HYDROTERRA TECHNOLOGIES, LLC
LAND SURVEY AND HYDROGRAPHIC SOLUTIONS

SURVEY PLAN **METHODOLOGY REPORT**

August 21, 2013

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY (CPRA)

COLE'S BAYOU MARSH RESTORATION (TV-63)
VERMILION PARISH, LA

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Section 1: General Project Description

Project Overview

The scope of this project was to perform topographic, bathymetric, and magnetometer surveys in the area of Cole's Bayou utilizing a combination of Real Time Kinematic GPS (RTK), electronic echo-sounding equipment and methodologies, and metal locators for the purpose of creating and nourishing a determined amount of brackish marsh.

Vicinity Map

Note: Identified project survey areas are outlined in Red.

Section 2: Project Planning

Reference Systems and Project Control

Horizontal Datum (Epoch): NAD 83 (CORS) Louisiana South Zone (LA-1702) US feet.
Vertical Datum (Epoch): GPS derived NAVD 88 (GEOID12A – Epoch 2010.00) US feet.

All surveys performed were adjusted and calibrated to the specified secondary monuments listed in the specifications as "TV12-SM-01" and "CRMSTV-SM-06" using industry accepted RTK GPS equipment and methodologies as outlined in this document.

Secondary monuments TV12-SM-01 and CRMSTV-SM-06 are referenced to GEOID99. As part of this survey, HydroTerra Technologies, LLC collected satellite data at the Base Station Receiver to establish updated Ellipsoid Heights and provide updated Data Sheets (See **Appendix A** for Data Sheets). A minimum of 4 hours of data were collected on 3 days. This data was then processed by HydroTerra through N.G.S. OPUS (Online Positioning User Service) to provide updated monument positions referenced to GEOID12A. HydroTerra surveyed the positions of six data sonde pipe locations throughout the project area. Elevations of the "Top of Cap" locations were surveyed and the point table can be found in **Appendix C** of this document and in the ASCII file named "Gages-Data Sondes.csv".

Preparation of Survey Transects

After reviewing the "Scope" provided, survey transects for each area of survey described in Sections 4.5 to 4.10 were created based on information provided by the client. All survey transects described in the "Scope" were converted using AutoCAD Civil 3D© and HYPACK© to a digital format that is compatible with the surveyor(s) task-specific data collection equipment for the use of navigation and preparation.

Section 3: Project Area and Perimeter Survey

Equipment

Equipment planned to be utilized during survey:

- One (1) Trimble GNSS R8 System (Including Receiver and Base)
- One (1) GulfNET VRS Network License.
- One (1) Odom MKIII Depth Sounder with Dual Frequency Transducer. (200khz/24kHz frequencies to be used during survey)
- One (1) YSI Cast Away CTD Probe (Velocimeter)
- One (1) Desktop Computer with Hypack© Navigation Software.
- One (1) Closed Cabin Survey Vessel.
- One (1) Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod.
- One (1) Probe Rod

The manufacturer's specification sheets for each item can be found in **Appendix D** at the end of this document.

Methodology

Survey Control

The survey began with the location and verification of the project secondary monuments TV12-SM-01 and CRMSTV-SM-06. Once the project monuments were located, visually inspected for integrity, and deemed undisturbed and suitable for use; multiple RTK GPS observations were made (using the GulfNET VRS System for Positional Corrections) then compared to the plan published values. A base receiver was then be set on the monument. Static GPS observations were recorded on said monument for a minimum of 4 hours and 1 minute for each date of survey until project completion. A log of the static observations were submitted and processed through OPUS for corrected positioning values. Three datasets of static GPS observations on CRMSTV-SM-06 and five Datasets of GPS observations on TV12-SM-01 were selected and submitted to OPUS for processing using precise ephemeris data for post processing. Please refer to **Appendix B** for the resulting OPUS reports.

Equipment Calibration for Bathymetric Surveys

Once the survey control was verified, the RTK system and the echo sounder transducer was hard mounted to the survey vessel using specially designed mounts welded to the hull on the bow or stern of the vessel.

The RTK antenna and transducer positional offsets were then measured and entered into the Hypack© Navigation Software for the tide and draft corrections to be applied (Fig. 1).

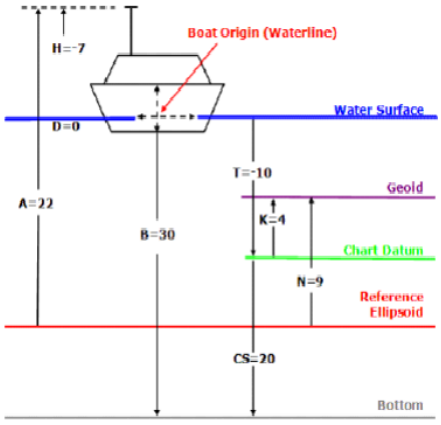

Fig. 1

A "Bar Check" of this system was then performed. A velocity probe was lowered into the water within the project site down to the sea floor to obtain velocities throughout the water column and determine an average. The average water velocity was then entered into the echo sounder and set. Then, a 2' x 2' stainless steel plate was lowered below the transducer at 5' increments down to the deepest survey depth to obtain the correct draft and index of the transducer and to calibrate the water velocities at each five foot increment. The "Bar Check" was recorded both on the thermal paper scroll on the echo sounder and electronically in the Odom E-chart Software.

Data Acquisition

Survey transects were provided digitally to field surveyor(s) for acquisition of data in the following areas: open water, broken marsh, and across pipeline canals within the proposed project area. Position, elevation, and water depth will be recorded every 50' along each transect or where elevation changes of greater than 0.5' occur. Topographic and bathymetric survey methods were used as applicable to obtain all transects. The topographic portions of all transects were merged with the bathymetric portion of all transects at the land/water interface. The topographic and bathymetric portion of the surveys were separated by no more than 50'. Side shots, as necessary, were taken to pick up variations in topographic features (highs and lows) such as trenasses, meandering channels, broken marsh areas, or any other existing features such as utility lines, well heads, warning signs, and bridge openings which may affect project design implementation. The use of a Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod to prevent the rod from sinking was utilized to collect topographic data where the use of bathymetric equipment is of no use.

The perimeter of the project area was surveyed at a minimum of 50’ intervals and included the toe, crown, crown, and toe. Additional shots were taken where an elevation change of greater than 0.5’ occur.

Section 4: Marsh Creation Fill Area Survey

Equipment

Equipment utilized during survey:

- One (1) Trimble GNSS R8 System (Including Receiver and Base)
- One (1) GulfNET VRS Network License
- One (1) Odom MKIII Depth Sounder with Dual Frequency Transducer. (200khz/24kHz frequencies to be used during survey)
- One (1) YSI Cast Away CTD Probe (Velocimeter)
- One (1) Desktop Computer with Hypack© Navigation Software.
- One (1) Closed Cabin Survey Vessel
- One (1) Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod
- One (1) Probe Rod

The manufacturer's specification sheets for each item can be found in **Appendix D** at the end of this document.

Methodology

Equipment Calibration for Bathymetric Surveys

Survey Control

The survey began with the location and verification of the project secondary monuments TV12-SM-01 and CRMSTV-SM-06. Once the project monuments were located, visually inspected for integrity, and deemed undisturbed and suitable for use; multiple RTK GPS observations were made (using the GulfNET VRS System for Positional Corrections) then compared to the plan published values. A base receiver was then be set on the monument. Static GPS observations were recorded on said monument for a minimum of 4 hours and 1 minute for each date of survey until project completion. A log of the static observations were submitted and processed through OPUS for corrected positioning values. Three datasets of static GPS observations on CRMSTV-SM-06 and five Datasets of GPS observations on TV12-SM-01 were selected and submitted to OPUS for processing using precise ephemeris data for post processing. Please refer to **Appendix B** for the resulting OPUS reports.

Equipment Calibration for Bathymetric Surveys

Once the survey control was verified, the RTK system and the echo sounder transducer was hard mounted to the survey vessel using specially designed mounts welded to the hull on the bow or stern of the vessel.

The RTK antenna and transducer positional offsets were then measured and entered into the Hypack© Navigation Software for the tide and draft corrections to be applied (Fig. 1).

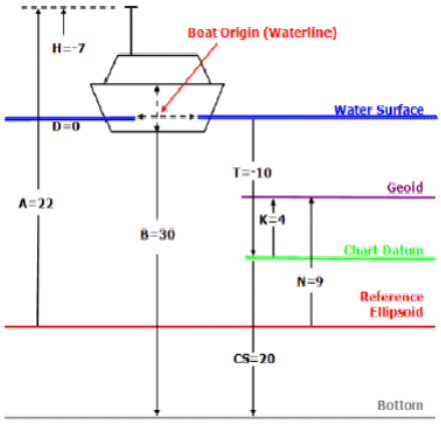

Fig. 1

A "Bar Check" of this system was then performed. A velocity probe was lowered into the water within the project site down to the sea floor to obtain velocities throughout the water column and determine an average. The average water velocity was then entered into the echo sounder and set. Then, a 2' x 2' stainless steel plate was lowered below the transducer at 5' increments down to the deepest survey depth to obtain the correct draft and index of the transducer and to calibrate the water velocities at each five foot increment. The "Bar Check" was recorded both on the thermal paper scroll on the echo sounder and electronically in the Odom E-chart Software.

Data Acquisition

Survey transects were provided digitally to field surveyor(s) for acquisition of data in the following areas: open water, broken marsh, and across pipeline canals within the proposed project area. Transects were spaced every 250', Position, elevation, and water depth will be recorded every 50' along each transect or where elevation changes of greater than 0.5' occur. Topographic and bathymetric survey methods were used as applicable to obtain all transects . The topographic portions of all transects were merged with the bathymetric portion of all transects at the land/water interface. The topographic and bathymetric portion of the surveys were separated by no more than 50'. Side shots, as necessary, were taken to pick up variations in topographic features (highs and lows) such as trenasses, meandering channels, broken marsh areas, or any other existing features such as utility lines, well heads, warning signs, and bridge openings which may affect project design implementation. The use of a Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod to prevent the rod from sinking was utilized to collect topographic data where the use of bathymetric equipment is of no use.

The perimeter of the project area was surveyed at a minimum of 50' intervals and included the toe, crown, crown, and toe. Additional shots were taken where an elevation change of greater than 0.5' occur.

Section 5: Access Routes and Pipeline Corridor Surveys

Equipment

Equipment utilized during survey:

- One (1) Trimble GNSS R8 System (Including Receiver and Base)
- One (1) GulfNET VRS Network License
- One (1) Odom MKIII Depth Sounder with Dual Frequency Transducer (200khz/24kHz frequencies to be used during survey)
- One (1) YSI Cast Away CTD Probe (Velocimeter)
- One (1) Desktop Computer with Hypack© Navigation Software
- One (1) Closed Cabin Survey Vessel
- One (1) Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod.
- One (1) Probe Rod

The manufacturer's specification sheets for each item can be found in **Appendix D** at the end of this document.

Methodology

Survey Control

The survey began with the location and verification of the project secondary monuments TV12-SM-01 and CRMSTV-SM-06. Once the project monuments were located, visually inspected for integrity, and deemed undisturbed and suitable for use; multiple RTK GPS observations were made (using the GulfNET VRS System for Positional Corrections) then compared to the plan published values. A base receiver was then be set on the monument. Static GPS observations were recorded on said monument for a minimum of 4 hours and 1 minute for each date of survey until project completion. A log of the static observations were submitted and processed through OPUS for corrected positioning values. Three datasets of static GPS observations on CRMSTV-SM-06 and five Datasets of GPS observations on TV12-SM-01 were selected and submitted to OPUS for processing using precise ephemeris data for post processing. Please refer to **Appendix B** for the resulting OPUS reports.

Equipment Calibration for Bathymetric Surveys

Once the survey control was verified, the RTK system and the echo sounder transducer was hard mounted to the survey vessel using specially designed mounts welded to the hull on the bow or stern of the vessel.

The RTK antenna and transducer positional offsets were then measured and entered into the Hypack© Navigation Software for the tide and draft corrections to be applied (Fig. 1).

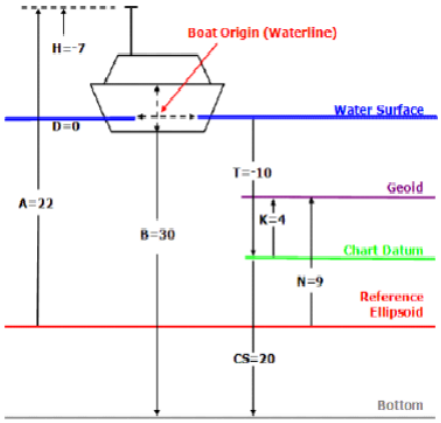

Fig. 1

A "Bar Check" of this system was then performed. A velocity probe was lowered into the water within the project site down to the sea floor to obtain velocities throughout the water column and determine an average. The average water velocity was then entered into the echo sounder and set. Then, a 2' x 2' stainless steel plate was lowered below the transducer at 5' increments down to the deepest survey depth to obtain the correct draft and index of the transducer and to calibrate the water velocities at each five foot increment. The "Bar Check" was recorded both on the thermal paper scroll on the echo sounder and electronically in the Odom E-chart Software.

Data Acquisition

Transect T-43 and "Access Channel" were taken every 500' in the canal perpendicular to the banks. Position, elevation, and description were recorded every 10' along each transect or where elevation changes of greater than 0.5' occur. The topographic portions of all transects were merged with the bathymetric portion of all transects at the land/water interface. The topographic and bathymetric portion of the surveys were separated by no more than 10'. Side shots, as necessary, were taken to pick up variations in topographic features such as those listed under the marsh creation fill area survey.

Section 6: Marsh Elevation and Vegetation Surveys

Equipment

Equipment planned to be utilized during survey:

- One (1) Trimble GNSS R8 System (Including Receiver and Base)
- One (1) GulfNET VRS Network License
- One (1) Closed Cabin Survey Vessel
- One (1) Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod

The manufacturer's specification sheets for each item can be found in **Appendix D** at the end of this document.

Methodology

Survey Control

The survey began with the location and verification of the project secondary monuments TV12-SM-01 and CRMSTV-SM-06. Once the project monuments were located, visually inspected for integrity, and deemed undisturbed and suitable for use; multiple RTK GPS observations were made (using the GulfNET VRS System for Positional Corrections) then compared to the plan published values. A base receiver was then be set on the monument. Static GPS observations were recorded on said monument for a minimum of 4 hours and 1 minute for each date of survey until project completion. A log of the static observations were submitted and processed through OPUS for corrected positioning values. Three datasets of static GPS observations on CRMSTV-SM-06 and five Datasets of GPS observations on TV12-SM-01 were selected and submitted to OPUS for processing using precise ephemeris data for post processing. Please refer to **Appendix B** for the resulting OPUS reports.

Data Acquisition

Average marsh elevation (NAVD 88) were determined at five marsh elevation sites, The average marsh elevation was defined as the point where a survey rod is resting among living vegetative stems and is supported by soil containing living vegetative roots. In order to get a consistent reading, it was necessary to cut stems in some marsh vegetation where stem density is extremely high. Twenty (20) elevations, each one separated by 20' to 40', at each of the five sites were collected for this determination. HydroTerra contacted Mel Guidry of the CPRA Lafayette Field Office (337-482-0682) and was accompanied by a representative during the survey. CPRA personnel was present at the time of the marsh elevation survey.

Section 7: Borrow Area Survey

Equipment

Equipment planned to be utilized during survey:

- One (1) Trimble GNSS R8 System (Including Receiver and Base)
- One (1) GulfNET VRS Network License
- One (1) Odom MKIII Depth Sounder with Dual Frequency Transducer (200khz/24kHz frequencies to be used during survey)
- One (1) YSI Cast Away CTD Probe (Velocimeter)
- One (1) Desktop Computer with Hypack© Navigation Software.
- One (1) Closed Cabin Survey Vessel
- One (1) Fixed Height Aluminum Rod (8' or 10' in length) with a 6" diameter metal plate as the base of the rod
- One (1) Probe Rod

The manufacturer's specification sheets for each item can be found in **Appendix D** at the end of this document.

Methodology

Survey Control

The survey began with the location and verification of the project secondary monuments TV12-SM-01 and CRMSTV-SM-06. Once the project monuments were located, visually inspected for integrity, and deemed undisturbed and suitable for use; multiple RTK GPS observations were made (using the GulfNET VRS System for Positional Corrections) then compared to the plan published values. A base receiver was then be set on the monument. Static GPS observations were recorded on said monument for a minimum of 4 hours and 1 minute for each date of survey until project completion. A log of the static observations were submitted and processed through OPUS for corrected positioning values. Three datasets of static GPS observations on CRMSTV-SM-06 and five Datasets of GPS observations on TV12-SM-01 were selected and submitted to OPUS for processing using precise ephemeris data for post processing. Please refer to **Appendix B** for the resulting OPUS reports.

Equipment Calibration for Bathymetric Surveys

Once the survey control was verified, the RTK system and the echo sounder transducer was hard mounted to the survey vessel using specially designed mounts welded to the hull on the bow or stern of the vessel.

The RTK antenna and transducer positional offsets were then measured and entered into the Hypack© Navigation Software for the tide and draft corrections to be applied (Fig. 1).

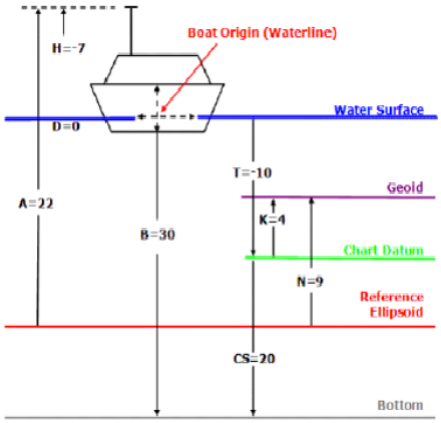

Fig. 1

A "Bar Check" of this system was then performed. A velocity probe was lowered into the water within the project site down to the sea floor to obtain velocities throughout the water column and determine an average. The average water velocity was then entered into the echo sounder and set. Then, a 2' x 2' stainless steel plate was lowered below the transducer at 5' increments down to the deepest survey depth to obtain the correct draft and index of the transducer and to calibrate the water velocities at each five foot increment. The "Bar Check" was recorded both on the thermal paper scroll on the echo sounder and electronically in the Odom E-chart Software.

Data Acquisition

HydroTerra performed topographic/bathymetric surveys for the borrow area in the form of transecting cross-sections. Survey transects shall be spaced at approximately 250'. Transects extended 50' beyond the boundary of the borrow area. Additionally, HydroTerra did not identify any protruding structures above mean water level, or otherwise noted during the course of the work performed, within the limits of the project areas such as, but not limited to, wellheads, warning signs, crab traps, and abandoned boats or any object that may prevent or hinder dredging operations.

Section 8: Magnetometer Survey

Equipment

Equipment planned to be utilized during survey:

- One (1) Trimble GNSS R8 System (Including Receiver and Base)
- One (1) GulfNET VRS Network License
- One (1) Desktop Computer with Hypack© Navigation Software
- One (1) Closed Cabin Survey Vessel
- One (1) Geometrics G-882 Cesium Magnetometer
- One (1) Probe Rod

The manufacturer's specification sheets for each item can be found in **Appendix D** at the end of this document.

Methodology

Survey Control

The survey began with the location and verification of the project secondary monuments TV12-SM-01 and CRMSTV-SM-06. Once the project monuments were located, visually inspected for integrity, and deemed undisturbed and suitable for use; multiple RTK GPS observations were made (using the GulfNET VRS System for Positional Corrections) then compared to the plan published values. A base receiver was then be set on the monument. Static GPS observations were recorded on said monument for a minimum of 4 hours and 1 minute for each date of survey until project completion. A log of the static observations were submitted and processed through OPUS for corrected positioning values. Three datasets of static GPS observations on CRMSTV-SM-06 and five Datasets of GPS observations on TV12-SM-01 were selected and submitted to OPUS for processing using precise ephemeris data for post processing. Please refer to **Appendix B** for the resulting OPUS reports.

Data Acquisition

The magnetometer utilized was a Geometrics 882 cesium magnetometer. Magnetometer readings were correlated to a position with RTK GPS with speed and position of the towfish relative to the vessel was t take into account using the Hypack© Navigation Software package.

HydroTerra performed a magnetometer survey in the proposed marsh creation areas and borrow areas,, to locate any pipelines or obstructions in the area. HydroTerra determined the source (e.g., pipeline, well, etc.) of each significant finding. When a pipeline was detected, HydroTerra probed the pipeline and determine the depth of cover and the elevation of the top of the pipeline.

Section 9: Data Processing

All bathymetric and magnetometer data was processed using the Hypack© 2012 Single Beam Editor software using the methodologies outlined in the project specifications document. Topographic data was processed using Trimble Geomatics Office (TGO) software. All processed data was then represented visually using an AutoCAD Civil 3D software version specified in the Scope for analysis.

Section 10: Deliverables

Three (3) copies of a report describing the survey methodology employed in the field, including but not limited to, control, any calibrations, equipment used, etc. The report contains the following:

- A set of half size (11" x 17") drawings including a plan view showing all survey lines run during the magnetometer survey.
- A hard copy of the data sets (file listing is stored in a comma delimited ASCII format):
    1. Baselines, including all stations and P.I.'s
    2. Fill Site Survey Transects (by station number), including point number, northing, easting, elevation, and description.
    3. Access Survey Transects (by station number), including point number, northing, easting, elevation, and description.
    4. Magnetometer Survey Readings and Source Information with tracklines.
- A copy of the field notebook records.
- The results and description of the marsh elevation surveys including locations and average marsh elevation.
- Electronic and Hard Copies of the Updated Data Sheets for Secondary Monuments TV12-SM-01 and CRMSTV-SM-06.
- Electronic and Hard Copies of the Vegetation Survey Sheet and accompanying photographs.

The drawing files conform to the CPRA AutoCAD Standards and are in AutoCAD *.dwg format. The plan view(s) are overlaid in conformance with Section 4.11 of the Scope and overlaid with the Louisiana State Plane Coordinate System South Zone Grid and include a table with benchmark locations (in State Plane and Geographic coordinates) and elevations (NAVD88 Geoidl2A) on which the survey is based. Three digital copies of the following files (on separate disks):

- Complete survey report describing the survey methodology employed in the field
- Drawing files in AutoCAD 2011 (.dwg) or later format
- All data sets listed in Section 5.1 of the Scope (in .csv format)

APPENDIX A

VICINITY MAP

Station Name: CRMSTV-SM-06

Monument Location: From the Intracoastal City landing head SW for 1.48 miles to the intersection of Freshwater Bayou Canal, than continue SW along Freshwater Bayou Canal for 9.83 miles to the intersection of Belle Isle Bayou on the left, head east along Belle Isle Bayou for 2.4 miles to the MicKinely Camp. Follow boat trail for 0.88 miles to the monument.

Monument Description: Aluminum cap attached to a ¾" steel rod driven 40 feet to refusal with a 6" PVC sleeve and protective cover set in concrete and stamped CRMSTV-SM-06.

Stamping: CRMSTV-SM-06

Adjustment: Coordinates are derived from OPUS Solution

Monument Recovered and Resurveyed By: HydroTerra Technologies, LLC

NAD 83(2011)(EPOCH:2010.0000)
Latitude 29 39 48.20422
Longitude 92 13 10.59896

STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [US Feet] 424,171.317
Easting (X) [US Feet] 2,999,354.276

Adjusted NAVD Height (Geoid 12A)
EL HGT: -82.328(ft)
ORTHO HGT: 1.973(ft) [NAVD88 (Computed using GEOID12A)]

VICINITY MAP

Station Name: TV12-SM-01

Monument Location: The station is located north of Vermilion Bay in Vermilion Parish Louisiana set in North Buck Point Oil and Gas field south east of Freshwater Bayou.

Monument Description: Aluminum cap attached to a ¾" steel rod driven to refusal with a 6" PVC sleeve and protective cover set in concrete and stamped "BUCK POINT".

Stamping: BUCK POINT

Adjustment: Coordinates are derived from OPUS solution.

Monument Recovered and Resurveyed By: HydroTerra Technologies, LLC

NAD 83(2011)(EPOCH:2010.0000)
Latitude 29 45 13.19165
Longitude 92 12 6.07517

STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [US Feet] 456955.043
Easting (X) [US Feet] 3005295.314

Adjusted NAVD Height (Geoid 12A)
EL HGT: -83.317(ft)
ORTHO HGT: 1.919(ft) [NAVD88 (Computed using GEOID12A)]

APPENDIX B

CRMSTV-SM-06

FILE: 29630800.13o OP1366813615451

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

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 2963080o.13o TIME: 14:30:12 UTC

SOFTWARE: page5 1209.04 master32.pl 082112 START: 2013/03/21 14:32:00
EPHEMERIS: igs17324.eph [precise] STOP: 2013/03/21 21:14:30
NAV FILE: brdc0800.13n OBS USED: 17742 / 18417 : 96%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 89 / 94 : 95%
ARP HEIGHT: 2.0 OVERALL RMS: 0.015(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2185)

X:	-214826.474(m)	0.003(m)	-214827.229(m)	0.003(m)
Y:	-5542634.691(m)	0.002(m)	-5542633.198(m)	0.002(m)
Z:	3137992.620(m)	0.011(m)	3137992.437(m)	0.011(m)

LAT:	29 39 48.20410	0.011(m)	29 39 48.22244	0.011(m)
E LON:	267 46 49.40083	0.003(m)	267 46 49.37062	0.003(m)
W LON:	92 13 10.59917	0.003(m)	92 13 10.62938	0.003(m)
EL HGT:	-25.094(m)	0.004(m)	-26.455(m)	0.004(m)
ORTHO HGT:	0.601(m)	0.013(m) [NAVD88 (Computed using GEOID12A)]		

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3281741.736	129287.672
Easting (X) [meters]	575520.638	914205.006
Convergence [degrees]	0.38623565	-0.44315002
Point Scale	0.99967037	0.99994298
Combined Factor	0.99967431	0.99994692

US NATIONAL GRID DESIGNATOR: 15RWN7552081741(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	FSHS			71160.2
	CAMR			107993.0
	MCNE			112139.4

NEAREST NGS PUBLISHED CONTROL POINT

AV0649	AUDUBON 2	N294052.532	W0921224.253	2346.8

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.

CRMSTV-SM-06

FILE: 65150940.13o OP1366812425461

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

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 6515094o.13o TIME: 14:07:54 UTC

SOFTWARE: page5 1209.04 master91.pl 082112 START: 2013/04/04 14:12:00
EPHEMERIS: igs17344.eph [precise] STOP: 2013/04/04 22:32:00
NAV FILE: brdc0940.13n OBS USED: 19055 / 19573 : 97%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 76 / 85 : 89%
ARP HEIGHT: 1.5 OVERALL RMS: 0.016(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2569)

X:	-214826.467(m)	0.005(m)	-214827.222(m)	0.005(m)
Y:	-5542634.687(m)	0.004(m)	-5542633.195(m)	0.004(m)
Z:	3137992.633(m)	0.010(m)	3137992.450(m)	0.010(m)

LAT:	29 39 48.20453	0.007(m)	29 39 48.22286	0.007(m)
E LON:	267 46 49.40108	0.005(m)	267 46 49.37088	0.005(m)
W LON:	92 13 10.59892	0.005(m)	92 13 10.62912	0.005(m)
EL HGT:	-25.091(m)	0.007(m)	-26.452(m)	0.007(m)
ORTHO HGT:	0.604(m)	0.017(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3281741.749	129287.686
Easting (X) [meters]	575520.645	914205.013
Convergence [degrees]	0.38623569	-0.44314998
Point Scale	0.99967037	0.99994298
Combined Factor	0.99967431	0.99994692

US NATIONAL GRID DESIGNATOR: 15RWN7552081741(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	CAMR			107993.0
	TONY			64106.1
	MCNE			112139.4

NEAREST NGS PUBLISHED CONTROL POINT

AV0649	AUDUBON 2	N294052.532	W0921224.253	2346.8

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.

CRMSTV-SM-06

FILE: 65150950.13o OP1366812615462

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

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 6515095o.13o TIME: 14:11:11 UTC

SOFTWARE: page5 1209.04 master3.pl 0821123 START: 2013/04/05 14:01:00
EPHEMERIS: igs17345.eph [precise] STOP: 2013/04/05 18:53:00
NAV FILE: brdc0950.13n OBS USED: 12040 / 12391 : 97%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 58 / 61 : 95%
ARP HEIGHT: 1.5 OVERALL RMS: 0.017(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2594)

X:	-214826.464(m)	0.003(m)	-214827.219(m)	0.003(m)
Y:	-5542634.691(m)	0.009(m)	-5542633.199(m)	0.009(m)
Z:	3137992.617(m)	0.007(m)	3137992.434(m)	0.007(m)

LAT:	29 39 48.20402	0.002(m)	29 39 48.22235	0.002(m)
E LON:	267 46 49.40120	0.003(m)	267 46 49.37100	0.003(m)
W LON:	92 13 10.59880	0.003(m)	92 13 10.62900	0.003(m)
EL HGT:	-25.096(m)	0.011(m)	-26.456(m)	0.011(m)
ORTHO HGT:	0.599(m)	0.022(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3281741.734	129287.670
Easting (X) [meters]	575520.648	914205.016
Convergence [degrees]	0.38623570	-0.44314997
Point Scale	0.99967037	0.99994298
Combined Factor	0.99967431	0.99994692

US NATIONAL GRID DESIGNATOR: 15RWN7552081741(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	TONY			64106.2
	CAMR			107993.0
	MCNE			112139.4

NEAREST NGS PUBLISHED CONTROL POINT

AV0649	AUDUBON 2	N294052.532	W0921224.253	2346.8

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.

TV12-0SM-01

FILE: 032713TJR.13o OP1366811539614

NGS OPUS SOLUTION REPORT
==========

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 0327086o.13o TIME: 13:53:36 UTC

SOFTWARE: page5 1209.04 master32.pl 082112 START: 2013/03/27 14:09:00
EPHEMERIS: igs17333.eph [precise] STOP: 2013/03/27 22:02:30
NAV FILE: brdc0860.13n OBS USED: 19528 / 20186 : 97%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 89 / 96 : 93%
ARP HEIGHT: 1.5 OVERALL RMS: 0.017(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2349)

X:	-212902.076(m)	0.004(m)	-212902.831(m)	0.004(m)
Y:	-5537745.860(m)	0.008(m)	-5537744.369(m)	0.008(m)
Z:	3146683.822(m)	0.013(m)	3146683.639(m)	0.013(m)

LAT:	29 45 13.19150	0.011(m)	29 45 13.20989	0.011(m)
E LON:	267 47 53.92508	0.004(m)	267 47 53.89486	0.004(m)
W LON:	92 12 6.07492	0.004(m)	92 12 6.10514	0.004(m)
EL HGT:	-25.385(m)	0.009(m)	-26.744(m)	0.009(m)
ORTHO HGT:	0.595(m)	0.019(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3291756.741	139280.171
Easting (X) [meters]	577186.120	916015.850
Convergence [degrees]	0.39619979	-0.43418809
Point Scale	0.99967351	0.99993499
Combined Factor	0.99967750	0.99993898

US NATIONAL GRID DESIGNATOR: 15RWN7718691756(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	TONY		54003.2	
	OAKH		125595.7	
	SJB1		127302.4	

NEAREST NGS PUBLISHED CONTROL POINT

AV0642	VERMILLION BAY WEST LIGHT	N294449.562	W0921219.002	808.9

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.

TV12-0SM-01

FILE: 032813TJR.13o OP1366811575923

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

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 0328087o.13o TIME: 13:53:46 UTC

SOFTWARE: page5 1209.04 master73.pl 082112 START: 2013/03/28 14:13:00
EPHEMERIS: igs17334.eph [precise] STOP: 2013/03/28 19:31:30
NAV FILE: brdc0870.13n OBS USED: 13049 / 13516 : 97%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 72 / 73 : 99%
ARP HEIGHT: 1.5 OVERALL RMS: 0.017(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2375)

X:	-212902.087(m)	0.009(m)	-212902.842(m)	0.009(m)
Y:	-5537745.839(m)	0.011(m)	-5537744.348(m)	0.011(m)
Z:	3146683.819(m)	0.006(m)	3146683.636(m)	0.006(m)
LAT:	29 45 13.19175	0.005(m)	29 45 13.21014	0.005(m)
E LON:	267 47 53.92464	0.009(m)	267 47 53.89442	0.009(m)
W LON:	92 12 6.07536	0.009(m)	92 12 6.10558	0.009(m)
EL HGT:	-25.404(m)	0.012(m)	-26.763(m)	0.012(m)
ORTHO HGT:	0.576(m)	0.023(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3291756.748	139280.179
Easting (X) [meters]	577186.108	916015.839
Convergence [degrees]	0.39619973	-0.43418815
Point Scale	0.99967351	0.99993499
Combined Factor	0.99967750	0.99993898

US NATIONAL GRID DESIGNATOR: 15RWN7718691756(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	CAMR			108748.5
	FSHS			67877.3
	TONY			54003.2

NEAREST NGS PUBLISHED CONTROL POINT

AV0642	VERMILLION BAY WEST LIGHT	N294449.562	W0921219.002	808.9

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.

TV12-0SM-01

FILE: 18000840.13o OP1366812167418

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

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 1800084o.13o TIME: 14:03:49 UTC

SOFTWARE: page5 1209.04 master73.pl 082112 START: 2013/03/25 14:49:00
EPHEMERIS: igs17331.eph [precise] STOP: 2013/03/25 20:02:00
NAV FILE: brdc0840.13n OBS USED: 14003 / 14366 : 97%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 66 / 70 : 94%
ARP HEIGHT: 1.5 OVERALL RMS: 0.018(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2294)

X:	-212902.082(m)	0.006(m)	-212902.837(m)	0.006(m)
Y:	-5537745.848(m)	0.002(m)	-5537744.357(m)	0.002(m)
Z:	3146683.820(m)	0.007(m)	3146683.637(m)	0.007(m)

LAT:	29 45 13.19164	0.006(m)	29 45 13.21002	0.006(m)
E LON:	267 47 53.92484	0.006(m)	267 47 53.89462	0.006(m)
W LON:	92 12 6.07516	0.006(m)	92 12 6.10538	0.006(m)
EL HGT:	-25.396(m)	0.005(m)	-26.755(m)	0.005(m)
ORTHO HGT:	0.584(m)	0.015(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3291756.745	139280.175
Easting (X) [meters]	577186.113	916015.844
Convergence [degrees]	0.39619976	-0.43418813
Point Scale	0.99967351	0.99993499
Combined Factor	0.99967750	0.99993898

US NATIONAL GRID DESIGNATOR: 15RWN7718691756(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	CAMR			108748.5
	AWES			123787.4
	TONY			54003.2

NEAREST NGS PUBLISHED CONTROL POINT

AV0642	VERMILLION BAY WEST LIGHT	N294449.562	W0921219.002	808.9

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.

TV12-0SM-01

FILE: 29620800.13o OP1366811820564

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

USER: keithr@hydroterratec.com DATE: April 24, 2013
RINEX FILE: 2962080n.13o TIME: 13:57:48 UTC

SOFTWARE: page5 1209.04 master53.pl 082112 START: 2013/03/21 13:17:00
EPHEMERIS: igs17324.eph [precise] STOP: 2013/03/21 20:59:00
NAV FILE: brdc0800.13n OBS USED: 20726 / 21296 : 97%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 110 / 112 : 98%
ARP HEIGHT: 1.5 OVERALL RMS: 0.015(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2184)

X:	-212902.088(m) 0.005(m)	-212902.843(m) 0.005(m)
Y:	-5537745.840(m) 0.004(m)	-5537744.349(m) 0.004(m)
Z:	3146683.818(m) 0.008(m)	3146683.635(m) 0.008(m)

LAT:	29 45 13.19170 0.009(m)	29 45 13.21009 0.009(m)
E LON:	267 47 53.92460 0.005(m)	267 47 53.89439 0.005(m)
W LON:	92 12 6.07540 0.005(m)	92 12 6.10561 0.005(m)
EL HGT:	-25.404(m) 0.001(m)	-26.763(m) 0.001(m)
ORTHO HGT:	0.576(m) 0.012(m) [NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (UTM (Zone 15))	STATE PLANE COORDINATES (SPC (1702 LA S))
Northing (Y) [meters]	3291756.747	139280.177
Easting (X) [meters]	577186.107	916015.838
Convergence [degrees]	0.39619973	-0.43418816
Point Scale	0.99967351	0.99993499
Combined Factor	0.99967750	0.99993898

US NATIONAL GRID DESIGNATOR: 15RWN7718691756(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	CAMR			108748.5
	MCNE			108885.3
	FSHS			67877.3

NEAREST NGS PUBLISHED CONTROL POINT

AV0642	VERMILLION BAY WEST LIGHT	N294449.562	W0921219.002	808.9

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.

TV12-0SM-01

FILE: 65150983.13o OP1367255369260

NGS OPUS SOLUTION REPORT
==========

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: keithr@hydroterratec.com DATE: April 29, 2013
RINEX FILE: 6515098n.13o TIME: 17:10:16 UTC

SOFTWARE: page5 1209.04 master52.pl 082112 START: 2013/04/08 13:20:00
EPHEMERIS: igs17351.eph [precise] STOP: 2013/04/08 20:45:00
NAV FILE: brdc0980.13n OBS USED: 18195 / 18955 :
96%
ANT NAME: TRM_R8_GNSS NONE # FIXED AMB: 97 / 101 :
96%
ARP HEIGHT: 1.5 OVERALL RMS: 0.019(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.2677)

X:	-212902.078(m) 0.006(m)	-212902.834(m) 0.006(m)
Y:	-5537745.856(m) 0.010(m)	-5537744.365(m) 0.010(m)
Z:	3146683.826(m) 0.012(m)	3146683.643(m) 0.012(m)

LAT:	29 45 13.19168 0.005(m)	29 45 13.21006 0.005(m)
E LON:	267 47 53.92500 0.006(m)	267 47 53.89475 0.006(m)
W LON:	92 12 6.07500 0.006(m)	92 12 6.10525 0.006(m)
EL HGT:	-25.386(m) 0.014(m)	-26.745(m) 0.014(m)
ORTHO HGT:	0.594(m) 0.026(m) [NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES (Zone 15)	STATE PLANE COORDINATES SPC (1702 LA S)
Northing (Y) [meters]	3291756.746	139280.176
Easting (X) [meters]	577186.118	916015.848
Convergence [degrees]	0.39619978	-0.43418810
Point Scale	0.99967351	0.99993499
Combined Factor	0.99967750	0.99993898

US NATIONAL GRID DESIGNATOR: 15RWN7718691756(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
	CAMR			108748.5
	TONY			54003.2
	THHR			86774.8

NEAREST NGS PUBLISHED CONTROL POINT

AV0642	VERMILLION BAY WEST LIGHT	N294449.562	W0921219.002	808.9

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.

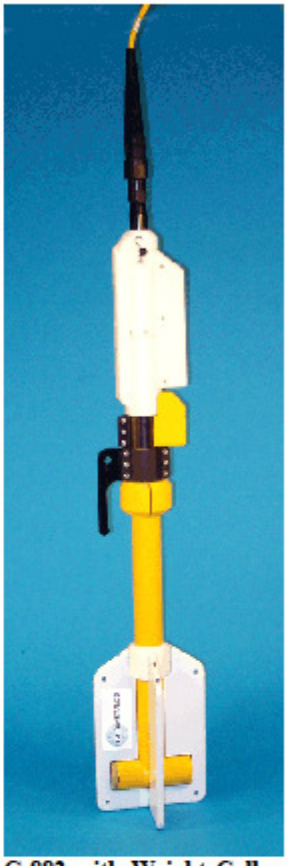
APPENDIX C

DATA SONDE POINT TABLE				
NAME	***Northing***	***Easting***	***Elevation***	***Description***
040513drb017	437636.1	2999799.2	6.0	CP_OTHER TV63-06
040513drb018	438098.6	2999772.3	9.1	CP_OTHER TV63-05 BIG PIPE
040513drb019	438101.2	2999772.1	9.9	CP_OTHER TV63-05 SMALL PIPE
040513drb020	443911.7	2998150.6	9.2	CP_OTHER TV63-04 SMALL PIPE
040513drb021	443912.3	2998148.4	8.1	CP_OTHER TV63-04 BIG PIPE
040512drb-2 001	450821.0	3000681.0	6.3	CP_OTHER TV63-03
040512drb-2 004	460086.3	3007993.2	6.4	CP_OTHER TV63-02
040512drb-2 005	456482.9	2991759.9	5.8	CP_OTHER TV63-01

APPENDIX D

G-882 MARINE MAGNETOMETER

- ***CESIUM VAPOR HIGH PERFORMANCE – Highest detection range and probability of detecting all sized ferrous targets***
- ***NEW STREAMLINED DESIGN FOR TOW SAFETY – Low probability of fouling in lines or rocks***
- ***NEW QUICK CONVERSION FROM NOSE TOW TO CG TOW – Simply remove an aluminum locking pin, move tow point and reinsert. New built in easy carry handle!***
- ***NEW INTERNAL CM-221 COUNTER MODULE – Provides Flash Memory for storage of default parameters set by user***
- ***NEW ECHOSOUNDER / ALTIMETER OPTION***
- ***NEW DEPTH RATING – 4,000 psi !***
- ***HIGHEST SENSITIVITY IN THE INDUSTRY – 0.004 nT/√Hz RMS with the internal CM-221 Mini-Counter***
- ***EASY PORTABILITY & HANDLING – no winch required, single man operation, only 44 lbs with 200 ft cable (without weights)***
- ***COMBINE TWO SYSTEMS FOR INCREASED COVERAGE – Internal CM-221 Mini-Counter provides multi-sensor data concatenation allowing side by side coverage which maximizes detection of small targets and reduces noise***



G-882 with Weight Collar Depth Option & Altimeter

Very high resolution Cesium Vapor performance is now available in a low cost, small size system for professional surveys in shallow or deep water. High sensitivity and sample rates are maintained for all applications. The well proven Cesium sensor is combined with a unique and new CM-221 Larmor counter and ruggedly packaged for small or large boat operation. Use your computer and standard printer with our MagLogLite™ software to log, display and print GPS position and magnetic field data. The G–882 is the lowest priced high performance full range marine magnetometer system ever offered.

The G-882 offers flexibility for operation from small boat, shallow water surveys as well as deep tow applications (4,000 psi rating, telemetry over steel coax available to 10Km). The G-882 also directly interfaces to all major Side Scan manufacturers for tandem tow configurations. Being small and lightweight (44 lbs net, without weights) it is easily deployed and operated by one person. But add several streamlined weight collars and the system can quickly weigh more than 100 lbs. for deep tow applications. Power may be supplied from a 24 to 30 VDC battery power or the included 110/220 VAC power supply. The tow cable employs high strength Kevlar strain member with a standard length of 200 ft (61 m) and optional cable length up to 500m with no telemetry required.
A rugged fiber-wound fiberglass housing is designed for operation is all parts of the world allowing sensor rotation for work in equatorial regions. The shipboard end of the tow cable is attached to an included junction box or optional on-board cable for quick and simple hookup to power and output of data into any Windows 98, ME, NT, 2000 or XP computer equipped with RS-232 serial ports.

The G-882 Cesium magnetometer provides the same operating sensitivity and sample rates as the larger deep tow model G-880. MagLogLite™ Logging Software is offered with each magnetometer and allows recording and display of data and position with Automatic Anomaly Detection and automatic anomaly printing on Windows™ printer! Additional options include: MagMap2000 plotting and contouring software and post acquisition processing software MagPick™ (free from our website.)

ECHOTRAC™ MKIII

MODEL DF3200

- Interchangeable paper chart or color LCD
- Frequency agile (both channels)
- Internal data storage and playback with color LCD
- Four serial ports and Ethernet interface
- Optional built-in DGPS
- AC/DC power input

TELEDYNE
ODOM HYDROGRAPHIC
A Teledyne Technologies Company

TRIMBLE R8 GNSS SYSTEM

KEY FEATURES

Advanced satellite tracking with **Trimble 360 receiver technology**

Includes Trimble Maxwell 6 chips with **440 channels**

Unmatched GNSS tracking performance

Web user interface and remote configuration

Base and rover communications **options to suit any application**

THE INDUSTRY LEADING TOTAL GNSS SOLUTION

The Trimble® R8 GNSS system has long set the bar for advanced GNSS surveying systems. Through advanced Trimble 360 tracking technology and a comprehensive set of communication options integrated into a flexible system design, this integrated GNSS system delivers industry-leading performance. For surveyors facing demanding RTK applications, the Trimble R8 is an invaluable GNSS partner.

TRIMBLE 360 RECEIVER TECHNOLOGY

Future-proof your investment

Powerful Trimble 360 receiver technology integrated in the Trimble R8 supports signals from all existing and planned GNSS constellations and augmentation systems providing unmatched GNSS tracking performance. With this leading-edge technology, it is now possible for surveyors to expand the reach of their GNSS rovers into areas that were previously too obscured, such as under trees and in dense urban areas.

With two integrated Trimble Maxwell™ 6 chips, the Trimble R8 offers an unparalleled 440 GNSS channels. Also capable of tracking carrier signals from a wide range of satellite systems, including GPS, GLONASS, Galileo, BeiDou (COMPASS), and QZSS, the Trimble R8 provides a robust solution for surveyors.

The CMRx communications protocol in the Trimble R8 provides unprecedented correction compression for optimized bandwidth and full utilization all of the satellites in view, giving you the most reliable positioning performance.

Designed with the future in mind, Trimble 360 technology is optimized to receive future planned signals as the number of available satellites continues to grow. With Trimble 360 technology, the Trimble R8 delivers business confidence with a sound GNSS investment for today and long into the future.

FLEXIBLE SYSTEM DESIGN

The Trimble R8 combines the most comprehensive feature set into an integrated and flexible system design for demanding surveying applications. Connect directly to the controller, receive RTK network corrections, and connect to the Internet via comprehensive communication options. With a built-in transmit/receive UHF radio, the Trimble R8 enables ultimate flexibility for rover or base operation. As a base station, the internal NTRIP caster provides you customized access[1] to base station corrections via the Internet.

Trimble's exclusive Web UI™ eliminates travel requirements for routine monitoring of base station receivers. Now you can assess the health and status of base receivers and perform remote configurations from the office. Likewise, you can download post-processing data through Web UI and save additional trips out to the field.

AN INDUSTRY LEADING FIELD SOLUTION

If you're seeking the industry leading field solution, pair the Trimble R8 GNSS receiver with one of our powerful Trimble controllers, such as the Trimble TSC3, Trimble CU or Trimble Tablet Rugged PC featuring Trimble Access™ field software. These rugged controllers bring the power of the office to the field through an intuitive Windows-based interface.

Trimble Access field software offers numerous features and capabilities to streamline the flow of everyday surveying work. Streamlined workflows such as Roads, Monitoring, Mines, and Tunnels—guide crews through common project types and allows crews to get the job done faster with less distractions. Survey companies can also implement their unique workflows by taking advantage of the customization capabilities available in the Trimble Access Software Development Kit (SDK).

Need to get data back to the office immediately? Benefit from real-time data sharing via Trimble Access Services, now available with any valid Trimble Access maintenance agreement.

Back in the office, seamlessly transfer your field data using Trimble Business Center. Edit, process, and adjust collected data with confidence.

The Trimble R8 GNSS system—the industry leader for GNSS surveying applications.

1 Cellular modem required.

Trimble

DATASHEET

TRIMBLE R8 GNSS VRS ROVER

KEY FEATURES

Proven GNSS technology from Trimble

Internal GSM/GPRS modem for fast Internet connection and data transfer

Lightweight, ergonomic, and cable free

Designed to optimally support the Trimble GNSS infrastructure solution

The Trimble® R8 GNSS VRS™ Rover is a multi-channel, multi-frequency GNSS (Global Navigation Satellite System) receiver, antenna, and data-link radio combined in one compact unit. The VRS rover combines advanced receiver technology with a proven system design to provide maximum accuracy and productivity.

TRIMBLE R-TRACK TECHNOLOGY FOR COMPREHENSIVE GNSS SUPPORT

Powered by an enhanced RTK engine, Trimble R-Track™ technology in the Trimble R8 GNSS VRS Rover supports the modernized GPS L2C and L5 signals as well as GLONASS L1/L2 signals. This extensive GNSS support is capable of providing surveying professionals with real field benefits.

With the world's GNSS' in constant development, surveying businesses small and large can be confident that investment in a Trimble GNSS system is protected. Trimble, already proven in GPS technology, will continue to lead the industry in GNSS support.

PROVEN SYSTEM DESIGN

From its powerful Trimble field software and controller to the receiver itself, the Trimble R8 GNSS VRS Rover's overall design has been tried, tested, and proven. It's rugged, lightweight and cable free for unsurpassed ergonomics and productivity in the field. Additionally, the Trimble R8 GNSS VRS rover consumes very little power and includes internal memory. These features also assist you in the field, enabling you to work longer without changing batteries or transferring data.

The Trimble R8 GNSS VRS Rover works optimally with Trimble controllers such as the Trimble CU or Trimble® TSC2® controller. Both controllers run industry-standard Microsoft® Windows™ operating systems, which are familiar and easy to use. They are also flexible for running both Trimble field software and other specialized applications.

The VRS rover includes an internal GSM/GPRS cell modem for wireless connection to the Internet via NTRIP (Networked Transport of RTCM via Internet Protocol). Quickly and easily access GNSS data from a Trimble GNSS infrastructure solution over the Internet. No additional cellphone or external modem is required.

AN IMPORTANT COMPONENT OF A TRIMBLE GNSS INFRASTRUCTURE SOLUTION

Trimble® GNSS Infrastructure is the most established and widely used GNSS infrastructure solution available. Additionally, all components of Trimble GNSS infrastructure—including the Trimble R8 GNSS VRS Rover—are designed to work together. This means the solution is scalable; that is, it will grow with you as your business needs change. And the solution is part of Trimble's Connected Site model, where products, techniques, services, and relationships combine to take your business to all-new levels of achievement.

With numerous fully modeled networks all over the world and dedicated GNSS infrastructure engineers on hand to support your unique needs, Trimble GNSS infrastructure solutions are always a wise investment. Surveying professionals like you can rely on Trimble's experience and expertise in this field, and be confident that choosing a Trimble GNSS infrastructure solution is the right decision.

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