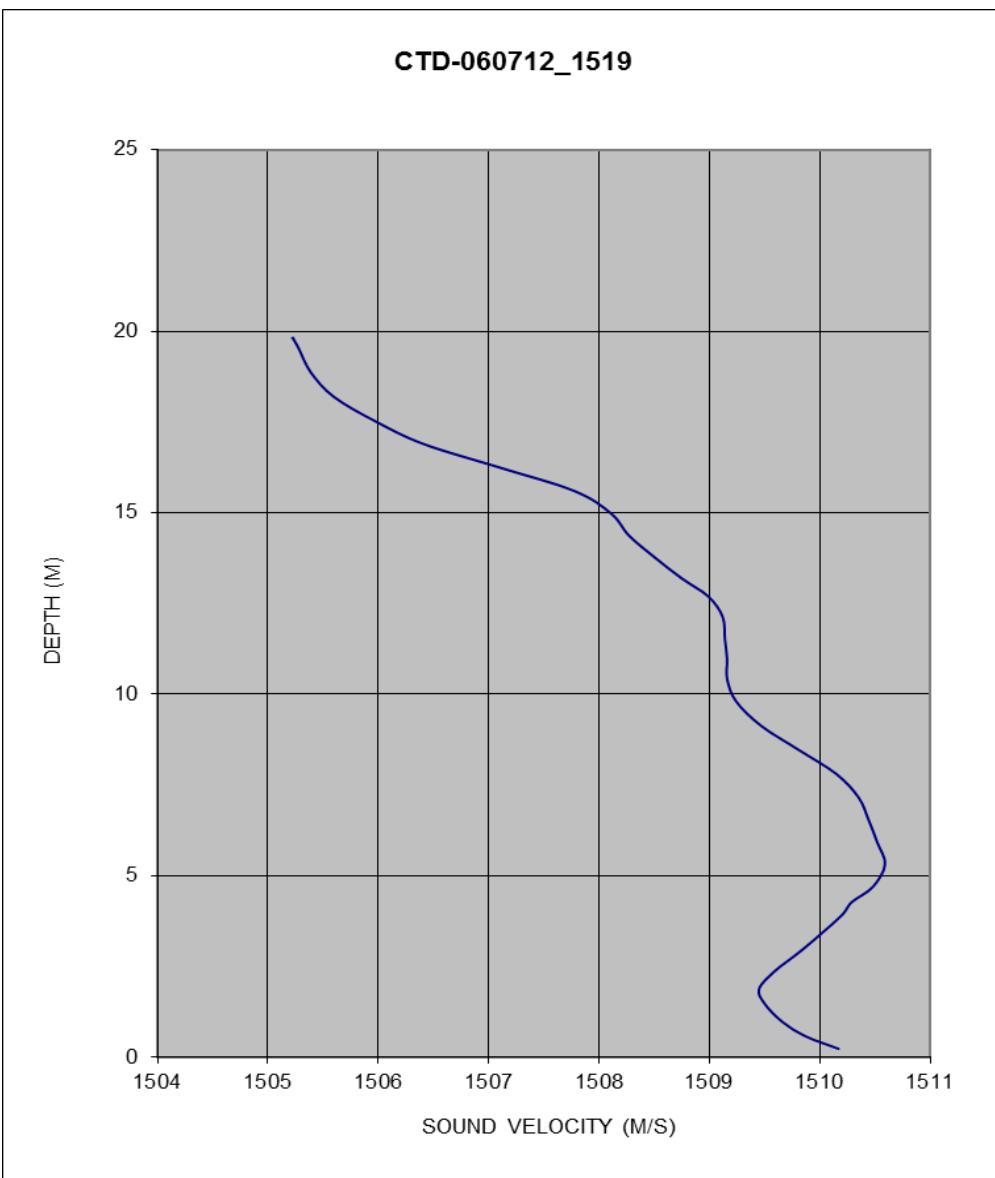


Figure 3.2-23
SVP 060712_1715 taken during the Spring 2012 multibeam survey at the HARS

1512.02 0.172
1511.72 0.615

CTD PROFILE # 060712 1715

Date	Time	NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
		Easting	Northing	Feet	N	W
06/07/12	17:15	1014477	75349	73	40 22 24.3707	73 53 29.4679

1510.11 3.824
1510.3 4.497
1510.32 5.126
1510.36 5.753
1510.38 6.336
1510.62 6.872
1510.62 7.455
1510.59 8.07
1510.52 8.691
1510.5 9.297
1510.49 9.901
1510.47 10.48
1510.36 11.07
1510.12 11.66
1509.84 12.27
1509.46 12.9
1509.16 13.51
1509.06 14.1
1509.02 14.67
1508.71 15.27
1508.28 15.86
1507.94 16.45
1507.54 16.98
1507.19 17.52
1507 18.08
1506.76 18.66
1506.45 19.24
1506.15 19.82
1505.85 20.4
1505.69 20.97
1505.65 21.5
1505.64 21.6
1505.66 21.61
1505.67 21.63
1505.68 21.65
1505.68 21.67
1505.69 21.68

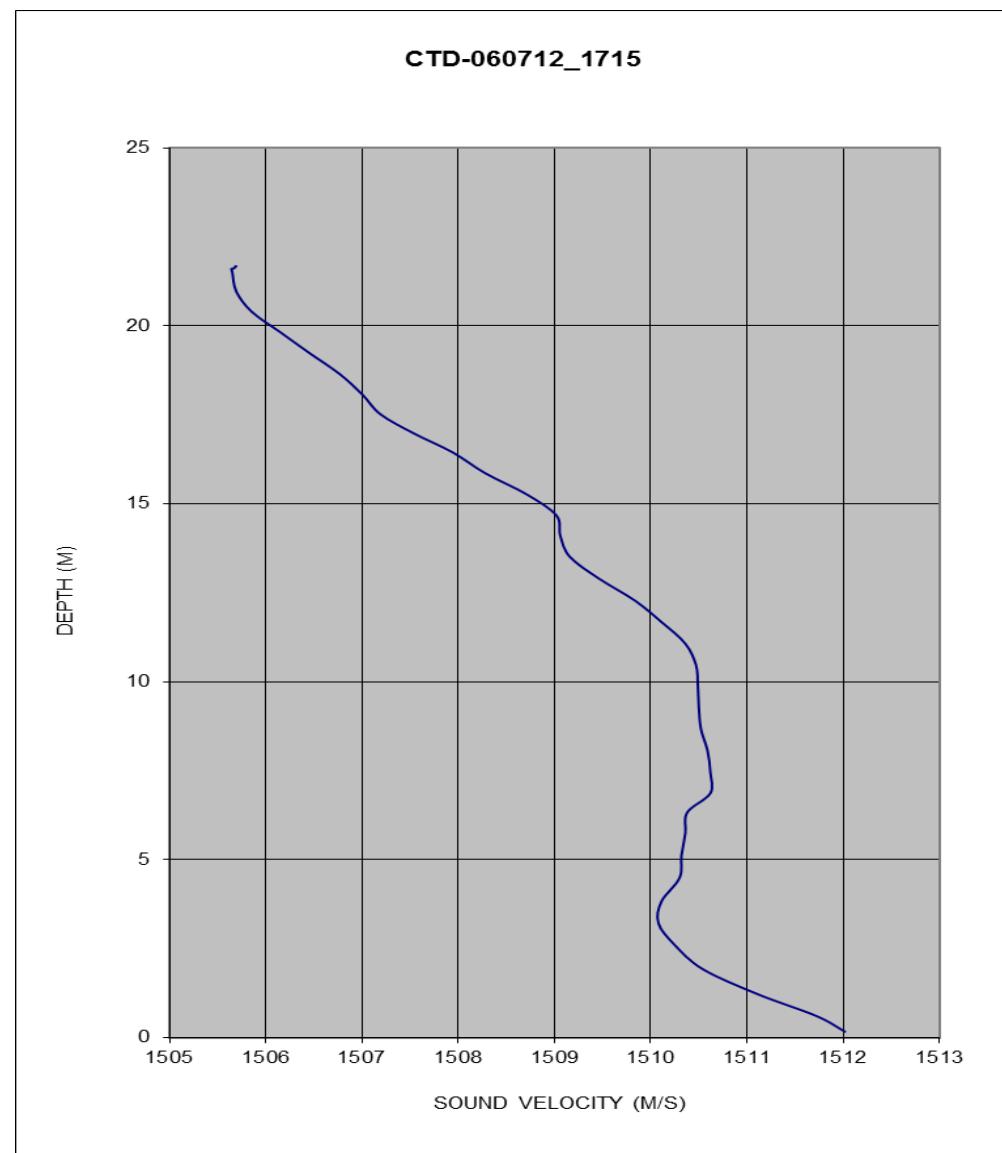


Figure 3.2-24
SVP 060712_1849 taken during the Spring 2012 multibeam survey at the HARS

1512.43 0.159

CTD PROFILE # 060712_1849

1512.29 0.771

1511.89 1.45

		NAD83 NY LI (Feet)		Water Depth	Latitude	Longitude
Date	Time	Easting	Northing	Feet	N	W
1511.55 2.105						
1511.02 2.772						
1510.55 3.469	06/07/12	18:49	1014787	70124	70	40 21 32.7423 73 53 25.5408

1510.33 4.167

1510.44 4.825

1510.66 5.516

1510.77 6.214

1510.86 6.864

1510.83 7.478

1510.64 8.155

1510.49 8.842

1510.32 9.55

1510 10.23

1509.66 10.92

1509.37 11.61

1509.2 12.3

1508.99 12.99

1508.73 13.69

1508.33 14.39

1508.02 15.1

1507.86 15.8

1507.77 16.48

1507.73 17.17

1507.72 17.86

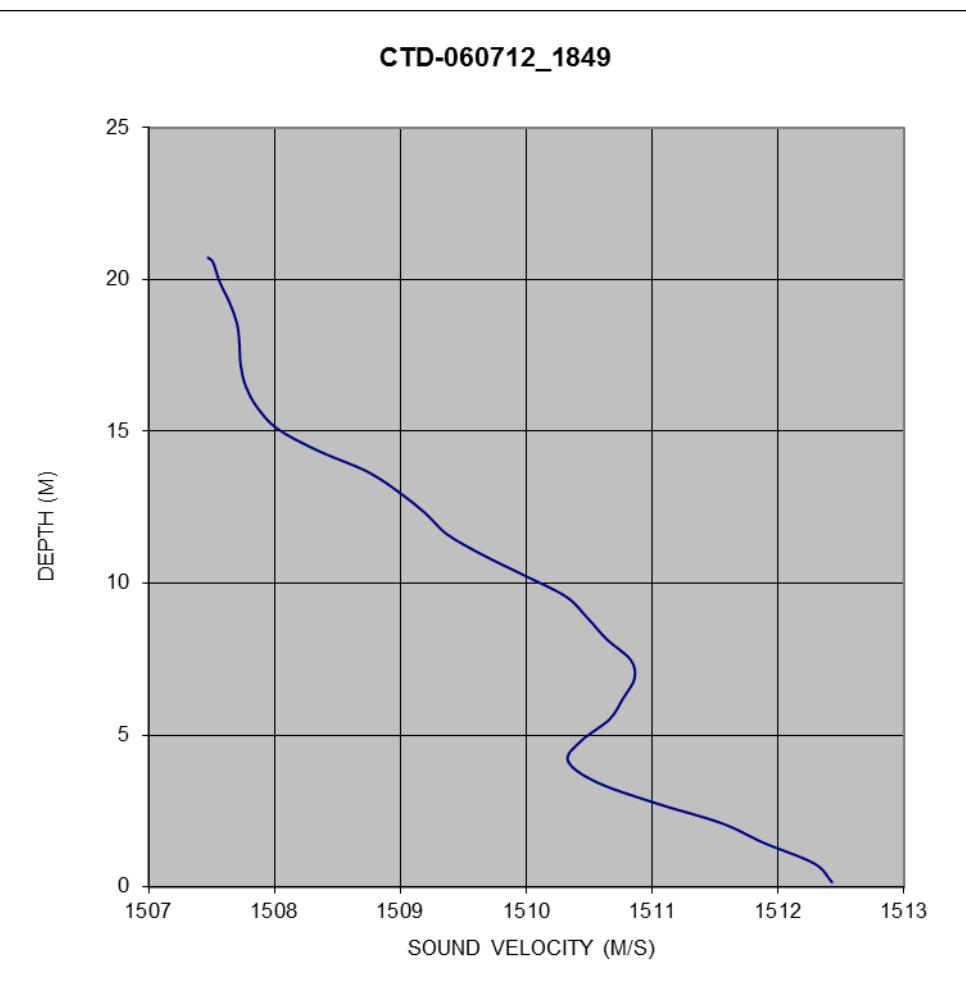
1507.7 18.56

1507.64 19.26

1507.56 19.95

1507.51 20.57

1507.47 20.72



4.0 Tidal Corrections

For the 2012 bathymetry survey the “Valeport Midas WLR” submersible tide gauge was deployed prior to collection of multibeam data at the HARS. This gauge which measures pressure was located on the sea floor attached to an anchor with an additional attachment to an acoustic release buoy (see Figure 3.0-1).

For the Spring 2012 bathymetry survey Real Time Kinematic GPS (RTK) option of the POS/MV on board the survey vessel was used at the start of each survey day to provide calibration water level measurements to apply to the submersible tide gauge readings during post processing. These RTK GPS water level calibration readings were collected for approximately five minutes each day with the survey vessel in the immediate vicinity above the submersible gauge. During post processing these readings were averaged to remove wave and swell action to provide the six calibration readings. With atmospheric pressure removed from the submersible data calculation, and the water column densities produced from the numerous velocity profiles taken during the survey substituted for the standard density used in the calculation, the RTK GPS readings were compared to the submersible data, and a mean adjustment applied to the submersible data to provide the final daily tide files which were applied to the multibeam sounding data to produce the final “XYZ” data set.

With previous surveys at the HARS site, tide data from NOAA’s reference tide station at Sandy Hook (Figure 4.1-1) was downloaded from N.O.A.A.’s web site. This NAVD88 tide data was then referenced to MLW as per the USACOE SOW, (0’ MLW is 1.73’ below 0’ NGVD29 and 2.84’ below NAVD88). Historic range and time correctors (used since 2006) of 0.94 and -30 minutes were then used to correct the Sandy Hook NOAA tide data for the HARS survey area. This data was compared to the corrected submersible tide data and the average difference between the two data sets for the period of surveying activities was 0.11’, with the NOAA adjusted data on average reporting the higher water level. The standard deviation reported was 0.08’. This comparison did not include NOAA tide data from 06/07/12 as the verified NOAA data for this date was not available at the time of the writing of this report.

4.1 Cross-Track Analysis

Cross-track analysis was performed to provide a quality check on the accuracy of the multibeam data. Cross-track lines are run perpendicular to the main direction of survey lines to produce areas of overlapping data that can be analyzed and errors quantified to provide an indication of the overall quality of data.

For the Spring 2012 survey the main body of survey lines were run in a North-South direction and for every ten (10) main body lines a cross-track line was run in an East-West direction. This yielded a total of eighteen (18) cross-track lines, which were then analyzed utilizing the Beam Angle Test module within the Hypack Processing software. The Beam Angle Test compares multibeam check lines to a reference surface and estimates the depth accuracy of the multibeam system at different angle limits. The estimated accuracy can be used to determine if the multibeam system meets survey specifications. In this case the reference surface used was the final 10x10 xyz of the processed main body multibeam data. Results from this analysis are seen in Section 4.1.

4.2 Cross-Track Analysis Results

Table 4.1-1 show the results from the Hypack Beam Analysis for each crossing. The analysis software generates; Max Outlier, Mean Difference, Standard Deviation and 95% Confidence for the beam angle limits specified. The averages for all crossings show that the 95% confidence is less than 0.83', while the mean difference for all crossings averages out to less than 0.07', the standard deviation for all crossings averages out to less than 0.43', and the maximum outlier is 14.6'. Figure 4.1-1 show screen captures of the summary plots for the errors at +/- 60 deg. for each crossing.

Table 4.1-1
Summary of Beam Analysis Results for all crossings during HARS 2012 survey

Crossing	Beam	Max.	Mean	Std	95%	Crossing	Beam	Max.	Mean	Std	95%	Crossing	Beam	Max.	Mean	Std	95%
	Angle	Outlier	Diff.	Dev.		Angle	Outlier	Diff.	Dev.		Angle	Outlier	Diff.	Dev.		Angle	
0517_1417	+/-20	2.33	-0.05	0.33	0.65	0517_1624	+/-20	4.46	-0.01	0.39	0.76	0517_1733	+/-20	1.64	-0.05	0.19	0.38
	+/-25	2.17	-0.06	0.32	0.62		+/-25	3.15	-0.02	0.41	0.81		+/-25	2.26	-0.05	0.17	0.33
	+/-30	2.17	-0.02	0.33	0.64		+/-30	5.21	-0.04	0.47	0.92		+/-30	0.78	-0.04	0.17	0.32
	+/-35	2.36	-0.05	0.32	0.63		+/-35	6.30	-0.03	0.47	0.92		+/-35	0.85	-0.04	0.17	0.33
	+/-40	2.85	-0.01	0.31	0.60		+/-40	6.82	-0.06	0.50	0.99		+/-40	1.37	-0.03	0.15	0.29
	+/-45	2.79	-0.01	0.32	0.62		+/-45	7.12	-0.07	0.46	0.91		+/-45	3.51	-0.04	0.19	0.37
	+/-50	2.33	0.01	0.25	0.48		+/-50	4.20	-0.10	0.49	0.96		+/-50	3.21	-0.03	0.19	0.36
	+/-55	3.47	0.02	0.25	0.49		+/-55	5.02	-0.12	0.53	1.03		+/-55	3.71	-0.03	0.20	0.40
	+/-60	2.82	0.08	0.27	0.53		+/-60	5.54	-0.12	0.59	1.15		+/-60	3.05	-0.03	0.22	0.42
0518_1214	+/-20	2.04	-0.09	0.21	0.41	0518_1353	+/-20	1.94	-0.05	0.21	0.40	0518_1421	+/-20	2.86	-0.04	0.29	0.56
	+/-25	2.20	-0.09	0.19	0.37		+/-25	2.24	-0.06	0.21	0.42		+/-25	3.02	-0.05	0.32	0.62
	+/-30	2.20	-0.08	0.18	0.36		+/-30	2.26	-0.06	0.22	0.43		+/-30	3.15	-0.06	0.38	0.75
	+/-35	2.07	-0.08	0.18	0.34		+/-35	3.15	-0.07	0.23	0.44		+/-35	3.15	-0.02	0.36	0.70
	+/-40	2.46	-0.09	0.17	0.34		+/-40	2.36	-0.06	0.21	0.40		+/-40	3.18	0.01	0.35	0.69
	+/-45	1.54	-0.08	0.18	0.34		+/-45	2.46	-0.05	0.19	0.37		+/-45	4.01	0.03	0.38	0.75
	+/-50	1.54	-0.07	0.17	0.34		+/-50	3.51	-0.07	0.18	0.36		+/-50	4.10	0.02	0.35	0.69
	+/-55	2.95	-0.07	0.19	0.38		+/-55	4.37	-0.05	0.19	0.37		+/-55	3.77	0.02	0.43	0.84
	+/-60	6.40	-0.05	0.20	0.39		+/-60	3.48	-0.04	0.25	0.48		+/-60	2.79	0.09	0.48	0.94
0518_1619	+/-20	4.43	-0.08	0.24	0.48	0524_1146	+/-20	2.01	-0.08	0.21	0.41	0524_1342	+/-20	5.38	-0.09	0.77	1.51
	+/-25	4.56	-0.09	0.27	0.53		+/-25	2.00	-0.06	0.24	0.47		+/-25	5.19	-0.02	0.80	1.56
	+/-30	4.40	-0.08	0.38	0.74		+/-30	3.64	-0.03	0.28	0.55		+/-30	11.71	-0.03	0.75	1.47
	+/-35	3.94	-0.06	0.27	0.54		+/-35	3.77	-0.01	0.31	0.60		+/-35	5.75	-0.03	0.73	1.43
	+/-40	3.35	-0.03	0.30	0.58		+/-40	4.10	0.01	0.29	0.57		+/-40	13.22	-0.02	0.79	1.55
	+/-45	4.20	0.04	0.39	0.77		+/-45	3.91	0.04	0.31	0.60		+/-45	7.28	-0.01	0.86	1.69
	+/-50	4.36	0.06	0.44	0.87		+/-50	3.06	0.05	0.33	0.65		+/-50	6.63	0.02	0.98	1.91
	+/-55	4.43	0.11	0.49	0.97		+/-55	3.15	0.09	0.33	0.65		+/-55	7.78	0.07	0.87	1.71
	+/-60	4.39	0.17	0.54	1.05		+/-60	3.19	0.13	0.32	0.63		+/-60	6.76	-0.01	0.88	1.73
0524_1508	+/-20	3.18	-0.09	0.28	0.54	0525_1141	+/-20	2.79	-0.03	0.23	0.44	0525_1337	+/-20	4.53	-0.04	0.45	0.88
	+/-25	3.18	-0.12	0.28	0.54		+/-25	1.57	-0.04	0.25	0.48		+/-25	4.60	-0.07	0.43	0.84
	+/-30	3.48	-0.09	0.30	0.58		+/-30	2.20	-0.05	0.25	0.50		+/-30	4.59	-0.07	0.37	0.72
	+/-35	4.52	-0.08	0.32	0.64		+/-35	3.05	-0.04	0.25	0.50		+/-35	3.90	-0.07	0.36	0.70
	+/-40	3.05	-0.10	0.31	0.60		+/-40	3.84	-0.05	0.25	0.50		+/-40	4.16	-0.06	0.36	0.71
	+/-45	5.87	-0.08	0.43	0.85		+/-45	3.90	-0.08	0.34	0.66		+/-45	3.67	-0.05	0.39	0.77
	+/-50	6.62	-0.06	0.44	0.86		+/-50	5.32	-0.11	0.26	0.52		+/-50	7.78	-0.08	0.47	0.92
	+/-55	6.62	-0.10	0.41	0.80		+/-55	9.25	-0.16	0.44	0.87		+/-55	6.86	-0.11	0.43	0.85
	+/-60	5.58	-0.12	0.38	0.74		+/-60	14.60	-0.19	0.79	1.54		+/-60	4.72	-0.10	0.38	0.75
0525_1547	+/-20	4.11	-0.01	0.23	0.45	0529_1148	+/-20	2.43	-0.11	0.43	0.84	0529_1401	+/-20	4.10	-0.02	0.48	0.94
	+/-25	2.53	-0.04	0.22	0.43		+/-25	4.95	-0.08	0.43	0.84		+/-25	4.53	-0.04	0.44	0.87
	+/-30	1.68	-0.04	0.21	0.41		+/-30	4.63	-0.09	0.52	1.02		+/-30	4.92	0.01	0.44	0.87
	+/-35	2.33	-0.07	0.20	0.40		+/-35	4.10	-0.11	0.54	1.05		+/-35	4.99	0.01	0.40	0.78
	+/-40	3.28	-0.05	0.20	0.39		+/-40	3.05	-0.04	0.52	1.02		+/-40	4.43	0.01	0.46	0.89
	+/-45	2.10	-0.08	0.20	0.38		+/-45	5.84	0.01	0.60	1.18		+/-45	5.51	0.04	0.53	1.03
	+/-50	1.84	-0.11	0.18	0.36		+/-50	5.91	0.00	0.80	1.57		+/-50	5.58	0.15	0.62	1.21
	+/-55	1.28	-0.15	0.20	0.39		+/-55	6.30	0.13	0.72	1.40		+/-55	6.27	0.18	0.62	1.21
	+/-60	1.54	-0.19	0.22	0.43		+/-60	4.07	0.21	0.66	1.29		+/-60	9.94	0.29	0.68	1.33
0607_1059	+/-20	6.63	-0.04	0.45	0.87	0607_1305	+/-20	0.92	-0.04	0.16	0.32	0607_1443	+/-20	0.95	-0.04	0.17	0.34
	+/-25	7.41	-0.05	0.48	0.93		+/-25	0.98	-0.03	0.16	0.32		+/-25	1.02	-0.04	0.17	0.33
	+/-30	6.76	-0.03	0.43	0.85		+/-30	0.79	-0.03	0.16	0.31		+/-30	0.98	-0.02	0.17	0.33
	+/-35	5.84	-0.03	0.57	1.11		+/-35	0.72	-0.02	0.16	0.31		+/-35	1.25	0.00	0.17	0.33
	+/-40	6.63	-0.02	0.54	1.06		+/-40	0.79	0.00	0.14	0.28		+/-40	0.88	0.00	0.17	0.32
	+/-45	7.12	-0.04	0.48	0.94		+/-45	1.02	0.03	0.15	0.30		+/-45	1.61	0.03	0.17	0.33
	+/-50	6.56	-0.06	0.48	0.94		+/-50	1.54	0.04	0.14	0.28		+/-50	2.72	0.06	0.18	0.36
	+/-55	6.13	-0.06	0.39	0.77		+/-55	2.95	0.05	0.16	0.32		+/-55	3.34	0.11	0.20	0.39
	+/-60	2.59	-0.03	0.29	0.57		+/-60	1.41	0.08	0.17	0.33		+/-60	1.94	0.17	0.23	0.45

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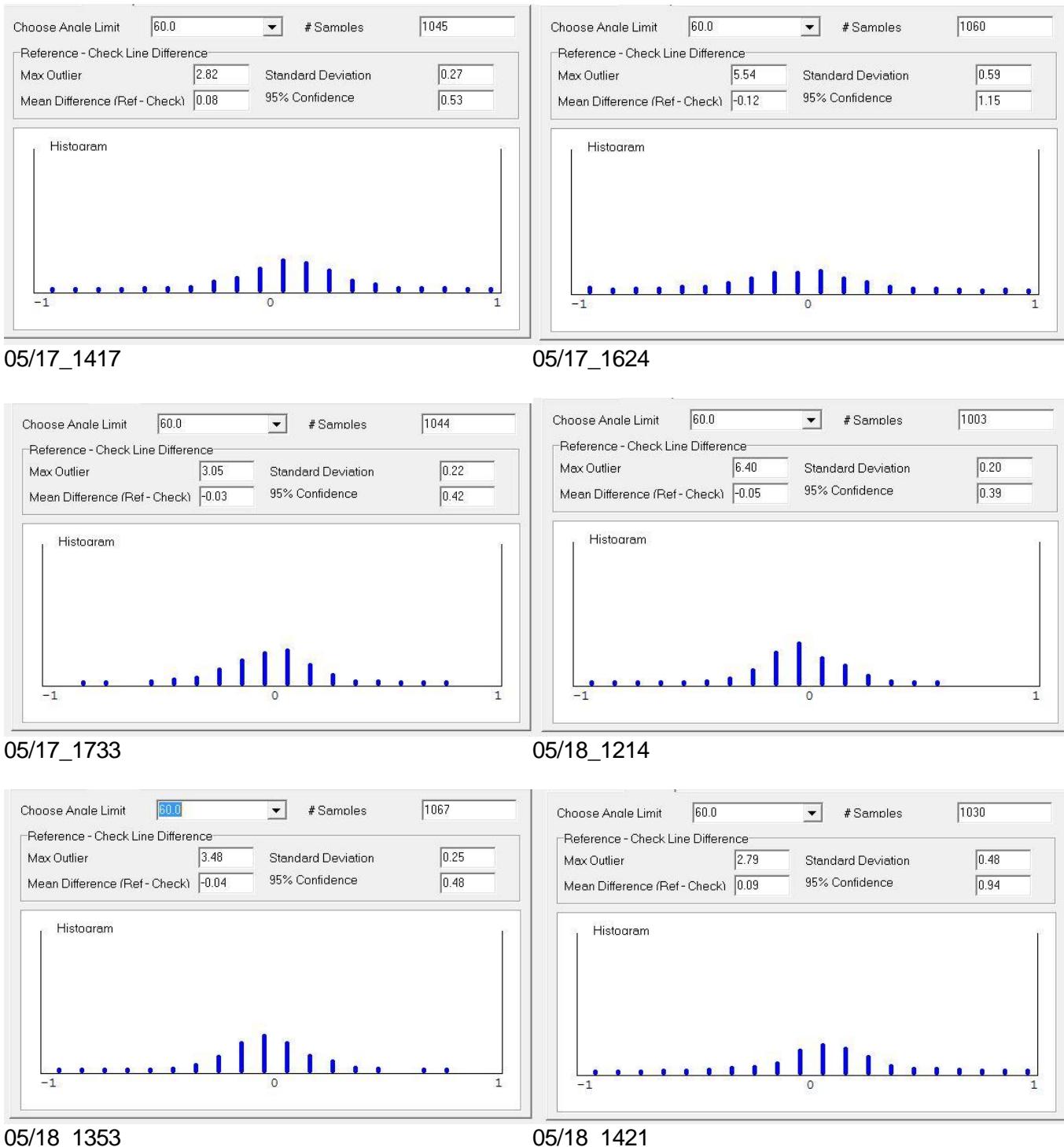
Boundary • Aerial • Topographic • Construction • Hydrographic

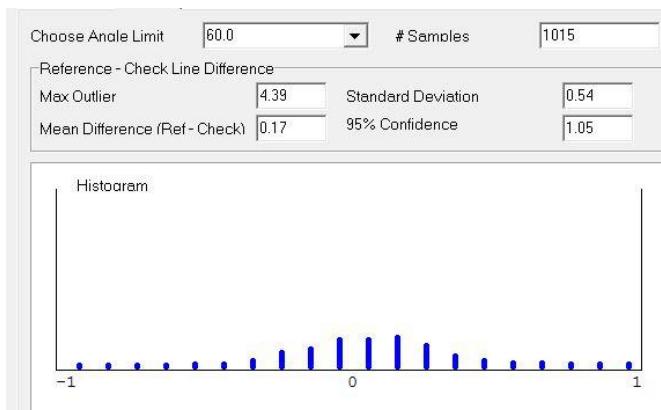
Beam	Max.	Mean	Std	95%
Angle	Outlier	Diff.	Dev.	
+/-20	6.63	-0.05	0.32	0.62
+/-25	7.41	-0.06	0.32	0.63
+/-30	11.71	-0.05	0.33	0.65
+/-35	6.30	-0.04	0.33	0.65
+/-40	13.22	-0.03	0.33	0.65
+/-45	7.28	-0.02	0.37	0.71
+/-50	7.78	-0.02	0.39	0.76
+/-55	9.25	0.00	0.39	0.77
+/-60	14.60	0.02	0.42	0.82

Summary of averages for all crossings.

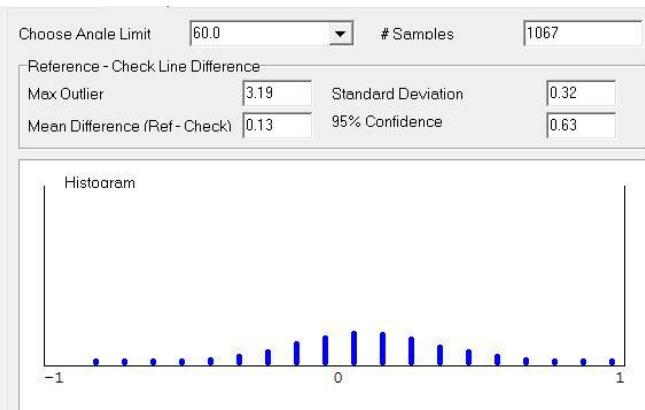
Figure 4.1-1

Plots of +/- 60 Deg. Beam Analysis Results for crossings 05/17 to 06/07 during HARS Spring 2012 survey.

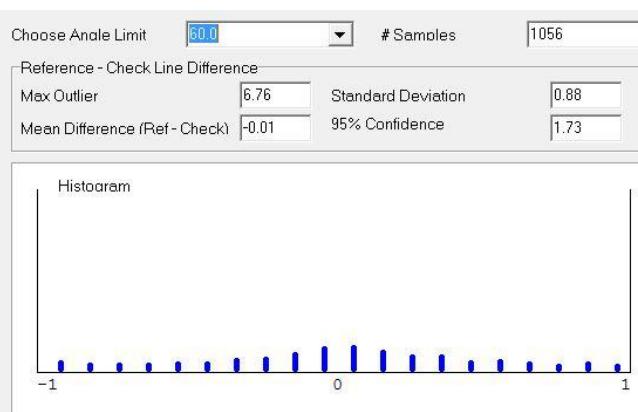




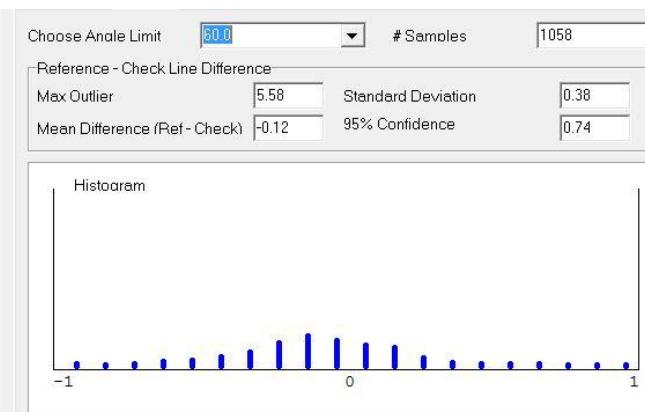
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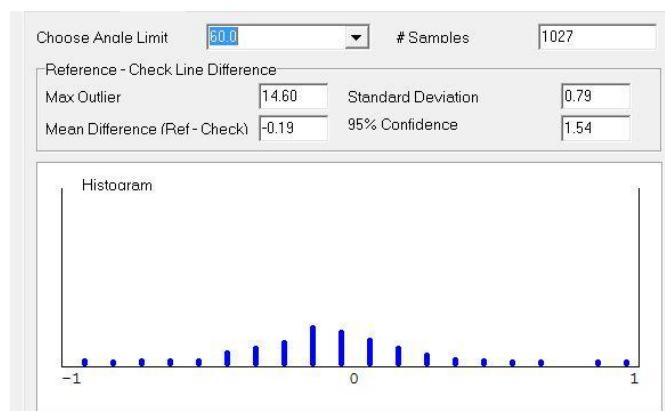
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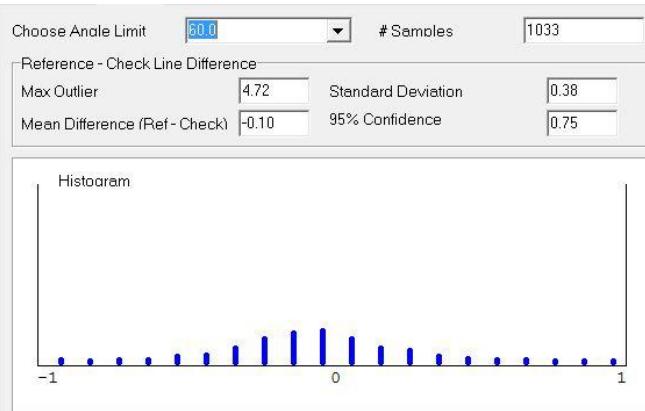
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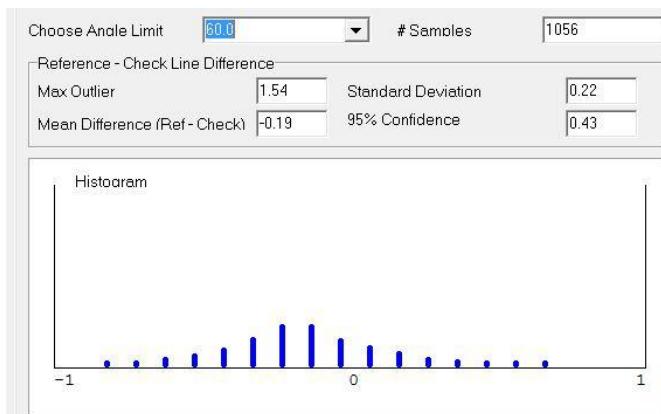
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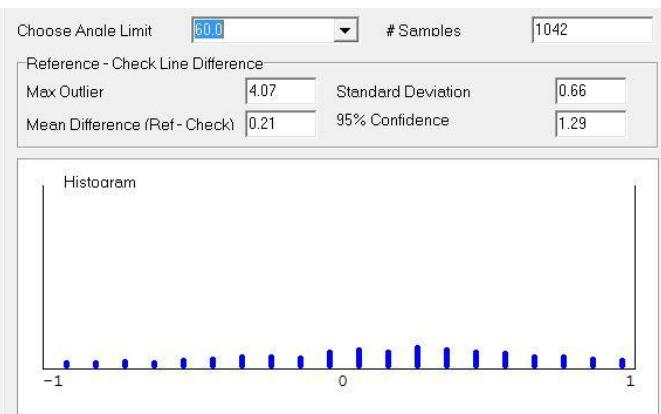
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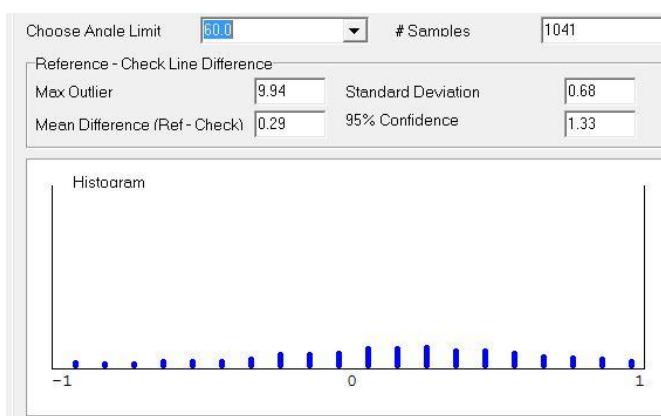
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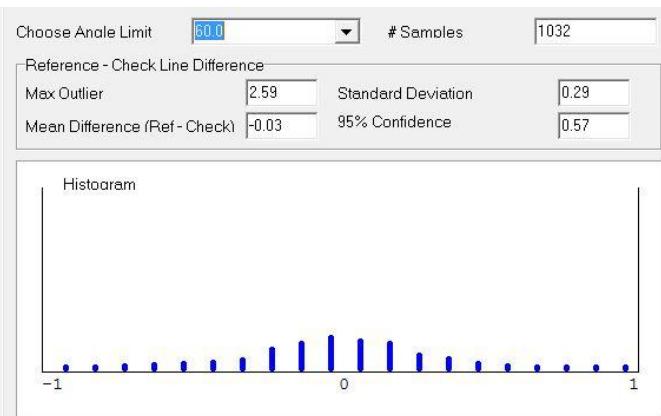
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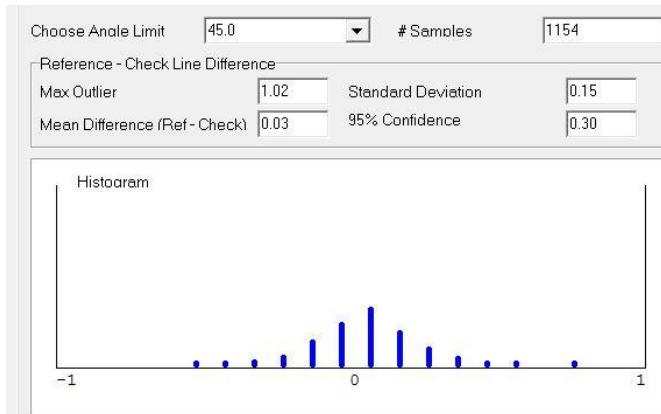
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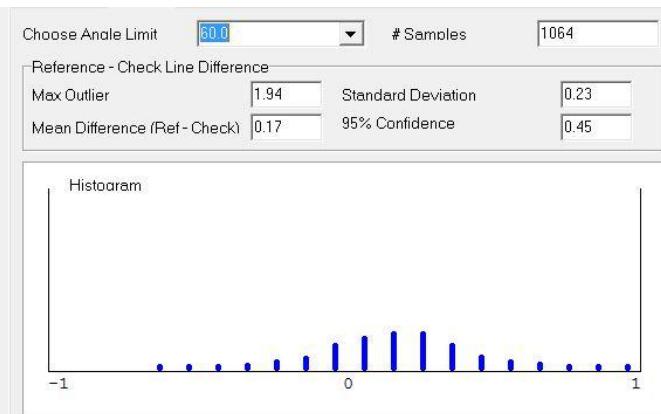
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06/07_1059



06/07_1305



06/07_1443