TWWHA Bushfire and Climate Change Research Project

Tasmanian Government's Response

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Tasmanian Climate Change Office
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1. BACKGROUND

1.1. Tasmanian Wilderness World Heritage Area 2016 bushfires

The Tasmanian Wilderness World Heritage Area (TWWHA) is one of Tasmania's iconic places. It contains globally significant examples of natural and cultural heritage and is an important natural, cultural, economic and social State asset.

In January and February 2016, Tasmania recorded thousands of lightning strikes, which started multiple fires in exceptionally dry climatic conditions (Tasmanian Government 2016). From 13 January to 15 March 2016, 229 vegetation fires affected approximately 126,800 hectares across Tasmania, including an estimated 19,800 hectares (around 1.3 per cent) of the TWWHA (Press 2016).

The 2016 firefighting effort was unprecedented and the total unbudgeted cost of the bushfires has been estimated at $55.45 million[1]; $12.02 million[2] of which was for the protection of natural and cultural values within the TWWHA.

The fires highlighted the need to consider the impact of climate change on future bushfire risk in the TWWHA and subsequent funding implications to protect this iconic region through appropriate management and response.

1.2. TWWHA Bushfire and Climate Change Research Project

In response to the 2016 fires, the Tasmanian Government committed $250,000 to investigate the impact of climate change on the TWWHA and to identify ways to improve how Tasmania prepares for, and responds to, bushfires in the TWWHA (Premier of Tasmania 2016).

The TWWHA Bushfire and Climate Change Research Project used leading edge research from the Australian science community led by eminent researcher Dr Tony Press, Adjunct Professor with the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC).

The Research Project was overseen by a high-level Steering Committee with representatives from the Tasmanian Government (Department of Premier and Cabinet (DPAC); Department of Primary Industries, Parks, Water and Environment (DPIPWE); Department of Police, Fire and Emergency Management) and the Australian Government (Department of the Environment and Energy).

A key component of the Research Project involved a comprehensive review and gap analysis of research and activities relating to bushfires in the TWWHA. This analysis considered the Prevention, Preparedness, Response and Recovery (PPRR) risk assessment bushfire model. As a result, the Final Report identifies current operational practice, work and research underway, and areas for future work and research relating to these areas.

[1] Estimate provided by the Department of Premier and Cabinet's Office of Security and Emergency Management in August 2017.
[2] Estimate provided by the Department of Premier and Cabinet's Office of Security and Emergency Management in August 2017.

1.3. Final Report for the Research Project

Dr Press provided the independent Final Report for the Research Project to the Tasmanian Government on 2 December 2016. The Final Report is available on DPAC's Tasmanian Climate Change Office website at www.climatechange.tas.gov.au.

The Final Report summarises the work undertaken through the Research Project, confirms that Tasmania has well-developed bushfire management procedures for the TWWHA, and provides recommendations to the Tasmanian Government regarding the future management of bushfire threat in the TWWHA.

The results of the Research Project, as communicated in the Final Report, indicate that Tasmania is likely to experience increasing bushfire risk as a result of a changing climate, which will have significant implications for future fire management in the TWWHA.

The Final Report states that protecting the natural and cultural values of the TWWHA will require actions beyond 'business as usual' and will also require decisions and investments to be made on a whole-of-government basis.

2. TASMANIAN GOVERNMENT'S RESPONSE

2.1. Purpose and context

The purpose of this document is to communicate the Tasmanian Government's response to the Final Report for the Research Project. It outlines the Government's position in relation to each of the recommendations and highlights current action in relation to implementation.

The recommendations are comprehensive, multifaceted and interrelated in nature. They yield both short and longer-term considerations for the Tasmanian Government, particularly in relation to strategic planning, resourcing and funding.

2.2. Summary of response

As outlined in Table 1 (Summary of Tasmanian Government's response to Final Report), the Tasmanian Government supports the recommendations, noting that the following recommendations are supported in part given implementation requires longer-term strategic planning, resourcing and funding considerations:

- Recommendation 4 (Monitoring the consequences of fire);
- Recommendation 7 (Lightning and ignition detection);
- Recommendation 8 (Capital investment);
- Recommendation 12 (Fire suppression techniques and methods); and
- Recommendation 17 (Role of bushfire Rapid Risk Assessment).

The Government's overarching support of the recommendations aligns with its commitment to protecting the TWWHA through continuous improvement in fire management.

2.3. Funding considerations

Existing funding arrangements

There is an existing partnership arrangement between the Australian Government and the Tasmanian Government for protecting the outstanding natural and cultural heritage of the TWWHA. This partnership arrangement is formalised under the Convention Concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention) and the associated Australian World Heritage Intergovernmental Agreement.

At present, the Australian Government provides the Tasmanian Government with $3.4 million per annum (baseline funding until 2018) to assist with management of the TWWHA under a World Heritage Grants Funding Agreement (Press 2016). The Tasmanian Government contributes a minimum of $4.9 million per annum (Press 2016).

In 2015, the Australian Government committed to supporting Tasmania in strengthening its management of the TWWHA by providing an additional $10.2 million, over four years from 2014-15, for its protection, conservation, presentation and rehabilitation (Press 2016).

To date, this partnership arrangement for the TWWHA has funded numerous activities that have increased Tasmania's capacity to manage and reduce the impacts of fires.

Under current arrangements, only firefighting costs related to the protection of infrastructure and community are eligible for assistance as a standard measure under the Australian Government's Natural Disaster Relief and Recovery Arrangements (NDRRA). Firefighting costs related to environmental protection are not eligible for partial reimbursement under the NDRRA unless approved by the Prime Minister. On 28 July 2017, the Prime Minister agreed to contribute 50 per cent of the costs of defending the TWWHA from the 2016 bushfires as an 'exceptional circumstances' measure under the NDRRA. This additional assistance of around $6 million is appreciated by the Tasmanian Government and is an excellent outcome. It demonstrates both a strong commitment by the Australian Government to protecting the TWWHA and an understanding of the extraordinary nature of the firefighting effort.

Tasmanian Government funding

The Tasmanian Government has allocated additional funding of $4 million over four years in the 2017-18 Budget for bushfire management in the TWWHA. This funding will support the implementation of a number of the Final Report's recommendations and will make a valuable contribution to enhancing the capability of DPIPWE's Parks and Wildlife Service (PWS) to manage bushfires in the TWWHA.

The new funding will directly contribute to improving bushfire management planning, bushfire risk assessment and modelling, bushfire recovery, developing a model of fire cover, and undertaking planned burning in the TWWHA. The funding will assist in addressing current knowledge gaps and building capability, and in prioritising strategic investment and activities to mitigate and supress bushfires in the short, medium and long-term. It will also contribute to the Tasmanian Government's commitment to meet national and international responsibilities to protect the outstanding universal value of the TWWHA.

Of the $4 million in new funding, $2 million will focus on supporting fuel reduction activities within and adjacent to the TWWHA. This will support broad-scale fire mitigation activities, primarily fuel reduction burning, to reduce the risk of fires impacting on TWWHA values. It will also assist in protecting critical electricity generation and transmission infrastructure inside and adjacent to the TWWHA.

2.4. Related investigations

Two external investigations related to the Research Project have been undertaken and relevant elements of these activities have been considered in this response.

- The Australasian Fire and Emergency Service Authorities Council (AFAC) undertook an independent operational review into the management of the Tasmanian fires of January 2016 (AFAC 2016). The AFAC Review report was publicly released in April 2016 and provided Tasmania's fire agencies with 12 recommendations.
- On 17 March 2016, the Australian Senate called an inquiry into the 'Responses to, and lessons learnt from, the January and February bushfires in remote Tasmanian wilderness'. The Senate Inquiry's report was released in December 2016 and the majority of its recommendations relate specifically to the Australian Government.

Table 1: Summary of Tasmanian Government's response to the Final Report

Recommendation	Tasmanian Government's response
1. Comprehensive fire management planning	SUPPORT
Bushfire Prevention	
2. The Bushfire Risk Assessment Model (BRAM)	SUPPORT
3. Objectives for planned burns	SUPPORT
4. Monitoring the consequences of fire	SUPPORT IN PART
Bushfire preparedness	
5. Research on fire, and natural and cultural heritage values	SUPPORT
6. Research on fire vulnerability, fire behaviour and fire model inputs	SUPPORT
7. Lightning and ignition detection	SUPPORT IN PART
8. Capital investment	SUPPORT IN PART
Bushfire response	
9. Mapping of values	SUPPORT
10. Operational capability	SUPPORT
11. Use of volunteers	SUPPORT
12. Fire suppression techniques and methods	SUPPORT IN PART
13. Aerial fire suppression	SUPPORT
14. Research on fire suppression chemicals	SUPPORT
15. Use of fire suppression chemicals	SUPPORT
16. Improved public information and communications	SUPPORT
Bushfire recovery	
17. Role of bushfire Rapid Risk Assessment	SUPPORT IN PART
18. Ecosystem rehabilitation and restoration trials	SUPPORT

3. RECOMMENDATIONS AND RESPONSE

3.1. Fire management arrangements for the TWWHA

Recommendation 1 – Comprehensive fire management planning

Clear, well-defined objectives for fire management should be incorporated into a Fire Management Plan for the TWWHA. These objectives should identify how fire management (fire suppression, 'let go' and management fires) will be used to protect and conserve the natural and cultural heritage values in the TWWHA.

The Fire Management Plan for the TWWHA should clearly set out the circumstances in which priority will be given to protecting the Outstanding Universal Value of the TWWHA over built assets within its boundaries.

Response: SUPPORT

Tasmanian Government position

The Tasmanian Government considers that the development of a fire management plan for the TWWHA is a key component of preparing for future fire risk in the region.

PWS is the operational manager for approximately 97 per cent of the TWWHA and meets its responsibility for managing bushfires in the region through a combination of activities. These activities are guided by the TWWHA Management Plan 2016, and other well-developed policies and plans covering bushfire prevention, preparedness, response and recovery.

The Management Plan prescribes the development of a holistic fire plan for the TWWHA that integrates all aspects of fire management. The Plan:

- includes objectives to guide the use of fire management;
- provides guidance on protection of outstanding universal values over other values and built assets;
- integrates cultural and ecological burning;
- maps strategic and priority actions for burning;
- identifies areas for strategic protective burning and cultural landscape burning;
- guides an increase in the level of planned burning and cultural landscape burning; and
- guides an increase in the level of planned burning to meet modelled risk management requirements (DPIPWE 2016).

The Management Plan also includes an action to implement and periodically update the Regional Strategic Fire Management Plans, which have been developed by PWS for each of its operational regions: Northern (DPIPWE 2009), Northwest (DPIPWE 2012) and Southern (DPIPWE 2011). The overarching principle of these Plans is to ensure that PWS's approach focuses resources on the areas with the highest levels of identified bushfire risk. The Regional Strategic Fire Management Plans inform the management of fire in the TWWHA, with bushfire risk assessment as their basis. The Plans cover fire prevention, preparedness, response, restoration, resource requirements, and standards monitoring and reporting (Press 2017).

Tasmanian Government action

The additional State funding in the 2017-18 Budget for bushfire management in the TWWHA will contribute to the development of a holistic fire management plan for the TWWHA.

PWS has commenced work on a number of components relating to fire management in the TWWHA, which will be incorporated in the fire management plan. This includes drafting a fire management zoning scheme and developing associated ecological, asset protection and strategic burning units.

The Bushfire Risk Assessment Model (BRAM) outlines the circumstances in which priority will be assigned to protecting TWWHA values. The role of BRAM in relation to identifying risk and potential impact of bushfires in Tasmania is discussed further in the response to Recommendation 2 (The Bushfire Risk Assessment Model).

3.2. Bushfire prevention

Recommendation 2 – The Bushfire Risk Assessment Model (BRAM)

The Tasmania Parks and Wildlife Service and DPIPWE should maintain an ongoing program of investment in, and development of, fire management tools, including BRAM and the Bushfire Operational Hazard Model (BOHM). As BRAM is used across all agencies and tenures in Tasmania, it is imperative that it is fully auditable, and that its structure, inputs and operability are regularly reviewed.

BRAM should be fully integrated as a whole-of-government decision-support system with appropriate governance structures established accordingly; and readily accessible by all Tasmanian fire agencies and incident management teams.

BRAM should be supported to a greater extent than it is at the present time. The current level of operation means that its full capacities are not being used, and the incorporation of new information and programming is restricted. It should be noted that while BRAM is an excellent tool to consider the spatial arrangement of risk, other risk modelling tools are available that simulate the spread of fire and these are now routinely used in fire management. BRAM cannot be considered as the sole bushfire risk assessment tool available for the TWWHA.

The current design of BRAM, however, limits the practical availability and use of the system to a small group of fire management officers within the Tasmania Parks and Wildlife Service. There would be significant benefit in increasing the accessibility of BRAM by rebuilding it as a new computer system that is available to inform fire managers in the Parks and Wildlife Service, Sustainable Timber Tasmania (previously Forestry Tasmania) and the Tasmania Fire Service, and from wherever they may be operating, to make critical decisions on priorities and dispatch in conjunction with other fire behaviour modelling tools. The provision of training on BRAM to a wider range of operational users is also required.

It is imperative that BRAM continues to incorporate the best knowledge of fire behaviour models. Enhancement of the system should include use of appropriate fire-spread simulation tools for new vegetation types (such as moorland) when they are developed. Existing fire behaviour models and fire simulators should not be misused, that is, used beyond the vegetation types and fuels for which they have been validated.

Response: SUPPORT

Tasmanian Government position

The Tasmanian Government agrees that bushfire risk assessment and modelling, using BRAM and the associated BOHM, is an important component of bushfire management in both the TWWHA and statewide.

BRAM is a computer modelling system that uses data from multiple sources to develop predictive modelling and mapping that identifies the risk and potential impact of bushfires in the State, including the TWWHA (Press 2016). BRAM is a decision support tool that assists in prioritising mitigation activities, such as fuel reduction burning, based on the risk assessment undertaken.

Use of BOHM further applies BRAM outputs by supporting the prioritisation of suppression or other response activities when bushfires approach or threaten particular values (Press 2016).

BRAM is being used to inform PWS's Regional Strategic Fire Management Plans. It is also used by fire duty officers for daily preparedness throughout the bushfire season and for determining values at risk and suppression priorities once fires start.

The Tasmanian Government agrees there are opportunities for improvement regarding BRAM and BOHM. This includes enhancing the accessibility and usability of BRAM so it is available to assist managers across Tasmania's fire agencies, and providing ongoing support to continuously improve the system. Outlined below are opportunities to improve the accuracy and precision of the data input to BRAM.

Tasmanian Government action

BRAM is an operational system updated annually by PWS. To ensure BRAM incorporates up-to-date data, DPIPWE's Natural and Cultural Heritage Division prepares annual updates on biological and geoheritage consequence data, which provides input to BRAM on natural values.

PWS is augmenting the operational capacity of BRAM to support decision making. This involves developing BOHM, which takes into account daily and forecasted weather observations to calculate fire weather indices and fire behaviour values, based on vegetation types and fuel loads. BOHM will assist personnel making resource deployment decisions, based on risk and the availability of resources, to prepare for and dispatch in response to bushfires.

The additional State funding in the 2017-18 Budget for bushfire management in the TWWHA will contribute to progressing work to enhance the capability of BRAM as a whole-of-government resource. As noted in the recommendation future development of BRAM will involve consultation with all relevant agencies including TFS and Sustainable Timber Tasmania with a focus on integrating Tasmanian Emergency Risk Assessment Guideline (TERAG) criteria. In light of this funding, PWS has commenced work to upgrade BRAM.

Additionally, the Natural and Cultural Heritage Division has commenced work to lodge the natural values consequence data from BRAM within DPIPWE's Common Operating Platform (COP). This work is contributing to enhancing the accessibility of BRAM, as COP provides a useful resource from which to make BRAM outputs available on a whole-of-government level.

The Government will also give further consideration to other bushfire risk assessment modelling tools for the TWWHA, which could be integrated with BRAM and BOHM. This is a longer-term consideration, as models can only be considered for incorporation into BRAM when they have been appropriately reviewed and are deemed suitable to the TWWHA.

Recommendation 3 – Objectives for planned burns

Clear objectives (at the strategic and program levels) should be set for management burning in the TWWHA.

The short, medium and long-term results of management fires should be monitored to evaluate the fires against specified objectives, and the findings used to retain, improve or modify approaches taken to management burning.

Burning programs should reflect the best available evidence. Fire simulation modelling tools should be used to guide the development of planned burning programs to meet objectives and new data incorporated into the models as they become available.

As with other management activities, the monitoring of management burns should be actively incorporated into the adaptive management framework for the TWWHA.

Similarly, the re-introduction of Indigenous burning practices should have clear objectives, and monitoring should be incorporated into the adaptive management framework for the TWWHA.

Response: SUPPORT

Objectives for planned burns, and monitoring the results of planned burns

Tasmanian Government position

Planned burning is used as a management tool in the TWWHA, where it is appropriate to do so, and where funding permits, to achieve a number of key objectives.

The Final Report observes that although there is some guidance provided by the Regional Strategic Fire Plans, there is no overall direction for undertaking planned burns in the TWWHA in any single existing document (Press 2016).

The Tasmanian Government agrees that clear objectives, at the strategic and program levels, should be set for management burning in the TWWHA. Furthermore, the Government agrees that planned burning should adopt an adaptive management approach that aims to use best available knowledge and evidence to inform and review fire management strategies and actions.

The Management Plan includes two actions relating to planned burning. The first action provides that if research suggests planned burning continues to be a viable strategy, then planned burning of moorlands and grasslands in the TWWHA should be substantially expanded to establish an appropriate age structure. The second action provides that burning guidelines continue to be adapted, including risk management programs, to maintain appropriate fire regimes in treatable vegetation types as suitable climate change projections become available.

Tasmanian Government action

PWS has set clear objectives for current burning activities in the TWWHA, which will be incorporated into the fire management plan for the TWWHA (refer to Recommendation 1 (Comprehensive fire management planning)).

As noted in the response to Recommendation 1, the additional State funding in the 2017-18 Budget for bushfire management in the TWWHA will contribute to the development of a fire management plan for the TWWHA. The additional Government funding will also support broad-scale fire mitigation activities, primarily fuel reduction burning, to reduce the risk of fires impacting on TWWHA values.

ACE CRC is undertaking a Prescribed Burning Project to investigate the changing opportunities for planned burning in Tasmania under a changing climate. The Tasmanian Government continues to provide in-kind support for this Project. The results will help inform future planned burning regimes, both in the TWWHA and statewide, and will also improve knowledge of the interaction between climate change, burning and impacts on vegetation types.

The Natural and Cultural Heritage Division has a well-established program of ecological fire research. Within this, moorland and grassland monitoring projects are addressing the ecological impacts of planned burning on these environments. For example, experimental burning of grassland to improve biodiversity is underway and a project assessing impacts of planned burning on organic soils is under development. The Natural and Cultural Heritage Division's research will be adapted, as necessary, in response to further refinement of planned burning objectives, burning outcomes, and the findings of the ACE CRC research.

Fire simulation modelling tools to guide planned burning

Tasmanian Government position

The Tasmanian Government agrees that fire simulation modelling should be used to guide the development of planned burning programs in the TWWHA.

A landscape fire simulation modelling tool, FIRESCAPE-SWTAS, has been developed for South-West Tasmania. The tool explores the benefit, in terms of reduction of damage to natural values, provided by planned burning. This tool has provided significant insight into the role planned burning in buttongrass can play in reducing the threat to natural values of unplanned fires in the TWWHA (Press 2016).

The Tasmanian Government acknowledges that the insight provided by FIRESCAPE-SWTAS is currently limited by the quality of data and the models available as inputs at the time the tool was developed (Press 2016). The Government agrees that the tool needs to be updated.

Tasmanian Government action

A project proposal to update FIRESCAPE-SWTAS was developed through the Research Project. The Research Project also funded Dr Press and ACE CRC to prepare an application for funding through the National Emerging Science Program Emerging Priorities Fund. The application was successful and ACE CRC has established a project to enhance FIRESCAPE-SWTAS. The project will take into account improved fire weather modelling, fuel layers and other spatial data. The project will also expand the tool so that it encompasses the whole of the TWWHA including the South West Conservation Area and other land adjacent to the western boundary of the TWWHA. This project will include an assessment of how FIRESCAPE-SWTAS performs under projections of climate change.

Improvements to fire simulation modelling will enhance PWS's ability to develop and validate planned burn programs, better understand the costs and benefits of planned burning for TWWHA values (eg mitigating impacts on values, reducing the number of bushfires and the area of fire burnt in bushfires), and improve the ability to demonstrate and communicate a systematic and scientific approach to planning fuel reduction programs.

There are also several projects underway in the Natural and Cultural Heritage Division that will produce data relevant to fire simulation modelling in the TWWHA.

Aboriginal burning practices

Tasmanian Government position

Planned burning is not only about bushfire prevention, Aboriginal people have been applying fire for cultural reasons in the TWWHA for thousands of years (Press 2016).

The Tasmanian Government acknowledges that there is a need to develop as complete an understanding as possible of Aboriginal burning practice and fire regimes across the TWWHA, to assist in developing future planned fire regimes. This needs to draw on all lines of evidence, including cultural, historic and scientific sources (Press 2016). The Management Plan includes an action to engage Aboriginal people to develop protocols that allow the use of fire as a traditional cultural practice (DPIPWE 2016).

The re-introduction of Aboriginal involvement in planned burning requires a partnership to be developed, and a new vision of planned burning that integrates objectives on cultural aspirations, biodiversity management and management of bushfire risk (Press 2016).

Tasmanian Government action

The Management Plan includes a key desired outcome and commitment to engage Aboriginal people to develop protocols that allow the use of fire as a traditional cultural practice. This work will be undertaken through an evaluated case study.

The Tasmanian Government is seeking to better understand and determine Aboriginal cultural values through projects including the Aboriginal Cultural Values Survey (AACV) project. An outcome of future projects on cultural values will involve consultation and engagement with the Aboriginal community and could include a focus on developing an increased understanding of the Aboriginal cultural values associated with Aboriginal burning practices, along with identifying a case study and/or project that focuses on this value.

The implementation of projects on cultural burning practices would involve DPIPWE's Aboriginal Heritage Tasmania consulting with the Aboriginal community in order to develop a framework that captures the aspirations and objectives around Aboriginal burning practices within the TWWHA. The knowledge and implementation of the projects could inform land managers of past fire use within the TWWHA property boundaries.

Discussions between Aboriginal Heritage Tasmania and PWS regarding strategies on how to reintroduce Aboriginal burning practices will be ongoing. Objectives of reintroducing Aboriginal burning practices include but are not limited to:

- maintaining a cultural landscape;
- reintroducing mosaic burns to different vegetation types;
- providing the Aboriginal community with access to the TWWHA; and
- providing opportunities for Aboriginal people to be involved in all aspects of land management within the TWWHA.

Consultation and engagement with the Aboriginal community on this matter is expected to occur over the life of the Management Plan.

Recommendation 4 – Monitoring the consequences of fires

The short, medium and long-term impacts of planned and unplanned fires should be monitored in order to understand the consequences of fire for the natural and cultural values of the TWWHA.

The findings of this monitoring should be used to plan future response to bushfires and to inform decisions about the use of management burning.

As with other management activities, monitoring the impacts of bushfire management should be actively incorporated into the adaptive management framework for the TWWHA.

Response: SUPPORT IN PART

Tasmanian Government position

The Tasmanian Government acknowledges that understanding the fire ecology of ecosystems present in the TWWHA is necessary in order to develop sustainable planned burning programs, and to protect the region's fire-sensitive and fire-dependent values.

Furthermore, the Tasmanian Government agrees that the short, medium and long-term impacts of planned and unplanned fires should be monitored in order to understand the consequences of fire for the natural and cultural values of the TWWHA.

The Government notes that the Senate Inquiry Report recognises the importance of identifying the ecological and biodiversity impacts of fire on the TWWHA's fire-sensitive natural values (Commonwealth of Australia 2016).

Tasmanian Government action

Fire ecology research and monitoring undertaken by DPIPWE has prioritised the TWWHA's unique buttongrass moorland vegetation, where planned burning plays both a crucial ecological and fire protection role. To date, a significant amount of research undertaken by DPIPWE, universities, CSIRO and non-government organisations has contributed to Tasmania's understanding of buttongrass vegetation ecology and, therefore, planned burning. As a result of this research, the Tasmanian Government understands that planned burning has an important ecological role in maintaining buttongrass moorland as well as a role in protecting fire-sensitive values in the TWWHA. The information obtained through research and monitoring continues to be used to plan future responses to bushfires and to inform decisions about the use of management burning.

At present, the impacts of planned burning in the TWWHA are assessed via the Reserve Activity Assessment process undertaken by PWS, which mandates an annual internal review of proposed planned burns. As outlined in the response to Recommendation 3 (Objectives for planned burns), PWS has set clear objectives for current planned burning activities in the TWWHA, which will be incorporated into the fire management plan for the TWWHA.

3.3. Bushfire preparedness

Recommendation 5 – Research on fire, and natural and cultural heritage values

An ongoing program of scientific research and monitoring should be maintained in the TWWHA that supports understanding:

- the interaction between climate change and the natural and cultural values of the TWWHA; and
- the evolving relationship between climate change and the projected impacts of fire on natural and cultural values in the TWWHA.

This research should focus, in the first instance, on those values that are expected to be most vulnerable in the short-term (for example, relict Gondwanan flora).

This program of research should involve a broad spectrum of the research community, as well as personnel from DPIPWE and other Tasmanian Government agencies.

The program of research should be regularly reviewed and audited. The 'DPIPWE TWWHA Bushfire Research Group' should continue to be actively engaged in the process of developing objectives for this research program.

Attachment 9[3] sets out a prospective list of priority research to support fire management in, and the understanding of the impacts of fire on, the World Heritage values of the TWWHA.

Response: SUPPORT

Tasmanian Government position

The findings of the Research Project indicate that the TWWHA is likely to experience increasing bushfire risk as a result of a changing climate, and that the conditions that led to the 2016 bushfires are expected to become more frequent as the century progresses (Press 2016). This increase in risk poses a major challenge to fire management in the TWWHA and the long-term protection of its natural and cultural values (Press 2016).

The Tasmanian Government acknowledges that an ongoing program of scientific research and monitoring, focusing on the impacts of a changing climate on TWWHA values, is important in order to inform bushfire management in the region.

The Final Report provides a prospective list of priority research to support fire management in the TWWHA and to improve the understanding of the impacts of fire in the region. The Tasmanian Government's response to each of the priority research areas is included in the responses to the 18 recommendations, as specified in Attachment 1.

[3] The prospective list of priority research is provided at Attachment 1.

The Management Plan includes a number of actions relating to this recommendation. It includes an action to continue to monitor and investigate changes in priority ecosystems in the TWWHA, such as coastal and alpine areas, to identify where key climate change threats can be mitigated through the development of management strategies. The Management Plan also includes an action to continue climate change research in the TWWHA to determine the viability of planned burning as a long-term management tool, and determine strategies for projected fire weather and future fire risk assessments.

It is noted that the Senate Inquiry Report highlights the importance of providing qualitative and quantitative data specific to climate-related and ecological threats to the TWWHA (such as dry lightning strikes) (Commonwealth of Australia 2016).

Tasmanian Government action

The Tasmanian Government has a strong history of engaging with, and providing support to, the research community. It considers scientific research to be a critical component to envisioning and planning for what Tasmania's future might look like in a changing climate.

DPIPWE's TWWHA Bushfire Research Group continues to be engaged in the process of informing research objectives and developing collaborations for progressing fire research in the TWWHA. In addition, the Government's scientific research program on the impacts of a changing climate in the TWWHA will continue to be informed by existing climate change risk assessments, and existing research and monitoring plans and reports.

The Research Project provides another example of the Tasmanian Government engaging with the research community. It involved extensive engagement with, and input from, the Australian science community and used leading edge research to inform the Final Report's recommendations. The Research Project also commissioned new research relating to the impacts of a changing climate in the TWWHA, some of which is still underway.

The response to this Recommendation is closely linked with Recommendation 6 (Research on fire vulnerability, fire behaviour and fire model inputs).

The national Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) provides a coordinated national research effort relating to bushfire and other natural hazards. From July 2013, $47 million over eight years in Australian Government funding to support BNHCRC has been matched from state and territory government organisations, research institutions and non-government organisations (BNHCRC 2017).

Recommendation 6 – Research on fire vulnerability, fire behaviour and fire model inputs

In the short to medium-term, significant research effort should be directed to:

- further understanding the consequential interactions of climate change with fire vulnerability, behaviour and impact;
- understanding fire behaviour and flammability thresholds, particularly in dry conditions, of organic soils and the interaction between climate change, fire and organic soils;
- developing a comprehensive understanding of soil and fuel moisture in the various vegetation communities in the TWWHA; efficient methods to monitor and model soil and fuel moisture across the vegetation types in the TWWHA; and the development of reliable soil moisture indices for the TWWHA that can then be incorporated into fire behaviour models and fire danger indices;
- developing techniques for more accurately assessing fuel loads and mapping fuel types in different vegetation communities in the TWWHA and incorporating these into fire behaviour models; and
- developing fire behaviour models and associated fire spread simulators for peatlands, grasslands, wet eucalypt forest, coniferous rainforest, rainforest without conifers, and other vegetation communities in the TWWHA.

This research should take into account national initiatives that are currently underway in the development of bushfire indices, and modelling and fire behaviour tools. The research should concentrate on those areas, soils and vegetation communities in the TWWHA that are not currently well represented in fire behaviour models and fire danger indices.

Response: SUPPORT

Tasmanian Government position

Understanding fire behaviour in different vegetation and fuel types is an important component of successful bushfire management. It assists fire managers in identifying which fires present the biggest threat. Fire behaviour modelling requires comprehensive soil moisture, fuel moisture and organic soil flammability threshold inputs (Press 2016).

To date, Tasmania's fire agencies have undertaken considerable work to inform the understanding of bushfire behaviour in the TWWHA, including research into rainforest flammability and establishing a fire behaviour model for buttongrass vegetation (Press 2016).

The Tasmanian Government acknowledges that there is an opportunity to improve the predictive power of fire behaviour models that are applicable to TWWHA vegetation types. The purpose of such modelling is to enhance the capacity of fire managers to prioritise and plan suppression operations during a bushfire event.

It is noted that the Senate Inquiry Report also highlights the need to develop fire assessment and modelling specifically suited to the TWWHA (Commonwealth of Australia 2016).

The Tasmanian Government understands that work is underway at a national level that will contribute to better fire spread prediction in the TWWHA, including the development of a high-resolution soil moisture system (Press 2016).

Tasmanian Government action

The Natural and Cultural Heritage Division has a project underway to assess fuel accumulation rate and distribution of sparse buttongrass moorland.

The University of Tasmania has received funding through the Tasmanian Bushfire Mitigation Grants Program to undertake a project to determine moisture thresholds for combustion of organic soils for key vegetation types in Western Tasmania (Premier of Tasmania 2017).

It is noted that the development and validation of fire behaviour models are long-term projects. In light of this, any Tasmanian Government investment in fire behaviour research will be considered as a long-term program of investment. Such investment may require further consideration in relation to investment in capital infrastructure to support associated soil and fuel moisture monitoring and incorporating information into relevant fire behaviour and risk assessment models.

As outlined in the response to Recommendation 5 (Research on fire and natural and cultural heritage values), the Government will continue to use appropriate consultative mechanisms, such as the Bushfire Research Group, to aid development of fire research objectives for the region.

Recommendation 7 – Lightning and ignition detection

The Tasmanian fire agencies, in consultation with the Australian Bureau of Meteorology, should keep abreast of emerging technologies for predicting and detecting lightning strikes and ignitions.

If, and when, new technologies become available, these should be incorporated into preparedness and response planning for bushfire in the TWWHA.

A detection strategy should be developed that details the bushfire detection arrangements for the TWWHA, based on contemporary ignition risks and detection methods.

Response: SUPPORT IN PART

Tasmanian Government position

Research undertaken through the Research Project indicates that lightning is the most significant cause of bushfire in the TWWHA. As such, prediction services for lightning events and the probability of fires starting are important tools in preparing for fire suppression in the TWWHA (Press 2016).

PWS participated in a State Fire Management Council initiated strategic review of fire detection strategies and systems in 2014. The Tasmanian Government supports the ongoing review of these systems and strategies.

Tasmanian Government action

Tasmanian fire agencies will continue to monitor developments in emerging technologies for improving the accuracy and forecast ability of lightning strikes and ignitions.

The PWS lightning detection strategy is set out in the existing Fire Action Plan. This Plan includes detection via fire spotter flights or fire patrols, monitoring lightning detection internet sites, weather observations and forecasts and observations from fire towers. This Plan will be reviewed, as needed, in response to relevant technological advances.

It is noted that the implementation of any identified (and suitable) new technologies relating to lightning detection into bushfire management in the TWWHA will require further consideration of potential funding and resourcing opportunities, particularly in relation to required infrastructure. Infrastructure needs, relating to lightning detection, is also a consideration under Recommendation 8 (Capital investment).

Recommendation 8 – Capital investment

The Tasmanian fire agencies should develop a whole-of-government program of investment in facilities and equipment that enhance fire management capabilities in the TWWHA and more generally in Tasmania. This program should include:

- identification and evaluation of options for installing new automatic weather stations in the TWWHA and nearby areas to improve weather and data records for the region; remote area sensors for monitoring local rainfall and soil moisture; and early detection facilities such as fire-watch installations;
- firefighting equipment available to fire agencies in different regions of Tasmania;
- improved communication facilities (that is for the radio network), to enable better communication between agencies, and for remote firefighting teams; and
- investment in facilities and equipment to enhance aerial firefighting efforts.

This investment program should be developed on a whole-of-government basis to maximise the benefits to all fire agencies and the Tasmanian community. Organisations such as the Bureau of Meteorology should be involved in order to ensure the fire agencies obtain the highest benefits from Tasmanian weather and climate data.

In constructing this investment program, an audit of existing weather and climate sensors in the region should be conducted and protocols developed for incorporating these data into real-time forecasts of fire weather.

Response: SUPPORT IN PART

Tasmanian Government position

A key finding of the Final Report is that increased bushfire risk will place pressure on Tasmania's firefighting capability in coming years, a sentiment echoed by the Senate Inquiry Report (Commonwealth of Australia 2016). The Final Report also provides that protecting the natural and cultural heritage values of the TWWHA will require actions that are beyond business as usual and will require decisions and investments to be made on a whole-of-government basis (Press 2016).

The Tasmanian Government understands that having a specialised firefighting capability, including firefighters and equipment based in Tasmania, is important in protecting the TWWHA's natural and cultural heritage. This specialised capability and equipment (including communication equipment/facilities, firefighting equipment, fuel moisture monitoring senses, helibases, airstrips, lightning and fire detection systems/facilities and weather data observation stations) is key to an effective initial attack, containment and suppression in the TWWHA (Press 2016). It is noted that the AFAC Review highlights the importance of ensuring Tasmania has sufficient firefighting capability to sustain initial attack capability until reinforcement (if necessary) by interstate capability (AFAC 2016).

Tasmanian Government action

For 20 years, PWS has employed firefighters specifically trained in remote area firefighting and has developed techniques, specialised equipment and expertise to support this activity. With regards to equipment, aircraft (primarily helicopters) are available for firefighting in the TWWHA from shared contracting arrangements coordinated by the Tasmania Fire Service (TFS).

Future consideration of capital investment is closely linked with Recommendation 10 (Operational capability), which focuses on the need to review operational capability for the purpose of ensuring that Tasmania has sufficient firefighters and firefighting resources to respond to bushfires in the TWWHA.

This recommendation is supported in part noting that statewide capital investment in firefighting capability incorporates longer-term strategic planning, resourcing and funding considerations.

With regards to weather stations, which are vital to understanding fire behaviour, the Tasmanian Government will give further consideration to conducting an audit of existing weather and climate sensors in the region, and to developing protocols for incorporating data into real-time forecasts of fire weather. TFS, through the Fuel Reduction Program, has purchased six portable automatic weather stations that meet the Bureau of Meteorology specification, and has enabled PWS to significantly upgrade its existing systems including fuel moisture meters attached to all weather stations. This has improved the understanding of fire behaviour in the TWWHA and statewide.

The National Resource Sharing Centre continues to review the Arrangement for Interstate Assistance Agreement and that remote area crews are included as a consideration in this review.

3.4. Bushfire response

Recommendation 9 – Mapping of values

DPIPWE and the Tasmania Parks and Wildlife Service should continue to improve mapping, and incorporate the most up-to-date and available vegetation, soil and other natural and cultural values mapping into TASVEG and the Bushfire Risk Assessment Model (BRAM).

The availability of high-resolution aerial imagery has increased significantly in the past decade. Higher resolution mapping of natural values will significantly improve the inputs to BRAM and enhance the fire risk assessments BRAM produces.

There is a role for the broader research community in providing both input to, and review of, natural and cultural values mapping for the TWWHA.

Response: SUPPORT

Tasmanian Government position

The Final Report provides that while BRAM is updated annually with the best available data, many fire-sensitive natural values in the TWWHA are not mapped with a particularly high level of accuracy (Press 2016). The natural values include threatened flora and fauna, vegetation communities, geomorphological values and fire-sensitive values (Press 2016).

The Tasmanian Government understands that more accurate mapping, which uses technological advances in high-resolution aerial imagery and is kept up-to-date, would enhance the ability of BRAM to determine priorities for bushfire management in the TWWHA (Press 2016).

Tasmanian Government action

The Tasmanian Government supports continually improving and incorporating the mapping of TWWHA values into BRAM and TASVEG (the digital vegetation map of Tasmania), with input from the research community.

Improving mapping of priority values is an ongoing consideration for the Natural and Cultural Heritage Division. Currently, the Division is undertaking work to refine the mapping of pencil pine, cushion plants and sphagnum. The Division is undertaking further work, in the short-term, to improve mapping of organic soils in the TWWHA.

TASVEG is updated as new mapping becomes available and BRAM is updated annually to incorporate changes to TASVEG and other information from the Natural Values Atlas.

Continuously improving mapping into BRAM is also a consideration under Recommendation 2 (The Bushfire Risk Assessment Model).

In relation to cultural values, the Tasmanian Government acknowledges the importance of continuing to improve the understanding of Aboriginal cultural values and to ensure the protection and conservation of Aboriginal cultural heritage in the TWWHA. The Management Plan includes commitments to identify, assess and document Aboriginal cultural values and sites and will include conducting surveys with the engagement, consultation and participation of the Aboriginal community (DPIPWE 2016). This work will assist in ensuring that Aboriginal cultural values are considered in fire planning in the TWWHA.

Key Aboriginal cultural values were added into DPIPWE's COP in 2015 following consultation with the Aboriginal Heritage Council (AHC). The Tasmanian Government is committed to ongoing engagement with AHC regarding the possibility of incorporating Aboriginal cultural values in BRAM. The Management Plan includes an action to identify and implement measures that will comprehensively incorporate Aboriginal cultural values in BRAM and produce a resourced implementation plan for those measures (DPIPWE 2016). Depending on AHC's receptiveness to incorporating Aboriginal cultural values in BRAM, an implementation plan will be developed, where resources allow, during 2017.

Recommendation 10 – Operational capability

The Tasmania Parks and Wildlife Service should review its immediate, medium and long-term fire suppression capabilities, including staffing.

This review should be done in consultation with other fire agencies in Tasmania as skills, demographic factors, and agency capabilities are expected to change significantly across all agencies.

This review should also take into account the spatial context of bushfire risk; emerging technological development; future fire suppression capabilities such as new fixed and rotary-wing aircraft; and the future requirements for skilled, remote area firefighting teams.

A review of resources and staffing arrangements should be undertaken to facilitate flexibility and responsiveness in capability to match annual variation in fire seasons (ie that impact workload).

The aim of this review is to understand what resources are required by the Tasmania Parks and Wildlife Service to manage current and future bushfire risk, and what actions need to be taken now to ensure that adequate levels of skill, staffing, equipment and decision-support tools are available for fire management in the future.

Response: SUPPORT

Tasmanian Government position

Records showing the causes of bushfires in or near the TWWHA indicate that the main risk is from lightning fires. Lightning ignitions can occur anywhere, including very remote parts of the TWWHA and a rapid suppression response to these fires is critical (Press 2016). In light of this, the Tasmanian Government acknowledges the importance of having sufficient firefighters and firefighting resources, of the right type in the right places, to respond at the time fires start.

The Final Report recommends that PWS undertakes a review of the financial and human resources required for bushfire planning, mitigation and response in the TWWHA, including the number and type of firefighting resources (eg remote fire crews and aircraft) required for initial bushfire attack. The aim of the review is to provide specified levels of bushfire risk coverage for the region while maintaining sufficient resources to address fire risk in non-TWWHA reserves.

Undertaking this review, for the purpose of developing an appropriate model of fire resource cover, is a challenging operational issue in terms of establishing a relationship between the extent of bushfire risk cover at the landscape level and the required levels of firefighting resources. The Tasmanian Government understands that there is currently no widely accepted best practice or standard method in Australia for analysing fire cover. The Government also acknowledges that strategic planning for bushfire management must address the resourcing of bushfire risk at the statewide level, not just for the TWWHA.

Tasmanian Government action

The Tasmanian Government supports undertaking a review to determine the appropriate level of fire management capability to cover the fire risk for the State.

The additional State funding in the 2017-18 Budget for bushfire management in the TWWHA will contribute to PWS undertaking this work.

TFS continually reviews operational capability through a formalised operational analysis system. Furthermore, TFS recently instigated a 'resource to risk' project to further define the risk it is responsible for and consider the current resourcing arrangements to then identify residual risk that can be mitigated using existing resources. While bushfire is a component of this work, the focus is broader in nature and also includes consideration of risk in relation to structural fire, and rescue disciplines such as urban search and rescue, trench, rope and road crash rescue.

Recommendation 11 – Use of volunteers

The Tasmania Parks and Wildlife Service, in conjunction with other Tasmanian fire agencies, should review the future potential for the use of volunteers in supporting fire management activities, including the potential to use trained remote area volunteer fire crews.

This review should be conducted in conjunction with the review of the Tasmania Parks and Wildlife Service's fire suppression capabilities.

Response: SUPPORT

Tasmanian Government position

In addition to reviewing PWS's fire suppression capabilities, the Final Report provides that options for additional remote firefighting capability for the TWWHA should be considered (Press 2016), including volunteer firefighters in PWS or TFS.

Consideration of the potential use of volunteers for remote firefighting in the TWWHA would involve complex workforce considerations including developing and maintaining the required fitness levels of personnel, and providing the necessary personnel training and equipment (Press 2016).

The Tasmanian Government notes that the AFAC Review recommends that a full review be undertaken of the benefits and costs of training a cadre of Tasmanian volunteer firefighters in remote area firefighting, with reference to the experience of jurisdictions that already do so (AFAC 2016).

Tasmanian Government action

As outlined in its response to Recommendation 10 (Operational capability), the Tasmanian Government supports a review of operational capability relating to bushfire management both in the TWWHA and statewide. This review will consider the use of volunteers.

Recommendation 12 – Fire suppression techniques and methods

The Tasmanian fire agencies should regularly review operational practices, fire suppression technologies and techniques used in other jurisdictions and determine their efficacy for Tasmania, including in the TWWHA. In the TWWHA, particular attention should be paid to:

- early intervention techniques and technologies such as early detection and rapid attack; and
- continuing to investigate methods and equipment for extinguishing ground (organic soil) fires (eg spike and pump combinations).

Response: SUPPORT IN PART

Tasmanian Government position

The Tasmanian Government understands that lightning ignitions can occur anywhere, including very remote parts of the TWWHA. Rapid suppression response to these fires, which can spread very quickly, is critical (Press 2016). The Final Report provides that the defensive strategies used in the TWWHA, particularly for protecting people and built assets, are broadly similar to those employed in other states and territories (Press 2016). In light of this, there may be potential for operational systems and techniques used in other parts of Australia, and countries such as Canada, to be introduced for the TWWHA (Press 2016).

The Tasmanian Government understands that this would require the evaluation of the suitability of various systems, techniques and equipment, and identification of the associated costs and benefits in terms of applying these strategies in the TWWHA (Press 2016). It is noted that the AFAC Review includes a recommendation to review and analyse fire suppression options for the TWWHA, with a focus on reviewing early intervention techniques such as aerial firefighting (AFAC 2016).

Tasmanian Government action

Strategies and tactics regularly used in firefighting in the TWWHA include rapid attack by helicopter-inserted crews, aircraft water bombing and the use of fire suppression chemicals. Consideration of relevant interjurisdictional fire management operational practices will be included in the review of operational capability (refer to Recommendation 10 (Operational capability)).

With regards to reviewing fire extinguishing tactics, the Tasmanian Government is undertaking research into the impact and effectiveness of the use of fire suppression chemicals in the TWWHA. This research, which is aimed at enhancing bushfire suppression in the TWWHA, is discussed further in the Government's response to Recommendation 14 (Research on fire suppression chemicals). As detailed in the response to Recommendation 15 (Use of fire suppression chemicals), the Government will use the results of this research to review the use of fire suppression chemicals in the TWWHA and will take an adaptive management approach to using these chemicals.

Recommendation 13 – Aerial fire suppression

The Tasmania Parks and Wildlife Service and the Tasmania Fire Service should review future capabilities in fixed and rotary-wing aircraft for fire suppression in the TWWHA, and for the safe insertion of remote area firefighting teams, including where landing or hover exit is not possible.

This review of aircraft support should be carried out in conjunction with the review of staffing capabilities.

Response: SUPPORT

Tasmanian Government position

The Final Report provides that options for future capabilities in (fixed-wing and rotary-wing) aircraft for fire suppression and remote area firefighting teams for the TWWHA should be considered (Press 2016).

The Tasmanian Government agrees that investigating the type and size of water bombing aircraft for fire suppression (rapid initial air attack) should form part of a review of fire response techniques and methods in the TWWHA.

While some smaller fixed-wing water bombers have been trialled in Tasmania, they are rarely used in the TWWHA and water bombing from large helicopters has never occurred in Tasmania (Press 2016). The Tasmanian Government understands significant infrastructure would be required to support the introduction of larger aircraft for fire suppression in the TWWHA. In light of this, an assessment of the potential benefit for the TWWHA of introducing such aircraft would require careful investigation and costing (Press 2016).

Tasmanian Government action

Contractual 'call when needed' and National Aerial Firefighting Centre sharing arrangements are currently in place for when Tasmania requires support for aerial fire suppression.

PWS is a signatory to an Arrangement between member agencies of the Forest Fire Management Group (FFMG), which includes similar fire and land management agencies across Australia and New Zealand. The purpose of this Arrangement is to:

- provide continuous improvement in the management of fire within forests and on rangelands in Australia and New Zealand;
- recognise that strong working relationships, goodwill and cooperation across organisational and interstate boundaries are critical to this process;
- promote and facilitate the exchange of bushfire management resources between the agencies; and
- provide for mutual support and aid during the fire management activities and emergency management activities.

Furthermore, TFS has interjurisdictional arrangements that can be called upon in times of need. The Arrangements for Interstate Assistance (AIA) provide for the timely and meaningful exchange of capability between states and territories during significant incidents. The AIA is now coordinated by the recently established National Resource Sharing Centre.

The National Aerial Firefighting Centre (NAFC) also provides a cooperative national arrangement for combatting bushfires by facilitating and coordinating the procurement of specialised firefighting aircraft to complement local aerial and ground based firefighting resources. Tasmania used this service during the 2015-16 bushfire season; it includes Australian Government funding that partially support aircraft contract costs. The Government will continue to engage with AFAC, NAFC, FFMG and interagency partners with regards to aerial fire suppression.

Aircraft capability for fire suppression (and remote area management and operational firefighting teams) will be considered in the review of operational capability (refer to Recommendation 10 (Operational capability)).

Recommendation 14 – Research on fire suppression chemicals

The current research on the efficacy and environmental impacts of the use of fire suppression chemicals in the TWWHA should be continued in the short-term.

This research should inform the development of guidelines for future use of fire suppression chemicals in the TWWHA.

Response: SUPPORT

Tasmanian Government position

The Tasmanian Government considers that this recommendation is consistent with work currently underway in relation to research on fire suppression chemicals in the TWWHA.

Tasmania's firefighting agencies use fire suppression chemicals added to water while combatting bushfires and certain chemicals were used during the 2015-16 bushfires in the TWWHA (Press 2016).

The Government understands that data on the effectiveness and impacts of the use of these chemicals in the region has not yet been collated or analysed (Press 2016).

Tasmanian Government action

Work is currently being undertaken by DPIPWE, through the Research Project, to examine the potential impact and effectiveness of fire suppression chemicals in the TWWHA. This includes undertaking a literature review and field trials.

The results of this work will inform the development of decision making tools and guidelines for the appropriate use of fire suppression chemicals in the TWWHA. It will also assist in communicating to the community and other stakeholders that a scientific program has been initiated to underpin any decisions regarding the use of fire-fighting chemicals in the region.

In the interim, PWS will continue to take a precautionary approach to the use of fire suppression chemicals in the TWWHA where application is assessed and approved on a case-by-case basis.

Recommendation 15 – Use of fire suppression chemicals

The Tasmania Fire Service, and Parks and Wildlife Service should review the future use of fire suppression chemicals in the TWWHA following the conclusion of the Research Project currently being undertaken.

Research, monitoring and adaptive management should continue on the use of fire suppression chemicals from the perspective of both impacts on TWWHA values, and guidelines on the effective and efficient operational strategies and tactics of the various fire chemical classes.

If the research determines that the use of fire suppression chemicals is appropriate in the TWWHA, suitable procedures will need to be established, as well as training and equipment, to manage the use of these products in a safe and responsible manner.

Protocols for future decisions to use fire suppression chemicals in the TWWHA should be incorporated into the TWWHA Fire Management Plan and associated operational fire guidelines.

As an interim measure, the use of fire suppression chemicals should be undertaken using a precautionary approach, where application is assessed and approved on a case-by-case basis.

The use of fire suppression chemicals for firefighting in the TWWHA should balance potential environmental impacts (if any) with the protection of the natural and cultural heritage values of the region.

Response: SUPPORT

Tasmanian Government position

The Tasmanian Government acknowledges the importance of reviewing the future use of fire suppression chemicals in the TWWHA and considers that this recommendation is consistent with work currently underway in relation to the use of fire suppression chemicals in the TWWHA.

Tasmanian Government action

As outlined in the response to Recommendation 14 (Research on fire suppression chemicals), the results of the current research into the impact and effectiveness of fire suppression chemicals will inform the development of decision making tools for the appropriate use of fire suppression chemicals in the TWWHA.

A literature review on the impacts of relevant suppression chemicals on natural values has been completed and PWS is developing interim decision support tools based on the findings to be made available on the COP. These tools will be updated once the field-based trials have been undertaken and as any other research becomes available.

Following the completion of the research, a workshop with relevant researchers and Tasmanian fire management officers will be held. The purpose of the workshop will be to examine the implications of the findings on how fires can best be managed from the perspective of fire suppression and environmental outcome within the TWWHA.

PWS will use the results of this research to review the use of fire suppression chemicals in the TWWHA and will take an adaptive management approach to future use of these chemicals. Depending on the outcomes of the research, PWS will endeavour to develop guidelines and procedures, and assess required training and equipment to manage the use of these chemicals in a safe and responsible manner.

The use of fire chemicals in Australia is governed by the longstanding position of AFAC, which provides that only products that have been approved by the United States Department of Agriculture can be used (Press 2016). The effectiveness of these chemicals, in general, is well established (Press 2016). As noted earlier, as an interim measure PWS will continue to take a precautionary approach to any use of fire suppression chemicals in the TWWHA, where application is assessed and approved on a case-by-case basis.

Recommendation 16 – Improved public information and communications

The Tasmania Parks and Wildlife Service should develop a specific communications plan on bushfires and fire management. This plan should include:

- public information on the restrictions on lightning fires in the TWWHA and the impacts of bushfire on sensitive natural and cultural assets;
- the dissemination of public information on fire danger during the fire season;
- the dissemination of public information during fire events including bushfires and management fires, including suppression activities; and
- the dissemination to the public of information on the extent and impacts of bushfire in the TWWHA.

The communications plan should also cover the provision of public information during extreme bushfire events, such as those that occurred during 2016.

Good quality public information can play an important role in building community support for fire management in the TWWHA, and for the efforts of fire agencies during extreme events.

Response: SUPPORT

Tasmanian Government position

The Final Report found that the information provided to the public about bushfires has improved dramatically in the past 20 years with the development of TFS fire alerts webpages, national standard warnings and the Australian Broadcast Authority's commitment as an emergency broadcaster (Press 2016).

The Tasmanian Government primarily communicated with stakeholders on the progress of the 2016 bushfires and firefighting efforts via TFS's website.

The information currently provided to the public during a bushfire incident is focused on keeping people safe (Press 2016). In light of this, the Government agrees that there is a need to expand the level of information provided to the Tasmanian community on bushfires beyond the delivery of fire-danger warnings and safety messages, while recognising that public safety is the highest priority. Such information could include:

- the impact of the fire(s), including estimates of the extent of fire-sensitive vegetation affected;
- the impact on recreational facilities and closure of areas to the public; and
- a summary of the firefighting resources (numbers and types) currently engaged in suppression and their tactics.

Both the AFAC Review and the Senate Inquiry highlighted the importance of enhancing public information communication on bushfire management, particularly during a bushfire event (AFAC 2016; Commonwealth of Australia 2016).

Tasmanian Government action

Public communication about all bushfire incidents in Tasmania is coordinated through systems and processes established and managed by TFS, in close consultation with PWS.

The Tasmanian Government supports the development and implementation of a fire communication plan for the TWWHA in order to improve communication with the public regarding the impacts of bushfires on reserve land and natural values, and opportunities for safe recreation in the reserve system.

The Management Plan includes an action to develop a TWWHA communication strategy, which is to include a review of the delivery of TWWHA management information relevant to local communities and the wider public and provide an appropriate level of community engagement when developing subsidiary plans and policies. Amongst other things, the Management Plan provides that the communication strategy is to examine communication of fire and emergency management issues.

3.5. Bushfire recovery

Recommendation 17 – Role of Bushfire Rapid Risk Assessment

The Tasmania Parks and Wildlife Service and other fire agencies should establish protocols for 'rapid assessment' of the impacts of major bushfires in the TWWHA and resourcing of immediate priorities for recovery action.

Rapid assessment techniques are used in many jurisdictions in Australia and overseas to provide an initial assessment of fire impacts and priorities for recovery and rehabilitation. While these 'rapid assessments' cannot replace long-term investigation and monitoring of fire impacts, they can be useful in prioritising recovery efforts and rationalising commitment of resources to recovery.

The efficacy and usefulness of rapid assessment techniques should subsequently be evaluated, and their implementation modified if required.

Response: SUPPORT IN PART

Tasmanian Government position

The Tasmanian Government agrees that rapid bushfire risk assessments can be useful in prioritising recovery efforts and rationalising commitment of resources to recovery.

Bushfire rapid risk assessment was developed from the United States Burned Area Emergency Response teams deployed to the Victorian bushfires in 2009 who introduced the concept of post-emergency rapid risk assessment.

Building on the Victorian approach, in 2011, New South Wales and the Australian Capital Territory developed burned area assessment teams and invited PWS to participate in a cooperative arrangement across jurisdictions. These teams draw together expertise in a range of scientific disciplines and conduct a rapid risk assessment immediately following an emergency event. These assessments are used to assist managers in identifying and minimising future impacts – both immediate and longer-term – caused by the emergency event. The goal is to reduce further threat to life, property, infrastructure and the environment. The outputs of the process, which include a written report, support the transition from emergency response to recovery.

Reports are not intended to replace more detailed recovery assessments that are usually required. The reports do, however, alert government agencies to the magnitude of potential post-fire risks (eg flooding) areas which may require further, more detailed rehabilitation or recovery planning, and the relative costs of mitigating post-fire risks compared to response operations.

Tasmanian Government action

PWS supports a multi-jurisdictional rapid risk assessment approach to bushfire recovery, providing some input to the development of the process and may provide personnel for teams in the future. This multi-jurisdictional approach was used by PWS, TFS and Sustainable Timber Tasmania in 2013 and 2016, drawing on the assistance of expertise from other jurisdictions.

The concept of rapid damage assessment is also recognised in the Tasmanian Emergency Management Plan and the subordinate State Special Emergency Management Plan Rapid Impact Assessment. These assessments are at a lower level and focus on damage to assets without considering the wider context and other risks that the fire impact may cause immediately or sometime after the fire event. For example, accelerated run-off of rainfall due to vegetation loss in fire causing erosion/siltation of dams and reservoirs, and flash flooding.

At present, DPIPWE has two staff trained in the rapid bushfire risk assessment process. Additionally, Tasmania has arrangements in place to work cooperatively with other states on burnt area assessments. PWS has developed some trigger points for initiating burnt area assessments, which were used during the 2015-16 bushfires to trigger a request for an assessment of the Lake Mackenzie complex of fires.

Recommendation 18 – Ecosystem rehabilitation and restoration trials

The Tasmania Parks and Wildlife Service and DPIPWE should undertake trials of post-bushfire rehabilitation techniques (eg erosion control, tree planting, seed germination and seed banks), especially for vulnerable species, communities and other significant values in the TWWHA.

This work should be integrated into a broader research strategy for the TWWHA, and incorporated into the Adaptive Management framework contained in the TWWHA Management Plan.

Response: SUPPORT

Tasmanian Government position

The Tasmanian Government acknowledges that undertaking trials of post-bushfire rehabilitation techniques in relation to the 2015-16 bushfires, targeting alpine and subalpine areas, is important to facilitate the acquisition of data on suitable rehabilitation methods for use in response to future bushfire events.

Tasmanian Government action

Fires are routinely mapped in the TWWHA by GPS from aircraft, while some larger fires are mapped from aerial images and remote sensing.

Since February 2016, the Natural and Cultural Heritage Division has been undertaking assessments of the impacts of the 2016 bushfires on the values of the TWWHA and other reserves. Data and photographs from these assessments were presented to the Bushfire Research Group, which considered the potential and priority for post-fire rehabilitation works and techniques during a workshop in June 2016. The Bushfire Research Group also assisted in the refinement of a qualitative decision tool for assessing post-fire rehabilitation priorities. One of the conclusions reached by the Bushfire Research Group was that the 2015-16 fire impacts provided a valuable opportunity to undertake targeted trials to investigate techniques of rehabilitation to restore ecosystem function and inform effective rehabilitation works in the event of future bushfire events in the TWWHA (Press 2016). It is noted that flooding events subsequent to the 2015-16 bushfires reduced DPIPWE's capacity to undertake such trials.

The additional State funding in the 2017-18 Budget for bushfire management in the TWWHA will support rehabilitation trials in alpine and subalpine areas impacted by the Mersey Forest Complex fires. This work is on track to commence by the end of 2017, and is expected to deliver results in 2021.

GLOSSARY AND ACRONYMS

Acronym or phrase	Definition
AACV	DPIPWE's Aboriginal Cultural Value Survey
ACE CRC	Antarctic Climate and Ecosystems Cooperative Research Centre
AFAC	Australasian Fire and Emergency Service Authorities Council
AHC	Aboriginal Heritage Council
AIA	Arrangements for Interstate Assistance
BOHM	Bushfire Operational Hazard Model – a computer-based mapping system developed by Tasmania Parks and Wildlife Service that assists in the preparedness and response to bushfires
BRAM	Bushfire Risk Assessment Model
Bushfire	Unplanned vegetation fire – a generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective
Bushfire Research Group	DPIPWE's TWWHA Bushfire Research Group
COP	DPIPWE's Common Operating Platform
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DPAC	Department of Premier and Cabinet
DPIPWE	Department of Primary Industries, Parks, Water and Environment
FFMG	Forest Fire Management Group
Fire-sensitive	Natural values that will be significantly damaged by any fire. In some cases, the value may survive a single fire in damaged form, but is unlikely to persist after repeated fires.

Acronym or phrase	Definition
Fire suppression	The activities connected with restricting the spread of a fire following its detection and before making it safe
Geoheritage	Globally, nationally, statewide to local features of geology that are intrinsically or culturally important sites that offer information or insights into the formation and evolution of the Earth, or into the history of science, or that can be used for research, teaching or reference
Initial attack	The first suppression work on a fire
Management Plan	TWWHA Management Plan 2016
NAFC	National Aerial Firefighting Centre
Natural and Cultural Heritage Division	DPIPWE's Natural and Cultural Heritage Division
PWS	DPIPWE's Parks and Wildlife Service
PPRR	Prevention, Preparedness, Response and Recovery risk assessment bushfire model
Research Project	TWWHA Bushfire and Climate Change Research Project
Senate Inquiry	Senate Inquiry into the 'responses to, and lessons learnt from, the January and February bushfires in remote Tasmanian wilderness'
Sustainable Timber Tasmania	Previously Forestry Tasmania
TASVEG	The Digital Vegetation Map of Tasmania
TFS	Tasmania Fire Service
TWWHA	Tasmanian Wilderness World Heritage Area

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ATTACHMENT 1

Prospective priority research and corresponding recommendations

The following is the prospective list of priority research to support fire management in, and the understanding of the impacts of fire on, the World Heritage values of the TWWHA (taken from Attachment 9 of the Final Report), and the Final Report's recommendations relating to each research area.

Bushfire Prevention	Corresponding Final Report recommendation(s)
Aboriginal fire regimes Develop as complete an understanding as possible of Aboriginal burning practices, drawing on all lines of evidence including cultural, historical and scientific sources.	Recommendation 3
Improved bushfire risk modelling Undertake further analysis using a landscape fire-spread modelling tool with improved input data and models to test specific hypotheses and planned burning scenarios, particularly under future climates.	Recommendation 3
Impacts from planned burning Undertake research to better understand the tolerance of species and landforms to fire frequency and intensity and the other fire regime requirements of fauna, flora and landforms, such as fire size and patchiness. Specific areas for further research should include: organic soils, fire regions, mapping of buttongrass fuels and organic soils, orange-bellied parrot, Invertebrate fauna and Montane grasslands.	Recommendation 4
Organic soil dryness field testing method Develop a quantitative method for measuring organic soil dryness in the field, to verify the assumed soil moisture.	Recommendation 6
Managing fire-sensitive values in flammable landscapes Investigate techniques and strategies to manage fire in areas in the TWWHA with fire-sensitive natural values that paradoxically occur in flammable parts of the landscape.	Recommendation 4
Fire refugia prediction Identify areas that are both fire refugia, and direct climate change refugia, to help to determine priorities for fire prevention, preparedness and response.	Recommendation 4

Preparedness	Corresponding Final Report recommendation(s)
Fuel dryness and fire behaviour Undertake the following activities to improve understanding of fuel dryness and fire behaviour: • quantifying fuel and soil moisture thresholds of flammability for most vegetation types; • quantifying soil moisture thresholds that control organic soil flammability; • designing and installing an adequate network of weather data observation stations across the TWWHA; • validating and customizing systems (eg soil moisture models) for the Western Tasmanian environment; and • developing new fire spread models for those vegetation types that need it (ie peat, wet forest, rainforest, alpine communities and other vegetation unique communities in the TWWHA) and for organic soils.	Recommendation 6
Strategies to manage future bushfire risk Taking into account the research undertaken through the Research Project on the impacts of climate change on future bushfire risk in the TWWHA (and associated impacts on fire behaviour and natural and cultural values), strategies should be developed to protect the natural and cultural values in the TWWHA as far as is practical.	Recommendation 1

Response	Corresponding Final Report recommendation(s)
Aboriginal heritage sites Undertake work with the Aboriginal Heritage Council to: • develop protocols for accessing data from the Aboriginal Heritage Register to facilitate the making of strategic and tactical decisions to protect known sites during fire suppression operations, while also respecting the cultural sensitivities of the information on sites. These protocols should also cover how Aboriginal Heritage Register records could be included in BRAM so that the fire risk to Aboriginal heritage can be assessed; and • gain a better understanding of the potential impacts of bushfires and suppression techniques on the different kinds of Aboriginal heritage sites in the TWWHA through ongoing funded research.	Recommendation 9

Response	Corresponding Final Report recommendation(s)
Better mapping of fire-sensitive TWWHA values Undertake the following work to improve mapping of fire-sensitive TWWHA values: • Improve the scale of resolution and accuracy of mapping of natural values to ensure that supporting systems such as BRAM provide as strong a basis as possible for determining priorities for prevention, preparedness, response, and for monitoring and reporting on fire impacts. The natural values include threatened flora and fauna, vegetation communities, geomorphological values and fire-sensitive values. • Invest in additional high-resolution photography to extend improved mapping of values beyond the Central Plateau. In some cases, a better understanding of fire impacts and responses are required to improve the identification of the natural values that are at risk from bushfires.	Recommendations 6 and 9

Recovery	Corresponding Final Report recommendation(s)
Ecosystem Recoverability Undertake research to understand the recoverability post-fire of communities such as alpine areas and rainforests of the TWWHA that have historically rarely been dry enough to burn.	Recommendation 18
Trials of rehabilitation techniques Undertake trials of rehabilitation techniques of natural values, particularly in alpine and subalpine zones. Such techniques to be considered include: constructing barriers to surface water movement; planting of seedlings and/or spreading seeds; feral animal control (eg rabbits); and fencing exclosures to prevent grazing from marsupials and introduced mammals.	Recommendation 18
Fire, climate change and introduced animals Monitor the spread of introduced species such as rabbits, starlings and fallow deer in the TWWHA and determine causal factors, such as the interaction between climate change and fire.	Recommendation 18
Improved techniques to attain higher resolution of fire scar mapping Undertake research to improve capacity to use remote-sensing methods to identify and map fire boundaries in the TWWHA.	Recommendation 18

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