5.0

Environmental Assessment

5.0 Environmental Assessment

5.1 Assessment Approach

This Chapter details the environmental assessment and mitigation measures for the ILS on-ground infrastructure and widening of the existing 150 metre runway strip to 300 metres, on Commonwealth airport land and on NSW State land. The ILS Project components are shown in Figure 2.4 and include:

- The glidepath footprint (at the northern end of runway 14 on Commonwealth land);
- 300 metre wide runway strip (150 metres either side of the runway centreline and extending 60 metres beyond the runway ends). The 300 metre runway strip is largely grassed but includes five patches of vegetation that form part of the airport's Environmentally Significant Areas (ESA), described further below. These patches are referred to in this report as ESA Impact Areas A, B, C, D and E, (Figure 5.1).
- The localiser footprint (at the southern end of runway 14 on NSW State land).

Trenching and under-boring for installation of power and communications infrastructure for the ILS will also occur as part of the project.

The above components of the project were referred to DoE by Airservices under Section 68 of the EPBC Act. DoE determined the works on NSW State land are not a controlled action and no approvals under the EPBC Act are required. In addition, DoE has advised DIRD under Section 161A of the EPBC Act that the action on Commonwealth airport land is unlikely to have a significant impact on the environment and that advice from the Minister for the Environment is not required. A minor amendment was made to the localiser footprint since the referral to DoE, which resulted in an increase of approximately 0.2ha to impacted vegetation communities in this area. This small increase does not change the outcome of the impact assessment and DoE have been provided details of the amendment.

As indicated in Chapter 1, the works in the localiser footprint that are outside the airport on NSW State land are not subject to the requirements of the Airports Act. These works are considered within this section to provide context with regard to the impacts of the project as a whole. The assessment of impacts in the localiser footprint has considered the impacts to Matters of National Environmental Significance (MNES) and the whole environment under the EPBC Act.

In accordance with the Airports Act, the environment strategy contained within the Gold Coast Airport Master Plan identifies ESAs at the airport. ESAs are shown in Figure 5.1. The method to determine environmental significance divided Gold Coast Airport into units of homogenous land use and vegetation communities. Each unit was then assessed based on:

- Whether it was known habitat for legislatively significant species (both Commonwealth and State);
- The legislative status of vegetation communities (both Commonwealth and State); and
- The size, condition and connectivity of the vegetation community.

Developments at the airport that affect ESAs trigger the preparation of an MDP as described in Section 1.2 and 3.2.1.

The environmental assessment considers the following aspects:

- Resource use;
- Land, including:
  - Soils
  - Contaminated land
  - Acid sulfate soils
- Surface and groundwater;
- Biodiversity, including:
  - Habitat values and wildlife corridors; and
  - Significant flora and fauna.
- Cultural heritage;
- Air and noise;
- Hazardous materials.

The aspects and mitigation measures considered in this environmental assessment are generally consistent with the environment chapter of the Master Plan. The environment chapter of the Master Plan contains two components:

- Environmental assessment and mitigation of potential environmental impacts associated with implementation of the Master Plan; and
- Management of potential environmental impacts associated with operational elements of airport activities (the environment strategy).

5.1.1 Review of Baseline Conditions

The baseline environmental assessment for the MDP included a desktop review of environmental information relevant to the ILS ground infrastructure (the study area) as well as two site surveys in the project footprint.

Desktop Review

The desktop study involved a review of GIS mapping as well as reports and literature relevant to fauna and flora values in the study area. This included the following sources:

- ESA mapping for the airport;
- Regional Ecosystem (RE) mapping from the Queensland Department of Environment and Heritage Protection;
- Fauna Corridor Data from the New South Wales Office of Environment and Heritage;
- Northern Rivers Vegetation Mapping from the New South Wales Office of Environment and Heritage (2010);
- Directory of Important Wetlands mapping from the Australian Department of Environment and Heritage (2005);
- The following species database searches:
  - EPBC Act Protected Matters Search Tool for the study area, accessed 3 June 2014;
  - DERM Wildlife Online database search, with a 1 square kilometre search area from the centre of the airport site (accessed 29 March 2013);
  - Atlas of New South Wales Wildlife, with a default 10 square kilometre search area (accessed 29 March 2013).
- Aerial photography;
- Review of key ecology studies undertaken at the airport, including annual fauna monitoring and significant species mapping;
- Other reports, literature and relevant airport management plans.

Site Survey

Two site surveys (14 March 2013 and 19 December 2013) were undertaken to verify mapped information reviewed during the desktop study. Both surveys:

- Undertook a vegetation mapping verification and habitat assessment, taking notes of habitat characteristics, vegetation structure and floristics;
- Recorded incidental observations of significant fauna.

A targeted aural frog survey was also undertaken on 14 March 2013 in the localiser footprint for Wallum Sedge Frog *(Litoria olongburensis)* and Wallum Froglet *(Crinia tinnula)* to supplement previous surveys undertaken in the area.

In addition to this, a habitat survey for Wallum Sedge Frog was undertaken within ESA Impact Area A within the 300 metre runway strip on 19 December 2013. The habitat assessment of ESA Impact Area A involved a walk-through of the area to identify areas of potentially suitable habitat for Wallum Sedge Frog along with transect surveys to identify floristics. The survey also included an aural survey, however conditions were considered sub-optimal as detailed in Section 5.6.2.

Both surveys were undertaken in line with the Draft Referral Guidelines for the Wallum Sedge Frog (SEWPaC 2011) as well as the Survey Guidelines for Australia's Threatened Frogs (DEWHA 2010) as far as practical.

5.1.2 Impact Assessment

The potential environmental impacts of the project have been assessed with the assumption that environmental management measures (such as the implementation of Environmental Management Plans) will be in place during construction and operation of the infrastructure. The implementation of Environmental Management Plans for the construction and operation of the project is described in Section 5.10.

The assessment criteria in Table 5.1 have been used to guide the assessment of impacts. These criteria are based on those used by GCAPL's consultants (Arup) who conducted the environmental assessment for the MDP.

Table 5.1: Assessment Criteria

Impact	Assessment Criteria
Major Adverse	These impacts are likely to be important considerations at the National, or State level and are likely to be major considerations in the decision making process. Major environmental impacts are likely to be of concern to the project including its stakeholders, the community and key planning regulatory instruments and their desired outcomes/objectives. Such impacts could also include significant acquisition or impact to community facilities, business or residents. Typically mitigation or management measures are unlikely to remove such adverse impacts.
Moderate Adverse	These impacts are likely to be important at a regional scale and would be considered in the decision making process. Moderate environmental impacts are potentially of concern to the project including some of its stakeholders, the community and key planning regulatory instruments and their desired outcomes/objectives. Such impacts could also feature some form of acquisition or impact to community facilities, business or residents. Although mitigation measures and detailed design work are unlikely to remove all potential impacts, the residual impact is likely to be of reduced significance.
Minor Adverse	These impacts may be raised as local issues and although they will form part of the decision making process, it is likely to be in the context of the wider project decision making. Generally, minor environmental impacts are expected to be experienced but mitigation measures and detailed design work will ameliorate some of the consequences upon the environment or community. It is possible that some residual impacts will arise. Such impacts could still include some form of direct property impact (i.e. partial acquisitions, small loss of developable land, short term impacts during construction only). The potential cumulative impacts of such impacts may lead to an increase in the overall impacts.
Negligible	No impacts or those which are beneath levels of perception.
Beneficial	The impacts of a project can also be beneficial – using the same scale minor, moderate and major.

The following EPBC Act guidelines have also been used to guide the assessment of impacts as they provide the Commonwealth framework for the assessment of the significance of impacts upon Matters of National Environmental Significance and the whole of the environment on Commonwealth land:

- Significant Impact Guidelines 1.1 - Matters of National Environmental Significance,
- Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land and Actions by Commonwealth Agencies.

5.1.3 Terminology

The term 'significant species' collectively includes migratory and marine species listed under the EPBC Act as well as threatened species. It also includes species that may be considered of special significance (e.g. due to limited distribution) though are not protected under State or Commonwealth legislation. The term 'threatened species' includes:

- Species listed under the EPBC Act as threatened;
- Species listed as Extinct, Endangered, Vulnerable or Near Threatened under the Queensland Nature Conservation Act 1992 (NC Act); and/or
- Species listed as Critically Endangered, Endangered or Vulnerable under the New South Wales Threatened Species Conservation Act 1995 (TSC Act).

The term "Threatened Ecological Communities" includes:

- Ecological communities listed as threatened under the EPBC Act; and/or
- Ecological communities listed as Critically Endangered, Endangered or Vulnerable under the TSC Act.

5.2 Resource Use

The construction and operation of the project will require resources in the form of materials and energy. Materials used during construction will include but not be limited to:

- Concrete for foundations, slabs and paths;
- Road base material and gravel;
- Fill material;
- Steel for antennae, building structures and fences;
- Cabling for services; and
- Concrete drainage pipes and culverts.

Energy will be required during construction and operation of the project.

The materials and energy required for the project are expected to result in a negligible impact to resources. The Construction Environmental Management Plan will identify opportunities for efficient use of materials and minimisation of waste.

5.3 Land

5.3.1 Baseline Conditions

Acid Sulfate Soils

The airport and surrounds are within a low-lying coastal area and, like much of the surrounding coastal land, there is a high likelihood that the glidepath footprint and 300 metre runway strip contain potential or actual acid sulfate soils.

Acid sulfate soil investigations undertaken as part of this project indicate that the localiser footprint comprises a thin layer of top soil over alluvial sands, extending to a depth of at least 5.5 – 6.0 metres below ground level. Net acidity concentrations above the action criteria within the Acid Sulfate Soils Assessment Guidelines (Stone et al. 1998) have been identified in some areas. Net acidity concentrations above the action criteria were reported at varying soil depths and for half of the samples analysed as part of the acid sulfate soil investigations. In some areas in particular, the top 200 millimetres of soil was considered to have relatively high levels of net acidity (net acidity was approximately five times the action criteria level).

Contaminated Land

A small number of contaminated sites are recorded on the airport, with one located within the glidepath footprint and the north-west section of the 300 metre runway strip, and another one to the west of the 300 metre runway strip, refer Figure 5.2.

A detailed stage 2 environmental site assessment was undertaken in 2007 for the portion of contaminated land within the glidepath footprint and north-west section of the 300 metre runway strip. The study notes that the area had been subject to historical filling activities associated with the Tugun Landfill and the Gold Coast Council sewerage treatment plant. The study found that the site contained various fill materials including nightsoil deposits, landfill wastes, asbestos fragments and general fill soils. The landfill waste was generally encountered at a depth of 0.5 metres below ground level and extended in some locations to a depth of approximately 2.5 metres below ground level. Soil samples collected at the site were analysed for a wide variety of potential contaminants however only two samples returned results marginally above the *Airport (Environmental Protection) Regulations 1997* (AEPR) acceptance limits. All sample results were found to be below the National Environment Protection (Assessment of Site Contamination) Measure 'Health-based Investigation Level F criteria' for commercial and industrial land use and the AEPR Acceptance Limits for General Areas. Evidence collected during the study suggests that the landfill and sewerage materials were introduced to the site in the late 1960s.

The area of contaminated land to the west of the 300 metre runway strip is associated with the Airservices fire training area. The site contains contamination associated with constituents of previously used firefighting foam (Perflurooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA)) and hydrocarbon contaminants.

PFOS and PFOA form part of a group of man-made chemicals known as perfluorinated chemicals (PFCs) which have a range of applications, however are an emerging contaminant as they are known to accumulate to levels of concern in the environment. PFCs are also known to be present outside of the area west of the runway as mentioned above.

A search of the New South Wales Contaminated Land Register did not identify contaminated land in the localiser footprint.

5.3.2 Assessment of Impacts

Glidepath Footprint

In the glidepath, minor excavations are likely to occur for trenching for provision of services to the glidepath facilities and for relocation of the existing drainage line. Site works may result in the exposure of soil from the movement of heavy machinery over soft grassed surfaces, excavation and grubbing activities. The use of fill soils to grade the area may also expose soils. Once soil is exposed to wind and rain, it has the potential to erode (which reduces soil quality at the site) and generate dust and sedimentation issues in surrounding areas. With the implementation of appropriate dust, erosion and sediment control measures, the impacts to soils are expected to be negligible.

Excavations in the glidepath footprint may expose potential or actual acid sulfate soils. With appropriate management through the development and implementation of an Acid Sulfate Soils Management Plan, the associated impact to soils, groundwater and above ground ecology and drainage systems from acid sulfate soil is expected to be negligible.

Disturbance of contaminated land has the potential to result in adverse impacts to the surrounding environment including waterways, soils and wildlife, or to have human health impacts. Due to the minor nature of excavations in the glidepath footprint the disturbance to contaminated soils is expected to be minimal. This would be confirmed during detailed design, and a Contaminated Land Management Plan will be developed and implemented. With implementation of a management plan for occurrences of this nature, impacts are expected to be negligible.

300 metre Runway Strip

Vegetation will be trimmed in ESA Impact Areas B to E to a height between 1.5 and 2.0 metres above ground level to comply with CASA requirements and in ESA Impact Area A, all vegetation will require clearing as vegetation type, density and height makes trimming unviable. ESA Impact Area A will be cleared, graded, grassed and mown. Clearing will temporarily expose soils over an area of approximately 1.3 hectares, before grass establishes.

Selected removal of plants and clearing activities will result in the exposure of soil from the movement of heavy machinery over vegetated surfaces, excavation and grubbing activities. The use of fill to grade the area is also likely to result in soils being exposed. Once soil is exposed to wind and/or rain it has the potential to erode (which reduces soil quality at the site) and generates dust and sedimentation issues in surrounding areas. With the implementation of appropriate soil, dust, erosion and sediment control, the impacts to soils from erosion are expected to be negligible.

Trenching or under boring for installation of services in the 300 metre runway strip is unlikely to encounter contamination associated with the above mentioned fire training ground. However, as the extent of this contamination isn't fully delineated further assessment will be undertaken prior to commencement of construction to identify if installation of services will disturb any contamination, and if so, a Contaminated Land Management Plan will be developed and implemented to manage potential impacts. The impacts from contaminated land are expected to be negligible.

Trenching or under boring for installation of services may encounter acid sulfate soils. An Acid Sulfate Soil Management Plan will be implemented during construction, if determined to be required in the detailed design phase. The impacts from acid sulfate soils to soils, groundwater and above ground ecology and drainage systems in the 300 metre runway strip is expected to be negligible.

Localiser Footprint

Works will result in the exposure of soil from the movement of heavy machinery over vegetated surfaces, excavation (e.g. trenching for provision of services to the localiser building and antenna array and realignment of drainage channels and grubbing activities. The use of fill soils to grade the area may also expose soils.

Erosion and sedimentation will be carefully managed, through the preparation of an Erosion and Sediment Control Plan, due to the proximity of the site to the Cobaki Broadwater as detailed in Section 5.10. With implementation of mitigation measures, the erosion, dust and water quality impacts potentially caused by soil disturbance are expected to be negligible.

Groundwater and acid sulfate soils testing undertaken in the localiser footprint identified that the small rate of consolidation associated with the bulk fill is unlikely to have any significant impact on the local water table or normal interactions between acid sulfate soils, groundwater and the adjacent surface waters of the Cobaki Broadwater. However, the sandy soils present a relatively high risk of generating acidity if dewatered, and if waterlogged potential ASS identified near the surface is allowed to oxidise. With appropriate management through the development and implementation of an Acid Sulfate Soil Management Plan and if required a Dewatering Management Plan, the associated impact from acid sulfate soils to groundwater, above ground ecology and drainage systems is expected to be negligible.

Figure 5.1: Environmentally Significant Areas and ESA Impact Areas

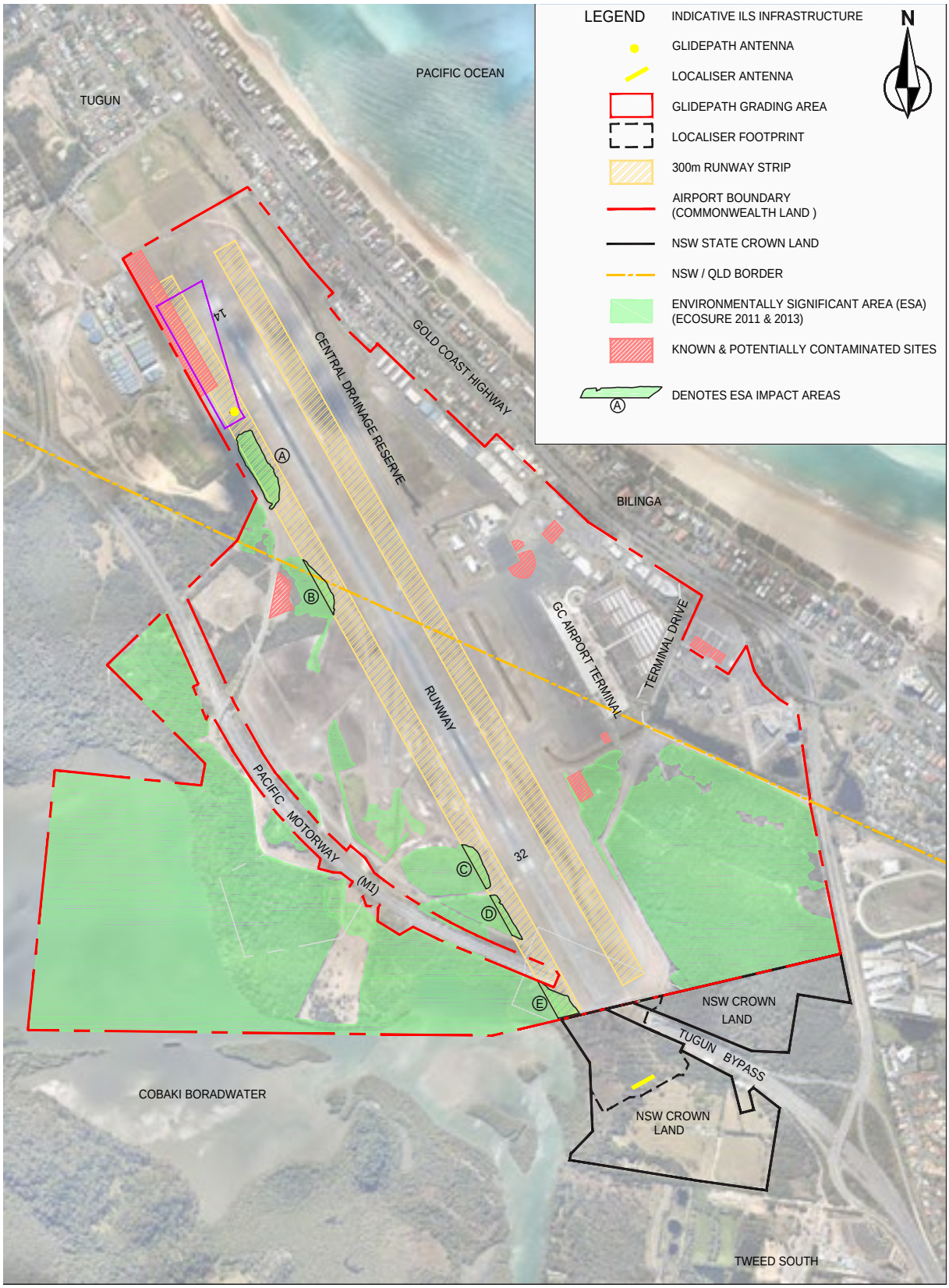


Figure 5.2 Known Contaminated Land Sites, Cultural Heritage Sites and Site Drainage

5.4 Surface and Groundwater

5.4.1 Baseline Conditions

Glidepath Footprint and 300 metre Runway Strip

There are two significant surface water bodies on the airport land, namely the Cobaki Broadwater and the drainage reserve (Figure 5.2). The Cobaki Broadwater is located along the western boundary of the Cobaki Environmental Precinct. Commonwealth airport land west of the runway discharges to the Cobaki Broadwater. The majority of stormwater runoff from the eastern side of the main runway discharges into the drainage reserve.

The drainage reserve within Gold Coast Airport commences at Betty Diamond Park to the north and leaves the airport at the southeast discharging to Kirra Beach via the Gold Coast City Council drainage network. It has been substantially modified through historic land use activities and is piped or channelised along most of its length. The drain receives stormwater from an urban catchment of approximately 3.7 square kilometres and is tidal towards the southern end of the airport (GCAPL 2011).

A water quality monitoring program is in place at Gold Coast Airport to identify impacts specifically from airport activities by assessing water quality both entering and leaving Gold Coast Airport. Surface water quality is monitored at sites within the drainage reserve, drainage channels leading to the Cobaki Broadwater and the Cobaki Broadwater itself. Water quality monitoring shows that while water within the drainage system upstream of airport activities often shows signs of low-level hydrocarbon, heavy metal and other forms of contamination, monitoring of the airport section indicates a general reduction in these contaminants as they pass through the airport's drainage system.

Several drainage lines have been constructed within the airport and surrounds including the glidepath footprint and 300 metre runway strip.

Beneath the airport, shallow alluvial sands and gravel deposits form a shallow, unconfined aquifer. The sands are saturated from approximately 0.5 - 0.6 metres below the ground level. Groundwater flows into the Cobaki Broadwater, the drainage reserve, other drainage channels, and low lying areas across the airport.

Localiser Footprint

The two main drainage lines in the localiser footprint are man-made, predominantly tidal and associated with the Cobaki Broadwater (Figure 5.2). There is also a drain immediately south of the runway which runs along the boundary of the airport and north of the localiser footprint area. Overland flow from the bushland areas to the east of the Tugun Bypass also drain into the area.

Flood modelling has been completed for the localiser footprint area. The drainage and earthworks design will be further developed to consider flood modelling results.

Surface water monitoring undertaken in the localiser footprint (Precise Environmental 2014b) identified that the physico-chemical water quality in the drains was typical of that expected of low-lying coastal wetlands and in general was consistent with water quality indicators. Whilst nutrient levels exceeded the water quality objectives this is expected of drainage from wetland areas after rainfall events.

Groundwater monitoring in the localiser footprint identified that the groundwater table is generally shallow in the area and tends to rise after significant rainfall. Dissolved metal concentrations in groundwater were generally compliant with water quality objectives (ANZECC/ARMCANZ 2000, marine aquatic ecosystem trigger values for slightly to moderately disturbed ecosystems), except for iron which was elevated, as is typical of environments where acid sulfate soils are present.

5.4.2 Assessment of Impacts

Glidepath Footprint and 300 metre Runway Strip

The existing open drainage line in the glidepath footprint will be relocated to provide the required level area for the glidepath facility. Erosion and sediment control measures will be implemented during the works and the impact to surface and groundwater is expected to be negligible. The change to surface water flows will be localised and is not expected to result in changes to vegetation at the glidepath footprint or surrounds, which is currently a grassed area. Due to the distance of the glidepath footprint from the Cobaki Broadwater (greater than 500 metres) there is not expected to be any impact to habitats or water quality in the Cobaki Broadwater.

Other than the drainage line relocation within the glidepath footprint, drainage lines within the 300 metre runway strip will not be impacted by the works.

Localiser Footprint

The open earth tidal drains traversing the ground pad at the localiser footprint will be diverted around the pad to maintain drainage patterns at the site. Impacts to surface water flows from the new drains at the site would be localised and temporary (during the construction of the new drains) and would be unlikely to affect surface flows on Commonwealth airport land to the north of the localiser footprint. Impacts to water quality during construction are expected to be localised and temporary and will be managed through the implementation of an Erosion and Sediment Control Plan and Acid Sulfate Soils Management Plan during construction.

Following construction, impacts to water quality in the localiser footprint area and surrounds (including the airport drain to the north of the localiser footprint) may occur due to the replacement of vegetation with grass. It has been identified that cutting of grass on the airport as part of normal airport operations, contributes organic phosphorous, ammonia and nitrogen to local waterways via decomposition and the transport of organic material. In addition grass cutting contribute to persistently low dissolved oxygen concentrations in waterways at the airport. This is again due to the transport of organic matter. It is possible that cutting of grass in the localiser footprint could result in similar impacts.

Vegetation influences flows of surface water and the infiltration of water through soils, therefore vegetation clearing at the site may have a minor effect to surface water flows and infiltration at the localiser footprint. However as only a small portion of the footprint will be hardstand and the majority will be grassed, the impact to surface flows and infiltration will be reduced and is not expected to have impacts on airport land to the north. Acid sulfate soils testing undertaken at the localiser footprint and surrounds has identified that the small rate of consolidation associated with the bulk fill is unlikely to have any significant impact on the local water table or normal interactions between acid sulfate soils, groundwater and the adjacent surface waters of the Cobaki Broadwater. It is also unlikely that vegetation clearing in the localiser footprint will significantly affect groundwater (including groundwater flows on airport land to the north) due to the area and type of vegetation being cleared, and the direct tidal influence of the Cobaki Broadwater on the groundwater in the area. Construction of the earth pad may result in short-term, localised impacts to groundwater levels.

The perimeter road around the localiser footprint has the potential to act as a barrier to tidal flows into the area, however cross drainage culverts will be incorporated under the access road to enable continued tidal exchange in the western portion of the localiser footprint.

Management for impacts to surface and groundwater would include investigating the need for water quality improvement devices, implementation of an Erosion and Sediment Control Plan during construction, and stabilisation of the realigned drainage channels as soon as possible after construction. Further management measures will be investigated and mitigated through design, monitoring and adaptive management. Flood modelling for works associated with the localiser footprint has been completed. The modelling results will be used in the detailed design of drainage and earthworks to minimise any impacts.

Preliminary investigations have indicated the project will result in a negligible to minor impact on surface and groundwater in the localiser footprint.

5.5 Habitat Values and Wildlife Corridors

5.5.1 Baseline Conditions

Glidepath Footprint

The glidepath footprint doesn't contain any identified ESAs nor does it contain significant environmental values.

300 metre Runway Strip

Figure 5.1 shows the ESA Impact Areas within the 300 metre runway strip.

The 300 metre runway strip is within the runway precinct and this land is managed primarily for the purpose of aircraft landing, take off and taxing operations etc. The area is largely mown grassland; however it overlays small patches of heath, sedgeland and saltmarsh. It is also subject to GCAPL's Bird and Wildlife Hazard Management Plan. This means that fauna in this area posing a risk to operations would be subject to active management to deter their presence. Although the plan limits the occurrence of some species, heath, sedgeland and saltmarsh vegetation in the 300 metre runway strip does attract and provide habitat for some fauna not posing a risk to operations.

The most northern ESA within the 300 metre runway strip, ESA Impact Area A, includes an area which is mapped as Least Concern Regional Ecosystem (RE, vegetation communities mapped in Queensland) with a 60/40 percent mix of 12.2.12 and 12.2.9 respectively (i.e. 12.2.12 is closed heath on seasonally waterlogged sand plains, whilst 12.2.9 is Wallum Banksia *(Banksia aemula)* woodland on dunes and sand plains, usually on deeply leached soils).

ESA Impact Areas B to D are at the fringes of larger areas of vegetation. The areas are predominantly heathland, with a small area of sedgeland in ESA Impact Area B. The south-eastern side of the 300 metre runway strip also contains strips of sedgeland associated with drainage lines. Despite ESA mapping undertaken previously indicating it has low environmental value, later surveys have detected Wallum Froglet in this sedgeland area providing evidence that it does contain some environmental value.

ESA Impact Area E is an area of saltmarsh adjacent to the airside road. This area is mapped as a SEPP 14 wetland. ESA Impact Area E is likely to provide habitat for aquatic fauna when it is inundated during higher tides. To the south of, and partially within ESA Impact Area E, is a mangrove-lined drain which drains to the Cobaki Broadwater. Similar to the areas of saltmarsh habitat in the localiser footprint, saltmarsh and mangroves within and adjacent to ESA Impact Area E are likely to provide high tide roost habitat for shorebirds that utilise feeding areas in the Cobaki Broadwater.

Localiser Footprint

The localiser footprint has been investigated as part of previous ecological assessments undertaken for the Tugun Bypass and a number of subsequent investigations including a site survey for the ILS project which included vegetation mapping verification, refer Figure 5.3. There are 16 different vegetation communities mapped, which can be summarised as follows:

- Bare Twig-rush *(Baumea juncea)* and Common Reed *(Phragmites australis)* sedgeland / rushland;
- Swamp She-oak *(Casuarina glauca)* low open forest, with various ground covers, such as Setaria *(Setaria sphacelata),*
- Swamp She-oak and Broad-leaved Paperbark *(Melaleuca quinquenervia)* open forest;
- Exotic grassland;
- Mangrove forest to open woodland;
- Salt Couch *(Sporobolus virginicus) (salt marsh)*;
- Prickly Couch *(Zoysia macrantha)* grassland *(salt marsh).*

There is evidence that the vegetation communities in the localiser footprint have changed in recent years. During the Tugun Bypass flora and fauna surveys, some of the land in the middle of the localiser footprint was considered to be Swamp Oak Woodland; however the ecological community appears to have since changed to a more brackish environment, as evidenced by the now widespread existence of saltmarsh as well as areas dominated by a ground layer of species such as Bare Twig-rush, Common Reed and Mangrove Fern *(Acrostichum speciosum)*. Such a change is reasonable to expect due to the potential alterations in drainage that may have resulted from construction of the Tugun Bypass, with some influence also from natural change. In regards to the latter, the area has undergone a significant change in the last 40 years. The localiser footprint was originally cleared for agriculture, and the current vegetation communities (including fringing mangroves) appear to have since grown, refer Figure 5.4.

Vegetation communities in the localiser footprint have also been identified as Endangered Ecological Communities (EECs) under the TSC Act. These are mapped in Figure 5.5 and include:

- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and south east corner bioregions;
- Swamp Oak Floodplain Forest of the New South Wales north coast, Sydney basin and south east corner bioregions;
- Swamp Sclerophyll Forest on coastal floodplains of the New South Wales north coast, Sydney basin and south east corner bioregions;
- Subtropical Coastal Floodplain Forest of the New South Wales north coast bioregion.

The Coastal Saltmarsh EEC under the TSC Act corresponds to the Subtropical and Temperate Coastal Saltmarsh Ecological Community (STCSEC), which is considered a Vulnerable Threatened Ecological Community (TEC) under the EPBC Act.

The Conservation Advice for the STCSEC provides a synopsis of studies that have estimated the original and current extent of the community, as follows:

"There is scattered information about the extent and decline of the Coastal Saltmarsh in NSW. Keith (2004) estimated that the current area of Coastal Saltmarsh covered an area of 7000 to 12 000 ha and that about 30 to 70% had been cleared since European settlement. West et al. (1985, in OEH 2011a) estimated the extent of Coastal Saltmarsh in NSW to be approximately 5700 ha while Creese et al. (2009) estimated the extent as 7259 ha. More recently, Daly (2013) summarised information about the extent of saltmarshes across all natural resource management regions and estuaries within NSW. Refer Table 5.2. (This indicated the ecological community covered an area of 7240 ha – i.e. it fell towards the lower end of Keith's (2004) range. Although Daly (2013) provided no overall estimate of loss across NSW, he did note that specific estuaries showed losses of saltmarsh ranging from 12 to 97 percent. In some cases there were apparent increases in saltmarsh extent but it was unclear whether this was due to actual expansion of the ecological community or improved mapping techniques. Tozer et al. (2010) determined the current extent of estuarine saltmarshes on the south coast of NSW (from Sydney to the Victorian border) to be about 2167 ha and estimated that this represented <50 percent of the original extent." (TSSC 2013, pp. 56-57)

Table 5.2: Estimate of current extent (hectares) for the subtropical and temperate coastal saltmarsh ecological community in NSW (from TSSC 2013)

Region	Daly (2013)	Tozer (2010)
Northern Rivers (Gold Coast Airport and surrounds is in this region)	2230	
Hunter/Central Rivers	3270	
Hawkesbury Nepean	290	
Sydney Metropolitan	190	2167
Southern Rivers	1260	
TOTAL	7240	79571

On the basis of the available survey data for New South Wales, the TSSC (2013) estimates that the current extent of the STCSEC ecological community is likely to be about 7000 to 8000 hectares. The TSSC (2013, pp.57) also states that the decline in extent is recognised to be highly variable but is estimated to be between 30 to 70 percent across the state. The Office of Environment and Heritage note that further reduction and fragmentation have occurred since the estimates within West et al. (1985 in OEH 2011a). As per Table 5.2, it is estimated that approximately 2230 hectares occur in Northern Rivers (Daly, 2013, in TSSC 2013).

The current extent of the other three ecological communities across New South Wales (Subtropical Coastal Floodplain Forest; Swamp Oak Floodplain Forest; and Swamp Sclerophyll Forest on Coastal Floodplains) is not fully known, though they are expected to be much less than 30 percent of their original ranges (OEH 2011b, c and d). For example, there were less than 350 hectares of each of these EECs within the Tweed lowlands in 1985 (Pressey & Griffith, 1992, in OEH 2011b, c and d).

The localiser footprint also has an area of SEPP 14 Wetland mapped on the western side, refer Figure 5.5. The areas of coastal saltmarsh and mangroves within the localiser footprint are likely to provide habitat for aquatic fauna when inundated during higher tides, and also provide high tide roost habitat for shorebirds that utilise feeding areas in the Cobaki Broadwater. However as described in Section 5.6, Swamp Oak, mangrove and sedge have encroached into the salt marsh resulting in a deterioration of shorebird habitat quality (Australian Wetlands 2010) for roosting and foraging, and declines in the number of birds using the site.

Fisheries Resources

The mangroves that line the Cobaki Broadwater are important habitats that form nursery areas for estuarine species and thereby contribute to the fisheries values of the Broadwater. Saltmarsh areas can also form habitat and shelter for fish during higher tides and are a source of nutrients to estuaries. The strip of mangroves along the Cobaki foreshore, west of the localiser footprint will remain which will assist in minimising the impacts to the fish habitat values of this area of the Cobaki Broadwater. The retention of saltmarsh to the west of the localiser earth pad and the design of the perimeter road for continued tidal inundation and connectivity will further minimise the impact to fish habitat values in the localiser footprint and allow for continued nutrient exchange with the Cobaki Broadwater.

Connectivity

Fundamental requirements for terrestrial fauna connectivity (Lindenmayer & Nix, 2002) are largely absent in and around the localiser footprint (i.e. between the Cobaki and habitat east of the localiser footprint). The current barriers to terrestrial wildlife movement in and around the localiser footprint include:

- The narrow pinch-point area of land that exists alongside the Cobaki Broadwater and the Tugun Bypass;
- The drainage channels and pinch-points associated with narrow drainage crossings;
- The disturbed habitat and pinch point associated with the Tugun Bypass running east west across the tunnel roof;
- The airside security fencing.

It is likely that these barriers provide significant hindrance to terrestrial connectivity for most terrestrial fauna between the Cobaki and habitat to the east of the Tugun Bypass. For instance, sedentary forest birds (e.g. Fairy Wrens) are known to have high resistance to mobility across land cover other than forests; though other volant species that inhabit large home ranges and a variety of habitats (e.g. bats, or bird species such as crows, cockatoos and parrots) will not be inhibited by these barriers.

Large mammals (such as koalas and wallabies) and reptiles are also likely to have limited mobility between the habitat east of the Tugun Bypass and the Cobaki due to a combination of the four barriers listed above. The pinch points and tidal drains are also likely to be significant barriers to movement/dispersal for the Common Planigale *(Planigale maculata)* and other small mammals.

5.5.2 Assessment of Impacts

Glidepath Footprint

Negligible impacts to habitat values and wildlife corridors are anticipated in the glidepath footprint.

300 metre Runway Strip

There are five ESA Impact Areas (A to E) within the 300 metre runway strip that will be affected by the project.

Due to the extent of vegetation in ESA Impact Area A that will exceed CASA height requirements, it is not feasible to maintain vegetation in this area. As such, ESA Impact Area A will be cleared entirely. ESA Impact Area A also includes the area of vegetation immediately to the west of the flyover area. Clearing of ESA Impact Area A will result in the loss of approximately 1.3 hectares of remnant habitat (melaleuca forest with a coastal heathland understorey and RE 12.2.12/12.2.9). This has been assessed as a minor adverse impact given the regional representation of this vegetation community.

There will be cumulative impacts to ESAs at the airport (including flora and fauna species and habitats) due to planned ESA clearing for terminal and apron expansion depicted in the Master Plan, to be undertaken as a separate project. That project has been determined by DoE to be a 'controlled action' under the EPBC Act and is subject to detailed environmental assessment to determine the appropriate mitigation and offsets. When the two projects are considered together, approximately 22% of total ESAs (terrestrial and aquatic) at the airport are to be cleared, of which the clearing for the ILS Project is a very small component (less than 1%).

As there are only scattered trees/plants that currently exceed height requirements in ESA Impact Areas B to D of the 300 metre runway strip, it is feasible to undertake trimming and selective plant removal (rather than clearing). This will be done as a mitigation measure to reduce the project's impact on Wallum Sedge Frog and Wallum Froglet, as the sedge and heath layer can be maintained. In this case, plants exceeding the flyover plane will be trimmed, or removed if the height renders the plant unviable (e.g. for large trees or shrubs).

For ESA Impact Areas B to D, trimming and selected plant removal will occur within the south western part of the flyover area to reduce the project's impact on Wallum Sedge Frog and Wallum Froglet. Plants exceeding the required height will be trimmed, or removed if the height renders the plant unviable (e.g. for large trees or shrubs).

ESA Impact Area E is an area of low growing saltmarsh with a mangrove lined drain to the south. Some scattered trees and mangroves may require trimming or removal in the future if they exceed CASA height requirements.

Trimming and selective plant removal in ESA Impact Areas B to E will result in a negligible impact to habitat values, as the heath, sedge and saltmarsh values can largely be maintained or improved through vegetation management. These areas will therefore be retained as ESAs.

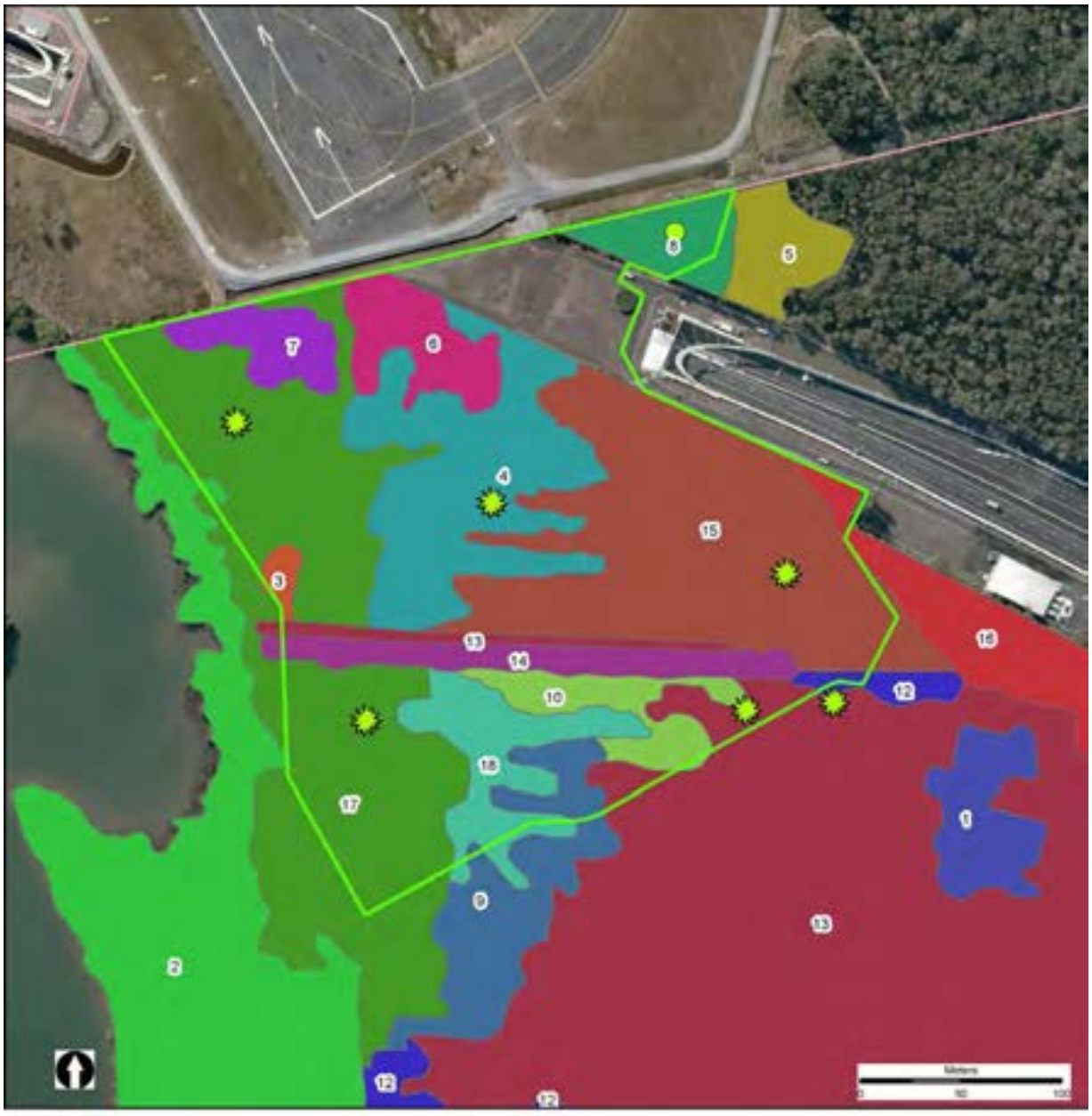
Localiser footprint

Clearing

The localiser footprint is to be cleared and maintained in a cleared state through ongoing vegetation management. The assessment below considers full site clearing to conservatively assess the impacts, however where possible, existing ground cover and low growing saltmarsh vegetation west of the localiser earth pad will be retained.

The localiser footprint is approximately 7.7 hectares in area, of which approximately 0.5 hectares was previously cleared as part of the Tugun Bypass Tunnel and now contains some regrowth and planted vegetation (i.e. above the tunnel on Lot 112 DP 1202048). Therefore the remaining area to be cleared is approximately 7.2 hectares, of which approximately 6.5 hectares is mapped as EEC, refer Figure 5.5.

Figure 5.3: Vegetation Communities in the Localiser Footprint



Legend

- Runway 14 Localiser Footprint
- Supplementary Frog Survey Point
- Vegetation Community Verification Point

Vegetation Communities (Ecosure 2009b & 2009c)

1. Acacia leiocalyx (open) woodland with ground stratum of Setaria sphacelata
2. Avicennia marina subsp. australasica low open forest to open woodland
3. Baumea juncea / Juncus kraussii / Juncus kraussii sedgeland / rushland
4. Baumea juncea / Phragmites australis sedgeland / rushland
5. Casuarina glauca / Melaleuca quinquenervia open forest
6. Casuarina glauca low open forest to woodland with ground stratum of Baumea juncea
7. Casuarina glauca low open forest to woodland with ground stratum of Baumea juncea / Fimbristylis ferruginea
8. Casuarina glauca low open forest with ground stratum of Sporadanthus interruptus et al
9. Casuarina glauca open forest to woodland with ground stratum of Eriochloa procera
10. Casuarina glauca open forest to woodland with ground stratum of Setaria sphacelata
11. Casuarina glauca open forest to woodland with ground stratum of Sporobolus virginicus / Eriochloa procera
12. Casuarina glauca open forest with ground stratum of Setaria sphacelata
13. Exotic grassland
14. Mangrove forest
15. Melaleuca quinquenervia / Casuarina glauca (open) woodland with ground stratum of Setaria sphacelata
16. Melaleuca quinquenervia open forest
17. Sporobolus virginicus grassland (saltmarsh)
18. Zoysia macrantha grassland (saltmarsh)

Figure 5.4: Historical (1975) Aerial Image of Localiser Footprint (black and white) with Current Aerial Image (colour)

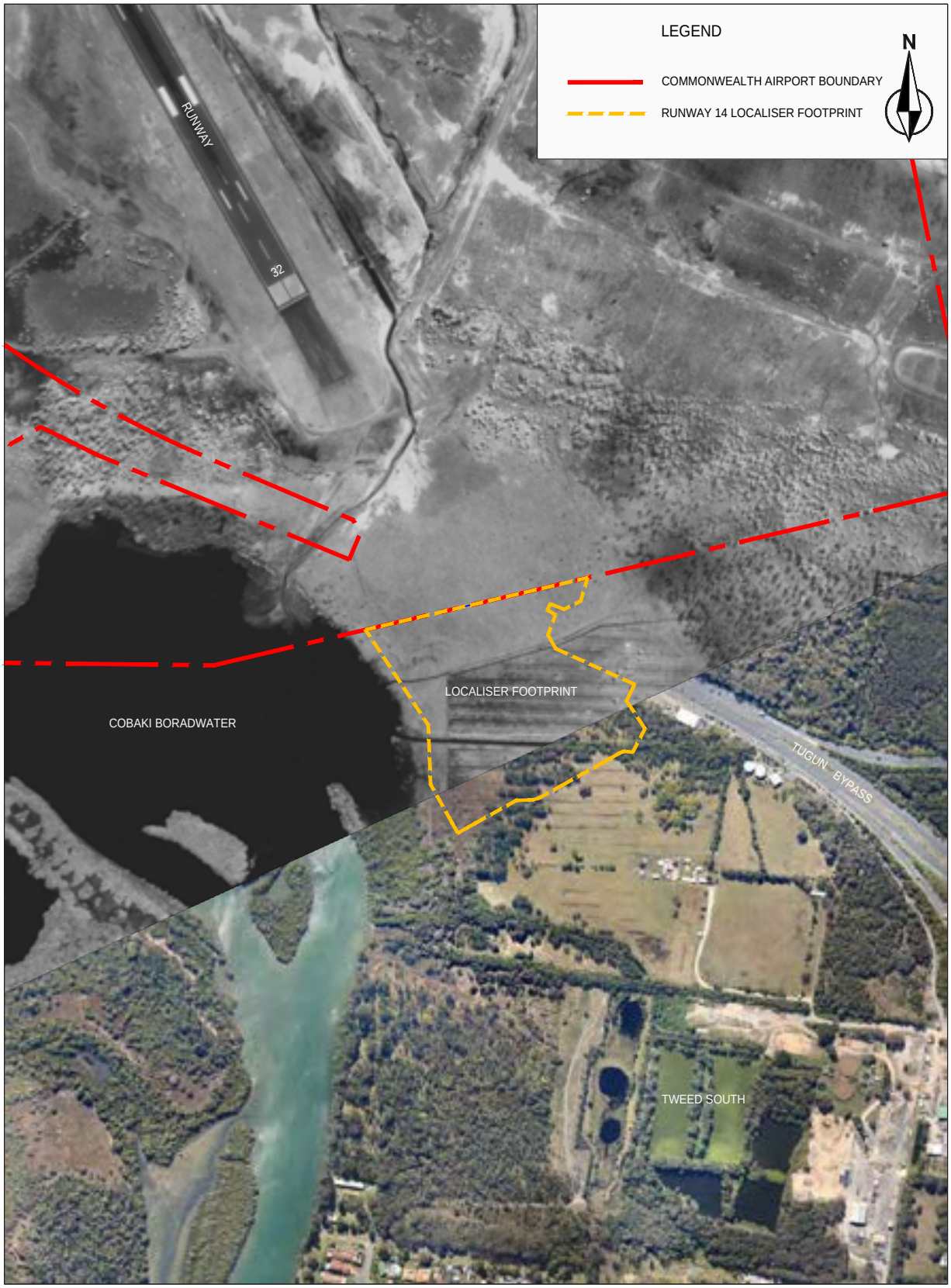
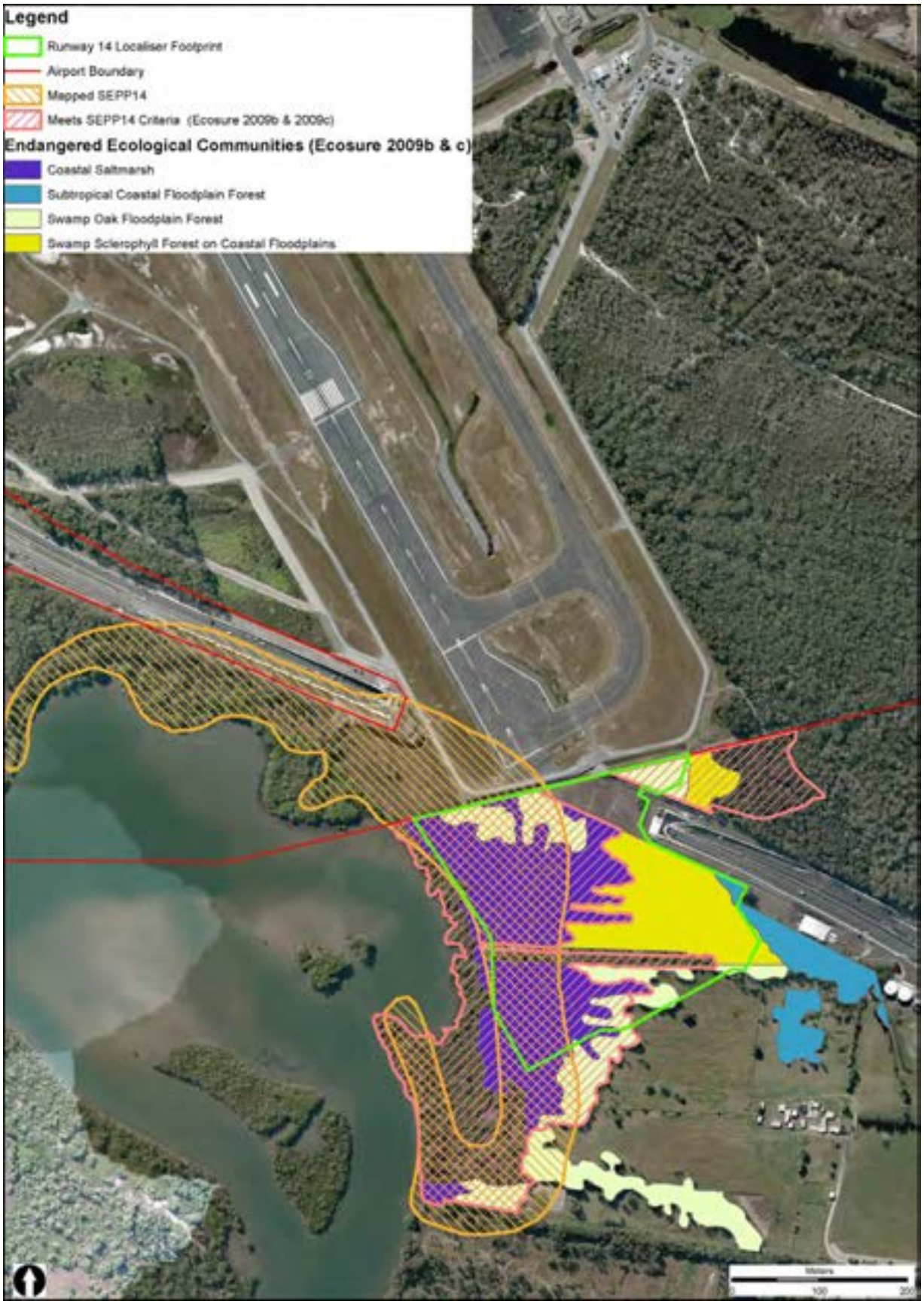


Figure 5.5: Wetlands and Endangered Ecological Communities in the Localiser Footprint



The vegetation to be cleared consists of:

- 0.7 hectares of non-EEC vegetation;
- Four EECs in the area:
  - 3.5 hectares of Coastal Saltmarsh (which is both a NSW EEC and listed as a vulnerable TEC under the EPBC Act
  - 0.05 hectares of Subtropical Coastal Floodplain Forest;
  - 1.2 hectares of Swamp Oak Floodplain Forest;
  - 1.8 hectares of Swamp Sclerophyll Forest on Coastal Floodplains.

Of this 3.1 hectares is also mapped as SEPP14 wetland in the area, whilst 4.7 hectares of vegetation meets the definition of SEPP14.

As the current extent of these EECs across the whole of New South Wales is not known (OEH 2011a, b, c and d), the impact of the project within a state wide context cannot be determined with accuracy. However, the clearing of EECs is considered a key threatening process under the NSW Emvironmental Planning and Assessment Act 1979.

On a Commonwealth level, pursuant to Section 18A(4)(b) of the EPBC Act, it is not an offence to have a significant impact on a Vulnerable TEC such as the Subtropical and Temperate Coastal Saltmarsh TEC in the localiser footprint. This is also outlined in the Department of Environment's Significant Impact Guidelines (2013, pp. 8), which states:

"…listed ecological communities in the vulnerable category of ecological communities listed under the EPBC Act, are not matters of national environmental significance for the purposes of Part 3 of the EPBC Act (requirements for environmental approvals)."

Despite the EPBC Act listed TEC not being considered a matter of National Environmental Significance for the purposes of Part 3 of the EPBC Act, the TEC does form part of the 'environment' as defined under the EPBC Act. Thus, as the clearing in the localiser footprint will be undertaken by a Commonwealth Agency (Airservices Australia) and the *Significant Impact Guidelines 1.2* apply, the impact to the EPBC Act listed TEC has been considered in this assessment.

The *Significance Impact Guidelines 1.2* provides some guidance on where impacts to 'plants' may be considered significant. The guidelines state that a significant impact is likely to occur if medium or large scale vegetation clearance is proposed. Clearance of the 7.7 hectares of vegetation in the localiser footprint as well as vegetation management activities is considered to be small scale vegetation clearance, which according to the guideline, would not be considered a significant impact. Furthermore, the cleared area represents a very small percentage of its current extent in the region, which is estimated at 2230 hectares. Previous land uses have affected the vegetation communities in the localiser footprint and vegetation communities have changed markedly in recent years due to changes in drainage. Weeds are also present in parts of the site.

Future terminal and apron expansion at the airport (a separate project) will also result in clearing of Swamp Sclerophyll Forest EEC, resulting in a cumulative impact of approximately 18ha, of which the ILS clearing is a very small component. The terminal and apron expansion project has been determined by DoE to be a 'controlled action' under the EPBC Act, and is currently subject to detailed environmental assessment and identification of appropriate mitigation measures and offsets for residual impacts to significant flora, fauna and ecological communities.

Shorebird Roost Habitat

The area of coastal saltmarsh that is being impacted in the localiser footprint represents a loss of roosting and foraging habitat for shorebirds, particularly for migratory and marine bird species listed under the EPBC Act that inhabit the Cobaki Broadwater and more widely, the Tweed River Estuary.

The Department of Environment's Significant Impact Guidelines 1.1 (2013, pp. 12) state that:

"An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will substantially modify, destroy or isolate an area of important habitat for a migratory species."

Significant Impact Guidelines 1.1 (2013, pp. 12) state an area of 'important habitat' for a migratory species is:

a. *"habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or*
b. *habitat that is of critical importance to the species at particular life-cycle stages; and/or*
c. *habitat utilised by a migratory species which is at the limit of the species range; and/or*
d. *habitat within an area where the species is declining."*

In addition to this, the Significant Impact Guidelines for 36 Migratory shorebird species (DEWHA 2009) identifies an area as being important habitat if:

1. The site is identified as internationally significant; or
2. The site supports:
    a. at least 0.1 percent of the flyway population of a single species;
    b. at least 2,000 migratory shorebirds; or
    c. at least 15 shorebird species.

For Latham's Snipe *(Gallinago hardwickii)*, habitat is considered 'important habitat' when it has been identified as internationally important for the species, or the site supports at least 18 individuals of the species, and the site has naturally occurring open freshwater wetland with vegetation cover nearby (DEWHA 2009).

Further to this, internationally important shorebird sites within the East-Australasian Flyway include those that support 20,000 or more shorebirds or 1 percent of the Flyway population of a migratory shorebird species or subspecies (Environment Australia 2002), as per the Ramsar Convention.

The localiser footprint is part of the Tweed River Estuary. Watkins (1993) originally classified the Tweed River Estuary as being nationally important for Whimbrel *(Numenius phaeopus)*; however Australian Wetlands (2010), Bamford et al. (2008) and Rohweder have noted that the Tweed River Estuary is no longer considered important (nationally or internationally) for any species of migratory shorebird.

Australian Wetlands (2010) state that the Tweed River Estuary is likely to be in the top 10 most important sites (ranked about 8) for New South Wales but is less important in an Australian context (Australian Wetlands 2010, pp. 70). Australian Wetlands (2010) predicts the population of shorebirds to be well below 1,000; though the Tweed River estuary supports around 22 migratory species.

Thus, the Tweed River Estuary would be considered important national habitat, using the definition used by the Department of Environment (DEWHA 2009).

Where feasible, low-growing saltmarsh species will be retained west of the earth pad within the localiser footprint.

As the action will not;

1. Substantially modify migratory bird habitat available in the Cobaki Broadwater and wider Tweed River Estuary (as per Significant Impact Guideline 1.1); or
2. Result in the loss of important habitat that causes a significant reduction in the capacity of the habitat to support migratory shorebirds (as per the Significant Impact Guidelines for 36 Migratory shorebird species);

It has been assessed that the clearing of roost habitat is unlikely to result in a significant impact as defined under the EPBC Act.

During construction, impacts to fish habitat values may arise from erosion and sedimentation or disturbance of acid sulfate soils which could result in reduced water quality in the Cobaki Broadwater if not managed adequately. Minimising the disturbance footprint through the retention of saltmarsh to the west of the localiser earth pad will significantly reduce this impact, in addition to the implementation of erosion and sediment controls and acid sulfate soil management during construction which are described in Section 5.10. Despite these measures there is likely to be a localised and temporary increase in turbidity adjacent to the localiser footprint during construction. Water quality monitoring will be conducted before, during and after construction so that the effectiveness of erosion and sediment controls can be assessed and improved if necessary.

Following construction, the site will be stabilised, tidal inundation will continue across the western portion of the site, and the realigned drainage channels will continue to drain to the Cobaki Broadwater. Therefore the impact to fisheries resources during operation would be low adverse, arising from the loss of some saltmarsh habitat.

Connectivity and Edge Effects

Currently, several significant barriers to connectivity exist between the Cobaki Broadwater and habitat on the eastern side of the Tugun Bypass, however there is a narrow corridor above the Tugun Bypass tunnel. Due to the proposed perimeter fencing and clearing, this narrow corridor (which connects habitat either side of the Tugun Bypass) will be severed.

Installation of the ILS will also result in the existing narrow Cobaki Broadwater foreshore west of the runway being extended south and further narrowed. This would be expected to reduce connectivity for terrestrial species, however some connectivity will be maintained along the banks of the Cobaki Broadwater for fauna that inhabit mangrove forest (e.g. Mangrove Honeyeater *(Lichenostomus fasciogularis)* or Collared Kingfisher *(Todiramphus chloris)*.

The alignment of the road and fence in the northwest corner of the localiser footprint area has been planned to minimise the extent to which the corridor along the Cobaki foreshore is impacted.

Impacts to connectivity in the localiser footprint would also potentially affect connectivity further north on Commonwealth airport land.

Given the poor current condition of connectivity in the area and the current significant barrier effects between the Cobaki and areas east of the localiser footprint, construction of the ILS is not expected to result in significant impact to current levels of connectivity.

Works in the localiser footprint may also create minor edge effects for the mangrove and salt marsh community along the banks of the Cobaki Broadwater. Edge effects may include minor weed colonisation and greater wind exposure (potentially leading to increased evapotranspiration or direct damage).

Assessment of Significance

It has been assessed that the installation of ILS infrastructure in the localiser footprint will result in a minor to moderate adverse impact to habitat values and wildlife corridors, primarily due to the impact of habitat clearance.

5.6 Significant Flora and Fauna

5.6.1 Baseline Conditions

The term 'significant species' includes migratory and marine species listed under the EPBC Act as well as threatened species. It also includes species that may be considered of special significance (e.g. due to limited distribution) though are not protected under State or Commonwealth legislation. The term 'threatened species' includes:

- Species listed under the EPBC Act as threatened;
- Species listed as Extinct, Endangered, Vulnerable or Near Threatened under the NC Act; and/or
- Species listed as Critically Endangered, Endangered or Vulnerable under the TSC Act.

Several studies over the last 10 years have assessed the presence of threatened species across the ILS study areas, and the presence of habitat for significant species was one of the considerations in the identification of ESAs. Due to the degree of environmental change that has happened across some of the study areas over time, the age of the studies and these changes have been taken into account within this assessment for the MDP.

Data was sourced from the existing reports (including assessments undertaken during the identification of ESAs at the airport), EPBC Protected Matters Search Tool (PMST), the Queensland Department of Environment and Heritage Protection's Wildlife Online Search Tool and the Atlas of New South Wales Wildlife.

The Atlas of New South Wales Wildlife included 2268 records from 670 species, with 217 of these being significant species (within the default 10 square kilometre search area). The EPBC PMST identified 41 listed threatened species and 42 migratory species which may occur in the search area, or whose habitat may occur in the search area. The Queensland Wildlife Online Search results show that four significant species have been observed within the search area.

No significant fauna or flora species were identified in the study area during the site surveys that was undertaken for this assessment. However, previous studies have identified threatened species within the area, and these are further discussed in the sections below.

Glidepath Footprint

Land within the glidepath footprint is mown grassland or hardstand managed as part of the runway precinct. This provides clear zones for safe aircraft landing, take off and taxiing. A grassed, open drainage line is present in the glidepath footprint. This area is not considered to provide suitable habitat for threatened aquatic or terrestrial flora or fauna species.

300 metre Runway Strip

Fauna

The 300 metre runway strip is within the current airfield and this land is managed primarily for the purpose of aircraft landing, take off and taxiing operations etc. It is also subject to GCAPL's Bird and Wildlife Hazard Management Plan. This means that fauna in this area would be subject to active management (directly removing or reducing the numbers of birds and other fauna where they pose a risk to aircraft operations).

There are ESAs within the 300 metre runway strip that provide habitat for Wallum Froglet and Wallum Sedge Frog. Monitoring undertaken as part of GCAPL's Significant Terrestrial Fauna Monitoring Program has identified Wallum Froglet and Wallum Sedge Frog as occurring in all of these areas in recent years. Refer Section 5.6.2 for habitat assessment for Wallum Sedge Frog.

The species likelihood assessment (Appendix A) also shows that a number of fauna species are known to occur, or could possibly occur in the 300 metre runway strip. These include:

- Two amphibian species, with one (Wallum Sedge Frog) listed under the EPBC Act and TSC Act, and the other (Wallum Froglet) listed under the TSC Act and NC Act;
- 22 bird species, with:
  - 12 listed under the EPBC Act as migratory or marine;
  - One listed as vulnerable under the EPBC Act (Red Goshawk *(Erythrotriorchis radiatus)*);
  - 10 listed under the TSC Act;
  - Two listed under the NC Act.
- 10 mammal species, with:
  - One (Grey-headed Flying Fox *(Pteropus poliocephalus)*) listed under the EPBC Act as vulnerable;
  - All ten listed under the TSC Act. Nine of these are bat species, with the Common Planigale being the only other mammal. It is worth noting that there are only small patches of suitable habitat for the Grey-headed Flying Fox.

The presence of habitat for legislatively significant species was a factor considered in the identification of ESAs at the airport.

Flora

Table 5.3 identifies the significant flora species that may occur in the 300 metre runway strip. This is summarised from the Species Likelihood of Occurrence Assessment in Appendix A.

Table 5.3: Significant flora species that may occur within the 300 metre Runway Strip

Species	Status	Distribution	Likelihood of occurrence in the 300 metre runway strip
Christmas Bells ***Blandfordia grandiflora***	Endangered under the Queensland NC Act	North from the Hawkesbury River area and inland to Glen Innes district.	Known. This species is found in the 300 metre runway strip, though the known population will not be impacted by the project as it will be below vegetation trimming requirements.
Dark Greenhood ***Pterostylis nigricans***	Vulnerable under the NSW TSC Act	The Dark Greenhood occurs in north-east New South Wales north from Evans Head, and in Queensland.	Possible. Marginally suitable habitat exists in the 300 metre runway strip.
Fringed Baeckea ***diosmifolia***	N/A	This species is generally found along the New South Wales coastline otherwise (Wilson 1997).	Possible. This species is not listed as threatened on a Commonwealth or state level, though the only known location on the Gold Coast is at the Gold Coast Airport. It is not known to be present in ESA Impact Areas A to E.
Lemon-scented grass ***Elyonurus citreus***	Endangered under the New South Wales TSC Act	Lemon-scented Grass occurs north from Grafton in New South Wales. It is only known from localities south of Casino, north-west of Grafton, near Cudgen Lake on the Tweed coast and in Yuraygir National Park. It also occurs in Queensland, Northern Territory, Western Australia and New Guinea.	Possible. Suitable habitat exists in the 300 metre runway strip.
Pink nodding orchid ***Geodorum densiflorum***	Endangered under the New South Wales TSC Act	North from the Macleay River on the north coast of New South Wales.	Possible. Suitable habitat exists.
Spider Orchid ***Dendrobium melaleucaphilum***	Endangered under the New South Wales TSC Act	Occurs in coastal districts and nearby ranges, extending from Queensland to its southern distributional limit in the lower Blue Mountains.	Possible. There is potential due to occurrence of the Prickly Paperbark (Melaleuca stypheliodes) in areas east of the runway.

Tiny Wattle ***Acacia baueri subsp. baueri***	Vulnerable under the Queensland NC Act. The species is not listed as threatened under the TSC Act	Tiny Wattle is found on infertile and often seasonally waterlogged sands in coastal heath (wallum) habitat and adjacent plateaus and low open woodland.	Known. Tiny Wattle is listed under the NC Act only, but occurs only on the New South Wales portion of the Gold Coast Airport. A significant population of this plant is present on the airport confined to areas of mown heath in New South Wales - not within ESA Impact Areas A to E; though partially within parts of the flyover area. This species is unlikely to be impacted by clearing in ESA Impact Area A and will not be impacted by trimming in in other areas of the flyover area due to its height.
Wallum bottlebrush ***Melaleuca pachyphylla***	City-wide significance in Gold Coast City	Restricted to poorly drained heath and moist areas of open forest on sand and sub-coastal metasediments. Sandy heath of coastal New South Wales and southern Queensland.	Known in Impact Areas A and B therefore would be impacted by clearing and possibly trimming.
Swamp grasstree ***Xanthorrhoea fulva***	City-wide significance in Gold Coast City	Wet sandy areas from Wyong on the New South Wales Central Coast north into Queensland.	Known in Impact Areas A and B therefore would be impacted by clearing and possibly trimming.
Wallum banksia ***Banksia aemula***	City-wide significance in Gold Coast City	Coastal areas of New South Wales and southern Queensland.	Known in Impact Area A therefore would be impacted by clearing.
Olive Tea Tree ***Leptospermum liversidegei***	City-wide significance in Gold Coast City	North-eastern New South Wales and south-east Queensland in sandy, swampy coastal heath.	Known in Impact Area B therefore possibly subject to trimming.

5.6.2 Results of the Habitat Assessment for Wallum Sedge Frog in ESA Impact Area A

ESA Impact Area A , refer Figure 5.1, has been identified as having suitable vegetation for Wallum Sedge Frog as the species is known to have strong affiliations with cylindrical, erect sedges such as sedges *(Baumea sp.)* and Grey Sedge *(Lepironia articulata)*. A targeted habitat assessment and survey of Area A was undertaken for the project, to determine its suitability for the Wallum Sedge Frog. Area A was largely found to be unsuitable habitat for the Wallum Sedge Frog as outlined below.

No frog species were heard calling during the survey and only one species was visually observed during the survey. This was Striped Rocket Frog (Litoria nasuta), which was visually observed in the mown sedge area that borders ESA Impact Area A. Striped Rocket Frog is not listed as a threatened species under state or Commonwealth legislation.

Based on quarterly frog surveys undertaken as part of the Significant Fauna Monitoring Program since 2006 and other historical data, there are previous records of the species in ESA Impact Area A:

- One record in the mid-north of ESA Impact Area A recorded in the early 2000's (actual date is unknown).
- Two records on the southern tip of ESA Impact Area A. These were recorded on the 10th of October 2011 and the 18th of January 2012. Two Wallum Sedge Frog were heard on each date; however this indicates presence only, not population numbers.
- Six records in the northern part of ESA Impact Area A in February 2015. These records occurred after the submission of the EPBC referral for the project, however the information was provided to DoE within the referral decision period and prior to the referral determination.

It appears that the 2011/2012 records of Wallum Sedge Frog in ESA Impact Area A came at a time when the population was increasing. Monitoring undertaken from July 2011 to June 2012 as part of the Significant Fauna Monitoring Program recorded a total of 78 Wallum Sedge Frog calls in spring and summer. This total is more than in the previous period (2010 - 11) when only 41 were recorded and the highest number of calls (66 individuals) was heard during January (summer), which had the highest total rainfall of the four months surveyed. This is the highest number of Wallum Sedge Frogs recorded during a single frog survey, with the next highest (38 individuals) recorded in February 2009.

Although the reasons for recording Wallum Sedge Frog in ESA Impact Area A during the 2011/2012 breeding season are not clear, higher frog populations across the airport site were potentially due to higher rainfall (all years since 2008, except 2011, had above average annual rainfall) and active weed management.

Such a conclusion is consistent with the ecology of the Wallum Sedge Frog as (similar to other frog species) the species is known to be in a state of flux, expanding and contracting according to climatic conditions (amongst other factors). Generally speaking, two sequential summers would provide favourable conditions for an expansion of the population; however other factors would also determine population size. It is worth nothing that despite continued higher than average annual rainfall since the recent observations, evidence shows the population has reduced across the airport.

Monitoring undertaken from July 2012 to June 2013 as part of the Significant Fauna Monitoring Program recorded a 46 percent reduction in Wallum Sedge Frog records from the 2011-12 monitoring period (across the whole airport), and that the 2012-13 monitoring period was similar to that of previous years prior to 2011-2012. This may explain why Wallum Sedge Frog was not recorded in ESA Impact Area A during the 2012-2013 monitoring period.

The 2015 records of Wallum Sedge Frog in ESA Impact Area A also occurred after significant rainfall (the airport has received approximately 800mm of rainfall in 2015, which is more than double the average rainfall for the period), therefore is consistent with the above theory that the Wallum Sedge Frog expands into the area after significant rainfall. Habitat observations at the time of the 2015 survey indicate that the area is not likely to be suitable breeding habitat as there is insufficient ponding water.

Other common species less adapted to acidic conditions are also regularly recorded in ESA Impact Area A. This includes Common Sedge Frog *(Litoria fallax)*, Striped Rocket Frog *(Litoria nasuta)*, Tyler's Tree Frog *(Litoria tyleri)* and Striped Marsh Frog *(Limnodynastes peronii)*. These frogs are likely to compete for resources and are known to displace Wallum Sedge Frog. In addition, their regular presence indicates the water pH in ESA Impact Area A may be generally too high for Wallum Sedge Frog.

ESA Impact Area A may provide low quality suitable habitat for Wallum Sedge Frog; though only during years where the population has increased and the species disperses to less favourable habitat.

The reasons why the area is generally low quality habitat is likely to relate to competition with other frog species, the low frequency of freestanding water and water quality. Further survey of the area (including tadpole surveys) will be conducted prior to works occurring in the area, and if required, an EPBC permit will be obtained for affecting an EPBC-listed threatened species on Commonwealth land.

Localiser Footprint

Fauna

Based on an assessment of species likelihood (see Appendix A), and with reference to the habitats present in the area, a number of significant fauna species are known to occur, or could possibly occur in the localiser footprint. These include:

- 43 bird species, with 32 of these listed under the EPBC Act (all are migratory or marine) and 18 listed under the TSC Act;
- Eight mammal species, with none listed under the EPBC Act and all eight listed under the TSC Act. Seven of these are bat species, with the Common Planigale being the only other mammal.

Frogs

Two threatened frog species – the Wallum Sedge Frog and the Wallum Froglet - are known to occur in adjacent areas to the localiser footprint. The Wallum Sedge Frog is listed as vulnerable under the EPBC Act, NC Act and TSC Act, whilst the Wallum Froglet is listed as vulnerable under the NC Act and TSC Act.

The habitat within the localiser footprint is not considered to be suitable for these two species as the Wallum Sedge Frog is generally found in wetlands with emergent reeds, ferns and/or sedges and in undisturbed coastal wallum. The Wallum Froglet is found in similar environments, including Paperbark swamps, sedgeland, and wet or dry heathland and wallum/woodland areas in the sandy coastal lowlands. Both species prefer wetlands characterised by acidic water bodies.

Common Froglet (Crinia signifera), which is not a threatened frog species, was heard during the survey for the ILS project in the small triangle of land to the south east of the localiser footprint. This species prefers less acidic environments and therefore can sometimes indicate that the habitat is unsuitable for the two acid frog species.

Significant Shorebirds

In the localiser footprint, 'significant shorebirds' include those listed as migratory, marine or threatened under the EPBC Act, or threatened under the TSC Act.

The mangrove and salt marsh areas in the localiser footprint have previously been referred to as the Pony Club Roost (Australian Wetlands 2010, Parsons Brinckerhoff 2004, Rohweder 2001 & 2007). The Pony Club Roost is one of 11 active migratory bird roosts in the Tweed River Estuary (Australian Wetlands 2010).

In 2001, Rohweder (2001) noted that the Pony Club Roost provided locally important high tide roost habitat for a number of significant shorebird species. However, since 1994, Swamp Oak, mangrove and sedge *(Juncus kraussii)* has encroached into the salt marsh resulting in a deterioration of habitat quality (Australian Wetlands 2012) for roosting and foraging.

Previous studies on shorebirds in the Cobaki, Rohweder (2001; 2007) and Australian Wetlands (2010) also note that the number of roosting sites used in the Cobaki has reduced due to disturbance and habitat loss.

Significant shorebird species known to use parts of localiser footprint as a high tide roost include:

- Grey-tailed Tattler *(Heteroscelis brevipes)*;
- Bar-tailed Godwit *(Limosa lapponica)*
- Eastern Curlew *(Numenius madagascariensis)*;
- Whimbrel *(Numenius phaeopus)*;
- Pacific Golden Plover *(Pluvialis fulva)*; and
- Common Greenshank *(Tringa nebularis)*.

All of these species are currently listed as both marine and migratory under the EPBC Act. Other migratory species that utilise the entire Tweed River Estuary may also use the localiser footprint (Wetlands Australia 2012).

Despite the changes to habitat in the localiser footprint and the associated reduction in use by shorebirds, the number of shorebirds using the localiser footprint would also be influenced by population decreases that have occurred in the context of declining migratory bird populations across the Tweed Estuary and Australia more generally (DECCW 2010; Hansen 2011). This is most likely due to habitat destruction within the East-Asian/ Australasian Flyway and, more locally in the Tweed River Estuary, foreshore development, increased levels of human recreation, vegetation encroachment, pollution, major projects and dredging (Rohweder 2007).

The total population of migratory shorebirds has significantly declined in the Tweed River Estuary (Rohweder 2007, Australian Wetlands 2010) with under half the shorebird numbers observed in 2009, compared to numbers observed between 1987-2002 (Australian Wetlands 2010). The migratory species with substantial population declines in the estuary include Bar-tailed Godwit Curlew Sandpiper *(Calidris ferruginea)* and Pacific Golden Plover (Australian Wetlands 2010).

Non-Threatened Fauna Species

Non-threatened species are known to exist in the area, including the Swamp Wallaby *(Wallabia bicolour)* and Common Froglet as well of a range of common bird species.

As part of studies conducted for the Tugun Bypass, there has also been a sighting of a species of Nudibranch (or sea slug) within the mangrove fringed drainage line in the localiser footprint. It is suspected that these are *Elysia bangtawaensis* (Cobb, 1997), a species that has been recorded in Thailand, India and Australia (Rudman 2007).

Elysia bangtawaensis (or any other Elysia species) is not currently listed as threatened under the TSC Act or EPBC Act. However, Cobb (2007) has suggested the species may have conservation significance because of its highly limited distribution.

Although the recording of the species within the localiser footprint is one of two known locations in Australia, the reason for the small number of known populations of this species may be due to a lack of targeted survey effort (and the difficulty of spotting the species) rather than a limited occurrence of suitable habitats or extant populations. The distribution of the species may also be indicated by the presence of other species of *Elysia*, which are known to inhabit the region and are common all round Australia except for Tasmania (Burn 1998). This may give further evidence that *Elysia bangtawaensis* may be present in other areas along the Queensland and New South Wales Coastline. This should be used with caution however, as there is very limited data on the species' actual distribution.

Flora

Previous surveys of the area and surveys undertaken for this project have not observed significant flora species in the localiser footprint. Pink Nodding Orchid *(Geodorum densiflorum)* is the only species that has a possibility of occurring in there due to the existence of suitable habitat. There is also a small population of Lesser Swamp Orchid *(Phaius australis)* (endangered under the EPBC Act and TSC Act) that exists approximately 200m to the east of the localiser footprint, though no suitable habitat exists within the localiser footprint.

Previous and current land uses (agriculture, Tugun Bypass construction, vegetation management on the approach of runway 32 and Pony Club operations) have influenced the types of vegetation in the area. The proximity to other cleared areas has also influenced the current state of the environment. Several declared weeds have been observed in the area, including:

- Groundsel *(Baccharis halimifolia)*;
- *(Chrysanthemoides monilifera subsp. rotundata)*;
- Camphor Laurel *(Cinnamomum camphora)*;
- Lantana *(Lantana camara)*; and
- Broad-leaved Pepper Tree *(Schinus terebinthifolia)*.

Weed management to remove widespread occurrence of these and other weeds (e.g. Setaria) is undertaken by GCAPL in and around the localiser footprint which has seen a reduction in the abundance and species of weeds in the localiser footprint.

5.6.3 Assessment of Impacts – Significant Flora and Fauna

Glidepath Footprint

No impact is anticipated as no significant flora or fauna have been recorded within, or are likely to inhabit the glidepath footprint.

300 metre Runway Strip

Fauna

Complete removal of ESA Impact Area A (1.3 hectares) will remove this habitat area for Wallum Froglet, though this is expected to provide a minor impact to the species due to the wide occurrence of the species in other areas within the airport boundary, and the extent of known populations along the northern New South Wales and south-east Queensland coastline.

Removal of ESA Impact Area A is likely to result in a minor impact to the other significant species that may inhabit the area. This is because the area is small and fragmented and the habitat type is well represented regionally. In addition, the occurrence of volant species (birds and bats) is reduced due to management activities that discourage their occurrence (i.e. *the Airport Bird & Wildlife Hazard Management Plan*) and their mobility.

Trimming requirements for the heath and sedgeland within ESA Impact Areas B to D will alter minor portions of heathland/sedgeland habitat on the western side of the runway. The Wallum Froglet and the Wallum Sedge Frog are known to inhabit sedgeland and heathland in these areas.

In ESA Impact Areas B to D, plants that exceed vegetation height requirements will be trimmed or removed if trimming renders the plant unviable. Due to trimming, these areas are likely to become further dominated by sedge and heath species, whilst emergent tree and shrub species will be trimmed or removed.

During trimming and/or selected plant removal, the habitat values will be disturbed; however, management measures can reduce the impact of these works. In the long term, management of vegetation in this area is likely to provide more favourable habitat conditions for species that inhabit heathland and sedgeland as removal of a tall shrub or tree layer frees resources for development of lower heath and sedgeland species.

Hopkins (2003, in Ecosure 2013) examined the temporal and spatial distribution of calling for Wallum Froglet and Wallum Sedge Frog across the airport grounds and found that these species were more likely to occur in ponds with increased ground cover and shrub density. With vegetation management, habitat values will potentially be enhanced for these two wallum frog species.

Trimming is expected to result in a negligible impact to the Common Planigale as this species utilises the ground layer and can persist in environments with varied canopy cover.

Removal of any plants that exceed the height requirements will remove some heath habitat value for birds and bats. However, the impact to these species will be minor because:

- The occurrence of bird species is reduced due to management activities that discourage their occurrence (i.e. the Airport Bird & Wildlife Hazard Management Plan); and
- The number of potential habitat trees being impacted will be minimal.

With appropriate management, the habitat values of heathland and sedgeland in ESA Impact Areas B to D will largely remain where trimming and selective plant removal is occurring.

In ESA Impact Area E, there are very few trees that will require trimming or removal as the area is largely low growing saltmarsh with a mangrove-lined drain to the south.

Due to the small scale clearing in ESA Impact Area A and the retention of habitat values in ESA Impact Area B to E, the works in the 300 metre runway strip are not expected to directly impact on listed threatened fauna species and will not substantially reduce or fragment available habitat for native species. The impact of the project to Wallum Sedge Frog and Wallum Froglet that are known to inhabit ESA Impact Areas B to D has been minimised through trimming and selective vegetation removal in preference to clearing.

The impacts to fauna in the 300 metre runway strip have been assessed as a minor impact. Further removal of ESAs that contain Wallum Froglet and Wallum Sedge Frog habitat is planned to occur at the airport due to future terminal and apron expansion as depicted in the Master Plan. This would increase the cumulative impact to these species, of which the ILS project is a small component. The terminal and apron expansion has been determined by DoE to be a controlled action under the EPBC Act and is currently subject to detailed environmental assessment and identification of appropriate mitigation measures and offsets for residual impacts to significant flora, fauna and ecological communities.

Flora

Trimming and selective plant removal in ESA Impact Areas B to E will result in a negligible impact to habitat values, as the heath, sedge and saltmarsh values can largely be maintained through vegetation management. Clearing or trimming in the 300 metre runway strip will not impact any known populations of significant flora. If significant flora species are identified during clearing or trimming, the plants will be clearly flagged. Removal or trimming of a plant will not occur until advice is sought on approval requirements and potential ways to minimise the impact (e.g. translocation).

Localiser Footprint

Clearing and construction of access road and fencing within the localiser footprint will remove habitat and reduce habitat connectivity for the significant fauna species identified as occurring or potentially occurring in this area. Most of the species are migratory bird species or bats, though the Common Planigale (vulnerable under the TSC Act) is also identified as potentially occurring in the area. Relocation of the drainage lines in the localiser footprint may also disturb potential habitat for the Nudbranch *Elysia bangtawaensis.*

Connectivity to and from areas north of the localiser footprint will also be impacted. Where feasible, existing ground cover and low growing vegetation west of the localiser earth pad will be retained to minimise the extent of impact.

The area of coastal saltmarsh that is being impacted represents a loss of roosting habitat for shorebirds, particularly for migratory and marine bird species listed under the EPBC Act that inhabit the Cobaki Broadwater and other areas of the Tweed River Estuary. As the works will not substantially modify migratory bird habitat available in the Cobaki Broadwater and wider Tweed River Estuary, it has been assessed that the clearing of roost habitat is unlikely to result in a significant impact as defined under the EPBC Act, refer Section 5.5.2).

The habitat within the localiser footprint is not considered to be of critical importance for bats as there is limited foraging or roosting habitat for the species. There is also limited suitable habitat available for *the Common Planigale* and would not support an ecologically significant proportion of their respective populations.

The installation of ILS infrastructure in the localiser footprint is likely to result in a minor adverse impact to fauna due to habitat loss and fragmentation. The impact in the localiser footprint is unlikely to result in a significant impact under the EPBC Act.

Flora

It is unlikely that significant flora species will be directly impacted by the works. Additionally, the current population of the Lesser Swamp Orchid (200 metre to the east of the localiser footprint) will not be impacted by the installation of the ILS.

5.7 Cultural Heritage

5.7.1 Baseline Conditions

The ILS project footprint lies within a significant regional cultural landscape known to the Aboriginal people of the Tweed and Gold Coast. A number of cultural heritage sites have been identified in the general locality of the project footprint as identified in Figure 5.2.

During the past fifty years, much of the Gold Coast Airport site has been substantially modified. For most of the site, land reclamation, sand mining and reshaping have been so extensive that physical evidence of Aboriginal occupation is difficult to interpret. However, in relatively undisturbed areas of the airport to the south and west, intact cultural heritage sites have been found. These sites contain large quantities of artefactual material which are an indication of the historic Aboriginal presence in the area.

A due diligence cultural heritage assessment was conducted for the ILS project (Everick Heritage Consultants 2015) and included a desktop study of previous archaeological reports and other literature, field inspections and consultation with Indigenous stakeholders. Searches of Queensland, New South Wales and Commonwealth heritage databases were conducted as part of the study to identify any registered sites within the project footprint and surrounds. Sites identified in these searched are detailed in Figure 5.2.

Subsequent cultural heritage surveys undertaken as part of the Gold Coast Airport Cultural Heritage Management Plan and Project Lift identified a number of new cultural heritage sites within Gold Coast Airport. None of these sites are located within the ILS project footprint with the closest being approximately 75m west of the 300m wide runway strip widening footprint.

One cultural heritage site is located within the 300 metre runway strip. This is an artefact scatter first identified by Hall (1990) on the eastern side of the runway.

No other Indigenous cultural heritage sites or relics were identified in the glidepath footprint, 300 metre runway strip or localiser footprint and no areas were identified that are considered to potentially contain subsurface deposits of significant Aboriginal heritage.

No known Commonwealth Heritage places are located within the project footprint. The cultural heritage assessment conducted for the project did not identify any historic (non-indigenous heritage) within the project footprint.

5.7.2 Assessment of Impacts

Glidepath Footprint and 300 metre Runway Strip

Negligible impact to cultural heritage is anticipated in the glidepath footprint due to no known cultural heritage sites and historical land disturbance.

The known cultural heritage site within the 300 metre runway strip is not expected to be impacted by the works, as no ground disturbance is required in the area which will be maintained in line with the current regime. Negligible impacts to cultural heritage are anticipated in this area.

In discussions during the site walkover with Indigenous stakeholders, potential for further investigation at one location within ESA Impact Area A was raised. Subsequent consultation has determined that an appropriate mitigation strategy would involve a post clearing survey of this area.

The alignment of services within the 300 metre runway strip (power and communication) will be selected to be within soil profiles having evidence of past ground disturbance to minimise the potential impacts to cultural heritage. If installation of services in undisturbed areas is unavoidable, cultural heritage monitoring will be undertaken and a cultural heritage find procedure implemented. The find procedure will be developed as part of the CEMP which is subject to approval by DIRD as part of the building approval process.

The impact to cultural heritage in the 300 metre runway strip is expected to be negligible.

Localiser Footprint

No Indigenous cultural heritage sites or relics were identified in the localiser footprint during the due diligence cultural heritage assessment and no areas were identified that are considered to potentially contain subsurface deposits of significant Aboriginal heritage. No historic heritage was identified in the localiser footprint.

A post excavation survey is proposed for the main drainage diversion works in the localiser footprint area. Although potential impacts on physical Aboriginal heritage is extremely low, a cultural heritage find procedure will be included in the CEMP in the event that cultural heritage is encountered during the works.

The impact to cultural heritage in the localiser footprint is expected to be negligible.

5.8 Air Quality, Noise and Light

Movement of machinery and equipment, vegetation clearing and minor earthworks required for the construction of the ILS have the potential to generate noise and air pollutants. The impacts from construction will be short term and localised, and are not expected to impact the nearest sensitive receptors (residential properties) which are located to the east of the airport in Bilinga.

There are not expected to be any significant sources of ground based noise or air emissions arising from operation of the ILS therefore there would be no impact to sensitive receptors adjacent to the airport.

The antennae in the glidepath and localiser footprints will have a red obstacle light, and the buildings in the glidepath and localiser footprints will have a fluorescent light which will only be operational when the building is in use. Due to the distance from sensitive receptors and the low intensity of the lighting, the impact from lighting to sensitive receptors or fauna is expected to be negligible.

Noise associated with the new flights paths associated with the ILS has been assessed in Chapter 6.

5.9 Hazardous Materials

Hazardous materials are substances with the potential to cause harm to persons, property or the environment. During construction and operation of the ILS project, small quantities of hazardous materials such as fuels, paints and solvents and herbicides will likely be present in the project footprint. These materials will be handled and stored in line with relevant standards, therefore there is not expected to be any impact to the environment from hazardous materials.

5.10 Mitigation Measures

Appropriate mitigation measures will be incorporated into the design of the ILS project along with the development of construction and/or operational environmental management plans to mitigate impacts of the development on the environment. The construction and/or operational environmental management plans would include issue-specific plans where relevant, for example:

- Erosion and Sediment Control Plan;
- Acid Sulfate Soil Management Plan;
- Contaminated Land Management Plan;
- Dewatering Management Plan; and
- Vegetation Management Plan.

Key mitigation measures for the project that will be incorporated into construction and/or operational plans and adopted in the construction and/or operational phase are detailed below. In addition, the environment strategy for the airport sets out environmental requirements that apply to all activities, and encompasses activities undertaken by airport operators, including GCAPL staff, tenants and contractors. The environment strategy would be applicable to the operation phase of the project.

5.10.1 Resource Use

The CEMP will identify opportunities for efficient use of materials and minimisation of waste during construction.

Due to the negligible use of resources during the operation phase, no specific mitigation measures are proposed.

5.10.2 Land

Management of Dust, Erosion and Sedimentation

Construction and maintenance activities will be conducted in a manner that minimises soil erosion and dust generation. An Erosion and Sediment Control Plan will be developed for the construction phase of the project and will consider:

- Installation of erosion and sediment control measures including sediment fences or sand bags prior to ground disturbance, and measures to remain in place until the site is stabilised following construction;
- Stabilisation of diverted drainage lines in the localiser footprint and temporary sediment controls such as check dams to be installed until they are stabilised to minimise the risk to water quality in the Cobaki;
- Mulching, revegetation or other measures applied to cleared areas as soon as possible to stabilise the soil;
- Dust control will be implemented through watering or other method to reduce dust generation from exposed areas in dry conditions;
- Any stockpiles will be located within the clearing footprint, away from drainage lines and water bodies, and will be covered or stabilised if remaining for more than one week;
- Erosion and sediment control measures will be checked regularly during construction and maintained in good working order;
- The site will be checked daily for signs of erosion and sedimentation and appropriate and reasonable corrective actions taken to rectify any non-conformity: and
- Tidal inundation of the site

During operation of the ILS, no mitigation measures are expected to be required for dust, erosion and sedimentation.

Management of Acid Sulfate Soils

The acid sulfate soil investigation and management plan prepared for components of the ILS project within the localiser footprint details the appropriate acid sulfate soil mitigation measures. The Acid Sulfate Soils Management Plan will be implemented during construction, including the following measures:

- Area of ground disturbance is to be minimised as far as possible;
- Removal of topsoil and placement of fill to be undertaken in a manner that minimises the duration that sub-soils are exposed;
- Agricultural lime to be placed over exposed soils following excavation and used to neutralise excavated soils;
- The treated material may be reused on site where fit for purpose, and if compliant with the relevant pH criteria;
- Surface water quality monitoring shall be undertaken at the locations and frequencies specified in the acid sulfate soil management plan;
- The discharge of leachate and/or surface water that has been in contact with acid sulfate soil shall be monitored in accordance with the acid sulfate soil management plan;
- Containment of untreated acid sulfate soils within bunded areas and treatment of leachate from bunded areas prior to discharge;
- Regular visual monitoring is to occur at the site to check for signs of acid sulfate soil;
- If visual and/or water quality monitoring indicates the production and migration of acidic leachate, additional treatment measures will be implemented as necessary; and
- Excavation will be planned to minimise the extent and duration of dewatering and a site specific Dewatering Management Plan will be prepared for all groundwater extraction that has the potential to expose acid sulfate soil to oxidising conditions.

During operation of the ILS there is not expected to be any impacts to acid sulfate soils so no mitigation measures are required.

Management of Contaminated Land

Further investigation will be conducted prior to construction and, a Contaminated Land Management Plan will be prepared, which will detail the mitigation measures to be implemented during the works, including:

- If excavations occur within areas of contaminated land, measures will be taken to minimise exposure of workers or users of the area through preventing dermal contact and dust through the maintenance of a surface capping layer of 0.5 metres. In the event that the underlying fill is disturbed, procedures will be adopted to minimise the exposure to the subsurface soils during any excavation works and to maintain or reinstate the surface barrier or capping layer once works are completed;
- Any excess soils or waste generated from excavation works in the identified contaminated area will be assessed and managed appropriately;
- Any imported soil fill will be verified as free of declared weed species and other contaminants; and
- In the event that previously unidentified contaminated land or suspected contaminated material is encountered during the works, works will cease in that area and suitably qualified advice sought. If necessary, further testing will be carried out to identify the best management/remediation option to be implemented.
- The risk of PFC contamination within the project footprint will be assessed as part of the contaminated land management plan. If the risk assessment identifies that there is the potential for PFC contamination, further assessment (including soil and/or water testing) will be conducted and if required appropriate management measures developed in consultation with DIRD prior to construction.

During operation of the ILS there is not expected to be any impacts from contaminated land so no mitigation measures are required.

5.10.3 Surface and Groundwater

Works in the glidepath area and the localiser footprint area have potential to impact upon waterways and drainage during construction.

The following mitigation measures will be incorporated into the construction management plan and implemented during construction to minimise impacts to surface and groundwater in the glidepath footprint:

- Implementation of an Erosion and Sediment Control Plan as described above;
- Visual monitoring following completion to check that water quality downstream is not impacted.

During construction at the localiser footprint area, the following mitigation measures for surface and groundwater impacts will be incorporated into the construction management plan and implemented:

- Implementation of an Erosion and Sediment Control Plan as described above;
- The realigned drainage channels will be stabilised as soon possible after completion;
- As the antenna array clear zone in the localiser footprint area will be grassed and drainage will be directed into the Cobaki Broadwater, potential elevated nutrients and reductions in dissolved oxygen will require management. Water quality improvement devices will be investigated as part of the detailed design to provide a stormwater treatment and conveyance function;

Water quality will be monitored during both construction and operational phases and if any water quality issues associated with the works are identified appropriate measures will be investigated to address these issues.

During operation of the ILS, the GCAPL operational water quality monitoring program will be updated to include monitoring in the localiser footprint.

5.10.4 Vegetation Management

In this section, the term 'vegetation management' includes clearing, selective plant removal and trimming during construction and operational phases of the development.

Prior to the commencement of vegetation management works, Vegetation Management Plan/s will be developed for ESA Impact Area A, ESA Impact Areas B to E and for the localiser footprint and will be implemented as part of construction management.

Mitigation measures that will be considered in the construction and operation VMPs include:

- Staff/contractor inductions for the works will include awareness training regarding the ecological values of the site and the required management measures;
- Fringing mangrove vegetation along the Cobaki Broadwater, west of the localiser footprint that provides a corridor around the south western corner of the runway will be retained;
- Where feasible, low-growing salt marsh species will be retained west of the earth pad within the localiser footprint;
- To protect areas of vegetation to be retained the works footprint will be clearly delineated and no-go areas established. All construction staff will be briefed on vegetation management protocols and exclusion zones;
- During construction, wash down procedures will be implemented for machinery and vehicles to prevent the introduction of weeds from other areas;

A pre-clearing survey will be conducted prior to vegetation clearing activities. If significant flora species are identified, these will be clearly flagged and removal or trimming of a plant will not occur until advice is sought on approval requirements and potential ways to minimise the impact (e.g. translocation);

- Vegetation trimming or selective plant removal will occur without the use of large machinery within the Impact Areas B-E, and personnel will be briefed on the possible existence of threatened species, to avoid trampling of the species;
- Declared plants (e.g. Lantana) and noxious weeds in the project footprint will be treated or removed prior to clearing and a weed management plan implemented post-construction to manage the regrowth of weeds.

The construction Vegetation Management Plans, including the measures above, will be updated for implementation in the operational phase.

5.10.5 Significant Species Management

The following mitigation measures will be implemented to reduce the impact upon significant species where vegetation management is required during construction or operation. These mitigation measures specifically relate to the clearing, selective removal or trimming of habitat within the ESA Impact Areas and localiser footprint, and will be included in the above mentioned Vegetation Management Plans:

- A fauna/spotter catcher will be engaged for the initial clearing works to undertake a pre-clearing survey and to be present during the vegetation clearing in the localiser footprint and Impact Areas A to E to facilitate the safe movement of fauna into adjacent habitat areas. The need for a fauna spotter/catcher will be considered prior to other vegetation management (including ongoing maintenance). As identified in this MDP the project is not likely to significantly affect the breeding place of listed fauna species, however expert advice will be sought if breeding places (e.g. nests, burrows or occupied hollows) for threatened fauna are identified and required to be relocated or destroyed;
- Disturbance to areas outside the clearing footprint will be prevented through clear demarcation of the clearing boundary and no-go zones;
- Measures will be identified to provide habitat for fauna, such as salvage of hollow logs from the clearing footprint and placement within retained vegetated areas. Other felled material will be mulched and spread over the site once construction is completed and/or removed from site. Burning of waste timber will not be undertaken;
- Frogs have been found to be very sensitive to some herbicide products, and specifically, the surfactants that are used to improve the effectiveness of the products. For this reason, selective and targeted use of herbicide in frog habitat areas will be used in a way that minimises risks to frog species;
- Measures will be incorporated to prevent the spread of diseases (e.g. Chytrid fungus) in frog habitat areas.

The construction Vegetation Management Plans, including the measures above, will be updated for implementation in the operational phase.

5.10.6 Cultural Heritage

Although no known cultural heritage sites are likely to be impacted during the works on either Commonwealth or State land, it is possible that previously unknown cultural heritage sites or artefacts may be encountered during ground disturbance during construction.

A cultural heritage due diligence assessment was undertaken for the project which includes recommendations for cultural heritage management that will be incorporated into construction management plans. These recommendations include:

- Plant operators undertaking initial ground disturbance for the project will attend a cultural heritage induction. The induction will include information on the legislative requirements with respect to cultural heritage, how to identify Aboriginal objects and procedures in the event of a cultural heritage find;
- A post clearing inspection for part of Impact Area A.
- A post excavation inspection for the drainage realignment within the localiser footprint.
- The alignment of services within the 300 metre runway strip (power and communication) will be selected to be within soil profiles having evidence of past ground disturbance to minimise the potential impacts to cultural heritage. If installation of services is undisturbed areas is unavoidable, cultural heritage monitoring will be undertaken and a cultural heritage find procedure implemented. The find procedure will be developed as part of the CEMP which is subject to approval by DIRD as part of the building approval process.

- Process for dealing with human remains should they be located at any stage during earthworks, including stop work arrangements and consultation with community and regulatory stakeholders;
- Process for dealing with suspected Aboriginal cultural material if uncovered during the works, including consultation with community and regulatory stakeholders, salvage procedures for any finds of low heritage significance and procedures for identifying an appropriate keeping place for any salvaged artefacts;
- Registration of any Aboriginal cultural heritage/materials if uncovered during the works in relevant State/Federal heritage registers.

Where maintenance activities require ground disturbance, expert advice will be sought and cultural heritage assessment and mitigation will be implemented where required.

5.10.7 Air Quality, Noise and Light

Air quality, noise and light impacts from the construction of the project are expected to be negligible. Nevertheless, standard mitigation measures for these issues will be included in construction management plans, for example:

- Implementation of an Erosion and Sediment Control Plan identified above to assist with dust control during construction, therefore minimising air quality impacts associated with dust generation; and
- Maintenance of vehicles and equipment used during construction to minimise noise and pollutant emissions.

Air quality, noise and light impacts associated with the on-ground ILS infrastructure, during the operational phase are expected to be negligible. No impacts are expected from the operation of the ILS so no mitigation measures are proposed for this phase.

No mitigation measures for air quality, noise or light are proposed during the operational phase.

5.10.8 Hazardous Materials

Minimal quantities of hazardous materials are likely to be handled or stored on site during construction of the project. Construction management plans will specify appropriate storage and handling requirements to prevent impacts to the environment or human health during construction, including:

- Where possible hazardous materials will not be stored on site, and quantities will be minimised;
- Storage areas will be secure, bunded and away from drainage lines;
- Refuelling will preferably not occur on site, or will occur in a designated hardstand refuelling area away from drainage lines.

No hazardous materials are expected to be present on site during operation.

5.11 Conclusion of Environmental Impact

The environmental impacts from the installation of the ILS at Gold Coast Airport have been assessed for the glidepath footprint, 300 metre runway strip and localiser footprint. Table 5.4 provides a summary of the outcomes of the assessment. The impact assessment has used the assessment criteria defined in Section 5.1.2 to guide the assessment of impacts. In general the ILS project has been assessed as having a negligible to minor residual impact to the environment, with the exception of vegetation clearing in the localiser footprint which has been assessed as a minor to moderate impact to habitat values and wildlife corridors.

Developments at the airport that affect ESAs trigger the need for an MDP as described in Section 1.2 and 3.2.1. The ILS project will result in full clearing of approximately 1.3 hectares of ESA in ESA Impact Area A, therefore the impacted area will no longer be classified as an ESA. ESA Impact Areas B to E will remain as ESAs, as trimming and selective vegetation removal will largely enable habitat values for significant species to be retained. There will be cumulative impacts to ESAs (including flora and fauna species and habitats) at the airport due to planned ESA clearing for terminal and apron expansion depicted in the Master Plan, to be undertaken as a separate project. The terminal and apron expansion has been determined by DoE to be a controlled action under the EPBC Act and is currently subject to detailed environmental assessment and identification of appropriate mitigation measures and offsets for residual impacts to significant flora, fauna and ecological communities.

The assessment also considers the significance of impacts upon Matters of National Environmental Significance (MNES) and the whole of the environment under the EPBC Act. The project has been assessed as unlikely to result in a significant impact to MNES or the environment under the EPBC Act.

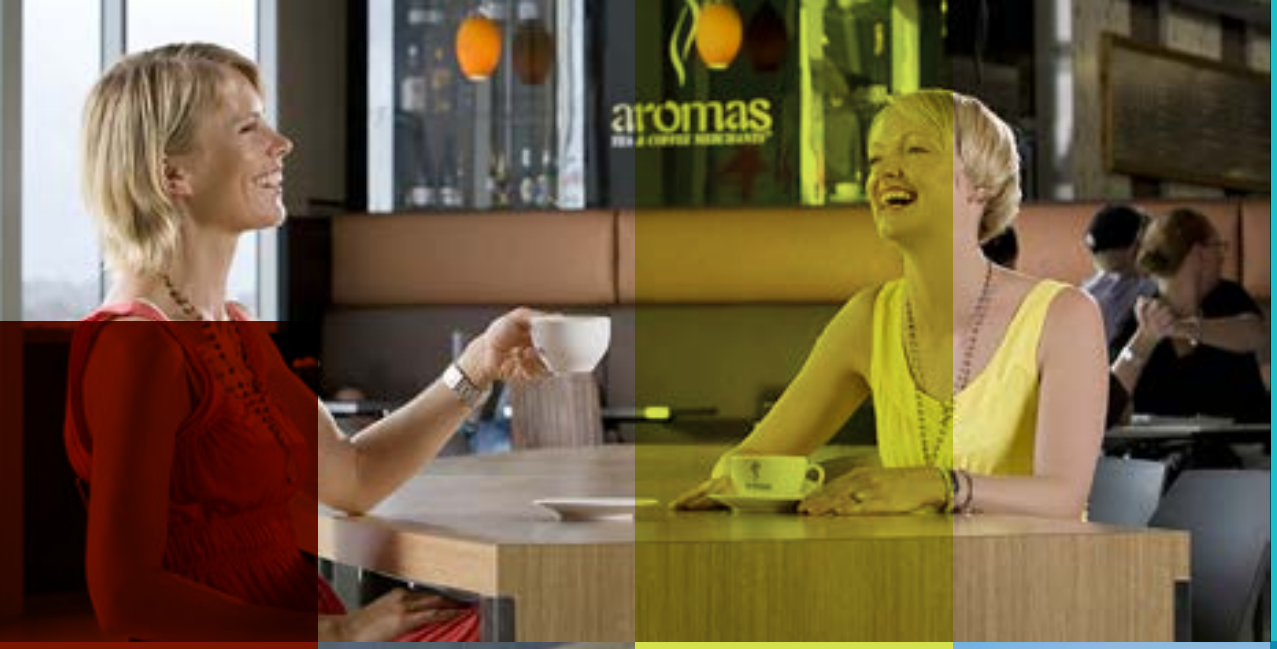
Table 5.4: Impact summary

Relevant Topic	Summary of Impact and Mitigation	Residual Impact
Resource Use	The materials and energy required for the project are expected to result in a negligible impact to resources. The construction management plans will identify opportunities for efficient use of materials and minimisation of waste.	**Negligible**
Land	**Glidepath Footprint** Minor excavations in the glidepath footprint for installation of services may expose soils to erosion or encounter acid sulfate soils or contaminated land. Further investigation will be undertaken in the detailed design phase and mitigation measures implemented including an Erosion and Sediment Control Plan, Acid Sulfate Soil Management Plan and if required, a Contaminated Land Management Plan.	**Negligible**
	300 metre Runway Strip Clearing, selective vegetation management and trenching for services in the 300 metre runway strip may expose soils to erosion. An Erosion and Sediment Control Plan will be implemented. Trenching or under-boring for installation of services are unlikely to encounter contaminated land associated with the fire training area however further investigation prior to construction will determine if a Contaminated Land Management Plan is required. These works may encounter acid sulfate soils. An Acid Sulfate Soils Management Plan will be implemented during construction.	**Negligible**
	Localiser Footprint Placement of fill in the localiser footprint is unlikely to have any significant impact on the local water table or normal interactions between acid sulfate soils, groundwater and the adjacent surface waters of the Cobaki Broadwater. However, the sandy soils present a relatively high risk of generating acidity if dewatered, and if waterlogged potential acid sulfate soils identified near the surface is allowed to oxidise. An Acid Sulfate Soil Management Plan and if required a Dewatering Management Plan will be implemented to manage impacts.	**Negligible**
Surface and Groundwater	**Glidepath Footprint** The existing open drainage line in the glidepath footprint will be relocated to provide the required level area for the glidepath facility. An Erosion and Sediment Control Plan will be implemented during the works and the residual impact to surface or groundwater is expected to be negligible.	**Negligible**
	300 metre Runway Strip Other than the drainage line relocation within the glidepath footprint, surface water or groundwater within the 300 metre runway strip will not be impacted by the works.	**Negligible**

	Localiser Footprint The open earth tidal drains traversing the ground pad at the localiser footprint will be diverted around the pad to maintain drainage patterns at the site. Impacts to water quality in the localiser footprint area and surrounds may also occur due to the replacement of vegetation with grass. The design of the perimeter road incorporates measures to allow continued tidal exchange connectivity with the Cobaki Broadwater. It is unlikely that vegetation clearing, in the localiser footprint will significantly affect groundwater due to the area and type of vegetation being cleared, and the direct tidal influence of the Cobaki Broadwater on groundwater in the localiser footprint. Localised impacts to groundwater levels may occur as a result of the earth pad construction although this is not expected to affect airport land to the north. An Erosion and Sediment Control Plan will be implemented during the works and water quality will be monitored during construction and operational phases.	**Negligible to minor**
Habitat Values and Wildlife Corridors	**Glidepath Footprint** The glidepath footprint doesn't contain any identified ESAs nor does it contain significant environmental values therefore no impacts are expected.	**Negligible**
	300 metre Runway Strip Trimming and selective plant removal in ESA Impact Areas B to E will result in a negligible impact to habitat values, as the heath and sedge values can largely be maintained through vegetation management. ESA Impact Area A will be cleared entirely, resulting in the removal of approximately 1.3 hectares of remnant habitat (paperbark forest with a coastal heathland understorey and RE 12.2.12/12.2.9). There will be cumulative impacts to ESAs (including flora and fauna species and habitats) at the airport due to planned ESA clearing for terminal and apron expansion depicted in the Master Plan, to be undertaken as a separate project. In total approximately 22% of ESAs at the airport will be cleared, of which the ILS clearing is a very small component (less than 1%).	**Negligible to Minor**

	Localiser Footprint The localiser footprint is to be cleared and maintained in a cleared state through ongoing vegetation management. Where feasible existing groundcover and low growing species west of the earth pad will be retained. At most, clearing will result in removal of 7.7 hectares of vegetation of which 0.5 hectares was previously cleared during construction of the Tugun Bypass Tunnel, and 6.5 hectares is mapped as Threatened Ecological Community (TEC) under the EPBC Act and/or Endangered Ecological Communities (EEC) under NSW legislation. The impact to the TEC is not considered to be significant under the EPBC Act as the cleared area represents a very small percentage of its current extent in the region, which is estimated at 2230 hectares. Previous land uses have affected the vegetation communities in the localiser footprint and vegetation communities have changed markedly in recent years due to changes in drainage. Weeds are also present in parts of the site. Future terminal and apron expansion at the airport (a separate project) will also result in clearing of Swamp Sclerophyll Forest EEC, resulting in a cumulative impact of approximately 18ha, of which the ILS clearing is a very small component. The terminal and apron expansion project has been determined by DoE to be a 'controlled action' under the EPBC Act, and is currently subject to detailed environmental assessment and identification of appropriate mitigation measures and offsets for residual impacts to significant flora, fauna and ecological communities. Clearing, road construction and fencing will result in a loss of poor quality roosting and foraging habitat for shorebirds and will sever an already constrained fauna corridor above the Tugun Bypass Tunnel. Some connectivity will be maintained along the banks of the Cobaki Broadwater however this will also be reduced by the access road and fencing, which could also affect connectivity to areas north of the localiser footprint on Commonwealth airport land.	**Minor to moderate**
Significant Flora and Fauna	**Glidepath Footprint** No impact is anticipated as no significant flora or fauna have been recorded within, or are likely to inhabit the glidepath footprint.	**Negligible**
	300 metre Runway Strip Complete removal of ESA Impact Area A (1.3 hectares) in the 300 metre runway strip will remove this habitat area for Wallum Froglet and Wallum Sedge Frog (although as described in Section 5.6.2, ESA Impact Area A is assessed as low quality habitat for Wallum Sedge Frog). With appropriate management, the habitat values of heathland, sedgeland and saltmarsh will largely remain where trimming and selective plant removal occurs in ESA Impact Areas B to E. Further removal of ESAs that contain Wallum Froglet and Wallum Sedge Frog habitat is planned to occur at the airport due to clearing for terminal and apron expansion (a separate project). This would increase the cumulative impact to these species, however known habitat areas for these species will still remain at the airport.	**Minor**

	Localiser Footprint Installation and operation of the ILS in the localiser footprint will not result in a significant impact to threatened flora or fauna; however, the project will result in a loss of poor quality shorebird roost habitat and remove habitat for a Nudibranch species that is not well documented. The Nudibranch species is not listed under the TSC or EPBC Act as a threatened species. Movement corridors for terrestrial fauna will also be impacted as identified above.	**Minor**
Cultural Heritage	**Glidepath footprint** Negligible impact to cultural heritage is anticipated in the glidepath footprint due to no known cultural heritage sites and historical land disturbance.	**Negligible**
	300 metre Runway Strip The known cultural heritage site within the current runway strip will not be impacted by the establishment of the 300 metre runway strip. The alignment of services within the 300 metre runway strip (power and communication) will be selected to be within soil profiles having evidence of past ground disturbance to minimise the potential impacts to cultural heritage. If installation of services is undisturbed areas is unavoidable, cultural heritage monitoring will be undertaken and a cultural heritage find procedure implemented. The find procedure will be developed as part of the CEMP which is subject to approval by DIRD as part of the building approval process.	**Negligible**
	Localiser Footprint No Indigenous cultural heritage sites or relics were identified in the localiser footprint during the due diligence cultural heritage assessment and no areas were identified that are considered to potentially contain subsurface deposits of significant Aboriginal heritage. No historic heritage was identified in the localiser footprint. A post excavation survey is proposed for the main drainage diversion works in the localiser footprint area. Although the risk of potential impacts on physical Aboriginal heritage is low, a cultural heritage find procedure will be included in the Construction Environmental Management Plan in the event that cultural heritage is encountered during the works.	**Negligible**
Air quality, Noise and Light	Temporary localised air quality, noise and light impacts may arise during construction of the ILS project. Management measures including dust control would be incorporated into construction management plans. No impact is expected at the nearest sensitive receptors off airport. Some lighting is required on ILS infrastructure during operation. Due to the distance from sensitive receptors the impact from lighting is expected to be negligible. Noise associated with the new flights paths associated with the operation of the ILS has been assessed in Chapter 6.	**Negligible**
Hazardous Materials	Minimal quantities of hazardous materials will be stored or handled during construction or operation of the ILS. Measures for the storage and handling of hazardous materials will be described in the construction and/or operational management plans.	**Negligible**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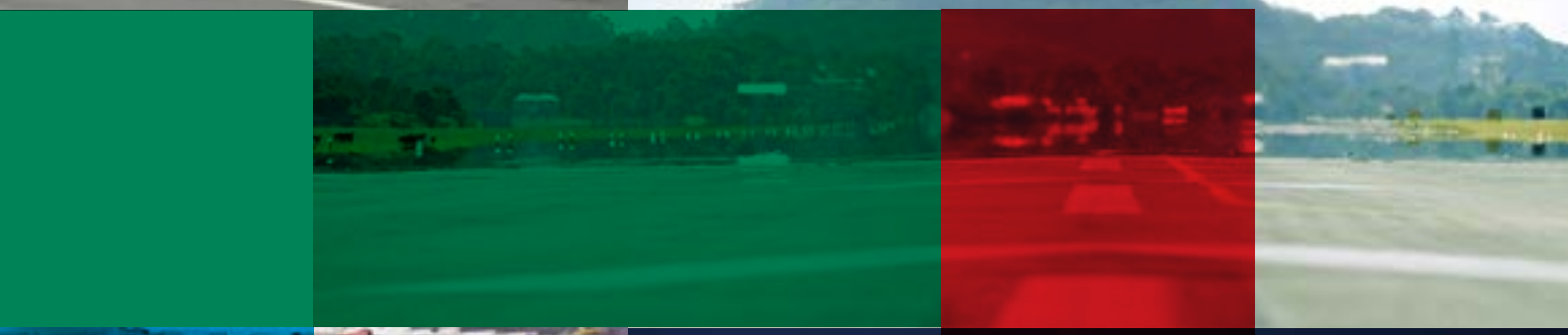


GOLD COAST AIRPORT