U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

HORIZONTAL &VERTICAL CONTROL REPORT

Type of Survey:	Hydrographic Survey
Project Number:	OPR-K339-KR-13
Time Frame:	November 2013-January 2014

LOCALITY

State:	Louisiana
General Locality:	Gulf of Mexico
Sub-locality:	Approaches to Barataria Bay, LA

2014

CHIEF OF PARTY

George G. Reynolds

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Date:

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NUMBERS:
HYDROGRAPHIC TITLE SHEET		H12550, H12551 H12552, H12553

State:	**Louisiana**
General Locality:	**Gulf of Mexico**
Sub-Locality:	**Approaches to Barataria Bay, LA**
Scale:	**1:40,000**
Date of Survey:	**November 9, 2013 to January 20, 2014**
Instructions Dated:	**April 16, 2013**
Project No.:	**OPR-K339-KR-13**
Vessel:	**R/V Ferrel - Official Number 1182802**
Chief of Party:	**George G. Reynolds**
Surveyed By:	**Ocean Surveys, Inc.**
Soundings by:	**Multibeam Echosounder**
Imagery by:	**Side Scan Sonar**
Verification by:	**Atlantic Hydrographic Branch**
Soundings Acquired in:	**Meters at MLLW**
H-Cell Compilation Units:	

Remarks: The purpose of this survey is to update existing NOS nautical charts in a high commercial traffic area. All times are recorded in UTC. Data recorded and presented relative to UTM Zone 16 North.

Contractor: Ocean Surveys, Inc.
129 Mill Rock Rd E
Old Saybrook, CT 06475

THE INFORMATION PRESENTED IN THIS REPORT AND THE ACCOMPANYING BASE SURFACES REPRESENTS THE RESULTS OF SURVEYS PERFORMED BY OCEAN SURVEYS, INC. DURING THE PERIOD OF 9 NOVEMBER 2013 TO 20 JANUARY 2014 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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A. VERTICAL CONTROL

A.1 Tide Station

Tide/water levels for this project were provided exclusively by NOAA as verified data from NOAA Tide Station 876-2075, Port Fourchon, LA. The project is located within zones indicated by preliminary tidal zoning data included in the project Statement of Work. Time and range corrections were applied to all Port Fourchon (876-2075) verified data according to Table 1. Figure 1 depicts the project and survey area, tide zone delimiters and the location of the Port Fourchon tide gauge.

Table 1
Tide Zones Associated with Project OPR-K339-KR-13

Zone	Time Correction	Range Correction
CGM370	-24 min	1.09
CGM372	-18 min	1.09
CGM373	-30 min	1.09
CGM725	-30 min	1.05
CGM726	-30 min	1.05
CGM727	-18 min	1.09
CGM729	-24 min	1.05

Based on the results of cross line analysis, it appears that the time and range factors as provided in the preliminary zoning scheme are adequate.

Coordinated Universal Time (UTC) was used to annotate the tide records and all other data obtained in this project.

Preliminary tide correctors were retrieved daily from the CO-OPS website. Verified tides were retrieved on a weekly basis once they were made available by CO-OPS. Tide data were applied to processed soundings employing the CARIS “apply tides” function. The CARIS-format zoning file, “K339KR2013CORP.zdf” (provided by CO-OPS), was employed to facilitate the application of final tide zoning scheme factors.

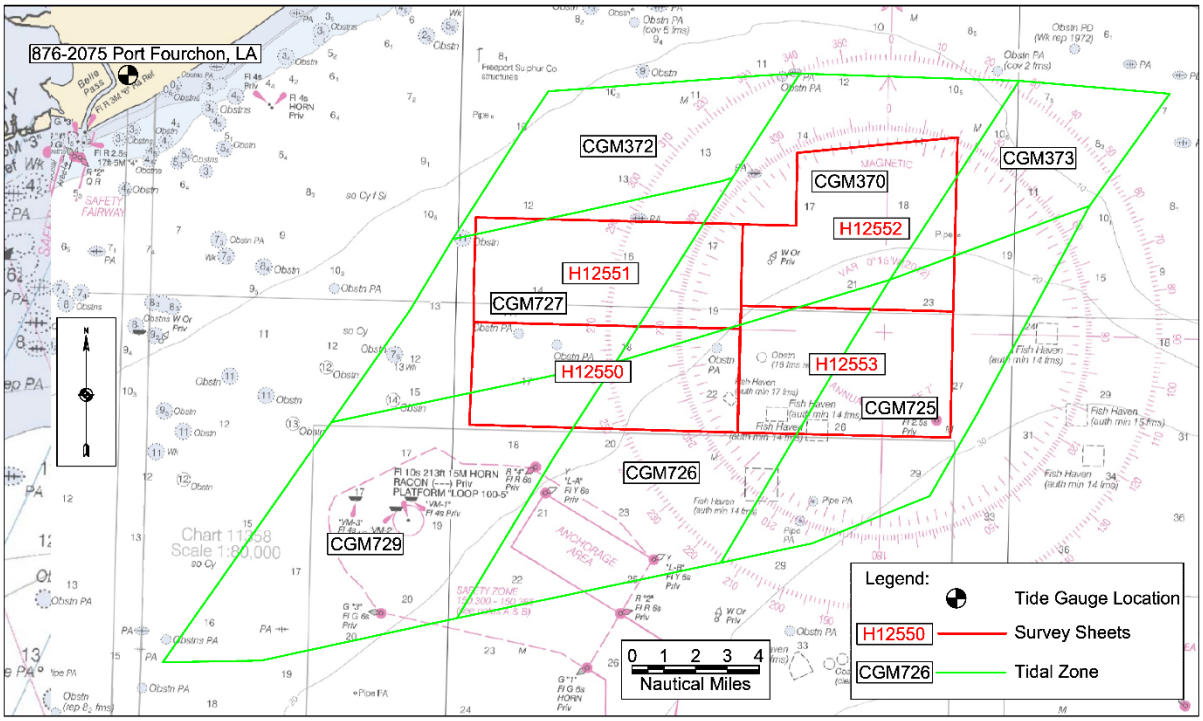

Figure 1. Project survey boundaries (red lines), tidal zone boundaries (green lines), and the Port Fourchon tide station location.

A.2 Unusual Tide Conditions

Specific information pertaining to individual surveys of Project OPR-K339-KR-13 will be documented in each survey's respective Descriptive Report.

In general, as expected, there are minor departures between predicted and verified tides due to wind setup. There was a gap in the preliminary tide gauge data of approximately 15 hours from January 13 to January 14, 2014 (Figure 2). As noted in the e-mail correspondence below, CO-OPS filled the tide gap using data from Grand Isle, LA (876-1724) (Figure 3).

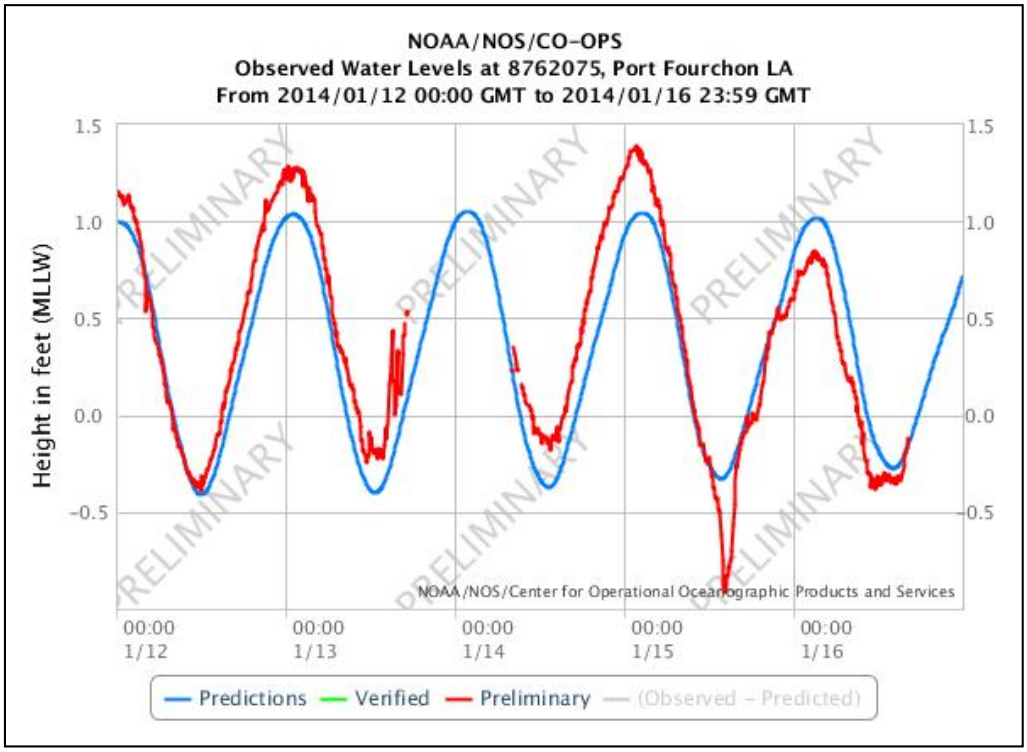

Figure 2. Preliminary tide data gap.

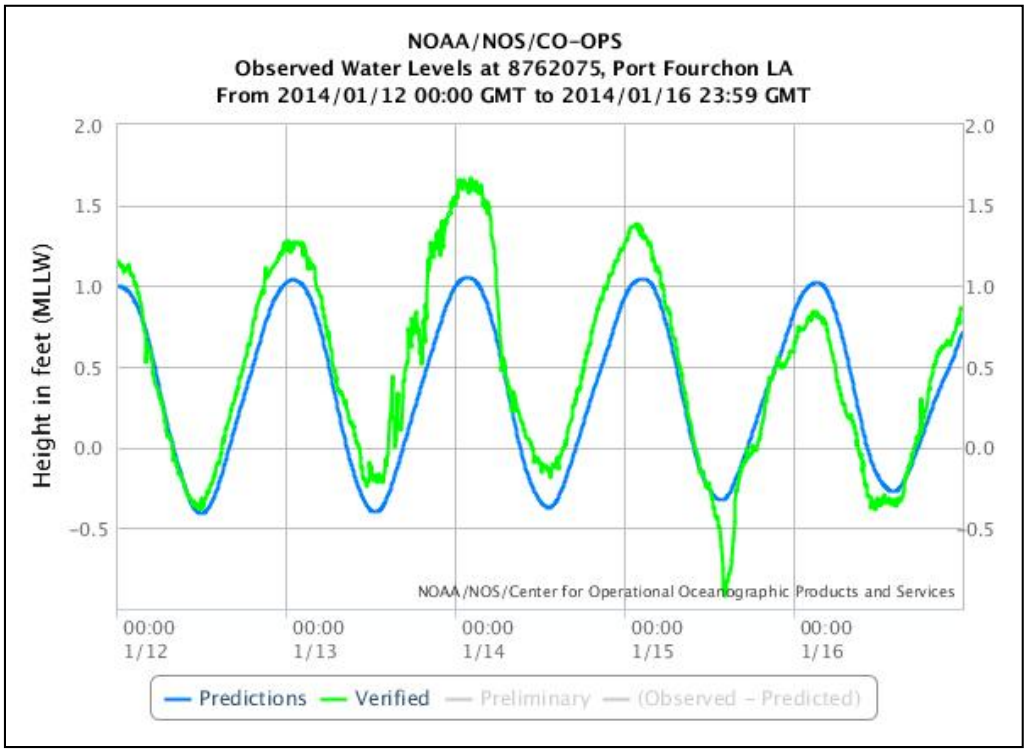

Figure 3. Verified Tides with preliminary tide data gap filled.

E-mail string associated with tide gauge outage

From: Paul Turner - NOAA Federal [mailto:paul.turner@noaa.gov]
Sent: Friday, January 17, 2014 1:43 PM
To: George Reynolds
Cc: Michael Gonsalves - NOAA Federal; Melissa Sampson - NOAA Federal
Subject: Fwd: Fourchon Tide Gap

Hi George-

Here's some additional info from CO-OPS regarding the tide gap for the 13 - 14. Please let me know if you need any additional information.

Thanks,

Paul

---------- Forwarded message ----------
From: **Colleen Fanelli - NOAA Federal** <colleen.fanelli@noaa.gov>
Date: Thu, Jan 16, 2014 at 3:11 PM
Subject: Re: Fourchon Tide Gap
To: Carolyn Lindley - NOAA Federal <carolyn.lindley@noaa.gov>
Cc: Richard Bourgerie - NOAA Federal <Richard.Bourgerie@noaa.gov>, Paul Turner - NOAA Federal <Paul.Turner@noaa.gov>

Carolyn,

Port Fourchon does not have a back-up sensor installed nor meteorological sensors. The gap on the 13th to 14th will be filled using Grand Isle data on Monday. The sharp low water observed in the data on the 15th is present at Grand Isle as well. At Grand Isle, the water level likely was drawn down by 20-25 knot S to SE (offshore) winds observed prior to and during the same time frame.

~Colleen

--
Colleen Fanelli
Oceanographer
NOAA/National Ocean Service
Center for Operational Oceanographic Products and Services
Station 7142
1305 East-West Highway N/OPS3
Silver Spring, MD 20910
Colleen.Fanelli@noaa.gov
Phone: (301) 713 – 2877 x 167

On Thu, Jan 16, 2014 at 2:39 PM, Carolyn Lindley - NOAA Federal <carolyn.lindley@noaa.gov> wrote:
Colleen, Rich B.,

I am guessing the reported gap is either fillable? or a back-up sensor is going? At field ops and not on the network right now or I would check the Diagtool myself.

Also, any thoughts on the low water anamoly?

Thanks!
Carolyn

---------- Forwarded message ----------
From: **Paul Turner - NOAA Federal** <paul.turner@noaa.gov>
Date: Thu, Jan 16, 2014 at 1:53 PM
Subject: Re: Fourchon Tide Gap
To: George Reynolds <ggr@oceansurveys.com>
Cc: "_NOS.CO-OPS.HPT" <nos.coops.hpt@noaa.gov>, CORMS@noaa.go, Michael Gonsalves - NOAA Federal <michael.gonsalves@noaa.gov>, Melissa Sampson - NOAA Federal <melissa.r.sampson@noaa.gov>

Hi George-

Thank you for bring this to my attention and I am cc'ing CO-OPS, HPT on this to workout the tide gap & anomaly you noticed in the data this week.

Let me know if you need anything else.

Thanks,

Paul

On Thu, Jan 16, 2014 at 12:57 PM, George Reynolds <ggr@oceansurveys.com> wrote:

Hi Paul,

We noticed a gap in the Port Fourchon preliminary tide data between ~16:54 UTC on 1-13 to 07:48 UTC on 1-14 (see attached image). The gauge data is also exhibiting what appears to be an anomaly at low tide on the 15th and 16th. We were collecting hydro data during the outage and during low tide on the 15th and 16th.

Should I contact CO-OPS regarding this issue or is this something that you would like to mention to CO-OPS?

Thanks, George

B. HORIZONTAL CONTROL

B.1 Horizontal Datum

The horizontal datum for this project is the North American Datum of 1983 (NAD83). Horizontal coordinates are referenced to Latitude/Longitude and Universal Transverse Mercator (UTM) Zone 16, in meters. The assigned project boundary falls entirely within UTM Zone 16.

B.2 Horizontal Control

With the exception of certain calibrations such as patch/performance/settlement testing, all survey tasks were executed employing Differential GPS (DGPS) positioning. English Turn, LA USCG DGPS beacon correctors were input to the primary navigation system (POS-MV). Eglin AFB, FL USCG DGPS beacon correctors were input to the secondary (alarm) navigation system.

OSI established three temporary X,Y navigation checkpoints (JWS-3, JWS-5, and JWS-9) adjacent to the survey vessel's fuel dock at the John W. Stone Oil Distributers Facility on 20th Street in Port Fourchon, LA. These points were established in May of 2012 during operations for Project OPR-K339-KR-12. Three points were established to help ensure that a navigation system performance check would be possible despite the fueling station assignment the boat was given at the busy fueling facility. The horizontal positions of JWS-3, JWS-5, and JWS-9 (Figures 4-6) were established by occupying the points with a Trimble 5700 GPS capable of recording dual-frequency GPS observables. Recorded data were submitted to the National Geodetic Survey's Online Users Positioning Service (OPUS) and solutions derived thus.

The temporary X,Y points were established using multiple OPUS observations for ≥ 15-minute at each point. The individual and average X,Y values for the observations are presented in Tables 4-6. The averages of the OPUS-reported position solutions were assigned to these points. The OPUS reports are appended at the end of the HVCR.

Navigation system confidence checks of the primary positioning system (POS-MV using USCG English Turn, LA correctors) were made referenced to a permanent shipboard bench mark [main deck mark positioned over the "reference point" (RP)] to the respective checkpoint on the fuel dock. All checks indicated that the navigation system components were operating properly and that the navigation system offsets were properly applied. As an additional QC verification, the primary positioning system was supplied with the signal from the secondary DGPS corrector source, Eglin AFB, FL. This check also yielded positive results. Vessel positions and distance measurements for each "nav check" were recorded in the acquisition log and are included herein and as well as with Appendix III of the DAPR.

Table 2
Summary of Navigation System Checkpoints

Nav. Check Point	Reference Easting UTM 16N, NAD83 (meters)	Reference Northing UTM 16N, NAD83 (meters)	Description of Position
JWS 3	187,783.35	3,225,665.85	Center of Bollard at JW Stone Port Fourchon Fuel Dock, Fueling Station 3
JWS 5	187,810.58	3,225,578.46	Center of Bollard at JW Stone Port Fourchon Fuel Dock, Fueling Station 5
JWS 9	187,863.47	3,225,415.01	Center of Bollard at JW Stone Port Fourchon Fuel Dock, Fueling Station 9

Table 3
Tabulation of Navigation System Performance Checks

Date	Time UTC	Nav. Check Point	DGPS Beacon	Observed Easting UTM 16N, NAD83 (meters)	Observed Northing UTM 16N, NAD83 (meters)	Calculated Distance RP to Nav. Check Point (meters)	Tape Measure RP to Nav. Check Point (meters)	Difference Calculated vs. Tape Measured (meters)
Nov 10, 2013 (DN 314)	15:52	JWS 9	English Turn, LA	187871.30	3225415.59	7.85	8.66	0.81
Nov 10, 2013 (DN 314)	15:58	JWS 9	Eglin, FL	187871.68	3225416.38	8.32	8.68	0.36
Nov 14, 2013 (DN 318)	16:49	JWS 5	English Turn, LA	187818.58	3225580.85	8.35	8.47	0.12
Nov 27, 2013 (DN 331)	17:58	JWS 5	English Turn, LA	187819.53	3225580.03	9.09	8.53	0.55
Dec 8, 2013 (DN 342)	03:26	JWS 9	English Turn, LA	187873.99	3225410.86	11.31	11.37	0.06
Dec 15, 2013 (DN 3349)	09:36	JWS 9	English Turn, LA	187871.95	3225418.25	9.08	8.65	0.43

Date	Time UTC	Nav. Check Point	DGPS Beacon	Observed Easting UTM 16N, NAD83 (meters)	Observed Northing UTM 16N, NAD83 (meters)	Calculated Distance RP to Nav. Check Point (meters)	Tape Measure RP to Nav. Check Point (meters)	Difference Calculated vs. Tape Measured (meters)
Jan 4, 2014 (DN 004)	10:43	JWS 9	English Turn, LA	187872.18	3225417.10	8.96	8.84	0.12
Jan 11, 2014 (DN 014)	10:05	JWS 3	English Turn, LA	187785.97	3225683.04	17.39	17.47	0.08
Jan 20, 2014 (DN 020)	23:07	*At Dock	English Turn, LA	187998.15	3225321.87	Near-simultaneous observed position solutions from the POS-MV using correctors from the English Turn, LA beacon and then the Eglin, FL beacon. The calculated difference between solutions is 0.49 meters.		
Jan 20, 2014 (DN 020)	23:08	*At Dock	Eglin, FL	187998.14	3225322.36			

*The fuel dock where OSI normally conducts navigation system performance checks was not available on the last day of the survey. Therefore, the ship was secured nearby and position fixes were recorded using independent DGPS corrector sources.

Table 4
OPUS Solution for JWS-3

Session #	Easting UTM 15N, NAD83 (meters)	Northing UTM 15N, NAD83 (meters)
1	771,643.627	3,224,631.034
2	771,643.625	3,224,631.035
Average	771,643.626	3,224,631.035
Per Corpscon v.6.0.1	**Easting UTM 16N, NAD83 (meters)**	**Northing UTM 16N, NAD83 (meters)**
	187,783.354	3,225,665.854

Figure 4. JWS-3

Table 5
OPUS Solution for JWS-5

Session #	Easting UTM 15N, NAD83 (meters)	Northing UTM 15N, NAD83 (meters)
1	771,675.267	3,224,545.171
2	771,675.255	3,224,545.162
Average	771,675.261	3,224,545.166
Per Corpscon v.6.0.1	**Easting UTM 16N, NAD83 (meters)**	**Northing UTM 16N, NAD83 (meters)**
	187,810.579	3,225,578.459

Figure 5. JWS-5

Table 6
OPUS Solution for JWS-9

Session #	Easting UTM 15N, NAD83 (meters)	Northing UTM 15N, NAD83 (meters)
1	771,736.395	3,224,384.675
2	771,736.396	3,224,384.670
Average	771,736.396	3,224,384.673
Per Corpscon v.6.0.1	**Easting UTM 16N, NAD83 (meters)**	**Northing UTM 16N, NAD83 (meters)**
	187,863.469	3,225,415.011

Figure 6. JWS-9

OPUS Reports for Navigation Checkpoint “JWS-3”

NGS OPUS-RS SOLUTION REPORT
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All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: rmw@oceansurveys.com DATE: November 02, 2012
RINEX FILE: 2818146p.12o TIME: 13:39:58 UTC

SOFTWARE: rsgps 1.37 RS30.prl 1.86 START: 2012/05/25 15:29:45
EPHEMERIS: igs16895.eph [precise] STOP: 2012/05/25 15:55:00
NAV FILE: brdc1460.12n OBS USED: 2592 / 2952 : 88%
ANT NAME: TRM41249.00 NONE QUALITY IND. 11.09/ 26.93
ARP HEIGHT: 0.00 NORMALIZED RMS: 0.366

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2012.39796)

X:	-20279.751(m)	0.006(m)	-20280.495(m)	0.006(m)
Y:	-5576259.763(m)	0.036(m)	-5576258.253(m)	0.036(m)
Z:	3085628.763(m)	0.023(m)	3085628.579(m)	0.023(m)

LAT:	29 7 16.16439	0.004(m)	29 7 16.18299	0.004(m)
E LON:	269 47 29.85911	0.006(m)	269 47 29.83139	0.006(m)
W LON:	90 12 30.14089	0.006(m)	90 12 30.16861	0.006(m)
EL HGT:	-21.546(m)	0.042(m)	-22.952(m)	0.042(m)
ORTHO HGT:	2.270(m)	0.044(m) [NAVD88 (Computed using GEOID12A)]		

	UTM COORDINATES (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3224631.034	69391.850
Easting (X) [meters]	771643.627	1109489.802
Convergence [degrees]	1.35940150	0.56249471
Point Scale	1.00051067	1.00004267
Combined Factor	1.00051406	1.00004605

US NATIONAL GRID DESIGNATOR: 15RYN7164324631(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	29194.6
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.652	46481.5
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	72315.8
DE8091	BVHS BOOTHVILLE CORS ARP	N292012.489	W0892423.010	81551.6
DH9599	NOLA LOYOLA UNIVERSITY CORS ARP	N295603.732	W0900712.646	90543.9
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.006	94991.5
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.634	131934.9
DL8635	GVMS GALVEZ MIDDLE SCH CORS ARP	N301851.796	W0905413.029	148386.1
DJ8941	MSGA GAUTIER CORS ARP	N302340.464	W0883842.490	206830.9

NEAREST NGS PUBLISHED CONTROL POINT

DJ9376	TE23 SM 01	N290642.285	W0901126.964	2002.6

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

NGS OPUS-RS SOLUTION REPORT
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All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: rmw@oceansurveys.com DATE: November 02, 2012
RINEX FILE: 2818146p.12o TIME: 13:35:55 UTC

SOFTWARE: rsgps 1.37 RS52.prl 1.86 START: 2012/05/25 15:55:45
EPHEMERIS: igs16895.eph [precise] STOP: 2012/05/25 16:20:15
NAV FILE: brdc1460.12n OBS USED: 1998 / 2007 : 100%
ANT NAME: TRM41249.00 NONE QUALITY IND. 7.82/ 11.32
ARP HEIGHT: 0.00 NORMALIZED RMS: 0.345

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2012.39801)

X:	-20279.753(m)	0.006(m)	-20280.497(m)	0.006(m)
Y:	-5576259.767(m)	0.018(m)	-5576258.257(m)	0.018(m)
Z:	3085628.766(m)	0.012(m)	3085628.582(m)	0.012(m)

LAT:	29 7 16.16441	0.003(m)	29 7 16.18301	0.003(m)
E LON:	269 47 29.85904	0.006(m)	269 47 29.83131	0.006(m)
W LON:	90 12 30.14096	0.006(m)	90 12 30.16869	0.006(m)
EL HGT:	-21.541(m)	0.022(m)	-22.947(m)	0.022(m)
ORTHO HGT:	2.275(m)	0.025(m) [NAVD88 (Computed using GEOID12A)]		

	UTM COORDINATES (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3224631.035	69391.851
Easting (X) [meters]	771643.625	1109489.800
Convergence [degrees]	1.35940149	0.56249470
Point Scale	1.00051067	1.00004267
Combined Factor	1.00051406	1.00004605

US NATIONAL GRID DESIGNATOR: 15RYN7164324631(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	29194.6
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.652	46481.5
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	72315.8
DE8091	BVHS BOOTHVILLE CORS ARP	N292012.489	W0892423.010	81551.6
DH9599	NOLA LOYOLA UNIVERSITY CORS ARP	N295603.732	W0900712.646	90543.9
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.006	94991.5
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.634	131934.9
DN8737	MSIN INFINITY CENTER CORS ARP	N301842.205	W0893615.507	144331.3
DL8635	GVMS GALVEZ MIDDLE SCH CORS ARP	N301851.796	W0905413.029	148386.1

NEAREST NGS PUBLISHED CONTROL POINT

DJ9376	TE23 SM 01	N290642.285	W0901126.964	2002.6

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

OPUS Reports for Navigation Checkpoint “JWS-5”

NGS OPUS-RS SOLUTION REPORT
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All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: rmw@oceansurveys.com DATE: November 02, 2012
RINEX FILE: 2818146q.12o TIME: 13:36:42 UTC

SOFTWARE: rsgps 1.37 RS90.prl 1.86 START: 2012/05/25 16:54:00
EPHEMERIS: igs16895.eph [precise] STOP: 2012/05/25 17:18:45
NAV FILE: brdc1460.12n OBS USED: 2250 / 2736 : 82%
ANT NAME: TRM41249.00 NONE QUALITY IND. 12.88/ 28.74
ARP HEIGHT: 0.00 NORMALIZED RMS: 0.389

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2012.39812)

X:	-20250.327(m)	0.005(m)	-20251.071(m)	0.005(m)
Y:	-5576302.319(m)	0.053(m)	-5576300.809(m)	0.053(m)
Z:	3085553.342(m)	0.030(m)	3085553.158(m)	0.030(m)

LAT:	29 7 13.35339	0.002(m)	29 7 13.37200	0.002(m)
E LON:	269 47 30.95320	0.005(m)	269 47 30.92548	0.005(m)
W LON:	90 12 29.04680	0.005(m)	90 12 29.07452	0.005(m)
EL HGT:	-21.166(m)	0.061(m)	-22.573(m)	0.061(m)
ORTHO HGT:	2.649(m)	0.062(m) [NAVD88 (Computed using GEOID12A)]		

	UTM COORDINATES UTM (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3224545.171	69305.596
Easting (X) [meters]	771675.267	1109520.230
Convergence [degrees]	1.35951642	0.56264667
Point Scale	1.00051088	1.00004287
Combined Factor	1.00051421	1.00004619

US NATIONAL GRID DESIGNATOR: 15RYN7167524545(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	29217.6
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.652	46537.4
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	72398.8
DE8091	BVHS BOOTHVILLE CORS ARP	N292012.489	W0892423.010	81549.1
DH9599	NOLA LOYOLA UNIVERSITY CORS ARP	N295603.732	W0900712.646	90627.3
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.006	95081.9
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.634	132023.0
DN8737	MSIN INFINITY CENTER CORS ARP	N301842.205	W0893615.507	144398.6
DL8635	GVMS GALVEZ MIDDLE SCH CORS ARP	N301851.796	W0905413.029	148476.7

NEAREST NGS PUBLISHED CONTROL POINT

DJ9376	TE23 SM 01	N290642.285	W0901126.964	1932.8

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

NGS OPUS-RS SOLUTION REPORT
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All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: rmw@oceansurveys.com DATE: November 02, 2012
RINEX FILE: 2818146r.12o TIME: 13:37:17 UTC

SOFTWARE: rsgps 1.37 RS50.prl 1.86 START: 2012/05/25 17:19:30
EPHEMERIS: igs16895.eph [precise] STOP: 2012/05/25 17:44:00
NAV FILE: brdc1460.12n OBS USED: 2250 / 2349 : 96%
ANT NAME: TRM41249.00 NONE QUALITY IND. 11.31/ 19.63
ARP HEIGHT: 0.00 NORMALIZED RMS: 0.382

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2012.39817)

X:	-20250.339(m)	0.005(m)	-20251.083(m)	0.005(m)
Y:	-5576302.297(m)	0.020(m)	-5576300.787(m)	0.020(m)
Z:	3085553.320(m)	0.012(m)	3085553.136(m)	0.012(m)

LAT:	29 7 13.35312	0.003(m)	29 7 13.37172	0.003(m)
E LON:	269 47 30.95275	0.005(m)	269 47 30.92503	0.005(m)
W LON:	90 12 29.04725	0.005(m)	90 12 29.07497	0.005(m)
EL HGT:	-21.196(m)	0.023(m)	-22.603(m)	0.023(m)
ORTHO HGT:	2.619(m)	0.026(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES UTM (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3224545.162	69305.587
Easting (X) [meters]	771675.255	1109520.218
Convergence [degrees]	1.35951636	0.56264661
Point Scale	1.00051088	1.00004287
Combined Factor	1.00051421	1.00004620

US NATIONAL GRID DESIGNATOR: 15RYN7167524545(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	29217.6
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.652	46537.4
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	72398.8
DE8091	BVHS BOOTHVILLE CORS ARP	N292012.489	W0892423.010	81549.1
DH9599	NOLA LOYOLA UNIVERSITY CORS ARP	N295603.732	W0900712.646	90627.3
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.006	95081.9
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.634	132023.0
DN8737	MSIN INFINITY CENTER CORS ARP	N301842.205	W0893615.507	144398.6
DL8635	GVMS GALVEZ MIDDLE SCH CORS ARP	N301851.796	W0905413.029	148476.7

NEAREST NGS PUBLISHED CONTROL POINT

DJ9376	TE23 SM 01	N290642.285	W0901126.964	1932.8

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

OPUS Reports for Navigation Checkpoint “JWS-9”

NGS OPUS-RS SOLUTION REPORT
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All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: rmw@oceansurveys.com DATE: November 02, 2012
RINEX FILE: 2818146s.12o TIME: 13:41:22 UTC

SOFTWARE: rsgps 1.37 RS13.prl 1.86 START: 2012/05/25 18:17:00
EPHEMERIS: igs16895.eph [precise] STOP: 2012/05/25 18:41:15
NAV FILE: brdc1460.12n OBS USED: 2952 / 3051 : 97%
ANT NAME: TRM41249.00 NONE QUALITY IND. 8.85/ 1.41
ARP HEIGHT: 0.00 NORMALIZED RMS: 0.418

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2012.39828)

X:	-20193.340(m)	0.007(m)	-20194.084(m)	0.007(m)
Y:	-5576381.400(m)	0.031(m)	-5576379.890(m)	0.031(m)
Z:	3085412.048(m)	0.017(m)	3085411.864(m)	0.017(m)

LAT:	29 7 8.09754	0.003(m)	29 7 8.11615	0.003(m)
E LON:	269 47 33.07169	0.006(m)	269 47 33.04396	0.006(m)
W LON:	90 12 26.92831	0.006(m)	90 12 26.95604	0.006(m)
EL HGT:	-21.020(m)	0.035(m)	-22.427(m)	0.035(m)
ORTHO HGT:	2.792(m)	0.037(m) [NAVD88 (Computed using GEOID12A)]		

	UTM COORDINATES (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3224384.675	69144.341
Easting (X) [meters]	771736.395	1109579.093
Convergence [degrees]	1.35974115	0.56294091
Point Scale	1.00051129	1.00004326
Combined Factor	1.00051459	1.00004656

US NATIONAL GRID DESIGNATOR: 15RYN7173624384(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	29259.5
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.652	46644.0
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	72555.5
DE8091	BVHS BOOTHVILLE CORS ARP	N292012.489	W0892423.010	81542.7
DH9599	NOLA LOYOLA UNIVERSITY CORS ARP	N295603.732	W0900712.646	90783.0
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.006	95251.3
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.634	132188.8
DL8635	GVMS GALVEZ MIDDLE SCH CORS ARP	N301851.796	W0905413.029	148647.0
DJ8941	MSGA GAUTIER CORS ARP	N302340.464	W0883842.490	206938.7

NEAREST NGS PUBLISHED CONTROL POINT

DJ9376	TE23 SM 01	N290642.285	W0901126.964	1805.9

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

NGS OPUS-RS SOLUTION REPORT
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All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: rmw@oceansurveys.com DATE: November 02, 2012
RINEX FILE: 2818146s.12o TIME: 13:45:32 UTC

SOFTWARE: rsgps 1.37 RS51.prl 1.86 START: 2012/05/25 18:41:45
EPHEMERIS: igs16895.eph [precise] STOP: 2012/05/25 19:06:00
NAV FILE: brdc1460.12n OBS USED: 2673 / 2952 : 91%
ANT NAME: TRM41249.00 NONE QUALITY IND. 5.34/ 1.30
ARP HEIGHT: 0.00 NORMALIZED RMS: 0.397

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2012.39833)

X:	-20193.339(m)	0.005(m)	-20194.083(m)	0.005(m)
Y:	-5576381.383(m)	0.033(m)	-5576379.873(m)	0.033(m)
Z:	3085412.033(m)	0.021(m)	3085411.849(m)	0.021(m)

LAT:	29 7 8.09739	0.004(m)	29 7 8.11599	0.004(m)
E LON:	269 47 33.07172	0.005(m)	269 47 33.04400	0.005(m)
W LON:	90 12 26.92828	0.005(m)	90 12 26.95600	0.005(m)
EL HGT:	-21.042(m)	0.039(m)	-22.449(m)	0.039(m)
ORTHO HGT:	2.770(m)	0.041(m) [NAVD88 (Computed using GEOID12A)]		

	UTM COORDINATES UTM (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3224384.670	69144.336
Easting (X) [meters]	771736.396	1109579.094
Convergence [degrees]	1.35974115	0.56294091
Point Scale	1.00051129	1.00004326
Combined Factor	1.00051460	1.00004657

US NATIONAL GRID DESIGNATOR: 15RYN7173624384(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	29259.5
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.652	46644.0
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	72555.5
DE8091	BVHS BOOTHVILLE CORS ARP	N292012.489	W0892423.010	81542.7
DH9599	NOLA LOYOLA UNIVERSITY CORS ARP	N295603.732	W0900712.646	90783.0
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.006	95251.3
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.634	132188.8
DN8737	MSIN INFINITY CENTER CORS ARP	N301842.205	W0893615.507	144523.8
DL8635	GVMS GALVEZ MIDDLE SCH CORS ARP	N301851.796	W0905413.029	148647.0

NEAREST NGS PUBLISHED CONTROL POINT

DJ9376	TE23 SM 01	N290642.285	W0901126.964	1805.9

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

C. APPROVAL SHEET

LETTER OF APPROVAL

PROJECT OPR-K339-KR-13

This report and the accompanying data are respectfully submitted.

Field operations contributing to the accomplishment of Project OPR-K339-KR-13 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and associated data have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Digitally signed by George G. Reynolds
Date: 2014.05.14 10:08:53 -04'00'

George G. Reynolds
Ocean Surveys, Inc.
Chief of Party
May 14, 2014