Draft NSW & National Recovery Plan

Recovery Plan for the Nowra Heath-myrtle (*Triplarina nowraensis*)

Draft for Public Comment

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Cover illustration: Flowering branchlet of the Nowra Heath Myrtle *Triplarina nowraensis*.

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Recovery Plan for the Nowra Heath-myrtle (*Triplarina nowraensis*)

Executive Summary

This document constitutes the formal draft Commonwealth and New South Wales State Recovery Plan for the Nowra Heath-myrtle *Triplarina nowraensis.* It considers the conservation requirements of the species across its known range, identifies the actions to be undertaken to ensure its long-term viability in its natural environment and the parties who will carry these out.

The Nowra Heath-myrtle is listed as Endangered (Schedule 1, Part 1) on the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* and Endangered (Schedule 1, Part 1) on the NSW *Threatened Species Conservation Act 1995*. It is an erect shrub attaining a maximum height of 5 m. There are five known populations, three of which form a cluster to the immediate west of Nowra. The fourth occurs in the Boolijong Creek catchment 18 km to the southwest of these and the fifth is located north of the Shoalhaven River on the plateau above Bundanon. For the most part these populations are found on Crown land, parts of which are subject to land claims. Sections of two populations occur on the recently dedicated Triplarina and Bamarang Nature Reserves and small sections of another extend onto private land.

The first actions to recover this species were carried out in 1998. Since then a number of other recovery actions have commenced using funds from the NPWS Southern Directorate Threatened Species Recovery Planning Budget. These previous actions are described in this plan.

The future recovery actions detailed in this Recovery Plan include: (i) An evaluation of the current size and extent of known populations, (ii) monitoring to detect any changes in population numbers, (iii) identification and control of threats to each population, (iv) research on the fire ecology and genetics of the species, (v) assessment of rezoning and development proposals which may have an impact on populations, (vi) establishment of appropriate regimes for the protection and management of land occupied by the species, and (vi) provision of information to the local community about the species and encouragement of community participation in the implementation of recovery actions.

It is intended that this Recovery Plan will be implemented over a five-year period. Actions will be largely implemented using existing resources of various NSW Government agencies and community based groups. An additional $12,400 will be required to implement some currently unfunded actions.

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Other individuals or organisations have been involved from time to time, particularly in the implementation of recovery actions. These include:

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Lorraine Oliver of the NPWS prepared the map presented in this plan

1 Introduction

The Nowra Heath-myrtle (*Triplarina nowraensis*) is an Endangered erect shrub attaining a maximum height of 5 m. There are five known populations, three of which form a cluster to the immediate west of Nowra. The fourth occurs 18 km to the southwest of these and the fifth is located north of the Shoalhaven River on the plateau above Bundanon.

This document constitutes the formal Commonwealth and New South Wales State Recovery Plan for the species. It considers its conservation requirements across its known range, identifies the actions to be taken to ensure its long-term viability in its natural environment and the parties who will carry these out.

The attainment of the objectives of this Recovery Plan is subject to budgetary and other constraints affecting the parties involved. It may also be necessary to amend this plan in the event of new information or following recommended changes to the recovery program by the Recovery Team. The information in this Recovery Plan is accurate to March 2003.

This draft will be placed on public exhibition for a period of six weeks. Readers are invited to comment on its contents. Further information regarding the submission process and a submission form can be found at the rear of this plan.

2 Legislative Context

2.1 Legal Status

The Nowra Heath-myrtle is listed as Endangered under both the *Threatened Species Conservation Act 1995* (TSC Act) and the *Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Among the consequences of listing as a threatened species on the TSC Act are that:

- A Recovery Plan must be prepared;
- Consideration be given to the species in assessing the impacts of developments and activities with the aim of minimising adverse impacts; and
- Actions that are likely to result in the harming or picking of that species or damage to its habitat are licensed.

2.2 Recovery Plan Preparation

The TSC Act provides a legislative framework to protect and encourage the recovery of threatened species, endangered populations and endangered ecological communities in NSW. Under this legislation the Director-General of the National Parks and Wildlife Service (NPWS) has a responsibility to prepare Recovery Plans for all species, populations and ecological communities listed as Endangered or Vulnerable on the TSC Act schedules. Similarly, the EPBC Act requires the Commonwealth Minister for the Environment to ensure the preparation of a Recovery Plan for nationally listed species and communities or adopt plans prepared by others including those developed by State agencies. Both Acts include specific requirements for the matters to be addressed by Recovery Plans and the process for their preparation.

This Recovery Plan has been prepared to satisfy both the requirements of the TSC Act and the EPBC Act. It is the intention of the Director-General of National Parks and Wildlife to forward the final version of this Recovery Plan to the Commonwealth Minister of the Environment for adoption, once it has been approved by the NSW Minister for the Environment.

2.3 Recovery Plan Implementation

The TSC Act requires that a public authority must take any appropriate measures available to implement actions included in a Recovery Plan for which they have agreed to be responsible. Public authorities and councils identified as responsible for the implementation of Recovery Plan actions are required by the TSC Act to report on measures taken to implement those actions. In addition, the Act specifies that public authorities must not make decisions that are inconsistent with the provisions of the plan. Public authorities responsible for the implementation of this Recovery Plan are the NPWS, Shoalhaven City Council (SCC), the Department of Land and Water Conservation (DLWC) and Integral Energy.

The EPBC Act specifies that a Commonwealth agency must not take any action that contravenes a Recovery Plan.

2.4 Relationship to other legislation

The lands on which the Nowra Heath-myrtle occurs include those that are owned or managed by private landholders, the DLWC and the NPWS. Relevant legislation includes:

- *National Parks and Wildlife Act 1974*
- *Environmental Planning and Assessment Act 1979*
- *Local Government Act 1993*
- *Rural Fires Act 1997*
- *Native Vegetation Conservation Act 1997*
- *Rivers and Foreshores Improvement Act 1948*
- *Crown Lands Act 1989*
- *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth legislation)

The interaction of these Acts with the TSC legislation is varied. The most significant implications are described below and in Section 2.5.

The clearing of native vegetation in NSW is subject to consent from the DLWC in accordance with the *Native Vegetation Conservation Act 1997* (NVC Act). The NVC Act requires that threatened species are taken into account when considering clearing applications under Part 4 of the EP&A Act. There are however a series of exemptions and the Act does not apply to certain types of land including land zoned as 'residential', 'township', 'village', 'industrial', or 'business'. None of the land on which the Nowra Heath-myrtle occurs is zoned for any of these purposes and, therefore the NVC Act applies.

The Act also allows for the development of Regional Vegetation Management Plans. Matters relating to threatened species and their habitats must be considered when preparing such a plan. Furthermore a Regional Vegetation Management Plan must be consistent with a Recovery Plan.

In addition any works (eg. excavation) within 40 metres of a stream must be assessed as a requirement under the *Rivers and Foreshores Improvement Act 1948* (RFI Act).

The *Rural Fires Act 1997* (RF Act) requires that all parties involved in fire suppression and prevention must have regard to the principles of Ecologically Sustainable Development (ESD) when exercising their functions and when preparing Draft Operational Plans and Draft Bush Fire Risk Management Plans. Consideration of the principles of ESD must include the conservation of biological diversity and ecological integrity. Within this, consideration must be given to the impact on threatened species and their habitats.

2.5 Environmental Assessment

The New South Wales *Environmental Planning and Assessment Act 1979 (*EP&A Act) requires that consent and determining authorities, and the Director-General of National Parks and Wildlife, as a concurrence authority, consider relevant Recovery Plans when exercising a decision-making function under Parts 4 and 5 of the EP&A Act. Decision makers must consider known and potential habitat, biological and ecological factors and the regional significance of individual populations.

The following public authorities currently have a decision making function in relation to the Nowra Heath-myrtle*:*

- Shoalhaven City Council,
- Department of Land and Water Conservation in relation to Crown Land, subject to the provisions of the *Crown Lands Act 1989*, and in relation to private land under the requirements of the NVC Act and the *Rivers and Foreshores Improvement Act 1948*;
- The NPWS as the land manager and determining authority where populations occur on NPWS estate; where a concurrence or consultation role under the EP&A Act is required (all tenures); or where a Section 91 Licence (under the TSC Act) or a Section 132 Licence (Licence to grow protected or threatened plants for sale) (under the NPW Act) is required (all tenures).

Additional public authorities may have a decision making function if the species is located in other areas in the future.

Any other action not requiring approval under the EP&A Act, and which is likely to have a significant impact on the Nowra Heath-myrtle, will require a Section 91 licence from the Director-General of NPW under the provisions of the TSC Act. Such a licence can be issued with or without conditions, or can be refused. Routine agricultural activities however, are exempt from the provisions of the TSC Act.

The EPBC Act regulates actions that may result in a significant impact on nationally listed threatened species and ecological communities. It is an offence to undertake any such actions in areas under State or Territory jurisdiction, as well as on Commonwealth-owned areas, without obtaining prior approval from the Commonwealth Environment Minister. As the species considered in this Recovery Plan is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on the species should refer the action to the Commonwealth Minister for the Environment for consideration. The Minister will then decide whether the action requires EPBC Act approval.

Administrative guidelines are available from Environment Australia to assist proponents in determining whether their action is likely to have a

significant impact. In cases where the action does not require EPBC Act approval, but will result in death or injury of an individual of the species considered in this Recovery Plan, and the individual is in or on a Commonwealth area, a permit issued by the Commonwealth Minister under the EPBC Act will be required.

The Environment Minister can also delegate the role of assessment and approval to other Commonwealth Ministers under a Ministerial Declaration and to the States and Territories under bilateral agreements. The development of a bilateral agreement between NSW and the Commonwealth is not yet complete, but when in place will avoid the need for duplication of environmental assessment.

2.6 Critical Habitat

New South Wales

The TSC Act makes provision for the identification and declaration of Critical Habitat. Under the TSC Act, Critical Habitat may be identified for any Endangered species, population or ecological community occurring on NSW lands. Once declared, it becomes an offence to damage Critical Habitat (unless the action is exempted under the provisions of the TSC Act) and a Species Impact Statement is mandatory for all developments and activities proposed within declared Critical Habitat.

To date, Critical Habitat has not been declared for the Nowra Heath Myrtle under the TSC Act.

Commonwealth of Australia

Under the EPBC Act, Critical Habitat may be registered for any nationally listed threatened species or ecological community. When adopting a Recovery Plan the Federal Minister for the Environment must consider whether to list habitat identified in the Recovery Plan as being critical to the survival of the species or ecological community. It is an offence under the EPBC Act for a person to knowingly take an action that will significantly damage Critical Habitat on Commonwealth land (unless the EPBC Act specifically exempts the action). Any action that is likely to have a significant impact on a listed species occurring within registered Critical Habitat on other areas is still subject to referral and approval under the EPBC Act. Proposed actions within registered Critical Habitat on non-Commonwealth areas are likely to receive additional scrutiny by the Commonwealth Minister.

This Recovery Plan does not specifically identify habitat that is critical to the survival of the Nowra Heath-myrtle. However, the distribution, habitat and ecological information included in this Plan (Sections 3.2-3.4) would assist the Federal Minister for the Environment in identifying habitat that is critical to the survival of this species. NPWS does not consider it appropriate that this Recovery Plan identifies or maps the occurrences of this species in the detail that would be required to define Critical Habitat.

3 Species Information

3.1 Description and Taxonomy

The genus *Triplarina* was reinstated from the closely related *Baeckea* by Bean in 1995. The seven species of *Triplarina* are endemic to Australia, with most species found within 80 km of the coast (Bean 1995).

In the Nowra district there are a number of *Baeckea sens. lat.* that grow in association with the Nowra Heath-myrtle: *B. ramosissima, B. virgata, B. imbricata, B. diosmifolia, B. brevifolia and B. linifolia.* These species can be easily distinguished from *Triplarina nowraensis* on the basis of leaf size and shape. A summary of additional characteristics that can be useful in distinguishing between the two genera is provided by Bean (1995) and listed below:

Baeckea L. sens. str. - "Calyx lobes simple; stamens 5-12, none opposite centre of petals; filaments straight; anthers versatile, dehiscing by long parallel slits; locules 2 (rarely 3); ovules 6-12 per loculus; seeds straight-sided, discoid to cuboid, angular, not arillate."

Triplarina Raf. - "Calyx lobes simple; stamens 14-18, none opposite centre of petals; filaments straight; anthers versatile, dehiscing by long parallel slits; locules 3; ovules 8-13 per loculus; seeds reniform, not angular, not arillate."

The following description of the Nowra Heath-myrtle is adapted from Bean (1995): A small erect shrub which can attain a maximum height of five meters in areas which remain fire free for long periods. Bark grey and scaly on the branchlets. Leaves are obovate to oblanceolate, 3.4-5.0 mm long and 1.2-1.7 mm wide. There are two parallel rows of large oil glands on either side of the midrib. The decussate arrangement of the leaves gives the shrub a distinctive appearance and the leaves are highly aromatic when crushed. The flowers are borne in pairs in the leaf axils and are about 4.5 mm across. The creamy-white flowers are produced in the spring. Fruits are hemispherical, wrinkled (2.0-2.9x2.1-2.8 mm) and the seeds are brown (0.6-0.8 long).

The Nowra Heath-myrtle is closely related to *Triplarina imbricata,* which occurs in north-eastern New South Wales.

3.2 Distribution

There are five known populations of the Nowra Heath-myrtle at the present time (Fig. 1). Three of these form a cluster to the immediate west of Nowra in an area 6 km by 2.5 km. These sites occur on Nowra Sandstone. Current estimates of population numbers are: Population A - 32,000; Population B - 13,000; and Population C – 3,500. The fourth population (D) in the Boolijong Creek valley occurs approximately 18 km to the southwest of populations A-C. This appears to be on the Conjola Formation, also a sandstone. The population here is much smaller, numbering several hundred individuals. The remaining population (E) is located north of the Shoalhaven River and appears to be confined to the plateau above Bundanon; more specifically, it is restricted to the creeklines north of Illaroo Road. Numbers here are estimated at 22,000. All five populations are limited in extent; ranging from <1 ha to approximately 15 ha.

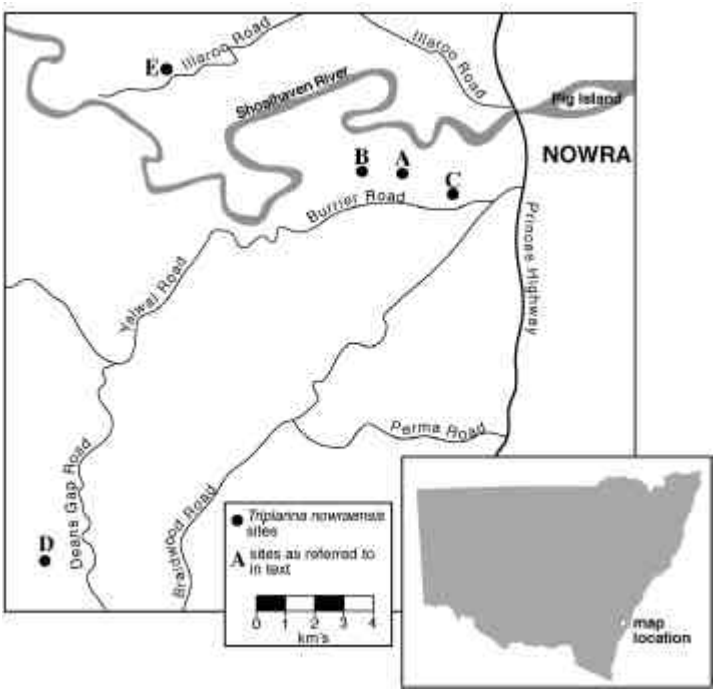

Figure 1. Map showing the five known populations of the Nowra Heath-myrtle

Populations of the Nowra Heath-myrtle have only been found between the elevations of 10 and 220 m. Rainfall averages in the area range from 1,038 mm at Nowra (records for 78 years) to 920 mm at Yalwal (records for 33 years).

In addition to the five known populations, there are also records of the Nowra Heath-myrtle having been found at two other locations along Nowra Creek. On recent visits to these areas it has not been possible to reconfirm the earlier records.

3.3 Land Tenure

Population A: The major part of this population (in Cabbage Tree Creek catchment) occurs on Crown land subject to a land claim. To the south and north this population extends onto private land (Portions 155 and 87). Portion 87 remains undisturbed, however, some recent clearing activity has taken place on Portion 155.

Population B: The land claim over the above area also extends across to the Sandy Creek catchment and affects the northern part of this population. To the south the greater part of this population (11,600 out of an estimated total population of 13,000) occurs in the recently dedicated Bamarang Nature Reserve.

Population C: Of the three discrete sub-populations in the Flat Rock Creek catchment, two are in the recently dedicated Triplarina Nature Reserve (2,300 out of an estimated total population of 3,500) and the third is on land owned by the Nowra Aboriginal Land Council.

Population D: Consists of two sub-populations in the Boolijong Creek area on Crown land subject to a land claim.

Population E: This extensive population in the Bundanon area to the north of the Shoalhaven River is confined to a large area of vacant Crown land.

The fact that substantial numbers of individuals of the species are on public land significantly improves prospects for the implementation of appropriate management measures and possibly also provision for further long term conservation of the species.

3.4 Habitat

Populations of the Nowra Heath-myrtle are often found on moist soils or poorly drained sites such as water courses and bedrock surfaces with impeded drainage although two populations are known to occur in drier sites. Populations occur in forest and woodland communities that are dominated by *Eucalyptus punctata, E. aggregata, E. sclerophylla, E.*

consideniana, E. piperita and Corymbia gummifera. Because of the preference for wetter sites, the species is often found in patches that are treeless or with a very open canopy. The species may also be found in sandstone sedgeland or shrubland dominated by *Kunzea ambigua.* Vegetation communities identified and described by Mills (1998a) where the species has been found are included below:

PUN-AGG : GreyGum-Stringybark Forest/Woodland

SCL-CAS : Scribbly Gum - Casuarina Forest

KUN-SHR : Kunzea Shrubland

SST-SDG : Sandstone Sedgeland

PIP-GUM : Peppermint-Bloodwood Forest

SCL-GUM: Scribbly Gum-Bloodwood Woodland

SCL-PUN: Scribbly Gum – Grey Gum Woodland

CON-GUM: Yertchuk – Bloodwood Woodland

SCL-HAK: Scribbly Gum – Hakea Open Woodland

Field data sheets have been completed for a number of sites within four of the populations and have been included as Appendix 2 in Mills (1998b). Information on associated species is also presented in Tables 3 and 4 of this publication. As expected, some of the associated shrub species are typical of moist, sandy soils such as Slender Wattle (*Acacia elongata*), Tall Baeckea (*Baeckea virgata)*, Yellow Teatree (*Leptospermum polygalifolium)* and Thyme Honey-Myrtle (*Melaleuca thymifolia*). Tree species either on or nearby the sites are commonly: Scribbly Gum (*Eucalyptus sclerophylla)*, Grey Gum (*Eucalyptus punctata*) and Red Bloodwood (*Corymbia gummifera*). Other tree species occasionally occurring include: Blackbutt (*Eucalyptus pilularis)*, Spotted Gum (*Corymbia maculata)*, Peppermint (*Eucalyptus piperita*), White Stringybark (*Eucalyptus globoidea)* and Grey Ironbark (*Eucalyptus paniculata)* with Yertchuk (*Eucalyptus consideniana)* in the Bundanon area.

3.5 Ecology

The life history and ecology of this species are not well known and have not, until recently, been the subject of any formal research investigations. A study carried out by Hogbin (2000) has now been completed which provides important preliminary information on the reproductive ecology of the Nowra Heath-myrtle. A number of life-history stages from pollination through to seed germination were investigated, including; flower morphology (as an indication of the likely mating system), pollen viability, pollination biology, fruit initiation, seed production, and seed germinability.

The flower morphology suggests that the species is protandrous, i.e. each flower releases pollen prior to the stigma becoming receptive. Protandry limits or reduces self-pollination within flowers (autogamy) and increases the efficiency of outbreeding. The pollen of the Nowra Heath-myrtle was found to have high viability. Abundant potential pollinator activity was observed, with a diverse range of insects visiting Nowra Heath-myrtle flowers. A pollinator exclusion experiment revealed that the species appears to have a predominantly outcrossing mating system, but is also capable of selfing in the absence of pollinator activity (autogamy). The ability to self pollinate in low frequencies may be a "fail safe" method of ensuring seed set when pollinator activity is low. The Nowra Heath-myrtle produces abundant seed, however not all ovules form seed. This excess ovule production is a common characteristic of many plant species and is, therefore, not of concern. The seed are capable of germination *ex-situ* and appear not to possess a dormancy mechanism. The absence of seed dormancy suggests that the species may possess a short-lived soil stored seed bank. No seedlings were observed *in-situ*, however the seedling survey was conducted up to only 3 months after seed release. It is vital that *in-situ* seed germination and survival be investigated further. There appear to be no major limits to the reproduction of the species in those stages from pollination through to seed germination. The species, therefore, appears to be stable and able to maintain itself.

The species has been observed to resprout from lignotubers after fire and on older plants a number of stems may originate from a single large lignotuber (Mills, 1998b). Sites where the species occurs have been burnt at various times in the past with known major fire events having taken place 18 months, ten years and more than twenty years ago. Increased knowledge of the detailed fire response and the genetic make-up of the species are also desirable from the perspective of making management actions more effective.

Because of the adaptation of the Nowra Heath-myrtle to moist soils or poorly drained sites, which may be regarded as somewhat extreme conditions for many species, there is a tendency for it to predominate in some areas of occurrence. Whether this is attributable entirely to the difficulty other species have in adapting to these environmental conditions or is to some extent an effect of competition between the Nowra Heath-myrtle and other species is not known. The result is that relatively large populations of the species may be concentrated in some locations, particularly along creeklines.

3.6 Ability of Species to Recover

With removal or suitable control of the threats described in Section 4 there is no reason to expect that this species will not continue to survive at most if not all of its present locations. The fact that there are a number of populations gives the species some security against a single catastrophic event. Appropriate efforts on the part of the various agencies responsible for the management of the sites and the cooperation of private property owners should result in good survival prospects for the species.

4 Management Issues

4.1 Previous Disturbance

There have been a number of historic disturbances that have resulted in the loss of parts of known populations of the Nowra Heath-myrtle. Vehicle tracks, particularly where they have crossed creeklines in the Sandy, Cabbage Tree, Flat Rock and Boolijong Creek catchments, have destroyed a number of individuals. Flooding of the Flat Rock Creek Dam probably also resulted in the loss of part of the population at this site. Past clearing associated with agriculture or other activities in the vicinity of Nowra Creek has either directly or indirectly caused the complete disappearance of a population of unknown size first recorded by Rodway in 1925 and more recently by Mills in 1988 in this area. The most significant loss, however, has probably been to the immediate east of the access road into the Nowra Landfill where surface scraping of road gravel has denuded an extensive area which probably supported a large population of the species. Most recently, clearing on private land (portion 155) has resulted in the loss of an estimated 1,500 individuals.

A pipeline corridor has been constructed through Population A. This has resulted in the removal of several hundred individuals of the Nowra Heath Myrtle which were held under glasshouse conditions and then replanted as part of the rehabilitation program. This appears to have been successful though more time is required before a full assessment can be made.

4.2 Threats

Threats that could, in future, have a detrimental effect on one or more of the populations of the Nowra Heath-myrtle and appropriate management responses are:

- The use, maintenance or widening of vehicle tracks in close proximity to Nowra Heath-myrtle populations have the potential to result in the loss of individuals from these populations. In order to ensure that this does not happen, information on such occurrences needs to be provided to authorities with management responsibilities for areas where the species occurs and their cooperation sought in protecting these occurrences (Action 1.1).

- The Nowra Heath-myrtle occurs naturally in a fire prone environment and has consequently acquired adaptations to periodic burning. Available evidence from recent fires in the Flat Rock Creek catchment suggests that the survival rate of the species from a single fire event is very high. It is, nevertheless considered an appropriate precautionary measure for the Recovery Team to liaise with the Shoalhaven Bush Fire Management Committee to ensure that any significant increases in fire frequency in areas where the Nowra Heath-myrtle occurs are carefully considered (Action 1.2). It is also considered advisable to carry out research on the fire requirements of the species (Action 3.1

- An extension of the Waste Disposal Facility on land bridging the catchments of Mundamia/Sandy and Cabbage Tree Creeks could potentially have a detrimental effect on populations of the Nowra Heath-myrtle in either or both of these catchments. Baseline water quality monitoring (Action 4.2) will provide a basis for assessing the significance of any impact this may have on the species.

- All populations of this species, particularly where they occur in close proximity to creeks, receive runoff from areas higher in the catchment and could, therefore, potentially be affected by land use changes taking place elsewhere in the catchment. While studies by Hogbin (2002) have shown that adult plants of the species are highly tolerant of elevated nutrient levels, seedling plants were shown to be more sensitive. There is also the possibility of increased competition from weed species adversely affecting reproduction and survival of the Nowra Heath-myrtle.

  The Nowra Bomaderry Structure Plan (Concept Plan Stage) has identified areas in Mundamia/Sandy and Cabbage Tree Creek catchments to be investigated for potential future urban development. Two approaches to the management of this potential threat have been identified. Firstly, baseline water quality monitoring in the catchments of Mundamia/Sandy and Cabbage Tree Creeks will be integrated into the Shoalhaven City Council program (Action 4.2). Secondly, the possibility will be investigated of rezoning any freehold land with populations of the

Nowra Heath-myrtle as Environmental Protection 7(a) Ecology (Action 5.3).

- The State Government (Planning NSW and NSW Roads and Traffic Authority) and Shoalhaven City Council have identified a Western Bypass Corridor which passes through part of population A of the Nowra Heath-myrtle. While this road is not expected to be built for at least 20 years, it is important that any proposal of this nature be adequately assessed and impacts minimised. To this end NPWS will produce environmental assessment guidelines to assist proponents and consent/determining authorities in making such assessments (Action 4.1).

5 Previous recovery actions

A recovery team was established by the NPWS and met for the first time on 22 July 1998.

Members of the Recovery Team and other volunteers conducted detailed surveys during 1998-99 to determine the full extent of the species in the Nowra area. This work in the catchments of Sandy, Cabbage Tree and Flat Rock Creek as well as on the Bundanon and Bugong Plateaus significantly extended our understanding of the distribution and abundance of the species.

An initial trial of a water quality monitoring program has been carried out on Sandy/Mundamia and Cabbage Tree Creeks. This has incorporated event sampling to determine whether during rainfall events nutrient levels are significantly elevated above normal background levels. In parallel with this program, studies on the tolerance of the species to elevated nutrient levels have also been carried out. The results of these investigations (Hogbin 2002) suggest that, while storm events do increase levels of some nutrients, these are still well within the tolerance limits of adult Nowra Heath-myrtle plants. *In situ* studies demonstrated that adult individuals are able to tolerate extremely high nutrient levels without any significant effect on growth or survival. Seedling survival was, however, adversely affected but only at levels well above those measured in soils associated with field populations.

Baseline water quality monitoring (see Action 4.2) will need to continue, however, because proposed developments in the catchments of Sandy and Cabbage Tree Creeks such as expansion of the landfill, construction of a Nowra bypass road and residential development have the potential to alter soil and water quality over time. This could impact directly on the species (particularly seedlings) through toxicity effects or indirectly through increased weed infestation.

An agreement has been reached with Integral Energy regarding modification of maintenance procedures where the Nowra Heath-myrtle is growing in the powerline easement at Bundanon. Signs have been erected at this site to alert maintenance workers to the presence of a threatened species and the need avoid slashing unless the vegetation encroaches on the statutory safety clearance.

Patricia Hogbin of the Australian National University has carried out a preliminary study of the reproductive ecology of the species. The results of this study relating to flower morphology, pollen viability, pollination biology and seed production and germinability are reported in Section 3.5 of this Recovery Plan.

Two Nature Reserves containing significant parts of two of the populations of the Nowra Heath-myrtle were created as a part of the Comprehensive Regional Assessment (CRA) process completed in 2001. These are Bamarang Nature Reserve containing 89% of Population B and Triplarina Nature Reserve containing 66% of Population C. Of the total known population of the species (approximately 70,700) about 20% is protected in these two Reserves.

6 Proposed Recovery Objectives, Actions and Performance Criteria for 2002-2006

The overall objective of this Recovery Plan is to downlist the Nowra Heath-myrtle from Endangered to Vulnerable within ten years by ensuring that current threats to sites are controlled and all or most populations are stable or increasing in size.

Specific Objective 1: To determine the extent and severity of threatening processes, and eliminate or minimise the impact as necessary

Action 1.1 Protect Nowra Heath-myrtle populations from impact of road and track maintenance.

Road and track maintenance is carried out by authorities such as SCC, the Rural Fire Service, the DLWC and the NPWS in areas where the Nowra Heath-myrtle occurs. Information on the locations where the species is found will be provided to these authorities and assurances of their cooperation in avoiding direct or indirect disturbances sought. Signs may also be considered for some areas if appropriate.

Action 1.2 The Recovery Team will liaise with the Shoalhaven Bush Fire Management Committee on the protection of the Nowra Heath-myrtle from frequent fire.

The Recovery Team will provide information to the Shoalhaven Bush Fire Management Committee on all known occurrences of the Nowra Heath-myrtle. While a better understanding of the fire ecology of the species needs to be obtained (Action 3.1) in order to develop site-specific guidelines, any increase in fire frequency would be cause for concern. Therefore, discussions will take place between NPWS and the Shoalhaven Bush Fire Management Committee on any areas where the Nowra Heath-myrtle occurs that are identified in the Bush Fire Risk Management Plan as Asset Protection or Strategic Management Zones. Some sites, at least, should remain unburnt indefinitely.

Action 1.3 Powerline maintenance by Integral Energy will be carried out so that impacts to Nowra Heath-myrtle populations are minimised.

Population E at Bundanon occurs, in part, on a powerline easement maintained by Integral Energy. Integral Energy has agreed that no slashing will take place 50 metres either side of the two drainage lines in which the Nowra Heath-myrtle is growing unless the vegetation in the area encroaches on the statutory safety clearance.

Performance Criterion 1

Management and maintenance practices that will not detrimentally affect Nowra Heath-myrtle populations in place within three years.

Specific Objective 2: To collect additional information required for the effective management and conservation of the Nowra Heath-myrtle

Action 2.1 Survey

A significant amount of survey work has already been carried out since the Recovery Team was established for the Nowra Heath-myrtle in July, 1998 (see Section 5). It is still possible, however, that further populations may exist in other areas. In particular, the Boolijong Creek and Nowra Creek areas should be investigated. If and when such sites are found, they will be surveyed in order to determine the size and extent of the populations.

Action 2.2 Monitoring

A monitoring program will be designed to detect any impacts from identified threats and to assess the effectiveness of any recovery actions undertaken. Monitoring of all sites should take place every three years. The program will be linked to monitoring of water quality in Mundamia and Cabbage Tree Creeks (Action 4.2) and to monitoring related to past and future fire events (particularly sites in the Flat Rock Creek and Boolijong Creek catchments). All monitoring should include collection of data on the incidence of weed species.

Performance Criterion 2

Survey in the Boolijong Creek, Nowra Creek and other potential areas of occurrence completed and a monitoring program designed and initial monitoring carried out within three years of finalising of Recovery Plan.

Specific Objective 3: Encourage research in order to obtain the detailed knowledge of the species necessary to make informed and effective management decisions

Action 3.1 Initiate University based research on the fire requirements of the Nowra Heath-myrtle

An understanding of the response of the Nowra Heath-myrtle to fire (including *in-situ* seed germination and survival) will be of value in making future management decisions for the species. The NPWS will therefore approach various universities and attempt to initiate research into the fire ecology of the species. The NPWS will seek funding to assist such research. This research should include the documentation of the fire history of all known Nowra Heath-myrtle sites and investigations of the response of the species to different fire regimes (frequency, timing and intensity of fire).

Action 3.2 Conduct research into the genetic structure of the populations of the Nowra Heath-myrtle

Knowledge of the degree of genetic difference or similarity between populations will be of value in assessing the significance of future threats to particular populations and in determining how to allocate resources to the protection of different populations. The NPWS will therefore approach various universities and attempt to initiate such research. The NPWS will seek funding to assist such research.

Performance Criterion 3:

Research on the fire response and genetics of the Nowra Heath-myrtle completed by the time of review of this plan.

Specific Objective 4: To assess rezoning and development proposals that may impact on the Nowra Heath-myrtle with a view to minimising any negative effects

Action 4.1 The NPWS will produce environmental assessment guidelines to ensure that any proposals for rezoning or development in the catchments in which the Nowra Heath-myrtle occurs will be adequately assessed and the impacts of any development minimised

Any proposals for development affecting land to the west of Nowra will need to be assessed by the proponents for their potential impacts on populations of the Nowra Heath-myrtle. The environmental assessment guidelines will assist applicants and consent/determining authorities in preparing and assessing eight part tests and species impact statements where the Nowra Heath Myrtle is or may be present. Until such time as more is known about the genetics of the different populations and a reasonable sample of the extant populations is protected in a NPWS or other conservation reserve, it is strongly recommended that no populations or significant parts of populations be lost to development.

Action 4.2 Shoalhaven City Council will integrate additional sampling with its current water quality monitoring program to establish a baseline against which to assess changes in soil and water quality in the catchments of Mundamia/Sandy Creek and Cabbage Tree Creek

An ongoing water and soil quality monitoring program is required to establish a baseline and to detect any changes in nutrient levels arising from future developments which might adversely impact on the Nowra Heath-myrtle.

Performance Criterion 4

Zoning and development proposals fully assessed as they arise and a soil and water quality monitoring program implemented by the time of review of this plan.

Specific Objective 5: Establish appropriate protection and management of land occupied by the Nowra Heath-myrtle

Action 5.1 Investigate the feasibility of further conservation reserves to secure the long term protection of the species

Significant populations of the Nowra Heath-myrtle occur on vacant crown land subject to a land claim. The NPWS will continue to liaise with Shoalhaven City Council, the Department of Land and Water Conservation and the aboriginal community on appropriate conservation reserves for these areas in conjunction with the Comprehensive Regional Assessment (CRA) process and Council's identification of population expansion and infrastructure requirements and priority conservation areas for the Nowra/Bomaderry Structure Plan.

Action 5.2 Develop alternative measures to adequately protect populations where it is not feasible to create conservation reserves

Parts of populations A,B and D occur on private land or are subject to land claims on behalf of the Local

Aboriginal Land Council. Because of the cost of acquiring this land for a conservation reserve a different type of approach to protection may be required. This could take the form of a Voluntary Conservation Agreement (VCA) or Property Management Plan. Elsewhere on private land protective fencing of areas in which the Nowra Heath-myrtle occurs may be appropriate.

Action 5.3 Shoalhaven City Council will investigate the possibility of rezoning land that supports populations of Nowra Heath-myrtle to Environmental Protection 7(a) Ecology

As part of the ongoing Nowra Bomaderry Structure Plan, Council will investigate the rezoning of lands that support known populations of Nowra Heath-myrtle to Environmental Protection 7(a) Ecology.

Performance Criterion 5

Assessment of the feasibility of further conservation reserves and, where necessary, the development of alternative measures completed by the end of the third year after the Recovery Plan is finalised. Land supporting populations of Nowra Heath-myrtle zoned as Environmental Protection 7(a) Ecology at the completion of the Nowra Bomaderry Structure Plan process.

Specific Objective 6: To involve the community in the conservation of the Nowra Heath-myrtle

Action 6.1 Inform and educate the local community about the value of the Nowra Heath-myrtle and the bushland in which it occurs

A brochure will be prepared and distributed to the public and land managers to increase awareness of the significance of the species and the actions being taken to ensure its continued survival. In future consideration could be given to the establishment of nursery grown plants of the species at a site where the public can view it without having an impact on the wild populations.

Action 6.2 Involve the local community in survey, monitoring and other actions

Contact will be established with the local community and if sufficient interest exists, a program for community participation in the recovery program for the Nowra Heath-myrtle will be developed.

Action 6.3 Assess the commercial potential for the species in the nursery trade

The Nowra Heath-myrtle is a very attractive shrub with a distinctive scent produced by aromatic oils in the leaves. For these reasons it may have commercial potential and this possibility will be pursued with appropriate representatives of the industry.

Performance Criterion 6

Contact established with the local community, an information brochure distributed and the commercial potential of the Nowra Heath-myrtle assessed by the end of the third year after the Recovery Plan is finalised.

7 Implementation

Table 1 outlines the implementation of recovery actions specified in this plan for the period of five years from publication.

8 Social and Economic Consequences

Potential social and economic benefits

- The main social benefit of conserving the remnant bushland habitat in which the Nowra Heath-myrtle survives is the prevention of further loss of this and other co-occurring threatened species, as well as the ecological communities in which they occur. There is a significant level of recognition in the community that such loss should be avoided if at all possible.
- The Nature Reserves encompassing the Nowra Heath-myrtle and a range of other species and ecosystems provide an educational resource for the University of Wollongong extension located on Yalwal Road and a focus for a variety of research projects.
- The distinctive aromatic oils in the leaves of the Nowra Heath-myrtle could prove to have commercial value at some time in the future.
- The attractive white flowers and small leaves of this species may make it suitable for the nursery trade.

Potential social and economic costs

While there are negligible immediate economic and social costs relating to the Recovery Plan, there are considerable longer term costs associated with the protection of the species. Shoalhaven City Council has for many years indicated that the major long term growth corridor for Nowra Bomaderry urban expansion was westward along the southern side of the Shoalhaven River. Council's Nowra Bomaderry Concept Plan reduced the urban growth potential in areas where the Nowra Heath-myrtle occurs specifically to conserve the species.

The additional costs of relocating growth to other locations are:

- Loss of revenue to the government from development of state land;
- Increased infrastructure costs for relocated growth,
- Loss of prime crop and pasture land;
- Major infrastructure costs incurred earlier;
- Increased travel to work from relocated growth areas; and
- Lower level of services in the western expansion areas due to smaller population.

Restrictions on the future use of private land in the catchments of Flat Rock and Cabbage Tree Creeks could lead to costs being incurred in terms of benefits foregone. Without knowing what type of alternative land uses might be considered for these areas it is impossible to assess social and economic costs which might arise from the need to protect or minimise the impacts on the Nowra Heath-myrtle

The Nowra Bypass corridor passes through the population of the Nowra Heath-myrtle in the Cabbage Tree Creek catchment. If and when the construction of a bypass is given detailed consideration and environmental assessment, ameliorative or protective measures required for the Nowra Heath-myrtle may add to the costs of bypass construction.

It is possible that other development proposals which have potential to impact indirectly on the Nowra Heath-myrtle such as residential development in the catchments of Sandy and Cabbage Tree Creeks may need to be modified (at some additional cost) in order to ensure the protection of the species.

9 Roles and Interests of Indigenous People

The Local Land Councils, elders and other groups representing indigenous people in the areas where the Nowra Heath-myrtle occurs have been identified and a copy of the draft Recovery Plan sent to them. Their comments on this draft have been sought and will be considered in the preparation of the final Recovery Plan. It is also the intention of the Recovery Team to consider the role and interests of these indigenous communities in the implementation of the recovery actions identified in this plan.

10 Biodiversity Benefits

The protection of the Nowra Heath-myrtle will, in turn, lead to some protection being accorded to the bushland in which it is found and other plant species associated with this bushland, some of which may also be threatened (e.g. Nowra Mallee *Eucalyptus langleyi*) or nationally rare (e.g. Many-veined Wattle *Acacia subtilinervis*, Nowra Tea Tree *Leptospermum sejunctum* and Hop Bush *Dodonaea rhombifolia*). In addition, threatened fauna species in habitat occupied by the Nowra Heath-myrtle include: Yellow Bellied Glider, Giant Burrowing Frog, Glossy Black-Cockatoo and possibly also Southern Brown Bandicoot, White Footed Dunnart, Large Pied Bat and Large-footed Myotis. The biodiversity benefits accruing in this way will depend in part on the size of the area protected and the type of land management regimes applied.

11 Preparation Details

Stephen Clark of the NSW National Parks and Wildlife Service (NPWS) prepared this Recovery Plan with input from members of the Nowra Heath-myrtle Recovery Team. Michael Saxon (Manager Threatened Species Unit, Southern Directorate of NPWS) performed final editing.

The Recovery Team is a non-statutory group of expert biologists, landowners/managers and other stakeholders and has been established by the NSW NPWS to discuss and resolve issues relating to the conservation and management of the species.

12 Review Date

In relation to its status as the State endorsed Recovery Plan for Nowra Heath-myrtle, any major changes to this Recovery Plan will require the revised Plan to be placed on public exhibition in NSW and re-approval by the NSW Minister for the Environment. The NPWS or other Recovery Team members should be contacted if it is believed any change to the Recovery Plan or to the Recovery Program should be considered. This Recovery Plan is to be formally reviewed by the NPWS in conjunction with the Recovery Team within 5 years from the date of publication of the Plan.

13 References

Bean, A. R. (1995). Reinstatement and revision of *Triplarina* Raf. (Myrtaceae). *Austrobaileya* 4: 353-367.

Hogbin, P. (2000). The reproductive ecology of *Triplarina nowraensis* (Myrtaceae). Unpubl. Report. NSW NPWS.

Hogbin, P. (2002). The impact of elevated nutrient levels on the growth and survival of the Endangered plant *Triplarina nowraensis*. Unpubl. Report. NSW NPWS.

Mills, K. (1998a). Rare Plant Species in the Illawarra 2: *Triplarina nowraensis* (Myrtaceae). *Illawarra Vegetation Studies (11),* Coachwood Publishing, Jamberoo, NSW.

Mills, K. (1998b). Vegetation Survey Methods and Natural Vegetation Types in the Coastal Parts of the City of Shoalhaven, New South Wales. *Illawarra Vegetation Studies (7),* Coachwood Publishing, Jamberoo, NSW.

Table 1: Estimated costs of implementing the actions identified in the Recovery Plan are provided below.

Action No.	Action Description	*Priority	^Feasibility	Responsible Party	Fund source	Cost Estimate ($'s/year)					Total Cost ($'s)
						Year 1	Year 2	Year 3	Year 4	Year 5	
1.1	Protect Nowra Heath-myrtle from impact from road and track maintenance	2	100%	NPWS	'in kind'	900	300	0	0	0	1,200
1.2	Liaise with the Shoalhaven Bush Fire Management Committee to protect the Nowra Heath-myrtle from frequent fire	2	100%	NPWS	'in kind'	900	300	0	0	0	1,200
1.3	Carry out powerline maintenance to minimise impact on Nowra Heath-myrtle	2	100%	Integral Energy	'in kind'	300	300	0	0	0	600
2.1	Undertake survey work to complete information on the distribution of the species	1	100%	NPWS	'in kind'	1,500	0	0	0	0	1,500
2.2	Establish a program to monitor populations to detect impacts from identified threats and assess the effectiveness of recovery actions	1	100%	NPWS	Cash	900	300	1,200	0	0	2,400
3.1	Initiate research on the response of the species to different fire regimes	3	80%	NPWS	Cash	0	2,500	2,500	0	0	5,000
3.2	Initiate research on the genetics of the species	2	80%	NPWS	Cash	0	0	0	4,000	0	4,000
4.1	Prepare guidelines to ensure adequate assessment of any development proposals which may affect Nowra Heath-myrtle	2	100%	NPWS	'in kind'	0	1,500	0	0	0	1,500
4.2	Integrate water quality monitoring of Mundamia and Cabbage Tree Creeks with Shoalhaven City Council's current program	2	100%	Shoalhaven CC	Cash	?	?	?	?	?	?
5.1	Investigate the feasibility of conservation reserves to ensure the long term protection of the species	1	100%	NPWS	'in kind'	0	1,500	1,500	0	0	3,000
5.2	Develop alternative protection measures where it is not feasible to include populations in conservation reserves	2	80%	NPWS	'in kind'	0	2,100	2,100	0	0	4,200
5.3	Investigate possibility of rezoning land supporting populations of Nowra Heath-myrtle to Environmental Protection 7(A) Ecology	2	80%	Shoalhaven CC	'in kind'	?	?	?	?	?	?
6.1	Inform relevant community groups of the importance of the conservation of the species	3	100%	NPWS	Cash	0	0	1,000	0	0	1,000
6.2	Where possible involve local community groups in actions to protect the species	3	90%	Recovery Team	'in kind	600	600	600	0	0	1,800
6.3	Assess commercial potential for the species	3	100%	NPWS	'in kind'	600	0	0	0	0	600
Total					**Cash**	**900**	**2,800**	**4,700**	**4,000**	**0**	**12,400**
Total					**'in kind'**	**4,800**	**6,600**	**4,200**	**0**	**0**	**15,600**

Total	**Annual cost of Nowra Heath-myrtle Recovery Program**				**Inkind + Cash**	**5,700**	**9,400**	**8,900**	**4,000**	**0**	**28,000**

sCostings are based on 2002 dollars rates.

* Priority ratings as defined by Commonwealth Recovery plan guidelines: 1 - action critical to prevent extinction, 2 - action prevents negative impact short of extinction,

^Feasibility assessment reflects estimated chance of success of the action on a scale of 0-100%.

Appendix 1. Summary of information for the five populations of Nowra Heath-myrtle

Population	Size	Tenure	Threats	Protection Approaches	Suggested long term management approach
A	32,000	Crown Land (subject to land claim) and private	Landfill runoff, Development and Fire	Actions 1.2, 3.1, 4.1, 4.2, 5.2 and 5.3	Seek VCAs with landholders
B	13,000 (11,600 in Nature Reserve)	Crown Land (subject to land claim) and Nature Reserve	Landfill runoff, Development and Fire	Actions 1.2, 3.1, 4.1, 4.2, 5.2 and 5.3	Seek VCAs with landholders
C	3,500 (2,300 in Nature Reserve)	Nature Reserve and private	Development, Fire	Actions 1.2, 3.1, 4.1, 5.2 and 5.3	Seek VCAs with landholders
D	200	Crown Land (subject to land claim)	Fire, Track Maintenance	Actions 1.1, 1.2, 3.1 and 5.1, 5.2, 5.3	Depending on outcomes of consideration of land claim – convert to National Park or Seek VCAs with landholder
E	22,000	Crown Land	Fire, Track Maintenance, Powerline maintenance	Actions 1.1, 1.2, 1.3, 3.1, 5.1 and 5.2, 5.3	Convert to National Park or Seek VCAs with landholder

Action 1.1 – Protect Nowra Heath-myrtle from impacts of road and track maintenance
Action 1.2 – Liaise with Shoalhaven Bush Fire Management Committee to protect species from frequent fire
Action 1.3 – Carry out powerline maintenance to minimise impact on Nowra Heath-myrtle
Action 3.1 – Carry out research on response of the species to fire regimes
Action 4.1 – Prepare guidelines for development assessment
Action 4.2 – Develop and implement an integrated water quality monitoring program
Action 5.1 – Investigate feasibility of further conservation reserves
Action 5.2 – Develop alternative protection approaches where conservation reserves not possible
Action 5.3 – Investigate feasibility of rezoning land to Environmental Protection 7(A) Ecology

Appendix 2: Making a submission regarding this Draft Recovery Plan

You are invited to make a written submission to the NPWS regarding this draft Recovery Plan. To make your submission as effective as possible, please:

- refer to the section or action of the plan you wish to address;
- briefly explain the reasons for your comments,
- providing source information or examples where possible; and
- provide your name and address to enable receipt of your submission to be acknowledged.

The NPWS will consider all written submissions received during the period of public exhibition and must provide a summary report of those submissions to the Minister for the Environment prior to final approval of this Recovery Plan.

Please note, that for the purposes of the NSW *Privacy and Personal Information Protection Act* 1998 any comments on this draft Recovery Plan, including your personal details, will be a matter of public record and will be stored in the NPWS records system. Following approval of the plan by the Minister, copies of all submissions, unless marked 'confidential', will be available, by arrangement, for inspection at the NPWS office responsible for the preparation of the Recovery Plan.

Should you not wish to have your personal details disclosed to members of the public once the Recovery Plan has been adopted, please indicate below whether you wish your personal details to remain confidential to NPWS and not available for public access. Further information on the *Privacy and Personal Information Protection Act* 1998 may be obtained from any office of the NPWS or from the website: www.npws.nsw.gov.au.

Submissions should be received no later than the advertised date. Submissions should be addressed to:

The Director General
c/o Threatened Species Unit,
NPWS Southern Directorate
PO Box 2115
Queanbeyan NSW 2620
Ph: (02) 6298 9700

Submission regarding the Draft Recovery Plan for the Nowra Heath Myrtle

Please ensure that you provide the information in the box below if you do not use the following form to make your submission.

Name Individual/ Organisation: .....

Postal Address .....

Postcode: ..... Contact Number(s): .....

Date: .....

❒ Yes, please keep my personal details confidential to the NPWS

Submission:

NSW
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