Surveyor's Report

Reference Elevation Audit Project
Lee, Monroe and Collier Counties, Florida

Cooner & Associates Project No. 070603.01

SFWMD Contract No. 4600000941 Work Order No. 1

Date of Last Field Work: May 12, 2008 in field book 228, pages 2-78; field book 230, pages 1-79; field book 233, pages 3-43, field book 234, pages 1-23, 27

Report Date: May 29, 2008

Submittal: Final

Prepared for:

South Florida Water Management District

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LEGEND:

BM = benchmark
Elev. = elevation
Info = information
n/a = not applicable
Ref. = reference
HW = headwater
TW = tailwater
STG = stage
SUB-CM = sub-centimeter
SUB-M = sub-meter

OVERVIEW OF THE PROJECT

PURPOSE

The purpose of this survey is to establish or verify elevations to third order National Geodetic Survey (NGS) standards at sixty-three (63) South Florida Water Management District (SFWMD) Recorder Well Sites. This survey is associated with the District's Vertical Datum Upgrade Project (VDUP). Another objective of this Work Order is to establish NGS third order elevations referring to both the North American Vertical Datum of 1988 (NAVD 1988) and the National Geodetic Vertical Datum of 1929 (NGVD 1929) at each of the sites.

Elevations were established or verified using existing Recorder Well Site vertical control marks where possible. These vertical control marks are published in the South Florida Water Management District's ATLAS database as assigned by the District. Recorder Well reference elevations and staff gauges were also verified. Field measured NGVD 1929 reference elevations were posted on brass tags and left at each Recorder Well Site for mounting by the SFWMD.

Where existing monumentation was found to be disturbed or destroyed new vertical control points were established at Recorder Well Sites. All set monuments were constructed in accordance with the NGS, Class C, Pour-In-Place Concrete Monument standards and were referenced by a Carsonite witness post.

In some cases elevations of exiting vertical control points found to be in good condition were verified by ties to posted NGS benchmarks.

It was also the purpose of this project to establish GPS horizontal positions referring to North American Datum 1983 (NAD 1983), Florida East Zone, State Plane Coordinate System each site's vertical control point.

Also included in this report is summary methods used to establish NAVD 1988 and NGVD 1929 elevations established on vertical control point "CORK2A" at Recorder Well Site CORK2.

Note: Of the sixty-three (63) District Recorder Well sites identified by the SFWMD for this Work Order. Five (5) were found to have already been surveyed and did not require reference elevations. These sites were not resurveyed.
These sites are:

6MI82
CORK-SCA
GRDN
GOLD-W1
HENDSG

Pictures of existing brass tags have been included in the results section of this report. Two sites (FMBMW & BCA7) were removed from the scope during the course of this project by the SFWMD.

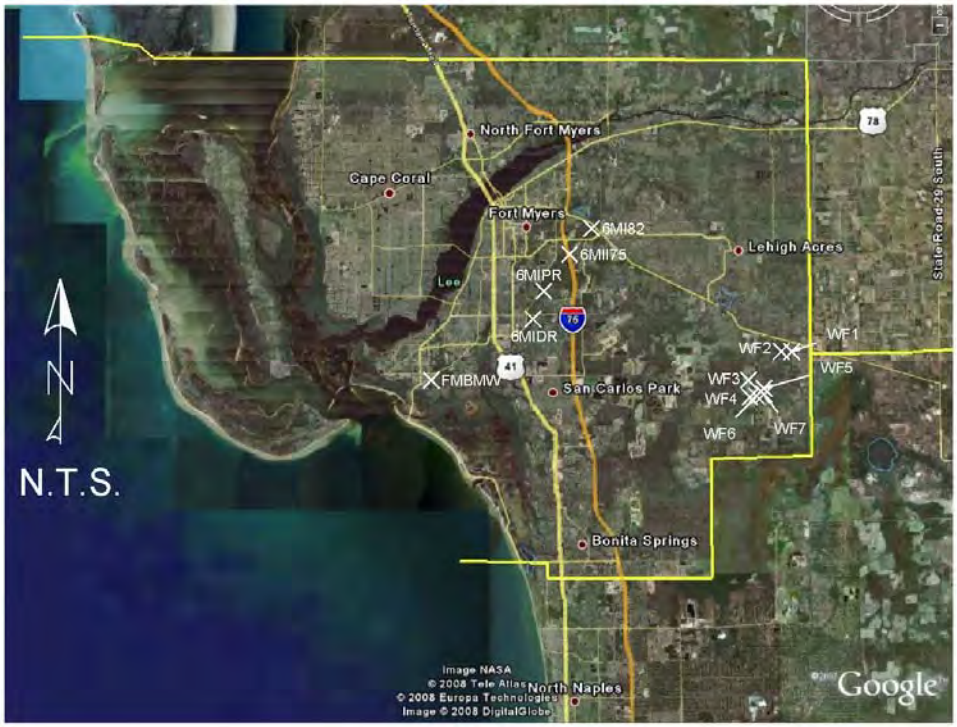
Site BCA14 was not resurveyed during this project due to access issues.

Pickett & Associates, Inc. was subcontracted by Cooner & Associates to complete this project. Please see report of survey by Pickett & Associates in Appendix "D". For a summary of tasks completed for each site, please refer to Appendix "C".

LOCATION OF PROJECT

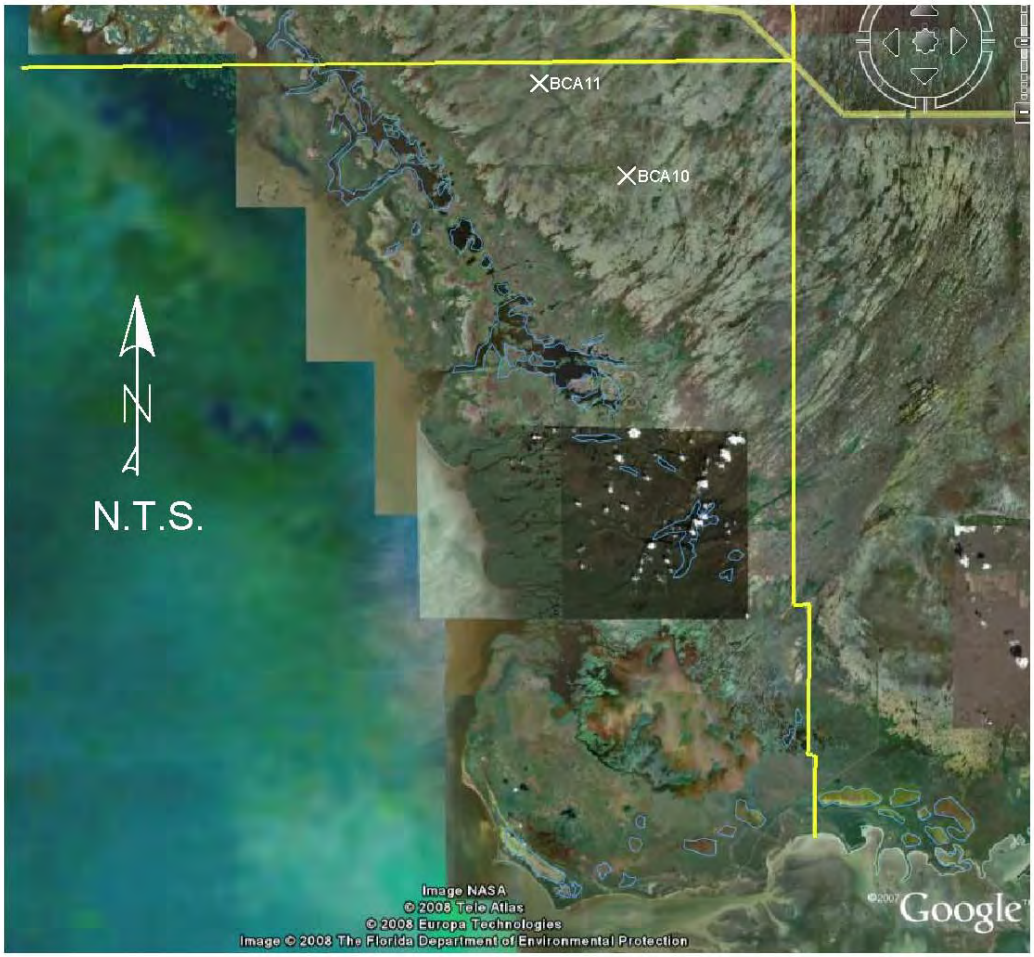
The Recorder Well Sites surveyed for this project are located in Lee, Monroe and Collier counties in the

state of Florida. The following vicinity maps depict the project Recorder Well Sites:



LEE COUNTY VICINITY MAP

COLLIER COUNTY VICINITY MAP



MONROE COUNTY VICINITY MAP

ITEMS DELIVERED TO THE CLIENT

The following items are delivered to the client in the CD accompanying this report. Neither the report nor the items listed below and copies thereof are complete without the other.

1. This Surveyor's Report in Adobe Acrobat format
2. Digital photos named by site
3. Digital copy of scanned field notes and files associated with this survey
4. Completed District benchmark description sheet for all set benchmarks
5. Updated SFWMD Registration Worksheets in Microsoft Excel format

Carsonite Witness Posts were installed at each set benchmark.

LEVELING METHODS

CONFIGURATION OF LEVEL RUNS

A total of ten level lines were run for this project to newly set vertical control points or to verify existing site control. For each level line, two existing NGS vertical marks were used. Each run was started at one of the NGS marks and continued through recovered or established benchmarks and closed on the second NGS mark. All runs were configured to be closed level loops. Appendix A contains a summary of each level run, control points used, length of loop and misclosure information, based on field notes. Appendix B contains the results of level runs made to verify existing control points.

EQUIPMENT USED

All leveling to newly set or existing vertical marks during the project was performed with a Leica NA3003 or DNA03 digital level and Leica two-section, fiberglass bar-code level rods. Information and technical specifications for these digital levels are available at http://www.leica-geosystems.com.

All leveling to establish reference elevations was performed using a Leica NA2 three-wire optical level.

VERTICAL DATUM FOR THE PROJECT

The vertical datum utilized for all level runs for the project is the North American Vertical Datum of 1988 (NAVD'88). For correlation with older data sets, the elevations of the benchmarks and reference tags are shown in NGVD'29. The NGVD'29 elevations were derived by one of the following methods. The methods are listed in order of priority:

1. Elevations posted in NGS or SFWMD benchmark recovery forms
2. Elevations posted in the file "NGVD29.txt" as provided by the SFWMD
3. Converted NAVD 1988 elevations using CORPSCON version 6.0.1

EXPECTED ACCURACY

The maximum allowable misclosure as specified in the project scope is 0.03 feet multiplied by the square root of the length of the level line in miles. Elevations derived from the methods outlined above meet Third-Order Accuracy Standards.

Note: See Appendix "D" for Pickett & Associates Leveling Methods.

HORIZONTAL METHODS

EQUIPMENT USED

Wherever possible, horizontal locations were performed with a Trimble 5800, dual-frequency Global Positioning Service (GPS) receiver. Control point positions were established by Real-Time Kinematic (RTK) GPS, or by Static GPS observations. Static GPS observations were post-processed using the Online Positional User Service (OPUS) provided by NGS. For areas where limited satellite accessibility was an issue, a Trimble mapping grade GPS receiver was used to establish GPS horizontal locations.

HORIZONTAL DATUM FOR THE PROJECT

The horizontal datum for the project is the Florida State Plane Coordinate System, East Zone, North American Datum of 1983 as verified by ties to the following National Geodetic Survey (NGS) high precision points:

"H 534"
"B 249"
"I75 U 32"
"M 250"
"X 534"
"F 533"
"E 533"

EXPECTED ACCURACY

Survey grade (RTK and Static) GPS methods outlined above have been tested and found by Cooner & Associates, Inc. to have a relative positional accuracy of less than 0.05 feet (SUB-CM). The expected accuracy for the mapping grade GPS method is at less than 3.28 feet (SUB-M).

Note: See Appendix "D" for Pickett & Associates Horizontal Methods.

PROJECT RESULTS

The following tables list the elevations established / verified at each Recorder Well Site in NAVD'88 and NGVD'29, the published elevations from the SFWMD or NGS Benchmark Databases, the Northing and Easting of the benchmarks (obtained from GPS observations), water elevations / staff gauge verification, observed staff gauge reading and photos of structures / reference marks/posted brass reference tags / benchmarks/staff gauges. Where applicable, we have also included benchmark recovery forms and site sketches for each set benchmark. Elevations and coordinates are in US Survey Feet and decimals thereof.

"RESULT LAYOUT EXAMPLE"

KEA846 (1)

BM INFO						
COLL32 (2)	Field Measured Elevation - if applicable		n/a (3)	(NAVD88)	n/a (4)	(NGVD29)
	SFWMD Database Elevation		22.60	(NAVD88)	23.91	(NGVD29)
SUB-CM (5)	Northing	739198.14 (6)	Monument found as described in the SFWMD Database.			
	Easting	497671.62				

BENCHMARK COLL32 **BM AREA LOOKING SOUTH**

(PICTURES SHOWN IN ACTUAL RESULT PAGES)

HW					
HW (8)	Tip of black marker arrow on well platform (7)	26.63	(NAVD88)	**27.64**	(NGVD29)

HW AREA LOOKING EAST **HW BRASS TAG AT REF. MARK**

(PICTURES SHOWN IN ACTUAL RESULT PAGES)

STAFF GAUGE INFO					
HW	Staff gauge was dry at 3:30pm, 03/10/08. Measured elevation at 22.50 mark on staff gauge. (9)			22.58 (10)	(NGVD29)

HW STAFF GAUGE LOOKING SOUTH

(PICTURES SHOWN IN ACTUAL RESULT PAGES)

1. Well name
2. Site Benchmark
3. Elevation of benchmark derived from this survey
4. Published elevation of benchmark based on SFWMD or NGS database
5. GPS method used Well type
6. Observed GPS coordinates of site benchmark
7. Reference mark
8. Well type
9. Observed conditions of staff gauge
10. Field measured water elevation or elevation of mark on staff gauge.

SITES AT WHICH BENCHMARKS WERE SET

I75MZ

BM INFO						
I75MZ	Field Measured Elevation - if applicable		10.52	(NAVD88)	11.84	(NGVD29)
	SFWMD Database Elevation		n/a	(NAVD88)	n/a	(NGVD29)
SUB-CM	Northing	668289.28	Set 3 1/2 inch brass SFWMD disk in the SW quadrant of existing concrete pad at well site I75MZ.			
	Easting	416563.07				

BENCHMARK I75MZ

WELL AREA LOOKING NORTH

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Rev. 8/07

DESIGNATION: I75MZ	**PROJECT:** REFERENCE ELEVATION AUDIT PROJECT
ESTABLISHED BY: COONER & ASSOC., INC.	**SURVEYOR:** T. FOUTY
RECOVERED BY:	**DATE:** 03/11/2008

GEOGRAPHIC POSITION

SECTION: 29	**TOWNSHIP:** 49 S	**RANGE:** 26 E
COUNTY: COLLIER	**NAME OF QUADRANGLE:** BELLE MEADE NW (1814)	
	GEOGRAPHIC INDEX OF QUAD: SW	

HORIZONTAL DATUM: 1927 (1983) Other_____ (circle one) ZONE (E) or W

VERTICAL DATUM: MSL 1929 (1988) Other_____ (circle one)

CONTROL ACCURACY: HORIZONTAL 1 2 (3) _____(circle one) VERTICAL 1 2 (3)

STATE PLANE COORDINATES	**X:** 416563.07'	**Y:** 668289.28'	**NAVD 88 ELEV.** 10.52' **NGVD 29 ELEV.** 11.84'

LATITUDE: 26° 10' 13.36" N	**LONGITUDE:** 081° 43' 49.95" W

RECOVERY DESCRIPTION

Stamping: I75 MZ 2008

To Reach:

FROM THE INTERSECTION OF AIRPORT ROAD (STATE ROAD 31) AND GOLDEN GATE PARKWAY, GO EAST ON GOLDEN GATE PARKWAY FOR 2.1 +/- MILES TO AN INTERSECTION WITH S.W. 62ND STREET, GO SOUTH ON S.W. 62ND STREET TO A DEAD END AND A LOCKED GATE. FROM THE LOCKED GATE GO SOUTH 350 +/- FEET TO THE MARK ON THE LEFT. THE MARK IS INSIDE A CHAIN LINK FENCE CONTAINING A MONITORING WELL "I75 MZ". THE MARK IS SET IN THE SOUTHWEST CORNER OF A 5 FOOT x 5 FOOT CONCRETE PAD. THE MARK IS A 3 ½ INCH BRASS DISK STAMPED "I75 MZ 2008 S. FLORIDA WATER MANAGEMENT DISTRICT SURVEY MARKER" AND IS 1.5 +/- FEET NORTH OF A CARSONITE POST.

Notable Land marks:

FIELD BOOK: 228 **PAGE:** 32, 37-38, 49

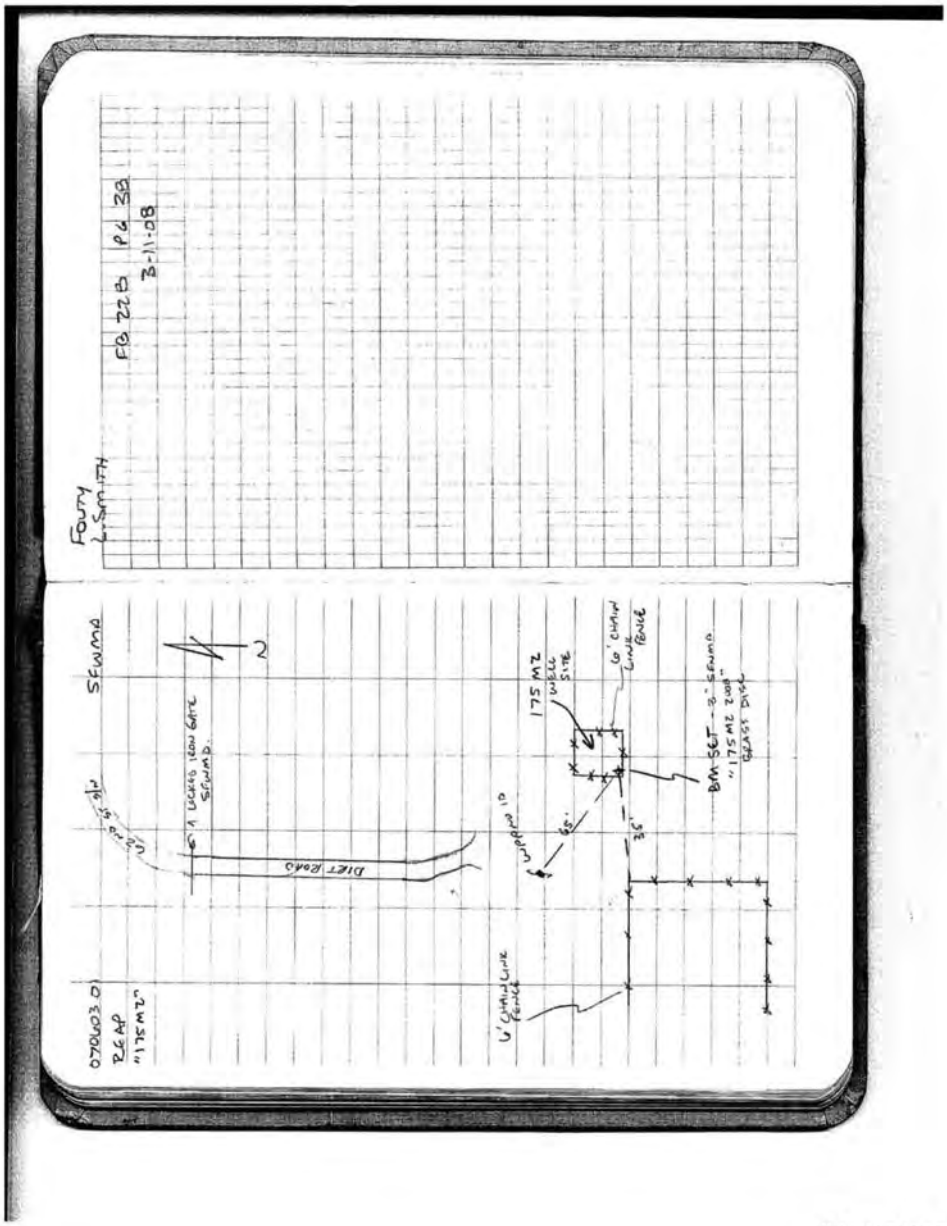
SKETCH

SEE PAGE 2 OF 2

PAGE 1 OF 2

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Rev. 8/07



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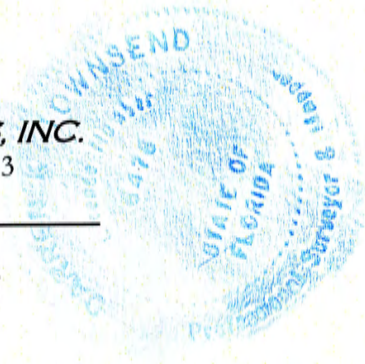
SURVEYOR'S CERTIFICATION

In my professional opinion, this report of survey meets applicable portions of the Minimum Technical Standards set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 61-G17, Florida Administrative Code.

This report is not valid without the signature and original raised seal of a Florida Licensed Surveyor and Mapper. Additions or deletions to this report by anyone, other that the signing party, are prohibited without written consent of the signing party.



COONER & ASSOCIATES, INC.
DBPR Authorization Number 6773

5/29/08
Date of Survey

By: _____
Darren Townsend, PSM
Professional Surveyor and Mapper
State of Florida
Certificate Number 6476

APPENDIX "A"

Level run information

SITE NAME	SITE BM	NGS BM(S)	LINE LENGTH	MISCLOSURE	ALLOWABLE MISCLOSURE
BCA3	EC2	I75 90 A74 I75 90 A73	1.6 MILES	0.03'	0.04'
BCA4	MR "A"	CATHAM3 AZ MK CATHAM3 S 248	24.0 MILES	0.01'	0.15'
BCA5	RP12	N248 X527	11.4 MILES	0.03'	0.07'
BCA12	KB4	I75 J 35 I17 40 A 89	6.6 MILES	0.08'	0.08'
CORK2	CORK2A	Q 534	2.4 MILES	0.03'	0.05'
ECOCO	ECOCO	872 5222 A TIDAL 2604	5.5 MILES	0.03'	0.07'
FU4S	FU4S	A584 B584	5.1 MILES	0.02'	0.07'
BICY	DONA	OCHOBEE RMS B249	2.1 MILES	0.00'	0.04'
IWSD	IWSD	F533 E533	2.8 MILES	0.02'	0.05'
I75MZ *	I75MZ	COLL36 D27	0.1 MILES	0.00'	0.01'

* I75MZ was elevated using benchmarks provided by SFWMD.

APPENDIX "B"

Adjusted level run elevation compared to published elevations.

SITE NAME	BENCHMARK	NAVD88 ADJUSTED ELEV.	NAVD88 PUBLISHED ELEV.	DIFFERENCE	NGVD29 ADJUSTED ELEV.
BCA3	EC2	13.05'	12.97'	+0.08'	14.42'
BCA4	MR "A"	7.55'	8.57'	-1.02'	8.98'
BCA12	RP12	9.62'	9.62'	0.00'	11.08'
BICY	KB4	13.02'	12.81'	+0.21'	14.42'

APPENDIX "C"
Task Breakdown by company

COONER & ASSOCIATES, TASKS COMPLETED

NO.	SITE NAME	SET MONUMENT	LEVEL RUNS	PROCESS RUNS	REF. & TAG	STAFF GAUGE	COORDINATES	REPORT
		per mon	per mile	per site	per site	per site	per site	per site
7	BCA1	0	0.0	0	1	1	1	1
8	BCA2	0	0.0	0	1	1	1	1
9	BCA3	0	1.6	1	1	1	1	1
10	BCA4	0	0.0	0	1	1	1	1
11	BCA5	0	11.4	1	1	1	1	1
13	BCA10	0	0.0	0	1	1	1	1
14	BCA11	0	0.0	0	1	1	1	1
15	BCA12	0	6.6	1	1	1	1	1
16	BCA13	0	0.0	0	1	1	1	1
18	BCA15	0	0.0	0	1	1	1	1
19	BCYP7	0	0.0	0	1	1	1	1
20	BICY	0	2.1	1	0	0	1	1
21	COC951	0	0.0	0	1	1	1	1
22	COCO3	0	0.0	0	1	1	1	1
23	COCOPR	0	0.0	0	1	1	1	1
27	D2-8	0	0.0	0	1	1	1	1
28	ECOCO	1	6.0	1	1	1	1	1
29	FAKI75	0	0.0	0	1	1	1	1
32	FU4	0	0.0	0	1	1	1	1
33	FU4S	1	5.1	1	1	1	1	1
34	FU5	0	0.0	0	1	1	1	1
36	GOL951	0	0.0	0	1	1	1	1
37	GOLD4A	0	0.0	0	1	1	1	1
39	GOLDW3	0	0.0	0	1	1	1	1
40	GOLDW4	0	0.0	0	1	1	1	1
43	HALDEM	0	0.0	0	1	1	1	1
44	HC1	0	0.0	0	1	1	1	1
45	HEND84	0	0.0	0	1	1	1	1
47	HF1	0	0.0	0	1	1	1	1
48	HF2	0	0.0	0	1	1	1	1
49	HF3	0	0.0	0	1	1	1	1
50	HF4	0	0.0	0	1	1	1	1
51	HF7	0	0.0	0	1	0	1	1
52	I75MZ	1	0.1	1	0	0	1	1
53	I75W1	0	0.0	0	1	1	1	1
54	IWSD	1	2.8	1	0	0	1	1
55	KEA846	0	0.0	0	1	1	1	1
56	MLRI75	0	0.0	0	1	1	1	1
57	WF1	0	0.0	0	1	1	1	1
58	WF2	0	0.0	0	1	1	1	1
59	WF3	0	0.0	0	1	1	1	1
60	WF4	0	0.0	0	1	1	1	1
61	WF5	0	0.0	0	1	1	1	1
62	WF6	0	0.0	0	1	1	1	1
63	WF7	0	0.0	0	1	1	1	1
	NUMBER	4	35.7	8	42	41	45	45

PICKETT & ASSOCIATES - TASKS COMPLETED

NO.	SITE NAME	SET MONUMENT	LEVEL RUNS	PROCESS LEVELS	REF. & TAG	STAFF GAUGE	COORDINATES	PORT - BY COON
		per mon	per mile	per site	per site	per site	per site	per site
2	6MIDR	0	0.0	0	1	1	1	1
3	6MII75	0	0.0	0	1	1	1	1
4	6MIPR	0	0.0	0	1	1	1	1
5	BARW4	0	0.0	0	1	1	1	1
6	BARW6A	0	0.0	0	1	1	1	1
24	CORK3-SCA	0	0.0	0	1	1	1	1
31	FU1	0	0.0	0	1	1	1	1
35	GOL846	0	0.0	0	1	1	1	1
41	GOLDW5	0	0.0	0	1	1	1	1
25	CORK2	0	2.4	1	0	0	1	1
	BCA4	0	24.0	1	0	0	0	0
	NUMBER	0	26.43	2	9	9	10	10