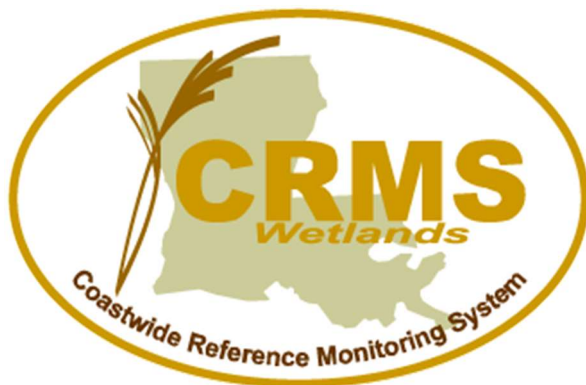


SURVEY DATA COLLECTION REPORT

2021 ELEVATION SURVEY UPDATE OF COASTWIDE REFERENCE MONITORING SYSTEM (CRMS) AND ASSOCIATED SECONDARY MONUMENTS FOR THE THIBODAUX REGIONAL OFFICE

PREPARED FOR:

**COASTAL PROTECTION AND RESTORATION AUTHORITY
OF LOUISIANA**



SUBMITTED BY:



NOVEMBER 16, 2022

1.0 Description

This report details the survey procedures conducted by T. Baker Smith, LLC (TBS) to provide the Coastal Protection and Restoration Authority (CPRA) with survey data required to update elevations on Secondary Monuments used for horizontal and vertical control at Coastwide Reference Monitoring System (CRMS) sites. The purpose of this task was to survey and update all necessary reference marks at CRMS sites into the Louisiana Coastal Zone (LCZ) GPS network utilizing the North American Vertical Datum of 1988 (NAVD88, Geoid 12B) in U.S. Survey Feet. In this survey, TBS updated the horizontal and vertical positions of fifty-four (54) GPS monuments (1 primary, 53 secondary) and five (5) Deep Rod (RSETs) needed to derive the elevations on reference marks at one-hundred twelve (112) CRMS Sites maintained by the Thibodaux Regional Office.

2.0 Location

The Secondary Monuments and CRMS sites surveyed with this effort are located within the Barataria, Terrebonne, and Atchafalaya Basins in coastal Louisiana. The location of the GPS monuments and CRMS Sites surveyed in this task are shown and graphically illustrated in Figure 1 below.

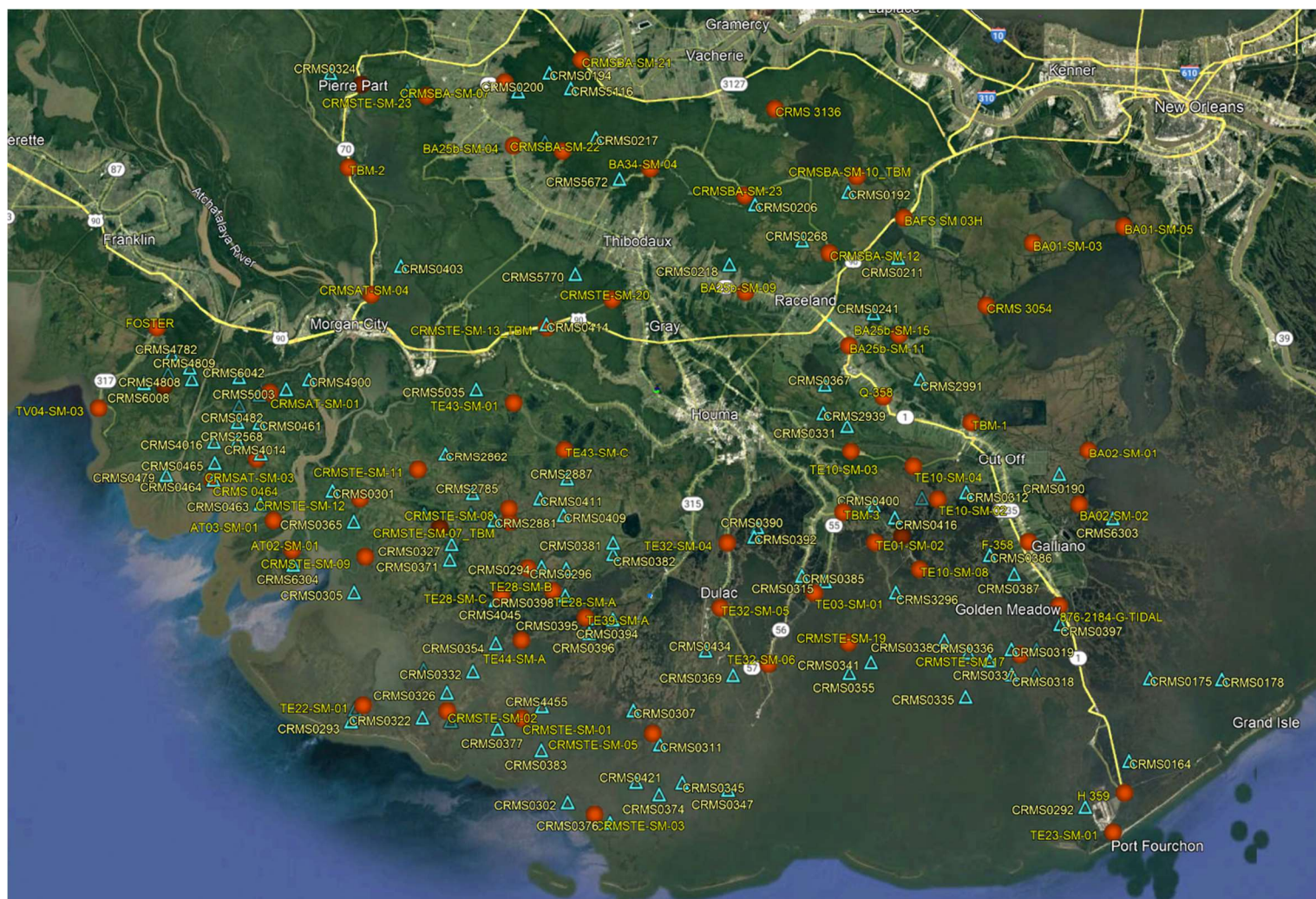


Figure 1 – Secondary Monuments and CRMS Sites surveyed by TBS

2.0 Permission and Access

Permission and access was obtained from landowners for properties containing Secondary Monuments and CRMS Sites. A list of landowners was supplied by CPRA at start of this project. Notifications to landowners outlining the survey with approximate dates were sent via mail and email notifications for access permission. Coastal Estuary Services (CES) was notified where TBS obtained keys for locked gates to certain CRMS sites. The Louisiana Department of Wildlife and Fisheries (LDWF) was also notified when applicable to obtain permits for access to properties and permissions for use of airboat equipment. All surveys were coordinated with landowners to limit the impacts to wildlife during hunting seasons. During data collection, Hurricane Ida passed and affected a portion of the project site. Additional coordination efforts continued with landowners to update the progress of survey work and request permissions for additional surveys needed at remaining CRMS sites post-Hurricane Ida.

3.0 Data Collection Summary on Deep Rod Monument Adjustments and High-Resolution Static GPS Observations on RSET Rods

Prior to data collection, TBS field crews performed field reconnaissance on all of the Secondary Benchmarks to document monument locations, record monument and site conditions, and perform clearing of small brush and vegetation from around monuments to help prepare site for static data occupations. The report for each of the secondary monuments utilized in this survey were noted on “Station Location Sketch and Visibility Diagram” sheets. In the event the TBS was unable to occupy a Secondary Monument as reference control to perform CRMS surveys, then TBS field crews obtained CPRA approval to install temporary benchmarks (surface monuments) or to occupy other RSETs at CRMS Sites near the original monument’s location. Once the monument sites were confirmed as suitable for occupation and all TBMs were set, a GPS Network Static Survey was performed to update the horizontal and vertical positions on all Secondary Monuments, TBMs, and Deep Rod RSETs to be used as Survey Control for all CRMS sites to be surveyed. The survey procedures as outlined in this section applies to both the Deep Rod Monument Adjustment and the High-Resolution Static GPS Observations on RSET Rods.

A GPS Network Plan and Sessions Schedule was prepared and submitted to CPRA for approval prior to data collection. To accomplish these GPS network surveys, static data was collected in small sessions (subnets) consisting of occupations ranging from a couple to several control points at the same time. The control points utilized varied from day to day consisting of multiple secondary monuments, TBMs, and/or RSET Rods. Control points in these sessions were occupied with Trimble GPS base stations to record static data simultaneously on all points within each subnet. In total, TBS field crews obtained static data on all required Secondary Monuments and RSETs with forty (40) separate GPS session subnets dating from July 2021 through February 2022. A listing of all Project Control Points surveyed for this project are shown in Exhibit “A” of this report. A summary and list of all GPS subnet sessions with dates and control points occupied during static data collection session are as shown in Exhibit “E” of this report. Field personnel documented each data collection setup in field books and “GPS log sheets” to document the date, start time, stop time, station name, GPS receiver serial number, and other relative data for each occupation. All field sketches and log sheets recorded before and during data collection are attached in the final deliverables for this project with examples of these field sheets gathered are shown in Exhibit “B” of this report. The equipment used for this project were Trimble model R10 and R12 for base station and rover units, utilizing Trimble TSC-7 data collectors. All survey data was recorded using these base stations equipped with 2.0-meter fixed height tripods. The GNSS base receivers were set to record L1 and L2 data from GPS and GLONASS satellites only, at a 5 second epoch rate with a 15-degree elevation mask. All survey data was recorded using published control from the existing Secondary Monument datasheets, which was provided by CPRA at start of the project. Survey methods and field procedures utilized for measurements obtained by static data collection surveys performed by TBS were gathered under the guidelines as outlined by CPRA in Sections B, C, & D of

“A Contractor’s Guide to the Standards of Practice for CPRA Contractors Performing GPS Surveys and Determining GPS Derived Orthometric Heights within the Louisiana Coastal Zone”, July 2019 version. The program used for the network adjustment was Trimble Business Center (TBC), version 5.50. The static data for selected Continuously Operating Reference Station(s) (CORS) gathered during the occupation times of the TBS data collection was also downloaded to be included in processing of GNSS Static Network Adjustments of Secondary Monuments and TBMs, and the High-Resolution Static GPS Observations on RSET Rods.

The CORS used in the processing of the GPS network were stations “HOUM” (Houma, LA), “FSHS” (Franklin, LA), “AWES” (Donaldsonville, LA), “AMER” (Amerada Pass, LA), “LWES” (Luling, LA), “GRIS” (Grand Isle, LA), and “LMCN” (Cocodrie, LA). The horizontal and vertical positions used for these CORS in the final GPS Network Adjustment were obtained by processing static data files collected at these stations during TBS survey data collection. Multiple static files for each CORS were processed through the Online Positioning User Service (OPUS) to obtain an average ITRF2014 position for each of the CORS during TBS survey data collection times (average epoch 2021.6813). These positions were then transformed through the NGS Horizontal Time-Dependent Positioning (HTDP) utility from the latest realization of the International Terrestrial Reference System, ITRF2014 (2021.6813) coordinates, into the required project datum of NAD83(2011) (epoch 2010.0000) coordinates. The final CORS positions used in all of the GPS Network Adjustments by TBS are as shown in the table below:

Final GPS Network Adjustment Values used - NAD83(2011) (2010.00)			
CORS	Latitude	Longitude	Ellipsoid Height (m)
AMER	N 29° 26' 58.4976"	W 91° 20' 17.2123"	-14.410
AWES	N 30° 06' 00.9628"	W 90° 58' 58.6346"	-8.956
FSHS	N 29° 48' 19.1028"	W 91° 30' 08.0510"	-14.516
GRIS	N 29° 15' 55.8830"	W 89° 57' 26.2622"	-15.701
HOUM	N 29° 35' 32.1097"	W 90° 43' 24.9882"	-11.369
LMCN	N 29° 15' 17.9044"	W 90° 39' 40.6512"	-14.809
LWES	N 29° 54' 01.2954"	W 90° 20' 57.8336"	-15.723

All static data collected from GPS sessions including monuments, TBMs, and CORS were downloaded into TBC to create baselines from CORS to the control points occupied during the GPS network session. These baselines expand the overall GPS network and are utilized in redundancy checks in the minimal and fully constrained network adjustment processes. After all static data and precise ephemeris were downloaded and imported into the overall network session in TBC, a least squares (free) adjustment was performed on all points using no constraints. This process helped identify any gross errors or blunders (outliers) in baselines created during data collection that should not be used in the processing. Baseline errors were either fixed or removed and the solutions were analyzed to assure that remaining baselines were within the of preset default standard errors. A minimal constrained least squares adjustment was then performed on the monuments by constraining one of the CORS fixed in latitude, longitude, and ellipsoid height. After the data was analyzed and the minimal adjustment passed the Chi Square Test, a fully constrained least squares adjustment was performed on the control points holding all of the CORS fixed in latitude, longitude, and ellipsoid heights. NAVD88 (Geoid 12B) was applied to the adjusted network to determine the orthometric heights (elevations) for all of the control points. A final listing of Control Points derived from GNSS Static Network Adjustments of Secondary Monuments and TBMs, and the High-Resolution Static GPS Observations on RSET Rods are listed in the fully-constrained-network adjustment reports as shown in Exhibit “H” & “I” of this report, respectively. All final adjusted data for Deep Rod Monument Adjustments on Secondary Monuments, TBMs, and RSET Rods are shown in NAD 83 (2011), Epoch 2010.00, Louisiana South Zone (1702), US Survey Feet with a vertical datum of NAVD 88 (Geoid12B). The adjusted data was also converted to UTM, NAD 83 (Zone 15) meters using the NGS Coordinate Conversion and Transformation Tool (NCAT). A snapshot of the final overall GPS Network conducted by TBS is shown in the figure below:

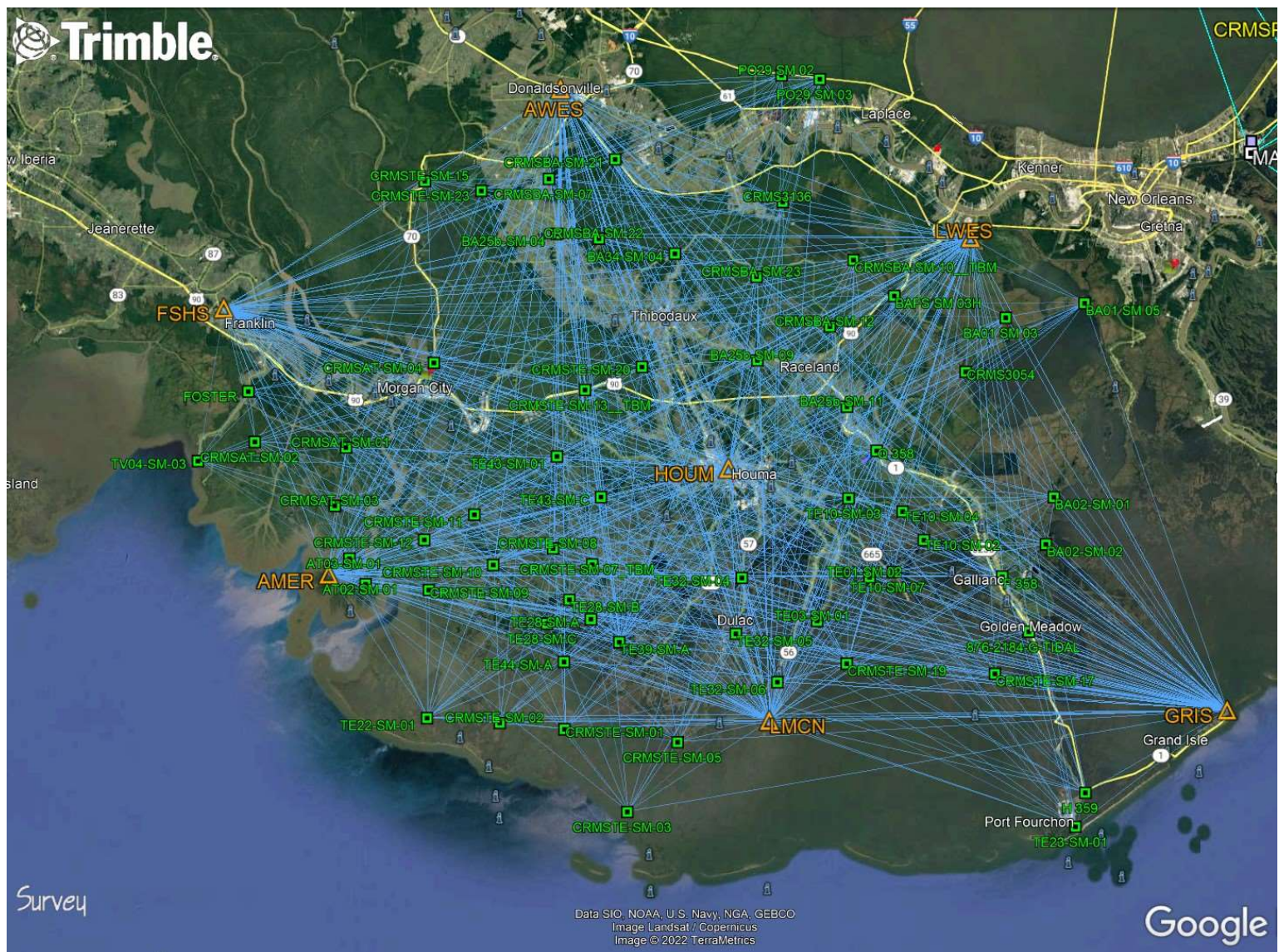


Figure 2 – Overall GPS Static Network as surveyed by TBS and select control points occupied by Fenstermaker and Fugro.

T. Baker Smith (TBS) coordinated with other Elevation Survey Update efforts being conducted by other CPRA offices located in New Orleans, LA (Fugro) and Lafayette, LA (Fenstermaker). Fenstermaker conducted survey work west of TBS survey area and Fugro conducted survey work east of TBS survey area. Coordination was done with both companies on separate dates to simultaneously collect static data in multiple sessions on separate control points. The static data collected in these sessions were shared between companies and added into each respective firm's GPS network adjustment. The processed control point data results were then compared between companies for additional QA/QC on the independent static networks. These point comparisons can be found in the tables below with the measurement units as supplied to TBS from Fenstermaker and Fugro respectively:

TBS Final Values (LA South Zone - 1702, US ft)				Fenstermaker Final Values (LA South Zone - 1702, US ft)				Delta Differences (US ft)		
Point	Easting	Northing	Elevation (Geoid 12B)	Point	Easting	Northing	Elevation (Geoid 12B)	Easting	Northing	Elevation (Geoid 12B)
AT02-SM-01	3297793.90	340941.69	1.62	AT02-SM-01	3297793.91	340941.68	1.65	-0.01	0.01	-0.03
CRMSAT-SM-01	3287916.80	407416.30	2.25	CRMSAT-SM-01	3287916.82	407416.32	2.36	-0.02	-0.02	-0.11
CRMSAT-SM-02	3243167.65	409975.60	1.28	CRMSAT-SM-02	3243167.65	409975.59	1.27	0.00	0.01	0.01
CRMSAT-SM-03	3282540.63	379038.23	1.90	CRMSAT-SM-03	3282540.64	379038.20	1.82	-0.01	0.03	0.08
CRMSAT-SM-04	3330714.32	448811.65	5.64	CRMSAT-SM-04	3330714.35	448811.64	5.61	-0.03	0.01	0.03
FOSTER	3239836.52	434531.55	6.61	FOSTER	3239836.53	434531.55	6.65	-0.01	0.00	-0.04
TV04-SM-03	3215247.77	400497.89	1.39	TV04-SM-03	3215247.77	400497.88	1.43	0.00	0.00	-0.04

TBS Final Values (LA South Zone - 1702, US ft)				Fugro Final Values (LA South Zone - 1702, US ft)				Delta Differences		
Point	Easting (m)	Northing (m)	Elevation (Geoid 12B) (m)	Point	Easting (m)	Northing (m)	Elevation (Geoid 12B) (m)	Easting (m)	Northing (m)	Elevation (Geoid 12B) (m)
BA01-SM-03	1100379.170	143899.083	0.034	BA01-SM-03	1100379.166	143899.082	0.031	-0.004	-0.001	-0.003
BA01-SM-05	1112154.406	146125.635	0.174	BA01-SM-05	1112154.402	146125.633	0.169	-0.004	-0.002	-0.005
BA25b-SM-04	1033409.835	156001.442	4.703	BA25b-SM-04	1033409.828	156001.442	4.717	-0.007	0.000	0.014
BA25b-SM-09	1063381.244	137371.829	2.853	BA25b-SM-09	1063381.234	137371.823	2.893	-0.010	-0.006	0.040
BA34-SM-04	1051026.566	153142.082	0.950	BA34-SM-04	1051026.560	153142.083	0.964	-0.006	0.001	0.014
CRMS3054	1094427.740	135844.482	0.945	CRMS3054	1094427.739	135844.480	0.943	-0.001	-0.002	-0.002
CRMS3136	1067059.875	160903.668	0.597	CRMS3136	1067059.877	160903.662	0.597	0.002	-0.006	0.000
CRMSBA-SM-07	1032210.307	164168.914	1.586	CRMSBA-SM-07	1032210.300	164168.912	1.594	-0.007	-0.002	0.008
CRMSBA-SM-21	1042068.769	167093.678	1.567	CRMSBA-SM-21	1042068.764	167093.679	1.568	-0.005	0.001	0.001
CRMSBA-SM-22	1039690.749	155330.822	0.724	CRMSBA-SM-22	1039690.743	155330.821	0.737	-0.006	-0.001	0.013
CRMSBA-SM-23	1063208.434	149772.977	0.515	CRMSBA-SM-23	1063208.428	149772.975	0.523	-0.006	-0.001	0.008
CRMSTE-SM-01	1034913.009	82559.373	0.584	CRMSTE-SM-01	1034912.987	82559.374	0.631	-0.022	0.001	0.047
CRMSTE-SM-08	1033096.984	109371.106	0.709	CRMSTE-SM-08	1033096.976	109371.106	0.751	-0.008	0.000	0.042
CRMSTE-SM-20	1046202.718	136325.030	1.686	CRMSTE-SM-20	1046202.706	136325.032	1.717	-0.012	0.002	0.031
CRMSTE-SM-23	1022137.414	162348.015	1.108	CRMSTE-SM-23	1022137.408	162348.020	1.112	-0.006	0.005	0.004
PO29 SM 02	1066797.980	179729.915	3.315	PO29 SM 02	1066797.978	179729.911	3.313	-0.002	-0.004	-0.002
PO29 SM 03	1072513.201	179177.314	3.584	PO29 SM 03	1072513.196	179177.314	3.595	-0.005	0.000	0.011
TE39-SM-A	1043019.356	95522.331	-0.003	TE39-SM-A	1043019.349	95522.326	0.061	-0.007	-0.005	0.064
TE44-SM-A	1034784.324	92564.256	-0.054	TE44-SM-A	1034784.359	92564.233	0.003	0.035	-0.023	0.057

Final horizontal and vertical positions shared between the three companies for the majority of selected control points yielded minor differences when compared was found to be acceptable as comparisons for this survey. The minor differences found between final network adjustment values may vary depending on site conditions at the time of survey, along with slight differences in positions of final constraints utilized for each separate network adjustment.

All static data collected for each control monument was sent to NGS Online Positioning User Service (OPUS) site to obtain an averaged OPUS position for a comparison with the values of the points derived from the final GNSS static network adjustment. All final control monument positions derived in TBC that TBS surveyed as compared to OPUS positions are shown on the table in Exhibit “C” of this report. Some monuments in the final adjustment had varying elevation differences as compared to OPUS results. These differences may be due to error propagation from poor site observation conditions (tall trees and vegetation near monument locations).

Final positions listed in this report are based on the final values established through final TBC network adjustments and are shown on the updated Secondary Monument and RSET datasheets prepared for this survey (datasheet example in Exhibit “D” of this report) and as attached on the CRMS Survey Reports in project deliverables.

4.0 Real Time Kinematic (RTK) Surveys at CRMS sites

During static data collection, Real Time Kinematic (RTK) surveys from Deep Rod Monuments and RSET Rods (control points) were performed by TBS field crews to obtain elevation updates located at 112 CRMS Sites as shown in Figure 1 in Section 2.0 of this report. CPRA supplied ESRI shapefiles of boat launches and approved access routes to CRMS sites which were utilized by TBS field crews for navigation to and from each site. For each CRMS site survey, a GNSS RTK base station was setup over a pre-determined control point and then used to transmit real time corrections to the rover unit where horizontal and vertical positions were obtained on specific CRMS site reference points. The “unadjusted” horizontal and vertical position for control monuments were used from datasheets supplied by CPRA using NAD83 (2011), Epoch 2010.00 horizontal values and NAVD88 (Geoid 12A) vertical values. The unadjusted horizontal and vertical positions on these reference points were collected and stored in the TSC-7 data collector. Tape measurements were performed

from the top of post to the nail shank and from the top of post to the water surface to determine the final adjusted positions of the reference points surveyed at each CRMS site. The un-adjusted survey data collected was downloaded and processed with final control monument values to determine the final values reported on datasheets for each CRMS site surveyed. Reference points surveyed and adjusted to NAVD88 (Geoid 12B) at CRMS sites included water levels, marks located on Open Water Continuous Recorders (H01), Marsh Well Continuous Recorders (W01), and Thin-Mat Continuous recorders (M01 or M02). Some of these stations had associated Staff Gauges (SG) that were also measured during each CRMS site survey. All field information was gathered with RTK measurements whenever allowable precisions were obtained at CRMS sites. At CRMS sites where heavy tree canopy and/or other error propagations occurred, additional measurements were taken with differential leveling to compare with tape measurements. All field measurements were recorded in the data collector and on field notes by TBS field personnel. During data collection on CRMS site surveys and static data collection, Hurricane Ida affected the area being surveyed on August 28, 2021. The storm caused irreparable damage to some of the CRMS sites. As a result of the storm damage, it was decided by CPRA to have TBS survey in the Continuous Recorders (H01) and Staff Gauges (SG) located at six (6) CRMS sites. These Post-Ida CRMS surveys were to collect data on reference points on the (H01) and (SG) installed at CRMS sites after the storm event. Separate “Post-Ida” CRMS Survey Reports were prepared for the six CRMS sites re-surveyed during this task. A list of these CRMS sites re-surveyed are shown in the table below:

<i>Site</i>	<i>Basin</i>	<i>Marsh Type</i>	<i>Location</i>	<i>Boat</i>	<i>SM</i>	<i>Survey Variables</i>
CRMS0190	BA	Attached	Cut Off	Airboat	BA02-SM-01	H01; E01
CRMS0211	BA	Floating	Des Allemands	Airboat Godevil	BAFS-SM-03H	H01
CRMS0386	TE	Attached	Golden Meadow	Airboat	F-358	H01; E01
CRMS0387	TE	Attached	Golden Meadow	Airboat	F-358	H01; E02
CRMS0397	TE	Attached	Golden Meadow	Airboat Godevil	876-2184-G-TIDAL	H01; E01
CRMS6303	BA	Attached	Cut Off	Airboat Surface Drive	BA02-SM-02	H01; E01

Upon completion of CRMS site elevation updates, Survey Reports were prepared for each CRMS site surveyed by TBS to outline the survey methodologies used, field notes, and the final datasheets prepared for reference points collected at during “Pre-IDA” and Post-Ida” CRMS site surveys. Draft copies of the CRMS Survey Reports prepared for each site were sent to CPRA for review, comments, and then final approvals. Once final approval was obtained by CPRA, all CRMS Survey Reports were sent as part of the final deliverables. An example of the final CRMS Survey Report prepared for each CRMS site surveyed is shown in Exhibit “G” of this report. Survey methods and field procedures utilized for measurements obtained by Real Time Kinematic (RTK) surveys performed by TBS were gathered under the guidelines as outlined by CPRA in Section K of “A Contractor’s Guide to the Standards of Practice for CPRA Contractors Performing GPS Surveys and Determining GPS Derived Orthometric Heights within the Louisiana Coastal Zone”, July 2019 version. All final adjusted data for the CRMS Site survey datasheets are shown in NAD 83 (2011), Epoch 2010.00, Louisiana South Zone (1702), US Survey Feet with a vertical datum of NAVD 88 (Geoid12B). The adjusted data was also converted to UTM, NAD 83 (Zone 15) meters using the NGS Coordinate Conversion and Transformation Tool (NCAT).

Exhibit “A”

**Project Control Points
(Secondary Monuments and RSET Rods)**

Point ID	Easting (SF)	Northing (SF)	Elevation (SF) (NAVD88, Geoid 12B)	Latitude (dms)	Longitude (dms)	Ellipsoid Height (SF)
876-2184-G-TIDAL	3622146.241	319371.657	0.309	N29°22'25.698278883"	W90°15'42.321835373"	-79.887
AT02-SM-01	3297793.901	340941.695	1.618	N29°26'14.994616147"	W91°16'48.184794337"	-80.390
AT03-SM-01	3289814.212	353352.307	2.383	N29°28'17.883899669"	W91°18'18.396353022"	-79.832
BA02-SM-01	3634114.362	384874.402	0.672	N29°33'12.997033618"	W90°13'19.882114321"	-81.035
BA02-SM-02	3630318.629	361933.688	2.076	N29°29'26.263918296"	W90°14'05.347717962"	-79.074
BA25b-SM-04	3390445.434	511814.731	15.430	N29°54'24.973841661"	W90°59'14.513163540"	-70.050
BA25b-SM-09	3488776.632	450694.076	9.361	N29°44'15.660476513"	W90°40'41.197299318"	-74.288
BA25b-SM-11	3532641.708	428417.377	5.283	N29°40'32.389785115"	W90°32'25.377378859"	-77.921
BA34-SM-04	3448242.991	502433.646	3.116	N29°52'49.924216156"	W90°48'18.277320506"	-81.913
BAFS SM 03H	3555529.184	482374.703	-1.675	N29°49'24.891208246"	W90°28'01.298896548"	-86.057
CRMSAT-SM-01	3287916.797	407416.299	2.254	N29°37'13.104588562"	W91°18'39.743433454"	-80.892
CRMSAT-SM-02	3243167.655	409975.599	1.276	N29°37'38.254747565"	W91°27'06.786875314"	-82.003
CRMSAT-SM-03	3282540.626	379038.232	1.895	N29°32'32.177175337"	W91°19'40.671221609"	-80.749
CRMSAT-SM-04	3330714.320	448811.647	5.640	N29°44'02.571997959"	W91°10'34.199006795"	-78.372
CRMSBA-SM-07	3386509.984	538610.847	5.203	N29°58'50.353643933"	W90°59'58.343224854"	-81.088
CRMSBA-SM-10_TBM	3535531.993	499770.555	1.020	N29°52'18.539560879"	W90°31'46.939965074"	-83.824
CRMSBA-SM-12	3524128.330	467384.316	2.016	N29°46'58.712131712"	W90°33'58.929602864"	-82.023
CRMSBA-SM-21	3418853.953	548206.508	5.142	N30°00'24.268139658"	W90°53'50.145530629"	-81.271
CRMSBA-SM-22	3411052.067	509614.539	2.374	N29°54'02.519495930"	W90°55'20.458171544"	-82.949
CRMSBA-SM-23	3488209.671	491380.174	1.691	N29°50'58.460553766"	W90°40'44.993752220"	-82.952
CRMSTE-SM-01	3395377.097	270863.542	1.917	N29°14'39.507595959"	W90°58'27.057739875"	-78.368
CRMSTE-SM-02	3363737.189	273788.825	0.888	N29°15'09.312775958"	W91°04'24.124987913"	-79.581
CRMSTE-SM-03	3426272.932	230740.255	3.248	N29°08'01.220675707"	W90°52'40.116729001"	-76.270
CRMSTE-SM-05	3450675.107	264838.404	2.620	N29°13'37.731948910"	W90°48'03.190725234"	-77.468
CRMSTE-SM-07_TBM	3408600.109	351130.694	1.538	N29°27'53.685688948"	W90°55'54.626201055"	-80.238
CRMSTE-SM-08	3389419.021	358828.372	2.328	N29°29'10.505356304"	W90°59'31.353328743"	-79.670
CRMSTE-SM-09	3328771.087	338308.280	1.880	N29°25'48.651854562"	W91°10'57.888321633"	-80.013
CRMSTE-SM-10	3360199.370	350640.432	2.181	N29°27'50.193107140"	W91°05'02.173984498"	-79.798
CRMSTE-SM-11	3350877.048	375041.174	2.536	N29°31'51.941536205"	W91°06'47.101643815"	-79.942
CRMSTE-SM-12	3326414.045	362698.493	2.709	N29°29'50.137101683"	W91°11'24.198404007"	-79.641
CRMSTE-SM-13_TBM	3404645.488	435972.299	3.412	N29°41'53.720260137"	W90°56'36.096525341"	-80.017
CRMSTE-SM-15	3325793.195	537302.624	2.587	N29°58'38.650977387"	W91°11'28.775441726"	-83.916
CRMSTE-SM-17	3605703.249	298779.871	0.410	N29°19'03.340337640"	W90°18'50.228551369"	-79.431
CRMSTE-SM-19	3533118.733	303440.680	0.818	N29°19'55.157772629"	W90°32'29.758765195"	-79.630
CRMSTE-SM-20	3432416.749	447259.703	5.532	N29°43'44.419795628"	W90°51'20.668650759"	-78.055
CRMSTE-SM-23	3353462.500	532636.778	3.634	N29°57'52.018279675"	W91°06'14.263279156"	-82.650
F 358	3608994.154	346119.405	1.359	N29°26'51.675768520"	W90°18'08.244606315"	-79.556
H 359	3650437.364	240894.814	4.163	N29°09'26.121007684"	W90°10'31.545843640"	-74.111
Q 358	3547285.212	407042.178	7.264	N29°36'59.755919698"	W90°29'41.150529750"	-75.463
TE01-SM-02	3544090.352	345504.809	2.861	N29°26'50.801191696"	W90°30'22.378865346"	-78.510
TE03-SM-01	3518577.645	324171.554	3.045	N29°23'21.347987145"	W90°35'12.508802064"	-77.962
TE10-SM-02	3570546.095	363703.634	5.611	N29°29'48.972807012"	W90°25'21.522041932"	-76.026
TE10-SM-03	3533636.520	383832.002	2.330	N29°33'10.951577184"	W90°32'17.607176928"	-79.940
TE10-SM-04	3560078.763	377546.250	2.453	N29°32'06.815072046"	W90°27'18.768436561"	-79.546
TE10-SM-07	3555395.668	348137.298	1.216	N29°27'16.036086524"	W90°28'14.288400400"	-80.163
TE22-SM-01	3328119.360	275965.456	1.285	N29°15'31.488628989"	W91°11'06.170812986"	-79.348
TE23-SM-01	3645688.828	224296.310	7.103	N29°06'42.284457514"	W90°11'26.963449487"	-70.959
TE28-SM-A	3408054.641	324457.818	1.595	N29°23'29.653156934"	W90°56'01.848745724"	-79.677
TE28-SM-B	3397496.639	333906.204	0.779	N29°25'03.537918880"	W90°58'00.857456270"	-80.712
TE28-SM-C	3386557.636	322262.348	2.704	N29°23'08.598058561"	W91°00'04.928318021"	-78.599
TE32-SM-04	3481678.378	344938.402	1.388	N29°26'49.125145148"	W90°42'08.320772990"	-80.175
TE32-SM-05	3478908.944	317749.086	1.989	N29°22'20.113579725"	W90°42'41.313019826"	-78.987
TE32-SM-06	3499286.831	294291.101	0.637	N29°18'26.740771177"	W90°38'52.589427388"	-79.769
TE39-SM-A	3421972.670	313392.847	-0.010	N29°21'39.607822751"	W90°53'24.999921765"	-81.033
TE43-SM-01	3391131.392	403567.096	1.159	N29°36'33.351805397"	W90°59'10.444600197"	-81.681
TE43-SM-C	3412721.379	383893.994	1.848	N29°33'17.884843389"	W90°55'06.662624598"	-80.528
TE44-SM-A	3394954.903	303687.896	-0.176	N29°20'04.467789042"	W90°58'30.665291811"	-81.080

CRMS0175-E01	3660611.384	289033.970	1.330	N29°17'21.620583461"	W90°08'31.165354802"	-77.850
CRMS0336-E01	3583563.815	299443.356	1.437	N29°19'11.791676598"	W90°23'00.244377287"	-78.584
CRMS0345-E01	3463079.339	244246.837	1.657	N29°10'13.295785052"	W90°45'44.358666098"	-78.034
CRMS0464-E01	3264202.815	370218.613	2.850	N29°31'04.828515496"	W91°23'08.233609039"	-79.639
CRMS3296-E01	3552821.539	324698.029	1.222	N29°23'24.192188975"	W90°28'45.380655109"	-79.607

Exhibit “B”

Examples of GPS Observation Log Sheets and Station Recovery Forms

USE THIS FORM IF USING FIXED HEIGHT TRIPODS TO DOCUMENT STATIC
SURVEYS ON BASE POINTS FOR ALL RTK SURVEYS

GPS LOG SHEET

Job No. 2021.0470 Date 10-26-21 Observer Troy Crochet
Client CPR A Job Description Elevation Survey
Location La Coastal Zone Proj. Mgr. Kim Knight

SESSION INFO

File Name 4 Characters 0826 Julian Date 3 Characters Session No. 1 Character

Long Name TE01-SM-02

Mon. Description Secondary deep road Monument

Rec. Base Type R-12 I Rec Serial # 6052F00826

Base Ant Type Integrated Base Ant Ser # N/A

Rover Ant Type Integrated Rover Ant Ser # N/A

Antenna Height Measurement is TRUE VERTICAL to the Bottom of Antenna Mount if Using Fixed Hgt Tripod

Fixed Hgt 2 Meter Tripod 2.2M Mtrs or Ft

Tripod Number

Actual Start Time 7:26 AM Actual Stop Time 3:41 PM Session Time (Min 2:01 Hr) 0:00

BASE STATION INFORMATION

WGS84, NAD83 or NAD27

DATUM Nad 83

ZONE La South

Example: LA South Zone or TX South Central Zone

Northing/Lat 345504.70

Coordinate Origin-Where did you get your positions?

Easting/Long. 3544090.30

Elevation 2.92 ft

Note any power problems, obstructions, weather issues, etc.

ALL WHITE BOXES MUST BE FILLED IN WITH INFORMATION. A MINIMUM OBSERVATION OF 2 HOURS IS REQUIRED TO DETERMINE THE 3-D POSITION OF AN UNKNOWN POINT USING NGS-OPUS

USE BACK OF THIS SHEET TO MAKE STATION SKETCH, REFERENCE TIES & DESCRIPTION

Date: 07-01-21



T. BAKER SMITH
A CENTURY OF SOLUTIONS
412 South Van Ave. Houma, LA 70363
(985)868-1050 - tbsmith.com

Party Crew: Fred Little

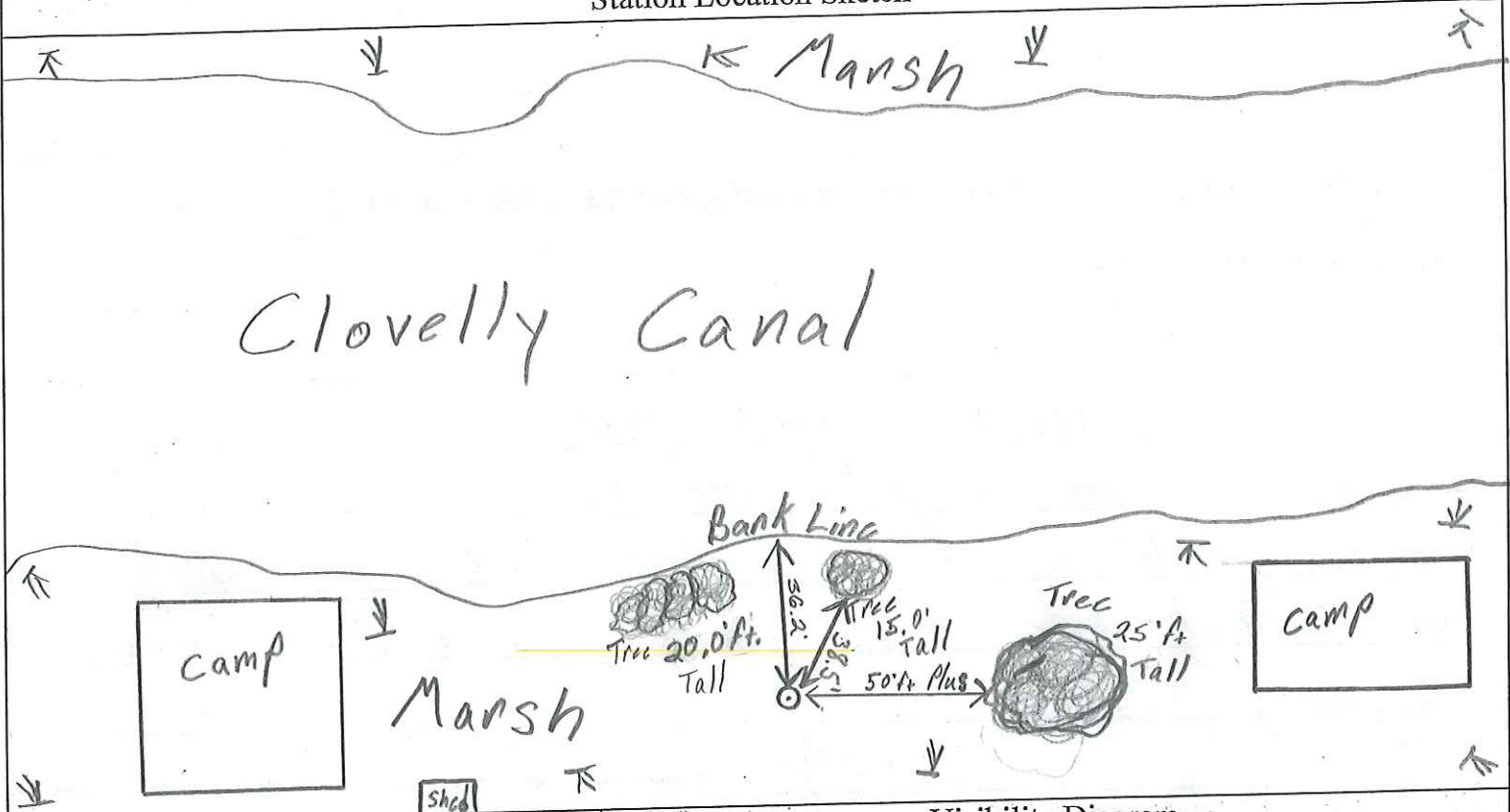
Troy Crochet

Project: 2021.0470 - CPRA- CRMS Elevation Survey

Monument Name: BA 02-SM-01

Station Location Sketch and Visibility Diagram

Station Location Sketch

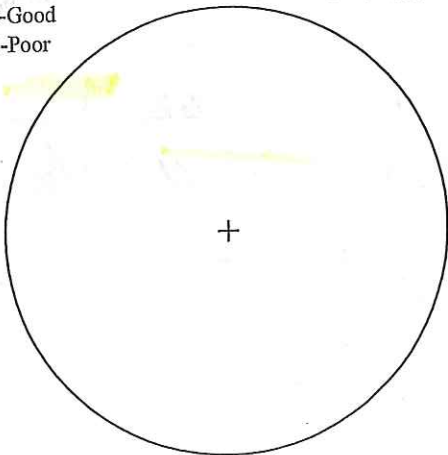


Sketch of Disk

Monument Stability Quality:

- ☐ -A-Most Stable
- ☐ -B-Excellent
- ☒ -C-Good
- ☐ -D-Poor

Soft mud around Mon.



Monument Stability Quality:

- ☒ Recessed 0.85 feet
- ☐ Flush With Ground Surface
- ☐ Projecting _____ feet

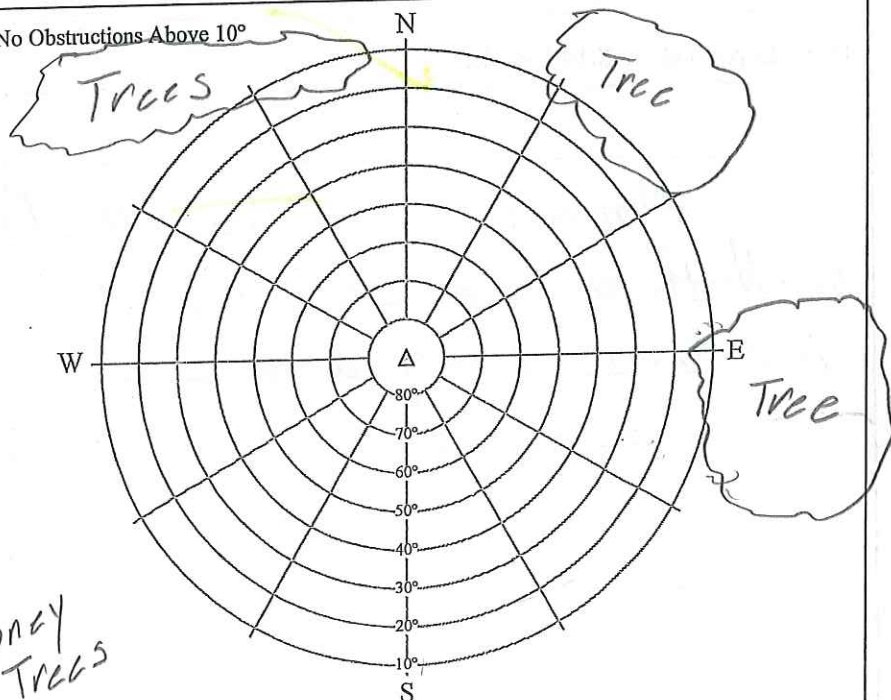
Disk Is Set:

- ☐ In Concrete
- ☒ In Structure
- ☐ In Natural Ground

Money Trees

Visibility Diagram

☐ No Obstructions Above 10°



General Monument Location: "The station is located in...."

☒ As Described on 2014 Datasheet

(Describe general location; include airline distance to three towns or mapped features.)

To Reach Narrative: "To reach the monument from the intersection of...."

☒ As Described on 2014 Datasheet

Soft Marsh around Monument & it was almost a foot deep to the top of rod & about another half of foot to the PVC. The water was filling the hole back up as we were digging.

(Leg-by-leg distances and directions from major road intersections or landmarks to monument.)

Monument Description and Measurements: "The monument is...."

☒ As Described on 2014 Datasheet

Monument is 36.2' A. from Top bank Line, 38.5' A. from Northeast Money tree that's on top bank, & 50' A. Plus from East Money tree

(Add at least 3 measurements to permanent, identifiable, nearby objects, and a description of the monument size, shape, height, etc.)

Exhibit “C”

Secondary Monuments and RSET Rods

Final GPS Network Adjustment positions as compared to OPUS solutions

T. Baker Smith - Final GPS Network Adjustment values on Secondary Monuments and RSETs as compared to average OPUS positions
Louisiana State Plane Coordinate System - SPCS (1702) South Zone, US Survey Feet

Station Name	2021 Final Network Adjustment Values			2021 Opus Average			Delta Differences		
	Easting	Northing	Elev. (Geoid 12B)	Easting	Northing	Elev. (Geoid 12B)	Easting	Northing	Elev. (Geoid 12B)
876-2184-G-TIDAL	3622146.24	319371.66	0.309	3622146.25	319371.66	0.272	0.010	0.006	-0.04
AT02-SM-01	3297793.90	340941.69	1.618	3297793.88	340941.66	1.665	-0.023	-0.035	0.05
AT03-SM-01	3289814.21	353352.31	2.383	3289814.21	353352.27	2.519	0.000	-0.035	0.14
BA02-SM-01	3634114.36	384874.40	0.672	3634114.35	384874.40	0.639	-0.011	-0.005	-0.03
BA02-SM-02	3630318.63	361933.69	2.076	3630318.63	361933.67	2.040	-0.001	-0.017	-0.04
BA25b-SM-04	3390445.43	511814.73	15.430	3390445.44	511814.72	15.456	0.006	-0.007	0.03
BA25b-SM-09	3488776.63	450694.08	9.361	3488776.62	450694.08	9.347	-0.010	-0.001	-0.01
BA25b-SM-11	3532641.71	428417.38	5.283	3532641.65	428417.34	5.107	-0.055	-0.035	-0.18
BA34-SM-04	3448242.99	502433.65	3.116	3448243.00	502433.64	3.069	0.007	-0.006	-0.05
BAFS SM 03H	3555529.18	482374.70	-1.675	3555529.17	482374.71	-1.647	-0.017	0.004	0.03
CRMSAT-SM-01	3287916.80	407416.30	2.254	3287916.79	407416.30	2.296	-0.006	-0.004	0.04
CRMSAT-SM-02	3243167.65	409975.60	1.276	3243167.65	409975.60	1.358	-0.001	0.004	0.08
CRMSAT-SM-03	3282540.63	379038.23	1.895	3282540.62	379038.23	1.874	-0.001	-0.003	-0.02
CRMSAT-SM-04	3330714.32	448811.65	5.640	3330714.31	448811.64	5.675	-0.007	-0.006	0.04
CRMSBA-SM-07	3386509.98	538610.85	5.203	3386509.94	538610.78	5.162	-0.045	-0.068	-0.04
CRMSBA-SM-10 TBM	3535531.99	499770.56	1.020	3535531.99	499770.56	0.956	-0.003	0.006	-0.06
CRMSBA-SM-12	3524128.33	467384.32	2.016	3524128.30	467384.32	1.976	-0.026	-0.001	-0.04
CRMSBA-SM-21	3418853.95	548206.51	5.142	3418853.96	548206.51	5.128	0.005	0.002	-0.01
CRMSBA-SM-22	3411052.07	509614.54	2.374	3411052.08	509614.53	2.402	0.009	-0.004	0.03
CRMSBA-SM-23	3488209.67	491380.17	1.691	3488209.66	491380.18	1.649	-0.015	0.007	-0.04
CRMSTE-SM-01	3395377.10	270863.54	1.917	3395377.09	270863.53	1.916	-0.004	-0.011	0.00
CRMSTE-SM-02	3363737.19	273788.83	0.888	3363737.18	273788.82	0.885	-0.011	-0.009	0.00
CRMSTE-SM-03	3426272.93	230740.25	3.248	3426272.93	230740.25	3.247	0.001	-0.002	0.00
CRMSTE-SM-05	3450675.11	264838.40	2.620	3450675.08	264838.37	2.449	-0.032	-0.039	-0.17
CRMSTE-SM-07 TBM	3408600.11	351130.69	1.538	3408600.08	351130.70	1.605	-0.029	0.004	0.07
CRMSTE-SM-08	3389419.02	358828.37	2.328	3389419.03	358828.34	2.308	0.005	-0.027	-0.02
CRMSTE-SM-09	3328771.09	338308.28	1.880	3328771.08	338308.26	1.804	-0.004	-0.022	-0.08
CRMSTE-SM-10	3360199.37	350640.43	2.181	3360199.39	350640.41	2.212	0.018	-0.021	0.03
CRMSTE-SM-11	3350877.05	375041.17	2.536	3350877.07	375041.18	2.509	0.018	0.003	-0.03
CRMSTE-SM-12	3326414.04	362698.49	2.709	3326414.04	362698.49	2.698	-0.001	-0.006	-0.01
CRMSTE-SM-13 TBM	3404645.49	435972.30	3.412	3404645.48	435972.29	3.428	-0.006	-0.007	0.02
CRMSTE-SM-15	3325793.19	537302.62	2.587	3325793.17	537302.65	2.562	-0.023	0.022	-0.03
CRMSTE-SM-17	3605703.25	298779.87	0.410	3605703.25	298779.87	0.342	-0.003	-0.005	-0.07
CRMSTE-SM-19	3533118.73	303440.68	0.818	3533118.74	303440.68	0.819	0.006	0.001	0.00
CRMSTE-SM-20	3432416.75	447259.70	5.532	3432416.76	447259.68	5.472	0.008	-0.021	-0.06
CRMSTE-SM-23	3353462.50	532636.78	3.634	3353462.32	532636.95	2.807	-0.179	0.171	-0.83
F-358	3608994.15	346119.40	1.359	3608994.15	346119.40	1.244	-0.006	-0.007	-0.12
H-359	3650437.36	240894.81	4.163	3650437.37	240894.79	4.073	0.004	-0.020	-0.09
Q-358	3547285.21	407042.18	7.264	3547285.20	407042.17	7.197	-0.016	-0.006	-0.07
TE01-SM-02	3544090.35	345504.81	2.861	3544090.30	345504.68	2.614	-0.053	-0.132	-0.25
TE03-SM-01	3518577.64	324171.55	3.045	3518577.66	324171.56	3.015	0.011	0.005	-0.03
TE10-SM-02	3570546.09	363703.63	5.611	3570546.08	363703.62	5.584	-0.020	-0.012	-0.03
TE10-SM-03	3533636.52	383832.00	2.330	3533636.51	383831.98	2.268	-0.009	-0.017	-0.06
TE10-SM-04	3560078.76	377546.25	2.453	3560078.79	377546.20	2.868	0.024	-0.052	0.41
TE10-SM-07	3555395.67	348137.30	1.216	3555395.65	348137.30	1.197	-0.015	-0.001	-0.02
TE22-SM-01	3328119.36	275965.46	1.285	3328119.35	275965.44	1.270	-0.006	-0.014	-0.02
TE23-SM-01	3645688.83	224296.31	7.103	3645688.84	224296.32	7.048	0.008	0.011	-0.05
TE28-SM-A	3408054.64	324457.82	1.595	3408054.62	324457.77	1.627	-0.017	-0.043	0.03
TE28-SM-B	3397496.64	333906.20	0.779	3397496.63	333906.23	0.713	-0.005	0.028	-0.07
TE28-SM-C	3386557.64	322262.35	2.704	3386557.61	322262.35	2.754	-0.025	-0.001	0.05
TE32-SM-04	3481678.38	344938.40	1.388	3481678.35	344938.38	1.365	-0.027	-0.022	-0.02
TE32-SM-05	3478908.94	317749.09	1.989	3478908.94	317749.08	1.971	-0.005	-0.010	-0.02
TE32-SM-06	3499286.83	294291.10	0.637	3499286.85	294291.09	0.666	0.019	-0.011	0.03
TE39-SM-A	3421972.67	313392.85	-0.010	3421972.67	313392.87	0.087	-0.001	0.023	0.10
TE43-SM-01	3391131.39	403567.10	1.159	3391131.45	403567.09	1.159	0.062	-0.006	0.00
TE43-SM-C	3412721.38	383893.99	1.848	3412721.44	383894.00	1.980	0.063	0.004	0.13
TE44-SM-A	3394954.90	303687.90	-0.176	3394954.93	303687.87	-0.155	0.030	-0.028	0.02
CRMS 0175-E01	3660611.38	289033.97	1.330	3660611.38	289033.96	1.282	-0.004	-0.014	-0.05
CRMS 0336-E01	3583563.82	299443.36	1.437	3583563.77	299443.38	1.441	-0.047	0.028	0.00
CRMS 0345-E01	3463079.34	244246.84	1.657	3463079.34	244246.84	1.702	-0.003	0.000	0.04
CRMS 0464-E01	3264202.82	370218.61	2.850	3264202.79	370218.61	2.824	-0.027	-0.007	-0.03
CRMS 3296-E01	3552821.54	324698.03	1.222	3552821.53	324698.04	1.154	-0.012	0.012	-0.07

Exhibit “D”

**Examples of Secondary Monuments and RSET Rods
Datasheets**



VICINITY MAP: Scale: 1" = 2000'
Station Name: "CRMSAT-SM-01"

2019 NAIP imagery provided by USDA Farm Service Agency

Monument Location: Commencing at Calumet Landing in St. Mary Parish along Wax Lake Outlet proceed in a Southwesterly direction 3.75 miles along said outlet to the intersection of the Intracoastal Waterway; thence along Intracoastal Waterway in an Easterly direction 4.54 miles to Possum Point; thence leaving said Intracoastal Waterway proceed in a Southerly direction along bayou inlet 0.26 miles to the intersection of Little Wax Bayou; thence proceed along said bayou in a Southwesterly direction 1.04 miles to the intersection of Cross Bayou; thence proceed along said bayou in an Easterly direction 1.07 miles to monument located on North side of Cross Bayou. The monument is roughly 20 feet from bank of Cross Bayou.

Monument Description: Top Security Floating Sleeve Monument (9/16" Stainless Steel) enclosed in an aluminum cap and 6" PVC sleeve set in concrete and stamped CRMSAT-SM-01. Steel rod driven 48 feet to refusal.

Date: January 2022

Monument Established By: NGS **Sponsor:** LA Department of Natural Resources

Adjusted NAD 83 Geodetic Position

Lat. 29° 37' 13.1046" N

Long. 91° 18' 39.7434" W

Adjusted NAD 83 Datum LSZ (1702) Feet

N = 407,416.30

E = 3,287,916.80

Adjusted UTM, NAD 83 Datum (Zone 15) Meters

N = 3,277,904.939

E = 663,525.032

Adjusted NAVD88 (2011) Height

Elevation Geoid12B = 2.25 feet (0.687 mtrs.)

Elevation Geoid12A = 2.25 feet (0.687 mtrs.)

Elevation Geoid99 = 2.82 feet (0.858 mtrs.)

Ellipsoid Height = -24.656 mtrs.

Geoid12B Height = -25.343 mtrs.

Ellipsoid Height = -24.656 mtrs.

Geoid12A Height = -25.343 mtrs.

Ellipsoid Height = -24.656 mtrs.

Geoid99 Height = -25.514 mtrs.



Adjusted position determined by T. Baker Smith, LLC for Coastal Protection and Restoration Authority



VICINITY MAP: Scale: 1" = 2000'

2019 NAIP imagery provided by USDA Farm Service Agency

Station Name: CRMS0175-E01

Location: Approximately 5.1 miles northeast of LA Hwy 1, at the Leeville Bridge near Bay Jaque in Lafourche Parish, Louisiana.

Monument Description: 9/16" stainless steel rod driven to refusal in a 6" PVC sleeve. Top of collar to top of rod distance: 0.55 feet.

Date of Survey: November 2021

Deep Rod RSET

NAD 83 Geodetic Position:

Lat. 29° 17' 21.6206" N
Long. 90° 08' 31.1654" W

UTM, NAD 83, Meters (Zone 15) Coordinates

N= 3,243,432.170
E= 777,651.636

NAD 83 Datum LSZ (1702) Feet

N= 289,033.97
E= 3,660,611.38

Top of Rod Elevation – NAVD 88 (2011)

Elevation Geoid12B = 1.83 ft (0.557 mtrs)
Elevation Geoid12A = 1.83 ft (0.557 mtrs)
Elevation Geoid99 = 2.53 ft (0.771 mtrs)

Ellipsoid Height = -23.577 mtrs.
Geoid12B Height = -24.134 mtrs.

Ellipsoid Height = -23.577 mtrs.
Geoid12A Height = -24.134 mtrs.

Ellipsoid Height = -23.577 mtrs.
Geoid99 Height = -24.348 mtrs.

Top of RSET Collar Elevation – NAVD 88 (2011)

Elevation Geoid12B = 1.33 ft (0.405 mtrs)
Elevation Geoid12A = 1.33 ft (0.405 mtrs)
Elevation Geoid99 = 2.03 ft (0.619 mtrs)

Ellipsoid Height = -23.729 mtrs.
Geoid12B Height = -24.134 mtrs.

Ellipsoid Height = -23.729 mtrs.
Geoid12A Height = -24.134 mtrs.

Ellipsoid Height = -23.729 mtrs.
Geoid99 Height = -24.348 mtrs

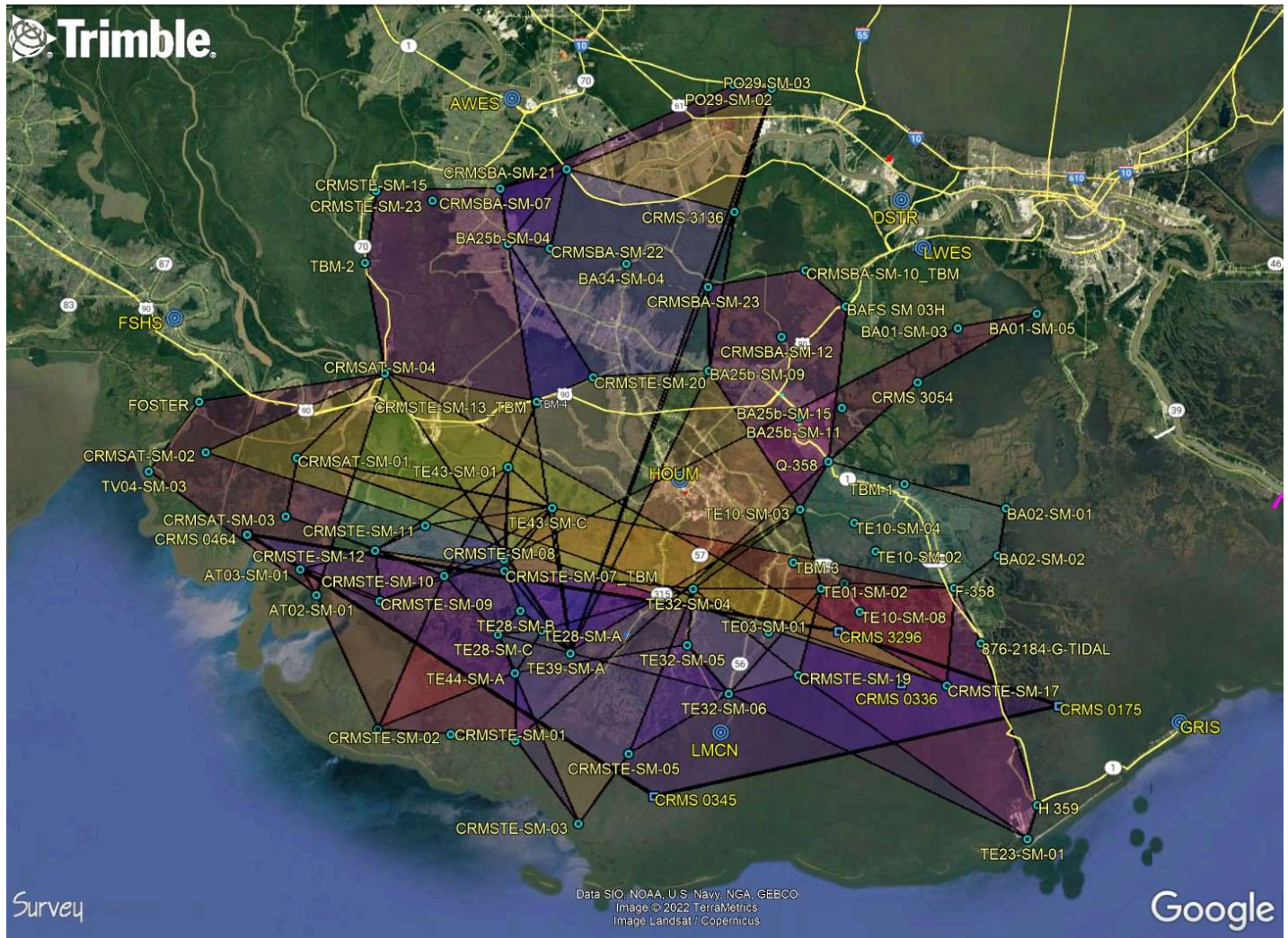
Adjusted Position Established by T. Baker Smith, LLC for the Coastal Protection and Restoration Authority



Exhibit “E”

**GPS Network Sessions gathered on
Secondary Monuments and RSET Rods**

GPS Data Collection Sessions



Overall Plan View of GPS Static Network as surveyed by TBS and select control points occupied by Fenstermaker and Fugro

Index to GPS Data Collection Sessions:

- TBS – Deep Rod Monument Adjustments.....Sessions 1 thru 34, 36, 38, 39 & 40
- TBS – High-Resolution Static GPS Observations on RSET Rods.....Sessions 35 & 37
- T. Baker Smith and Fenstermaker – Static Data collection.....Sessions 31 & 32
- T. Baker Smith and Fugro – Static Data collection.....Sessions 11, 12, & 16, 17, 18 & 19

Secondary Monument Static Data Occupations		
Session 1		
Monument ID	Start Time	Duration
CRMSTE-SM-10	7/8/2021 8:30:15	5:14:40
CRMSTE-SM-08	7/8/2021 9:06	4:42:50
CRMSTE-SM-12	7/8/2021 10:10	2:59:15
TE43-SM-C	7/8/2021 7:40	5:48:51
TE43-SM-01	7/8/2021 8:20	4:53:28

Session 2		
Monument ID	Start Time	Duration
CRMSTE-SM-11	7/9/2021 6:59	5:41:05
CRMSTE-SM-10	7/9/2021 7:59	4:18:05
CRMSTE-SM-12	7/9/2021 7:47	4:32:50
TE43-SM-01 A	7/9/2021 6:43	5:50:36
TE43-SM-C	7/9/2021 7:09	5:06:11

Session 3		
Monument ID	Start Time	Duration
CRMSTE-SM-11	7/9/2021 12:41	4:50:25
CRMSTE-SM-10	7/9/2021 12:19	4:58:30
CRMSTE-SM-08	7/9/2021 12:56	4:48:10
CRMSTE-SM-12	7/9/2021 12:21	4:43:45
TE43-SM-01	7/9/2021 12:35	4:54:45
TE43-SM-C	7/9/2021 12:17	4:57:50

Session 4		
Monument ID	Start Time	Duration
TE28-SM-A	7/12/2021 8:26	4:19:30
TE28-SM-B	7/12/2021 7:39	5:03:11
TE28-SM-C	7/12/2021 7:31	5:08:15
TE39-SM-A	7/12/2021 7:47	6:22:30

Session 5		
Monument ID	Start Time	Duration
TE28-SM-C	7/12/2021 12:41	4:33:15
TE28-SM-A	7/12/2021 12:48	4:31:00
TE28-SM-B	7/12/2021 12:44	4:31:16

Session 6		
Monument ID	Start Time	Duration
TE28-SM-C	7/13/2021 7:33	5:06:50
TE44-SM-A	7/13/2021 8:04	4:14:55
TE28-SM-B	7/13/2021 8:06	4:14:26
TE28-SM-A	7/13/2021 7:24	5:27:57

Session 7		
Monument ID	Start Time	Duration
TE28-SM-C	7/13/2021 12:42	4:24:15
TE44-SM-A	7/13/2021 12:21	5:05:55
TE28-SM-B	7/13/2021 12:21	5:18:36
TE28-SM-A	7/13/2021 12:52	4:14:33

Session 8		
Monument ID	Start Time	Duration
TE39-SM-A	7/14/2021 7:46	4:22:45
CRMSTE-SM-07_TBM	7/14/2021 7:01	5:05:20
TE32-SM-04	7/14/2021 6:28	5:37:15
CRMSTE-SM-19	7/14/2021 7:27	4:37:35
TE32-SM-06	7/14/2021 7:15	5:15:37
TE32-SM-05	7/14/2021 6:48	5:28:22

Session 9		
Monument ID	Start Time	Duration
TE32-SM-04	7/14/2021 12:06	4:58:55
CRMSTE-SM-19	7/14/2021 12:11	4:32:50
TE32-SM-06	7/14/2021 12:31	4:14:59
TE32-SM-05	7/14/2021 12:18	4:42:18

Session 10		
Monument ID	Start Time	Duration
TE32-SM-04	7/16/2021 6:05	6:20:00
TE01-SM-02	7/16/2021 7:27	4:36:35
CRMSTE-SM-19	7/16/2021 7:23	4:21:40
TE32-SM-05	7/16/2021 6:36	5:26:22
TE32-SM-06	7/16/2021 6:55	4:50:10

Session 11		
Monument ID	Start Time	Duration
CRMSTE-SM-08	7/26/2021 7:38	9:40:45
CRMSTE-SM-10	7/26/2021 8:16	8:20:00
TE44-SM-A	7/26/2021 7:32	9:28:30
CRMSTE-SM-01	7/26/2021 8:08	8:28:15
CRMSTE-SM-02	7/26/2021 7:53	8:41:20
TE22-SM-01	7/26/2021 7:59	8:36:12
CRMS 3054 (Fugro)	7/26/2021 7:31	6:03:15
BA01-SM-03 (Fugro)	7/26/2021 9:48	21:52:15
BA01-SM-05 (Fugro)	7/26/2021 8:25	6:05:15

Session 12		
Monument ID	Start Time	Duration
CRMSTE-SM-01	7/27/2021 8:03	8:21:30
CRMSTE-SM-02	7/27/2021 7:44	8:33:30
CRMSTE-SM-08	7/27/2021 7:08	9:37:25
CRMSTE-SM-10	7/27/2021 7:49	8:28:50
TE22-SM-01	7/27/2021 7:57	8:21:45
TE44-SM-A	7/27/2021 7:31	9:29:15
CRMS 3054 (Fugro)	7/27/2021 7:18	6:57:30
BA01-SM-03 (Fugro)	7/27/2021 7:49	6:03:15
BA01-SM-05 (Fugro)	7/27/2021 8:12	6:13:15

Session 13		
Monument ID	Start Time	Duration
TE44-SM-A	7/28/2021 7:59	9:15:25
CRMSTE-SM-01	7/28/2021 8:31	8:15:40
CRMSTE-SM-03	7/28/2021 7:54	8:50:30
CRMSTE-SM-05	7/28/2021 7:04	10:11:05
TE32-SM-05	7/28/2021 6:29	10:38:05
TE32-SM-06	7/28/2021 7:02	9:46:15

Session 14		
Monument ID	Start Time	Duration
TE32-SM-04	7/29/2021 6:13	10:52:25
CRMSTE-SM-05	7/29/2021 7:04	9:39:40
TE28-SM-A	7/29/2021 7:15	9:27:45
CRMSTE-SM-03	7/29/2021 7:53	8:24:15
TE39-SM-A	7/29/2021 8:00	9:20:32
TE28-SM-C	7/29/2021 8:02	8:18:15

Session 15		
Monument ID	Start Time	Duration
CRMSTE-SM-07_TBM	7/30/2021 8:18	6:16:50
CRMSTE-SM-08	7/30/2021 8:23	6:08:40
TE28-SM-A	7/30/2021 7:17	7:57:30
TE28-SM-B	7/30/2021 7:40	7:23:20
TE43-SM-01	7/30/2021 7:02	7:47:05
TE43-SM-C	7/30/2021 7:31	6:58:30
TE39-SM-A	7/30/2021 7:41	6:19:49

Session 16		
Monument ID	Start Time	Duration
BA25b-SM-04	8/4/2021 7:02	9:50:35
CRMSAT-SM-04	8/4/2021 6:58	9:47:25
CRMSBA-SM-07	8/4/2021 8:03	8:31:05
CRMSTE-SM-13_TBM	8/4/2021 7:49	8:32:50
CRMSTE-SM-15	8/4/2021 7:28	8:49:55
CRMSTE-SM-20	8/4/2021 7:04	9:40:30
CRMSTE-SM-23	8/4/2021 7:30	8:45:05
TE39-SM-A	8/4/2021 7:22	7:17:53
PO29-SM-02 (Fugro)	8/4/2021 7:41	7:17:15
PO29-SM-03 (Fugro)	8/4/2021 8:22	7:47:45
CRMS 3136 (Fugro)	8/4/2021 8:54	6:06:30

Session 17		
Monument ID	Start Time	Duration
CRMSTE-SM-15	8/5/2021 7:01	9:10:27
CRMSTE-SM-13_TBM	8/5/2021 6:55	9:14:00
CRMSTE-SM-20	8/5/2021 6:28	9:21:50
CRMSTE-SM-23	8/5/2021 7:16	8:27:15
BA25b-SM-04	8/5/2021 6:11	10:10:15
CRMSBA-SM-07	8/5/2021 6:35	9:29:10
CRMSAT-SM-04	8/5/2021 7:31	8:14:20
TE39-SM-A	8/5/2021 7:43	9:59:59
PO29-SM-02 (Fugro)	8/5/2021 7:28	7:10:45
PO29-SM-03 (Fugro)	8/5/2021 7:59	3:57:45

Session 18		
Monument ID	Start Time	Duration
BA25b-SM-04	8/6/2021 6:52	9:38:12
CRMSBA-SM-23	8/6/2021 7:21	9:07:25
CRMSTE-SM-20	8/6/2021 6:51	9:11:20
BA34-SM-04	8/6/2021 6:49	9:12:45
CRMSBA-SM-21	8/6/2021 9:29	6:31:10
BA25b-SM-09	8/6/2021 7:29	9:04:45
CRMSBA-SM-22	8/6/2021 7:19	8:52:19
PO29-SM-03 (Fugro)	8/6/2021 7:22	7:07:45

Session 19		
Monument ID	Start Time	Duration
BA25b-SM-04	8/9/2021 7:00	8:30:32
CRMSBA-SM-22	8/9/2021 6:38	9:13:15
BA25b-SM-09	8/9/2021 7:09	8:55:55
BA34-SM-04	8/9/2021 6:58	8:52:35
CRMSTE-SM-20	8/9/2021 6:25	9:08:00
CRMSBA-SM-07	8/9/2021 6:34	9:22:35
CRMSBA-SM-21	8/9/2021 7:05	8:25:05
CRMSBA-SM-23	8/9/2021 6:33	8:57:50
TE39-SM-A	8/9/2021 8:37	5:57:51
CRMS 3136 (Fugro)	8/9/2021 8:10	6:11:15

Session 20		
Monument ID	Start Time	Duration
BA25b-SM-09	8/10/2021 6:28	10:40:57
BA25b-SM-11	8/10/2021 6:48	10:01:30
BAFS SM 03H	8/10/2021 6:22	10:26:40
CRMSBA-SM-12	8/10/2021 6:51	10:17:20
CRMSBA-SM-23	8/10/2021 6:48	11:05:25
Q 358	8/10/2021 7:15	9:35:45
CRMSBA-SM-10_TBM	8/10/2021 8:32	8:22:00
TE10-SM-03	8/10/2021 6:36	10:47:45
TE39-SM-A	8/10/2021 9:20	2:49:10

Session 21		
Monument ID	Start Time	Duration
BA25b-SM-09	8/11/2021 6:23	9:45:35
BA25b-SM-11	8/11/2021 6:40	9:04:55
BAFS SM 03H	8/11/2021 6:36	9:08:10
CRMSBA-SM-10_TBM	8/11/2021 7:22	8:22:50
CRMSBA-SM-12	8/11/2021 6:14	9:54:20
CRMSBA-SM-23	8/11/2021 6:15	10:21:10
Q 358	8/11/2021 6:44	9:06:15
TE10-SM-03	8/11/2021 6:10	10:11:45
TE39-SM-A	8/11/2021 7:44	5:55:11

Session 22		
Monument ID	Start Time	Duration
CRMSAT-SM-01	8/16/2021 8:18	9:34:15
CRMSAT-SM-03	8/16/2021 8:56	8:19:30
CRMSAT-SM-04	8/16/2021 7:37	9:38:05
CRMSTE-SM-08	8/16/2021 7:38	9:36:55
CRMSTE-SM-10	8/16/2021 7:31	10:08:05
CRMSTE-SM-12	8/16/2021 8:07	9:05:55
CRMSTE-SM-13_TBM	8/16/2021 6:54	10:46:40
TE43-SM-01	8/16/2021 7:03	10:42:00

Session 23		
Monument ID	Start Time	Duration
CRMSTE-SM-07_TBM	8/17/2021 7:42	6:52:55
CRMSAT-SM-01	8/17/2021 7:44	8:28:10
CRMSAT-SM-03	8/17/2021 8:18	7:25:05
CRMSTE-SM-11	8/17/2021 7:09	7:47:55
CRMSTE-SM-12	8/17/2021 7:42	6:51:30
TE43-SM-C	8/17/2021 7:09	7:53:45

Session 24		
Monument ID	Start Time	Duration
H 359	8/18/2021 7:28	8:42:25
F 358	8/18/2021 7:00	9:35:00
TE10-SM-07	8/18/2021 7:55	8:54:25
876-2184-G-TIDAL	8/18/2021 7:23	8:51:55
TE01-SM-02	8/18/2021 6:59	9:11:35
CRMSTE-SM-19	8/18/2021 7:27	8:47:20
TE23-SM-01	8/18/2021 7:55	8:28:10

Session 25		
Monument ID	Start Time	Duration
876-2184-G-TIDAL	8/19/2021 6:39	9:12:15
CRMSTE-SM-19	8/19/2021 6:52	8:53:45
F 358	8/19/2021 6:20	9:49:15
H 359	8/19/2021 7:20	8:35:55
TE01-SM-02	8/19/2021 6:54	9:36:05
TE23-SM-01	8/19/2021 7:32	8:14:55
TE32-SM-06	8/19/2021 6:00	9:46:25

Session 26		
Monument ID	Start Time	Duration
TE10-SM-04	8/20/2021 6:25	10:38:15
BA02-SM-02	8/20/2021 7:53	8:19:50
TE01-SM-02	8/20/2021 6:33	9:38:50
TE10-SM-03	8/20/2021 7:43	9:30:20
BA02-SM-01	8/20/2021 7:29	9:14:35
F 358	8/20/2021 6:42	9:26:20
TE10-SM-07	8/20/2021 7:11	9:35:25
Q 358	8/20/2021 6:07	10:31:45
TE10-SM-02	8/20/2021 7:25	8:44:25

Session 27		
Monument ID	Start Time	Duration
BA02-SM-01	8/23/2021 7:08	9:19:55
BA02-SM-02	8/23/2021 7:37	8:23:35
F 358	8/23/2021 6:05	9:54:50
Q 358	8/23/2021 6:36	9:53:50
TE01-SM-02	8/23/2021 7:16	8:44:05
TE10-SM-02	8/23/2021 6:46	9:44:45
TE10-SM-03	8/23/2021 6:01	10:59:25
TE10-SM-04	8/23/2021 7:15	8:45:45
TE10-SM-07	8/23/2021 6:29	10:06:30

Session 28		
Monument ID	Start Time	Duration
TE28-SM-C	8/24/2021 7:24	9:22:10
AT03-SM-01	8/24/2021 8:03	7:30:45
TE44-SM-A	8/24/2021 8:07	7:02:45
AT02-SM-01	8/24/2021 8:37	6:39:30
CRMSTE-SM-09	8/24/2021 8:27	6:42:35
CRMSTE-SM-12	8/24/2021 7:53	7:44:50
CRMSTE-SM-10	8/24/2021 7:20	8:42:25
TE22-SM-01	8/24/2021 8:10	7:43:20

Session 29		
Monument ID	Start Time	Duration
CRMSBA-SM-07	10/18/2021 9:24	9:07:05
BA25b-SM-04	10/18/2021 9:05	9:20:55
CRMSBA-SM-21	10/18/2021 9:49	8:18:30
CRMSBA-SM-22	10/18/2021 9:29	8:37:40

Session 30		
Monument ID	Start Time	Duration
CRMSTE-SM-07_TBM	10/19/2021 8:41	8:19:10
TE10-SM-03	10/19/2021 7:59	9:06:00
CRMSTE-SM-13_TBM	10/19/2021 7:49	9:54:25
CRMSTE-SM-20	10/19/2021 7:32	9:54:45
TE32-SM-04	10/19/2021 7:12	10:29:55
BA25b-SM-09	10/19/2021 6:58	10:01:35
TE43-SM-01	10/19/2021 7:39	10:03:15

Session 31		
Monument ID	Start Time	Duration
CRMSAT-SM-04	10/21/2021 7:02	10:51:50
CRMSAT-SM-03	10/21/2021 11:03	5:06:00
CRMSAT-SM-01	10/21/2021 10:27	6:09:05
AT02-SM-01	10/21/2021 11:17	4:52:25
CRMSAT-SM-02	10/21/2021 11:52	4:18:25
TV04-SM-03 (Fenstermaker)	10/21/2021 7:08	8:46:40
FOSTER (Fenstermaker)	10/21/2021 7:42	8:29:20

Session 32		
Monument ID	Start Time	Duration
CRMSAT-SM-04	10/22/2021 6:34	9:10:55
CRMSAT-SM-03	10/22/2021 9:36	4:16:15
AT03-SM-01	10/22/2021 9:14	4:53:10
CRMSAT-SM-01	10/22/2021 9:01	5:19:00
CRMSAT-SM-02	10/22/2021 8:59	5:01:10
AT02-SM-01	10/22/2021 9:33	4:18:00
TV04-SM-03 (Fenstermaker)	10/22/2021 7:38	6:21:30
FOSTER (Fenstermaker)	10/22/2021 7:14	7:05:10

Session 33		
Monument ID	Start Time	Duration
TE32-SM-04	10/25/2021 6:49	10:35:55
TE03-SM-01	10/25/2021 7:44	9:29:25
TE01-SM-02	10/25/2021 7:22	9:21:55
CRMSTE-SM-19	10/25/2021 8:29	8:14:05
TE32-SM-05	10/25/2021 7:07	9:59:25
TE10-SM-03	10/25/2021 6:44	10:32:20
TE32-SM-06	10/25/2021 7:29	9:18:30

Session 34		
Monument ID	Start Time	Duration
TE32-SM-06	10/26/2021 7:20	9:04:35
TE03-SM-01	10/26/2021 6:24	9:45:15
TE01-SM-02	10/26/2021 7:27	8:14:25
CRMSTE-SM-19	10/26/2021 7:17	8:22:10
TE32-SM-04	10/26/2021 6:51	10:03:25
TE10-SM-03	10/26/2021 6:51	9:24:30
TE32-SM-05	10/26/2021 7:03	9:38:05

Session 35		
Monument ID	Start Time	Duration
CRMS0175-E01	11/1/2021 8:48	8:15:30
CRMS0336-E01	11/1/2021 8:06	8:55:45
CRMS0345-E01	11/1/2021 8:18	8:45:40
CRMS0464-E02	11/1/2021 8:13	8:53:20
CRMS3296-E01	11/1/2021 7:27	9:59:20

Session 36		
Monument ID	Start Time	Duration
CRMSAT-SM-01	11/3/2021 7:58	9:41:20
CRMSTE-SM-17	11/3/2021 8:15	8:17:05
F 358	11/3/2021 6:38	10:51:10

Session 37		
Monument ID	Start Time	Duration
CRMS0175-E01	11/4/2021 8:06	8:44:30
CRMS0336-E01	11/4/2021 7:34	9:15:00
CRMS0345-E01	11/4/2021 7:50	8:59:30
CRMS0464-E02	11/4/2021 8:33	8:18:30
CRMS3296-E01	11/4/2021 8:01	9:08:50

Session 38		
Monument ID	Start Time	Duration
CRMSAT-SM-04	11/5/2021 6:49	11:50:55
CRMSTE-SM-17	11/5/2021 7:46	9:14:45
CRMSAT-SM-02	11/5/2021 8:44	8:18:00

Session 39		
Monument ID	Start Time	Duration
AT03-SM-01	2/25/2022 10:38	5:54:55
CRSMTE-SM-09	2/25/2022 11:30	4:30:20

Session 40		
Monument ID	Start Time	Duration
AT03-SM-01	2/28/2022 9:36	5:37:55
CRSMTE-SM-09	2/28/2022 10:09	4:37:00

Exhibit “F”

Coastwide Reference Monitoring System (CRMS) Sites Surveyed

Site	Basin	Marsh Type	Location	Boat	SM	Survey Variables
CRMS0164	BA	Attached	Fourchon	Airboat	H 359	H01; E01
CRMS0175	BA	Attached	Leeville	Airboat	CRMSBA-SM-25 CRMS0175-E01	H01; E01
CRMS0178	BA	Attached	Grand Isle	Skiff	CRMSBA-SM-25 CRMS0175-E01	H01; E01
CRMS0190	BA	Attached	Cut Off	Airboat	BA02-SM-01	H01; E01
CRMS0192	BA	Floating	Kraemer	Airboat	CRMSBA-SM-10 Set TBM.	H01
CRMS0194	BA	Swamp	Vacherie	N/A	CRMSBA-SM-21	W01; E01
CRMS0197	BA	Swamp	Napoleonville	Godevil Tunnel	BA25b-SM-04	W01; E01
CRMS0200	BA	Swamp	Napoleonville	Godevil Tunnel	CRMSBA-SM-07	W01; E01
CRMS0206	BA	Swamp	Kraemer	Godevil	CRMSBA-SM-23	H01; E01
CRMS0211	BA	Floating	Des Allemands	Airboat Godevil	BAFS-SM-03H	H01
CRMS0217	BA	Swamp	Chackbay	Godevil	CRMSBA-SM-22	H01; E01
CRMS0218	BA	Swamp	Thibodaux	Airboat	BA25b-SM-09	H01; E01
CRMS0268	BA	Floating	Kraemer	Airboat	CRMSBA-SM-12	H01
CRMS0290	TE	Floating-Thin Mat	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-08	H01; M01
CRMS0292	TE	Attached	Fourchon	Airboat Godevil	TE23-SM-01	H01; E01
CRMS0293	TE	Attached	Dularge	Airboat	TE22-SM-01	H01; E01
CRMS0294	TE	Floating	Dularge	Airboat	TE28-SM-B	H01
CRMS0296	TE	Floating	Dularge	Airboat	TE28-SM-B	H01
CRMS0301	TE	Floating	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-12	H01
CRMS0302	TE	Attached	Dularge	All	CRMSTE-SM-03	H01
CRMS0303	TE	Attached	Dularge	Airboat	CRMSTE-SM-02	H01; E01
CRMS0305	TE	Attached	Dularge	Airboat	CRMSTE-SM-09	H01; E01
CRMS0307	TE	Attached	Cocodrie	All	CRMSTE-SM-05	H01; E01
CRMS0309	TE	Attached	Dularge	Airboat	TE22-SM-01	H01; E01
CRMS0310	TE	Attached	Golden Meadow	Airboat Godevil	CRMSTE-SM-17	H01; E01
CRMS0311	TE	Attached	Cocodrie	Airboat Tunnel	CRMSTE-SM-05	H01; E01
CRMS0312	TE	Attached	Larose	Airboat Godevil	TE10-SM-02	H01; E01
CRMS0315	TE	Attached	Montegut or Isle de Jean Charles	All	TE03-SM-01	H01; E01
CRMS0318	TE	Attached	Golden Meadow	Airboat Godevil	CRMSTE-SM-17	H01; E01
CRMS0319	TE	Attached	Golden Meadow	Airboat Godevil	CRMSTE-SM-17	H01; E01
CRMS0322	TE	Attached	Dularge	Airboat	CRMSTE-SM-02	H01; E01
CRMS0324	TE	Swamp	Pierre Part	All	CRMSTE-SM-15	H01; E01
CRMS0326	TE	Attached	Dularge	Airboat	CRMSTE-SM-02	H01; E01
CRMS0327	TE	Floating	Dularge	All	CRMSTE-SM-10	H01
CRMS0329	TE	Floating-Thin Mat	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-10	H01; M01
CRMS0331	TE	Floating	Lockport	All	TE10-SM-03	H01
CRMS0332	TE	Attached	Dularge	Airboat	CRMSTE-SM-02	H01; E01
CRMS0335	TE	Attached	Point aux Chien	Airboat Godevil	CRMSTE-SM-18 CRMS336-E01	H01; E01
CRMS0336	TE	Attached	Pointe au Chein	All	CRMSTE-SM-18 CRMS336-E01	H01; E01
CRMS0337	TE	Attached	Pointe au Chein	All	CRMSTE-SM-17	H01; E01
CRMS0338	TE	Attached	Pointe au Chein	All	CRMSTE-SM-18 CRMS336-E01	H01; E01
CRMS0341	TE	Attached	Isle de Jean Charles	Airboat Godevil	CRMSTE-SM-19	H01; E01
CRMS0345	TE	Attached	Cocodrie	Airboat Tunnel	CRMSTE-SM-04 CRMS0345-E01	H01; E01
CRMS0347	TE	Attached	Cocodrie	Airboat Tunnel	CRMSTE-SM-04 CRMS0345-E01	H01; E01
CRMS0354	TE	Attached	Dularge	Airboat	TE44-SM-A	H01; E01
CRMS0355	TE	Attached	Isle de Jean Charles	Airboat	CRMSTE-SM-19	H01
CRMS0365	TE	Floating	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-12	H01
CRMS0367	TE	Floating-Thin Mat	Lockport	Airboat Tunnel	BA25b-SM-11	H01; M02
CRMS0369	TE	Attached	Cocodrie	All	TE32-SM-06	H01; E01
CRMS0371	TE	Floating	Gibson or Amelia	Airboat	CRMSTE-SM-10	H01
CRMS0374	TE	Attached	Cocodrie	All	CRMSTE-SM-05	H01; E01
CRMS0376	TE	Attached	Cocodrie	All	CRMSTE-SM-03	H01; E01
CRMS0377	TE	Attached	Dularge	Airboat	CRMSTE-SM-01	H01; E01
CRMS0381	TE	Floating	Dularge	Airboat	CRMSTE-SM-07 Set TBM.	H01
CRMS0382	TE	Floating	Dularge	Airboat	CRMSTE-SM-07 Set TBM.	H01
CRMS0383	TE	Attached	Dularge	All	CRMSTE-SM-01	H01; E01
CRMS0385	TE	Attached	Chauvin	N/A	TE03-SM-01	H01; E01
CRMS0386	TE	Attached	Golden Meadow	Airboat	F-358	H01; E01
CRMS0387	TE	Attached	Golden Meadow	Airboat	F-358	H01; E02
CRMS0390	TE	Attached	Dulac	Airboat Godevil	TE32-SM-04	H01; E01
CRMS0392	TE	Attached	Dulac	Airboat Godevil	TE32-SM-04	H01; E01
CRMS0394	TE	Attached	Dularge	Airboat	TE39-SM-A	H01; E01
CRMS0395	TE	Attached	Dularge	Airboat	TE39-SM-A	H01; E01
CRMS0396	TE	Attached	Dularge	Airboat	TE39-SM-A	H01; E01
CRMS0397	TE	Attached	Golden Meadow	Airboat Godevil	876-2184-G-TIDAL	H01; E01
CRMS0398	TE	Attached	Dularge	Airboat	TE28-SM-A	H01; E01
CRMS0399	TE	Attached	Dularge	Airboat	CRMSTE-SM-02	H01; E01
CRMS0400	TE	Attached	Pointe au Chein	Airboat Godevil	TE01-SM-02	H01; E01
CRMS0403	TE	Swamp	Stephenville	Airboat Godevil	CRMSAT-SM-04	H01; E01
CRMS0409	TE	Floating	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-07 Set TBM.	H01
CRMS0411	TE	Floating-Thin Mat	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-08	H01-RT; M01
CRMS0414	TE	Swamp	Donner	N/A	CRMSTE-SM-13 Set TBM.	H01; E01

CRMS0416	TE	Attached	Pointe au Chein	Airboat Godevil	TE10-SM-07	H01; E01
CRMS0421	TE	Attached	Cocodrie	All	CRMSTE-SM-05	H01; E01
CRMS0434	TE	Attached	Dulac	All	TE32-SM-05	H01; E01
CRMS0461	AT	Attached	Berwick	All	CRMSAT-SM-01	H01; E01
CRMS0463	AT	Attached	Calumet	Airboat	AT03-SM-01	H01; E01
CRMS0464	AT	Attached	Calumet	Airboat	AT04-SM-01 CRMS0464-E01	H01; E02
CRMS0465	AT	Attached	Calumet	Airboat	AT04-SM-01 CRMS0464-E01	H01-RT; E02
CRMS0479	AT	Attached	Calumet	Airboat	AT04-SM-01 CRMS0464-E01	H01; E01
CRMS0482	AT	Attached	Berwick	All	CRMSAT-SM-03	H01; E01
CRMS0978	TE	Attached	Golden Meadow	Airboat	CRMSTE-SM-17	H01; E01
CRMS2568	AT	Attached	Berwick	All	CRMSAT-SM-03	H01; E01
CRMS2785	TE	Floating	Gibson or Amelia	Airboat	CRMSTE-SM-08	H01
CRMS2825	TE	Attached	Pointe au Chein	Godevil	TE10-SM-04	H01; E01
CRMS2862	TE	Floating	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-11	H01
CRMS2881	TE	Floating-Thin Mat	Gibson or Amelia	Skiff Tunnel	CRMSTE-SM-08	M01
CRMS2887	TE	Floating-Thin Mat	Gibson or Amelia	Skiff Tunnel	TE43-SM-C	H01; M01
CRMS2939	TE	Floating	Bourg	Airboat Godevil	TE10-SM-03	H01
CRMS2991	BA	Floating	Valentine	Airboat or ATV	Q-358	W01
CRMS3296	TE	Attached	Isle de Jean Charles	Airboat Godevil	TE10-SM-08 CRMS3926-E01	H01; E02
CRMS4014	AT	Attached	Berwick	All	CRMSAT-SM-03	H01; E01
CRMS4016	AT	Attached	Berwick	All	AT04-SM-01 CRMS0464-E01	H01; E01
CRMS4045	TE	Attached	Dularge	All	TE28-SM-C	H01; E01
CRMS4455	TE	Attached	Dularge	Airboat Godevil	CRMSTE-SM-01	H01; E01
CRMS4779	AT	Swamp	Centerville	Airboat Godevil	CRMSAT-SM-02	H01; E01
CRMS4782	AT	Swamp	Calumet	All	CRMSAT-SM-02	H01; E01
CRMS4808	AT	Swamp	Calumet	All	CRMSAT-SM-02	H01; E01
CRMS4809	AT	Swamp	Calumet	Airboat	CRMSAT-SM-02	H01; E01
CRMS4900	AT	Swamp	Berwick	Airboat	CRMSAT-SM-01	H01; E01
CRMS4938	AT	Swamp	Berwick	Airboat	CRMSAT-SM-01	H01; E01
CRMS5003	AT	Swamp	Berwick	Airboat	CRMSAT-SM-01	H01; E01
CRMS5035	TE	Swamp	Gibson or Amelia	All	TE43-SM-01	H01; E01
CRMS5116	BA	Swamp	Donaldsonville	Airboat	CRMSBA-SM-21	H01; E01
CRMS5536	TE	Swamp	Paincourtville	All	CRMSTE-SM-23	H01; E01
CRMS5672	BA	Swamp	Choupique	N/A	BA34-SM-04	H01; E01
CRMS5770	TE	Swamp	Thibodaux	N/A	CRMSTE-SM-20	H01; E01
CRMS6008	AT	Swamp	Centerville	Airboat	CRMSAT-SM-02	H01; E01
CRMS6038	AT	Swamp	Berwick	All	CRMSAT-SM-01	H01; E01
CRMS6042	AT	Swamp	Calumet	Airboat	CRMSAT-SM-01	H01; E02
CRMS6303	BA	Attached	Cut Off	Airboat Surface Drive	BA02-SM-02	H01; E01
CRMS6304	AT	Attached	Berwick	All	AT02-SM-01	H01; E01

Exhibit “G”

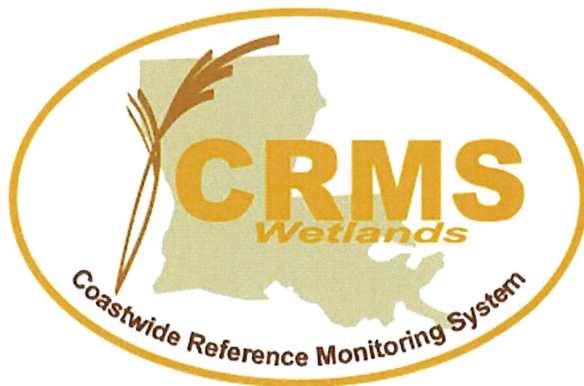
**TBS Survey Report example for
Coastwide Reference Monitoring System (CRMS) Sites Surveyed**

ELEVATION AND CONTROL SURVEY REPORT

CRMS 0164

PREPARED FOR:

COASTAL PROTECTION AND RESTORATION AUTHORITY
OF LOUISIANA



SUBMITTED BY:



SEPTEMBER 30, 2022



SECTION 1

METHODOLOGY REPORT

1.0 DESCRIPTION

This report details the procedures followed by T. Baker Smith, LLC to provide the Coastal Protection and Restoration Authority (CPRA) with survey data required to update elevations on Coastwide Reference Monitoring System (CRMS) sites utilizing the North American Vertical Datum of 1988 (NAVD88) in Feet and Geoid12B model to determine orthometric heights. These sites are further classified as attached marsh, swamp, floating marsh, or floating marsh thin-mat habitats. Depending on habitats and site specific methods, elevations and coordinates will be updated on open water continuous recorders (H01), marsh well continuous recorders (W01), thin-mat continuous recorders (M01 or M02), and RSET rods (E01 or E02).

2.0 LOCATION

CRMS0164 is located approximately 2.6 miles north-northwest of the intersection of LA Hwy 1 and LA Hwy 3090 in Port Fourchon, Louisiana. The site is located near the western shore of Lake Laurier in Lafourche Parish, Louisiana.

3.0 CRMS SURVEY SUMMARY

The equipment used for this project was a Trimble R12 base station, a Trimble R12 rover unit, A Trimble TSC-7 data collector, and a tape measure. All survey data was recorded using published control from the Secondary Monument “H-359”, which was provided by CPRA. The published data for the monument was in Louisiana South Zone (1702) NAD 83 feet with vertical datum of NAVD 88 (Geoid12A). The GNSS RTK base station was setup over Secondary Monument “H-359” and used to transmit real time corrections to the rover unit where horizontal and vertical positions were established on the RSET Collar at the number 5 position, top of RSET, top of posts, top of nail shanks, and water surface at both the Continuous Recorder and Staff Gauge. The unadjusted horizontal and vertical positions on these reference points located at CRMS 0164 were collected and stored in the TSC-7 data collector. A reading was taken on the Staff Gauge, and tape measurements were performed from the RSET Collar to the top of the RSET Rod, the top of posts to the nail shanks, from the tops of posts to the water surface, and from the top of the Staff Gauge post to the three (3) foot mark on the Staff Gauge as a check and to minimize errors. The data was downloaded and processed through TBC (Trimble Business Center) software to adjust the survey data to the final adjusted network position of “H-359”. The final values for the secondary monuments were used for a final adjustment of RTK data gathered at all of the CRMS sites that were surveyed. The survey commenced and was completed on August 18, 2021 by G. Guidry and J. Kopfler.

4.0 SURVEY CONTROL

The program used for the network adjustment was Trimble Business Center (TBC), version 5.50. All survey data was recorded using Trimble R12 RTK base stations equipped with Trimble R12 antennas with 2.0-meter fixed height tripods. The GNSS base receivers were set to record L1 and L2 data from GPS and GLONASS satellites only, at a 5 second epoch rate with a 15-degree elevation mask. The “unadjusted” horizontal and vertical position for primary monument “H-359” was obtained from the May 2014 datasheet supplied by CPRA using NAD83 (2011), Epoch 2010.00 horizontal values and NAVD88 (Geoid 12A) vertical values. Field personnel documented each data collection setup in field books and GPS log sheets to document the date, start time, stop time, station name, GPS receiver serial number, and other relative data for each occupation. The GNSS base receiver on monument “H-359” simultaneously collected static data with other receivers set on other secondary monuments. This process was repeated on separate days to create redundant measurements and multiple subnets across the area of the GNSS static network survey. All occupations and data gathered used in the final network adjustment were established in accordance with CPRA’s “Contractor’s Guide to the Standards of Practice for CPRA Contractors Performing GPS Surveys and Determining GPS Derived Orthometric Heights within the Louisiana Coastal Zone” dated July 2019. The static data occupations for monument “H-359” and other secondary monuments simultaneously surveyed in the static network sessions are as shown in the table below:

Secondary Monument Static Data Occupations		
Session 1		
Point ID	Start Time	Duration
F 358	8/18/2021 7:00	9:35:00
TE10-SM-07	8/18/2021 7:55	8:54:25
876-2184-G-TIDAL	8/18/2021 7:23	8:51:55
H 359	8/18/2021 7:28	8:42:25
TE01-SM-02	8/18/2021 6:59	9:11:35
CRMSTE-SM-19	8/18/2021 7:27	8:47:20
TE23-SM-01	8/18/2021 7:55	8:28:10
Session 2		
Point ID	Start Time	Duration
TE32-SM-06	8/19/2021 6:00	9:46:25
876-2184-G-TIDAL	8/19/2021 6:39	9:12:15
CRMSTE-SM-19	8/19/2021 6:52	8:53:45
F 358	8/19/2021 6:20	9:49:15
H 359	8/19/2021 7:20	8:35:55
TE01-SM-02	8/19/2021 6:54	9:36:05
TE23-SM-01	8/19/2021 7:32	8:14:55
TE32-SM-06	8/19/2021 6:00	9:46:25

The static data for selected Continuously Operating Reference Station(s) (CORS) during the occupation times of the data collection was downloaded to be included in processing of the GNSS static network adjustment. The CORS used in the processing of the GPS network were stations “HOUM” (Houma, LA), “FSHS” (Franklin, LA), “AWES” (Donaldsonville, LA), “AMER” (Amerada Pass, LA), “LWES” (Luling, LA), “GRIS” (Grand Isle, LA), and “LMCN” (Cocodrie, LA). Static data from each CORS was downloaded into TBC to create baselines from CORS to the control points occupied in the GPS network. These baselines are utilized in redundancy checks and used in both the minimal and fully constrained network adjustment.

After all static data and precise ephemeris were downloaded and imported into the overall network session in TBC, a least squares (free) adjustment was performed on all points using no constraints. This process helped identify any gross errors or blunders (outliers) in baselines that should not be used in the processing. Baseline errors were either fixed or removed and the solutions were analyzed to assure that remaining baselines were within the of preset default standard errors. A minimal constrained least squares adjustment was then performed on the monuments constrained by one of the CORS fixed in latitude, longitude, and ellipsoid height. After the minimal adjustment passed the Chi Square Test, a fully constrained least squares adjustment was performed on the monuments holding all of the CORS fixed in latitude, longitude, and ellipsoid heights. NAVD88 (Geoid 12B) was then applied to the adjusted network to determine the orthometric heights (elevations) for all of the secondary monuments. In an effort to compare secondary monument values, which were derived from final GNSS static network adjustments, T. Baker Smith coordinated with CPRA Elevation Survey Update efforts in New Orleans (Fugro) and Lafayette (Fenstermaker) to simultaneously collect static data on select secondary monuments. The static data collected in these sessions were shared between companies and added into each respective static network. The processed secondary monument data results were then compared between companies for additional QA/QC on the independent static networks.

All static data collected for each control monument was sent to NGS Online Positioning User Service (OPUS) site to obtain an averaged OPUS position for a comparison with the value of the points derived from the final GNSS static network adjustment. The final control monument positions derived in TBC compared to OPUS differed by 0.02 feet in the horizontal position, and -0.09 feet in the vertical position. All positions listed in this report are based on the final values established through final TBC network adjustments and are shown on the datasheets. All final adjusted data for Secondary Monuments and CRMS Site reference points are shown in NAD 83 (2011), Epoch 2010.00, Louisiana South Zone (1702), US Survey Feet with a vertical datum of NAVD 88 (Geoid12B). The adjusted data was also converted to UTM, NAD 83 (Zone 15) meters using the NGS Coordinate Conversion and Transformation Tool (NCAT).

[illegible][illegible]

Date: 8/18/2021

RTK Survey **CRMS 0164**

Survey Crew:

G. Guidry, J. Kopfler

Julian Day: 230

Date: 8/18/2021

Tape Meas.

RSET (E01) Measurements

Top of Rod to Collar = 0.51'

Collar Position of Measuremnt = #5

Continuous Recorder (H01) Measurements

Top of Post to Water Surface = 4.50'

Top of Post to Nail Shank = 1.01'

Staff Gauge (H01) Measurements

Top of Post to Water Surface = 4.36'

Top of Post to Gauge 3' Mark = 2.55'

Top of Post to Nail Shank = 2.00'

CRMS 0164 - Continuous Recorder and Staff Gauge Survey Data Sheet

CRMS Station	Date	Time	Continuous Recorder Gauge (H01)				
			Top of Recorder Support Pole (4x4 Post, Cap of Pipe, etc.)	Top of Support Pole to Nail or Top of 1/4" Hole	Nail or Hole Elevation	Top of Recorder Support Pole to Top of Water Distance	Water Elevation
			(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)
0164	8/18/2021	1:30 PM	5.51'		4.50'		0.82'
Calculated Differences (RTK) =				1.02'		4.70'	
Tape Measurements =				1.01'		4.50'	
Differences =				0.01'		0.20'	

CRMS Station	Date	Time	Staff Gauge (H01)								
			Existing Staff Gauge Reading (Upon Arrival)	Top of Support Pole to Nail or Top of 1/4" Hole	Nail or Hole Elevation	Top of Staff Gauge Support Pole	Top of Staff Gauge Support Pole to Top of Water Distance	Water Elevation	Staff Gauge Reading (After Establishment or Adjustment)	Computed Difference (Water Elevation vs. Staff Gauge)	Elevation at 3' Mark
			Old Datum	(Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)		(NAVD88)
0164	8/18/2021	1:30 PM	1.29'		3.37'	5.36'		0.94'	NA	-0.36'	2.81'
Calculated Differences (RTK) =				1.98'			4.42'				
Tape Measurements =				2.00'			4.36'				
Differences =				-0.02'			0.06'				

Rod Set (E01) & Marsh Well (W01)								
CRMS Station	Date	Elevation at Top of ROD SET	Top of Rod Set to Top of Collar	Elevation of Rod Set	Elevation of Rod Set Collar at Point #5	Elevation at Top of Marsh Well Post	Top of Marsh Well Post to Nail	Marsh Well Elevation at TBM Nail
		(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)	(NAVD 88, Ft.)	(Ft.)	(NAVD 88, Ft.)
0164	8/18/2021	1:30 PM		1.89	1.35			
Calculated Differences (RTK) =			0.53					
Tape Measurements =			0.51					
Differences =			0.02					



VICINITY MAP: Scale: 1" = 2000'

2019 NAIP imagery provided by USDA Farm Service Agency

Station Name: CRMS0164-E01

Location: Approximately 2.6 miles north-northwest of the intersection of LA Hwy 1 and LA Hwy 3090 in Port Fourchon, Louisiana. The site is located near the western shore of Lake Laurier in Lafourche Parish, Louisiana.

Monument Description: 9/16" stainless steel rod driven to refusal in a 6" PVC sleeve. Top of collar to top of rod distance: 0.51 feet

Date of Survey: August 2021

Deep Rod RSET

NAD 83 Geodetic Position:

Lat. 29° 11' 37.9202" N
Long. 90° 10' 11.4787" W

UTM, NAD 83, Meters (Zone 15) Coordinates

N= 3,232,781.656
E= 775,199.059

NAD 83 Datum LSZ (1702) Feet

N= 254,225.83
E= 3,652,081.42

Top of Rod Elevation – NAVD 88 (2011)

1.89 feet Geoid12B
1.89 feet Geoid12A
2.62 feet Geoid99

Top of RSET Collar Elevation – NAVD 88 (2011)

1.35 feet Geoid12B
1.35 feet Geoid12A
2.08 feet Geoid99





VICINITY MAP: Scale: 1" = 2000'

2019 NAIP imagery provided by USDA Farm Service Agency

Station Name: "CRMS0164-CR-H01"

Location: Approximately 2.6 miles north-northwest of the intersection of LA Hwy 1 and LA Hwy 3090 in Port Fourchon, Louisiana. The site is located near the western shore of Lake Laurier in Lafourche Parish, Louisiana.

Gauge Description: The gauge is a continuous recorder type gauge attached to a 4" x 4" treated wood post with reference nail driven horizontally into the wood post.

Date of Survey: August 2021

Continuous Recorder Gauge

NAD 83 Geodetic Position

Lat. 29° 11' 40.0036"
Long. 90° 10' 14.5767"

UTM, NAD83, Meters (Zone 15) Coordinates

N= 3,232,843.800
E= 775,113.796

NAD 83 Datum LSZ (1702) Feet

N= 254,433.49
E= 3,651,804.70

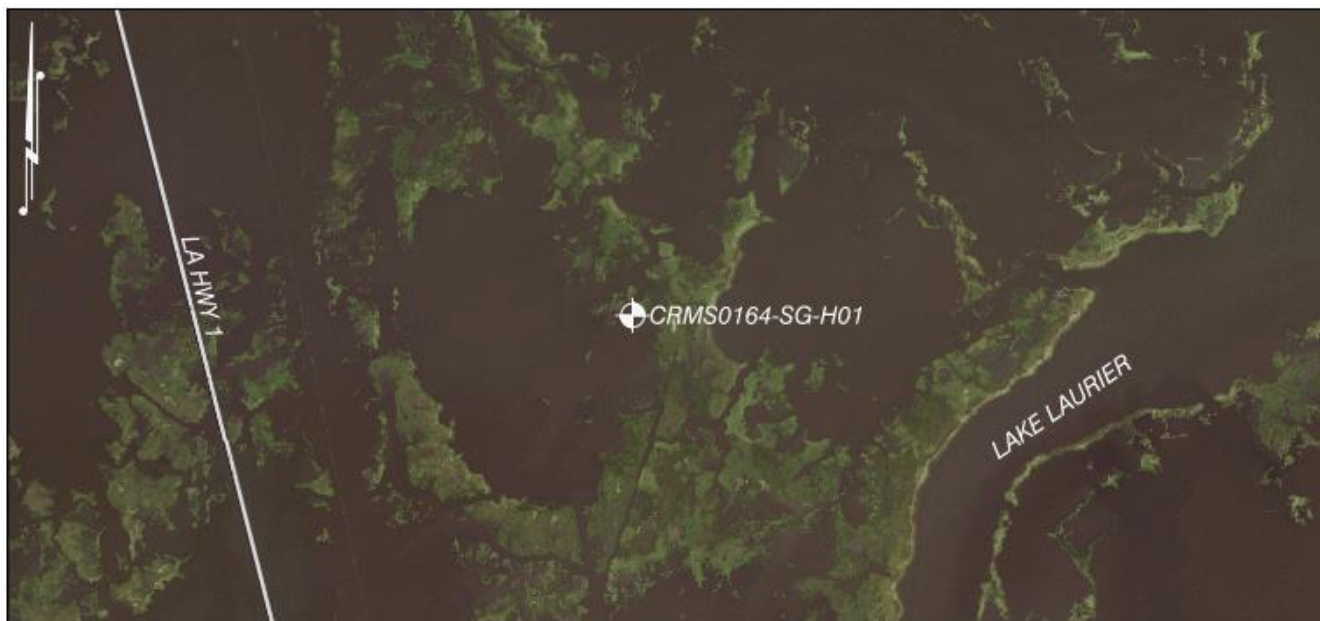
Top of 4"x4" Post Elevation - NAVD88 (2011)

5.51 feet Geoid12B
5.51 feet Geoid12A
6.24 feet Geoid99

Top of Nail Shank Elevation - NAVD88 (2011)

4.50 feet Geoid12B
4.50 feet Geoid12A
5.23 feet Geoid99





VICINITY MAP: Scale: 1" = 2000'

2019 NAIP imagery provided by USDA Farm Service Agency

Station Name: "CRMS0164-SG-H01"

Location: Approximately 2.6 miles north-northwest of the intersection of LA Hwy 1 and LA Hwy 3090 in Port Fourchon, Louisiana. The site is located near the western shore of Lake Laurier in Lafourche Parish, Louisiana.

Gauge Description: The gauge is a ceramic coated staff gauge attached to a 4" x 4" treated wood post with reference nail driven horizontally into the wood post.

Survey Date: August 2021

Staff Gauge

NAD 83 Geodetic Position

Lat. 29° 11' 40.0189" N
Long. 90° 10' 14.4816" W

UTM, NAD83, Meters (Zone 15) Coordinates

N = 3,232,844.332
E = 775,116.354

NAD 83 Datum LSZ (1702) Feet

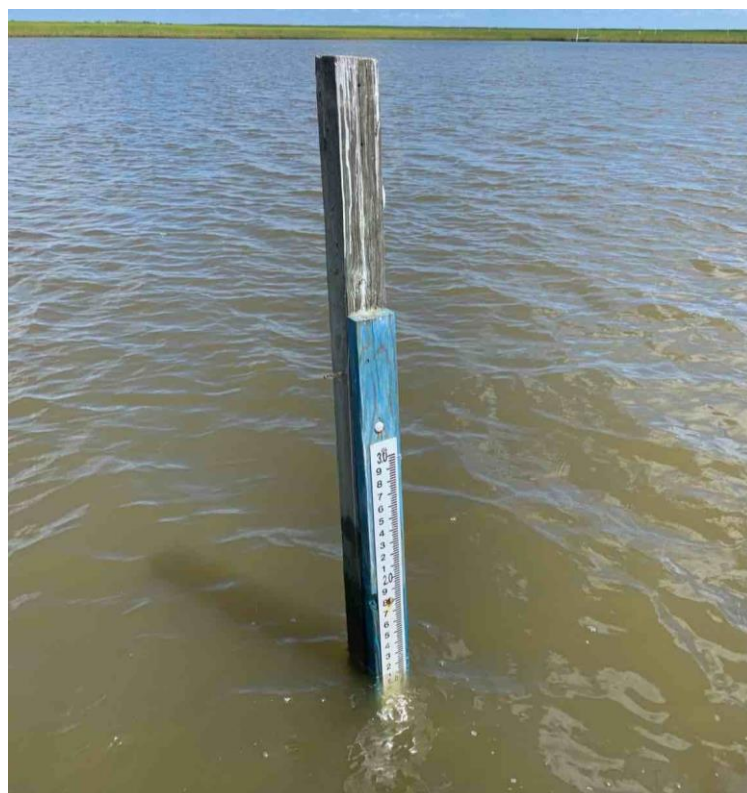
N = 254,435.12
E = 3,651,813.11

Top of 4"x4" Post Elevation - NAVD88 (2011)

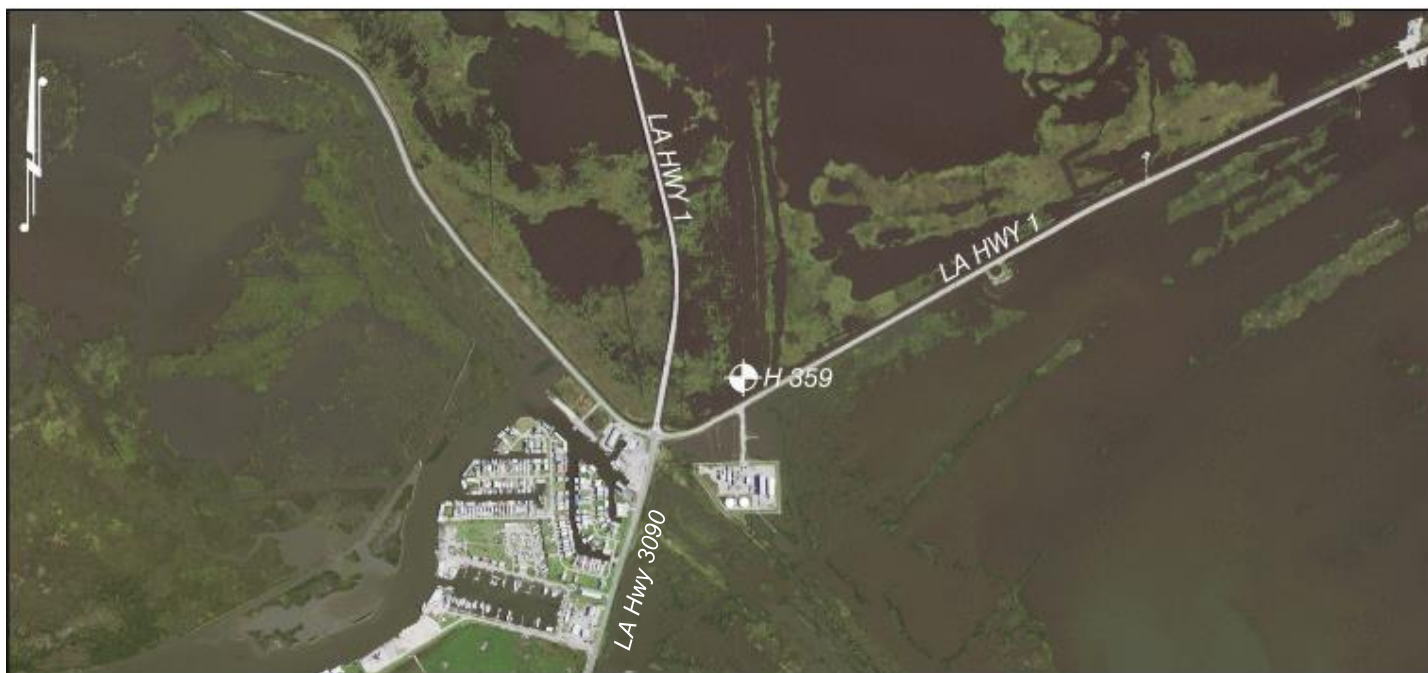
5.36 feet Geoid12B
5.36 feet Geoid12A
6.09 feet Geoid99

Top of Nail Shank Elevation - NAVD88 (2011)

3.37 feet Geoid12B
3.37 feet Geoid12A
4.10 feet Geoid99



*Position Determined by using Real-Time Kinematic (RTK) survey from Secondary GPS Monument "H-359"
Adjusted Position Established by T. Baker Smith, LLC for the Coastal Protection and Restoration Authority*



VICINITY MAP Scale: 1" = 2000'

2019 NAIP imagery provided by USDA Farm Service Agency

Station Name: "H 359"

Monument Location: From the bridge crossing Bayou Lafourche in Leeville, Louisiana, proceed south southeasterly on State Highway 1 for approximately 7.0 miles to a road on right leading to Port Fourchon. Proceed left on Highway 1 towards Grand Isle for approximately 0.1 mile to a limestone drive leading to a radio tower and Loop Incorporated Electric Substation and station on left. The station is 53.5 feet north of the chain link fence, 12.1 feet east of the center of the drive, 2.0 feet north of the north face of a key card machine, 1.0 feet west from a guard post.

Monument Description: Stainless steel rod driven to refusal within a sleeve, set in concrete and stamped "H 359 1982".

Date: October 2000

Date of Survey: February 2022

Stamping: H359

Monument Established By: National Geodetic Survey

Adjusted NAD 83 Geodetic Position

Lat. 29°09'26.1210" N

Long. 90°10'31.5458" W

Adjusted NAD 83 Datum LSZ (1702) Feet

N= 240,894.81

E= 3,650,437.36

Adjusted UTM, NAD 83 Datum (Zone 15) Meters

N = 3,228,709.710

E = 774,754.423

Adjusted NAVD88 (2011) Height

Elevation Geoid12B = 4.16 ft (1.269 mtrs.)

Elevation Geoid12A = 4.16 ft (1.269 mtrs.)

Elevation Geoid99 = 4.90 ft (1.492 mtrs.)

Ellipsoid Height = -22.589 mtrs.

Geoid12B Height = -23.858 mtrs.

Ellipsoid Height: -22.589 mtrs.

Geoid12A Height = -23.858 mtrs.

Ellipsoid Height: -22.589 mtrs.

Geoid99 Height = -24.081 mtrs.



USE THIS FORM IF USING FIXED HEIGHT TRIPODS TO DOCUMENT STATIC
SURVEYS ON BASE POINTS FOR ALL RTK SURVEYS

GPS LOG SHEET

Job No. 2021.0470 Date 8-18-21 Observer Gary Guidry
Client CPRA Job Description CRMS-CCPPRA
Location LA COASTAL ZONE Proj. Mgr. Kim Knight

SESSION INFO

File Name ^{4 Characters} 0197 Julian Date ^{3 Characters} 230 Session No. ^{1 Character} 0

Long Name H 359

Mon. Description STAINLESS Rod In NATURAL GROUND

Rec. Base Type R12 Rec Serial # 6103F00197

Base Ant Type Base Ant Ser # 6103F00197

Rover Ant Type Rover Ant Ser #

Antenna Height Measurement is TRUE VERTICAL to the Bottom of Antenna Mount if Using Fixed Hgt Tripod

Fixed Hgt 2 Meter Tripod 2.2 meters ^{Bottom} Mtrs or Ft ANT MOUNT

Tripod Number

Actual Start Time 7:28 AM

Actual Stop Time 4:10 PM

Session Time (Min 2:01 Hr) 0:00

BASE STATION INFORMATION

WGS84, NAD83 or NAD27

DATUM NAD 83

Example: LA South Zone or TX South Central Zone

ZONE LA South 1702

Northing/Lat 29°09'26.1211"

Coordinate Origin-Where did you get your positions?

Easting/Long. 90°10'31.5457"

Elevation 4.36'

OPUS

Note any power problems, obstructions, weather issues, etc.

Mon NEXT TO BALLARD & Key Pad For Gate

ALL WHITE BOXES MUST BE FILLED IN WITH INFORMATION. A MINIMUM OBSERVATION OF 2 HOURS IS REQUIRED TO DETERMINE THE 3-D POSITION OF AN UNKNOWN POINT USING NGS-OPUS

USE BACK OF THIS SHEET TO MAKE STATION SKETCH, REFERENCE TIES & DESCRIPTION

USE THIS FORM IF USING FIXED HEIGHT TRIPODS TO DOCUMENT STATIC
SURVEYS ON BASE POINTS FOR ALL RTK SURVEYS

GPS LOG SHEET

Job No. 2021. 0420 Date 8-19-21 Observer Gary Guidry
Client CPRA Job Description CRMS-CCARA
Location LA COASTAL ZONE Proj. Mgr. Kim Knight

SESSION INFO

File Name ^{4 Characters} 3958 Julian Date ^{3 Characters} 231 Session No. ^{1 Character} 0
Long Name H 359
Mon. Description STAINLESS Rod In NATURAL Ground/ROCKS
Rec. Base Type R 10 Rec Serial # 555 345 3958
Base Ant Type Base Ant Ser # 555 345 3958
Rover Ant Type Rover Ant Ser #

Antenna Height Measurement is TRUE VERTICAL to the Bottom of Antenna Mount if Using Fixed Hgt Tripod

Fixed Hgt 2 Meter Tripod 2.2 meters ^{Mtrs or Ft} Bottom Ant Mount

Tripod Number

Actual Start Time 7:20 Am

Actual Stop Time 3:56 pm

Session Time (Min 2:01 Hr) 0:00

BASE STATION INFORMATION

WGS84, NAD83 or NAD27

Example: LA South Zone or TX South Central Zone

DATUM NAD 83

ZONE LA South 1702

Northing/Lat 29°09'26.1211"

Coordinate Origin-Where did you get your positions?

Easting/Long. 90°10'31.5457"

OPUS

Elevation 4.36'

Note any power problems, obstructions, weather issues, etc.

ALL WHITE BOXES MUST BE FILLED IN WITH INFORMATION. A MINIMUM OBSERVATION OF 2 HOURS IS REQUIRED TO DETERMINE THE 3-D POSITION OF AN UNKNOWN POINT USING NGS-OPUS

USE BACK OF THIS SHEET TO MAKE STATION SKETCH, REFERENCE TIES & DESCRIPTION

Exhibit “H”

**Final Network Adjustment Report for
Deep Rod Monument Adjustments and TBMs**

Exhibit “I”

**Final Network Adjustment Report for
High Resolution Static GPS Observations on RSET Rods**