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Tylophora linearis Propagation and Translocation Program

Annual Report 2021

Maules Creek Coal Mine

Prepared for: Whitehaven Coal

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Glossary and abbreviations

Acronym	Description
BMP	Biodiversity Management Plan
EPBC Act	Commonwealth's *Environment Protect and Biodiversity Conservation Act 1999*
MCCM	Maules Creek Coal Mine
TFPP	Threatened Flora Project Plan
WHC	Whitehaven Coal

1 Summary

In accordance with section 4.1.2 and section 6.14 of the approved Biodiversity Management Plan (BMP) for Maules Creek Coal Mine (MCCM), a *Tylophora linearis* Propagation and Translocation Program was prepared and included as Appendix C of Maules Creek Coal Mine Biodiversity Management Plan (WHC 2017). This document was superseded by the 'Threatened Flora Project Plan' (TFPP) prepared by Ecoplanning (2021a). The TFPP describes how WHC will undertake monitoring of threatened flora species (including *T. linearis*) and implement actions to manage threatened flora species, within and adjacent to WHC mining operations and Biodiversity Offset Areas.

In 2021, ongoing monitoring and management of *T. linearis* has demonstrated that *T. linearis* individuals within WHC Offset Properties have continued to complete their life-cycle including production of new stems and flowering. However, no seed development was detected within WHC Offset Properties in 2021 which has limited opportunities for further germination trials and translocations.

The continuation of the growth study (WHC 2017) has identified that stem numbers within monitored sub-populations of *T. linearis* are highly variable over time. Stem numbers have generally declined during dry periods and increased following wet periods. However, during the generally wet conditions across 2021 small declines in stem numbers were observed within natural populations which was attributed to competition from other native understorey species.

Within the Teston South Offset, translocation of topsoil containing *T. linearis* rhizomes are yet to produce any above ground stems of the species. However, given that previous monitoring has shown that the plants may remain leafless for up to three years, these rhizomes are potentially still capable of re-sprouting when conditions are suitable. Further monitoring is required to determine the success of this technique.

2 Introduction

This report has been prepared to document the results of management actions and monitoring surveys conducted for *Tylophora linearis* in 2021 and is a summary of quarterly monitoring reports prepared by Ecoplanning (2021b, c, d, e).

Tylophora linearis is a threatened flora species listed as vulnerable under the NSW *Biodiversity Conservation Act* 2016 (BC Act) and endangered under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The species is a twiner or subshrub with cylindrical stems, up to 3 mm diameter, with linear-lanceolate leaves up to 10 cm long and 4 mm wide (PlantNET 2020). The species has been recorded from Armidale to Temora, within dry scrub and open forests in association with *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (NSW Office of Environment and Heritage [OEH] 2020).

Tylophora linearis was identified at Maules Creek Coal Mine (MCCM) during pre-clearing surveys in 2014 and 2015. On 14 May 2014, the former NSW Department of Planning and Environment requested an addendum to the MCCM BMP to document a propagation and translocation program for *T. linearis*. The propagation and translocation program is made up of the following stages (MCCM BMP 2017 Appendix C):

- Stage 1 – Root Architecture (complete) and Growth Study (ongoing);
- Stage 2 – Seed Production Monitoring (complete);
- Stage 3 – Seed Collection and Storage (complete);
- Stage 4 – Seed Propagation (complete); and
- Stage 5 – Translocation Trials (ongoing).

Stages 2 – 4 of the previous *T. linearis* Propagation and Translocation Program (MCCM BMP 2017 Appendix C) have been completed and documented in previous annual reviews (WHC 2019). During 2021, WHC (through its specialist consultants) continued research into Stages 1 and 5 of the translocation program.

In 2020 and 2021 an updated TFPP (Ecoplanning 2021a) and *T. linearis* Restoration and Translocation Strategy (Ecoplanning 2020) were prepared which supersede the previous documents (WHC 2019; MCCM BMP 2017 Appendix D). Ongoing monitoring and management actions outlined within the updated TFPP (Ecoplanning 2021a) and Restoration and Translocation Strategy (Ecoplanning 2020) for *T. linearis* are as follow:

- Ongoing monitoring of the translocated individuals for life cycle/biology analysis.
- Surveillance of natural populations of *T. linearis* to continue to monitor seed production and germination, identify any threats to threatened flora and to increase knowledge of each species' ecology and reproductive habits.
- Further translocations of *T. linearis* via multiple methods including salvage translocations of whole plants and seed collection to enable further germination trials.

3 Methods

3.1 Growth study

The growth study involved quarterly monitoring of a natural population of *Tylophora linearis* on Wollandilly Offset to count the number of stems present. The location of the natural population is shown in **Figure 3.1**. Previous monitoring of sub-populations within Leard State Forest was discontinued in 2021 as detailed within the 2020 Annual Report (Ecoplanning 2021f).

3.2 Translocation study

The translocation study included monitoring of *T. linearis* individuals translocated to the Wollandilly BOA in December 2015. Monitoring involved recording remaining stem numbers and stem height of the original 77 plants. Additional information recorded included vegetative condition and flowering and fruiting phenology.

Approximately 20 cm of topsoil (including shrubs and ground cover), from areas to be cleared for mining and identified during pre-clearance surveys as supporting *T. linearis* was translocated and spread within five enclosures, designated E1 – E5, located within the Teston South MCCM offset site in 2019 (**Figure 3.2**). The Teston South offset site was chosen as a recipient site based upon the following:

- having modelled suitable habitat,
- previous *T. linearis* records within the site,
- proximity to the donor sites,
- presence of natural woodland
- proximity to existing tracks for delivery, management and monitoring access.

Monitoring of the five enclosures involved recording the number of *T. linearis* stems present (quarterly inspections with all stems flagged, numbered, their length measured and dated) and weed monitoring.

Figure 3.1: *Tylophora linearis* monitoring locations within Wollandilly Offset.

Figure 3.2: Teston South monitoring locations.

3.3 Rainfall

Weather and in particular drought conditions, have been identified as the primary influence on monitoring projects in previous seasons (Ecoplanning 2020f). Monthly rainfall data, as recorded at the Wollandilly Offset Property (Advitech 2021), indicates that rainfall in 2021 was above average (784 mm recorded in 2021 compared to long-term average of 615 mm). Above average rainfall was recorded from January to April and again in December (**Figure 3.3**). In particular, above average rainfall was recorded from February to March and again in November to December (**Figure 3.3**). Drier conditions including well below average rainfall occurred in January and April while close to average rainfall was recorded from May to October (**Figure 3.3**). The above average rainfall recorded in 2021 follows above average rainfall in 2020, although drier conditions including below average rainfall occurred from 2017 to 2019 (Ecoplanning 2020f).

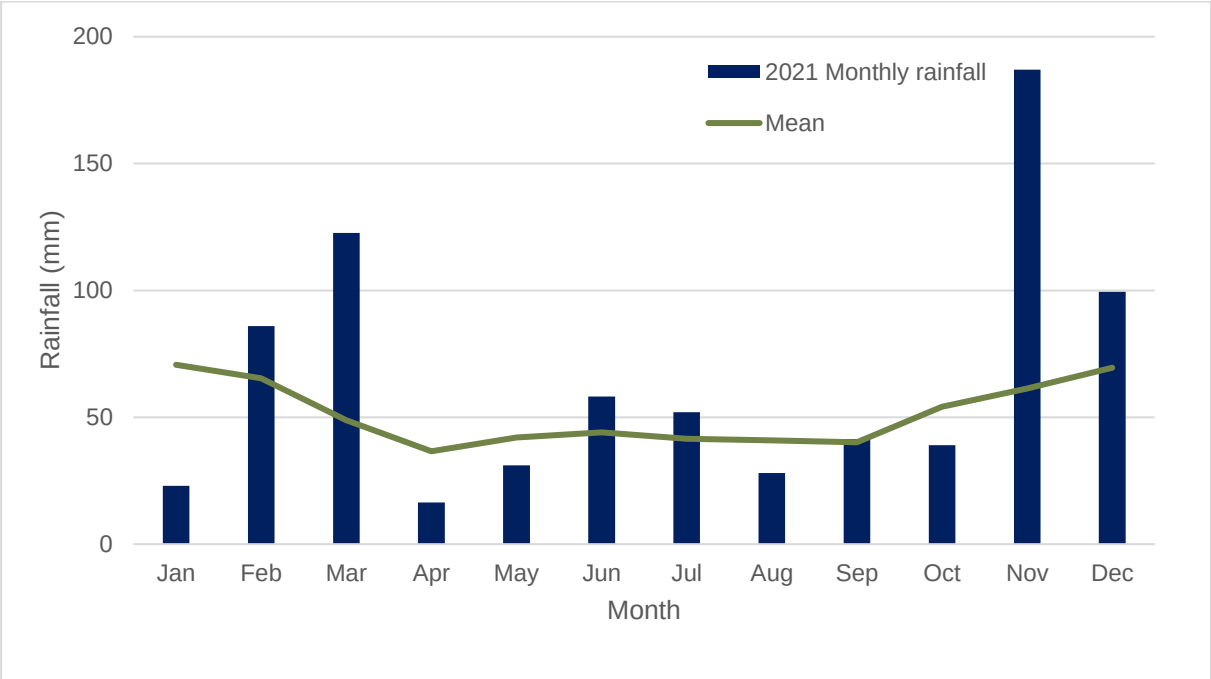

Figure 3.3: Monthly rainfall totals for 2021 and mean monthly rainfall (Gunnedah BOM)

3.4 Seed collection

In accordance with the updated TFPP (Ecoplanning 2021a), all offset area populations and some additional wild populations (Leard State Forest) were surveyed in 2021 in search of seed for translocation trials. A subset of the known populations were inspected each quarter to detect any flowers or follicles. Where flowering plants were detected more regular inspections were undertaken to identify follicle and seed development. Additionally, searches for *T. linearis* with follicles were conducted within the Maules Clearing Area in March 2021 as part of pre-clearance surveys. The purpose of these surveys was to enable seed collection and plant 'salvage' prior to vegetation clearance.

4 Results and discussion

The outcomes of ongoing translocation trials, representing Stage 5 of the *T. linearis* Propagation and Translocation Program (MCCM BMP 2017 Appendix D), are summarised in **Table 3.2**. Results of each trial as of 2021 and ongoing work conducted across the reporting period are detailed in the following sections.

Table 4.1: Summary of *T. linearis* translocation to December 2021

Source (provenance)	Date	Plants/seeds translocated	Translocation method	Surviving translocations	Cumulative count of surviving translocated individuals
MCCM Project boundary	03/12/2015	77	Seed collection & propagation	4*/77	4*

* Based on number of plants as at December 2021 with above ground growth. However, this study has found plants can go up to 3 years without above ground growth so maximum number of plants with above ground growth in last 3 year has been 8.

4.1 Growth Study

4.1.1 Wollandilly Offset

The number of stems within the Wollandilly natural population of *T. linearis* is shown in **Table 4.2** and **Figure 4.1**. The number of stems present in 2021 continued to decline from November 2020 into the first three quarters of 2021 with only a single stem recorded in September 2021. However, the number of stems increased in December 2021 with 12 stems recorded (**Table 4.2**). Previous results have identified that increased number of stems within the Wollandilly natural population are associated with periods of increased rainfall. However, results from 2021 do not reflect this trend with decreases in stem number recorded during periods of above average rainfall including in early 2021. While the cause of this decline is unknown, it may be related to competition with native understorey species which increased in cover in response to ongoing wet conditions.

Table 4.2: The number of stems of *T. linearis* within the natural population at the Wollandilly Offset site

Survey period	Number of stems	Survey period	Number of stems
Dec-16	0	Sep-18	23
Jan-17	0	Dec-18	69
Feb-17	1	Mar-19	16
Mar-17	0	Jun-19	64
Apr-17	0	Oct-19	11
May-17	0	Dec-19	9

Survey period	Number of stems	Survey period	Number of stems
Jun-17	23	Mar-20	19
Jul-17	30	Jul-20	16
Aug-17	15	Sep-20	16
Sep-17	5	Nov-20	13
Oct-17	24	Mar-21	8
Nov-17	6	May-21	5
Dec-17	15	Sep-21	1
Mar-18	52	Dec-21	12
Jun-18	0		

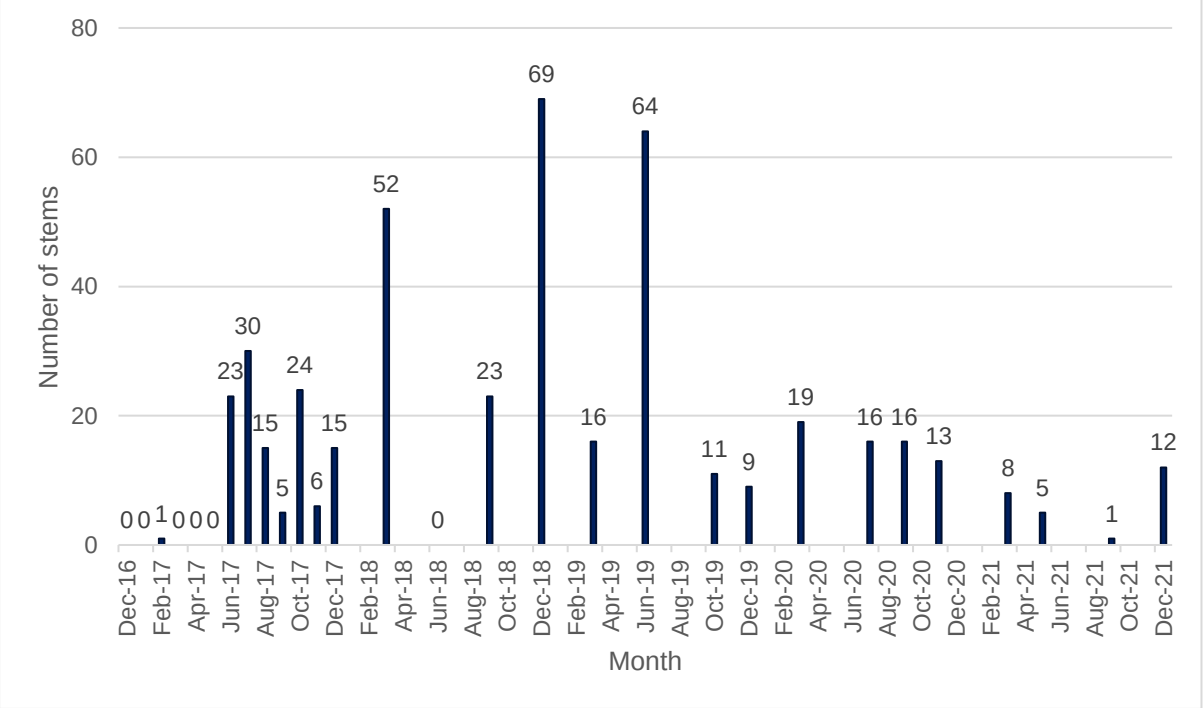

Figure 4.1: Number of stems at the Wollandilly natural population of *T. linearis*

4.2 Translocation study

4.2.1 Wollandilly Offset

In 2021, monitoring continued for the 77 *Tylophora linearis* seedlings propagated from seed collected onsite and transplanted in December 2015 into the seven purpose-built enclosures (A to G). Of the original 77 *T. linearis* individuals, between four and six plants were observed (first quarter – 5 plants; second quarter – six plants; third quarter – 6 plants; fourth quarter –

four plants). Results from 2021 are broadly similar to previous seasons, although represent a slight decline from 2020 (peak of eight stems recorded) and more similar to 2019, with only five live plants recorded in December 2019. Some declines in translocated plants, including fewer leaf pairs and stems, was recorded in 2021 and was attributed to competition from the native climber *Glycine canescens*. Selective manual removal occurred where this species was observed competing with translocated *Tylophora linearis*.

As previously recorded, surviving translocated stems have included flowering individuals with over twenty developing umbels observed on plant G8 and 15 developing umbels on plant G12 in March 2021. These plants continued to produce flowers and umbels throughout 2021, although no follicle development was observed.

4.2.2 Teston South

Monitoring of the five enclosures and the control site did not detect any *T. linearis* stems growing from the translocated topsoil. Observations across 2020 and 2021 detected a moderate cover of exotic species including *Rapistrum rugosum* (Turnip Weed), *Opuntia stricta* (Common Prickly Pear), *Solanum nigrum* (Black-berry Nightshade), *Leontodon saxatilis* (Lesser Hawkbit), *Sonchus oleraceus* (Common Sowthistle), and *Conyza* sp. Generally, weed cover was reduced in 2021 compared to 2020 and as of December 2021, only a low cover of exotic vegetation was recorded.

4.3 Seed collection

No *T. linearis* were recorded during pre-clearance surveys of the Maules Clearing Area in March 2021. Consequently, no reproductive material from this area could be collected or translocated in accordance with the TFPP.

Searches for reproductive material within enclosures on WHC BOAs and within Leard SF identified flowering individuals across multiple sub-populations in multiple seasons. However, with the exception of a single plant observed in February 2021, no other follicle or seed development was observed. The single follicle observed in February 2021 was found on a plant in Leard SF. Regular inspections of this follicle were conducted by WHC, however the follicle matured, dehisced and dropped seed between inspections on the 30 March and 12 April 2021. Consequently, no seed was collected from this individual.

5 Conclusions and recommendations

The overall aim of the *T. linearis* Restoration and Translocation Strategy (Ecoplanning 2020) is to directly support the conservation of *T. linearis*, and to maintain a self-sustaining, genetically diverse population of the species within the WHC Offset Properties, which is capable of surviving in the long term. The continued occurrence of *T. linearis* within multiple enclosures across WHC Offset Properties, as detected during quarterly searches for reproductive material, indicates that a self-sustaining population of the species persists within the WHC Offset Properties.

To support the overall aim of the strategy, one of the objectives of the strategy is to guide the successful translocation of *T. linearis* individuals grown from seed, stem cuttings, or soil seedbank transfer, to suitable habitat within the protected areas that form part of the WHC Offset Areas. The source of regenerative material for the *T. linearis* within the strategy is to include material collected from natural populations across WHC Offset Properties, State Forest and populations identified within approved mine disturbance footprints ('salvage'). In 2021, no individuals of *T. linearis* were identified within the approved MCCM disturbance footprint and therefore no salvage translocations could occur. Additionally, no seed development was detected within WHC Offset Properties in 2021 which also limited opportunities for further germination trials and translocations. The cause of the limited flowering and seed production of naturally occurring *T. linearis* in 2021 remains unknown, although appears to be part of the species' reproductive biology. While opportunities to undertake translocations in 2021 were restricted and the objective of undertaking additional translocations did not occur, this did not impact upon the overarching aim of maintaining a self-sustaining population of the species across the WHC Offset Properties.

The following recommendations are made to continue to achieve the aim of the strategy and the objective to undertake further translocations:

- As per the TFPP (Ecoplanning 2021a), continued quarterly surveillance of naturally occurring populations should occur to observe natural populations and to identify opportunities for seed collection and propagation. Despite the limited seed availability in 2021, the collection and propagation of seed from naturally occurring populations of *T. linearis* is still considered the least invasive way to support *T. linearis* conservation without impacting naturally occurring populations.

- As per the *T. linearis* Restoration and Translocation Strategy (Ecoplanning 2020), where inspections of naturally occurring populations in 2022 continue to detect limited or no seed production, propagation via stem cuttings should be trialled from healthy and robust individuals of the species. Cuttings should either be taken by qualified horticulturalists, or under their direction, ensuring that resources and materials are ready and available to receive the cuttings.

- As per the *T. linearis* Restoration and Translocation Strategy (Ecoplanning 2020), identification of *T. linearis* should be undertaken as part of pre-clearance surveys. Any *T. linearis* within approved MCCM disturbance footprints should be translocated via a combination of seed collection (where seeds are present), stem cuttings and whole plant translocations.

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