

## **Review of the Gold Coast Airport Environmental Monitoring Units (EMUs)**

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Prepared by: **Chief Acoustics Engineer**

Issue Date: **Sept 2012**

Approved by:

**Aircraft Noise Information Manager**

Authority:

**Manager Environmental Services**

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## Version Control

Version Number	Detail	Prepared by	Date
1	Draft for Review	BB & ML	Sept 2012
2	Final – updated with CACG comments	ML	Feb 2015

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# 1 Executive Summary

A review of Gold Coast Environmental Monitoring Unit (EMU) locations has been performed in accordance with Airservices Australia's legislated obligation referred to in the Terms of Reference Document (See Appendix A).

The study has established the following:

- The number of correlated noise events for jets compared to total jet flights is high at the Gold Coast. This indicates that the system is capturing current jet air traffic well. Non jet operations have a lower correlation number due to the variability of flight paths and lower noise levels.
- Sensitive areas around the Gold Coast have been identified from complainant data and flight paths. The highest number of complaints within the assessed period was from Fingal Head and areas directly south from the airport.
- Each permanent EMU is aligned with the main runway and therefore positioned well to accommodate Standard Instrument Departures (SIDs) and Standard Arrival Routes (STARs).
- Permanent EMU 2 located at Tweed Heads West is currently non-operational. This monitor covered an essential area to the south of the airport and is recommended to be re-instated in a similar location.
- The remaining permanent sites, EMUs 1 and 3 are recommended to remain as currently positioned.
- The short term monitoring program will be used to initially assess noise levels at the following locations:
  - Tweed Heads to find a suitable replacement location for permanent EMU2.
  - Fingal Heads to the south east of the airport to capture jet departures that are vectored over the area.
  - Kingscliff to the south of the airport.
  - Palm Beach to the north of the airport.
- A noise monitoring program has been recommended to help assess the impact of RNP operations in the future. Specific locations for noise monitors are to be determined once RNP tracks are fully established.
- The NFPMS is in general compliance with ISO20906:2009, with the following exceptions:
  - The measurement of wind conditions and flagging of potential wind induced noise events above 10 m/s is not performed.
  - An estimation of uncertainty within the noise measurements for EMUs with non-ideal positions is not in place.
- The background noise levels at EMU 1 and 3 have been assessed. EMU 1 (Tugun) has some correlated aircraft noise events that are within 15 dB of the average background levels. However the average aircraft maximum noise levels at Tugun are greater than 15 dB above the background enabling adequate identification of aircraft movements.
- The EMU configuration in terms of threshold settings, correlation zones and missed noise events has been determined within the Service Provider's Noise Verification Report. No cause to adjust these settings has been found.
- Recommendations have been given to integrate weather stations onto permanent and portable EMUs to enable compliance with ISO20906:2009.

## 2 Context

Airservices Australia has a legislated obligation, via the *Air Services Act (1995)*, to regard the safety of air navigation as its most important consideration. Subject to that requirement it also has obligations to, as far as practicable; protect the environment from the impact of the operation and use of aircraft. Further, a Ministerial Direction made under this Act requires Airservices to maintain and operate a Noise and Flight Path Monitoring System (NFPMS) at major Australian airports. At present this system operates around Perth, Adelaide, Melbourne/Essendon, Canberra, Sydney, Gold Coast, Brisbane and Cairns airports.

The NFPMS comprises a number of components, including Environmental Monitoring Units (EMUs) that collect noise data. Airservices Australia periodically conducts a review of the location of the EMUs. This is a key element of the quality management of the NFPMS.

## 3 Purpose

The purpose of this review is to assess the performance of the EMUs at Gold Coast Airport against Airservices Australia's environmental and business requirements for the management of aircraft noise. In performing this function the placement and individual configuration of each of the EMUs needs to be optimised for the measurement of the impacts of aircraft operations on the local community from operations at Gold Coast Airport. This review will assess the location of the current EMUs and make recommendations about the future use of the EMUs.

Note that the term NMT (Noise Monitoring Terminal) is sometimes used in place of EMU (Environmental Measurement Unit) within the images of this report. Both terms have the same meaning and refer to the physical system hardware.

## 4 Scope of Review

This review addresses:

- 1) The location of each current EMU,
  - a) With respect to complainants.
  - b) With respect to sensitive regions.
  - c) With respect to flight paths.
  - d) With respect to communications coverage and reliability.
  - e) With respect to ISO 20906:2009.
  - f) Against local environmental conditions.
  - g) For security and access for maintenance.
- 2) Licensing issues,
- 3) Configuration of each EMU,
  - a) For noise event detection parameters; threshold, pre-trigger, duration.
  - b) For calibration and preventative maintenance.
  - c) Correlation zone.
  - d) For false positives.
  - e) For missed noise events.

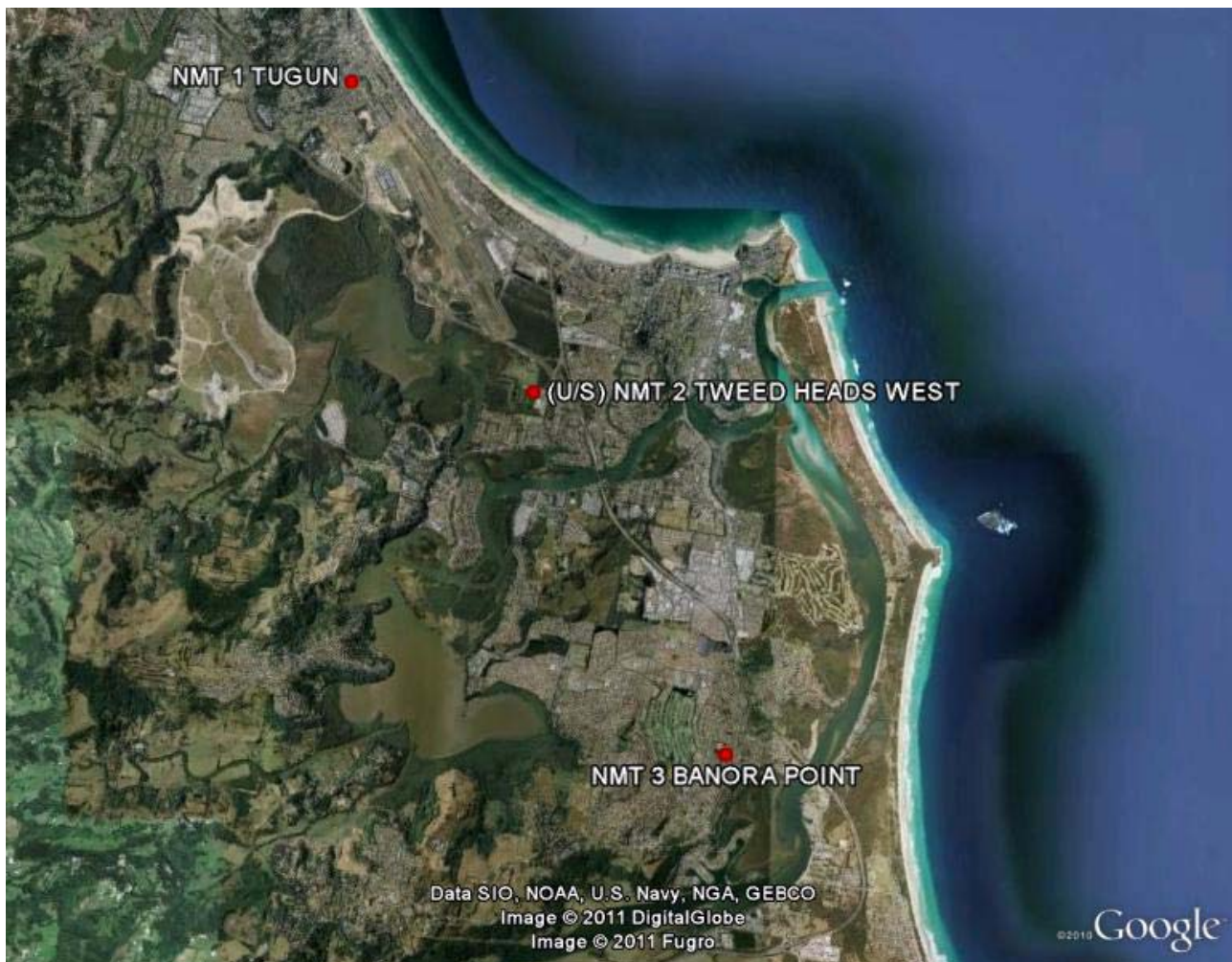
In addition to the Terms of Reference, this review also assesses:

- 4) The location of each EMU with respect to the population density.

## 5 Gold Coast EMU Background

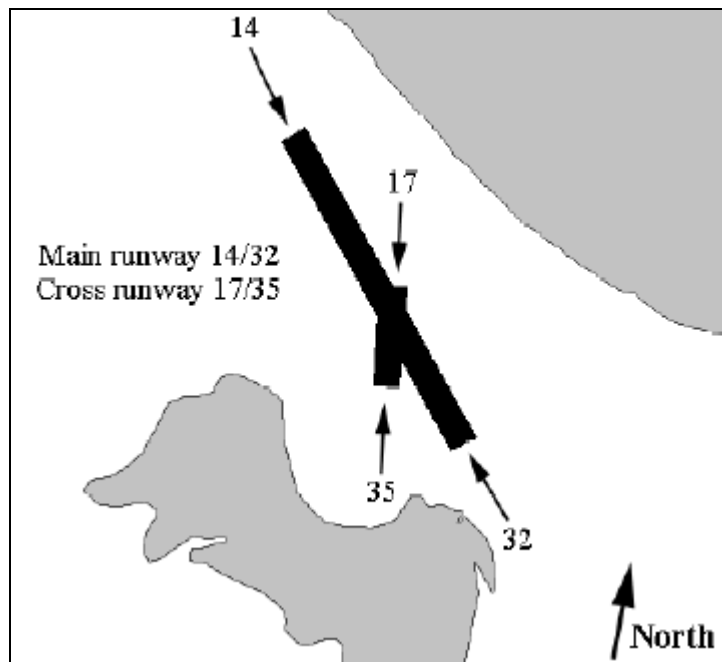
The NFPMS has been installed and operating around Gold Coast Airport since November 1995. There are currently two permanently installed EMUs located to the north and south of the airport. A third EMU located directly south of the airport (EMU 2) was decommissioned in Q1 2009 as described below.

**Figure 1 Gold Coast EMU Locations**



EMU 2 located at the Wastewater Treatment Works in Tweed Heads West was decommissioned during Q1 2009, due to site works. EMU2 could not be reinstated at its original location due to site works by the owner during. As result, a new location for the monitor is required. The short term monitoring program has been proposed to identify suitable replacement locations for EMU 2. The images throughout this report include the previous location of EMU 2.

**Figure 2 Gold Coast Runways**



## 5.1 Current EMU Locations

The exact location of each EMU is given in the table below with details of the runway to which the EMU is aligned.

**Table 1 Permanent EMU Locations**

	EMU 1 (Tugun)	EMU 2 (Tweed Heads West) (Decommissioned)	EMU 3 (Banora Point)
Longitude	153°29'35.48"E	153°31'4.94"E	153°32'38.69"E
Latitude	28°8'48.30"S	28°10'55.96"S	28°13'23.05"S
Altitude (m) ASL	5	2	51
Main Runways aligned with	14 / 32	14 / 32	14 / 32
Distance to Runway end (DL)	1.31 km	0.82 km	6.02 km
Distance to Runway centerline (DS)	0.11 km	0.09 km	0.09 km
Current Noise Capture Threshold radius (km)	1.5km	2.0km	2.5km

## 5.2 History of EMU Locations

Permanent EMU locations were chosen based on their close proximity (within 10 km) from the airport and location directly under the flight paths at the time. Noise data is available within quarterly NFPMS reports published on the Airservices website.

## 6 Overall Correlated Noise Events and NFPMS Performance

The NFPMS relies on the capture and correlation of aircraft noise, therefore one measure to determine the effectiveness of the EMU system as a whole is to compare the number of flights that do not cause a correlated noise event (CNE) with the total number of movements. This provides an indication of how well the system captures and correlates aircraft noise as a whole and how many movements were potentially missed.

A non event may be caused by:

- a) Aircraft noise levels being too low at the EMU due to aircraft type,
- b) Large distances between the aircraft and the nearest EMU,
- c) Incorrect threshold settings of the EMU, or
- d) Meteorological effects.

High background noise levels have the reverse effect by causing a CNE that may be corrupted by extraneous (non-aircraft) noise.

The following tables present a summary of flights without correlated noise events compared with the total movements for the quarter for Gold Coast airport.

**Table 2 Arrivals – non-correlated / total movements**

Period	Q3 2010	Q4 2010	Q1 2011	Q2 2011
Jets	48 / 4960 (1%)	620 / 5088 (12%)	37 / 5075 (1%)	44 / 4604 (1%)
Non – Jets	956 / 1721 (56%)	709 / 1339 (53%)	649 / 1305 (50%)	534 / 1270 (42%)

**Table 3 Departures - non-correlated / total movements**

Period	Q3 2010	Q4 2010	Q1 2011	Q2 2011
Jets	248 / 4967 (5%)	822 / 5083 (16%)	339 / 5075 (7%)	373 / 4602 (8%)
Non – Jets	1093 / 1691 (65%)	911 / 1309 (70%)	969 / 1296 (75%)	1003 / 1265 (79%)

Note that Helicopters and “unknowns” are excluded from the above table. Unknowns are usually aircraft that do not have a flight plan recorded in the air traffic control system and are mainly smaller propeller driven General Aviation aircraft.

The above table indicates that jet movements have a low level of non-correlated movements and therefore the NFPMS is capturing most jet movements. EMUs are closely aligned with the main runway where jet movements occur. During the study period, the cross runway was used less than 1% of the time of all movements.

For non-jets, higher percentages of non-correlated movements occur. At a given distance, non-jet aircraft produce noise levels that are lower than jets and may not meet the EMU threshold settings.



## 7 Complaints Analysis

The following sections analyse complaints for Gold Coast Airport and show where the EMUs are positioned in relation to complainants. The data is gathered from 1 July 2010 to 30 June 2011.

**Table 4 Total Number of Complaints and Complainants (July 2010 to June 2011)**

Airport	Complainants	Complaints	Comments	Enquiries
Gold Coast	482	30,076	62	58

### 7.1 Complainant Density

To determine the community impact from aircraft noise, the number of complainants has been analysed. The figure below presents a graphic where suburbs are highlighted if they have complainant numbers of 1 or more.

**Figure 3 Gold Coast Airport Complainants July 2010 – June 2011**

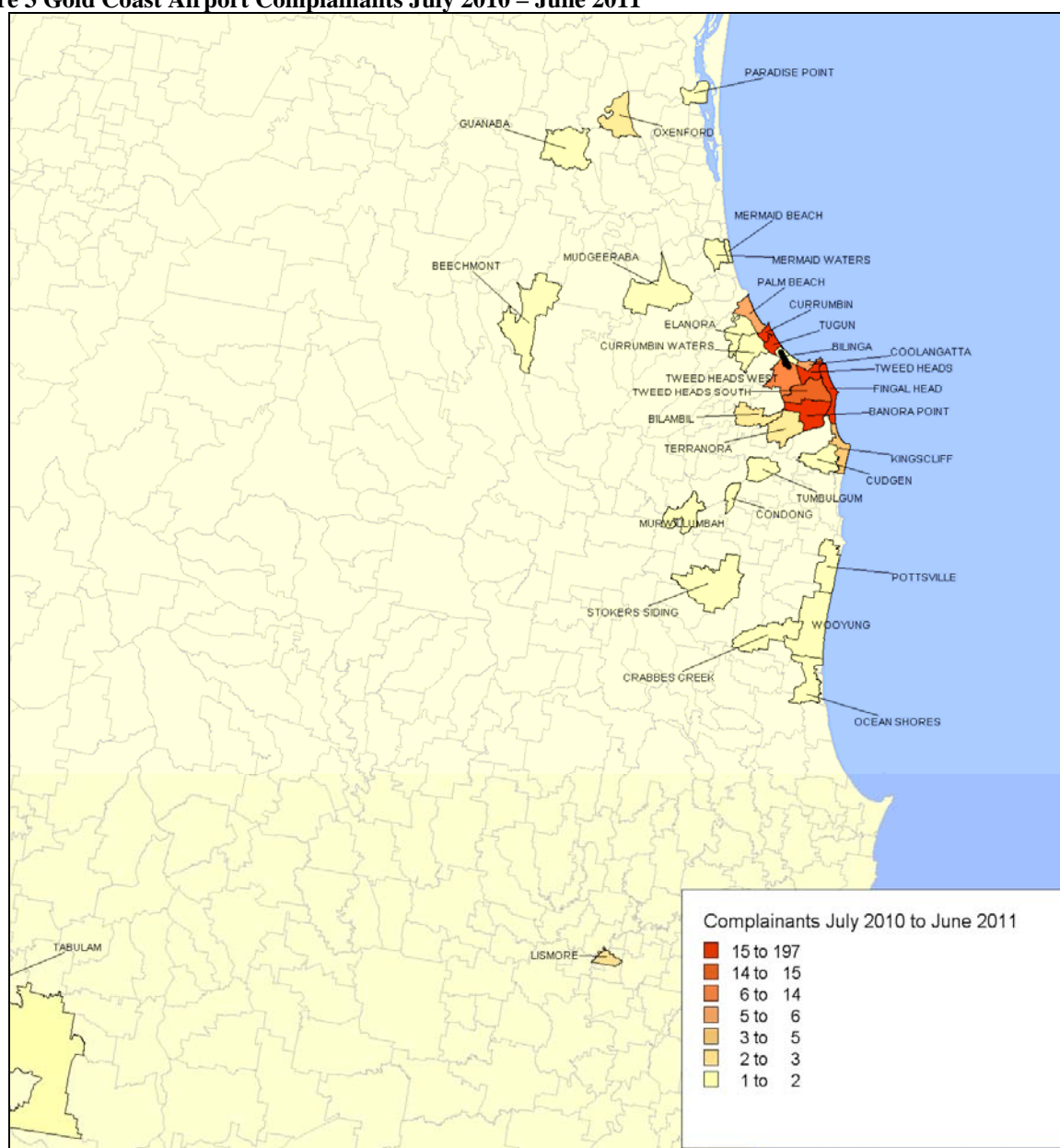
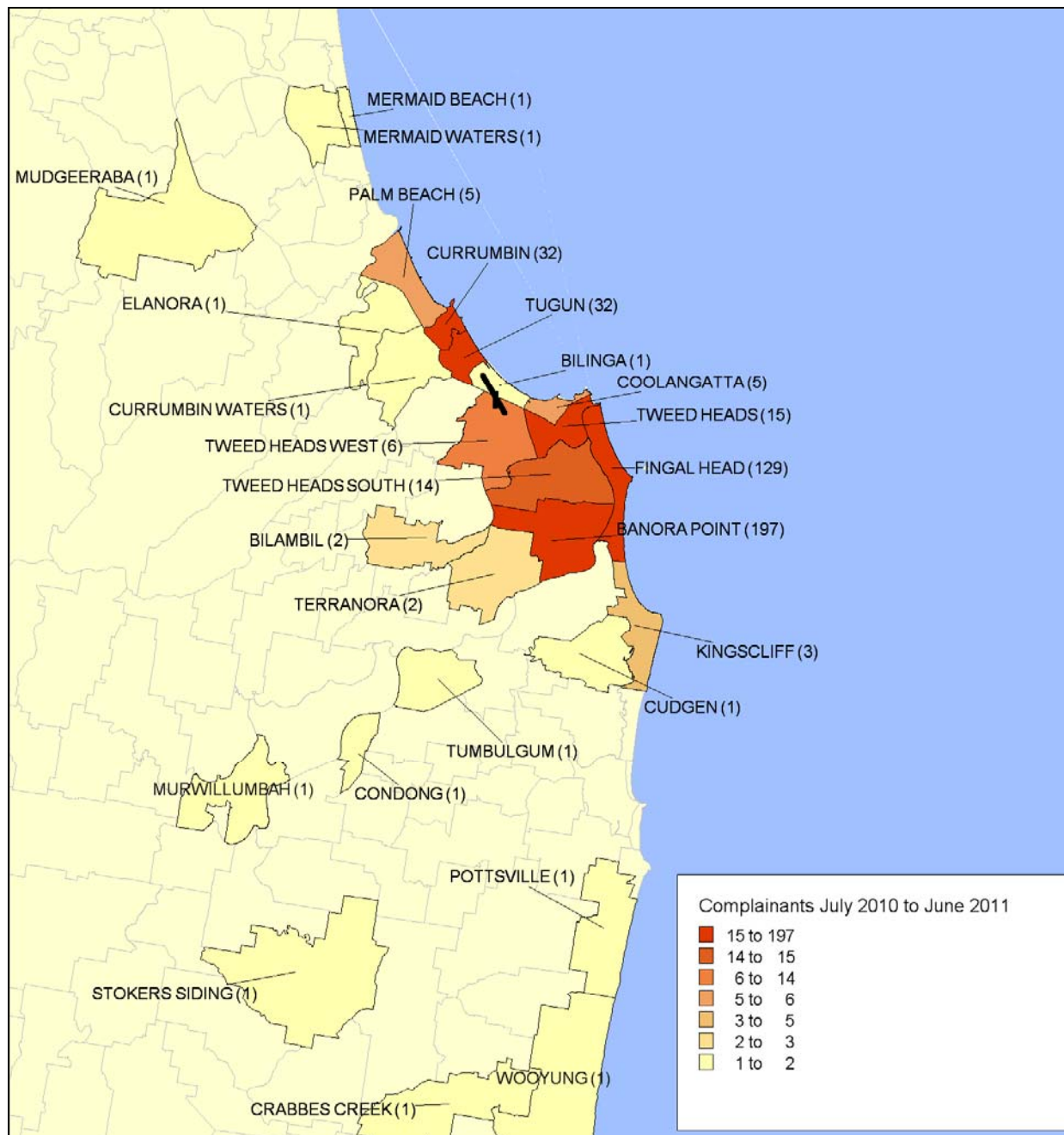


Figure 3 shows suburbs with relatively high numbers of complainants relating to Gold Coast Airport operations. Figure 4 below focuses on the suburbs with the highest number of complainants which are Banora Point, Fingal Head, Currumbin, Tugun and Tweed Heads. The numbers of complainants for these suburbs are 197, 129, 32, 32 and 15, respectively.

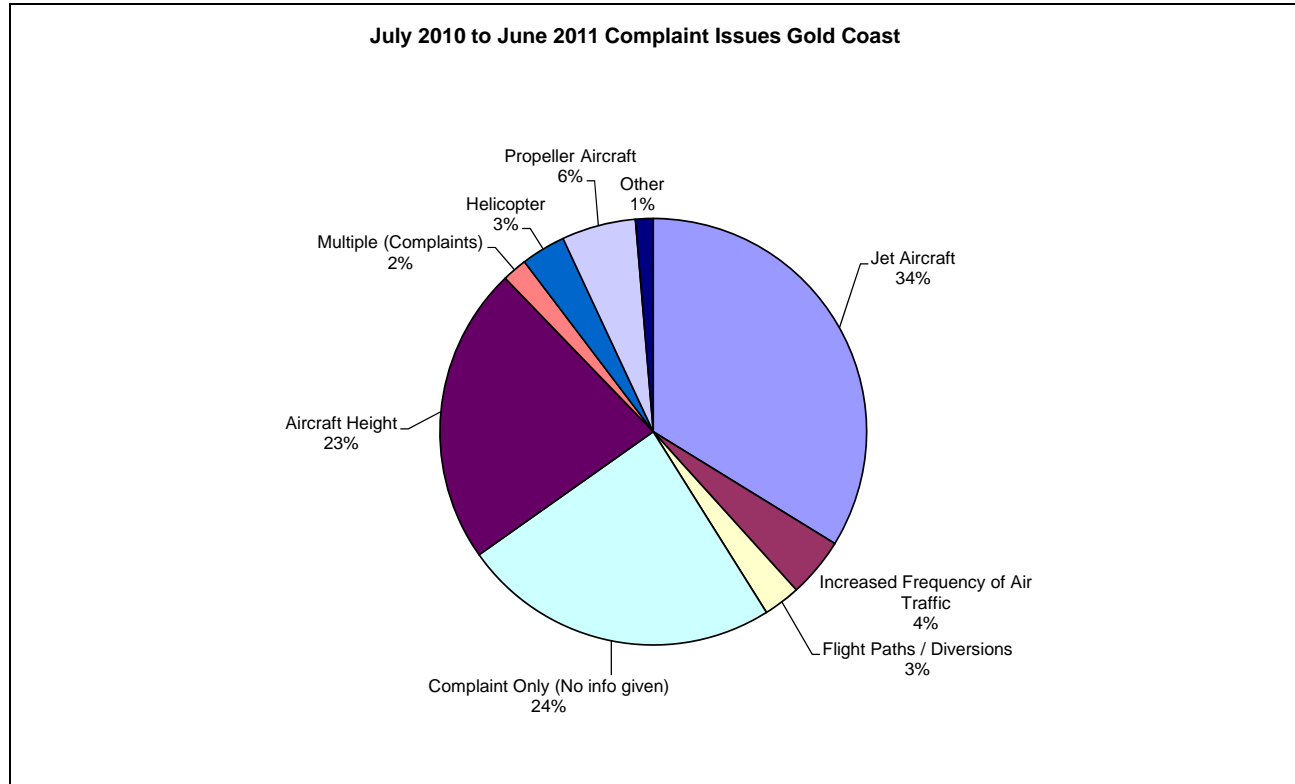
**Figure 4 Close-up of Gold Coast Airport Complainants July 2010 – June 2011**



## 7.2 Key Issues of Complaints

Each complaint can be related to a number of issues. The table below presents the complaint issues for complaints relating to Gold Coast airport, gathered over July 2010 to June 2011. The key issues were related to jet aircraft, aircraft height and complaints where specific information was not given.

**Table 5 Gold Coast Airport Complaint Subjects July 2010 – June 2011**



The above figure highlights the main issues of complaints associated with Gold Coast airport. The chart shows no specific attention to any issue that can be easily related to EMU placement. The category Multiple is used when a single complaint relates to a number of aircraft operations. The category Other includes complaints related to issues such as circuit training, curfew, health issues, odour, positive comments, property enquiry, runway selection, variable RWY 14 departure heading trial and Webtrak.

### 7.3 Complainants with Respect to Flight Paths

Complainants with respect to flight paths have been assessed in the following section. The figures below overlay complainant data with jet movements from a typical single week, aligned with the standard flight routes for arrivals and departures.

**Figure 5 Gold Coast Airport Complainants with Respect to Jet Departures**

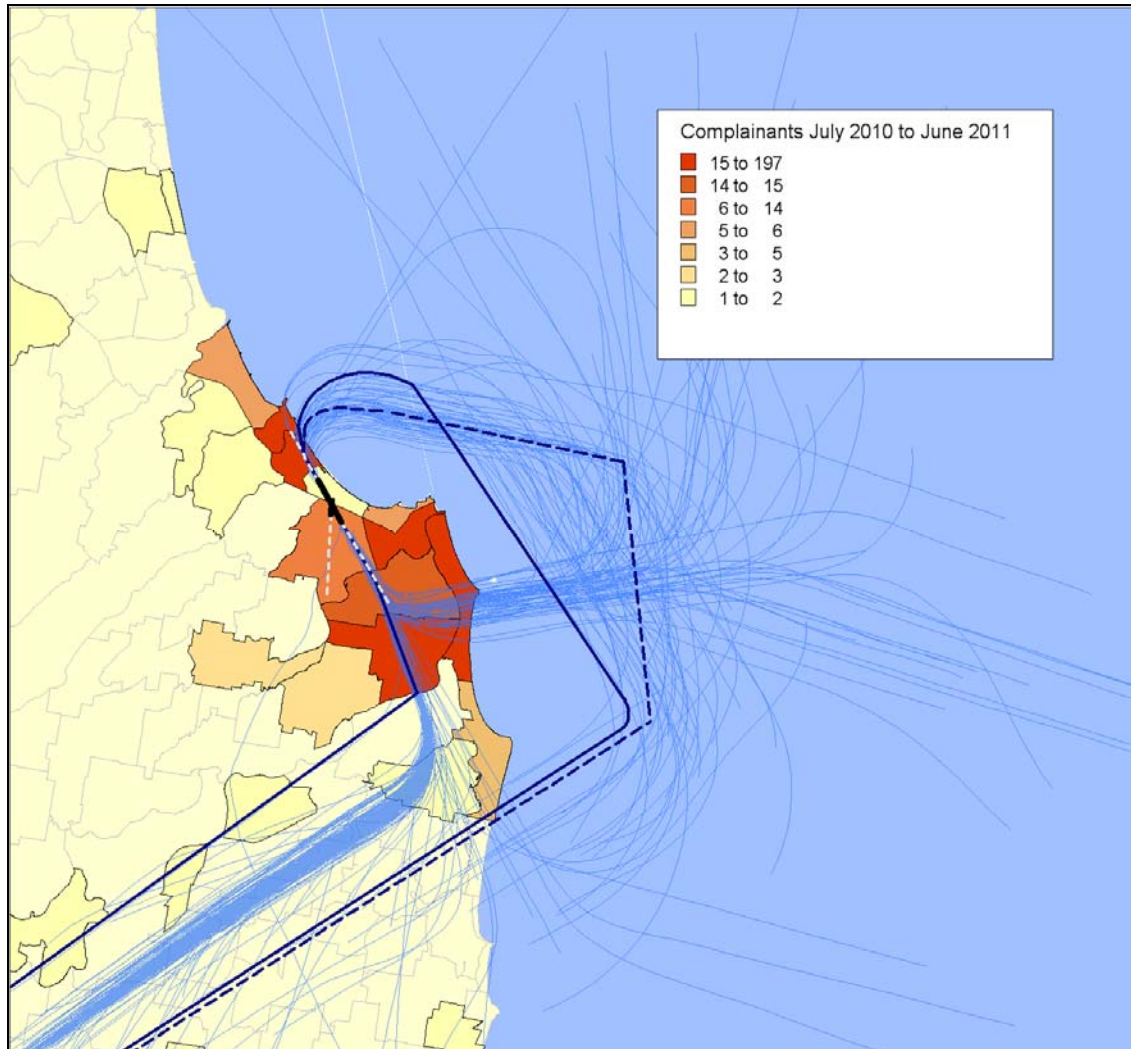


Figure 5 shows how actual flight paths of aircraft correlate with Standard Instrument Departures (in bold line above) during a one week period. The period selected for the jet departures above is 6 June 2011 to 13 June 2011. The bold lines are indicative only and are generally produced by connecting waypoints. The aircraft tracks shown above represent the actual flight path of the aircraft, and therefore turn smoothly according to the aircraft capabilities.

Currently, Gold Coast Airport has three Standard Instrument Departures (SIDs). The first SID is the Gold Coast Three Departure for Runways 14, 17 & 32. Aircraft may turn to their assigned heading after reaching 600ft for Runway 14, 1000ft for Runway 17 and 600ft for Runway 32. As the turning points for aircraft may differ and do not have a defined waypoint, the SID has been represented in the figure with white dashed lines to show the direction aircraft travel. Aircraft over Fingal Head to the south east use this SID.

The second SID which is Micks Two (Jet), has turning points dependant on height also. Therefore, it is represented with blue dashed lines and shows the approximate track flown by aircraft. This track is to the north off runway 32 and involves an initial heading of 319° and



then 334° until 700ft. After reaching this height, aircraft turn and continue on a bearing of 100° and then continue tracking to defined waypoints.

The third SID, Runway 14/32 South has defined waypoints for the whole track, and is shown in Figure 7.

**Figure 6 Gold Coast Airport Complainants with Respect to Jet Arrivals**

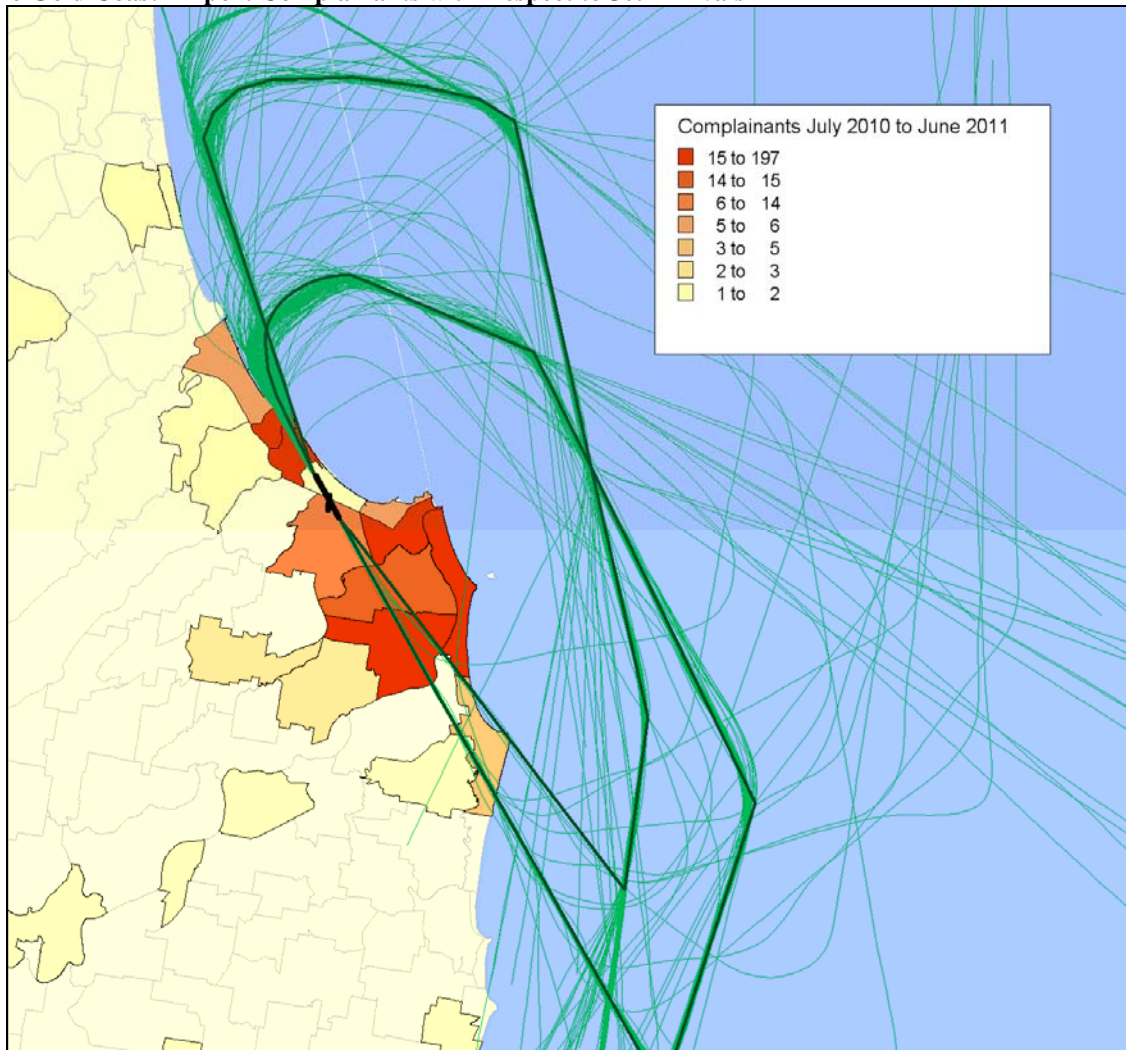


Figure 6 shows the Standard Arrival Routes (STARs) for Gold Coast airport. There is a high concentration of flight traffic north-west of the airport around the Tugun monitor. The aircraft generally follow the STARs, however some deviations can be seen in the image above.

## 7.4 Complainants in Relation to EMU Locations

When reviewing the thematic maps provided above of complainant data, the following observations can be made:

- There is some deviation between actual aircraft flight paths and the standard operating procedures. This is mainly evident on aircraft turns, which is expected due to navigational tolerances of different aircraft types.
- Departures to the south east over the Fingal Head area show some spread due to aircraft turning at an altitude.
- Residential areas that would benefit from portable or short term noise monitoring and that have not previously been monitored include:
  - South east of Gold Coast Airport at Fingal Head and south at Kingscliff.
  - North of the airport at Palm Beach (further north of Tugun).

Noise monitoring in these locations would help to establish aircraft noise levels within these areas.

## 7.5 Population within Capture Threshold

The population within the capture zone of each EMU is assessed below to help determine how useful EMU locations are in relation to community coverage.

The population around each EMU has been calculated using available 2006 census data from the Australian Bureau of Statistics (ABS). The current settings of each EMU have been used to determine the population within each capture zone. The capture zones are highlighted below.

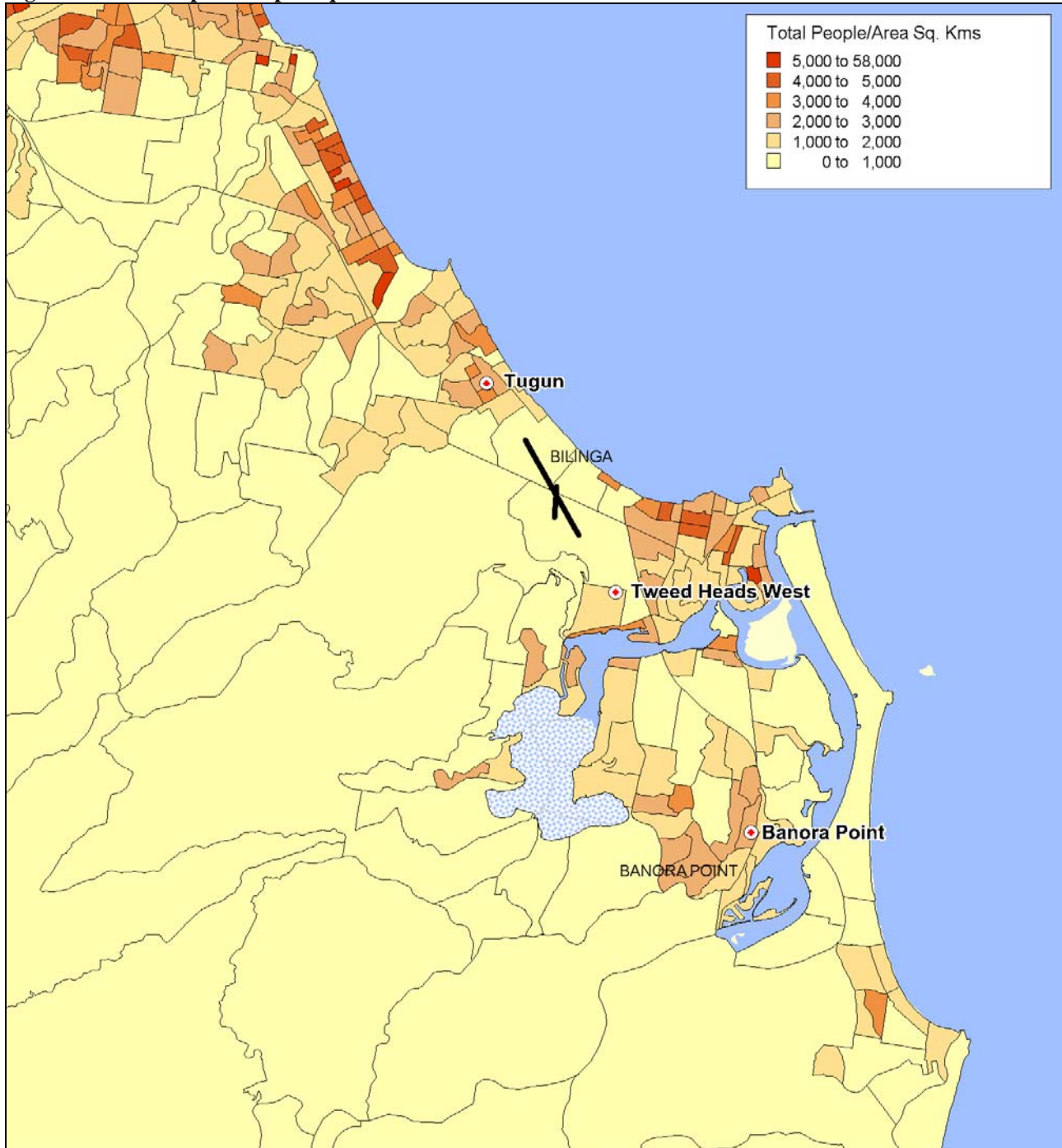
**Note:** Population data within this report is based on 2006 census data. This was the most up to date data available at the time of the analysis. The latest census data from 2011 was not available when the analysis was undertaken.

**Figure 7 Population Covered by Permanent EMUs**



The highest population coverage is from EMU 3 at Banora Point followed by EMU 2 at Tweed Heads West. Note that EMU 2 is currently not in operation. To determine the overall population density for Gold Coast, a thematic map has been created and shown below for population per square km.

**Figure 8 Overall Population per Square Km**



The figure above is used to display the heavily populated areas of the Gold Coast. It shows the populated areas along the coast. Some high density hot spots exist near the Tweed Heads West EMU and above the Tugun EMU to the north.



## 8 Analysis of Sensitive Areas

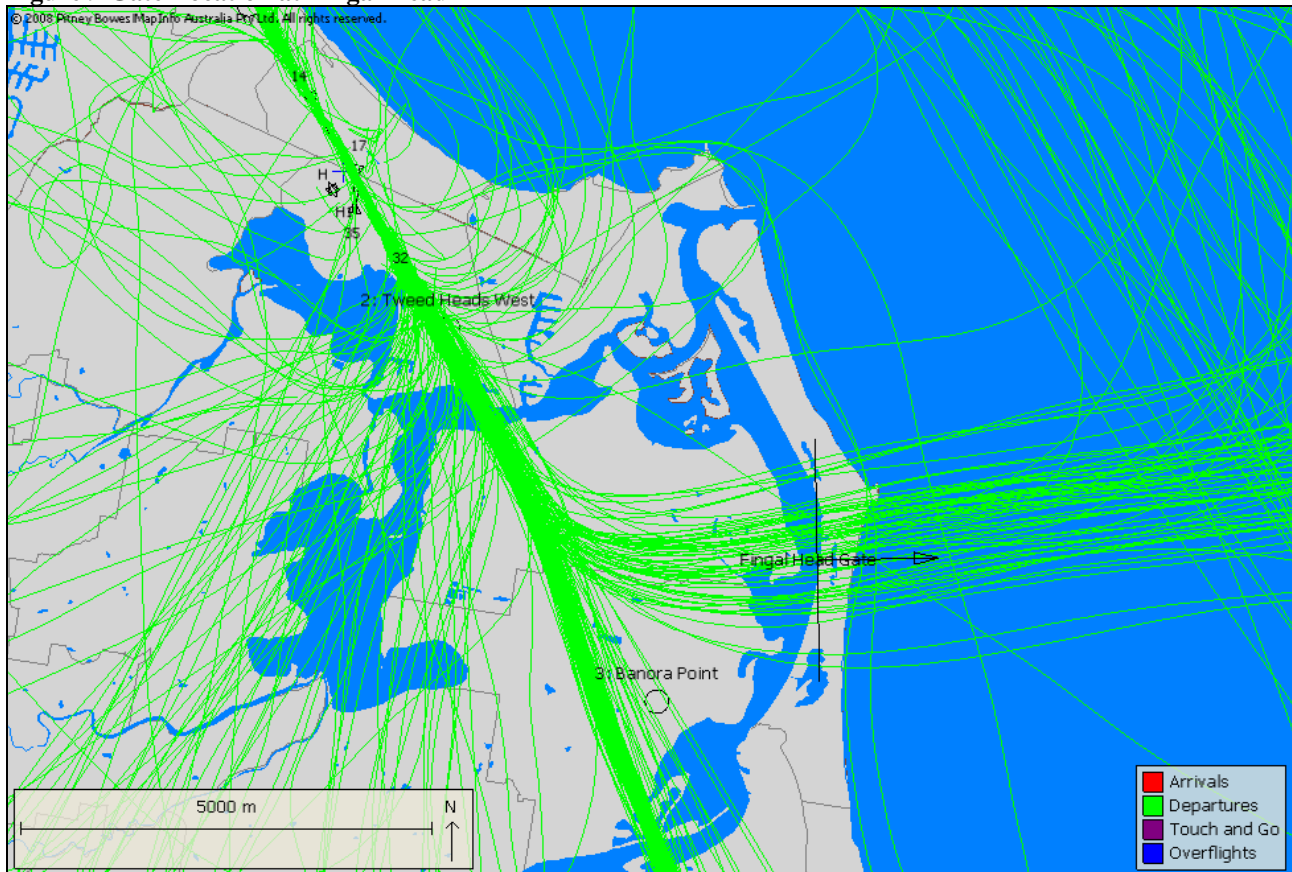
The following section analyses the Fingal Head area in detail. Fingal Head has been shown to have a number of complaints and complainants. Other sensitive areas exist, however Fingal Head has been analysed in detail because of its particular sensitivity.

### 8.1 Fingal Head

High levels of complaints have been received from the suburb of Fingal Head in NSW which is located south-east of Gold Coast Airport. According to 2006 Census data, this suburb has a population of 575 people. This suburb has 129 complainants (22% of Fingal Head population) from July 2010 to June 2011.

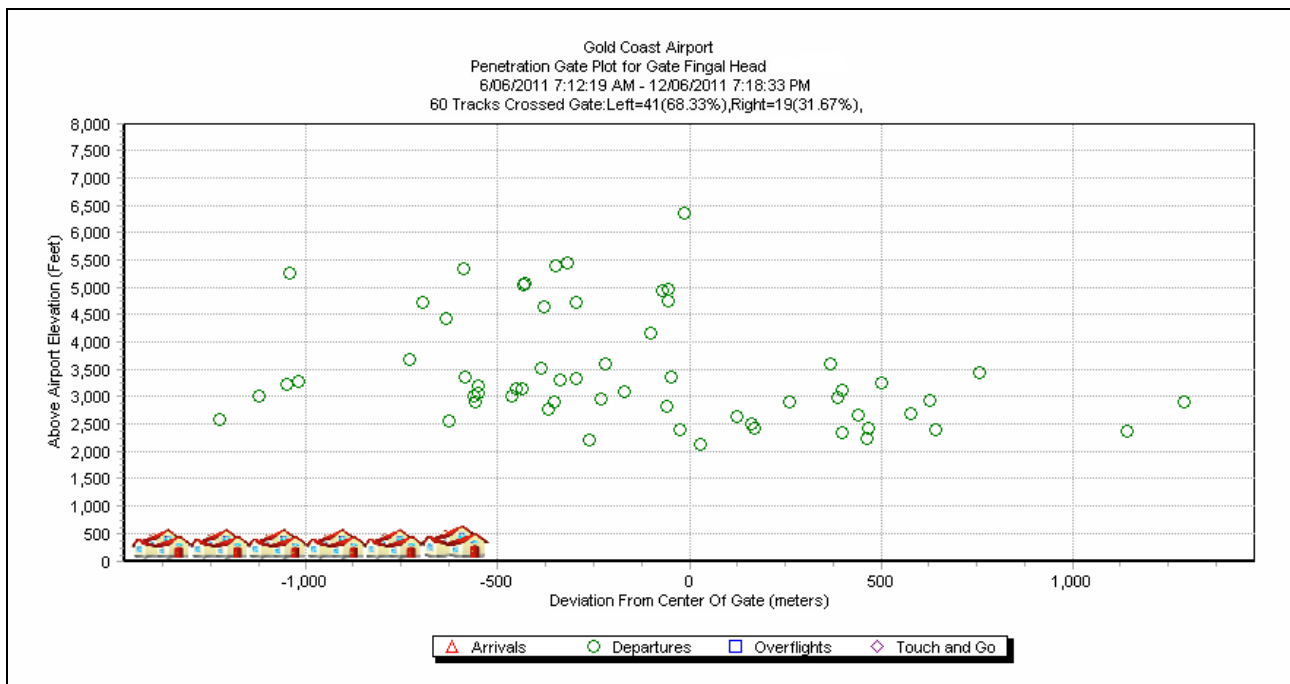
The main aircraft movements over Fingal Head are departures from runway 14. A gate has been used in the NFPMS to analysis aircraft heights over the area.

**Figure 9 Gate Location at Fingal Head**



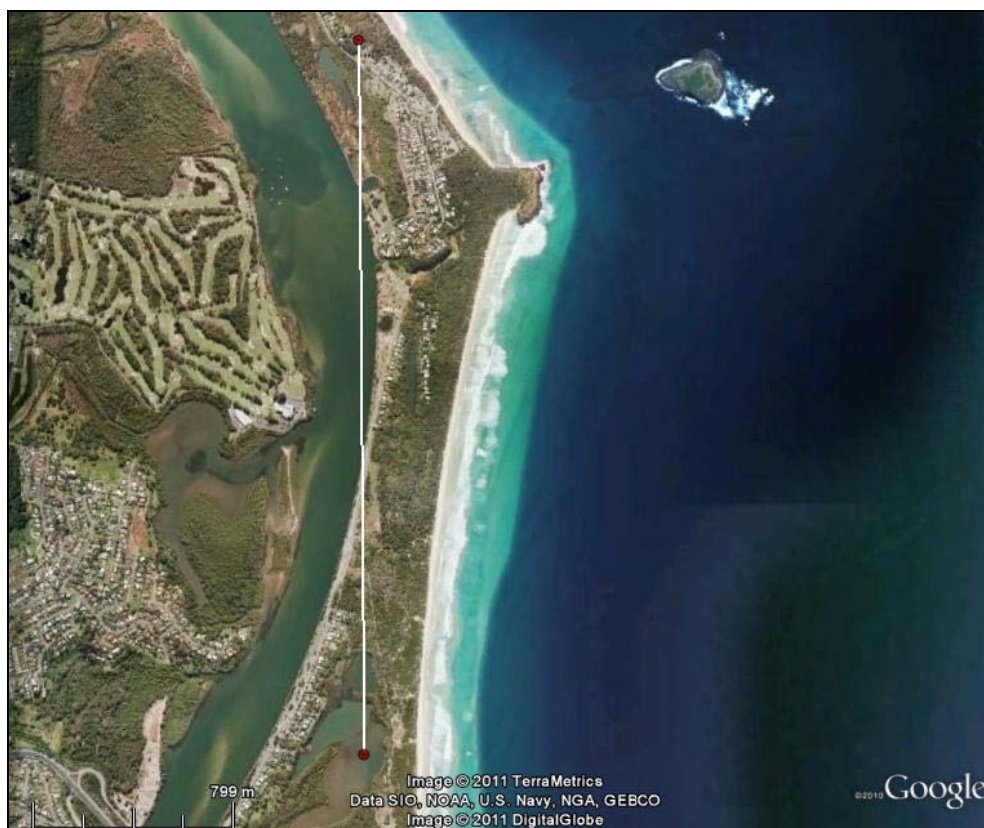
The above image is sourced directly from the NFPMS and shows the location of the gate in black.

**Figure 10 Aircraft Heights above Fingal Head (6/06/2011 to 13/06/2011)**



The above figure shows aircraft movements in one week of June 2011 that tracked over Fingal Head. This cross section figure also displays where the majority of houses are located to the north of the gate, however houses are scattered along the gate. The figure also shows the spread of aircraft as they track over the Fingal Head area. The location of the gate over a map can be seen in Figure 11.

**Figure 11 Fingal Head Aerial View Showing the Gate**

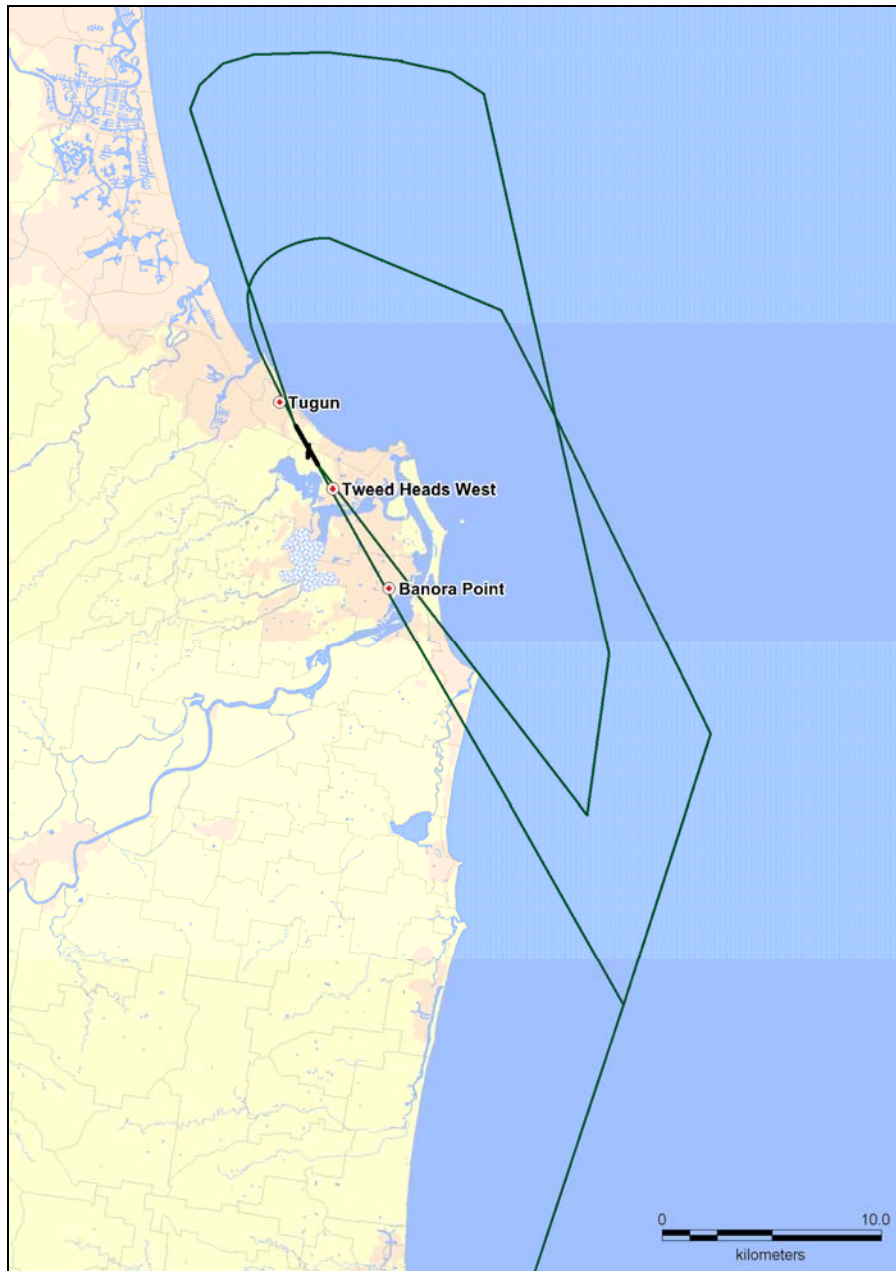


## 9 Overall Flight Path Analysis

EMU locations have been assessed against the current Standard Arrival Routes (STARs) and Standard Instrument Departures (SIDs). Jet STARs and SIDs can be seen above in Section 7.3 with flight track information and below. A list of all STARs and SIDs can be seen in Appendix B.

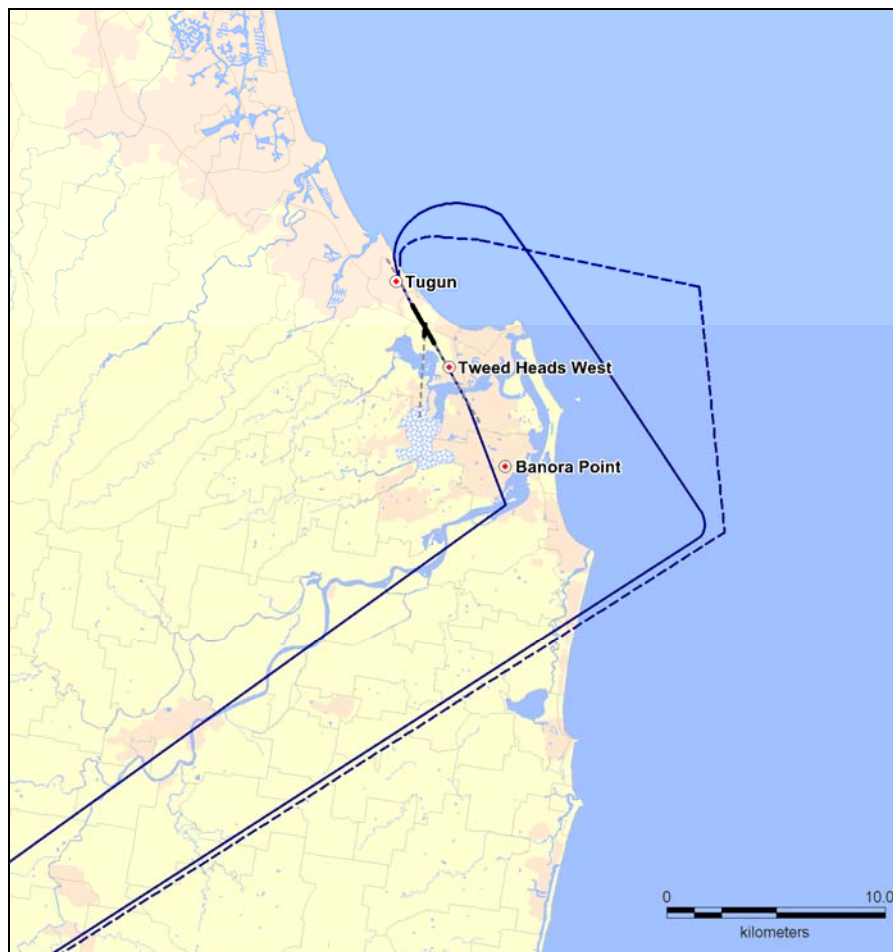
The jet STARs and SIDs are presented in Figure 12 and Figure 13 below in red and blue respectively. Jet procedures have been used in the following analysis as they are associated with the greatest impact to the community.

**Figure 12 Gold Coast Airport STARs**



As shown above, permanent EMUs align well with respect to the current STARs.

**Figure 13 Gold Coast Airport SIDs**



As shown above, permanent EMUs align well with respect to the current SIDs. Note that the cross runway was used less than 1% of the time within the study period of this report.

## 9.1 Proposed Flight Paths – RNP

Airservices Australia has established a project team to manage the Australian implementation of Performance Based Navigation (PBN). The PBN concept embraces the well established Area Navigation (RNAV) methodology and adds a relatively new form of RNAV known as Required Navigation Performance (RNP).

The project, known as Implementation of Terminal Area RNP (ITAR), is overseeing the introduction of RNP Authorisation Required Multi Variant Design (RNP MVD) procedures. Part of this project is a plan to develop RNP approach and departure procedures for Runways 14 and 32 at Gold Coast Airport.

The location of proposed RNP flight tracks has not yet been determined.

## 10 Communications Coverage and Reliability

The following table presents the number of days that each EMU was available to collect data over Q3/Q4 2010 and Q1/Q2 2011. Note that the total possible number of days is within the brackets. Outages occur due to:

- Network outage,
- Preventative maintenance,
- Internal calibration,

- Power outages, and
- Internal faults within the EMU itself.

**Table 6 Analysis of Operational Days**

Number	Location	Q3 2010 (92)	Q4 2010 (92)	Q1 2011 (90)	Q2 2011 (91)
EMU 1	Tugun	91.8	91.4	89.7	90.8
EMU 2	Tweed Heads	N/A	N/A	N/A	N/A
EMU 3	Banora Point	91.8	91.3	89.8	90.8

Note that EMU 2 at Tweed Heads was non-operational during the study period of this report.

Each permanent EMU achieved very high availability over the study period. EMUs were partially operational during brief periods of preventative maintenance and internal calibration. One localised power issue was experienced in Q4 2010 for both EMUs 1 and 3, however data loss was limited to 10 hourly records. No major communication concerns have been identified.

## 11 ISO 20906:2009 Requirements

ISO 20906:2009 relates to unattended permanent monitoring of aircraft noise in the vicinity of airports. To be compliant with this standard, the following site requirements are relevant:

- Aircraft noise should be at least 15dB above the non-aircraft background noise;
- Angle of elevation of aircraft relative to the ground plane is to be greater than 30 degrees;
- The line-of-sight angle to the flight path should be free of any obstructions for at least 70 degrees;
- Microphone is to be 6 m from ground and 10 m from reflecting surfaces (to limit the uncertainty of measured noise data);
- Meteorological conditions (except wind) need to be monitored close to airport;
- Wind conditions need to be monitored at several sites;
- Noise events that occur for wind speeds >10 m/s should be flagged by the system;
- Calibration of noise and meteorological instrumentation need to be performed yearly;
- An estimate of the uncertainty for measurements must be made.

The current Noise and Flight Path Monitoring System is in general accordance with the above requirements with the exception of wind conditions and an estimate of uncertainty. Noise events measured during periods of wind speed greater than 10 m/s are currently not flagged. Therefore, the NFPMS runs the risk of reporting on noise levels that may be elevated due to high wind conditions.



## 11.1 EMU Calibration and Preventative Maintenance

EMU preventative maintenance and site inspection for each permanent site is performed annually. An EMU Maintenance Report is produced by the Service Provider. For 2011, the annual maintenance report was dated 8<sup>th</sup> April 2011 and contained the following summary:

**Table 7 Preventative Maintenance Summary 2011**

EMU	Location	Date	Details
1	Tugun	28/04/11	Replaced microphone and wind screen
3	Banora Point	29/04/11	Replaced microphone , wind screen and bird spike

Automatic calibration checking is performed daily using an electrostatic calibration test. Daily calibration is performed 4 times a day. Calibration checking can also be performed adhoc as required.

Annual acoustic calibration is performed at each site. All microphones were replaced during preventative maintenance and calibrated. Calibration results are provided in the EMU Maintenance Report. The above calibration methods are in accordance with Section 4.8 of ISO20906:2009(E).

## 11.2 Average Elevation Angle

To be in accordance with ISO20906:2009, aircraft captured by the EMU should have a minimum angle of elevation of 30 degrees. This is to reduce any ground attenuation affects on the noise levels. Based on the month of May in 2011, the table below presents the average elevation angle of the aircraft relative to the ground when the aircraft's maximum noise level is recorded ( $L_{Amax}$ ).

**Table 8 Angle of Elevation Summary**

	Average Angle of Observation (degrees) at $L_{Amax}$	Standard Deviation
EMU 1	37.4	16.5
EMU 3	49.0	13.2

## 11.3 Background noise levels compared to requirements of ISO 20906

ISO 20906 indicates that to provide reliable aircraft noise event detection using a technique based on Sound Level discrimination only; sites should be selected such that the maximum sound pressure level of the quietest aircraft to be detected is at least 15 dB greater than the residual long-term-average sound pressure level (background noise level  $L_{90}$  dB(A)). The Noise and Flight Path Monitoring System uses both radar and noise information to correlate noise events, and therefore the requirements of ISO 20906 do not strictly apply however Airservices Australia generally adopts this criterion for permanent EMUs. The level of 15dB above background is considered a reasonable approach and is the level at which the aircraft sound event will be uncontaminated by background or residual sound. Table 9 presents the background noise levels at each site compared to the minimum  $L_{Amax}$  recorded for an aircraft noise event and the average  $L_{Amax}$  of aircraft noise events over the month of January. One month has been used for this analysis to reduce the amount of data required for the calculation.

**Table 9 Background Noise Levels vs  $L_{Amax}$**

EMU Location	Average $L_{90}$ dB(A)	Min $L_{Amax}$	Average $L_{Amax}$	Min $L_{Amax} - L_{90}$ dB(A)	Ave $L_{Amax} - L_{90}$ dB(A)
EMU 1	47.7	62.0	79.2	14.3	31.5

EMU 2	N/A	N/A	N/A	N/A	N/A
EMU 3	43.1	63.3	72.0	20.2	28.9

The above table indicates that EMU 1 (Tugun) has correlated aircraft noise events that are within 15 dB of the average background levels. The highlighted number in the above table is generated from the single minimum noise event over the month of January 2011. The average  $L_{Amax}$  noise levels at EMU 1 are well within the requirements of ISO20906. No reason has been found to alter the threshold settings of any EMU.

## 12 Local Environmental Conditions

Currently, each EMU is not setup to capture meteorological data and therefore the specific local environmental conditions are not available. CATIS weather data is collected at the airport and fed into the NFPMS and is therefore not EMU specific or sufficient for compliance with ISO 20906:2009. The Standard requires that wind speeds at the time of each aircraft noise event are recorded in the reporting of data and that wind speeds above 10 m/s are flagged. The current NFPMS is not compliant with this requirement.

A wind speed of 10 m/s equates to 36 km/hr. Average wind speeds at Gold Coast do not exceed this level; however there are periods of high wind that should be flagged. The following table presents a summary of CATIS weather data collected over July 2010 to June 2011 for comparison with ISO 20906:2009.

**Table 10 CATIS Weather Summary Data for 2010 and 2011**

Average wind speed (m/s) at Gold Coast Airport	5.1 (m/s)
Average wind speed (km/h) at Gold Coast Airport	18.36 (km/hr)
Total instances of wind events recorded as $\geq 36$ km/hr	131
Total duration of wind events recorded $\geq 36$ km/hr	129 Hours

The table indicates that there is a period of 129 hours over the last two quarters of 2010 and first two quarters of 2011 that had recorded wind speeds of 36 km/hr or greater. This equates to a total of around 5.4 days or 1.5% of total available time. The Standard indicates that any correlated noise events captured during this time should have been flagged as having high wind conditions. Although this is a low number of total days, it is recommended that events during high wind conditions should be flagged.

## 13 Security and Access for Maintenance

No security incidents were reported for each EMU in 2010. All preventative maintenance activities were performed as scheduled.

## 14 Licensing Arrangements

The following section details the licensing arrangements for each EMU.

### 14.1 EMU 1 Tugun

Location: Tugun Bowls Club, Tugun

License Agreement: Tugun Bowls Club Inc.

Renewal Date: 30/06/2012. A renewal letter has recently been issued by Airservices Property Management.

## 14.2 EMU 2 Tweed Heads West

Location: The Short Term Monitoring program will attempt to find a suitable location for this monitor. Once found a license will be established for the long term placement of this monitor.

## 14.3 EMU 3 Banora Point

Location: Banora Point Primary School, Banora Point

License Agreement: Banora Point Primary School.

Renewal Date: 31/10/2020

# 15 Configuration of the EMUs

The configuration of each operational EMU has been reviewed by the service provider B&K and data provided in a Noise Verification Report.

The Service Provider Noise Verification Report details the configuration of each EMU in relation to:

- Threshold settings for each EMU including noise event detection parameters and trigger settings,
- Noise correlation results including missed events and an analysis of false positives, and
- Calibration and preventative maintenance.

A summary of the Noise Verification Report is detailed below.

All Noise Monitors were examined for Coolangatta Airport and based on the noise threshold and noise correlation analysis performed, no changes to the configuration parameters are recommended.

The results from this assessment confirm that the noise thresholds are set appropriately and that aircraft are correlating accurately to noise events at both EMU1 (100%) and EMU3 (99.6%).

In terms of the false positive analysis, departure operations correlated at EMU3 were most affected, with 10% of the SEL noise levels of the subject aircraft falling outside the expected SEL vs Lmax Distance correlation pattern. The cause of this may be attributed to, incorrect correlation, meteorological conditions or environmental non aircraft noise.

In conclusion, the results indicate the Noise Monitors are working as intended and the system is correlating aircraft correctly to Noise Events that occur at the Noise Monitors.



## 16 Recommendations

As a result of the above analysis, it is recommended that:

- The current permanent EMUs 1 and 3 remain in their current location with the same settings.
- Permanent EMU 2 is re-instated at a similar location to its previous location of Tweed Heads West.
- The short term monitoring program will be used to initially assess noise levels at the following locations:
  - Tweed Heads to find a suitable replacement location for permanent EMU2.
  - Fingal Heads to the south east of the airport to capture jet departures that are vectored over the area.
  - Kingscliff to the south of the airport.
  - Palm Beach to the north of the airport.
- Noise monitoring of flight paths associated with the implementation of RNP is undertaken.

The above recommendations take flight paths, complainants and previous noise studies into consideration.

## 16.1 Short Term Noise Monitoring Program

The following section proposes areas for noise monitoring to form part of the short term monitoring program.

Noise monitors have been proposed within the Tweed Heads, Fingal Head, Palm Beach and Kingscliff areas.

**Figure 14 Short Term Noise Monitoring Locations**



Location: Tweed Heads (TBA)

Location: Palm Beech

Approximate Coordinates: 28°06'34.64" S, 153°27'47.86" E

Location: Fingal Head (Commercial Property)

Approximate Coordinates: 28°12'03.92" S, 153°33'50.42" E

Address: Fingal Road, Fingal Head, NSW.

Other potential areas include Fingal Head Public School or Fingal Head, Surf Life Saving Club. The Fingal Head area experiences 11% of total departures from the main runway (5.5%-6% of total flights at Gold Coast Airport) and has a high number of complainants. It is likely that longer term monitoring will be required within this area once the short term monitoring is complete.

Location: Kingscliff (Public School)

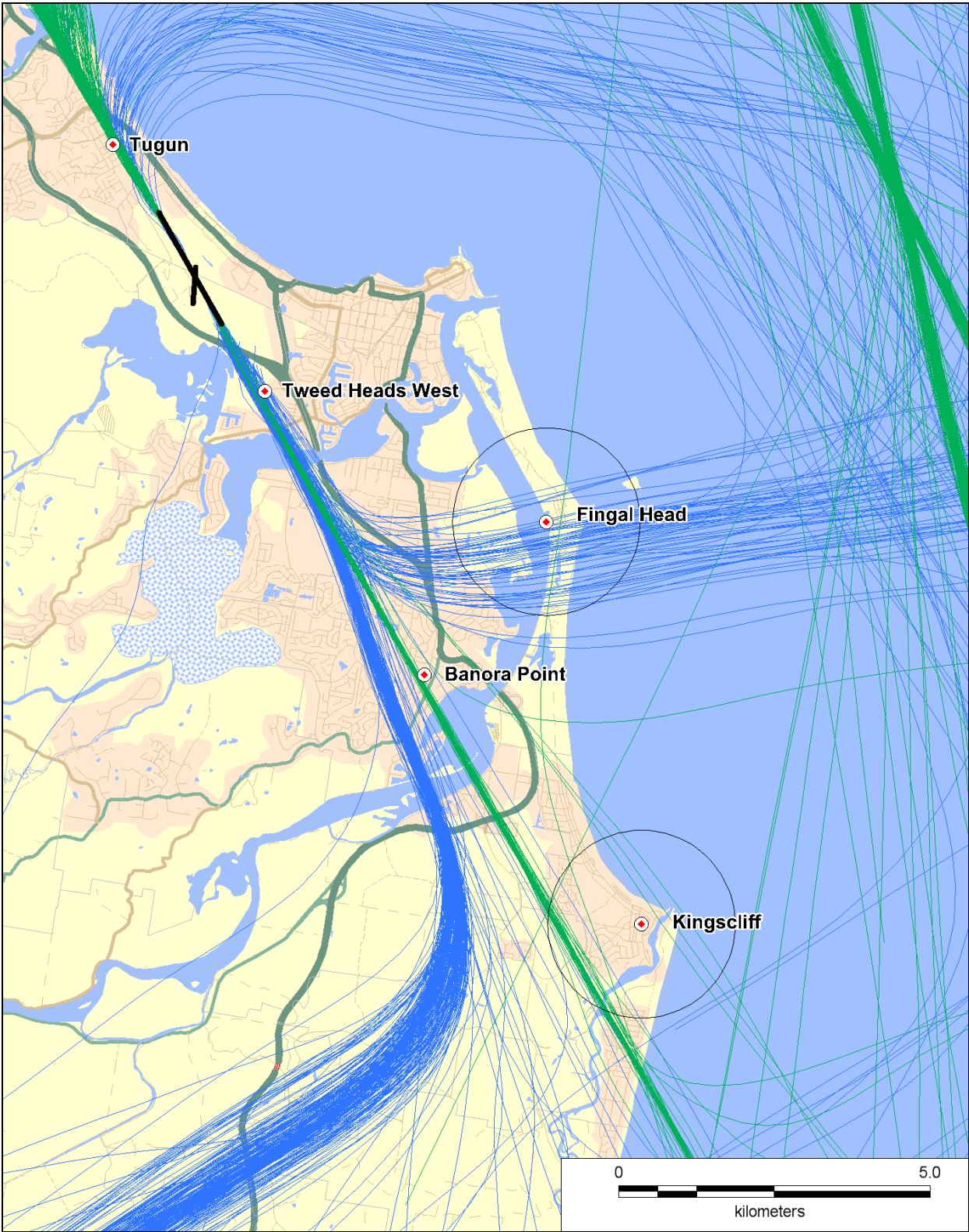
Approximate Coordinates: 28°15'32.63" S, 153°34'46.34" E

Address: Orient Street, Kingscliff NSW 2487.

The Kingscliff area experiences arrivals from the main runway and air traffic along the coast line.

Figure 15 shows the above proposed noise monitoring locations with current flights over the Kingscliff and Fingal Heads areas. Departures are shown in blue and Arrivals in green.

Figure 15 Proposed Short Tern Monitoring Locations with Flight Tracks



## 16.2 Proposed Noise Monitoring for RNP

Noise monitoring is recommended to help assess the noise impact from changes to flight paths resulting from the RNP project. Specific locations for monitoring will be determined once proposed RNP flight paths have been determined.

## 16.3 Capturing Weather Data

Weather data is currently not captured at any EMUs at the Gold Coast. Weather station equipment is available through the Service Provider. It is recommended that a weather station is integrated onto at least one permanent EMU to enable the NFPMS to achieve full compliance with ISO20906.

In addition to the above, a weather station should be implemented to a portable unit. Portable units are generally placed within areas that are some distance from the airport and other permanent EMUs. Wind speeds and meteorological conditions may vary greatly at portable locations and therefore a weather station is essential.

## Appendix A Terms of Reference

### **Airservices Australia Review of the Gold Coast Airport Environmental Monitoring Units**

#### **Terms of Reference**

##### **Context**

Airservices Australia has a legislated obligation, via the Air Services Act (1995), to regard the safety of air navigation as its most important consideration. Subject to that requirement it also has obligations to, as far as practicable; protect the environment from the impact of the operation and use of aircraft. Further, a Ministerial Direction made under this Act requires Airservices to maintain and operate a noise and flight monitoring system (NFPMS) at major Australian airports. At present this system operates around Perth, Adelaide, Melbourne/Essendon, Canberra, Sydney, Gold Coast, Brisbane and Cairns airports.

The NFPMS comprises a number of components, including environmental monitoring units (EMUs) that collect noise data. Airservices Australia periodically conducts a review of the location of the EMUs. This is a key element of the quality management of the NFPMS.

##### **Purpose**

To review the performance of each EMU at Gold Coast Airport against the Airservices Australia's environmental and business requirements for the management of aircraft noise. In performing this function the placement and individual configuration of the each of the EMUs needs to be optimised for the measurement of the impacts of aircraft operations on the local community from operations at Gold Coast Airport.

This review will assess the location of the current EMUs and make recommendations about the future use of the EMUs.

##### **Scope**

The review will address:

1. Replacement location for the Tweed Head monitoring site, EMU 2, (decommissioned in 2010 at the site owners request).
2. Current location of EMUs 1 and 3
  - a. With respect to complainants
  - b. With respect to sensitive regions
  - c. With respect to flight paths
  - d. With respect to proposed RNP flight paths
  - e. With respect to communications coverage and reliability
  - f. With respect to ISO 20609
  - g. Against local environmental conditions
  - h. For security and access for maintenance
3. Licensing - are there any ongoing licensing issues?
4. Configuration of the EMUs
  - a. For noise event detection parameters; threshold, pre-trigger, duration

- b. For calibration and preventative maintenance
- c. Correlation zone
- d. For false positives
- e. For missed noise events

## **Consultation with Interested Parties**

Airservices will consult with interested parties via the Gold Coast Airport Aircraft Noise Management Consultative Committee convened by airport management.

## **Review Process**

### *Terms of Reference*

The Draft Terms of Reference will be circulated to Committee members through the Chair of ANACC.

### *Review Report*

A draft of Airservices report will be provided to members of the Airport's Community Aviation Consultation Committee for discussion at a date to be advised.

### *Final Report*

The final report date will be advised.

## Appendix B Gold Coast Airport Approach and Departure Routes

Gold Coast airport has the following standard operating procedures:

**Table 11 Gold Coast Airport Standard Arrival Routes (STAR)s**

STAR GREAV FIVE ARRIVAL
STAR ROONY TWO ARRIVAL (RNAV)

**Table 12 Gold Coast Airport Standard Instrumented Departure (SID)s**

SID GOLD COAST THREE DEPARTURE (RADAR) – RWY 14,17 AND 32
SID MICKS TWO (JET) (RNAV)
SID RWY 14/32 SOUTH (JET) (RNAV)



## Appendix C Public Comments via the Gold Coast Community Aviation Consultation Groups (CACG) and Airport Noise Abatement Consultative Committee (ANACC), including Airservices responses

The Gold Coast EMU review was established to ensure monitors are in the most appropriate locations to capture noise and operational data and to determine the contribution of aircraft noise to the overall noise exposure of a community. There were a number of recommendations regarding EMU locations, in relation to aircraft noise sources and population. Feedback from the community was received via the CACG and ANACC in regards to the recommendations. Below is a summary of comments received and Airservices responses:

1. Fingal Head, Banora Point, Bilinga and Kingscliff community members confirmed they wanted noise monitoring.

Airservices response: It was noted that this feedback would be provided to the Airservices acoustics team for consideration and, as there were no objections raised, that the initial rollout of temporary monitoring would be as per the recommendations in the EMU review. Possible locations for short term monitoring were identified as Fingal Head (to capture jet departures over the suburb), Kingscliff (to capture arrivals), Tweed Heads (to investigate location for EMU 2) and Palm Beach (to capture noise levels from aircraft operations to the north of the Airport in a populated area where no previous noise data existed).

2. A request was made to consider placement of an EMU beside the river/water to pick up the impact of aircraft noise reverberating off water. No specific location was given in this request.

Airservices response: While raised at the CACG by one person, there was no further support noted and no specific location identified by the community. No recommendation was made.

3. Bilinga community members requested for monitoring to be done beside the airport at Bilinga

Airservices response: As the suburb of Bilinga is within close proximity to the airport, a noise monitor located in this suburb would have a capture zone covering the airport itself. As a result noise events captured by the monitor could be influenced by noise from taxiing aircraft and general airport noise from activities on the ground. It is therefore considered unfavorable to have a short term noise monitor in this location due to erroneous aircraft noise events.

4. Banora Point community members asked for monitoring to be done in Banora Point west.

Airservices response: Location to be explored.

5. General question: how many portable locations can be suggested by the committee?

Airservices response: It was advised there is not a fixed number set aside and will be reviewed once the feedback on locations has been received.

6. A member of the community asked where the location of the current Tweed Heads EMU was situated.

Airservices response: It was advised that the lease changed on the site. The original plan was to reinstall the EMU 2 in the same location but asbestos had been found. It was recommended that Airservices would maintain EMU 1 and EMU 3 at current locations and reinstate EMU 2 at a similar location in Tweed Heads.

7. Community raised Smart Tracking and when it is coming to the Gold Coast.

Airservices response: It was advised that one of the recommendations from the review was that Airservices may carry out a monitoring program for Smart Tracking if required. Smart Tracking was

implemented to Runway 14 in November 2014. A post implementation review of Smart Tracking will be undertaken in due course when sufficient data is available.