Typhonium Management Plan
Kununurra Heavy Vehicle Route

1 Introduction

The Department of Environment and Conservation (DEC) granted Main Roads Western Australia (Main Roads) a permit to clear native vegetation (CPS 2892/1) for road construction activities associated with the Kununurra Heavy Vehicle Route (HVR), under section 51E of the *Environmental Protection Act 1986*.

As part of the clearing permit conditions for the Kununurra HVR, the DEC requested a Typhonium Management Plan (TMP) be developed having regard to a commitment to conserve Declared Rare Flora (DRF) species *Typhonium* sp. Kununurra. CPS 2892/1 specified the TMP must involve, at a minimum, the following steps in relation to areas identified as being in association with populations of *Typhonium* sp. Kununurra:

- Analysis of current hydrological flows within areas identified (refer to Report on Waterway Design of Environmental Culverts for Typhonium sp. Kununurra, BG&E 2010);
- Management actions for preventing, controlling and abating changes to the hydrological flow within areas identified;
- Ongoing maintenance and monitoring of hydrological flows within areas identified.

Main Roads has committed to the preparation and implementation of a TMP for the management of *Typhonium* sp. Kununurra potentially affected by construction activities associated with Kununurra HVR.

The plan has the broad objective of monitoring the impact of the construction of the Kununurra HVR on *Typhonium* sp. Kununurra.

The TMP details procedures to be implemented as part of the construction and post-construction of the Kununurra HVR.

2 Background

2.1 Objectives and Relevant Legislation

The following objectives, guidelines and legislation are applicable to management of DRF and were considered during the preparation of this plan.

Environmental Projection Authority (EPA) Objectives:

- Protecting DRF and Priority Flora consistent with the provisions of the *Wildlife Conservation Act 1950* and the *Environmental Protection and biodiversity Conservation Act 1999.*

Relevant guidelines:

- *Wildlife Conservation Act 1950*
- *Environmental Protection and biodiversity Conservation Act 1999.*
- *EPA Position Statement No. 2* – Environmental Protection of Native Vegetation in Western Australia.
- *Department of Conservation and Land Management Draft Policy Statement No. 9* - Conserving threatened species and ecological communities.

2.2 Current Conservation Status

State legislation (*Wildlife Conservation Act 1950*) protects *Typhonium* sp. Kununurra.

Typhonium sp. Kununurra is currently listed as a DRF species. It is an offence under the *Wildlife Conservation Act 1950* to "take", that is remove, dig up, destroy, or pick, species classified as DRF without Ministerial Approval.

Typhonium sp. Kununurra is not currently listed under the *Environmental Protection and biodiversity Conservation Act 1999.*

Threat to this species is considered to be from road construction activities i.e. potential alteration in surface hydrology and drainage, associated with Kununurra HVR.

2.3 Species Description

Typhonium sp. Kununurra typically occurs as an erect perennial, herb with hastate, basal leaves, that appears above ground in the wet season (late December – March), depending on rainfall.

Typhonium sp. Kununurra has been observed to typically grow to 0.2 m tall. However, a majority of the plants collected during the 2009 survey ranged from 0.02 to 0.05 m, with two plants recorded at 0.2 m and 0.4 m high. No plants were observed to be mature (i.e. with fruiting bodies) in either 2008 or 2009, with a majority of the plants displaying only one to two small leaves (Plate 3). There is some evidence that breaking of dormancy may be staggered (Handasyde et al., 2004), where in dry years, late emerging plants may regress to corms without reproducing (Start, n.d.).

2.4 Biology and Ecology

Typhonium sp. Kununurra has an underground tuber which sprouts in the wet season. The plant grows through the wet season, and dies back to become dormant over the dry season. Flowers

and fruiting bodies have not been recorded by GHD in the field surveys undertaken as part of the Kununurra HVR project.

2.5 Habitat and Distribution

Typhonium sp. Kununurra has been recorded growing in dark grey clays, commonly known as black soils. These are locations waterlogged in the wet season and inundated after rain. This species has been commonly recorded growing on the edges of gilgai or depressions in these seasonally waterlogged locations.

Typhonium sp. Kununurra is currently known only from black soils associated with the Ord River floodplain within the vicinity of Kununurra. Historical collections of *Typhonium* sp. Kununurra have been made within the vicinity of King Location 781 by A.N. Start, as well as from collections undertaken by T. Handasyde (DEC) and John and Pauline Kirby (Kirby Rural Developments).

GHD recorded a total of 84 Typhonium sp. Kununurra plants in 2008 and 37 plants in 2009 from within the vicinity of the Kununurra HVR project area (including portions of King Location 781 and the adjacent Ivanhoe Station.

3 Impacts of the Kununurra Heavy Vehicle Route on *Typhonium* sp. Kununurra

This section identifies the potential impacts on *Typhonium* sp. Kununurra associated with construction of the Kununurra HVR. Impacts have been split into direct impacts resulting from clearing and habitat loss, and indirect impacts related to the construction and operation of the HVR following completion of works. Management (including monitoring) of impacts is addressed in subsequent sections.

3.1 Direct Impacts from Clearing

The extent of the impact of the construction of the HVR on *Typhonium* sp. Kununurra has been determined based on the combined results of the 2008 and 2009 surveys and the current road design. Plant locations (based on surveyed point locations) were superimposed on the proposed HVR alignment using a Geographic Information System (GIS).

No specimens of *Typhonium* sp. Kununurra are identified as located within the footprint of the proposed road and drainage works associated with this project. As a result, no Declared Rare Flora will be directly impacted by the project.

A total of 11 hectares of black soil (*Typhonium* sp. Kununurra habitat) will be directly impacted by the Kununurra HVR corridor.

3.2 Indirect Impacts

The following is seen as the main potential indirect impacts associated with the construction of the Kununurra HVR: changes to surface hydrology and drainage.

Changes to surface hydrology and drainage

The response of *Typhonium* sp. Kununurra to altered surface hydrology and drainage appears to be largely unknown. On-going survival of the species requires sites that are waterlogged through summer and inundated after rainfall. A reduction in soil moisture could potentially have negative impacts on the plant.

The hydrology study undertaken by BG&E (2010) involved a detailed assessment of the existing drainage conditions in the project area. Road and drainage design has been altered as a result of this study to ensure construction of the Kununurra HVR remains hydrologically neutral.

The environmental culverts recommended by BG&E for installation along the Kununurra HVR (adjacent to black soil areas) are proposed to minimise disruption to the existing annual surface flow patterns. These culverts will maintain the inundation of the black soil fingers following runoff producing rainfall events and will assist in maintaining waterlogged soils downstream by conveying frequent minor runoff events. Construction of the Kununurra HVR is therefore proposed to be hydrologically neutral and any alteration in the surface hydrology and drainage patterns currently present are expected to be minimal or non existent.

4 Management actions for preventing, controlling and abating changes to the hydrological flow within areas identified

The primary focus of this management plan is in relation to management of indirect impacts resulting from construction: i.e. potential alteration in surface hydrology and drainage.

The design of the Kununurra HVR has been undertaken in such a manner as to produce a road that is hydrologically neutral.

4.1 Pre-construction

A monitoring programme to determine pre-construction surface hydrology and drainage regime is considered to be impractical. Natural drainage patterns are already altered by the current Victoria Highway alignment channelled through culverts, with no apparent impact on downstream *Typhonium* sp. Kununurra.

Surface drainage is considered to be primarily broad sheet-flow originating from higher rocky areas associated with Bandicoot Range to the south of the Kununurra HVR.

4.2 Post-construction

Considering the Kununurra HVR will be designed and constructed to be hydrologically neutral, it is not considered that there should be any long-term change to the surface water hydrology and drainage and therefore the health of the *Typhonium* sp. Kununurra population occurring on black soil downstream of the HVR.

The monitoring of surface hydrology and drainage following the construction of the Kununurra HVR will determine if there is any alteration to the current regime. This will be managed by the installation of surveyed monitoring sites to observe:

- Upstream versus downstream water levels at culverts and floodways during drainage flow in the wet season; and
- Examining the health of selected Typhonium sp. Kununurra plants in a downstream transect at marked locations within set distances from the HVR.

Management Measures

Table 1 Summary of Management Measures

Phase	Action	Responsibility
Pre-construction	The Kununurra HVR road will be designed to be hydrologically neutral, and therefore not alter the existing surface hydrology and drainage regime	Design Manager, Hydrology Modeller
	Where *Typhonium* sp. Kununurra exists within the proposed Kununurra HVR road reserve, areas will be flagged to minimise impact on *Typhonium* sp. Kununurra plants and habitat	Construction Manager
	Prior to the commencement of construction and on an ongoing basis, all construction staff will be required to complete a site-specific induction, which will include: • Specific reference to and an explanation of the significance of *Typhonium* sp. Kununurra • An explanation of the significance of black soil habitat • An explanation of clearing limits and penalties for exceeding clearing limits (both project specific and legislative).	Construction Manager
	Clearing boundaries will be surveyed and marked in the field prior to commencement of ground disturbances	Construction Manager
	In the vicinity of *Typhonium* sp. Kununurra populations, clearing limits will be temporarily flagged to ensure that there are no accidental over-clearing incidents	Construction Manager
Construction	Clearing boundaries will be adhered to at all times	All Construction Personnel
	Penalties will be imposed on construction staff who exceed clearing limits	Construction Manager

Phase	Action	Responsibility
	Any modifications of clearing boundaries and batter design will be considered on a case by case basis with specific consideration of impacts on *Typhonium* sp. Kununurra and black soil habitat	Construction Manager and Environmental Manager
	Procedures for the removal, handling and storage of vegetation and topsoil detailed in the vegetation management plan will be implemented	Construction Manager
	Stockpiling and storage of site-won vegetation and topsoil is not to impact areas of native vegetation or drainage surrounding habitat which may contain *Typhonium* sp. Kununurra	Construction Manager
	All vehicle laydown areas and other storage areas will be located in previously disturbed areas	Construction Manager
	No burning off of vegetative material or rubbish is to be allowed on site	Construction Manager
	No fires of any kind are to be deliberately lit within the project area	Construction Manager
	Cigarette butts will be disposed of appropriately at all times in designated containers	All Staff
	In the event that a fire is started either within the project area or adjacent bushland, staff are to immediately inform the construction manager who will inform FESA, the DEC and the landholder	All Staff
	Construction machinery will be equipped with fire extinguishers and extinguishers will be placed at sites of high risk activities (welding, angle grinding, etc.)	All Staff
Post-Construction	For a period of 3 years following completion of construction of the HVR monitoring will be undertaken annually (each March) to assess: • The location of all *Typhonium* sp. Kununurra individuals within 50 m of the limit of the works; • The health of *Typhonium* sp. Kununurra at known locations in one transect downstream from the HVR; • Any additional *Typhonium* sp. Kununurra individuals encountered during the monitoring programme will be GPS located, flagged and reported to the DEC	Environmental Manager / Main Roads
	Annual inspection of culverts to ensure water flows are neutral and no blockages are evident	Environmental Manager / Main Roads
	In the event that monitoring indicates that remedial action is required, discussions will be conducted with the DEC to determine the appropriate strategy	Environmental Manager / Main Roads
	Remedial actions will be implemented as appropriate	Environmental Manager / Main Roads

5 Ongoing maintenance and monitoring of hydrological flows within areas identified

For a period of 3 years following completion of construction of the HVR monitoring will be undertaken annually (each January or February, following wet season rains) to assess:

- The presence or absence of ponding of water by the HVR upstream of the formation;
- The presence or absence of scour downstream of the HVR in selected culverts and floodways;
- The water level on upstream and downstream sides of the HVR formation at selected culverts and floodways (particularly those flowing into areas of black soil).

The installation of culverts at key locations outlined in the BG&E report (2010) aim to maintain existing hydrological flows. A three-year monitoring programme is considered to be adequate to determine if there are any changes to the surface hydrology of *Typhonium* sp. Kununurra habitat and plant health.

Details of the offset measures to compensate for the unavoidable impacts on *Typhonium* sp. Kununurra, including the proposed area of black soil on Ivanhoe Station, west of King Location 781, are discussed separately in the KUNUNURRA HEAVY VEHICLE ROUTE STAGE 1 WESTERN LINK - OFFSET PROPOSAL FOR PURPOSE PERMIT CPS 2892/1.

6 References

GHD Pty Ltd (2008). *Kununurra Heavy Vehicle Route: Stage 1 Western Link: Environmental Impact Assessment.* Report prepared for Main Roads Western Australia.

GHD Pty Ltd (2008a). *King Location 781 Typhonium sp. Kununurra Survey.* Report prepared for Kirby Rural Developments, Valentine Falls, Kununurra.

GHD Pty Ltd (2009). *Western Link Kununurra Heavy Vehicle Route: Response to EPASU and DEC Comments – Targeted Flora and Fauna Survey.* Report prepared for Main Roads Western Australia. Document Number:

Handasyde, T., Start A.N. and Done C. (2004). *Distribution, abundance and taxonomic status of Typhonium species (Araceae) in the east Kimberley.* Unpublished report to the Western Australian Threatened Species and Communities Unit, Department of Conservation and Land Management, Perth. Report pertaining to: $2000 Bankwest Landscope Conservation Visa Card Grant.