Woodstock Environmental Offset Project Tharra Rehabilitation Plan

Weed Control Plan

February 2022

Report prepared for Budadee Aboriginal Corporation and Pilbara Environmental Offset Program by Terra Rosa Consulting

Disclaimer

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We acknowledge the Traditional Owners and custodians of country throughout Australia and their continuing connection to land, waters, and community. We pay our respects to the people, the cultures, and the Elders past, present and emerging.

1. EXECUTIVE SUMMARY

The Woodstock Abydos Protected Reserve (WAPR) is located approximately 150 km south of Port Hedland and is one of the most culturally significant places in the Pilbara. The Palyku portion of the WAPR is traditionally known as Tharra and is home to extensive rock-art complexes and a large number of culturally significant sites. The river systems within the Tharra contain a large number of cultural heritage sites, many of which are under direct threat from weed invasion and stock impacts.

In February 2021, Terra Rosa Consulting (TRC) was commissioned by Budadee Aboriginal Corporation (BAC) to assist in the delivery of environmental planning, monitoring and rehabilitation works across Tharra funded by the Pilbara Environmental Offset Fund (PEOF). The objective of this Project, the Woodstock Environmental Offset Program (WEOP), is to enhance environmental health of Tharra, based on both cultural and conservation values. After a series of meetings between the BAC, TRC, DWER and other stakeholders held in March & April 2021, the initial Project scope was redefined accommodating a staged approach; comprising initially of Stage 1 and Stage 2. There were three primary objectives of Stage 1 of the Woodstock Environmental Offset Project:

- Create a plan (the *Tharra Rehabilitation Plan*) for the improvement of riparian vegetation condition through targeted control of problematic weed species;
- Establish a monitoring system for measuring changes in vegetation condition over time;
- Improve the capacity of the Ranger team to carry out rehabilitation and monitoring activities as per DWER's Monitoring and Evaluation Framework and the *Tharra Rehabilitation Plan*.

The focus for Stage 1 (2021 - 2022) was to collect information to inform future weed management actions within the riparian zones of Tharra, the exchange of botanical knowledge between Traditional Owners and scientists and to inform the design of a vegetation monitoring approach and the creation of the *Tharra Rehabilitation Plan*. *Calotropis procera* was identified as a primary management concern for Budadee, as its recent increase in density and distribution directly threatens the rich environmental and cultural values within Tharra, particularly those within the riparian zones of the reserve.

Stage 2 will focus on targeted control of the priority *Calotropis procera* infestations identified in Stage 1, opportunistic control of *Calotropis procera* on monitoring trips

and continued monitoring of vegetation condition at established photo-panorama monitoring sites. The primary objective of Stage 2 is to improve the condition of at least 1000 ha of riparian vegetation within Tharra. The *Tharra Rehabilitation Plan* will serve as a guide document for Stage 2 of the WEOP.

In 2022, the Budadee Rangers and TR personnel will undertake the following activities:

- A planning workshop in Port Hedland or on-country with the Budadee Rangers, Elders and appropriate stakeholders;
- Two ten-day field trips (with four Graduate Rangers and two TR personnel) focused on intensive targeted control of *Calotropis procera* in priority areas;
- Three five-day field trips (with four Graduate Rangers, one Elder and two TR personnel) focused on vegetation condition monitoring and opportunistic weed control; and
- Delivery of a Bi-Annual and an Annual Progress Report to DWER.

In 2023, the Budadee Rangers and TR personnel will undertake the following management activities:

- A planning workshop in Port Hedland or on-country with the Budadee Rangers, Elders and appropriate stakeholders;
- One five-day field trip (with four Graduate Rangers and two TR personnel) focused on follow-up control of *Calotropis procera* in priority areas;
- Three five-day field trips (with four Graduate Rangers, one elder and two TR personnel) focused on vegetation condition monitoring and opportunistic weed control;
- Delivery of a Bi-Annual and an Annual Progress Report to DWER; and
- The update of *Tharra Rehabilitation Plan* to facilitate its use as a guiding document for future management projects within Tharra.

The objectives of Stage 2 (in short) are as follows:

- Implement a targeted *Calotropis procera* management program;
- Continue mapping the distribution of weeds within the riparian zones of Tharra, to track the progress of targeted weed control program;
- Collect vegetation condition assessment data within the riparian zones of Tharra;

- Further improve the capacity of the Budadee Ranger team to conduct rehabilitation and monitoring activities as per DWER's Monitoring and Evaluation Framework; and
- Facilitate leadership from Traditional Owners in the delivery of the above objectives, and ensure that traditional knowledge and values influence decision-making and that cultural protocols are observed on-country.

The following deliverables can be expected from Stage 2:

- Bi-Annual and Annual Progress Reports detailing the progress towards achieving the project objectives, including the results of the weed mapping and vegetation condition assessments undertaken that year;
- The submission of photos, GPS data and track logs from trips to DWER throughout the project;
- Control of the majority of *Calotropis* individuals within the riparian zones of Tharra, significantly reducing infestation distribution and density, by the end of 2023; and
- An updated *Tharra Rehabilitation Plan* based on the Stage 2 works and consultations, to serve as a guiding document for future management within the reserve.

The successful implementation of this project will produce the following outcomes:

- Improvement of vegetation condition in at least 1000 ha of riparian vegetation within Tharra; and
- Mortality of the majority of mature *Calotropis procera* individuals within Tharra, and significantly reduced infestation density and distribution, by the end of 2023.

The anticipated benefits from the aforementioned outcomes include:

- Improved condition of native animal habitat in riparian zones, and reduction of the risks that dense weed infestations pose to water flow dynamics and river bank stability;
- Protection of culturally significant sites from the negative impacts of *Calotropis* infestation;
- The suppression of *Calotropis procera* population to a level which can be effectively controlled long-term through opportunistic removal of new seedlings;

- Analysis of riparian vegetation condition data to track changes in condition and success of management actions; and
- Emphasising the centrality of cultural knowledge and values of Traditional Owners while undertaking planning and implementing management strategies to ensure optimal protection of the cultural values and sites within Tharra.

To deliver the above outcomes and benefits, some of the key success factors to be considered in the planning and deliver of Stage 2 are:

- Scheduling on-country trips and workshops based on the availability of Budadee Rangers and Elders;
- Scheduling on-country trips and workshops outside of law and other cultural event times;
- Ensuring cultural protocols are observed while on-country, including avoiding sacred sites within Tharra as directed by traditional owners; and
- Ensuring continuation of established methodology when undertaking management actions.

Budadee operates on a Caring-for-Country model, and throughout the course of the WEOP strong emphasis has been placed on leadership from Traditional Owners while on-country and in workshops to ensure that cultural values are protected and cultural protocols are followed. It is vital that future management planning and implementation continues to be guided and delivered by Traditional Owners, to best protect the rich cultural and ecological values of the Tharra Reserve. This document, the *Tharra Rehabilitation Plan,* is perceived to be a living document with the potential to update to include new projects as the PEOF project progresses.

2. PROJECT INTRODUCTION

In February 2021, Terra Rosa Consulting (TRC) was commissioned by Budadee Aboriginal Corporation (BAC) to assist in the delivery of environmental planning, monitoring and rehabilitation works across the Woodstock Abydos Protected Reserve (WAPR), funded by the Pilbara Environmental Offset Fund (PEOF). The objective of this Project, the Woodstock Environmental Offset Program (WEOP), is to enhance environmental health of Tharra, based on both cultural and conservation values.

These works are set in a larger regional effort to facilitate the coordinated delivery of environmental offset projects located wholly or partly within the Pilbara Interim Biogeographic Regionalisation of Australia (IBRA) region of Western Australia. This regional effort is referred to as the Pilbara Environmental Offsets Fund and derives from the culmination of individual offset payments required under the Environmental Protection Act 1986 (EP Act) and Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) and is administered by the Department of Water and Environmental Regulation (DWER).

Budadee Aboriginal Corporation employs a ranger team (Budadee Rangers) who undertake cultural and environmental management activities, primarily within Tharra, and all works in this Project are to be undertaken by the graduate Budadee Rangers (Cert III in Conservation and Land Management and Cert III in Aboriginal Sites Work) alongside specialist consultants. The Project Area is comprised of riparian vegetation, waterways, and several pools; habitats which are all particularly susceptible to livestock damage and weed invasion. The riparian zones within Tharra contain a large number of highly significant cultural heritage sites, many of which are under direct threat from weed impacts and livestock damage.

After a series of meetings between the BAC, TRC, DWER and other stakeholders held in March & April 2021, the initial Project scope was redefined accommodating a staged approach; comprising initially of Stage 1 and Stage 2. There were three primary objectives of Stage 1 of the Woodstock Environmental Offset Project:

- Create a plan (the *Tharra Rehabilitation Plan*) for the improvement of riparian vegetation condition through targeted control of problematic weed species;
- Establish a monitoring system for measuring changes in vegetation condition over time;

- Improve the capacity of the Ranger team to carry out rehabilitation and monitoring activities as per DWER's Monitoring and Evaluation Framework and the *Tharra Rehabilitation Plan*.

The focus for Stage 1 (2021 - 2022) was to collect information to inform future weed management actions within the riparian zones in Tharra, the exchange of botanical knowledge between Traditional Owners and scientists and to inform the design of a vegetation monitoring approach and riparian weed control plan for Stage 2 (2022-2023) of the WEOP. During Stage 1, the Weed of National Significance (WONS) *Calotropis procera* was identified as a primary threat to riparian vegetation condition and was the focus of management actions. Stage 2 (2022-2023) of the WEOP will focus on targeted control of the priority *Calotropis procera* infestations identified in Stage 1, opportunistic control of *Calotropis procera* individuals encountered during photo-panorama monitoring trips and continued monitoring of vegetation condition at established photo-panorama monitoring sites. The primary objective of Stage 2 is to improve the condition of at least 1000 ha of riparian vegetation within Tharra.

The purpose of this document, titled the *Tharra Rehabilitation Plan,* is to detail the Project approach, rationale, and priorities for Stage 2, following on from the Stage 1 works undertaken by TRC and BAC Rangers. The document details the Project Rationale and Methodology, Project Logic, Project Outcomes and Deliverables, Anticipated Benefits and Key Success Factors and a Schedule of Works. The *Tharra Rehabilitation Plan* will act as a guiding document for riparian vegetation management within Tharra in 2022, 2023 and beyond.

PROJECT AREA BACKGROUND

The Woodstock Abydos Protected Reserve is located approximately 150 km south of Port Hedland and is one of the most culturally significant places within the Pilbara, with songlines passing through the region that connect several communities through Traditional Law including Palyku, Kariyarra, Njamal, Nyiyaparli and Martu people.

The Palyku portion of the WAPR is traditionally known as Tharra and is home to extensive rock-art complexes and a large number of other cultural significant sites. The reserve contains catchments of the Yule River, Shaw River and Turner River, as well as many ecologically and culturally significant rockholes. The river systems within Tharra contain a large number of cultural heritage sites, many of which are under direct threat from weed invasion and stock impacts (including Pulkunah Spring,

Burraganyah Pool, Tharra Pool, Tambourah Pool, Tambina Spring, Honeymoon Pool and Dead Horse Pool).

In addition to the rich cultural values of Tharra, over two-hundred vertebrate species have been recorded in the WAPR and surrounding areas, including five amphibian, 31 mammal (including five bat species and seven introduced species), 68 reptile (including one turtle) and 104 bird species (Berry, P et al. 1991; DBCA 2021). The reserve is home to a rich assemblage of reptiles and small mammals, many of which are threatened. Five of these species are listed as endangered or vulnerable under the Environmental Protection and Biodiversity Conservation Act 1999. Currently, the distribution and abundance of these species within WAPR is unknown, however numerous threats have been identified including feral species, water degradation, fuel loading, and the spread of invasive weeds of national significance.

During the 2021 on-country trips, *Calotropis procera* was identified by the Budadee Rangers and environmental consultants as the primary weed of concern due to its alarming changes in distribution and density within Tharra. In 2018, *Calotropis procera* was recorded at two sites along the Turner River and by 2021 there were more than 800 mature plants identified throughout the reserve within the upper catchments of all three river systems (the Turner, Yule and Shaw Rivers). Prior to these records *Calotropis procera* was undocumented within the reserve, and Budadee believe that it is a recent (<10 years) introduction to Tharra. Further spread of *Calotropis* poses a significant risk to the large number of cultural heritage sites located along the river systems within Tharra, as well as plant and animal communities.

Calotropis procera physiology

Calotropis procera is a tree or shrub, typically growing 1-4 m high, with fleshy leaves and distinctive purple and white flowers. It is recognised as a Weed of National Significance (WONS), and is classified as a Declared Pest (s22(2)) within Western Australia (Western Australian Organism List, 2021).

Calotropis procera thrives on nutrient poor soils in arid, sub-arid, tropical and sub-tropical areas, particularly where over-grazing by stock has reduced competition from native plant species. Once established in a suitable habitat, *Calotropis procera* forms dense thickets, outcompeting native species and restructuring vegetation communities. The replacement of native riparian vegetation with dense thickets of *Calotropis* reduces plant diversity, impacts habitat and food availability for native

fauna, and suppresses germination and growth of native tree species, which can have long-term effects on bank stability and the water table.

Calotropis procera primarily reproduces by seed, which can be dispersed long distances by wind, water and in mud that becomes attached to vehicles and animals, particularly cattle. Although it produces seeds prolifically (Menge et al., 2016; Menge et al., 2016a), *Calotropis procera* does not form a persistent seed bank, with seed viability rapidly declining over the first three months, and reducing to zero after 15 to 24 months of burial (Bebawi et al., 2015). On average, *Calotropis procera* individuals will flower 190 days after germination, but they will not set seed until 412 days post germination (Bebawi et al., 2015). These aspects of *Calotropis procera*'s reproductive biology make it a highly susceptible to control and indicate land managers can achieve eradication within two years of the control of all mature individuals by targeting new seedlings (Bebawi et al., 2015).

The physiology of *Calotropis procera* and the current restriction of mature individuals to a relatively small portion of Tharra indicate that a concentrated effort to control this plant could be feasibly undertaken. It is important to note that eradication of *Calotropis procera* within Tharra is not achievable due to the connectivity of the reserve to the surrounding country and the vulnerability of riparian areas to weed invasion due to stock access. However, following the implementation of Stage 2, management on *Calotropis procera* within Tharra will simply involve ongoing surveillance and opportunistic control of new seedlings. Timely implementation of this targeted *Calotropis* control program is crucial to protecting the rich cultural and environmental values of Tharra.

The primary objective of the Stage 2 is to undertake a targeted *Calotropis procera* control program in 2022 and 2023, informed by the data collected in Stage 1. The key outcome of Stage 2 is improved condition of at least 1000 ha of riparian vegetation within Tharra.

Stage 1 Works

For full outline of Stage 1 Works and Milestones refer to the Woodstock Environmental Offset Project Field Survey Technical Note.

Between June and October 2021, four on-country trips and a methodology approach workshop were conducted with the aim of determining weed distribution within Tharra and identifying focal areas for management effort based on feasibility, Traditional

Knowledge, proximity to cultural sites and ecological values. During the on-country trips, led by the BAC Rangers, the key weed species were identified, their relative impacts and feasibility of control was assessed, and their distribution was mapped. Forty photo-panorama vegetation condition monitoring points were also installed within riparian zones, and base-line data was collected, enabling the BAC Rangers to assess changes in vegetation condition over time (refer to *Appendix 1, Map 3*). Opportunistic control of low and medium density *Calotropis procera* infestations was undertaken wherever feasible (refer to *Appendix 1, Map 2*). A total of ~1800 ha of the Turner River and ~7000 ha of the Yule River were traversed during Stage 1, with all identified *Calotropis procera* individuals either controlled or marked for control (refer to *Appendix 1, Map 1)*. An estimated total of 734 mature Calotropis individuals were controlled during the Stage 1 works.

The plan for Stage 2 (2022 – 2023) of the WEOP is based upon the field observations and data collected during the 2021 on-country field trips (Stage 1), as well as recommendations from Traditional Owners during on-country consultations and planning workshops with experienced Environmental Consultants. Priority sites for management were established based on weed mapping and vegetation monitoring results, and observed threats to cultural sites. Based on the Preliminary Findings from the on-country field trips conducted in 2021 (refer to *Technical Note*), the following the Project Rationale and Methodology, Project Logic, Outcomes, Deliverables, Anticipated Benefits and Key Success Factors and a Schedule of Works has been created.

3. PROJECT RATIONALE/METHODOLOGY

Stage 2 of the WEOP entails the targeted control of known *Calotropis* infestations, the continuation of riparian vegetation condition monitoring at forty photo-panorama sites and opportunistic control of *Calotropis* individuals encountered during monitoring fieldwork. Leadership from Traditional Owners throughout the delivery of this project is integral to ensure Traditional Knowledge and values guide decision making and that cultural protocols are observed while on country.

Calotropis procera control

In 2021, mature *Calotropis* plants were identified at eight locations within the reserve; and at five of these locations (all located in the upper catchment of the Turner River)

control was not undertaken (refer to *Appendix 1, Map 3*). These five uncontrolled infestations of mature *Calotropis* identified within the Turner River in 2021 will be the initial target of the intensive *Calotropis* control effort in 2022. When managing weeds in riparian areas, it is best practice to start control programs upstream to limit the number of seeds dispersed by water flow, hence 2022 control effort will begin at the most southern Turner River infestations, working north-ward. Once the Turner River infestations are controlled, the three previously controlled infestations of mature *Calotropis* (located on the western boundary of the Yule River) will be targeted.

Calotropis plants will continue to be controlled using the 'cut and paint' method used in Stage 1. This method was shown to be the most reliable *Calotropis* control method (Jo Williams, Pilbara Mesquite Management Council, on-country training), and entails severing trees at their base and immediately dousing in herbicide (active ingredient: 4.47 g/L Aminopyralid, 44.7 g/L Picloram).

Following initial control of *Calotropis procera*, it is expected to observe a high density of seedling regrowth in the 12 months following the control event (Bebawi et al., 2015), which is what is expected to be observed at previously controlled sites when returning to Tharra in 2022. If this seedling regrowth is treated in 2022, alongside any original plants which survived previous control efforts, then very little germination from the seed bank should occur in 2023 (Bebawi et al., 2015). However, at the five high density sites which were not feasible to control in 2021, the control process will be a year behind the rest of the control sites. At these five locations, high density seedling regrowth will be observed and targeted for control in 2023, with very limited germination expected to be observed from 2024 onwards.

Ongoing annual surveillance and opportunistic control by land managers is recommended to prevent new plants from establishing and replenishing seed banks, especially as dispersal of seed (via wind, water or animals) from adjacent areas could result in ongoing recruitment (Bebawi et al., 2015). Opportunistic control of *Calotropis procera* will be undertaken on annual vegetation condition monitoring trips within Tharra. The following mapping methodology will be implemented to monitor changes in *Calotropis procera* density and distribution within Tharra.

Weed mapping

During Stage One, weed mapping was conducted continually through light vehicle reconnaissance when moving between sites, on foot during field surveys and while installing photo-panorama monitoring sites. Individual instances of weeds were recorded as point data using the ArcGIS application Quick Capture. GPS points were

recorded at each weed control site and GPS track logs recorded all movements within the reserve. Areas where control could not be feasibly undertaken alongside mapping and survey works (high density infestations and/or larger plants) were marked for future weed control. Future weed control sites, also referred to as priority areas, were mapped and density was recorded using handheld GPS units and Samsung tablets through ArcGIS Collector (Quick Capture application). This data collection and weed mapping methodology will continue to be implemented throughout Stage 2 works, and the weed mapping data collected will be used to assess the effects of control efforts on *Calotropis* density and distribution.

As mentioned above, maintaining surveillance (and implementing control where required) is necessary to preventing new *Calotropis* infestations within Tharra. Following this project, ongoing surveillance of Calotropis procera will be continued through use of the Quick Capture application. The Quick Capture application enables simple and efficient mapping of weed distribution, which can easily be undertaken by a designated individual when travelling in a vehicle or on foot. This weed mapping methodology will be undertaken by the Budadee Ranger team, when appropriate, during other management trips on Tharra from 2024 onwards.

Vegetation monitoring

During Stage 1, forty photo-panorama monitoring sites were installed within the riparian zones of Tharra (refer to *Appendix 1, Map 3*) to monitor the vegetation change over time, as per the methodology outlined in *AusPlots Rangelands Survey Protocols Manual* (*Chapter 4*). Each monitoring site was assigned a plot identity code using the following naming system: the code format is WAPB PIL01 XXXX, WA (Western Australia), P (Photo-panorama), B (Budadee), PIL01 (Chichester), XXXX representing the monitoring point number. For example, the first site installed was assigned the code WAPB PIL01 0001, the second site was assigned WAPB PIL01 0002, and so on.

Additionally, estimations of *Calotropis procera* density were recorded at each photo-panorama monitoring sites to document changes in density over time. Based of *Calotropis procera* densities (prior to opportunistic control) in the surrounding area, each photo-panorama monitoring site was classified into one of the following categories:

- *Riparian:* River system with no instances of *Calotropis* within 1km radius of point);
- *Low Density:* Less than 5 *Calotropis* individuals within 1 km radius of point.

- *Medium Density:* Greater than five *Calotropis* individuals, but less than 100, within 1 km radius of point. (Typically, scattered instances including flowering or seeding plants);
- *High Density*: Greater than 100 *Calotropis* individuals within 1 km radius of point.

This established methodology will be continued throughout Stage 2, and the data collected from these monitoring trips will be used to measure the success of control methods and to track changes in riparian vegetation over time. The images taken at each photo-panorama monitoring site can be processed using suitable algorithms to monitor change over time and track plot condition (as per methodology in *AusPlots Rangelands Survey Protocols Manual*). Photos, GPS data and track logs collected during on-country trips will be backed up on a portable hard drive daily and submitted to DWER.

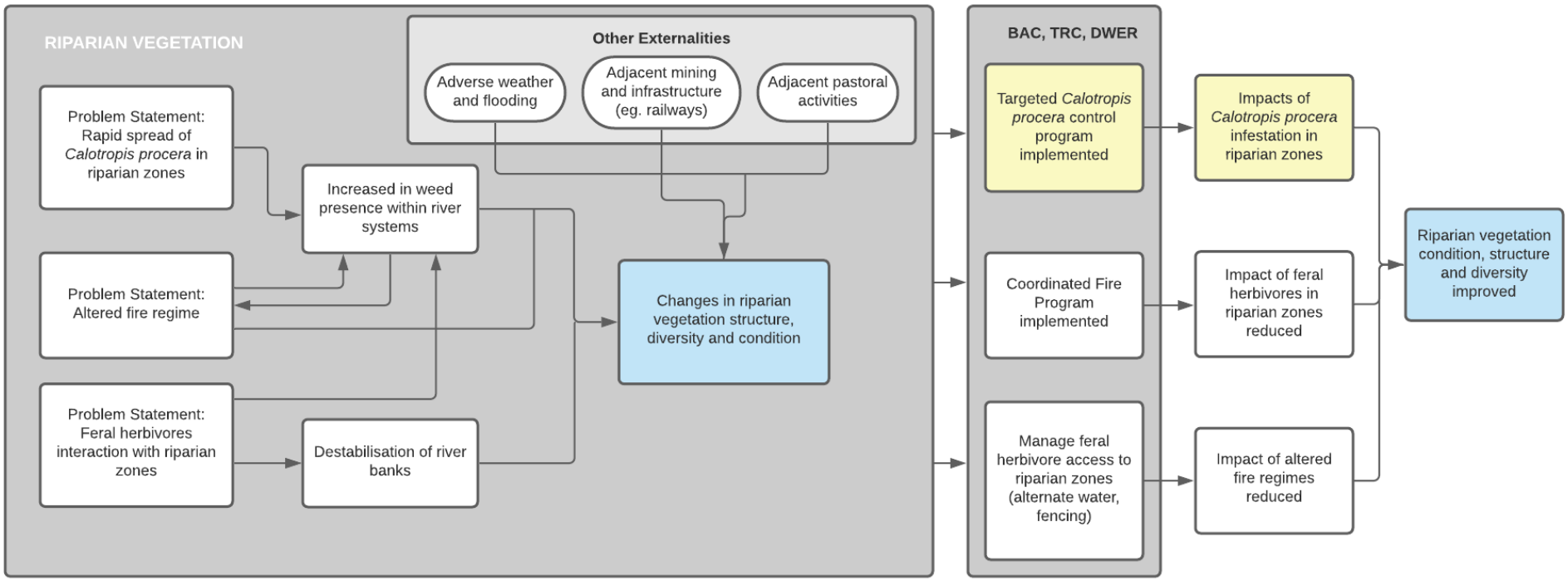
The on-country trips which involve monitoring the photo-panorama sites will aim to be conducted at a similar time of years to their installation so as to reduce the effect of seasonal condition changes on the monitoring data. Additionally, if feasible, photo-panorama monitoring sites will be monitored at least several weeks after targeted control efforts have been undertaken, so the success of the control is clear and individuals surviving the previous control attempt can be opportunistically targeted. The timing of these on-country trips is also dependent on several external factors including ranger availability, timing of law and cultural activities, weather conditions and water levels in river. The length of monitoring trips and the frequency of visits to photo-panorama monitoring sites may be adjusted once PEOF's monitoring program requirements have been confirmed.

The Stage 2 works described above will be undertaken over the next two years. In 2022, two ten-day field trips focused on intensive targeted control of *Calotropis* in priority areas will be undertaken, followed by three five-day trips focused on photo-panorama monitoring and opportunistic weed control (refer to the *WEOP Estimated Costs Stage 2 – 2022* Table in the Schedule of Works for PAX). In 2023, one five-day field trip will be undertaken to complete follow-up control, and three five-day field trips focused on photo-panoramic monitoring and opportunistic weed control will be undertaken (refer to the *WEOP Estimated Costs Stage 2 – 2023* Table in the Schedule of Works below for PAX). It is predicted that the management actions undertaken in Stage 2 will improve the condition of at least 1000 ha of riparian vegetation within Tharra.

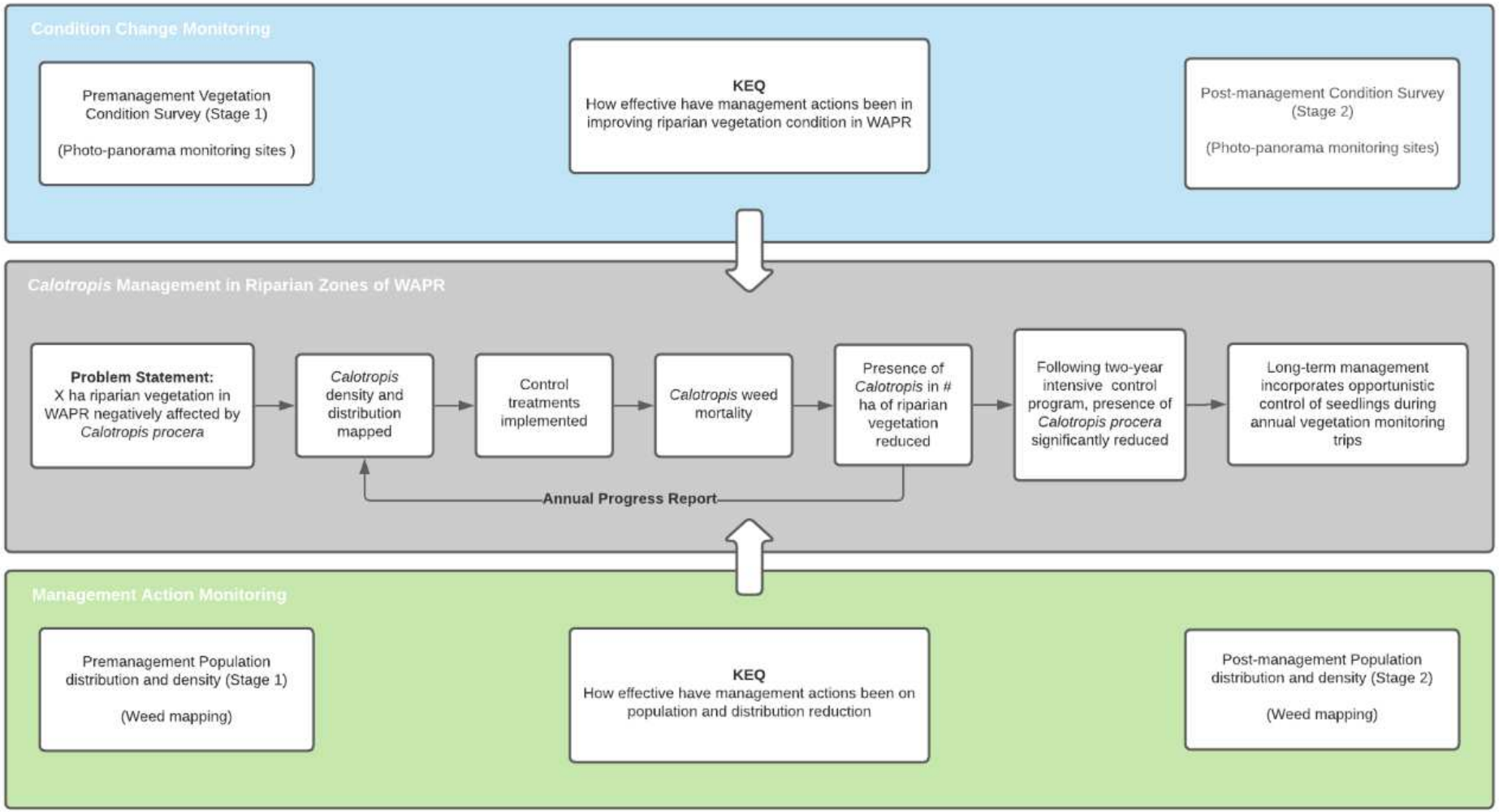
4. PROJECT LOGIC

INTEGRATED RIPARIAN MANAGEMENT TO IMPROVE VEGETATION CONDITION WITHIN THARRA

Integrated Riparian Management



TARGETED *CALOTROPIS PROCERA* CONTROL IN RIPARIAN ZONES WITHIN THARRA



5. PROJECT OBJECTIVES AND DELIVERABLES

As stated in the 'Section 2: Project Introduction', the Woodstock Environmental Offset Project has three primary objectives:

- Create a plan (the *Tharra Rehabilitation Plan*) for the improvement of riparian vegetation condition within the WAPR through targeted control of problematic weed species;
- Establish a monitoring system for measuring change in vegetation condition over time; and
- Improve the capacity of the Budadee Ranger team to carry out rehabilitation and monitoring activities as per DWER's Monitoring and Evaluation Framework and the *Tharra Rehabilitation Plan*.

The main objective of Stage 2 of the WEOP is to implement the *Tharra Rehabilitation Plan,* of which the key outcome will be the improvement of condition of at least 1000 ha of riparian vegetation within the Woodstock Abydos Protected Reserve. The objectives of the *Tharra Rehabilitation Plan* are as follows:

- Implement a targeted *Calotropis procera* management program, informed by field observations collected during Stage 1 and traditional knowledge and values;
- Continue mapping the distribution of weeds within the riparian zones of Tharra, to track the progress of targeted weed control program. Weed distribution mapping data will be presented in the Annual Progress Report;
- Collect vegetation condition assessment data within the riparian zones of Tharra, including *Calotropis procera* density estimations, in line with established monitoring and evaluation framework methodology. A summary of the vegetation condition monitoring results will be reported in the Annual Progress Report, alongside updated recommendations for vegetation condition rehabilitation and protection;
- Further improve the capacity of the Budadee Ranger team to conduct rehabilitation and monitoring activities as per DWER's Monitoring and Evaluation Framework and the *Tharra Rehabilitation Plan*; and

- Facilitate leadership from Traditional Owners in the delivery of the above objectives, and ensure that traditional knowledge and values influence decision-making and that cultural protocols are observed on-country.

The delivery of these above objectives is expected to help improve the overall condition of the riparian vegetation within Tharra, and enable analysis of the effects of management actions on vegetation condition, which will inform future management decision-making and planning. The facilitation of leadership from Traditional Owners in the delivery of management actions, and the continued incorporation of traditional knowledge and values in management planning will help ensure the best possible outcomes for the environmental and cultural values within Tharra.

The key deliverables from Stage 2 of WEOP are as follows:

- A Bi-Annual Progress Report detailing the progress towards achieving the project objectives, which will be submitted to DWER in their preferred reporting template;
- An Annual Progress Report (*Technical Note*) detailing the progress towards achieving the project objectives, which will be submitted to DWER in their preferred reporting template. This report will also summarise the results of the weed mapping and vegetation condition assessments undertaken that year;
- The submission of photos, GPS data and track logs from trips to DWER throughout the project. This will add to the existing weed distribution mapping dataset and the vegetation condition assessment dataset and will be used to measure success of management actions and guide decision-making; and
- Control of the majority of *Calotropis* individuals within the riparian zones of Tharra, significantly reducing infestation distribution and density, by the end of 2023.

6. ANTICIPATED BENEFITS AND KEY SUCCESS FACTORS

The successful implementation of the *Tharra Rehabilitation Plan* is anticipated to produce the following outcomes:

- Improvement of vegetation condition in at least 1000 ha of riparian vegetation within Tharra;
- Mortality of at least 95% of known mature *Calotropis procera* individuals within Tharra, and significantly reduced infestation density and distribution, by the end of 2023.

These expected outcomes will, in turn, provide a range of environmental and cultural benefits within Tharra. The anticipated benefits of the *Tharra Rehabilitation Plan* include:

- The significant reduction of *Calotropis* density and distribution will likely improve riparian vegetation diversity, structure and condition within the riparian zones of Tharra. This is expected to lead to improved habitat condition for native animals, and minimise the risks that dense weed infestations pose to water flow dynamics and riverbank stability;
- Protection of culturally significant sites located within the riparian zones of Tharra from the negative impacts of *Calotropis* infestation;
- The suppression of *Calotropis procera* population to a level which can be effectively controlled long-term through opportunistic removal of new seedlings during annual vegetation condition monitoring trips. This will allow for a shift in focus to other management priorities, facilitating better rehabilitation outcomes within Tharra;
- Analysis of riparian vegetation condition data collected within Tharra will help guide future management actions, enabling informed decision-making and facilitate the best possible long-term rehabilitation outcomes for Tharra; and
- The centring of the knowledge and values of Traditional Owners while undertaking planning and implementing management strategies ensures better protection of the cultural values and sites within Tharra.

The timely implementation of an intensive targeted *Calotropis* control program is key to reducing the risk of widespread infestation and the associated environmental, cultural and economic costs.

To successfully carry out Stage 2 of the WEOP and deliver the best environmental and cultural outcomes within Tharra, there are many factors to be taken into consideration. The consideration of the following key success factors, during the planning process and while on-country, are key to maximising the benefits of the *Tharra Rehabilitation Plan*. Key success factors to be consider include:

- Scheduling on-country trips and workshops based on the availability of Budadee Rangers and Elders;
- Scheduling on-country trips and workshops outside of law and other cultural event times;
- Ensuring cultural protocols are observed while on-country, including avoiding sacred sites within Tharra as directed by Traditional Owners;
- Scheduling photo-panorama monitoring trips at a similar time each year, to minimise the effects of seasonal change on vegetation condition results;
- Where possible, scheduling targeted *Calotropis* control trips based on seasonal timing recommended by researchers, to maximise efficiency of control efforts;
- Timing of on-country trips outside of the hottest parts of the year, and postponing trips based on severe weather warnings (cyclones), to maintain a greater level of safety;
- Keeping up-to-date with the most recent *Calotropis* control recommendations, and updating methodology accordingly;
- Maintain the photo-panorama methodology described in *AusPlots Rangelands Survey Protocols Manual*, to ensure vegetation monitoring data is comparable to previous years; and
- Ensure appropriate data management protocols are followed, including daily back-ups of all GPS points and vegetation condition assessment data.

7. SCHEDULE OF WORKS

2022 *CALOTROPIS PROCERA* CONTROL AND MONITORING

The goal of the 2022 *Calotropis* control and monitoring efforts will be to undertake two ten-day field trips focused on intensive targeted control of *Calotropis* in priority areas, followed by three five-day trips focused on photo-panorama monitoring and opportunistic weed control.

The two ten-day intensive control field trips (with four Graduate Rangers and two TR personnel) should be undertaken between March and June 2022 and will initially focus on the five locations where mature plants were recorded but were unable to be

controlled in 2021. These five locations are located in the upper catchment of the Turner River (refer to *Appendix 1, Map 3*). Control efforts should begin at the most southern Turner River infestations, working north-ward; and once the Turner River infestation is controlled, the infestations on the western boundary of the Yule River infestations will be controlled. A continuation of the 'cut and paint' control technique will be undertaken during these trips by BAC Rangers and Environmental Consultants.

The three five-day field trips (with four Graduate Rangers, one Elder and two TR personnel) are planned to take place between July and October 2022, and will focus on photo-panorama monitoring and opportunistic weed control. During these trips, the forty photo-panorama monitoring sites along Turner River, Yule River and Coorong Creek (Yule) Rivers (refer to (refer to *Appendix 1, Map 3*) will be revisited and monitored as per methodology outlined in *AusPlots Rangelands Survey Protocols Manual*. Opportunistic control of *Calotropis procera* individuals will also be undertaken on these field trips.

In 2021, installation of photo-panorama monitoring sites and opportunistic control was conducted over three trips, taking approximately 10 full field days. Similar time and trip length has been allocated in the 2022 Schedule of Works, and three photo-panorama monitoring trips have been budgeted for. Shorter trips are easier to schedule to align with ranger availability and increase the likelihood of securing accommodation at Rail Camp 145 (which reduces logistical considerations and costs of accommodation and food). Fatigue and reduced motivation are also factors to consider when scheduling longer trips, as well as sanitation logistics. If necessary, the photo-panorama monitoring trips can be combined into one or two trips with 10 full field days between them (i.e. one 12-day trip or two seven-day trips) to reduce expenditure on flights and fuel. Trip lengths may be adjusted off based of discussions with Budadee Aboriginal Corporation and DWER, in consideration with the key success factors discussed in the section above. Additionally, the photo-panorama monitoring trip plans may require adjustment once PEOF's monitoring program requirements have been confirmed.

As majority of the photo-panorama sites were installed in August 2021, it is preferable to re-visit these monitoring points around the same time of year so the effect of seasonal conditions on photo-panorama monitoring results is minimised. Additionally, if feasible, photo-panorama monitoring sites should be visited at least several weeks after intensive control efforts have been undertaken, so the success level of control is clear and individuals surviving the previous control attempt can be opportunistically targeted. The timing of these on-country trips is also dependent on

several external factors including ranger availability, timing of law and cultural activities, weather conditions and water levels in river. The budget allows for one Elder to accompany each vegetation monitoring trip, to continue the centring of Traditional Knowledge and values when undertaking management actions and in the planning of future management strategies

In addition to these on-country trips, a planning workshop will be held in on-country with the Budadee Rangers, Elders and appropriate stakeholders, to ensure that current management strategies are in line with Budadee's values and continue workshopping future management actions based off Budadee's vision for Tharra. This workshop will take place around April 2022, and will ideally added on to a scheduled field trip to minimise fuel and flight expenses. Timing will be dependent on the availability of Rangers, Elders and appropriate stakeholders, and additional flights, travel days and travel expenses have added to the budget in the event that the workshop has to be held separate to the management trips. These expenses will be refunded/not invoiced if they are not required.

A Bi-Annual Report will be submitted to DWER in July 2022, and it will provide an update on the progress of the project and summarise the works conducted so far. Following the 2022 on-country trips, an Annual Progress Report (or Technical Note) on the *Tharra Rehabilitation Plan* works will be compiled. This Annual Progress Report will detail the control efforts implemented throughout the year, photo-panorama monitoring results, updated weed distribution maps, and any updated recommendations based on field observations and feedback from BAC Rangers and Elders. The report will be submitted to DWER before EOY 2022.

Summary tables of the Proposed Schedule of Works and the Budget for 2022 can be found below.

Proposed Schedule of Works 2022*			
Deliverable	**Timing***	**Personnel**	**Duration**
Planning Workshop in Port Hedland	April 2022	Budadee Rangers Elders Environmental Consultants Other stakeholders as required	2 days
Intensive Control Trip 1	23 May - 3 June 2022	Budadee Rangers Environmental consultants	10 days
Intensive Control Trip 2	13 - 24 June 2022	Budadee Rangers Environmental consultants	10 days
Monitoring Trip 1	1 - 5 August 2022	Budadee Rangers Elder Environmental consultants	5 days
Monitoring Trip 2	15 - 19 August 2022	Budadee Rangers Elder Environmental consultants	5 days
Monitoring Trip 3	29 August – 2 September 2022	Budadee Rangers Elder Environmental consultants	5 days
Bi- Annual Progress Report	July 2022	Environmental consultants with Budadee Rangers	5 days
Annual Progress Report	December 2022	Environmental consultants with Budadee Rangers	10 days

*Please note the above dates for field trips and workshops are tentative and subject to change depending on the availability of Budadee Rangers and TR Personnel, PEOF requirements and various logistical considerations.

a camping allowance has been included in the 2022 Budget. The Budadee Ranger team and TR Personnel will stay at Rail Camp 145 during on-country trips whenever this option is available and feasible (accommodation at Rail Camp 145 is provided in-kind by FMG to the Budadee Ranger team). In the event that the team is unable to utilise Rail Camp 145 for accommodation, they will camp on country for the duration of the field trips. The camping allowance covers the cost of camping equipment and food; and will be refunded (or not invoiced) if camping is not undertaken.

2023 *CALOTROPIS PROCERA* CONTROL AND MONITORING

The aim of the 2023 on-country trips will be to complete follow-up control at priority sites and to continue with photo-panoramic monitoring and opportunistic weed control. Follow-up control at priority sites will be undertaken on one five-day field trip, and photo-panoramic monitoring and opportunistic weed control will be carried out over three five-day field trips.

The first five-day field trip (with four Graduate Rangers and two TR personnel) of 2023 should take place sometime before June 2023, and will focus on conducting follow-up control of *Calotropis procera* at priority sites. The follow-up control trip will initially focus on the previous high-density infestation sites along Turner River as a priority, followed by the previous high-density infestation sites on the western boundary of the Yule River. A continuation of the 'cut and paint' techniques will be used to control *Calotropis procera* individuals, unless management recommendations are updated.

The other three five-day field trips (with four Graduate Rangers, one Elder and two TR personnel) will take place between July and October 2023 and will focus on photo-panorama site monitoring and opportunistic weed control. During these trips, the forty photo-panorama monitoring sites along Turner River, Yule River and Coorong Creek (Yule) Rivers (refer to *Appendix 2, Map 3*) will be revisited and monitored as per methodology outline in *AusPlots Rangelands Survey Protocols Manual*. Opportunistic control of *Calotropis procera* individuals will also be undertaken on these field trips.

In 2021, installation of photo-panorama monitoring sites and opportunistic control was conducted over three trips, taking approximately 10 full field days. Similar time and trip length has been allocated in the 2023 Schedule of Works, and three photo-

panorama monitoring trips have been budgeted for. Shorter trips are easier to schedule to align with ranger availability and increase the likelihood of securing accommodation at Rail Camp 145 (which reduces logistical considerations and costs of accommodation and food). Fatigue and reduced motivation are also factors to consider when scheduling longer trips, as well as sanitation logistics. If necessary, the photo-panorama monitoring trips can be combined into one or two trips with 10 full field days between them (i.e. one 12-day trip or two seven-day trips) to reduce expenditure on flights and fuel. Trip lengths may be adjusted off based of discussions with Budadee Aboriginal Corporation and DWER, in consideration with the key success factors discussed in the section above. Additionally, the photo-panorama monitoring trip plans may require adjustment once PEOF's monitoring program requirements have been confirmed.

As a majority of the photo-panorama sites were installed in August 2021, it is preferable to re-visit these monitoring points around the same time of year so the effect of seasonal conditions on photo-panorama monitoring results is minimised. Additionally, if feasible, photo-panorama monitoring sites should be visited at least several weeks after follow-up control efforts have been undertaken, so the success of the control is clear and individuals surviving the previous control attempt can be opportunistically targeted. The timing of these on-country trips is also dependent on several external factors including ranger availability, timing of law and cultural activities, weather conditions and water levels in river. The budget allows for one Elder to accompany each vegetation monitoring trip, to continue the centring of Traditional Knowledge and values when undertaking management actions and in the planning of future management strategies.

In addition to these on-country trips, a planning workshop will be held in on-country with the Budadee Rangers, Elders and appropriate stakeholders, to ensure that current management strategies are in line with Budadee's values and continue workshopping future management actions based off Budadee's vision for Tharra. This workshop will take place around April 2022, and will ideally added on to a scheduled field trip to minimise fuel and flight expenses. Timing will be dependent on the availability of Rangers, Elders and appropriate stakeholders, and additional flights, travel days and travel expenses have added to the budget in the event that the workshop has to be held separate to the management trips. These expenses will be refunded/not invoiced if they are not required.

A Bi-Annual Report will be submitted to DWER in July 2023, and it will provide an update on the progress of the project and summarise the works conducted so far.

Following the 2023 on-country trips, an Annual Progress Report (or Technical Note) on the *Tharra Rehabilitation Plan* works will be compiled. This Annual Progress Report will detail the control efforts implemented throughout the year, photo-panorama monitoring results, updated weed distribution maps, and any updated recommendations based on field observations and feedback from BAC Rangers and Elders. The report will be submitted to DWER before EOY 2023. In addition to the Annual Progress Report, an updated version of the *Tharra Rehabilitation Plan* will be drafted, which will outline a clear schedule of works to continue improving riparian vegetation condition within Tharra and to ensure continued suppression of *Calotropis procera* infestation levels long-term.

This draft will be circulated to DWER in January 2024 and be presented to Traditional Owners through an agenda item during the Palyku-Jartayi Aboriginal Corporation general meeting and/or the Budadee Aboriginal Corporation general meeting. The *Tharra Rehabilitation Plan* will then be amended based on feedback received. An amended draft will then be submitted to DWER for final approval, and the final *Tharra Rehabilitation Plan* will act as the guiding document for the management of the riparian vegetation health in the WEOP for 2024 onwards.

Summary tables of the Proposed Schedule of Works and the Budget for 2023 can be found below.

*Please note the above dates for field trips and workshops are tentative and subject to change depending on the availability of Budadee Rangers and TR Personnel, PEOF requirements and various logistical considerations.

Proposed Schedule of Works 2023*			
Deliverable	**Timing***	**Personnel**	**Duration**
Planning Workshop in Port Hedland	April 2023	Budadee Rangers Budadee Elders Environmental Consultants Other stakeholders as required	2 days
Follow-up Control Trip 1	23 May - 3 June 2023	Budadee Rangers Environmental consultants	5 days
Monitoring Trip 1	31 July - 4 August 2023	Budadee Rangers Elder Environmental consultants	5 days
Monitoring Trip 2	14 - 18 August 2023	Budadee Rangers Elder Environmental consultants	5 days
Monitoring Trip 3	28 August – 1 September 2023	Budadee Rangers Elder Environmental consultants	5 days
Bi-Annual Progress Report	July 2023	Environmental consultants with Budadee Rangers	5 days
Annual Progress Report	December 2023	Environmental consultants with Budadee Rangers	10 days
Updated Tharra Rehabilitation Plan	January 2024	Environmental consultants with Budadee Rangers	17 days

*Due to the uncertainty of COVID-19 restrictions and the limited capacity of FMG's Rail Camp 145 to provide accommodation to larger groups for more than a few days, a camping allowance has been included in the 2023 Budget. The Budadee Ranger team and TR Personnel will stay at Rail Camp 145 during on-country trips whenever this option is available and feasible (accommodation at Rail Camp 145 is provided in-kind by FMG to the Budadee Ranger team). In the event that the team is unable to utilise Rail Camp 145 for accommodation, they will camp on country for the duration of the field trips. The camping allowance covers the cost of camping equipment and food; and will be refunded (or not invoiced) if camping is not undertaken.

8. LONG TERM MANAGEMENT

Long-term *Calotropis* management

As mentioned in the Project Rationale/Methodology, long-term eradication of *Calotropis procera* from Tharra is unachievable due to the connectivity of the reserve to the surrounding country. However, following Stage 2, long-term control of *Calotropis procera* within Tharra will likely be feasible through opportunistic removal during vegetation condition monitoring trips. Ongoing surveillance (and mapping) of *Calotropis* presence within Tharra will be undertaken during on-country trips for other projects, using the simple and efficient Quick Capture application. The continued use of Quick Capture in recording weed distribution within Tharra will be integral in monitoring the potential threat of *Calotropis* reinfestation and will also involve recording occurrences of other weeds, such as *Cenchrus ciliaris.* This data can be analysed to assess the effects of the *Calotropis* control on other weed species, and can be used to inform future weed management programs.

The images collected at each monitoring site will be analysed with a suitable algorithm to monitor for change in plot condition over time, and to provide measurements of basal area and biomass. This data will be used to assess the success of this project, to inform future management actions within Tharra and to highlight priority areas for further rehabilitation actions. The density estimations recorded at each photo-panorama site will also be analysed to assess the success of this project. This density estimation methodology should be continued as a part of the ongoing surveillance. Photo-panorama monitoring should continue to be conducted long-term to track the success of other management actions within Tharra, and to increase our understanding of the dynamics of riparian vegetation within Tharra.

Other Threats within Tharra

An array of other threats to the ecological and cultural values at Woodstock Abydos Protected Reserve have been observed including: unmanaged fire, bank erosion due to stock impacts, riparian weed invasion, roadside and railway weed invasion and lack of information about vegetation, overall condition and cultural values. To maximise the effectiveness and long-term benefits of management actions within Tharra, it is imperative to apply a holistic management approach. This entails the planning and implementation of a range of management actions targeted reducing the impacts of the primary threats to vegetation condition and protection cultural values, alongside weed control.

Management strategies that are currently being undertaken within the Tharra Reserve include diversion of cattle from riparian zones through the provision of alternate water sources, and the aforementioned *Calotropis procera* control. The diversion of cattle from riparian zones is a part of the Feral Ungulate Management Program funded under the State NRM Natural Resource Management Grant. The ongoing delivery of these management strategies should be incorporated into plans for future management. Ongoing discussions between Budadee, Terra Rosa and DWER have flagged the possibility of implementing following management actions in the future:

- Mitigation of the effects of the altered fire regime, potentially through the development and implementation of a Coordinated Fire Program; and
- The installation of fencing to reduce stock impacts within the reserve, with the possibility of fencing the entire perimeter.

Confirmation from Budadee and Traditional Owners will be required before beginning any formal planning process. Budadee operates on a Caring-for-Country model, and throughout the course of the WEOP strong emphasis has been placed on leadership from Traditional Owners while on-country and in workshops to ensure that cultural values are protected and cultural protocols are followed. It is vital that future management planning and implementation continues to be guided and delivered by Traditional Owners, to best protect the rich cultural and ecological values of the Tharra Reserve. The collaboration and exchange of knowledge between Traditional Owners and environmental consultants ensures that management strategies provide the best outcomes culturally and ecologically.

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Quality Statement

PROJECT MANAGER
Mat Oliver

PREPARED BY
Mat Oliver, Joe Meadham, Danika Penson and Nell Taylor

REVIEWED BY	APPROVED FOR ISSUE BY
Nerida Haynes	Nell Taylor

TERRA ROSA CONSULTING.

96 Marine Terrace
Walyalup (Fremantle) WA 6160
TEL 1300 008 726