C. VERTICAL AND HORIZONTAL CONTROL

Refer to the Horizontal and Vertical Control Report for a detailed description of the horizontal and vertical control used during this survey. Refer to Appendix IV for specific times and dates of relevant tide data. A summary of horizontal and vertical control used for the survey follows.

C.1 VERTICAL CONTROL

Vertical control for this survey was based on MLLW at the National Water Level Observation Network (NWLON) stations at San Juan, PR (9755371), Lameshur Bay, VI (9751381), and Charlotte Amalie, VI (9751639), as well as subordinate stations at Ruy Point, VI (9751768), Water Bay, VI (9751583), and Leinster Point, VI (9751309).

The San Juan station (9755371) served as datum control for this project. Data collected at the San Juan station was used to conduct a MLLW datum transfer to the three tertiary gauges installed by JOA. This station was not used for the reduction of soundings. The Lameshur Bay station (9751381) was used for preliminary and final reduction of depth soundings and was used to derive preliminary and final tidal zoning for the project area. The subordinate stations at Ruy Point (9751768), Water Bay (9751583), and Leinster Point (9751309) were established in late 2010 by JOA and were used for preliminary and final reduction of depth soundings. The Charlotte Amalie station (9751639) was used for the preliminary reduction of depth soundings only. All tide stations recorded continuously during data collection periods and were used for the duration of the survey. Station details are as follows:

		NAD83	
Gauge	**Location**	**Latitude (N)**	**Longitude (W)**
9755371	San Juan, PR	18° 27.5’	066° 06.9’
9751381	Lameshur Bay, USVI	18° 19.0'	064° 43.4'
9751639	Charlotte Amalie, USVI	18° 20.1’	064° 55.2’
9751768	Ruy Point, USVI	18° 22.3'	064° 57.8'
9751583	Water Bay, USVI	18° 20.9'	064° 51.8'
9751309	Leinster Point, USVI	18° 22.1'	064° 43.2'

C.2 ZONING

Tide zones covering the extent of the survey area were derived from tide zone coordinates supplied by NOAA CO-OPS. The tide zones were modified to extend approximately 20 miles offshore and to leave no gaps over land to ensure that all lidar coverage would be covered by zones. Also, the zoning cell geometry was simplified, while preserving a similar shape, in order to meet FLI’s requirement that each zoning cell have 10 or fewer vertices. Each of these tide zones use time and range correctors relative to the Lameshur Bay NWLON tide station and three subordinate tide stations installed by JOA. These are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
VIR80	TA10	-6 minutes	x1.05	9751381
VIR69	TA11	0 minutes	x0.96	9751583
VIR71B	TA12	0 minutes	x1.04	9751583
VIR71A	TA13	0 minutes	x1.04	9751583
VIR75	TA14	0 minutes	x0.96	9751768
VIR74	TA15	0 minutes	x1.00	9751768
VIR1A	TA16	0 minutes	x0.92	9751768
VIR72	TA17	-6 minutes	x1.04	9751583
VIR71	TA18	0 minutes	x1.04	9751583
VIR1B	TA19	-24 minutes	x1.13	9751381
VIR33	TA20	12 minutes	x0.99	9751309
VIR32	TA21	18 minutes	x0.98	9751309
VIR31	TA22	-6 minutes	x1.11	9751381
VIR30	TA23	-6 minutes	x0.99	9751381
VIR35	TA24	0 minutes	x1.00	9751309
VIR34	TA25	6 minutes	x1.00	9751309
VIR35A	TA26	0 minutes	x1.03	9751309
VIR73	TA27	0 minutes	x0.98	9751768
VIR31A	TA28	6 minutes	x1.11	9751381
VIR68	TA29	0 minutes	x1.00	9751583
VIR25	TA30	-12 minutes	x0.99	9751381
VIR27	TA31	-6 minutes	x1.11	9751381
VIR31B	TA32	24 minutes	x1.11	9751381
VIR70	TA33	0 minutes	x1.00	9751583
VIR28	TA34	-12 minutes	x1.11	9751381
VIR29	TA35	-6 minutes	x0.99	9751381
VIR66	TA36	-18 minutes	x1.23	9751381
VIR67	TA37	0 minutes	x1.04	9751583
LAND1	TA38	0 minutes	x1.00	9751381
LAND2	TA39	0 minutes	x1.00	9751381

For final tide application, the time and range correctors were applied to NOAA verified and JOA quality controlled tide data, smoothed by JOA. Soundings were then reduced to MLLW using these final tides. An analysis of depth benchmark and crossline comparisons, and overlaps of the mainlines of sounding concluded that final tide zoning was adequate.