

APPENDIX E: MISSISSIPPI RIVER BORROW AREAS GEOPHYSICAL DATA AND SURVEYS



MARINE AND FRESHWATER
SURVEY SERVICES

OCEAN SURVEYS, INC.

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Metairie, LA 70002

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September 9, 2011

Mr. Santiago Alfageme
Moffatt & Nichol
104 West 40th Street, 14th Floor
New York, NY 10018

SUBJECT: MULTIBEAM HYDROGRAPHIC SURVEY, AND MAGNETOMETER SURVEY, MISSISSIPPI RIVER LONG DISTANCE SEDIMENT PIPELINE PROJECT, MISSISSIPPI RIVER, BELLE CHASSE, LA

Dear Mr. Alfageme:

During the period 4-17 August, 2011, an Ocean Surveys, Inc. (OSI) field team conducted a multibeam (MBES) hydrographic condition survey and hazard-to-dredging (magnetometer) survey in the Mississippi River in the vicinity of Alliance, LA. The survey was conducted in support of the Long Distance Sediment Pipeline Project. The MBES study area includes the continuous section of the River from above the candidate Wills Point borrow area to below the Alliance South candidate borrow area as shown by the blue hatched area in Figure 1 below. The magnetometer survey areas are shown as the two (2) outlined sub-areas labeled Wills Point and Alliance South in the same Figure 1 below.

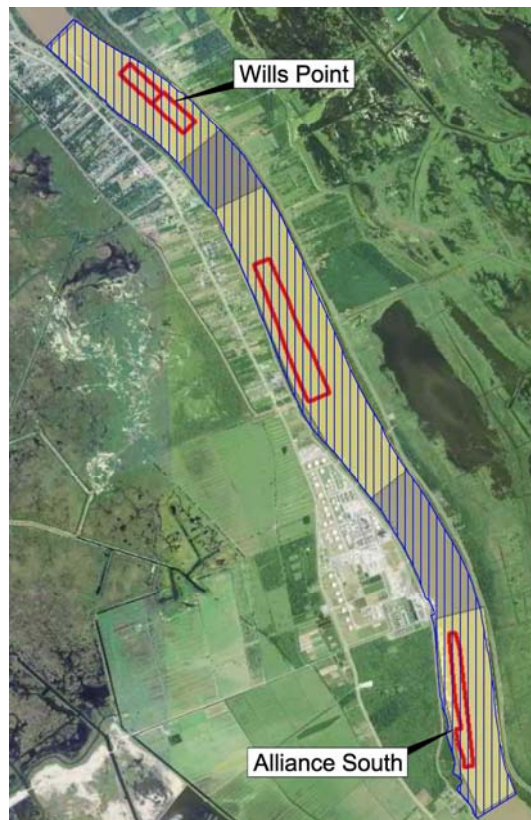


Figure 1. Multibeam (Blue Hatched) and the two Magnetometer Survey Areas.

The purpose of the survey was to characterize the river bottom conditions and detect magnetic anomalies in the area. This letter report outlines the procedures and instrumentation employed during the survey and is submitted in conjunction with Drawing 1, Sheets 1-4.

SUMMARY OF FIELD INVESTIGATION & EQUIPMENT

Survey Vessel and Equipment

Survey systems were installed on OSI's *R/V Able II*, a dual outboard powered 26' enclosed hydrographic survey vessel employed in acquisition of vibratory core samples during a separate phase of the project.

Two Real Time Kinematic Global Positioning System (RTK GPS) receivers were installed on the survey vessel. The first RTK GPS receiver, integral to the POS-MV motion compensation electronics, was used for primary positioning. The second RTK GPS system was used as a backup positioning source. Communication between the vessel RTK GPS systems and the reference station GPS was made possible via radio link. This integrated 3-dimensional precision positioning system provided the field crew with the ability to navigate the survey vessel precisely along pre-plotted tracklines.

A summary of the primary equipment installed on the survey vessel and employed to complete this investigation follows:

- Trimble MS750 RTK-GPS interfaced to a Pacific Crest radio link (base station)
- Applanix POS-MV (positioning, vessel attitude and heading)
- Trimble R7 RTK GPS (positioning)
- HYPACK (navigation and data-logging software package)
- Reson SeaBat 7101 (multibeam echosounder)
- Sea-Bird SBE19+ V2 CTD (profiler for water mass speed of sound determination)
- Geometrics G882 (marine cesium vapor magnetometer)

Horizontal and Vertical Control

A Trimble MS 750 Real Time Kinematic Global Positioning System (RTK GPS) base station was established over the project GPS base station point. The coordinates of the base station point "AEP Wash" were established previously by OSI for the January 2011 multibeam survey of the Alliance Anchorage area (see OSI Report 11ES002, February 21, 2011) employing NOAA's Online Positioning Users Service (OPUS). The coordinates of "AEP Wash" were derived based on an average of multiple OPUS observations recorded on January 18, 2011. OPUS solution reports are included in Attachment 1. "AEP Wash" is situated on a capped, steel piling cluster at AEP's river operations wash dock in Myrtle Grove, LA.



Based on the known and the calculated position of the RTK GPS base station reference antenna, the base unit generates correctors for each GPS satellite in view and transmits these values via radio modem to the shipboard RTK GPS unit. The shipboard RTK GPS unit employs the correctors in calculating position data with a manufacturer's stated centimeter level accuracy.

Prior to data acquisition, the horizontal and vertical accuracy of the positioning systems was verified by comparing the real time observed solution of the positioning systems with the published coordinates of project control points. The Trimble R7 was employed to complete the performance checks. The horizontal accuracy of the POS-MV was verified by comparison to a temporary point established using the Trimble R7 at a convenient dockside location. All navigation system performance checks demonstrated positioning accuracy within manufacturer's stated limits.

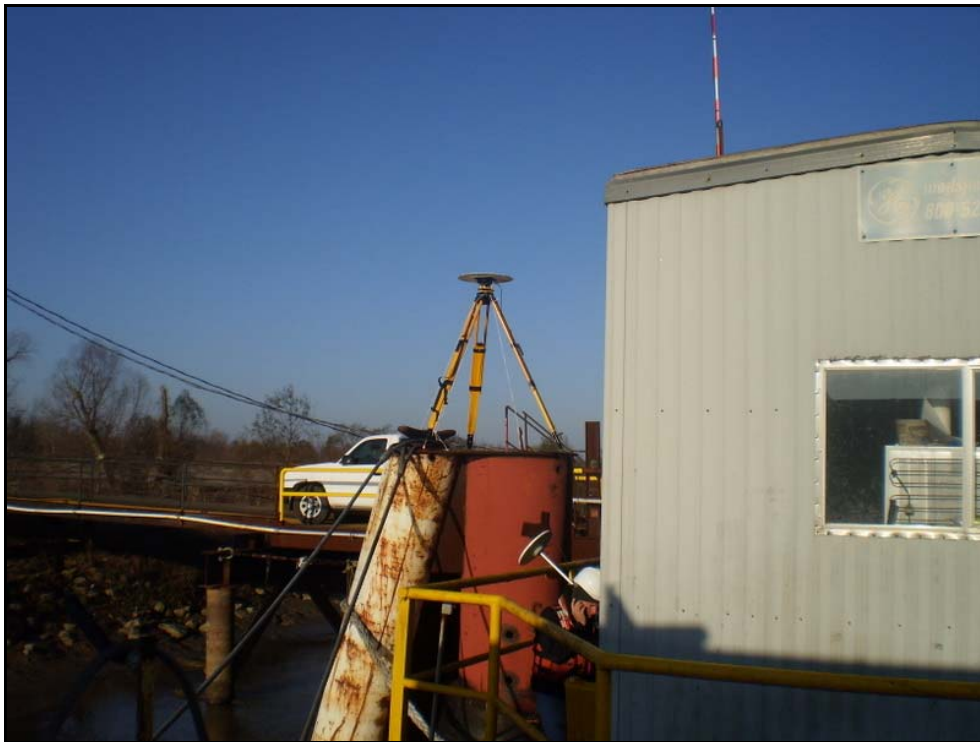


Figure 2. RTK GPS Base Station Deployed at "AEP WASH."

The survey results and coordinates of primary project control "AEP Wash" and "BA03C SM 01 Reset" are referenced horizontally to the Louisiana State Plane Coordinate System, South Zone (1702), NAD 83, U.S. Survey Feet. The coordinates of "BA03C SM 01 Reset" were provided by Moffatt & Nichol.

The survey results are referenced vertically to the North American Vertical Datum of 1988 (NAVD 88-2004.65) based on preliminary water level values recorded at the U.S. Army Corps of Engineers Mississippi River water level station "Alliance" (01390). Project control provided by Moffatt & Nichol is included in Attachment 2.

Project Control Summary

STATION	NORTHING	EASTING
AEP Wash	409,777.74	3,733,178.79
BA03C SM 01 Reset	438,744.19	3,708,256.17

Calibration and Data Acquisition

Before commencement of multibeam sounding operations, the sound velocity profile of the local water mass speed of sound was determined by means of a CTD cast. A sensor alignment test or “patch test” was also performed prior to survey operations. Initially, the precise vertical and horizontal offsets between multibeam system components (echosounder transducer, motion sensor, navigation antennas) were physically measured. Once the physical offsets were stored in the data collection platform, the required patch test data were acquired and analyzed to determine the system roll, pitch, and heading biases along with any navigation timing errors. The angular and timing values, along with water level and water column sound velocity profile information, were subsequently used during data processing to determine the final depth and position of each sounding.

At the beginning of each survey day the depth measuring accuracy of the echosounder was confirmed by means of a “bar check.” The bar check procedure consists of lowering an acoustical target on a graduated sounding line to the deepest practical depth. The target is then raised to successively shallower depths and the displayed digital depths noted. During the course of the survey the water column velocity profile was monitored by means of additional CTD casts and all observed changes in sound speed (as a result of changing tide and temperature, etc.) recorded. During post processing, sound velocity profile data were applied to the multibeam soundings yielding maximum accuracy in the resulting depth data.

Multibeam soundings were collected along a set of parallel tracklines oriented roughly parallel to the long axis of the survey area. The trackline plan consisted of lines offset at intervals intended to result in over 100% ensonification of the river floor. Additional soundings were acquired using a single beam echo sounder in the shallow areas along the river banks in order to supplement the multibeam data coverage.

Magnetometer data were acquired along a series of 75-foot spaced tracklines oriented nominally parallel with the long axis of each of the two candidate borrow areas. The magnetometer sensor was towed at a nominal height of 10-15 feet above the bottom along each of the magnetometer survey transects. The survey coverage for each of the two (2) survey areas, Wills Point and Alliance South, respectively (see Figure 1) extended 50' beyond the delineated borrow area towards the shoreline, 250' towards the center of the River and extend 150' beyond the upstream and the downstream borrow area delineation.



Data Processing

Following completion of the field survey, raw data files and records were submitted to preliminary processing while still on site to ensure data quality and data density. These data were subsequently delivered to OSI's headquarters in Old Saybrook, Connecticut, where final data processing tasks were completed.

Procedurally, the raw multibeam data files for each trackline were sequentially loaded into the HYPACK multibeam editor. Within the editor, raw data files, consisting of multibeam range and beam information, water level, water column velocity profile, vessel position and attitude information, were "cleaned" (edited) to eliminate invalid sensor data using automated and manual editing tools. After the sensor data were cleaned datum-corrected, binned X, Y, Z data points were computed.

Sounding X, Y, Z data points were contoured using Quicksurf Version 5.1 operating within AutoCAD 2004. Plan view elevation contours and a shaded relief map are presented at a scale of 1" = 300' on Drawing 1 (4 sheets). These products were developed from 4-foot by 4-foot binned data with the average depth within each bin posted in the center of the bin. A digital listing of binned X,Y,Z data is also included in the digital deliverable. After the field survey was completed, M&N provided modified borrow area limits (LDSP_Borrow_Areas.dwg, 08/30/2011). The modified limits are displayed on the project drawings.

Magnetometer data were processed and reviewed using Geometrics MagPick software package (version 3.2). In the Wills Point survey area, seventy three magnetic anomalies were identified. Twenty eight of the anomalies are located within the modified borrow area limits. In the Alliance South Area, 221 magnetic anomalies were identified. Anomalies A-157 and A-181 are likely associated with a sunken barge that was evident on the multibeam imagery. Summary tables of magnetic anomalies in each area are included in Attachment 3.

OSI appreciates the opportunity to support Moffatt & Nichol on this project and we look forward to continuing this working relationship in the future. If you have any questions regarding any aspect of this survey, or we can be of service on other survey efforts, please do not hesitate to contact me.

Sincerely,

OCEAN SURVEYS, INC.

Margaret H. Sano

Margaret Sano
Senior Project Scientist

MHS/lf
Attachments



ATTACHMENT 1

OPUS SOLUTION REPORTS



Moffatt & Nichol
Multibeam Survey Operations Report 11ES055

From: opus [opus@NGS.NOAA.GOV]
Sent: Thursday, January 20, 2011 6:24 AM
To: rmw@oceansurveys.com
Subject: OPUS-RS solution : 19960180.DAT 000195946

FILE: 19960180.DAT 000195946

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.

Your station is 3.7 KM outside the polygon enclosing the
reference stations.

NGS OPUS-RS SOLUTION REPORT
=====

USER: rmw@oceansurveys.com DATE: January 20, 2011
RINEX FILE: 1996018r.11o TIME: 06:24:25 UTC

SOFTWARE: rsgps 1.35.1 RS50.prl 1.66 START: 2011/01/18 17:06:30
EPHEMERIS: igr16192.eph [rapid] STOP: 2011/01/18 17:36:15
NAV FILE: brdc0180.11n OBS USED: 819 / 819 :
100%

ANT NAME: TRM55971.00 QUALITY IND. 32.86/ 13.60
ARP HEIGHT: 1.433 NORMALIZED RMS: 0.289

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00
(EPOCH:2011.04856)

X: 8749.054(m) 0.029(m) 8748.337(m) 0.029(m)
Y: -5549222.927(m) 0.031(m) -5549221.430(m) 0.031(m)
Z: 3133725.617(m) 0.021(m) 3133725.409(m) 0.021(m)

LAT: 29 37 8.67022 0.011(m) 29 37 8.68839 0.011(m)
E LON: 270 5 25.20237 0.029(m) 270 5 25.17580 0.029(m)
W LON: 89 54 34.79763 0.029(m) 89 54 34.82420 0.029(m)
EL HGT: -20.386(m) 0.035(m) -21.791(m) 0.035(m)
ORTHO HGT: 4.483(m) 0.037(m) [NAVD88 (Computed using GEOID09)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 16) SPC (1702 LA S)
Northing (Y) [meters] 3280114.815 124900.499
Easting (X) [meters] 218241.499 1137875.195
Convergence [degrees] -1.43899724 0.71185173
Point Scale 1.00057966 0.99994780
Combined Factor 1.00058286 0.99995100

US NATIONAL GRID DESIGNATOR: 16RBT1824180114(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DK3577	ENG5 ENGLISH TURN 5 CORS ARP	N295244.246	W0895630.197	28973.8
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	39460.1
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.007	59616.5
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	78898.1
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.653	83348.7
DG6568	COVG COVINGTON CORS ARP	N302833.269	W0900543.923	96658.2
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.635	116614.1

NEAREST NGS PUBLISHED CONTROL POINT
AT0708 R 366 N293648.203 W0895430.095 645.4

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.



Moffatt & Nichol
Multibeam Survey Operations Report 11ES055

From: opus [opus@NGS.NOAA.GOV]
Sent: Thursday, January 20, 2011 6:06 AM
To: rmw@oceansurveys.com
Subject: OPUS-RS solution : 19960181.DAT 000195947

FILE: 19960181.DAT 000195947

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.

Your station is 3.7 KM outside the polygon enclosing the
reference stations.

NGS OPUS-RS SOLUTION REPORT
=====

USER: rmw@oceansurveys.com DATE: January 20, 2011
RINEX FILE: 1996018s.11o TIME: 06:05:24 UTC

SOFTWARE: rsgps 1.35.1 RS10.prl 1.66 START: 2011/01/18 18:06:30
EPHEMERIS: igr16192.eph [rapid] STOP: 2011/01/18 18:36:15
NAV FILE: brdc0180.11n OBS USED: 840 / 1127 :
75%
ANT NAME: TRM55971.00 QUALITY IND. 22.55/ 14.90
ARP HEIGHT: 1.433 NORMALIZED RMS: 0.316

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00
(EPOCH:2011.04867)

X: 8749.032(m) 0.015(m) 8748.315(m) 0.015(m)
Y: -5549222.930(m) 0.032(m) -5549221.433(m) 0.032(m)
Z: 3133725.645(m) 0.027(m) 3133725.437(m) 0.027(m)

LAT: 29 37 8.67096 0.027(m) 29 37 8.68914 0.027(m)
E LON: 270 5 25.20155 0.015(m) 270 5 25.17499 0.015(m)
W LON: 89 54 34.79845 0.015(m) 89 54 34.82501 0.015(m)
EL HGT: -20.369(m) 0.032(m) -21.774(m) 0.032(m)
ORTHO HGT: 4.500(m) 0.034(m) [NAVD88 (Computed using GEOID09)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 16) SPC (1702 LA S)
Northing (Y) [meters] 3280114.838 124900.522
Easting (X) [meters] 218241.478 1137875.173
Convergence [degrees] -1.43899736 0.71185161
Point Scale 1.00057966 0.99994780
Combined Factor 1.00058286 0.99995100

US NATIONAL GRID DESIGNATOR: 16RBT1824180114(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DK3577	ENG5 ENGLISH TURN 5 CORS ARP	N295244.246	W0895630.197	28973.7
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	39460.1
DJ9603	LWES LAKEWOOD ELMENTRY CORS ARP	N295401.295	W0902057.833	52734.7
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.007	59616.4
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.653	83348.7
DG6568	COVG COVINGTON CORS ARP	N302833.269	W0900543.923	96658.2
AJ7833	HAMM HAMMOND CORS ARP	N303047.051	W0902803.428	112761.6

NEAREST NGS PUBLISHED CONTROL POINT
AT0708 R 366 N293648.203 W0895430.095 645.4

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.



Moffatt & Nichol
Multibeam Survey Operations Report 11ES055

From: opus [opus@NGS.NOAA.GOV]
Sent: Thursday, January 20, 2011 6:10 AM
To: rmw@oceansurveys.com
Subject: OPUS-RS solution : 19960182.DAT 000195948

FILE: 19960182.DAT 000195948

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.

Your station is 3.7 KM outside the polygon enclosing the
reference stations.

NGS OPUS-RS SOLUTION REPORT
=====

USER: rmw@oceansurveys.com DATE: January 20, 2011
RINEX FILE: 1996018t.11o TIME: 06:10:01 UTC

SOFTWARE: rsgps 1.35.1 RS23.prl 1.66 START: 2011/01/18 19:06:30
EPHEMERIS: igr16192.eph [rapid] STOP: 2011/01/18 19:36:15
NAV FILE: brdc0180.11n OBS USED: 960 / 1112 :
86%
ANT NAME: TRM55971.00 QUALITY IND. 4.91/ 23.49
ARP HEIGHT: 1.433 NORMALIZED RMS: 0.269

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00
(EPOCH:2011.04878)

X: 8749.026(m) 0.010(m) 8748.309(m) 0.010(m)
Y: -5549222.950(m) 0.015(m) -5549221.453(m) 0.015(m)
Z: 3133725.617(m) 0.007(m) 3133725.409(m) 0.007(m)

LAT: 29 37 8.66985 0.006(m) 29 37 8.68802 0.006(m)
E LON: 270 5 25.20133 0.010(m) 270 5 25.17476 0.010(m)
W LON: 89 54 34.79867 0.010(m) 89 54 34.82524 0.010(m)
EL HGT: -20.366(m) 0.015(m) -21.771(m) 0.015(m)
ORTHO HGT: 4.503(m) 0.019(m) [NAVD88 (Computed using GEOID09)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 16) SPC (1702 LA S)
Northing (Y) [meters] 3280114.804 124900.487
Easting (X) [meters] 218241.471 1137875.167
Convergence [degrees] -1.43899738 0.71185158
Point Scale 1.00057966 0.99994780
Combined Factor 1.00058286 0.99995100

US NATIONAL GRID DESIGNATOR: 16RBT1824180114(NAD 83)

BASE STATIONS USED
PID DESIGNATION LATITUDE LONGITUDE DISTANCE(m)
DK3577 ENG5 ENGLISH TURN 5 CORS ARP N295244.246 W0895630.197 28973.8
DH7121 GRIS GRAND ISLE CORS ARP N291555.883 W0895726.262 39460.1
DJ9603 LWES LAKEWOOD ELEMENTRY CORS ARP N295401.295 W0902057.833 52734.7
DH9596 DSTR DESTRAHAN H.S. CORS ARP N295752.395 W0902256.007 59616.5
DF5771 LMCN LUMCON CORS ARP N291517.904 W0903940.653 83348.7
DG6568 COVG COVINGTON CORS ARP N302833.269 W0900543.923 96658.2
AJ7833 HAMM HAMMOND CORS ARP N303047.051 W0902803.428 112761.6
DL8631 AWES AWES 147 BC ALWES CORS ARP N300600.962 W0905858.635 116614.1

NEAREST NGS PUBLISHED CONTROL POINT
AT0708 R 366 N293648.203 W0895430.095 645.4

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.



Moffatt & Nichol
Multibeam Survey Operations Report 11ES055

From: opus [opus@NGS.NOAA.GOV]
Sent: Thursday, January 20, 2011 6:05 AM
To: rmw@oceansurveys.com
Subject: OPUS-RS solution : 19960183.DAT 000195949

FILE: 19960183.DAT 000195949

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.

Your station is 3.7 KM outside the polygon enclosing the
reference stations.

NGS OPUS-RS SOLUTION REPORT
=====

USER: rmw@oceansurveys.com DATE: January 20, 2011
RINEX FILE: 1996018u.11o TIME: 06:04:50 UTC

SOFTWARE: rsgps 1.35.1 RS28.prl 1.66 START: 2011/01/18 20:06:30
EPHEMERIS: igr16192.eph [rapid] STOP: 2011/01/18 20:36:15
NAV FILE: brdc0180.11n OBS USED: 2160 / 2700 :
80%
ANT NAME: TRM55971.00 QUALITY IND. 7.44/ 17.58
ARP HEIGHT: 1.433 NORMALIZED RMS: 0.478

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00
(EPOCH:2011.04890)

X: 8749.032(m) 0.010(m) 8748.315(m) 0.010(m)
Y: -5549222.893(m) 0.029(m) -5549221.396(m) 0.029(m)
Z: 3133725.605(m) 0.028(m) 3133725.397(m) 0.028(m)

LAT: 29 37 8.67043 0.022(m) 29 37 8.68860 0.022(m)
E LON: 270 5 25.20155 0.010(m) 270 5 25.17499 0.010(m)
W LON: 89 54 34.79845 0.010(m) 89 54 34.82501 0.010(m)
EL HGT: -20.421(m) 0.034(m) -21.826(m) 0.034(m)
ORTHO HGT: 4.448(m) 0.036(m) [NAVD88 (Computed using GEOID09)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 16) SPC (1702 LA S)
Northing (Y) [meters] 3280114.822 124900.505
Easting (X) [meters] 218241.477 1137875.173
Convergence [degrees] -1.43899735 0.71185161
Point Scale 1.00057966 0.99994780
Combined Factor 1.00058287 0.99995101

US NATIONAL GRID DESIGNATOR: 16RBT1824180114(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DK3577	ENG5 ENGLISH TURN 5 CORS ARP	N295244.246	W0895630.197	28973.8
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	39460.1
DJ9603	LWES LAKEWOOD ELMENTRY CORS ARP	N295401.295	W0902057.833	52734.7
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.007	59616.5
DG5315	HOUM HOUMA CORS ARP	N293532.109	W0904324.988	78898.1
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.653	83348.7
DG6568	COVG COVINGTON CORS ARP	N302833.269	W0900543.923	96658.2
AJ7833	HAMM HAMMOND CORS ARP	N303047.051	W0902803.428	112761.6
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.635	116614.0

NEAREST NGS PUBLISHED CONTROL POINT
AT0708 R 366 N293648.203 W0895430.095 645.4
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.



Moffatt & Nichol
Multibeam Survey Operations Report 11ES055

From: opus [opus@NGS.NOAA.GOV]
Sent: Thursday, January 20, 2011 6:09 AM
To: rmw@oceansurveys.com
Subject: OPUS-RS solution : 19960184.DAT 000195950

FILE: 19960184.DAT 000195950

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.

Your station is 3.7 KM outside the polygon enclosing the
reference stations.

NGS OPUS-RS SOLUTION REPORT
=====

USER: rmw@oceansurveys.com DATE: January 20, 2011
RINEX FILE: 1996018v.11o TIME: 06:09:02 UTC

SOFTWARE: rsgps 1.35.1 RS40.prl 1.66 START: 2011/01/18 21:06:30
EPHEMERIS: igr16192.eph [rapid] STOP: 2011/01/18 21:36:15
NAV FILE: brdc0180.11n OBS USED: 3240 / 3240 :
100%
ANT NAME: TRM55971.00 QUALITY IND. 17.48/ 32.98
ARP HEIGHT: 1.433 NORMALIZED RMS: 0.339

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00
(EPOCH:2011.04901)

X: 8749.020(m) 0.009(m) 8748.303(m) 0.009(m)
Y: -5549222.913(m) 0.014(m) -5549221.416(m) 0.014(m)
Z: 3133725.613(m) 0.011(m) 3133725.405(m) 0.011(m)

LAT: 29 37 8.67033 0.005(m) 29 37 8.68851 0.005(m)
E LON: 270 5 25.20110 0.009(m) 270 5 25.17454 0.009(m)
W LON: 89 54 34.79890 0.009(m) 89 54 34.82546 0.009(m)
EL HGT: -20.400(m) 0.017(m) -21.805(m) 0.017(m)
ORTHO HGT: 4.469(m) 0.020(m) [NAVD88 (Computed using GEOID09)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 16) SPC (1702 LA S)
Northing (Y) [meters] 3280114.819 124900.502
Easting (X) [meters] 218241.465 1137875.161
Convergence [degrees] -1.43899741 0.71185155
Point Scale 1.00057966 0.99994780
Combined Factor 1.00058287 0.99995100

US NATIONAL GRID DESIGNATOR: 16RBT1824180114(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DK3577	ENG5 ENGLISH TURN 5 CORS ARP	N295244.246	W0895630.197	28973.8
DH7121	GRIS GRAND ISLE CORS ARP	N291555.883	W0895726.262	39460.1
DJ9603	LWES LAKEWOOD ELMENTRY CORS ARP	N295401.295	W0902057.833	52734.7
DH9596	DSTR DESTRAHAN H.S. CORS ARP	N295752.395	W0902256.007	59616.4
DG5315	HOUH HOUMA CORS ARP	N293532.109	W0904324.988	78898.0
DF5771	LMCN LUMCON CORS ARP	N291517.904	W0903940.653	83348.6
DG6568	COVG COVINGTON CORS ARP	N302833.269	W0900543.923	96658.2
AJ7833	HAMM HAMMOND CORS ARP	N303047.051	W0902803.428	112761.6
DL8631	AWES AWES 147 BC ALWES CORS ARP	N300600.962	W0905858.635	116614.0

NEAREST NGS PUBLISHED CONTROL POINT
AT0708 R 366 N293648.203 W0895430.095 645.4
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.



Moffatt & Nichol
Multibeam Survey Operations Report 11ES055

From: opus [opus@NGS.NOAA.GOV]
Sent: Thursday, January 20, 2011 6:14 AM
To: rmw@oceansurveys.com
Subject: OPUS-RS solution : 19960185.DAT 000195952

FILE: 19960185.DAT 000195952

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.
Your station is 3.7 KM outside the polygon enclosing the
reference stations.

NGS OPUS-RS SOLUTION REPORT
=====

USER: rmw@oceansurveys.com DATE: January 20, 2011
RINEX FILE: 1996018w.11o TIME: 06:13:59 UTC

SOFTWARE: rsgps 1.35.1 RS11.prl 1.66 START: 2011/01/18 22:06:30
EPHEMERIS: igr16192.eph [rapid] STOP: 2011/01/18 22:36:15
NAV FILE: brdc0180.11n OBS USED: 2817 / 3240 :
87%
ANT NAME: TRM55971.00 QUALITY IND. 10.53/ 2.73
ARP HEIGHT: 1.433 NORMALIZED RMS: 0.352

REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000) ITRF00
(EPOCH:2011.04913)

X: 8749.018(m) 0.011(m) 8748.301(m) 0.011(m)
Y: -5549222.938(m) 0.032(m) -5549221.441(m) 0.032(m)
Z: 3133725.632(m) 0.019(m) 3133725.424(m) 0.019(m)

LAT: 29 37 8.67047 0.007(m) 29 37 8.68864 0.007(m)
E LON: 270 5 25.20103 0.011(m) 270 5 25.17447 0.011(m)
W LON: 89 54 34.79897 0.011(m) 89 54 34.82553 0.011(m)
EL HGT: -20.369(m) 0.036(m) -21.774(m) 0.036(m)
ORTHO HGT: 4.500(m) 0.038(m) [NAVD88 (Computed using GEOID09)]

UTM COORDINATES STATE PLANE COORDINATES
UTM (Zone 16) SPC (1702 LA S)
Northing (Y) [meters] 3280114.823 124900.506
Easting (X) [meters] 218241.463 1137875.159
Convergence [degrees] -1.43899743 0.71185154
Point Scale 1.00057966 0.99994780
Combined Factor 1.00058286 0.99995100

US NATIONAL GRID DESIGNATOR: 16RBT1824180114(NAD 83)

BASE STATIONS USED
PID DESIGNATION LATITUDE LONGITUDE DISTANCE(m)
DK3577 ENG5 ENGLISH TURN 5 CORS ARP N295244.246 W0895630.197 28973.7
DH7121 GRIS GRAND ISLE CORS ARP N291555.883 W0895726.262 39460.1
DJ9603 LWES LAKEWOOD ELEMENTRY CORS ARP N295401.295 W0902057.833 52734.7
DH9596 DSTR DESTRAHAN H.S. CORS ARP N295752.395 W0902256.007 59616.4
DG5315 HOUM HOUMA CORS ARP N293532.109 W0904324.988 78898.0
DF5771 LMCN LUMCON CORS ARP N291517.904 W0903940.653 83348.6
DG6568 COVG COVINGTON CORS ARP N302833.269 W0900543.923 96658.2
AJ7833 HAMM HAMMOND CORS ARP N303047.051 W0902803.428 112761.6
DL8631 AWES AWES 147 BC ALWES CORS ARP N300600.962 W0905858.635 116614.0
NEAREST NGS PUBLISHED CONTROL POINT
AT0708 R 366 N293648.203 W0895430.095 645.4

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.



ATTACHMENT 2

SURVEY CONTROL





VICINITY MAP Not to Scale

Reproduced from Google Earth ©2010

Station Name: "BA03C SM 01 RESET"

Location: From the oil storage tanks in Alliance, Louisiana, proceed north on La Highway 23 for approximately 0.7 miles to the pipelines on the right crossing over the Mississippi River Levee. Turn around and proceed south in the southbound lane of the Highway to the south side of a ring levee and the monument on the right.

Monument Description: NGS style floating sleeve monument; datum point set on 9/16" stainless steel sectional rods driven 68 feet to refusal, set in sand filled 6" PVC pipe with access cover set in concrete, flush with ground.

Stamping: BA03C SM 01 RESET

Installation Date: MAY 4, 2010 **Date of Survey:** MAY 4, 2010

Monument Established By: JCLS

For: CPRA, OCPR

NAD83 Geodetic Position (CORS96)(EPOCH 2002.0)

Lat. 29° 41' 58.38928" N
Long. 089° 59' 13.29628" W

NAD83 Datum LSZ (1702) Ft (CORS96)(EPOCH 2002.0)

N= 438,744.19
E= 3,708,256.17

NAVD88 Height (CORS96)(EPOCH 2002.0)

Elevation = 1.98 feet (0.603 mtrs)

*Ellipsoid Height = -24.565 mtrs.
Geoid09 Height = -25.168 mtrs.*

NAVD88 Height (CORS96)(EPOCH 2002.0)

Elevation = 2.14 feet (0.652 mtrs)

*Ellipsoid Height = -24.565 mtrs.
Geoid03 Height = -25.217 mtrs. (2004.65)*



Adjusted Position Established by John Chance Land Surveys, Inc. for the Office of Coastal Protection & Restoration

ATTACHMENT 3

MAGNETIC ANOMALY SUMMARY TABLES



WILLS PT PROPOSED BORROW AREA

MAGNETIC ANOMALIES

Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
W-1	3703700.5	453440.1	+M	11.0	72.4	10.5	1.3	13.2
W-2	3703384.0	453735.1	+M	25.2	95.92	11.8	3.6	43.1
W-3	3702844.0	454234.6	+M	7.3	52.34	10.0	0.8	7.7
W-4	3703877.0	453183.0	+M	5.0	57.76	8.9	0.4	3.6
W-5	3703423.3	453600.0	D	16.1	117.34	10.5	1.8	19.1
W-6	3702819.0	454154.9	-M	5.2	73.18	12.0	0.8	9.4
W-7	3702965.5	453916.3	+M	6.7	69.86	10.8	0.8	8.7
W-8	3702805.8	454067.5	-M	12.4	66.36	11.8	1.8	20.9
W-9	3702459.0	454385.3	-M	39.2	64.3	10.1	4.1	41.4
W-10	3701693.3	455085.3	-M	25.5	94.66	9.9	2.6	25.6
W-11	3703282.3	453525.2	D	38.6	32.48	11.6	5.4	62.1
W-12	3702993.8	453794.4	+M	12.1	97.94	9.7	1.2	11.5
W-13	3703451.8	453264.0	+M	21.0	79.64	9.7	2.1	20.0
W-14	3703218.3	453481.2	-M	12.4	108.18	8.7	1.0	8.6
W-15	3702562.0	454089.4	+M	8.5	53.32	9.7	0.8	8.0
W-16	3702371.8	454264.1	D	39.3	97.04	11.8	5.7	67.2
W-17	3702916.8	453674.2	D	9.7	16.32	7.7	0.6	4.7
W-18	3702389.8	454161.3	D	13.7	21.42	8.3	1.0	8.2
W-19	3701713.0	454788.6	+M	17.5	146.64	13.6	3.4	46.2
W-20	3703069.8	453429.9	-M	11.8	58.5	7.0	0.6	4.2
W-21	3702780.8	453698.0	-M	54.3	98.98	11.6	7.6	87.8
W-22	3701456.8	454913.3	D	181.1	31.38	10.7	21.6	232.0
W-23	3702827.5	453550.8	D	97.4	21.54	8.3	7.0	58.2
W-24	3702723.3	453642.9	+M	11.0	64.5	12.1	1.7	20.4
W-25	3701687.8	454599.1	-M	11.6	91.72	11.9	1.7	20.4
W-26	3701123.0	455125.5	-M	23.4	93.48	10.3	2.6	26.5
W-27	3704094.8	452266.8	+M	19.5	68.3	10.2	2.1	21.4
W-28	3703884.5	452462.0	-M	18.3	37.56	10.7	2.2	23.5
W-29	3702515.0	453722.0	D	13.4	21.8	15.2	3.2	49.3
W-30	3701319.8	454826.4	+M	14.0	147.1	13.7	2.7	37.7
W-31	3703277.8	453016.3	+M	7.7	104.14	12.9	1.3	17.2



Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
W-32	3703624.5	452698.6	D	10.9	39.12	9.4	1.0	9.3
W-33	3703787.0	452545.3	D	10.8	46.64	6.6	0.5	3.2
W-34	3701538.8	454532.4	D	88.4	33.76	7.6	5.3	40.4
W-35	3701293.8	454761.6	+M	11.3	63.22	15.2	2.7	40.7
W-36	3701094.8	454950.3	D	97.2	31.26	8.1	6.6	52.8
W-37	3700780.8	455247.0	D	44.4	23.72	11.5	6.1	70.5
W-38	3702998.3	453073.2	D	55.3	15.66	13.2	10.0	132.4
W-39	3702886.5	453176.2	D	241.9	15.62	8.5	18.1	154.0
W-40	3702323.5	453693.9	-M	19.7	58.52	10.6	2.3	24.1
W-41	3701147.5	454782.6	+M	13.7	60.54	10.9	1.7	18.1
W-42	3702088.0	453912.1	-M	12.0	63.7	14.1	2.5	34.9
W-43	3702857.8	453111.5	D	14.5	22.64	14.2	3.0	43.3
W-44	3702279.8	453639.8	+M	68.4	99.72	11.0	8.7	95.6
W-45	3701488.5	454375.7	D	17.3	37.8	11.1	2.2	24.6
W-46	3700695.5	455113.6	D	26.0	70.06	11.4	3.5	40.4
W-47	3703409.5	452486.2	D	183.6	26.84	8.6	14.0	119.6
W-48	3703074.3	452798.1	+M	8.7	55.18	12.9	1.5	19.1
W-49	3701993.8	453797.4	D	20.6	18.62	10.9	2.5	27.4
W-50	3700554.5	455123.6	D	175.2	56.1	10.7	20.8	222.5
W-51	3703602.0	452221.3	+M	7.2	56.18	16.9	2.1	36.0
W-52	3703527.0	452290.5	D	18.2	17.82	11.5	2.5	28.5
W-53	3702864.3	452894.8	D	56.3	224.52	14.7	12.7	186.6
W-54	3701956.0	453743.7	+M	11.2	57.24	7.2	0.6	4.4
W-55	3701664.5	454021.2	D	43.3	65	13.2	7.8	102.5
W-56	3700995.8	454630.3	D	58.4	33	11.2	7.7	85.9
W-57	3703991.0	451762.8	-M	25.6	27.8	19.6	10.2	200.2
W-58	3703247.5	452435.1	-M	56.1	75.98	19.7	22.6	445.9
W-59	3702653.0	452984.2	D	379.6	43.84	12.3	59.2	724.6
W-60	3701631.0	453922.7	-M	96.3	80.52	13.9	19.4	270.2
W-61	3702068.3	453525.1	+M	28.4	110.44	12.2	4.4	53.3
W-62	3703613.5	452004.8	-M	30.0	50.24	12.8	5.1	64.9
W-63	3702236.3	453571.0	-M	58.5	320.62	13.1	10.3	134.9
W-64	3703339.8	452257.0	D	72.1	19.04	9.9	7.4	73.1
W-65	3701052.3	454371.8	-M	26.9	95.44	4.8	0.6	3.1
W-66	3700456.5	454927.3	-M	17.3	111.12	13.9	3.5	47.9
W-67	3703273.3	452218.9	-M	465.7	43.98	51.8	1299.2	67344.6
W-68	3702852.3	452599.1	+M	12.0	56.4	16.4	3.4	55.0



Magnetic Anomaly	Easting¹	Northing¹	Type²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole)³	Mass Estimate (lbs) (dipole)³
W-69	3702688.3	452763.2	D	47.6	20.2	10.1	5.0	50.6
W-70	3702178.0	453231.6	+M	59.8	46.18	6.5	2.6	17.1
W-71	3701628.0	453737.9	+M	124.6	88.16	9.3	11.1	103.3
W-72	3702331.8	452973.1	-M	95.8	192.18	14.3	20.3	289.1

Notes:

1. Coordinates are in U.S. feet, referenced to Louisiana State Plane Grid System, South Zone (1702) NAD 83
2. Anomaly type: +M = positive monopole; -M=negative monopole; D=dipole.
3. Estimated ferrous mass is based on the magnetic moment which can vary by an order of magnitude.



ALLIANCE SOUTH PROPOSED BORROW AREA

MAGNETIC ANOMALIES

Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
A-1	3718449.0	420985.3	-M	26.3	274.3	24.5	16.5	403.7
A-2	3717818.3	422463.3	+M	18.5	118.7	20.6	8.1	166.7
A-3	3717786.8	422812.3	-M	523.9	671.9	22.2	267.3	5923.7
A-4	3717682.3	423652.4	+M	6.2	120.4	19.4	2.4	46.7
A-5	3717659.3	423922.8	D	76.1	19.2	8.9	6.2	55.1
A-6	3717633.3	424165.3	+M	9.9	60.0	11.6	1.4	16.0
A-7	3717553.5	424832.2	D	13.1	33.4	12.7	2.2	28.1
A-8	3717514.0	425138.4	D	17.7	98.5	14.5	3.9	56.4
A-9	3717488.8	425383.5	-M	16.0	119.6	16.2	4.4	70.9
A-10	3717329.3	426852.0	D	38.0	23.4	12.8	6.4	81.9
A-11	3717246.5	427463.3	+M	6.0	55.8	15.8	1.5	24.5
A-12	3717121.0	428559.6	D	12.0	41.9	28.6	10.2	290.1
A-13	3718144.0	421309.9	-M	4.8	97.6	20.6	2.1	43.5
A-14	3717693.3	422971.8	+M	27.9	85.9	13.1	5.0	65.2
A-15	3717625.8	423531.7	-M	43.3	91.6	8.8	3.5	31.1
A-16	3717512.3	424491.5	D	53.3	23.7	11.8	7.8	91.8
A-17	3717455.5	424971.2	D	40.5	23.9	11.0	5.0	55.3
A-18	3717286.5	426442.1	D	111.5	31.7	9.3	10.1	94.4
A-19	3717164.3	427429.9	+M	18.5	58.2	14.8	4.2	61.7
A-20	3717119.3	427847.3	D	244.0	147.4	16.5	68.8	1133.0
A-21	3717060.0	428433.5	-M	96.2	66.2	6.7	4.5	30.4
A-22	3718068.0	421288.0	+M	10.6	89.8	16.1	2.8	45.7
A-23	3717651.3	422658.8	-M	79.4	47.2	11.0	10.0	110.3
A-24	3717589.0	423187.2	-M	7.8	37.2	11.8	1.1	13.2
A-25	3717522.0	423760.7	D	19.6	18.8	10.7	2.3	24.9
A-26	3717446.8	424378.6	D	21.4	34.7	14.4	4.6	66.8
A-27	3717433.3	424522.8	D	66.9	27.5	12.3	10.5	129.8
A-28	3717399.3	424794.9	D	62.9	16.8	12.2	9.8	119.9
A-29	3717343.0	425289.4	D	130.3	54.2	10.2	14.2	144.9
A-30	3717293.3	425731.7	+M	19.3	67.2	12.6	3.2	40.5



Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
A-31	3717251.0	426121.7	D	30.7	36.4	8.7	2.4	21.2
A-32	3717212.3	426445.3	D	95.1	26.2	10.7	11.3	121.6
A-33	3717135.0	427099.1	D	55.0	46.6	19.7	22.2	438.4
A-34	3717111.3	427348.8	+M	14.4	55.9	7.6	0.9	6.7
A-35	3717084.5	427561.9	+M	19.0	50.9	12.9	3.3	42.6
A-36	3717031.0	428020.7	-M	70.6	86.6	10.1	7.5	75.4
A-37	3718435.8	420596.0	+M	114.2	212.6	13.1	20.4	268.1
A-38	3718160.3	421014.1	+M	13.8	60.3	10.0	1.4	14.3
A-39	3718092.8	421118.2	-M	7.6	60.6	10.8	0.9	9.9
A-40	3717643.3	422108.2	+M	19.0	40.6	14.6	4.2	61.4
A-41	3717540.3	423010.4	D	14.9	29.3	7.8	0.9	7.4
A-42	3717468.3	423609.7	D	23.2	55.8	9.1	2.0	17.9
A-43	3717428.0	423978.3	D	59.2	39.1	13.3	10.9	145.4
A-44	3717403.0	424102.3	D	3.1	125.9	10.1	0.3	3.3
A-45	3717373.8	424438.3	D	99.4	22.1	6.4	4.2	26.4
A-46	3717355.5	424595.0	D	12.1	20.3	5.9	0.4	2.6
A-47	3717209.8	425786.3	D	163.8	23.5	13.9	33.1	461.1
A-48	3717194.0	425922.5	+M	31.7	80.0	9.6	3.0	28.7
A-49	3717135.0	426424.5	D	44.4	19.7	10.8	5.4	57.9
A-50	3717105.3	426692.3	+M	14.9	57.3	11.0	1.9	20.8
A-51	3716984.5	427770.3	+M	33.9	84.9	8.7	2.7	23.0
A-52	3716940.0	428215.5	D	34.5	28.8	10.5	4.0	41.5
A-53	3718323.0	420622.3	+M	105.8	171.3	13.9	21.3	296.4
A-54	3717500.0	422542.2	+M	28.6	54.7	10.6	3.4	35.7
A-55	3717346.3	423870.9	D	55.8	21.3	10.5	6.4	66.7
A-56	3717247.5	424730.3	D	97.3	27.5	12.3	15.3	188.9
A-57	3717212.3	425038.5	D	53.6	21.2	15.2	12.9	195.6
A-58	3717111.8	425896.0	D	195.1	29.5	12.5	31.5	393.7
A-59	3717021.0	426674.9	D	98.1	17.3	10.9	12.0	130.6
A-60	3716997.0	426931.3	D	52.8	11.4	9.2	4.7	43.3
A-61	3716968.5	427178.6	-M	45.5	82.7	10.2	4.9	49.6
A-62	3716947.0	427348.7	D	57.4	30.7	10.9	7.1	77.9
A-63	3716901.0	427744.4	-M	18.5	37.4	14.2	3.9	54.8
A-64	3716841.5	428074.1	-M	194.0	306.2	28.8	166.9	4806.1
A-65	3716815.3	428459.2	+M	88.7	88.6	14.6	19.7	287.2
A-66	3717367.5	423078.1	D	13.2	9.0	7.8	0.8	6.6
A-67	3717299.3	423574.7	-M	21.6	46.7	13.6	4.1	55.9



Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
A-68	3717270.0	423834.0	D	184.9	120.6	16.1	49.5	795.2
A-69	3717197.8	424519.0	D	151.2	22.0	9.5	14.1	132.9
A-70	3717166.0	424740.6	D	45.3	26.6	9.0	3.8	34.6
A-71	3717130.8	425054.8	-M	56.1	98.2	17.4	17.7	307.5
A-72	3717118.5	425188.8	D	15.8	25.2	16.1	4.2	67.9
A-73	3717086.3	425473.8	D	65.6	60.6	14.2	13.7	194.8
A-74	3717036.0	425875.4	-M	32.9	51.3	10.6	3.9	41.1
A-75	3717033.5	425974.2	+M	9.0	40.6	7.6	0.5	4.1
A-76	3717005.5	426106.6	D	119.4	15.3	9.2	10.6	97.8
A-77	3716928.8	426803.6	-M	103.1	72.2	12.5	16.8	211.3
A-78	3716897.5	427087.6	+M	34.0	41.2	8.5	2.5	21.5
A-79	3716867.3	427327.9	D	55.4	15.2	12.5	9.0	113.3
A-80	3716815.3	427781.4	+M	52.6	48.2	10.8	6.3	68.5
A-81	3716785.5	428039.1	-M	166.2	131.4	18.6	59.5	1105.2
A-82	3716761.5	428284.3	+M	21.6	45.2	14.6	4.8	69.1
A-83	3716745.8	428440.6	+M	18.9	61.0	10.4	2.1	22.2
A-84	3716723.5	428611.8	D	114.4	35.8	18.6	41.1	763.5
A-85	3717389.0	422201.8	D	24.7	13.0	11.0	3.1	33.8
A-86	3717200.5	423801.8	D	296.6	38.8	12.9	51.1	658.1
A-87	3717093.5	424735.0	D	169.4	14.1	10.8	20.4	220.0
A-88	3716960.3	425877.6	D	40.2	16.8	13.6	7.7	104.1
A-89	3716840.5	426906.8	D	167.4	22.6	14.7	37.7	555.7
A-90	3716816.5	427140.2	-M	45.4	120.5	14.0	9.3	130.4
A-91	3716765.3	427597.2	+M	10.6	37.5	10.2	1.1	11.5
A-92	3716742.0	427809.3	D	25.1	14.0	10.5	2.9	30.0
A-93	3716715.8	428005.5	D	64.3	89.0	15.3	15.7	241.2
A-94	3716700.8	428175.9	+M	283.6	68.6	15.1	67.2	1015.1
A-95	3716676.3	428399.5	D	50.3	24.6	10.0	5.3	52.7
A-96	3717578.0	421336.0	D	18.0	74.0	9.4	1.7	15.6
A-97	3717219.5	422994.4	-M	101.9	506.8	7.7	6.2	47.5
A-98	3717131.5	423752.0	D	60.3	46.2	11.4	8.2	93.5
A-99	3717103.8	424007.0	D	47.0	12.6	9.6	4.5	42.9
A-100	3717005.3	424844.8	D	103.3	72.0	10.4	11.6	119.9
A-101	3716985.8	425024.1	-M	12.5	139.3	11.7	1.8	21.0
A-102	3716933.0	425444.8	D	78.9	15.2	12.2	12.1	147.6
A-103	3716919.0	425604.5	+M	15.1	43.2	12.7	2.5	31.9
A-104	3716886.8	425857.5	D	28.6	120.2	12.4	4.5	55.9



Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
A-105	3716735.8	427167.4	D	61.4	40.5	13.3	11.2	149.1
A-106	3716655.0	427890.3	D	144.5	40.5	14.7	32.5	478.6
A-107	3716630.8	428131.3	D	34.5	27.8	15.5	8.6	132.4
A-108	3716865.5	426052.3	-M	27.5	64.3	13.2	5.0	65.4
A-109	3716612.8	428298.1	D	55.7	115.6	13.5	10.5	141.0
A-110	3717559.5	421225.7	D	693.3	22.7	15.5	173.4	2691.2
A-111	3717294.5	421712.7	D	48.8	19.6	14.2	10.1	143.6
A-112	3717237.0	422162.4	+M	48.1	89.2	8.7	3.8	33.4
A-113	3717202.0	422569.4	-M	22.3	91.7	10.0	2.3	23.0
A-114	3717142.5	423038.7	-M	367.5	486.2	8.9	30.5	273.2
A-115	3717063.8	423706.3	+M	21.1	39.8	14.2	4.4	62.2
A-116	3717022.8	424037.6	+M	18.1	61.1	13.6	3.5	47.7
A-117	3717014.8	424130.7	-M	21.0	60.4	15.1	5.0	75.6
A-118	3716961.0	424611.1	-M	38.3	88.6	13.1	6.8	88.4
A-119	3716936.3	424771.1	D	164.4	15.9	9.3	14.8	137.5
A-120	3716903.3	425043.8	D	24.6	14.2	10.4	2.8	28.9
A-121	3716894.5	425144.1	D	522.9	11.9	10.9	64.9	710.0
A-122	3716872.8	425349.1	+M	52.8	113.9	11.2	6.9	77.9
A-123	3716856.0	425475.2	+M	65.4	57.3	11.5	9.0	103.6
A-124	3716837.5	425670.6	-M	20.5	93.4	10.4	2.3	23.9
A-125	3716819.5	425826.0	-M	18.9	46.9	11.0	2.4	25.7
A-126	3716783.5	426106.3	D	146.5	16.9	9.6	13.9	133.3
A-127	3716729.8	426568.3	D	158.4	104.4	13.7	30.9	422.6
A-128	3716672.0	427071.8	D	129.9	9.3	10.7	15.4	164.6
A-129	3716638.5	427402.0	D	31.7	21.6	10.4	3.6	37.1
A-130	3716622.5	427515.3	+M	21.7	35.3	11.3	2.9	32.9
A-131	3716562.8	428048.3	D	537.1	18.7	15.5	133.9	2075.1
A-132	3716531.5	428332.3	-M	109.7	63.6	15.0	25.5	380.9
A-133	3717197.5	422016.1	D	35.4	40.1	15.6	8.9	138.6
A-134	3717176.8	422190.9	D	19.4	24.3	14.6	4.3	62.3
A-135	3717126.0	422619.8	-M	21.8	87.3	18.7	7.9	148.1
A-136	3717086.8	422940.5	-M	1680.5	384.7	19.3	651.7	12594.3
A-137	3716951.8	424124.7	D	29.4	23.4	17.8	9.7	172.8
A-138	3716932.5	424291.7	D	203.3	15.4	9.8	20.2	197.7
A-139	3716858.5	424882.3	D	277.0	11.2	8.5	21.0	179.1
A-140	3716850.5	424976.9	D	25.6	28.6	9.2	2.3	20.9
A-141	3716834.3	425119.0	+M	34.6	52.5	10.1	3.6	36.5



Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
A-142	3716809.8	425308.8	D	2050.0	14.3	11.2	268.7	3018.8
A-143	3716788.5	425521.9	D	9.7	17.1	12.7	1.6	20.4
A-144	3716777.3	425616.5	D	19.6	16.5	13.1	3.5	45.4
A-145	3716747.8	425854.4	+M	47.5	83.5	20.0	19.8	396.5
A-146	3716727.5	426022.3	D	73.2	24.2	16.1	19.6	314.8
A-147	3716700.8	426245.2	+M	79.4	34.3	7.8	5.0	38.9
A-148	3716687.5	426370.4	D	733.0	31.4	6.9	36.2	250.0
A-149	3716647.8	426686.5	+M	29.9	41.0	5.8	1.0	6.0
A-150	3716622.3	426939.2	+M	41.2	101.9	10.3	4.6	47.1
A-151	3716558.8	427504.0	+M	14.2	53.7	10.5	1.6	17.0
A-152	3716554.8	427548.4	+M	70.1	42.0	9.2	6.2	57.1
A-153	3716531.8	427739.2	D	200.4	183.3	12.0	30.1	362.8
A-154	3716473.0	428288.0	D	47.8	212.0	17.1	14.5	248.5
A-155	3717290.3	421617.0	-M	31.8	63.4	16.1	8.6	139.1
A-156	3717088.0	422357.3	+M	13.6	60.0	22.9	7.4	169.0
A-157	3717012.0	422962.9	-M	8177.4	440.3	22.2	4185.0	92906.5
A-158	3716917.5	423752.4	-M	29.9	88.2	18.6	10.7	198.2
A-159	3716894.0	423962.6	D	87.6	32.4	15.6	22.1	343.6
A-160	3716861.3	424243.6	-M	28.0	69.6	15.8	7.3	115.7
A-161	3716823.8	424543.0	+M	16.0	49.1	16.4	4.4	72.8
A-162	3716794.5	424836.1	+M	144.2	56.7	15.4	35.4	544.7
A-163	3716723.0	425426.3	+M	13.9	31.3	12.7	2.3	29.7
A-164	3716636.5	426157.0	D	597.4	40.5	7.3	32.9	239.8
A-165	3716622.5	426288.2	D	202.5	27.3	8.2	14.3	117.9
A-166	3716598.5	426499.6	+M	273.5	58.3	11.2	35.7	400.0
A-167	3716573.0	426709.9	D	145.9	27.6	12.0	21.7	259.4
A-168	3716558.3	426836.4	D	176.1	21.1	12.1	26.7	322.0
A-169	3716530.8	427058.8	D	167.5	12.4	9.1	14.4	130.9
A-170	3716517.0	427187.3	-M	89.2	34.4	9.2	7.9	73.1
A-171	3716504.0	427295.5	D	203.8	17.3	11.0	25.4	278.6
A-172	3716492.5	427391.6	D	43.4	20.9	11.4	5.8	66.3
A-173	3716482.5	427482.9	-M	38.1	42.0	11.5	5.3	60.6
A-174	3716478.5	427533.5	-M	68.4	35.8	10.9	8.4	91.8
A-175	3716470.3	427614.8	+M	83.1	50.3	11.9	12.2	144.5
A-176	3716453.5	427752.8	D	42.8	12.5	12.5	6.9	86.5
A-177	3716436.3	427892.6	D	45.1	12.5	14.8	10.2	150.6
A-178	3716430.5	427957.3	+M	148.9	46.3	15.3	36.3	557.1



Magnetic Anomaly	Easting ¹	Northing ¹	Type ²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole) ³	Mass Estimate (lbs) (dipole) ³
A-179	3716418.5	428103.8	D	99.4	62.2	15.4	24.6	379.3
A-180	3717672.5	420639.7	D	1102.0	9.9	20.3	473.0	9615.5
A-181	3716921.5	422882.8	D	9130.1	22.2	15.1	2163.2	32674.8
A-182	3716840.8	423638.2	D	33.3	19.9	10.5	3.8	39.8
A-183	3716832.0	423779.8	-M	148.4	47.3	11.1	19.0	210.8
A-184	3716789.0	424114.3	D	139.4	85.4	11.1	17.8	197.1
A-185	3716755.3	424409.3	+M	169.7	65.6	9.2	14.9	137.2
A-186	3716733.8	424586.5	D	71.1	18.7	9.6	6.9	66.1
A-187	3716714.5	424748.4	-M	86.5	56.7	10.2	9.3	94.9
A-188	3716677.8	425067.2	D	56.9	12.5	10.2	6.1	61.9
A-189	3716659.5	425232.8	-M	394.2	34.5	9.4	35.9	336.8
A-190	3716615.8	425601.8	D	3088.0	21.1	14.5	671.0	9705.4
A-191	3716543.8	426193.4	+M	246.6	42.4	8.3	17.5	144.3
A-192	3716543.8	426236.7	D	236.4	11.6	6.9	11.6	79.4
A-193	3716525.5	426423.4	-M	322.1	50.5	10.5	37.1	391.1
A-194	3716518.8	426474.8	+M	308.1	38.1	11.0	38.8	428.1
A-195	3716503.0	426585.8	+M	140.3	55.1	15.1	33.0	497.2
A-196	3716490.3	426695.1	-M	140.9	34.9	10.1	14.9	149.9
A-197	3716430.0	427199.6	-M	353.0	63.0	12.8	59.9	765.2
A-198	3716408.8	427385.8	D	402.1	15.9	14.5	87.9	1275.7
A-199	3716377.3	427694.3	D	353.4	25.8	10.1	37.2	374.7
A-200	3716366.0	427781.9	+M	405.6	61.4	10.9	50.2	548.4
A-201	3716344.3	427939.7	-M	150.3	37.5	13.8	29.5	406.5
A-202	3716322.0	428177.5	D	84.2	10.8	17.7	27.4	484.0
A-203	3716297.8	428386.4	D	406.0	42.5	15.5	101.9	1583.7
A-204	3716264.3	428645.9	+M	192.5	58.1	14.6	42.7	625.1
A-205	3716778.3	423679.1	-M	47.0	33.3	18.1	15.9	288.1
A-206	3716725.0	424094.3	D	63.6	21.8	19.7	25.5	501.6
A-207	3716711.5	424236.3	-M	29.4	29.6	17.5	9.4	164.6
A-208	3716649.5	424775.2	D	184.6	63.6	17.9	61.7	1107.0
A-209	3716622.8	424986.4	+M	146.8	49.4	16.8	42.9	719.7
A-210	3716594.8	425266.3	D	265.5	20.1	14.6	58.8	859.0
A-211	3716553.3	425554.7	+M	305.3	53.2	11.3	40.4	456.3
A-212	3716530.3	425769.1	D	1631.0	45.2	9.1	139.2	1261.6
A-213	3716508.8	425963.0	D	1057.7	26.4	11.8	152.3	1793.1
A-214	3716476.3	426241.6	D	3865.4	11.7	10.5	445.1	4686.6
A-215	3716453.3	426436.9	D	514.8	119.7	13.3	94.6	1259.0

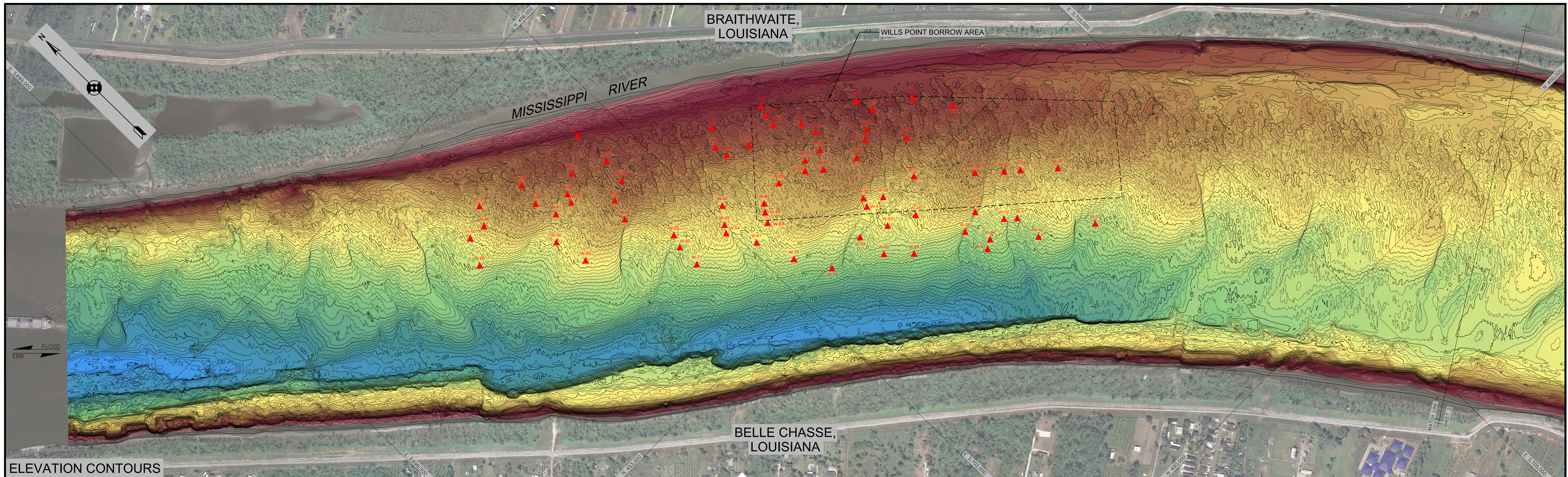


Magnetic Anomaly	Easting¹	Northing¹	Type²	Amplitude (gammas)	Duration (feet)	Sensor Altitude (feet)	Mass Estimate (lbs) (monopole)³	Mass Estimate (lbs) (dipole)³
A-216	3716407.0	426881.5	+M	225.6	18.9	8.9	18.5	163.7
A-217	3716382.8	427072.2	+M	204.1	27.4	12.6	33.6	423.5
A-218	3716372.3	427133.4	-M	200.5	43.4	14.6	44.1	641.2
A-219	3716358.5	427236.2	D	116.4	20.4	18.6	41.8	777.2
A-220	3716337.0	427466.3	D	379.9	45.4	12.6	62.2	780.6
A-221	3716300.5	427742.2	D	1632.0	25.3	16.7	471.8	7871.8

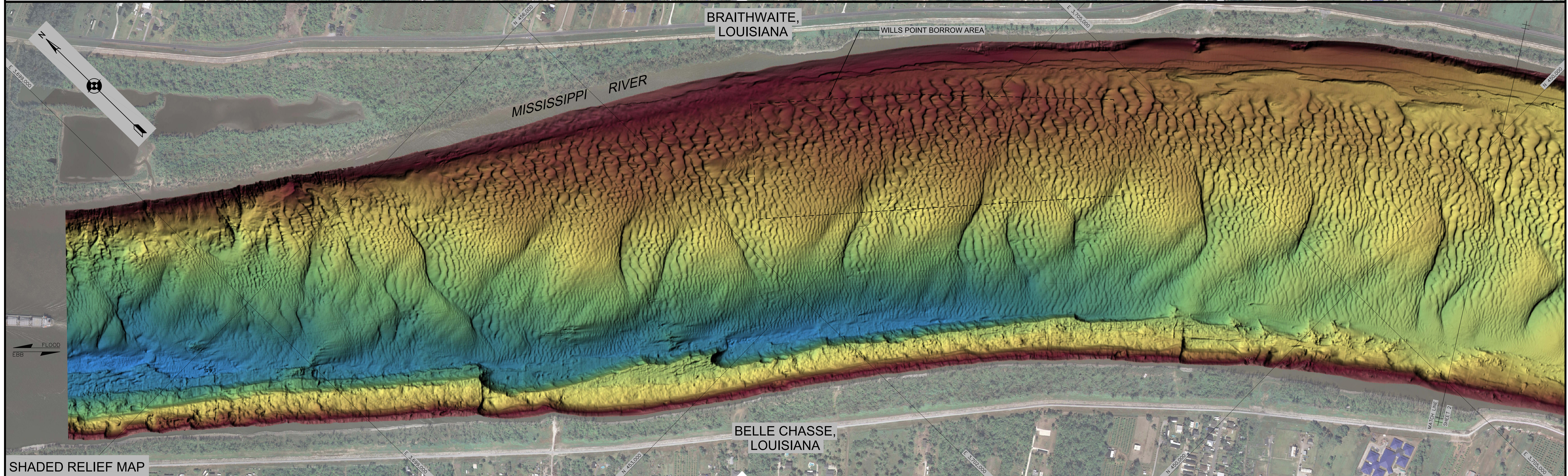
Notes:

1. Coordinates are in U.S. feet, referenced to Louisiana State Plane Grid System, South Zone (1702) NAD 83
2. Anomaly type: +M = positive monopole; -M=negative monopole; D=dipole.
3. Estimated ferrous mass is based on the magnetic moment which can vary by an order of magnitude.





ELEVATION CONTOURS



SHADED RELIEF MAP

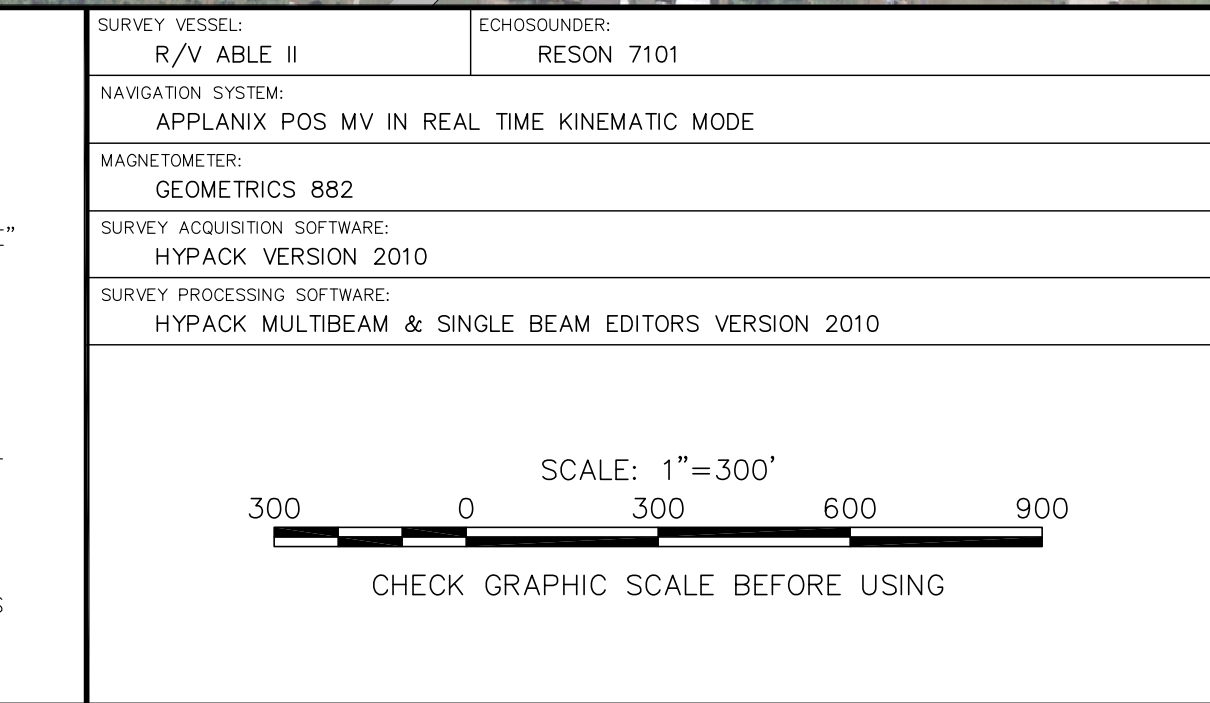


	MAGNETIC ANOMALY		SHADED RELIEF INFORMATION: SUN POSITION ALTITUDE: 55° AZIMUTH: 340°
	BORROW AREA DREDGE LIMITS (AS PROVIDED BY MOFFATT & NICHOL ON 30 AUGUST 2011)		ELEVATIONS (NAVD 88)
	TEN-FOOT CONTOUR		
	TWO-FOOT CONTOUR		

NOTES

- GRID SYSTEM IS THE LOUISIANA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE (1702), NAD 83, U.S. SURVEY FEET.
- ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88-2004.65) BASED ON PRELIMINARY WATER LEVEL VALUES RECORDED AT THE U.S. ARMY CORPS OF ENGINEERS MISSISSIPPI RIVER WATER LEVEL GAUGE "ALLIANCE" (01390).
- CONTOURS ARE IN FEET AND WERE GENERATED USING "QUICKSURF" OPERATING WITHIN AUTODESK "AUTOCAD". HYDROGRAPHIC CONTOURS WERE DEVELOPED FROM FOUR FOOT BY FOUR FOOT BINNED DATA WITH THE AVERAGE DEPTH WITHIN EACH BIN POSTED IN THE CENTER OF THE BIN.
- SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2006 AND OBTAINED FROM THE USGS SEAMLESS DATA WAREHOUSE.
- THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 4-17 AUGUST 2011 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.

SURVEY VESSEL: R/V ABLE II	CHRONOMETER: RESON 7101
NAVIGATION SYSTEM: APPLANIX POS MV IN REAL TIME KINEMATIC MODE	
MAGNETOMETER: GEOMETRICS 882	
SURVEY ACQUISITION SOFTWARE: HYPACK VERSION 2010	
SURVEY PROCESSING SOFTWARE: HYPACK MULTIBEAM & SINGLE BEAM EDITORS VERSION 2010	



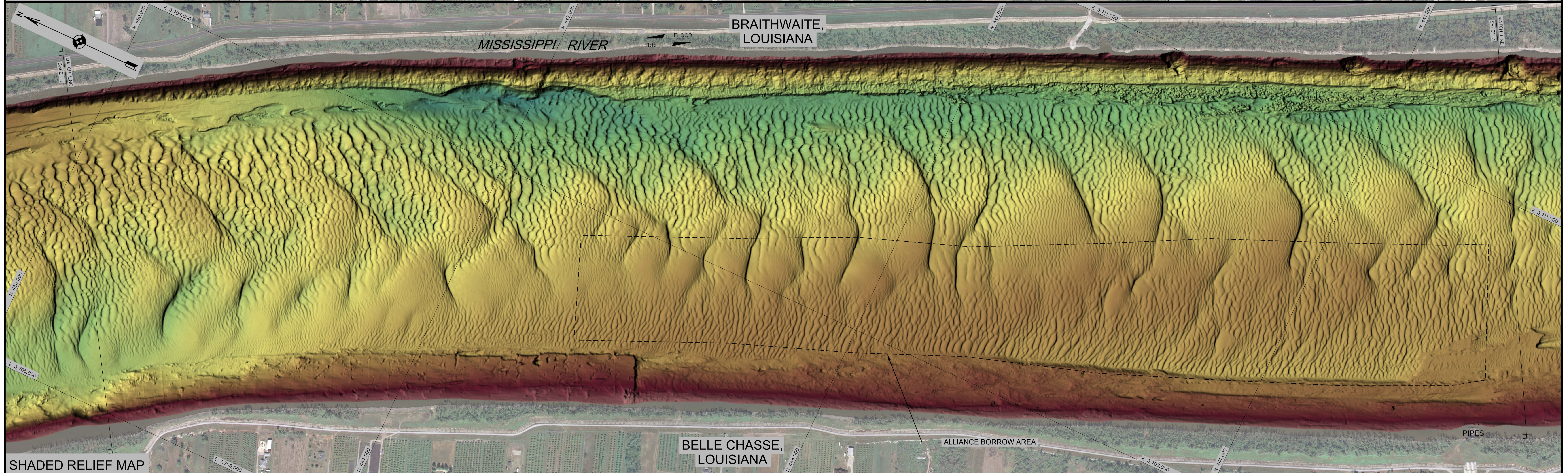
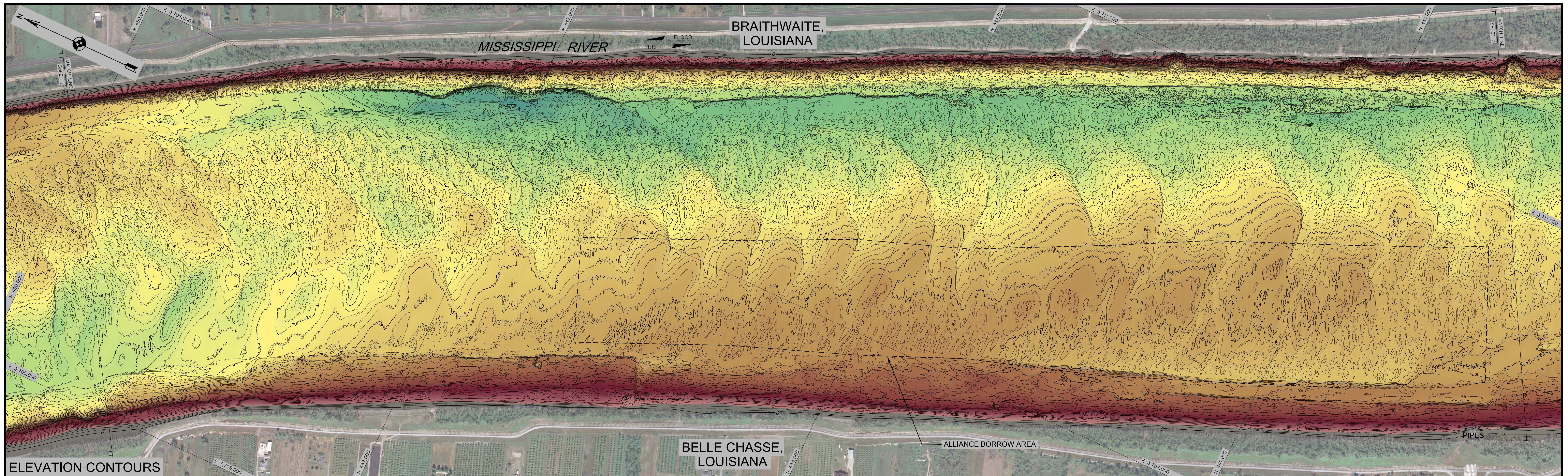
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**MULTIBEAM HYDROGRAPHIC SURVEY AND
MAGNETOMETER SURVEY**
MISSISSIPPI RIVER LONG DISTANCE SEDIMENT
PIPELINE PROJECT
MISSISSIPPI RIVER, BELLE CHASSE, LOUISIANA

PROJECT MANAGER: D. BELL	SURVEY DATE: 4-17 AUGUST 2011	PROJECT NUMBER: 11ES055
DRAFTED BY: A. RIZZO	DATE: 9 SEPTEMBER 2011	DRAWING: 1

1 OF 4



LEGEND	
	MAGNETIC ANOMALY
	BORROW AREA DREDGE LIMITS (AS PROVIDED BY MOFFATT & NICHOL ON 30 AUGUST 2011)
	TEN-FOOT CONTOUR
	TWO-FOOT CONTOUR

SHADED RELIEF INFORMATION:	
	SUN POSITION ALTITUDE: 55° AZIMUTH: 340°

ELEVATIONS (NAVD 88)	
-1	FEET
-30	
-60	
-90	
-120	
-150	

NOTES	
1.	GRID SYSTEM IS THE LOUISIANA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE (1702), NAD 83, U.S. SURVEY FEET.
2.	ELEVATIONS ARE IN FEET AND ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88-2004.65) BASED ON PRELIMINARY WATER LEVEL VALUES RECORDED AT THE U.S. ARMY CORPS OF ENGINEERS MISSISSIPPI RIVER WATER LEVEL GAUGE "ALLIANCE" (01390).
3.	CONTOURS ARE IN FEET AND WERE GENERATED USING "QUICKSURF" OPERATING WITHIN AUTODESK "AUTOCAD". HYDROGRAPHIC CONTOURS WERE DEVELOPED FROM FOUR FOOT BY FOUR FOOT BINNED DATA WITH THE AVERAGE DEPTH WITHIN EACH BIN POSTED IN THE CENTER OF THE BIN.
5.	SHORELINE AND ONSHORE FEATURES ARE APPROXIMATE AND WERE TAKEN FROM DIGITAL ORTHOPHOTO QUADRANGLES FLOWN IN 2006 AND OBTAINED FROM THE USGS SEAMLESS DATA WAREHOUSE.
6.	THE INFORMATION PRESENTED ON THIS DRAWING REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 4-17 AUGUST 2011 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.

SURVEY VESSEL: R/V ABLE II		COPIES/NUMBER: RESON 7101
NAVIGATION SYSTEM: APPLANIX POS MV IN REAL TIME KINEMATIC MODE		
MAGNETOMETER: GEOMETRICS 882		
SURVEY ACQUISITION SOFTWARE: HYPACK VERSION 2010		
SURVEY PROCESSING SOFTWARE: HYPACK MULTIBEAM & SINGLE BEAM EDITORS VERSION 2010		
CHECK GRAPHIC SCALE BEFORE USING		
OCEAN SURVEYS, INC. METAIRIE, LOUISIANA www.oceansurveys.com		
PREPARED FOR: MOFFATT & NICHOL		
MULTIBEAM HYDROGRAPHIC SURVEY AND MAGNETOMETER SURVEY MISSISSIPPI RIVER LONG DISTANCE SEDIMENT PIPELINE PROJECT MISSISSIPPI RIVER, BELLE CHASSE, LOUISIANA		
PROJECT MANAGER: D. BELL	SURVEY DATE: 4-17 AUGUST 2011	PROJECT NUMBER: 11ES055
DRAFTED BY: A. RIZZO	DATE: 9 SEPTEMBER 2011	DRAWING: 1 SHEET: 2 OF 4