Survey Report

Precise Differential
Levelling

Fiji

May 2003

This project is sponsored by the Australian Agency for International Development (AusAID), managed by Australian Marine Science and Technology Ltd (AMSAT), and supported by NTF Australia at the Flinders University of South Australia.

PACIFIC MULTI-COUNTRY SEA LEVEL AND CLIMATE MONITORING PROJECT

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Quality Certification:

I authorise the issue of this document in accordance with the National Tidal Facility Australia Quality Assurance procedures.

Bill Mitchell
Acting Director - National Tidal Facility Australia

December 2003

LAUTOKA, FIJI

Bench Mark Locality Map

CONTENTS

South Pacific Sea Level and Climate Monitoring Project

Precise Differential Levelling Survey

FIJI

May 2003

The eighth precise differential levelling survey of the deep bench mark array in Lautoka, Viti Levu, Fiji has been successfully completed by Mr. Steven Turner and Mr. Andrick Lal.

Precise levelling connections were made to the SEAFRAME Sensor Bench Mark and to the Continuous Global Positioning System (CGPS) pillar and associated reference marks.

Survey of Deep Bench Mark Array and SEAFRAME Station

Precise Differential Levelling was undertaken between the six deep bench marks, BM 3243 - BM 3248, the CGPS pillar and the SEAFRAME station. Access to the Wharf Pillar was possible during the survey. The levelling was a repeat of levelling carried out on seven previous occasions since October 1992.

All the bench marks were found undisturbed. Three of the holding marks levelled during the 2002 survey were not found. These marks have been replaced and an extra three holding marks have been placed. Wherever possible the new marks are stainless steel bolts drilled and glued into concrete.

As well as the CGPS pillar bench mark, FIJIBM, the three reference marks, RM 1, RM 2 and RM 3 were also levelled during the survey.

Results of the Bench Mark Array Survey

All the data have been reduced holding BM 3243 fixed at the value determined in the adjustment of the 1992 levelling and used in all subsequent adjustments. The datum for levelling is Tide Staff Zero. In the absence of a suitable datum at the time an RL of 0.0000

was adopted for the Tide Staff Zero.

As noted in previous reports, until the 1998 survey there was generally good agreement between the results of the levelling surveys. In 1998 a relative movement of 5mm, attributed to the effect of a prolonged dry spell experienced in the area followed by the heavy rain during the survey, was measured at BM 3245 between the 1997 and 1998 surveys.

The 2000 survey saw an apparent rebound of the deep bench mark again probably due to climatic factors although there was also a lot of activity near BM 3245 that may have contributed to movement of that mark. The last two surveys show only small movements of the bench marks since the 2000 survey.

Currently it is not possible to say with any certainty which bench marks are stable. There has been minimal relative movement between BM 3243, the Tide Gauge Bench Mark (TGBM) and FIJIBM at the CGPS Pillar. However there has been movement outside of Project Specifications for FIJ 13, the SEAFRAME Sensor BM and the original deep bench marks BM 3244 and BM 3245 relative to the TGBM.

Results from the next levelling survey over the enlarged array will assist in assessing the stability of the deep bench marks. Until these results are available BM 3243 will continue to be designated as the TGBM and will be held fixed in the adjustment.

Levelling the Tide Gauge Bench Mark, BM 3243

All the data have been reduced and adjusted. An internal precision of better than 1.0mm **/** K

was achieved for all of the bays levelled. This precision being well within the 2.0mm **/** K Project specification.

The comparison of the RL's for these marks is as follows:

Mark number	1992RL (m)	1994RL (m)	1995RL (m)	1997RL (m)	1998RL (m)	2000RL (m)	2002RL (m)	2003RL (m)
BM 3243	3.1285	3.1285	3.1285	3.1285	3.1285	3.1285	3.1285	3.1285
BM 3244	4.1601	4.1597	4.1606	4.1607	4.1612	4.1630	4.1632	4.1635
BM 3245	16.6280	16.6270	16.6293	16.6293	16.6243	16.6314	16.6313	16.6327
BM 3246							7.8170	7.8179
BM 3247							20.9526	20.9533
BM 3248							35.2283	35.2294
FIJIBM							31.3337	31.3338
FIJ 13	4.4326	4.4336	4.4345	4.4341	4.4342	4.4352	4.4348	4.4368

Mark Number	03-02 (mm)	03-92 (mm)
BM 3243	FIXED	FIXED
BM 3244	0.27	3.38
BM 3245	1.40	4.72
BM 3246	0.90	
BM 3247	0.71	
BM 3248	1.03	
FIJIBM	0.10	
FIJ 13	-0.38	2.21

Several of the holding pins, especially those in or near the playing fields, continue to show substantial movement.

Survey Support

On-going work commitments and a shortage of staff meant that no surveyor was able to participate in the survey. The experienced chainman who has worked on the levelling survey for many years has been reassigned to office duties due to failing eyesight. Unfortunately there was no replacement available at the time of the survey.

The usual warm welcome and the assistance provided by personnel from the Lands and Survey Department in all other matters associated with the Project were most appreciated.

FIJI

VITI LEVU - LAUTOKA

- **BM 3243** is the adopted reference point for the coastal array.
  RL = 3.1285175 metres

- The height of **BM 3243** was derived by:

  1992 Adopting **TIDE STAFF ZERO**

  1994 Adopting the height of **BM 3243** as derived in the 1992 survey.
  RL = 3.1285175 metres

- Points **BM 3243, BM 3244, BM 3245, BM 3246, BM 3247 & BM 3248** are Deep Bench Marks.

- **FIJ 13** is the SEAFRAME Sensor Bench Mark

- **FIJ 12** is the Project's Plaque

- **FIJIBM** is the bench mark on the Continuous Global Positioning System pillar

- **FIJ 79, FIJ 94 & FIJ 103** not found in the 2003 survey:

- New points placed in the 2003 survey:

  FIJ 104 - FIJ 107 (Stainless Steel Bolts)

  FIJ 108 (Deck Spike)

FIJI

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2003 REDUCED LEVELS

INSTRUMENT: Wild NA3003 S/N 92987 **DATUM:** Tide Staff Zero

DATE: 24th - 30th May 2003 **PAGES:** 3113 - 3169

POINT #	2003 DIFF.	2003 RL
BM 3243	**3.1285175**	**Adopted Height**
FIJ 104	+0.5773775	3.7058950
FIJ 47	-0.6688800	3.0370150
FIJ 105	-0.0054475	3.0315675
FIJ 47		3.0370150
FIJ 81	-0.3660775	2.6709375
FIJ 65	-0.0032050	2.6677325
FIJ 81		2.6709375
FIJ 44	+0.8895475	3.5604850
FIJ 11	+0.6472650	4.2077500
FIJ 12	-0.1453350	4.0624150
FIJ 13	+0.3743550	**4.4367700**
BM 3243	**3.1285175**	**Adopted Height**
FIJ 104	+0.5773775	3.7058950
FIJ82	-0.1355350	3.5703600
FIJ 62	+1.6852825	5.2556425
FIJ 106	+0.0574450	5.3130875
FIJ 62		5.2556425
WHARF PILLAR	-0.4588700	4.7967725
FIJ 62		5.2556425
FIJ 83	-2.0097275	3.2459150
FIJ 61	+0.1832750	3.4291900
FIJ 83		3.2459150
FIJ 84	-0.2088025	3.0371125
FIJ 7	-0.0385575	2.9985550

POINT #	2003 DIFF (cont.)	2003 RL (cont.)
FIJ 84		3.0371125
FIJ85	+0.0986225	3.1357350
FIJ 78	+0.5897450	3.7254800
FIJ 46	+0.7670625	4.4925425
FIJ 66	+0.1462775	4.6388200
BM 3244	-0.4753550	**4.1634650**
FIJ 66		4.6388200
FIJ 32	+0.5601875	5.1990075
FIJ 86	+1.6631849	6.8621924
FIJ 87	+0.5344521	7.3966445
BM 3246	+0.4212981	**7.8179426**
FIJ 88	+1.1903380	9.0082806
FIJ 89	+4.3533571	13.3616377
FIJ 90	+3.6505752	17.0122129
FIJ 91	+2.6507220	19.6629349
BM 3247	+1.2903801	**20.9533150**
FIJ 92	+5.2943182	26.2476332
RM 1	+2.7570468	29.0046800
FIJIBM	+2.3290704	**31.3337504**
RM 3	-0.7495750	30.5841754
FIJIBM		**31.3337504**
RM 2	-1.0032868	30.3304636
BM 3248	+4.8989146	**35.2293782**
FIJ 96	-0.5348573	34.6945209
FIJ 95	-1.9476144	32.7469065
FIJ 107	-1.5785841	31.1683224
FIJ 102	-1.5362251	29.6320973
FIJ 101	-2.4994455	27.1326518
FIJ 100	-3.6941467	23.4385051
FIJ 99	-4.0801955	19.3583096
FIJ 98	-5.2087371	14.1495725
FIJ 97	-1.4701733	12.6793992
FIJ 93	+0.7487750	13.4281742
FIJ 1	+0.3304250	13.7585992
FIJ 80	+2.3336975	16.0922967
BM 3245	+0.5403925	**16.6326892**
FIJ 97		12.6793992
FIJ 2	-1.4960511	11.1833481
FIJ 3	-2.6081655	8.5751826
FIJ 4	-1.2442309	7.3309517
FIJ 108	-1.1416277	6.1893240
FIJ 32	-0.9903163	5.1990077

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VITI LEVU - LAUTOKA

TABLE OF REDUCED LEVELS

INSTRUMENT: Wild NA3003 S/N 92987 **DATUM:** Tide Staff Zero

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POINT #	2003 RL	2002 RL	1992 RL (see note below)
BM 3243	**3.1285175**	**3.1285175**	**3.1285175**
FIJ 104	3.7058950	**New Point (2003)**	
FIJ 47	3.0370150	3.0371875	3.0370100
FIJ 105	3.0315675	**New Point (2003)**	
FIJ 81	2.6709375	2.6718500	**New Point (2002)**
FIJ 65	2.6677325	2.6686300	2.6753325
FIJ 44	3.5604850	3.5588000	3.5576025
FIJ 11	4.2077500	4.2055875	4.2039200
FIJ 12	4.0624150	4.0602725	4.0590950
FIJ 13	**4.4367700**	**4.4367700**	**4.4325900**
FIJ 82	3.5703600	3.5713650	**New Point (2002)**
FIJ 62	5.2556425	5.2582800	5.2647500
FIJ 106	5.3130875	**New Point (2003)**	
WHARF PILLAR	4.7967725		4.7971200
FIJ 83	3.2459150	3.2466350	**New Point (2002)**
FIJ 61	3.4291900	3.4302250	3.4296775
FIJ 84	3.0371125	3.0375375	**New Point (2002)**
FIJ 7	2.9985550	2.9994675	3.0082175
FIJ 85	3.1357350	3.1365950	**New Point (2002)**
FIJ 78	3.7254800	3.7268375	3.7291025
FIJ 46	4.4925425	4.4932225	4.4979842
FIJ 66	4.6388200	4.6389625	4.6354275
BM 3244	**4.1634650**	**4.1631975**	**4.1600825**

POINT #	2003 RL (cont.)	2002 RL (cont.)	1992 RL (cont.) (see note below)
FIJ 32	5.1990075	5.2039575	5.1820400
FIJ 86	6.8621924	6.8635725	**New Point (2002)**
FIJ 87	7.3966445	7.3980426	**New Point (2002)**
BM 3246	**7.8179426**	**7.8170419**	**New Point (2002)**
FIJ 88	9.0082806	9.0118541	**New Point (2002)**
FIJ 89	13.3616377	13.3743630	**New Point (2002)**
FIJ 90	17.0122129	17.0216092	**New Point (2002)**
FIJ 91	19.6629349	19.6624280	**New Point (2002)**
BM 3247	**20.9533150**	**20.9526024**	**New Point (2002)**
FIJ 92	26.2476332	26.2477993	**New Point (2002)**
RM 1	29.0046800	29.0047872	**New Point (2002)**
FIJIBM	**31.3337504**	**31.3336546**	**New Point (2002)**
RM 2	30.3304636	30.3302576	**New Point (2002)**
RM 3	30.5841754	30.5842421	**New Point (2002)**
BM 3248	**35.2293782**	**35.2283451**	**New Point (2002)**
FIJ 96	34.6945209	34.6962461	**New Point (2002)**
FIJ 95	32.7469065	32.7486004	**New Point (2002)**
FIJ 107	31.1683224	**New Point (2003)**	
FIJ 102	29.6320973	29.6389660	**New Point (2002)**
FIJ 101	27.1326518	27.1315709	**New Point (2002)**
FIJ 100	23.4385051	23.4401787	**New Point (2002)**
FIJ 99	19.3583096	19.3684503	**New Point (2002)**
FIJ 98	14.1495725	14.1512483	**New Point (2002)**
FIJ 97	12.6793992	12.6821918	**New Point (2002)**
FIJ 2	11.1833481	11.1860605	11.1762825
FIJ 3	8.5751826	8.5788189	8.6035175
FIJ 4	7.3309517	7.3360064	7.3367650
FIJ 108	6.1893240	**New Point (2003)**	
FIJ 93	13.4281742	13.4283893	**New Point (2002)**
FIJ 1	13.7585992	13.7587568	13.7715650
FIJ 80	16.0922967	16.0927918	16.0899350
BM 3245	**16.6326892**	**16.6312868**	**16.6279675**

NOTE: The RL listed under 1992 is the first RL determined for that point. The RL may not have first been determined in 1992 but is listed in that column for simplicity.

FIJI

VITI LEVU - LAUTOKA

COMPARISON OF RL DIFFERENCES:

INSTRUMENT: Wild NA3003 S/N 92987 **DATUM:** Tide Staff Zero

DATE: 24th - 30th May 2003 **PAGES:** 3113 - 3169

POINT #	03RL – 02RL (mm)	03RL – 92RL (mm)
BM 3243	**Adopted Height**	
FIJ 47	-0.17	+0.00
FIJ 81	-0.91	
FIJ 65	-0.90	-7.60
FIJ 44	+1.69	+2.88
FIJ 11	+2.16	+3.83
FIJ 12	+2.14	+3.32
FIJ 13	**+1.97**	**+4.18**
FIJ 82	-1.00	
FIJ 62	-2.64	-9.11
WHARF PILLAR		-0.35
FIJ 83	-0.72	
FIJ 61	-1.04	-0.49
FIJ 84	-0.43	
FIJ 7	-0.91	-9.66
FIJ 85	-0.86	
FIJ 78	-1.36	-3.62
FIJ 46	-0.68	-5.44
FIJ 66	-0.14	+3.39
BM 3244	**+0.27**	**+3.38**
FIJ 32	-4.95	+16.97
FIJ 86	-1.38	
FIJ 87	-1.40	
BM 3246	**+0.90**	

FIJ 88	-3.57	
FIJ 89	-12.73	

POINT #	03RL – 02RL (mm)	03RL – 92RL (mm)
FIJ 90	-9.40	
FIJ 91	+0.51	
BM 3247	**+0.71**	
FIJ 92	-0.17	
RM 1	-0.11	
FIJIBM	**+0.10**	
RM 3	-0.07	
RM 2	+0.21	
BM 3248	**+1.03**	
FIJ 96	-1.73	
FIJ 95	-1.69	
FIJ 102	-6.87	
FIJ 101	+1.08	
FIJ 100	-1.67	
FIJ 99	-10.14	
FIJ 98	-1.68	
FIJ 97	-2.79	
FIJ 93	-0.22	
FIJ 4	-5.05	-5.81
FIJ 3	-4.64	-28.33
FIJ 2	-2.71	+7.07
FIJ 1	-0.16	-12.97
FIJ 80	-0.50	+2.36
BM3245	**+1.40**	**+4.72**

NOTE: The RL difference listed under 03RL – 92RL is the first RL difference determined for that point. The RL may not have first been determined in 1992 but is listed in that column for simplicity.

SOUTH PACIFIC SEA LEVEL

AND CLIMATE MONITORING PROJECT

REDUCED LEVELS – LAUTOKA, VITI LEVU, FIJI

INSTRUMENT: Wild NA 3003 S/N 92897

DATE OF LEVELLING: 24th – 30th May 2003

SURVEY TYPE: First Order

DATUM FOR LEVELLING: Tide Staff Zero

BENCH MARK ADOPTED: BM 3243 (3.1285 metres)

SURVEY MARK	2003 RL	TYPE OF MARK
BM 3243	3.1285	Deep Bench Mark
FIJ 104	3.7059	Stainless Steel Bolt in Concrete
FIJ 47	3.0370	Masonry Nail in Concrete
FIJ 105	3.0316	Stainless Steel Bolt in Concrete
FIJ 65	2.6677	Masonry Nail in Concrete
FIJ 81	2.6709	Stainless Steel Bolt in Concrete
FIJ 44	3.5605	Masonry Nail in Concrete
FIJ 11	4.2078	Bolt in Radio Tower
FIJ 12	4.0624	Project Plaque
FIJ 13	4.4368	SEAFRAME Sensor Bench Mark
FIJ 82	3.5704	Stainless Steel Bolt in Concrete
FIJ 62	5.2556	Masonry Nail in Concrete
FIJ 106	5.3131	Stainless Steel Bolt in Concrete
WHARF PILLAR	4.7968	Fundamental Bench Mark
FIJ 61	3.4292	Masonry Nail in Concrete
FIJ 83	3.2459	Stainless Steel Bolt in Concrete
FIJ 7	2.9995	Metal Pin
FIJ 84	3.0371	Stainless Steel Bolt in Concrete
FIJ 85	3.1357	Stainless Steel Bolt in Concrete
FIJ 78	3.7255	Metal Pin
FIJ 46	4.4925	Bench Mark
FIJ 66	4.6388	Masonry Nail in Concrete
BM 3244	4.1635	Deep Bench Mark

SURVEY MARK	2003 RL	TYPE OF MARK
FIJ 32	5.1990	Masonry Nail in Concrete
FIJ 86	6.8622	Stainless Steel Bolt in Concrete
FIJ 87	7.3966	Stainless Steel Bolt in Concrete
BM 3246	7.8179	Deep Bench Mark
FIJ 88	9.0083	Stainless Steel Bolt in Concrete
FIJ 89	13.3616	Deck Spike
FIJ 90	17.0122	Deck Spike
FIJ 91	19.6629	Stainless Steel Bolt in Concrete
BM 3247	20.9533	Deep Bench Mark
FIJ 92	26.2476	Stainless Steel Bolt in Concrete
RM 1	29.0047	Bench Mark
FIJIBM	31.3338	Bench Mark
RM 3	30.5842	Bench Mark
RM 2	30.3305	Bench Mark
BM 3248	35.2294	Deep Bench Mark
FIJ 96	34.6945	Deck Spike
FIJ 95	32.7469	Deck Spike
FIJ 107	31.1683	Stainless Steel Bolt in Concrete
FIJ 102	29.6321	Masonry Nail in Concrete
FIJ 101	27.1327	Masonry Nail in Concrete
FIJ 100	23.4385	Masonry Nail in Concrete
FIJ 99	19.3583	Masonry Nail in Concrete
FIJ 98	14.1496	Masonry Nail in Concrete
FIJ 97	12.6794	Masonry Nail in Concrete
FIJ 2	11.1833	Metal Pin
FIJ 3	8.5752	Metal Pin
FIJ 4	7.3310	Metal Pin
FIJ 108	6.1893	Deck Spike
FIJ 93	13.4282	Masonry Nail in Concrete
FIJ 1	13.7586	Metal Pin
FIJ 80	16.0923	Masonry Nail in Concrete
BM 3245	16.6327	Deep Bench Mark

SOUTH PACIFIC SEA LEVEL

AND CLIMATE MONITORING PROJECT

REDUCED LEVELS – LAUTOKA, VITI LEVU, FIJI

INSTRUMENT: Wild NA 3003 S/N 92897

DATE OF LEVELLING: 24th – 30th May 2003

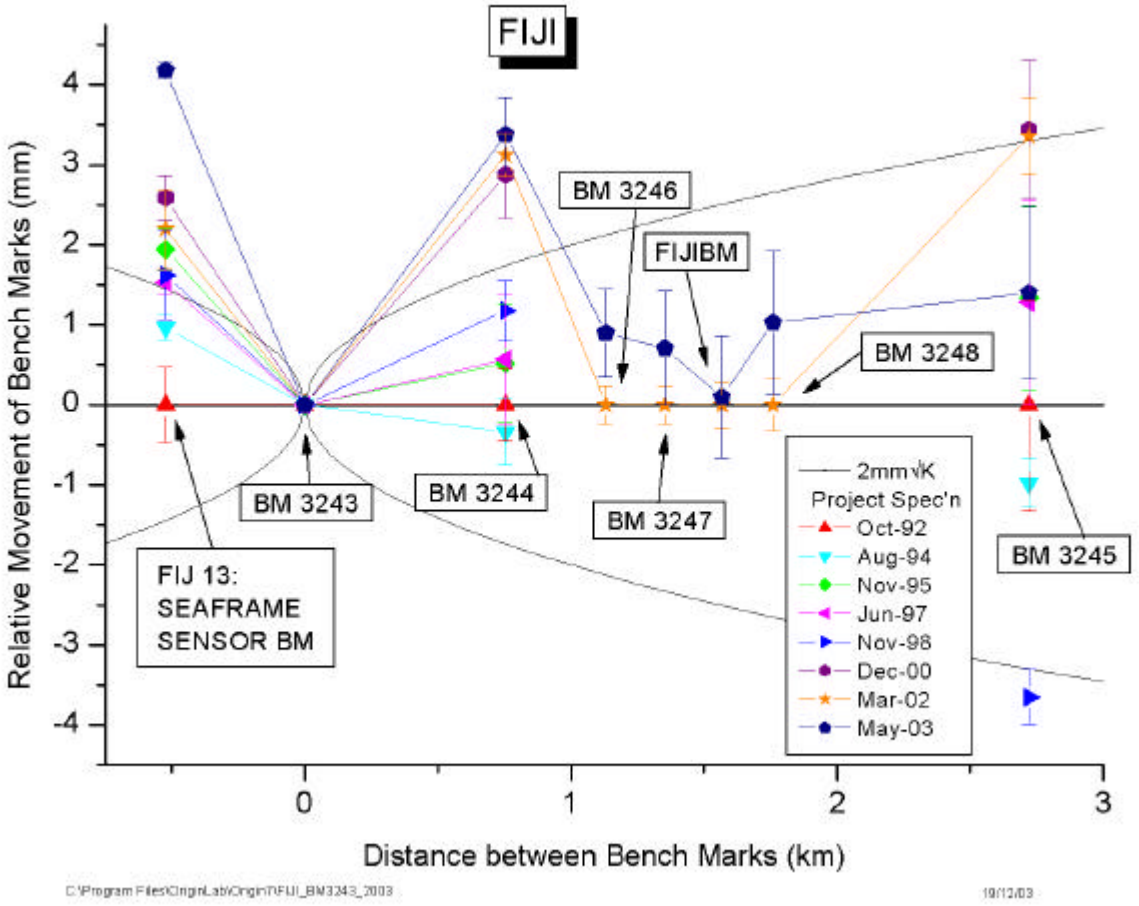
SURVEY TYPE: First Order

DATUM FOR LEVELLING: Mean Sea Level

BENCH MARK ADOPTED: Wharf Pillar – Fundamental Bench Mark (3.752 metres M.S.L.)

SURVEY MARK	2003 RL	TYPE OF MARK
BM 3243	2.0837	Deep Bench Mark
FIJ 104	2.6611	Stainless Steel Bolt in Concrete
FIJ 47	1.9922	Masonry Nail in Concrete
FIJ 105	1.9868	Stainless Steel Bolt in Concrete
FIJ 65	1.6230	Masonry Nail in Concrete
FIJ 81	1.6262	Stainless Steel Bolt in Concrete
FIJ 44	2.5157	Masonry Nail in Concrete
FIJ 11	3.1630	Bolt in Radio Tower
FIJ 12	3.0176	Project Plaque
FIJ 13	3.3920	SEAFRAME Sensor Bench Mark
FIJ 82	2.5256	Stainless Steel Bolt in Concrete
FIJ 62	4.2109	Masonry Nail in Concrete
FIJ 106	4.2683	Stainless Steel Bolt in Concrete
FIJ 61	2.3844	Masonry Nail in Concrete
FIJ 83	2.2011	Stainless Steel Bolt in Concrete
FIJ 7	1.9538	Metal Pin
FIJ 84	1.9923	Stainless Steel Bolt in Concrete
FIJ 85	2.0910	Stainless Steel Bolt in Concrete
FIJ 78	2.6807	Metal Pin
FIJ 46	3.4478	Bench Mark
FIJ 66	3.5940	Masonry Nail in Concrete
BM 3244	3.1187	Deep Bench Mark

SURVEY MARK	2003 RL	TYPE OF MARK
FIJ 32	4.1542	Masonry Nail in Concrete
FIJ 86	5.8174	Stainless Steel Bolt in Concrete
FIJ 87	6.3519	Stainless Steel Bolt in Concrete
BM 3246	6.7732	Deep Bench Mark
FIJ 88	7.9635	Stainless Steel Bolt in Concrete
FIJ 89	12.3169	Deck Spike
FIJ 90	15.9674	Deck Spike
FIJ 91	18.6182	Stainless Steel Bolt in Concrete
BM 3247	19.9085	Deep Bench Mark
FIJ 92	25.2029	Stainless Steel Bolt in Concrete
RM 1	27.9599	Bench Mark
FIJIBM	30.2890	Bench Mark
RM 3	29.5394	Bench Mark
RM 2	29.2857	Bench Mark
BM 3248	34.1846	Deep Bench Mark
FIJ 96	33.6497	Deck Spike
FIJ 95	31.7021	Deck Spike
FIJ 107	30.1235	Stainless Steel Bolt in Concrete
FIJ 102	28.5873	Masonry Nail in Concrete
FIJ 101	26.0879	Masonry Nail in Concrete
FIJ 100	22.3937	Masonry Nail in Concrete
FIJ 99	18.3135	Masonry Nail in Concrete
FIJ 98	13.1048	Masonry Nail in Concrete
FIJ 97	11.6346	Masonry Nail in Concrete
FIJ 2	10.1386	Metal Pin
FIJ 3	7.5304	Metal Pin
FIJ 4	6.2862	Metal Pin
FIJ 108	5.1446	Deck Spike
FIJ 93	12.3834	Masonry Nail in Concrete
FIJ 1	12.7138	Metal Pin
FIJ 80	15.0475	Masonry Nail in Concrete
BM 3245	15.5879	Deep Bench Mark


FIJI
BM 3246
FIJIBM
BM 3248
BM 3243
BM 3244
BM 3247
BM 3245
FIJ 13:
SEAFRAME
SENSOR BM
2mm√K
Project Spec'n
Oct-92
Aug-94
Nov-95
Jun-97
Nov-98
Dec-00
Mar-02
May-03
Relative Movement of Bench Marks (mm)
Distance between Bench Marks (km)
4
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1
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-2
-3
-4
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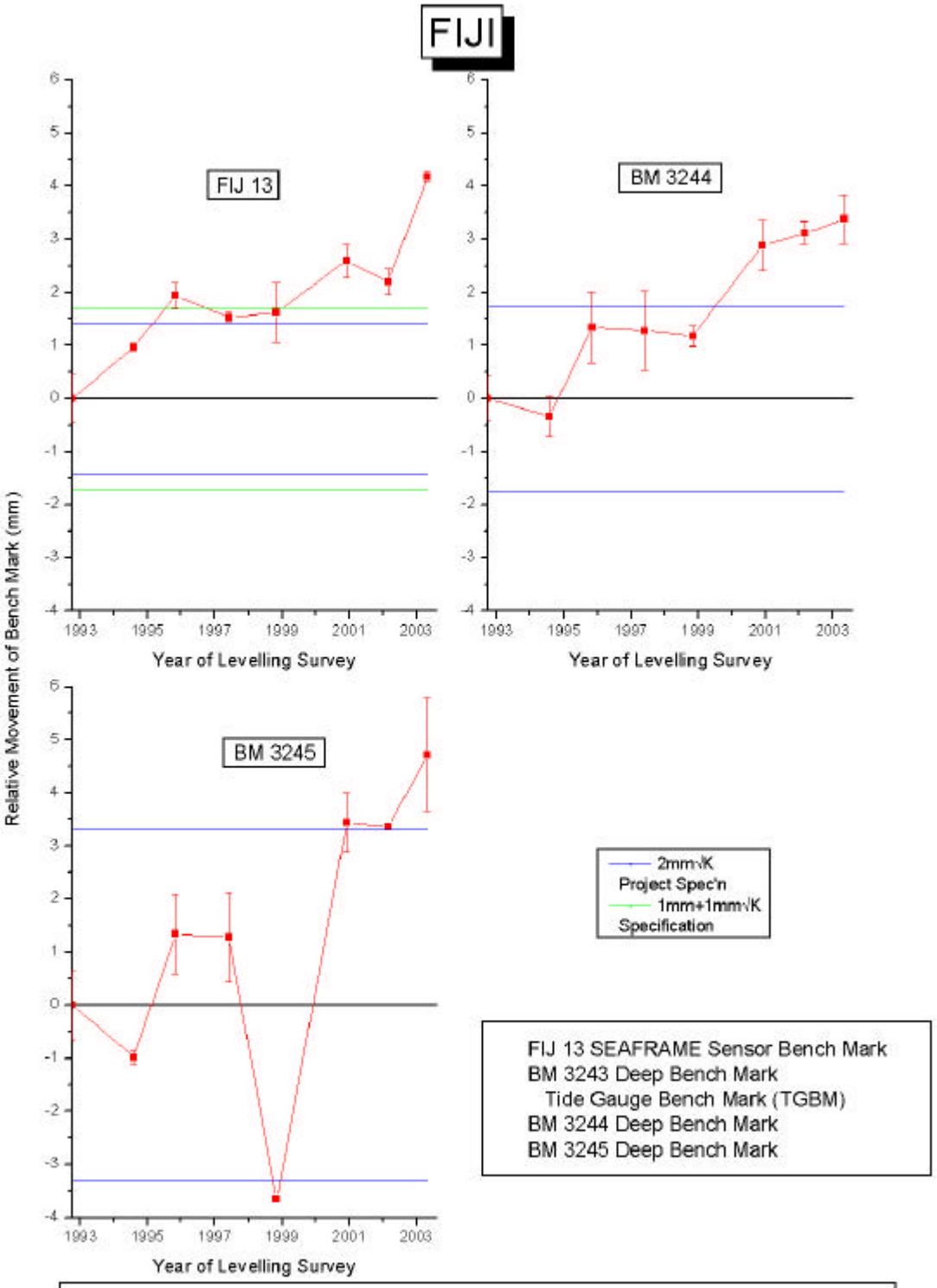
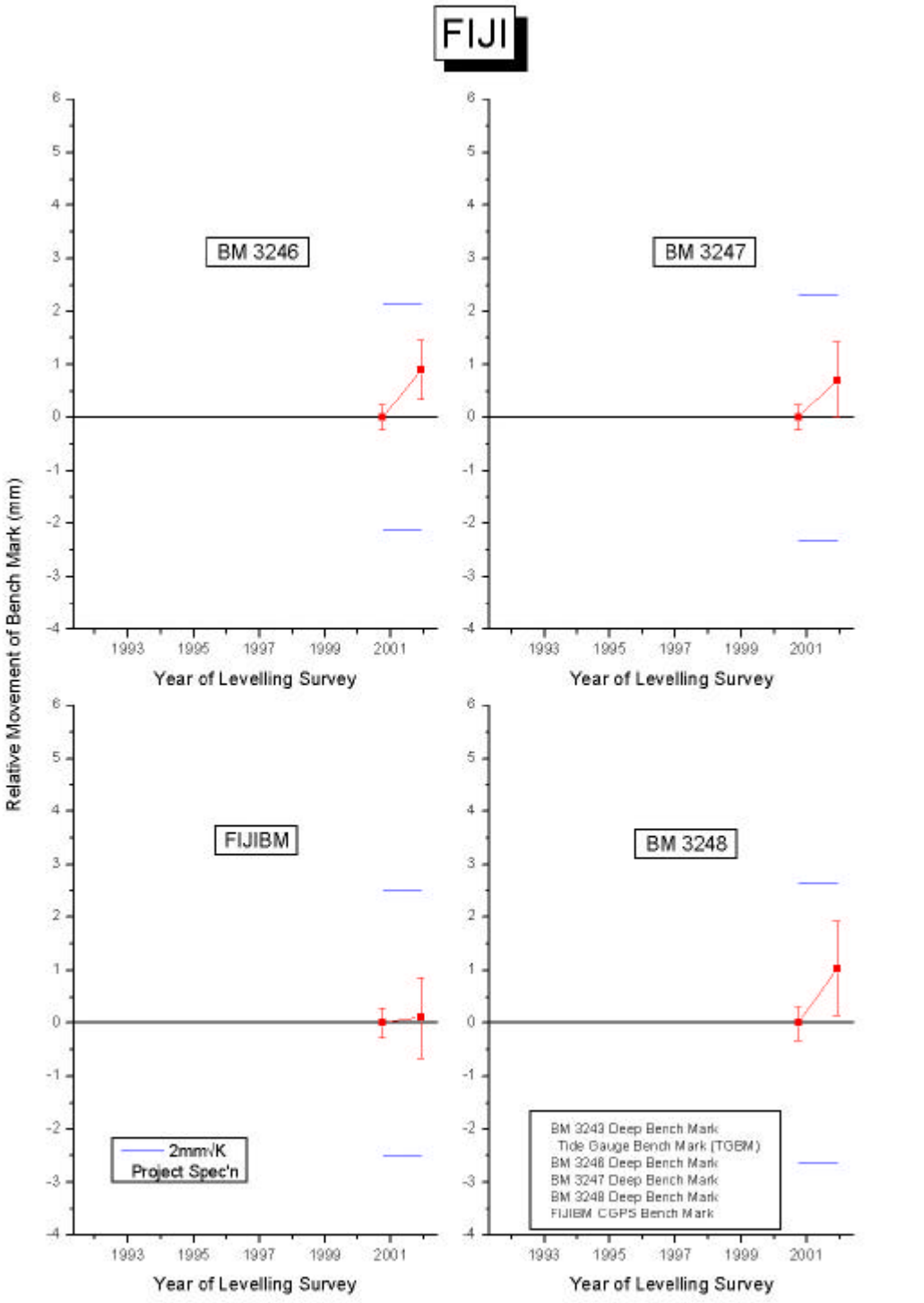
1
2
3


FIJI
FIJ 13
BM 3244
BM 3245
Relative Movement of Bench Mark (mm)
Year of Levelling Survey
Year of Levelling Survey
Year of Levelling Survey
2mm√K
Project Spec'n
1mm+1mm√K
Specification
FIJ 13 SEAFRAME Sensor Bench Mark
BM 3243 Deep Bench Mark
Tide Gauge Bench Mark (TGBM)
BM 3244 Deep Bench Mark
BM 3245 Deep Bench Mark
Time series of Bench Mark movement relative to the
Tide Gauge Bench Mark, BM 3243, since October 1992
C:\Program Files\OriginLab\Origin7\FIJI INDIVIDUAL PLOTS - BM 3243 FIXED - 2003_1
22/12/03



Time Series of Bench Mark movement relative to the Tide Gauge Bench Mark, BM 3243, since October 1992

C:\Program Files\OriginLab\Origin7\FIJI INDIVIDUAL PLOTS - BM 3243 FIXED - 2003_2

21/01/04

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	25-10-92	24-08-94			22-11-95				22-06-97			
Point no.	1. Meas.	2. Measurement			3. Measurement				4. Measurement			
	Height TSZ	Height TSZ	³	D 2-1	Height TSZ	³	D 3-2	³ D 3-1	Height TSZ	³	D 4-3	³ D 4-1
	m	m	³	mm	m	³	mm	³ mm	m	³	mm	³ mm
FIJ1	13.77157	13.77809	³	6.52	13.77622	³	-1.87	³ 4.65	13.78681	³	10.59	³ 15.24
FIJ2	11.17628	11.17577	³	-0.51	11.16766	³	-8.11	³ -8.62	11.18413	³	16.47	³ 7.85
FIJ3	8.60352	8.60618	³	2.66	8.59310	³	-13.08	³ -10.42	8.58605	³	-7.05	³ -17.47
FIJ4	7.33677	7.34298	³	6.21	7.30426	³	-38.72	³ -32.51	7.33552	³	31.26	³ -1.25
FIJ7	3.00822	3.00705	³	-1.17	3.00665	³	-0.40	³ -1.57	3.00624	³	-0.41	³ -1.98
FIJ11	4.20392	4.20451	³	0.59	4.20562	³	1.11	³ 1.70	4.20593	³	0.31	³ 2.01
FIJ12	4.05910	4.05967	³	0.57	4.06056	³	0.89	³ 1.46	4.06076	³	0.20	³ 1.66
FIJ13	4.43259	4.43356	³	0.97	4.43453	³	0.97	³ 1.94	4.43412	³	-0.41	³ 1.53
FIJ32			³		5.18204	³		³	5.19647	³	14.43	³ 14.43
FIJ44			³		3.55760	³		³	3.55801	³	0.41	³ 0.41
FIJ46			³		4.49798	³		³	4.49985	³	1.87	³ 1.87
FIJ47			³			³		³	3.03701	³		³
FIJ61			³			³		³	3.42968	³		³
FIJ62			³			³		³	5.26475	³		³
BM3243	3.12852	3.12852	³	0.00	3.12852	³	0.00	³ 0.00	3.12852	³	0.00	³ 0.00
BM3244	4.16008	4.15974	³	-0.34	4.16060	³	0.86	³ 0.52	4.16065	³	0.05	³ 0.57
BM3245	16.62797	16.62699	³	-0.98	16.62931	³	2.32	³ 1.34	16.62925	³	-0.06	³ 1.28
PILLAR	4.79712	4.79562	³	-1.50	4.79394	³	-1.68	³ -3.18	4.79608	³	2.14	³ -1.04

Difference from 1st measurement always refers to 1st measurement of respective point (D=last-initial measurement),
Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	25-03-99			04-12-00			07-03-02		
Point no.	5. Measurement			6. Measurement			7. Measurement		
	Height TSZ m	D 5-4 mm	D 5-1 mm	Height TSZ m	D 6-5 mm	D 6-1 mm	Height TSZ m	D 7-6 mm	D 7-1 mm
FIJ1	13.76824	-18.57	-3.33	13.76692	-1.32	-4.65	13.75878	-8.14	-12.79
FIJ2	11.15878	-25.35	-17.50	11.18460	25.82	8.32	11.18608	1.48	9.80
FIJ3	8.56160	-24.45	-41.92	8.57917	17.57	-24.35	8.57983	0.66	-23.69
FIJ4	7.30975	-25.77	-27.02	7.33439	24.64	-2.38	7.33602	1.63	-0.75
FIJ7	3.00524	-1.00	-2.98	3.00003	-5.21	-8.19	2.99947	-0.56	-8.75
RM_1							29.00482		
RM_2							30.33030		
RM_3							30.58428		
FIJ11	4.20605	0.12	2.13	4.20864	2.59	4.72	4.20557	-3.07	1.65
FIJ12	4.06056	-0.20	1.46	4.06105	0.49	1.95	4.06026	-0.79	1.16
FIJ13	4.43421	0.09	1.62	4.43518	0.97	2.59	4.43479	-0.39	2.20
FIJ32	5.19545	-1.02	13.41	5.20384	8.39	21.80	5.20396	0.12	21.92
FIJ44	3.55917	1.16	1.57	3.55916	-0.01	1.56	3.55878	-0.38	1.18
FIJ46	4.49643	-3.42	-1.55	4.49364	-2.79	-4.34	4.49323	-0.41	-4.75
FIJ47	3.03597	-1.04	-1.04	3.03807	2.10	1.06	3.03718	-0.89	0.17
FIJ61	3.42973	0.05	0.05	3.43112	1.39	1.44	3.43023	-0.89	0.55
FIJ62	5.25993	-4.82	-4.82	5.25970	-0.23	-5.05	5.25829	-1.41	-6.46

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Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	25-03-99			04-12-00			07-03-02		
Point no.	5. Measurement			6. Measurement			7. Measurement		
	Height TSZ	D 5-4	D 5-1	Height TSZ	D 6-5	D 6-1	Height TSZ	D 7-6	D 7-1
	m	mm	mm	m	mm	mm	m	mm	mm
FIJ65	2.67533			2.67064	-4.69	-4.69	2.66862	-2.02	-6.71
FIJ66	4.63546			4.63872	3.26	3.26	4.63897	0.25	3.51
FIJ78				3.72910			3.72684	-2.26	-2.26
FIJ80				16.08997			16.09283	2.86	2.86
FIJ81							2.67183		
FIJ82							3.57137		
FIJ83							3.24663		
FIJ84							3.03754		
FIJ85							3.13660		
FIJ86							6.86358		
FIJ87							7.39806		
FIJ88							9.01187		
FIJ89							13.37438		
FIJ90							17.02163		
FIJ91							19.66246		
FIJ92							26.24783		
FIJ93							13.42841		
FIJ95							32.74864		
FIJ96							34.69628		

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Difference from 1st measurement always refers to 1st measurement of respective point (D=last-initial measurement),
Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	25-03-99			04-12-00			07-03-02		
Point no.	5. Measurement			6. Measurement			7. Measurement		
	Height TSZ m	D 5-4 mm	D 5-1 mm	Height TSZ m	D 6-5 mm	D 6-1 mm	Height TSZ m	D 7-6 mm	D 7-1 mm
FIJ97							12.68221		
FIJ98							14.15127		
FIJ99							19.36847		
BM3243	3.12852	0.00	0.00	3.12852	0.00	0.00	3.12852	0.00	0.00
BM3244	4.16126	0.61	1.18	4.16296	1.70	2.88	4.16320	0.24	3.12
BM3245	16.62432	-4.93	-3.65	16.63141	7.09	3.44	16.63133	-0.08	3.36
BM3246							7.81706		
BM3247							20.95263		
BM3248							35.22838		
FIJ100							23.44020		
FIJ101							27.13160		
FIJ102							29.63900		
FIJIBM							31.33369		
PILLAR				4.79586	-0.22	-1.26			

Difference from 1st measurement always refers to 1st measurement of respective point (D=last-initial measurement),
Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	30-05-03									
Point no.	8. Measurement			9. Measurement			10. Measurement			
	Height TSZ m	D 8-7 mm	D 8-1 mm	Height TSZ m	D 9-8 mm	D 9-1 mm	Height TSZ m	D 10-9 mm	D 10-1 mm	
FIJ1	13.75864	-0.14	-12.93							
FIJ2	11.18338	-2.70	7.10							
FIJ3	8.57521	-4.62	-28.31							
FIJ4	7.33098	-5.04	-5.79							
FIJ7	2.99856	-0.91	-9.66							
RM_1	29.00473	-0.09	-0.09							
RM_2	30.33051	0.21	0.21							
RM_3	30.58422	-0.06	-0.06							
FIJ11	4.20776	2.19	3.84							
FIJ12	4.06242	2.16	3.32							
FIJ13	4.43678	1.99	4.19							
FIJ32	5.19902	-4.94	16.98							
FIJ44	3.56049	1.71	2.89							
FIJ46	4.49256	-0.67	-5.42							
FIJ47	3.03702	-0.16	0.01							
FIJ61	3.42920	-1.03	-0.48							
FIJ62	5.25565	-2.64	-9.10							

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Difference from 1st measurement always refers to 1st measurement of respective point (D=last-initial measurement),
Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	30-05-03										
Point no.	8. Measurement			9. Measurement			10. Measurement				
	Height TSZ	D 8-7	D 8-1	Height TSZ	D 9-8	D 9-1	Height TSZ	D 10-9	D 10-1		
	m	mm	mm	m	mm	mm	m	mm	mm		
FIJ65	2.66774	-0.88	-7.59								
FIJ66	4.63884	-0.13	3.38								
FIJ78	3.72549	-1.35	-3.61								
FIJ80	16.09234	-0.49	2.37								
FIJ81	2.67094	-0.89	-0.89								
FIJ82	3.57036	-1.01	-1.01								
FIJ83	3.24592	-0.71	-0.71								
FIJ84	3.03712	-0.42	-0.42								
FIJ85	3.13574	-0.86	-0.86								
FIJ86	6.86221	-1.37	-1.37								
FIJ87	7.39667	-1.39	-1.39								
FIJ88	9.00831	-3.56	-3.56								
FIJ89	13.36167	-12.71	-12.71								
FIJ90	17.01225	-9.38	-9.38								
FIJ91	19.66297	0.51	0.51								
FIJ92	26.24768	-0.15	-0.15								
FIJ93	13.42821	-0.20	-0.20								
FIJ95	32.74695	-1.69	-1.69								
FIJ96	34.69456	-1.72	-1.72								

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Difference from 1st measurement always refers to 1st measurement of respective point (D=last-initial measurement),
Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

MOVEMENT LIST

SOUTH PACIFIC SEA LEVEL AND CLIMATE MONITORING PROJECT

Date:	30-05-03										
Point no.	8. Measurement			9. Measurement			10. Measurement				
	Height TSZ m	D 8-7 mm	D 8-1 mm	Height TSZ m	D 9-8 mm	D 9-1 mm	Height TSZ m	D 10-9 mm	D 10-1 mm		
FIJ97	12.67943	-2.78	-2.78								
FIJ98	14.14960	-1.67	-1.67								
FIJ99	19.35834	-10.13	-10.13								
BM3243	3.12852	0.00	0.00								
BM3244	4.16348	0.28	3.40								
BM3245	16.63274	1.41	4.77								
BM3246	7.81797	0.91	0.91								
BM3247	20.95336	0.73	0.73								
BM3248	35.22942	1.04	1.04								
FIJ100	23.43854	-1.66	-1.66								
FIJ101	27.13269	1.09	1.09								
FIJ102	29.63213	-6.87	-6.87								
FIJ104	3.70590										
FIJ105	3.03157										
FIJ106	5.31310										
FIJ107	31.16836										
FIJ108	6.18935										
FIJIBM	31.33380	0.11	0.11								
PILLAR	4.79677	0.91	-0.35								

Difference from 1st measurement always refers to 1st measurement of respective point (D=last-initial measurement),
Difference from measurement n-1 always refers to penultimate measurement (D=last-penultimate measurement)

FIJI

VITI LEVU - LAUTOKA

PRECISION OF 2003 SURVEY:

INSTRUMENT: Wild NA3003 S/N 92987 **DATUM:** Tide Staff Zero

DATE: 24th - 30th May 2003 **PAGES:** 3113 - 3169

POINT #	FORWARD LEVELLING	BACK LEVELLING	DIFF (mm)	DIST (km)	PRECISION
BM 3243					
FIJ 13	+1.3081950	+1.3083100	0.115	0.516	0.16 / K
BM 3243					
BM 3244	+1.0353050	+1.0345750	0.730	0.754	0.84 / K
BM 3244					
BM 3246	+3.6544500	+3.6543200	0.130	0.376	0.21 / K
BM 3246					
BM 3247	+13.1354300	+13.1351700	0.260	0.229	0.54 / K
BM 3247					
BM 3248	+14.2760450	+14.2758250	0.220	0.406	0.35 / K
BM 3247					
FIJIBM	+10.3803950	+10.3803400	0.055	0.215	0.12 / K
BM 3243					
BM 3246	+4.6897550	+4.6888950	0.860	1.130	0.81 / K
BM 3243					
BM 3247	+17.8251850	+17.8240650	1.120	1.353	0.96 / K
BM 3243					
FIJIBM	+28.2055800	+28.2044050	1.175	1.568	0.94 / K

POINT #	FORWARD LEVELLING	BACK LEVELLING	DIFF (mm)	DIST (km)	PRECISION
BM 3248					
BM 3245	-18.5968000	-18.5970550	0.255	0.961	0.26 **/** K
BM 3243					
BM 3245	+13.5044300	+13.5028350	1.595	2.720	0.97 **/** K
FIJ 13					
BM 3245	+12.1961200	+12.1946400	1.480	3.236	0.82 **/** K
FIJ 13					
BM 3248	+30.7929200	+30.7916950	1.225	2.275	0.81 **/** K
FIJ 13					
FIJIBM	+26.8972700	+26.8962100	1.060	2.084	0.73 **/** K

INDIVIDUALS CONSULTED DURING THE GEODETIC SURVEY VISIT

DEPARTMENT OF LANDS AND SURVEYS

Mr. Shiri Narayan, Divisional Surveyor - Western
Mr. Swarath Singh, Senior Surveyor
Mr. Walmik, Senior Surveyor
Mr. Rakesh Prasad, Survey Assistant
Mr. Hira Sami Goundar, Survey Assistant

PORTS AUTHORITY OF FIJI

Mr. Jone Cakau, Safety Officer, Port of Lautoka

FIJI METEOROLOGICAL SERVICE

Mr. Rajendra Prasad, Director
Mr. Yunus Mohammed, Manager Technical Systems

GEODETIC SURVEY VISIT ITINERARY

Depart Adelaide	0820	QF740	Sunday 11 May 2003
Arrive Sydney	1040		Sunday 11 May 2003
Depart Sydney	1235	QF391	Sunday 11 May 2003
Arrive Nadi	1830		Sunday 11 May 2003
Depart Nadi	0645	PC502	Monday 12 May 2003
Arrive Suva	0715		Monday 12 May 2003
Depart Suva	0830	PC601	Monday 12 May 2003
Arrive Funafuti	1045		Monday 12 May 2003
Depart Funafuti	1130	PC602	Thursday 22 May 2003
Arrive Suva	1345		Thursday 22 May 2003
Depart Nadi	1015	FJ211	Saturday 31 May 2003
Arrive Tonga	1235		Saturday 31 May 2003
Depart Tonga	0820	PH749	Saturday 07 June 2003
Arrive Auckland	1000		Saturday 07 June 2003
Depart Auckland	1300	QF190	Saturday 07 June 2003
Arrive Sydney	1430		Saturday 07 June 2003
Depart Sydney	1650	QF765	Saturday 07 June 2003
Arrive Adelaide	1825		Saturday 07 June 2003