PAMPHLET No. 7

BULLETIN No. 58

The Foresters' Manual

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PART III

FIRE CONTROL

(South-West—1956)

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CONTENTS.

APPENDICES.

INTRODUCTION.

The attention of officers receiving this pamphlet is drawn to the introduction in Pamphlet No. 1 which is applicable to the Manual as a whole.

It is to be noted that each section as issued will override the instructions contained in circulars on subjects covered by the section and such circulars will automatically be cancelled.

A. C. HARRIS,
Conservator of Forests.

1956.

THE IMPORTANCE OF FIRE CONTROL.

Importance of Fire Control.

745. The problem of fire control is intimately bound up with the questions of reforestation and afforestation and the ultimate success of the Department's efforts in these projects is largely dependent on a strong measure of public sympathy and co-operation in attacking the fire problem.

746. Of almost equal importance is the proper use of controlled fires in silvicultural and protective operations.

747. The eucalypt forests of Western Australia lend themselves to hazard reduction by the intelligent use of fire in the Spring, Autumn and Winter by Prescribed Burning.

POLICY.

748. At the passing of the Forests Act, 1918, the Northern half of the State Forests had been ravaged by unrestricted cutting and uncontrolled fires.

749. Since 1919 the Northern half of the forest has been roaded and until recently given complete protection at a very high cost.

During this period, the extension of group settlement and other farming ventures resulted in heavy damage due to indiscriminate firing of much of the Southern forest area where the forestry organisation was not yet established.

750. It was found that after 15 or 20 years protection the accumulation of combustible material was such that even very heavy expenditure on men and equipment could not "stay" a fire under the severe weather conditions that occur periodically in Western Australia. Other States have learned this lesson with equal force.

751. The result of nearly four decades of fire control experience and research is a policy introduced in 1954 which may be briefly summarised as follows:—

(a) Put all available funds into the roading of valuable forest areas to check annual losses by uncontrolled fires.

(b) Use prescribed burning and intelligent planning to the fullest extent possible to reduce the danger of severe uncontrolled fires.

(c) Use our well developed fire-fighting organisation to quell outbreaks in the dangerous summer months, but fight fires with discretion and with an eye to the cost of the operation.

(d) Train officers and men to think in terms of costs and collateral values on every operation involving fire protection.

(e) Train and trust the junior officer to use fire as a controlled weapon to accomplish sylvicultural ends and to guard against calamities.

Demarcation of Zones.

752. In the implementation of this policy it has been found necessary to divide the forest into three zones indicating the degree of fire protection aimed at and for the annual Fire Report.

"A" Zone.

753. **"A" Zone.**—This will comprise all country on which fires will be attacked immediately they become known.

This will include regenerated or planted forest as well as the greater part of the prime forest over which fire control measures are gradually being extended.

Within this zone there will be a proportion of sub-marginal forest and even unforested country as well as private property.

"B" Zone.

754. **"B" Zone.**—Will include forest on which it is possible to afford limited protection only by broadcast burning in suitable weather.

Fires in this zone will be suppressed only when threatening "A" Zone, or when creating heavy smoke haze which may interfere with fire control measures on adjoining forest areas.

This zone will also include certain areas of private property adjacent to State Forest boundaries.

Plantation Zone.

755. **"Plantation" Zone** will comprise areas planted or sown with exotic or indigenous species in plantation form, areas cleared or part cleared awaiting planting and a protective buffer area surrounding these areas.

The "Plantation" Zone is in "A" Zone as for paragraph 753 but is instituted for the convenience of the Annual Fire Report, see Appendix F.

Reports to refer to zones.

756. All fire reports dealing with damage to the forest will refer to the area in terms of these zones.

The fire organisation.

757. The Forests Department's organisation covers a large area loosely controlled and must train, organise and prepare in periods of little danger for periods of extreme effort. This involves emergency measures and the use of untrained men and incomplete equipment. In all such organisations, stress is placed upon the clear definition of duties and responsibilities. Those definitions and responsibilities are laid down in this section of the Manual, and all officers must clearly understand that such duties are the responsibility of the position rather than the actual rank of the officer.

Duties of Acting Officer.

758. For example, where the duties of a D.F.O. or District Officer are defined, it follows that in his absence, even temporarily, such duties devolve upon the officer acting in that position.

Branches of Fire Control.

759. The work of fire control falls into three main branches:—

(1) Fire Prevention.
(2) Fire Pre-suppression.
(3) Fire Suppression.

These branches are dealt with under each heading in the following pages.

DEFINITIONS.

760. **Broadcast Burning.**—Fire used to destroy surface material in such a way that it burns freely over a considerable area with or without the use of firebreaks.

761. **Controlled Burning.**—(a) Any deliberate use of fire whereby burning is restricted to a predetermined area and intensity; or (b) Deliberate burning of a prescribed area at a predetermined time.

762. **Danger (Fire).**—A general term expressing the sum of the factors Risk, Hazard, Inflammability which determine whether fires will start, the damage they may cause and the extent to which they can be controlled.

763. **Dangerous Fire Weather.**—In connection with the stopping of bush locomotives (paragraph 821) dangerous fire weather is to be interpreted to mean all days of "Dangerous" on our scale of fire hazard and on some days of "Severe Summer" when, for special reasons, it is considered advisable by the Divisional Forest Officer.

764. **Fire, Crown.**—The crown fire is a fire burning through the crowns of the trees in advance of the following surface fire.

This type of fire is rare and occurs only under extreme weather conditions.

A crown fire cannot continue to burn unless fed by a following surface fire, by surface fires lit, either along with, or ahead of, the crown fire by burning debris dropping down from or blown ahead of the running crown fire.

765. **Fire, Ground.**—A ground fire is one that burns below the surface of the forest litter in peat or very deep litter.

This type of fire is rare in Western Australia, but has been experienced in some of our wide flats or in deep dry river bottoms.

766. **Fire, Surface.**—The surface fire is one that burns through the scrub and litter on the forest floor.

This is the usual type of fire in this State.

767. **Fire Protected Area.**—Any portion of the State declared a Fire Protected Area under the Bush Fires Act.

In a Fire Protected Area no one may light a fire between 1st October and the next 31st May, that is including the prohibited period without a permit from an officer authorised by the Minister for Lands (see paragraphs 789 and 790).

768. **Forest Officers.**—An officer appointed under the Forests Act or the Public Service Act irrespective of whether they are permanent or temporary officers and includes Professional Officers and field staff, but does not include overseers or other wage employees.

769. **Hazard (Fire).**—A measure of that part of fire danger which is due to the fuels available for burning.

That is the relative amount, class, character, moisture content, condition and distribution.

Hazard refers to fuels only.

Risk refers only to the agencies that may cause fire.

770. **Inflammability** is the susceptibility of the fuel to ignition and is closely related to its moisture content.

771. **Mopping up.**—The term used for the work done in rendering a fire safe after it has been brought under control.

772. **Prescribed Burning (American).**—The application of fire to land under such conditions of weather, soil moisture, time of day and other factors as will result in the controlled spread and intensity of heat required to accomplish specific sylvicultural or fire hazard reduction purposes.

773. **Pre-suppression.**—Those activities carried out during the safe period and maintained throughout the season to ensure that when a fire starts the whole suppression organisation will act efficiently.

The activities are the organisation, instruction and management of the fire control force, and the inspection, maintenance and improvement of fire control equipment and supplies to ensure effective suppression.

774. **Prevention.**—Those fire control activities concerned with the attempt to reduce the number of fires through Education, Law Enforcement and Hazard reduction.

All those steps taken prior to and during the fire season to stop fires from starting.

775. **Risk (Fire).**—The relative chance or probability of fire starting, determined by the presence or absence of causative agencies.

FIRE PREVENTION.

Branches of Fire Prevention.

776. Fire prevention, a most important branch of fire control, can be divided into the following sections and subheadings which are dealt with in turn:—

(1) Risk Reduction.
  (a) Education.
  (b) Law Enforcement.
(2) Hazard Reduction.

Causes of Fires.

777. Before discussing details of fire prevention activities a study of fire causes will be of value as indicating sources of fire incidence and possible points of attack in the campaign against future outbreaks.

The percentage incidence of fire from various causes over past years is as follows:—

Cause.	Per cent.
Escapes from Private Property	21
Bush Locomotives	14
W.A.G.R. Locomotives	10
Escapes from Controlled Burning	7
Hunters and Fishermen	7
Unknown	6
Travellers	6
Deliberately lit	6
Stockmen	5
Bush Workers	5
Other Government Departments	2
Mill surroundings	2
Lightning	2
Children	2
Householders	1
Miscellaneous	3

RISK REDUCTIONS.

778. A study of fire causes will give some indication of the risks to be reduced or eliminated, and Risk Reduction can be either by Education, Law Enforcement or merely mechanical adjustment.

Smoking in Plantations.

779. Smoking will be prohibited in all plantations except on fire lines when butts and spent matches must be deposited on bare mineral soil and buried.

Billy Fires.

780. When it is necessary to light a billy fire it must be lit on an area cleared down to mineral soil and the remains of the fire doused with water and covered with soil.

Instruction of Employees.

781. All new employees must be instructed in these precautions and the provision of the two preceding paragraphs rigidly enforced.

EDUCATION.

782. The most effective means of fire prevention is popular education. The objective is to make everyone fire conscious, and to make the general public realise the value and necessity of fire control.

Visiting of Schools.

Taking the long view, special attention should be given to the training of the younger members of society. Children are more receptive than adults, the child in the classroom today, is the responsible citizen of tomorrow. Moreover, the child will take the doctrine of fire prevention from the school room to the home. Every effort should be made by the Forest Officer to introduce the subject of fire prevention into the schools of his district.

783. Posters advocating fire prevention should be displayed at bus shelters, railway sidings, crossroads and other suitable permanent places throughout the forest. A recent innovation is the sign board carrying the daily Fire Weather Forecast which is a very effective means of educating the travelling public, but the information on the board must be always up-to-date. Posters and Sign Boards.

784. Suggestions for striking posters should be submitted to the Fire Control Office, and officers are encouraged to develop fire warning signs.

Requisitions for posters required should be submitted to Head Office before September in each year.

785. Small pamphlets, giving information concerning the provisions of the Bush Fires Act, the fire provisions of the Forests Act, organisation of Bush Fire Brigades and hints on controlled burning and fire suppression methods are prepared by Head Office from time to time and should be distributed among local residents and settlers by the local Forest Officer. Pamphlets.

Personal discussions at the time of distribution of these pamphlets and notices of intention to burn will greatly assist the work.

Recommendations for the printing of new pamphlets and requisitions for supplies should be submitted in September each year.

786. Lectures and the showing of such propaganda films as are available can be arranged where fire control measures are instituted. Lectures and films.

Application for the services of a lecturer if none is available locally, and/or the Departmental projector should be made to Head Office, as required.

LAW ENFORCEMENT.

787. Every forest officer must make himself acquainted with the Bush Fires Act and Regulations, and make sure that his copy of the Act is kept up-to-date by entering any amendments that are gazetted. Bush Fires Act.

788. Besides the provision of the Bush Fires Act, the attention of all forest officers is drawn to the following fire provisions of the Forests Act. Fire provisions of Forests Act.

Section 46.—Penalty for unlawful lighting of fires (minimum 1/20th of maximum).

Section 47.—Forest officers calling for assistance to extinguish fires.

Section 48.—Setting fires to bush without notice to forest officers.

789. The Bush Fires Act makes provision for the declaration of Fire Protected Areas in which the lighting of fires (during the "restricted burning times") is prohibited except by written permit to burn issued by the Minister for Lands or an officer acting with his authority. Fire Protected Areas.

There are only two such areas so far gazetted, one within a twelve mile radius of Collie Railway Station, and the other an irregular area in the Mundaring Weir district.

790. Forest officers have the sole authority to issue permits to burn in these areas. Foresters may issue.

791. The correct procedure for the issue of permits to burn in fire protected areas is fully set out in the Regulations under the Bush Fires Act and must be followed. Permits to burn.

792. Generally, the forest officer shall have an inspection made of the area to be burned to ensure that all precautions are taken. Inspections to be made.

No permits during prohibited period.

793. No permit to burn shall be issue during the prohibited period except during a period when the Department has obtained a suspension of the prohibited period, and then only if the forest officer is satisfied that conditions are safe.

Prohibited period.

794. The Bush Fires Act provides that there shall be a prohibited period each year, during which the lighting of fires, except for certain specific purposes is prohibited. The dates for the prohibited periods for different zones are published in the *Government Gazette* from time to time.

Suspension of prohibited period.

795. Provision is also made for this Department to obtain a suspension of the prohibited period to enable us to carry out protective burning.

796. Before the beginning of the prohibited period the Forester-in-Charge should apply to Head Office for any suspension required, setting out the reason for his request, the minimum period required, the Road District concerned and the particular areas on which the burning operations are to be carried out.

Application for suspension.

All such applications for the suspension of the prohibited period must be countersigned by the Regional Superintendent or the Fire Control Superintendent.

Suspensions applied for at this time if endorsed as above will be granted up to 31st December for all districts except Nannup and Pemberton where suspension up to 6th January may be applied for, although it must be appreciated that this is a serious matter.

Any further suspension required must be the subject of a special application about the end of December; they will not be considered before this date.

No suspension beyond 15th January will be considered.

797. In every case of fire the local officer must take immediate steps to ascertain the cause with a view to possible law enforcement. The procedure to be followed is set out in paragraph 968.

Investigation of Fires.

798. From his local knowledge the forester will generally have a good idea of the cause of most fires which occur. Where it is obvious that it is directly due to human agency, immediate steps should be taken to obtain more specific information concerning the identity of the culprit, and some points on how to go about such an investigation are given in Appendix A.

Blacktracker.

799. The Department now employs a black tracker for the Fire Season when one is available and if the Forester has any doubt at all of his ability to follow tracks found, or if he cannot find any tracks, the services of the tracker must be sought.

Transport for tracker.

800. Each season when the tracker commences his duties with the Department all districts will be advised of his location. The Forester requiring his services will arrange transport by mutual arrangement with the Forester in whose district the tracker is stationed.

Accommodation.

801. Accommodation for the tracker if he is to be kept overnight must be arranged by the forest officer using him. Usually by arrangement with the Commissioner of Police, the tracker is accommodated at the Police Station, otherwise a tent or hut must be provided. The tracker will usually bring his own blankets and one meal.

Tracker from C.I.B.

802. If the tracker is temporarily engaged elsewhere, or in the case of Northern districts close to Perth, the Forester should ask his Divisional officer to secure the services of a police tracker from the Metropolitan Area through Head Office.

803. A frequent source of uncontrolled fires is escapes from settlers' burning off operations. Farmers' fires.

Most of these are due to ignorance and lack of experience so that discussion with farmers and bush fire brigades should go far to minimise this trouble.

804. Some of these escapes are due to inadequate safeguards and where settlers persist in ignoring the provisions of the Bush Fires Act they must be prosecuted.

805. Where a breach of the Bush Fires Act occurs on private property outside the boundary of State Forest the Local Authority, which is charged with the policing of the Act, should carry out the prosecution. Local Authority to Prosecute.

806. The forester may assist officers of the Local Authority to obtain evidence, but as far as possible should leave prosecutions to the Local Authority where the breach occurs on private property. Forest Officer to assist.

807. Where a Local Authority fails to take legal action against flagrant breaches of the Bush Fires Act, particularly if there are several cases of such failure, immediate advice of the incidents together with full details should be sent to the Fire Control Superintendent so that the matter may be taken up with the Bush Fires Board without delay. Lack of action by Local Authority.

808. When any illegal burning outside State Forest boundaries is located, the Local Authority should be notified immediately by telephone of the position of the fire and a record made in the office log book. Notice to Road Board.

809. Once a week a confirmatory letter should be sent to the Board listing all the fires located in their area during the period and notice of which they have already received by telephone.

A copy of these letters should be sent to the Fire Control Superintendent.

810. With each daily report of the fire position (see Para. 944) advice of any illegal fires reported as above should be included so that the Fire Control Superintendent can keep the Bush Fires Board posted with the day to day position. F.C.S. to be advised.

811. If the Local Authority is known to be taking disciplinary action in any case advice of this should also be sent to Head Office without delay. Action by Road Board.

812. Forest officers must be most punctilious in the observance of all provisions of the Act. Forest officers to observe the Law.

Bush Locomotives.

813. Under Regulation 135 all bush locomotives must be provided with efficient spark arresters and ash pans from 1st December to 30th April each year or any other period the Conservator may indicate in writing to the sawmill management. Bush locomotives to have spark arresters and ash pans.

814. Officers inspecting locomotive spark arresters and ash pans must have a sound knowledge of possible points of failure and notes on Locomotive Fire Prevention Apparatus is given in Appendix B.

815. Locomotives should be carefully inspected when cold at intervals through the fire season, not merely at the commencement of the season. In addition, locomotives should be inspected whenever opportunity offers in the bush to ensure that spark arrester flaps are not propped open or other irregular practices adopted by the locomotive crew which will reduce the efficiency of the fire prevention apparatus. Inspection of arresters.

Sawmill locomotives may be stopped.

816. Regulation 136 authorises the holding up of locomotives for inspection at any point and confers on forest officers the power to stop them from running if the fire prevention apparatus is considered unsatisfactory. The final test of the efficiency of such apparatus is freedom from outbreak along the route travelled.

Manager to be advised.

817. After inspecting a mill locomotive the mill manager must be advised immediately of any defect in the apparatus and this advice must be confirmed in writing to the district office.

Consistently troublesome locomotives.

818. If any locomotive is found to be consistently causing trouble, the mill management must be made responsible for detecting the defect in the apparatus and remedying such defect before putting the locomotive into commission again.

819 Where local response is unsatisfactory, full details should be forwarded to the Fire Control Superintendent through the Divisional office. The matter can then be taken up with the Permit holder by the Conservator.

Overalls for Inspectors.

820. An officer who regularly undertakes the job of spark arrester and ashpan inspection will be provided with a suit of overalls for the purpose on requisition to Head Office. The height and weight of the officer must be noted on the requisition.

Locomotives to be stopped during dangerous weather.

821. Regulations under the Forests Act provide that a forest officer may stop the running of bush locomotives when "dangerous fire weather" (see Para. 763) is forecast or develops during the months of January, February and March. This practice must be adopted regularly throughout the summer. When this action is taken the Conservator must be advised of the fact together with details of weather conditions prevailing at the time.

Mill Management and Conservator to be advised.

822. The mill management should be advised immediately by telephone.

Mills to be circularised early.

823. The Forester-in-Charge should circularise the management of each mill in his district well before the summer, reminding them that this practice will be adhered to and advising the building up of an adequate stock pile of logs to tide them over any periods of dangerous weather conditions during the summer.

W.A.G.R Locos.

W.A.G.R. locomotives have spark arresters.

824. It is the policy and practice of the Railways Commission to fit all W.A.G.R. locomotives with spark arresters during the summer months. Forest officers have no authority to stop or inspect any W.A.G.R. locomotives suspected of being faulty.

Liaison with W.A.G.R.

825. The Railways Commissioners have promised full co-operation in fire prevention and details of the organisation set up will be found in Appendix C.

Forest officers must maintain close liaison with local W.A.G.R. officers in all matters of fire prevention.

Fires to be reported promptly.

826. Immediately a forest officer is reasonably certain that a W.A.G.R. locomotive has started a fire he should advise, by telephone either the District Locomotive Superintendent at East Perth, Bunbury or Narrogin, the Locomotive Foreman at Collie or the Driver in charge at Pinjarra, depending on the locality..

827. In the event of the appropriate W.A.G.R. officer not being available, the information should be telephoned to the Locomotive Power Engineer at B 8061 or BA 7070 (continuous service). Locomotive Power Engineer.

However, it must be realised that the local W.A.G.R. officer is in a better position to remedy the fault than an officer in Perth.

828. These telephoned reports must be confirmed in writing as soon as practicable and a copy forwarded to the Fire Control Superintendent in Perth. Report to be confirmed in writing.

829. The report of a fire having been lit by a W.A.G.R. locomotive should contain the following information:—

(a) Number of the locomotive.
(b) Locality.
(c) Date and time.
(d) Direction of travel.
(e) Any other relevant information.

830. Every effort must be made to have the local Permanent Way Gang patrol behind a train with a defective engine to deal with any fires which may occur. Information required.

831. In dangerous fire weather it is often advisable for a Departmental gang with fire equipment to patrol a section of W.A.G.R. line behind a defective engine.

CONTROLLED BURNING.

832. There are six types of controlled burning for fuel reduction that are standard practice. Assistance from Permanent Way Gangs.

833. (1) Cleaning up firebreaks around areas of high risk, that is areas where fires frequently start or occur more or less regularly, e.g. external boundaries, railway lines, main roads and certain areas of private property. Patrol of line.

(2) Burning out buffer areas or dangerous flanks and pockets of dangerous hazard. The burning of these two types is carried out as frequently as possible, but not less frequently than every third year. Types of controlled burning.

(3) Protection of mills, schools, townsites, and isolated settlements in the forest. Paragraphs 846-852.

(4) Prescribed burning according to the prescribed burning plan. Paragraphs 837-845.

(5) Advanced burning. Paragraphs 853-855.

(6) Top disposal. Paragraphs 856-858.

834. Usually it is impossible to get a clean burn in the forest more frequently than once in three years and burning plans are drawn up accordingly. Frequency of Burning.

835. The Forester-in-Charge, is responsible for burning in his own district. Foresters responsible for burning.

836. The local officer must inspect each area to be burnt to assess its inflammability and decide the weather conditions under which it should be burnt. A member of the Field Staff must issue instructions for each piece of burning. This should not be left to an overseer or leading hand. A district officer should attend controlled burning operations on all possible occasions and must inspect all burns after they are completed. Foresters to supervise burning.

Current burning plan.

837. Immediately after the completion of the annual fire report, and before 1st October in each year, the Forester-in-Charge shall draw up a current burning plan setting out his burning programme for the next Spring, Autumn and Winter.

Subject to approval or amendment by the D.F.O. or F.C.S. this plan shall form the basis of his controlled burning operations.

Periodic burning.

838. All areas which do not require complete protection will be burned systematically by light controlled fires.

Areas afforded complete protection.

839. Complete fire protection will be afforded to:—

(a) Plantations.

(b) Regeneration areas nominated in Section 640A of the Manual.

(c) Where possible areas listed for trade operations in order that they will carry a fire immediately before trade cutting commences so that subsequent top disposal fires will not run.

(d) Karri tops awaiting a seed year.

(e) Areas required for research and investigation.

Unburnt patches to be marked.

840. Each year the Forester carrying out spring controlled burning will mark on a plan those areas, such as wet gullies, that were not burned to schedule and arrange for their burning at a date later in spring.

841. It is of paramount importance to make certain that these areas are burned before the main danger period as they constitute a weak link in the protection system and can lead to the escape of a fire that otherwise was confined.

Firelines.

842. The practice of constructing non trafficable firelines through the forest has been discontinued, and replaced by the forming of tracks which permit access by firefighting vehicles as well as serving as firelines.

Buffer strips, etc.

843. The worst fires with which the forester has to contend are those that originate outside the forest and sweep in on a wide face.

All external boundaries and boundaries of private property within the forest must receive special attention.

844. A cleared track, trafficable if possible, should be prepared along the boundary and depending on the hazard, one or more secondary tracks selected at variable distances not less than ten chains from the boundary to ensure protection in depth. In many cases whole compartments will suffice.

Northern and Western boundaries.

845. The Northern and Western boundaries are usually the more dangerous, and where these boundaries adjoin large areas of vacant Crown Lands special attention must be given to the controlled burning of wide buffer strips.

Schools.

Burning around school.

846. Protective burning should be carried out around school buildings and quarters in the forest areas and nearby.

Details of any school or other Government buildings not adequately protected must be forwarded to the Divisional Officer for advice to Head Office so that the departments concerned can be advised of the position.

Mill Villages and Townships.

Mill Villages and townships.

847. For the protection of mill villages and townships against the danger of loss of life or material damage from uncontrolled forest fires the Forester-in-Charge should prepare details of any precautionary measures considered necessary and discuss them with the respective mill managers or road board secretary, or local Bush Fire Control Officer in the case of townships.

Breaks around settlements.

848. Around each mill, town or settlement in the forest it will be necessary to select or construct tracks such that it is possible to provide a burnt break around the settlement at least twenty chains deep from the perimeter.

Local settlers to assist.

849. The burning of these belts will be an important annual task to be so arranged that it is performed by the towns-people, mill employees or departmental gangs, as the case may be.

Reports on local response.

850. A report on the lack of response of such local people should be submitted to Fire Control Superintendent early for further action if necessary.

Sawmills.

851. It is of great importance to the economy of the State that the risk of damage or destruction of sawmills by fire be reduced to the absolute minimum and the controlled burning programme must ensure that mills are protected from bush fires.

Occasional fires may arise in the grounds of mill towns and action should be taken in conjunction with the mill management to reduce the hazards responsible.

Forest Settlements.

852. Every possible precaution must be taken to ensure that every forest settlement is safe from damage by forest fires. This is the direct obligation of the Forester-in-Charge of the settlement who should draw the attention of his Divisional Officer to any cases of exceptional hazard or risk.

Advance Burning. (See also Para. 624 (Sylviculture.))

853. The importance of burning country in advance of falling operations, as a means of modifying and controlling subsequent fires cannot be over-emphasised.

Exceptional cases will arise where burning is impossible, and in such cases the Forester-in-Charge should send prior information to the Divisional Office and the Fire Control Superintendent.

Burning should be confined to the annual cutting sections. (See Para. 638.)

Time of advanced burning.

854. Preferably an area to be cut over should be burned in the early spring prior to the fallers commencing operations, but in any case should not be burnt more than eighteen months in advance.

Where an Autumn burn is necessary it should be left as late as possible.

855. A fire twelve or eighteen months prior to the commencement of felling operations will leave the forest floor in such a state that it will not burn again immediately in front of the fallers, but will yet run a fire when the crowns and bark litter the ground. This adds to the difficulty of disposing of this litter without damage to the remaining crop.

Top Disposal.

856. Serious damage can be done to the remaining tree crop by uncontrolled fires following in the wake of "falling" operations. Not only are saplings, poles and piles destroyed in this way, but where the butts of mature trees are surrounded by a litter of tops the resulting scorching reduces the value of the standing crop by the production of dry sides, hollow butts, or death and by allowing the ingress of termites and wood destroying fungi.

Judicious expenditure on top disposal operations generally will be repaid many times over in the saving of valuable timber.

Clearing debris.

857. Unless otherwise directed by the D.F.O., workmen will follow the fallers and clear away limbs and other debris for a distance of about three feet from around valuable trees and saplings. Elsewhere tops will be lopped flat.

The amount of work to be done around any tree will depend on its value. Trees which already have valuable timber in them are worth many saplings. A pile, for example, may justify the expenditure of a couple of hours labour, while a short sapling (even though sound) requiring half an hour's work to clear round, would not be worth tackling.

In judging the value of a tree it should be born in mind that many trees cut today would have been passed by a few years ago, and that some trees today considered uneconomic will be saleable in years to come.

Top burning.

858. Top burning is carried out during mild weather or at night to reduce damage to the remaining trees. However, in order to dispose of as much limb wood as possible it should be left until the debris has dried out thoroughly.

The length of time between trade cutting and top disposal will be determined by the silvicultural requirements of the stand.

CONTROLLED BURNING—GENERAL PROVISIONS.

Controlled burning.

859. Controlled burning will be carried out in spring, autumn and winter.

To obtain best results, country which would burn fiercely should be burned on a cool day or at night, whereas country which is difficult to burn will need to be lit in the heat of the day. Although one extensive burn is cheapest, it may be found necessary to burn by small sections for purposes of control and to minimise damage.

No control burning in March.

860. No controlled burning shall be carried out in March without the authority of the Fire Control Superintendent or a Regional Superintendent.

No fires on High Hazard.

861. No fires should be lit on days of high summer hazard or higher except in the Karri where burning is permitted in high summer weather, though it must be appreciated that this is a serious risk.

Towers.

862. Sufficient towers to give adequate coverage must be manned while controlled burning is being carried out. Towers should make early and late observations as instructed by the D.F.O.

Heavy Duty units.

863. A heavy duty outfit must be taken to every controlled burn except where otherwise directed by the Divisional Forest Officer.

General.

864. The actual face of the fire should be kept as short as possible.

In general, burning should be done against the wind.

864. The butts of all trees within a chain of the edge of the area to be burned must be raked around when burning in proximity to a fuel bed over three years old.

Patrol General.

865. All fires must be carefully patrolled, special attention being given to fires in dead trunks and tops of standing trees.

Patrol of a fire or Controlled Burn after a cool change or rain is absolutely necessary. Although rain may stop a fire it will not necessarily extinguish burning logs.

Patrolling must be regarded as a very important duty involving the following:—

(a) Patrol on the morning of the day following a fire.

(b) Patrol of areas of high risk some days after the burn if the hazard rises to High Summer, or worse, including a few days after rain.

The use of Heavy Duty pumpers to hose burning debris will reduce the amount of patrolling required.

Report by patrols.

866. Following a patrol the patrolman should submit a brief report to the Forester covering the following:—

(1) Route followed.

(2) Burning trees.

(3) Burning logs.

(4) Burning stumps or other debris.

(5) Inflammability of the forest adjoining the burn.

Fortnightly burning report. F.D. 421.

867. It is essential that close attention be paid to the condition of the forest, both before and after the burn, and to weather conditions prevailing at the time to provide more information to assist in perfecting prescribed burning technique.

To this end the fortnightly controlled burning report (F.D. 421) will be filled in daily and forwarded at the end of the fortnight to the Divisional office where it will be available to visiting officers.

The first section of the form should be filled in by the overseer or officer in charge of the gangs engaged on the work while the second section pre-supposes an inspection of the burn by the district officer before completion.

Assistance to settlers.

868. There is no objection to our assisting adjoining landholders in burning breaks either on their property or on adjoining State Forest or Crown Land. In many cases this assistance is most desirable and it may be necessary for the Forester-in-Charge to roster settlers burning to ensure that there is not an excessive number of fires burning simultaneously.

Responsibility of settler.

869. The settler's responsibilities must be clearly understood and impressed upon him. When the burning is being done on private property the owner must be in attendance and should do the actual lighting, or should at least commence it. He must understand also that future patrol is entirely his responsibility.

Breaks on State Forest.

870. When a break is being burned in State Forest or Crown Lands adjoining private property at the request of the owner of the property he must be notified of the time of the burn, irrespective of the time of year, and burning will not be done unless he agrees to attend the burn and assist with the fire, at least to the extent of patrolling his property, and accepting responsibility for future patrol on his land.

Form F.D. 426.

871. When a request is received from a settler for assistance in carrying out any burning whatever, the request must be acknowledged on Form F.D. 426 which sets out the above points.

Notice of intention to burn. F.D. 243.

872. When any burning is to be carried out by Departmental gangs during the "restricted period" (see Bush Fires Act) notice of our intention to do such burnings must be given on Form F.D. 243 to all adjoining landholders *as required by the Bush Fires Act.*

We are looked upon as the main exponents of fire control and it is essential that all forest officers be most careful to comply with the provisions of the Bush Fires Act.

FIRE PRE-SUPPRESSION.

873. Pre-suppression may be divided into the following headings:—

(1) Manpower.
  (a) Training.
  (b) Departmental gangs.
  (c) Auxiliary manpower.
(2) Equipment.
(3) Transport.
  (a) Regular.
  (b) Auxiliary.
(4) Detection.
(5) Communication.
(6) Water Supplies.
(7) Roads, tracks and firelines.

MANPOWER

874. (a) **Training.**—The Forester-in-Charge shall see that his gangs get regular training in handling equipment, fire suppression methods and organisation of fire fighting gangs.

Each member of a regular fire gang should be trained so that as far as possible he is capable of taking charge of a gang, and should be fully instructed in the policy of the Department in fire control.

Training may be possible during the winter, but the early spring burning season should be a time of intensive training in preparation for the dangerous period.

The Forest-in-Charge must see that his gangs get ample opportunity for training. The overseer in charge of the gang can carry out the training as a routine part of his work, but the forester should exercise an overall supervision of this training.

Bush Fire Brigade.

875. Every effort should be made to encourage the formation of bush fire brigades in the surrounding community and these brigades, together with auxiliary gangs picked up from sawmills, etc., should be given training in handling Departmental equipment and in our methods of fire control and suppression.

Auxiliary gangs picked up to assist in controlled burning can gain valuable instruction while working with Departmental gangs.

Location of gangs.

876. (b) **Departmental Gangs.**—The Forester-in-Charge must so arrange the work of his gangs in the fire season that on days of bad hazard they are working in close proximity to Headquarters or to areas of high risk.

The location of all gangs must be shown on the Staff Movement Board or in the office log book.

Auxiliary power.

877. (c) **Auxiliary Manpower.**—The department has not sufficient men at this juncture completely to protect the forest.

However, there is a large manpower pool living in and around the forest, some of whom are forest workers and every effort must be made to have these men trained and available to assist in fire control measures as untrained men are an embarrassment at a fire.

Farmers.

878. Farmers outside the boundary of the forest should be helped and encouraged to form Bush Fire Brigades to combat fires likely to sweep in on the forest and to assist in controlled burning around the boundaries.

Isolated farmers living within the forest could almost be incorporated in regular Departmental gangs. Such association and training is of greater assistance to the farmer himself than a policy of isolationism and at the same time helps to augment our gangs.

Timber Workers.

879. Sawmill employees, both bush workers and those working in the mill form a very considerable body of men who should be available for fire control.

The local forester should make it his business to encourage interest in the protection of the forest.

Large towns in the forest are a potential source of auxiliary manpower but these men are usually much more apathetic than timberworkers.

Lists of auxiliary manpower.

880. Each year before the commencement of the spring burning programme the forester in charge shall make a list of all sources of auxiliary manpower.

The list should show such headings as sawmills, other industry, large firms, bush fire brigades and private individuals.

The list should show for each unit: —

(a) Name and telephone number of Manager, Assistant Manager, Captain of fire brigade.
(b) Number of men available and at what notice.
(c) Men likely to be in charge of gangs.
(d) Transport available.
(e) Messing arrangements.
(f) Equipment available and where to be picked up.

In the case of individual farmers or private individuals in a town, the address, telephone number, means of contact and transport must be shown where possible. A special note should be made of relief bulldozer or truck drivers.

The lists must be readily available for relieving officers who may not be conversant with the district.

Some indication should be given whether any of them are available for routine controlled burning as distinct from emergency fire fighting.

W.A.G.R. gangs should always be available to assist with controlled burning along railways.

This co-operation should be arranged by the forester in charge with the local ganger and the District Engineer.

EQUIPMENT.

Equipment.

881. The forester in charge will list and order the equipment he considers necessary for his district and will be responsible for seeing that it is obtained and kept up to strength.

This equipment will comprise sufficient to equip his gangs with the necessary replacements and additional equipment for the auxiliary gangs he is likely to pick up under normal conditions.

Reserves of fire equipment will be held at centres determined by the Divisional Forest Officer.

Equipment to be branded.

882. Units of equipment should be clearly distinguished by some painted mark to indicate the gang or district to which it belongs to facilitate collection after a fire.

After every fire all equipment must be checked, to determine and replace losses and effect repairs to damaged items.

Insurance claims.

883. In the case of equipment burnt in a fire, a claim for insurance must be submitted immediately. Any undue delay may result in the claim being disallowed.

Overhaul of equipment.

884. At the end of the fire season all equipment shall be checked, overhauled and stored away ready for the next season.

Power pumpers must be thoroughly overhauled and put in good working condition at the end of the fire season then checked over and run for short intervals at least once a fortnight during the winter to obviate any deterioration during storage.

Before the commencement of the spring burning season equipment must be checked over again to make sure it is all there and in good order, particular attention being given to pack sprays to ensure that the leather pump buckets, and rubber hose have not perished and that the tank is not leaking.

885. Standard equipment units are shown in Appendix "D."

TRANSPORT.

Regular.

886. The forester in charge shall advise the Fire Control Superintendent of inadequate transport for his regular gangs and shall see that his vehicles are in running order and readily available to the gangs.

Bulldozer and heavy water-tank transporters shall be kept in close proximity to their loads during the fire season.

Auxiliary.

887. At the beginning of the season check arrangements for auxiliary transport, adequate to cope with the auxiliary and emergency manpower with a margin of safety in the event of any vehicle hold-up.

The forester should make sure that owners are prepared to make their vehicles available when needed.

Carriers.

888. It should be possible in the case of carriers or transport contractors in towns to give the forester their probable itinerary on days of dangerous hazard, so that they can be contacted without delay, or no time lost in looking for them if they are out of the district.

DETECTION.

889. Early detection and accurate location of fires is of paramount importance in fire control.

Fires are located by plotting the bearings on it from two or more towers. Towers shall be manned continuously from the first day of average summer after the 1st October until the end of the fire season.

Inspection of towers.

890. Prior to the manning of the towers the forester in charge shall arrange the inspection of all towers to ascertain what repairs are necessary, and to see that the area around the tower is clear of debris. See Appendix "E" paras. 998-1001.

He shall see that all the equipment for the tower is installed and working or in the case of small articles, available in the district office.

Equipment on towers.

891. The equipment required in the tower is shown in Appendix "E."

Manning towers.

892. Prior to the need for the manning of towers the forester shall make sure that towerman is available.

If a local man is employed arrangements must be made for him to be available when required.

If no local man is available, a request must be sent to Head Office in ample time to have the man on the job when required.

893. The forester must make sure that he has an efficient towerman and should take some trouble in teaching him the requirements of the job and the layout of the country he is to guard.

Towerman.

894. The towerman is The Watchman of the forest and as such must be willing to render continuous service from dawn till after dark if required in an emergency.

He should possess the qualifications set out in Appendix "E" and should be tested for them.

895. At the end of the fire season the forester must submit a report to the Fire Control Office on each of the towermen employed in his district. Report on towerman.

This report should be detailed and contain recommendations as to whether the towerman was satisfactory and suitable for further employment in that capacity.

If suitable, the forester in charge should indicate the likelihood or otherwise of the man being available for the following year and whether he is a local man or one engaged through Head Office.

COMMUNICATION.

896. Effective means of communication are vital, not merely in fire control, but in the successful administration of the Department.

897. There are four "legs" to the communication system for fire control:—

(1) Lookout to Headquarters.
(2) Headquarters to fire gang.
(3) Fire back to Headquarters.
(4) Point to point round the fire.

898. The first "leg" will invariably be by telephone line. The second and third are usually by radio, but can be by telephone if the gang is working in close proximity to an established line.

899. A spur line may be run from the nearest established line to the fire gang. Spur lines.

If the spur line is of insulated wire, distance is of little consequence and even with bare wire it is found that during the dry summer months, a line run out over bushes and on the ground up to two to three miles works quite satisfactorily.

Whenever feasible, however, the line should be kept down to about a maximum of half-a-mile. Long lenths of loose line are not easy to handle.

900. Communications, point to point round the fire are very important to provide the officer in charge with a clear picture of the changing situations.

Radio can give this difficult link at large fires and should be exploited to the full. Failing radio, one or more runners, preferably reliable men on horseback, more than justify their being out of the fire fighting ranks to be kept essentially as messengers and not to attempt fire suppression.

Every forester at a fire must realise the vital necessity of keeping in constant touch with his gangs and with the controlling officer.

901. Radio telephone is playing an increasingly important role in forest communications. Radio telephones.

Full details of radio procedure are laid down in Radio Communication instructions and every forest officer must keep his copy up to date and be conversant with the subject matter of the orders.

902. It is the forester's duty to see that his lines of communication are functioning efficiently. Forester to watch communication.

Every failure of a telephone line circuit must be investigated as soon as possible and that fault rectified.

Before the spring burning season commences the forester must arrange a thorough maintenance of all his telephone lines.

FOREST FIRE WEATHER.

903. In an endeavour to arrive at a better understanding of the relationship between weather and forest fires a Fire Weather Station was set up at Dwellingup in 1934. This was later followed by the establishment of stations at Pemberton and Dryandra, and in recent years fire weather reports have also been obtained from Ludlow and Margaret River.

Early investigations showed clearly that it was not possible to measure the degree of fire danger by readings of any single weather element such as temperature, relative humidity, barometric pressure, evaporation, etc.

It became obvious that the degree of inflammability of the fuel was the result of interaction of all weather elements. It was then decided to study the moisture content of the various timbers and experiments proved that the variation in moisture content of ½in. cylinders of locally grown Pinus radiata showed an almost identical trend as the averaged estimate of fire hazard given by a number of experienced forest officers.

50 gram units (oven dry weight) of these cylinders are now in use as the standard measure of fire hazard in this State.

904. In order to express the Fire Hazard, two scales were adopted. An empirical scale from 0-10 for use in fire weather research and a general scale of Nil, Low, Moderate, Average, High, Severe and Dangerous for general and public use.

The relationship of these scales and the moisture content of the present wood cylinders is given in the table hereunder:—

	Empirical Scale.	Moisture Content of ½in. pine cylinders.
Nil	Less than 1	19.4—17.0%
Low	1 -4	16.9—11.0%
Moderate	4.1-6	10.9— 7.9%
Average	6.1-7	7.8— 6.5%
High	7.1-8	6.4— 5.3%
Severe	8.1-9	5.2— 4.1%
Dangerous	9.1-10	4.0— 3.2%

905. Close co-operation is maintained with the Meteorological Bureau to whom weather telegrams are despatched at 9 a.m. and 3 p.m. each day during the fire season from Dwellingup, Pemberton and Dryandra. The 3 p.m. telegram also includes the maximum Fire Hazard for that day.

Using the current fire hazard as a basis and applying their knowledge of possible future weather conditions, the Bureau pass a forecast by telephone to Dwellingup at 4 p.m. each day. This is in the form of a brief weather forecast and the estimated Fire Hazard for the following day for both the Jarrah and Karri forest areas.

These forecasts are transmitted over the department's radio system from Dwellingup at the 4.15 p.m. call.

906. At 7.30 a.m. next morning weather reports are received by Dwellingup and these together with Dwellingup readings are used to check the forecast made on the previous afternoon. The latest forecast of weather and Fire Hazard is then transmitted from Dwellingup at 7.45 a.m. with a view to having this information available before the gangs leave headquarters for work.

907. This forecast is normally picked up by the Divisional fixed stations and it is the responsibility of the Divisional office to see that the information is passed on promptly to all Districts.

908. In all cases where fires are running and a special forecast is required, this may be obtained from Dwellingup, who will contact the Meteorological Bureau if considered necessary.

909. A sound knowledge of the weather and the state of the fuel is essential in any prescribed burning operations. Forest officers must be able to interpret the effect of weather on the rate and intensity of burning if they are to make full use of all days suitable for controlled burning operations.

WATER SUPPLIES.

910. With the increase in the use of mobile water tankers and power pumpers, the provision of adequate static water points becomes increasingly important. Static water supply.

The forester in charge should prospect all possible water sources and construct roads of access and stagings to allow the entry and turn-around of power pumpers for refilling.

The objective should be to provide water points not more than three miles apart so that tankers can obtain refills by a journey of not more than 1½ miles.

Water points can be of various types, permanent springs, wells, dams, sumps, creeks or swamps providing either permanent or intermittent supplies.

In cases where there is ample water in winter but none in summer tanks can be erected to be filled in winter from the natural source and refilled by tanker as the water is used during the fire season.

Sumps should not be less than about 1,000 to 1,500 gallons capacity, but preferably in the vicinity of 2,500 gallons, providing six refills for the standard tanker.

Types of water points will vary with local conditions and each case must be treated according to its own particular problem.

911. The roads of access and turn-arounds must be given particular attention. Roads of access.

In most cases the water point will be at a spring or on the edge of a swamp where scrub growth is dense and prolific.

It will be necessary to grub or grade deeply all such approaches, and if possible, gravel or stone them to prevent rapid encroachment of the scrub.

A firm road bed with sufficient room to turn and back to the water is essential to obviate bogging, as much traffic on these approaches may be at night when visability is restricted and manoeuvring difficult.

912. As each new water point is established, its exact location should be indicated on office plans and Head Office advised so that master plans may be kept up to date for future inclusion in Departmental lithos. Location of water points.

Reference trees should be established at the water point or in close proximity to it.

This marking of the water points on lithos is particularly necessary for the information of officers or drivers from outside districts and to ensure that water points not used for long intervals do not become lost.

913. The roads into water points should be well sign-posted. It is not sufficient to place one notice on the turn-off from a main track. Signposting.

If a water point is some distance from a main track each intersection on the road to the point should have a sign indicating the correct route.

These signs should be prominently displayed so as to be easily visible to strange drivers using the road at night.

Capacity of water points.

914. Notes should be kept in the local office of capacity, supply and permanence of water points with a view to incorporating this information on Departmental lithos at some future date and to improving the supply where necessary.

Maintenance.

915. As soon as possible after the beginning of the spring burning season all wells and water holes should be put into good condition for the fire season.

The information required for this work will be obtained automatically where spring burning is being carried out, but a special patrol must be sent out to inspect all water points particularly in country that has not been burned within the previous three years.

Roads and tracks.

916. Apart from routine maintenance, immediately following winter, inspections should be made of all roads and tracks in the district to locate and report on blockages, washed out bridges, culverts, etc. and immediately following trade cutting and thereafter as frequently as necessary all bridges and culverts must be inspected and cleared around to protect them from fire.

FIRE SUPPRESSION.

917. For the three types of forest fires—

(a) ground fires,
(b) surface fires,
(c) crown fires,

see paragraphs 764-766.

Fire behaviour.

918. The intensity of a fire depends on weather conditions and fuel density, though rate of spread will be influenced also by topography and wind strength.

In a dead calm on a level horizontal surface with an even fuel layer a fire spreads slowly in an ever widening circle at an even rate in all directions.

With a wind blowing, or up a slope, a fire rapidly assumes a long oval shape and has three distinct parts—

(a) the head fire.
(b) the flank or side fire.
(c) the tail fire.

Head fires.

919. The head fire is the most forward portion of the fire, usually narrow, travelling fastest and very hot. It is causing the greatest damage and if possible must be controlled first.

Flank fires.

920. The flank fires, on either side of the head fire are spreading more slowly but have greater length and can rapidly develop into head fires with change of wind or topography. One side is usually more dangerous than the other due to weather trends or topography and this dangerous flank must be controlled simultaneously with the head fire or very soon after it.

Tail fires.

921. The tail fire is burning slowly and quietly against the wind, is doing least damage and should be controlled last, but must on no account be entirely neglected.

Fire attack.

922. No two bush fires can be fought in exactly the same manner, each one calls for a different approach depending on weather conditions, men and equipment available, fuel bed and topography.

Speed of attack.

923. The two essentials for all fires are early attack and aggressiveness. The earlier the fire is attacked the sooner it is brought under control. Once a fire is allowed to develop a long perimeter, the task of controlling it is increased tremendously.

924. The man in charge of the fire gang must take the offensive from the outset, he must realise he has the strength and training to stop any fire with which he is sent to deal. Officer in charge to take offensive.

Officers can do much to foster this idea in the minds of their gangs.

If a defensive attitude is adopted the fire is master of the situation, the gangs have a feeling of frustration, hesitate to atack the fire face directly, tend to fall back on fire lines or tracks and wait for better conditions, by which time the fire has increased in size and needs many more men and equipment to bring it under control.

925. Speed of attack is essential and will depend to a considerable extent on the Despatcher, who will usually be the officer responsible for co-ordination of fires. Fire action.

926. After locating the position of a fire requiring attention the Despatcher will— Despatcher action.

(1) Advise the nearest available fire gang (gang A) by the most rapid means of communication.
(2) Record in the log book, the time of their departure.
(3) Arrange for a listening watch.
(4) Despatch one wagon pumper.
(5) If in leaf litter over five years old, or on a day of severe summer or higher—load bulldozer and scraper.
(6) Alert gang B and C if gang B already despatched. All subsequent gangs arriving at the fire will operate under overseer of gang A until relieved by senior officer.
(7) Advise District Officer concerned as soon as possible.

927. The gang overseer will— Overseer action.

(1) Advise Despatcher of time of departure.
(2) Proceed directly by the quickest route to the nearest location to the Head of the fire.
(3) On arrival make a quick reconnaisance of the fire while **the gang will—**
  (a) Set up radio and report arrival.
  (b) Unload equipment and arrange for its protection. (Paragraphs 934-940.)
  (c) Proceed to forward section of the fire and commence suppression under control of No. 1 pack-spray man.
(4) After reconnaissance arrange report to Despatcher—
  (a) Position of fire.
  (b) Possible cause.
  (c) Details of size.
  (d) Type of fuel.
  (e) Estimated time to control.
  (f) Whether further assistance required.
(5) Assume control of gang and proceed with suppression by the application of such routine as the situation demands.
(6) Report to Despatcher at half-hourly intervals if possible, but without fail if fire is proving difficult to control.
(7) Report fire under control and estimated time of mopping up.
(8) Report when fire safe and gang leaving.
(9) Advise Despatcher what further patrol action necessary.

928. The District Officer will— District action.

(1) Inspect fire during or as soon as possible after suppression.
(2) Check efficiency of gang's work.
(3) Enquire into cause. (See paragraphs 797-798.)
(4) Complete Fire Report (form F.D. 304, see also paragraph 941) in duplicate and forward original to Despatcher or Divisional officer.

Direct attack.

929. Basically there are only two methods of fire suppression, direct attack and counter or back firing.

The advancing edge of the fire is attacked directly and stopped either by the use of water, mineral soil, beating or raking the burning fuel back on to the burnt ground, or by raking a narrow strip clear of fuel a few feet ahead of the fire and letting the main fire burn up to the raked strip.

This raked strip should be constructed as near to the fire face as the heat of the fire will permit.

If the area of unburned fuel is more than a few feet wide it should be lit up and burned out immediately but care must be taken not to prepare the strip too far back from the advancing fire.

The method of direct attack should be used whenever possible.

Counter firing.

930. In counter-firing the fire fighters fall back some considerable distance from the advancing fire, usually to a prepared fire line or track and there set "back fires" which are allowed to run back towards the main fire with the object of burning out a wide strip of country ahead of the main fire.

This method should never be used if any of the direct attack methods are likely to succeed.

Back firing is always risky since if the main fire is too hot to handle directly the back fire will also be very hot.

If the fire fighters fall back to an area that can be burned easily, then the main fire could be handled easily in this fuel type.

One of the main dangers in back firing is the tremendous up-draft that frequently occurs when the two fires meet, leading to showers of burning debris being carried over ahead of the main fire beyond the line where the back fire started.

The greatest care must be taken in setting back fires, as little face as possible should be lit at a time, never back fire from anything but a good break line which is long enough to ensure that the back fire does not escape round the ends of the fire line.

Always light close to the fireline so that the backfire has no opportunity to gain any forward momentum, and only burns back slowly towards the main fire.

General rules.

931. **General Rules.**

1. Assess back firing possibilities carefully before spending much time clearing the break.
2. Rake around dangerous trees well back from the edge. It is often advisable to burn the heaps of debris separately before the back fire reaches them.
3. Never light a longer line than can be held, special care is necessary if choppy winds are likely.
4. Always burn clear to the line and well in towards the main fire.
5. If burning on a slope, start at the top and burn down.
6. If the main fire is coming up a slope, back fire from the lee of the ridge top, that is, just over the top from the direction of the main fire.
7. Patrol continuously.
8. Keep as close to the main fire as is commensurate with safety.
9. Back fire against the head fire and attack the flanks and tail directly.
10. Select the base line with great care.

Mopping up, general.

932. **Mopping up** is the term used for the work done in rendering a fire safe after it has been brought under control.

When a running fire is brought under control it is only stopped and not by any means safe. It is obviously futile to spend considerable energy on stopping a bush fire only to have it escape and need as much or more work to bring it under control a second time.

Mopping up means completely extinguishing every piece of burning material that might permit the fire to escape.

Mopping up operations.

933. A strip at least 2ft. wide must be cleared around every fire, strictly following its edge.

All low stumps or logs within a chain of the edge must be extinguished with water or mineral soil or both.

Heaps of smouldering debris must be broken up and dispersed to prevent too great a flame close to the edge.

Heaps of debris round the butts of trees close to the edge must be cleared away.

All burning trees or spars within five chains of the edge should be extinguished or felled or burnt around to provide an adequate margin of safety.

If water is used to extinguish burning logs or trees care must be taken to ensure that they are really out.

Piles of logs or tops must be separated and dampened down and if necessary, covered with earth.

In mopping up, power pumpers should be brought right in to the face so that water can be applied to burning trees and stumps.

If mopping up is done during the heat of the day the pumpers should go round fairly rapidly damping down the more dangerous areas and then return to consolidate the position.

Patrol.

Patrolling of all stopped fires is essential and should follow the instructions laid down under controlled burning.

Precautions to be taken.

934. **Protection of Equipment at Fires.**—All equipment taken to the vicinity of a fire is in danger of being burnt and whenever any such equipment is left unattended every precaution must be taken to see that it is adequately protected.

Officers must ensure that overseers and gang members are conversant with the following instructions.

Overseer to take precautions.

935. The overseer's first duty on arriving at a fire is to detail a man to prepare a cleared area to accommodate spare equipment with a minimum of four feet clearance round the gear.

Motor vehicles.

936. In the case of motor vehicles, greater care must be taken than for hand equipment in view of their greater value and more inflammable nature of the unit.

937. The safest place to park a vehicle is on cold burnt ground or bare mineral soil, such as gravel pits, away from overhanging trees.

If the ashes are still hot a strip must be raked down to mineral soil for each wheel and all smoking embers raked from under and round the truck. Care must be taken to see that the truck is sufficiently removed from burning trees to preclude the possibility of sparks or burning debris dropping on the vehicle.

938. If the vehicle must be left on unburned ground it should be placed on an area clear of scrub and trees. All litter must be raked from under it and for a space of six feet all round it, and any trees that might possibly drop debris on the truck must be raked to ensure that they do not become alight from any fire.

Raked litter must be well scattered and not left in heaps.

939. When a vehicle is left on a road, all litter must be raked away from the sides of the vehicle and dangerous trees raked.

Do not leave a vehicle on a road unless there is ample clearance to permit the passage of other vehicles.

Escape route.

940. A vehicle should always be left facing an escape route so that it is possible to drive straight away without the need for time wasting manoeuvring.

941. **Fire Reports.**

F.D. 304 Preliminary report.

At the first opportunity the Officer-in-charge of a gang shall fill in the preliminary fire report on Form F.D. 304, and hand it in to the district office.

Reports should be submitted while details are fresh in mind because it is from these reports that wages sheets are checked and the Annual Fire Report prepared.

The reverse side of the form should be completed immediately by the office staff and the form submitted to the Senior Officer for his information and comments.

Large fires to be reported.

942. All fires in protected forest that are likely to attain an area of 100 acres and all fires in plantations must be reported immediately by telephone or radio to the Fire Control Office who will advise Head Office.

Damage claims to be reported.

943. In all cases where a claim for damages against the Department is likely to arise out of a fire the details must be reported immediately to the Fire Control Officer by telephone or telegram, and this must be confirmed in writing giving a full detailed report of the circumstances.

Daily fire report.

944. All centres will submit a daily report on the fire position for the previous day.

These reports will be given over the air each morning to Collier (VL6DE) at 0815 hrs. except on Saturdays and Sundays. Details required are set out in Appendix "F", paragraphs 1006-1009.

Annual Fire Report.

945. Immediately on the close of the fire season but not later than the end of the June quarter, the Annual Fire Report, with the fire plan must be forwarded to the Fire Control Superintendent.

The Annual Fire Report shall be in the form set out in Appendix "F".

Staff organisation.

946. The role of the forester in fire control is organisation. Successful fire control cannot be based on a strenuous personal effort alone.

The Forester should see that his men are trained and equipped, and at a fire should confine his efforts to directing his forces to the best effect.

Forester on call continuously.

947. The Forester is expected to be on call for fire duty continuously during the fire season.

As far as is compatible with the demands of the season, officers are allowed freedom of movement at weekends provided that the senior officer knows of their movements and can recall them in the event of an emergency.

Generally, mutual amicable arrangements can be made for the staffing of a district during the fire season without recourse to a rigid roster.

948. The overseer is responsible to the Forester-in-Charge for the fire control of his area, the maintenance and replenishment of his equipment and the training of his gang. The Overseer.

He should know his area intimately and should form a close liaison with his neighbours for co-operative fire control measures.

He should make sure that his equipment is complete and make a point of keeping under the notice of the Forester-in-Charge any shortages until they are replenished.

949. Weekend patrol and standby are not ordinarily required, but may be engaged as directed by the Divisional officer. Standby.

950. During the fire season, the Forest Assistant is vital to the fire organisation. The Forest Assistant.

He is frequently the first officer to be advised of the fire and must then assume the role of Despatcher. As such he must be fully conversant with paragraphs 926 and 927 so that the suppression force swings into action with the minimum delay.

951. He is required to record and co-ordinate all messages from towers and gangs, supervise communications and the posting of staff and gang movements, be able to produce for a visiting or relief officer a clear, up to the minute picture of the existing situation.

952. He will receive direct, or arrange to have received the 0745 fire weather forecast and see that it is re-transmitted to all towers and outstations in the area. He will be responsible for keeping the office daily log posted regularly during the day.

953. First thing in the morning he will bring up to date the Staff Movement Board. Staff Movement Board.

This Board consists essentially of a blackboard prominently displayed in the office and carries information under the following headings.

Date, forecast of hazard, wind direction, officers' duties, location, means of communication and estimated time of return to Headquarters.

It should be extended to include this information for gangs as well as individual officers.

"Means of Communication" should show radio call sign, telephone number or both.

If an officer or gang is resting after a turn of duty at a fire this information should be shown and the time they came off duty. In this case E.T.A. Headquarters will be the time they will be again available for duty.

954. The Staff Movement Board must be brought up to date each morning, and as changes occur, otherwise it becomes misleading, useless, and therefore dangerous.

955. All messages dealing with fires must be recorded in the office log as received. If the message is merely for the information of the office it may be recorded independantly. If, however, it is an instruction to be passed to an officer it should be written out in duplicate, the original handed to the officer concerned or relayed to him by phone or radio and the duplicate filed. If the message is relayed to an officer the original should be sent to him as well, if possible. This procedure lessens the possibility of error, enables mistakes to be rectified, and is a protection for the Forest Assistant. Messages.

956. Duplicate messages are of considerable value to a relieving officer, enabling him to follow the progress of the organisation at the fire

Radio Message pads.

957. Radio message pads are recommended for this purpose, even if the message comes by 'phone or word of mouth.

Outward messages.

958. Messages should be written out before transmission by radio or 'phone, and the original filed for future reference for the same reasons as for inward messages.

It is essential that this procedure be followed in radio transmission to stop unnecessary talking.

959. **Fire Diary.**

When a large fire, or a large number of fires necessitates many complicated gang movements and staff rotation, a clear picture of the situation must be available to a controlling officer. To provide this picture a fire diary or series of diaries should be used. The diary consists of a large book or pad from which the pages can be torn for filing.

960. Pages are headed with the fire serial number, date and all relevant information, such as location, cause and weather conditions. A margin on the left hand provides a space for entry of times and the 24-hour system should always be used. The remainder of the page is used for details of all messages and reports received or transmitted.

961. The diary should be left on the control table or by the radio or telephone and everything relating to the fire in question written in the appropriate diary.

Specimen entries might read as follows:—

1037—By radio, For. Smith reports fire broken away from Jones' gang near ref. tree C.Q. 67/1. Advanced about 10 chains by three. Robb's gang being sent from S.E. corner of fire to assist.

1045—By radio, Robb reports arrival at breakaway, gang commenced work. They need another H.D. outfit.

1047—By radio, A/For. Robins reports relieving gang under Overseer White arrived to replace Black's gang who are going home to rest. Fire quiet on this sector, need some more rations before night. And so on.

Fire plan with Diary.

962. Later, the diary provides a basis on which to conduct a fire study from which much vital information may be obtained.

A fire plan should be kept in conjunction with the diary to complete the picture of the situation.

APPENDIX "A".

POINTS IN INVESTIGATING OUTBREAK OF FIRE

Speed essential.

963. Speed in reaching the source of the fire is important; it may be possible to intercept the persons lighting the fire, either on the spot or going away from it.

Further, an officer should get there early to pick up any tracks that may be in the vicinity before they are obliterated by fire fighters, and to ascertain as nearly as possible the exact point of origin of the fire.

Tracks to be covered.

964. Any tracks found should be protected as far as possible by covering with bushes or bark or by placing a small log over them.

Possible clues.

965. The following are a few of the possible clues that should be looked for:—

(1) Remains of a camp fire.
(2) Cartridge cases.
(3) The spot where someone stopped to light a cigarette. This might be indicated by the tracks of two vehicles pulling up together, footprints by the side of the vehicle tracks, or by spent matches.
(4) Cattle tracks overmarked by horse or dog tracks indicating travelling stock.
(5) Pieces of smouldering bag or other lighting material.
(6) Ash from old blackboy cores or rotten branches in a cleared patch indicating a delayed action fuse.

Tracks important.

966. Careful note must be made of any tracks in the vicinity. Their direction, size, whether boots or shoes or in the case of horse tracks whether shod or unshod and any peculiarities such as hob-nails and patched soles. The width and tread marks of tyres, the width between wheels and whether dual or single rear wheels, should be looked for.

Police assistance.

967. It is usual and advisable to call in the services of the local Police Constable to accompany the forest officer and tracker. The moral effect of police attendance and questioning of suspected persons and possible informants is very considerable.

Every person in the locality who is likely to have useful information must be interviewed.

Report to be submitted.

968. A full report must be submitted to the Fire Control Office immediately after the investigation is completed. The following details should be included:—

(1) Full name and address of the person lighting or suspected of having lit the fire.
(2) Signed statements from this person if possible.
(3) The section of the Act infringed.
(4) Exact location of the start of the fire with an attached plan.
(5) Tenure of land where fire started, e.g., State Forest or Private Property.
(6) Time fire started as nearly as possible.
(7) Method of lighting.
(8) Reason, e.g., carelessness, match, cigarette butt, or if deliberate incendiarism, the suggested motive.
(9) Name and address of witnesses with signed statements.

APPENDIX "B".

Wire Mesh Spark Arresters.

Types of arresters.

969. Wire mesh spark arresters consist essentially of a fine screen to prevent the escape of sparks up the chimney. There are three common types:—

(a) **The Cheney,** consisting of a mesh cone fitted to the top of the chimney and supported by the upper rim. It is now seldom used.

(b) **W.A.G.R. Smoke Box Type,** consisting of a complete wire screen inside the smoke box between the ends of the heating tubes and the chimney.

(c) **The Brew,** consisting of a cylindrical screen inside the smoke box.

Mesh size.

970. **Mesh Size.**—All wire mesh should be of 16 gauge five or six holes per inch for Jarrah fuel, six holes per inch for Karri fuel. The Railways Commission use four holes per inch for Newcastle coal and try to change to six holes per inch for Collie coal.

Fitting of mesh.

971. **Fitting of Mesh.**—It is necessary that all corners and joints be effectively sealed with mesh or plate, special attention being paid to jointing around the steam inlet pipes and the exhaust.

Condition of mesh.

972. **Condition of Mesh.**—The mesh should be entire, i.e. no holes or breakages.

It should not be liable to corrode through at any time.

The life of the mesh in use is considered to be two years.

Testing of mesh.

973. **Testing of Mesh.**—A suitable test for badly fitting mesh with holes in it consists in holding a lighted candle or piece of burning kerosene soaked waste to the under surface of the mesh. If in good condition no flame should be seen above the mesh.

974. **Special Points.**

Cheney Arrester.

Cheney Type.—In order to give satisfactory service, it is necessary that:—

(1) The mesh be entire and not broken.

(2) The mesh should be frequently cleaned on account of cylinder oil which passes out with the exhaust gases and clogs the mesh.

975. **W.A.G.R. Smoke Box Screen Type.**

W.A.G.R. Smoke Box screen type.

(1) It is essential to see that the horizontal screen is above the smoke tubes, but below the outlet of the blast pipe.

(2) The vertical portion (with flap) must be fitted to obviate what would otherwise be a faulty junction of the horizontal portion with the smoke box door.

(3) The buckling of the framework must not be serious enough to prevent the true seating of the flap and thus allow the passage of sparks larger than those ordinarily passing through the mesh. This can be usually tested with a piece of wire or stick.

Brew Arrester.

976. **The Brew Arrester.**—The Brew Arrester screen is a cylindrical box, not fitted to the sides of the smoke box and is capable of being rotated from the engine cab and being cleaned by a series of steam jets placed vertically inside the screen.

This type of arrester is easier to inspect than the common type, but has similar faults which must be looked for.

977. **Cleaning of Smoke Box.**—This should be carried out at least at the commencement of each outward and return trip. On long runs, or where heavy pulling would fill the smoke box, this latter should be emptied at definite dumping grounds along the route, which should be decided upon and constantly used, and made safe at the beginning of each summer by satisfactorily controlled burning. Cleaning of smoke box.

To some locos. are fitted special smoke box ash ejectors which provide a ready means of clearing the smokebox without opening the door. In summer its use should be confined to "safe" places, for it is probable that the stem jet forcing out the ash would not be adequate to quench the live sparks.

Ashpans.

978. (a) **Hopper Type Ashpan.**—This should be fitted when major repairs to a loco. involving the removal of the boiler are necessary. A disadvantage originally associated with this type of ashpan was the difficulty of removing the sliding doors on account of buckling. This has been overcome by welding 2 or 3 bars (1¼in. x 1¼in.) across the bottom of each slide. Another satisfactory alternative is to use much heavier plate for the sliding door to the hopper. Hopper type Ashpans.

979. (b) **Subsidiary Trays for Ashpans.**—Pending the provision of (a) locos. must have the subsidiary tray at the front or leading end and where possible the rear of the old type ashpan. Subsidiary trays for ashpans.

980. **Clips for Ashpan Damper Door.**—In some cases difficulty is experienced in fitting trays at both front and rear of the ashpan, and permission has been given to run with one tray and the damper door at the other end fitted with a pair of clamps. These clamps can only be operated while the engine is over a pit and the damper floor must be clamped closed when the loco. is running. Clips for ashpan damper door.

981. **Cleaning of Trays.** Cleaning of trays.

(1) Mechanical difficulties in fitting trays to ashpans must be considered before insisting on standard size trays, but when smaller types are permitted more frequent cleaning must be enforced. Cleaning of standard size trays should be carried out at least twice daily, and more often when additional trips or longer runs are undertaken.

(2) It is necessary to ensure that the movable bottom of the tray is in good working order, and can be pushed fully home after dumping the ashes, leaving no opening for the escape of live coals.

(3) The old type of ashpan screen under the doors is not sufficient to prevent the dropping of live coals from the ashpan.

(4) Buckling of the ashpan and damper doors sufficient to permit the escape of live coals is often experienced only a few weeks after fitting new material. The provision of subsidiary trays is the most satisfactory method for preventing the escape of these coals.

(5) The ashpan should be inspected to ensure that the material has no holes or buckles which would allow the escape of coals.

982. Ashpan sprays have been fitted to many locos., but these are not satisfactory without the trays. In some cases a spray is attached to each injector and passes along each side of the pan. Ashpan sprays.

Most sprays are supplied with water from the injector overflow pipe. Some may be supplied direct from the boiler or tender, in which case the spray does not come into play automatically with the operation of the injector.

983. (c) **Firebars and Fuels.**

Firebars and fuels.

(1) Firebars should not be so badly burnt through or buckled to allow larger and more coals into the ashpan. Good spacing is $\frac{3}{8}$in. between the bars, but distances from $\frac{1}{2}$in. to $\frac{3}{4}$in. are common in bush locos.

(2) All fuel should be free of bark and as dry as possible.

GENERAL NOTES.

General Notes.

984. With the "blanketing" effect of the smoke box arrester, every effort should be made to get the maximum efficiency from the fire box. Good bars and seasoned fuel help considerably in this direction.

Overloading to be avoided.

985. The overloading of rakes can be a fruitful source of excessive spark emission, particularly on sections of line with short sharp dips.

Co-operation with the bush boss should be maintained to avoid the occasional overloaded rake which causes this trouble.

APPENDIX "C".

W.A.G.R. ORGANISATION.

W.A.G.R. organisation.

986. There are in the State eight railway districts, each with a Senior Locomotive Inspector or a Locomotive Foreman; and in each District a Staff car is available.

Locomotives are checked in and checked out by a Locomotive Foreman or Driver-in-Charge who has to certify to the condition of:—

Smoke Box,
Brick Arch,
Ash Pan.

Every locomotive, before attachment to a train must be cleared on these three points and signed for by the officer in charge of the locomotive depot.

At destination, the officer-in-charge has to certify that the locomotive was received with the smoke box, brick arch and ash pan in correct order.

If a locomotive operating in a fire hazard area is found to be faulty it proceeds to the next station where advice is sent that the train cannot proceed. The nearest centre then sends an officer out to inspect it.

Fines are imposed on engine crews when a fire is started by a defective locomotive, provided it is proved that the locomotive when received was in correct order.

There are district Locomotive Superintendents at:—Geraldton, Northam, Kalgoorlie, East Perth, Narrogin and Bunbury.

Bunbury controls the South-West from Pinjarra to Bowelling and all the lower South West.

There are loco Foremen in charge of the depots at Bunbury and Collie, and drivers in charge at Brunswick Junction, Pinjarra, Bridgetown and Busselton.

APPENDIX "D".

FIRE FIGHTING TRUCK EQUIPMENT.

Gang truck 6 men.

987. Standard equipment for a six-man gang truck shall be:—

4 axes.
2 crosscut saws.
8 rakes or shovels and slashers in the Southern Division.
4 torches.
1 hammer
3 wedges.

1 shovel.
Tucker box.
First aid kit.
4 water bags.
4 pack sprays.
4 water pumps.
4 bottles kerosene.
1 ball of candle cotton.
1 mounted departmental litho.
Water tank.
Low-down force pump or light pumper.
2 lengths of 1in. rubber hose with directors.
Kangaroo jack and crowbar are very useful accessories.

988. Standard equipment for a heavy duty truck shall be:— **Heavy duty truck.**
Water tank with power pump.
Auxiliary pump.
Hydraulic reel with 120ft. 1in. rubber hose.
5 x 100 ft. lengths of 1½ canvas hose on runners.
2 short lengths of 1½ canvas hose.
3 hose directors.
1 Y coupling.
1 hose key.
2 pack sprays.
4 rakes, 2 axes, 2 torches, 1 crosscut saw.
1 shovel, 2 water bags, kerosene.

APPENDIX "E".

TOWERS AND TOWERMEN.

989. The towerman must possess the following qualifications. **Qualifications.**

1. Must have good eyesight.
2. Must have reasonably good enunciation and good hearing for the use of the telephone.
3. Must be capable of reading a map and learning the country visible from the tower.
4. Must become proficient in using the instruments and in furnishing reliable information.
5. Must be able to endure the necessary isolation and take care of himself and must be sober.

990. Instructions for Use of Forest Service Eye Test for Fire Lookouts.

The lookout eye-test is designed to measure the relative ability of towermen to see small smokes. The eye-test target which may be obtained from Head Office if testing of towermen is to be done in the field, consists of a 7in. square white board with a large black spot in the centre, black diagonal bars on the corners, and a SMALL (1/16in.) black spot midway between the centre and one diagonal bar. The maximum distance that a man can see this small spot is a measure of his power to see small columns of smoke at long distances. The eye-test is given as follows:—

Select a suitable place out-of-doors. Either a sunny or cloudy day will do. A dark foreground, such as green grass or earth is necessary. Avoid bright foregrounds, such as dusty or gravelled roads.

Insert the round peg in the block on the back of the board to form a handle hold eye-test board in full light of open sky but shaded from direct rays of sun. Avoid getting under eaves of buildings or tree crowns.

Hold eye-test board upright so that one pair of diagonal black bars is vertical, the other horizontal (the SMALL spot will be up, down, to right, or to left), with white side of eye test board facing toward person being tested.

Have man being tested back away from eye-test board until SMALL black spot almost disappears (usually 35 or 40 feet). He should not face sun.

Whirl eye-test board several times so the SMALL black spot may assume a new position, up, down, right or left. Have observer signal or state new position of the SMALL spot. If correct, have him step back 2 or 3 feet. Repeat procedure until the observer indicates position of SMALL black spot incorrectly. Have him guess when he is no longer certain. He may rest his eyes if he wishes.

Record the observer's rating as the distance in feet **from eye-test board to the last point from which he can indicate position of the small black spot correctly**. The distance at which this small spot can be seen is definitely related to the distance at which small smoke colums can be easily detected. The following tabulation indicates quality of eye-sight in relation to eye-test rating in feet:—

Maximum distance at which small black spot can be seen (feet)	Quality of Eyesight
64 or over	Exceptional
58 to 63	Good
50 to 57	Average
44 to 49	Fair
43 or under	Poor.

Duties.

991. The Towerman shall be required to:—

(1) Make such early and late observations as the D.F.O. shall require.

(2) At first observation ensure that the orientation of the plan and finder is correct. This may be done by checking the bearings on one or two known points.

(3) At 8 a.m. he will obtain the early morning fire weather forecast and pass it on to neighbouring towers or Divisions. This information should be written on the top of the page of the day's observations.

(4) Report the wind direction and strength and visibility in each of the four quarters of the compass to district Headquarters. This information must be supplied as conditions change, hourly or more frequently as required.

(5) Remain on continuous watch during such hours of the day as the D.F.O. shall determine with stipulated times off for meals or short breaks as advised.

(6) Maintain a careful watch at all times for smoke.

(7) Immediately on locating a smoke the lookout man should take a bearing and estimate the position of the fire. He should communicate this bearing and approximate location together with a description of volume and character of the smoke to central towerman or district headquarters, as previously instructed by the D.F.O.

(8) When the position of a fire has been definitely determined, the towerman will be supplied with the location and the serial number of the fire to be entered in the log book and in the margin of the plan at a point which is a continuation of the bearing. This serial number will be used in all further reports concerning such fire.

(9) All messages to and from the tower must be entered in the tower log book against the time of the transmission.

In transmitting information from the tower the following codes will be used:— Codes.

Visibility 1.—Clear vision up to 15 miles.
2.—Clear vision up to 10 miles.
3.—Clear vision up to 7 miles.
4.—Clear vision up to 5 miles.
5.—Clear vision less than 5 miles.

Wind strength.
A.—Calm.
B.—Gentle breeze.
C.—Moderate breeze.
D.—Strong wind.

Description of smokes.
A.—Direct view.
B.—Not direct view.

Volume	Character	Colour
Fine 1	Columnar 1	Blue 1
Medium 2	Spiral 2	White 2
Heavy 3	Billowy 3	Brown 3
Dense 4	Blankety 4	Black 4
	Drift 5	Copper 5

992. The towerman should receive some instructions on the use and care of instruments along the following lines. Instructions of towerman.

993. Direction Finder.—Care should be taken in removing and replacing the steel arm of the direction finder to see that the sighting vane and arm are not damaged. Any damage should be reported immediately.

994. Plan Board.—The plan board should be protected as much as possible from any damage by rubbing and scraping and should be covered in the event of rain.

On vacating the tower each evening the cover should be placed on the plan.

995. Binoculars.—The binoculars should be worn with a short strap and should not be left lying on the table or box to be picked up when required.

They should not be jarred or strained and when not in use they should be placed in the case and hung up.

996. **Sunglasses.**—Sunglasses assist in the detection of fires in hazy conditions and to relieve unnecessary eye-strain resulting from continuous observation under conditions of heavy haze, sun glare and high winds. They should be kept clean and placed in the case when not in use.

The best type of sunglasses are of the "polaroid" type, but it sometimes happens, particularly with the vizor type of sun shield that the material is not mounted in the plane of best effect. This can be tested by holding the shield or glasses before the eyes and slowly rotating to find the position of least glare. It might be necessary to use them with the head tilted slightly to one side.

997. **Panorams.**—Panorams should be kept as clean as possible. Covers should be placed over the boards each evening and sometimes during the day to give protection from sun, wind and rain.

The towerman should be encouraged to make additions to the panorams as points are identified from time to time.

998. **Care of Fire Towers and Lookout Trees.**—At the end of the fire season the tower plan, sighting vane, logbook panorams, binoculars and sunglasses should be removed from the tower and the two last mentioned locked up. Lookout Towers and Trees.

At the same time the tower or tree hut should be inspected and a full report with suggested renovations or repairs if any should be submitted to the Divisional Office. The tower should be inspected with a view to determining—

(1) Whether it is necessary to place iron bands round uprights which may be splitting badly.

(2) The need for treating exposed ends of timber with hot creosote, petrolatum or some similar compound.

(3) The need for painting or otherwise treating any exposed wood or ironwork.

(4) The need for renovations or improvements to the tower cabin and hut.

Trees should be inspected for the following:—

(5) Dying back of the limbs or trunk.

(6) Patches of rot in dead areas.

(7) Rot or borer attack in tree pegs.

999. With the exception of towers which have been erected on a concrete base, it is important that each fire tower should be carefully examined two years after erection and at regular intervals from 2 to 3 years thereafter particularly the condition of piles supporting the tower where they enter the ground.

At each inspection the ground around the piles should be opened to a depth of 18in. and any weathered or decayed wood should be scraped off and the exposed section whether sound, or showing superficial signs of decay or termite attack, should be painted thoroughly with hot creosote. If there are any indications of termites or decay, deeper holes should be opened and the affected wood cleaned away. The creosote, before application, should be heated to simmering point, but not allowed to boil violently. The piles should be allowed to dry before treatment.

The tightening of bolts used in the construction of fire towers should only be necessary at the beginning of each fire season for the first two or three years, after which further tightening should not be necessary.

Excessive tightening of bolts is to be avoided. In the course of this work any patches of decay noted in the structural timbers should be cleaned out and a dressing of hot creosote applied to the affected area.

It is estimated that for the treatment of the supporting piles in each tower 8 gallons of creosote may be required.

Any excess creosote left after painting the legs and other affected parts can be used for puddling the earth round the legs, particularly in the vicinity of any patches showing rot or termite attack.

Supplies of creosote as required should be requisitioned.

1000. In addition to the above periodic inspections, all towers and trees should be inspected before each fire season and officers in charge of Districts where towers or trees are located should submit a report to the Fire Control Superintendent not later than the 30th September in each year setting out the general condition of the lookout and the towerman's hut.

Towers to be cleared.

1001. At the beginning of the fire season steps must be taken to clear all undergrowth for a radius of five chains around each tower or tree so that there is no possibility of its carrying fire on the hottest day.

During the fire season at least two pack sprays or 4 gallon drums filled with water must be kept on the tower in case of emergency.

APPENDIX "F".

REPORTS AND FORMS.

1002. Form F.D. 434 will form the basis of the Annual Fire Report and should be kept as a running day to day record of fire occurrence. Form F.D. 434.

It should be kept in duplicate and the original forwarded to Head Office with the Annual Fire Report.

Column 1 is the serial number of the outbreak.
Column 2, date of outbreak.
Column 3, maximum hazard of day of outbreak.
Column 4. Point of origin will indicate the type of tenure of point of origin such as State Forest, Crown Lands, Private Property or as the case may be.
Column 5. Zone of origin indicates in which of the three zones, as set out in paras. 752-755, the point of origin occurs.
Column 6. Location is the name of compartment or property.
Column 7. Cause.
Columns 8, 9 and 10 give the area burnt in "A" Zone in three degrees of scorching and should indicate the actual fire damage done to the forest.
Column 11 gives the total area of the fire, if known, and is not merely the sum of Columns 8, 9 and 10.
Column 12. The cost to the nearest pound.

ANNUAL FIRE REPORT.

1003. A separate Annual Fire Report is required for the natural forest and for the plantation zone where a plantation has been established in a District that also fire protects the natural forest. Separate Reports.

1004. The Annual Fire Report for areas of natural forest will be in the following form and this schedule must not be departed from without Head Office approval. Fire Report natural forest.

ANNUAL FIRE REPORT.

.....Division No..... Season .....

1. **Introduction.**

Area protected—Zones A. and B.
Treated for Regeneration.
Period considered as fire season and covered by the Report.

2. **Prevention.**

(a) Controlled burning.
(b) Top disposal.
(c) Roads and tracks.
(d) Fire lines and firebreaks.
(e) Locomotive fire prevention apparatus. Action taken during fire season and any serious troubles in connection with use or misuse.
(f) Publicity and propaganda.
(g) Co-operation with local settlers.

3. **Organisation for Fire Season.**

(a) Fire hazard.
(b) Detection. Dates of manning and vacating towers.
(c) Communication.
(d) Suppression. Efficiency of employees; fire training schools.
(e) Water supply.

4. **Fires During Season.**

Date of first fire.
Date of last fire.

TABLE I.—TOTAL NUMBER OF FIRES.

Starting in:— Attention	A. Zone		B. Zone	
	No.	Area	No.	Area
Suppressed.				
Investigated.				
Reported but not attended.				
Total:				

TABLE II.—TOTAL FIRES ATTENDED IN ZONE A.

Size of Fire (acres)	Oct. X	Oct. Y	Nov. X	Nov. Y	Dec. X	Dec. Y	Jan. X	Jan. Y	Feb. X	Feb. Y	Mar. X	Mar. Y	Apr. X	Apr. Y	Total
Less than 1															
1 to 5															
6 to 10															
11 to 20															
21 to 50															
51 to 100															
101 to 200															
Over 200															
TOTAL:															

Column "X" refers to fires occurring in Managed Forest.
Column "Y" refers to fires occurring in breaks, flats, wastelands, etc.

TABLE III.—TOTAL FIRES IN ZONE B.

Size of Fire (acres)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Less than 1								
1 to 5								
6 to 10								
11 to 20								
21 to 50								
51 to 100								
101 to 200								
Over 200								
TOTAL:								

TABLE IV.—DETAILS OF FIRES ATTENDED.

(This table will be Form F.D. 434.)

TABLE V.—CAUSES OF ALL FIRES ATTENDED.

Cause.	No.	Area.
W.A.G.R. Locos. { Ash Pan		
{ Smoke Stack		
Mill Locos. { Ash Pan		
{ Smoke Stack		
Escapes from Controlled Burning—		
Bush Workers		
Bush Navvies		
Hunters and Fishers		
Householders		
On and from Private Property—		
Firewood Cutters		
Travellers		
Lightning		
Deliberately lit		
Children		
Mill Surroundings		
Mine Surroundings		
Other Govt. Employees		
Stockmen		
Unknown		
Totals:		

TABLE VI.—OCCURRENCE OF FIRES IN RELATION TO MONTH AND HAZARD.

Month	Low	Moderate	Average	High	Severe	Dangerous	Total
TOTALS:							

TABLE VII.—SUMMARY OF DAMAGE.

Zone	Scorching Acres			
	Under 15′	15-30′	Over 30′	Total
A. Managed Forest				
Waste Land				
B.				
Total:				

TABLE VIII.—SUMMARY OF POINTS OF ORIGIN.

	No.	Area of State Forest.
State Forest		
Private Property		
Crown Lands and Reserves		

TABLE IX.—CONTROLLED BURNING CARRIED OUT.

Area	Acres	Miles	Advance Burning and T.D. (acres)

TABLE X.—RAINFALL FIGURES FOR THE SEASON.

Month June to May	Wet Days	Points

5. **Summary of Expenditure.** (To agree with 91 and 92 Form.)

Cost of Manning Towers.
Cost of Maintenance of Towers.
Fire Fighting and Patrols.
Week-end Detention.
Top Disposal.
Controlled Burning.
Fire Fighting Training Schools.
Training Overseers and Gangs.
Fire Fighting Equipment and Maintenance.
Radio Maintenance.
Fire Weather.
Road and Firebreak Maintenance.
Hire of Private Motor Vehicles on fire control work.

6. **Transport.**

No. of Departmental Vehicles on fire control work.
Total mileage run on fire control work (exclusive of Officers' transport.
Total mileage run by outside vehicles hired for fire control work.
Number of tractors, bulldozers, used on fire control work.
Total hours worked by tractors, used on fire control work.

7. **Recommendation for Next Season:**

8. **Fire Plan.**—A paper litho to be forwarded with fire report showing:—

(1)	A, B. Zone boundaries	BLUE
(2)	Controlled Burning—Spring	YELLOW
	Autumn	BROWN
	Top Disposal	YELLOW WITH RED HATCH
(3)	Uncontrolled Fires	RED and numbered with Serial No.
(4)	Private Property fires during prohibited period	GREEN Cross hatched RED
(5)	Private Property fires during open season	GREEN

(The plan should not be folded but rolled on stick for placing in folder.)

1005. Plantation Zone.

Annual Fire Report Plantation Zone.

The Annual Fire Report for a plantation zone will be in the following form and this schedule must not be departed from without Head Office approval.

ANNUAL FIRE REPORT.

.....Plantation. Season.....

1. Introduction.
   - Acres of plantation.
   - Acres of natural regeneration.
   - Acres awaiting planting.
   - Other.
   - Total:
2. Prevention.
   - (a) Controlled burning (to include boundary burning within buffer area and any other protective burning inside the plantation, around headquarters, etc.).
   - (b) Clearing burn for planting or sowing.
   - (c) Roads, tracks and firelines:—
     - (i) Construction—Details with chainages of new work within the plantation. Progressive total chainage of roads, tracks and firelines.
     - (ii) Maintenance—Details, with chainages, of grading, handwork, etc.
   - (d) Firebreaks.
     - (i) Construction. Details of new work.
     - (ii) Maintenance. Details of old breaks cultivated or scraped.
   - (e) Publicity and Propaganda.
   - (f) Co-operation with local settlers.

   (Note.—(e) and (f) not required if ordinary fire report is also forwarded unless there are some special features).
3. Organisation for Fire Season.

   As for natural forest report and not required if ordinary report forwarded unless there are some special features.
4. Fires During the Season.
   - Date of first Fire.
   - Date of last Fire.

Table 1. Total Number of Fires.

Attention	Within Plantation Zone				Outside Zone *		
	Planted or Sown		PP. or Wasteland		No.	Area if known	Total No.
	No.	Area	No.	Area			
Suppressed							
Investigated							
Reported not attended							
Total:							

* Where not reported in other report.

Table 2. Areas of Fires in Plantation Zone.

Area acs.	Oct. X	Y	Nov. X	Y	Dec. X	Y	Jan. X	Y	Feb. X	Y	March X	Y	Apl. X	Y	Total X	Y
0-5																
6-10																
11-20																
21-50																
Over 50																
Total																

Total area burnt X Acs.
Total area burnt Y Acs.
X represents areas planted or sown.
Y represents fires in the buffer belt or in wasteland within the planted areas.

Table 3. Details of Fires Attended.
(This table will be Form F.D. 434).

Table 4. Causes of Fires Within Plantation Zone.

Cause	Number	Area of Plantation

TABLE 5.—OCCURRENCE OF FIRES IN RELATION TO MONTH AND HAZARD

(As for Table VI)

TABLE 6.—SUMMARY OF DAMAGE

Area Killed.—(a) Salvageable .....
(b) Non-salvageable .....
Area burnt but not damaged .....

TABLE 7.—RAINFALL FIGURES

Month	No. of Wet Days	Points
June		
—		
—		
—		
—		
—		
May		
Total:		

5. **Expenditure**

(a) Items 3A and 3B. Total expenditure under these items with short descriptive note outlining on what work the money was expended.
(b) Items 1K and 2K. Work under these items within plantation zone.
(c) Items 1L and 2L.
(d) Total expenditure.

6. Transport as for natural forest report.

7. Recommendations for next Season.

8. **Fire Plan.**

A paper litho to be forwarded with the fire report showing (this plan should not be folded but rolled on stick for placing in folder): —

1. Zone Boundaries—Blue
2. Controlled Burning—
   Spring—Yellow.
   Autumn—Brown.
   Clearing burn—Yellow with Red Hatch
3. Uncontrolled fires—Red and numbered.
4. Private Property during Prohibited period—Green crosshatched Red.
5. Private Property fires during open season—Green.

DAILY FIRE REPORT.

Daily fire report.

1006. The Daily Fire Report as required in paragraph 944 will set out:—

(1) Number of uncontrolled fires over 20 acres on the previous day.
(2) Total acreage of controlled burning carried out under the headings:—
   (a) Advanced burn.
   (b) Prescribed burning.
   (c) Top disposal.
(3) Details of any major fires still running.

The Monday morning report will give details of both Saturday and Sunday.

Fire report code.

1007. To facilitate transmission and tabulation the report will be given in simple code as under.

Uncontrolled Fire.

Details will be preceded by the word "Fires" followed by the number over 20 acres then by the letter T and total acreage. This will be followed by a brief note on each fire giving its location, cause, and size, and if controlled or still running.

Controlled Burning.

Details preceded by the word "Burning" then—

"A" represents Advanced Burning.
"C" represents Prescribed Burning.
"T" represents Top Disposal.

followed by the acreage in each case.

1008. To illustrate, if a district had two fires over 20 acres, with one still running, with a total approximate acreage of 120. No advanced burning, 50 acres of prescribed burning and 100 acres of top disposal had been carried out, the message would read:—

"..... District. Fires 2.T.150.
Smith Compartment 10, lightning, 30 acres under control.
Lang Compartment 2, hunters, 120 acres still running.
Burning A. zero C.50, T100.

Order of reporting.

1009. Districts will report in the order called by the controlling officer at VL6DE.

1010. The following pages illustrate the various F.D. Forms mentioned in the foregoing text.

Form F.D. 243
Forests Department,
.....
(District Office)

.....

.....

.....

Dear Sir,

It is our intention, weather permitting, to carry out some protective burning adjoining your property.....
Location No.....on or about the.....19.....

I would very much appreciate your co-operation in this controlled burning and it might be in your interest to be present.

I would remind you that the Bush Fires Act makes provision for you to carry out the burning of breaks on your own property in co-operation with this Department and it is suggested that now is an opportune time for you to do any burning you consider desirable for our mutual protection.

If you wish to discuss the programme more fully, I shall arrange for an officer to call on you at an early date.

Yours faithfully,

Divisional Forest Officer,
Forester-in-Charge.

Form F.D. 289
Forests Department,
.....Office.

.....

.....

.....

.....

Dear Sir,

I beg to acknowledge receipt of your notice of intention to burn.....
on your property.....
on.....
.....
.....

Yours faithfully,

FOREST OFFICER,

Form F.D. 304.

FIRE REPORT

Instructions concerning fire received from.....
.....at.....a.m.p.m. on.....

Position of fire was given as.....

Position of fire was found to be.....
.....

Time of arrival at fire.....a.m./p.m.

Estimated area then burnt.....acres.

Time required to stop running fire.....hours.....
minutes.

Time spent mopping up.....hours.....minutes.

Main gang left the fire at.....a.m./p.m. and re-
commenced work at.....a.m./p.m.

Suspected cause of fire was.....
.....
.....

Total area burnt was estimated to be.....acres,
made up as follows:—

Treated or planted forest—
Badly damaged ....acres.
Slight damage ....acres.

Untreated areas—
Good quality forest ....acres.
Waste land ....acres.
Private property ....acres.

Quantity of water used.....gallons.

Men employed on fire—

Departmental Employees.	Ordinary hours.	Outside ordinary hours.	Additional Men.	Ordinary hours.	Outside ordinary hours.

Mileage run by Departmental vehicles.....miles.

If any other vehicles engaged, give name of owner, mileage, and rate of payment arranged.....
.....

What arrangements were made for patrol of burnt area?.....
.....

Special comments (if any).....
.....
....., *Signature.*

Report to be made out by man in charge of fire gang and forwarded to local office within 12 hours of leaving fire.

OFFICE RECORD

Serial No..... Zone.....

Report received at Office at.....a.m./p.m. on.....

COSTS.

	£	s.	d.
Departmental employees:			
Within ordinary hours			
Outside ordinary hours			
Extra labour engaged:			
Within ordinary hours			
Outside ordinary hours			
Transport costs:			
Departmental vehicle:			
.....miles at 6d. per mile			
Hired vehicle:			
.....miles at.....per mile			
TOTAL			

Particulars of area burnt and damage done.....

.....

.....

.....

.....

.....

Weather data—

Fire weather forecast for day.....

Local Estimate.....

	At time of outbreak.	Peak for the day.
Temperature	.....	.....
Relative humidity	.....	.....
Wind direction and force (from nearest tower)	.....	.....

Cause of fire.....

.....

.....

Officer compiling.

Notes and Comments by D.F.O.—

.....

.....

.....

.....

.....

Form F.D. 421.

FORTNIGHTLY CONTROLLED BURNING REPORT

Date.	Location.	Condition of Forest, Age of Litter, Scrub Type, Density, Aspect.	Weather Conditions at Time of Burn.		Time of day and No. of Men.	Method of Lighting.	Officer in Charge of Burning	Report on Burning.									
			Wind Strength and Direction.	Cloud Type and Density.				Estimate of Hazard.	Area Burnt (app.).	Class of Burn.	Ht. of Scorching % of Area.			Temp.	R.H.	Other Remarks.	Reporting Officer's Initials.
											Under 15 ft.	15-30 ft.	Over 30 ft.				

Form F.D. 426.
Forests Department,

.....

Date.....

To.....

.....

.....

Dear Sir,

In connection with your request that this Department—

(a) Assist you in carrying out a controlled burn on your location.....

or

(b) Burn a break adjoining your location.....

.....

I have to advise that we are prepared to accede to your request and the burning will be carried out at ..... a.m. p.m. on.....

You are requested to be in attendance with whatever men and equipment you have available and it will be your responsibility to patrol your property during and subsequent to the burning operations.

.....
Forest Officer.

Form F.D. 434.

DETAILS OF FIRES ATTENDED.

Division or District..... Fire Season 19.....19.....

Serial Number.	Date.	Hazard.	Point of Origin.	Zone of Origin.	Location.	Cause.	Area Burnt and Damage.				Cost.
							Zone A.				
							Under 15 ft.	15 ft.–30 ft.	Over 30 ft.	Total Area.	