

Survey Report
of the
Portuguese Bend Landslide Monitoring Survey
September 19, 2014 Full Monitoring, February 7, 2015 and April 16, 2015 Partial Monitoring
for the
City of Rancho Palos Verdes
by
McGee Surveying Consulting
February 11, 2015, Revised June 10, 2015

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ATTACHMENT: MOVEMENT DATA POSTING.xlsx (Monitoring points: periodic and overall movements)

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September 19, 2013 Full Monitoring
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PROJECT OVERVIEW:

McGee Surveying Consulting performed a landslide monitoring and control survey in September 2014 at Portuguese Bend on behalf of the City of Rancho Palos Verdes. This survey established positions on monitoring points to determine overall and periodic movements. The results of the survey are described in this Report and on an attached spreadsheet titled “MOVEMENT DATA POSTING.xlsx” hereafter referred to as the “Movement Data Posting”. A two partial monitoring surveys will be performed in the winter and spring of 2015 and reported as an addendum to this Report.

The field survey was planned, coordinated and executed by Michael McGee, PLS3945 of McGee Surveying Consulting who was also responsible for the final processing of the observations, network adjustments, analysis and reports. The monitoring points cover a 1½ mile square area and are measured to determine the rate and extent of ground movement. The monitoring has occurred annually since 2007, semi-annually for the last two years and will be three times a year beginning with the September 2014 survey. The Global Navigation Satellite System (GNSS formerly referred to as GPS) technology was used to measure positions based on the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD 88). This survey is referenced to the California CGPS (Continuous GPS) Stations in the region which are permanently mounted GPS receivers used for monitoring seismic activity. The CGPS in California are similar to the national CORS (Continuously Operated Reference Stations).

Points that move a few inches or less per year are required to meet an accuracy standard of one centimeter (0.033 feet) at the 95% Level of Confidence. In the active slide area where the movements are greater than 0.3 feet per year (PB and UB points in the central portion), the accuracy standard is two centimeters (0.066 feet) at the 95% Level of Confidence. Field procedures are designed to accomplish this purpose and Quality Control-Quality Assurance (QAQC) processes discussed hereafter are incorporated to verify these accuracies are attained.

The movements reported between October 4, 2013 and September 19, 2014 (11.5 months) statistically attained an average accuracy of 0.016 feet at the 95% Level of Confidence. The actual accuracy of measurements held to the one centimeter standard are estimated to approach 0.01 feet as demonstrated by the vector residuals, repeatability of measurements at points considered stable, and the analysis of movement deflections over time. Refer to the sections titled ACCURACY and QAQC ANALYSIS in this Report for more information.

HISTORY

This monitoring survey is a continuation of a program initiated by the County of Los Angeles and taken over by the City of Rancho Palos Verdes circa 1994. McGee Surveying Consulting has conducted the field surveys and reporting since September 2007. See the September 2007 Survey Report for a history of the previous survey process between 1994 and 2007. See the subsequent annual Survey Reports for details of each monitoring campaign. Beginning with the 2012 rainy season (begins in September) full monitoring continued as usual and a partial monitoring was initiated in the following winter-spring. Beginning in September 2014 a full monitoring will be conducted and a partial monitoring will be conducted in the following January-February and April-May.

PROJECT DATUMS, REFERENCE SYSTEM

Horizontal Datum: North American Datum of 1983 (NAD83) established by the National Geodetic Survey (NGS); **Epoch:** 2007.00 referred to as NAD83 (2007); **Units:** Feet

Reference Network: The survey is referenced to the CGPS Stations (continuously operating GNSS receivers). For more information see NGS Data Sheets for the PID's listed below (no data sheet exists for PVE3). The positions listed below were obtained in September 2007 from the California Spatial Reference Center (CSRC). The CSRC provides CA Public Resources Code sanctioned positions for the California CGPS Stations.

CGPS	Latitude (dms)			Longitude (dms)			EH (feet)	NGS PID	NAME
PVE3	33	44	35.853290	-118	24	15.269036	235.42	none	PALOS VERDES CORS
PVHS*	33	46	46.020150	-118	22	19.741258	853.99	AJ1915	PENINSULA HIGH SCH
PVRS**	33	46	25.891904	-118	19	14.067218	198.63	AJ1916	PALOS VERDES RES
VTIS*	33	42	45.489584	-118	17	37.712290	197.52	AJ1936	MARINE EXCHANGE

* Not Operational During Survey

** Falls in the proximity of a Fault Line as shown below but appears unaffected to date



Vertical Datum: North American Vertical Datum of 1988 (NAVD88) established by the NGS.

Geoid Model: Geoid 03; note Geoid09 became available from the NGS in 2009 and Geoid12A in 2012; however, Geoid03 is retained to be consistent with prior reported heights and the primary purpose of determining relative changes over time.

Reference Network: CGPS Station VTIS is also a Second Order leveled benchmark and the original basis for the heights by this survey (see NGS Data Sheets for PID's listed above)

CGPS	NAVD88 Ht(feet)	
PVE3	none	
PVHS	972.1	Based on a Refined Geoid Model
PVRS	316.37	Based on Second Order Leveling by CSRC
VTIS	315.26	Based on Second Order Leveling by CSRC and original basis for this survey

Projection: NAD83 California State Plane Coordinates Zone 5: The State Plane Coordinate Parameters follow: The average Scale Factor is 1.00007543, the Height Reduction Factor based on the average ellipsoid heights is 0.99999092, and the average Combined Grid Factor is 1.00006635. Distances in this survey are grid. To obtain ground distances divide grid distances by the Combined Grid Factor. Grid bearings resulting from this survey must be rotated by a Convergence Angle to obtain geodetic (true) bearings. The average convergence angle is $-0-12-30\pm$ (rotate left 0-12-30).

Datum Stability: The NAD83 (2007) Epoch 2007.00 adjustment is one of a series of national adjustments of NAD83 since its adoption in 1986 and is the realization used for these monitoring surveys since 2007. Rancho Palos Verdes sits on the Pacific Plate which is moving west-northwesterly relative to the North American Plate about 4 centimeters (0.14 feet) per year. The area southwesterly of the Fault Line shown on the above map includes the City and is moving at a constant rate as exhibited by the International Terrestrial Reference Frame (ITRF) north, east and up velocities of the CGPS Stations listed below. These CGPS Stations provide a rigid reference frame for the Portuguese Landslide Monitoring Program that is validated during each monitoring campaign. See the Adjustment results below and the September 2007 Monitoring Survey Report by McGee Surveying Consulting for additional information.

Annual Velocities in Meters						
SITE	END DATE	N	E	U	START DATE	
PVE3	2014.863	0.019	-0.039	-0.000	2000.732	
PVHS	2013.965	0.019	-0.040	0.001	1999.512	
PVRS	2014.863	0.019	-0.039	0.000	1999.094	
VTIS	2014.863	0.019	-0.039	-0.001	1998.940	

FIELD SURVEYS, DATA COLLECTION, EQUIPMENT & PROCESSING

Three Leica geodetic GNSS receivers/antennas listed below were mounted on two meter fixed height poles to collect satellite signal data. The GS15 receivers track Navstar GPS and GLONASS satellites. Prior to initiating the field observations a calibration of the fixed height poles was conducted to verify their heights and plumb. The top of the poles were found to be plumb within 0.003 feet of the bottom consistent with prior years. There were no equipment failures.

Sixty-four monitoring points were occupied and reported in this survey. Site photographs and recovery sheets detailing the location, character of the monuments and obstructions were maintained and updated. See the Appendix for "Monitoring Point Status". Monument AB61, established in September 2007 on Portuguese Point, is used as the primary base station in each survey because it sits above a stable basalt formation. AB20 serves as a secondary base for the surveys.

The field survey commenced each day by setting a Leica GS15 GNSS receiver on a fixed height pole at AB61 and on a tribrach on a tripod at AB20 while a third GS15 GNSS receiver roamed freely collecting observations on a fixed height pole at the other 62 points. Points with annual movements less than 0.3' were measured with two or more independent occupations resulting in a minimum of four vectors to each point from AB61 and AB20. Independent occupations means the points were occupied under a different constellation of satellites usually on a different day. If the two measurements were within 0.03 feet (1 cm) horizontally they were accepted, otherwise a third measurement was obtained. On each day over a six day period, vectors based on 4-10 hours of observations connected AB61, AB20 to the CGPS stations. Sixteen points, in the active areas, with

annual movements greater than 0.3' were single occupied. A comparison with the linear movements from prior years was made to verify their accuracy.

Many of the points are over-shadowed by mature trees and shrubberies which interfere with signals received from satellites and affect the quality of measurements. To obtain the best possible accuracies, the satellite constellation is compared with obstruction diagrams to estimate the best time for observing un-obstructed satellites. To improve the accuracy of the measurements, satellites obstructed by foliage and trees are either turned off during the observation or noted for removal in post-processing. If six or more un-obstructed satellites with a GDOP of less than four (measure of the geometry or strength of figure of the constellation) are available, then the measurement commenced for a minimum of 15 minutes of data collection. If the geometry and number of satellites are insufficient then the receiver was moved to another point and returned later when satellite availability improved.

Date of Survey: 9/16/14 to 9/22/14 (mean date 9/19/2014) between 0600-1800 PDST (+7 hrs for UTC).

GNSS Survey Parameters:

Constellation: 30 US NAVSTAR GPS satellites and 24 Russian GLONASS satellites.

Observables: GPS L1 & L2 and GLONASS L1 & L2 Carrier Waves

Epoch Rate & Occupation Times: 15 seconds epochs for 15 minutes and 4-10 hours at base stations

Satellites: 12-17; GDOP < 2.1; Elevation Mask for Data Collection at 15° and Processing at 15°

Ephemeris: Rapid for Static Post-Processing of CGPS connections and Broadcast for onsite.

Weather: Generally clear skies, temperature 67°-80° F.

Space Weather: Boulder K Index was 1-3 except it reached 4 between 1100-1400 hours on 9/19/14 (gauges ionospheric activity on a scale of 0-9, 5 or greater can result in noisy data).

Equipment:

GNSS Base Receiver Unit No.: M5, Operator: M. McGee, PLS; Station Occupied: AB61 (Base1)

Make & Model: Leica GS15; Antenna Leica GS15; Mount: Fixed Height Pole #1; Antenna Height: 1.803m

GNSS Rover Receiver Unit No.: M6, Operator: M. McGee, PLS;

Make & Model: Leica GS15; Antenna Leica GS15; Mount: Fixed Height Pole #3; Antenna Height: 1.800m

GNSS Rover Receiver Unit No.: M7, Operator: M. McGee, PLS, Station Occupied: AB20 (Base2)

Make & Model: Leica GS15; Antenna Leica GS15; Mount: Tribrach on Tripod; Antenna Height: varies

Vectors were processed using Leica LGO v8.1 post processing software. Analysis of residuals led to the rejection of 0 out of 29 vectors connecting the CGPS Stations to AB61 and AB20, and 0 out of 220 vectors connecting monitoring points. Network adjustments and analysis were performed with "Starnet-PRO" version 7.2.0.21 software. Rinex files of the satellite measurements for the CGPS Stations were downloaded from the SOPAC website. The Rapid Ephemeris and Absolute Antenna Models were downloaded from the NGS website.

NETWORK

AB61, the primary Base Station, sits on Portuguese Point and is the focal point of the static network connecting the monitoring points and CGPS Stations. AB20, a second Base Station is centrally located sitting on top of a high bluff overlooking Portuguese Bend. Sixty-four points and two CGPS Stations were connected with 249 vectors. See the following Network Maps and the Aerial View in the Appendix.

The monitoring plan utilizes the CGPS Stations to verify the stability of the reference frame. The primary CGPS Station used to control this survey is PVE3 located just south of City Hall and 1.8 miles west-northwest of Base Station AB61. CGPS Station PVHS is 2.8 miles north, PVR5 is 3.9 miles northeast, and VTIS is 4.9 miles east-southeast of AB61 are used to validate the stability of the network. During this survey only PVE3 and PVR5 were operating.

MONITORING POINT HISTORY and STATUS

For data management purposes during the field survey and data processing, the point names were prefixed with "M10" to distinguish between the different monitoring surveys i.e. AB61 was named M10AB61. M10 indicates this survey is the 10th monitoring since the initial September 2007 Monitoring Survey. The prefix is stripped in the COORDINATES LIST and FULL DATA POSTING.

Between 1994 and 2006, 149 monitoring points were established to monitor the Portuguese Bend Landslides, many of which were lost or destroyed. Sixty of the original points were recovered in 2007. Eight of the 60 points were deleted because they were in close proximity of other points better suited for GNSS satellite measurements leaving 52 points monitored and reported between September 2006 and September 2007. Three of the 52 points (AB09, KC11 & PB51) were monitored in September 2007 for the last time because they were replaced by new points, set nearby and better suited for satellite observations. Eighteen new points were set in 2007 and had their movements reported for the first time in the following December 2008 survey. Therefore, in December 2008, 49 original and 18 new points were surveyed for a total of 67 monitoring points.

In the September 2007 Report, it was noted that KC01 was previously reported by others on 9/14/2006 to have moved N 29°E 1.24' from its 12/9/2005 position. In the 2008 survey, a buried partially illegible brass cap in concrete stamped "COUNTY ENGINEER RE8869 1956 STA ??IELDS" was found S31°29'W 1.48 feet from the 1" IP used by this survey in the initial September 2007 and subsequent surveys. The original 1994 position of KC01 was re-referenced to the 1" IP, resulting in correct overall reported movements.

In the December 2008 Report, it was noted that AB05 had been disturbed by a mowing machine. AB05 was found chipped and leaning to southerly about 0.4'. The movement reporting resumed in 2009. Analysis of the movement and historic data made it possible to estimate the disturbance to within 0.05'. The original 1995 position of AB05 was re-referenced S14°02'E 0.29' to be consistent with the disturbed position, resulting in correct overall reported movements.

In 2009, PB64 was set east of the Archery Range to replace PB63 (set 2007) which had become unsafe to access and was lost in 2010. PB64 was reported for the first time in October 2010.

In 2010, points AB03 and BB25 were discontinued. AB03 is on the edge of a cliff 192 feet west-southwest of AB61 making it redundant, and BB25 is on a freestanding rock susceptible to disturbance by wave action. In the summer of 2010, PB62 was destroyed by road construction. In October 2010, PB65 was set 24' south-southwest of PB62 and reported for the first time in October 2011. The following points may have been disturbed prior to the October 2010 survey. AB05 appears to have been disturbed by mower machinery, AB15 (½" GIP in a meter box) is driven over by vehicles occasionally accessing an adjacent field, and KC02 (½" GIP in a meter box) is occasionally parked on by vehicles accessing the beach.

In October 2011, new points AB62 and AB63 (initially referred to as AB62R and AB63R) were set to replace AB06 and AB07 which were hazardous to occupy due to their location near the traveled way of Palos Verde Drive South.

Prior to initiating the September 2012 survey, eight new monuments AB64, AB65, AB66, AB67, AB68, CR53, KC17 and PB66 were constructed to replace AB54, AB18, AB52, AB55, AB15, CR52, KC04 and PB53 respectively. The monuments were replaced because of poor sky visibility except for KC04 which was difficult to access and AB55 which was destroyed by trenching in the past year. Monuments were set with the following design. Monuments set in soil are 1" x 5' GIP driven flush and encase in a 6" PVC pipe sitting on a concrete collar down about 18". Monuments set in asphalt are 1/2" x 2' rebar driven below the surface inside a free floating 2" concrete collar.

In September 2012, points AB15, AB18, AB52, AB54, CR52, KC04 and PB53 were surveyed for the last time and discontinued in October 2013.

In April 2014, PB64 was monitored for the last time due to unsafe conditions for access and PB67 (a 5' t-bar steel post driven 3' into the ground) was set about 300' northerly as a replacement and reported for the first time in September 2014. BB52 is on a freestanding rock susceptible to disturbance by wave action and was monitored for the last time and discontinued.

In the September 2014 survey, two of the four CGPS Stations PVHS and VTIS were not operating. PB67 was reported for the first time but only for 4.5 months since the April 2014 survey whereas, all other points in the "Movement Data Posting" are reported for the 11.5 months since October 2013. See the "Monitoring Point Status" in the Appendix for the present status of monitoring points.

ADJUSTMENTS & ANALYSIS

Adjustment 1: Minimally Constrained Adjustment processed to develop NAD83 (2007) 2007.00 Epoch Geodetic, Ellipsoid and State Plane Coordinates.

Fixed Control: CGPS Station PVE3 was fixed at its published NAD83 (2007) position in a Minimally Constrained Adjustment to determine positions and verify its stability relative to other CGPS stations. PVE3 is located 1.8 miles west of and outside the influence of the slide area. PVE3 has been fixed in all adjustments since 2007. The CSRC publishes a Time Series for the horizontal and vertical stability of PVE3 which indicate the position has been stable prior to 2007. The primary base station AB61 and one other operating CGPS Stations was measured relative to PVE3 and used to assess stability of the survey reference frame. The positions are based on 4 to 10 hour measurements collected over six days. The coordinate differences from previous positions to the present are listed below in feet.

10/2013 Positions to 09/2014				< Fixed >	9/2007 Positions to 09/2014			
Station	dN	dE	dZ		Station	dN	dE	dZ
PVE3	0.000	0.000	0.000		PVE3	0.000	0.000	0.000
PVRS	-0.011	-0.011	-0.003		PVRS	-0.005	0.009	-0.016
AB17	0.004	0.029	-0.078		AB17	-0.019	-0.005	-0.062
AB61	0.019	-0.005	-0.005	<Base Station>	AB61	0.002	0.004	-0.054
CR51	0.001	-0.006	-0.047		CR51	-0.038	0.010	-0.129
KC16	0.004	-0.023	-0.038		KC16	-0.001	-0.013	-0.058

The following is noted: The base station AB61 has no indication of movement horizontally since 2007 and well as the CGPS Station PVRS relative to CGPS Station PVE3. Both CGPS Stations are well outside the slide areas. The vertical differences at several stations are larger than seen in past years for which there is no explanation at this time. The survey reference frame is deemed stable and successfully recovered at the level of 0.01 feet horizontally by 0.02 feet vertically as indicated. An adjustment constrained to the other CGPS Stations is not preferred or necessary because the purpose here is to track their positions over time to test the stability of the reference frame. See the "COORDINATE LIST" in the Appendix for a list of coordinates resulting from this adjustment. See prior Survey Reports for coordinates resulting from earlier surveys.

Adjustment 2: Minimally Constrained Adjustment to develop Orthometric Heights (Elevations) in NAVD88

Fixed Control: The CGPS Station PVE3 was fixed horizontally and vertically at its NAVD88 orthometric height determined in the September 2007 survey. The 2007 height was based on the published 2nd Order NAVD88 Height of CGPS Station VTIS. This Adjustment combined the measured ellipsoid height differences with the NGS Geoid 03 (models the separation between the ellipsoid and geoid surfaces) to determine NAVD88 orthometric heights of the other CGPS Stations and the monitoring points. See the Adjustment #1 above for vertical differences at key points in this survey.

ACCURACY

These surveys conform to the intent of the Federal Geodetic Control Subcommittee (FGCS) "Specifications for GPS Relative Positioning" (1988) and the California Geodetic Control Committee (CGCC) "Specifications for High-Production GPS Surveying Techniques" (1993).

Vector Residuals: The number of vectors, vector lengths, two dimensional residuals and the absolute value of the vertical residuals resulting from Adjustment #1 are listed below in feet. Thirty-four vectors to single occupied monitoring points are not included because they have no residuals and would optimistically skew the results. The statistics given below are applicable to all points.

Network	No.	Vector Lengths		Two Dimensional Residuals			Vertical Residuals (absolute)		
		Vary	Average	Average	Std.Dev.	Maximum	Average	Std.Dev.	Range
Monitoring	186	479-7182	3320	0.007	0.004	0.021	0.008	0.007	-0.031 to +0.028
CGPS	29	13-20692	14203	0.005	0.004	0.018	0.011	0.010	-0.023 to +0.034

Local Accuracy: The precisions and accuracy of vectors resulting from the minimally constrained adjustment at the 95% Level of Confidence are listed below in feet.

Network	Relative Distance Error		
	Average	Maximum	Av. Precision
Monitoring	0.008	0.010	1: 474,000
CGPS	0.004	0.004	1:2,841,000

The precision ratio, based on the averages for vectors connecting the Monitoring Points, exceeds the criteria for a First Order (C-1) by a factor of 4.7. The precision ratio for vectors connecting AB61, AB20 and the CGPS Stations exceeds the criteria for a B Order survey by a factor of 2.8 per the FGCS requirements for the former classification system.

Coordinate Accuracy: The Standard Deviations (68% Level of Confidence) of the coordinates derived from Adjustment #1, relative to the CGPS Station PVE3 follow in feet.

	Monitoring Point			CGPS Stations		
	North	East	Up	North	East	Up
Average Standard Deviation	0.004	0.003	0.009	0.002	0.002	0.005
Average 95% Error	0.009	0.008	0.017	0.002	0.002	0.005
Maximum Standard Deviation	0.005	0.004	0.012	0.002	0.002	0.005

At the 95% confidence level, the average coordinate has a horizontal radius of circular error is 0.009 feet and a vertical of 0.016 feet with a max of 0.011 and 0.024 feet respectively.

Network Accuracy: The network accuracy (absolute accuracy relative to the reference frame) is expected to be less than 0.02 feet horizontal relative to the NAD83 Datum based on the CGPS Stations.

NAVD88 Heights: The North American Vertical Datum of 1988 orthometric heights resulting from Adjustment #2 are derived from the difference in ellipsoid heights combined with the Geoid 03 model and constrained to the height of PVE3 determined in 2007. The average relative accuracy of the heights is 0.03 feet at the 95% level of confidence but may be greater at obstructed sites. The absolute accuracy of the heights relative to the datum is dependent on the published value on the CGPS Station VTIS. Although relative elevation accuracies can be within 0.03 feet, up until October 2011 there were no requirements for vertical accuracies. In October 2011, a preference of 0.03 foot relative vertical accuracy was instigated for the following points: AB17, AB57, CR07, CR50 and CR51. In the September 2012 and subsequent surveys the criteria was extended to all points.

Movement Accuracy: For this period, 48 points moved less than 0.30 feet with an average movement of 0.03 feet and a range of 0.01 to 0.08 feet. The relative error at the 95% Level of Confidence averaged 0.015 feet with a range of 0.006 to 0.028 feet. Overall, the estimated 95% relative movement error averaged 0.016 feet with a range of 0.006 to 0.028 feet. No movement is considered detected unless the movement exceeds the 95% Error

for individual points. See the attached "MOVEMENT DATA POSTING" for the estimated relative movement errors at the 95% Level of Confidence for individual points for any period.

QUALITY CONTROL - QUALITY ASSURANCE (QAQC) ANALYSIS

To ensure the accuracy and validity of the measurement systems used in these GNSS monitoring surveys, an independent test was made using conventional terrestrial based instruments as reported in the "QAQC ANALYSIS" section of the September 2007 Monitoring Survey Report. Comparing the results of the GNSS systems with conventional instrumentation found horizontal measurements agreed 0.01 feet on average. In November of 2011 the GNSS instruments and fixed height poles used in this survey were calibrated on the Santa Maria National Geodetic Survey Baseline and found to agree with published distances 0.003 to 0.006 feet.

To validate the radial survey method used in these surveys to position points from base stations AB61 and AB20, independent GNSS cross connections were measured and compared with the stand alone computed inverse distances in the 2007, 2008 and 2009 surveys. The results found the two dimensional accuracy to agree 0.01 feet on average, indicating the radial method of measurements is reliable and the additional labor cost of measuring cross connection between points is not warranted. See the "QAQC ANALYSIS" section of the September 2007 and the December 2008 Monitoring Survey Reports for detailed analysis.

Deflection Analysis is a method established by this surveyor to assess the consistency of the direction of movements reported from period to period. Assuming that movements are generally linear for points moving less than a ½ foot, the separation or the deflection between the direction of the previous and present periods taken over the moved distance implies the accuracy obtained with the equipment, methods and procedures. Analysis of individual deflections indicates that for points with multiple occupations the separations varied 0.01 to 0.02 feet.

SUMMARY

Prior to September 2007, successive coordinate differences were used to compute movements which do not provide statistical information about the relative movement accuracies. Beginning with the initial 2007 survey, field and office procedures were designed to assure the accuracy and reliability of measurements and provide for queries between epochs that include statistical information about the relative precisions of the reported movements. Thereafter, measurement of temporal movements are based on a rigorous simultaneous least squares adjustment of multiple observations at two different epochs for each point.

The results of the October 4, 2013 to September 19, 2014 monitoring period indicates the relative accuracy of the reported movements average 0.016 feet at the 95% Level of Confidence. Statistically, the probability at the 95% level of confidence is that movement (signal) has occurred at a point when the horizontal distance between two epochs is greater than the 95% Error (noise). See the "Movement Data Posting" for a listing of the 95% Error estimates (range 0.006 to 0.028 feet). Applying this criteria, 17 points have not moved.

Between October 4, 2013 to September 19, 2014 (11.5 months), points moved 0.02 to 1.65 feet and 4.6 feet for 4.5 months at PB67s in the Portuguese Bend Landslide (PB##), 0.01 to 0.06 feet in the Abalone Cove Landslide (AB##), and 0.01 to 0.05 in the Klondike Canyon (KC##). See the Contours of Horizontal Movement in the Appendix for a graphical representation of the movements.

See the attached "MOVEMENT DATA POSTING" spreadsheet for overall and periodic movements of each point. The movements are given in north, east and up or down as well as a vector of distance and direction relative to north. The direction is given as an azimuth in degrees where 0° is north and increases clockwise (90° East, 180° South, 270° West). The overall movements are from the beginning position of each point which varies between 1994 and the present for newly established points.

The present listing and status of monitored points is provided in the Appendix under "Monitoring Point Status". The historical status of all monitoring points is provided in the September 2007 Survey Report. The historical 1994-2006 positions of all points are listed in the Charles Abbott Associates Inc. file "ALL POINTS MOST RECENT OBSERVED POSITION AS OF SEPTEMBER 15, 2006.xls" attached as an electronic file to the 2007 Report.

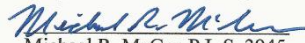
RECOMMENDATION

An ongoing re-location program for monuments has long term benefits resulting in better accuracy lower cost surveys due to improved sky visibility for tracking satellites. In this September 2014 survey, no monuments were re-located. Points AB16, AB24 and AB58 have limited sky visibility and should be re-located or deleted. AB12 is in a horse corral and has limited access

Attachments: The following document is attached to this Report.
"PB MOVEMENT DATA POSTING" lists the coordinates of the initial positions, the overall and periodic movements of monitoring point since 2007 and the NAD83(2007.00) State Plane Coordinates and NAVD88 Heights.

SURVEYOR'S STATEMENT

This Report on the criteria, procedures and results of the September 19, 2014 City of Rancho Palos Verdes Portuguese Landslide Monitoring Survey was prepared by me January 7, 2015 at the request of Ron Dragoo, Assistant City Engineer of the City of Rancho Palos Verdes.

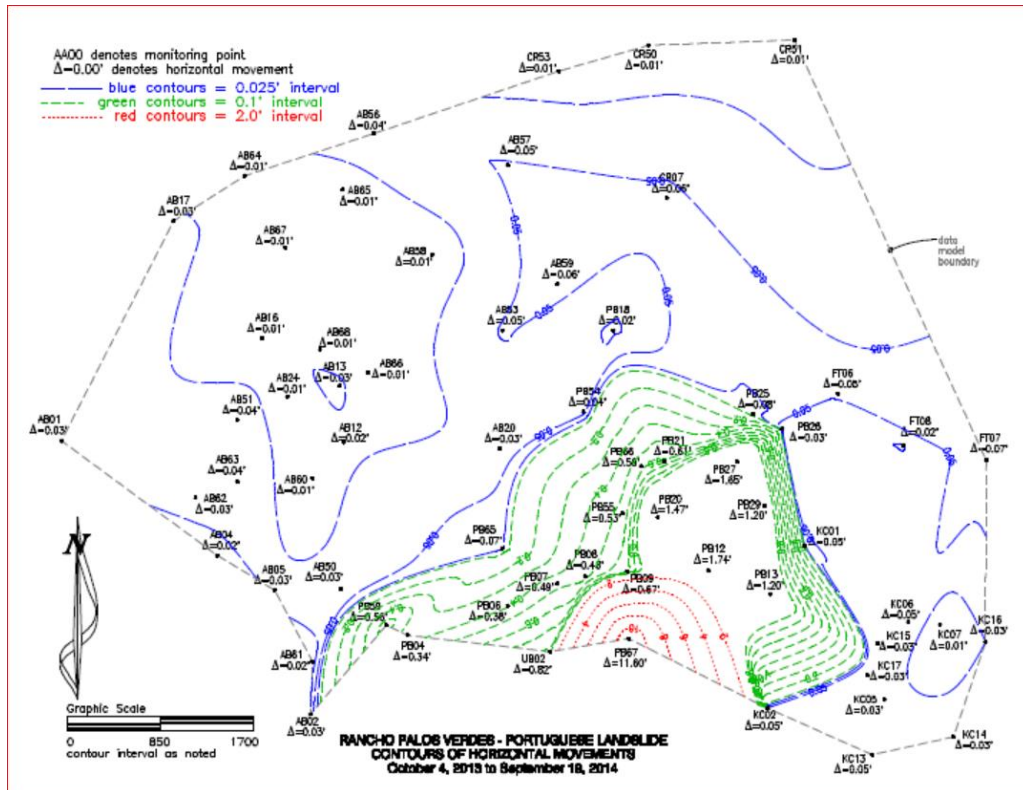

Michael R. McGee P.L.S. 3945



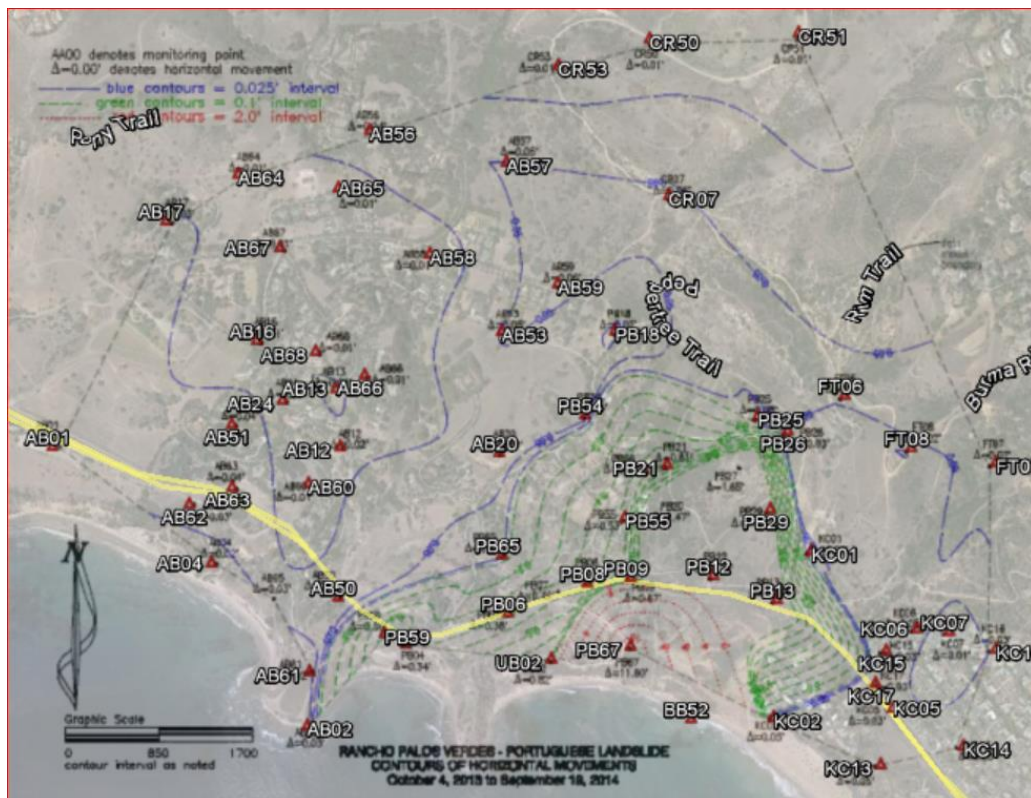
APPENDIX

- 12- Contours of Horizontal Movements
- 13- Aerial Photo and Oblique Aerial View of Monitoring Points
- 14- Monitoring Point Status
- 15- Coordinate List- Sept. 19, 2014 Survey NAD83(2007) Geodetic, Grid Coordinates, NAVD88
- 17- Addendum Report for the February 7, 2015 Partial Monitoring Survey

Contours of Horizontal Movements Oct. 4, 2013 to Sept. 19, 2014



Contour of Horizontal Movements Overlayed on an Aerial Photo



MCGEE SURVEYING CONSULTING							
RANCHO PALOS VERDES - PORTUGUESE LAND SLIDE MONITORING POINT STATUS for 2015 Prepared 12/06/2014							
Notes:	162+/- Monitoring Points established since 1994						
09/01/07	71 Points Surveyed 60 old points found with 52 monitored plus 19 new points						
12/01/08	67 Points Surveyed AB09, KC11, PB51 discontinued; BB53 destroyed; AB05 disturbed						
11/01/09	68 Points Surveyed Set PB64 to replace PB63 destroyed subsequently						
10/01/10	65 Points Surveyed Discontinued AB03, BB25; set PB65 to replace PB62 destroyed by paving						
10/03/11	69 Points Surveyed; Set AB62 & AB63 to replace AB06 & AB07						
09/14/12	72 Points Surveyed; Discontinued AB06, AB07; AB55 destroyed by trenching; Added 8 new points						
10/06/13	65 Points Surveyed; Discontinued AB15, AB18, AB52, AB54, CR52, KC04, PB53						
9/19/14	64 Points Surveyed; Discontinued BB52, PB67 set in April 2014; Added PVE3RP (reference to PVE3 antenna)						
12/17/13	28-30 Points to Survey in Jan-Feb 2015 and April-May 2015						
Pt ID	Last Obs'd	Comments	GNSS	Pt ID	Last Obs'd	Comments	GNSS
AB01	9/19/2014	Base 1994-2006	G	FT07	9/19/2014		G
AB02	9/19/2014		G	FT08	9/19/2014		G
AB04	9/19/2014		G				
AB05	9/19/2014		G	KC01	9/19/2014	NE'ly/2 pipes 1.5' apart	G
AB12	9/19/2014		G	KC02	9/19/2014		G
AB13	9/19/2014		F	KC05	9/19/2014		G
AB16	9/19/2014		P	KC06	9/19/2014		G
AB17	9/19/2014		F	KC07	9/19/2014		G
AB20	9/19/2014	NE'ly/ 2 monuments	G	KC13	9/19/2014		G
AB24	9/19/2014		F	KC14	9/19/2014		G
AB50	9/19/2014		G	KC15	9/19/2014		F
AB51	9/19/2014		G	KC16	9/19/2014		G
AB53	9/19/2014		F	KC17	9/19/2014	Replaced KC04	G
AB56	9/19/2014		F				
AB57	9/19/2014		G	PB04	9/19/2014		G
AB58	9/19/2014		P	PB06	9/19/2014		G
AB59	9/19/2014		G	PB07	9/19/2014		G
AB60	9/19/2014		G	PB08	9/19/2014		G
AB61	9/19/2014	BASE since 2007	G	PB09	9/19/2014		G
AB62	9/19/2014	Replaced AB06	G	PB12	9/19/2014		G
AB63	9/19/2014	Replaced AB07	G	PB13	9/19/2014		G
AB64	9/19/2014	Replaced AB54	G	PB18	9/19/2014		G
AB65	9/19/2014	Replaced AB18	G	PB20	9/19/2014	S'ly/ 2 pipes 5.3' apart	G
AB66	9/19/2014	Replaced AB52	G	PB21	9/19/2014		F
AB67	9/19/2014	Replaced AB55	G	PB25	9/19/2014		G
AB68	9/19/2014	Replaced AB15	G	PB26	9/19/2014		F
				PB27	9/19/2014		G
BB52	10/4/2013	Discontinued	G	PB29	9/19/2014		G
				PB54	9/19/2014		F
CR07	9/19/2014		F	PB55	9/19/2014		F
CR50	9/19/2014		G	PB59	9/19/2014		G
CR51	9/19/2014		G	PB64	9/19/2014	Replaced PB63	G
CR53	9/19/2014	Replaced CR52	F	PB65	9/19/2014	Replaced PB62	G
				PB66	9/19/2014	Replaced PB53	G
FT06	9/19/2014		G	PB67	9/19/2014	Replaced PB64	G
				UB02	9/19/2014		G
GNSS column indicates site is Good, Fair or Poor for Satellite Visibility Conditions							

McGEE SURVEYING CONSULTING
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COORDINATE LIST							
Portuguese Landslide 09/19/2014 Monitoring Survey							
Prepared by McGee Surveying Consulting: Document Date: 12/31/2015							
Datum: Horizontal & EH NAD83 (2007) Epoch; California State Plane Zone 5; Vertical: NAVD88							
Note, Fixed CGPS Station PVE3 at Record 3D Position & Orthometric Height per 09/2007 Survey; See 2007 and subsequent Survey Reports							
Point	Latitude	Longitude	EH (ft)	North (ft)	East (ft)	OrthoHt(ft)	Description
AB01	33-44-38.30243	118-22-53.05172	60.02	1729427.54	6445709.57	178.50	Punched 1/2" GIP in meter box
AB02	33-44-13.84871	118-22-26.19225	-2.06	1726946.97	6447968.70	116.44	4" BC "SAN PEDRO 1936" on conc. block
AB04	33-44-28.09124	118-22-36.28725	-51.31	1728389.94	6447121.49	67.15	BC "CO ENG STA Q2.." on 2"GIP in mass of conc.
AB05	33-44-24.99015	118-22-30.09124	-38.00	1728074.49	6447643.60	80.45	BC "CO ENG STA Q3.." on 2"GIP in mass of conc.
AB12	33-44-38.27505	118-22-22.72074	164.81	1729415.16	6448271.06	283.15	BC "CO ENG STA 7A.." in mass of conc.
AB13	33-44-43.34520	118-22-23.16126	246.10	1729927.85	6448235.76	364.42	Punched 1/2" GIP in meter box
AB16	33-44-47.57976	118-22-31.51220	258.05	1730358.55	6447532.12	376.38	Punched 1/2" GIP in meter box
AB17	33-44-58.06065	118-22-41.08410	324.40	1731421.10	6446727.77	442.73	Punched 1/2" GIP in meter box
AB20	33-44-37.77487	118-22-05.96625	277.92	1729359.38	6449685.82	396.19	BC "CO ENG STA W. FIX 1956.." in mass of conc.
AB24	33-44-42.35411	118-22-28.79487	217.35	1729829.43	6447759.63	335.71	Cotton spindle in conc. In road
AB50	33-44-25.11152	118-22-22.94543	63.57	1728084.52	6448247.15	181.99	Nail & shiner in conc. collar of well
AB51	33-44-40.22977	118-22-34.15185	186.74	1729616.36	6447306.42	305.12	PK mag nail in plastic plug "LS6957" in 1"GIP
AB53	33-44-48.36803	118-22-05.70038	234.58	1730430.17	6449712.20	352.80	Chisled + on s edge conc. Vault
AB56	33-45-05.96970	118-22-19.59257	453.32	1732213.86	6448545.61	571.53	6" mag nail & washer in conc. in 2"x 36" GIP
AB57	33-45-03.17002	118-22-05.20569	446.55	1731926.37	6449759.45	564.71	6" mag nail & washer in conc. in 2"x 36" GIP
AB58	33-44-55.14428	118-22-13.27637	287.31	1731117.54	6449074.94	405.53	Punched RR spike on s side road
AB59	33-44-52.54061	118-21-59.79460	316.00	1730850.16	6450212.47	434.18	6" mag nail & washer in conc. in 2"x 36" GIP
AB60	33-44-35.04165	118-22-26.06505	60.93	1729089.34	6447987.41	179.31	6" mag nail & washer in conc. in 2"x 28" GIP
AB61	33-44-18.57321	118-22-25.95801	21.94	1727424.50	6447990.26	140.41	6" mag nail & washer in conc. in 2"x 24" GIP
AB62	33-44-33.23061	118-22-38.63206	24.53	1728910.23	6446925.41	142.96	6" mag nail & washer in conc. in 1"x 24" GIP
AB63	33-44-34.71811	118-22-34.12085	62.36	1729059.18	6447306.96	180.77	Punched 1/2 x 48" rebar
AB64	33-45-02.13633	118-22-33.46077	413.88	1731830.70	6447373.07	532.16	2" mag nail on NE side 2' conc. Collar/Well B12
AB65	33-45-00.93229	118-22-22.90390	340.23	1731705.66	6448264.09	458.47	2" mag nail & washer in conc. in 1"x 60" GIP
AB66	33-44-44.53550	118-22-20.14990	255.91	1730047.23	6448490.52	374.21	1/2" x 24" punched rebar 1" below AC conc. collar
AB67	33-44-55.71729	118-22-29.06589	286.99	1731180.41	6447741.78	405.28	1/2" x 24" punched rebar 1" below AC conc. collar
AB68	33-44-46.61264	118-22-25.31209	275.09	1730258.83	6448055.35	393.41	1/2" x 24" punched rebar 1" below AC conc. collar
CR07	33-45-00.26892	118-21-48.09426	513.96	1731627.83	6451203.37	632.06	6" mag nail & washer in conc. in old 1" IP
CR50	33-45-13.97061	118-21-50.11946	754.54	1733013.57	6451037.36	872.60	Tack & shiner on lower rock wall
CR51	33-45-14.49679	118-21-34.43625	858.13	1733062.00	6452361.87	976.12	Tack & shiner on conc pad
CR53	33-45-11.63388	118-21-59.73920	662.60	1732780.30	6450224.19	780.70	2" mag nail & washer in conc. in 1"x 60" GIP
FT06	33-44-42.78549	118-21-29.58563	370.54	1729854.81	6452760.04	488.62	6" mag nail & washer in conc. in 2"x 36" GIP
FT07	33-44-36.87025	118-21-13.65923	470.56	1729252.07	6454102.93	588.60	6" mag nail & washer in conc. in 2"x 36" GIP
FT08	33-44-38.19502	118-21-22.57436	540.33	1729388.65	6453350.50	658.40	6" mag nail & washer in conc. in 2"x 36" GIP
KC01	33-44-29.13375	118-21-33.10882	194.08	1728475.80	6452457.57	312.26	6" mag nail & washer in conc. in old 1" IP
KC02	33-44-14.54748	118-21-37.05751	-104.56	1727002.45	6452118.80	13.71	Punched 1/2" GIP in meter box
KC05	33-44-15.37058	118-21-24.50986	109.26	1727081.88	6453178.85	227.46	Punched 1/2" GIP in meter box
KC06	33-44-22.33190	118-21-21.96636	181.67	1727784.84	6453396.17	299.83	Punched 1/2" GIP in meter box
KC07	33-44-22.09046	118-21-18.55886	195.30	1727759.42	6453683.86	313.44	Punched 1/2" GIP in meter box
KC13	33-44-10.41212	118-21-25.78288	72.83	1726581.00	6453069.56	191.06	Cotton spindle in AC turnout
KC14	33-44-12.03493	118-21-17.07063	141.70	1726742.45	6453805.97	259.89	Punched spike in center road
KC15	33-44-20.39789	118-21-25.21724	168.83	1727590.31	6453120.91	287.01	Cotton spindle in cul-de-sac
KC16	33-44-20.55016	118-21-13.64621	208.72	1727602.25	6454098.22	326.85	Punched spike in intersection
KC17	33-44-17.55010	118-21-26.32443	97.00	1727302.75	6453026.38	215.20	2" mag nail & washer in conc. in 1"x 50" GIP
PB04	33-44-20.97495	118-22-15.80836	48.11	1727664.12	6448848.37	166.52	Nail & tag "RCE26120" in conc. in 3" pipe
PB06	33-44-23.67725	118-22-05.05061	58.70	1727933.95	6449757.93	177.04	Punched cap on 2" GIP
PB07	33-44-25.66040	118-21-59.68621	79.04	1728132.78	6450211.72	197.35	Brass tag "LA CO DPW" in conc. in 2" GIP
PB08	33-44-26.30225	118-21-56.71928	75.96	1728196.75	6450462.53	194.25	Punched cap on 2" GIP
PB09	33-44-26.76704	118-21-52.15074	70.18	1728242.33	6450848.53	188.45	Punched cap on 2" GIP in cable box
PB12	33-44-26.87598	118-21-43.46342	65.00	1728250.70	6451582.26	183.23	Punched cap on 2" GIP in cable box
PB13	33-44-24.80452	118-21-36.77345	88.20	1728039.26	6452146.51	206.42	Punched cap on 2" GIP in cable box
PB18	33-44-48.41020	118-21-53.76788	244.73	1730430.76	6450719.90	362.90	Punched 1/2" GIP in meter box
PB20	33-44-31.67750	118-21-48.91649	113.15	1728737.75	6451123.48	231.38	Punched cap on 2" GIP in cable box
PB21	33-44-36.63950	118-21-48.28309	153.69	1729239.17	6451178.78	271.89	Punched cap on 2" GIP in cable box
PB25	33-44-40.93116	118-21-38.74096	207.78	1729670.12	6451986.19	325.91	Punched cap on 2" GIP in cable box
PB26	33-44-39.63753	118-21-35.58685	164.76	1729538.39	6452252.09	282.88	Brass tag "LA CO DPW" in conc. in 2" GIP
PB27	33-44-36.66094	118-21-40.42476	152.40	1729238.94	6451842.44	270.56	Punched cap on 2" GIP in cable box
PB29	33-44-32.70392	118-21-37.45680	51.32	1728838.03	6452091.66	169.49	Brass tag "LA CO DPW" in conc. in 2" GIP
PB54	33-44-41.07907	118-21-56.95047	239.40	1729690.63	6450448.44	357.61	PK mag nail in plastic plug "LS6957" in 1"GIP
PB55	33-44-32.00869	118-21-52.73494	120.97	1728772.40	6450801.12	239.21	PK mag nail in plastic plug "LS6957" in 1"GIP
PB59	33-44-21.88238	118-22-18.05185	39.91	1727756.55	6448659.23	158.33	PK mag nail in plastic plug "LS?" in 1" GIP
PB65	33-44-28.81974	118-22-05.66827	169.29	1728454.01	6449707.67	287.61	2" alum. cap "MCGEE SURVE.." on 5/8"x24"rebar
PB66	33-44-36.20569	118-21-50.75356	169.89	1729196.07	6450969.99	288.10	2" mag nail & washer in conc. in 1"x 60" GIP
PB67	33-44-20.75176	118-21-52.01724	-42.91	1727634.20	6450857.60	75.40	4' high T-bar steel fence post
UB02	33-44-19.54913	118-22-00.47239	-55.78	1727515.23	6450143.07	62.57	PK mag nail in plastic plug "?" in 1"GIP
PVE3	33-44-35.85329	118-24-15.26904	235.42	1729207.09	6438765.18	354.36	CGPS Pos. Fixed in 2007 and subsequent surveys
PVE3RP	33-44-35.74229	118-24-15.27455	227.93	1729195.87	6438764.67	346.87	Mag Nail in Concrete Base 11' S/ PVE3
PVRS	33-46-25.89198	118-19-14.06724	198.58	1740239.30	6464237.89	316.29	CGPS Pos. Determined 10/04/2013 Survey

First Addendum Report

February 7, 2015 Partial Monitoring Survey

Portuguese Bend Landslide

for the

City of Rancho Palos Verdes

by

McGee Surveying Consulting

February 12, 2015, Revised June 10, 2015

Overview:

This Addendum Report describes the first tri-annual partial monitoring survey in February 2015 at Portuguese Bend. This survey included a sub-set of 27 points of the full monitoring set and one temporary point AB69 set as a backup to AB12. This survey follows the procedures described in the above Report on the September 19, 2014 full monitoring. The detailed results of this survey are reported on Page 11 of the attached spreadsheet titled "PB MOVEMENT DATA POSTING 2007-2015.2" listing the coordinates, and periodic movements of points between September 19, 2014 and February 7, 2015 and the overall movement since 2007.

The movements reported between September 19, 2014 and February 7, 2015 (4.5 months) statistically attained an average accuracy of 0.012 feet at the 95% Level of Confidence as demonstrated by the measured vector residuals, repeatability of measurements at points considered stable, and the analysis of movement deflections. For a detailed history of the program and surveys see "History" above and previous Reports back to 2007. The field survey took place between February 6 and February 8, 2015. The Field Surveys, Equipment, Data Collection and Network Design were as described in the above Report. The survey included two onsite base stations and 26 onsite points each connected with two to six vectors. Three continuously operating GPS stations (CGPS) were connected to this survey with six vectors each. The Adjustments followed the process as described in the above Report with the following results.

Adjustment: Minimally Constrained Adjustment processed to develop NAD83 (2007) 2007.00 Epoch Geodetic, Ellipsoid and State Plane Coordinates in feet. CGPS Station PVE3 was fixed and the difference are listed in feet from the September 19, 2014 to the February 7, 2015 positions for the CGPS stations and points considered to mostly stable.

09/2014 Positions to 02/2015			
Station	dN	dE	dZ
AB17	-0.002	0.001	0.002
AB61	-0.005	-0.006	-0.019
CR50	-0.004	0.001	0.014
KC16	-0.007	-0.009	-0.013
KC17	-0.002	-0.008	0.002
PVE3	-0.000	-0.000	-0.000
PVRS	-0.009	-0.009	0.014

The adjustment was constrained as a standard procedure to the CGPS station PVE3 which finds CGPS station PVRS in agreement with the September 2014 horizontal position at 0.01 feet. AB61, AB17 and KC16 are historically stable and continue to be so. The survey reference frame was deemed stable and successfully recovered.

Summary of Movements: Between September 19, 2014 to the February 7, 2015 (4.5 months), points in this subset moved 0.03 to 3.36 feet in the Portuguese Bend Landslide (PB##), 0.03 to 0.07 feet in the Abalone Cove Landslide (AB##), and 0.02 feet in the Klondike Canyon (KC##). See the attached spreadsheet titled "PB MOVEMENT DATA POSTING 2007-2015.4" for the periodic movements of each point.

Second Addendum Report April 16, 2015 Partial Monitoring Survey Portuguese Bend Landslide

for the
City of Rancho Palos Verdes

by
McGee Surveying Consulting
June 10, 2015

Overview:

This Addendum Report describes the second tri-annual partial monitoring survey in April 2015 at Portuguese Bend. This survey included a sub-set of 27 points of the full monitoring set, temporary points AB69 set in February, temporary point AB70 set as a backup to AB12 which has challenging access in a horse corral, and three new points PB68, PB69 and PB70 set along PVDS. This survey followed the procedures described in the above September 19, 2014 full monitoring Report. The detailed results of this survey are reported on Page 12 of the attached spreadsheet titled "PB MOVEMENT DATA POSTING 2007-2015.4" listing the coordinates, and periodic movements of points between February 7 and April 17, 2015 and the overall movement since 2007.

The movements reported between February 7, 2015 and April 16, 2015 (2.3 months) statistically attained an average accuracy of 0.015 feet at the 95% Level of Confidence as demonstrated by the measured vector residuals, repeatability of measurements at points considered stable, and the analysis of movement deflections. For a detailed history of the program and surveys see "History" above and previous Reports back to 2007. The field survey took place between April 15 and April 18, 2015. The Field Surveys, Equipment, Data Collection and Network Design were as described in the above Report. The survey included two onsite base stations and 30 onsite points each connected with two to six vectors. Three continuously operating GPS stations (CGPS) were connected to this survey with seven vectors each. The Adjustments followed the process as described in the above Report with the following results. It is to be noted that solar activity was high during the survey resulting in somewhat noisy data collection.

Adjustment: Minimally Constrained Adjustment processed to develop NAD83 (2007) 2007.00 Epoch Geodetic, Ellipsoid and State Plane Coordinates in feet. CGPS Station PVE3 was fixed and the difference are listed in feet from the September 19, 2014 to the February 7, 2015 positions for the CGPS stations and points considered to mostly stable.

09/2014 Positions to 02/2015				
Station	dN	dE	dZ	
AB17	-0.014	-0.033	0.102	
AB50	-0.002	0.010	0.019	
AB61	0.002	0.013	0.008	Primary Base Station
CR50	0.014	0.002	0.072	
KC16	-0.000	0.022	0.023	
PVE3	-0.000	-0.000	-0.000	Fixed CGPS Station
PVRS	0.037	0.031	-0.029	
VTIS	0.003	0.017	0.024	CGPS Station

The adjustment was constrained as a standard procedure to the CGPS station PVE3 which finds CGPS station VTIS and the base station AB61 in agreement with the September 2014 and February 2015 position as expected. CGPS station PVRS is larger than expected and to be watched. The AB17 and KC16 historically don't move, however, AB17 has begun to move based on the last several monitoring surveys. The survey reference frame was deemed stable and successfully recovered.

Summary of Movements: Between February 7, 2015 to April 16, 2014 (2.3 months), points in this subset moved 0.13 to 1.45 feet in the Portuguese Bend Landslide (PB##), and 0.03 to 0.04 feet in the Abalone Cove Landslide (AB##), 0.02-0.03 feet in the Klondike Canyon (KC##). See the attached spreadsheet titled "PB MOVEMENT DATA POSTING 2007-2015.4" for the periodic movements of each point. See the Table below for a condensed summary of movements and elevation changes.

PORTUGUESE BEND LANDSLIDE MONITORING MOVEMENTS IN FEET FOR SEPTEMBER 2014 to APRIL 2015						
	Sept. 19, 2014 to Feb. 7, 2015		Feb. 7, 2015 to April 16, 2015		Sept. 19, 2014 to April 16, 2015	
Point ID	Movement	Elevation	Movement	Elevation	Movement	Elevation
	Distance	Change	Distance	Change	Distance	Change
AB04	0.05	0.01	0.01	-0.02	0.06	-0.01
AB12	0.03	-0.02	0.03	0.02	0.06	0.00
AB16	0.00	-0.02	0.02	0.05	0.02	0.03
AB17	0.00	0.00	0.04	0.10	0.04	0.10
AB20	0.01	-0.01	0.01	0.04	0.02	0.03
AB50	0.02	-0.02	0.01	0.02	0.03	0.00
AB59	0.02	0.00	0.02	0.05	0.04	0.05
AB60	0.02	-0.02	0.02	0.00	0.05	-0.02
AB61	0.01	-0.02	0.01	0.01	0.02	-0.01
AB65	0.07	-0.03	0.02	0.05	0.09	0.03
CR07	0.03	0.00	0.02	0.06	0.05	0.06
CR50	0.00	0.01	0.01	0.07	0.02	0.08
FT06	0.03	-0.04	0.02	0.05	0.05	0.02
FT07	0.03	0.00	0.01	0.06	0.04	0.06
KC06	0.00	-0.01	0.03	0.02	0.03	0.01
KC07	0.02	0.00	0.01	0.02	0.02	0.02
KC13	0.02	0.00	0.02	0.01	0.04	0.01
KC16	0.01	-0.01	0.02	0.02	0.03	0.01
KC17	0.01	0.00	0.03	0.02	0.04	0.02
PB04	0.42	-0.14	0.12	-0.05	0.54	-0.19
PB12	0.74	-0.19	0.30	-0.04	1.04	-0.23
PB13	0.51	-0.05	0.18	-0.01	0.70	-0.06
PB18	0.03	-0.04	0.01	0.05	0.04	0.01
PB26	0.04	-0.03	0.01	0.07	0.05	0.04
PB59	0.65	-0.33	0.21	-0.09	0.86	-0.42
PB66	0.31	-0.06	0.13	0.04	0.44	-0.01
PB67	3.36	-0.45	1.45	-0.17	4.80	-0.61
Note: Given the accuracies of the measurements, only Movements & Elevation Changes exceeding 0.02 feet (1/4") and 0.04 feet (1/2") respectively are deemed to have actually moved.						
See "PB MOVEMENT DATA POSTING 2007-2015.4.xlsx" for more details.						

PORTUGUESE BEND LANDSLIDE MONITORING - MOVEMENT DATA POSTING as of September 24, 2007													Page 1/12
Prepared by McGee Surveying Consulting													
MONITORING POINTS													
NAD83(2007) STATE PLANE COORDINATES & NAVD88 ELEVATIONS of Original Positions, 2007 & Post 2007 Positions													
Notes:	# Indicates stable points, not moving												
	* Indicates no signal of horizontal movement detected in the last period at the 95% level of confidence												
	1= 2005 and prior surveys used a nearby monument S31-29W 1.48', the original position is adjusted here to be relative to the 1" IP used presently, resulting in correct Overall Movements, see Reports												
	9/24/2007(1994) Indicates the 2007 position was used for overall; see the 2011 Report for original 1994 positions												
Point	Date	Original Positions			Sept. 24, 2007 Positions			Overall Movements (US Feet)					
		NAD83 SPC Zone 5 (ft)		NAVD88	NAD83 SPC Zone 5 (ft)		NAVD88	Original Position to Sept. 24, 2007					
		North (ft)	East (ft)	Elev(ft)	North (ft)	East (ft)	Elev(ft)	North	East	Height	Azim.°	Dist.	Note
AB01	12/1/1994	1729427.58	6445709.61	178.62	1729427.55	6445709.64	178.62	-0.03	0.03	0.00	138	0	#
AB02	9/24/2007(1994)	1726946.98	6447968.69	116.48	1726946.98	6447968.69	116.48						
AB03	12/1/1994	1727338.34	6447818.82	139.60	1727338.39	6447818.81	139.59	0.04	-0.01	-0.01	351	0.04	#
AB04	11/30/1994	1728391.99	6447123.34	67.57	1728390.55	6447122.03	67.31	-1.44	-1.32	-0.26	222	1.95	
AB05	3/14/1995	1728075.72	6447645.17	80.90	Disturbed between 2007-2008								
AB06	4/27/1995	1729059.73	6446976.26	165.28	1729058.58	6446975.91	164.91	-1.15	-0.35	-0.37	197	1.21	
AB07	11/30/1994	1728982.79	6447358.41	159.92	1728981.51	6447357.74	159.40	-1.28	-0.67	-0.52	208	1.44	
AB12	11/30/1994	1729416.49	6448271.64	283.43	1729415.67	6448271.30	283.19	-0.82	-0.35	-0.24	203	0.89	
AB13	11/30/1994	1729928.90	6448236.04	365.03	1729928.25	6448235.90	364.54	-0.65	-0.13	-0.49	192	0.66	
AB15	11/30/1994	1730312.09	6448099.38	397.28	1730311.64	6448099.31	396.90	-0.45	-0.07	-0.38	189	0.45	
AB16	11/30/1994	1730358.89	6447532.12	376.62	1730358.70	6447532.17	376.44	-0.19	0.04	-0.18	168	0.19	
AB17	9/24/2007(1994)	1731421.12	6446727.77	442.80	1731421.12	6446727.77	442.80						
AB18	12/1/1994	1731602.62	6448187.49	457.19	1731602.37	6448187.58	456.93	-0.26	0.09	-0.26	162	0.27	
AB20	3/16/1995	1729369.63	6449686.27	396.43	1729368.08	6449686.03	396.23	-0.62	-0.23	-0.20	261	0.67	
AB24	3/12/1997	1729830.35	6447759.96	335.92	1729829.83	6447759.82	335.74	-0.52	-0.14	-0.18	196	0.54	
AB50	1/16/1998	1728085.00	6448248.18	181.98	1728084.71	6448247.54	182.03	-0.29	-0.65	0.05	246	0.71	
AB51	3/22/2002	1729617.01	6447306.54	305.42	1729616.73	6447306.52	305.25	-0.28	-0.02	-0.17	184	0.28	
AB52	3/22/2002	1730016.10	6448624.44	368.61	1730015.79	6448624.36	368.39	-0.31	-0.08	-0.22	195	0.32	
AB53	3/22/2002	1730431.11	6449712.37	353.13	1730430.77	6449712.33	352.90	-0.34	-0.04	-0.23	187	0.34	
AB54	9/24/2007	1731111.94	6447047.87	407.31	1731111.94	6447047.87	407.31						
AB55	9/24/2007	1731174.77	6447753.57	405.38	1731174.77	6447753.57	405.38						
AB56	9/24/2007	1732214.31	6448545.46	571.65	1732214.31	6448545.46	571.65						
AB57	9/24/2007	1731926.91	6449759.36	564.93	1731926.91	6449759.36	564.93						
AB58	9/24/2007	1731118.02	6449074.93	405.67	1731118.02	6449074.93	405.67						
AB59	9/24/2007	1730850.87	6450212.56	434.37	1730850.87	6450212.56	434.37						
AB60	9/24/2007	1729089.70	6447987.57	179.45	1729089.70	6447987.57	179.45						
AB61	9/24/2007	1727424.50	6447990.26	140.47	1727424.50	6447990.26	140.47						
AB62	11/13/2011	1729059.39	6447307.03	180.84	Replacement for AB06								
AB63	11/13/2011	1729059.39	6447307.03	180.84	Replacement for AB06								
AB64	9/14/2012	1731830.69	6447373.08	532.25	Replacement for AB54								
AB65	9/14/2012	1731705.674	6448264.07	458.53	Replacement for AB18								
AB66	9/14/2012	1730047.285	6448490.53	374.28	Replacement for AB52								
AB67	9/14/2012	1731180.409	6447741.76	405.33	Replacement for AB55								
AB68	9/14/2012	1730258.855	6448055.37	393.45	Replacement for AB15								
BB25	11/4/1998	1729369.63	6449686.27	396.43	1729368.08	6449686.03	395.23	-0.29	-0.01	0.31	182	0.29	
BB52	9/24/2007	1726996.36	6451384.38	3.83	1726996.36	6451384.38	3.83						
BB53	9/24/2007	1726831.16	6451840.89	13.81	1726831.16	6451840.89	13.81						
CR07	11/30/1994	1731628.78	6451203.29	632.48	1731628.37	6451203.29	632.48	-0.41	0.10	-0.80	166	0.42	
CR50	9/24/2007(1998)	1733013.62	6451037.38	872.66	1733013.62	6451037.38	872.66						
CR51	9/24/2007(1998)	1733062.03	6452361.86	976.25	1733062.03	6452361.86	976.25						
CR52	9/24/2007(1998)	1732867.58	6450239.32	779.63	1732867.58	6450239.32	779.63						
CR53	9/14/2012	1732786.275	6450224.19	780.72	Replacement for CR52								
FT06	9/24/2007	1729855.61	6452760.21	489.06	1729855.61	6452760.21	489.06						
FT07	9/24/2007	1729253.24	6454104.75	589.01	1729253.24	6454104.75	589.01						
FT08	9/24/2007	1729388.68	6453350.51	658.44	1729388.68	6453350.51	658.44						
KC01	11/30/1994	1728476.78	6452458.23	312.88	1728476.36	6452457.91	312.42	-0.42	-0.32	-0.46	217	0.52	1
KC02	3/14/1995	1727002.89	6452118.99	13.84	1727002.74	6452118.89	13.74	-0.15	-0.11	-0.10	216	0.18	
KC04	3/14/1995	1727559.56	6452667.24	238.84	1727559.46	6452667.09	238.51	-0.10	-0.15	-0.33	236	0.18	
KC05	11/30/1994	1727082.00	6453179.09	227.86	1727082.01	6453178.94	227.53	0.01	-0.15	-0.33	273	0.15	
KC06	11/30/1994	1727784.91	6453396.67	300.35	1727784.94	6453396.40	299.97	0.03	-0.26	-0.86	276	0.26	
KC07	11/30/1994	1727759.19	6453683.92	313.83	1727759.37	6453683.85	313.51	0.18	-0.07	-0.32	340	0.19	
KC13	9/24/2007	1726581.16	6453069.63	191.20	1726581.16	6453069.63	191.20						
KC14	9/24/2007	1726742.44	6453806.05	259.94	1726742.44	6453806.05	259.94						
KC15	9/24/2007	1727590.45	6453121.10	287.10	1727590.45	6453121.10	287.10						
KC16	9/24/2007	1727602.25	6454098.23	326.90	1727602.25	6454098.23	326.90						
KC17	9/14/2012	1727302.764	6453026.42	215.25	Replacement for KC04								
PB04	11/30/1994	1727675.94	6448851.74	170.52	1727667.25	6448849.17	167.49	-8.69	-2.57	-3.03	196	9.06	
PB06	3/15/1995	1727968.45	6449761.84	183.06	1727941.12	6449758.81	178.25	-27.33	-3.03	-4.81	186	27.50	
PB07	3/14/1995	1728175.93	6450219.76	200.21	1728141.60	6450213.44	198.02	-34.32	-6.32	-2.19	190	34.90	
PB08	12/1/1994	1728237.51	6450469.80	193.68	1728204.81	6450463.98	194.09	-32.70	-5.82	0.41	190	33.21	
PB09	11/30/1994	1728288.58	6450851.02	192.52	1728252.20	6450849.11	189.84	-36.38	-1.91	-2.68	183	36.43	
PB12	11/30/1994	1728330.49	6451604.57	193.29	1728268.52	6451587.83	186.93	-61.97	-16.74	-6.36	195	64.19	
PB13	3/14/1995	1728085.97	6452164.34	210.54	1728080.44	6452151.18	207.21	-35.53	-13.16	-3.33	206	37.89	
PB18	3/15/1995	1730446.88	6450711.00	367.58	1730431.80	6450719.76	363.24	-15.08	8.77	-4.34	150	17.44	
PB20	3/14/1995	1728812.77	6451135.67	243.54	1728753.50	6451126.52	234.48	-59.27	-9.16	-9.06	189	59.97	
PB21	3/14/1995	1728298.22	6451172.05	280.02	1729249.90	6451177.92	273.29	-48.32	5.87	-6.73	173	48.68	
PB25	12/1/1994	1729702.31	6451985.65	328.99	1729671.12	6451986.48	326.10	-31.19	0.83	-2.89	178	31.20	
PB26	3/14/1995	1729562.65	6452249.56	285.34	1729539.22	6452252.23	282.95	-23.42	2.67	-2.39	174	23.58	
PB27	3/14/1995	1729339.34	6451836.06	284.42	1729257.91	6451842.02	273.51	-81.43	5.96	-10.91	176	81.65	
PB29	3/15/1995	1728888.95	6452120.49	185.93	1728849.86	6452097.03	173.29	-39.08	-23.46	-12.64	211	45.58	
PB53	12/4/1997	1729252.77	6450753.92	297.75	1729224.25	6450754.60	291.85	-28.52	0.67	-5.90	179	28.53	
PB54	12/4/1997	1729694.90	6450448.69	358.62	1729691.38	6450448.62	357.73	-3.52	-0.07	-0.89	181	3.52	
PB55	1/21/1998	1728812.28	6450804.04	246.33	1728782.51	6450801.87	241.07	-29.77	-2.18	-5.26	184	29.85	
PB59	6/26/2001	1727766.36	6448661.67	163.39	1727761.30	6448660.42	160.61	-5.07	-1.24	-2.78	194	5.25	
PB62	9/24/2007	1728476.64	6449717.56	287.25	1728476.64	6449717.56	287.25						
PB63	9/24/2007	1727734.04	6451488.11	126.06	1727734.04	6451488.11	126.06						
PB64	11/18/2008	1727466.29	6450946.95	72.78	Replacement for PB63								
PB65	10/26/2010	1729454.67	6450971.02	257.75	Replacement for PB63								
PB66	9/14/2012	1729197.647	6450959.92	288.33	Replacement for PB53								
PB67	4/7/2014	1727638.73	6450858.18	76.01	Replacement for PB64								
UB02	7/23/1997	1727581.11	6450133.78	67.15	1727534.46	6450140.57	63.20	-46.66	6.78	-3.95	172	47.15	

PORTUGUESE BEND LANDSLIDE MONITORING - MOVEMENT DATA POSTING as of December 10, 2008																	Page 2
Prepared by McGee Surveying Consulting																	
FULL ANNUAL MONITORING																	
Notes:																	
# Indicates stable points, not moving																	
* Indicates no signal of horizontal movement detected in the last period																	
2 = Hit by mover sometime between 09/07 and 12/08 with an estimated displacement S14E 0.29", the original position is adjusted here to be relative to monitored position used presently, resulting in correct Overall Movements, see Rpt																	
Point	Dec. 10, 2008 Positions			Overall Movements (US Feet)						Periodic (14.5 months) Movements (US Feet)							
	NAD83 SPC Zone 5 (East)	(East)	NAV88 Elev(ft)	North	East	Height	Azlm.*	Dist.	Note	North	East	Height	Azlm.*	Dist.	95%Err	Note	
AB01	1729427.54	6445709.63	178.59	-0.05	0.02	-0.03	161	0.05	#	-0.01	-0.01	-0.03	231	0.02	0.02	#	
AB02	1726946.99	6447968.68	115.46	0.00	-0.01	-0.02	297	0.61	#	0.00	-0.01	-0.02	297	0.61	0.02	#	
AB03	1727339.31	6447819.31	139.58	0.01	-0.01	-0.02	348	0.04	#	0.00	-0.01	-0.02	270	0.01	0.02	#	
AB04	1728390.43	6447121.92	67.27	-1.56	-1.43	-0.30	222	2.12		-0.12	-0.11	-0.04	222	0.16	0.02		
AB05	1728074.86	6447644.04	80.59	-0.86	-1.13	-0.31	233	1.42	2							2	
AB06	1729058.49	6446975.88	164.85	-1.24	-0.38	-0.43	197	1.30		-0.09	-0.03	-0.06	198	0.09	0.02		
AB07	1728981.40	6447357.70	159.34	-1.39	-0.71	-0.58	207	1.56		-0.11	-0.04	-0.06	202	0.12	0.02		
AB12	1729415.57	6448271.26	283.19	-0.92	-0.38	-0.24	203	0.99		-0.10	-0.03	0.00	199	0.11	0.02		
AB13	1729928.17	6448235.69	364.54	-0.73	-0.15	-0.49	192	0.74		-0.08	-0.01	0.00	191	0.08	0.02		
AB15	1730311.56	6448009.36	395.89	-0.53	-0.08	-0.40	189	0.53		-0.08	-0.01	-0.02	188	0.08	0.02		
AB16	1730358.65	6447532.17	376.46	-0.24	0.05	-0.16	168	0.24		-0.05	0.01	0.02	170	0.05	0.02		
AB17	1731421.12	6446727.77	442.79	0.00	0.00	-0.01	194	0.00	#	0.00	0.00	-0.01	194	0.00	0.02	#	
AB18	1731602.31	6448187.61	456.91	-0.32	0.11	-0.28	160	0.34		-0.06	0.03	-0.02	155	0.07	0.02		
AB20	1729359.84	6449685.99	396.23	-0.79	-0.28	-0.20	199	0.83		-0.16	-0.04	0.00	195	0.17	0.01		
AB24	1729829.75	6447759.77	335.76	-0.61	-0.19	-0.16	197	0.63		-0.09	-0.04	0.02	205	0.10	0.02		
AB50	1728064.66	6448247.47	161.98	-0.34	-0.71	0.00	245	0.79		-0.05	-0.07	-0.05	235	0.08	0.02		
AB51	1729616.65	6447306.51	395.26	-0.36	-0.03	-0.16	185	0.36		-0.09	-0.01	0.01	190	0.09	0.02		
AB52	1730015.76	6448624.32	368.38	-0.40	-0.12	-0.23	196	0.42		-0.10	-0.03	-0.01	200	0.10	0.03		
AB53	1730430.62	6449712.30	352.90	-0.49	-0.07	-0.23	188	0.50		-0.15	-0.03	0.00	189	0.15	0.03		
AB54	1731111.93	6447047.87	407.39	-0.01	0.00	-0.01	165	0.01	*	-0.01	0.00	-0.01	165	0.01	0.03	*	
AB55	1731174.72	6447753.58	405.39	-0.05	0.01	0.01	166	0.05		-0.05	0.01	0.01	166	0.05	0.02		
AB56	1732214.21	6448545.49	571.64	-0.10	0.03	-0.01	161	0.11		-0.10	0.03	-0.01	161	0.11	0.02		
AB57	1731926.78	6449759.49	564.90	-0.13	0.03	-0.03	166	0.13		-0.13	0.03	-0.03	166	0.13	0.02		
AB58	1731117.90	6449074.93	485.65	-0.12	0.00	-0.02	178	0.12		-0.12	0.00	-0.02	178	0.12	0.02		
AB59	1730850.76	6450212.53	434.35	-0.17	-0.02	-0.02	188	0.17		-0.17	-0.02	-0.02	188	0.17	0.02		
AB60	1729889.63	6447987.54	179.39	-0.08	-0.03	-0.06	200	0.08		-0.08	-0.03	-0.06	200	0.08	0.02		
AB61	1727424.49	6447990.27	140.43	-0.01	0.01	-0.04	114	0.01	*	-0.01	0.01	-0.04	114	0.01	0.00	#	
BB25	1727200.25	6449932.58	4.15	-0.29	-0.16	0.34	208	0.33		0.00	-0.15	0.03	269	0.15	0.02		
BB52	1726995.24	6451384.35	3.83	-0.12	-0.03	0.00	194	0.13		-0.12	-0.03	0.00	194	0.13	0.02		
BB53	Destroyed																
CR07	1731628.24	6451203.32	632.36	-0.54	0.13	-0.02	166	0.55		-0.13	0.03	-0.12	168	0.13	0.02		
CR50	1733013.62	6451037.38	872.71	0.01	0.01	0.05	45	0.01		0.01	0.01	0.05	45	0.01	0.02	*	
CR51	1733062.02	6452361.86	976.24	-0.01	0.00	-0.01	171	0.01		-0.01	0.00	-0.01	171	0.01	0.02	*	
CR52	1732867.58	6450239.31	779.64	0.00	-0.01	0.01	258	0.01		0.00	-0.01	0.01	258	0.01	0.02	*	
FT06	1729855.42	6452760.17	488.97	-0.19	-0.04	-0.09	192	0.19		-0.19	-0.04	-0.09	192	0.19	0.03		
FT07	1729253.01	6454104.39	588.99	-0.23	-0.36	-0.02	237	0.43		-0.23	-0.36	-0.02	237	0.43	0.02		
FT08	1729388.67	6453350.53	658.47	-0.01	0.02	0.03	114	0.02		-0.01	0.02	0.03	114	0.02	0.02	*	
KC01	1728476.25	6452457.85	312.38	-0.53	-0.38	-0.50	215	0.66	1	-0.12	-0.06	-0.04	208	0.13	0.02		
KC02	1727002.67	6452118.88	13.72	-0.22	-0.11	-0.12	207	0.25		-0.07	-0.04	-0.02	185	0.07	0.02		
KC04	1727559.42	6452667.06	238.47	-0.14	-0.18	-0.37	233	0.23		-0.04	-0.04	-0.04	223	0.05	0.02		
KC05	1727081.98	6453178.94	227.52	-0.02	-0.15	-0.34	261	0.05		-0.03	0.00	-0.01	180	0.03	0.02		
KC06	1727784.92	6453396.36	209.93	0.01	-0.30	-0.42	273	0.30		-0.01	-0.04	-0.04	252	0.05	0.02		
KC07	1727759.38	6453683.87	313.50	0.18	-0.05	-0.33	346	0.19		0.00	0.02	-0.01	84	0.02	0.02	*	
KC13	1726581.12	6453069.62	191.23	-0.04	-0.01	0.03	194	0.04		-0.04	-0.01	0.03	194	0.04	0.02		
KC14	1726742.44	6453806.04	259.91	0.00	-0.02	-0.03	259	0.02	*	0.00	-0.02	-0.03	259	0.02	0.02	*	
KC15	1727590.41	6453121.06	287.13	-0.05	-0.04	0.03	220	0.06		-0.05	-0.04	0.03	220	0.06	0.02		
KC16	1727602.24	6454098.24	326.92	-0.01	0.00	0.02	135	0.01	*	-0.01	0.00	0.02	135	0.01	0.02	*	
PB04	1727666.83	6448849.07	167.37	-9.10	-2.67	-3.15	196	9.49		-0.41	-0.10	-0.12	194	0.43	0.02		
PB06	1727939.65	6449758.62	177.96	-28.80	-3.22	-5.10	186	28.88		-1.47	-0.18	-0.29	187	1.48	0.02		
PB07	1728139.62	6450213.09	197.88	-36.10	-6.67	-2.33	190	36.72		-1.78	-0.35	-0.14	191	1.82	0.02		
PB08	1728203.20	6450463.68	194.13	-34.31	-6.12	0.45	190	34.85		-1.61	-0.30	0.04	190	1.64	0.02		
PB09	1728250.32	6450848.98	189.58	-38.26	-2.04	-2.94	183	38.31		-1.88	-0.13	-0.26	184	1.88	0.02		
PB12	1728265.36	6451586.81	186.31	-65.13	-17.76	-6.98	195	67.51		-3.16	-1.03	-0.62	198	3.32	0.02		
PB13	1728048.48	6452150.38	207.09	-37.49	-13.96	-3.45	200	40.91		-1.96	-0.80	-0.12	202	2.12	0.02		
PB18	1728043.47	6452098.03	363.18	-15.41	0.85	-4.40	150	17.77		-0.33	0.08	-0.06	176	0.34	0.02		
PB20	1728750.65	6451126.05	233.99	-62.12	-9.63	-9.55	189	62.86		-2.85	-0.47	-0.49	189	2.89	0.02		
PB21	1729247.73	6451178.08	273.02	-50.49	6.03	-7.00	173	50.85		-2.17	0.16	-0.27	176	2.17	0.02		
PB25	1729670.88	6451986.42	326.07	-31.44	0.77	-2.92	179	31.45		-0.25	-0.07	-0.03	195	0.26	0.02		
PB26	1729539.03	6452252.21	282.94	-23.62	2.65	-2.40	174	23.77		-0.20	-0.02	-0.01	187	0.20	0.02		
PB27	1729254.41	6451842.14	272.98	-84.93	6.08	-11.44	176	85.15		-3.50	0.13	-0.53	178	3.50	0.02		
PB29	1728847.75	6452098.03	172.60	-41.20	-24.48	-13.33	211	47.91		-2.11	-1.01	-0.69	205	2.34	0.02		
PB53	1729222.48	6450754.69	291.44	-30.28	0.68	-6.31	179	30.29		-1.76	0.00	-0.41	180	1.76	0.02		
PB54	1729691.20	6450448.58	357.73	-3.70	-0.11	-0.89	182	3.70		-0.18	-0.04	0.00	183	0.18	0.02		
PB55	1728780.51	6450801.66	240.62	-31.77	-2.38	-5.71	184	31.86		-2.01	-0.21	-0.45	186	2.02	0.03		
PB59	1727760.70	6448660.28	160.34	-5.66	-1.39	-3.05	194	5.83		-0.59	-0.15	-0.27	194	0.61	0.02		
PB62	1728476.42	6449717.52	287.22	-0.21	-0.04	-0.03	192	0.22		-0.21	-0.04	-0.03	192	0.22	0.02		
PB63	1727724.58	6451485.79	121.78	-9.45	-2.32	-4.28	194	9.73		-9.45	-2.32	-4.28	194	9.73	0.02		
VB02	1727530.48	6450141.10	63.00	-50.63	7.31	-4.15	172	51.16		-3.97	0.53	-0.20	172	4.01	0.02		

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Notes:															
* Indicates no signal of horizontal movement detected in the last period at the 95% level of confidence															
Point	April 18, 2013 Positions			Overall Movements (US Feet)						Periodic (7.1 months) Movements (US Feet)					
	NAD83 SPC Zone 5 (Ft)		NAVD88	Original Position to April 18, 2013						Sept. 14, 2012 Position to April 18, 2013					
	North (ft)	East (ft)	Elev(ft)	North	East	Height	Azim.°	Dist.	Year	North	East	Height	Azim.°	Dist.	95%Err
AB04	1728389.95	6447121.48	67.17	-2.04	-1.86	-0.40	222	2.76	1994	-0.02	-0.04	-0.04	246	0.04	0.01
AB12	1729415.20	6448271.07	283.17	-1.29	-0.58	-0.26	204	1.41	1994	-0.02	-0.03	-0.02	232	0.03	0.01
AB16	1730358.57	6447532.13	376.44	-0.32	0.01	-0.18	178	0.32	1994	0.01	0.00	0.02	8	0.02	0.02
AB17	1731421.09	6446727.75	442.78	-0.03	-0.02	-0.02	219	0.03	2007	0.00	0.00	-0.02	45	0.00	0.01
AB20	1729359.43	6449685.84	396.21	-1.19	-0.42	-0.22	200	1.26	1995	-0.06	-0.03	-0.01	205	0.07	0.01
AB50	1728084.51	6448247.18	182.00	-0.49	-1.01	0.02	244	1.12	1998	-0.03	-0.04	-0.03	236	0.05	0.01
AB59	1730850.25	6450212.49	434.24	-0.62	-0.07	-0.13	186	0.62	2007	-0.06	-0.01	-0.01	192	0.07	0.01
AB60	1729089.33	6447987.40	179.32	-0.37	-0.17	-0.13	204	0.41	2007	-0.02	-0.01	-0.05	215	0.02	0.01
AB61	1727424.49	6447990.26	140.41	-0.01	0.00	-0.06	135	0.01	2007	0.00	0.00	-0.04	338	0.01	0.00
AB65	1731705.66	6448264.06	458.53	-0.01	0.00	-0.01	194	0.01	2012	-0.01	0.00	-0.01	194	0.01	0.02
CR07	1731627.92	6451203.36	632.18	-0.86	0.17	-1.10	169	0.87	1994	-0.04	0.00	0.01	183	0.04	0.02
CR50	1733013.59	6451037.36	872.66	-0.02	-0.01	0.00	214	0.03	1998	0.00	0.00	0.05	194	0.00	0.01
FT06	1729854.91	6452760.05	488.68	-0.70	-0.16	-0.38	193	0.72	2007	-0.06	-0.02	-0.04	201	0.07	0.01
FT07	1729252.14	6454103.03	588.65	-1.10	-1.72	-0.36	237	2.04	2007	-0.04	-0.09	-0.02	246	0.10	0.02
KC06	1727784.86	6453396.20	299.84	-0.05	-0.47	-0.51	264	0.47	1994	0.00	-0.02	-0.04	284	0.02	0.01
KC07	1727759.41	6453683.87	313.46	0.22	-0.05	-0.37	346	0.23	1994	0.02	0.01	-0.02	31	0.02	0.01
KC13	1726581.02	6453069.56	191.09	-0.14	-0.07	-0.11	208	0.16	2007	0.00	-0.02	-0.02	276	0.02	0.01
KC16	1727602.23	6454098.23	326.88	-0.02	0.00	-0.02	188	0.02	2007	0.00	0.00	0.01	243	0.00	0.01
KC17	1727302.74	6453026.40	215.23	-0.02	-0.02	-0.02	229	0.03	2012	-0.02	-0.02	-0.02	229	0.03	0.01
PB04	1727664.58	6448848.49	166.69	-11.36	-3.25	-3.83	196	11.82	1994	-0.24	-0.08	-0.12	198	0.25	0.02
PB12	1728253.25	6451583.09	183.84	-77.23	-21.48	-9.45	196	80.17	1994	-1.39	-0.45	-0.37	198	1.46	0.01
PB13	1728046.95	6452147.25	206.54	-45.02	-17.10	-4.00	201	48.16	1995	-0.87	-0.39	-0.13	204	0.95	0.02
PB18	1730430.79	6450719.89	362.95	-16.09	8.89	-4.62	151	18.39	1995	-0.08	-0.03	-0.05	200	0.09	0.02
PB26	1729538.46	6452252.09	282.90	-24.18	2.53	-2.44	174	24.32	1995	-0.07	-0.02	-0.03	197	0.08	0.01
PB59	1727757.34	6448659.41	158.71	-9.03	-2.25	-4.68	194	9.30	2001	-0.36	-0.11	-0.21	197	0.38	0.07
PB64	1727382.15	6450930.51	60.16	-84.14	-16.44	-12.60	191	85.73	2009	-12.41	-2.45	-3.53	191	12.65	0.02
PB66	1729197.003	6450969.91	288.22	-0.64	-0.01	-0.10	181	0.64	2012	-0.64	-0.01	-0.10	181	0.64	0.01

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* Indicates no signal of horizontal movement detected in the last period at the 95% level of confidence																		

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Notes:																
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