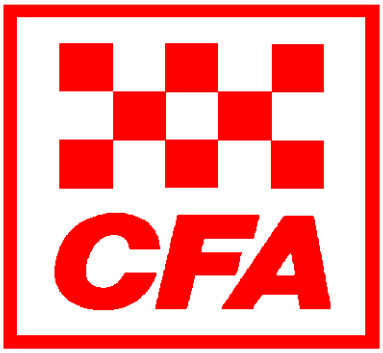


NORTH WEST AREA

DISCUSSION PAPER

ON

GUIDELINES FOR THE

INTRODUCTION AND TERMINATION

OF THE

FIRE DANGER PERIOD

JUNE 2004

Prepared By: **John Mealia**
Manager, Community Safety
North West Area (Region 2)

Table of Contents **Page**

1. Background

Management responsibility for the declared Fire Danger Period (FDP) is established within the provisions of the CFA Act 1958. The Chief Executive Officer of CFA after consultation with the Department Head of the Department of Sustainability and Environment (DSE) is responsible for the declaration and termination of the Fire Danger Period under Section 4 of the CFA Act. Both Chief Officers from CFA and DSE administer this responsibility.

Municipal Fire Prevention Committees have historically been charged with providing advice and recommendations based on their local knowledge and expertise to assist in the decision making process.

An eight-year review of fire danger indices on particular introduction and termination dates of the FDP in municipalities across the North West Area (NWA) has shown there is no apparent consistency between specific indices and introduction or termination, and there appears to be no standard logic or methodology applied to measuring the level of risk to communities. These conclusions are supported by an analysis of CFA response trend over a six-year period.

Appendices D 1 and D 2 look at comparisons in the Swan Hill Rural City Council and the City of Greater Bendigo as two sample municipalities.

Appendices E1, E2 and E3 consider the number of vegetation fires for Swan Hill and Mildura Rural City Council along with the City of Greater Bendigo leading up to and during FDPs. The results have shown a variation ranging from minor reductions to an increase in the number of fires after the introduction date.

The results from both analyses suggest the decision-making process is questionable and lacks a risk-based approach. If correct, inappropriate introduction and termination dates may be chosen. It also suggests FDP regulatory controls alone are not reducing the occurrence of fire.

To overcome these deficiencies and achieve improvements in reducing the level of risk to the community, it is recommended CFA and DSE consider a new and holistic approach to the management of the wildfire risk environment.

2. Purpose

The purpose of this paper is to generate discussion by proposing a holistic approach to fire prevention based on sound risk management principles. It proposes new systems and processes to assist MFPC's, Brigade Officers and Fire Managers from CFA and DSE to identify, analyse and determine the appropriate mix of fire prevention strategies to reduce the likelihood of fires within individual Municipalities.

Once the consultative process is completed and agreement achieved, an easy to use step-by-step guide and supporting range of tools will be developed.

These tools will assist MFPC members, Brigade Officers and Fire Managers to apply common systems and processes.

3. PROJECT OBJECTIVE

The project objective which has led to this discussion paper is as follows:

On the basis of risk analysis, use a declared Fire Danger Period and other treatments to minimise both risk and loss from fire, thereby supporting the achievement of CFA and DSE organizational outcomes whilst meeting the needs and expectations of the community.

4. DISCUSSION PAPER OBJECTIVE

The objective of this discussion paper is to identify and examine the contributing risk factors which influence the likelihood of fire occurring and the potential impact and consequences of fire on the community. It also proposes a decision making process which could be used as a guide when assessing risk treatment options in order to arrive at an acceptable level of residual risk.

5. RISK MANAGEMENT APPROACH

A risk management approach, which might be used to assist with achieving the project objective, has five key elements:

- Identification of the risk factors related to the project objective;
- Analysis of contributing risk factors;
- Risk Assessment Process;
- Implement a holistic approach to treating identified risks; and
- Monitor and review outcomes

6. IDENTIFICATION OF CONTRIBUTING RISK FACTORS

Contributing risk factors can be broken into 5 main categories:

1. **Climate**
2. **Vegetative condition**
3. **Human Activity**
4. **Brigade Response**
5. **Fire Behaviour**

Climate

- Drought Index (DI)
- Forest Fire Danger Index (FFDI)
- Grass Fire Danger Index (GFDI)

Vegetative condition

- Fuel curing
- Grass & Crop Growth
- Condition & Quality of Grass
- State of Forest or Scrub
- Land Fallowed

Human Activity

- Agricultural
- Recreational
- Domestic
- Commercial
- Special and Unique (one off)

Brigade Response

- Number of responses to fires, the social and financial impact on Brigades and DSE

Fire Behaviour

- Rate of spread
- Activity level
- Spotting
- Brigade / DSE capacity to respond

For detailed information on each of the contributing risk factors and to assist in determining the relevance to each Municipality, refer to Appendices A, B & C.

7. ANALYSIS OF CONTRIBUTING RISK FACTORS

For the purpose of this paper, within the natural environment context, risks have been broken into two categories - forest and grassland. The contributing risk factors will affect fire likelihood and behaviour in both natural environment categories.

The severity and degree of effect of the risk factors varies according to the weighting of each and their interrelationship. For example, in the case of a low DI, irrespective of the fuel load, there is a lower likelihood of fire occurring and its consequences would be low. Alternatively, a high DI with moderate fuel load significantly increases the likelihood of fire with high intensity, rapid rate of spread and potential for major consequences.

The contributing risk factors also depend on their relationship to Climate and Vegetation condition which affects fire potential and behaviour.

To assist in better understanding this relationship, both in forest and grassland, this paper uses Fire Danger Meters to predict fire potential and behaviour against critical indices.

These indices have been determined through research and practical experience from both CFA and DSE.

7.1 Forest Fire Danger Index (FFDI)

The fire danger index is directly related to the chances of a fire starting, its rate of spread, intensity and difficulty of suppression according to various combinations of temperature, relative humidity, wind speed and both long and short-term drought effects.

The level of risk is determined when the Drought Index, State of Forest or Scrub Dryness and Forest Fuel Hazards, is assessed against air temperature, relative humidity and wind which provides a Forest Fire Danger Index (FFDI).

The Forest Fire Danger Meter Mk5 (CSIRO) has been used for the purpose of assessing fire potential in terms of occurrence, spread and growth.

Once the FFDI is determined, Table 1 is a useful tool to assist in determining rate of spread, in kilometres per hour (R), flame height in metres (H) and average spotting distance in kilometres (S) against various fuel quantities. Fuel Quantity is expressed in tonnes per hectare of combustible material less than six millimetres in diameter.

Table 1 - Forest Fire Danger Meter Mk5 - CSIRO

Fuel Quantity (t/ha)	Fire Behavior	Forest Fire Danger Index				
		5	10	15	20	25
5	R (km/h) H (m) S (km)	0.03 0.3 -	0.06 0.6 -	0.09 1.0 -	0.12 1.5 0.1	0.14 2.0 0.2
10	R (km/h) H (m) S (km)	0.06 1.0 -	0.12 2.0 -	0.18 3.0 0.2	0.23 4.0 0.4	0.29 5.0 0.6
15	R (km/h) H (m) S (km)	0.09 2.0 -	0.18 3.5 0.2	0.26 5.0 0.6	0.35 7.0 0.9	0.43 8.0 1.2
20	R (km/h) H (m) S (km)	0.12 2.5 0.1	0.24 5.0 0.5	0.36 7.0 0.9	0.48 9.0 1.3	0.60 11.0 1.7
25	R (km/h) H (m) S (km)	0.14 3.0 0.1	0.30 7.0 0.6	0.45 10.0 1.1	0.60 12.0 1.6	0.75 14.0 2.1

7.2 Suppression Difficulty

To assess suppression difficulty within forests, this paper uses data from a study into first attack effectiveness by NRE in the period 1991/92 – 1994/95 (McCarthur and Tolhurst 1998). It indicates the following probabilities of (normal) first attack success (e.g. 6 crew, 1 or 2 slip-ons, 1 D3/D4) for given Overall Fuel Hazard Levels and FDI's. Extended Fire Attack (>10 crew, large tankers and slip-ons, D6dozer/s, aircraft) may be required to improve success rates at low to moderate FDI's on very high and extreme overall sites, and high to very high FDI's on High Overall sites.

Two tables are presented for discussion purposes, Table 2.1 from CFA and Table 2.2 from DSE. Both are designed to assist in assessing conditions to achieve probability of first attack success. They should be used in conjunction with the Overall Fuel Hazard Guide, Third Edition, May 1999, developed by NRE Fire Management Department.

Table 2.1 - Probability of first attack success.

Overall Fuel Hazard Rating	Max FDI for 100% probability of first attack success	Max FDI for 80% probability of first attack success	Max FDI for 50% probability of first attack success
Extreme	0	11	24
Very High	0	24	65
High	17	50	100
Moderate	50	100	100
Low	90	100	100

Or

Table 2.2 - Probability of first attack success.

Overall Fuel Hazard Rating	Range of FDI for Which First Attack Success Probability		
	100%	80%	50%
Extreme	First attack will fail	< 12	<25
Very High	First attack will fail	12 - 24	25 – 65
High	< 18	24 – 50	65+
Moderate	18 – 50	50+	First attack should always succeed
Low	50 – 90	First attack should always succeed	First attack should always succeed

Success probabilities based on what is considered appropriate for DSE Fuel Management Zones 1 – 3.

Deductions

There is a direct relationship with Overall Fuel Hazard Levels, FDI's and suppression difficulty. Both tables indicate a middle to high likelihood of first attack success under Extreme FDI's for Low to Moderate Overall Fuel Hazard Ratings.

However, the same probability of first attack success requires much lower FDI's once the Overall Fuel Hazard Rating reaches High to Very High, and significantly lower FDI's for Extreme Overall Fuel Hazard Rating.

7.3 Analysis of Forest Fire Indices and Other Contributing Risk Factors

It is now appropriate to analyse FFDIs, suppression difficulty and the probabilities of first attack success against over all fuel hazard ratings for individual Municipalities.

For discussion purposes, the table below has been developed to consider suggested fuel types, hazard ratings, and FFDI over a given period for individual municipalities.

This could be used as the first part of the analytical process to support decision-making by identifying the critical levels for each of the contributing risk factors in terms of fire indices to determine if the risk is acceptable or unacceptable within the forest environment.

Once the risk is considered unacceptable, this could be used as the trigger to identify the need for a detailed risk analysis of all contributing risk factors.

The process would identify fuel types and overall rating for each municipality. Once the FFDI has reached the critical level over a predetermined period, i.e. three days in seven, any days, which exceeds an FDI of 50, there is a high likelihood first attack will fail. This could be considered an unacceptable risk and therefore require a treatment or range of treatments to be implemented in order to mitigate it.

Table 3 – Critical Indices - Forest

Municipality & Fuel Type	Over all Fuel Hazard Rating	FFDI	Duration	Maximum FDI for 100% probability of first attack success
City of Greater Bendigo Box / Iron bark	Moderate	16	3 days in 7	50
Mt Alexander Shire Box / Iron bark	High	12	3 days in 7	0 – 17
Loddon Shire Council Box / Iron bark	Moderate	18	3 days in 7	0 – 17
Buloke Shire	Not applicable			
Campaspe Shire Box /Iron bark	Moderate	16	3 days in 7	50
Gannawarra Shire	Not applicable			
Swan Hill Rural City	Not applicable			
Mildura Rural City	Not applicable			
Yarriambiack Shire	Not applicable			

Note: The ratings and figures are presented as examples. It is proposed they be considered for discussion purposes only and agreed ratings and figures determined through the discussion process.

7.4 Grass Fire Danger Index

The contributing risk factors are fuel curing, fuel loads, air temperature, relative humidity and wind speed to provide a Grass Fire Danger Index (GFDI). The GFDI, whilst not directly related to rate of spread, is related to the chances of a fire starting, difficulty of control and the amount of damage it will cause. The Grass Fire Danger Meter – CSIRO Modified McArthur Mk4 Meter has been used for the purpose of assessing fire potential.

Fire potential is defined as rate of spread, flame height and suppression difficulty. The following three tables are useful in determining fire potential.

Table 4 - Grass Fire Danger Meter – CSIRO modified McArthur Mk4 meter

Fire Danger Index	Fire Danger Rating	Difficulty of Suppression
0 – 2.5	Low	Low. Head fire stopped by roads and tracks.
2.5 – 7.5	Moderate	Moderate. Head fire easily attacked with water
7.5 – 20	High	High. Head fire attack generally successful with water
20 – 50	Very High	Very High. Head fire attack may succeed in favorable circumstances.
50 - 200	Extreme	Extreme. Direct attack will generally fail.

Table 5 - Grassland Fire Danger Meter – Rate of Spread and Fuel Loads

Grassland Fire Danger (MCARTHUR MARK IV)	Rate of Spread (Km/h)	Fuel Load (t/ha)				
		1	2	3	4	5
Low	0.1	50	100	150	200	250
Low	0.2	100	200	300	400	500
Moderate	0.5	250	500	750	1000	1250
High	1.0	500	1000	1500	2000	2500
High	2.0	1000	2000	3000	4000	5000
Very high	5.0	2500	5000	7500	10000	12500

For the purpose of determining fire intensities (kW/m) for various combinations of fuel load and rate of spread, the table above is a useful guide. Shaded areas indicate, direct attack likely to succeed.

Table 6 Flame Height - Grassland

Mean flame height in each pasture condition for various rates of spread is given in the table below. Flashes of flame may extend to twice these values.

ROS (km/h	Flame height (m)		
	Natural Pasture	Grazed Pasture	Eaten-out Pasture
1	1.8	0.9	0.3
6	3.1	1.3	0.5
10	3.6	1.5	0.7
20	4.4	1.9	-

Deduction

Tables 4 and 5 indicate a similar relationship in terms of Fuel Levels (t/ha), FDI's and suppression difficulty as with forest fires. Fires burning under Very high to extreme FDI's are very difficult to suppress once fuel loads exceed 3 tonnes per hectare (t/ha).

7.5 Analysis of Grass Fire Indices and Other Contributing Risk Factors

It is now appropriate to analyse GFDIs and suppression difficulty for individual Regions. Unlike forest, where fuel types and fuel loads vary significantly between municipalities, generally fuel loads are consistent for grassland and therefore can be assessed at a regional level.

For discussion purposes, Table 7 has been developed to consider suggested indices and ratings to assist in determining suppression difficulty based on Tables 4, 5 & 6.

This information could be used as the first part of the analytical process to support decision-making by identifying the critical levels for each of the contributing risk factors in terms of fire indices to determine if the risk is acceptable or unacceptable within the grassland environment.

An unacceptable risk level could be used as the trigger to identify the need to go through a detailed risk analysis of all contributing risk factors.

The process suggests GFDIs for Regions 18 and 20 in which suppression difficulty would be considered high to very high using Tables 4, 5 & 6 as a guide. (Region 2 uses FFDI as the basis for their risk analysis process and therefore is not included). Once the GFDI has reached the critical level over a predetermined period, i.e. averaged over seven days, the level of suppression difficulty could be considered as unacceptable and therefore require a treatment or range of treatments to be implemented.

Table 7 - Critical Indices – Grassland

Region	GFDR	Preparedness Level	Duration	Suppression Difficulty
2	N/A	N/A	N/A	N/A
18	19	Yellow	Averaged over 7 days	High
20	30	Yellow	Averaged over 7 days	Very High

Note:
Preparedness levels for each Region is based on FDI's using a color coded approach for description purposes as described below:

Region 2 – FFDI:
Code Yellow 6-20, Code Orange 21-40, Code Red >40

Region 18 – GFDI:
Code Green <7, Code Yellow 8-19, Code Orange 20-49, Code Red 50+

Region 20 – GFDI:
Code Yellow 10-30, Code Orange 31-44, Code Red >45.

7.6 Human Activity

There is a direct relationship between human activity and ignition sources as shown in Table 8. This is the result of an investigation conducted into CFA's ignition descriptions (ignition activity and ignition heat form) for all vegetation fires involving human activity for the NWA for 1999 to 2003. The investigation only looked at those ignition activities exceeding 20 incidents. Data was also sought from DSE however has not yet been made available.

The information contained within Table 8 is useful for determining fire causation and therefore could be used as another source of data for identifying appropriate prevention, mitigation and education strategies.

However, the CFA database does not provide the true extent of each specific cause due to the large number of unclassified data available from CFA Fire and Incident Reporting System. (Of 7740 reports assessed, 1389 or 18% are not classified into a specific incident description.)

Table 8 - Ignition Types from Human Activity by Number of Incidents

Description	Number
Ignition Activity	
Land based commercial activities such as farming	640
Transportation (Not off Road)	633
Malicious activity	590
Burning waste heaps, rubbish, garden litter	248
Fuel reduction burning (grass, stubble, forest etc)	190
Camping, picnicking (include home barbeques)	101
Construction and maintenance	76
Land clearing, heaps or windrows etc	61
Inside activity normal to occupancy of structure	32
Vehicle – off road	21
Ignition Heat Form	
Burn-off Fires (private)	403
Match	349
Spark, ember, flame escaping from liquid-fuelled equipment	208
Cigarette	177
Heat, spark from friction	129
Lighter (flame type)	120
Re-kindled from a previous fire	106
Camp fires	75
Heat from flying brand, ember, spark	53
Rubbish fires	48
Hot ember ash	47
Molten, hot material	26
Spontaneous ignition, chemical reaction	23
Arc, spark from operating equipment or switch	20
Fires unclassified due to insufficient information or not classified	**1389**

Deduction

The main ignition types appear to evolve around a combination of unsafe work practices, faulty equipment, and human behaviour. With the exception of malicious activity, it would be reasonable to assume we could achieve significant reduction in the number of fires occurring by promoting safer work practices and modifying human behaviour. This would be best achieved through a mixture of targeted community education programs, and enforcement.

7.7 Brigade Response

Increased number and size of fires put significant demand on Brigades in terms of financial and social impacts. This may have a negative effect on their capacity to respond.

- Financial Impact – include over-time (career staff), loss of wages, fuel in terms of CFA and private appliances and vehicles, maintenance and repair costs, injuries and insurance claims, loss of production time for farmers and small business owners fighting fires.

- Social impact – is of particular importance to volunteers in terms of time spent away from family, pressures on business and employers, and short or long term disability due to injuries.

All these have a direct impact, particularly on volunteer Brigades' capacity to respond to large numbers of fires and/or protracted fires. The definition of risk therefore must also consider the potential impact on CFA volunteers, their families, employers and business. To achieve this, during the risk assessment process, we must take into regard the impact on volunteers, their families and employers in terms of minimising both the financial and social impact.

This would suggest a greater emphasis on prevention and mitigation activities in order to reduce suppression and response demands on brigades.

7.8 Fire Activity Rates and Behaviour

Increased Brigade/DSE wildfire response rates are an indicator of risk within both forest and grassland and therefore potential for loss. They also provide important information about fire behaviour and suppression difficulties.

Whilst Fire Danger Meters are useful in assessing levels of potential risk and suppression difficulty, Brigade/DSE activity rate feedback provides valuable information on actual risk for a given area. This would include causation, human activity, ease of ignition, fire behaviour and verification of fire danger meter assessments.

This is useful information which should be considered during the assessment process to measure the level of risk and identify the appropriate treatments. Table 9 provides a risk assessment table to assist with the process.

Whilst response would be considered as one of a range of treatments, in order to reduce the likelihood of fire and its impact, emphasis should be on prevention, mitigation and education as the primary treatments.

8. RISK ASSESSMENT PROCESS

Having examined the contributing risk factors associated with likelihood and severity, the next step should consider an assessment process which allows us to determine if the risk is acceptable or unacceptable. As an aid to discussion, the following process is presented for consideration:

8.1 Risk Assessment Process

1. Identify risk descriptors
2. Assess likelihood of risk descriptors occurring
3. Insert likelihood score
4. Assess consequences using qualitative measures
5. Insert consequences score
6. Combine scores to determine risk rating
7. Refer to risk assessment matrix to determine level of risk
8. Assess acceptability or unacceptability of risk rating using risk treatment process.

The following tables are provided as a range of tools, which may be useful whilst working through the risk assessment process.

Table 9 – Risk Assessment Table
For assistance in determining the most suitable likelihood and consequences risk score, refer to Tables 10 & 11 which detail description of event and impact.

Risk Category	Specific Risk	Description of Risk	Likelihood	Consequences	Risk Rating
Forest	FFDI	The risk of FFDI exceeding critical indices for 3 days in 7. Refer table 3.			
Grass	GFDI	The risk of GFDI reaching Yellow averaged over 7days. Refer table 7.			
Brigade/ DSE Response	No of fire calls	The risk of the number of fire calls increasing due to increased fire danger Index. Refer table 1 (FFDI) or 4 (GFDR)			
Brigade/ DSE Response	Suppression Difficulty	The risk of a first attack failing. Refer table 2 (FFDI) or tables 4, 5 & 6 (GFDR).			
Brigade/ DSE response	Resource and capacity	The risk of insufficient resources to respond quickly and effectively			
Human Activity	Commercial (Farming)	The risk of fire starting from farming activities, i.e. cropping, harvesting, etc			
Human Activity	Commercial (work practices)	The risk of fire starting from commercial activities, i.e. welding, grinding, slashing.			
Human Activity	Burn-offs, (stubble, rubbish)	The risk of fires getting away from burning off, i.e. stubble, rubbish, weekenders.			
Human Activity	Camping	The risk of fire starting by campers, picnickers, fishing, hunting, off road driving			
Human Activity	Major events	The risk of a major community event starting a fire			
Human Activity	Other ignition sources	The risk of other Human activities starting a fire			

Note:

Likelihood + Consequences = Risk Rating. i.e., Likelihood (unlikely) 2 + Consequences (moderate) 3 = Risk Rating 5 (Low risk).

Once the risk rating has been determined, refer to risk treatment process to determine the appropriate treatment or mix of treatments to reduce the risk.

Table 10 - Likelihood Table (Qualitative Measures)

Risk Score	Risk Rating	Description Of Events
5	Almost Certain	A fire is expected to occur in most circumstances. High level of known fires within last year (historic records/experience). Strong potential to recur (opportunity or means to recur).
4	Likely	A fire will probably occur in most circumstances. Regular fires known in last two years. (records/experience) Considerable opportunity, means to occur.
3	Moderate	A fire might occur at some time. Few infrequent, random fires within the last five years but not in the last two years. Some opportunity or means to occur
2	Unlikely	A fire is not expected to occur. One or two isolated minor fires within the last five years. Little opportunity, means or reason to occur.
1	Rare	A fire may occur only in exceptional circumstances. No previous fires. Almost no opportunity to occur.

TABLE 11 - CONSEQUENCES / IMPACT
(Qualitative Measures)

Consequences	**Insignificant - 1**	**Minor – 2**	**Moderate – 3**	**Major – 4**	**Catastrophic - 5**
Injuries	No injuries	Small number of injuries		Extensive injuries	Large number of severe injuries
Fatalities	No fatalities	No fatalities	No fatalities	Fatalities	Significant fatalities
Medical Treatment		First aid treatment required	Medical treatment required, some hospitalisation	Significant hospitalisation	Extended and large numbers requiring hospitalisation
Displacement	Small number or no people are displaced and only for short duration	Some displacement of people (<24hrs)	Localised displacement of people (<24hrs)	Large number displaced (>24hrs)	General and widespread displacement for extended duration
Personal Support	Little or no personal support required (not monetary or material)	Some personal support required	Personal support satisfied through local arrangements	External resources required for personal support	Extensive personal support
Damage	Inconsequential or no damage	Some damage	Localised damage that is rectified by routine arrangements	Significant damage that requires external resources	Extensive damage
Disruption	Little or no disruption to community	Some disruption (<24 hrs)	Normal community functioning with some inconvenience	Community only partially functioning, some services available	Community unable to function without significant support
Environmental Impact	Mo measurable impact on environment	Small impact on environment with no lasting effects	Some impact on environment with no long term effect or small impact with long term effect	Some impact on environment with long term effects	Significant impact on environment and/or permanent damage
Financial Loss	Little or no financial loss	Some financial loss	Significant financial loss	Significant financial loss, some financial assistance required	

Table 12 - Risk Assessment Matrix

Use the risk-ranking matrix to combine the likelihood and consequences ratings based on the results from the risk assessment Table 9 for each risk category.

	Consequences				
Likelihood	**Insignificant 1**	**Minor 2**	**Moderate 3**	**Major 4**	**Catastrophic 5**
Almost Certain 5	6	7	8	9	10
Likely 4	5	6	7	8	9
Moderate 3	4	5	6	7	8
Unlikely 2	3	4	5	6	7
Rare 1	2	3	4	5	6

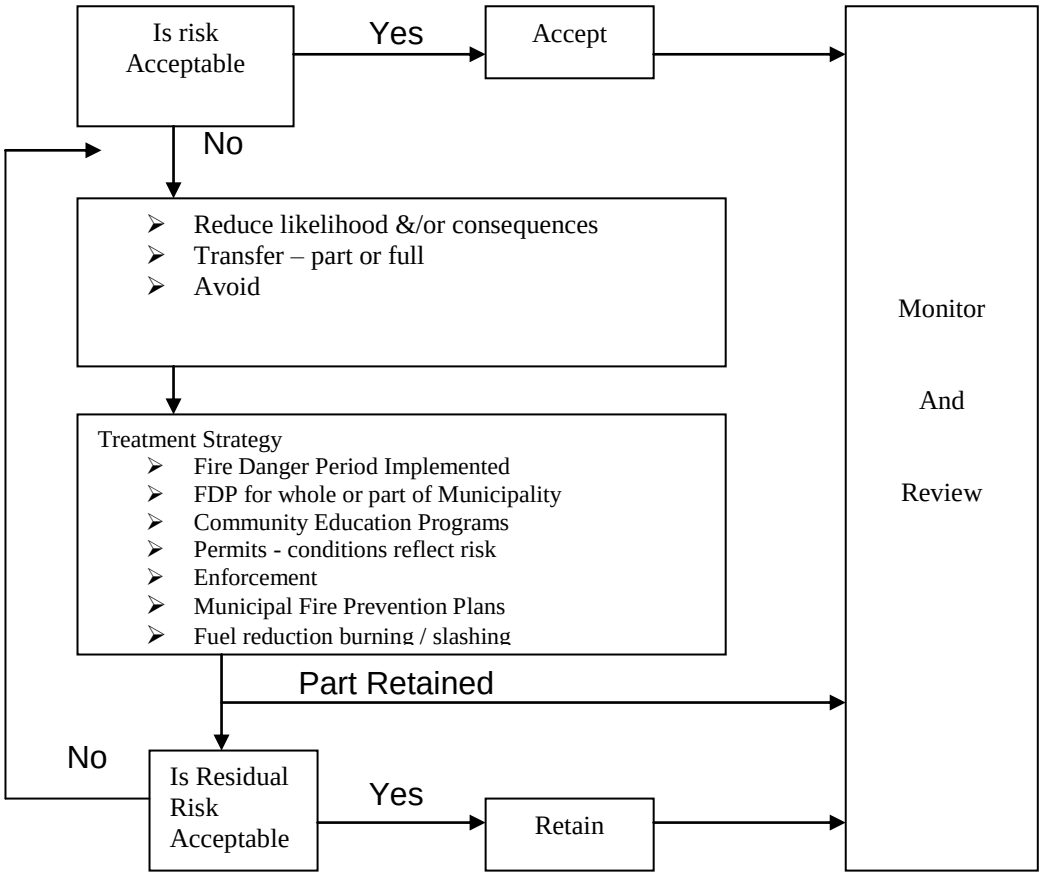
	High risk:	Large fires extremely difficult to control are likely to occur. Fires may threaten life and cause major to catastrophic damage to community assets and properties.
	Significant risk:	Medium to large fires which are difficult to control may occur. Fires may threaten life, and cause moderate to major damage to community assets and properties.
	Moderate risk:	First attack may or may not succeed. Fires unlikely to threaten life; may cause minor to moderate damage to community assests and properties
	Low risk:	First attack likely to be successful without threat to life; may cause insignificant to minor damage to community assets and properties

Definitions:

First Attack:	Suppression Difficulty – Refer Table 2 (Forest) or Table 4, 5 & 6 (Grassland)
Life:	Fire fighters, farmers, tourists, general public.
Community assets :	Forests, public utilities, infrastructure, environment, townships, historic buildings/sites, wildlife, water catchment areas, plantations, tourist attractions, caravan parks, schools, town halls, etc
Properties:	Farms, private houses, crops, livestock, fences, machinery,

9. RISK TREATMENT PROCESS

The decision tree set out below can be used as a guide when assessing risk treatment options in order to arrive at an acceptable level of residual risk. After risks have been reduced or transferred, there may be residual risk. If at the completion of this process, a residual risk is not considered acceptable, the risk treatment process will need to be repeated.



9.1 Assessment of Risk Treatment Options

9.1.1 Fire Danger Period

The CFA Act during the declared FDP stipulates certain control measures for the lighting of fire in the open air for agricultural or waste burning purposes. The conditions or control measures also impose certain limitations on, campfires, cooking, use of machinery near vegetation, and welding and grinding in the open. This system, whilst considered effective in reducing the level of risk, should be considered as one of a range of treatment options.

9.1.2 Permits to Burn

Permits to burn under the CFA Act are only required during the FDP. They stipulate certain conditions to reflect localised risks and to reduce the likelihood of a fire getting away. Responsibility for compliance with permit conditions rests with the permit holder, therefore should only be issued to responsible people who have the ability to comply with all stipulated conditions.

The point for discussion is the effectiveness of permits and to identify any failures with the current system.

A number of permit fires got away towards the end of the 2003/04-FDP. Preliminary investigation has shown the cause was that permit holders had allegedly failed to fully comply with their conditions.

Potential failures with the existing system may include:

- Permits being issued without a proper risk assessment, and therefore conditions do not adequately reflect the risk;
- Lack of understanding by permit holders of their legal responsibility and liability;
- Lack of permit condition enforcement by CFA, DSE and Municipalities leading to complacency by permit holders; and
- Reluctance of brigades to report breaches of permits to Police or CFA Region Offices.

These failures would suggest the need for improvements to the permit assessment process, greater emphasis on educating permit holders and enforcement.

9.1.3 Permit Conditions

The above conclusions suggests the need to more closely examine permit conditions. Conditions should reflect current levels of risk based on a risk assessment of the immediate and surrounding area in terms of fuel loads, available water supplies, geographic location, topography, brigade / DSE capacity, proximity to forests, threat to life and community assets.

The risk assessment could be conducted by each Municipal Fire Prevention Committee with input from the local CFA and DSE Regional Office at each committee meeting.

The following points should be considered.

- ***Light Up Times***

  Light up times, if they were applied consistently across Municipalities and they reflected existing fire danger conditions, would assist in

distinguishing between legal and illegal burn offs, particularly by fire towers and local residents.

- ***Restrict Burning Off Near Forests***

  Burning off near forests can pose an increased level of risk should the fire get away. The level of risk is determined by the level and consistency of fuel leading up to the forest, forest fuel loads and distribution, dryness, topography, dwellings and/or townships adjacent to the forest, brigade and DSE capacity. To reduce the level of risk, any application for a permit within 3 kms of a forest may require referral to DSE for special consideration. DSE may apply additional conditions beyond those of other permits.

- ***Enforcement***

  Random inspection of burn-offs to ensure compliance with permit conditions and pursuing prosecution for illegal fires which get away, may act as a useful deterrent to others. Pursuing prosecution should only be considered if there is clear evidence of negligence or non compliance.

9.1.4 Community Education

Greater emphasis on community education programs should be considered as a key prevention and mitigation strategy. Targeting people likely to use fire for a specific purpose, including landowners, tourists, roadside slashing, motorists, campers, weekenders, etc, could be included. Community education programs, which may be effective in this area, are:

- Media campaign
- Bush Fire Blitz
- Visiting camp sites and caravan parks
- Farm Fire Safe
- Brigades in Schools
- Road side and camp site fire prevention signs
- Community meetings
- Displays

9.1.5 Municipal Fire Prevention Plans

The primary objective of Municipal Fire Prevention Plans (MFPPs) is to achieve effective fire prevention and preparedness strategies.

MFPP's are developed using Risk Management Principles. In most cases, the identification and assessment phase considered information from relevant reports, previous fire prevention strategies, fire policies and plans, demographic data, land management plans and maps held by Councils, DSE, Parks Victoria and other agencies and groups.

The outcome of the process is a range of treatments identified to mitigate the risks unique to each Municipality. Some of these treatments could support achieving the objective of this project and therefore would be worth considering.

Investigation of treatments within a number of MFPP's regarding the natural environment found the following program headings which contain a number of prevention and mitigation options:

- Land-use Planning Controls
- Fuel reduction - Burning, Slashing.
- Local Law Controls
- Community Education
- Strategic Water Points
- Information for Tourists
- Farm Machinery Safety
- Fire Prevention Notices
- Road Side Slashing
- Strategic Fire Breaks
- Fuel reduction Burns

9.1.6 DSE North West Region Fire Protection Plan

DSE's Fire Protection Plan main purpose is the protection of life, assets and environment from wildfire. The plan has defined objectives and strategies which cover wildfire prevention, preparedness, suppression and recovery.

In the areas of Wildfire prevention and preparedness, treatments include:

- Community Fire Education
- Enforcement
- Road and track access
- Water points
- Detection (fire towers)
- Fuel management
- Fuel management Burn Plans
- Fuel Management Zones
- Fuel Breaks
- Slashing / bulldozing and grading
- Grazing

10. MONITOR AND REVIEW

CFA and DSE Regions should monitor Brigade/DSE response activities and fire behaviour leading up to and during the Fire Danger Period to assess fire behaviour, suppression difficulty and area burnt. This would assist with assessing the level of risk and effectiveness of treatments strategies.

Each MFPC could at the end of each fire season, measure effectiveness by assessing fire activity and losses against the range of treatments implemented to mitigate the risk.

The objective would be to identify any gaps within the guidelines and recommend improvements to ensure they continue to meet the objectives for each Municipality within NWA, for Brigades and for their communities as part of a continuous improvement process.

11. CONCLUSION

The research underpinning this discussion paper suggests there may be a number of deficiencies in the way we currently assess and manage wildfire risk, particularly in respect to the current risk assessment process for the introduction and termination of the FDP.

Current strategies seem to emphasise response and suppression as the primary treatment option.

Based on the evidence presented above there appears to be a need for a holistic approach to the treatment of elevated risk levels during the FDP. Such an holistic approach could easily be integrated into CFA and DSE strategic planning.

12. RECOMMENDATIONS

1. Consideration be given to the process described in this Paper for adoption by CFA and DSE for the management of risks within the natural environment.

2. An easy to use set of guidelines based on the outcomes of this discussion paper be jointly developed to assist in the application of agreed systems and processes.

3. Municipal Fire Prevention Plans, Municipal Emergency Management Plans and DSE NW Region Fire Protection Plan across North West Area be amended to include guidelines and processes agreed as a result of this discussion paper.

13. REFERENCES

a. P. Cheney & A. Sullivan (1997) Grass Fires, fuel, weather and fire behavior

b. Natural Resources & Environment (1999) Overall Fuel Hazard Guide

c. CSIRO (1992) Forest Fire Danger Meter Mk5

d. CSIRO (1997) grassland Fire Danger Meter (CSIRO – modified Mk4 meter)

e. Emergency Management Australia (2000) Emergency Risk Management (Application Guide)

f. CFA (1999 – 2003) - Fire and Incident Reporting Service, Incident Statistics

g. City of Greater Bendigo (2003 – 2004) Municipal Fire Prevention Strategy

h. Mt Alexander Shire Council (2003 – 2004) Municipal Fire Prevention Plan

i. Loddon Shire Council (2002) Municipal Fire Prevention Plan

j. Northern Grampians Shire Council (2003) Municipal Fire Prevention Plan

k. DSE (2002) Draft North West Region Bendigo Fire District Fire Protection Plan

Appendix A

CLIMATE

Rainfall

The amount of rainfall recorded in a geographic location is a factor in fuel curing rates, fuel loads and fuel availability. Contribution of rainfall is factored into Drought Index.

Drought Index

The Keech-Byram Drought Index provides a measure of the probable moisture content of the soil and vegetation through the recording of rainfall and evaporation loss. 100 (southern parts of NWA) and 120 (in the Mallee) could be used as a base figure for the introduction of FDP and 80 and 100 (respectively) for termination unless local conditions determine otherwise.

Fire Danger Index (FDI)

FDI is a measure of fire danger based on drought index, air temperature, relative humidity, and wind speed to assist with operational preparedness both within the forest and grassland. Within NWA, the following FDI's are used:

Region 2 – FFDI:
Code Yellow 6-20, Code Orange 21-40, Code Red >40

Region 18 – GFDI:
Code Green <7, Code Yellow,8-19, Code Orange 20-49, Code Red 50+

Region 20 – GFDI:
Code Yellow 10-30, Code Orange 31-44, Code Red >45

Appendix B

VEGETATIVE CONDITIONS – GRASS LAND

Fuel Curing

Fuel Curing is a measure of the life cycle of vegetation and varies from 0% (Green) to 100% (Very Dry). The greatest rate of change in the degree of curing and its effect on fire spread occurs when grass is between 75% and 90% cured. Critical Curing Values are between 80 and 85% at which uncontrolled grassfires can occur. Therefore 75% could be used as a consideration for the introduction of the FDP prior to the point where uncontrolled fires occur.

Rainfall determines the moisture content of grass prior to becoming 100% cured, for the purpose of a quick visual assessment, pasture conditions can be described as Green, Green Shoot, Dry, Very Dry.

Pasture Condition	% Cured
Green	0% - 30%
Green Shoot	30% - 50%
Dry	50% - 75%
Very Dry	75% – 100%

Grass & Crop Growth

Fuel loads in grass lands and crops will vary based on pre-fire season rainfall and usually range between 1 and 5 tonnes per hectare. For the purpose of visual assessment, they can be described as either: Poor, Fair, Good, Abundant

Grass / Crop Growth	Fuel load (t/ha)
Poor	1 – 2
Fair	3
Good	4
Abundant	5

Note: Refer to Appendix A for guidelines on fire intensities and rate of spread.

Land Fallowed Percentage

The percentage of land fallowed is useful in determining farming fuel loads and continuity of fuel which contributes to the potential fire risk in terms of size of fires and threat to farming and community assets. Large areas of fallowed land would reduce the risk by providing a network of fuel breaks.

Appendix C

VEGETATIVE CONDITIONS – FOREST

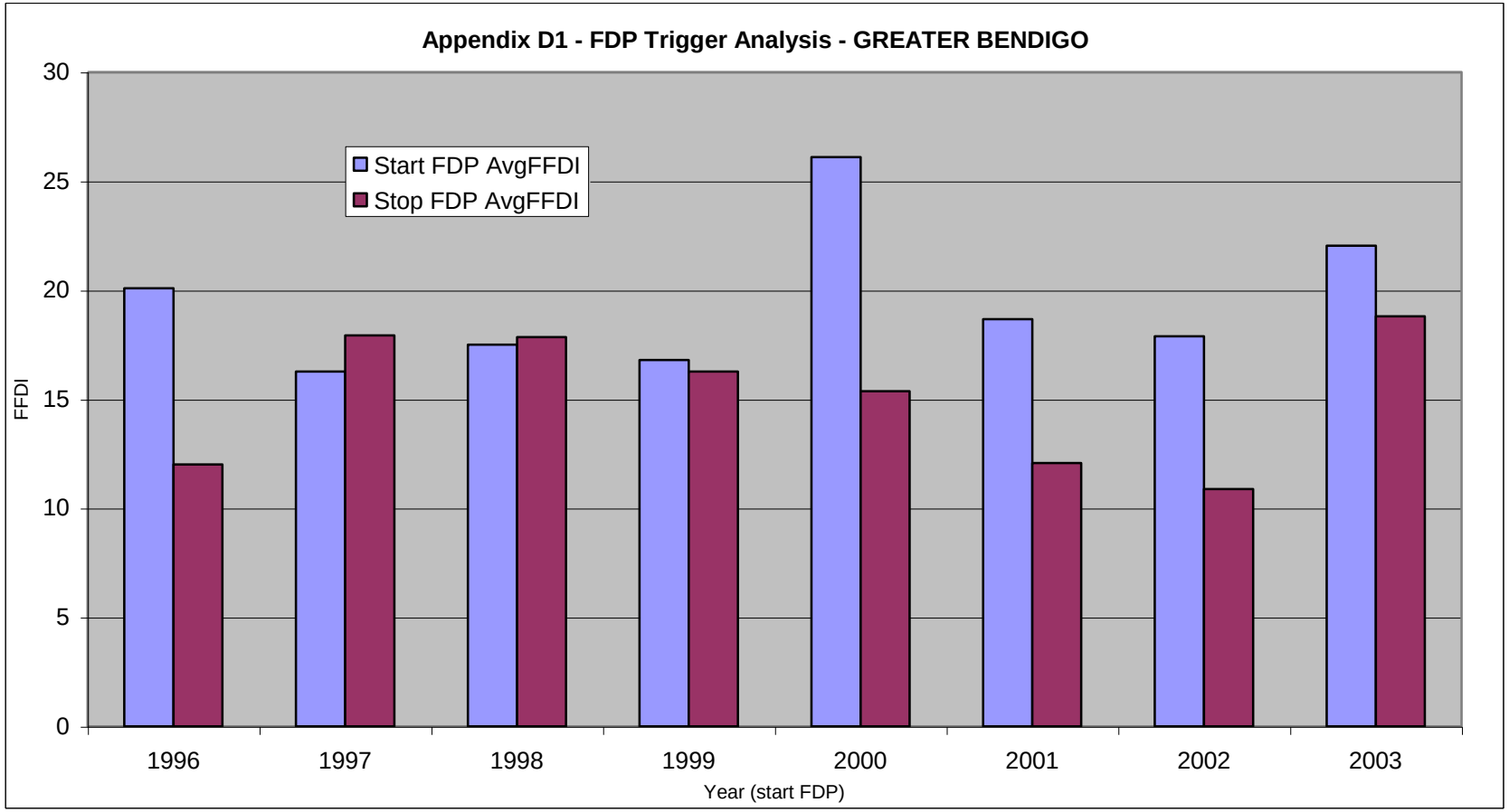
State of Forest or Scrub

Rainfall determines the moisture content of forest and scrub, for the purpose of a quick visual assessment, vegetation condition can be described as Wet, Damp, Dry, Tinder Dry.

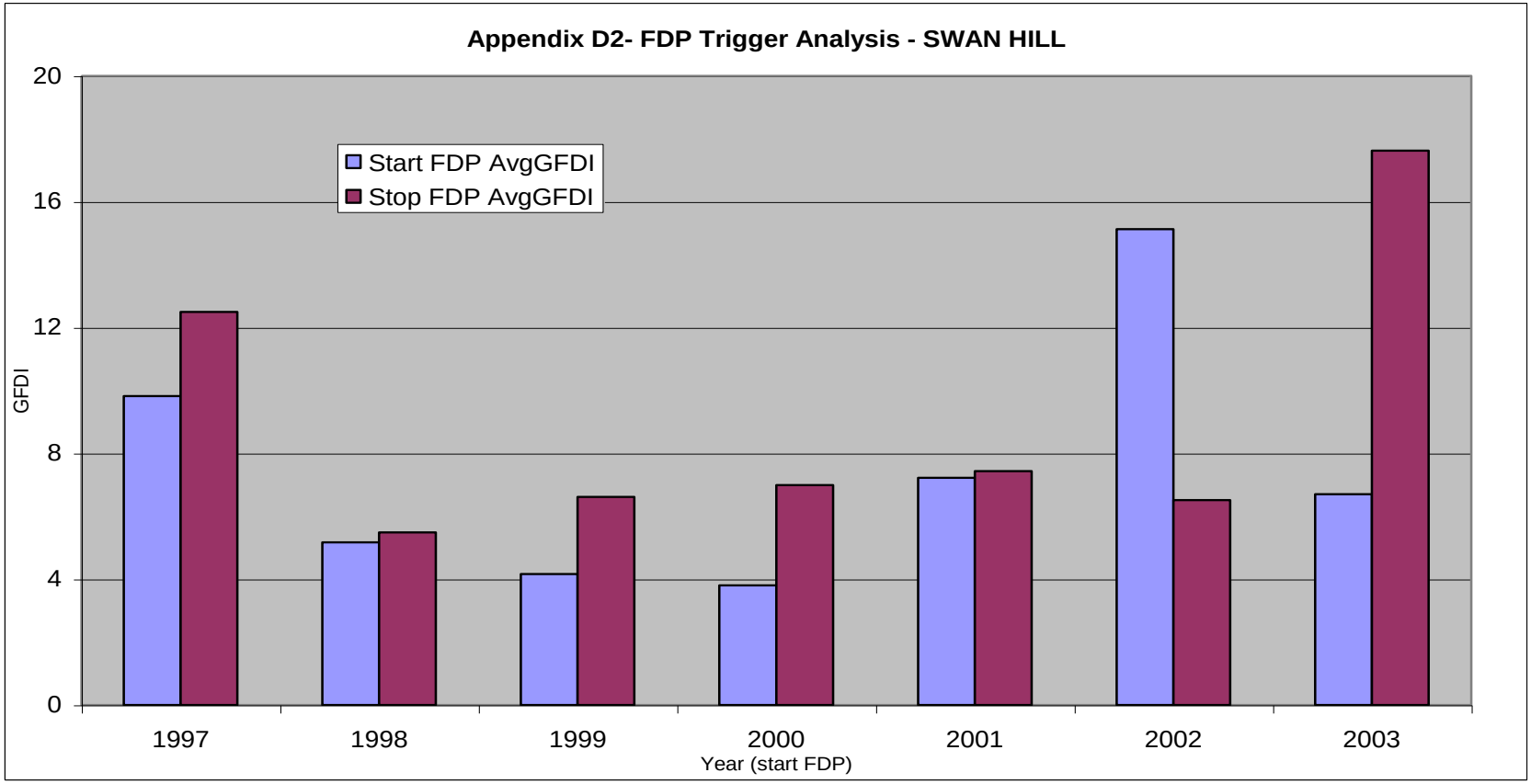
Forest Fuel Hazards

Overall forest fuel hazards is defined as (the sum of the influence of) Bark Hazard + Elevated Fuel Hazard + Surface Fine Fuel Hazard. The Overall Fuel Hazard Guide (NRE - Third Edition 1999) is a good guide in assessing the hazards posed by Bark Fuel, Elevated Fuel and Surface Fine Fuel.

Fuel loads will vary among Municipalities and therefore actual figures will need to be obtained from DSE each year.

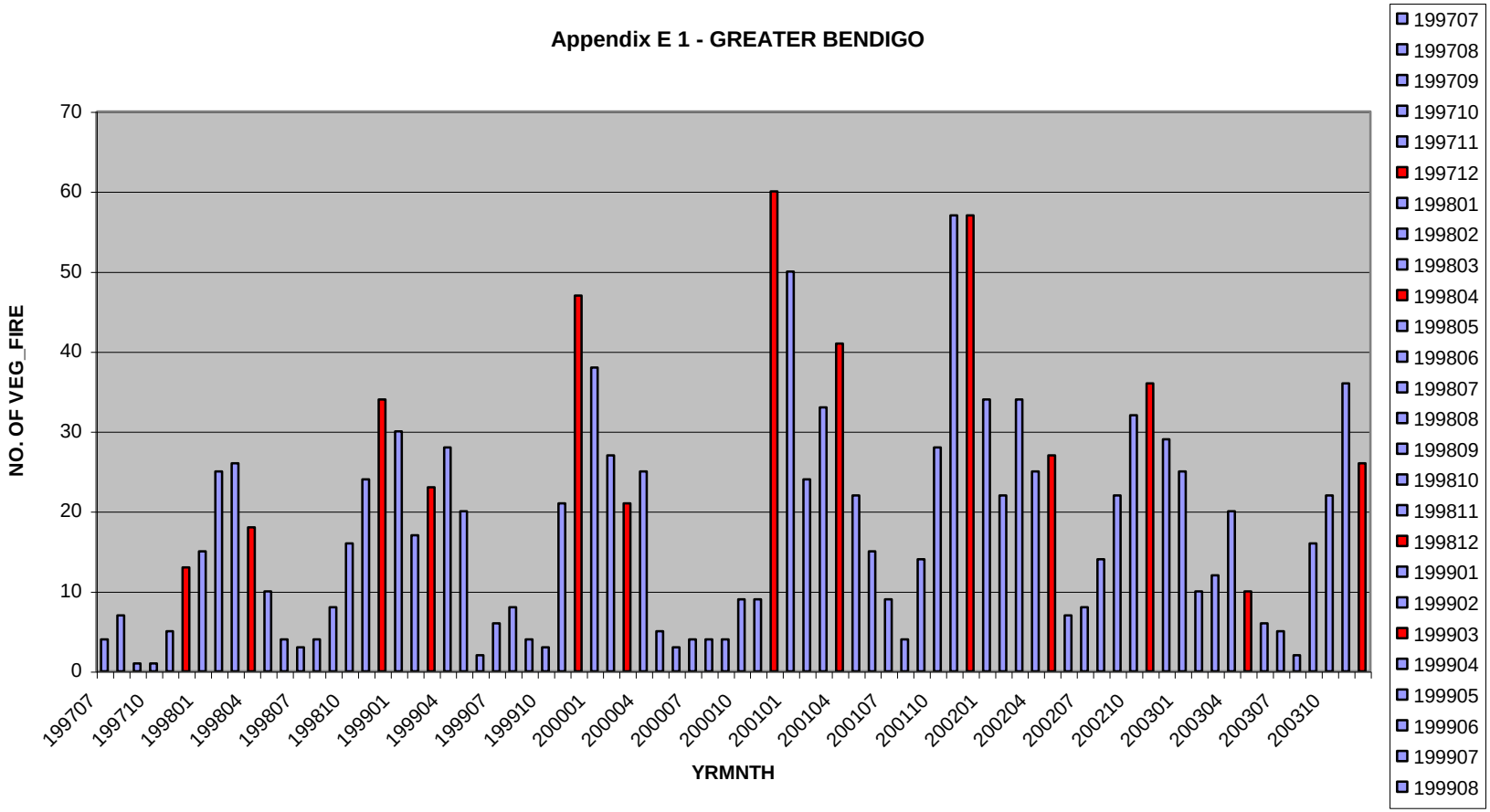


This shows the average FFDI for a period of 2 weeks leading up to the date when the decision to introduce FDP would have been made. Actual introduction date would have occurred 10 days later due to Government Gazette administrative requirements. The graph shows large variances between introduction and termination FFDIs for 50% of the sample period. The FFDIs for introduction in six out of eight dates is between 16 to 20, which is consistent with the suggested FFDI of 16 in Table 3. A similar trend occurs with termination dates with 5 out of 8 close to the suggested introduction FFDI. In two cases the termination FFDI is higher then the introduction FFDI for the same year. **Conclusion:** 1. No apparent consistency for the introduction and termination of FDP; 2. Introduction and termination dates do not reflect the level of risk; 3. No standard logic or methodology applied to measuring the level of risk.



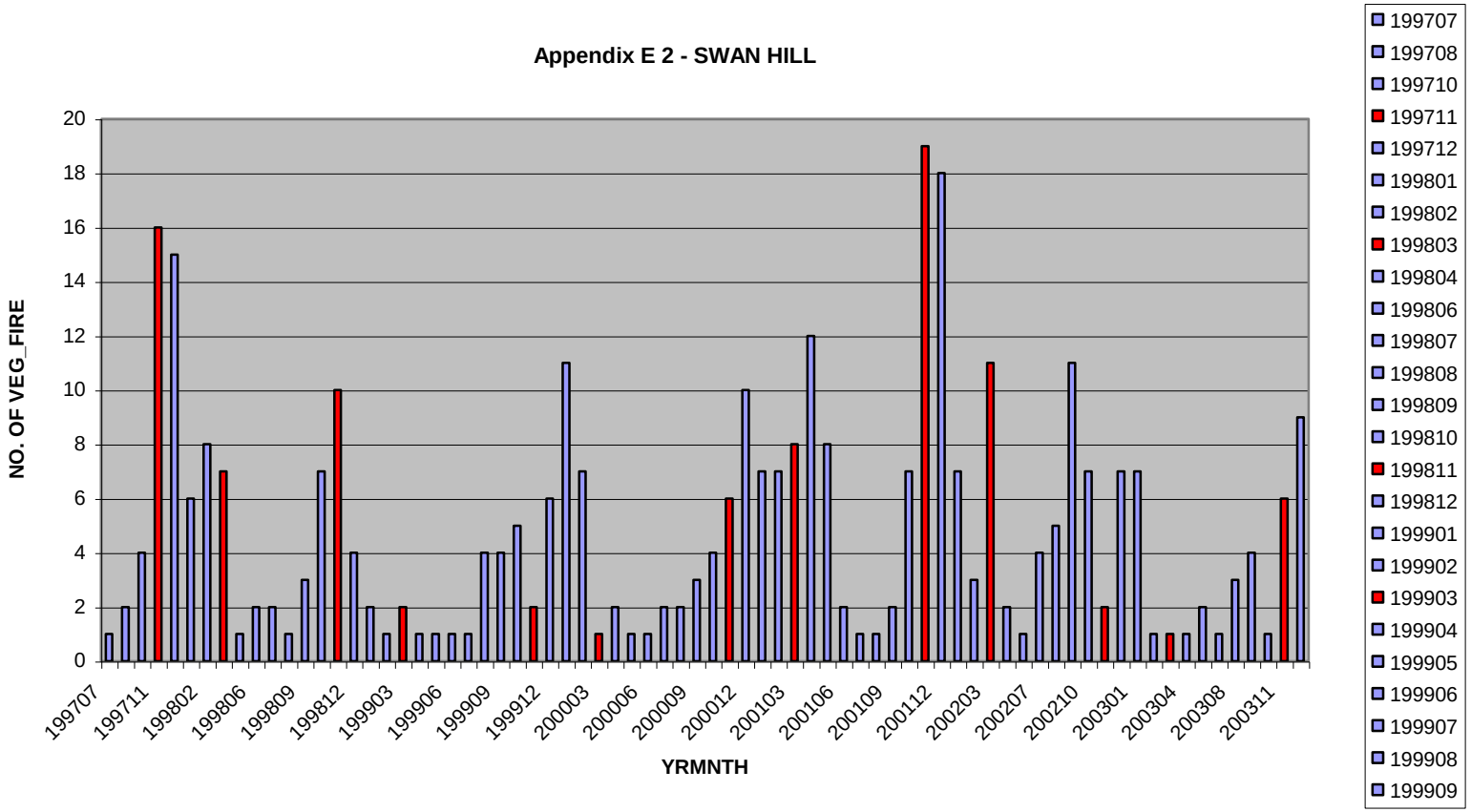
This graph shows the average GFDI for a period of 2 weeks leading up to the date when the decision to introduce FDP would have been made. Actual introduction dates would have occurred 10 days later due to Government Gazette administrative requirements. The graph shows large variances between introduction and termination GFDIs for 50% of the sample period. The GFDIs for introduction and termination dates, with the exception of one, fall well short of the suggested GFDI of 19 listed in Table 7. On four occasions the termination GFDI is markedly higher then the introduction GFDI for the same year.

Conclusion: 1. No apparent consistency to the introduction and termination of FDP; 2. Introduction and termination dates do not reflect the level of risk; 3. No standard logic or methodology used to measure the level of risk.



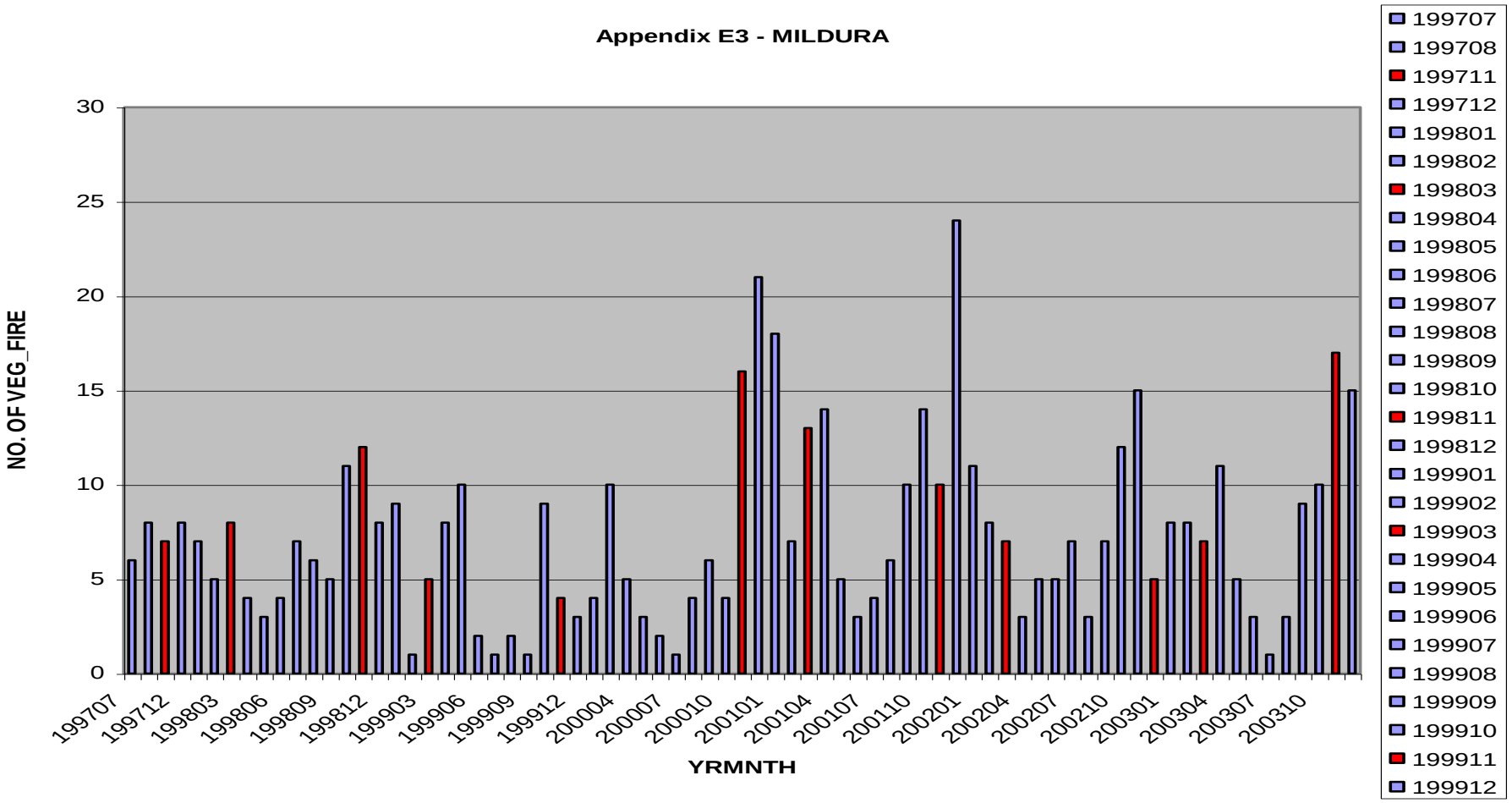
Introduction	1/12/97		14/12/98		6/12/99		18/12/00		3/12/01		4/11/02
Termination	24/4/98		29/3/99		27/03/00		2/04/01		1/05/02		1/05/03

Notes: There is no apparent link between fire activity and introduction and termination dates. There also appears to be no pattern associated with the number of vegetation fires leading up to, during and after the FDP. This would suggest there is no link between fire risk and introduction and termination dates.



Introduction			23/11/98		22/11/99		27/11/00		23/11/01		11/11/02
Termination	10/03/97		9/03/99		14/03/00		13/3/01		12/3/02		11/3/03

Notes: There is no apparent link between fire activity and introduction and termination dates. There also appears to be no pattern associated with the number of vegetation fires leading up to, during and after the FDP. This would suggest there is no link between fire risk and introduction and termination dates.



Introduction	10/11/97		16/11/98		1/11/99		13/11/00		12/11/01
Termination	10/3/98		9/3/99		14/3/00		13/3/01		18/3/02

Notes: There is no apparent link between fire activity and introduction and termination dates. There also appears to be no pattern associated with the number of vegetation fires leading up to, during and after the FDP. This would suggest there is no link between fire risk and introduction and termination dates.