

Defence Training Facilities, Greenbank Training Area

Environmental Offset Strategy

EPBC 2011/5896 approval decision

November 2018



Australian Government
Department of Defence

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1. Declaration of Accuracy

I declare that:

1. To the best of my knowledge, all the information contained in, or accompanying this Environment Offset Strategy is complete, current and correct.
2. I am duly authorised to sign this declaration on behalf of the Department of Defence.
3. I am aware that:
 - a. Section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading.
 - b. Section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) where the person knows the information or document is false or misleading.
 - c. The above offences are punishable on conviction by imprisonment, a fine or both.

Signed

Full name (please print)

Organisation (please print)

Date —/—/—

Version	Date	Author	Approver
1.0- Submission to DoEE Delegate	31 October 2018	Fred Ford	Kate Leane
2.0- Final submission	21 November 2018	Fred Ford	Kate Leane

1. Executive Summary

The Australian Government announced the Enhanced Land Force (ELF) initiative in 2006 with an objective of providing a significant increase to the capacity of the Australian Defence Force. ELF aimed to increase the size of the ADF by approximately 3000 members. To achieve the objectives of ELF, the ELF Stage 2 facilities project was commenced in 2010 to construct, extend or refurbish facilities that are required to support a new battalion housed in Brisbane, including significant facilities development at Greenbank Training Area (GBTA) 30 km south of Brisbane. GBTA is a key field training area for Brisbane-based Australian Defence Force units and includes a large central impact area, fifteen dedicated weapons ranges, a camp and a driver training facility. In order to provide the upgraded facilities for ELF, 67 ha of remnant and regrowth vegetation was cleared.

The Department of Defence referred the proposal for the ELF Stage 2 developments at GBTA to the Minister for the Environment in March 2011 (EPBC Act referral 2011/5896). The action was determined by a delegate to be a “Controlled Action” requiring full assessment and approval. Controlling provisions were:

- Listed threatened species or communities (section 18 and 18A of the EPBC Act); and
- Commonwealth action (section 28 of the EPBC Act).

Condition 2 of the approval requires Defence to prepare and submit an Environmental Offset Strategy, which identifies the measures that compensate for the residual adverse impacts from the construction and operation of the facilities. The offset plan “must provide for the enhancement and protection of native vegetation; the riparian zone of water courses; and habitat for threatened species within the Greenbank Training Area.”

The offset area is comprised of two separate segments totalling 384 ha in which habitat improvement activities will be implemented. Complementary activities will occur outside the offset area, partly to meet approval conditions that require landscape planting around facilities and rehabilitation of a decommissioned sewerage treatment plant, or to achieve specified offset requirements.

The offset area was chosen based on the following criteria:

- The individual segments each exceed the 50 ha minimum size required by approval conditions
- The segments are subject to relatively low intensity, low impact training activities
- Boundaries of the segments are clearly delineated and identifiable to site users
- The segments fall outside the restricted impact area and are generally accessible for environmental management activities
- Each segment can support achievement of different aspects of the Offset Strategy
- The offset area provides a good representation of regional ecosystems that were impacted by ELF 2 and of endangered regional ecosystems

The area safeguards existing EPBC ‘particular manner’ fauna crossing requirements under the Centenary Highway.

The Offset Strategy will be implemented over a ten-year period commencing in January 2019 and ending in December 2028. In order to achieve and have adequate time to demonstrate successful improvement of the offset area and benefits delivered by complementary offset measures intensive improvement actions will be concentrated in the earlier years of the strategy. In the short-medium term (<5 years), monitoring and research programs may indicate modifications and improvements to the offset measures are required to achieve the intended improvements to habitat quality and connectivity. After this period it is anticipated that the incremental, additive benefits of the various offset actions will begin to have measurable benefit without additional works and the core focus of the strategy will shift to maintenance, monitoring and reporting. At the end of a ten-year period specific monitoring and reporting against the Offset Strategy will cease (assuming satisfactory demonstration of outcomes), and the ongoing maintenance of offset measures and monitoring of fauna and flora will return to business as usual site management processes that will maintain or improve the new benchmark condition.

A number of key actions will be undertaken to achieve the following overarching management objectives:

- Formally identify offset area and update administrative arrangements to protect the offset area
- Establish Oxley Creek management framework
- Baseline surveys
- Establish monitoring program
- Weed eradication and suppression program
- Vertebrate pest management program
- Other habitat improvement measures against BioCondition benchmarks and community integrity measures
- Fauna movement measures and habitat supplementation that will improve connectivity to surrounding native vegetation

All planned actions will be adaptively implemented in consultation with local councils, community groups, Oxley Creek catchment management association and the Flinders Karrawatha Regional panel.

2. Conditions of approval reference table

2. The person taking the action must prepare and submit for approval an Environment Offset Strategy to the Minister. The Environment Offset Strategy must be submitted and approved by the Minister within 6 months of the date of this approval.	
Approval Condition	Strategy Section
The Environment Offset Strategy must provide for: the enhancement and protection of native vegetation; the riparian zone of water courses; and habitat for threatened species within the Greenbank Training Area.	As detailed below
The Environment Offset Strategy must include the following:	
a. A commitment to rehabilitate and protect no less than 350 ha of remnant vegetation or regrowth within the Greenbank Training Area. The area identified can comprise either one single, or a number of individual areas, provided those areas are greater than 50 ha in size. Information on the offset areas to be rehabilitated and protected must include (but not be limited to) the following:	<i>Section 5.</i> Two areas totalling 384 ha have been identified as the environmental offset area in which the bulk of rehabilitation actions will occur. Additional actions will also be undertaken at the northern exit of Oxley Creek from the Training area in order to improve connectivity and riparian condition.
(i) The location and boundaries of the area(s) through maps and textual descriptions as well as an accompanying shapefile(s);	<i>Section 5.1, 5.2, Fig. 3.</i>
(ii) A description of the regional ecosystem classification contained within the area(s) identified for remediation and protection. Information must also include records of high conservation value fauna and flora species known from/or likely to utilise these areas;	<i>Section 6.3, 6.3, Fig. 6.</i> The environmental offset area consists predominantly of endangered dominant or sub-dominant regional ecosystems. Potential secondary evidence of koalas is present in both areas, and at least one further EPBC threatened species may be resident in the offset area and several others may occasionally use the area or benefit from environmental improvements.
(iii) Detailed measures for controlling and managing invasive weeds in those areas identified for protection;	<i>Section 6.6, Fig 7.</i> Detailed weed surveys have been undertaken across the site. The offset areas contain low to moderate weed infestations that allow for the practical target of eradication many species and maintaining others at very low numbers following intensive initial treatment program.
(iv) Information on how the remediation and protection of the area(s) will improve habitat connectivity for threatened species with the Greenbank/Karawatha Wildlife Corridor; and	<i>Section 6.8, Fig. 9, Fig. 10.</i> The offset area includes the key junction of GBTA with the forested southern continuation of the Flinders-Karawatha corridor. Improvements to shelter and cross-taxon permeability of the security fence in this area will facilitate better, safer, fauna movement through the corridor. Additional improvement actions to be undertaken at the northern exit of Oxley Creek will improve the only viable northern faunal connectivity within the corridor at its most significant pinch-point.
(v) Key performance indicators and indicative timeframes for undertaking the rehabilitation and protection. The key performance indicators must be sufficient to confirm whether any remediation actions	<i>Section 7, Table 1.</i>

have resulted in a net-environmental gain to the environmental values of the Greenbank Training Area.	
b. Details of ongoing vertebrate surveys at the Greenbank Training Area (excluding the range impact area). The monitoring must be of a design that will detect any great changes to the numbers of threatened species within the Greenbank Training Area;	<i>Section 6.9.</i> Monitoring programs are highly unlikely to detect significant changes in threatened species given the very low numbers and detectability of those species present in the area. However, dedicated monitoring for vertebrate native and pest fauna will guide management actions and a dedicated research partnership will investigate the effectiveness of improvement measures aimed at promoting movement of all fauna.
c. Details of and a commitment to undertake landscape planting within the facilities. The plantings used must be naturally occurring within the Greenbank Training Area;	This action is complete. <i>See Appendix 1.</i>
d. Details of and a commitment to undertake the decommissioning, remediation and revegetation within the footprint of the existing sewage treatment plant;	This action is complete. <i>See Appendix 2.</i>
e. A commitment to undertake remediation actions that will halt soil erosion and increase bank stability from selected areas within the Greenbank Training Area currently affected by soil erosion; and	<i>Section 6.10, Fig. 11, Fig. 12.</i> There are limited incidences of localised erosion on GBTA, generally associated with old tracks. Those located within the offset area will be remediated or allowed to recover naturally where appropriate. The process of stream channel widening evident within Oxley Creek is outside the control of Defence. However, riparian improvements through weed management and practical vegetation re-establishment will be undertaken in continuing association with the Oxley Creek Catchment Association.
f. A description of how the environmental management systems of the Department of Defence will provide for the permanent protection of the areas described in 2(a) from inappropriate activities or actions that are not consistent with the maintenance of the conservation values of the Greenbank Training Area.	<i>Sections 5.3, 5.4.</i> The offset area will be secured through: • a site selection board process, • restriction of permitted activities in Range Standing Orders • recording as an environmental offset on the Defence Garrison and Estate Management System
The Environment Offset Strategy must clearly state the legal person or persons responsible for implementation.	<i>Section 7.</i> The Deputy Secretary Estate and Infrastructure Group is accountable for management and delivery of services set down in the Offset Strategy.

3. Objectives and context of the project

3.1. Greenbank Training Area

The 4665 ha Greenbank Training Area (GBTA) is located 30 km south of Brisbane, largely within the local government area of Logan City, with a small portion within Ipswich City (Fig. 1). It is bordered by the Logan Motorway and Forestdale to the north, the Springfield-Greenbank Arterial and Goodna Roads in the south, the interstate railway line in the east and suburbs of Camira, Springfield and Springfield Lakes in the west. GBTA is a key field training area for Brisbane-based Australian Defence Force units and includes a large central impact area, fifteen dedicated weapons ranges, a camp and a driver training facility.

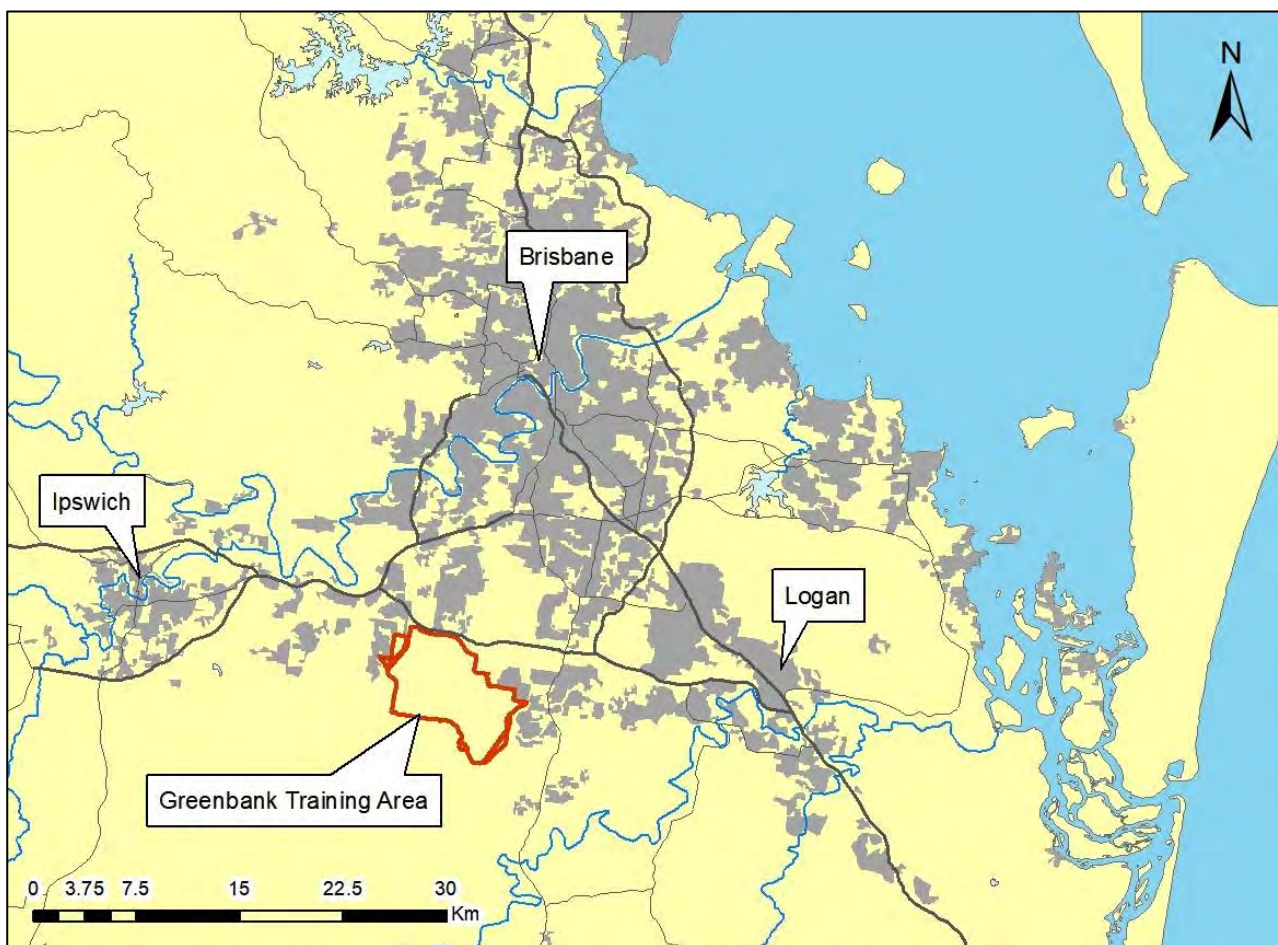


Figure 1. Location of Greenbank Training Area.

The north-western half of the GBTA has been used for military activities since the 1940s. The area was known as the Gailes Armament Range and was used for air to ground gunnery and bombing practice by the Royal Australian Air Force and the United States Air Force stationed at the nearby RAAF Amberley and Archerfield airfields during WWII. The south-eastern half of GBTA was formally acquired in 1951 by the Commonwealth Government for military training activities, including long range target practice and other military manoeuvres. The site was named the 'Greenbank Army Camp' and was primarily used for cadet camps. However, with the introduction

of National Service in 1951 a rifle range and accommodation facilities were built in the south of the Training Area to house and train 2,300 personnel from the Citizens Military Force. In the mid 1960's the Commonwealth acquired the area that was previously used as the Gales Armament Range and western portions of the present property.

GBT A is recognised as an important area of relatively intact natural environment on the outskirts of the rapidly growing population centres of Brisbane, Ipswich and Logan. It is listed on the Commonwealth Heritage List for its natural values including its importance for the conservation of old growth forest in South East Queensland (SEQ) and for containing high quality habitat areas for Koala's (*Phascolarctos cinereus*) – *Eucalyptus microcorys*, *Eucalyptus propinqua*, *Eucalyptus tereticornis*, *Eucalyptus resinifera* and *Eucalyptus signata*, and for containing three 'Endangered' and one 'Of Concern' Regional Ecosystem and species that are threatened, uncommon, or restricted in the Brisbane area. GBT A is a key element of the Flinders Karawatha Corridor, which is "one of SEQ's most important regional biodiversity corridors, providing habitat and movement opportunities for a range of species that have state, regional and local significance" (QLD DEHP 2014). The training area is also listed on the Directory of Important Wetlands, Australia (Section 3.8.2.4) and recognised under the Queensland Environmental Protection (Water) Policy 2009 as an area containing high ecological value freshwaters.

3.2. Enhanced Land Force Stage 2 project

The Australian Government announced the Enhanced Land Force (ELF) initiative in 2006 with an objective of providing a significant increase to the capacity of the Australian Defence Force. ELF aimed to increase the size of the ADF by approximately 3000 members through:

- Accelerating the re-establishment of a second mechanised battalion, 7th Battalion, the Royal Australian Regiment to be located in Adelaide;
- Converting the 3rd Battalion, the Royal Australian Regiment, to a light infantry battalion and relocating to Townsville; and
- Re-raising the 8th/9th Battalion, Royal Australian Regiment (8/9 RAR), to be located in Southeast Queensland.

To achieve the objective of re-raising 8/9 RAR, the ELF Stage 2 facilities project was commenced in 2010 to construct, extend or refurbish facilities that are required to support the battalion.

Facilities that were proposed for GBT A under the ELF Stage 2 project were:

- Upgrades and extension of the existing Battle Shooting Range to a Marksmanship Training Range Type B,
- A new Safe Driver Training Area,
- A new Urban Operations Training Facility (UOTF),
- A new entry point off Goodna Road on the southern boundary,
- A new Range Control compound,
- A new 250 person permanent camp,
- New 25th/49th Battalion, Royal Queensland Regiment

During the planning phase of the project an environmental impact assessment of the proposed activities was completed. One of the key recommendations from this assessment was to "identify an

alternative location for the UOTF in non-remnant vegetation or on a different property” (ERM 2010). The outcome of this recommendation was that the UOTF was not constructed at GBTA, but was instead constructed at Wide Bay Training Area. All other facilities were constructed at GBTA, requiring the removal of 39.74 ha of remnant vegetation and a total of 67 ha of habitat suitable for Koalas including areas of regrowth.

3.3. Environment Protection and Biodiversity Conservation Act (1999) conditions of approval

The Department of Defence referred the proposal for the ELF Stage 2 developments at GBTA to the Minister for the Environment in March 2011 (EPBC Act referral 2011/5896). The action was determined by a delegate to be a ‘Controlled Action’ requiring assessment and approval under the EPBC Act. Controlling provisions were:

- Listed threatened species or communities (section 18 and 18A of the EPBC Act); and
- Commonwealth action (section 28 of the EPBC Act).

Condition 2 of the approval (see Section 2 for details) requires Defence to prepare and submit an Environmental Offset Strategy (the Offset Strategy), which identifies the measures that compensate for the residual adverse impacts from the construction and operation of the facilities. The offset plan “must provide for the enhancement and protection of native vegetation; the riparian zone of water courses; and habitat for threatened species within the Greenbank Training Area.” Condition 3 of the approval requires Defence to prepare and submit an annual Environmental Performance Report. The compliance report must report outcomes of the vertebrate monitoring program that forms part of the Offset Strategy.

The offset arrangements detailed in the approval decision predate the current EPBC Act offsets policy and process. As such, the determination of offsets was undertaken during the decision making process and the EPBC offsets calculator and current policy do not form a consideration in the Offset Strategy.

4. Risk Assessment and Risk Management Framework

Effectively managing risk is a core obligation on Commonwealth Agencies under the Accountable Authority Instruction 1 issued under the Commonwealth Public Governance, Performance and Accountability Act 2013 and within Defence is integrated into all planning, approval, review and implementation processes, at all levels (Sec/CDF Joint Instruction 30/2015). The risk management process for the Offset Strategy takes a project-based approach where feasibility and risk of non-delivery of specific action are assessed against their impact to achievement of the overall strategy, rather than risk to the environment *per se*. Associated impacts that would result from not delivering an action were also assessed against using consequence description from the Defence Estate and Infrastructure Group Risk Management Framework (Appendix 3).

4.1. Risk Assessment Summary

Packages of complementary actions have been proposed in the strategy specifically to broaden the risk base and reduce the individual impact of any one measure under-performing. Some actions, such as vertebrate pest management and actions to improve vegetation against BioCondition benchmarks (QLD Department of Science Information Technology and Innovation 2012a) through importation of fallen timber, weed management and provision of nesting hollows are low risk as they rely on well-established techniques with relatively predictable outcomes. Rates of effort can be easily adjusted within a treatment period to ensure target outcomes are met, and monitoring will allow adaptive management to occur if performance standards are not being met. The fenced boundary of GBTA also provides some buffering against high rates of re-invasion by key vertebrate pest (cats, dogs, foxes) following treatment programs.

Failure to put effective fauna movement structures in place to increase connectivity through the security fence is considered to have a major consequence on the overall effectiveness of the Offset Strategy. While simple technical solutions are available to provide fauna movement through and over the fence, the driver of this risk is internal Defence requirements regarding security and safety. The risk of inadequate improvement to habitat connectivity will therefore be mitigated through research to test and develop reliable movement measures that also meet security requirements.

Burning, erosion remediation and other activities with less certainty of success due to the impacts of weather and climate are generally medium risk, but are individually less important to achieving Strategy objectives. Where likelihood of failure is possible or lower, and the consequence is low or insignificant, some risks have been accepted rather than invest in alternative measures or mitigations early in the offset delivery process. Monitoring and adaptive management processes over the life of the Offset Strategy will ensure that these medium risk activities are adequately reviewed and actions are modified if required. A summary of the distribution of risks against offset activities is presented below (Fig. 2). Specific risk mitigation actions are detailed against actions in section 6.

One action (Engineering modifications to halt creek bank erosion along Oxley Creek) was deemed too risky to proceed due to Almost Certain failure to achieve an outcome and Major financial loss with no environmental gain as a consequence (detailed in section 6.10). Alternative riparian

improvement measures have been proposed that take into account the lack of control that Defence has over processes affecting the stability of Oxley Creek.

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Severe
Almost Certain				4:4	
Likely		1:1			
Possible	3:3	5:2	4:1	1	
Unlikely		1:1	5:3	1	
Rare		5:8	4:9		

Figure 2. Risk distribution for proposed actions to achieve Offset Strategy outcomes.

Assessed risk level is the risk of failing to achieve offset outcomes expected of a particular action. Unmitigated risk levels shown in grey, mitigated risk in black, cancelled action struck through. Details of actions, outcomes and mitigations are presented in section 6. Appendix 3 presents risk assessment framework and assessment of each action.

5. Location and Management arrangements for the offset area

5.1. Location of the offset area

A desktop analysis was conducted of the landscape context, management constraints, known environmental values, and legacy or current environmental pressures across GBTA. The offset area was chosen based on the following criteria:

- The individual segments each exceed the 50 ha minimum size required by approval conditions
- The segments are subject to relatively low intensity, low impact training activities
- Boundaries of the segments are clearly delineated and identifiable to site users
- The segments fall outside the restricted impact area and are generally accessible for environmental management activities
- Each segment has a context and environmental deficiencies that support achievement of different aspects of the Offset Strategy
- The offset area provides a good representation of regional ecosystems that were impacted by ELF 2 and of endangered regional ecosystems
- The area safeguards existing EPBC ‘particular manner’ fauna crossing requirements under the Centenary Highway

The offset area is comprised of two segments totalling 384 ha in which habitat improvement activities will occur (Fig. 3). The offset area includes the entirety of Training Area 1b (TA1b; the portion of TA1 west of the Centenary Highway (137 ha)) and 247 ha of Training Area 2 adjoining the south-western corner of GBTA.

5.2. Location of complementary offset actions

Landscape plantings around ELF facilities and rehabilitation of the sewerage treatment plant are required to be included in the Offset Strategy under the EPBC approval. These actions had to occur outside the offset area as they relate to specific locations not suitable for other offset measures (Fig. 3). Other management and connectivity works will also be implemented in the northern exit corridor of Oxley Creek from the site. This area falls in the northern junction of GBTA with the Flinders Karawatha Corridor. It is constrained by the site boundary and the internal impact area and cannot be delineated to meet the 50 ha minimum size requirement imposed by the EPBC approval for inclusion in the protected offset area. However, restoration of the riparian corridor and fauna movement structures to be installed in this location will make an important contribution toward meeting the intent of the Offset Strategy and directly complement actions that will be undertaken in TA2 to improve southward connectivity to the Flinders-Karawatha corridor (Fig. 3). These complementary offset actions under the Offset Strategy will be managed, reviewed and reported using the same processes as the offset area.

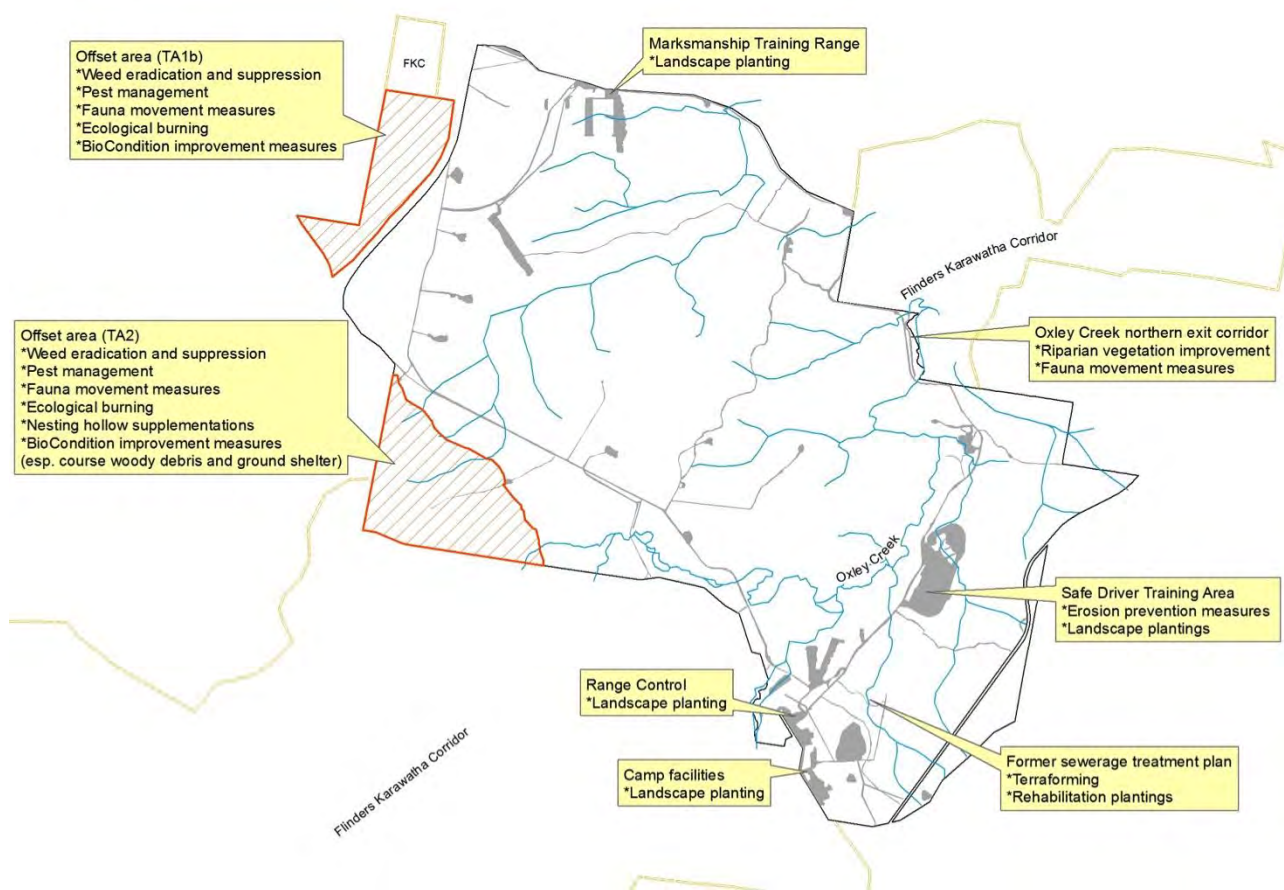


Figure 3. Location of offset areas and actions at GBTA.
The entire training area is included within the Flinders Karawatha Corridor.

5.3. Protection of the offset site

Following EPBC Act approval of the Offset Strategy the offset area will be formally protected under Defence land planning processes. This is a step-wise process in which a site selection board assesses the proposed location and approves a board report detailing the specific considerations in siting the offset in the proposed location. This report is then approved by the Assistant Secretary Estate Planning exercising their authority under the Defence Estate Strategy. Once formally approved, the offset area will be mapped and documented as an environmental offset in the Garrison and Estate Management System (GEMS). Among other benefits (section 5.5), inclusion on GEMS provides the offset area with a unique identifier against which risks, maintenance and land management services can be created and tracked. The offset area remains part of the Defence Training Area, and in keeping with EPBC approval conditions, training activities are still permissible within the offset area in so far as they do not inhibit environmental improvement activities and achievement of management goals. The Defence Act 1903 confers authority to Defence to prohibit access within declared Defence Areas. Public access is not permitted to the entire training area, and Defence users are bound to follow GBTA Range Standing Orders, which are a lawful instruction enforceable under the Defence Force Discipline Act 1982. Range Standing Orders will be updated to prohibit actions that are incompatible with conservation values within the offset area. Activity restrictions within the offset area are detailed in section 6.5.

5.4. Management of the offset area

The Deputy Secretary Estate and Infrastructure is the Training Area Management Authority for all training areas. All governance and service delivery functions required to implement the Offset Strategy are within Estate and Infrastructure Group (E&IG).

First Assistant Secretary Infrastructure is the sponsor for Defence Policy on the Management of Training Areas. The responsibility for policy and technical authority functions are performed by the Directorate of Land Planning & Regulation within Estate Planning Branch. Training Area Management is delivered in accordance with Defence Instruction (General) ADMIN 59-1 and the Defence Training Area Management Manual (DTAMM).

Environmental compliance with the Offset Strategy is managed by the Directorate of Environmental Planning and Compliance in Estate and Engineering Branch.

The Directorate of Operations and Training Area Management within Estate Service Delivery Branch manages the day-to-day operation of GBTA on behalf of Army, while delivery of land management and environmental services is the responsibility of the Directorate of Estate, Environment and Energy Service Delivery, also within the Estate Service Delivery Branch.

Land Management services, including weed, pest and bushfire management, are conducted by the Base Services Contract Land Management contractor, currently Spotless Services. Other specialist environmental contractors are engaged as appropriate either by Defence or by Spotless.

Various Defence management forums can have an impact on management of GBTA, including the Defence Estate Management Meeting which includes all branch heads from the two divisions within E&IG that hold management functions for GBTA and the delivery of the Offset Strategy. In addition to internal governance processes the requirement to integrate Defence estate and land management into the broader geo-political environment is an integral part of site management. Two key consultation forums that support this integration and that are directly relevant to the GBTA Offset Strategy are the GBTA Environmental Advisory Committee (EAC) and the Flinders Karawatha Corridor Regional Panel.

5.4.1. GBTA Environmental Advisory Committee

Defence recognises the importance of the environmental values of GBTA to the wider community. Community, local and state government input into management of GBTA is facilitated through an Environmental Advisory Committee (EAC) that includes the Queensland Department of Environment and Heritage Protection, Logan City Council, Ipswich City Council, Brisbane City Council, Jagera-Daran Pty Ltd, Thompson Family, Yuggera People, Oxley Creek Catchment Association, Greenbank State School and the Queensland Fire and Rescue Service. The objective of the EAC is “to provide a forum and focal point for which local environmental issues and advice, commensurate with Defence’s objective for ecologically sustainable military use of GBTA, are

highlighted and directed to Defence for inclusion in its consideration of environmental planning and management activities” (Greenbank Military Training Area Environmental Advisory Committee Terms Of Reference 2013 v.2). The Offset Strategy includes adaptive management processes that rely on decisions based on monitoring or research outcomes to ensure effective delivery of Offset Strategy actions. The EAC will provide a forum in which Defence can engage and inform key regional partners in annual decision-making processes that may modify the specific delivery mechanism for certain works (for example adopting a new weed management technique that has proven effective in adjoining properties if a spraying and mechanical removal method are failing to meet required performance standards set down in the section 6 and 7).

5.4.2. Flinders Karawatha Corridor

GBTA forms a key component of the Flinders Karawatha corridor. This 60 km corridor runs from Karawatha Forest on the outskirts of Brisbane through GBTA, southwards through Spring Mountain and on to Wyaralong Dam in the Scenic Rim. The corridor’s 56,350 hectares of eucalypt bushland is the most significant area of eucalypt bushland between the Brisbane River and Queensland border. Defence is a partner in the Flinders Karawatha Regional Panel that guides integrated management actions across the corridor in accordance with the Flinders Karawatha Corridor Management Strategy 2014–2019. These include a specific action to “Continue to engage with Australian Government on the future of Greenbank defence training area and seek to enhance the ecological value of the area.” Defence will continue to liaise with the panel and ensure that the Offset Strategy is integrated and supports wider initiatives as fully as possible, as well as seeking specific advice and assistance from the panel in achieving strategy outcomes.

5.5. The Defence Garrison and Estate Management System

The Garrison and Estate Management System (GEMS; Fig. 4) is being implemented as a business and estate management system across E&IG. It will increasingly support and enable Defence environmental management to implement the GBTA Offset Strategy. GEMS is a SAP-based software system comprised of linked modules that include; an inventory of environmental values present on a site (Environmental Factors), risk assessments, management actions, monitoring data, environmental incidents and other relevant data including projects and works associated with environmental values. The design and relationship of modules within GEMS has been configured to support all the key elements of an ISO 14001 Environmental Management System, and in simple terms supports a “Plan, Do, Check” approach to environmental management. All management and monitoring information, compliance reports, project information and key information relevant to implementing the Offset Strategy will be documented in GEMS.

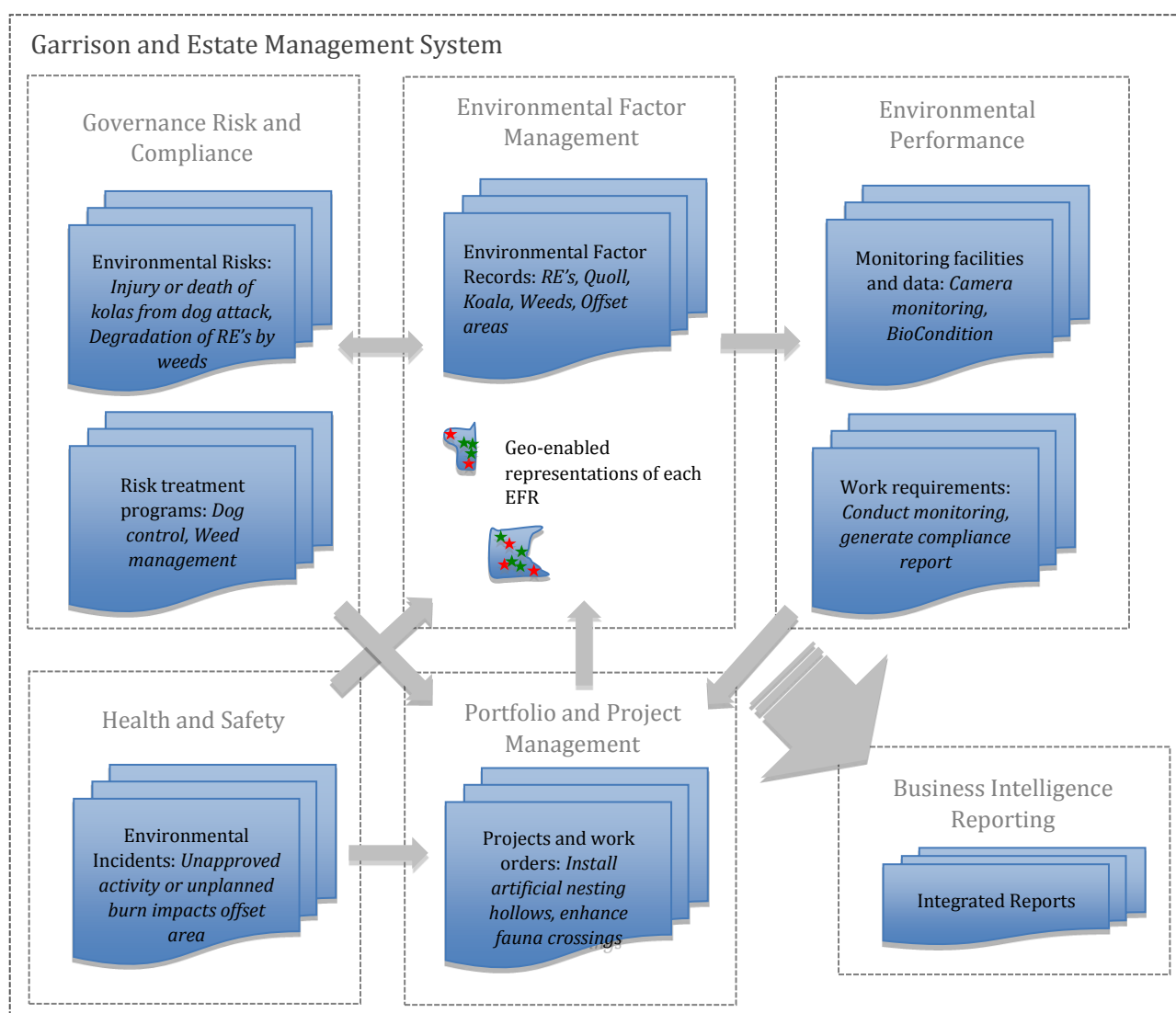


Figure 4. Garrison and Estate Management System.

Modules within GEMS are indicated in Grey Text within dotted lines. Blue boxes describe main functions within each module relevant to environmental management along with examples of the type of data stored within that component of the system. Arrows show data relationships and visibility of content between modules. For example, data from all modules is reportable through the Business Intelligence function, and data on projects, risks and incidents is linked and visible in Environmental Factor Management. Monitoring against EFRs in Environmental Performance can generate works if monitoring thresholds are exceeded, and both risk and incident records can be used to generate required works requests to address environmental issues.

6. Offset management measures

6.1. Offset delivery process and timeline

The Offset Strategy will be implemented over a ten-year period commencing in January 2019 and ending in December 2028. In order to achieve and demonstrate successful improvement of the offset area and benefits delivered by complementary offset measures intensive improvement actions will be concentrated in the earlier years of the strategy. In the short-medium term (<5 years), monitoring and research programs may indicate modifications and improvements to the offset measures are required to achieve the intended improvements to habitat quality and connectivity. After this period it is anticipated that the incremental, additive benefits of the various offset actions will begin to have measurable benefit without additional works and the core focus of the strategy will shift to maintenance, monitoring and reporting. At the end of a ten-year period specific monitoring and reporting against the Offset Strategy will cease (assuming satisfactory demonstration of environmental improvements against performance criteria), and the ongoing maintenance of offset measures and monitoring of fauna and flora will return to business as usual site management processes that will maintain or improve the new benchmark condition (Fig. 5).

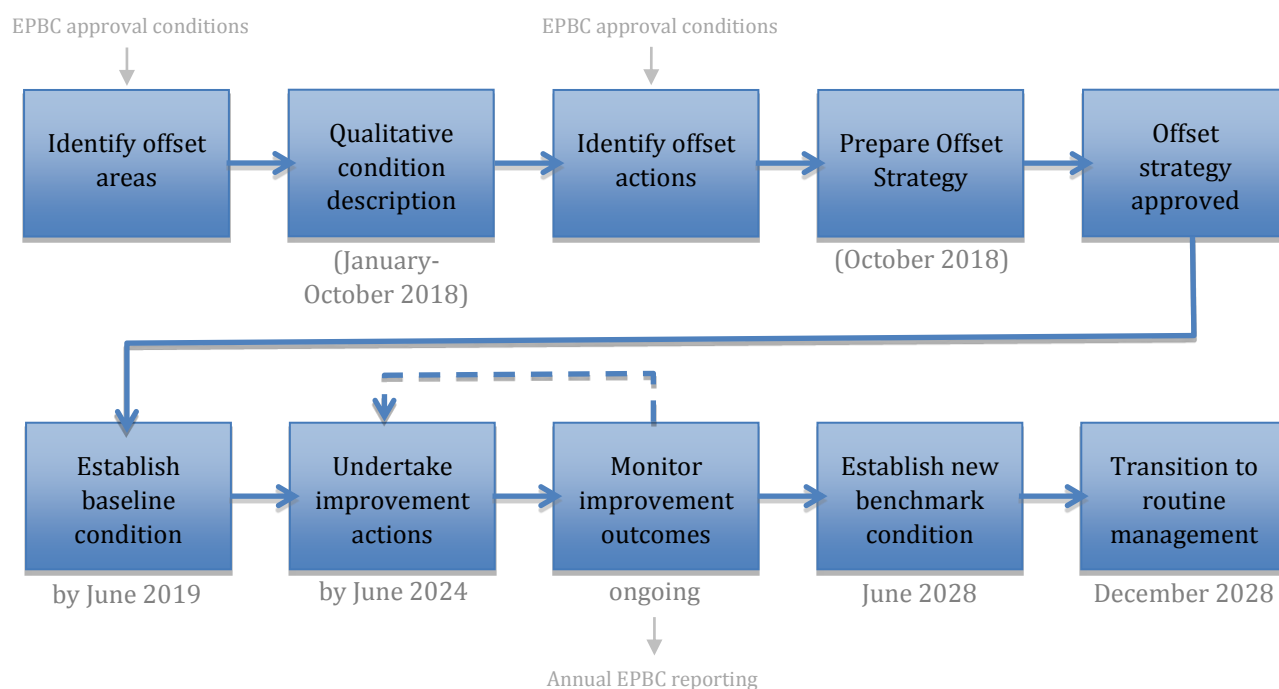


Figure 5. Offset delivery process and timeline.

Key EPBC approval influences on the strategy development process are shown (e.g. approval conditions set offset area parameters and required offset measures). The key EPBC influence after approval of the strategy will be through the annual reporting process that includes monitoring of the success of offset measures and any requirements for additional or modified actions.

6.2. Environmental condition of the offset area

TA1b is dominated by the endangered regional ecosystems 12.9-10.12 (*Eucalyptus seeana*, *Corymbia intermedia*, *Angophora leiocarpa* woodland on sedimentary rocks) and 12.5.3 (*Eucalyptus racemosa* woodland on remnant Tertiary surfaces) (Fig. 6). Smaller occurrences of riparian vegetation occur along Sandy Creek and a headwater of Bullock Head Creek that include

(least concern) 12.3.11 (*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open-forest on alluvial plains usually near coast) and 12.3.7 (*Eucalyptus tereticornis*, *Casuarina cunninghamiana* subsp. *cunninghamiana* +/- *Melaleuca* spp. fringing woodland). The western boundary adjoins suburbs, and the Ipswich Council Kola Conservation and Habitat Management Plan (2018) identified the area as an “urban node” rather than core habitat or strategic remnant.

The segregation of TA1b from the rest of GBTA by the Centenary Highway corridor means that it is a semi-isolated block of vegetation that tenuously links GBTA to relatively minor treed corridors to the northwest, primarily the riparian corridor of Sandy Creek. Connection to the remainder of TA1 is partly achieved through wildlife crossings put in place as ‘particular manner’ requirements of the QLD Department of Main Roads and Transport (EPBC 2007/3214) that duplicated the Centenary Highway and extended a railway through the same alignment. The transport corridor is otherwise fenced to prevent fauna strike. The western boundary backing suburbs shows clear signs of invasion from garden plants and other edge effects. TA1 has the most diverse weed assemblage in GBTA, and TA1b is the area that contains the densest infestations and diversity of weeds within TA1. Seventy-one species of weed, 15 of which are declared under QLD legislation and six Weeds of National Significance (WONS), were recorded in 429 small weed populations and 37 large weed infestations in TA1 by Ecosure (2016) (Fig. 7).

Like TA1b, TA2 contains extensive endangered 12.9-10.12 (*Eucalyptus seeana*, *Corymbia intermedia*, *Angophora leiocarpa* woodland on sedimentary rocks) in mixed dominance with 12.9-10.19 (*Eucalyptus fibrosa* subsp. *fibrosa* woodland on sedimentary rocks) (Fig. 6). Least concern 12.9-10.3 (*Eucalyptus moluccana* woodland on sedimentary rocks) extends into the north west of the area and occurs more extensively to the north of TA2. Of Concern 12.3.11 (*Eucalyptus tereticornis* +/- *Eucalyptus siderophloia*, *Corymbia intermedia* open-forest on alluvial plains usually near coast) and 12.3.6 (*Melaleuca quinquenervia*, *Eucalyptus tereticornis*, *Lophostemon suaveolens* open-forest on coastal alluvial plains) occur along drainage lines leaving the north west of TA2, including a very small part of the offset area.

In contrast to the diversity and extent of weeds in TA1b, TA2 is remarkably weed-free with the exception of some dense lantana infestations and associated co-occurring weeds. Only 16 species of weeds in 39 small populations and 17 large infestations were detected in TA2 by Ecosure (2016). Two WONS and six state-listed weeds were recorded (Fig. 7). TA2 was subject to historical logging prior to Defence purchase of the area in the 1960’s. Aerial images from the 1940s show clear evidence of vegetation thinning and removal resulting from forestry activity (Fig. 8). Forestry activities have had an enduring impact on the age structure of the forest, particularly presence of larger trees and availability of hollows and harbour within the area. TA2 backs larger semi-rural style housing blocks to the south that are included within the Flinders-Karawatha corridor. At the south-western corner there is a forested block that forms the only forested connection through to the more expansive forests of Spring Mountain Reserve to the south. This is a key component of the Flinders-Karawatha Corridor and represents one of two pinch-points of forested habitat in the corridor adjoining GBTA. To the immediate north of this forest corridor TA2 abuts suburban blocks of Springfield Lakes. Appendix 5 contains photos of the offset area taken during site inspections to establish qualitative environmental condition of the offset area in 2018.

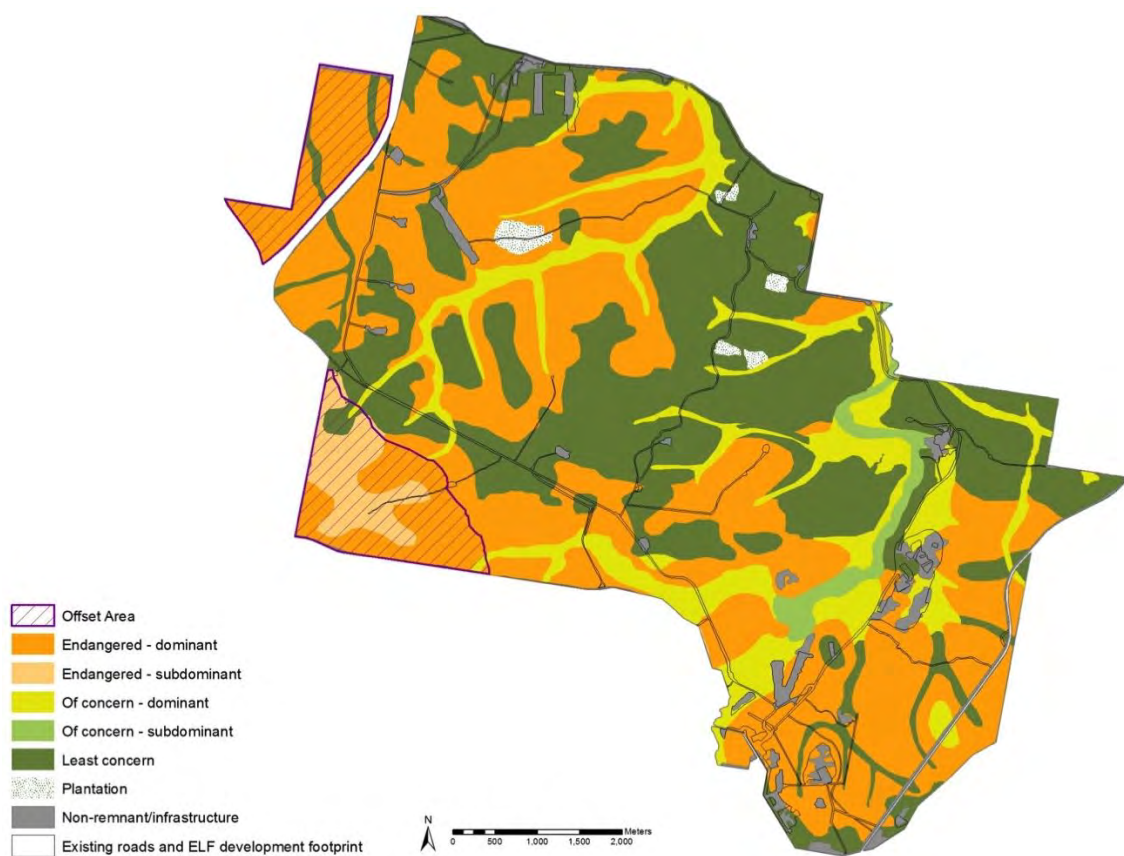
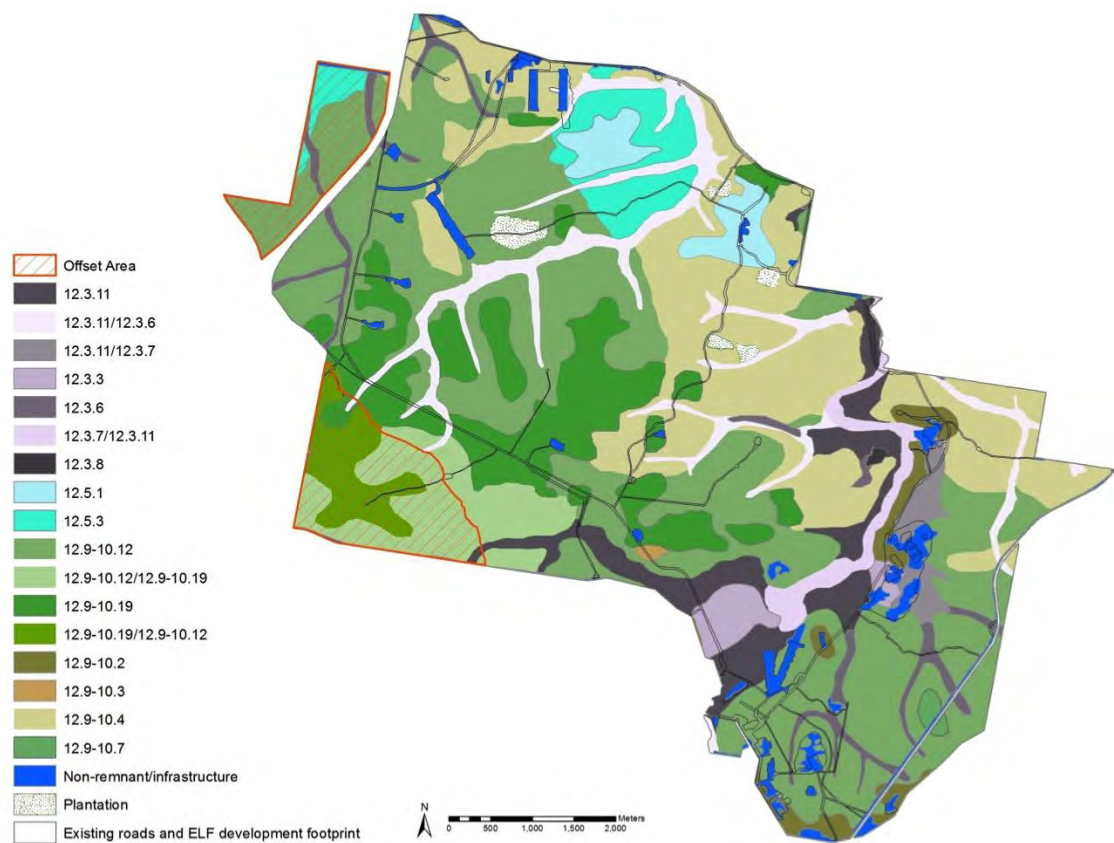


Figure 6. Regional ecosystems and conservation value of GBTA and the offset area.



Weed density classes by area (m ²)					
Low		Medium		High	
●	0 - 20	●	0 - 20	●	0 - 20
●	21 - 250	●	21 - 250	●	21 - 250
●	251 - 1000	●	251 - 1000	●	251 - 1000
Transect weed cover					
			Low		
			Medium		
			High		

Fig 7. Distribution of WONS and QLD Class 2 weeds (LPA Act 2002) in TA1b and TA2 (Ecosure 2016). Note that the offset area does not contain north-eastern portion of TA2.

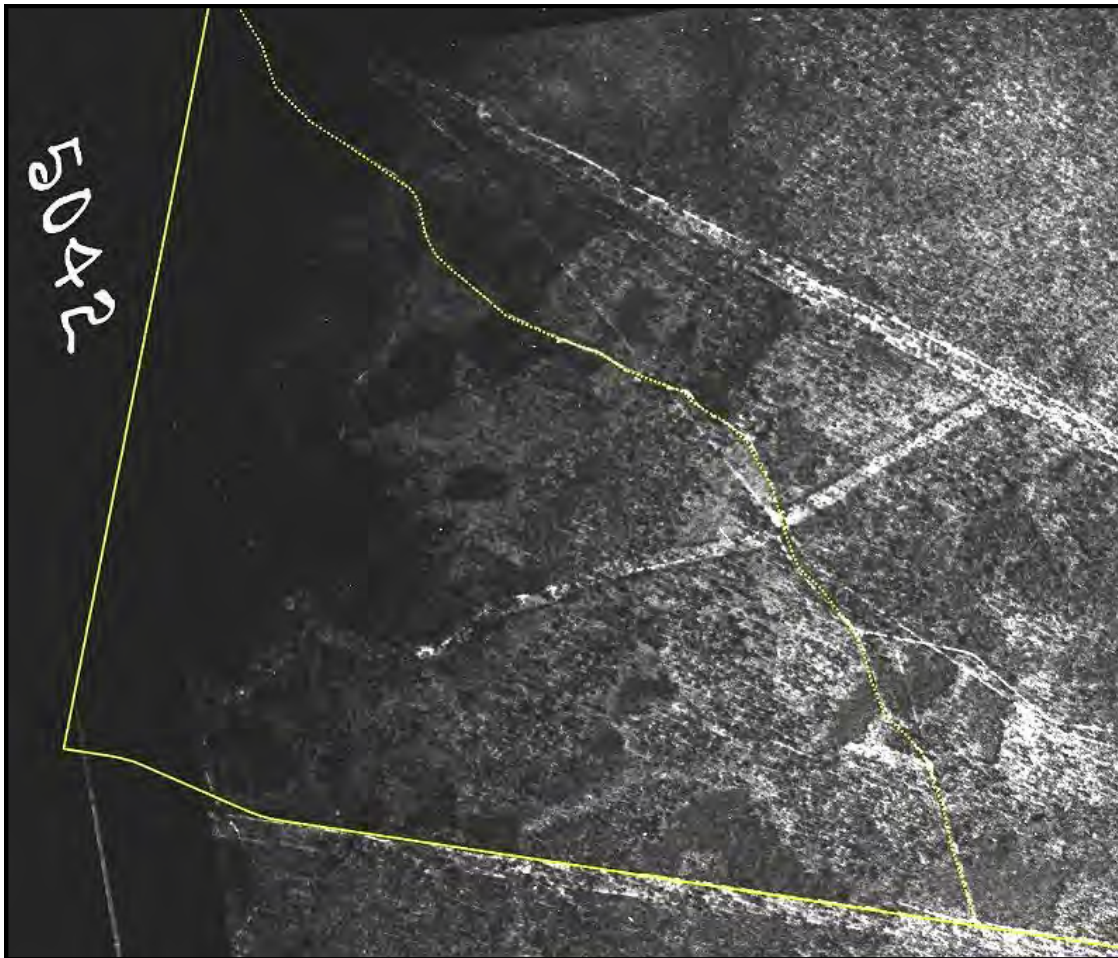


Figure 8. Logging impacts in TA2, 1948.

6.3. Threatened species of the offset area

The offset area contains potential habitat for the EPBC vulnerable koala (*Phascolarctos cinereus*) and EPBC endangered spotted-tail quoll (*Dasyurus maculatus*). There are no records of either species from the offset area. Potential koala scratch marks were noted in both segments of the offset area during field surveys in 2018, and there have been three remote camera images of koalas on GBTA, from within 1 km of TA1b (in 2016) and 1.5 km east of TA2 (in 2015). Scattered quoll records have been recorded over a number of years in the Greenbank area including road kill records and expert sightings (Barrenger and Whyte 2015). However, two records from GBTA are questionable based on the observer's experience. Other EPBC threatened fauna species recorded from GBTA or its immediate surrounds that may occur within the offset area include the vulnerable greater glider (*Petaroides volans*) which may be a permanent resident, vulnerable grey-headed flying fox (*Pteropus poliocephalus*) which is likely to forage in the area, and critically endangered regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*) have been recorded as migrants in nearby areas. The endangered plant *Plectranthus habrophyllus* has been recorded from Oxley Creek on GBTA but is not known from the offset area. A number of forest species known from the general area are conservation listed in Queensland including the powerful owl and glossy black cockatoo, both of which may transit the offset area. A list of potential threatened species known from the bioregion is provided in Appendix 4. However, most species on the list are unlikely to occur on GBTA due to habitat preferences or localised distributions that are not known to include GBTA. However, a detailed inventory of threatened species will be established through

the baseline studies and ongoing monitoring program to be implemented as part of the Offset Strategy.

6.4. Offset management actions

The EPBC conditions of approval identify that rehabilitation and protection of remnant or regrowth vegetation is the overarching goal of the offset, as well as enhancing connectivity and improving habitat within the Flinders Karawatha corridor. Weed management, erosion remediation and ongoing vertebrate surveys are actions specified in the EPBC approval that support the above goals. The approval specifically cites koalas and quolls as focal species for the approval decision. However, neither species occurs at abundances where there is a realistic chance of demonstrating benefit of offset actions to them. There is, however, sufficient ecological knowledge of these species to undertake actions that will create higher quality, accessible, habitat for them irrespective of their detectability. In addressing the offset requirements, the Offset Strategy therefore focuses on measures to facilitate the movement of animals in combination with habitat improvement against recognised ecological community benchmarks. The combination of approaches to managing the offset area is consistent with Ipswich City's (2018) nominated approach for managing habitat for koalas in TA1b and adjoining bushland, which were identified as urban node vegetation; "... the focus will be in conserving local koala populations by mitigating present threats such as:

- road crossing and vehicle strikes
- domestic and wild dog control
- habitat fragmentation and edge effect
- landscape level connectivity."

6.5. Protection and enhancement of vegetation

The offset area represents a mixture of remnant (TA1b) and previously logged vegetation (TA2). Both areas can be enhanced by addressing deficiencies in habitat quality and through treating threatening processes like weed invasion and damaging activities.

Specific activity restrictions within the offset area will include:

- No vegetation removal other than for a management activity required to implement the Offset Strategy
- No off-road driving or parking
- No excavation
- No construction
- No importation of vegetation except for a management purpose
- No fires other than for a management activity required to implement the Offset Strategy
- No live-fire activities or use of pyrotechnics likely to start fires

Targets for improving vegetation condition will be informed by BioCondition benchmarks for regional ecosystem condition assessment (QLD Department of Science Information Technology and Innovation 2012a,b). Benchmark measures include species richness of different plant types, canopy and sub-canopy height and cover, coarse woody debris, number of large trees per hectare, shrub, litter and grass cover and non-native plant cover. BioCondition benchmarks are not published for RE 12.9-10.12 that is the most common community through the offset area, but other dominant communities do have published benchmarks, as do two of the riparian communities. Reasonable inferences about how some benchmark values would compare to current condition for

RE 12.9-10.12. For example, adjoining communities have values of 555m, 432m, 667m and 299 m per hectare, but very few areas visited during field inspections in TA2 approached even the lowest of these values.

Course woody debris is a core element of BioCondition that is amenable to manipulation. Addition of course woody debris has been shown to increase invertebrate diversity, modify soils and in turn have flow-on effects thorough the food chain (Goldin and Hutchinson 2013, Manning et al 2013). Debris also offers refuge to mobile animals such as quolls. Diversity of ground refuges requires more than just course woody debris, which only has to be 10cm diameter and 0.5m long to be included within benchmark calculations. Larger hollow logs provide potentially important shelter for several ground dwelling animals, and reinforce benefits provided by management of introduced predators. Larger logs and shelters will therefore be opportunistically distributed through the offset area as a separate action to supplementation of course woody debris.

Another clear deficiency against benchmarks is evident in the number of large trees, especially within TA2. This artefact of logging history cannot be changed and will naturally remediate over the coming 30-50 years. However, the ecosystem service provide by old trees can be reinstated to some extent by provisioning of deadfall and through creation or supplementation of nesting hollows. Very few hollows were noted in TA2, and this is likely to equate to low possum and glider numbers, which will have impacts on native predators such as powerful owls and quolls. If it proves practical to do so, trees that are currently losing branches, but not yet developing hollows, will have hollows drilled into branch stubs. Artificial nest boxes are a tried and tested method that will also be used to “artificially age” the offset area.

Other BioCondition attributes such as litter, grass and shrub cover are best manipulated using careful application of fire within the prescriptions of the Queensland Regional Ecosystem Fire Management Guidelines. Fire is also an important tool to reduce the risk to the offset area from a large, uncontrolled fire destroying habitat improvement works. The offset area will be designated as a fire sensitive asset in future Bushfire Management Plans and be assessed for any additional protection measures that may be required in surrounding areas to reduce the risk of bushfire impacts.

Some minor occurrences of erosion were noted during site inspections. These were all old tracks adjoining current tracks that had been re-routed. Only one did not appear to be stabilised by vegetation. Such areas will be identified, monitored and managed as required (section 10.6.2).

Summary of Actions

- Confirm offset location and seek endorsement from ASEP
- Update Range Standing Orders
- Offset area and management requirements uploaded to Garrison and Estate Management System (GEMS)
- Increase course woody debris in TA2

- Opportunistically increase ground shelter in TA2 and TA1b by ensuring course woody debris includes, or is supplemented with, hollow timber or other shelter, or is arranged to provide areas of cover
- Fine-scale ecological burning with spot ignitions to achieve mosaic targets set down in RE fire management guidelines and to support achievement of BioCondition sub-canopy layer targets
- Supplementation of nesting hollows
- Other actions as indicated as relevant by BioCondition monitoring

Risks to Success

- Lack of support for offset location
- Lack of source for course woody debris
- Uncontrolled bushfire damages environmental improvements

Risk Mitigations and Alternative Actions

- Preliminary agreement to offset location has been received from key stakeholders
- On-site management projects can be directed to distribute pruning and other removed woody debris in offset area
- Offset location will be explicitly considered as a fire sensitive asset in updated Bushfire Management plan
- Mosaic fire management protocols within offset area lessen impacts of burning

6.6. Weed management

Weed management is essentially an aspect of enhancement of vegetation condition against benchmarks. However, weed management has its own risk profile and requires ongoing programs of treatment and monitoring to inform the success of treatment. The specific treatment methods used at any given time are not specified in this Offset Strategy to allow flexibility to adopt and test new methods (such a biocontrol agent) that may become available over the life of the Strategy. The EAC has a key role in assessing and advising on local experiences with management methods. Ecosure (2016) identified a wide diversity of weeds across GBTA, including 25 that were listed as class 2 or 3 weeds under the QLD Land Protection (Pest and Stock Route Management) Act 2002. Landholders are required to remove class 2 weeds from their property, while class 3 weeds should be managed to prevent economic and environmental harm but eradication is not a legal requirement. Six class 2 weeds were recorded in TA1b; *Ambrosia artemisiifolia*, *Baccharis halimifolia*, *Bryophyllum delagoense*, *Opuntia stricta*, *Opuntia tomentosa*, *Senecio madagascariensis*. Only *Ambrosia artemisiifolia* was recorded in TA2. The management target under the Offset Strategy is to eradicate all class 2 weeds from the offset area. However in recognition that to achieve this outcome continuous suppression may be required over the life of the Strategy, and repeated invasion from surrounding areas is possible, a threshold for success will be a reduction in density/abundance/cover (whichever is more appropriate for a given species or circumstance) to less than 5% of the baseline for each species.

Additional treatment priorities are included in the Queensland Weed and Pest Animal Strategy 2016-20. For key damaging weeds that already occur within QLD management outcomes are stipulated as “contain” or “asset protection”. Weeds that are still restricted in their extent and can be prevented from infesting new areas are subject to a “contain” strategy. This is achieved through either reducing the number of plants and controlling spread within core areas of known infestation (Area B) or removing every plant in areas where the plant is not yet established (Area A). Fireweed (*Senecio madagascariensis*) is the only “contain” species (Area B) currently known from the offset area, and as a class 2 weed the management target is to eradicate the species. Future establishment of new “contain” weeds may be treated differently if they otherwise fall into class 3 (below).

Class 3 weeds will be controlled as fully as possible, with a management target of eradication and a threshold of less than 10% of the baseline for each species. “Asset protection” is strategy applied to already widespread weeds that can nonetheless still cause significant harm in the wrong circumstances. The GBTA offset area is an asset that should be protected from these weeds. WONS species will be prioritised in asset protection treatments of class 3 weeds, and all localised WONS infestations will be individually managed and monitored with a view to eradication.

In practice, not all weed species will be present within BioCondition monitoring plots. However, currently mapped infestations of environmentally dominant weeds such as lantana will be specifically included within BioCondition monitoring plots. These locations were noted in site inspections as being areas of generally higher weed abundance and will provide monitoring outcomes for other species. Nonetheless, other weed occurrences will be monitored individually to ensure that they are suitably treated. Overall weed management outcomes will also be tracked through BioCondition monitoring plots, where a target abundance of less than 5% exotic species cover will be set as a threshold for each plot.

Summary of Actions

- Undertake baseline BioCondition assessment
- Establish long-term BioCondition monitoring plots at a sub-set of baseline assessment locations that exhibit current deficiencies against target benchmark conditions
- Conduct annual monitoring
- All weeds within offset area identified and treated to the minimum standard required by Queensland weed and pest animal strategy (2016-2020), and all occurrences of class 2 weeds identified and removed
- Eradication or continuous suppression to less than 5% of baseline levels of all class 2 weeds and WONS in the offset area.
- Continuously suppress class 3 weeds to less than 10% of their baseline levels.

Risks to Success

- Continuous weed reinvasion of offset from surrounding areas
- Uncontrolled movements and activities spread weeds into/within offset area
- Ineffective treatment program due to methods or environmental circumstances

Risk Mitigations and Alternative Actions

- Ongoing monitoring to adjust rate of effort, timing etc to improve program delivery
- Coordinated fire and weed management program delivered by the same contractor

6.7. Pest Management

Vertebrate pests on GBTA, including introduced predators, are currently managed to low numbers. The management target for all terrestrial vertebrate pests within the offset area is 0 individuals. Creation of a more permeable fence will facilitate faster recolonisation of treated areas by wild foxes and cats in particular. Research in to how fauna movement structures are being used may provide information about how best to deal with this issue, including any usage by domestic cats.

Summary of Actions

- Continue current site-wide pest management arrangements
- Reactively treat detections of dogs, cats, foxes into offset area noted by monitoring or research programs
- Reactively treat any incursions of pigs and deer into GBTA

Risks to Success

- Continuous reinvasion of offset from surrounding areas
- Ineffective pest program due to methods or environmental circumstances

Risk Mitigations and Alternative Actions

- GBTA boundary fence limits re-invasion rates.
- Ongoing monitoring to adjust rate of effort, timing etc to improve program delivery
- Coordinated fire and weed management program delivered by the same contractor

6.8. Habitat connectivity

The connectivity of vegetation through the wider Flinders Karawatha Corridor is beyond Defence control. However, under Defence management, GBTA will remain almost entirely forested by native vegetation, and the offset area consists entirely of native vegetation with the exception of boundary fire breaks and weedy understorey components. The Offset Strategy therefore focuses on improving habitat connectivity by providing better movement opportunities across the boundary of GBTA, and through the provision of greater shelter and harbour within areas of nearby habitat to ensure moving animals are safer and potentially have a more productive foraging environment.

The entire GBTA fence presents little barrier to quolls and gliders, but is significant to koalas, macropods and bandicoots without provision of specific crossing measures that allow passage through or over the fence. All ground dwelling animals, including quolls, will benefit from strategically located gates or passages through the fence. The focal areas for fauna movement structures are the TA2 perimeter fence and the perimeter fence around the Oxley Creek northern exit corridor (Fig. 9). The Sandy Creek fauna crossing under the Centenary Highway between TA1a and TA1b may benefit from additional measures being put in place nearby, depending on how it is being used, and by what species.

The TA2 fence divides the junction of GBTA and the only fully forested southern extension of the Flinders Karawatha Corridor. Fauna gates have previously been installed in this area. Some of these are clearly in use (Fig. 10). Around half have been fenced closed due to security concerns and others have poles installed to constrict entry. Ensuring that the permeability of this fence to fauna is re-instated is a core goal of the Offset Strategy. However, fauna access must be balanced against security restrictions and safety concerns, as people entering the training area can gain access to the impact area in which unexploded ordnance is present, unknowingly exposing themselves to significant risk. Similar fauna movement structures are required through the fence at the Oxley Creek northern exit corridor. This corridor provides the best remaining opportunity for faunal movement around a significant pinch point of vegetation at the junction of Johnson Road and Stapylton Road (Fig 9). Effective koala crossings are the main priority to have in place by 2022.

A research partnership will be established to better understand the effectiveness and potential improvement of fauna movement structures and potentially to design and test structures that overcome security concerns that have led to existing fauna gates being closed off. A university partner will be identified to run a combined monitoring and research program that addresses the following questions:

- What animals are using the current fauna movement structures?
- What animals are present in the immediate surrounds of the areas proposed for fauna movement structures that may benefit from them?
- Where, and how many, structures should be put in place?
- What structures should be put in place?
- Can koala and ground fauna structures meet security requirements for the site?
- Once in place, what animals are using the structures?
- Given usage of structures do they provide improvement to the potential connectivity of the site into the Flinders Karawatha Corridor for koalas and quolls?

Summary of Actions

- Undertake baseline fauna crossing assessments in TA2, Sandy Creek, and Oxley Creek northern exit corridor
- Establish a Research partnership to:
 - Increase fence permeability for ground-dwelling fauna and koalas in TA2 and Oxley Creek northern exit corridor
 - Selective adjustments to fauna movement structures based on research program

- Establish effectiveness of fauna movement structures under Centenary Highway in maintaining connectivity of TA1a and TA1b
- If relevant suggest collaborative enhancements to QLD Transport and Main Roads and improve supporting habitat features around fauna crossings
- Conduct annual monitoring

Risks to Success

- Inability to design fauna crossings that meet security and safety requirements
- Lack of uptake of crossings by fauna

Risk Mitigations and Alternative Actions

- Establish a research partnership to address usage, design and effectiveness actions
- Dual security and monitoring cameras with signage
- Ongoing engagement with security and range management prior to deploying new fauna movement structures
- Strategic location of measures at focal movement locations



Figure 9. Forest connectivity through GBTA and the Flinders Karawatha Corridor. Movement measures in the fence line of TA2 will enhance existing forest connectivity through the southwest of GBTA. Connectivity in the southwest is partly impacted by the Springfield-Greenbank Arterial Road. However, fauna in that area is not so funnelled or subject to traffic volumes when compared to the very narrow north-eastern corner where the significantly busier Johnson Road/Stapylton Road junction (a) creates a barrier to faunal movement. The Offset Strategy therefore aims to preferentially promote faunal movement along the Oxley Creek corridor in this area.

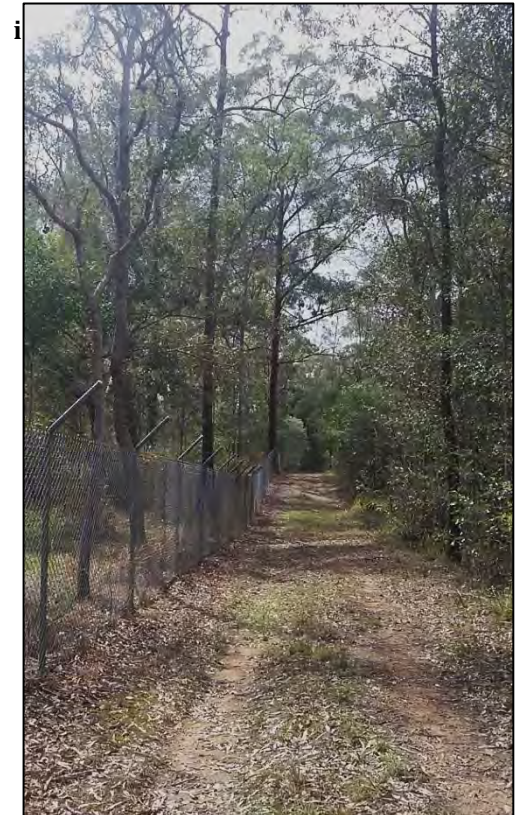


Figure 10. Key fauna movement locations on GBTA.

TA1b a, b: fauna crossing under Centenary Highway. TA2 c, d: open fauna gates with d in clear use, e: closed fauna gate due to security concerns, f: closed fauna gate with poles, g: open gate clearly in use. Oxley Creek corridor h: informal fauna gate, i: vegetation across Oxley Creek corridor fence line already provides good connection for gliders.

6.9. Vertebrate surveys and monitoring

EPBC conditions of approval require vertebrate surveys and “monitoring that must be of a design that will detect any great changes to the numbers of threatened species within the Greenbank Training Area”. While baseline surveys will employ a variety of methods to ensure the widest chance of detecting species present within the offset area and surrounds, ongoing annual monitoring will rely primarily on remote cameras. Defence invested in a significant body of research into the use of remote camera and sound monitoring methods to provide comprehensive wildlife monitoring programs. This research resulted in world-leading methods for the detection of reptiles using cameras (Welbourne et al 2017), and comparative analysis that demonstrated camera methods can be more effective than detailed ecological surveys conducted by highly skilled researchers (Welbourne et al 2015). The only recent record of a koala from GBTA was on a remote camera.

Although quolls have been very successfully monitored using cameras in many locations (Nelson 2007), numbers of quolls in the Greenbank area are so low that camera monitoring by the Wildlife Preservation Society of Queensland and others has failed to detect a single quoll (WPSQ 2015). Ad hoc records have only been gleaned from road kill and occasional incidental sightings. This indicates that any monitoring method is likely to fail to yield detections of quolls in any given year. Wherever possible, additional surveys will be facilitated to generate the greatest chance of detecting quolls. However, to generate a consistent inter-annual monitoring data set, cameras will be the technique committed to as the Offset Strategy deliverable. Camera monitoring also affords excellent cross-taxon monitoring that will also inform pest animal management programs and cameras will be paired with one adjacent to tracks like paired to one 100m into forest, wherever possible spanning the two sides of a BioCondition plot.

The design of the monitoring program will not be finalised until after baseline surveys have been conducted as the best locations for cameras will be partly related to fauna present in a given area. Cameras will be associated with areas in which improvement activities are conducted, but also across the wider landscape to provide a control data set and broader context to the observations from the offset area. This is especially important for pest management where the overall management of the site impacts directly on the offset area, and for potential quoll or koala detections where knowing of any movements through any parts of GBTA may inform the adequacy of the location of fauna movement structures. Cameras will also be used to monitor fauna movement structures.

Indicative camera deployments are:

5 individual cameras at areas with fauna movement structures in place (TA2 and Oxley Creek northern exit Corridor), moved to cover all available movement options for a minimum period of at least twenty nights every six months.

Paired cameras elsewhere with one on track edge and one located 100m off the track, pairs approximately 500 m apart. This equates to around fifteen pairs in TA2 and ten pairs in TA1b. Cameras will be deployed for at least 20 nights every six months (~2000 camera nights per year for core offset area monitoring).

Single cameras will be set every kilometre and 50 m back from road edge (where possible) along entire GBTA ring road in years 2, 5, 7 and 10 for a minimum of 20 nights.

While detection of both quolls and koalas is unlikely to be frequent at current densities, these methods are capable of detecting these target species and many other vertebrates species likely to occur in the area. The intensity of survey detailed above should be sufficient to demonstrate any significant increase in population size or usage of the offset area by vertebrate species, particularly in conjunction with the targeted monitoring of fauna movement measures (6.8).

Summary of Actions

- Undertake baseline survey of fauna using live trapping, cameras, sound recorders, secondary evidence, direct observation
- Establish long-term remote camera and sound monitoring program at a subset of baseline survey locations.
- Establish nest box monitoring program

Risks to Success

- Inability to meet EPBC approval conditions that require population estimates and reporting of inter-annual variation in numbers of koalas and quolls is interpreted as inadequate monitoring strategy rather than very low local detectability of target species.

Risk Mitigations and Alternative Actions

- Augmentation of camera and sound monitoring with detector dogs and other ad-hoc survey methods.

6.10. Erosion management

EPBC conditions of approval specify that the offset plan should detail “remediation actions that will halt soil erosion and increase bank stability from selected areas within the Greenbank Training Area currently affected by soil erosion”. The most obvious erosive process on GBTA is the ongoing erosion within the creek channel of Oxley Creek. However, independent research prior to planning and development of ELF facilities at GBTA concluded that engineering solutions to halt stream widening of Oxley Creek are not economically feasible and that sediment load in the creek is almost entirely derived from in-channel processes and not erosion across the wider landscape. Almost the entire length of Oxley Creek on GBTA is also within the impact area, and creek works would carry a risk of encountering unexploded ordnance. Although halting creek bank erosion along Oxley Creek is not feasible, smaller occurrences of erosion within the offset area will be managed as part of the offset delivery.

6.10.1. Studies of channel erosion in Oxley Creek.

Erosion of Oxley Creek has been a noted environmental issue for decades (Jacobs 1999). Two key relevant studies of erosion in Oxley Creek have been undertaken in the last decade. Coffey (2014) were commissioned by Defence to undertake an assessment of Oxley Creek and assess what, if any, Defence actions contributed to erosion of the creek channel. The work concluded “Our view is that the development of SDTA, which is 130m immediately east of the creek, is responsible for the sudden creek bed deterioration from an increase in overland flow from the SDTA catchment”. They proposed putting bank protection measures in place and also clearing fallen timber and debris from the creek line as they increase flow velocity and therefore potentially erosion around areas with vegetation blockages.

In contrast to that work, the Australian Rivers Institute (Pietsch et al (2009)) conducted an independent catchment-wide analysis. They examined the development of channel width and depth along the course of the creek and identified much of the length of Oxley Creek through GBTA as a “Reach at risk” (Fig. 11), where channel width versus depth was out of phase with stream discharge through the site. They suggested that channel expansion would continue over the next few decades before returning to being in phase. They concluded “It is our contention that heavy engineering efforts to disrupt this re-equilibration are unlikely to be economic in the longer term. Rather, such resources as are available should be directed to:

- Understanding the natural processes operating to produce equilibrium forms and functions
- Small scale opportunistic interventions to enhance the natural process, i.e. “assisted natural regeneration” and engineered log jams
- Infrastructure re-engineering and design (including planning) that anticipates change and its likely endpoint

The fact that around ten kilometres of Oxley Creek immediately upstream of GBTA, and more than four kilometres of stream within the site, are continuing to equilibrate in this fashion has significant implications for any attempts at revegetation or other works. The bulk of sediment carried by Oxley Creek was found to be generated by in-stream processes (as opposed to hillslope or broader landscape erosion). Given GBTA is located at the lower end of a reach at risk, continued on-site erosion, as well as significant sediment deposition from upstream, will continually hamper efforts to establish vegetation for bank stabilisation or other purposes.

The clearly observed pattern of channel erosion in Oxley Creek through GBTA is entirely consistent with the conclusions of the Australian Rivers Institute, and inconsistent with the Coffey report. Prior to the commencement of construction of the SDTA during 2008-2010 a series of minor to moderate flood events occurred in the Brisbane area, followed by the major flood event of January 2011. The impacts of these events can be seen in the upstream migration of stream bank erosion in Oxley Creek between October 2003 and January 2012 (Fig. 12 (a) and (b)), immediately prior to SDTA construction. Continued periodic rainfall peaks through the period to 2017 have seen the continued upstream progression of stream widening past the SDTA, and this process will continue unabated until such time as some equilibrium is reached (Fig. 12 (c-h)).

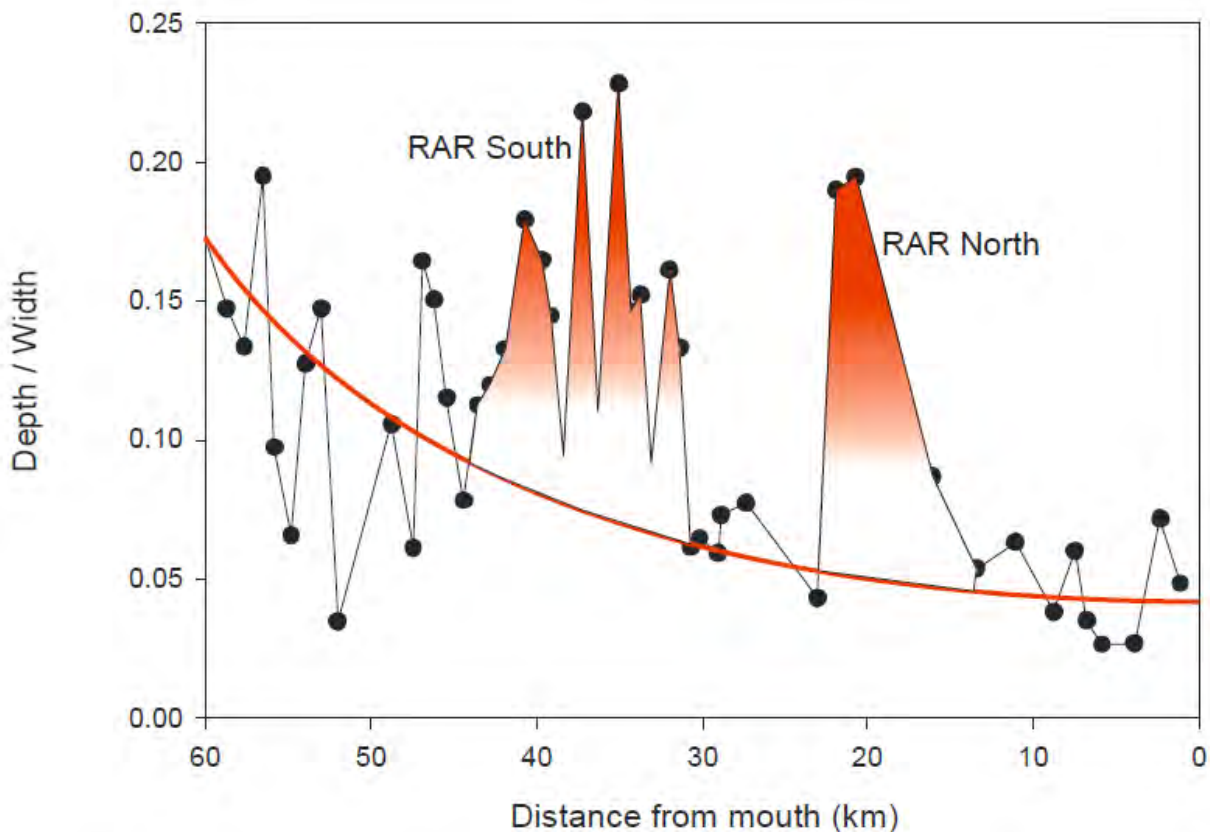


Figure 11. Reaches at risk as determined by Pietsch et al (2009).

Red shaded areas represent “sustained departures of the Depth/Width ratio (black dotted line) from the expected trend (red line)” (Fig. 14, Pietsch et al (2009)). Reach at risk (RAR) south begins approximately 2 km inside the boundary of GBTA and continues upstream through the remaining 4.5 km of channel on GBTA and many kilometres further south.

6.10.2. Management approach

The impracticality of undertaking physical works to halt erosive processes means that it is not possible to set targets for creek stabilisation under this plan. However, there is an active Oxley Creek Catchment Management Association with strong links to local government, industry and community groups. The Oxley Creek Catchment Management Plan 2009 also provides a strong contextual framework for the importance of GBTA as a large natural area with ecological and heritage values within the catchment. The Brisbane City Council Oxley Creek Transformation draft Master Plan (April 2018) also sets down an ambitious vision for landscape-scale improvement to the catchment immediately downstream from GBTA.

There is no certainty of when and how revegetation or bank stabilisation planting actions can be conducted. Therefore, the key goal to be achieved under this plan is ongoing integration of Defence management into the wider Oxley Creek management framework. This will be achieved by collaboratively identifying any immediate practical weed management or revegetation works that will significantly contribute to upstream or downstream programs coordinated by the Oxley Creek Catchment Association (a member of the GBTA EAC) and the development of a program of riparian improvements through the Oxley Creek northern exit corridor. This stretch of creek has greatest potential to create weed problems downstream to the area covered by the Brisbane City

Council Oxley Creek Transformation draft Master Plan (April 2018), and is heavily infested with lantana. It is outside the impact area and more accessible for safe management actions.

Within the offset area, small localised erosion (example image in Appendix 4) will be identified, mapped and recorded in GEMS. If the location appears to be naturally revegetating/ed and erosion is attenuating, then an informal program of photographic monitoring during years 3, 8 and 10 will be undertaken. For sites that are potentially still active and may expand, a quantitative monitoring program will be implemented to track erosion and vegetation cover. If monitoring indicates that intervention is required (i.e. the erosion is active and expanding), revegetation of groundcovers will be undertaken. Where earthworks are required to re-form the ground surface and restore grade because natural stabilisation is not occurring, works bids will be placed using the Estate Investment Requirement process.

Summary of Actions

- Identification of immediate high value revegetation and weed management works with Oxley Creek Catchment Management Association
- Collaboratively determine GBTA Oxley Creek management thresholds with OCCA and GBTA EAC
- Documentation of localised erosion issues
- Monitoring of localised erosion
- Remediation of localised erosion features that are not stabilised

Risks to Success

- Financial resourcing of activities
- Inability of volunteer partners to participate in planning to conduct activities
- Vegetation removal activities create environmental issues due to high stream flows prior to completion

Risk Mitigations and Alternative Actions

- Utilise existing relationships and management arrangements
- Ensure strategic incremental replacement of removed weeds by native species

October 2003



Jan 2012



April 2012



April 2013



March 2014



April 2015



June 2016



April 2017



Figure 12. Progression of channel erosion along Oxley Creek. The clear re-invigoration of channel erosion can be seen between 2003 and 2012 prior to development of the SDTA, as can the ongoing progression of erosion with significant ongoing peak flows since that time.

7. Completion criteria and performance targets

All tasks described in the works schedule presented in Table 1 will be delivered by the Defence Estate and Infrastructure Group. The Deputy Secretary Estate and Infrastructure is therefore accountable for implementing the Offset Strategy.

No performance indicators are described for the landscape plantings and sewerage treatment plan remediation as they have already been completed (Appendices 1&2). These areas were also inspected as part of an EPBC compliance audit in 2018.

Table 1. Detailed works schedule for strategy implementation.

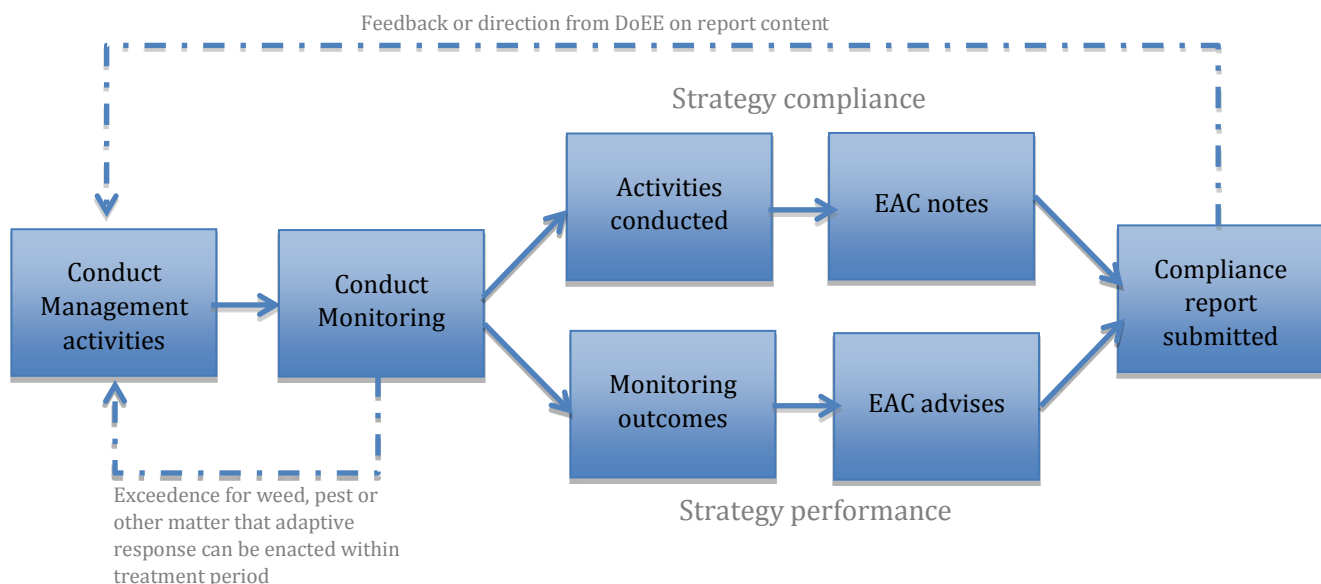
Activity	Description of proposed works	Key Performance Indicator	Timeframe for completion
1. Formally identify offset area and update administrative arrangements to protect the offset area	1.1 Confirm offset location and seek endorsement from ASEP	Site Selection brief signed by ASEP	December 2018
	1.2 Update Range Standing Orders	Range Standing Orders updated to reflect offset area	On next review
	1.3 Offset area and management requirements uploaded to Garrison and Estate Management System (GEMS)	Environmental Offset EFRs created in GEMS for TA1b, TA2 and Oxley Creek northern exit corridor	March 2019
2. Establish Oxley Creek management framework	2.1 Identification of immediate high value revegetation and weed management works with Oxley Creek Catchment Management Association	Minuted outcomes of at least one on-site meeting at which advice has been provided to Defence on any practical measures that could be put in place to ensure integration of Oxley Creek northern exit corridor works contribute to downstream master planning and whole-of-catchment strategies for weed and waterway improvements.	December 2018
	2.2 Collaboratively determine GBTA Oxley Creek management thresholds with OCCA and GBTA EAC	Minuted acceptance by EAC of core actions and thresholds with respect to environmental improvements of Oxley Creek northern exit corridor (e.g. weed density, established native replacement vegetation). Monitoring facilities and baseline data uploaded to GEMS Target thresholds for key taxa (if appropriate) identified and recorded against monitoring facilities in GEMS	December 2019
3. Baseline surveys	3.1 Undertake baseline BioCondition assessment	Monitoring facilities and monitoring data uploaded to GEMS	June 2019
	3.2 Undertake baseline survey of fauna using live trapping, cameras, sound recorders, secondary evidence, direct observation	Environmental factor records entered or updated in GEMS	June 2019

	3.3 Undertake baseline fauna crossing assessments in TA2, Sandy Creek, and Oxley Creek northern exit corridor	Monitoring facilities and baseline data uploaded to GEMS	June 2020
4. Establish monitoring program	4.1 Establish long-term remote camera and sound monitoring program, ideally in collaboration with Wildlife Preservation Society of QLD at a subset of baseline survey locations.	Agreement in place with WPSQ to integrated community-based monitoring Monitoring facilities and data uploaded to GEMS Target thresholds for key taxa (if appropriate) identified and recorded against monitoring facilities in GEMS	June 2019
	4.2 Establish long-term BioCondition monitoring plots at a sub-set of baseline assessment locations that exhibit current deficiencies against target benchmark conditions	Monitoring facilities and monitoring data uploaded to GEMS Target benchmarks for key habitat attributes identified as thresholds and recorded against monitoring facilities in GEMS (e.g. length course woody debris, weed density)	June 2019
	4.3 Establish nest box monitoring program	Monitoring facilities and monitoring data uploaded to GEMS	December 2022
	4.4 Conduct annual monitoring activities in accordance with finalised arrangements	Monitoring data uploaded to GEMS within 28 days of completion of annual surveys	(Annually until) December 2028
5. Weed eradication and suppression program	5.1 All weeds within offset area identified and treated to the minimum standard required by Queensland weed and pest animal strategy (2016-2020), and all occurrences of class 2 weeds identified and removed	Any “Eradication” or “Containment: Area A” weeds identified within offset area treated. Individual monitoring facilities created for each occurrence and target thresholds of “0” individuals recorded against each facility in GEMS	December 2019
	5.2 Eradication or continuous suppression to less than 5% of baseline levels of all class 2 weeds and WONS in the offset area.	Monitoring program yields no records of class 2 weed species	December 2023
	5.3 Continuously suppress class 3 weeds to less than 10% of their baseline levels.	No threshold breaches recorded by monitoring program	Ongoing
6. Vertebrate pest management program	6.1 Continue current site-wide pest management arrangements	Camera monitoring program and fauna movement structures research have reduction in detection rate of introduced predators, or no increase from a zero-detection baseline.	Ongoing
	6.2 Reactively treat detections of dogs, cats, foxes into offset area noted by monitoring or research programs	Camera monitoring program and fauna movement structures research have reduction in detection rate of introduced predators, or no increase from a zero-detection baseline.	Ongoing
	6.3 Reactively treat any incursions of pigs and deer into GBTA	BioCondition monitoring detects no presence or damage to habitat quality caused by pigs or deer	Ongoing
7. Other habitat improvement measures	7.1 Increase course woody debris in TA2 through opportunistic distribution of material sourced from tree management and other works on site	BioCondition monitoring records 10% increase in course woody debris length over baseline	December 2024
	7.2 Opportunistically increase ground shelter in TA2 and TA1b by ensuring course woody debris includes,	Annual reporting documents activity has been undertaken. Photographs uploaded against BioCondition monitoring facilities in GEMS	December 2024

	or is supplemented with, hollow timber or other shelter, or is arranged to provide areas of cover		
	7.3 Fine-scale ecological burning with spot ignitions to achieve mosaic targets set down in RE fire management guidelines and to support achievement of BioCondition sub-canopy layer targets	Fire history reflects burn prescriptions in QLD Government Regional Ecosystem Fire Management Guidelines	Ongoing
	7.4 Supplementation of nesting hollows	Monitoring of nest box use indicates uptake by native species.	December 2023
	7.5 Potential localised erosion issues documented	Notable erosion recorded in GEMS as EFRs	December 2019
	7.6 Monitoring of localised erosion	Monitoring facilities recorded in GEMS for all erosion EFRs Vegetation cover and feature size thresholds defined for all erosion features in GEMS based on no increase in size and maintaining or increasing current vegetation cover	June 2024
	7.7 Remediation of localised erosion features that are not stabilised	Monitoring data indicates vegetation and size thresholds have not been exceeded	December 2024
8. Fauna movement measures	8.1 Increase fence permeability for ground-dwelling fauna and koalas in TA2 and Oxley Creek northern exit corridor	Fauna gates and other measures in place. Monitoring data indicates increased fauna movement	June 2022
	8.2 Selective adjustments to fauna movement structures based on research program	(if possible) Monitoring indicates increased movements by koalas and quolls	December 2024
	8.3 Establish a Research partnership to: ○ Increase fence permeability for ground-dwelling fauna and koalas in TA2 and Oxley Creek northern exit corridor ○ Establish effectiveness of fauna movement structures under Centenary Highway in maintaining connectivity of TA1a and TA1b ○ If relevant suggest collaborative enhancements to QLD Transport and Main Roads and improve supporting habitat features around fauna crossings	Research paper or report available	December 2023
	8.4 Conduct annual monitoring	Annual monitoring data uploaded to GEMS	(Annually until) December 2028

8. Monitoring and Reporting

Monitoring and reporting will be structured around EPBC annual compliance reporting that requires vertebrate monitoring results be included. Outcomes of intended management actions have largely been attributed pre-defined thresholds that indicate success or failure to attain the target in any given year. Annual reporting can therefore be based around consideration of threshold exceedences; circumstances where desirable thresholds have not yet been achieved, or undesirable thresholds have been breached. The annual report must include proposed remedial actions to bring Offset Strategy delivery back into alignment with Key Performance Indicators. A second reporting stream will be on compliance with the strategy. This will be achieved by an assessment of whether Offset Strategy actions for the preceding twelve months were performed in accordance with strategy work schedule (Table 1). Critical advice and feedback on strategy performance monitoring will be sought from the EAC. Compliance against the Offset Strategy work schedule is a secondary consideration to achievement of environmental Key Performance Indicators. Compliance levels will be reported to the EAC, along with any remedial work plan to bring the Offset Strategy back in to compliance if required works have not been completed on time. Outcomes of the EAC review may be integrated in to compliance reporting to the Department of Environment and Energy.



9. Review and audit

The Defence Audit Branch can commence an independent audit of the Offset Strategy at any time. However, audit of strategy implementation would be most beneficial during the fourth and eighth years of the strategy. These timings would allow time for adaptive management to occur ahead of two key planned transitions; the five-year transition from undertaking improvement actions to a monitoring focus, and the ten-year cessation of monitoring on the assumption that monitoring has demonstrated sustained achievement of Key Performance Indicators. Defence Audit Branch will be requested to perform audits against different terms of reference for each audit (Table 2).

Table 2. Terms of reference for proposed audits of strategy implementation.

Fourth year audit 2022	Eighth year audit (2027)
Has management of the Offset Strategy been effective?	What key legal, organisational or other high-level changes have influenced delivery of the Offset Strategy since its commencement?
How much has the Offset Strategy cost to date?	Has management of the Offset Strategy been effective?
Has the strategy work schedule been delivered?	How much has the Offset Strategy cost to date?
Have delivered works achieved performance standards?	Have monitoring programs been implemented?
Is it practical to deliver remaining work schedule commitments?	Are remedial works required to achieve performance standards?
Will alternate or delayed deliverables (beyond five years) be required to achieve performance standards?	Has the Offset Strategy benefited or influenced wider site management of GBTA?
	What, if any, additional measures are required to successfully complete the Offset Strategy?

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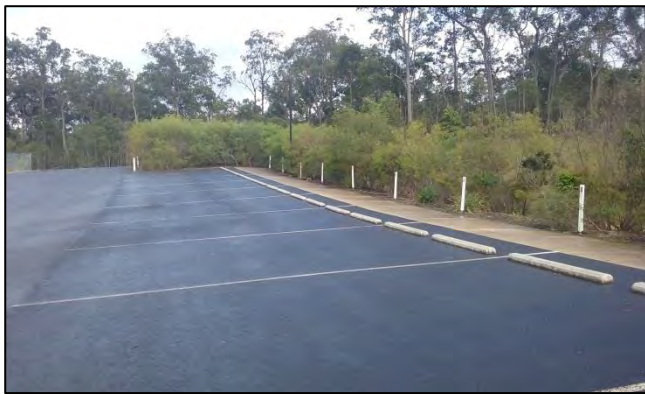
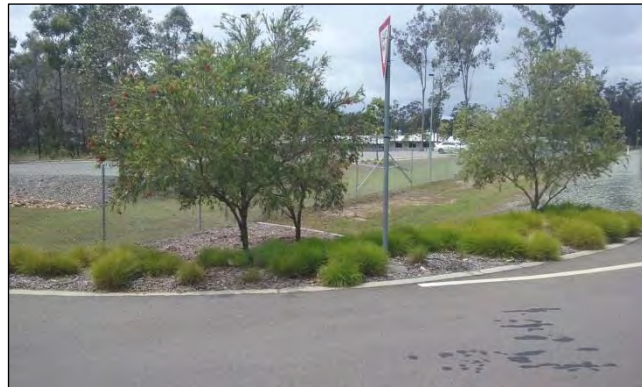
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11. Appendix 1. Completed Landscape Plantings

Small feature beds near Camp facilities and Range Control, especially of bottle brush and blady grass



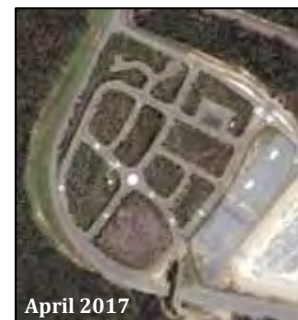
Dense plantings of shrubs around carpark and shelter sheds at Marksman Training Range



Large, diverse, plantings of trees, shrubs, grasses and rushes at Safe Driver Training Area



Rapid, successful, establishment of plantings at the SDTA can be seen in the change in vegetation cover on disturbed ground surfaces between 2014 and 2017. Arrow shows location and orientation of image.



12. Appendix 2. Completed Sewerage Treatment Plant Rehabilitation

Original footprint of rehabilitated site can be seen. Original ground levels and contours were re-established as closely as possible, including re-establishment creek channel (1). Vigorous shrub and tree regrowth is taking hold across site (2) and (3)



Ground covers and litter are beginning to provide effective ground protection and re-establishment of soil structure. This process is being reinforced by bandicoots and other digging fauna, indicating normal ecosystem processes are returning to the site.

13. Appendix 3. Risk Assessment of Individual Actions

Action	Driver	Likelihood	Consequence	Risk Level	Mitigation or Acceptance reasoning	Mitigated or Accepted Risk
1.2 Update Range Standing Orders	Missed action in review	Possible	Insignificant	Low	Ensure requirement communicated to DOTAM. Make out-of-session update if required.	Low
2.1 Identification of immediate high value revegetation and weed management works with Oxley Creek Catchment Management Association	Lack of capacity for OCCA to attend site/participate in process	Possible	Insignificant	Low	Take reasonable actions to improve corridor and engage when possible	Low
2.2 Collaboratively determine GBTA Oxley Creek management thresholds with OCCA and GBTA EAC	Lack of capacity for OCCA to attend site/participate in process	Possible	Insignificant	Low	Take reasonable actions to improve corridor and engage when possible	Low
8.1 Increase fence permeability for ground-dwelling fauna and koalas in TA2 and Oxley Creek northern exit corridor	Security and safety constraints prevent deployment of effective measures	Possible	Major	High	Solutions are available, research partnership proposed to assist delivery and demonstrate solutions, but not essential to trial implementation	Medium
6.2 Reactively treat detections of dogs, cats, foxes into offset area noted by monitoring or research programs	Timely response not possible	Possible	Minor	Medium	None	Medium
6.3 Reactively treat any incursions of pigs and deer into GBTA	Timely response not possible	Possible	Minor	Medium	None	Medium
7.7 Remediation of localised erosion features that are not stabilised	Financial constraints to delivering engineering remediation in comparison to completing alternative offset actions with greater benefit	Possible	Minor	Medium	Non-engineering solutions possible to establish vegetation on uneven slopes if original landform not required to prevent ongoing erosion	Low
6.1 Continue current site-wide pest management arrangements	Contract change or change in service	Possible	Minor	Medium	Alternative delivery avenues available	Low
4.4 Conduct annual monitoring activities in accordance with finalised arrangements	Contract change or change in service	Possible	Minor	Medium	Alternative delivery avenues available	Low
3.2 Undertake baseline survey of fauna using live trapping, cameras, sound recorders, secondary evidence, direct observation	Lack of availability of service provider	Rare	Minor	Low	None	Low
3.3 Undertake baseline fauna crossing assessments in TA2, Sandy Creek, and Oxley Creek northern exit corridor	Lack of availability of service provider	Rare	Minor	Low	None	Low
3.1 Undertake baseline BioCondition assessment	Lack of availability of service provider	Rare	Minor	Low	None	Low
4.1 Establish long-term remote camera and sound monitoring program, ideally in collaboration with Wildlife Preservation Society of QLD at a subset of baseline survey locations.	Lack of availability of service provider	Rare	Minor	Low	None	Low
4.2 Establish long-term BioCondition monitoring plots at a sub-set of baseline assessment locations that exhibit current deficiencies against target benchmark conditions	Lack of availability of service provider	Rare	Minor	Low	None	Low
4.3 Establish nest box monitoring program	Lack of availability of service provider	Unlikely	Minor	Low	None	Low
7.1 Increase course woody debris in TA2 through opportunistic distribution of material sourced from tree management and other works on site	Lack of source for wood	Possible	Moderate	Medium	Requirements placed on other site projects to provide wood, some stockpiled wood already available	Medium
7.5 Potential localised erosion issues documented	Lack of resources to perform task	Rare	Moderate	Low	None	Low
1.3 Offset area and management requirements uploaded to Garrison and Estate Management System (GEMS)	Lack of resources to perform task	Rare	Moderate	Low	None	Low
7.6 Monitoring of localised erosion	Lack of resources to perform task	Rare	Moderate	Low	None	Low
7.3 Fine-scale ecological burning with spot ignitions to achieve mosaic targets set down in RE fire management guidelines and to support achievement of BioCondition sub-canopy layer targets	Inability to meet burn windows and prescriptions	Rare	Moderate	Low	Wide seasonal and inter-annual burn windows, low intensity prescriptions allows greater burn window	Low

7.4 Supplementation of nesting hollows	Financial and practical constraints in provisioning tall trees with sufficient hollows and net boxes to effect improvement	Unlikely	Moderate	Medium	Artificial nest boxes provisioned via established process, including on GBTA. Direct-drilling not essential technique to achieving habitat outcomes.	Low
1.1 Confirm offset location and seek endorsement from ASEP	Lack of agreement by board	Unlikely	Moderate	Medium	Preliminary agreement in place from key stakeholders	Low
8.4 Conduct annual monitoring	Bushfire or other incident destroys equipment, unable to deploy equipment	Unlikely	Moderate	Medium	Technique is relatively forgiving compared to others. Ensure back-up equipment available and broad time periods (season) available for monitoring	Low
8.2 Selective adjustments to fauna movement structures based on research program	Partnership is not established, or breaks down prior to delivery of solutions	Unlikely	Moderate	Medium	Contracted solutions can replace partnership is required	Low
8.3 Establish effectiveness of fauna movement measures under Centenary Highway in maintaining connectivity of GBTA sections	Partnership is not established, or breaks down prior to delivery of solutions	Unlikely	Moderate	Medium	Contracted solutions can replace partnership is required	Low
5.2 Eradication or continuous suppression to less than 5% of baseline levels of all class 2 weeds and WONS in the offset area.	Ineffective treatment	Possible	Moderate	Medium	Monitoring program	Low
5.1 All weeds within offset area identified and treated to the minimum standard required by Queensland weed and pest animal strategy (2016-2020), and all occurrences of class 2 weeds identified and removed.	Ineffective treatment	Possible	Moderate	Medium	Monitoring program	Low
5.3 Continuously suppress class 3 weeds to less than 10% of their baseline levels.	Ineffective treatment, ongoing re-invasion and recruitment of wide variety of lower-risk weeds	Possible	Moderate	Medium	Monitoring program	Medium

14. Appendix 4. Threatened species of GBTA and surrounding bioregion.

List derived from database searches of occurrences within 5 km of the offset area on the Atlas of Living Australia, QLD Wildnet and HERBRECS and Atlas of Living Australia predicted habitat modelling within 5 km of the offset area.

Scientific name	Common name	EPBC Act status	QLD NC Act status
<i>Alectryon ramiflorus</i>	Isis Tamarind	Endangered	Endangered
<i>Arthraxon hispidus</i>	Hairy-joint Grass	Vulnerable	Vulnerable
<i>Bertya opposens</i>	Coolabah Bertya	Vulnerable	-
<i>Bosistoa transversa</i>	Three-leaved Bosistoa	Vulnerable	-
<i>Bulbophyllum globuliforme</i>	Miniature Moss-orchid	Vulnerable	Near threatened
<i>Cadellia pentastylis</i>	Ooline	Vulnerable	Vulnerable
<i>Callitris baileyi</i>	Bailey's Cypress Pine	-	Near threatened
<i>Caustis blakei</i> subsp. <i>macrantha</i>	Koala Fern	-	Vulnerable
<i>Corchorus cunninghamii</i>	Native Jute	Endangered	Endangered
<i>Corynocarpus rupestris</i> subsp. <i>arborescens</i>	Southern Corynocarpus	-	Vulnerable
<i>Cossinia australiana</i>	Cossinia	Endangered	Endangered
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	Vulnerable	-
<i>Cupaniopsis shirleyana</i>	Wedge-leaf Tuckeroo	Vulnerable	Vulnerable
<i>Cupaniopsis tomentella</i>	Boonah Tuckeroo	Vulnerable	Vulnerable
<i>Cycas megacarpa</i>	-	Endangered	Endangered
<i>Cycas ophiolitica</i>	Marlborough Blue	Endangered	Endangered
<i>Cyperus clarus</i>	-	-	Vulnerable
<i>Dichanthium queenslandicum</i>	King Blue-grass	Endangered	Vulnerable
<i>Dichanthium setosum</i>	Bluegrass	Vulnerable	-
<i>Eucalyptus taurina</i>	Ironbark	-	Vulnerable
<i>Eucalyptus virens</i>	Shiny-leaved Ironbark	Vulnerable	Vulnerable
<i>Floydia praealta</i>	Ball Nut	Vulnerable	Vulnerable
<i>Fonatineia rostrata</i>	Deep Creek Fontainea	Vulnerable	Vulnerable
<i>Fontainea venosa</i>	Veiny Fontainea	Vulnerable	Vulnerable
<i>Gossia gonoclada</i>	Angle-stemmed Myrtle	Endangered	Endangered
<i>Lepidium peregrinum</i>	Wandering Pepper-cress	Endangered	-
<i>Leptospermum oreophilum</i>	-	-	Vulnerable
<i>Leucopogon recurvisepalus</i>	Curly Beardheath	-	Endangered
<i>Macadamia integrifolia</i>	Smooth-shelled Macadamia	Vulnerable	Vulnerable
<i>Macadamia tetraphylla</i>	Rough-shelled Macadamia	Vulnerable	Vulnerable
<i>Marsdenia coronata</i>	Slender Milkvine	-	Vulnerable
<i>Marsdenia longiloba</i>	Clear Milkvine	Vulnerable	Vulnerable
<i>Maundia triglochinosoides</i>	Small Water Ribbons	-	Vulnerable
<i>Melaleuca irbyana</i>	Swamp Teatree	-	Endangered
<i>Notelaea ipsviciensis</i>	Cooneana Olive	Critically endangered	Endangered
<i>Notelaea lloydii</i>	Lloyd's Olive	Vulnerable	Vulnerable
<i>Paspalidium grandispiculatum</i>	-	Vulnerable	Vulnerable
<i>Persicaria elatior</i>	Pink Smartweed	Vulnerable	Vulnerable
<i>Phaius australis</i>	Southern Swamp-orchid	Endangered	Endangered
<i>Picris conyzoides</i>	-	-	Vulnerable
<i>Planchonella eerwah</i>	Shiny-leaved Condoo	Endangered	Endangered

<i>Plectranthus habrophyllus</i>	Native Coleus	Endangered	Endangered
<i>Plectranthus nitidus</i>	Nightcap Plectranthus	Endangered	Endangered
<i>Polianthion minutiflorum</i>	Small-flowered Polianthion	Vulnerable	Vulnerable
<i>Pomaderris coomingalensis</i>	-	-	Endangered
<i>Pouteria eerwah</i>	Shiny-leaved Condoo	Endangered	Endangered
<i>Randia moorei</i>	Spiny Gardenia	Endangered	Endangered
<i>Ricinocarpos speciosus</i>	Springbrook Wedding Bush	-	Vulnerable
<i>Samadera bidwillii</i>	Quassia	Vulnerable	Vulnerable
<i>Sophora fraseri</i>	Brush Sophora	Vulnerable	Vulnerable
<i>Thesium australe</i>	Austral Toadflax	Vulnerable	Vulnerable
<i>Zieria collina</i>	-	Vulnerable	Vulnerable
<i>Zieria furfuracea</i> subsp. <i>gymnocarpa</i>	Belmont Zieria	-	Endangered

15. Appendix 5. Offset Area Images

Training Area 1b:

Deep, widely spaced scratch marks consistent with koalas were found on a number of trees.



Pool and riparian vegetation on Sandy creek adjacent to fauna crossing point.



Hollow bearing trees were more common in TA1b than in TA2.



Lower and midstorey vegetation is generally denser in TA1b.



Scratch marks from possums, and potentially koalas.



Diverse weed assemblages were noted along the western portion of TA1b, consistent with Ecosure's (2016) assessment. However, as in this image where five weed species are present, they are generally not dominant or beyond eradication/effective control.



Training Area 2.

Some parts of TA2 have moderately dense midstories of casuarina.



The overall stand diversity, and tree ages of TA2 is limited and almost exclusively lack old, hollow-bearing trees. Because of this, there is limited dead fall and ground shelter available.



Localised erosion was noted in locations adjoining tracks where they had been re-routed. All but one appear to be stabilised with vegetation as per the below situation.



Some patches of dense lantana were generally associated small patches of diversity of other weeds.



Oxley Creek northern exit corridor

For practical reasons, the boundary fence does not exactly follow the property boundary along riparian areas. Note dense lantana to left of fence and canopy connectivity over fence.



Lantana, passion vine, wild tobacco and other weeds provide a stabilising effect to riparian areas. Carefully staged replacement will be implemented.



Mixed native canopy and midstorey provide a framework for understorey rehabilitation.



