# Datum Transformations in PNG – EPSG Updates

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# Overview of Geodetic datums used in PNG

## AGD66 – Australian Geodetic Datum 1966

Used from 1960s (1:100,000 topographic mapping and still required by Oil and Gas Sector)

## WGS 72 and NWL-10D

Used by Doppler satellites (TRANSIT) in 1970s and 1980s. Especially for airport surveys

## PNG94 – Papua New Guinea Geodetic Datum 1994

Current gazetted datum from 1996

## ITRF (currently ITRF2008 and ITRF2014) – Global datum

## WGS 84 – GPS Reference System

# Difference between Datums

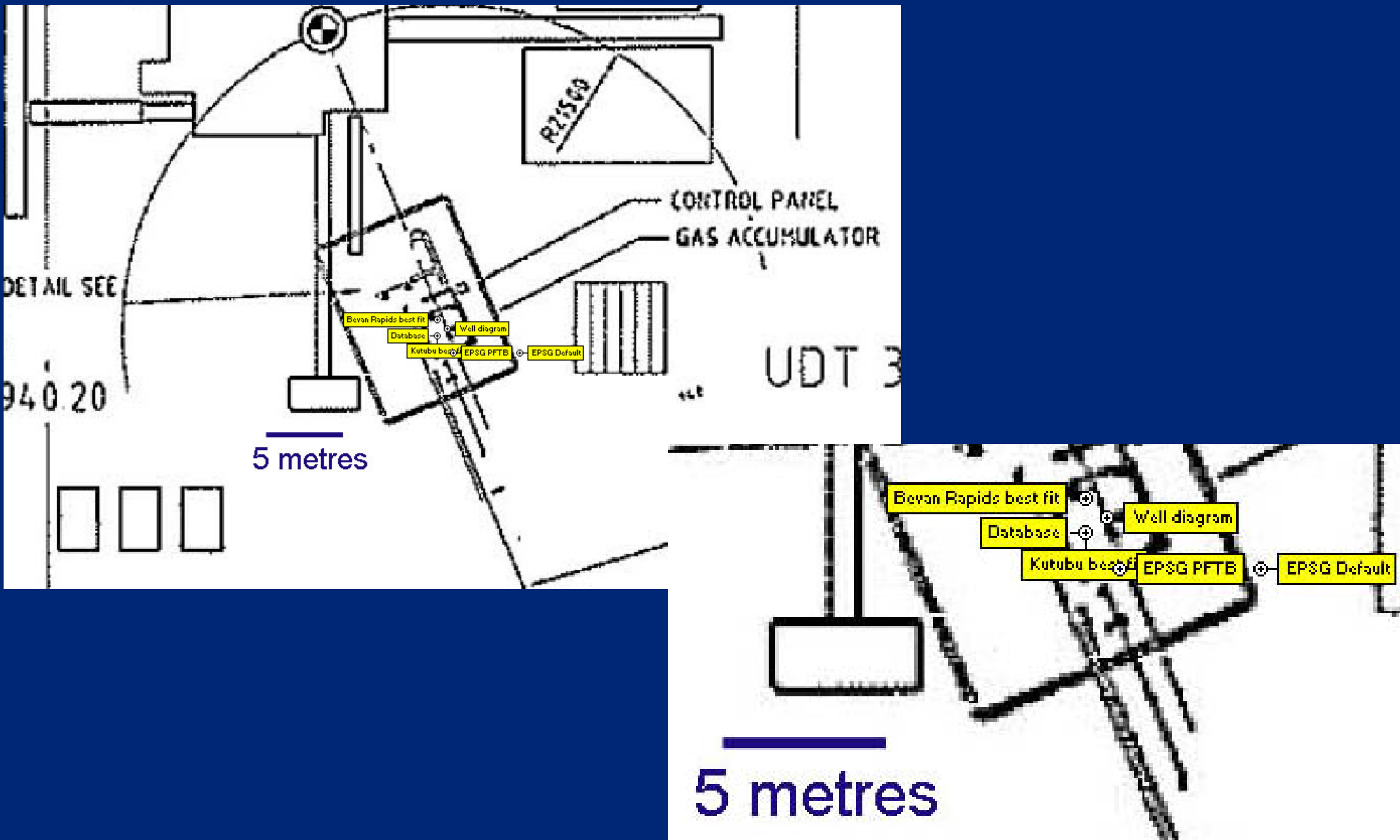
**Same point**

**(e.g. peg, PSM, corner)**

**DIFFERENT**

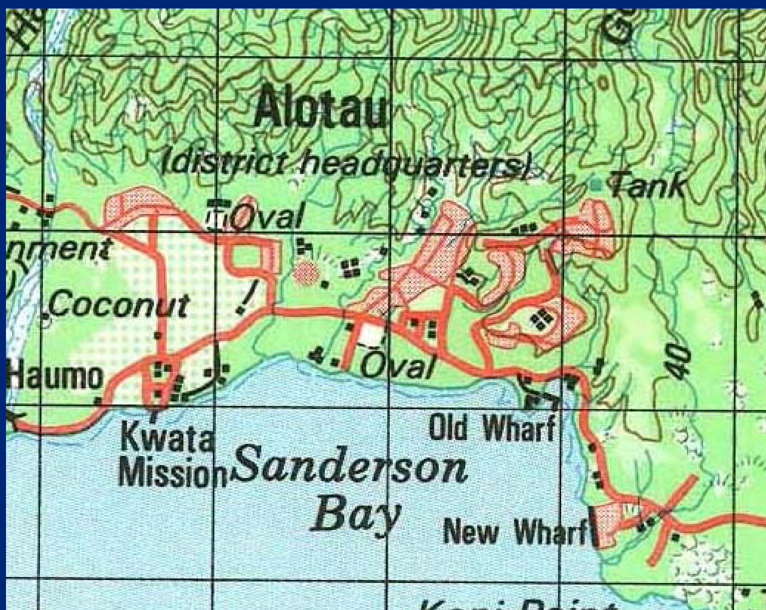
**COORDINATES**

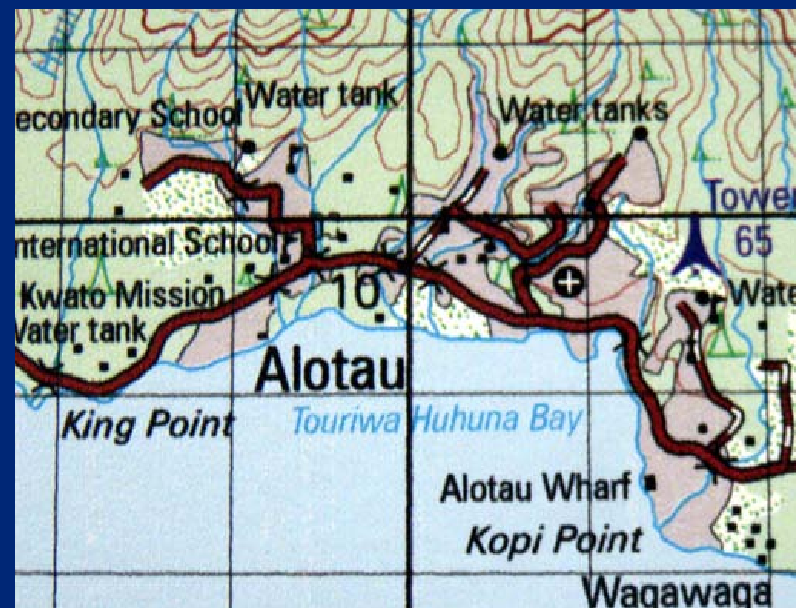
# AGD66 transformation parameter differences



# WSG84 PNG94 and AGD66 differences

# Comparison of AGD66 and WGS 84 topo maps



# Types of transformation – static datums

3 parameter – geocentric translation

7 parameter – geocentric translation, rotation and scale

10 parameter – Molodensky Badekas

Block shift (topocentric translation)

NTv2 distortion grid (grid of topocentric translations for interpolation)

Affine transformation (topocentric translation, rotation and scale)

# Developing AGD66 to PNG94 transformation parameters

2010 – Robert Rosa (then OSG geodetic section lead) compiled a spreadsheet of PNG geodetic control (mostly AGD66 and WGS72) from paper based records

2010 – 2014 – Richard Stanaway collated static GPS observations made on any AGD66 control stations in the database. Data processed in ITRF2008 at epoch of observation.

ITRF2008 to PNG94 conversion using time-series analysis or site velocity estimation.

Seven parameter transformation estimated using least-squares. Iterative process to isolate outliers and different AGD66 realisations and gross errors or typos.

Mainland PNG AGD66 is homogeneous at the 1 m level.

Island AGD66 substantially variable.

Tabubil and Kiunga (North Fly) is significantly different (8 m) – separate set.

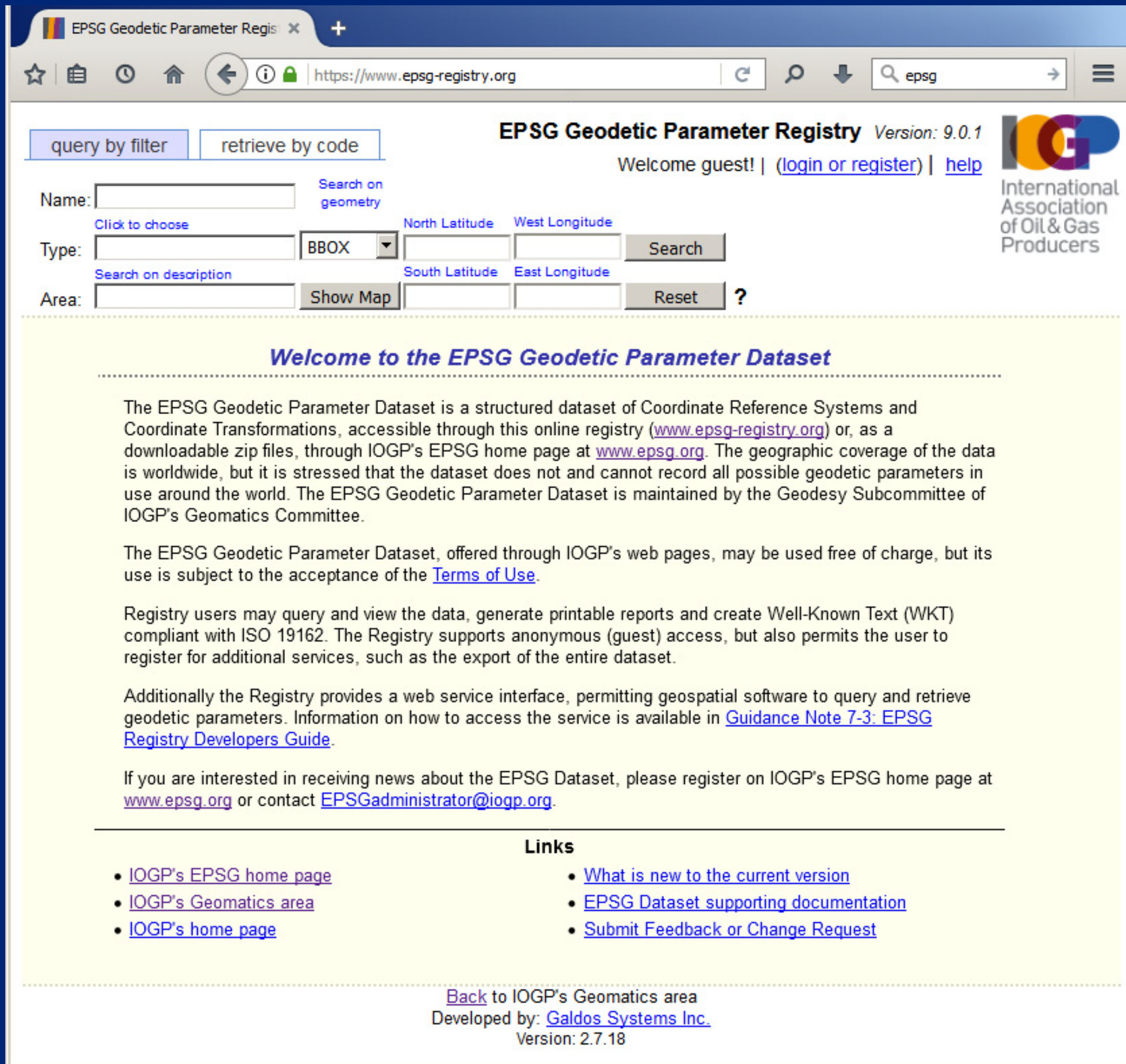
Also, PNG Oilfield PFTB have 1 m offset introduced in early 1990s. Mainland and PFTB parameters aligned to AA 070 Bevan Rapids.

# Submission to EPSG/IOGP

3 and 7 parameter transformations submitted to EPSG in October 2014 for review. Registry entry finalised in 2015.

GIS software updates (e.g. ESRI and QGIS) with transformations during 2015 and 2016.

# EPSG Registry



EPSG Geodetic Parameter Regis

https://www.epsg-registry.org

query by filter | retrieve by code

**EPSG Geodetic Parameter Registry** *Version: 9.0.1*

Welcome guest! | (login or register) | help

International Association of Oil & Gas Producers

Name: | Search on geometry

Click to choose

Type: | BBOX | North Latitude | West Longitude | Search

Search on description

Area: | Show Map | South Latitude | East Longitude | Reset | ?

## *Welcome to the EPSG Geodetic Parameter Dataset*

The EPSG Geodetic Parameter Dataset is a structured dataset of Coordinate Reference Systems and Coordinate Transformations, accessible through this online registry (www.epsg-registry.org) or, as a downloadable zip files, through IOGP's EPSG home page at www.epsg.org. The geographic coverage of the data is worldwide, but it is stressed that the dataset does not and cannot record all possible geodetic parameters in use around the world. The EPSG Geodetic Parameter Dataset is maintained by the Geodesy Subcommittee of IOGP's Geomatics Committee.

The EPSG Geodetic Parameter Dataset, offered through IOGP's web pages, may be used free of charge, but its use is subject to the acceptance of the Terms of Use.

Registry users may query and view the data, generate printable reports and create Well-Known Text (WKT) compliant with ISO 19162. The Registry supports anonymous (guest) access, but also permits the user to register for additional services, such as the export of the entire dataset.

Additionally the Registry provides a web service interface, permitting geospatial software to query and retrieve geodetic parameters. Information on how to access the service is available in Guidance Note 7-3: EPSG Registry Developers Guide.

If you are interested in receiving news about the EPSG Dataset, please register on IOGP's EPSG home page at www.epsg.org or contact EPSGadministrator@iogp.org.

**Links**

- IOGP's EPSG home page
- IOGP's Geomatics area
- IOGP's home page
- What is new to the current version
- EPSG Dataset supporting documentation
- Submit Feedback or Change Request

Back to IOGP's Geomatics area
Developed by: Galdos Systems Inc.
Version: 2.7.18

# EPSG Registry – PNG transformation search

EPSG Geodetic Parameter Registry *Version: 9.0.1*

Welcome guest! | (login or register) | help

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query by filter | retrieve by code

Name: png94

Type: Coordinate Transformatic | BBOX | North Latitude | West Longitude | Search

Area: | Show Map | South Latitude | East Longitude | Reset | ?

**Search Results (1 - 9 of 9 possible results)**

Report all results ? | WKT for all results ? | Entities per page: 10

<<first <prev | page 1 of 1 | next> last>>

| Report | Name | Code | Type | Status | Area Description | Remarks / Description | |
|---|---|---|---|---|---|---|---|
| ☐ | AGD66 to PNG94 (1) | EPSG::5662 | CoordinateTransformation | Valid (R) | Papua New Guinea - Papuan fold and thrust belt. | Derived at 25 stations in 2007. Replaced by AGD66 to PNG94 (4) (code 6939). | view |
| ☐ | AGD66 to PNG94 (2) | EPSG::6937 | CoordinateTransformation | Valid | Papua New Guinea - mainland onshore. | Derived in 2014 at 38 stations around the PNG mainland. Aligned to the Bevan Rapids Geodetic Origin AA 070 as required by the Papua New Guinea Oil and Gas Act 1998. | view |
| ☐ | AGD66 to PNG94 (3) | EPSG::6938 | CoordinateTransformation | Valid | Papua New Guinea - mainland onshore. | Derived in 2014 at 38 stations around the PNG mainland. See AGD66 to PNG94 (2) for a more accurate 7-parameter transformation. May be taken as an approximate transformation AGD66 to WGS 84 - see tfm c... | view |
| ☐ | AGD66 to PNG94 (4) | EPSG::6939 | CoordinateTransformation | Valid | Papua New Guinea - Papuan fold and thrust belt. | Derived in 2014 at 23 stations around the Kutubu oilfields. Aligned to the Bevan Rapids Geodetic Origin AA 070 as required by the Papua New Guinea Oil and Gas Act 1998. Replaces AGD66 to PNG94 (1) (tf... | view |
| ☐ | AGD66 to PNG94 (5) | EPSG::6940 | CoordinateTransformation | Valid | Papua New Guinea - Papuan fold and thrust belt. | Derived in 2014 at 23 stations around the Kutubu oilfields. See AGD66 to PNG94 (4) for a more accurate 7-parameter transformation. May be taken as an approximate transformation AGD66 to WGS 84 - see t... | view |
| ☐ | AGD66 to PNG94 (6) | EPSG::6941 | CoordinateTransformation | Valid | Papua New Guinea - North Fly area (between 5°04'S and 6°36'S and west of 141°32'E). | Derived in 2014 at 7 stations in Ningerum and Tabubil (North Fly District). | view |
| ☐ | AGD66 to PNG94 (7) | EPSG::6942 | CoordinateTransformation | Valid | Papua New Guinea - North Fly area (between 5°04'S and 6°36'S and west of 141°32'E). | Derived in 2014 at 7 stations in Ningerum and Tabubil (North Fly District). See AGD66 to PNG94 (6) for a more accurate 7-parameter transformation. May be taken as an approximate transformation AGD66 t... | view |
| ☐ | PNG94 to PNG08 height (1) | EPSG::7655 | CoordinateTransformation | Valid | Papua New Guinea - between 0°N and 12°S and 140°E and 158°E - onshore and offshore. | | view |
| ☐ | PNG94 to WGS 84 (1) | EPSG::5553 | CoordinateTransformation | Valid | Papua New Guinea - onshore and offshore. Includes Bismark archipelago, Louisade archipelago, Admiralty Islands, d'Entrecasteaux Islands, northern Solomon Islands, Trobriand Islands, New Britain, New I... | Exact in 1994 but due to significant and variable tectonic activity in PNG, in 2011 PNG94 and WGS 84 differ generally by 2m but in areas of significant tectonic activity differences can exceed 9m. | view |

# AGD66 to PNG94 and WGS84 parameters in PNG

**AGD66 to PNG94 transformation parameters**

| Area of Use | EPSG Code | Accuracy (m) | Tx (m) | Ty (m) | Tz (m) | Rx (sec) | Ry (sec) | Rz (sec) | Sc (ppm) |
|---|---|---|---|---|---|---|---|---|---|
| **Medium accuracy - 7 parameter Position Vector convention** | | | | | | | | | |
| PNG Mainland | 6937 | 1.0 | -0.41 | -2.37 | 2.00 | 3.592 | 3.698 | 3.989 | 8.843 |
| PFTB | 6939 | 1.0 | -131.876 | -54.554 | 453.346 | -5.2155 | -8.2042 | 0.0900 | 5.02 |
| North Fly | 6941 | 0.5 | 45.928 | -177.212 | 336.867 | -4.6039 | -3.0921 | 0.5729 | 36.796 |
| **Medium accuracy - 7 parameter Coordinate Frame rotation convention** | | | | | | | | | |
| PNG Mainland | 6937 | 1.0 | -0.41 | -2.37 | 2.00 | -3.592 | -3.698 | -3.989 | 8.843 |
| PFTB | 6939 | 1.0 | -131.876 | -54.554 | 453.346 | 5.2155 | 8.2042 | -0.0900 | 5.02 |
| North Fly | 6941 | 0.5 | 45.928 | -177.212 | 336.867 | 4.6039 | 3.0921 | -0.5729 | 36.796 |
| **Lower accuracy - 3 parameter** | | | | | | | | | |
| PNG Mainland | 6938 | 4.0 | -129 | -58 | 152 | | | | |
| PFTB | 6940 | 2.0 | -131.3 | -55.3 | 151.8 | | | | |
| North Fly | 6942 | 2.5 | -137.4 | -58.9 | 150.4 | | | | |

**AGD66 to WGS84 transformation parameters (3 parameter) in PNG**

| Area of Use | EPSG Code | Accuracy (m) | Tx (m) | Ty (m) | Tz (m) |
|---|---|---|---|---|---|
| PNG Mainland | 6943 | 5.0 | -129 | -58 | 152 |
| PFTB | 6944 | 4.0 | -131.3 | -55.3 | 151.8 |
| North Fly | 6945 | 4.0 | -137.4 | -58.9 | 150.4 |

# GIS and Survey Software parameters

**Most GIS software vendors import EPSG registry updates into software updates.**

**Ensure software is up-to-date**

**ESRI   MapInfo   QGIS**

# Transformation Pitfalls

Use the right transformation parameters for the area (recall 8 m differences earlier)

Parameters are not perfect so there will be differences with existing control coordinates

Be consistent with the use of parameters. Avoid changing parameters mid-project

Extreme care using WGS84 as a hub datum for transformations.

If manually configuring transformation parameters take care with Position Vector (PV) and Coordinate Frame (CF) convention for rotations.  Strongly recommend validating configuration with test data.

# Tinani and thank you