Establishment of the new GNSS base station at Eda Tano Haus in Waigani

Richard Stanaway

Quickclose Pty Ltd

Also acknowledging:

Luther Sipison (DLPP) and Charles Ouba (OSG)

John Kwasi, John Oa, Lui Gawi, Manis Manoka and Ivero Topre

(PNG OSG – Geodetic Section)

48th Association of Surveyors of Papua New Guinea Congress, Port Moresby, 24-26 July 2014

The NMB GPS base station (MORE) 1993 to 2011

Primary GPS base station for PNG Geodetic surveys

Used in development of PNG94

OSG-NMB GPS upgrade 2011 (NMB2) 2011 - 2014

old Ashtech receiver and antenna replaced by Leica GRX1200 GNSS+ in October 2011. Using same antenna mount as MORE. 6 cm offset due to clay soil on site and tower damage. This required new site name.

Connected to APREF network using Telikom WiMax – but site not to IGS standard. Connected to CNES DORIS beacon on IDS network.

Relocation of Base station – January 2014

The Imminent demolition and redevelopment of the NMB offices required movement of the base station to a new location.

The roof of the new Eda Tano building was chosen after reconnaissance of existing sites. It is a suitable interim location until a more stable bedrock location can be identified with power, internet and security access in the future.

Choice of new CORS site (WAIG) – Eda Tano Haus

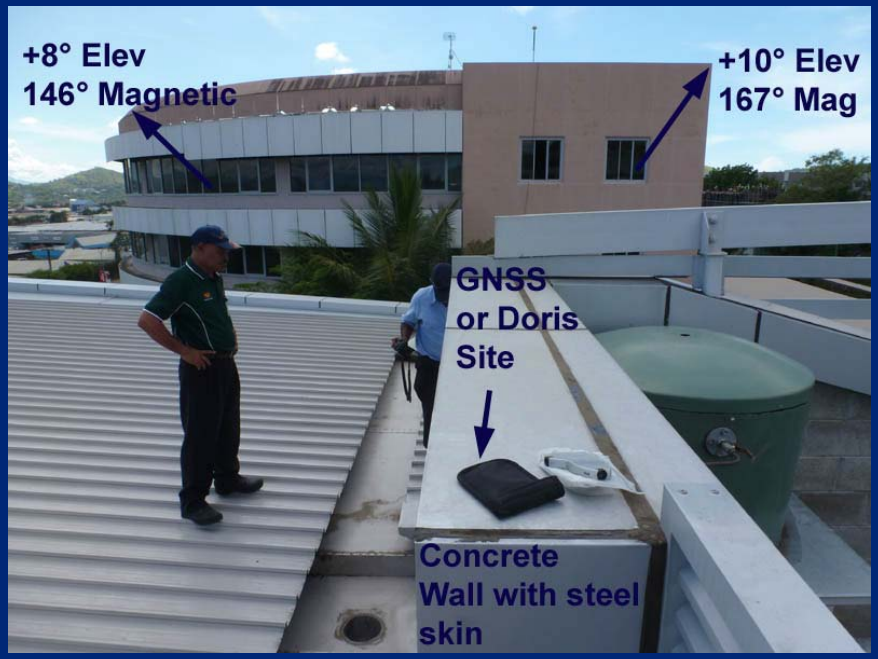
Newly constructed concrete building (metal clad) with bedrock foundation

Roof parapet sufficiently clear of obstructions for GNSS/GPS

Antenna cable long enough to reach computer room in geodetic survey office

Site not suitable for DORIS beacon after some consideration

Site ID WAIG chosen after verification with SOPAC (defacto site name authority)



Construction of new antenna mount

Stainless steel base disk secured to top of parapet using 5/8” stainless bolt

Bolt also acts as antenna mount

Plate levelled and secured

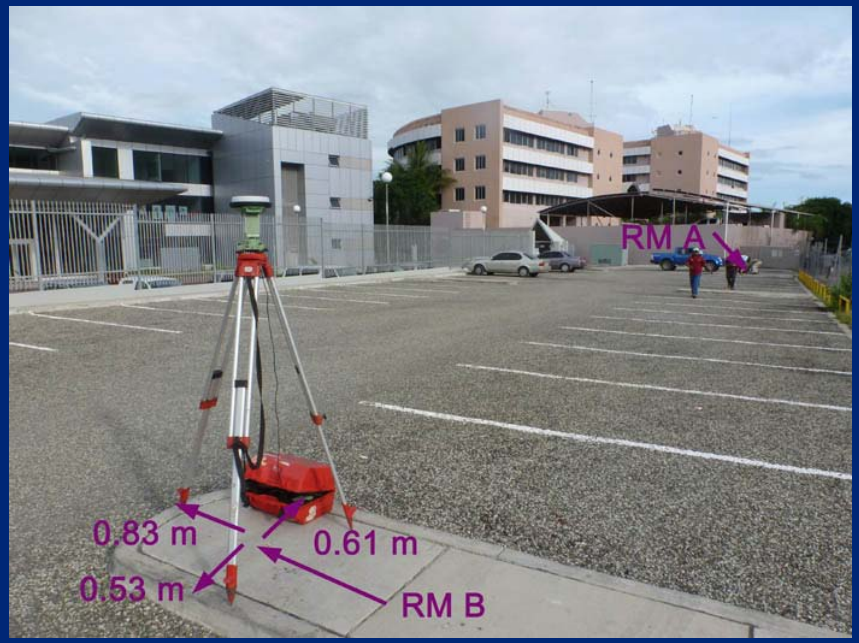
PSM 33362 assigned to new CORS monument

Site tie GNSS survey

Leica GS15 Rover GNSS set up on WAIG

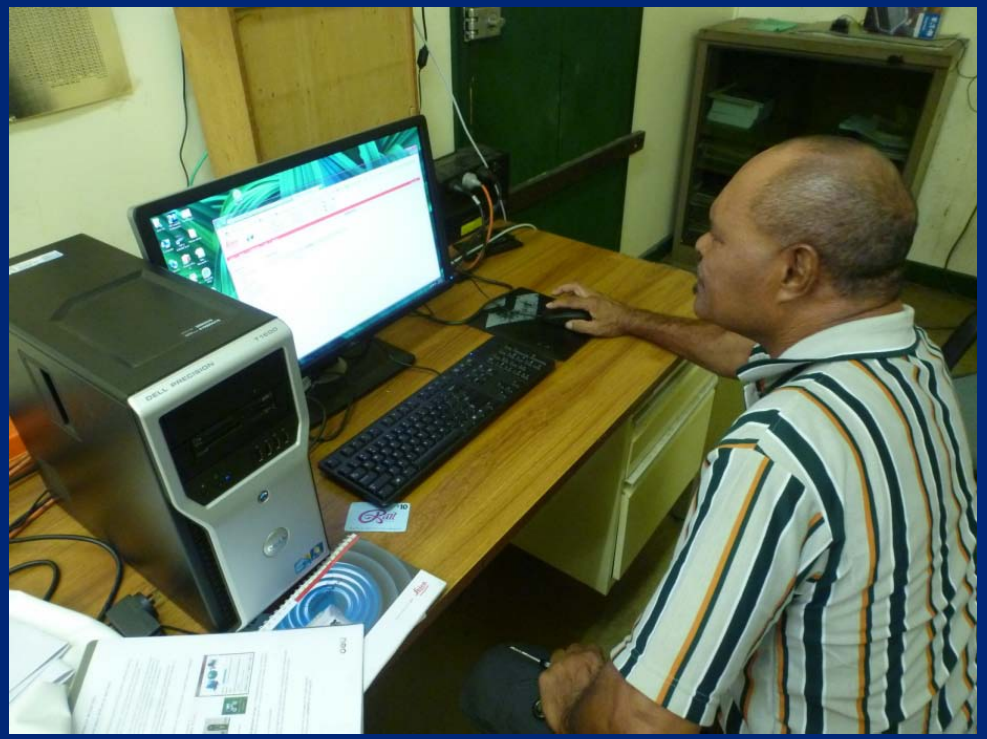
24 hour collocated measurement with existing NMB2 CORS

RMs at old NMB2 site and new WAIG site also occupied by GNSS for full site tie network. Total station survey of DORIS beacon monument and antenna.



Dismantling of old GPS station 17/1/2014

RM receivers kept running while old station shut down (John Oa below) and antenna removed from mount



Installation of new site – WAIG – 17/1/2014

The antenna was placed on the new mount and the cable fed through service ducts and vents to the GPS computer room.

Receiver reconfigured for new site. Process took five hours.

RM receivers were operating continuously during the process in order to effect the site tie survey.

Computation of WAIG ITRF2008 position

In February 2014, 7 days (24 hours each) of WAIG data were processed by AUSPOS using IGS Final Orbits to compute ITRF2008 position of WAIG at mean epoch.

4 Computed Coordinates, ITRF2008

All computed coordinates are based on the IGS realisation of the ITRF2008 reference frame. All the given ITRF2008 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

4.1 Cartesian, ITRF2008

Station	X (m)	Y (m)	Z (m)	ITRF2008 @
WAIG	-5288102.899	3410380.240	-1039517.319	22/01/2014
ALIC				
CEDU				
COEN				

WAIG	-5288102.903	3410380.243	-1039517.325	17/01/14	2014.047
WAIG	-5288102.900	3410380.241	-1039517.326	18/01/14	2014.049
WAIG	-5288102.904	3410380.241	-1039517.328	19/01/14	2014.052
WAIG	-5288102.899	3410380.240	-1039517.326	20/01/14	2014.055
WAIG	-5288102.899	3410380.239	-1039517.324	21/01/14	2014.058
WAIG	-5288102.899	3410380.240	-1039517.319	22/01/14	2014.060
WAIG	-5288102.898	3410380.241	-1039517.324	23/01/14	2014.063
avg	-5288102.900	3410380.241	-1039517.325		2014.055
s	0.002	0.001	0.003		

Computation of site tie network

L1 Baseline processing Using Leica Geo Office

ITRF2008 at Epoch 2014.00 - Cartesian Coordinates

Station Name	X	Y	Z	Positional Uncertainty 1σ		
				X	Y	Z
WAIG PSM 33362	-5288102.899	3410380.242	-1039517.327	0.003	0.001	0.002
WAIG RM A	-5288070.699	3410397.766	-1039540.492	0.010	0.004	0.001
WAIG RM B						
NMB2 PSM 31						
NMB2 RM A						
NMB2 RM B						
NMB2 RM C						
NMB2 RM D						
MOSB 400 MHz						
MOSB 2 GHz Ce						
MOSB Station M						
MOSB RM						

ITRF2008 at Epoch 2014.00 - Ellipsoidal Coordinates

Station Name	Latitude			Longitude			Ellipsoid Height	MSL (PNG08)	Positional Uncertainty 1σ		
	Deg	Min	Sec	Deg	Min	Sec			λ	ϕ	Ht
WAIG PSM 33362	-9	26	33.67845	147	10	53.03152	154.655	78.937	0.001	0.003	0.003
WAIG RM A											
WAIG RM B											
NMB2 PSM 319											
NMB2 RM A											
NMB2 RM B											
NMB2 RM C											
NMB2 RM D											
MOSB 400 MHz											
MOSB 2 GHz Cer											
MOSB Station M											
MOSB RM											

ITRF2008 at Epoch 2014.00 - UTM (Southern Hemisphere) Grid Coordinates

Station Name	UTM Zone	Easting	Northing	Ellipsoid Height	MSL (PNG08)	Positional Uncertainty 1σ		
						E	N	Ht
WAIG PSM 33362	55	519913.339	8956199.653	154.655	78.937	0.001	0.003	0.003
WAIG RM A	55	519881.160	8956173.948	141.131	65.419	0.002	0.003	0.010
WAIG RM B	55	519855.293	8956206.809	141.778	66.066	0.002	0.003	0.011
NMB2 PSM 31927	55	520499.037	8957149.645	122.966	47.113	0.001	0.001	0.004
NMB2 RM A	55	520505.833	8957141.177	116.374	40.523	0.001	0.002	0.003
NMB2 RM B	55	520487.419	8957144.188	116.451	40.601	0.002	0.002	0.006
NMB2 RM C	55	520487.120	8957155.100	116.364	40.513	0.003	0.002	0.006
NMB2 RM D	55	520492.129	8957154.960	116.490	40.639	0.002	0.002	0.008
MOSB 400 MHz ARP	55	520482.240	8957158.795	118.660	42.809	0.002	0.002	0.004
MOSB 2 GHz Centre	55	520482.240	8957158.793	119.135	43.284	0.002	0.002	0.004
MOSB Station Mark	55	520482.241	8957158.794	117.810	41.959	0.001	0.002	0.004
MOSB RM	55	520480.991	8957154.681	116.186	40.336	0.002	0.002	0.006

DOMES number and APREF setup

Applied to IERS for DOMES Number 51007M001 – approved 17/1/14

Applied to GA (APREF data centre) for Site acceptance – approved 17/1/14

```
DOMES INFORMATION FORM (DIF)

 1. Request from (full name) : Richard Stanaway
    Agency                   : Office of the Surveyor-General Papua New Guinea
    E-mail                   : richard.stanaway@quickclose.com.au
    Date                     : 16th January 2014

 2. Site Name                : Port Moresby CORS WAIG
 3. Country                  : Papua New Guinea
 4. Point Description        : Stainless Steel plate on parapet of new Lands Department Building
 5. DOMES Number             : 51001M004?
 6. Local Number             : PSM 33362
 7. 4-Char Code              : WAIG

 8. Approximate Position
    Latitude (deg min)       : -009 26 33.7
    Longitude (deg min)      : +147 10 53.0
    Elevation (m)            : +148

 9. Instrument               : LEICA GRX1200+GNSS LEIAR10
10. Date of Installation     : 16 January 2014

11. Operation Contact Name   : Richard Stanaway
    Agency                   : Office of the Surveyor-General
    E-mail                   : richard.stanaway@quickclose.com.au

12. Site Contact Name        : John Oa
    Agency                   : Office of the Surveyor-General
    E-mail                   : oajgeodesy@gmail.com

GUIDELINES: ONE form per point should be prepared:
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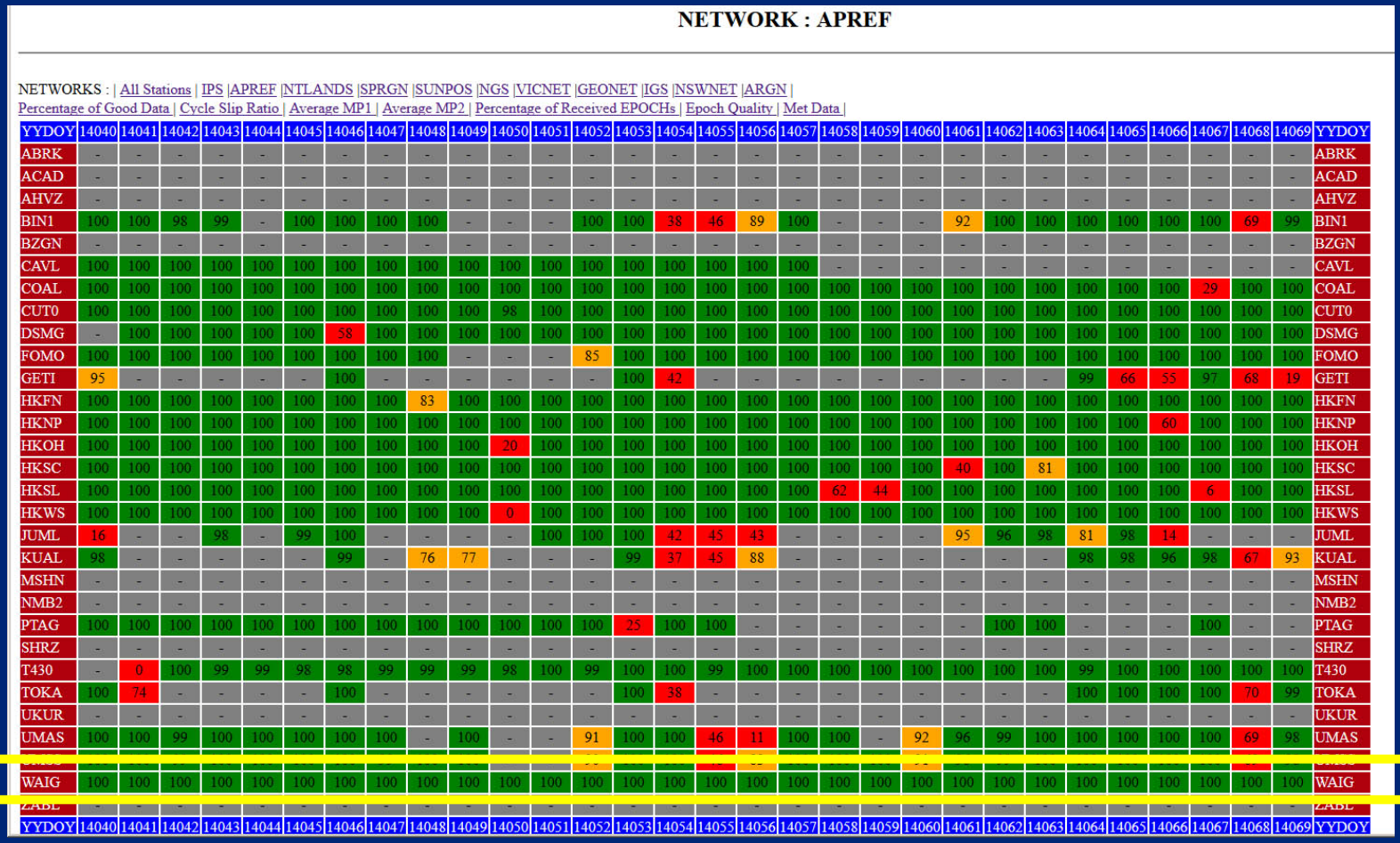
WAIG Data in Internet

If there are no internet issues, WAIG is the best performing station on the APREF network. Internet stoppage should be resolved by end of 2014.



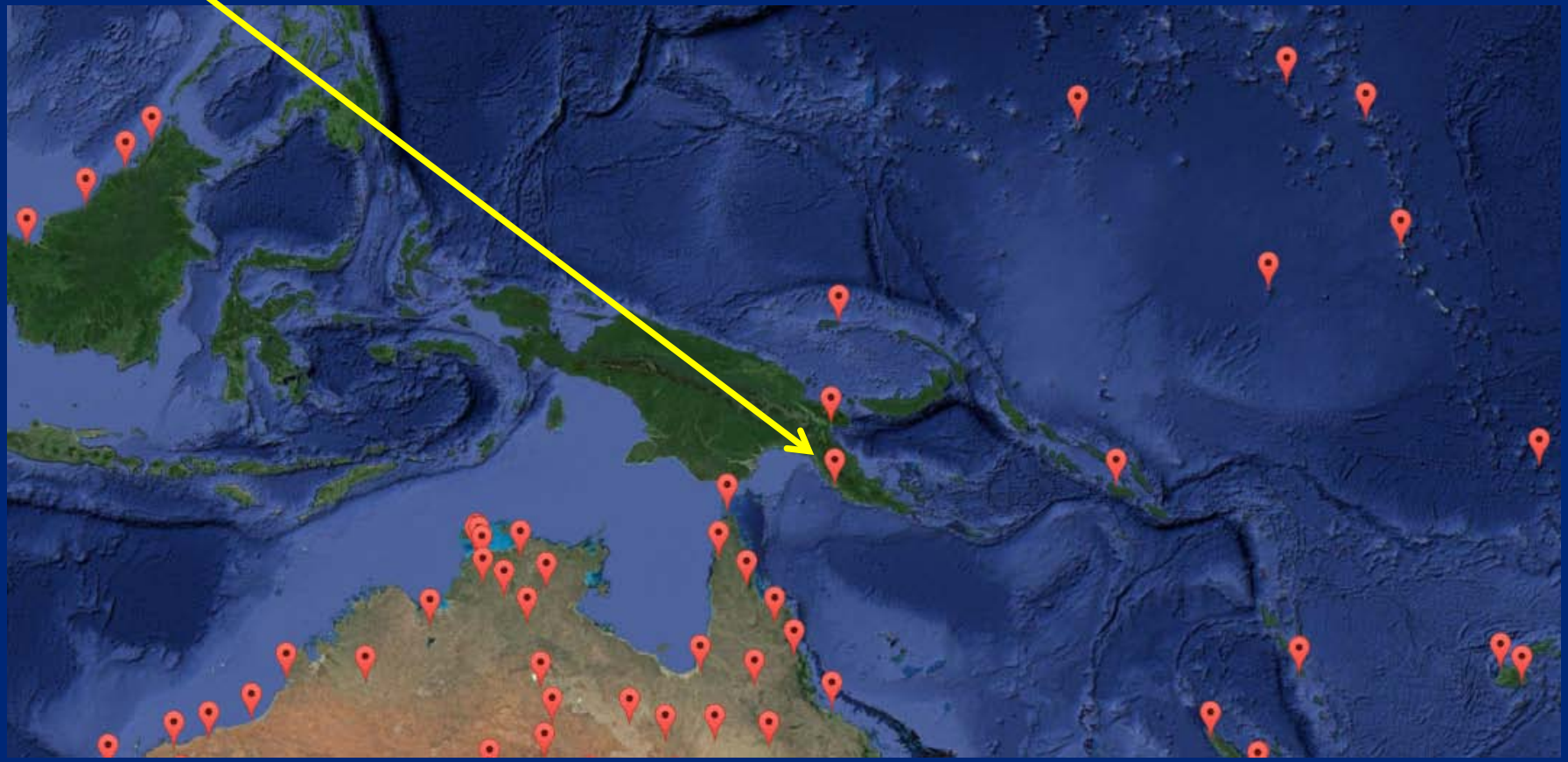
NETWORK : APREF

NETWORKS : | All Stations | IPS | APREF | NTLANDS | SPRGN | SUNPOS | NGS | VICNET | GEONET | IGS | NSWNET | ARGN |
Percentage of Good Data | Cycle Slip Ratio | Average MP1 | Average MP2 | Percentage of Received EPOCHs | Epoch Quality | Met Data |

YYDOY	14040	14041	14042	14043	14044	14045	14046	14047	14048	14049	14050	14051	14052	14053	14054	14055	14056	14057	14058	14059	14060	14061	14062	14063	14064	14065	14066	14067	14068	14069	YYDOY
ABRK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ABRK
ACAD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ACAD
AHVZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AHVZ
BIN1	100	100	98	99	-	100	100	100	100	-	-	-	100	100	38	46	89	100	-	-	-	92	100	100	100	100	100	100	69	99	BIN1
BZGN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BZGN
CAVL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-	CAVL
COAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	29	100	100	COAL
CUT0	100	100	100	100	100	100	100	100	100	100	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	CUT0
DSMG	-	100	100	100	100	100	58	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	DSMG
FOMO	100	100	100	100	100	100	100	100	100	-	-	-	85	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	FOMO
GETI	95	-	-	-	-	-	100	-	-	-	-	-	-	100	42	-	-	-	-	-	-	-	-	-	99	66	55	97	68	19	GETI
HKFN	100	100	100	100	100	100	100	100	83	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	HKFN
HKNP	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	60	100	100	100	HKNP
HKOH	100	100	100	100	100	100	100	100	100	100	20	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	HKOH
HKSC	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	40	100	81	100	100	100	100	100	100	HKSC
HKSL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	62	44	100	100	100	100	100	100	100	6	100	100	HKSL
HKWS	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	HKWS
JUML	16	-	-	98	-	99	100	-	-	-	-	100	100	100	42	45	43	-	-	-	-	95	96	98	81	98	14	-	-	-	JUML
KUAL	98	-	-	-	-	-	99	-	76	77	-	-	-	99	37	45	88	-	-	-	-	-	-	-	98	98	96	98	67	93	KUAL
MSHN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MSHN
NMB2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NMB2
PTAG	100	100	100	100	100	100	100	100	100	100	100	100	100	25	100	100	-	-	-	-	-	-	100	100	-	-	-	100	-	-	PTAG
SHRZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SHRZ
T430	-	0	100	99	99	98	98	99	99	99	98	100	99	100	100	99	100	100	100	100	100	100	100	100	99	100	100	100	100	100	T430
TOKA	100	74	-	-	-	-	100	-	-	-	-	-	-	100	38	-	-	-	-	-	-	-	-	-	100	100	100	100	70	99	TOKA
UKUR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	UKUR
UMAS	100	100	99	100	100	100	100	100	-	100	-	-	91	100	100	46	11	100	100	-	92	96	99	100	100	100	100	100	69	98	UMAS
WAIG	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	WAIG
YYDOY	14040	14041	14042	14043	14044	14045	14046	14047	14048	14049	14050	14051	14052	14053	14054	14055	14056	14057	14058	14059	14060	14061	14062	14063	14064	14065	14066	14067	14068	14069	YYDOY

WAIG on APREF

WAIG is a key station in the Asia-Pacific Reference Frame (APREF)



Unix Hatanaka compressed RINEX Data can be downloaded at
ftp://ftp.ga.gov.au/geodesy-outgoing/gnss/data/daily

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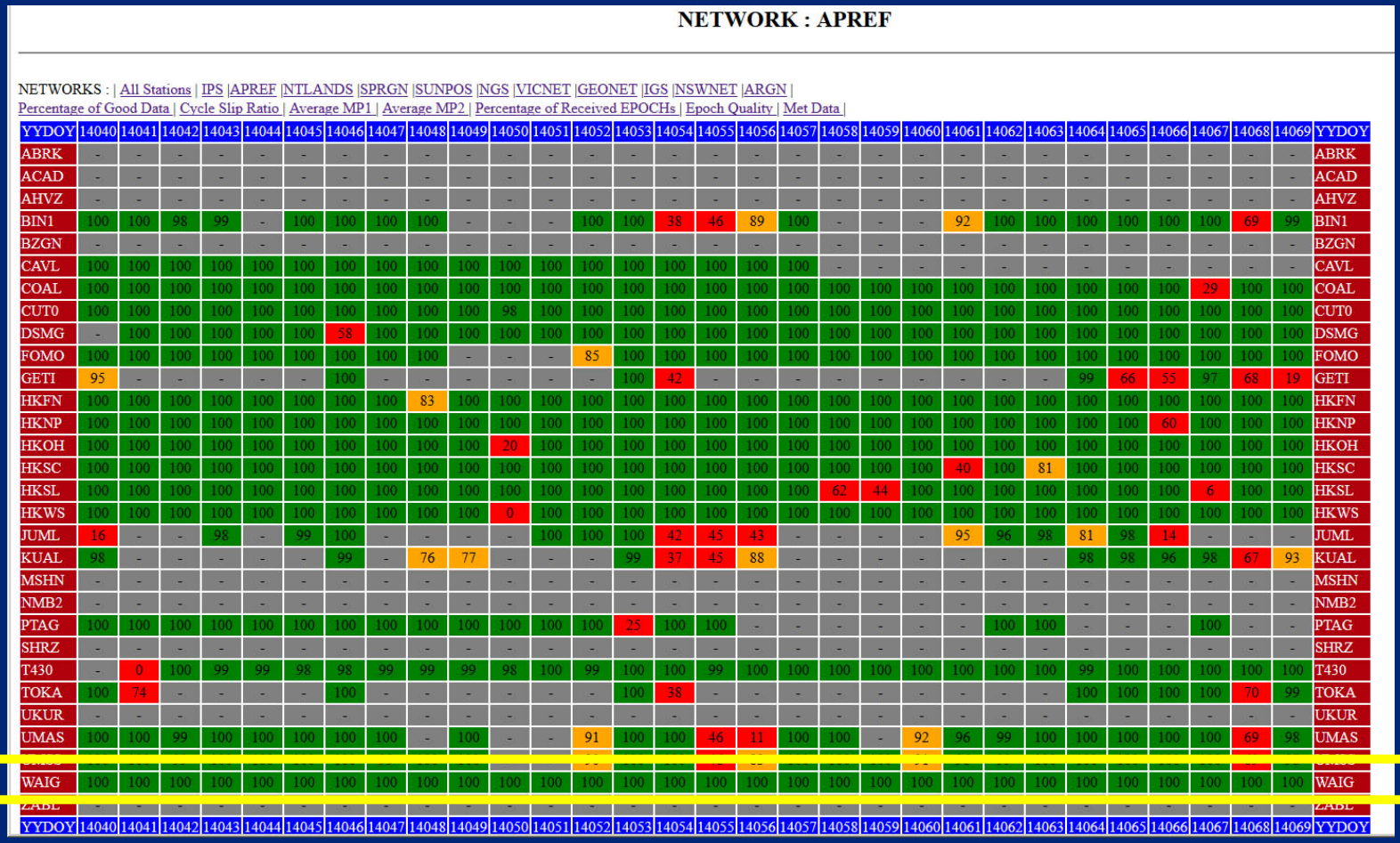

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ABRK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ABRK
ACAD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ACAD
AHVZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AHVZ
BIN1	100	100	98	99	-	100	100	100	100	-	-	-	100	100	38	46	89	100	-	-	-	92	100	100	100	100	100	100	69	99	BIN1
BZGN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	BZGN
CAVL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-	CAVL
COAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	29	100	100	COAL
CUT0	100	100	100	100	100	100	100	100	100	100	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	CUT0
DSMG	-	100	100	100	100	100	58	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	DSMG
FOMO	100	100	100	100	100	100	100	100	100	-	-	-	85	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	FOMO
GETI	95	-	-	-	-	-	100	-	-	-	-	-	-	100	42	-	-	-	-	-	-	-	-	-	99	66	55	97	68	19	GETI
HKFN	100	100	100	100	100	100	100	100	83	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	HKFN
HKNP	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	60	100	100	100	HKNP
HKOH	100	100	100	100	100	100	100	100	100	100	20	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	HKOH
HKSC	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	40	100	81	100	100	100	100	100	100	HKSC
HKSL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	62	44	100	100	100	100	100	100	100	6	100	100	HKSL
HKWS	100	100	100	100	100	100	100	100	100	100	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	HKWS
JUML	16	-	-	98	-	99	100	-	-	-	-	100	100	100	42	45	43	-	-	-	-	95	96	98	81	98	14	-	-	-	JUML
KUAL	98	-	-	-	-	-	99	-	76	77	-	-	-	99	37	45	88	-	-	-	-	-	-	-	98	98	96	98	67	93	KUAL
MSHN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MSHN
NMB2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NMB2
PTAG	100	100	100	100	100	100	100	100	100	100	100	100	100	25	100	100	-	-	-	-	-	-	100	100	-	-	-	100	-	-	PTAG
SHRZ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	SHRZ
T430	-	0	100	99	99	98	98	99	99	99	98	100	99	100	100	99	100	100	100	100	100	100	100	100	99	100	100	100	100	100	T430
TOKA	100	74	-	-	-	-	100	-	-	-	-	-	-	100	38	-	-	-	-	-	-	-	-	-	100	100	100	100	70	99	TOKA
UKUR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	UKUR
UMAS	100	100	99	100	100	100	100	100	-	100	-	-	91	100	100	46	11	100	100	-	92	96	99	100	100	100	100	100	69	98	UMAS
WAIG	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	WAIG
YYDOY	14040	14041	14042	14043	14044	14045	14046	14047	14048	14049	14050	14051	14052	14053	14054	14055	14056	14057	14058	14059	14060	14061	14062	14063	14064	14065	14066	14067	14068	14069	YYDOY

WAIG and PNG94

GNSS/GPS Base Station for Port Moresby and Central Province GNSS Surveys

PNG94 - Ellipsoidal Coordinates - 2014 Adjustment

Station Name	Latitude			Longitude			Ellipsoid Height	MSL (PNG08)
	Deg	Min	Sec	Deg	Min	Sec		
WAIG PSM 33362	-9	26	33.71310	147	10	53.00986	154.655	78.937

PNG94 PNGMG94 Grid Coordinates - 2014 Adjustment

Station Name	Zone	Easting	Northing	Ellipsoid Height	MSL (PNG08)	Positional Uncertainty 1σ		
						E	N	Ht
WAIG PSM 33362	55	519912.678	8956198.589	154.655	78.937	0.016	0.012	0.023
WAIG RM A	55	519880.499	8956172.884	141.131	65.419	0.016	0.012	0.023
WAIG RM B	55	519854.632	8956205.745	141.778	66.066	0.016	0.012	0.023

Contact – Geodetic Section at Eda Tano Haus or NMB Office for base station data in RINEX format.

Mission Accomplished