Goldfields Fire 13

(Boorabbin Fire)

Operational Review

Prepared by GHD Pty Ltd

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Prepared for

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About the Author

Paul de Mar is a principal consultant in the natural resources group of GHD Pty Ltd (GHD). Since joining GHD in July 2007, Paul has been providing consulting services to clients around Australia, principally working in the fields of bush fire and risk management, and natural resource management consulting.

Prior to joining GHD, Paul worked for Forests NSW (FNSW), a government owned trading enterprise with management responsibility for 2.6 million hectares of native forests and more than 260,000 hectares of timber plantations. Paul spent twelve years with FNSW, with responsibilities including management of the fire management branch, leading program development and implementation for the management of fire across FNSW native forest and timber plantation estate. FNSW fire management programs incorporated scientific research into fire behaviour and ecological impacts; fire risk management, prevention, mitigation and preparedness programs; fire management training and competence evaluation; and State level coordination of fire suppression operations.

During the period Paul led FNSW fire management programs, NSW experienced a number of severe fire seasons including the severe El Nino season of 1997/98, the 2001 'Christmas Bushfires', the nationally severe 2002/03 fire season, and the prolonged drought-affected 2006/07 fire season. Paul led and coordinated FNSW operational response to the many large fires which occurred during the long, and at times intense inter-agency fire suppression campaigns. This involved extensive liaison and operational coordination with other fire authorities in NSW, from inter-state, and from New Zealand.

In 2000, Paul led a team of 96 Australian and New Zealand fire incident control and fire aviation operations specialists deployed to the northern Rocky Mountains region of Montana and Idaho in the USA, to assist US fire and land managers control the worst forest fires experienced in the US since their benchmark season of 1910. Paul worked within Incident Management Teams and Area Commands gaining valuable experience in the incident command systems used for large fires in the US. In 2002, at the request of the US National Wildfire Coordinating Group (NWCG), Paul returned to the US to organise the provision of operational assistance from Australia and New Zealand for large forest fires burning in Oregon and northern California.

During his time with FNSW, Paul was a member of the NSW Bushfire Coordinating Committee, a statutory, inter-agency body responsible for establishing standards for coordinated fire management in NSW. At national level, Paul represented FNSW on the Australasian Fire Authorities Council (AFAC), the Bushfire Cooperative Research Centre (CRC) stakeholder council, and the Forest Fire Management Group (a sub-committee of the Primary Industries Ministerial Council) of which he was chairman from 2002 to 2005. During the Council of Australian Governments national enquiry on Bushfire Mitigation and Management, Paul was invited to participate in the invited specialists forum.

Paul has been invited to provide Australian fire management perspectives at conferences and international policy forums in Australia, New Zealand, the USA, Canada, Greece, Brazil, Uruguay, Costa Rica, Thailand and Indonesia. This has allowed him to gain valuable insights into international approaches and standards for fire management.

Prior to working for FNSW, Paul served as a commissioned officer in the Royal Australian Navy for 13 years, specialising in fire and damage control, gaining operational command and control systems experience, and saw active war service aboard HMAS WESTRALIA during the first Gulf War.

Executive Summary

On 28 December 2007 a fire started in Boorabbin National Park in the Western Australian Goldfields. Fire suppression operations were initiated by the Department of Environment and Conservation WA (DEC) on 28 December 2007 and operations continued until the fire was declared contained on 8 January 2008. In accordance with fire incident naming protocols, DEC gave the fire the official incident name of "Goldfields Fire 13" (the fire also came to be generally referred to in the public domain as the Boorabbin Fire).

Influenced by the remote location of the fire, the vegetation in which it was burning, and the prevailing weather conditions in the days following the fire's ignition, the fire grew to a final size of approximately 39,634 hectares by 8 January 2008. During the fire's growth and major runs the fire posed significant challenges for containment and control, and impacted high value infrastructure including the Great Eastern Highway (GEH), high and low voltage powerlines, and the goldfields water pipeline. Tragically, on Sunday 30 December 2007, two trucks travelling west along the GEH were overrun by the fire and the three occupants died. A Coronial Inquiry will be conducted into the circumstances of the deaths.

This review titled *Goldfields Fire 13 - Operational Review* (GHD, 2008), prepared for DEC by GHD, reviews DEC's management of the fire. The review has been completed with the objective of providing:

- An accurate and discriminating account of the operational management of the fire to identify the causes and contributing influences that resulted in the significant fire outcomes, and
- The report will identify 'Identified Learning Points' arising from the operational management of the fire, that link to a set of recommendations.

In meeting the above review objectives, the review covers the *Prevention, Preparedness, Response and Recovery* phases of fire management, and is in the context of Australian Inter-service Incident Management System (AIIMS) used as the operating system for fire management in Western Australia.

Fire location and landscape characteristics

Goldfields Fire 13 occurred adjacent to the Great Eastern Highway in semi-arid sandplain country between Southern Cross and Coolgardie. The sandplains of WA's Goldfields region are highly fire prone, and support fast moving wind driven fires. In sandplain country, fire prone heath-scrub vegetation typically occupies the upland areas of the landscape, with the lowest parts of the landscape occupied by salt lakes. The lowland areas adjacent to salt lakes, and the broad shallow valleys that drain to them, are occupied by Eucalypt woodlands. These woodlands typically have a very sparse understorey, often with large inter-connected patches of bare earth, and therefore do not normally carry fires.

Typically, fires in these sandplain landscapes burn through areas of heath-scrub, moving quickly when the wind speed is sufficient to drive the fire forward, and then stop when they run into a large expanse of Eucalypt woodland, salt lakes or recent fire scars where there is insufficient fuel to continue carrying the fire. When wind speeds are light and variable, fires in heath-scrub spread sporadically, and relatively slowly, often leaving a patchy mosaic of burnt and unburnt vegetation. Fires can burn for many days or weeks, spreading through the areas of sandplain heath-scrub, with their expansion promoted by the natural variability in wind direction and speed. On hot, dry, windy days, fires can cover large areas, creating very large fire perimeters, which pose significant problems for containment. Fire containment in the Goldfields region is undertaken when fires are burning in proximity to fire vulnerable assets and transport routes.

Weather conditions leading up to the fire

In the weeks and months leading up to the fire, the eastern goldfields area had experienced a severe and prolonged period of drought. In the Boorabbin National Park area where the fire occurred, the six months leading up to the fire were particularly dry and the vegetation was in a severely drought stressed condition, rendering it even more fire prone than usual. The severe rainfall deficits during the winter and spring months leading up to the fire were exacerbated by the effects of long term drought which had affected the eastern goldfields for at least 3 years.

DEC's fire management responsibilities and operating context

DEC as the major public land manager in WA, has extensive bushfire responsibilities requiring a robust and effective fire management capacity. At State, regional and local level DEC plays a very significant role in the management of bushfire in WA. With land management responsibility also comes statutory obligations to protect people and property from bushfire damage, and manage appropriate fire regimes across WA's extensive area of public lands. In practice, managing bushfires and applying appropriate fire regimes necessitates having the operational capacity to plan and safely conduct prescribed burning operations and to contain and extinguish unwanted fires and those that may threaten community and environmental assets. DEC has bushfire prevention, mitigation, preparedness response (suppression) and recovery responsibility across the estate it manages.

The career and volunteer fire brigades managed by local Governments and WA's Fire and Emergency Services Authority (FESA) provide the capacity for fire management across private lands and play a vital role in protecting communities from fire. Local Government, FESA and DEC support each other in cooperative fire management, and this is no more evident than at the urban-bushland interface where fires frequently move between public and private land tenures. The roles of DEC, local Government and FESA are complementary (not duplicated).

DEC plans and conducts the largest prescribed burning program of any land and fire management agency in Australia, and probably the world. DEC is recognised among Australian fire and land management agencies as running the most pro-active prescribed burning program in the country, and is recognised by it's peers as a leader in the field of fire management. The same resources that implement DEC's extensive prescribed burning program outside the bushfire danger period, are mobilised and respond to the many bushfires that start on or move onto public lands each year.

With a larger volume of fire management operations (prescribed burning and fire suppression) to conduct than any other land and fire manager in Australia, DEC's fire crews and incident management teams are among the most experienced and competent in the country.

DEC's national and State level operating context and fire management capacity are outlined at sections 3.1 and 3.2 of this report.

Goldfields Fire 13 occurred within DEC's Goldfields region, the largest in WA covering 84,285,534 hectares (34% of WA). For perspective, the DEC Goldfields region covers an area larger than the State of NSW. Within the Goldfields region there are 8,589,047 hectares of conservation reserves and areas managed for conservation. There are just 30 full-time DEC staff in Goldfields region to undertake the full range of DEC land and conservation management responsibilities across the estate, and off-estate regulatory functions. At the time of the fire, 14 were trained and available for firefighting operations (all but one have other primary responsibilities). These resourcing levels mean that it is routine for Goldfields region to supplement locally available resources with resources mobilised from other DEC regions when a fire requiring extended attack occurs.

At local level, the fire management operating environment in Boorabbin National Park, where the fire occurred, is demanding. Summer daytime conditions are typically hot and dry. On days when NE to NW wind flows influence the weather pattern, temperatures are typically over 40^{o}C and extremely dry with relative humidity below 10%. Sustained physical activity in the heat and sun in such conditions is physically and mentally challenging. The remoteness, lack of facilities, constant and persistent flies adds to the challenging operating conditions. These were the conditions firefighters and other personnel at the fire were operating in on 30 DEC 07.

Operational review: Fire prevention program planning and implementation

DEC in partnership with local Governments and FESA had prepared a Wildfire Threat Analysis and Fire Prevention Plan (WTA&FPP) for Crown Lands between Southern Cross and Coolgardie. This plan was acclaimed by incident management personnel to be a most valuable resource for identifying and prioritising assets requiring protection from fire, the fire risk assessments it contained were very useful for decision support in determining appropriate fire response, and raising awareness among asset owners/managers of the threats bushfires pose to their assets. A number of out-of-area firefighters felt that it would be highly beneficial to conduct the Wildfire Threat Analysis process in their own area. This WTA&FPP won an Australian Safer Communities Award in 2005.

Pursuant to implementing the WTA&FPP, DEC's Goldfields region sought and obtained significant funding enhancements in 2006, and at the time Goldfields Fire 13 occurred, implementation of the WTA&FPP strategies and actions was ahead of schedule.

The WTA&FPP for Crown Lands between Coolgardie and Southern Cross is now the best practice benchmark for fire prevention and preparedness planning in WA, and many other higher fire risk areas than the Goldfields do not have any comparable inter-agency multi-tenure plan. This is a shortcoming and potentially a significant risk exposure for DEC, local Governments, FESA and the WA Government in the event of adverse consequences fires occurring in such areas. This issue is addressed in more detail at section 4 of this report. Recommendations 2 to 6 address this issue and other fire prevention improvements that can be made in WA.

Operational review: Fire Preparedness

DEC's Goldfields region had in place a Fire Preparedness and Response Plan (FPRP) which was acclaimed as a useful document and was used by incident management team personnel, particularly the logistics unit. There are some minor enhancements that can be made to the plan, to pick up learning points from Goldfields Fire 13, which are subject of recommendation 7.

The major preparedness issue affecting Goldfields Fire 13 was its occurrence during the traditional Christmas - New Year holiday period when a high proportion of businesses and providers of services in Kalgoorlie were closed down. This made obtaining goods and services for Goldfields Fire 13, and gaining assistance from other public sector departments and their contractors difficult. Recommendation 8 is made to improve preparedness during the traditional Christmas – New Year holiday period.

Operational review: Response – Reporting of the Fire and Initial Attack (Phase 1)

The fire started during the early afternoon on 28 December 2007, in a truckbay on the northern side of the GEH, approximately 80 km west of Coolgardie. A fire cause investigation carried out by a DEC fire investigator identified the fire's point of origin in a strip of roadside vegetation and attributed the cause to either deliberate or accidental ignition by a person or persons unknown. Fanned by S/SE winds the fire spread from the truckbay to mature heath-scrub vegetation adjacent to the goldfields water pipeline and began to spread quickly north. During the afternoon and evening of 28 DEC 07, the fire spread approximately 17.5 kilometres north. By midnight the fire had burnt an area of approximately 2,219 hectares and had a perimeter in excess of 40 kilometres long, posing a significant challenge for containment.

The fire was first reported to DEC's Kalgoorlie office at approximately 15:00. By 16:00 an initial attack crew was dispatched to locate, reconnoitre and report back on the fire.

The initial attack crew departed with overnight provisions and equipment anticipating the requirement for extended operations and a need to commence setting up an Operations Point for suppression operations. By the time the initial attack crew arrived at the fire, it had already spread more than 8 km north of the Great Eastern Highway and continuing to run N/NW. There was no constructive initial attack action that could be taken other than monitoring and reporting on the fire's spread and setting up an operations point for extended suppression operations to commence the next day. The IA crew had taken a computer, communication equipment, maps, fire planning and contact information, resource boards and other equipment necessary for extended operations with them, and established a functional Operations Point and staging area during the first shift.

DEC's initial attack response to the fire was well executed with a prompt and thorough initial response which anticipated the need for extended operations. Some learning points and improvements have been identified which could further improve fire reporting and preparedness for initial attack (see recommendations 9 to13). The setting up of an Operations Point was well executed, and facilitated prompt and productive commencement of operations during the second shift. Some system improvements can be made, to further improve outcomes for establishing Operations Points (see recommendations 16 and 17).

DEC assessed early that the fire would required extended attack operations and promptly mobilised out-of-area (from the wheat belt and coastal districts) IMT, fire crews and equipment, and aerial fire reconnaissance resources. These were tasked, prepared and underway within 2 to 3 hours of the fire being reported and the helicopter was dispatched at first light. This was a strong, prompt and very well executed mobilisation of firefighting resources noting the timing within the traditional Christmas/New Year holiday break. Some procedural matters relating to fire classification and declaration can be improved and are the subject of recommendations 14 and 15.

Operational review: Response – Fire escalation north of the Great Eastern Highway (Phase 2)

During 29 DEC 07 the fire continued its growth north of the GEH. E/SE winds averaging around 11 km/h during the day reignited hotspots on the western flank of the fire causing the fire to spread in a W/NW direction. Unexpectedly, between 10:00 and 11:00 (Western Daylight-Saving Time (WDT)) a significant 'finger' of fire developed at the heel of the previous days run and ran through heath-scrub to the W/NW during the day at a rate of around 1 km/h. This finger ran approximately 9 km during the day, opening up a significant new flank north of the GEH as it progressed.

In accordance with suppression strategies planned the previous evening, direct flank attack with earthmoving machinery commenced during the morning as resources arrived at the fire. On the eastern

flank of the previous days run, approximately 12 km of containment line was constructed from the GEH to the Merbine track. Approximately 8 km of containment line was constructed along the new SW flank created by the run of the fire to the W/NW during the day.

From approximately 18:00, fire behaviour on the SW flank began to decline becoming patchy and spreading sporadically making it increasingly difficult for earthmoving machinery to conduct direct flank attack. By 19:00, fire spread had become so patchy and sporadic that containment efforts were abandoned leaving approximately 2 km to reach a 2000 fire scar, towards which the fire was heading and was expected to stop at.

At approximately 07:00 on 30 DEC 07 flank attack operations resumed on the SW flank. Earthmoving machinery attempted to track the convoluted fire edge which had burnt the previous evening. By 11:00 the containment line had been completed through to the 2000 fire scar, however the last 2 km of the containment line wound tightly in and around the meandering fire perimeter, and numerous patches of unburnt vegetation remained within the burnt area. During the late morning, fire began to jump the SW flank containment line. Fire crews were able to contain the first hop-over which occurred at about 09:30, but five subsequent hop-overs that occurred from 10:45 onwards were unable to be contained.

Weather conditions on the 30 DEC 07 were forecast to reach extreme, with strong N/NW winds expected. As it turned out, weather conditions observed on 30 DEC 07 at Southern Cross (which are indicative of the conditions at the fire) recorded the third hottest December day (45.2^{o}C) at Southern Cross ever recorded since measurements began in 1908, and a sustained period of extreme fire danger (almost 10 hours continuous) that ranked in the top five for longest duration of extreme fire danger index since FDI records for Southern Cross began in 1999 (BoM, 2008). As far as fire weather goes, it was a very bad day – a worst case scenario.

At the time the hop-overs occurred around 11:00, the fire danger rating had already reached extreme, and the wind was from the north averaging 24 km/h and gusting to 35 km/h. Under these severe fire weather conditions the hop-overs spread rapidly south toward the GEH at a rate of around 4 km/h and ran through the 2000 fire scar and across the highway. For safety, all suppression operations were abandoned and crews withdrawn to pre-planned safety zones, and roadblocks were established on the GEH immediately east and west of the fire impact zone on the highway.

Fire suppression operations functions at Goldfields Fire 13 in general were very well executed, despite the very challenging physical conditions and the communications difficulties that arose from the remote location of the fire. A feature of the operational management at Goldfields Fire 13 was the efficiency with which operations were executed, and their productivity, and above all the proactive and well executed attention to firefighter safety throughout the incident. A range of learning points have been identified to further improve the implementation of operations functions at fires which are the subject of recommendations 28 to 33.

Operational review: Response – Fire escalation south of the Great Eastern Highway (phase 3)

Having crossed the GEH at about midday, the fire spread rapidly south in mature heath-scrub. Observed rates of spread approached 9 km/h. By 13:30 the fire had reached a large expanse of Eucalypt woodland about 10 km south of the GEH which halted the fire's southerly spread. During the afternoon, transient changes in wind direction from the NW to the W/NW periodically fanned the eastern flank of the fire creating new fire fronts which ran strongly to the SE when the winds returned to the prevailing NW direction. Periodically, tongues of fire formed in the unburnt heath-scrub north of the GEH and these ran south as narrow fingers to the highway.

Large numbers of vehicles built up at the road blocks during the afternoon, with motorists held at hot, windy and dusty parking bays exposed to mid-afternoon sun with the temperature over 40^{o}C in the shade, and without access to drinking water or food. Public safety and welfare at the roadblocks became a significant issue. Consideration of traffic management issues, and operational tactics devised to manage and control traffic, involved extensive consultation between DEC, WA Police and FESA staff present at the fire. During the afternoon, DEC, WA Police and FESA units working cooperatively, periodically escorted convoys of traffic through the roadblocks during periods when fire activity on the highway diminished, with fire activity observed and 'windows of opportunity' identified to ground crews from a helicopter positioned over the highway.

By 19:00 the full width of the southern fire perimeter was contained by a large expanse of Eucalypt woodlands and salt lakes. Fire behaviour along the uncontained eastern flank south of the highway had began to decline significantly as the wind speed dropped becoming light and variable. This lull in wind speed was due to the influence of an approaching trough which was forecast to bring a gusty S/SW change to the fireground between 19:00 and 20:00.

Between 18:50 and 19:15 (during which time the pre-trough lull in wind speed was occurring), DEC's helicopter conducted a fire reconnaissance flight over the southern extent of the fire. The Air Observer reported that fire behaviour on the eastern flank had reduced considerably (mostly smouldering and low flames around half a metre high, with the most active fire behaviour being at the far southern extent of the flank with flame heights at most of 1 to 2 metres). Upon receiving this report, the Incident Controller made his final assessments considering the issue of re-opening the highway. Applying his local knowledge and experience of fire behaviour in the Goldfields, and aerial observations of fire behaviour between 18:50 and 19:15 along the highway and the eastern flank of the fire (as reported by the Air Observer), the Incident Controller assessed that:

- Current fire behaviour observed on the highway and eastern flank at the time he was considering opening the highway, posed no immediate risk to the highway,
- Fire behaviour along the eastern flank for a distance of about 8km from the highway was benign, and he considered was declining to a 'dead edge' which he assessed was very unlikely to become active again during the night,
- The most active section of the fire was 8 to 10 km south of the highway, contained to the north east by woodlands and sufficiently far away from the highway that it did not pose a risk.
- The S/SW wind change was not due until approximately 21:00 (IC's assumption) and therefore the currently benign fire behaviour situation would decline even further by the time the change arrived, with significant fire behaviour escalation not expected to result from the wind change.

On this basis, the Incident Controller reached the conclusion that it was safe to re-open the highway with contingency arrangements put in place to monitor safe passage of traffic convoys through the burnt section of highway and effect a re-closure of the road if fire behaviour escalated requiring such action. The Incident Controller considered that the likelihood of fire behaviour escalating to a level that required a re-closure of the road that night to be low, and did not expect to have to re-close the highway.

Significantly, the assumption that the wind change was not due until 21:00 was incorrect. The incorrect assumption arose from the Incident Controller having read the tabulated "*Forecast Conditions*" section of the spot weather forecast but not the accompanying "*Significant Wind Change*" section text which specifically indicated the S/SW change would arrive between 19:00 and 20:00, bringing strong and gusty wind conditions, and may be preceded by a lull in wind speeds during the hour before the change. The

Operations Officer, with whom the Incident Controller consulted regarding arrangements for opening the highway, had not received or seen the spot forecast and was not aware of the timing of the change.

A critically important factor in the events which took place at Goldfields Fire 13, and which underpinned decision making regarding re-opening of the Great Eastern Highway during the evening of 30 DEC 07, was the local knowledge and understanding of fire behaviour in sandplain heath-scrub vegetation.

At the time Goldfields Fire 13 occurred, there was no scientific or physical attributes based fire behaviour prediction model available for sandplain heath-scrub. In the absence of locally developed fire behaviour prediction models, fire appreciation and decision making during fire suppression operations (historically and during Goldfields Fire 13) had been made on the basis of historical operational knowledge. This knowledge, not being well documented, is passed on orally through the firefighting workforce, and is often expressed as generalisations. While fire behaviour generalisations may be valid for a certain range of conditions, there are also a range of conditions for which they are not valid. The most commonly expressed generalisations of Goldfields fire behaviour knowledge include:

- *Except in extreme conditions, fires do not spread through Eucalypt woodlands,*
- *Fires in heath-scrub are benign overnight; active fire behaviour can expected to resume between 10:00 and 11:00AM,*
- *Heath-scrub fires are wind driven and can be expected to make high intensity runs during the day if there is sufficient wind, spreading in mature heath at rates up to or exceeding 5 km/h in extreme conditions*
- *As sunset approaches, fire behaviour begins to decline and by nightfall, fire behaviour becomes benign such that it is difficult to visibly detect the active fire edge and therefore fireline construction at night is impracticable.*
- *Fire will not propagate through fire scars up to 8 years old; it can be expected that running fires will stop when they reach fire scars less than 8 years old.*

During interviews held with both local DEC Goldfields staff and staff from other DEC regions, these generalisations were consistently provided in answer to questions about how fires behave in the Goldfields region.

Of particular interest is the assessment of fire behaviour potential around the time of the S/SW wind change, which occurred just before 20:00 on 30 December 2007. From interviews held, it appears that staff making assessments of the fire situation may have subconsciously been looking for fire behaviour cues that fitted the local ‘generalised model’ (often referred to as rules of thumb) that fire behaviour begins to decline in the hour before sunset, becoming benign as darkness falls and thereafter. Fire observations were made (from the air) along the north east flank between 18:50 and 19:15. Mild and declining fire behaviour was reported, in near-still wind, not running, with half a metre flame height, and 1 to 2 metre flame heights at far southern extent of fire (8 to 10 km south of GEH). These observations may have served to reinforce any perception that observed fire behaviour was following the local ‘generalised model’.

Under normal diurnal weather patterns occurring in average or close to average weather conditions, the approach of darkness is frequently associated with increasing humidity, decreasing temperature, and very often a decrease in wind speed in the absence of any topographic effects. With a relatively small change to any of these parameters, but particularly declining wind speed, a significant decline in fire behaviour often occurs which is readily apparent to on site observers. Even though very low fuel moisture content may continue to prevail, this by itself, in the absence of a threshold wind speed, may

not be sufficient to sustain free burning and spread in patchy discontinuous fuel types such as sandplain heath-scrub.

In the case of 30 DEC 07, weather conditions were not average or close to average. The actual conditions leading up to the S/SW wind change were (using 20:00 data):

- Temperature: 39 ^{o}C (and had been above 40 ^{o}C since midday)
- Relative Humidity (RH): Less than 10% (and had been below 10% since midday)
- These temperature and RH conditions generate very low Fuel Moisture Content (FMC) conditions of around 3%

These conditions are significantly dryer and hotter than the average conditions (on which rules of thumb are frequently based) for this time of evening, at this time of year.

The reduction in wind speed observed at the fireground and reported by the Air Observer at 19:15 was not associated with the normal diurnal weather cycle, it was associated with the movement of the forecast trough which would later bring about a rapid and significant change in wind direction and speed. This lull in wind speed was that forecast by the BoM in their 17:09 spot weather forecast for the fire.

However, because of the pre-trough lull's timing in the early evening, when such reductions in wind speed often occur under normal conditions and diurnal weather cycles, and in the absence of having read the significant wind change notes in the spot forecast, it is likely that many firefighters and IMT members would have associated the reduction in wind speed as signalling reduced wind speeds for the remainder of the evening, as frequently occurs in the Goldfields (and as occurred the previous evening). As they now know, this reduction in wind speed was only transient, and was to precede a period of the strongest wind speeds for the day, and from a direction that would change the long, uncontained NE flank into a head fire.

The forecast 30 km/h S/SW winds, with gusts to 50 km/h, arrived just before 20:00 and fanned active fires burning quietly in fuels on the NE flank. This resulted in an immediate return of the fire danger index to the extreme range. Using the forecast post-trough wind speeds with the DEC Mallee-heath fire behaviour model, a rate of spread approaching 5 km/h with flame lengths greater than 14 metres are predicted which turns out to be very close to the actual post-wind change fire behaviour which occurred. This fire behaviour at this time of day certainly surprised many of the people who had prior experience with Goldfields fires, whose understanding of heath-scrub fire behaviour was from the 'rules of thumb' reference points that had been passed down to them, and may have been reinforced by their personal experience at fires they had attended in less severe weather conditions. None of the personnel GHD interviewed who were at the fire or in the IMT had ever seen or experienced sandplain heath-scrub fires burning near the upper limits of fire behaviour possible in that vegetation type, at that time of day. Unfortunately, these personnel can probably now state that the fire behaviour of this fire exceeded their prior experience with fires in these vegetation types.

It is equally clear that the weather experienced on 30 December 2007 fell into the very upper levels of severity, and this particular day ranks as one of the more severe fire days recorded for the locality – 3rd hottest December temperature, 5th longest duration of extreme fire weather period (ca. 10 hours).

The foregoing analysis underlines the importance of using fire behaviour models based on physical fuel and weather attributes for predicting fire behaviour potential. Generalised time-based approaches are usually only valid when fuel and weather conditions are close to average, but become increasingly deficient as conditions depart further from average conditions.

Informed by his local ‘generalised model’ or ‘rules of thumb’ based understanding of fire behaviour in the Goldfields, the Incident Controller approved the re-opening of the Great Eastern Highway to traffic at approximately 19:20, with sentries to be placed on the highway east and west of the burnt area for the purpose of monitoring traffic passage and fire behaviour, and re-closing the highway should the need arise.

Just before 20:00, when the S/SW change arrived at the fire, fire behaviour along the eastern flank escalated quickly. With the passage of the trough across the fire ground, the winds continued to back quickly to the south. Fire behaviour along the highway adjacent to the eastern flank had escalated by 20:15, and a wide fire front that had formed 3 to 4 km south of the highway was running strongly north through Tamma scrub – a low dense highly fire prone form of heath-scrub – towards the highway, spreading quickly at a rate of around 4 to 6 km/h.

The traffic convoys that had been released from Yellowdine and Bullabulling at approximately 19:20 when the GEH was re-opened, were approaching the burnt area at the time the S/SW wind change was arriving at the fire. The Coolgardie convoy was approximately 20 minutes behind the Bullabulling convoy. The unescorted convoy that had departed from Yellowdine (west of the fire) passed through the fire area just before 20:00 without incident. The convoy from Bullabulling (east of the fire) escorted by WA Police passed through the fire area just after 20:00, without incident, and with no escalation in fire behaviour apparent adjacent to the highway at that time.

By approximately 20:25, the unescorted convoy, which had departed from Coolgardie, began to arrive at the fire, by which time fire behaviour had escalated significantly adjacent to the highway. Some vehicles in the Coolgardie convoy drove through the fire affected area getting through to the west, however others, not willing to drive through the burning area, pulled over along the highway east of the fire affected area. The eastern fire sentry went to the aid of a truck which had continued into the fire, and got into difficulty during its passage through the fire. The eastern sentry became stranded on the western side of the fire, as the fire behaviour escalated to the east of his position, preventing his passage back through to the east of the fire. This left the eastern side of the fire without a sentry to re-close the highway, with vehicles in the Coolgardie convoy continuing to arrive at the fire.

Four trucks, which had attempted to proceed through the burning area, did not make it through. Tragically, two of these trucks were impacted by fire during their attempt to drive through the fire (between 20:35 and 20:45) at the time the main fire front was arriving at the highway from the south. The fire front which impacted the two trucks was intense and fast moving. The three occupants of the two trucks died when the truck cabins in which they were sheltering became engulfed in flames. It appears that the two trucks in which the fatalities occurred had seen that it was untenable to continue their passage west through the fire, and it is likely they were in the process of turn-around manoeuvres when the main fire front arrived at their position on the highway. The fire crossed the highway and continued spreading to the north until it ran into a 2006/07 fire scar late in the evening.

During Phase 3 of the fire, no constructive fire suppression operations were able to be undertaken due to the major fire runs in extreme conditions. The major operational activity undertaken was road closure, opening and traffic management. Road closure, opening and traffic management became the key issue of Goldfields Fire 13. It is an area already identified by WA authorities as requiring significant attention to improve planning and procedures for future incident management operations. The identified learning points relating to traffic management are among the most important learning points arising from Goldfields Fire 13. Detailed discussion of traffic management issues and the decision to re-open the Great Eastern Highway is provided at sections 7.3.2 and 7.3.3 of this report. Recommendations 35 to 40 are made in support of improvements to road closure/opening and traffic management.

Operational review: Response – Operations after 30 December 2007 (Phase 4)

Having undergone major growth on 30 DEC 07, the entire 21,502 hectares of fire was uncontained. Fire spread to the south from the southern perimeter of the fire was restricted by the large expanse of Eucalypt woodlands and salt lakes however the northern, eastern and western sections of the fire perimeter were not contained by natural features. Daily outlines of suppression activity undertaken on each day from 31 DEC 07 to 8 JAN 08 are provided at section 6.6 of this report.

Operations were in general well executed throughout phase 4 of the fire. Areas for improvement arising from the After Action Review process are discussed at section 7.4 of this report.

Operational Review: Incident Control and Coordination

The Incident Control System being applied at the fire was consistent with the national AIIMS model. It was clear within the command structure that the Incident Controller was in charge of incident management operations. Functional delegations (Control, Planning, Operations and Logistics) within the IMT followed a conventional AIIMS ICS structure. Fundamental incident management processes such as preparation of an Incident Action Plan for the approval of the Incident Controller were undertaken in accordance with routine DEC practice.

The firefighting component of Incident Management at Goldfields Fire 13 was well handled with a robust and aggressive 'safety first' approach. Firefighter safety management was a strength throughout the operation. Initial liaison and coordination functions were conducted in a timely and pre-emptive manner with the appropriate range of stakeholder agencies. Although this initial liaison was appropriate, subsequent liaison and coordination actions needed to be more persuasive and forceful (and OAMG activation triggered) when it became apparent that some authorities were reluctant or unable to commit appropriate resources to the incident.

Whilst control of the firefighting component was generally proactive and well executed, incident management attention to potential 'consequences management' was more reactive, and without adequate planning for the 'worst case scenario'. With the remote location, local resource shortages, and fast developing nature of the incident that changed from a fire control incident to a consequences management incident (traffic management and asset protection), this rapidly overwhelmed the Incident Control resources. Some of the higher priority incident management learning points arise from these matters of inter-agency liaison, and the importance of consequence management and worst case scenario planning. Recommendations 18 and 19 are made with respect to these incident control and coordination matters.

Operational Review: Incident Management - Planning

Incident Action Planning (IAP) resources commenced their planning efforts during the 'transition stage' of the incident on Saturday 29 DEC 07, as resources began to arrive at the fire and commence operations. Having set up the planning unit after arrival at the ICC and encountering some difficulties with incident mapping and communications during the transition phase, the planning unit succeeded in developing an IAP that included identification of the intended containment strategies. Planning did not adequately extend to considering the potential consequences of the preferred strategy failing. The 'transition phase' which is always a challenge for incident planning, was immediately followed by a 'blow-up' day and the failure of the preferred strategies, rendering all previously planned containment strategies redundant, and with inadequate planning in place for consequences management. This placed severe pressure on the planning unit which was under-resourced to deal with the range of planning functions and level of incident complexity and tempo it now had to deal with.

Subsequent to 30 DEC 07, when a fully staffed planning unit was established (and it should be noted that incident tempo had reduced) planning functions were generally well executed for the remainder of the incident.

Some of the more important learning points identified from Goldfields Fire 13 relate to incident action planning, particularly ensuring appropriate planning attention is given to current, next shift, and longer range incident development, to consequences management if containment is not possible or is unsuccessful, and consideration of the worst case scenario. Recommendations 20 to 27 are made in relation to incident planning issues.

Operational Review: Incident Management - Logistics

Logistics functions at Goldfields Fire 13 were in general well planned and executed. Incident logistical support to field units, facilities, and catering, which more often than not is an area of criticism at fires, attracted generally favourable comments from fire crews. The main issue arising in relation to logistics, that arose as an issue during Goldfields Fire 13 at this point is a policy issue for DEC rather than a current management issue for Logistics Units at fires. The key issue is the best means of providing quality accommodation and catering for fire crews at remote area fires whilst not adversely impacting on operational efficiency and fatigue management. This issue is dealt with in some depth at section 7.6 of this report, and is the subject of recommendation 34.

Operational Review: Communications

Due to the remoteness of the area in which Goldfields Fire 13 occurred, incident communication presented challenges and required mobile repeater infrastructure to support operations. Currently, DEC operates five communications buses which are fitted with a radio suite capable of HF, VHF (mid and high bands) and UHF CB radio communication. Each is also fitted with a satellite dish facilitating satellite phone communication (to provide phone communication outside mobile coverage areas). DEC also has two trailer mounted portable VHF repeaters which are deployed to fires where fixed repeater networks do not provide adequate VHF radio coverage. At the time of Goldfields Fire 13, DEC was building a prime mover hauled communications trailer which is now nearing completion. This trailer has an extensive radio, satellite enabled phone and data communications suite. DEC's investment in mobile communications infrastructure has positioned it well to enable the rapid enhancement of fire ground communications in areas where fixed infrastructure does not provide adequate coverage.

The chief issue remaining for DEC to address is to enhance the fit-out of the existing mobile repeaters and buses to improve communication at remote area fires where HF, UHF and VHF radio traffic integration is desirable, and a means of communicating fireground radio traffic back to the ICC is

required (for further detail refer to section 7.5 of this report). Recommendations 41 to 43 are made regarding communications capability.

Operational Review: Fatigue Management

DEC has in place fatigue management guidelines which are comparable to those used in other States. It also has in place a firefighter health and fitness program, which is important because fitness has a significant bearing on fatigue.

DEC went to considerable lengths to implement their fatigue management guidelines at Goldfields Fire 13. There were periods during the fire when work:rest ratio guidelines were not achieved and these were mostly associated with IMT transition periods and on 30 DEC 07 when critical incident response extended well beyond the planned end of shift. The remote nature of the fire, with the long travel distances between the fire and crew accommodation location, made balancing fatigue management with optimising operational shift periods to the most suitable periods for firefighting very challenging. For further detail on fatigue management at Goldfields Fire 13 refer to section 7.6 of this report. Recommendation 44 is made addressing improvements to fatigue management.

Operational Review: Aviation Management

At Goldfields Fire 13, DEC's contract aerial reconnaissance helicopter with pilot and Air Observer were mobilised early with the initial out-of-area resource mobilisation. It has not been common practice in the past for helicopters to be dispatched to Goldfields fires, this being the first time. The helicopter proved a most valuable resource in the management of Goldfields Fire 13, providing regular, accurate assessments of fire location and behaviour to support incident planning and operational decision making. The value provided by the helicopter was commented upon favourably in a number of staff interviews and After Action Reviews.

Some areas for further improvement of DEC's aerial fire management operations arose from After Action Reviews. These are discussed at section 7.7 of this report and are the subject of recommendations 45 and 46.

Operational Review: Potential Application on Thermal Imaging Technology

Thermal imaging technology was not used (not available) at Goldfields Fire 13, however with the operating conditions with heath-scrub fires, thermal imaging technology application has the potential to improve fire mapping, containment line construction optimisation, and mop-up/patrol effectiveness. Thermal imaging technology has become a key strategic planning and operations optimisation tool in fire management in Victoria and NSW.

More detailed discussion of the potential application of thermal imaging technology in WA is provided at section 7.8 of this report, and is the subject of recommendations 47 to 49.

Operational Review: Fire Training Programs

Although review of DEC's fire training programs was not within the scope of this operational review, the review has made two recommendations (50 and 51) which have consequences for DEC's suite of fire training programs.

Operational Review: Recovery

The main recovery activities to be undertaken for Goldfields Fire 13 were Critical Incident Counselling (CIC) for personnel at the fire, and the implementation of After Action Review (AAR) and Post Incident Analysis (PIA) processes after the fire. Both these activities were done well in difficult circumstances. The AAR and PIA processes were particularly comprehensive.

Section 8 of this report addresses post-fire recovery functions. Improvements to recovery management are the subject of recommendations 52 to 55.

Operational Review : Research

DEC has maintained a sound bushfire research capability through the last few decades, whilst a number of other land management agencies have experienced significant contraction of their fire research capability. DEC's fire researchers have made among the most prominent contributions to Australia's current collective knowledge and understanding of fire behaviour and fire ecology. The recent completion of Project Vesta in WA's Jarrah forests has provided the most significant advance in forest fire behaviour scientific understanding since the first major forest fire behaviour models were developed in the late 1950s and early 1960's. Project Vesta was jointly designed and undertaken by DEC's fire scientists in partnership with CSIRO's bushfire behaviour and management research unit. Australia's current knowledge and scientific understanding of heathland fire behaviour is similarly underpinned by significant scientific research contributions from WA. Australia's fire and land management organisations have much to thank DEC WA for regarding their contribution to Australia's scientific understanding of fire behaviour.

Despite DEC's nationally significant fire research efforts, there are still vegetation types in WA for which fire behaviour research is yet to be carried out, with Goldfields sandplain heath-scrub among these. Section 7.10 of this report addresses matters of heath-scrub fire behaviour knowledge and research, which is the subject of recommendation 1.

Identified Learning Points

From the operational review presented in Chapter 7 of this report, and prevention, preparedness and recovery matters arising from Chapters 4, 5 and 8 respectively, "Identified Learning Points" have been drawn out and tabulated in Chapter 8 of this report. Each "Identified Learning Point" is tabulated together with relevant recommendations.

Identified learning points become 'lessons learnt' after they are acted upon and the learning is translated into new or improved operational practice. Therefore, it will be necessary for DEC to review these "Identified Learning Points" and associated recommendations, identify which are valid and acceptable, and, it is suggested, to put in place a Goldfields Fire 13 "Lessons Learnt" coordination team to plan the implementation actions required to implement the accepted recommendations and monitor the progress of implementation.

End Note 1

A key matter the author wishes to emphasise to readers of this report is that DEC staff, and staff committed to the fire by other agencies, were working in very demanding and severe conditions, on a rapidly escalating emergency incident with significant life, property and personal safety risks to manage. Post-incident analysis and operational reviews necessarily focus on key learning points and areas for improvement, with the aim of improving performance and avoiding a recurrence of tragic circumstances in the future. Whilst attempts are made to identify things done well at an incident, reports can never adequately recognise the enormous number actions carried out by individuals and teams that were

carried out well. It should be acknowledged, and cannot be over-emphasised, that at Goldfields Fire 13, many people performed a very large number of difficult tasks well, at times requiring considerable courage, acting in good faith and carrying out their duties to the best of their abilities and in the public interest.

End Note 2

This executive summary is just that – a compressed summarisation of the main points and issues in the operational management of Goldfields Fire 13. Due to the necessity for brevity, it lacks the more comprehensive attention given to identifying the actions taken in managing the fire, and analysing their context and application that are provided through the main sections of this report. The author is of the view that the report should be read as a whole, not selectively or as separate parts, otherwise its full value and context may be lost. Accordingly, a summary of recommendations is not provided in this executive summary, however, the 'Identified Learning Points' section (section 9) contains the full suite of recommendations arising from this report, setting them out clearly together with their associated learning points.

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Appendices

1. Introduction

On 28 December 2007 a fire started in Boorabbin National Park in the Western Australian Goldfields. Fire suppression operations were initiated by the Department of Environment and Conservation WA (DEC) on 28 December and operations are continued until the fire was declared contained on 8 January 2008. In accordance with fire incident naming protocols, DEC gave the fire the official incident name of "Goldfields Fire 13" (the fire also came to be generally referred to in the public domain as the Boorabbin Fire).

Influenced by the remote nature of the location of the fire, the vegetation in which it was burning, and the prevailing weather conditions in the days following the fire's ignition, the fire grew to a final size of approximately 39,634 hectares by 8 January 2008. During the fire's growth and major runs the fire posed significant challenges for containment and control.

Tragically, on Sunday 30 December 2007, two trucks travelling west along the Great Eastern Highway were overrun by the fire and the three occupants died. The tragic incident was widely reported in WA and national media. A Coronial Inquiry will be conducted into the circumstances of the deaths.

DEC is undertaking a series of reviews of the fire and related matters to determine the facts and to identify lessons that might improve fire management in the future. Reviews undertaken by DEC will be made available to the Coroner.

On 25 February 2008, DEC engaged GHD to conduct this review titled "*Goldfields Fire 13 – Operational Review*". The review has been completed with the objective of providing:

- An accurate and discriminating account of the operational management of the fire to identify the causes and contributing influences that resulted in the significant fire outcomes, and
- The report will identify 'Lessons Learnt' arising from the operational management of the fire, presented as conclusions that link to a set of recommendations.

In meeting the above review objectives, the review will cover the *Prevention, Preparedness, Response and Recovery* phases of fire management, and be in the context of Australian Inter-service Incident Management System (AIIMS) used as the operating system for fire management in Western Australia.

It is important to note that in conducting this Operational Review, the focus is on DEC's operational practice and not that of other agencies participating in the incident. GHD has been provided with full and open access to DEC's staff for interviews and incident information, and to DEC systems and documentation for analysis, but (intentionally) not to the staff, systems and documentation of other agencies that participated in the management of Goldfields Fire 13. Accordingly, the recommendations in this review are focussed on actions which need to be taken by DEC alone, or in partnership with other agencies or communities.

Please note that times used throughout this report are Western Daylight-Saving Time (WDT).

2. Methods

GHDs review of DEC's operational management of Goldfields Fire 13 commenced approximately two months after fire suppression operations were completed. In the weeks after the fire, documentation (electronic and hardcopy) produced during the fire suppression operation and post-incident review processes had been comprehensively collected and organised through a thorough incident information gathering process implemented by DEC. All documentation collected through this process was provided to the WA Police and to GHD to assist in the operational review.

With any large and complex fire, it is not feasible to document the detail of operational tactics implementation and constantly changing fire situation dynamics. To compile detailed information about fire behaviour at particular locations and specific times, and the operational actions taken in response developing fire circumstances it is necessary to access the recollections of individuals participating in the incident management and present at the fire scene. This is usually done by a combination of reviewing personal diary notes, any 'statements' prepared by individuals pursuant to official investigation processes, and interviewing participants in the fire management operation. GHD conducted interviews with DEC personnel identified as potentially possessing important information about the management of the incident. These interviews were conducted in the period 10 to 14 March 2008, two months after the fire suppression operation. Most of the personnel interviewed had participated in DEC after action reviews (AARs) and WA Police interviews conducted as part of the Police investigation process of and preparing a 'Statement'.

Two months after the fire the memory recall of those interviewed was still relatively fresh, however, event recall during interviews with GHD was made in the context of having additional recall from post-fire discussion with colleagues, the DEC AAR processes and Police interviews.

2.1 Structuring the chronological account of Incident Management

The Scope of Works for the Operational Review identify four phases for the Goldfields Fire 13 Incident:

- **Phase 1: The Initial Phase:** the period when the fire is detected, reported and initial fire appreciation and dispatch and incident organisation actions are taken.
- **Phase 2: Escalation north of the Great Eastern Highway:** the period from first light on 29 December to approximately 12:00 AM 30 December 2007 in which the fire develops to the north of the Great Eastern Highway.
- **Phase 3: Escalation south of the Great Eastern Highway:** the period from 12:00 AM to midnight 30 December 2007 in which the fire escalates and develops to the south of the Great Eastern Highway.
- **Phase 4: Post 30 December fire period:** the remaining period (post-fire fatalities incident) of fire operations (from 31 December 2007 to 8 January 2008) during which the fire was brought under control and extinguished.

Guided by the Scope of Works for the review, GHD has given the greatest degree of review intensity to Phases 1 to 3 of the incident. GHD has structured the account of incident management for Phases 1 to 3 using the Australian Inter-Service Incident Management System framework. This comprises the following functional areas:

- Control (incorporating Liaison/Coordination)
- Planning
- Operations
- Logistics

For Phase 4, review intensity is reduced to daily snapshots of fire development, strategies and implementation.

2.2 Information sources used to construct a chronological account of the operational management of the fire

Sources of information and interpretations of such information used to construct the chronological account of the incident management include:

- The Fire Development and Chronology Review (GHD, 2008),
- Post-fire field assessment of the burnt area to observe physical evidence of fire direction and intensity,
- Incident Action Plans for each shift,
- Maps of the fire produced during ground and aerial fire reconnaissance missions,
- Photos taken from the ground or air of the fire location and behaviour at specific times,
- Reports and diary notes from field and IMT staff, and miscellaneous incident documentation
- Records of After Action Reviews (AARs) and Post-Incident Analyses (PIAs) conducted after the fire by DEC
- Interviews conducted with DEC staff from 10 to 14 March 2008, and
- Copies of incident Statements given by DEC staff to WA Police (as provided voluntarily by staff interviewed by GHD)

GHD has used a combination of all the above fire information sources in conducting this Operational Review.

2.3 Post-fire field assessment

As fires burn they leave behind physical evidence that provides indications of the direction and intensity of the fire, and of course it is possible to locate burnt and unburnt areas. Fire suppression operations, particularly the construction of containment lines are readily evident in the field after the fire.

GHD staff conducted field visits to the fire to conduct post-fire assessment and gain a landscape perspective of the fire site. On 23 January 2008, Paul de Mar and Dominic Adshead (GHD), accompanied by Ryan Butler (DEC Goldfields Regional Fire Coordinator (GRFC)), conducted field observations along the Great Eastern Highway, and in the fire area to the north of the highway where the fire burned during the first two days of the fire. On 24 January 2008, Paul de Mar (GHD) accompanied by DEC staff Mr Rick Sneeuwjagt (Manager, Fire Management Services), Dr Lachlan McCaw (Program Leader Landscape Conservation Science Division) and Ryan Butler (GRFC). In the afternoon of 24 January 2008, de Mar, Sneeuwjagt and McCaw flew over the fire in a light aircraft to view the more

remote sections of the fire and gain a landscape perspective of the fire runs and the extent of fire containment actions taken during the fire. On 11 March 2008 Paul de Mar and Peter Moore (GHD) conducted further field observations focussing on suppression strategy confirmation and the area of the Great Eastern Highway subject to traffic management procedures during the fire.

2.4 Photos and video footage of the fire

During the course of the fire, many photos were taken by a range of people including those involved in the firefighting operation and members of the public. For those photos where the location, view direction and time can be reliably established, the photos provide valuable visual evidence of the fire behaviour for the particular location and time.

DEC provided GHD with access to an extensive range of photos, and some video footage taken by DEC staff during the fire. Where reliable location and time information was supplied with the photos, GHD has used a number of the photos in our assessments of fire behaviour and location, and has used a number of the photos in this report to provide a visual record of fire activity.

2.5 Interviews with IMT and field operations staff

Only a relatively small volume of the available fire location and behaviour information is ever committed to paper in fire planning documentation and records. A large amount of such information is held in the memories of those who were at the scene of the fire, observing the location and fire behaviour at the time and implementing the incident management strategies. This is a most valuable and often overlooked source of fire information. Whilst some of this valuable information comes out during After Action Review (AAR) and Post Incident Analysis (PIA) processes, much of the more detailed information regarding incident management strategies and tactics at specific times is gained through interviews with those in a position to observe the location and behaviour of the fire at the time.

GHD conducted an extensive range of interviews with key persons present at the fire, particularly during the first three days (28,29 and 30 DEC 07). From the interviews, GHD has been able to access a significant amount of valuable fire location and behaviour information and operational response actions undertaken that is unavailable from other sources, or which assists by providing a first hand visual confirmation of other information sources.

3. The Operating Context

3.1 National Level

3.1.1 National Emergency/Disaster Management Framework: Prevention, Preparedness, Response and Recovery (PPRR)

The Department of Environment and Conservation (DEC) operates within national frameworks for emergency management. The first of these is the national framework for emergency/disaster management which sets out four elements of emergency management, known as PPRR, as follows:

Prevention

Preparedness

Response, and

Recovery

The State Bushfire Emergency Management Plan for WA, issued jointly by DEC and the Fire and Emergency Services Authority of WA (FESA), adopts and is structured using the PPRR framework.

3.1.2 Australasian Inter-service Incident Management System (AIIMS)

DEC has for twenty years used the nationally adopted AIIMS for incident management. This ensures that DEC's incident management system is compatible with that used by FESA and other fire and land managers across Australia and New Zealand. As AIIMS was developed from the US National Incident Management System, DEC's systems are compatible with those used across North America. The result is that DEC is able to work seamlessly in inter-agency incident management operations, and is able to provide/receive assistance to from fire and land management agencies throughout the Australian States and Territories, New Zealand, the United States and Canada.

The operating system of AIIMS is the Incident Control System, for which DEC has advanced, well developed and practiced systems in place, which are routinely applied in all DEC's fire management operations. The Department holds ready sufficient resources on a daily basis to mount effective initial attack based on the current fire weather and situation. There is capacity with DEC Regional structures to enable skilled and competent management of wildfire incidents. Pre-formed teams are established and rostered to assist Regions/Districts which have incidents beyond the Region/District resource capacity. DEC has five pre-formed Incident Management Teams that DEC may deploy to Level 2 and 3 fire incidents when needed. These pre-formed IMTs are experienced in the management of complex fire incidents, and have developed high levels of teamwork and competence in applying AIIMS at fire incidents.

3.1.3 National Policies, Programs and Standards

DEC is an actively participating member of both the national policy and industry peak organisations relevant to fire and land management – the Forest Fire Managers Group (FFMG), a sub-committee of the Primary Industries Ministerial Council, and the Australasian Fire Authorities Council (AFAC) a peak organisation for the fire industry in Australasia. These two organisations have key roles in setting national

standards and systems for fire management. As one of the more active members of these, DEC's fire management policies, standards and programs are consistent with those adopted at national level.

3.2 State Level – DEC's role in fire management in WA

DEC as the major public land manager in WA, has extensive bushfire responsibilities requiring a robust and effective fire management capacity. At State, regional and local level DEC plays a very significant role in the management of bushfire in WA. This section outlines the State level operating context and capacity of DEC's fire management capability.

3.2.1 DEC's fire management operating context

DEC recognises that bushfires are a natural, inevitable and essential environmental factor in Western Australia. Fire, together with climate, landform and soils, has operated over millions of years to shape the biodiversity of WA's ecosystems. The forest, woodland and rangeland ecosystems of WA are fire-maintained, and appropriate fire management is fundamental to ecologically sustainable management in WA.

In Australia, responsibility and accountability for the health and vitality of natural environments on public lands is assigned to land management agencies, in the case of WA, DEC carries this responsibility. Therefore, to discharge these responsibilities effectively, DEC maintains a fire management capability with the appropriate skills and capacity to analyse and understand the role of fire in the ecosystems they manage, and the ability to identify and apply the appropriate fire regimes necessary to maintain their health and vitality. In practice, applying appropriate fire regimes necessitates having the operational capacity to plan and safely conduct prescribed burning operations and to contain and extinguish unwanted fires and those that may threaten community and environmental assets.

It is a matter of fact that DEC plans and conducts the largest prescribed burning program of any land and fire management agency in Australia, and probably the world. DEC is recognised among Australian fire and land management agencies as running the most pro-active prescribed burning program in the country, and is recognised by it's peers as a leader in the field of fire management.

With land management responsibility also comes statutory obligations to protect people and property from bushfire damage. DEC has bushfire response (suppression) responsibility across the estate it manages. The same resources that implement DEC's extensive prescribed burning program outside the bushfire danger period, are mobilised and respond to the many bushfires that start on or move onto public lands each year. With a larger volume of fire management operations (prescribed burning and fire suppression) to conduct than any other land and fire manager in Australia, DEC's fire crews and incident management teams are among the most experienced and competent in the country.

DEC manages over 27 million hectares of conservation lands and has a fire prevention and mitigation responsibility for a further 86 million hectares of Unallocated Crown Lands and unmanaged Reserves. This land is spread across a land mass that exceeds one third of Australia. Climate varies from subtropical in the north to maritime influenced Mediterranean in the south. The ecosystem types requiring fire management vary enormously from tall Eucalypt forests in the south, through deserts that have vegetation totally dependant upon cyclonic rains, to tropical savannas in the north.

DEC has a significant decentralised (dispersed through DEC's Regions and Districts) firefighting capacity. DEC employs 765 people, which are directly involved with fire management and are trained in

a range of general and specialised fire management roles including fire suppression. DEC's fire management infrastructure includes the following key elements:

» 106 Fire Trucks

» 9 Bulldozers

» 11 Loaders

» 11 Low Loaders

» 177 Light Units (4 wheel drive utilities with water tank, pump, hose and firefighting equipment)

» 6 mobile communications facilities

3.2.2 DEC's place in a cooperative fire management institutional framework

In Australia, and WA is no exception, the mainstay of fire response capacity in rural and urban-bushland interface areas are volunteer fire brigades. These brigades began to develop more than 100 years ago, in response to the need to protect their local communities from bushfires – that is to say their historical basis is 'response' orientated. In recent decades volunteer brigade activities have had an increasing component of fire prevention activities, but their role does not generally extend to planning and using fire for the management of ecological values. As an indication of this, in Western Australia, on unallocated crown lands, fire prevention, mitigation and environmental stewardship responsibility is allocated to DEC, whilst fire suppression responsibility is allocated to volunteer brigades (through Local Government and FESA).

Career and volunteer fire brigades provide the capacity for fire management across private lands and play a vital role in protecting communities from fire. Communities and Governments are provided great value by volunteer brigades who willingly provide their time and skills at no charge.

The roles of DEC, local Government and FESA are complementary (not duplicated). It would not be cost-effective (and not possible in any case) for DEC to possess enough fire response capacity to control all fires occurring on their land without assistance from local Government and FESA. Therefore, the availability of local Government brigades and FESA staff to assist and bolster the capacity of DEC when responding to fires is essential. It should be noted that in the remote and sparsely populated Goldfields region, whilst there are local volunteer brigades in Southern Cross, there are no other bushfire brigades throughout the region.

On the other hand, with the overwhelming proportion of local Government brigades being volunteer brigades, DEC's fire management capacity fills a critical role in providing a continually available and dispersed initial response capability which is absolutely critical to early attack success for fires. Efficiencies are optimised under such institutional arrangements, as when fires and fire management works are not occurring, DEC's personnel that are available to respond immediately to a fire are not sitting idle or engaging in make-shift work, they are engaged carrying out other essential land management work activities (eg. road maintenance, biodiversity and ecosystem management works, recreation facility management, and weed and feral animal control) and are working within the parks and reserves providing for prompt initial attack when fires start.

Importantly also, DEC's experienced field operations staff are available to fill vitally important roles during suppression operations, that being field operations supervision. Their local knowledge of the parks and reserves, operational management skills supervising work gangs and machinery to construct and

maintain roads and trails and control fires, access to new technology to detect, map and manage fires, and their local knowledge and experience of fire behaviour in the local vegetation types is among the most valuable combination of skills and experience for fire control and is highly valued by local volunteer brigades during joint operations. The people who have developed these highly valued practical skills obtained them through many years of full-time operational land and fire management work.

A fundamental basis for maintaining and improving fire management service delivery in WA is to ensure that the capacity of both land managers and emergency service providers continues to be strengthened to deal with the increasing risk being generated by the growth of infrastructure and communities at risk from bushfires and the impacts of climate change. This means ensuring the fire management capacities of DEC, local Government and FESA are strengthened as fire risks to communities, infrastructure and biodiversity grow. The degree to which the capabilities and skills of the agencies complement each other is high. A decline in DEC fire suppression responsibility and capability (through future attrition or active reduction) would reduce also their capacity to undertake the extensive bushfire prevention, mitigation, and ecological fire management activities that cannot realistically be expected to be undertaken by volunteers. The value of prevention and mitigation activities is often under-valued. A reduction in such capacity leads to a higher proportion of small fires escaping control and becoming large damaging bushfires with adverse economic, community safety and environmental consequences.

3.3 Regional level

DEC's Goldfields region is the largest in WA covering 84,285,534 hectares (34% of WA). For perspective Goldfields region covers an area larger than the State of NSW. Within Goldfields region there are 8,589,047 hectares of conservation reserves and areas managed for conservation, including National Parks, Conservation Parks, Nature Reserves, Timber Reserves, State Forest, and former pastoral leases. DEC has primary fire management responsibilities (fire prevention, mitigation, suppression, recovery and fire use for conservation) across this estate. In addition there are 40.27 million hectares of Unallocated Crown Land and unmanaged reserves within the region for which DEC has conservation responsibility, and fire prevention and mitigation responsibility including prescribed burning.

There are 30 full-time DEC staff in Goldfields region to undertake the full range of DEC land and conservation management responsibilities across the estate, and off-estate regulatory functions. At the time of the fire, 14 were trained and available for firefighting operations (but have other primary responsibilities). Only since 2005 has Goldfields region had a position for a full-time employee (Regional Fire Coordinator position) solely dedicated to fire management responsibilities. At incident management level, in addition to the Regional Fire Coordinator there are three other qualified, competent staff that can contribute to Regional Duty Officer roles and to a local Incident Management Team in one of the Incident Control, Planning or Operations functions.

Most of Goldfields region is remote arid rangelands and desert with limited four-wheel-drive access only. Many areas are two or more days drive from the Regional Office in Kalgoorlie and require fully self-sufficient operations (fuel, water, food, camp equipment etc).

Map 1 on the following page shows the DEC regional boundaries, indicating the location and large geographical extent of DEC's Goldfields region.

Legend

- DEC Regions
- DEC Estate
- Unallocated Crown Land
- Major Hwys

KIMBERLEY

PILBARA

MIDWEST

GOLDFIELDS *84,285,534.7 HA*

SWAN

WHEATBELT

SOUTH COAST

WARREN

Wiluna

Leinster

Sandstone

Laverton

Leonora

Menzies

Kalgoorlie

Southern Cross

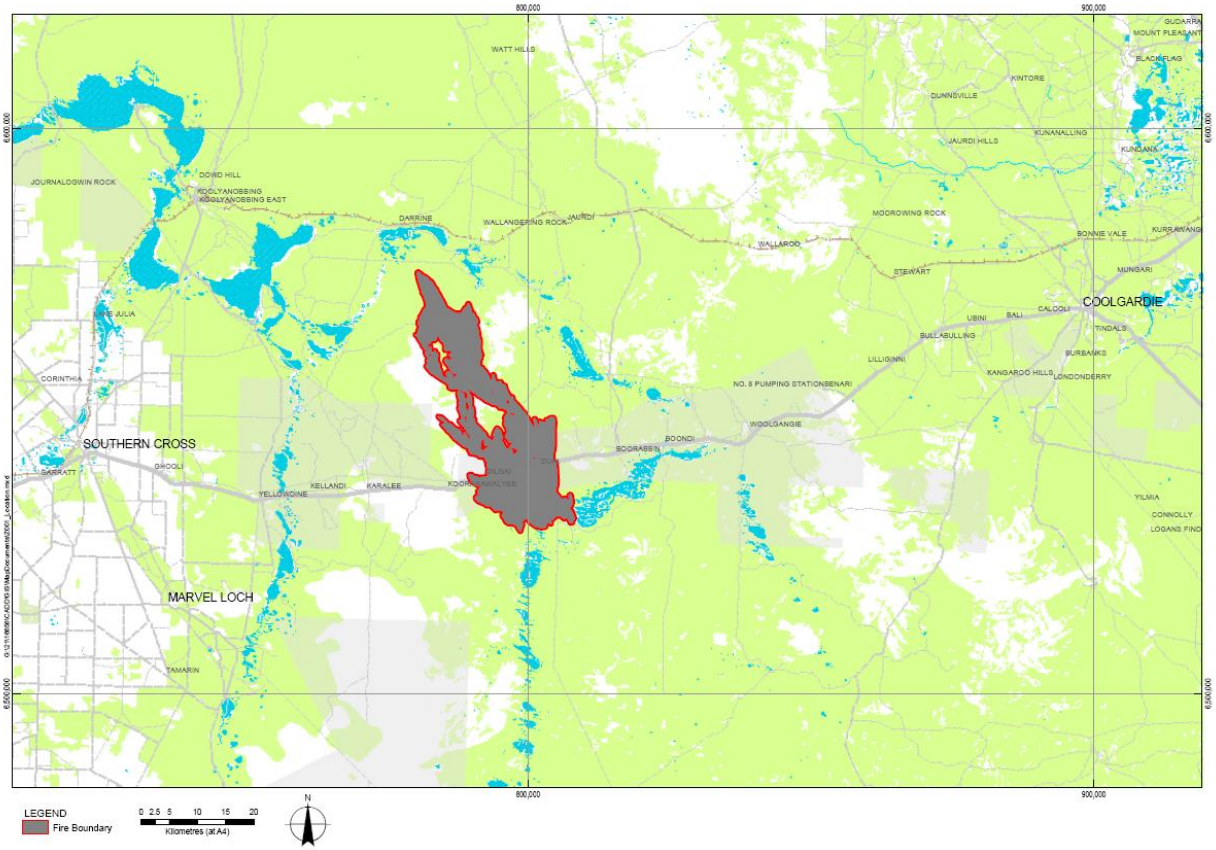
Norseman

Salmon Gums

3.4 Local Level Operating Conditions

The Boorabbin National Park (BNP), where the fire occurred, is located between Southern Cross (60 km to the west and Coolgardie (80 Km to the east). To the north and south of BNP is unallocated crown land. The landscape currently supports negligible economic activity and very few people live in the general area where the fire occurred. The Great Eastern Highway, Goldfields water pipeline and associated infrastructure, Telstra facilities, and high and low voltage powerlines are the main infrastructure features on reserves and easements running through the national park and a large expanse of native vegetation.

Map 2 Goldfields Fire 13 Location



Summer daytime conditions are typically hot and dry, providing challenging conditions for firefighting.

On days when NE to NW wind flows influence the weather pattern, temperatures are typically over 40^{o}C and extremely dry with relative humidity below 10%. Sustained physical activity in the heat and sun in such conditions are physically and mentally challenging. The remoteness, lack of facilities, constant and persistent flies adds to the challenging operating conditions.

4. Fire Prevention

4.1 The WA planning framework for fire prevention

WESTPLAN – BUSHFIRE stipulates that in WA, hazard management agencies are responsible for bushfire prevention and mitigation. However, WESTPLAN – BUSHFIRE does not place any specific requirement for inter-agency or even single agency pre-incident planning for fire prevention and mitigation. There are no requirements arising from any WA legislation to prepare and implement plans relating to fire prevention and mitigation.

This is somewhat unusual relative to arrangements in other States. For example in NSW, the Rural Fires Act 1997 requires the preparation of Bushfire Risk Management Plans (BRMPs) which cover prevention and mitigation, by local Bushfire Management Committees. The required plans are all tenure and inter-agency in coverage. Considerable resourcing is provided by the NSW Rural Fire Service and public land management agencies to facilitating the planning process and preparing BRMPs.

In Victoria, Municipal Fire Prevention Committees prepare all tenure inter-agency Municipal Fire Prevention Plans. Following recent changes arising from the Inquiry into the 2002-2003 Victorian Bushfires, the Victorian Government has allocated $3.93 million over three years, with annual recurrent funding of $1.43 million, to replace the Municipal Fire Prevention Planning process with an Integrated Municipal Fire Management Plan process covering all four PPRR phases of fire management.

In South Australia, the *Fire and Emergency Services Act 2005* requires that Regional and District Bushfire Prevention Committees prepare Bushfire Prevention Plans. Again these are inter-agency committees which prepare inter-agency plans. In July 2007 a Ministerial Review of Bushfire Management in South Australia identified a need to broaden fire planning from a prevention focus to a risk management focus. The Ministerial Review recommended, among other things, a range of legislative changes to broaden the functions of District Committees (and the State level Committee) and the scope of the plans they produce to cover the PPRR phases of management, and involve community consultation. Implementation of the review recommendations remains a work in progress.

In WA the framework for fire prevention is very different from the States described above. WA has a system of Emergency Management Committees from State to District level which are all hazards in scope, therefore they do not have a specific focus on fire. The function of District Emergency Management Committees is to “assist in the establishment and maintenance of effective emergency management arrangements for the district for which it is constituted”. It is not a function of the committees to prepare hazard specific plans and they do not do so. Their primary focus is on preparedness and response.

4.2 Wildfire Threat Analysis and Fire Prevention Plan for Crown Lands between Coolgardie and Southern Cross

Despite the absence of requirements to prepare fire prevention plans in WA, DEC and FESA had prepared a *Wildfire Threat Analysis and Fire Prevention Plan for Crown Lands between Coolgardie and Southern Cross* (WTA&FPP) covering the area where the fire occurred. The area is one of only seven in WA to have such a plan in place. In essence, the plan describes the characteristics of the landscape and bushfires in the area, establishes goals for fire protection, identifies the type and location of assets at risk from fires in the area (and the agencies/companies responsible for managing them), ranked the levels of

fire risk in the area, proposed a prioritised work plan to mitigate the risks, and recommended actions needed to facilitate implementation of the works program. The *Wildfire Threat Analysis and Fire Prevention Plan for Crown Lands between Coolgardie and Southern Cross* won an Australian Safer Communities Award in 2005.

In the process of developing the WTA&FPP consultation with and engagement of the various asset managers in the process proved to be a valuable means of improving awareness regarding the levels and nature of fire risks in the area, and the actions needed to be taken by each to mitigate the risks. Personnel involved in Goldfields Fire 13 commented that the WTA&FPP was a very useful source of fire risk information during the fire which they relied on being the only source of such information in existence for the area.

Goldfields Fire 13 has confirmed the value of a Wildfire Threat Analysis process. A number of out-of-area firefighters felt that it would be highly beneficial to conduct the Wildfire Threat Analysis process in their own area, as there is effectively no such process currently in place to bring communities and asset managers together with fire authorities to consider fire risks and plan the suite of prevention and mitigation actions required. WTA&FPP is a key instrument among a suite of tools needed to achieve best practice for fire prevention and preparedness planning in WA, and many other higher fire risk areas than the Goldfields do not have any comparable inter-agency multi-tenure plan.

It is rather ironic that in one of the areas in WA where DEC chose to implement a higher level of formal prevention and mitigation planning than elsewhere, tragic outcomes eventuated. That should not stifle further planning elsewhere, or attempts to review and improve this plan, particularly with respect to strengthening inter-agency involvement in fire and emergency planning. Indeed, it should be recognised that despite having the WTA&FPP in place, tragic consequences occurred in the area covered by the plan (largely attributable to matters of response rather than prevention/mitigation) and that the flow on effect of those consequences should be to strengthen the planning process as recommended in this review.

Continuation of the *status quo* whereby there is no obligation to undertake all-tenure, inter-agency fire prevention and mitigation planning in WA, is a significant shortcoming and potentially a significant risk exposure for DEC, local Governments, FESA and the WA Government, particularly in the event of an adverse consequences fires occurring in areas without such planning in place. DEC has indicated that a more extensive values/risk assessment process is required in WA. This is an appropriate view, and consistent with the risk management approaches developed inter-state over the past 10 years.

It is recommended that DEC review the WTA&FPP process used for Crown Lands between Coolgardie and Southern Cross, and consider what improvements could be made (eg. coverage of communications capacity) to the process and format.

Given the current lack of an inter-agency, all-tenure risk based planning approach to bush fire prevention, mitigation and preparedness in WA, it is recommended that DEC in partnership with FESA and local Government, seek the support of the WA Government to develop and initiate an inter-agency risk management based approach (based on DEC and FESA's acclaimed WTA&FPP) to fire planning in high fire risk areas of WA (prioritised to areas where high values and fire likelihood and consequence intersect). This will require consideration of the required legislative and policy frameworks, planning standards and resources, and audit processes to monitor and report on plan implementation. Models currently in use in NSW and currently being developed in Victoria are worthy of examination in developing a WA approach.

4.3 WTA&FPP Implementation

Since developing the WTA&FPP in 2003/04, DEC significantly increased resourcing for fire management in the Goldfields region. The fire management works budget for the Goldfields region was significantly enhanced from previous levels to $350,000 and further still to $530,000 in 2007/08. Goldfields region was also successful in obtaining Australian Government funding through the Bushfire Mitigation Program. These funding enhancements enabled DEC's Goldfields region to complete the prioritised fire management works program proposed in the WTA&FPP on reserves and in Unallocated Crown Land. More than 3,200 kilometres of access tracks and firebreaks on reserves and unallocated crown land in the Goldfields region have been constructed or upgraded pursuant to implementing the WTA&FPP. Prescribed burning works were also undertaken at Lorna Glen, Lake Mason and along the railway east of Koolyanobbing inside the area covered by the WTA&FPP. Aerial prescribed burning trials and operational burns were conducted in the Great Victoria Desert and in sandplain heath vegetation in reserves and on unallocated crown land. The increased fire management works program was made possible by the creation of a new Regional Fire Coordinator position in 2005.

4.4 Ignition Sources

As identified in the WTA&FPP, lightning is the main cause of fires in the Goldfields region. The WTA&FPP also identified the Great Eastern Highway (GEH) as a significant source of fires. Along the GEH there are numerous car and truck parking bays (some are designated parking bays and others undesignated clearings which get used as parking bays) which provide locations for highway users to stop, and where some people may legally or illegally light camp or cooking fires. There is however no fire awareness and prevention signage along the highway aimed at reducing unlawful or inappropriate fire use during the bushfire danger period.

It is recommended that DEC initiate an inter-agency working group (DEC, FESA, MRWA, local Shires) to consider and develop a system of bush fire awareness and prevention signage along the GEH aimed at reducing unlawful and careless fire ignition. DEC should investigate the extent to which this recommendation is relevant to other major highways such as the Eyre and Brand Highways.

Many of the parking bays along the GEH are located in non fire-prone areas, such as Salmon Gum woodlands, from which fires are unlikely to spread, but a number are located in highly fire-prone heath-scrub areas, such as the one in which Goldfields Fire 13 started. Within the parking bays located in heath-scrub areas, roadside vegetation within and adjacent to the parking bay is often mature or over-mature and in a condition conducive to fire escalation and spread. It would therefore appear that fire prevention has not been a consideration when planning the location and maintenance of parking bays on the GEH.

It is recommended that DEC work with MRWA, local Shires and FESA to review the current network of parking bays along the GEH to identify opportunities to relocate fire prone area parking bays to less fire prone areas, and to establish fire prevention maintenance standards for parking bays and adjacent vegetation. Further consideration should be given to the provision of constructed camp/cooking fire places, with appropriate signage, within designated parking bays.

In addition to parking bay location, consideration should be given to designating truck turn around points at appropriate locations, with signage clearly indicating they are turn around points to be kept clear and not to be used for parking or camping.

5. Fire Preparedness

5.1 State Level: WESTPLAN - BUSHFIRE

At the State level, FESA, DEC and Local Governments are jointly responsible for the development of WESTPLAN – BUSHFIRE detailing the arrangements for the management of multi-agency bushfire emergencies. In relation to preparedness WESTPLAN – BUSHFIRE requires that hazard management agencies in Western Australia develop pre-incident plans covering preparedness. DEC meets this requirement through the development of Regional Incident Preparedness and Response Plans (see section 5.2)

At the State level, preparedness coordination across the regions is managed on a daily basis through the fire season through the conduct of daily teleconferencing calls in accordance with *Fire Operations Guideline 82 – Procedures for Daily Teleconferencing Calls During the South West Fire Season*. During these coordination calls, summaries of forecast weather are provided, Regional Fire activity reports are provided, situation reports on major incidents are provided with preparedness and incident resourcing issues prioritised and resolved. These procedures were implemented throughout the fire.

These daily conference calls have proven to be a very effective means of communicating fire activity and priority information between DEC regions, providing for the State Operations Coordinator and State Duty Officer to maintain good situational awareness of fire activity around the State, and for discussion and resolution of preparedness requirements and identifying out-of-area resource mobilisation priorities and actions. The procedures used are comparable to those used in other States such as NSW and Victoria.

5.2 Goldfields Fire Preparedness and Response Plan

Goldfields Region had available a Fire Preparedness and Response Plan, prepared pursuant to DEC's Fire Operations Guideline 07 – Guidelines for the Preparation of Incident Preparedness and Response Plans (IPRP). The Plan was comprehensive and current and in accordance with FOG 07.

There are some areas of the plan that would benefit from more detailed consideration:

» The facilities section (Section 11) should provide an office layout plan for how best to set up the Goldfields Region Office as an ICC, drawing on the learning gained from the management of Goldfields Fire 13.

» The radio communications section (Section 13) should be enhanced to provide capability and limitations information about DEC's communications buses (and those of FESA/SES), trailer based mobile repeaters, and the new communications trailer. Basic information on how these can be used to enhance fireground communication and contact information for further information would be useful.

5.3 Resources availability during traditional holiday periods

Goldfields Fire 13 occurred during a traditional holiday period between Christmas and New Year when a high proportion of businesses and providers of services in Kalgoorlie and other Goldfields towns are closed down. This made obtaining goods and services for Goldfields Fire 13, and gaining assistance from other public sector departments and their contractors difficult. As it happened, when calls were made to obtain resources or the assistance of other service providers and emergency services, the result was often that requirements or requests were unable to be met. With hindsight it may have been a useful

exercise to have contacted key service providers and government authorities to determine what level of service would be available from key businesses/departments that provide services to DEC during fires, and the periods during which any may be closed down over the traditional Christmas – New Year break.

It is recommended that prior to each Christmas – New Year period, all DEC regions contact their key fire goods and services suppliers and partner agencies to determine levels of availability and record these for use by Duty Officers (as is presently done in the DEC's south-west region).

6. Goldfields Fire 13 Operational Response – Chronology of Events

Section 6 of this report provides a chronological outline of the incident management operations undertaken during Goldfields Fire 13. It is important to recognise that an outline only can be provided, documenting the key decisions and actions that were taken in managing the fire.

The chronology of key decisions and actions has been constructed from interviews, and where willingly provided, statements prepared by DEC staff participating in the incident. It is important to note that these statements and recollections during interviews are based on the memory recall of individuals, and different people will recall actions taken and times differently. It is frequently the case that event recollection amongst a range of people present in the same place at the same time will be in conflict.

The purpose of providing this chronology is to provide a broad outline of the event flow and operating context for the operational review, not to provide an authoritative, verified and comprehensive log of events and decisions at the incident. This was not intended nor possible within the scope of this review.

6.1 Historical approach to heath and shrubland fire suppression in the WA Goldfields

The typical strategies and tactics for firefighting in the sandplains of the Goldfields region are discussed here to provide background understanding to the strategies and tactics used during Goldfields Fire 13. Two text boxes summarise the general operational context factors for Goldfields fire management (Text Box 1) and the General firefighting approaches typically employed in the Goldfields Region (Text Box 2).

Text Box 1 Important operational context factors for Goldfields firefighting

Important operational context factors for Goldfields firefighting

The following operational factors significantly influence Goldfields firefighting strategies:

a. Water is an extremely scarce resource in the arid to semi-arid sand plain landscapes, therefore firefighting on all but the smallest fires requires dry firefighting techniques,

b. Very few people live in the sandplain country between Coolgardie and Southern Cross, local resources to respond to fires are negligible. Response to fires reported in the sandplain country are usually mobilised from Southern Cross, Coolgardie and Kalgoorlie.

c. There is very limited availability of firefighting resources in the Goldfields region (eg. firefighters, fire trucks/slip-ons, earthmoving plant suitable and available for firefighting) relative to more developed regions with higher and more dispersed populations. Therefore, firefighting strategies generally aim to minimise active suppression activity and maximise the use of natural features in the landscape, diurnal weather cycles, and advantageous weather such as rain to contain fires.

d. Due to the extreme difficulty of finding the active (smouldering) edge of flank fires in sandplain scrub once fuel moisture content has risen at night, flank fire attack at night is rarely practicable.

Given the nature of vegetation, climate and fire behaviour factors (see the Goldfields Fire 13 Fire Development and Chronology review for detail) and local operational context factors (see Text Box 1), the following general strategies are typically employed for fire suppression in the Goldfields region:

Text Box 2 **General firefighting approaches typically employed in the Goldfields Region**

Recent ignitions and small, low intensity fires: Provided that initial attack fire crews can be mobilised and reach a fire while it is still small and burning at low intensity (eg recent lightning ignition or roadside campfire escape), direct attack with hand tools and water/firefighting foam is the normal strategy. Earthmoving machinery may be tasked to create a mineral earth break around the fire perimeter if there is a reignition risk.

Fires in remote sandplain areas with limited/no access: Lightning is a common cause of fires in the Goldfields region, and it is common for fires to start in remote areas where there are no developed assets at risk, and limited access or trails for containment. In such cases it is an accepted and routine practice that no suppression action is taken, and that the fire is monitored and allowed to burn until contained by natural features in the landscape, previous fires and/or weather events. The Wildfire Threat Analysis and Fire Prevention Plan for Crown Lands between Coolgardie and Southern Cross (DEC, 2003) identified that as many as 80% of fires in the region are met with no suppression response.

Fires in locations that constitute a potential threat to life/property/infrastructure:

Fires that start in locations such that they may at some later time threaten human life, or adversely impact valuable assets in the Region, are prioritised for fire suppression action to prevent or mitigate such impacts. The Wildfire Threat Analysis and Fire Prevention Plan for Crown Lands between Coolgardie and Southern Cross (DEC, 2003) comprehensively identifies the range of assets potentially at risk from fires, their locations and level of fire risk.

Every fire has different circumstances, and warrants a planned response tailored to its specific circumstances. However, there are some basic principles that are routinely applied in fighting fires in the sandplain landscapes of the Goldfields region:

» The head of wind-driven fires running in sandplain heath and shrublands is too intense to safely attempt head fire attack,

» Flank attack from a safe anchor point, and 'with one foot in the black' is usually conducted to contain the lateral spread of the fire, and to contain/extinguish the flank so it does not become a source of new head fires in the event of a wind change,

» Wind driven fires running in sandplain vegetation spread quickly, and therefore flank attack requires the use earthmoving machinery in order to quickly establish a mineral earth break along the flank and to keep up with the fire spread,

» Flank attack is generally only efficiently achieved by day, as through the night after relative humidity has risen, flank fire behaviour reduces to barely detectable smouldering and it is extremely difficult for fire crews and plant operators to locate the active edge for containment,

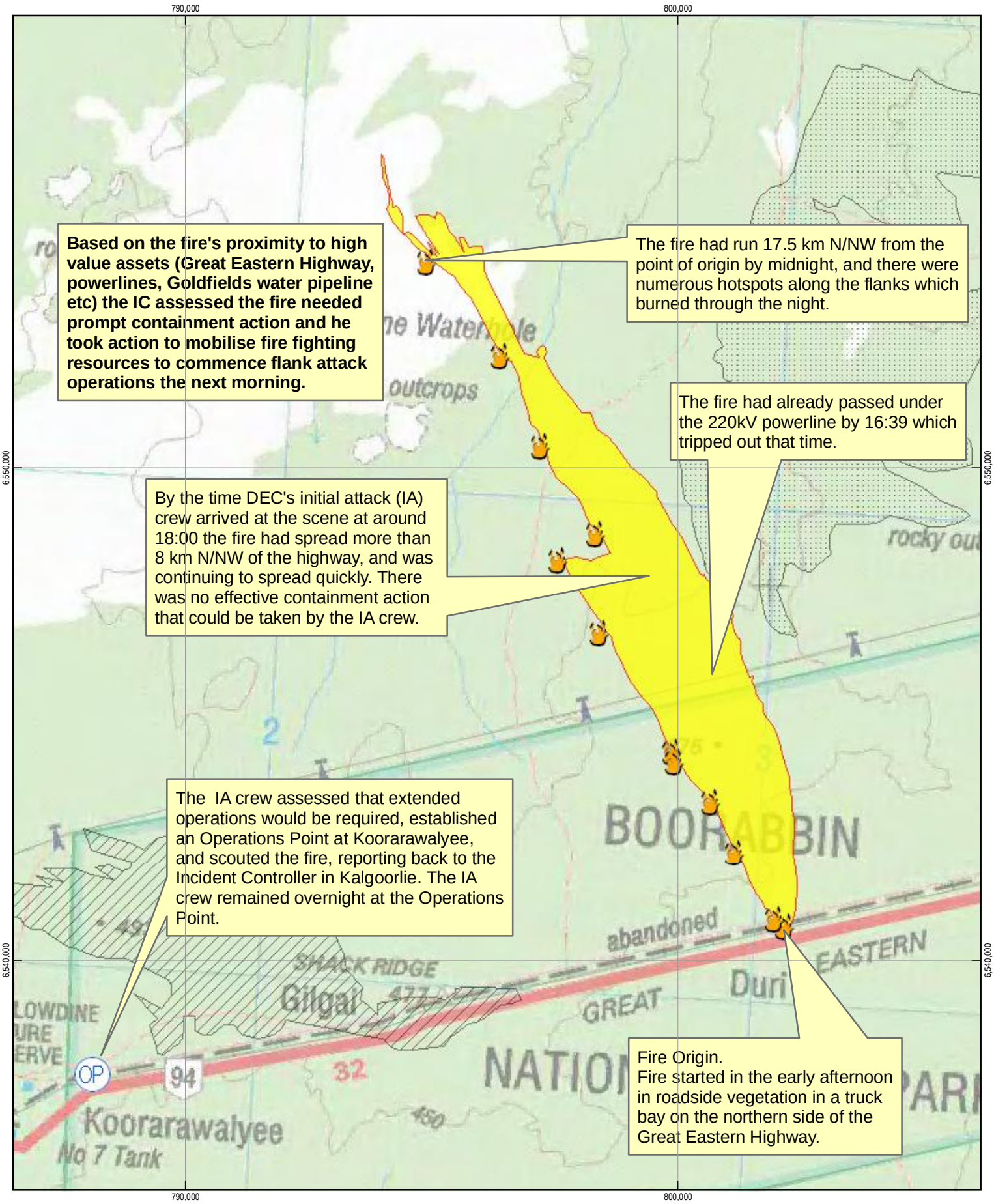
» The general strategy common to active suppression of all but the most unusual of large sandplain fires is to contain the fire flanks and work the headfire(s) towards natural features in the landscape such as an expanse of Eucalypt Woodland, a recent fire scar or bare areas such as salt lakes where it can be brought under control.

6.2 Incident Chronology - Phase 1 : Ignition, initial fire development, appreciation and response

Time Period 15:00 – 23:59 28 DEC 07	
Objectives: » Locate and conduct appreciation of fire, » Identify resource requirements and mobilise resources » Establish Incident Management arrangements	**Strategies:** » Dispatch initial attack crew to locate, reconnoitre and conduct appreciation of fire, » Devise strategies, order and mobilise out-of-area resources through State Duty Officer (SDO), » Establish Incident Control Centre and Operations Point
Operations chronology: Key decisions/actions *15:00 DEC GFR Duty Officer receives report of fire. Orders initial attack crew to prepare for fire response, potentially requiring overnight in field.* *15:40 Operations Officer for 29/12/07 requested through the SDO conference call.* *16:00 Initial attack (IA) crew (2) departs Kalgoorlie to locate and report on fire.* *17:30 Enroute to fire, IA crew liaises with Coolgardie Shire Fire Control (Bob Ellis).* *18:00 IA crew arrives at fire, reports to IC that fire is approx 200 ha, beyond initial attack, recommends mobilisation of earthmoving machinery and fire crews for flank attack the following day.* *18:40 IA crew liaises with Koorarawalyee residents (who reported the fire).* *19:30 IA crew conducts field reconnaissance of fire and reports to IC.* *21:00 IA crew sets up an Operations Point at Koorarawalyee.* *22:00 IA crew conducts field reconnaissance of fire and reports to IC*	**Control & Coordination chronology: Key decisions/actions** *15:15 IC receives a call from the 000 call centre in Perth advising of the fire and then liaises with FESA; confirms report of fire.* *15:30 IC calls DEC State Duty Officer to report fire and discuss control options/requirements.* *15:50 IC informs Kalgoorlie Police of fire, requests assistance to manage traffic on GEH* *16:10 IC calls Hamptons (local earthmoving contractors) requests dozer and grader for 29/12/07.* *16:15 IC participates in daily fire conference call coordinated by SDO. Four light units, 5 heavy duty units, and 1 FEL mobilised from DEC Wheatbelt and Swan regions.* *17:00 IC liaises with FESA, arranges FESA liaison officer for IMT and FESA communication van.* *17:35 IC liaises with Western power re 220KV power outage*

Planning chronology: Key decisions/actions	**Logistics chronology: Key decisions/actions**
During late afternoon/evening, IC assess fire extent and growth potential from field reports, in consultation with SDO establishes incident objective to contain fire north of the GEH, selects flank attack strategy, and requests/mobilses field operations resources and IMT support. SDO mobilises planning assistance from DEC Blue Team to travel to Kalgoorlie AM 29/12/07.	SDO mobilises logistics unit assistance from DEC Blue Team to travel to Kalgoorlie AM 29/12/07. Overnight accommodation at Southern Cross and Merredin arranged for crews mobilising PM 28/12/07.

Map 3 on the following page shows the location of the fire north of the Great Eastern Highway, and the location of the Operations Point established at Koorarawalyee.



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Kilometres (at A4)
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

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DEC WA
Goldfields Fire 13 - Chronology
28/12/2007
Operations

Job Number 21-17228
Revision REVA
Date 4 July 2008

Map 3

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10 Bond Street Sydney NSW 2000 Australia T 61 2 9239 7000 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

Data source: GHD Pty Ltd, Fire boundaries, 17/04/08. Created by: P de Mar

6.3 Incident Chronology - Phase 2 : Fire development north of the Great Eastern Highway

Time Period 00:01 – 23:59 29 DEC 07	
Objectives: » Contain the fire north of the Great Eastern Highway	**Strategies:** » Direct flank attack on eastern flank (Sector A) » Assess longer-term options for head fire containment and prepare access tracks (Sector B) » Direct flank attack on south-western flank (Sector C)
Operations chronology: Key decisions/actions *05:55 Operations Officer (OO) arrives at Operations Point, set up and commences incident orientation.* *06:42 OO contacts IC confirms role and Operations resources organised and en route.* *07:00 OO receives briefing from IA crew who arrive back from early morning fire reconnaissance.* *07:30 - 09:30 DEC Crews progressively arrive at Ops Pt from overnight accommodation in Merredin and Southern Cross, and receive briefing from OO. FESA Liaison Officer arrives with FESA radio repeater unit.* *09:30 (approx) Tanker crew dispatched to ensure point of origin contained to north side of GEH. OO requests FESA liaison set up radio repeater.* *09:40 OO requests DEC contractor to remove dog traps from fire area* *10:00 (approx) DEC helicopter and Air Observer arrive at Ops Pt, OO, Regional Fire Coordinator and Air Observer conduct reconnaissance/orientation flight over fire.*	**Control & Coordination chronology: Key decisions/actions** *05:30 IC commences work in ICC, checked Sentinel and Landgate systems to ascertain fire extent.* *06:42 IC receives call from OO; confirms Incident Strategies, resources ordered and enroute and OO role.* *08:00 (approx) Planning and Logistics Unit resources arrive from Kalgoorlie Airport and shown office area where ICC to be set up.* *08:54 IC conducts IMT meeting and provides briefing, with OO participating by phone hookup.* *11:40 IC conducts IMT meeting, with OO participating by phone hookup.* *12:35 IC conducts IMT meeting, with OO participating by phone hookup.*

Operations chronology (continued): Key decisions/actions

11:00 – 11:30 Fire crews commence flank attack operations:

E flank (Sector A) 1 x FEL; 2 x Heavy Duty (HD) Tanker; 1 Light Unit (LU)

SW flank (Sector C) 1 x Wheeled Dozer; 2 x HD Tanker; 1 x LU

12:15 – 12:30 OO updates IC on situation and confirms Incident Strategies

14:22- 14:50 OO and FESA Liaison conduct reconnaissance flight over fire to view fire growth and flank attack progress.

15:30 – 16:00 Hamptons FEL and Grader arrive and off-loaded at fire; FEL proceeds along Merbine track to north end of Sector A, Grader commences work on southern end Sector A

17:00 Hamptons FEL commences work south from Merbine track on Sector A

18:00 Fire behaviour declining on Sector C, wheeled dozer having difficulty tracking flank

19:00 – 19:30 East flank containment line complete (12 kms of line from Origin to Merbine track); SW flank operations terminated due to difficulty tracking edge; conditions not suitable for burning out (2km left to complete to 2000 fire scar)

19:30 – 20:00 Fire Crews take evening meal at Operations Point.

20:00 (approx) Crew transport bus attempts to depart Ops Pt, but gets stuck on obstruction.

21:00 (approx) Bus freed from obstruction, tanker crews depart for Kalgoorlie accommodation

23:00 Tanker crews arrive at overnight accommodation in Kalgoorlie (FEL and Wheeled Dozer operators remain overnight at Ops Pt to facilitate early start on 30 DEC 07)

Control & Coordination chronology (continued)

17:35 IC conducts IMT meeting. Discussed that next day weather forecast was for extreme weather, with winds from the north, very high temperature and low RH.

18:00 IC liaises (separately with each of) with DEC SDO, Goldfields Regional Manager, and WA Police about fire situation adverse weather for 30 DEC 07, incident strategies and resourcing for 30 DEC 07, and requests Police assistance for traffic management on highway.

22:00 (approx) IC approves IAP for 30 DEC 07

23:59 (approx) IC finishes work in ICC.

Planning chronology: Key decisions/actions

08:00 Planning Unit arrives at ICC from Kalgoorlie Airport

08:54 Initial IMT meeting conducted

09:00 – 17:00 Planning Unit sets up in ICC, sources/organises relevant fire, fuel and weather information; participates in IMT meetings; attempts to prepare fire incident maps using GIS. Requested fire mapper (arrives at 20:00).

17:00 – 22:00 Planning Unit prepares IAP for IC approval.

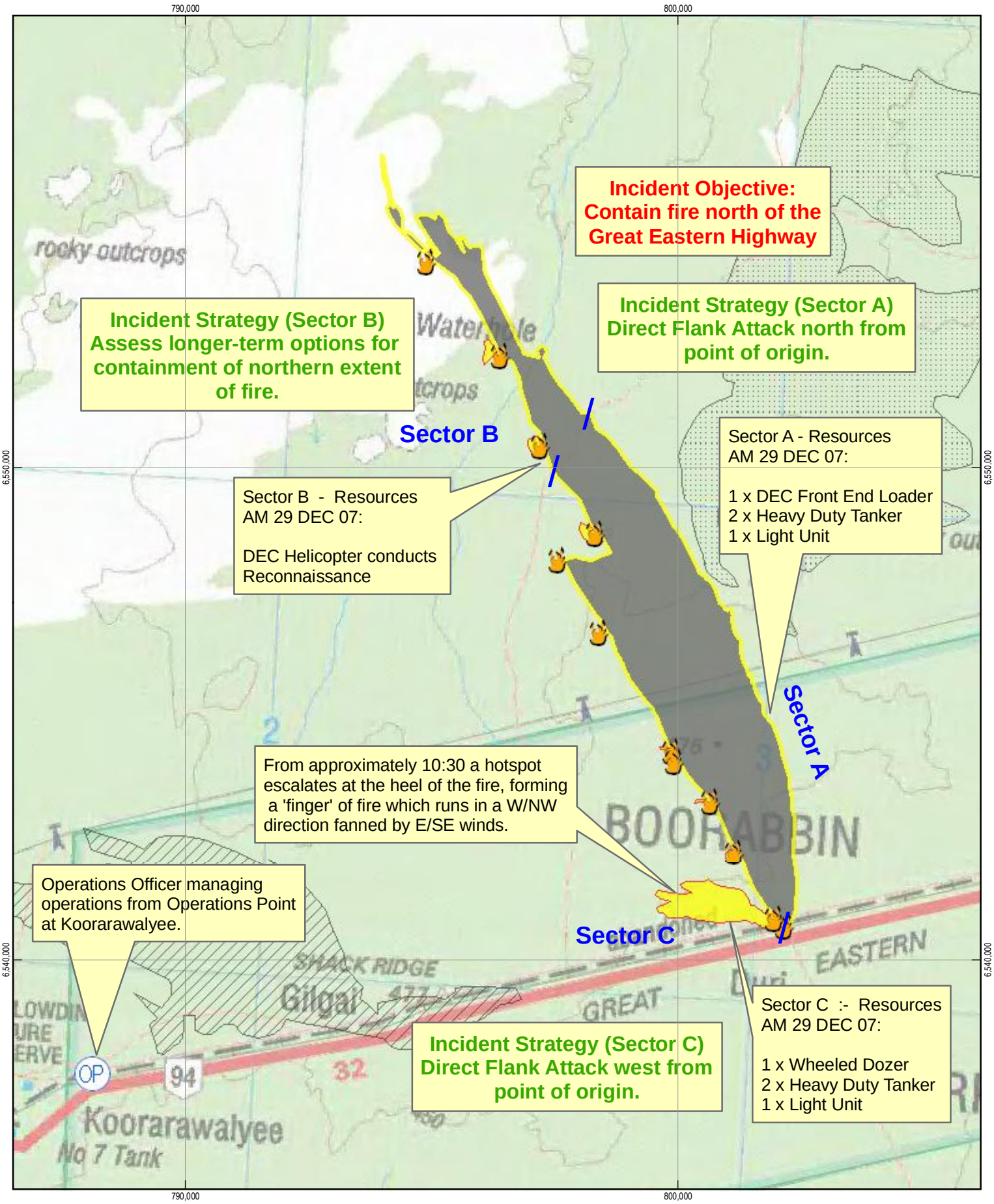
Logistics chronology: Key decisions/actions

08:00 Logistics Unit arrives at ICC from Kalgoorlie Airport

08:54 Initial IMT meeting conducted

09:00 - 17:00 Organises accommodation for fire crews; meal catering for fire crews; replenishment of IMT supplies; and responds to Operations section resource requests

17:00 – 22:00 Completes Logistics components of IAP.



LEGEND

Sector Boundaries

HotSpots

Active Fire Boundaries

Recently Burnt Area

Pre-existing Fire Scars

2000 Fire

2006/07 Fire

Operations Point

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Kilometres (at A4)

Map Projection: Transverse Mercator

Horizontal Datum: Geocentric Datum of Australia 1994

Grid: Map Grid of Australia, Zone 50

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Goldfields Fire 13 - Operations

29/12/2007 to 1200 WDT Operations

Job Number	21-17228
Revision	REVA
Date	4 July 2008

Map 4

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Data source: GHD Pty Ltd, Fire boundaries, 17/04/08. Created by: P de Mar

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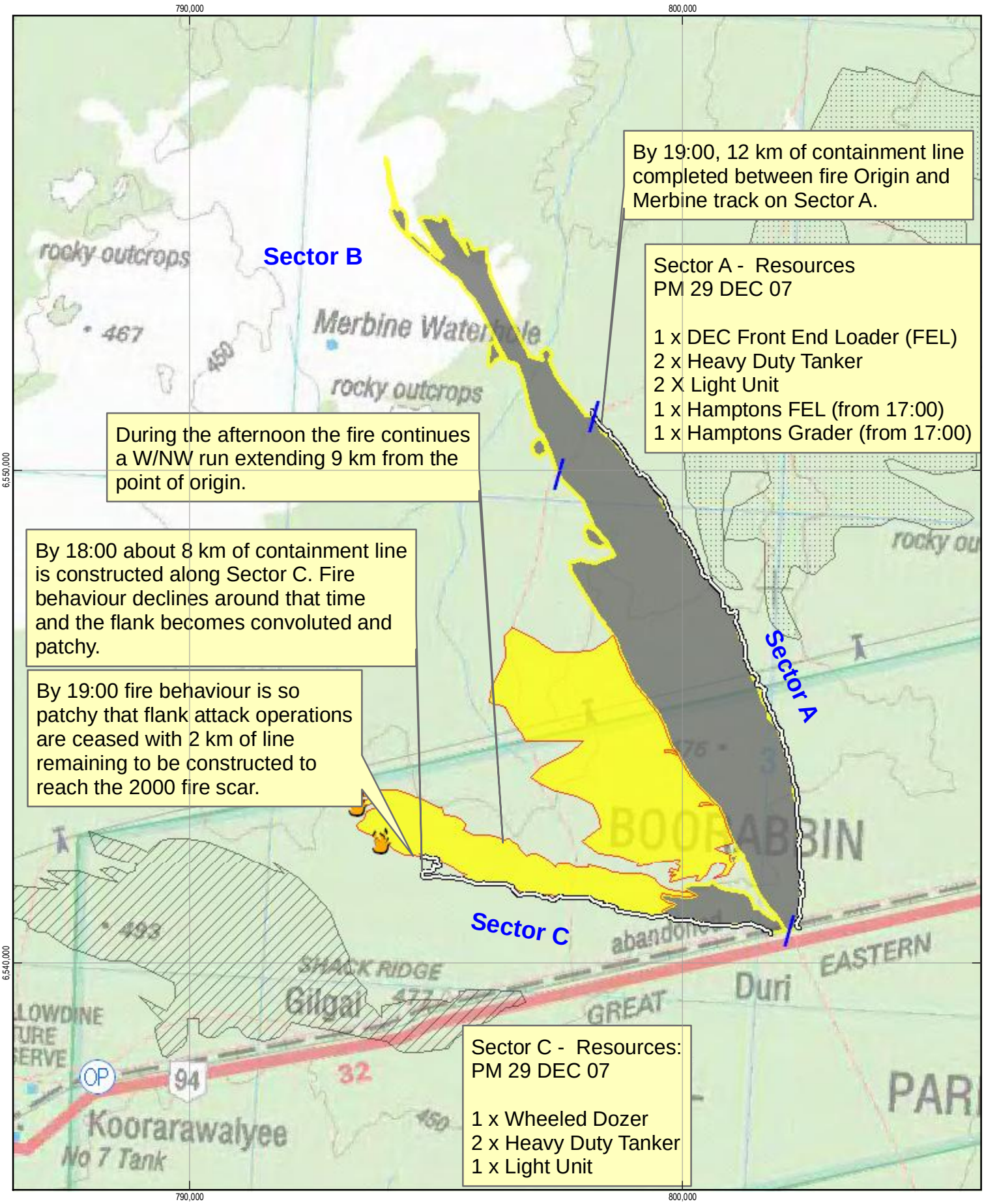

LEGEND

- OP Operations Point
- HotSpots
- ControlLines
- Sector Boundaries
- Active Fire Boundaries
- Recently Burnt Area
- 2000 Fire
- 2006/07 Fire

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Kilometres (at A4)
Map Projection: Transverse Mercator
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Goldfields Fire 13 - Operations
29/12/2007 from 1200 WDT
Operations

Job Number 21-17228
Revision REVA
Date 4 July 2008

Map 5

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Data source: GHD Pty Ltd, Fire boundaries, 17/04/08. Created by: P de Mar

10 Bond Street Sydney NSW 2000 Australia T 61 2 9239 7000 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

6.4 Incident Chronology - Phase 2 : Fire development north of the GE Highway 00:01 – 12:00 30 DEC 07

Time Period 00:01 – 12:00 30 DEC 07	
Objectives: » Contain the fire north of the Great Eastern Highway » Prepare for the contingency of smoke or fire impact on the Great Eastern Highway	**Strategies:** » Consolidate and patrol containment lines on eastern flank (Sector A) » Complete, consolidate and patrol containment line on south-western flank (Sector B), » Prepare for the contingency of smoke or fire impact on the GEH Eastern Highway
Operations chronology: Key decisions/actions *05:30 Operations Officer (OO) prepares crew briefings.* *06:10 (approx) OO briefs crews that remained at Ops Pt overnight.* *06:15 – 06:30 OO dispatches wheeled dozer and Narrogin HD tanker to complete control line construction on the SW flank; DEC FEL and one light unit to consolidate containment lines on E flank; and the Hamptons Grader and one light unit to upgrade escape routes from Sector C to the GEH.* *07:20 Wheeled dozer reports it has commenced work on Sector C.* *08:10 OO contacts IC to discuss tactical changes, particularly the allocation of resources to improving escape routes on Sector C and putting in place a Divisional Commander on Sector C. These were approved.* *08:56 OO receives report that containment lines all quiet on Sector A.* *09:00 (approx) OO receives report that additional smoke hazard warning signs were now in place as briefed on the GEH.*	**Control & Coordination chronology: Key decisions/actions** *06:00 IC commences work at Kalgoorlie ICC, checked Sentinel and Landgate systems to ascertain fire extent, checked weather forecast, prepared for crew briefings.* *08:00 IC accompanied by PO and LO conducted a crew briefing and provided copies of the IAP to fire crews at the Railway Hotel where they had breakfast prior to departing for the fire.* *08:35 IC conducts IMT meeting at ICC (OO by phone hookup).IMT received reports of quiet fire activity; winds N/NE; fire sector resourcing; hazards and safety issues including fire behaviour, highway traffic, potential heat exhaustion, live power lines, tyre punctures. OO requested SPOT forecast.* *09:00 (approx) Nine additional IMT personnel arrive to start duty in office support roles.*

Operations chronology: Key decisions/actions

09:07 OO receives report of hop-over on the western end of Sector C – contained by 09:30.

09:19 OO receives report that Narrogin HD tanker (escorting the wheeled dozer) is low on water.

09:23 Helicopter arrives at the fire. OO requests helicopter to fly the fire to locate any problem areas. Helicopter completes reconnaissance and lands at 10:30

09:30 (approx) DEC crews arrive at Ops Pt from Kalgoorlie.

09:40 OO gives updated incident briefing to crews.

10:00 Crews dispatched to commence operations on Sectors A and C.

10:20 Perth Hills HD Tanker (PH 42) gets a flat tyre – spare provided by PH 32.

10:30 Perth Hills HD tanker (PH32) sent to support Wheeled Dozer on Sector C

10:43 Power failure occurs at the Ops Pt - landline and email communication disrupted.

10:45 – 11:00 (approx) Wheeled Dozer reports it has completed containment line through to 2000 fire scar; hop-over occurs on western end of Sector C behind the wheeled dozer (to the east). Hop-over reported to OO at approx 11:00.

11:00 OO requests helicopter to get airborne and report on hop-over. Helicopter airborne at 11:05. OO directs PH 40 (HD tanker) from Sector A to Sector C.

11:12 Air observer reports hop-over has taken off and is already approx 700m south of containment line and moving south quickly.

11:15 – 11:30 Wheeled dozer supported by PH 32 attempt to track western flank of hop-over. Hop-over reported to IMT in Kalgoorlie.

11:40 Air Observer reports fire has reached narrow section of 2000 fire scar near the GEH and is burning through it. OO receives report of a second hop-over to the west of the main hop-over.

Control & Coordination chronology: Key decisions/actions

10:00 (approx) IC contacts McMahons (Main Roads WA contractors) warning of potential for highway closure due to fire. Primary McMahons contact advised he was unavailable and referred IC to second contact. IC contacted alternative contact and requested he confirm his availability for highway closure work (advised IC he needed to get approval from supervisor).

10:45 IC departs office for Kalgoorlie Airport. IC appoints PO as acting IC during his absence.

10:40 – 10:50 (approx) Power failure occurs in Kalgoorlie.

11:00 IC departs Kalgoorlie in fixed wing fire reconnaissance aircraft to view fire situation. Enroute to the fire, IC hears radio traffic about hop-overs.

11:45 – 12:00 (approx) IC observes hop-overs develop and cross highway to the south. He observed the WA Police road block locations, and monitored fireground/helicopter radio traffic.

Planning chronology: Key decisions/actions

06:00 PO commences work in ICC, makes final preparations for crew briefing at Railway Hotel.

08:02 PO assists IC with crew briefing at Railway Hotel.

08:35 IMT meeting at ICC. Discussed extreme weather and received update on containment progress. Requested by OO to provide SPOT forecast.

Operations chronology: (continued) Key decisions/actions

11:45 (approx) Flank attack on hop-over ceased (futile). After discussion with OO, Division Commander orders Sector C units to withdraw to safety zone.

11:48 WA Police units (2) depart Ops Pt to close the GEH. Two road blocks are established on the GEH: The western roadblock at a parking bay 600 metres west of the entrance to the Ops Pt. The eastern roadblock east of the Merbine track intersection with the GEH.

11:50 Air observer reports fire has reached and is crossing the GEH.

11:54 Report made from Ops Pt to IMT that fire has crossed highway and Police are closing GEH.

Logistics chronology : Key decisions/actions

08:02 LO assists IC with crew briefing at Railway Hotel.

08:35 Participates in IMT meeting at ICC.

09:00 (approx) LO orients new IMT support personnel to incident, assigns office support/runner roles

09:00 - 12:00 Organises accommodation for new personnel; meal catering for fire crews; and responds to Operations section resource requests (tyres)

Planning chronology (cont.): Key decisions/actions

08:45 – 09:45 (approx) Makes preparations for the contingency that smoke or fire impact the GEH. PO contacts McMahons and WA Police re fire situation. Developed contact list for if fire broke containment lines.

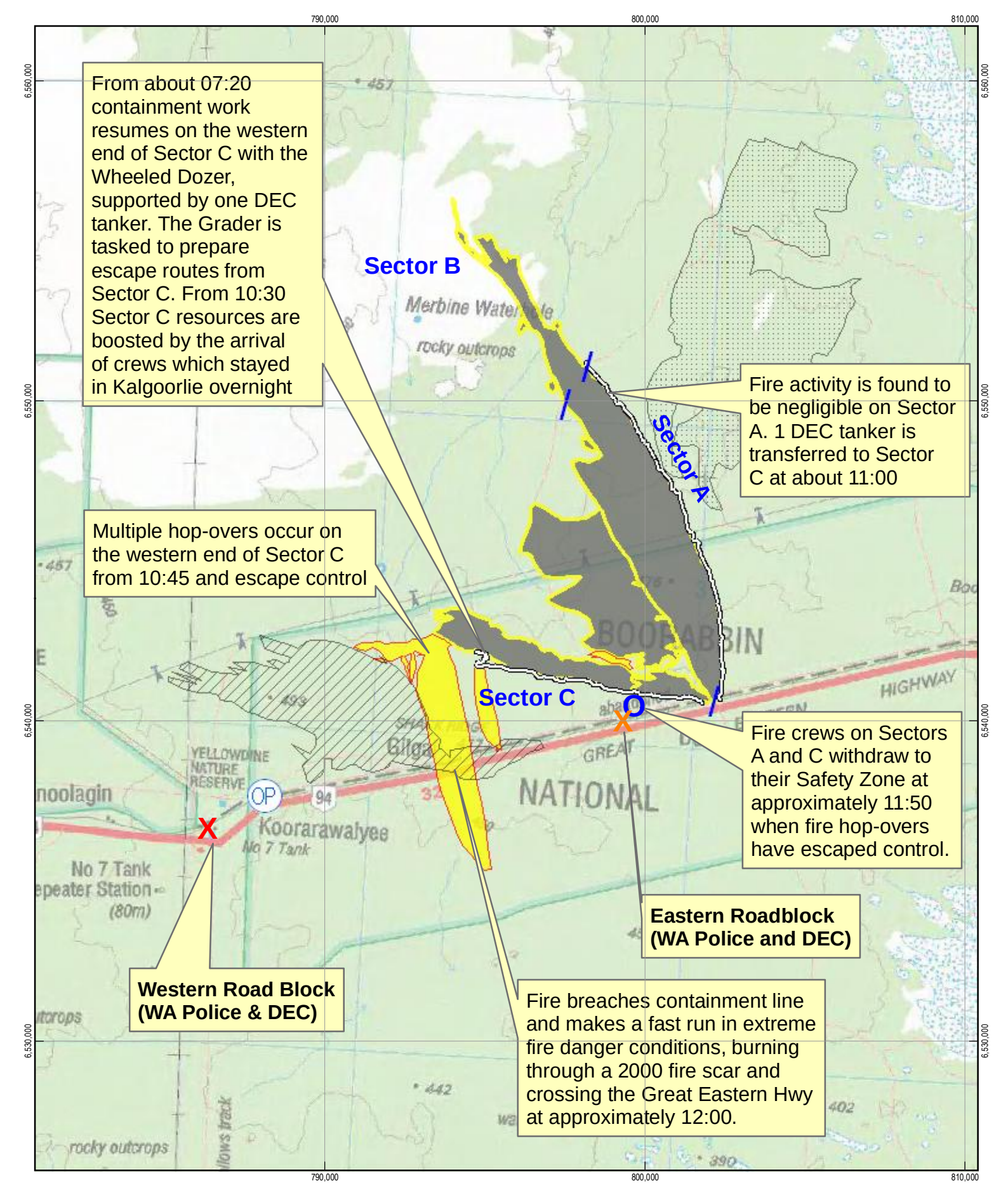
10:00 PO conducts planning meeting. PO briefed Planning Unit staff on planning requirements for the day. Advised fire breakout notification requirements and need to start planning alternative containment strategies.

11:00 PO commenced planning for "information function' requirements. Contacted DEC media liaison officer to update on fire status. Received request for photos and fire information for the public.

11:30 PO receives reports of hop-overs from Ops Pt. PO instructs SU Leader to contact Southern Cross Police.

11:35 SU Leader speaks with Southern Cross Police who are already enroute to Ops Pt. Contacts Coolgardie Police who confirm they are about to leave for the Ops Pt to assist with road blocks.

Map 6 on the following shows the fire development and operational situation during the morning of 30 December 2007, when the SW containment line on the western end of Sector C was breached by hop-overs, which ran rapidly south, through a 2000 fire scar and across the Great Eastern Highway, necessitating its closure and withdrawal of fire crews to safety zones.



LEGEND

OP Operations Point

ControlLines

Active Fire Boundaries

2000 Fire

Recently Burnt Area

2006/07 Fire

Sector Boundaries

1:150,000
0 0.5 1 2
Kilometres (at A4)
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

N

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DEC WA
Goldfields Fire 13 - Operations

Job Number 21-17228
Revision REVA
Date 4 July 2008

30/12/2007 to 1230 WDT Operations

Map 6

G:\21\16656\CADD\GIS\MapDocuments\Operations\071230_to1230.mxd

Data source: GHD Pty Ltd, Fire boundaries, 17/04/08. Created by: P de Mar

10 Bond Street Sydney NSW 2000 Australia T 61 2 9239 7000 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

6.5 Incident Chronology - Phase 3: Fire development south of the GE Highway 12:00 – 19:00 30 DEC 07

Time Period **12:00 – 19:00 30 DEC 07**

Objectives:

Objectives planned for 30 DEC 07 become redundant as fire has crossed to the south of the GEH and is beyond the limits of control. Responding to the new fire situation the objectives become:

» Manage traffic and public safety on the Great Eastern Highway

» Protect vital assets located along GEH corridor

» Monitor the fires development and commence planning new incident strategies for when fire behaviour moderates

Strategies:

» Fire crews to remain at safety zones, ready to support asset protection / traffic management operations on highway as required

» Establish and manage road blocks on GEH,

» Helicopter to monitor fire development and map fire extent to facilitate development of new containment strategies

Operations chronology: Key decisions/actions

12:00 Fire has crossed GEH, Operations Officer (OO) has ordered all fire crews to proceed to safety zones, WA Police have road blocks in place on GEH, helicopter is monitoring and reporting southern spread of fire.

12:15 Air Observer checks powerlines – reports no damage at that time.

12:20 – 13:00 Convoys (E to W and W to E) of vehicles escorted from roadblocks through burnt area under Police escort supported by DEC HD tankers. Fire behaviour monitored from helicopter. Air Observer (AO) gave indications of when convoys could proceed (during periods of lulls in fire behaviour). IC overhead in fixed wing aircraft in radio contact with ground crews and helicopter, observed convoys passage.

13:11 Helicopter lands and refuels.

13:15 (approx) IC (in fixed wing aircraft over the fire) departs for Kalgoorlie

Control & Coordination chronology: Key decisions/actions

12:00 - 1315 IC is over the fireground in a fixed wing aircraft, in radio communication with the helicopter and fire crews, getting a good appreciation of the fire development and traffic management activities and issues, and observes traffic convoys escorted through the burnt area.

12:15 IMT contacts DEC media liaison officer to inform him about road closure.

12:20 IMT contacts Western Power to advise of fire impacting low voltage lines.

13:15 Western Power advises IMT they are dispatching crews to check and repair low voltage lines.

13:25 IMT updates DEC Media Liaison about power lines.

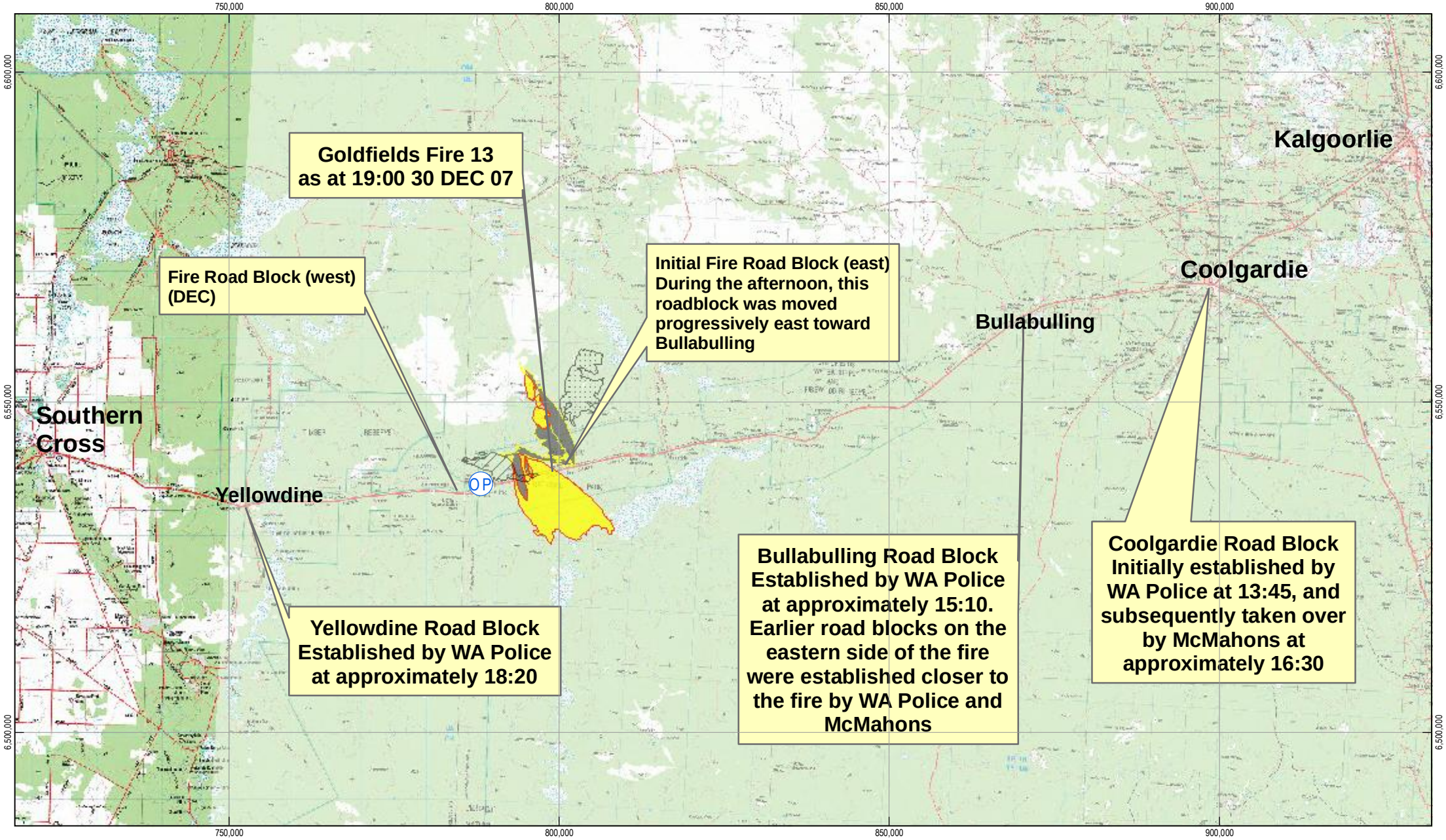
Operations chronology (continued): Key decisions/actions	Control & Coordination chronology: Key decisions/actions
14:00 OO and AO get airborne in helicopter. They observe 5 low voltage power poles burnt down and 2 damaged along GEH. *14:10 Western Power confirm powerlines are off, Western Power crews escorted by DEC crews are in attendance extinguishing burning power poles.* *14:10 – 14:40 OO and AO fly over southern extent of fire observing that fire is contained by woodlands along southern perimeter, the eastern flank continues to expand with wind direction fluctuations and run south as intense tongues.* *14:40 – 15:35 (approx) Two large convoys of traffic (one from each of the E and W roadblocks) are escorted from roadblocks through the burnt area under Police, DEC and FESA unit escort. OO calling go-time for convoys from helicopter.* *15:35 WA Police apprehend a drink driver following convoy escort operations and take the offender to Southern Cross for processing. WA Police presence at fire reduced to one vehicle and two officers.* *15:45 Helicopter lands and refuels; OO returns to Ops Pt.* *16:00 Fanned by a sustained period of westerly wind, the fire adjacent to the GEH spreads east towards the Safety Zone. The Safety Zone is relocated east to the truckbay where the fire originally started.* *16:30 (approx) At OO direction, wheeled dozer with HD tanker escort commences flank attack on western flank south of the highway. Flank attack later abandoned as wind fluctuation causing hop-overs.* *16:55 Helicopter gets airborne again with AO and Goldfields Region Fire Coordinator on board. Winds are back to NW and fire behaviour adjacent to the highway has moderated. .* *17:00 – 18:00 (approx) Further traffic convoys escorted from west to east under FESA and DEC escort. Convoy passage timing opportunities were advised from the helicopter above which is monitoring fire behaviour.*	*13:30 – 13:50 (approx) IMT contacts Kalgoorlie Police to update them on fire situation and inviting them to send a liaison officer to the ICC to attend an IMT briefing. This was declined; agreed to keep each other informed.* *13:50 IMT informs DEC Media Liaison that WA Police have advised Radio West about roadblocks on GEH. DEC Media Liaison advised he had contacted Main Roads WA about road closure and powerlines down.* *14:00 (approx) IC arrives back in Kalgoorlie after reconnaissance flight.* *14:00 – 14:30 (approx) IC briefed by office staff about phone calls enquiring about GEH closure duration and requesting estimated re-opening times.* *14:35 (approx) IC briefs IMT members that he will deal with traffic management issues and calls and requests IMT to concentrate on tomorrows IAP and developing fire information for issue to the public.* *14:35 – 15:30 IC contacts WA Police and McMahons requesting roadblocks be put in place at Yellowdine and Coolgardie, and that the eastern roadblock near the fire be taken back to Bullabulling.* *15:30 IC conducts IMT meeting at ICC (OO by phone hookup). Discussed and approved flank attack on western flank south of the GEH.* *15:45 IMT receives advice from McMahons (MRWA contractors) that the road block was in place at Coolgardie.*

Operations chronology (continued): Key decisions/actions	Control & Coordination chronology: Key decisions/actions
18:00 – 18:20 Helicopter observes and reports fire has crossed to the east of the Duri track 7 km south of the GEH, and fire intensity on the eastern flank is declining. *18:00 OO receives advice from IMT that meals for fire crews will soon be arriving from Yellowdine, and the bus to return crews to Kalgoorlie accommodation will arrive at 19:30 (crews need to be fed prior to departure).* *18:22 Helicopter lands and refuels.* *18:30 – 19:00 (approx) OO contacted by IC to discuss if GEH can be re-opened. OO not in favour of re-opening highway, and advises that he would like a further aerial assessment of fire behaviour to support such a decision.* *18:45 (approx) OO requests AO to assess fire behaviour on eastern flank prior to returning back to Kalgoorlie in the helicopter.* *18:50 – 19:15 AO gets airborne in helicopter and assesses the E flank to have mild fire behaviour declining in near-still wind, not running, flame heights 0.5 metres with 1 to 2 metre flame heights at far southern extent of fire (8 to 10 km south of GEH).*	*15:45 - 18:00 Numerous phone calls received at the ICC, taken by reception, IC and PO, with requests for information on when the GEH will be re-opened to traffic. IC declines to give a time due to the uncertain fire situation, and continues liaison with the Ops Pt, WA Police and McMahons.* *16:10 (approx) WA Police advise IMT that Police have closed the GEH east of Southern Cross, and confirm the GEH is closed at Coolgardie.* *18:30 – 19:00 IC contacts OO to discuss fire situation and if GEH can be opened. OO requests decision be delayed until an aerial reconnaissance of fire behaviour on the eastern flank is conducted. IC has further discussions with WA Police about arrangements for opening GEH* *18:50 – 1910 IC contacts OO seeking to make preparations for re-opening the highway. They discuss and agree that GEH can be re-opened subject to favourable reports from the aerial reconnaissance of the E flank, with the following actions in place:* » *Sentries to be placed on GEH east and west of the burnt area to monitor fire behaviour and re-close GEH if required.* » *Bullabulling convoy to be escorted by WA Police* » *WA Police to return east after escorting Bullabulling convoy and pick-up Coolgardie convoy which would be 20 minutes behind Bullabulling convoy* » Yellowdine convoy to be released unescorted

Planning chronology: Key decisions/actions	**Logistics chronology : Key decisions/actions**
12::00 – 14:00 Planning Officer acting as IC whilst IC flying over fire. *12:00 Acting IC conducts IMT meeting (OO by phone hookup).IMT obtained update on fire situation, road blocks and power line impacts.* *12:00 – 14:00 SU Leader liaising with Ops Pt gathering and recording information about the rapidly changing fire situation and passing situation reports on to other authorities and DEC Media Liaison.* *14:00 (approx) IC returns to ICC, PO resumes planning duties. With IC's approval PO requests DEC SDO to deploy remainder of pre-formed IMT.* *14:35 – 19:00 (approx) Planning Unit focuses on developing fire information for issue to the public, and reviewing new containment strategy options for the development of the 31 DEC 07 IAP. Planning Unit also undertaking liaison with Western Power and Water Corp whilst IC focused on traffic management.* *15:30 IMT meeting at ICC (OO by phone hookup). Discussed and approved flank attack on western flank south of the GEH.* *16:55 (approx) SU Leader requests SPOT forecast from BoM. Advised by BoM that it should be available in 15 – 20 minutes. The SPOT forecast was subsequently received and the SU Leader provided it to the IC and PO.* *17:30 – 18:30 The planning unit focus was on preparing an IAP for 31 DEC 07.*	*12:00 – 14:00 Logistics Unit responds to breakdown repair request for DEC's Front End Loader which shredded a fan belt during morning operations; also responded to requests for tyres.* *14:00 – 15:35 Logisitics Unit transport arrangements, and accommodation for remainder of pre-formed IMT requested for the following day. Also organising evening meals for fire crews at Ops Pt, and crew transport arrangements from fire to Kalgoorlie.* *15:35 LO participates in IMT meeting.* *16:00 - 18:00 Logistics Unit focus on preparing logistics input to IAP and to preparing a Medical Plan and St Johns Ambulance availability for 31 DEC 07.* *18:00 - 19:00 Logistics unit supporting IAP development..*

Map 7 on the following page shows the area burnt by the fire between 12:30 and 19:00, and the road block arrangements on the Great Eastern Highway from Yellowdie to Coolgardie.

Map 8 (on page 34) shows the fire location as it was at 19:00, and indicates how the fire grew during the afternoon between 12:30 and 19:00.



1:750,000

0 5 10 20

Kilometres (at A4)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

OP Operations Point

Active Fire Boundaries

Recently Burnt Area

2000 Fire

2006/07 Fire

GHD

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DEC WA
Goldfields Fire 13 - Operations

Job Number	21-16656
Revision	RevA
Date	9 July 2008

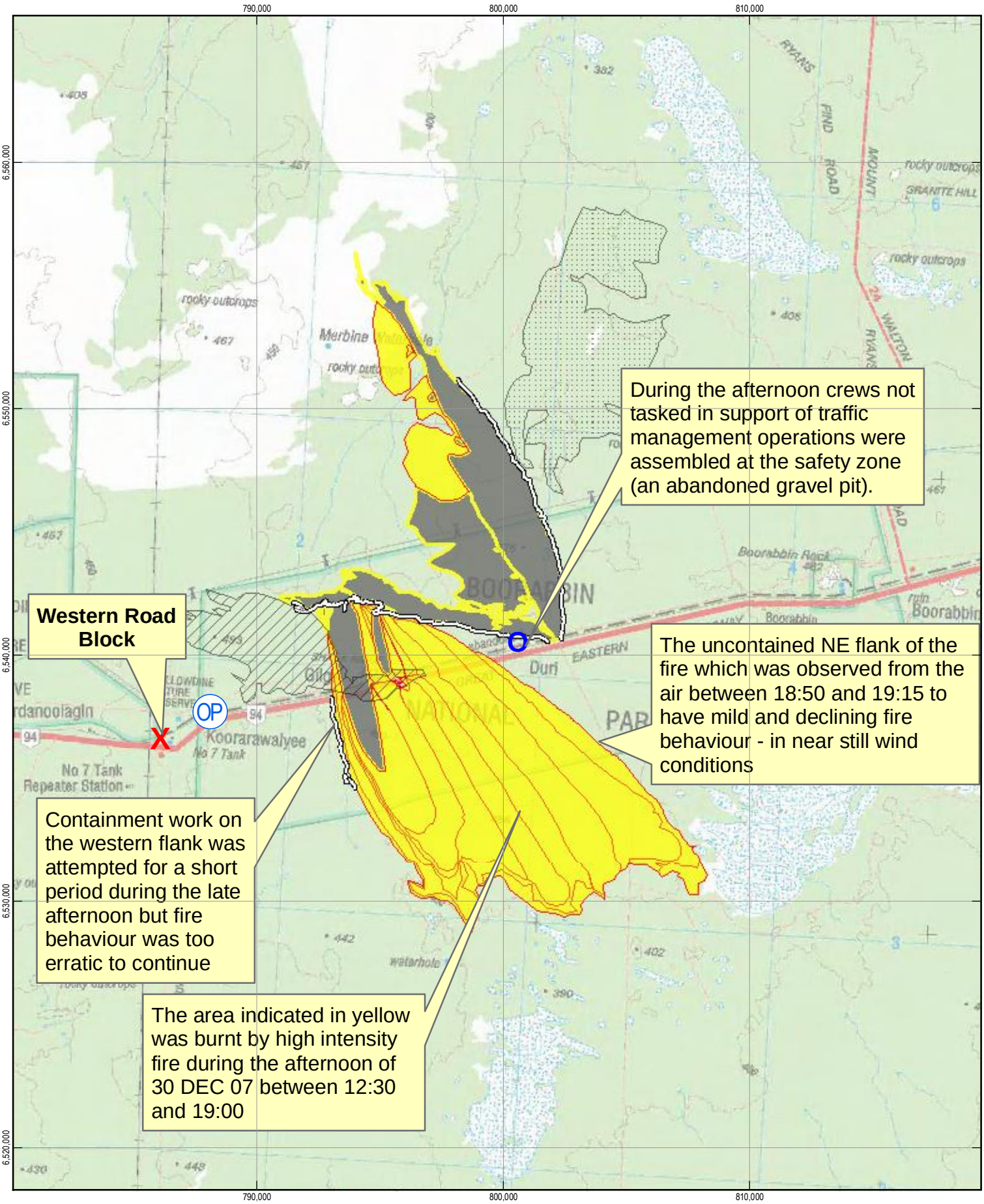
30/12/2007 from 1230 to 1900 WDT
Road Block

Map 7

G:21\16656\CADD\GIS\Map Documents\Operations\071230_from1230to1900.mxd

10 Bond Street Sydney NSW 2000 Australia **T** 61 2 9239 7000 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Geoscience Australia, National 1:250000 Topographic Map. Created by: P de Mar



Legend

OP Operations Point

Active Fire Boundaries

Recently Burnt Area

2000 Fire

2006/07 Fire

ControlLines

1:200,000

0 1 2 4

Kilometres (at A4)

Map Projection: Transverse Mercator

Horizontal Datum: Geocentric Datum of Australia 1994

Grid: Map Grid of Australia, Zone 50

N

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Goldfields Fire 13 - Operations

Job Number 21-17228

Revision REVA

Date 4 July 2008

30/12/2007 from 1230 to 1900 WDT

Operations

Map 8

G:\21\16656\CADD\GIS\MapDocuments\Operations\071230_to1230.mxd

Data source: GHD Pty Ltd, Fire boundaries, 17/04/08. Created by: P de Mar

10 Bond Street Sydney NSW 2000 Australia T 61 2 9239 7000 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au

6.6 Incident Chronology - Phase 3 : Fire development north of the GE Highway 19:00 – 23:59 30 DEC 07

Time Period **19:00 – 23:59 30 DEC 07**

Objectives:	**Strategies:**
» Prepare IAP with new containment strategies for the next day » Prepare for and re-open the GEH when conditions allow	» Devise new incident control strategies, order and mobilise out-of-area resources through State Duty Officer (SDO), » Establish appropriate operational arrangements on the GEH to support re-opening the GEH when conditions allow
Operations chronology: Key decisions/actions	**Control & Coordination chronology: Key decisions/actions**
19:00 Fire crews at Ops Pt having dinner prior to planned departure to Kalgoorlie at 19:30. *19:15 OO receives report from AO that the E flank shows mild declining fire behaviour in near-still wind, fire not running, flame heights 0.5 metres with 1 to 2 metre flame heights at far southern extent of fire (8 to 10 km south of GEH). OO relays this report to IC* *19:20 OO directs one DEC unit and one FESA unit to take up positions on the GEH as sentries either side of the burnt area to monitor fire behaviour and the passage of vehicle convoys through the burnt area, and to re-close the highway in necessary.* *19:40 Sentries report they are in place as briefed on the GEH* *19:50 – 20:00 (approx) A strong and gusty SW wind change arrives at the fire, winds continue to back further south as the trough passes across the fireground.* *19:55 – 20:00 (approx) The unescorted Yellowdine convoy passes through the burnt area without incident. No escalation in fire behaviour apparent.* *20:00 – 20:05 The WA Police escorted Bullabulling convoy passes through the burnt area with no escalation in fire behaviour apparent.* *20:15 WA Police vehicle attempts to return east to meet up with Coolgardie convoy but cannot get through due to significant fire behaviour escalation on GEH.*	*18:50 – 1910 IC contacts OO seeking to make preparations for re-opening the highway. They discuss and agree that GEH can be re-opened subject to favourable reports from the aerial reconnaissance of the E flank, with the following risk control actions in place:* » *Sentries to be placed on GEH east and west of the burnt area to monitor fire behaviour and re-close GEH if required.* » *Bullabulling convoy to be escorted through by WA Police* » *WA Police to return east after escorting Bullabulling convoy and pick-up Coolgardie convoy which would be 20 minutes behind Bullabulling convoy* »Yellowdine convoy to be released unescorted *19:20 Following receipt of the AO's report on fire behaviour on the E flank, the IC approves the removal of road blocks at Yellowdine, Bullabulling and Coolgardie subject to agreed risk control actions (see above) being taken*

Operations chronology (continued): Key decisions/actions	Control & Coordination chronology: Key decisions/actions
20:25 Lead vehicles in unescorted Coolgardie convoy begin arriving at eastern side of the fire. Fire behaviour has escalated significantly. East sentry unable to stop all vehicles, some proceed through burning area and get through, however others not willing to drive through the burning area pull over east of the fire affected area. *20:25 – 20:30 (approx) Eastern sentry sends urgent message over radio for assistance. OO responds three HD tankers immediately, and mobilises remaining crews who are having dinner to proceed to W fire sentry position to provide assistance.* *20:30 (approx) E fire sentry proceeds into burning area to assist a truck which got into difficulty attempting to drive through the fire, sentry gets stranded on W side of fire* *20:35 – 20:40 DEC units arrive at the fire to assist as required, assisting trucks emerging from W side of the fire, and provide first aid to a truck driver with minor burn injuries to hands. Fire behaviour on the highway is intense, the W fire sentry has re-closed the highway to traffic heading east but there are no DEC, FESA or Police units on the E side of the fire to effect a road closure on the east side. OO dispatches a light unit to re-establish a western road block at the parking bay where it had been established earlier in the day. OO contacts IMT advises of escalation in fire behaviour, and emergency activity on GEH, and requests road be re-closed on the east side as a matter of urgency.* *20:35 – 20:45 Two trucks which had attempted to drive through the fire affected area from the east are over-run by an intense, fast moving fire front arriving at the highway from the south. It appears these two trucks were attempting turn-around manoeuvres at the time they were impacted by the fire. The three occupants of the two trucks died when the truck cabins they were sheltering became engulfed in flames.* *20:45 – 21:15 No units able to, or allowed to enter fire impact zone near burning trucks due to fire intensity and hazmat/flammable fuel risks.*	*20:30 (approx) IC receives call from OO that fire behaviour has escalated on the GEH and that he had responded all available DEC units in response to an urgent call for assistance from the E fire sentry, and had dispatched a light unit to re-close the highway at the parking bay road block site* *20:35 (approx) IC called WA Police at the scene of the fire – Police reported a truck on the W side of the fire reversing away from the fire area* *20:35 – 21:00 Numerous phone calls received at IMT from units at the fire, providing reports of emergency activity at the scene. IMT calls 000 to call for ambulances.* *21:00 (approx) IC calls McMahons requesting they re-close the highway at Coolgardie as a matter of urgency.* *21:00 – 23:59 Numerous phone calls between Ops Pt and IMT relaying incident developments/information. IC notifies DEC SDO of major incidents on the GEH.* *21:25 IMT meeting held (OO by phone hookup). Discussed that highway would be dangerous for the next 4 – 5 hours and would need to remain closed with the eastern roadblock to be maintained at Coolgardie.*

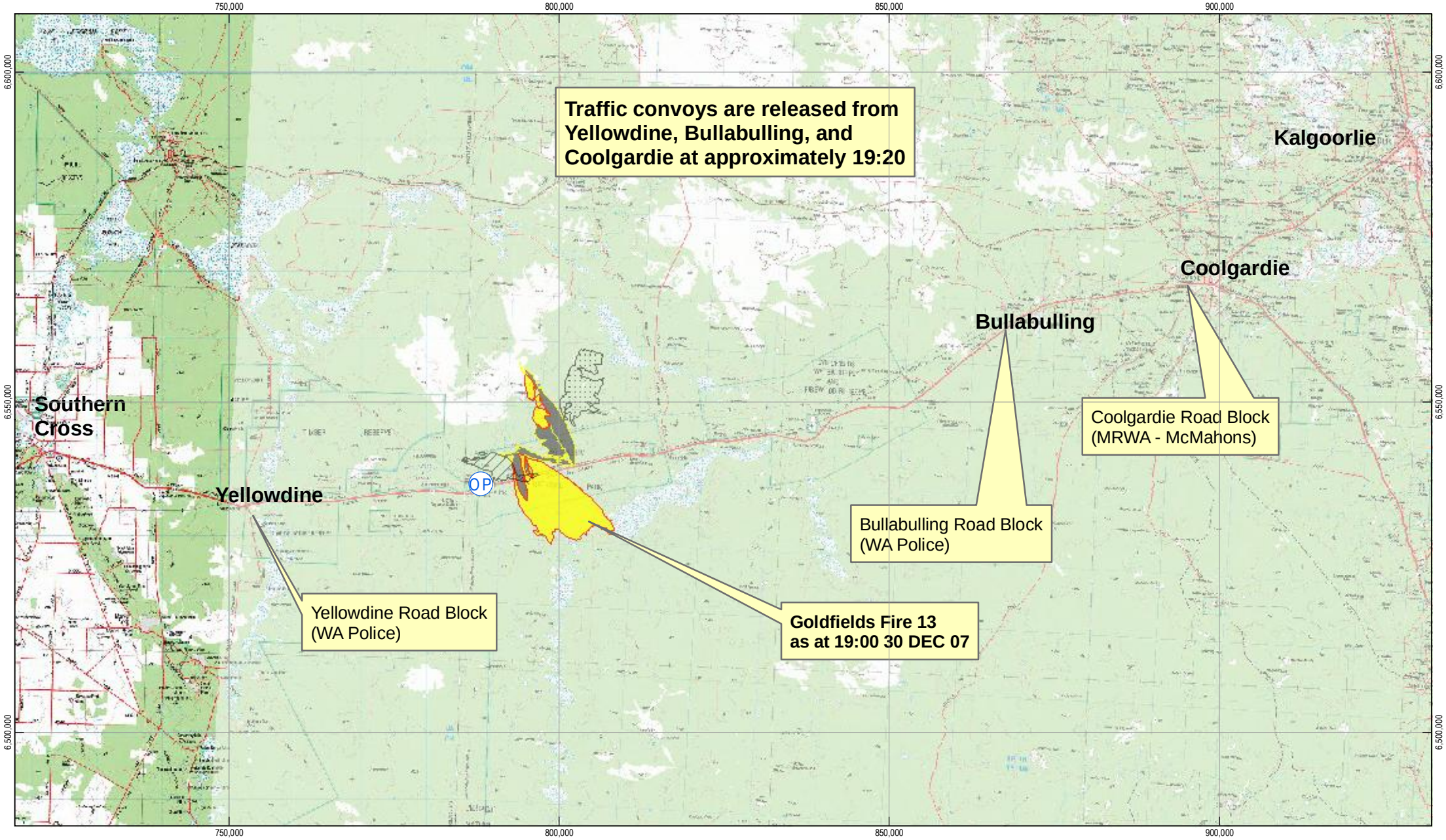
Operations chronology (continued): Key decisions/actions	**Control & Coordination chronology: Key decisions/actions**
21:15 – 21:30 (approx) Two FESA Officers arrive at the Ops Pt. OO gives the FESA officers a briefing and hands over the highway component of the incident due to the hazardous materials potential. OO orders DEC units not to attempt approaching within 100 metres of the area with burning trucks due to hazardous materials safety concerns. *21:30 – 23:59 DEC units protect vehicles and machines parked at the Safety Zone on the GEH and assist with staffing road blocks on the W side of the fire. FESA investigates and responds to the burning trucks and manages the fatal accident site. Remainder of DEC crews withdrawn to Ops Pt where they are accommodated overnight.*	*21:55 IMT meeting held (OO not available). Checked through all the notifications that had been made and discussed arrangements for truck drivers in prime-movers returning to pick up abandoned trailers, and planning for clearingburnt vehicles from the highway.* *00:10 IC receives advice from FESA that the burnt trucks had involved fatalities.*
Planning chronology: Key decisions/actions	**Logistics chronology: Key decisions/actions**
19:00 – 20:30 Planning Unit working on containment options and IAP development for 31 DEC 07. *20:14 PO receives a call from the Ops Pt that fire behaviour is picking up with flare-ups on both sides of the GEH* *20:50 (approx) PO received a call from the Ops Pt advising that a road train had caught fire, potentially creating a HAZMAT incident.* *20:53 PO phones DEC SDO to inform him about burning truck incident.* *20:55 IC informs Planning Unit that fire has impacted the GEH and the highway has been re-closed. Planning Unit assists IC with follow up actions to get highway closed, and call ambulances.* *21:11 PO in contact with senior FESA officer at the fire, discusses and agrees that FESA are to take control of the HAZMAT incident site on the GEH.* *21:13 PO receives call from Ops Pt that a truck driver with burnt hands has been treated and is OK.*	*19:00 IAP component preparation for 31 DEC 07* *20:30 – 21:25 LO in contact with bus driver who was to collect fire crews from the Ops Pt for transport to Kalgoorlie, but who couldn't get through due to fire. Bus driver is on eastern side of the fire, and relays information about numbers of trucks and trailers on the eastern side of the fire and information heard from truck driver radio communications made on UHF channel 40. Relays this info to IMT.* *21:25 IMT conference call with Ops Pt.* *21:30 – 23:59 Assists IC as required with response to burning truck incident, and prepares for incoming IMT personnel due to arrive the next morning.*

Planning chronology (continued): Key decisions/actions *21:18 PO provides verbal situation report update to DEC SDO.* *21:21 PO contacts WA Police to organise a withdrawal of all traffic on the eastern side of the fire back to Coolgardie* *21:25 IMT conference call with Ops Pt. Discussed highway closure arrangements and need to keep DEC staff clear of burning trucks.* *20:30 – 22:00 PO relays information regarding truck and trailer numbers parked on eastern side of fire to Ops Pt.* *22:00 PO calls MRWA who were aware of burnt truck incident and were establishing a road block at Southern Cross.* *22:00 – 23:59 Assist organising arrangements and information for incoming IMT IC and OO expected to arrive at Kalgoorlie at 07:10.*	

Map 9 on the following page shows the road block locations in relation to the fire as they were at the time the Great Eastern Highway was re-opened.

Map 10 on page 40 shows the section of the Great Eastern Highway which was impacted by fire following the arrival of the S/SW wind change during the evening of 30 DEC 07. It depicts a reconstruction of how the fire developed from 2000 and ran firstly NE and then north, with fires merging and running across the highway.

Map 11 on page 41 gives a whole day overview of the fire developed during 30 DEC 07.



1:750,000

0 5 10 20

Kilometres (at A4)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

OP Operations Point

Active Fire Boundaries

Recently Burnt Area

2000 Fire

2006/07 Fire

GHD

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DEC WA
Goldfields Fire 13 - Operations

30/12/2007 at 1900 WDT
Road Block

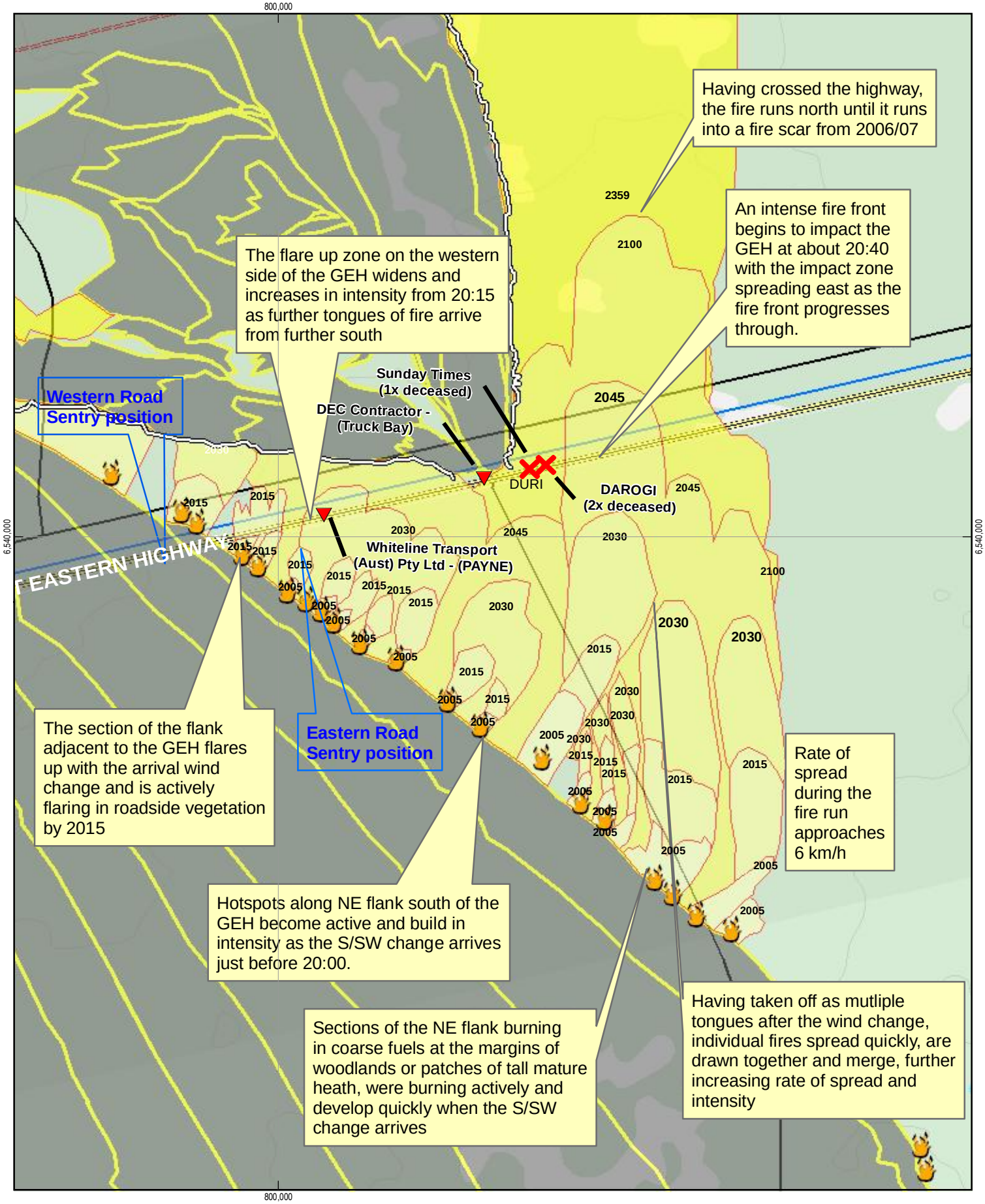
Job Number	21-17228
Revision	RevA
Date	9 July 2008

Map 9

G:21\16656\CADD\GIS\Map Documents\Operations\071230_at1900.mxd

10 Bond Street Sydney NSW 2000 Australia **T** 61 2 9239 7000 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Geoscience Australia, National 1:250000 Topographic Map. Created by: P de Mar



LEGEND

Truck/truck bay locations
- Deceased
- Other

OP Operations Point

2000 Fire

2006/07 Fire

30/12/2007 TimeWDT
- 2005
- 2015
- 2030
- 2045
- 2100
- 2359

Burnt Area

1:50,000
0 0.5 1 2
Kilometres (at A4)
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

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Goldfields Fire 13 - Operations

Job Number 21-17228
Revision REVA
Date 4 July 2008

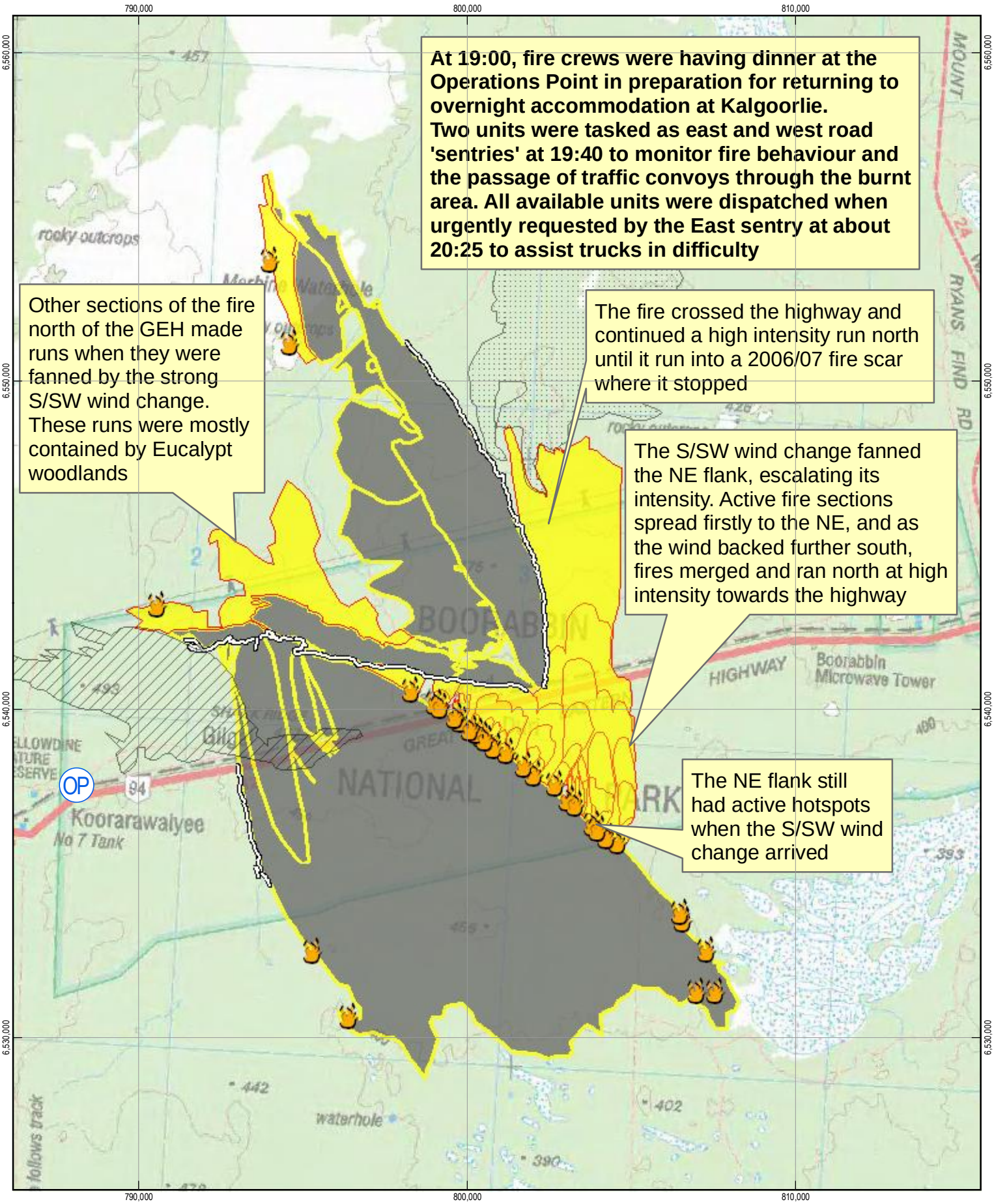
30/12/2007 after 1900 WDT Operations

Map 10

G:\21\16656\CADD\GIS\MapDocuments\Map10_071230_after1900_1.mxd

Data source: GHD Pty Ltd, Fire boundaries, 17/04/08. Created by: P de Mar

10 Bond Street Sydney NSW 2000 Australia T 61 2 9239 7000 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au



Legend

OP Operations Point

2000 Fire

2006/07 Fire

HotSpots

ControlLines

Active Fire Boundaries

Recently Burnt Area

1:150,000

0 1 2 4

Kilometres (at A4)

Map Projection: Transverse Mercator

Horizontal Datum: Geocentric Datum of Australia 1994

Grid: Map Grid of Australia, Zone 50

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Goldfields Fire 13 - Operations

30/12/2007 after 1900 WDT Operations

Job Number	21-17228
Revision	REVA
Date	9 July 2008

Map 11

G:\21\16656\CADD\GIS\MapDocuments\Operations\071230_after1900_2.mxd

Data source: GHD Pty Ltd, Fire boundaries, 17/4/08, Geoscience Australia National 1:250000 Topographic Map. Created by: P de Mar

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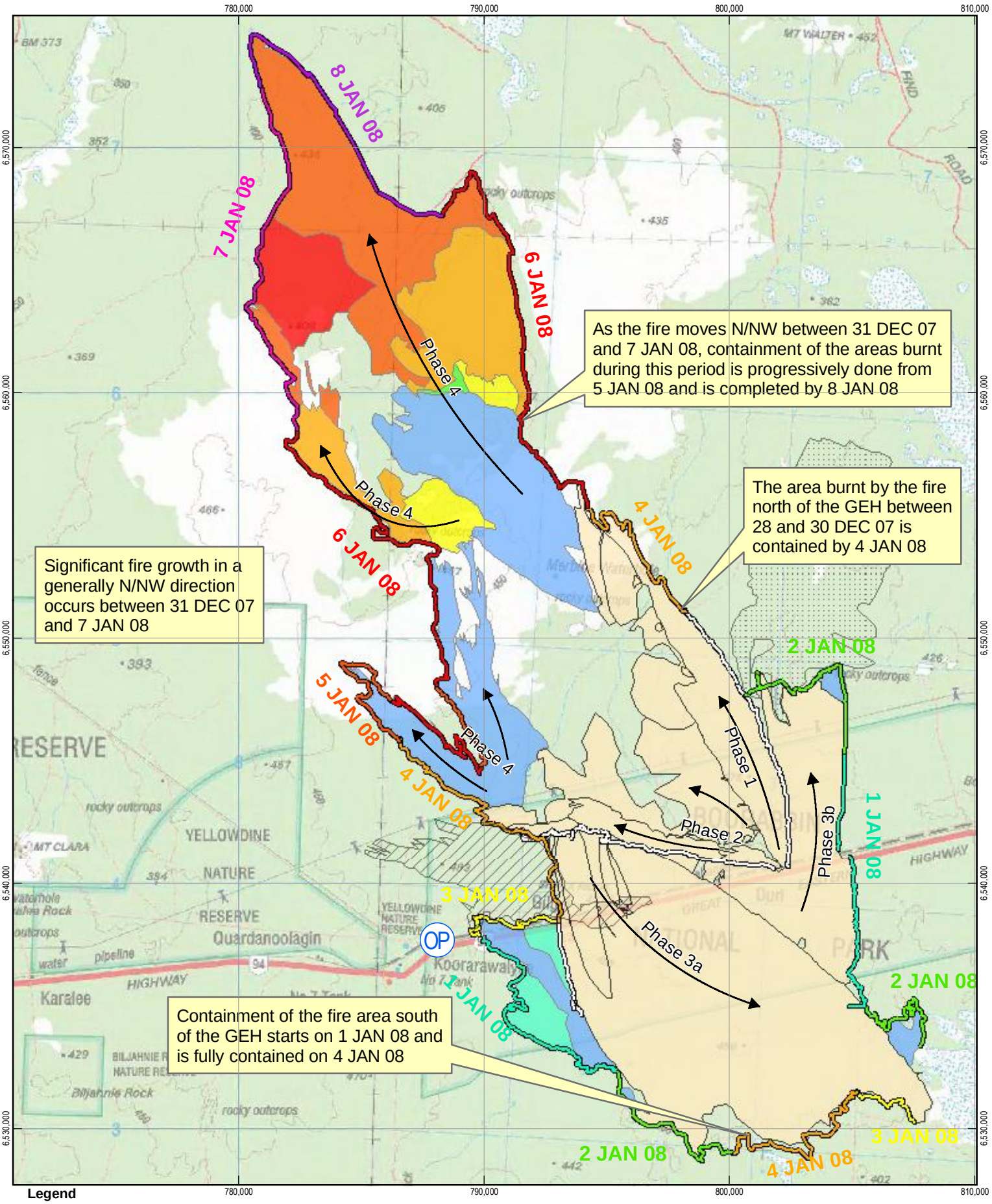
6.7 Incident Management Chronology - Phase 4 : 31 DEC 07 to 8 JAN 08

Phase 4 of the Goldfields Fire 13 incident is the period from the morning of 31 DEC 07 to 8 JAN 08, being those shifts which occurred after the fatalities occurred on the GEH. In accordance with the scope of works, Phase 4 is given less review intensity that Phases 1 to 3. For shifts occurring during Phase 4, summary information identifying the Incident objectives, strategies and resources are identified.

Map 12 on the following page provides an overview of how the fire developed from 31 DEC 07 until 8 JAN 08, and of how the fire containment operations progressed during the period.

- Following the highway fatalities on 30 DEC 07, operations on 31 DEC 07 were primarily focussed on relocating the Operations Point from Koorarawalyee to Yellowdine, removing crews from the field as part of post critical incident response, and managing the highway closure while WA Police investigated the fatal accident site.
- Fire suppression operations resumed on 1 JAN 08, focussing initially on containing sections of uncontained fire closest to the Great Eastern Highway and other assets.
- From 2 JAN 08 to 4 JAN 08 the priority was to fully contain the section of the fire south of the GEH, as winds were expected to come from the SE quadrant over the ensuing days, which had the potential to push uncontained fire south of the highway towards the GEH, and potentially to threaten Koorarawalyee.
- From 4 JAN 08 to 8 JAN 08 the priority was to progress containment north of the GEH along the flanks of areas burnt in previous days, and to close in on the far NW section of the fire and contain it. This involved a major track construction operation over 5 days, and included contingency scrub-rolling works to ensure that high voltage powerlines and other assets including the GEH and Koorarawalyee were given protection against the contingency that fire returned to the NE or NW quadrants.

Map 12 on the following page provides an operational overview of how phase 4 of the fire progressed, daily summaries of fire suppression operations are provided at sections 6.7.1 to 6.7.9 covering each day of the period from 31 DEC 07 to 8 JAN 08 when the fire was fully contained.



Legend

- IndicativeArrows
- OP Operations Point
- prior to 31/12/2007
- 1/01/2008
- 2/01/2008
- 3/01/2008
- 4/01/2008
- 5/01/2008
- 6/01/2008
- 7/01/2008
- 8/01/2008
- prior to 31/12/2007
- 31/12/2007
- 1/01/2008
- 2/01/2008
- 3/01/2008
- 4/01/2008
- 5/01/2008
- 6/01/2008
- 2000 Fire
- 2006/07 Fire

1:200,000
0 1 2 4
Kilometres (at A4)
Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 50

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DEC WA
Goldfields Fire 13 - Operations

Job Number 21-17228
Revision REVA
Date 9 July 2008

Fire growth & operations
Operations

Map 12

G:\21\16656\CADD\GIS\MapDocuments\Operations\071230_FireGrowth&Operations.mxd

Data source: GHD Pty Ltd, Fire boundaries, 17/4/08, Geoscience Australia National 1:250000 Topographic Map. Created by: P de Mar

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6.7.1 Incident Management Overview: 31 December 2007

Suppression strategies during 31 December 2007 are impacted by the fatalities that occurred the previous evening, with the need to preserve the fatality scene on the highway, and minimise adverse impacts on fire crews associated with seeing the fatality site.

Work activity is focussed on the western flank, asset protection north of the highway, and on relocating the Operations Point from Koorarawalyee to Yellowdine due to the potential for the uncontained western flank of the fire to spread towards Koorarawalyee.

<table>
<tr><td colspan="3">Objective: Protect assets, improve access north of highway, prevent westerly spread of fire.</td></tr>
<tr><td>Strategies:
1. Patrol fire areas north of highway, improve access on Merbine tranck and 220 KVA powerline easement (North Division)</td><td>2. Construct control lines along western flank of fire south of the GEH (South Division).</td><td>3. Support Highway Management and fatality site protection on Highway (Highway Division).</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to demobilise fatigued crews from fire to Kalgoorlie, and organise replacements for 1/1/08.
Resource use during the day was limited mainly to morning period, relocation of Operations Point and Staging Area to Yellowdine, with limited activity during afternoon when resources were demobilising to Kalgoorlie.</td></tr>
<tr><td>North Division
1 x Hamptons Grader
1 x Hamptons Cat 980 Front End Loader
1 x Dozer
6 x Heavy Duty Tanker
1 x Light Unit</td><td>South Division
1 x Wilson Wheeled Dozer
1 x Komatsu Front End Loader
4 x Heavy Duty Tanker (Perth Hills)
2 x Light Unit (Sector Commander vehicle)</td><td>Highway Division
4 x Light Unit.</td></tr>
</table>

On the Northern Division no suppression activity was undertaken on 31 DEC 07. Aerial reconnaissance and patrol was the primary activity undertaken.

On the Southern Division, containment line construction was planned for the western flank (Sector Z) south of the highway. However, due to fire escalation on the western flank containment strategies were not pursued.

Fire crews were demobilised to Kalgoorlie during the day. The fire effectively burnt uncontained during 31 DEC 07.

6.7.2 Incident Management Overview: 1 January 2008

Suppression activity on 1 JAN 08 increases significantly from the previous day as fresh crews have arrived to replace the crews which demobilised on 31 DEC 07.

Containment activity is focussed on the western flank south of the highway (about 12 km of line production), and on the eastern flank both north and south of the highway (about 12 km of line production). The Operations Point had relocated from Koorarawalyee to Yellowdine the previous day, and the GEH remained closed.

<table>
<tr><td colspan="3">Objective: Contain easterly and westerly spread of the fire (prioritised to areas adjacent to the highway), reduce hazard under 220 KVA powerline, and plan for the containment of uncontained sections of fire.</td></tr>
<tr><td>Strategies:
1. Construct and hold containment lines on eastern boundary of fire
4. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements.</td><td>
2. Construct and hold containment lines on western boundary of fire, south of the highway.
5. Monitor the effectiveness of natural features containing the southern boundary of the fire.</td><td>
3. Conduct scrub rolling under 220 KVA powerlines.</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was commence containment lines on sections of fire in vicinity of GEH, to reduce the potential for future fire runs impacting the highway.</td></tr>
<tr><td>North Division
1 x Wheeled Dozer
1 x Front End Loader
2 x Heavy Duty Tanker
2 x Light Unit</td><td>South Division (West Sector)
1 x D8 Dozer
1 x Front End Loader
4 x Heavy Duty Tanker
4 x Light Unit</td><td>South Division (East Sector)
1 x D7 Dozer
1 x Grader
1 x Front End Loader
5 x Light Unit</td></tr>
</table>

On the North Division approximately 4.5 km of control line was established on the eastern flank north of the Great Eastern Highway. Fire activity on this section of the fire was negligible, having not experienced any lateral growth since its run on the evening of 30 DEC 07.

On the eastern sector of South Division , approximately 7.5 km of control line was established on the eastern flank south of the Great Eastern Highway. Fire activity on this section of the fire was negligible, having not experienced any lateral growth since its run on the evening of 30 DEC 07. Fire activity on the eastern flank during the day was restricted to an isolated fuel patch in the far south east corner of the fire adjacent to salt lakes and woodland.

On the western sector of the South Division, approximately 12 km of control line was established on the western flank south of the Great Eastern Highway. Fire activity on this section had been active the previous day during a NW run to the Great Eastern Highway. Containment work completed on this flank is likely to have reduced the westerly spread of the fire south of the highway.

6.7.3 Incident Management Overview: 2 January 2008

Suppression activity on 2 JAN 08 continues the strategies commenced the previous day, consolidating existing containment lines and extending these.

<table>
<tr><td colspan="3">Objective: Contain all active fire south of the highway, extend containment on the eastern flank as far north as possible, and plan for the containment of uncontained sections of fire.</td></tr>
<tr><td>Strategies:
1. Extend containment lines south on the south eastern portion of the fire through to the salt lakes (SE Division).
4. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements</td><td>2. Extend containment lines south on the south western portion of the fire through to woodland-salt lake complex (SW Division).</td><td>3. Extend containment lines north towards the Merbine track on the north eastern flank of the fire (NE Division).</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to complete as much containment as possible south of the highway, and to continue northward progress on the eastern flank.</td></tr>
<tr><td>South West Division
1 x Wheeled Dozer
1 x D7 Dozer
1 x Front End Loader
6 x Heavy Duty Tanker
2 x Light Unit</td><td>South East Division
1 x D8 Dozer
1 x Grader
2 x Heavy Duty Tanker
3 x Light Unit</td><td>North East Division
1 x D9
2 x FEL (1 x unserviceable)
2 x Heavy Duty Tanker
2 x Light Unit</td></tr>
</table>

On the North East Division approximately 7 km of containment lines are constructed during the day, fully containing the eastern flank of the fire from the Great Eastern Highway to the Merbine track.

On the South East Division, the south east flank containment line is extended to the south east through to the chain of salt lakes fully containing the SE flank. The south eastern extent of the flank was in woodland involving a convoluted tightly winding edge.

On the South West Division, about 8 km of containment line was constructed, predominantly through woodland areas involving convoluted fire edge and winding track construction. This work fully contained the SW flank.

6.7.4 Incident Management Overview: 3 January 2008

Suppression activity on 3 JAN 08 continues the strategies commenced the previous day, consolidating existing containment lines and extending these.

<table>
<tr><td colspan="3">Objective: Contain all active fire south of the highway, extend containment on the eastern flank as far north as possible, and plan for the containment of uncontained sections of fire.</td></tr>
<tr><td>Strategies:
1. Commence construction of containment lines from south east flank to south west flank, across southern perimeter of fire (Sector Y).
4. Mop up and patrol SE and SW flanks. (Sectors X and Z)</td><td>2. Patrol containment lines from 2006/07 fire scar to Merbine track. (Sector B)
5. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements</td><td>3. Contain uncontrolled fire immediately north of GEH on Western Flank (Sector E).</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to complete as much containment as possible south of the highway, and to contain uncontrolled fire on the western flank immediately north of the GEH.</td></tr>
<tr><td colspan="2">South Division
<u>Sector X:</u>
1 x D7 Dozer; 1 x D9 Dozer; 1 x Grader
2 x Heavy Duty Tanker; 3 x Light Unit
<u>Sector Y:</u>
1 x Wheeled Dozer; 1 x D8; 1 x Front End Loader
3 x Heavy Duty Tanker; 2 x Light Unit
<u>Sector Z</u>
1 x D6
2 x Heavy Duty Tanker; 2 x Light Unit</td><td>North Division
<u>Sector B</u>
1 x Front End Loader
3 x Heavy Duty Tanker; 2 x Light Unit
<u>Sector E:</u>
1 x Front End Loader
1 x Heavy Duty Tanker; 2 x Light Unit</td></tr>
</table>

In the Northern Division sector B was fully mopped up, and containment of fire on the western flank immediately north of the GEH on Sector E was completed.

In the Southern Division, containment lines along the south west and south east flanks were strengthened and fully mopped up. Approximately 2 km of new containment line was constructed on the southern fire perimeter (on Sector Y), predominantly through woodland areas involving convoluted fire edge and winding track construction.

6.7.5 Incident Management Overview: 4 January 2008

Suppression activity on 4 JAN 08 continues the strategies commenced the previous day, consolidating existing containment lines and extending these.

<table>
<tr><td colspan="3">Objective: Eliminate the potential for further fire spread south of the GEH by completing containment lines around the southern fire perimeter; extend containment lines north of the GEH, on both the eastern flank and western flanks as far north as possible; plan for the containment of uncontained sections of fire.</td></tr>
<tr><td>Strategies:
1. Complete containment lines along the southern fire perimeter (Sector Y)

4. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements (Sector C)</td><td>2. Extend containment lines on the western flank north from the GEH, beyond the 220 KV powerline as far north as possible (Sector D).
5. Mop up and patrol (Sectors A, B, X, E and Z)</td><td>3. Extend containment lines on the eastern flank north from the Merbine track on the north eastern flank as far north as possible (Sector B).</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to fully contain the southern fire perimeter, and to extend containment of the east and west flanks as far north as possible.</td></tr>
<tr><td colspan="2">South Division
<u>Sector X:</u>
3 x Light Unit
<u>Sector Y:</u>
1 x D8 Dozer; 1 x Front End Loader
1 x Heavy Duty Tanker; 2 x Light Unit
<u>Sector Z</u>
1 x Wheeled Dozer; 1 x Grader
1 x Heavy Duty Tanker; 3 x Light Unit</td><td>North Division
<u>Sector A</u>
1 x FEL;
1 x Heavy Duty Tanker; 3 x Light Unit
<u>Sector B</u>
1 x Front End Loader; 1 x D9 Dozer
1 x Heavy Duty Tanker; 1 x Light Unit
<u>Sector C</u>
1 x Light Unit
<u>Sector D</u>
1 x D7 Dozer; 1 x D6 Dozer
3 x Heavy Duty Tanker; 1 x Light Unit
<u>Sector E:</u>
1 x Light Unit</td></tr>
</table>

6.7.6 Incident Management Overview: 5 January 2008

Suppression activity on 5 JAN 08 continues the strategies from the previous day, consolidating containment lines constructed over the past two days, and extending containment along the south west flank, north of the 220 KV powerline.

<table>
<tr><td colspan="3">Objective: Consolidate existing containment lines; construct new containment lines along the SW flank to eliminate the potential for westerly fire spread from the fire run of 31 December 2007. Plan for the containment of uncontained sections of fire.</td></tr>
<tr><td>Strategies:
1. Mop up and patrol containment lines (Sectors A, B, X/Y, E and Z.

4. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements</td><td>
2. Extend containment lines on the south-western flank as far north as possible (Sector D).

5. Scrub roll 220 KV powerline easement and along vermin proof fence (Sector D).</td><td>
3. Continue line constriction north along the NE flank north of the Merbine Track. (Sector C)</td></tr>
<tr><td colspan="3">Resourcing: The major focus during the day was to extend containment along the south-west flank as far north of the 220 KV powerline as possible and to protect 220 KV powerlines and vermin proof fence by scrub rolling.</td></tr>
<tr><td colspan="2">South Division
<u>Sector X/Y (combined):</u>
1 x Heavy Duty Tanker; 1 x Light Unit
<u>Sector Z</u>
1 x Heavy Duty Tanker; 2 x Light Unit</td><td>North Division
<u>Sector A/B (combined)</u>
2 x Light Unit
<u>Sector C</u>
2 x FEL; 1 x Light Unit
<u>Sector D</u>
2 x Grader; 2 x FEL; 1 x D7 Dozer; 1 x D8 Dozer
2 x D9 Dozer; 1 x D6 Dozer; 1 x Wheeled Dozer
5 x Heavy Duty Tanker; 4 x Light Unit
<u>Sector E:</u>
2 x Light Unit</td></tr>
</table>

6.7.7 Incident Management Overview: 6 January 2008

Suppression activity on 6 JAN 08 continues the strategies from the previous day, consolidating containment lines constructed over the past two days, and extending containment along the south-western and north-eastern flanks of the fire runs which occurred two days earlier on 4 January 2008.

<table>
<tr><td colspan="3">Objectives: Consolidate existing containment lines; construct new containment lines to eliminate the potential for easterly and westerly fire spread from the flanks of the fire run of 4 January 2008. Plan for the containment of uncontained sections of fire.</td></tr>
<tr><td>Strategies:
1. Mop up and patrol containment lines (Sectors A, B, X/Y, E and Z.

4. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements</td><td>
2. Extend containment lines on the south-western flank as far north as possible (Sector D).

5. Continue scrub rolling 220 KV powerline easement and along vermin proof fence (Sector D).</td><td>
3. Extend containment lines on the north-eastern flank as far north as possible (Sector C).</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to extend containment along the flanks of the fire run from 4 January 2008 and continuation of scrub rolling.</td></tr>
<tr><td colspan="2">South Division
<u>Sector X/Y (combined):</u>
1 x Light Unit
<u>Sector Z</u>
2 x Light Unit</td><td colspan="2">North Division
<u>Sector A/B (combined)</u>
2 x Light Unit
<u>Sector C</u>
4 x FEL; 1 x D7; 1 x Grader
1 x Heavy Duty Tanker; 4 x Light Unit
<u>Sector D</u>
2 x Grader; 1 x D8 Dozer 2 x D9 Dozer;
1 x D7 Dozer; 1 x Wheeled Dozer
5 x Heavy Duty Tanker; 5 x Light Unit
<u>Sector E:</u>
nil</td></tr>
</table>

6.7.8 Incident Management Overview: 7 January 2008

Suppression activity on 7 JAN 08 continues the strategies from the previous day, consolidating containment lines constructed over the past two days, with the focus of new containment work focussed on extending containment of the western flank as far north as possible.

<table>
<tr><td colspan="3">Objectives: Eliminate the potential for further southerly, easterly and westerly spread of the fire by extending control lines along the western and eastern flanks.</td></tr>
<tr><td>Strategies:
1. Mop up and patrol containment lines (Sectors A, B, X/Y, E and Z.

4. Continue scrub rolling 220 KV powerline easement and along vermin proof fence (Sector D).</td><td>2. Extend containment lines along the eastern and western flanks to contain section burnt on 5 and 6 January 2008 (Sectors C and D).</td><td>3. Monitor fire growth on the northern part of the fire and plan containment strategies and resource requirements.</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to extend containment along the eastern and western flanks to contain fire sections burnt on 5 and 6 January 2008, and continuation of scrub rolling.</td></tr>
<tr><td colspan="2">South Division
<u>Sector X/Y (combined):</u>
1 x Heavy Duty Tanker; 1 x Light Unit
<u>Sector Z</u>
1 x Heavy Duty Tanker; 2 x Light Unit</td><td>North Division
<u>Sector A/B (combined)</u>
2 x Light Unit
<u>Sector C</u>
4 x FEL; 1x D7 Dozer; 1 x Grader;
1 x Heavy Duty Tanker; 5 x Light Unit
<u>Sector D</u>
1 x Grader; 1 x D8 Dozer 2 x D9 Dozer;
1 x Wheeled Dozer; 1 x D6 Dozer
5 x Heavy Duty Tanker; 5 x Light Unit
<u>Sector E:</u>
nil</td></tr>
</table>

6.7.9 Incident Management Overview: 8 January 2008

Suppression activity on 8 JAN 08 continues the strategies from the previous day, consolidating containment lines constructed over the past two days, with the focus of new containment work focussed on extending containment of the western flank as far north as possible.

<table>
<tr><td colspan="3">Objectives: Eliminate the potential for further southerly, easterly and westerly spread of the fire by extending control lines along the western and eastern flanks.</td></tr>
<tr><td>Strategies:
1. Mop up and patrol containment lines (Sectors A, B, X/Y, E and Z.

4. Plan demobilising of equipment.</td><td>2. Consolidate containment lines on eastern and western flanks (Sectors C and D).</td><td>3. Complete containment lines around northern extent of fire fully enclosing fire behind containment lines (Sector F).</td></tr>
<tr><td colspan="3">Resourcing: Focus during the day was to complete containment around the northern extent of the fire and consolidate containment lines built in the past two days.</td></tr>
<tr><td colspan="2">South Division
<u>Sector X/Y (combined):</u>
1 x Light Unit
<u>Sector Z</u>
2 x Light Unit</td><td>North Division
<u>Sector A/B (combined)</u>
2 x Light Unit
<u>Sector C</u>
2 x FEL; 1 x Heavy Duty Tanker; 3 x Light Unit
<u>Sector D</u>
1 x Grader; 2 x FEL
3 x Heavy Duty Tanker; 1 x Light Unit
<u>Sector F:</u>
2x D8 Dozer 1 x Wheeled Dozer; 2 x D6 Dozer;
1 x Grader; 3 x Heavy Duty Tanker; 3 x Light Unit
<u>Sector E:</u>
1 x Light Unit</td></tr>
</table>

7. Goldfields Fire 13 Response - Operations Review

In this chapter, the systems and procedures used by DEC in responding to the Goldfields Fire 13 incident, and the manner in which they were implemented are reviewed. The review is structured according to the four phases of fire development during the incident, in accordance with the scope of works for the review.

The operational aspects reviewed were identified through a combination of interviews with DEC staff and matters identified during DEC's After Action Review (AAR) and Post Incident Analysis (PIA) process. These processes are focussed on learning by doing and continuously improving systems, procedures and performance. The review process necessarily identifies and reviews both strengths (things done well) and weaknesses (areas requiring improvement). The AAR and PIA process implemented by DEC (in accordance with *Fire Operational Guideline 31 – After Action Reviews and Post Incident Analysis*) provides for a very detailed assessment of incident response (including readiness), across the range of incident management functions. Issues identified can range from matters with State, agency and/or inter-agency level implications (eg. road and traffic management during fires) to more detailed matters of unit level and/or local level significance (eg identification of unserviceable items of equipment that require repair or replacement). It is important that all matters raised in the AAR/PIA process and are attended to appropriately, including the unit and local level matters. For this review however, the focus will be on the matters of State level and/or agency (and in many cases inter-agency) significance.

The review of key operational aspects in this section incorporates issue identification and discussion at an overview level, sufficient to provide the operating context for recommendations, and which may provide an initial scoping of issues for the more detailed analysis that will be required in the process of implementing recommendations. A range of recommendations are made through this operations review section. These are, quite deliberately, not intended to be prescriptive. Generally, to avoid constraining innovation, a process is recommended in which those with responsibility for implementation can develop solutions. Solutions to operational issues are best developed by people with a sound understanding of the local operating context, including the organisational cultures and administrative arrangements within participating agencies, the statutory framework and relevant policy environment, resourcing opportunities and constraints, and a practical sense of what will be involved in implementing a selected option.

The issues identified and discussed in this operational review chapter, are summarised and presented in the "Identified Learning Points" (Chapter 8) with relevant recommendations, providing a consolidated list of the lessons and recommendations identified in this review. It should be noted that the focus of this review is on DEC operations. Accordingly, recommendations are focussed on actions which need to be taken by DEC alone or by DEC in partnership with other agencies or communities.

7.1 Phase 1 - Fire detection and report, initial attack response, fire appreciation and extended response planning

Once a fire is detected and reported, the initial response phase is a critically important period in the management of a fire incident. Of utmost importance is the initial attack. Fires are more easily brought under control when they are small, before they develop to their full fire behaviour potential, and before they grow to a size and complexity that will require multiple shifts to bring under control. Action taken to contain a fire in its early development stage can avert the need for extended, multi-agency operations which may result if the fire escapes initial response. Initial attack success probability is a function of:

» The severity of the weather conditions prevailing when the fire starts,

» How conducive the vegetation is to rapid fire growth,

» The time taken to respond to the fire, and

» The number and type of resources available to respond quickly to the fire

In the Goldfields operating context, a significant challenge arises in that:

» In the sandplain heath-scrub of the Goldfields, a wind speed of just 10 km/hr is all that is typically required to generate a wind driven fire that is beyond initial attack by handcrews (ie. will require the deployment of earthmoving machinery).

» Due to the vast spatial scale of the Goldfields, initial attack travel distances are often long,

» Due to the very low population densities in the Goldfields region, firefighting resources are scarce, and concentrated in major populations centres remote from where fires occur.

Therefore it is very often the case that fires will grow to proportions beyond the capability of initial attack crews to contain.

In this operating context (a significant likelihood that fires will not be contained during the first shift), decisions made and actions planned during the period of the first shift, will define the operating constraints with which subsequent shifts have to work. Therefore, during the first shift, the assessments made of how the fire is likely to develop, and what resources are required and ordered are vitally important.

7.1.1 Initial fire detection and fire report

Goldfields Fire 13 was reported by phone to DEC around 15:00 (about 2 hours after the time the fire is likely to have started) by one of only two permanent residents of the Boorabbin National Park area. Due to the high level of local knowledge of the person reporting the fire, the fire location information provided was accurate. It is understood that the fire was also reported via the 000 system. DEC did not receive notification of this 000 call until approximately 15:15.

While the fire report received by DEC on this occasion contained accurate fire location information, this is not often the case. The most common source of fire reports between Coolgardie and Southern Cross are from passing motorists via the 000 system. For motorists passing through, and unfamiliar with the local area, it can be difficult to accurately describe the location of the fire, particularly in a landscape with relatively few distinguishing features or roadside signage to use for location purposes. Similar situations exist elsewhere in Australia, and in some locations, signage along the major roads is provided that assists motorists to accurately identify their location in relation to major towns which is of great assistance when making emergency reports through the 000 system. Such signage systems often combine fire awareness and prevention messages, with location and fire reporting information. Given that the Great Eastern Highway corridor between Coolgardie and Southern Cross is identified as containing the highest priority assets for fire protection in the area, it may be worth giving consideration to developing a signage system along the highway that addresses fire awareness, prevention and incident location requirements.

If the delay in notifying DEC of the 000 call was unrelated to issues of fire location uncertainty, and was a procedural or implementation failure, then 000 call notification arrangements should be reviewed.

7.1.2 Initial Attack Response

DEC's initial attack response was mobilised promptly, within one hour of the fire being reported. Preparations undertaken prior to departure from Kalgoorlie included, provisioning for the possibility of overnight operations in the field, preparation of local maps, and assembling communications and computer equipment required for the contingency that a field Operations Point may need to be established.

Dispatch of a light unit with 2 crew was consistent with standard Goldfields Region operating procedures, and was well executed. A few minor items such as mobile phone chargers, and multiple socket powerboards would have proved useful during the second and subsequent shifts.

To further improve initial incident mobilisation for Goldfields fires, it may be useful to develop a standard incident mobilisation manifest and 'grab kits' for establishing field Operations Points.

7.1.3 Incident Liaison and Coordination

Standard incident liaison and coordination functions were undertaken by the Incident Controller. The DEC State Duty Officer was informed promptly, appraised of the available information, and consulted in terms of incident management strategies and resourcing requirements. WA Police were contacted, notified of public safety concerns on the GEH, and requested to provide assistance. Western Power were appraised of the fire situation when it became apparent that the fire had reached the 220KV powerline (before the initial attack crew had arrived at the fire). Local FESA contacts were notified of the fire, assistance in the form of a FESA liaison officer for the IMT requested, and FESA resource availability established. Contact was also made with the Coolgardie Shire in which local government area the fire was burning. Notification of the Main Roads Department does not appear to have been made in the initial attack phase. During the initial attack phase the fire had a negligible impact on highway traffic.

7.1.4 Declaration of Wildfire / Fire Appreciation

DEC has in place a procedure for 'Declaration of Wildfires' (FOG 83). The aim of FOG 83 is:

> *"…to define the procedure to follow when declaring the **potential** status of a fire and the notification that is to be provided up the chain of command to ensure that fire suppression resources and personnel are dispatched within an adequate timeframe.*
>
> *In particular, it will enable the State Duty officer to maintain situational awareness and to activate the deployment of pre-formed AIIMS Teams."*

FOG 83 establishes a three level system (consistent with the three level AIIMS classification system) for classifying DEC fires, and that all fires must be classified:

- A Level 1 fire is a "minor incident" able to be managed with local resources and likely to be resolved in hours (widely interpreted within DEC to be within the first shift).
- A level 2 fire is one that in addition to requiring local resources will require resources from outside the local DEC district, could involve more than one agency and will take more than one shift to resolve,
- A level 3 fire is a "major incident" will involve many resources, but which will take days or weeks to resolve,

Level 2 and 3 incidents require notification to the State Duty Officer, require to be managed from an Incident Control Centre, and the deployment of a pre-formed incident management team.

The FOG 83 version current at the time of the fire was dated 26 NOV 07.

The system of fire classification relies on an appreciation of the fire's development **potential** under current and predicted fire weather and resourcing conditions. "Potential" is given emphasis (bold print) in the FOG.

The fire was considered by both the Regional Duty Officer (also Incident Controller) and the State Duty Officer as being a Level 2 fire. The notification and indeed strategy consultation actions taken by the Regional Duty Officer were consistent with FOG 83, for a level 2 fire.

Fire development projections based on forecast weather and resourcing levels were discussed between the RDO and the SDO. These were not documented at the time. Accordingly, there is no documented situation analysis recording what assumptions were factored in about containment strategy success ahead of the bad weather predicted for Sunday 30 DEC 07. Procedures current at the time did not require the documenting of such information during initial fire appreciation stage. During interviews conducted by GHD, it was expressed that on Friday evening, having discussed flank containment strategies and the resources mobilised, there was a high level of confidence in containing the flanks of the fire (as they existed on 28 DEC 07) on 29 DEC 07. It is likely therefore that fire classification was considered on the assumption that the containment activities planned for 29 DEC 07 would be successful.

One aspect of FOG 83 that was not fully implemented was the requirement to dispatch a pre-formed Team to a Level 2 fire. Rather than dispatching a full pre-formed team, the decision was taken to mobilise planning and logistics unit resources from a pre-formed team to support locally experienced personnel performing Control and Operations functions.

The decision not to send a full pre-formed team does not appear to have been due to any neglect or ignorance of the procedure, but a considered decision giving regard to historical and operating context factors associated with fire operations in the Goldfields and in consideration of severe fire weather conditions across the entire south-west land division. The following factors were given consideration in taking the decision not to send a full pre-formed IMT:

- There was no historical precedent for sending a full pre-formed IMT to a Goldfields fire. Previously, IMT positions for large Goldfields fires were filled by local resources, with supplementation by out-of-area resources when requested by the Incident Controller.
- Historically, Goldfields fires had been managed by relatively small IMTs (typically not more than 3 or 4 people in office based IMT roles, and the rest out in the field),
- Some thought and concern was given to the potential for 'overwhelming' the local office staff that could occur if a full pre-formed IMT was dispatched (approximately 60 people).
- The local personnel nominated as IC and Operations Officer, had substantial field operations experience and local experience in Goldfields fire operations.
- Fire conditions were severe in the entire south-west land division.

Issues that (with hindsight) should have been given greater consideration were:

- The potential for the fire to become a complex Level 3 incident, involving fire impacts on the GEH and other infrastructure, if flank containment strategies planned for 29 DEC 07 were unsuccessful.

- The level of past reliance by small local IMTs on the local knowledge, advice and management direction of the Goldfields Regional Manager during fires (during Goldfields Fire 13, the Goldfields RM was on leave),
- The significant additional level of difficulty that is associated with managing fires remote from an Incident Control Centre (ICC), and with situational awareness challenges such as no fireground radio relay to the ICC and the impacts that accommodating crews long travel distances from the fire can have on productive shift lengths.

Currently, FOG 83 places the duty of fire classification with the District Duty Officer. The only fire classification that does not require deployment of a pre-formed IMT is a Level 1 fire (which is characterised as a minor incident that can be handled using local resources on the first shift). In regions such as the Goldfields region, this generates some fire classification issues. For example, what is the appropriate fire classification for a fire that will not be resolved in the first shift (applies to most Goldfields fires), will draw on resources from outside the District (will apply to almost any fire that requires heavy duty fire tankers) but is not considered to require an IMT of the size that comes with a pre-formed IMT? Using FOG 83, such a fire cannot be correctly classified as a Level 1 incident, as it will take longer than one shift to resolve. It cannot properly be classified as a Level 2 incident as it does not require a pre-formed IMT.

There will in the future be fire incidents that will go longer than one shift, but that do not require deployment of a pre-formed IMT. FOG 83 does not cater adequately for this potentially common scenario. The Level 2 incident description used in FOG 83, specifically the trigger that a pre-formed IMT is required, is not entirely consistent with the Australian Inter-service Incident Management System (AIIMS). Under AIIMS, Level 2 incidents cater for scenarios that require significantly less functional and sub-functional delegation than which occurs within a DEC pre-formed IMT.

Accordingly, it is recommended FOG 83 be reviewed. In particular, consideration should be given to:

- What role the Regional Duty Officer and State Duty Officer have in classifying fires at Level 2 and 3,
- Amending the Level 2 fire classification to better cater for fire scenarios that will require more than one shift to resolve, but that involve relatively modest levels of resourcing in the field that do not warrant the levels of sub-functional delegation that come with a DEC pre-formed IMT.
- Providing an alternative to providing full pre-formed IMTs for incidents that will go longer than one shift. This is likely to involve a non-prescriptive approach in which the RDO and SDO can make decisions on IMT resourcing that are commensurate with the potential complexity of the incident.
- If pre-formed IMTs are not required for all multi-shift fires, then a robust, risk based system for determining what competence levels are required for Level 2 incidents will be important. It is noted that one of the major advantages DEC sees in sending a pre-formed IMT to an incident is that the personnel filling the IMT leadership roles (IC, PO, OO, and LO) are among the most experienced personnel DEC have in their employ, and have demonstrated experience in their assigned IMT roles at complex incidents.
- Introduction of a requirement that decisions to send pre-formed IMT's or part IMT's should be based on a documented situation analysis.

7.1.5 Extended attack resource mobilisation

The RDO and SDO recognised early, before the initial attack crew had arrived at the fire, that extended attack would be required for Goldfields Fire 13. They also recognised that in order to commence containment action the following morning, it would be necessary to pre-empt the assessment of the initial attack crew and get resources mobilised that evening. The DEC systems used to mobilise resources worked very effectively. Within 2 hours of the fire report being received, out-of-area fire crews from DEC's Wheatbelt and Swan Coastal districts, with 4 light units, 5 heavy units, and a Front End Loader with prime mover and float had been mobilised, and IMT personnel, a helicopter and air observer organised to depart early the following morning.

This was a rapid and well organised mobilisation of firefighting resources.

While the potential for fire impacts on the Great Eastern Highway was recognised during Phase 1, and local Police contacted and alerted to the potential, preparation for the contingency that the GEH may need to be closed or traffic management measures put in place was not pursued with the same vigour as the firefighting component of the operation.

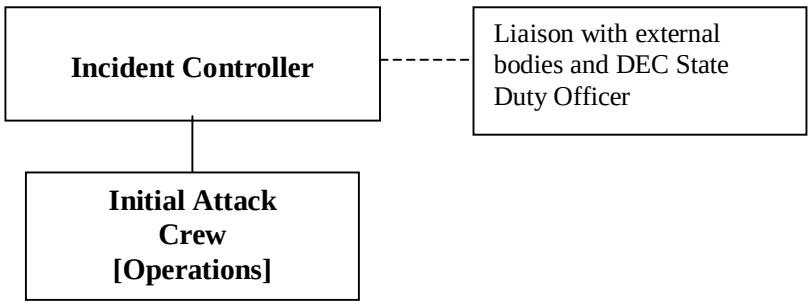
For fires occurring in the vicinity of major roads, and which have the potential to generate traffic management requirements, early identification of traffic management resource requirements should be made in consultation with relevant agencies (eg WA Police, Main Roads WA and FESA) – see section 7.3.2 for more detailed consideration of traffic management issues, planning and management. As appropriate, out-of-area traffic management resource mobilisation should be initiated early to supplement any shortfalls in locally available resources.

7.1.6 Phase 1 - Incident Management

During Phase 1 of the incident, only local Goldfields region office resources were available, and these were reduced from normal levels as the fire occurred during the Christmas to New Year break when higher than normal numbers of staff were on leave.

The following Incident Management Structure was in place:

Note: Incident Controller is in charge of the fire response, and performing Control, Planning and Logistics functions.
SDO and staff in assisting regions (Wheatbelt and Swan) are providing logistic and administrative support to IC.



The major activity of the Incident Controller was gathering incident information to form an appraisal of the fire situation and developing containment strategies, mobilising local and out-of-area resources to be available for the following day, and performing notification/liaison functions (eg with Police, FESA and local Government).

The Incident Controller was the only person experienced in fire operations to remain in the DEC Goldfields regional office in Kalgoorlie. The other two fire operations experienced personnel were dispatched to the field as the first response crew.

No formal, documented Incident Action Plan (IAP) was prepared during the first shift, however, assessment of the fire location and extent, forecast fire weather, local vegetation and fire scars, and assets requiring protection was made. Incident objectives (keeping the fire north of the GEH) and strategy development (flank attack) were developed, and resources mobilised to pursue the objective and strategies.

DEC's Incident Action Planning is guided by FOG 03 "*Minimal Requirements For Incident Action Plan (IAP)*". The version current at the time of the fire was issued on 23 JUL 07. This provides guidance and a planning template for production of an IAP for Level 2 and 3 incidents. Production of an IAP in accordance with the requirements of FOG 03 requires well developed planning competencies such as those possessed by DEC's accredited Planning Officers.

FOG 03 does not however provide guidance on the minimal Incident Action Planning requirements for Level 1 incidents, or during the mobilisation phase of higher level incidents before the IMT is in place. In the absence of guidelines for IAP requirements for Level 1 incidents and the mobilisation phase of higher level incidents, a range of approaches are taken within DEC. These include undocumented plans formulated in the mind of the IC; planning information assembled on whiteboards or incident room map walls (including information written onto the whiteboard and other printed information such as weather forecasts and incident maps posted on the whiteboard or map wall using magnetic strips or blue tac), and simple paper based plans that document basic planning information. There appears however to be no standard process for this within DEC.

Examples of Level 1 IAPs are available from other states, for example NSW and Victoria. In NSW, a single page Situation Report which contains text based information on fire origin, area (total and by tenure), type, status, losses, map sheet reference, control centre contact details, resources assigned, threats posed by the fire, and incident objectives and strategies. A map of the fire (typically a GIS generated map or photocopied section of a topographic map marked up by hand to indicated the fire location and control features) is appended to the Situation Report. The situation report and accompanying map form the Level 1 IAP.

DEC should review FOG 03 to incorporate guidance regarding the minimum IAP requirements for Level 1 incidents and for higher level incidents which are in the initial mobilisation phase.

7.1.7 Establishing an Operations Point

For fires in the Goldfields and other remote regions, the functions of the initial attack crew can be categorised into three activity areas:

1. Contain or put the fire out if it is possible to do so,
2. If the fire can't be put out without additional assistance, gather information about the fire, the local conditions and what the fire is likely to do, what man made and natural features are

available locally to assist with containment efforts, and recommend what resources are required to commence suppression operations, and report the information and recommendations back to the incident controller, and

3. If there is no constructive containment action can be taken, locate a suitable area and begin preparations to establish an Operations Point

There are a number of sometimes conflicting attributes to consider when choosing a location for an Operations Point. One of the most critical attributes is selecting a location from which good quality (signal strength and clarity) and coverage of communication with the both the fireground and ICC can be established. Other attributes to consider are the availability of clear areas to set equipment, park vehicles, conduct briefings, shelter from the weather and direct sun, access to power, water, and toilet facilities and areas to set up tents for personnel needing to remain a close travel distance to the fire overnight. Koorarawaylee was the obvious choice.

7.2 Phase 2 - Fire escalation north of the Great Eastern Highway

Phase 2 of Goldfields Fire 13 was the period in which the fire developed north of the Great Eastern Highway on 29 December 2007, and up to midday on 30 December 2007. This was the period when fire containment operations commenced, and the Incident Management Team scaled up to include an Incident Controller, Planning Officer, Operations Officer and Logistics Officer, and staff to fulfil various sub-functions within these functional areas.

7.2.1 Incident resources build-up and orientation

IMT resources flew into Kalgoorlie during the morning arriving at the Kalgoorlie DEC Office at 08:55. Therefore the remainder of the morning was spent obtaining incident information from the Incident Controller, setting up equipment, establishing communications, working arrangements, equipment and routines.

At the Operations Point, the Operations Officer arrived at 05:55 and began the process of incident orientation, conferring with and agreeing tactics with the Incident Controller, and then receiving, briefing and tasking operational units as they arrived at the fire during the morning.

DEC's contract helicopter, pilot and air observer took off from Perth at 06:25 and arrived at the fire at 10:50 for briefing and tasking.

Whilst the initial build-up and orientation generally proceeded well, the fact that the fire and Operations Point were two hours travel from the Incident Control Centre meant that key personnel such as the Operations Officer and Air Observer proceeded directly to the fire and therefore had limited opportunity to collect or be briefed on incident information. Both the Operations Officer and Air Observer took the initiative to create maps of the fire area to assist performance of their functions (as their experience was that good maps are often hard to come by in the initial shift of an incident). This took considerable effort and time, and may not have taken advantage of the best available mapping resources. DEC's current procedures in this regard are as good as procedures currently used by inter-state agencies. However, with relatively recent advances in technology (compact, high memory capacity external hardrives which can store large volumes of data and pre-formatted maps, high processor capacity laptop computers which can run GIS applications, and compact colour printers) there are likely to be system improvements that DEC can make which may reduce the effort required for out-of-area personnel to obtain good incident maps.

It is recommended that DEC review current procedures for making operations maps and spatial data for map-generation available at the Operations Point from the time it is established. Options for consideration include production of hardcopy fire map atlases, and external hard-drives (or DVD's containing regional spatial information relevant for fire management (that can be plugged into an Operations Point laptop computer), that are taken to the fire by an Initial or Extended Attack crew as part of an Operations Point grab kit.

7.2.2 Control Function – Remote Operations

Incident Control functions were carried out from Kalgoorlie. The fire was two hours drive to the west. One of the significant challenges for the Incident Controller was gaining and maintaining good situational

awareness of what was happening at the fire, and ensuring effective communication and information flow between the Operations, Planning and Logistics functions. For the effective exercise of Control functions, good situational awareness is critical to:

» Inform the development and approval of appropriate incident objectives and strategies for the IAP, and anticipating the need to scale up or scale down resources.

» Provide the IC with the incident information necessary to carry out liaison functions with organisations and people working outside the incident management structure, and to effectively communicate information to organisations, communities and people affected by, or likely to be affected by the fire.

Gaining good situational awareness in Goldfields Fire 13 was made more difficult in the IMT by the lack of a radio link with the fire. In less remote regions, the geographic area of the region typically has a network of radio repeaters that link back to the Regional Office. This means that real-time fireground radio traffic at the fire can be monitored in the Incident Control Centre. This plays a key role in members of the IMT being able to maintain their awareness of the operational situation at the fire, particularly during periods of high operational tempo, and can reduce the level of enquires made from the IMT to the Operations Point to find out what is going on. Due to the large geographic area covered by the Goldfields region, it is not economically viable to provide VHF radio coverage across the region or linkage back to the Regional Office. Therefore IMTs located in Kalgoorlie, need to make alternative arrangements to access operational information from the fire so they can maintain awareness of the fire situation, progress of suppression operations, and anticipate support and external liaison needs of the operation. In the case of Goldfields Fire 13, this was largely achieved through phone calls to the Operations Point and email.

Remote operations require additional measures to be taken to overcome the challenges that arise with distance from the fire and lack of radio communication with the fire. The provision of operational support assistance (with operational experience), to both the Operations Officer and the Incident Controller can improve communication of information between the Operations Point and IMT during remote operations. As the Operations Officer will usually be kept very busy managing operational resources, monitoring performance of tasks and the tactical situation, dealing with operational problems as they arise, and making changes to resource deployments on the fireground as the tactical situation changes, the situation is usually too busy (particularly so during high operational tempo periods) for the Operations Officer to effectively communicate a regular and adequate flow of fireground information to the IMT (this would require a substantial amount of time on the phone which detracts from the Operations Officer's ability to perform other functions). Therefore, in remote area fires, the provision of assistance to the Operations Officer is necessary to improve information flow between the IMT and the Operations Point, and carry out operations support functions (eg. updating maps, resource boards, recording incident information and answering phones and email communications, maintain communication with the IMT at times when the Operations Officer needed to be absent from the Operations Point).

At Goldfields Fire 13 during Phase 2, the Operations Officer did not have an assistant to carry out operations support functions (the Staging Area Manager carried out some of these functions as time permitted). This was a contributing factor in the IMT experiencing difficulty maintaining a high level of situational awareness. On Saturday 29 DEC 07, the tactical situation in the field was such that sub-optimal levels of situational awareness within the IMT did not manifest into any significant operational efficiency or safety issues.

It is recommended that at all level 2 and 3 fires, the Operations Officer in the field be provided appropriate levels of operations support assistance to assist with maintaining good information flow between the operations point and the IMT.

Further discussion and recommendations of improvements to communications infrastructure that can provide linking of fireground VHF radio traffic to a remote ICC are discussed at section 7.5.

7.2.3 Operations Function

Phase 2 of the fire was the period during which operations to contain the fire were commenced. It is often the case at fires that operations can be slow to commence during the initial stages (referred to by firefighters as hurry up and wait syndrome) as Operations Points, Staging Areas are established, appliances and personnel progressively arriving at the fire and are tasked and briefed, and communications between the Operations Point and the IMT are established. This was not the case at Goldfields Fire 13; operational response was commenced promptly and efficiently. The outcome was that approximately 20 km of containment lines were constructed along the flanks of the fire during the day.

Strengths

At Goldfields Fire 13, operations were commenced with impressive efficiency. Strengths evident in the commencement of operations on Saturday 29 DEC 07 included:

- A functional Operations Point was quick to be established,
- Helicopter support was quick to be established, and fire reconnaissance operations commenced promptly following arrival of the helicopter,
- Reconnoitring of fireground access and egress was completed early,
- Staging Areas for firefighting appliances were established and organised promptly,
- Maps of the fire to support operational briefings were developed early,
- The fireground was sectorised and containment tactics developed promptly,
- Resources arriving at the fireground were provided high quality operational briefings (including good coverage of safety issues), and tasked to their sectors promptly
- Fireground communications was established and working effectively,
- Phone and email links between the Operations Point and IMT were established promptly.

Issues and areas for improvement

- Meandering of the fire edge when wind speed drops or wind direction variability increases

  The eastern flank of the fire had burnt the previous day driven by a fresh evening breeze. This presented a relatively straight fire edge for machinery to track, with minimal fire activity due to a combination of favourable wind direction, and fire activity reduction overnight. However, the SW flank of the fire was from a new, unexpected finger of fire which commenced a NW run from the heel of the fire in the morning. Winds were relatively light during the afternoon (averaging about 11 km/hr), and late in the day from about 17:00, the fire edge began to meander as wind direction became more variable. This made close tracking of the fire edge with machinery very difficult, with the end result

that flank attack operations were ceased at approximately 19:00, with the SW flank containment line incomplete ahead of adverse weather expected the following day.

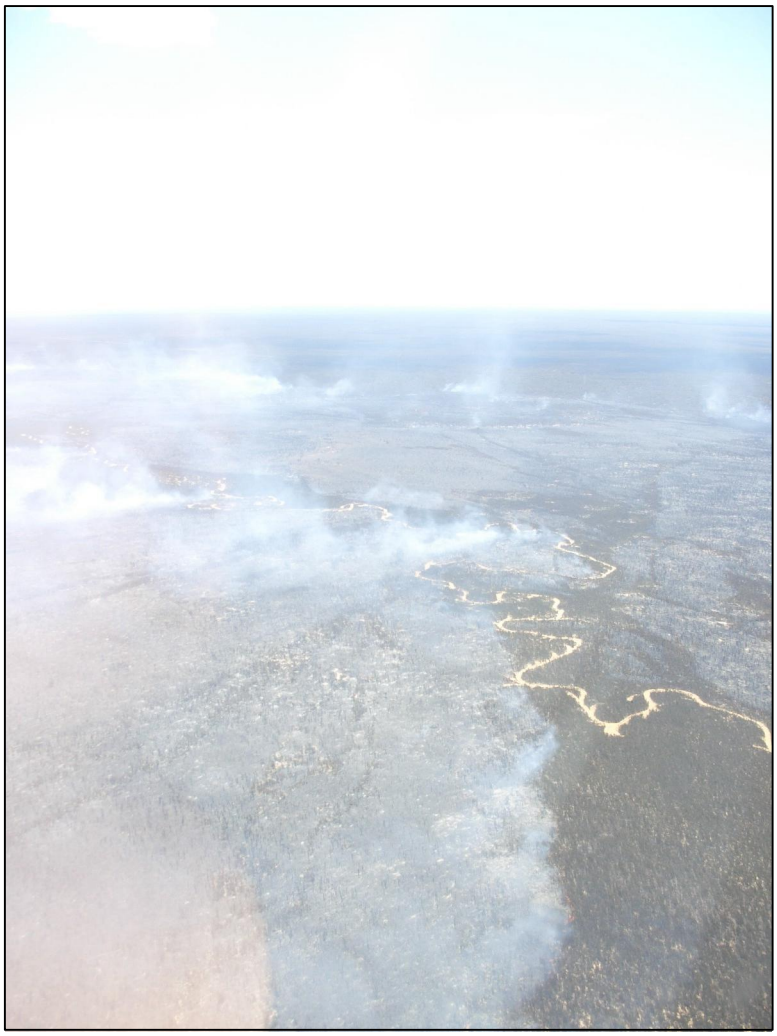


Figure 1
Tightly winding containment line at the western end of the SW flank
Picture taken from the helicopter by the Operations Officer at 15:06 30/12/07, from just north of the Great Eastern Highway looking north-west.
The tightly winding containment line along the western end of the SW flank of the previous days run can be seen winding through the centre of the picture.
On the right half of the picture, a patchy mosaic of burnt and unburnt patches north of the containment line can be seen. These patches burnt late in the day on 29 DEC 07 and went out overnight except for some hotspots at the head of the run.
On the left half of the picture is the section of winding control line built during the morning of 30 DEC 07. To the north of the line, the burnt area is less patchy – this burnt driven by E/NE winds during the early morning of 30 DEC 07 .
South of the line, the area burnt by the hop-overs that breached the western end of the containment line can be seen. The southerly direction of their spread is indicated by the less intensely burnt strips left where the flanks had been burning during the southerly fire runs.

The question that arises from lessons learnt about sandplain heath-scrub flank fire behaviour and its relationship to wind speed (see Goldfields Fire 13 Fire Development Chronology (GHD, 2008) section 7) during Goldfields Fire 13 is what suppression tactics are best suited to different flank fire behaviour scenarios?

- when wind driven fire conditions leave a relatively straight fire edge, direct flank attack has been found to be an effective tactic,

- when wind conditions are such that a meandering fire edge is created, alternative tactics (depending on the available resources) should be considered such as:
    i. parallel flank attack creating a relatively straight containment line with unburnt fuel inside the line that requires burning out, or
    ii. parallel flank attack with double or multiple machine passes to leave a wider than normal containment line, leaving a relatively straight containment line with unburnt patches inside the line (risk of hop-overs reduced by the extra line width), or
    iii. scrub rolling adjacent to (inside) containment line, or
    iv. selection of indirect firefighting strategy – fall back to a suitable existing road or containment feature and burn out fuels between the line and the flank when conditions allow.

Of the above alternative tactics, alternative (i) was not realistically available in the late afternoon of 29 DEC 07 as there was insufficient time and resources, and wind conditions were not favourable to safely executing this tactic.

With alternative (ii) it may have been possible to construct an extra-wide containment line from where the fire behaviour began to decline, through to the 2000 fire scar (approximately 3.5 km of straight, double width line) if works had commenced in the evening of 29 DEC 07. However, such an approach would have consequences for the availability of machine operators to start early the next day (due to fatigue management requirements) on a day of predicted extreme fire danger, and would have left significant areas of unburnt fuel inside the line for which conditions were not suitable to burn them out (providing the fire with an opportunity to make a run at the containment line). It is doubtful the tactic would have succeeded in the severe weather conditions experienced on 30 DEC 07, which drove fire through a 2000 fire scar and across the Great Eastern Highway.

Alternative tactic (iii) was not an available option as the requisite machinery and equipment was not available within the timeframes required.

Implementation of alternative tactic (iv) could not have been implemented along the section of the Great Eastern Highway where the 2000 fire scar was located. The 2000 fire scar would not have carried fire in the conditions prevailing on 29 DEC 07 when the wind was from a favourable direction for burning out tactics. The 2000 fire scar extended along the highway for a significant proportion (more than one third) of the area that would have needed to be burnt out, and as it turned out this was the critical section where fire running south impacted the highway.

Creating a new control line along the northern boundary of the 2000 fire scar, and burning out from this, would have involved operating machinery and support crews parallel to the uncontained active edge of the fire with mature, unburnt heath-scrub fuels between crews and the fire edge. This would have meant operating in the ‘deadman zone’ which is an option avoided by fire agencies for good reason.

Therefore, alternative (iv) had significant implementation and safety issues, which would also have been compounded by the need to put in place traffic management on the highway if it had been attempted (for which adequate resources were not available) and therefore, was not really a practical option in the prevailing circumstances at the time.

The direct flank attack option undertaken at Goldfields Fire 13, was in the circumstances the safest and most practical option available given the weather, fuels and firefighting resource constraints existing on 29 DEC 07 and the morning of 30 DEC 07.

Whilst there were particular circumstances at Goldfields Fire 13 excluded the of alternative tactics to direct flank attack, this suite of adverse circumstances will not always be in place at scrub-heath fires, and situations of declining fire behaviour resulting in a patchy and meandering fire edge will occur again at fires in the future. Therefore it is prudent that fire containment tactics for such situations be reviewed to pick up the improved knowledge of fire behaviour gained from Goldfields Fire 13.

It is recommended that a review of flank attack tactics in sandplain heath fuel types be conducted which takes account of the improved fire behaviour knowledge arising from Goldfields Fire 13.

» Light and Heavy Duty Tanker support for Goldfields operations

Tyres. Heavy and light unit tyre punctures became a significant problem at Goldfields Fire 13. It can be expected that similar problems will be encountered at any fires where flank attack through scrub-heath vegetation is involved due to occurrence of hard, sharp woody stakes left during line construction. It is recommended that light and heavy units deploying to Goldfields fires deploy with extra spare tyres, and the logistics unit give early consideration to the potential for frequent tyre punctures during fires in sandplain heath-scrub.

Tanker Replenishment. Water is a very scarce resource in the Goldfields region and substantial travel distances may be involved for tankers needing to replenish their water tanks. It is recommended that whenever extended operations with light and heavy tankers are envisaged, large water pumpers also be deployed to each staging area. The installation of hydrants/standpipes providing access to water from the Goldfields water pipeline for fire/emergency authorities should also be considered.

» Staging area access/egress.

Staging areas will often need to provide sufficient room for prime movers with low loaders to turn in, around, and out. In the case of Goldfields Fire 13, a problem arose when a charter bus collecting firefighters from the staging area became stuck fast on an obstruction whilst departing the staging area, delaying departure by about one hour. It is recommended that when establishing staging areas, turn in, turn around and turn out alignment and dimensions be considered and any necessary improvements made early during establishment of the staging area.

» Electronic information transfer from Operations Point.

As field observations and situation reports are made, and as aerial fire reconnaissance information arrives at the Operations Point new incident information is developed which needs to be passed to the IMT. The most efficient means of doing this is via email. There are a range of means of transferring information from the Operations Point including:

- Marking up maps by hand; photograph with mobile phone (Next G); transfer to IMT (requires mobile phones to have picture transfer functionality enabled)

- Marking up maps by hand; photograph with digital camera; download to laptop; email to IMT
- Digitise new fire event information in GIS at Operations Point; email shapefile to IMT or export updated fire map from GIS to pdf map format and email to IMT (requires access to corporate GIS data at Operations Point, GIS software application on laptop at incident, operator with suitable GIS skill at Operations Point)

It is recommended that DEC Fire Management Services consider different methods of rapid incident data capture for different level incidents (including initial attack phase, before or when Operations Points are being set up) and develop procedures to optimise incident data/information transfer.

7.2.4 Planning function

The essence of the planning function is involved with information management. The AIIMS manual (Third edition issued 2005) identifies the scope of the planning function as:

» Collection, evaluation and dissemination of information on the current and forecast situation,

» Preparation and dissemination of the plans and strategies that are to be used in controlling the incident,

» Collection and maintenance of information about the resources that are allocated to the incident, and

» Provision of management support services.

Having arrived at the ICC during the morning of Phase 2 of the fire, the main focus of the Planning Unit was getting set up in the ICC, locating local information sources (eg spatial data, maps) obtaining current information about the fire and current suppression strategies and their implementation, and producing an Incident Action Plan for the next day (30 DEC 07). Therefore the Planning Unit activities had little influence on fire operations on 29 DEC 07 other than seeking information from the Operations Point for production of the 30 DEC 07 IAP.

In terms of output, products provided by the Planning Unit and provided to the Operations Point were:

» A map of the fire at 12:50 (supplied to Operations Point by email at 15:46 and again at 16:06),

Products produced in the Planning Unit and provided to the IMT on 29 DEC 07 were:

» Production of personnel (shift) and equipment registers,

» Production of IMT meeting minutes,

» The Incident Action Plan (IAP) for 30 DEC 07 (supplied to Operations personnel at 08:00 30 DEC 07), and

» Maps of the fire as at 12:50 and 15:00

Strengths

Strengths evident in the setting up and commencement of incident planning on Saturday 29 DEC 07 included:

» Gathering information from IC and Operations on Incident strategies, sectorising of the fire and resources (personnel and equipment) at the fire,

» Production of the shift register,

» Documenting incident information and IMT meeting minutes

Issues and areas for improvement

» Incident Action Planning: Situation assessment - fire development/incident prediction

GHD has reviewed a range of IAP formats used in Australia (NSW, Victoria, Tasmania and SA), and the DEC template compares most favourably with the best of these. The sequence of the planning information is logical, and another key strength is that the plan format is relatively concise without missing important information. However, it has one key area where it can be improved, this being the "Situation Analysis" component of the plan.

Incident management objectives and strategies need to be based on what the fire will do in current and forecast conditions. One of the key roles of the Planning Unit is to prepare projections of how the fire is expected to develop in the forecast conditions. This usually involves preparing a map depicting where the fire is likely to spread during the period for which the plan is to apply. Fire spread projections often involve making assumptions that the current containment strategies will succeed, and where appropriate preparing a contingency plan (fire spread projection for the likely situation if the preferred strategies do not succeed).

In Goldfields Fire 13, during Phase 2 of the fire, formal fire spread projections (maps depicting likely fire spread) were not developed. The IAP prepared on 29 DEC 07 for the following day indicates a "High" level of probability that the selected containment strategy would succeed, and therefore that there would be negligible fire development on 30 DEC 07 (whilst acknowledging the forecast strong hot N/NW winds in the plan). Whilst no formal projections of fire spread were prepared, the potential for the fire to have impacts on the Great Eastern Highway was considered, the IAP reflected that the chief concern was smoke adversely affecting traffic on the highway. The IAP did not incorporate planning, objectives or strategies for the contingency that the containment lines on Alpha Sector (eastern flank) or Charlie Sector (SW flank) failed resulting in fire impacting the highway.

DEC's model IAP (issued with FOG 03) contains one key page pertaining to situation analysis (ICS 1.1 – 05/05 "Situation Analysis – Background and Objectives"). This page was completed and included in the Goldfields Fire 13 Shift 3 IAP (covering the period 08:00 to 21:00 30 DEC 07). The ICS 1.1 – 05/05 format provides useful triggers for consideration of the values at risk from the fire, operational constraints, and safety risks and hazards, however, with regard to analysis of the fire situation it is focussed on "Current Incident Behaviour" and lacks prompts or obvious areas in the format for consideration of potential or predicted (future timeframe) fire development. As ICS 1.1 – 05/05 is a primary tool in the IAP process for developing incident objectives, it could be improved to better prompt and require development of incident objectives that consider fire development potential at a range of future time scales.

DEC's model IAP contains page ICS 1.8 – 05/05 "IAP – Fire Behaviour Forecast". It provides a framework and process for the Planning Unit to consider, quantify and document what fire behaviour is expected during the period of the plan (future timeframe focus) and what implications there are for warnings and safety messages. ICS 1.8 – 05/05 was not included in the Shift 3 IAP prepared on 29 DEC 07 (ICS 1.8 – 05/05 was included in IAPs from shift 5 onwards).

The Shift 3 IAP also contained an additional page (not included in the FOG 03 model IAP) called ICS 1.2 – 9/01 "Situation Analysis – Strategies". Essentially, it provided a process for documenting the

strategy selection process. It includes a section for rating (high, medium or low) the probability of success of the strategies, but not considering the consequences or risks of the strategies failing.

One of the key issues emerging from the incident planning for Goldfields Fire 13 is a need to review the situation analysis component and improve the focus on predicted and potential fire development before deciding incident objectives and strategies. It is recommended that the Situational Analysis IAP forms (ICS 1.1 – 05/05 and ICS 1.2 – 9/01) and the Fire Behaviour Forecast (ICS 1.8 – 05/05) be reviewed and an improved incident objective and strategy development process that takes account of predicted fire development and incorporates a more robust, risk-based assessment of the factors which may cause the strategy to fail, and provide contingency planning for preferred strategy failures occur. Some templates from other Australian States, particularly NSW and Victoria, have aspects of situation analysis that WA can draw on, but in GHD's view there is no 'stand-out' IAP template available with respect to providing a robust framework for 'situation analysis'. The NSW 'Bushfire Appreciation' format provides a comprehensive template that is the best available, but which could be made more user friendly and deal with potential consequences more explicitly. It is worthy of DEC's consideration when reviewing the current DEC IAP template.

Further, some improvements to the IAP template should be considered which may assist in avoiding the potential for Incident Action Planning to be overly focussed on the 'next shift'. ICS 1.1 "Situation Analysis – Background and Objectives" could be enhanced by the provision of timescale prompts that encourage the planning unit to undertake incident potential projections for times both within and beyond the next shift (eg. consider prompts for 12, 24, 48 and 72 hours ahead). These would be particularly relevant to the Values at Risk, Safety Risks and Hazards, Weather and Incident Behaviour sections.

» Fire map production – GIS competencies

On 29 DEC 07, one of the key tasks of the Planning Unit was to prepare an accurate incident map for the fire. Another key mapping task was to obtain operational progress information from the Operations Point and update maps in the ICC to show progress, for the information of the IMT.

DEC's IMTs have taken up GIS technology, and make extensive use of GIS applications to prepare fire maps. This typically requires personnel trained in the use GIS software (DEC uses ESRI products) to access spatial data from corporate spatial databases, enter new fire event spatial data, and prepare map outputs (in electronic and printed versions). To do this specialist task, trained GIS operators are assigned to IMT's performing the role of "situation mapper". DEC has developed a high quality fire incident mapping application, used by GIS trained situation mappers to enter and capture fire event spatial information (fire boundaries, control line locations, fire vulnerable asset locations, Operations Point and Staging Area locations, etc). The application is well supported with a comprehensive user guide and training. At Goldfields Fire 13, a situation mapper was not deployed with the initial deployment of planning unit resources. The Planning Unit had to work around GIS skill gaps to prepare incident maps, which delayed map production and updating considerably, and reduced the level of quality achievable. As DEC's fire mapping standards and procedures have become increasingly reliant on GIS, it is recommended that a situation mapper be deployed with all Planning Unit deployments where the fire is likely to become a Level 2 or Level 3 incident.

7.2.5 Logistics Function

Logistics functions providing support for the strategies being implemented on 29 DEC 07 were effectively implemented. Having arrived in Kalgoorlie during the morning, catering for the evening meal in the field was organised for field crews, accommodation organised in Kalgoorlie, and crew transport between Kalgoorlie and the fire arranged. Diesel refuelling, a bulk water carrier, spare tyres and additional ICC support items and personnel were promptly organised.

The primary logistics issue arising during Phase 2 was how to accommodate the field crews and provide them with adequate rest while optimising their availability (shift length) at the fire. The IMT decided to accommodate all machine operators, the Narrogin tanker crew, a Sector Commander, and the Operations Officer at Koorarawalyee to facilitate a 06:00 start on 30 DEC 07. This was in recognition of the need to complete containment of the SW flank before the expected influence of strong northerly winds. All other field crews were accommodated overnight in Kalgoorlie.

Transit time between the fire and Kalgoorlie was approximately 2 hours. Hence, for the crews accommodated in Kalgoorlie, valuable, post-sunrise firefighting opportunity during the morning of 30 DEC 07 was lost whilst crews were transported back to the fire. Field crews did not reach their accommodation in Kalgoorlie until approximately 23:00 on 29 DEC 07 (departure from fire delayed 1 hour by crew transport bus becoming stuck on an obstacle). Crews arrived back at the fire at approximately 09:30 for briefing and deployment onto sectors.

Crew and IMT accommodation for remote area fires is a difficult issue faced by DEC and many other land management and fire agencies in Australia. On one hand there is the important need to manage fire crew fatigue. Firefighting is hot, sweaty and often strenuous work. Adequate breaks between shifts, with quality sleep, are essential for firefighter recuperation so productivity and safety can be maintained during operations. Accommodating crews and IMT personnel in the field in ‘fire camps’ can maximise the amount of productive time firefighters can spend on the fireline, however this must be balanced with the need to provide comfortable and quiet sleeping conditions so crews can get adequate sleep. Accommodating crews and IMT personnel long travel distances from the fire in comfortable accommodation where they can get a good sleep has the downside that it reduces the productive shift length due to transit time to and from the fire. Providing quality field accommodation, particularly in harsh environments such as the Goldfields, is a challenge which involves an organisational (including the firefighting workforce) commitment to, and investment in mobile fire camp infrastructure. The decision to accommodate crews and other personnel in the field at remote area fires presently rests with the IMT, and DEC is yet to develop policy or FOGs addressing remote camping of crews. There is really only one fire and land management agency in Australia that has a well developed and resourced fire camp capability – the Department of Sustainability and Environment (DSE) Victoria. DEC staff have recently visited DSE to scope up the issues associated with establishing a remote fire camping capability.

It is recommended DEC complete a feasibility analysis considering the pros and cons of field fire camps for remote fires, and develop policy and guidelines identifying the appropriate circumstances and standards (relevant for WA conditions) for accommodating crews and IMT personnel in the field at remote area fires. These standards could then provide the basis for developing mobile fire camp infrastructure specifications to enable appropriate cost estimates for the development of a ‘business case’ for investment in mobile fire camping infrastructure.

Subject to the feasibility analysis and business case supporting an investment in mobile fire camping capacity, it is further recommended that DEC seek the support of the WA Government to invest in and

build mobile fire camping capacity, recognising that it may have significant potential for application for use in response to other remote area emergency response operations.

7.3 Phase 3 - Fire escalation south of the Great Eastern Highway

The IMT had commenced operations on 30 DEC 07 with a high level of confidence that the flank attack strategies for containing the fire north of the GEH would be successful. From about 09:00 weather conditions deteriorated rapidly and from about 10:00 it became increasingly apparent that the strategies were not likely to succeed and had failed by 11:00. Section 7.3 of this report reviews the incident management issues arising during this critical phase of Goldfields Fire 13.

7.3.1 Summary of fire development and operational response during Phase 3

Weather conditions on 30 DEC 07 were forecast to reach extreme, with strong N/NW winds expected. As it turned out, weather conditions observed on 30 DEC 07 at Southern Cross (which are indicative of the conditions at the fire) recorded the third hottest December day (45.2^{o}C) ever recorded since measurements at Southern Cross began in 1908, and a sustained period of extreme fire danger (almost 10 hours continuous) that ranked in the top five days ever recorded for longest duration of extreme fire danger index at Southern Cross since FDI records began for that location in 1999 (BoM, 2008). As far as fire weather goes, it was a very bad day – *a worst case scenario*.

The adverse weather conditions created extreme levels of difficulty for fire containment, and fire escaped control efforts on the western end of the SW containment line and made a fast, high intensity run to the south, impacting the Goldfields water pipeline, powerlines and the Great Eastern Highway. This completely changed the circumstances facing the Incident Management Team and fire crews, and rendered incident objectives and strategies planned for the day untenable and redundant. Fire crews retreated from firelines to safety zones and the primary focus of activities throughout the afternoon became firefighter safety, management of road blocks and traffic on the GEH, and liaising with agencies responsible for power, water and other infrastructure regarding fire impacts to assets.

In preparing for the potential that smoke or fire may impact on the GEH, the IMT had requested WA Police resources and a FESA liaison officer to attend the Operations Point, the placement of smoke hazard warning signs on the GEH, and made an advisory phone call at 10:00 to McMahons (Main Roads WA contractors at Coolgardie) to advise that roadblocks may be required if fire broke through containment lines. However, the more detailed planning of how many road blocks would need to be established, their location, and what resources would required at the scene to promptly execute and manage these had not been undertaken (the IMT had expected containment action on the SW flank would be successful), by any of the agencies involved, before the fire broke containment lines. This left the IMT and field resources in a reactive situation when the fire escaped and made a run to the highway between 11:00 and 12:00.

Having crossed the GEH at about midday, the fire spread rapidly south in mature heath-scrub. Observed rates of spread approached 9 km/h. By 13:30 the fire had reached a large expanse of Eucalypt woodland about 10 km south of the GEH which halted the fire's southerly spread. During the afternoon, transient changes in wind direction from the NW to the W/NW periodically fanned the eastern flank of the fire creating new fire fronts which ran strongly to the SE when the winds returned to the prevailing NW direction. Periodically, tongues of fire formed in the unburnt heath-scrub north of the GEH and these ran south as narrow fingers to the highway.

Large numbers of vehicles built up at the road blocks during the afternoon, with motorists held at hot, windy and dusty parking bays exposed to mid-afternoon sun with the temperature over 40 ^{o}C in the

shade, and without access to drinking water or food. Public safety and welfare at the roadblocks became a significant issue. During the afternoon, convoys of traffic were periodically escorted through the roadblocks during periods when fire activity on the highway diminished, with fire activity observed and 'windows of opportunity' identified to ground crews from a helicopter positioned over the highway (a more detailed synopsis of traffic management actions taken is provided at section 7.3.2).

By 19:00 the full width of the southern fire perimeter was contained by a large expanse of Eucalypt woodlands and salt lakes. Fire behaviour along the uncontained eastern flank south of the highway had began to decline significantly as the wind speed dropped becoming light and variable. This lull in wind speed was due to the influence of an approaching trough which was forecast to bring a gusty S/SW change to the fireground between 19:00 and 20:00.

Just before 20:00 a S/SW change arrived at the fire. With the temperature still above 39 ^{o}C and the relative humidity below 10%, fire behaviour along the eastern flank escalated quickly when impacted by the strong SW winds that arrived with the change. With the passage of the trough across the fire ground, the winds continued to back quickly to the south. Fire behaviour along the highway adjacent to the eastern flank had escalated by 20:15, and a wide fire front that had formed 3 to 4 km south of the highway was running strongly north through Tamma scrub – a low dense highly fire prone form of scrub-heath – towards the highway, spreading quickly at a rate of around 4 to 6 km/h.

Between 18:50 and 19:15 (during which time the pre-trough lull in wind speed was occurring), DEC's helicopter conducted a fire reconnaissance flight over the southern extent of the fire. The Air Observer reported that fire behaviour on the eastern flank had reduced considerably (mostly smouldering and low flames around half a metre high, with the most active fire behaviour being at the far southern extent of the flank with flame heights at most of 1 to 2 metres). Upon receiving this report, the Incident Controller approved the re-opening of the Great Eastern Highway to traffic at approximately 19:20, with sentries to be placed on the highway east and west of the burnt area for the purpose of monitoring fire behaviour and the passage of vehicle convoys through the fire area, and re-closing the highway should the need arise (more detailed analysis of the decision to open the highway is provided at section 7.3.3). An unescorted convoy that had departed from Yellowdine (west of the fire) passed through the fire area just before 20:00 without incident. A convoy from Bullabulling (east of the fire) escorted by WA Police passed through the fire area just after 20:00, without incident, and with no escalation in fire behaviour apparent adjacent to the highway at that time.

By approximately 20:25, an unescorted convoy, which had departed from Coolgardie, began to arrive at the fire, by which time fire behaviour had escalated significantly adjacent to the highway. Some vehicles in the Coolgardie convoy drove through the fire affected area getting through to the west, however others, not willing to drive through the burning area, pulled over along the highway east of the fire affected area. The eastern fire sentry went to the aid of a truck which had continued west, and got into difficulty during its passage through the fire. The eastern sentry became stranded on the western side of the fire, as the fire behaviour escalated to the east of his position, preventing his passage back through to the east of the fire. This left the eastern side of the fire without a sentry to re-close the highway, with vehicles in the Coolgardie convoy continuing to arrive at the fire.

Four trucks, which had attempted to proceed through the burning area, did not make it through. Tragically, two of these trucks were impacted by fire during their attempt to drive through the fire (between 20:35 and 20:45) at the time the main fire front was arriving at the highway from the south. The fire front which impacted the two trucks was intense and fast moving. The three occupants of the two trucks died when the truck cabins in which they were sheltering became engulfed in flames. It appears

these two trucks were attempting turn-around manoeuvres at the time they were engulfed by the fire. The fire crossed the highway and continued spreading to the north until it ran into a 2006/07 fire scar late in the evening.

During the extreme fire weather conditions of 30 DEC 07, the fire expanded from 4,169 hectares to 21,502 hectares. A more detailed account of the fire's development during the afternoon and evening of 30 DEC 07 is provided in the *Goldfields Fire 13 - Fire Development Chronology* (GHD, 2008).

7.3.2 Traffic Management Operations on the Great Eastern Highway

Synopsis of traffic management events

When the fire broke containment lines and escaped control efforts during the hour before midday on 30 DEC 07, the available WA Police and DEC resources reacted quickly to close the highway east and west of the fire vicinity. Police and DEC units were positioned at each of the two initial roadblocks established east and west of the fire. With the road blocks in place and the most active fire behaviour well south of the highway, Police, DEC and the FESA liaison officer discussed opportunities to move traffic held at the roadblocks through the burnt area. It was decided that during lulls in fire activity on the highway, traffic convoys held at road blocks close to the fire could be escorted through the burnt area in both directions. These discussions and the decision process to commence moving traffic through the fire affected area are probably best described as an evolving process involving liaison between WA Police, FESA's liaison officer at the scene, and DEC's operational personnel at the scene, including communication with the Air Observer.

Between 12:30 and 13:00, Police and DEC units escorted one convoy of vehicles from the east of the fire through to the west, and one convoy from the west to the east. These initial traffic convoys through the fire area were escorted by Police and DEC vehicles, with safe clearance indications given from the DEC helicopter which was stationed overhead monitoring fire behaviour in the vicinity of the highway before and during the passage of each convoy.

Following successful escorted passage of the initial convoys, vehicle numbers at the western roadblock began accumulating again, with high numbers of vehicles building up in very hot dry weather conditions. The adverse physical environmental conditions were creating severe discomfort and unrest for motorists held at roadblocks near the fire. WA Police, FESA and DEC officers discussed options to reduce the volume of traffic arriving at the roadblocks near the fire.

Between 14:35 and 15:30 attempts were made to organise road blocks at Yellowdine further west of the fire, but there were no Main Roads WA contractors or Police resources made available to do so. With no road block able to be established at Yellowdine, large numbers of vehicles continued to build up at the western road block.

On the eastern side of the fire, WA Police established a road block at Coolgardie at approximately 13:45. Control of the Coolgardie road block was subsequently handed over to McMahons at approximately 16:30. Prior to this time, McMahons had been assisting with the road block on the eastern side of the fire. Initially the eastern road block was established at the fire by WA Police and was located near the safety zone at the fire, but during the early afternoon this was progressively moved further east. By 15:10 it had been moved back to Bullabulling where it remained for the rest of the day. These two road blocks (Bullabulling and Coolgardie) were effective in significantly reducing traffic volumes reaching the fire from the east. See Map 7 on page 33 showing the Goldfields Fire 13 road block locations.

Concerns rose about public safety and welfare in very hot conditions among the increasing volume of traffic held at remote roadblocks near the fire, in particular the western block. Discussions were again held between WA Police, FESA and DEC at the Operations Point regarding moving the significant volume of traffic held at the remote roadblocks through the fire affected section of the highway. It was again decided to move convoys through under escort during lulls in fire behaviour, under observation and with safe passage opportunities called from the helicopter.

At approximately 3:30pm a convoy was escorted through the fire area from the eastern side of the fire to the west. During the passage of this convoy, Police identified an erratic driver, which they detained on suspicion of a traffic offence. At approximately 15:35 two of the four Police officers at the fire left for Yellowdine to process the traffic offender. This left the road block and traffic management capacity at the fire under-resourced.

Further large, west to east convoys of traffic were escorted through the road block during the late afternoon. At some stage later in the afternoon, a roadblock was established at Yellowdine by WA Police. This was effective in reducing the traffic volume arriving at the western parking bay roadblock.

Whilst most of the traffic held at roadblocks to the west of the fire had been released through the road block during the course of the day, traffic held at Bullabulling and the road block at Coolgardie continued to be held during the afternoon. Motorists at these eastern roadblocks had observed convoys of traffic coming through from the west during the afternoon. McMahons contractors managing the Coolgardie roadblock reported to the Incident Controller increasing levels of frustration from motorists and truck drivers held at the Coolgardie roadblock.

During the afternoon at the ICC, a number of phone calls had been received from members of the public, and companies expressing frustration that the road had been opened to traffic from the west but closed to traffic from the east. Main Roads WA had also called the ICC requesting information regarding when the highway could be reopened. The overall effect was that during the afternoon, pressure had been building to re-open the highway. The Incident Controller resisted this pressure during the afternoon, and decided to personally focus on and deal with the escalating highway and traffic management issues, advising the IMT members of this intention, and leaving the remainder of the IMT to focus on preparation of the Incident Action Plan for the following day.

Between approximately 18:30 and 19:00, the Incident Controller initiated phone discussions with the Operations Officer regarding re-opening the highway. Initially, the Operations Officer expressed his preference not to re-open the highway. He arranged for a reconnaissance flight to be conducted by the helicopter which was done between 18:50 and 19:15. While the reconnaisance flight was being conducted, the Incident Controller, seeking to further prepare for re-opening the highway, had further discussions with the Operations Officer centred on identifying what arrangements needed to be put in place to provide for safe passage of traffic through the fire area, whilst managing the potential for increased fire behaviour should it occur with the arrival of a forecast S/SW change. Subject to the results of the reconnaissance flight, the Incident Controller and Operations Officer agreed to re-open the highway (see section 7.3.3 regarding the decision making process) to traffic from both east and west with the following arrangements in place:

» The Bullabulling convoy to be escorted by WA Police.

» The Coolgardie convoy to be released unescorted, with McMahons contractors having refused to escort traffic stating that they were only able to put in place and maintain a roadblock, but not to regulate traffic through a road block. Coolgardie Police advised the Incident Controller they were unavailable to assist due to other priorities.

» The Yellowdine convoy to be released unescorted

» It was planned that the WA Police vehicle would escort the Bullabulling convoy through to the west and then return to the eastern side of the fire to escort the already moving Coolgardie convoy through to the west,

» One DEC light unit to take up a position on the western side of the fire, as a road 'sentry', to monitor fire behaviour and re-establish a road block if fire conditions escalated,

» A FESA light unit to take up a position on the eastern side of the fire as a road 'sentry' to monitor fire behaviour and re-establish a road block if fire conditions escalated.

At 19:15 the Air Observer called the Operations Officer reporting near-still wind conditions and benign fire behaviour on the eastern flank (mostly smouldering and low flames around half a metre high, with the most active fire behaviour being at the far southern extent of the flank with flame heights at most of 1 to 2 metres). The helicopter needed to depart immediately for Kalgoorlie as last light was approaching. Having directed the agreed traffic management arrangements be put in place, the Incident Controller made contact with the eastern and western road blocks ordering their removal at approximately 19:20. The Operations Officer directed the DEC and FESA units to take up their positions on the highway which was done by approximately 19:40.

The Yellowdine convoy proceeded east through the burnt area at about 20:00 before any appreciable increase in fire behaviour, without incident. The Bullabulling convoy proceeded under WA Police escort west through the burnt area at 20:05 before any appreciable increase in fire behaviour, without incident. By the time the WA Police unit attempted to return east at approximately 20:15 to meet the west-bound convoy from Coolgardie, the fire behaviour adjacent to the highway had escalated significantly under the influence of the S/SW change, preventing passage of the Police vehicle to the east. The FESA unit had taken up a position thought to be on the eastern side of the fire, but which as the fire developed was found to be in the middle of the fire path. After attending to and providing emergency assistance to a truck at approximately 20:30 which had come from the Coolgardie and got into difficulty on the fire impacted section of the highway, the FESA unit became stranded on the western side of the fire leaving eastern side of the fire unattended with the unescorted Coolgardie convoy continuing to arrive at the fire which was now very active adjacent to the highway. Whilst many of the unescorted Coolgardie convoy pulled over and stopped on the eastern side of the fire, others continued driving west and attempted to travel through the burning section of highway. Two of these trucks did not make it through, and it would appear that whilst attempting turn-around manoeuvres to head back to the east, they became caught in the fire path, tragically resulting in 3 fatalities.

Traffic Management – Issues and areas for Improvement

Traffic management at fires can become a complex and potentially hazardous activity, as it did at Goldfields Fire 13. Traffic management complexity arises from a range of factors:

» The inter-agency nature of traffic management operations,

- Many road users, being members of the public, are likely not to understand or be familiar with the nature of fire and smoke hazards, or traffic management arrangements
- The potential for the actions of one member of the public to endanger other members of the public,
- The resources, communications and coordination arrangements necessary for safe and effective traffic management,
- The potential complexity of risk management decision making processes regarding when it is safe to allow passage of traffic along a fire affected section of road, and
- In some areas, the relatively infrequent occurrence of events requiring road closures or traffic management with the consequence that local staff may have little experience in implementing traffic management arrangements.

DEC had in place Fire Operational Guideline 75 at the time Goldfields Fire 13 occurred. FOG 75 is aimed at informing departmental officers involved in fire suppression operations of the powers, responsibilities, road closure types, notification requirements and mechanisms available to close roads during fire suppression operations.

FOG 75 does not provide guidance on the planning of, and preparations for road closures. In essence, FOG 75 sets out that DEC Officers may take action to close roads in the short term to ensure the safety of firefighters and the public, and sets out a procedure for notifying the road manager (in the case of the Great Eastern Highway – Main Roads WA) so they can take appropriate actions to formally close the road using their contractors, and seeking the assistance of WA Police.

As far as FOG 75 goes, DEC personnel at the fire implemented the guidelines to the extent they could. They undertook the following actions:

1. Requested and assisted WA Police to close the highway when fire broke containment lines and commenced a run which impacted the highway,
2. Notified Main Roads WA via the local Main Roads WA contractor (McMahons) that the highway was “fire impacted” and closed at the fire. Requested action by the contractor to put in place the formal road closures at Yellowdine and Coolgardie.
3. Provided personnel and vehicles with flashing lights and appropriate personal protective equipment to assist with road blocks.

As Main Roads WA’s contractors advised they were not able to establish a road block at Yellowdine, WA Police, assisted by DEC took alternative action to establish and maintain a road block on the western side of the fire.

FOG 75 did not provide guidelines beyond the road closure process and notification requirements. Therefore, during the afternoon of 30 DEC 07, DEC participated in a range of traffic management activities during the day with WA Police and the FESA officer at the scene, for which no DEC or inter-agency guidelines or procedures existed, including:

- managing the safety and welfare of the public held at roadblocks,
- regulating and escorting traffic through road blocks, and
- relocating roadblocks.

Further, in the absence of any guidelines (DEC or inter-agency) for re-opening roads, the Incident Controller, took a course of action he considered appropriate in the circumstances, liaising with Police, McMahons and the Operations Officer, then making the decision to re-open the highway and issuing instructions for how the re-opening was to be implemented.

Transport route closures due to fire inevitably attract considerable levels of public, media and Government interest, particularly when major transport routes are closed and there are no practicable detour alternatives or the closure remains effective for a lengthy period. It is often difficult for people not at the fireground to understand why a particular route is closed and remains so for some time.

There is often substantial pressure applied to fire services to re-open closed roads or allow certain individuals to have access to the fireground via the closed routes. These pressures can in some cases come from Government downwards. Guidelines applying to road closure and traffic management therefore need to be robust and provide clear and certain guidance for officers faced with what is often a very difficult task in deciding to close or re-open road or rail transport routes.

DEC found itself in a difficult position where it not only recommended major transport route closures, but by necessity had to step in to unfamiliar major transport route traffic management implementation roles, attending to the welfare of motorists at closure points, managing the movement of traffic through road closure points, and finally managing the re-opening of roads with large and multiple traffic convoys to be managed.

The traffic management approach implemented at Goldfields Fire 13 was a significant contributing factor in the tragic fire outcomes. Accordingly, there are a range of issues arising from the traffic management at Goldfields Fire 13 that require inter-agency consideration and review.

Integrating traffic management planning into the Incident Action Planning process - At Goldfields Fire 13, the potential for fire to adversely impact the Great Eastern Highway was recognised at the outset. The potential for such impact was a major factor in DEC's decision on 28 DEC 2007 to mobilise a prompt and robust fire suppression response. Whilst fire suppression strategies were planned early and suppression resources were mobilised quickly, the same level of planning and resource mobilisation was not applied to traffic management. One of the key lessons emerging from Goldfields Fire 13, for DEC, WA Police, Main Roads WA (and their Term Network Contractors) and FESA is the need to consider what the nature of potential fire impacts on roads might be during an incident, what traffic management strategies and resources will be required to manage the potential impacts, and make the appropriate arrangements for the necessary resources to be available and prepared to respond. If local resources are insufficient to meet identified requirements, then out-of area resources need to be sourced and mobilised (as is done for the fire suppression component of the operation). Traffic management requires inter-agency planning and response, and hence personnel from the appropriate agencies need to be made available to participate in the IMT's process of developing an incident traffic management plan.

» Guidelines or operating procedures for traffic management should go beyond the process of closing a road (current scope of FOG 75). Inter-agency guidelines or procedures should be developed which cover:

1. The roles and responsibilities of each agency in executing a road closure, and managing vehicle control points,
2. How the risk of road impact by fire and smoke should be assessed,

3. Traffic management planning guidelines for the IMT (planning process and format; factors for consideration in selecting roadblock locations and features, and planning alternative/detour routes),
4. The decision process and operational procedures for the planned closure of a road,
5. The decision process and operational procedures for the emergency (unplanned) closure of a road,
6. The decision process and operational procedures for establishing alternative traffic routes (detours),
7. The decision process and operational procedures for relocating a vehicle control points,
8. The decision process and operational procedures for regulating traffic through a vehicle control points,
9. Managing the welfare and safety of the public held at vehicle control points,
10. The decision process and authority for declaring a road safe to re-open,
11. The operational procedures for re-opening a road,

Following the extensive 2003 bushfires in south-east Australia, Victoria developed and implemented inter-agency procedures for road and traffic management during fires. These require inter-agency planning for road and traffic management issues by Incident Management Teams. WA Police, Main Roads WA, FESA and DEC have used the Victorian model to draft new inter-agency traffic management guidelines applicable for Western Australia. GHD has reviewed the draft WA guidelines as were current at 18 JUN 07. Whilst a most considerable improvement on arrangements in place prior to Goldfields Fire 13, it is GHD's assessment that they do not yet adequately address dot points 1, 2, 3, 4, 5 and 6 above. In particular, they would benefit from further improvement to identify the preparedness planning and arrangements appropriate before a road closure is required.

The Victorians again experienced a severe and protracted fire season in 2005/06 and the new procedures they had developed were widely implemented and tested. The guidelines were further strengthened following the 2005/06 and 2006/07 bushfire seasons. One of the key lessons learnt was a key need to conduct training in the new procedures, reinforced by inter-agency exercises so that any local implementation glitches can be sorted out before a real time event occurs when it is too late.

Exercises were subsequently conducted and the agencies involved recognised the considerable benefits that emerge from ongoing exercises. One of the strong benefits arising in Victoria was the interaction between the agencies and local personalities in a low stress exercise situation (as opposed to during a high stress real life situation). This enabled a clearer expression of authority and responsibility.

Without regular inter-agency exercises to practice implementation of operational guidelines for traffic management and appreciate the coordination issues, the situation can arise where a relatively junior officers from one Department may attempt to invoke provisions within their legislation, to the detriment of the coordinated effort if they do not fully appreciate the whole-of-incident context and inter-agency coordination issues.

Therefore in conjunction with developing new inter-agency guidelines for road closure and traffic management, development and delivery of relevant training will need to be implemented promptly, and supported by inter-agency exercising on a regular [suggest annual] basis.

7.3.3 Decision making process for re-opening the highway

At the time of Goldfields Fire 13, no guidelines existed to guide decision making processes for re-opening roads. In the absence of guidelines, on 30 DEC 07 the Incident Controller took responsibility for making the decision. In considering the issue of re-opening the highway, the Incident Controller consulted with Police, McMahons and the Operations Officer. The major points of consideration were:

» The fire behaviour at the time, and whether or not the fire behaviour may escalate to a level that could threaten the safety of traffic using the Great Eastern Highway if the road was opened, and

» The contingency arrangements for if fire behaviour did escalate, requiring traffic control and potentially a re-closing of the road.

Based on his local knowledge and experience of fire behaviour in the Goldfields, and aerial observations of fire behaviour between 18:50 and 19:15 along the highway and the eastern flank of the fire (as reported by the Air Observer), the Incident Controller assessed that:

» Current fire behaviour observed on the highway and eastern flank at the time he was considering opening the highway, posed no immediate risk to the highway,

» Fire behaviour along the eastern flank for a distance of about 8km from the highway was benign, and declining to a 'dead edge' which he considered very unlikely to become active again during the night,

» The most active section of the fire was 8 to 10 km south of the highway, contained to the north east by woodlands and therefore sufficiently contained by natural features and distant from the highway that it did not pose a risk that evening.

» The S/SW wind change was not due until approximately 21:00 and therefore the currently benign fire behaviour situation would decline even further by the time the change arrived, with significant fire behaviour escalation not expected to result from the wind change.

On this basis, the Incident Controller reached the conclusion that it was safe to re-open the highway with contingency arrangements put in place to effect safe passage for traffic and re-closure of the road if fire behaviour escalated requiring such action. The Incident Controller considered that the likelihood of fire behaviour escalating to a level that required a re-closure of the road that night to be low, and did not expect to have to re-close the highway.

Significantly, the assumption that the wind change was not due until 21:00 was incorrect. The incorrect assumption arose from the Incident Controller having read the tabulated *Forecast Conditions* section of the BoM spot weather forecast but not the accompanying *Significant Wind Change* section text which specifically indicated the S/SW change would arrive between 19:00 and 20:00, bringing strong and gusty wind conditions, and may be preceded by a lull in wind speeds during the hour before the change. The Operations Officer, with whom the Incident Controller consulted regarding arrangements for opening the highway, had not received or seen the spot forecast and was not aware of the timing of the change.

<u>Decision making process for re-opening roads – Issues and areas for improvement</u>

Decisions to re-open roads after a period of closure due to fire, are essentially a risk management decision. A zero fire risk approach is not always optimal as it may result in closure of a road for longer than necessary with potentially significant negative community and economic consequences. The key issue is that the level of fire risk is safely manageable (not necessarily zero).

The key factors in determining risk in relation to re-opening a road after a period of closure due to fire are:

» The proximity of uncontained fire edge (and contained fire edge if a risk of it breaching containment lines still exists) to the road,

» The time it will take the fire to travel to the road in the forecast weather conditions, and the potential fire impact zone along the road,

» The time it will take for smoke, which may impair visibility along the road, to create a level of hazard requiring road closure or traffic control,

» The 'warning time' available to the IMT (from detection and report that the fire is moving toward the road and when the fire/smoke will get to the road in the forecast conditions),

» What fire behaviour a fire reaching the road would have in the forecast conditions,

» The likelihood that an event requiring road re-closure will occur, and

» How long it would take to execute an effective re-closure of the road (in accordance with the traffic management plan proposed to be implemented if a road re-closure is required)

It is recommended that DEC,develop a road re-opening risk assessment process (intended for implementation by an IMT) that considers the above factors, uses current and forecast weather, uses an appropriate physical attributes based fire behaviour prediction model, applies worst case predicted weather and fuel factors, and applies a reasonable additional precautionary time factor to allow for contingencies that may arise in effecting the road re-closure. GHD is not aware of any road closure specific risk assessment processes in use in other fire and land management agences.

It is further recommended that the application of such a risk assessment process utilise BoM spot weather forecast information, and that the risk assessment prepared by the Planning Unit be considered by the IMT (including agencies responsible for implementing and maintaining the road closure).

Basing decisions on valid weather assumptions

A critical point contributing to the tragic Goldfields Fire 13 outcomes, included under this section of the review because it is directly relevant to considerations of decisions to re-open the highway (but which also has much wider implications) was the failure of personnel who had received the BoM spot weather forecast to identify the forecast lull in wind speed predicted to occur in the hour prior to the expected wind change, or the timing and description of the wind change itself.

From the interviews GHD conducted with DEC personnel who had received the spot forecast, all indicated they had 'missed' the *Significant Wind Change* notes on the spot forecast which appear immediately below the 3 hour tabulated *Forecast Conditions* section. In the course of this review, the author met with a number of DEC staff who are members of other DEC Incident Management Teams (albeit only a relatively small sample of the total numbers of staff in such teams) and it does not appear that there is a systemic issue with the interpretation of spot weather forecasts within DEC, or with the format of the forecasts themselves. It may be the case that this was a most unfortunate, but isolated case where all IMT personnel who saw the forecast did not read or register the important *Significant Wind Change* section. Whatever the case, this is a matter of concern that DEC will need to attend to, as a matter of priority, to ensure that all relevant DEC fire training modules give appropriate emphasis to the importance of weather forecast information, of interpreting these thoroughly, and the importance of

making the connection between the weather forecast information and its implications for fire behaviour, and in turn, its implications for incident management.

A second matter of concern was that the spot forecast, when received by the IMT at approximately 17:20, was not promptly distributed to Operations personnel. Whenever routine weather forecast updates or new spot weather forecasts are sought and received, it is imperative that the information contained therein be made available to and understood by personnel in the operational chain in a timely manner. Safety at fires has a couple of critical components from a weather perspective:

» Local Level Safety: Personnel in charge of fire crews at the fire ground, and crews themselves, must maintain a high level of situational awareness and maintain an ability to react tactically to locally induced weather effects that may serve to alter the generally prevailing weather (i.e. people at the fireground must look after themselves at all times and be alert to local weather variation).

» Incident Level Safety: It is imperative that the operations section are able to garner accurate and timely information about any significant changes to the generally prevailing weather pattern, from the IMT (where fire weather forecast information is usually received in the first instance). If the IMT is also in the field, then it must be able to garner such timely information from a person remote from the fire. Impending significant weather changes are not always apparent to field crews before their onset. It is essential that timely transmission of likely changes occurs to enable adequate warnings to reach the fireline, in sufficient time to alter tactics, rearrange the deployment of firefighters on the fireground, and/or to provide public warnings. All this means that a person who is not at the fireground, must be constantly alert to significant weather events, that may not be apparent to those at the fireground, and be in a position to provide timely warnings to the fireground and public when changed circumstances are likely. Such functions are usually undertaken within the planning unit of the IMT.

At Goldfields Fire 13 these weather forecast associated incident level safety matters were not adequately attended to. In the case of this fire, a more complete and wider understanding of the spot forecast may not have caused any different outcomes if those within the IMT and operations section still held expectations, that the fire behaviour would not escalate significantly due to their accepted historical ‘rule of thumb’ based understanding that fire behaviour in sandplain heath-scrub vegetation declines in the early evening (see more detailed discussion of this in section 7.10). Conversely however, if receipt of spot forecast information about the 19:00 to 20:00 timing of the wind change and the forecast pre-trough lull in wind speed had been communicated to operations section personnel, the more immediate nature of its impending arrival may have triggered higher levels of concern regarding the implications for fire behaviour escalation on the highway. Although a hypothetical proposition in this case, it serves to underline the importance of timely communication of weather information to operations section personnel at the fireground.

A number of inter-state incidents resulting in fatalities to firefighters have stemmed directly from a lack of understanding by field units about particular significant weather changes or events. In almost all cases, relevant forecast information had been provided to the fire organisation and/or IMT, but distribution systems in place did not provide timely transmission of that information to field operators – with tragic consequences.

Accordingly, to eliminate the potential for a future occurrence of the spot forecast distribution delays which occurred at Goldfields Fire 13, there is a need for DEC to put in place procedures that ensure that relevant weather forecast information, is regularly sought, and when received is promptly transmitted through the IMT organisation, and critically also, to persons with field operations responsibilities. Receipt

of weather forecast information by field operations, with confirmation that its content and implications for fire behaviour have been communicated to field units, should be acknowledged.

7.3.4 IMT arrangements and functioning

Incident Control and Coordination functions

The IMT was operating in Kalgoorlie carrying out incident control, planning and logistics functions. The operations function was being managed entirely from the field at the Koorarawalyee Operations Point. During the afternoon of 30 DEC 07 there were four significant planning and operations tasks:

» Operational management of the resources at the fire (fire reconnaissance and reporting, firefighting, asset protection, managing safe access to the fireground by infrastructure repair crews (eg. Western power), reorganising the allocation of resources as the tactical situation changed, and providing operational support to traffic management operations).

» Planning fire containment strategies for the next shift and beyond and developing the next shift IAP,

» Generating fire information updates to enable the issue of information and warnings to the public, agency administrators, and the media, and

» Planning, coordinating and executing traffic management operations on the GEH

These were all very significant tasks given the rapidly increasing complexity and operational tempo of the incident.

The Incident Controller was airborne conducting a reconnaissance of the fire at the time the fire escaped containment lines and ran south necessitating closure of the GEH. He flew over the fire during the period it was making a major run south of the highway and when the first convoys of vehicles were being escorted through the road blocks. He was informed about the location of road blocks (and observed these), Mc Mahon's refusal (on the basis of a lack of available local resources) to establish a road block on the western side of the fire, and the issues with large numbers of vehicles building up in the severe weather conditions. This provided him with good situational awareness of the fire and traffic management issues.

When the Incident Controller arrived back at the ICC in Kalgoorlie, he recognised the magnitude of the planning and operations tasks and the IMT resourcing constraints. He responded by requesting additional resources to form a full IMT (realising that these would not arrive until the next day). Further, he organised the activities of the available IMT resources such that the Operations Officer dealt with the tactical level operational management in the field; the planning unit focussed their planning efforts on preparing the next shift IAP and preparing fire information, and the IC undertook to personally manage the external liaison and coordination of traffic management. His intention was to ensure that the planning and tactical operations could be continued without being adversely impacted by the increasing demands of traffic management coordination. He considered this action necessary as the IMT was under-resourced to deal with the level of incident complexity that had developed during the afternoon, exacerbated by shortfalls in traffic control resources from Police and Main Roads WA.

The time demands on the Incident Controller of liaising and coordinating traffic management activities and responding to requests for incident information were high, and perhaps as a result of attending to these demands, the cohesiveness of the IMT diminished. Following his return from the reconnaissance flight at 14:00, only one IMT meeting was held prior to the highway fire fatalities, this being at 15:30. This

meeting focussed on current and next shift suppression options, and providing information to the planning unit so they could prepare fire information and the IAP for the next shift.

Focus on traffic management was at the tactical level and reactive to issues as they arose. There was an emphasis on moving road blocks away from the fire, welfare management of the public held at road blocks, and periodically releasing escorted convoys of traffic through roadblocks. This took considerable coordination, liaison and management effort on the part of the Incident Controller and Operations Officer. There was relatively less emphasis given to traffic management planning at the strategic level; for future timescales such as when the forecast S/SW change was due, and developing improved traffic management strategies and addressing resource shortfalls for the next day.

The experience and learning from Goldfields Fire 13 is that traffic management at fires can rapidly become a complex, time demanding and resource hungry activity requiring inter-agency coordination and both strategic and tactical management. Both the strategic planning and tactical management should be carried out by appropriately trained and experienced personnel from the agencies responsible for road and traffic management (not by the Incident Controller), and undertaken within the IMT structure.

Decisions to re-open a highway after a period of closure due to fire or smoke should be made by the appropriate authority, following strategic assessment and consideration by the IMT (see section 7.3.3 for decision making process), and on the final recommendation of the Incident Controller.

Planning Unit – The Incident Action Planning process

One of the key functions of the Planning Officer is to manage the preparation of the Incident Action Plan, which requires significant inputs from outside the planning unit as well as the sub-functional areas within the planning unit. Over the years, fire and land management agencies have developed comprehensive Incident Action Plan templates. DEC is no exception having in place Fire Operations Guideline (FOG) 03 "*Minimum requirements for Incident Action Plans*" which provides a structured and detailed IAP template for use by IMTs. Completion of an IAP for a complex incident, and in particular a quickly developing one, can entail several hours of work.

It can sometimes be the case that Incident Action Planning can become process focussed, with production of a comprehensive IAP, with detailed GIS maps and documentation of incident information in fine detail, becoming an end in itself. As Incident Action Plans are focussed on the next shift time period, if the planning unit becomes overly focussed on IAP production, it can be the case that it loses focus and engagement with current operations. This is often of little consequence when the situation and existing strategies for the current shift are progressing in accordance with the current plan, however, when the situation changes significantly, as happened at Goldfields Fire 13, there needs to be adequate planning focus on re-forecasting the current situation and reviewing short-term objectives and strategies. It was the case at Goldfields Fire 13, that the fire situation changed and increased in operational tempo dramatically during the course of 30 DEC 07 and required re-assessment and planning adjustment. From about 15:30 onwards, the under resourced planning unit had a significant focus on preparing the IAP for the next shift, and became less engaged in planning for the remainder of the current shift.

Addressing this shorter-term planning horizon in a structured way can be addressed through having a standing agenda item for IMT meetings which considers whether the current incident projections, and therefore objectives and strategies are valid and progressing according to plan. If they are not then this can serve to prompt up-dating of incident projections, objectives and strategies. This does not

necessitate the production of detailed GIS maps and a full new IAP – rapid analysis and hand drawn incident projections are appropriate in rapidly changing high tempo periods during an incident.

It is recommended that DEC review current procedures and training for the conduct of IMT meetings and planning unit meetings to ensure that appropriate planning attention is given to current shift situation, objectives and strategy implementation.

It can also be the case that dissemination of information relevant to other functions such as Operations and Logistics can inadvertently be delayed if planning unit information dissemination is on a cycle linked to completion of the IAP. It was the case that during the afternoon of 30 DEC 07, the planning unit was focused on preparation of the IAP for the next shift, and made little contribution to planning for the remainder of the current shift, a function largely undertaken by the IC.

Planning Unit – Information function

When fires affect roads, other major transport infrastructure (eg airports or trains), power distribution infrastructure, industries or communities, the requirement to generate information for public awareness and warning and for dissemination through the media escalates significantly. With a full IMT in place, these information functions are undertaken by the Information Unit (within the Planning section). The Information Unit prepares information in formats suitable for public and media consumption. Maps provided for the public and media can be quite different from the more technical maps prepared for the IMT. Fire situation summaries, briefing notes, press releases and information prepared for delivery to communities are very different in format and style than incident summary information incorporated in IAP production for IMT consumption. Therefore the staff within the Information Unit need to have a different range of skills and experience than staff in the Situation Unit, and carry out related but different tasks. The information Units within DEC's pre-formed IMTs are well practiced and highly competent at carrying out the Information Unit functions, as was demonstrated once Information Unit resources were assigned to the fire from 31 DEC 07.

In Goldfields Fire 13, on 29 and 30 DEC 07 fire information functions were taken on by the Planning Officer and Situation Officer, at times assisted by resources unit staff. This added significant additional workload, in tasks they were not practised at, to personnel whose primary functions are normally the development of incident development projections and the preparation of options of incident management objectives and strategies. Learning and experience emerging from Goldfields Fire 13 is that for fires that have the potential to impact key infrastructure, communities or industries, for level 2 and 3 fires an Information Unit should be mobilised to perform Information Unit functions.

Operations Functions

During the afternoon of 30 DEC 07, the operations units in the field were essentially taking refuge in safety zones as the fire was well beyond the limits of control. At times, operations resources were allocated highway monitoring and convoy escort roles in support of traffic management. For a brief period, containment work was commenced on the western flank of the fire south of the highway, but this was abandoned after a short period of time after erratic fire behaviour became a problem.

Strengths

Strengths evident during operations on Sunday 30 December 07 included:

- Operations briefings, including coverage of firefighter safety issues in the context of the expected severe fire potential conditions, were good,

- Crews were mobilised quickly onto the fireground once they arrived from Kalgoorlie,
- Good emphasis was given to the preparation of safety zones and egress routes to safety zones - these were very important for fire crew safety given the weather conditions,
- Tactical review of operations, and the reassigning of resources from Sector A to Sector C was done promptly,
- Prior to the re-opening of the highway, the efforts made by DEC fire crews in supporting road block operations, and managing public welfare at roadblocks in trying conditions (in under-resourced circumstances) were effective.

Issues and areas for improvement

- It was not clear which agency, or who, was in charge of managing roadblocks, and operations to release escorted traffic convoys through roadblocks. During briefings, prior to operations commencing, the Operations Officer on behalf of the Incident Controller should make clear to all personnel operating from the operations point at the fire (including personnel from other agencies), the command and control arrangements for traffic control, and the roles of DEC personnel in supporting traffic management operations.
- Should the need arise to close a road in an emergency (unexpected or unplanned closure), then once the road closure is established, the Operations Officer, on behalf of the Incident Controller should make clear to all personnel participating in or supporting road closure operations (including personnel from other agencies), the command and control arrangements for traffic control, and the roles of DEC personnel in supporting traffic management operations.

Logistics Functions

The main tasks facing the Logistics Unit during phase 3 of the fire were:

- Organising for the remainder of the “Blue Team” pre-formed IMT to mobilise and deploy to Kalgoorlie,
- Organise accommodation for incoming out-of area resources,
- Organise operations point catering,
- Responding to resource requests from operations,
- Once the fatality incidents occurred on the highway, organising critical incident counselling support for fire crews and personnel at Kalgoorlie.

These tasks were attended to efficiently. Through incident feed back obtained through After Action Reviews the following strengths were idendified;

Strengths

- Catering to the fireline was of a high standard,
- Accommodation was well organised and comfortable,
- Transport and travel arrangements worked effictively,
- Logistics Unit was prompt and accommodating in responding to incident needs,

7.3.5 Fatal Incident Response

When it became apparent that two trucks had caught on fire, the highway area for 100m either side of the burning trucks was declared a Hazardous Materials (HAZMAT) zone due to concerns about the hazard potential of cargo and fuel carried by the trucks. The HAZMAT aspects and area of the incident was allocated to FESA for management recognising their training and skills in HAZMAT incident management.

Ambulances were called promptly to attend to injured personnel. Although the IAP for 30 DEC 07 did not contain a Medical Plan (as is required by FOG 03 for all level 2 and 3 incidents), this does not appear to have resulted in any delay in medical response.

7.4 Phase 4 - Fire response 31 December 07 to 08 January 08

For the purpose of this review Phase 4 of Goldfields Fire 13 is the period from 31 December 07 to 8 January 2008, that being the period after the shift in which the fatal incidents occurred on the Great Eastern Highway, until the fire was fully contained. In this review, in accordance with the scope of works, Phase 4 is given less intensity of focus than Phases 1 to 3 which led up to and included the fatalities. After Action Reviews and Post Incident Analyses, conducted in accordance with DEC's Fire Operations Guideline 31, were reviewed for issues arising during Phase 4, and significant issues and trends identified for incorporation in this operational review. The following issues are addressed in sections 7.4.1 to 7.4.4:

- Critical Incident Response
- Agency Coordination – Operations Area Management Group (OAMG)
- Operations Point relocation
- Ongoing closure of the Great Eastern Highway

7.4.1 Critical Incident Response

The fatalities which occurred during the evening of 30 December 2007 added yet another level of complexity to an already complex incident. There was now not only an uncontained fire adjacent to a major highway and other important infrastructure to deal with, but a fatal accident scene to be preserved for investigation, continuing traffic management requirements with the GEH again closed, a range of staff suffering differing levels of critical incident stress to deal with, significantly increased media interest in the fire, and post-fatal accident response procedures to be implemented (including public and next-of-kin matters to attend to).

In addition to assigning additional firefighting resources from DEC's 'Blue' IMT, additional critical incident counselling resources were dispatched to the fire to undertake the process of post-incident stress management and counselling. The prompt arrival of critical incident counselling specialists to the fire, the efficient organisation for involved staff to receive counselling, and the manner in which the counselling was conducted was praised by staff and found to be of value. Beyond this general reflection that the procedures implemented were efficient and well received there was no more detailed analysis or post-incident review of the arrangements. This is possibly due to post-incident counselling not being listed as an agenda item for consideration during After Action Reviews and Post Incident Analysis.

It is recommended that FOG 31 be reviewed to include critical incident response/counselling as a specific item for consideration under the 'recovery' section. Further consideration should be given to

reviewing the arrangements successfully implemented at Goldfields Fire 13 and incorporating these into a Fire Operations Guideline on critical incident response.

7.4.2 Agency Coordination - Operations Area Management Group (OAMG)

The role of an OAMG is to assist in providing local resources and the activation of local arrangements, including recovery management to an operation (Westplan- Bushfire, 2005). Section 5.4 of the WA State Bushfire Emergency Management Plan (Westplan – Bushfire) details the considerations and triggers for appointment of an OAMG. It provides a high degree of discretion to an Incident Controller as to when an OAMG should be convened, with the only situation where it is mandatory to convene an OAMG being when there are multiple Level 3 fires burning in an area.

At Goldfields Fire 13 the initial convening of the OAMG was on 31 December 2007, after the fatalities had occurred. During DEC's After Action Reviews and the Post Incident Analysis workshop it was raised that for future incidents it may be beneficial to request the appointment of an OAMG earlier. In discussion it was raised that activating an OAMG may serve to improve commitment to the timely supply of local and out-of-area resources from support agencies to support the firefighting operation.

Whilst WESTPLAN – BUSHFIRE provides lists of issues for consideration by Incident Controllers, when considering whether to request appointment of an OAMG, it does not provides clear guidance on what level of issue complexity (for each of the issues for consideration) constitutes a level appropriate for triggering OAMG appointment. It is recommended that DEC develop a Fire Operations Guideline clarifying appropriate incident complexity/fire risk trigger points for requesting that an OAMG be convened. Alternatively, a process of jointly developing improved OAMG appointment triggers with FESA, for incorporation into WESTPLAN – BUSHFIRE, may be worthy of consideration.

7.4.3 Operations Point Relocation

On 31 December 2007, the Operations Point was relocated from Koorarawalyee to Yellowdine, due to the potential existing for fire to threaten Koorarawalyee from the south-east. Planning for relocation of the operations point was done during the evening of 30DEC07 and morning of 31DEC07. DEC personnel planning the relocation identified that it was not something they had done before, and they didn't have any planning templates or checklists to use so developed their own. They indicated that they found the operations point relocation planning task to be a relatively complex task, and felt that it may be useful to have a planning template developed and available for use in future operations.

7.4.4 Ongoing closure of GEH

Following the re-closure of the Great Eastern Highway immediately after the fatalities occurred, the highway remained closed for eight days. Authorities were understandably reluctant, in the aftermath of the tragic circumstances, to re-open the highway until the risk of fire impacting the highway was negligible. Some in the community hold the view that the highway was closed for longer than it needed to be, with negative impacts on business activities. Whilst keeping the highway closed until the risk of fire again impacting the highway was past was a rational and understandable approach in the circumstances, a future approach that maximises opportunity for traffic to safely use the highway, whilst ensuring that levels of fire risk are controlled is desirable. Risk assessment based decision support

systems are required to achieve this. The issue of improving decision making process for the closing and opening of roads in fire situations is discussed at section 7.3.3 of this report.

7.5 General Issues: Communications

Getting good communications in place early on large multi-agency fires is a challenging task, made more difficult when operating in remote areas, distant from the Incident Control Centre. This was the case at Goldfields Fire 13. Proactive efforts were made to establish good fire ground communications with the following results achieved:

- Internet email and web access was established promptly at the Operations Point,
- Landline phone communications were established from the Operations Point,
- Mobile phone coverage was available across much of the fire area,
- The majority of units at the fire were DEC Units and there was effective VHF radio communications between most units,
- Communications Plans for both the Operations Point and ICC were prepared and included in the Incident Action Plan on 29 DEC 07, providing relevant contact information,
- Communications and IT specialists were dispatched to the fire as part of the initial response on 28 DEC 07 to deal with any technical issues in establishing radio communications and IT network access.
- One of DEC's portable radio repeaters was dispatched to the fire as part of the initial response on 28 DEC 07, to assist in establishing radio coverage between units on the fireground and the Operations Point.

During the first three days of the fire, communications issues were not so much about hardware issues as about the available resourcing to deal with the volume and frequency of communication (particularly between the Operations Point and the ICC), and network planning to identify the most efficient deployment of portable radio repeater equipment on the fire ground. The issue of providing adequate resources to facilitate good communication between the Operations Point and the ICC is addressed in more detail at section 7.2.2 of this report.

With regard to communication issues raised during After Action Reviews and interviews, the following are the more significant issues to be raised:

- Due to the geographic scale of the Goldfields region, there is no VHF radio network operating across the Goldfields region with links back to the ICC in Kalgoorlie (as there is in more densely populated coastal regions). This made it difficult for the IMT to gain and maintain good situational awareness during the fast developing periods of the fire, and necessitated increased reliance on telephone usage.
- Due to the geographic scale of the Goldfields, fire/field operations vehicles are fitted with HF and UHF radios. Out-of-area vehicles deployed to the fire (from Perth Hills, Swan Coastal and Wheatbelt) were fitted with mid band VHF radios which are not compatible with HF radios. Hire vehicles used at the fire were not fitted with any radios. The result was that local Goldfields vehicles were unable to communicate by radio with out-of-area units at the fire,
- DEC units not fitted with UHF CB radios were unable to issue warnings over Channel 40 to trucks inbound to the fire,

- The VHF radio network established at the fire using portable repeaters and one of DEC's radio buses was slow to be set up effectively,
- Communications with the helicopter from Kalgoorlie could not be established, with sub-optimal work- arounds being established for SAR watch routines and fire information relay.
- The wide area network hardware equipment and services failed in the Kalgoorlie office due to the lack of back-up mains power and the equipment and services not able to be restored after the power failure. The power failures were caused by the main powerline being tripped out by Goldfields Fire 13.

With project funding from the WA Government, DEC and FESA are currently implementing a major VHF radio infrastructure upgrade. Both agencies are shifting from mid band VHF to high band VHF. New generation radios are available with UHF and high band VHF cross-banding, and these are in the process of being fitted to vehicles operated in DEC's remote regions. Completion of this radio upgrade will overcome issues of UHF and VHF radio incompatibility that was experienced at Goldfields Fire 13.

Currently DEC operates five communications buses which are fitted with a radio suite capable of UHF, VHF (mid and high bands) and UHF CB radio communication. Each is also fitted with a satellite dish facilitating satellite phone communication (to provide phone communication outside mobile coverage areas.

DEC also has two trailer mounted portable VHF repeaters which are deployed to fires where fixed repeater networks do not provide adequate VHF radio coverage.

At the time of Goldfields Fire 13, DEC was building a prime mover hauled communications trailer which is now nearing completion. This trailer has an extensive radio, satellite enabled phone and data communications suite.

With the appropriate integration of current and emerging communications technology, these mobile communications platforms provide DEC with good capacity to quickly scale up local communications infrastructure at fires. To optimise the effectiveness of the investment already made in these mobile communication platforms it will be necessary to upgrade existing units such that radio traffic at the fireground (analog) can be converted to digital format and transmitted to the ICC via existing wireless telecommunications networks or satellite communication technology.

With currently available 'radio over IP' technology, the potential exists for DEC to overcome the problems of relaying remote fireground radio communications to an Incident Control Centre many hundreds of kilometres away. DEC are currently investigating what upgrading is required for their current fleet of communications trailers and buses, to incorporate 'radio over IP' capability. It is anticipated that technical solutions will be available for trialling by the 2008/09 fire season.

DEC and the other Western Australian Fire hazard management agencies will effectively be in a radio infrastructure transition phase for a period of up to three years. During and after this time the new radio communication capacity that the upgrade will bring, will increase the complexity of communications planning at fires. Personnel allocated communications planning functions will need to have (or have ready access to) knowledge about who needs to communicate with who and what kind of communication (eg. voice, video, data), the capabilities and limitations of the different mobile communications infrastructure operated by DEC, and a practical understanding of how to deploy combinations of communications infrastructure across large firegrounds (potentially with topography related coverage issues), and inter-operability issues with other agencies. DEC will need to carefully consider the best way

to ensure that the suite of communications planning competencies are available at fires in the early stages when radio and communications networks are being designed and established.

It is recommended that DEC form a multi-disciplinary group (with IMT, field operations, radio technicians, IT systems, and training skills/backgrounds) to consider the competencies required by personnel filling the role of Communications Planner at fires. Careful consideration should be given to the level of 'technical' communications competence required of the position given existing access to technical advice available through DEC's radio/IT technical support fire duty roster.

There will be a need to consider what communications hardware needs to be established in locations to be used as ICC's, including provision of air to ground radio capability, and use of accessories that best suit IMT functions (eg. consideration of wireless headsets for appropriate IMT staff). Further, there needs to be a capability for all key computing and data transfer systems and hubs to be monitored on a '24/7' basis by the people responsible for daily and after hours emergency communications systems in DEC Fire Management Services.

7.6 General Issues: Fatigue Management

Fatigue is a significant issue that requires management at all multi-shift fires. In the bushfire management operating environment, fatigue management is a complex and challenging issue to manage. It is important to recognise from the outset that realistic approaches to fatigue management aim to manage fatigue, not attempt to eliminate it as a factor during firefighting. In particular, the following operating environment attributes come together to make fatigue management during bushfire suppression operations particularly challenging:

» Unlike structural firefighting operations, bushfires suppression operations often extend over many days, and it is not uncommon for operations to extend for many weeks.

» Most bushfires start or are reported during the afternoon, often late afternoon, after workers (who have core business work activities other than firefighting) have already been at work all day. It is a practical constraint that in rural and bushland areas it is highly unlikely that 'rested fire crews' will be available to respond to a fire that breaks out in the afternoon.

» It is widely recognised that bushfires are generally more easily brought under control in their early stages of development, and hence there are strong operational imperatives for an early, robust and sustained initial attack response to bushfires. This very often requires a response extending into and often through the night hours, when fire weather and behaviour have diminished, to achieve containment before the onset of adverse weather conditions the following day (so as to prevent escalation of fires to proportions that may otherwise take many days to contain). Extended first shift operations therefore are very often vital to successful early containment.

» The bush firefighting operating environment is frequently hot, dry, dusty and windy, and often requires strenuous work in demanding field conditions. Managing workforce fitness is a key component of managing fatigue.

» Bushfires come with a range of hazards (eg spreading fire and burning trees prone to falling or dropping branches) and potentially hazardous, higher-risk activities (operating chainsaws, earthmoving machinery and truck driving). All bushfire fighting activities require a degree of alertness and vigilance (which is adversely impacted by fatigue), and the higher-risk situations and activities

require higher levels of alertness and vigilance. There is no simple, one-size-fits-all solution for fatigue management at bushfires.

» Travel distances to bushfires, particularly in remote areas can be long, requiring early starts if operations are to commence following first light when conditions are conducive to productive, safe and successful operations.

7.6.1 DEC's Fatigue Management Guidelines

At the time of Goldfields Fire 13, DEC had in place *Fire Operations Guideline 12 – Guidelines for Fatigue Management in Emergency Situations* (version current during Goldfields Fire 13 was dated 17/09/07). The key elements of FOG 12 are:

» Fatigue management should be viewed as a 'shared responsibility' with the Incident Controller (supported by the IMT) responsible to ensure work schedules for personnel assigned to the incident permit adequate sleep, rest and recovery time, and incident personnel are responsible to ensure they use the 'non-work' time responsibly to sleep, rest and recover.

» An employee's first shift should not exceed 24 hours (including work time prior to responding to the fire, and travel time to and from the fire). The guideline recognises that a 24 hour first shift length may need to be exceeded in remote fires with long travel distances.

» Second and subsequent shifts should not exceed 16 hours including travel time. If there is no alternative to working a shift longer than 16 hours, the IMT should undertake a risk assessment to determine high risk activities and take steps to mitigate fatigue risks associated with these activities.

» Personnel who's work period exceeds 16 hours should be provided with a 10 hour rest break following their shift.

» There is a guideline that personnel who have worked in excess of 16 hours should be driven back to their place of rest.

» On completion of five consecutive day shifts or three consecutive night shifts, a minimum 24 hour rest period should be provided.

There are no national guidelines or standards for fatigue management at bushfires. DEC's guidelines are comparable to guidelines and procedures used in a number of other inter-state land and fire management agencies.

An important point to note in relation to DEC's fatigue management guidelines, is that most of DEC's multi-shift fire operations are two shift operations (a day shift and a night shift). In general these allow for a 12 hour 'on task' shift time, allowing four hours for shift change-over, travel time and before or after shift meals. DEC's fatigue management guidelines cater particularly to this two shifts per day operation scenario.

At Goldfields Fire 13, operations were on a one shift per day basis. This was primarily driven by the fact that heath-scrub fires present major difficulties for night firefighting operations (very difficult to locate the fire edge) and it is very rare for night shifts to be undertaken in Goldfields fires.

Usually, single shift per day operations in the Goldfields aim to start soon after first light to take best advantage of mild early morning conditions, (typically aiming to commence work on the fireline between 06:00 and 07:00, and continue until around sunset (typically until around 19:00). This results in an 'on task' period of around 12 hours, with meals, briefings, pre and post shift preparations (eg fuelling, water

replenishment, and equipment maintenance/preparation/pack-up), and travel to/from the fire needing to be completed within 4 hours. This can be difficult to achieve in remote areas where travel time to and from the fire can take up the full four hours, as it did at Goldfields Fire 13.

7.6.2 Fatigue Management implementation at Goldfields Fire 13

At Goldfields Fire 13, to deal with the challenging shift time management situation described above, a range of fatigue risk management actions were taken:

» Key operations supervision staff and machine operators were accommodated at Koorarawalyee close to the fire to reduce travel time,

» Other field crews were transported to and from their Kalgoorlie accommodation by bus, to reduce fatigue risks during the four hours of travel time to and from the fire.

» Meals catering was organised to occur at the Operations Point to reduce the meal time periods and maximise rest/sleep period.

For personnel in a single shift per day IMT it is typical for the work period to extend beyond that of the field crews. There are morning briefings of field crews to prepare for in the morning. At the end of the days operations, as there is no night shift to prepare an IAP for the following day, the IAP needs to be completed and approved by the end of the day shift. The most common cause of IMT personnel working beyond 16 hours is delays in finalising the IAP for the following day.

At Goldfields Fire 13, the first shift on Friday 28 DEC 07 was typical of many fires, with the fire being reported during the afternoon, initial assessment of the fire being made during the late afternoon with field crews providing reports by around sunset, and work extending into the evening to develop incident objective and strategies, identify resource requirements, consult with the State Duty Officer, organise and for out-of-area resources to be mobilised, and prepare for their arrival the following day.

It is common for key IMT personnel not to sleep well unless they feel they have fully prepared for the commencement of operations the next day. This can result in a relatively late finish to the first shift, followed by an early start to prepare for the incoming resources. For the first shift in Goldfields Fire 13 this was the general sequence of events that occurred. As far as implementing FOG 12 goes, it is evident that the 24 hour limit guideline on the first shift length was observed.

In the case of the second shift, which was in effect a ‘transition’ shift, there were a number of personnel who worked (inclusive of travel time) for periods longer than 16 hours and a number of these personnel did not have an 10 hour rest break at the end of their extended shift. Contributing factors to this included:

» Significantly extended travel time was involved in travelling during the early morning from home districts to Kalgoorlie and/or the fire,

» For IMT staff which arrived from Perth to the ICC during the morning, substantial time was involved in setting up the Kalgoorlie DEC office as an ICC, setting up equipment and systems, and getting oriented with local fire information and plans.

» Establishing communications routines with the Operations Point and building a picture and initial situational awareness of the situation at the fire.

The result was, as commonly happens during transition shifts, that the IAP was not completed until relatively late in the evening, and with an extreme fire danger day forecast for the following day there

were strong operational and safety imperatives to complete the IAP and rise early the next day to brief crews prior to operations commencing.

For field crews accommodated in Kalgoorlie overnight, the already tight second shift timeframes were compounded by the crew transport bus departure from the fire to Kalgoorlie being delayed by more than an hour when it reversed and became stuck on an obstruction at the Operations Point. Field crews got to their accommodation at around 23:00. This meant a shift longer than 16 hours for many, with the required 10 hour rest necessitating a 07:00 rise with briefings and transport to the fire to follow. A later than usual start to operations on 30 DEC 07 was necessitated to provide an appropriate rest break.

On the third shift, shift planning schedules to accommodate fire crew work:rest requirements were completely disrupted as a result of the fire fatalities which occurred that evening requiring critical incident response late into the night.

Beyond the third shift, another transition shift occurred during shift 4, as crews affected by the fire fatality incidents were rotated off the fire, and fresh incoming crews rotated in and with the arrival of additional IMT personnel resulting in some extended shift activity. After shift 4, shift rotation settled into a more regular single shift per day pattern again.

7.6.3 Improvements to DEC's fatigue management

The fatigue management guidelines contained in FOG 12 are generally appropriate and comparable with guidelines used by other land and fire management agencies in Australia. There are some minor improvements that could be made to the guidelines, to improve their coverage of how to treat consecutive days worked prior to commencing a five day assignment to a fire. The fatigue management guidelines used by Forests NSW and DSE Victoria may provide useful reference material in this regard.

However, the main issue facing DEC is addressing some factors that can make implementing the guidelines difficult.

Reducing travel times for remote area fires

Once the first shift and 'transition' (or build-up) phase have been completed, operations can settle into a routine, and provided that travel distances between the fire and crew accommodation are not great, the fatigue management guidelines can be implemented with appropriate discipline from the IMT and field crews. However, as travel from the fire to accommodation begins to exceed an hour (each way), fatigue management guideline implementation difficulty rises significantly. As travel time increases above an hour each way, two potential outcomes begin to emerge – either the fatigue management guidelines don't get complied with, or the productive shift time reduces below 12 hours, creating difficulties for implementing a two shifts per day shift routine.

To address the travel time reduction issue, there are two main options. The first is to transport crews to the fire using helicopters. This can be effective (but expensive), although it has limitations when large numbers of personnel need to be transported.

The second option is accommodating crews in fire camps in the field close to the fire. This can be done and is done effectively in the US, Canada, and more recently in Victoria. However, with the major objective being to get fire crews adequate rest and sleep, establishing fire camps that achieve this, for both day and night shifts, at hot, windy and often busy locations takes a considerable investment in fire camping infrastructure. Provision of field catering units, bulk refrigeration, showers, toilets and laundering

facilities, a first aid centre, comfortable quiet sleeping facilities providing good sleeping conditions (eg air conditioned by day), fire camp lighting, power generation and drinking water supply is a major logistical exercise.

In the US and Victoria, the IMT may also be set up at the fire camp, requiring all the facilities usually provided at command and control centres or offices to be set up in the field.

On the skills side, personnel that can plan how to best set up fire camp facilities in remote field locations, project manage their set-up, manage the camp efficiently, and then organise the demobilisation of facilities and equipment and rehabilitation of the camp are required.

Fire camps offer DEC a means of reducing travel time at fires, and are likely to have considerable benefits for fatigue management at remote fires, however, heading down the path of providing fire camps for remote fires will necessitate organisation level commitment (management and employees) to the fire camping concept, and significant investment in fire camp infrastructure, and developing staff capacity to deploy, establish and manage camps. Making the necessary investment in fire camping capability first requires policy decisions and frameworks (addressing such issues (among others) as identifying the situations in which fire camps should be used; the minimum standards for fire camp infrastructure; dealing with any industrial issues that may arise in fire camp use; addressing any inter-agency issues to establishing the IMT at fire camp locations, considering the environmental issues of establishing fire camps, etc) be established to support it.

It is recommended that DEC investigate the feasibility of fire camping, and if considered feasible and desirable, develop the appropriate policy and program frameworks to begin investing in and operationalising fire camping capability.

Fatigue management discipline, monitoring and reporting

Any guidelines, particularly ones with ‘advisory’ rather than ‘mandatory’ standards are only as good as the management commitment and discipline applied to applying them. It is apparent from Goldfields Fire 13 that fatigue management was identified as an issue, and active steps taken to manage firefighter fatigue in compliance with the guidelines, and where operational circumstances made non-compliance unavoidable, steps were taken to mitigate the risk.

Additional steps that could encourage greater scrutiny and application of fatigue management guidelines is a process of monitoring and reporting compliance during IMT meetings. For example, an activity which could be undertaken by incident safety advisors is to prepare a daily report on fatigue management compliance for both the IMT and field divisions, which tracks start and finish times and rest period lengths. Such a report need not be onerous to prepare, can provide incident personnel with the comfort that fatigue is being monitored, the monitoring and open reporting may provide a disincentive for individuals to work beyond maximum shift length parameters, and provides the IMT with a satisfactory information base from which to manage fatigue effectively.

It is recommended DEC develop a structured system for daily monitoring and reporting of fatigue management guideline compliance for daily consideration by IMT’s. Any resulting procedures should be incorporated into FOG 12.

7.7 General Issues - Aviation Management

At Goldfields Fire 13, DEC's contract aerial reconnaissance helicopter with pilot and Air Observer were mobilised early with the initial out-of-area resource mobilisation. It has not been common practice in the past for helicopters to be dispatched to Goldfields fires. The helicopter proved a most valuable resource in the management of Goldfields Fire 13, providing regular, accurate assessments of fire location and behaviour to support incident planning and operational decision making. The value provided by the helicopter was commented upon favourably in a number of staff interviews and After Action Reviews.

Two main issues requiring attention arose during Goldfields Fire 13.

Search and Rescue (SAR) watch procedures in remote locations

SAR watch procedures for DEC's contract helicopter are routinely carried out over DEC's VHF radio network. As a VHF radio network is not a practical option in the Goldfields region, the Goldfields region office did not have VHF radio communication with the helicopter to carry out mandatory SAR watch procedures. A system of using SMS text messages was used to overcome the lack of radio communication. While this was the best that could be done at the time, a better system needs to be developed to meet mandatory SAR watch procedures for future operations.

It is recommended that DEC Fire Management Services and DEC Goldfields Region review the available options for conducting SAR watch procedures when aircraft are operating in Goldfields region and develop procedures that fully comply with SAR watch requirements. The system/procedures developed are likely to have application for other remote areas that do not have VHF radio network coverage and should be adopted with any necessary local customising in those areas.

Rapid processing and distribution of aerial reconnaissance information

DEC WA's Air Observer's currently used proven, traditional hand drawn aerial mapping techniques for observing and recording the perimeter of a fire. This is supplemented by GPS data capture indicating the position of the aircraft. To get these hand drawn maps to personnel at the Operations Point and IMT, the aircraft must land and the hand drawn map scanned, copied or digitised and distributed electronically to those who need the mapped information. The maps used by Air Observers, upon which they mark the fire perimeter information are often developed from air photos or satellite images as these provide visual depiction that is most similar to and representative of the actual ground features they will observe from the aircraft.

In recent years, emerging technology is providing alternative means for Air Observers to map fires, and electronically download their maps to ground locations such as Operations Points and ICCs without the need to land. The key technology components to recently emerge that facilitate these new methods of mapping and downloading are Toughbook Tablet style Personal Computers, with external hard drives (terabyte capacity) for storage of spatial data, and "Next G" network communications. Current technology enables an Air Observer to hand draw fire perimeters on to a Tablet style PC screen displaying map information of similar quality as hardcopy printed maps prepared using air photo or satellite images.

DSE and CFA in Victoria are currently trialing Tablet PCs with Next G modems for aerial mapping of fires, and downloading over the internet without the need to land. The systems being developed are likely to be of interest to DEC.

It is recommended that DEC investigate the air observation electronic mapping and download systems being developed and trailed in Victoria to determine their potential application in WA. DEC should also

investigate alternative satellite technology to provide coverage for operations outside areas with NextG coverage.

7.8 General Issues – Potential application of Thermal Imaging technology applications

One of the significant challenges in controlling heath-scrub fires is identifying hotspot and active fire locations and prioritising areas for containment action. The following factors contribute to the difficulty of this task:

- Sandplain scrub-heath fires can cover large areas relatively quickly very often creating more fire perimeter that can be assessed or contained in one (or more) shifts
- Because of the sparse and patchy occurrence of surface fuels in heath-scrub, when the wind speed drops fire behaviour can decline and contract to small isolated patches of active burning (glowing embers and smouldering in coarse fuels) to the extent that the burning activity is very difficult to visibly detect,
- Very often there will be no vehicle access to the flanks of the fire allowing inspection for hotspots in sandplain country
- The low rainfall environment provides that in summer, coarse fuels will often be dry enough to continue burning for long periods of time until they burn out completely (i.e. they will often not burn-out overnight)

As a result, because it can be extremely difficult to differentiate areas with undetectable active hotspots from areas where the fire has extinguished, fire containment action, and mop-up and patrol resources are sometimes applied to the full fire perimeter (as they were in Goldfields Fire 13), with the consequence that scarce resources are expending effort on sections of fire that have no re-ignition risk.

Thermal Imaging Camera (TIC) technology has significant potential for application in heath-scrub fires. TICs detect heat (infra-red light spectrum radiation) which is invisible to the human eye. This provides a means of differentiating active hotspots from burnt out/extinguished areas. Thermal Imaging technology can be used at both the strategic and tactical level of incident management.

Infra red and multi-spectral line scanners

At the strategic level, thermal imaging equipment commonly referred to as line scanners, are fitted in fixed wing aircraft and deployed to fly at high altitude over a fire to obtain an image of the whole fire. The image is generated from infra-red and visible spectrum data, and provides a geo-rectified image of where the fire is in the landscape with other landscape features such as roads, rivers, ridges and valleys, residential areas, changes in vegetation cover visible in the image. These line scan images provide strategic fire intelligence of very high value to incident management teams, which use them primarily for optimising containment strategy selection, assessing backburning/burning out operations effectiveness, and the risk of fire breaching containment lines.

In NSW, land and fire managers access commercially operated line scanning aircraft through a government contract (current contract is with Air Affairs). A Daedalus 1268 line scanner fitted in a King Air aircraft is available for tasking year round, with the aircraft and line scanning equipment operated by the contractor. Recent specification in the contract of satellite downlinking provides for rapid data transfer to the ground immediately after the a scan is completed, for GIS processing and distribution to the IMT.

All NSW fire authorities (NSW Rural Fire Service, NSW Fire Brigades, Forests NSW and the NSW National Parks and Wildlife Service) can and do access the line scanner.

In Victoria, the Department of Sustainability and Environment (DSE) owns a Daedalus line scanner, and seasonally contracts an aircraft (with pilot) into which the line scanner is fitted. DSE contract a line scanner operator each season to operate the line scanning equipment.

Both Daedalus line scanners used in NSW and Victoria have been customised to the fire reconnaissance application over time, with significant modification made to correct for aircraft pitch, yaw and roll, and convert analog to digitial data for transmission over ground and satellite based communications systems.

The potential benefits of using line scanners for fire control operations in Western Australia are substantial, being as relevant to operations in WA as they are in the east coast operating environment. The two line scanner units operating on the east coast are unlikely to be reliably available for deployment on a call-when-needed basis to WA due to their high strategic value to fire and land management authorities in NSW and Victoria, and being subject to contract in those States.

It is recommended that DEC, in partnership with FESA, examine the potential applications and benefits of combined infra-red/ multi/hyper-spectral airborne sensors (such as those used in NSW and Victoria) for fire management in WA, and develop an operational trial program for an appropriate system.

GHD understands that Air Affairs Australia have recently purchased a second line scanner (as a back-up for their first unit) and are currently examining the commercial feasibility of offering services utilising their second line scanner within the Australian market.

Airborne Forward Looking Infra-Red Camera and Hand-held Thermal Imaging Cameras

At the tactical level, helicopter mounted forward looking infra red (FLIR) camera systems, and hand-held thermal imaging cameras (TIC) for use by ground crews can be used to identify the locations of visibly undetectable fire activity. This enables the IMT and field divisions and crews to optimise mop-up and patrol effort efficiency. The efficiency gains come from:

- Avoiding committing earth moving machinery (and escort tankers) to control line construction along sections of fire that have gone out,
- Avoiding the commitment of mop-up and patrol resources to sections of fire line that are out,
- Better prioritising and targeting of mop-up effort to the locations with the highest risk of containment line breaching (eg. specific hot spot locations adjacent to control lines)
- Increasing safety by enabling dangerous tree and limb identification without approaching within the danger zone of the falling tree/limb hazard,
- Reducing the amount of post-fire rehabilitation that needs to be done, by reducing the length of control line construction required.

The total of these efficiencies can be substantial, particularly on large fires with long perimeters as was the case with Goldfields Fire 13.

Land and fire management agencies in NSW and Victoria use both helicopter mounted FLIR units and portable hand-held TIC's. FESA in Western Australia use a helicopter mounted FLIR unit with video capability, with live IR/Video footage transmission capability.

Helicopter mounted FLIR units are typically used to locate areas of significant hot spot activity, so ground crews can be sent to the most active or highest priority areas. Hand-held TICs are used by the ground crews to then find and mop-up the individual hotspots. A range of makes and models are available.

It is recommended that DEC trial use of the FESA helicopter mounted FLIR unit in a range of forest, woodland and heath vegetation fires, to identify the operational applications in which FESA's current FLIR capacity may be of benefit during DEC operations.

It is further recommended that DEC investigate the potential for current generation hand-held TIC's to improve the prioritising and targeting of mop-up operations and develop an operational trial program to evaluate one or more units.

7.9 General Issues - Goldfields ICC

During Goldfields Fire 13, DEC's Kalgoorlie Office was established as the Incident Control Centre for the fire. The IMT customised the office to best meet their requirements. Overall the office served as a functional and effective ICC with some areas identified for improvement in the After Action Review process. The issues raised were chiefly relating to the availability of equipment (eg Whiteboards, map plotters, and office equipment for scanning, colour copying, and printing) and consumables (eg stationery and office equipment consumables) used by large IMTs during protracted operations.

It is recommended that Goldfields Region develop a standard ICC set-up plan for the office, in accordance with the Appendix 1 (IPRP Volume 2 section 5..2.1 Office Layouts) of FOG 07 *Guidelines for Incident Preparedness and Response Plans.* Consideration should be given to how important incident information is displayed in the ICC (eg fire operations map, fire development prediction maps, latest weather forecasts, incident communications, and incident resources information).

It is recommended that a minimum office equipment/consumables stock list (suitable for supporting pre-formed IMT operation) be developed for the office, with stock levels maintained through the fire season.

7.10 General Issues - Sandplain Heath-Scrub Fire Behaviour Prediction

The *Goldfields Fire 13 - Fire Development Chronology* (GHD, 2008) identified issues associated with the lack of a physical attributes based fire model for sandplain heath-scrub. In the absence of locally developed fire behaviour prediction models, fire appreciation and decision making during fire suppression operations (historically and during Goldfields Fire 13) are made on the basis of historical operational knowledge. This knowledge, not being well documented, is passed on orally through the firefighting workforce, and is often expressed as generalisations. While fire behaviour generalisations may be valid for a certain range of conditions, there are also a range of conditions for which they are not valid. The most commonly expressed generalisations (rules of thumb) of Goldfields fire behaviour knowledge include:

- *Except in extreme conditions, fires do not spread through Eucalypt woodlands,*
- *Fires in heath-scrub are benign overnight; active fire behaviour can expected to resume between 10:00 and 11:00AM,*
- *Heath-scrub fires are wind driven and can be expected to make high intensity runs during the day if there is sufficient wind, spreading in mature heath at rates up to or exceeding 5 km/h in extreme conditions*

» *As sunset approaches, fire behaviour begins to decline and by nightfall, fire behaviour becomes benign such that it is difficult to visibly detect the active fire edge and therefore fireline construction at night is impracticable.*

» *Fire will not propagate through fire scars up to 8 years old; it can be expected that running fires will stop when they reach fire scars less than 8 years old.*

During interviews held with both local DEC Goldfields staff and staff from other DEC regions, these generalisations were consistently provided in answer to questions about how fires behave in the Goldfields region.

Of particular interest is the assessment of fire behaviour potential around the time of the S/SW wind change which occurred just before 20:00 on 30 DEC 07. From interviews held, it appears that staff making assessments of the fire situation may have subconsciously been looking for fire behaviour cues that fitted the local 'generalised model' that fire behaviour begins to decline in the hour before sunset, and becomes benign as darkness falls and thereafter. Fire observations were made (from the air) along the north east flank between 18:30 and 19:15 and fire behaviour was observed to be reduced considerably (mostly smouldering and low flames around half a metre high, with the most active fire behaviour being at the far southern extent of the flank with flame heights at most of 1 to 2 metres). A further factor for consideration was the lull in wind speed experienced in the hour before the wind change. The reduction in fire behaviour that was associated with the lull in wind speed prior to the wind change may have served to reinforce any perception that observed fire behaviour was following the local 'generalised model'.

Under normal diurnal weather patterns occurring in average or close to average weather conditions, the approach of darkness is frequently associated with increasing humidity, decreasing temperature, and very often a decrease in wind speed in the absence of any topographic effects. With a relatively small change to any of these parameters, but particularly wind speed, a significant decline in fire behaviour often occurs which is readily apparent to on site observers. Even though very low fuel moisture content may continue to prevail, this by itself, in the absence of a threshold wind speed, may not be sufficient to sustain free burning and spread in patchy discontinuous fuel types such as sandplain heath-scrub.

In the case of 30 DEC 07, weather conditions were not average or close to average. The actual conditions leading up to the S/SW wind change were (using 20:00 data):

» Temperature: 39 ^{o}C (and had been above 40 ^{o}C since midday)

» Relative Humidity (RH): Less than 10% (and had been below 10% since midday)

» These temperature and RH conditions generate very low Fuel Moisture Content (FMC) conditions of around 3%

These conditions are significantly dryer and hotter than the average conditions (on which rules of thumb are frequently based) for this time of evening at this time of year.

The reduction in wind speed to near still conditions that was experienced at the fireground at the time the helicopter was doing its reconnaissance flight over the fire between 18:50 and 19:15 was not associated the normal diurnal weather cycle, often observed at this time of day, it was associated with the movement of the forecast trough which would be bring about a rapid and significant change in wind direction and speed. This lull in wind speed was that forecast by the BoM in their 17:09 spot weather forecast for the fire.

However, because of the pre-trough lull's timing in the early evening when such reductions in wind speed often occur under normal conditions and diurnal weather cycles, and in the absence of having read and understood the significant wind change notes in the spot forecast, it is likely that many firefighters and IMT members would have associated the reduction in wind speed as signalling declining fire behaviour for the remainder of the evening, as frequently occurs in the Goldfields (and as occurred the previous evening). As they now know, this reduction in wind speed was only transient, and was to precede a period of the strongest wind speeds for the day, and from a direction that would change the long, uncontained NE flank into a head fire.

The forecast 30 km/h S/SW winds with gusts to 50 km/h arrived and fanned fire, which had been burning quietly at that time, in fuels with a very low fuel moisture content likely to have been around 3%. The increased wind speeds resulted in an immediate return of the fire danger index to the extreme range. Using the forecast post-trough wind speeds with the DEC Mallee-heath fire behaviour model, a rate of spread approaching 5 km/h with flame lengths greater than 14 metres are predicted which turns out to be very close to the actual post-wind change fire behaviour which occurred. This certainly surprised many of the people who had prior experience with Goldfields fires whose understanding of heath-scrub fire behaviour was from the 'rules of thumb' reference points that had been passed down and may have been reinforced at fires they had personally attended in less severe weather conditions. None of the personnel GHD interviewed who were at the fire or in the IMT had ever seen or experienced sandplain heath-scrub fires burning near the upper limits of fire behaviour possible in that vegetation type, at that time of day. Unfortunately, these personnel can probably now state that the fire behaviour of this fire exceeded their prior experience with fires in these vegetation types.

It is equally clear that the weather experienced on 30 December 2007 fell into the very upper levels of severity, and this particular day ranks as one of the more severe fire days recorded for the locality – 3rd hottest December temperature, 5th longest duration of extreme fire weather period (ca. 10 hours).

The analysis above underlines the importance of using fire behaviour models based on physical fuel and weather attributes for predicting fire behaviour potential. Generalised time-based approaches are usually only valid when fuel and weather conditions are close to average, but become increasingly deficient as conditions depart further from average conditions. Whilst there remains a place for collective wisdom and experience to be handed down, it needs to be tempered with periodic analysis and review of known data and ought to be formally documented.

The *Goldfields Fire 13 - Fire Development Chronology* (GHD, 2008) has documented a number of the fire behaviour observations and learning from the fire and the fire behaviour analysis section may provide a useful (in the short-term) future reference for fire behaviour understanding in Goldfields vegetation. However, it is important that the current experience based 'generalised model' or 'rules of thumb' are replaced with a more robust model with a scientific basis.

7.11 General Issues - Fire Training Programmes

The primary purpose of this operational review is to identify lessons that can be learnt from Goldfields Fire 13, and make improvements to operational practices. A range of actions to improve operational practices have been identified in this review which will require implementation. Many of these will further require the review and amendment of training materials relating to the improved operational practice. A systematic approach to this task will need to be taken to ensure the full range of issues requiring

amendments to training packages are attended to. Therefore it is recommended that DEC's fire training specialists review the suite of accepted recommendations in this report, to identify the range of training packages that will require updating to reflect any changes to operational practice arising from this review.

The upgrading of training packages may take some considerable time and it is likely that not all packages will be able to be attended to before the next fire season (2008/09). In order for DEC's firefighting workforce to learn the lessons arising from Goldfields Fire 13 before the next fire season, particularly some of the more important lessons, there will need to be a process implemented that 'fast-tracks' communication of the learning points and operational practice improvements. The usual means of disseminating information via DEC's intranet, and disseminating amended Fire Operations Guidelines will be important as always, however, additional steps should be taken to maximise the take-up and depth of understanding of the issues and changes.

It is recommended that DEC conduct a series of workshops aimed at disseminating lessons learnt during Goldfields Fire 13 prior to the onset of the 2008/09 fire season. Priority areas for workshops to focus on are:

- Road closure, opening and traffic management at fires
- The fire appreciation process and situation analysis in planning
- Fire behaviour prediction and the decision trap of over-reliance on generalised anecdotal based understandings of fire behaviour; also, the implications of drought affected fuels
- Fire incident communications planning
- Operations – particularly tactics for control of heath type fires.

8. Recovery

The post-critical incident response and the manner in which critical incident counselling was organised and implemented is addressed at section 7.4.1.

8.1 Post-fire rehabilitation

The planning and procedures implemented for rehabilitation of fire suppression works at Goldfields Fire 13 were not considered in the After Action Review and Post Incident Analysis processes conducted after the fire. Rehabilitation planning was completed during the last incident management shift and referred the Goldfields region for consideration. Rehabilitation works were implemented after the AAR and PIA processes were undertaken.

It is recommended that an After Action Review be undertaken to consider the things done well and areas for improvement in the rehabilitation of Goldfields Fire 13.

8.2 After Action Review and Post Incident Analysis Process

DEC has in place *Fire Operational Guideline 31 - After Action Reviews and Post Incident Analysis* which establishes the procedures to be followed for reviewing and learning from DEC's management of fire incidents. FOG 31 is quite comprehensive in its provision of standard formats for After Action Review (AAR) and Post Incident Analysis (PIA) and suggested techniques for facilitators. FOG 31 was applied for Goldfields Fire 13 with AARs conducted at IMT level (and in some cases unit level), participating District level. A Post Incident Analysis was also conducted on account of the significant and tragic outcomes of the fire. Overall, both processes were applied as intended by FOG 31, were documented in each case, and provided DEC management with a detailed list of incident management activities and processes that went well and areas and suggestions for improvement.

What is not clear or outlined by FOG 31 is the process to followed in analysing and responding to the matters raised in DEC's AAR and PIA process. Additionally, DEC has commissioned and independent operational review of Goldfields Fire 13 (resulting in this review).

For completeness, it is recommended that DEC review FOG 31 with a view to providing clarification and guidance on the following:

» A monitoring and review process to ensure that the matters raised during AAR's and PIAs are appropriately responded to,

» Guidance on how to avoid duplication of effort in the PIA process that follows the AAR process, and

» How independent operational reviews fit in to the incident review and continuous improvement process.

9. “Identified learning points”

A key matter that requires emphasis at this point is that DEC staff, and staff committed to the fire by other agencies, were working in very demanding and severe conditions, on a rapidly escalating emergency incident with significant life, property and personal safety risks to manage. Post-incident analysis and operational reviews necessarily focus on key learning points and areas for improvement, with the aim of improving performance and avoiding a recurrence of tragic circumstances in the future. Whilst attempts are made to identify things done well at an incident, reports can never adequately recognise the enormous number actions carried out by individuals and teams that were carried out well. It cannot be over-emphasised that at Goldfields Fire 13, many people performed a very large number of difficult tasks well, at times requiring considerable courage, acting in good faith and carrying out their duties to the best of their abilities and in the public interest.

‘Identified learning points’ have been extracted from the discussion of strengths, areas for improvement and issues contained in the Operational Review (Chapter 7) and tabulated in this chapter together with relevant recommendations. Identified learning points become ‘lessons learnt’ after they are acted upon and the learning is translated into new operational practice. Therefore, it will be necessary for DEC to review these ‘identified learning points’ and associated recommendations, identify which are valid and acceptable, and, it is suggested, to put in place a Goldfields Fire 13 “Lessons Learnt” coordination team to plan the implementation actions required to implement the accepted recommendations and monitor the progress of implementation. A number of the recommendations in this report will require resourcing enhancements above current levels. Therefore, for each recommendation which is accepted for implementation, it will be necessary to consider the resourcing implications, and allocate appropriate additional resources. Without this critical step, accepted recommendations may languish un-implemented and therefore with key identified learning points not progressing to ‘lessons learnt’ in a timely manner.

The sequence used in this “identified learning points “ section of the report is Research, followed by the PPRR categories Prevention, Preparedness, Response and Recovery. This picks up the addition of research to the PPRR categories which was recommended in the Council of Australian Governments (COAG) Report from the national inquiry into Bush Fire Mitigation and Prevention conducted following the severe 2003 fire season.

As this section of the report summarises learning points arising in the foregoing sections of the report, important contextual information is missed if it is read in isolation from the rest of the report. To gain an adequate understanding of the issues raised, this report needs to be read in its entirety. GHD counsels strongly against readers forming conclusions based on reading the “identified learning points” section alone.

9.1 Research

DEC has maintained a sound bushfire research capability through the last few decades, whilst a number of other land management agencies have experienced significant contraction of their fire research capability. DEC's fire researchers have made among the most prominent contributions to Australia's current collective knowledge and understanding of fire behaviour and fire ecology. The recent completion of Project Vesta in WA's Jarrah forests have provided the most significant advance in forest fire behaviour scientific understanding since the first major forest fire behaviour models were developed in the late 1950s and early 1960's. Project Vesta was jointly designed and undertaken by DEC's fire scientists in partnership with CSIRO's bushfire behaviour and management research unit. Australia's current knowledge and scientific understanding of heathland fire behaviour is similarly underpinned by significant scientific research contributions from WA. Australia's fire and land management organisations have much to thank DEC WA for regarding their contribution to Australia's scientific understanding of fire behaviour. Despite DEC's nationally significant fire research efforts, there are still vegetation types in WA for which fire behaviour research is yet to be carried out, with Goldfields sandplain heath-scrub among these.

	Identified learning point: No scientific fire behaviour research has been conducted for the scrub-heath vegetation types which commonly occur in the goldfields region. Accordingly, incident management team personnel did not have an approved or recommended physical attributes based fire spread prediction model to use for incident planning and decision support, so they relied on local, generalised anecdotal knowledge based understanding of fire behaviour in the goldfields. This understanding proved to be deficient as the conditions experienced on 30DEC07 were outside the range of experience of those managing the fire. Operational analysis of the fire spread prediction table incorporated within DEC's *Guidelines for Fire Behaviour Prediction in Mallee-heath in southern Western Australia* identified that with some adaptation and modification, the Mallee-heath fire spread prediction table has potential for use in Goldfields heath-scrub fuel types (for further detail, refer to section 7.10 of this report, and *Goldfields Fire 13 – Fire Development Chronology* chapter 7).
1	**Recommendation:** DEC should examine the potential for Table 3 of the *Guidelines for Fire Behaviour Prediction in Mallee-heath in southern Western Australia* to be used for fire behaviour prediction in sandplain heath-scrub types. The scope of work for this activity should include identification of scrub-heath fuel types or attributes for which the model may not be applicable or requires correction factors, and to develop an operational and scientific research program to validate the applicability of the model if it is used. Note: DEC should determine whether current heathland fire behaviour research being conducted under the Bushfire Cooperative Research Centre (CRC) has application to sandplain heath-scrub fuel types.

9.2 Prevention

	Identified learning point: The Great Eastern Highway service lines corridor contains a concentration of important high value assets that require fire protection, but is also a source of fire ignition (by people using the highway). Presently there is no fire awareness and prevention signage along the highway aimed at reducing unlawful or inappropriate fire use during the bushfire danger period (for further detail, refer to section 4.4 of this report).
2	**Recommendation:** DEC should initiate an inter-agency working group (DEC, FESA, MRWA, local Government) to consider and develop a system of bush fire awareness and prevention signage along the GEH aimed at reducing unlawful and careless fire ignition. DEC should investigate the extent to which this recommendation is relevant to other major highways such as the Eyre and Brand Highways.
	Identified learning point: Along the GEH there are numerous car and truck parking bays (some are designated parking bays and others undesignated clearings which get used as parking bays) which provide locations for highway users to stop, and where some people may legally or illegally light camp or cooking fires. Many of these parking bays are located in non fire-prone areas, such as Salmon Gum woodlands, from which fires are unlikely to spread, but a number are located in highly fire-prone heath-scrub areas, such as the one in which Goldfields Fire 13 started. Within the parking bays located in heath-scrub areas, roadside vegetation within and adjacent to the parking bay is often mature or over-mature and in a condition conducive to fire escalation and spread. It would therefore appear that fire prevention has not been a consideration when planning the location and maintenance of parking bays on the GEH (for further detail, refer to section 4.4 of this report).
3	**Recommendation:** DEC should work with MRWA, local Government, and FESA to review the current network of parking bays along the GEH to identify opportunities to relocate fire prone area parking bays to less fire prone areas, and to establish fire prevention maintenance standards for parking bays and adjacent vegetation. Further consideration should be given to the provision of constructed camp/cooking fire places, with appropriate signage, within designated parking bays. In addition to parking bay location, consideration should be given to designating truck turn around points at appropriate locations, with signage that they are turn around points to be kept clear and not to be used for parking or camping.

	Identified learning point: The Wildfire Threat Analysis and Fire Prevention Plan (WTA&FPP) prepared for crown lands between Southern Cross and Coolgardie was acclaimed by incident management personnel to be a most valuable resource for identifying and prioritising assets requiring protection from fire, the fire risk assessments it contained were very useful for decision support in determining appropriate fire response, and raising awareness among asset owners/managers of the threats bushfires pose to their assets. A number of out-of-area firefighters felt that it would be highly beneficial to conduct the Wildfire Threat Analysis process in their own area. WTA&FPP is now the best practice benchmark for fire prevention and preparedness planning within WA, and many other higher fire risk areas than the Goldfields do not have any comparable inter-agency multi-tenure plan. This is a shortcoming and potentially a significant risk exposure for DEC and the WA Government in the event of adverse consequences fire occurring in such areas. Note: In NSW, an inter-agency Bushfire Risk Management Planning process similar to WTA&FPP is mandated by legislation (*the Rural Fires Act 1997*). The key features of the NSW approach are that the plans are risk focussed, strongly inter-agency and all-tenure in nature, and feature a community consultation process. Many features of the approach used in NSW are very relevant for WA, if WTA&FPP is to be expanded to a Statewide program. For details of the approach see section 4.1 of this report. Further, Victoria is currently running a pilot program called Integrated Municipal Fire Management Planning (IMFMP), also all tenure and inter-agency in focus and with community engagement. This project arose following recommendations from the Victorian Government's Inquiry into the 2002-2003 Victorian Bushfires, the 2003 Auditor-General's Performance Audit of Fire Prevention and Preparedness. For further details on the Victorian IBFMP approach see section 4.1 and 4.2 of this report.
	Recommendations:
4	DEC should review the WTA&FPP process used for Crown Lands between Coolgardie and Southern Cross, consider what improvements could be made (eg. coverage of communications capacity) to the process and format.
5	Given the current lack of an inter-agency, all-tenure risk based planning approach to bush fire prevention, mitigation and preparedness in WA, it is recommended that DEC in partnership with FESA, seek the support of the WA Government to develop and initiate an inter-agency risk management based approach (based on DEC and FESA's acclaimed WTA&FPP) to fire planning in high fire risk areas of WA (prioritised to areas where high values and fire likelihood and consequence intersect). This will require consideration of the required legislative and policy frameworks, planning standards and resources, and audit processes to monitor and report on plan implementation. Models currently in use in NSW and Victoria are worthy of examination in developing a WA approach.

	Identified learning point: The Wildfire Threat Analysis and Fire Prevention Plan (WTA&FPP) prepared for Crown Lands between Southern Cross and Coolgardie provided the basis of a 'business case' for DEC's Goldfields region to seek and obtain funding enhancements to undertake fire mitigation and preparedness works. Fortunately for DEC, the funding enhancement submissions were successful, which included the employment of a Regional Fire Coordinator, to coordinate and drive the range of planned works required, and the implementation of scheduled works was completed. A number of the trails upgraded during WTA&FPP implementation were used during Goldfields Fire 13. The key point here is that to realise benefits, WTA&FPP needs to be actioned, and this may require allocation of additional resources. If a WTA&FPP is conducted which identifies a range of necessary works and these are not implemented, then organisations can become exposed in the event of a fire that generates scrutiny of WTA&FPP implementation (for further detail refer to section 4.3 of this report).
6	**Recommendation:** In considering a roll out of the WTA&FPP process to other parts of WA, DEC and partner agencies need to identify a process for ensuring the necessary resourcing to implement WTA&FPP work programs.

9.3 Preparedness

	Identified learning point: The Incident Preparedness and Response Plan (IPRP) was acclaimed as a useful document and was used by incident management team personnel, particularly the logistics unit. The plan can be enhanced to provide improved pre-incident planning information on communications, and response for road closures to pick up learning points from Goldfields Fire 13.
7	**Recommendation:** DEC should review the Incident Preparedness and Response Plan for the Goldfields Region, consider what improvements could be made to the format and range of pre-incident planning coverage, and update the plan to incorporate lessons learnt from Goldfields Fire 13 (for further detail refer to section 5.2 of this report).
	Identified learning point: Goldfields Fire 13 occurred during a traditional holiday period between Christmas and New Year when a high proportion of businesses and providers of services in Kalgoorlie are closed down. This made obtaining goods and services for Goldfields Fire 13, and gaining assistance from other public sector departments and their contractors difficult. As it happened, when calls were made to obtain resources or the assistance of other service providers and emergency services, the result was often that requirements or requests were unable to be met. With hindsight it may have been a useful exercise to have contacted key service providers and government authorities to determine what level of service would be available from key businesses/departments that provide services to DEC during fires, and the periods during which any may be closed down over the traditional Christmas – New Year break.
8	**Recommendation:** It is recommended that prior to each Christmas – New Year period, all DEC regions contact their key fire goods and services suppliers and partner agencies to determine levels of availability and record these for use by Duty Officers (as is presently done in the DEC's south-west region).

9.4 Response

The response phase of emergency management encompasses a wide range of actions and processes. Therefore the lessons learnt under the response phase a further broken down to facilitate interpretation.

9.4.1 Reporting and Notification of the Fire

	Identified learning point: In the goldfields region motorists using the Great Eastern Highway (GEH) are the primary fire detection and reporting source for fires occurring in or adjacent to the GEH corridor. Given the relatively flat featureless landscape and the fact that a high proportion of motorists will be unfamiliar with the area, it is likely that many motorists would struggle to accurately describe the location of a fire should they find one and wish to report it through the 000 network, or worse still may provide a misleading fire location report (for further detail refer to section 7.1.1 of this report).
9	**Recommendation:** A fire prevention and education signage system (see recommendation 1) along the GEH should incorporate location information on signs to facilitate members of the public to make accurate fire location reports.
	Identified learning point: DEC did not receive notification of the initial 000 call reporting the fire until around 15:15 after other notification. While this is not likely to have been of any consequence for Goldfields Fire 13 it indicates there may be system failures for 000 call notification which could be repeated in the future with potentially serious consequences.
10	**Recommendation:** DEC and FESA should investigate the 000 call notification procedures implemented for Goldfields Fire 13 to identify the reason that DEC was not notified of the fire sooner. From this investigation, corrective action should be taken to ensure that all fires burning on or near DEC managed lands are reported to DEC.

	Identified learning point: DEC uses verbal fire reporting processes (to the Regional and State Duty Officers) for Level 1 fires and for the initial attack stages of higher level incidents. It is important that the State Duty Officer can quickly attain good situational awareness of fire potential in order to carry out their role of concurring with/suggesting amendment of fire declaration levels and considering appropriate out-of-area resource dispatch levels. A map based initial fire report format which facilitates visualisation of potential fire development maybe a better way of conveying current and potential fire information. This is particularly important for any fire that is likely to take more than one shift to control (for further detail refer to section 7.1.6 of this report).
11	**Recommendation:** DEC should review current procedures for initial fire reports and reporting of level 1 incidents, and consider a one page SITREP plus fire map style format for fires that are likely to take longer than one shift to control.

9.4.2 Initial Attack

DEC's initial attack response to the fire was well executed with a prompt and thorough initial response which anticipated the need for extended operations. Some learning points and improvements have been identified below which could further improve preparedness for initial attack.

	Identified learning point: Due to the large geographic area covered by the Goldfields Region, there is a significant likelihood that the initial attack crew will not be able to contain a fire during the first shift, thus requiring the initial attack crew to begin setting up an Operations Point for extended operations. Whilst this was done well during Goldfields Fire 13, there are some improvements that can be made to pre-incident planning for remote operations point establishment (for further detail refer to section 7.1.2 of this report).
12	**Recommendation:** DEC should consider what are the key requirements for the initial establishment of an Operations Point, with particular consideration of remote area fires, and assemble an operations point 'grab kit', and manifest of additional required items not in the kit, that can be quickly gathered by an initial attack crew tasked to respond to a fire. Pre-incident preparedness for establishing an Operations Point should also be covered in the Incident Preparedness and Response Plan.

	Identified learning point: Initial attack crews assemble highly valuable incident information at the scene of the fire (of high value to the ICC), often on hardcopy maps, battle boards or whiteboards (as occurred at Goldfields Fire 13). Current mobile phone technology enables pictures of such information to be taken using the mobile phone camera and sent to the ICC. This was in done during initial attack at Goldfields Fire 13.
13	**Recommendation:** DEC should consider the potential for mobile phones to transmit valuable visual fire information by initial attack crews, and consider what mobile phone functionality and plans are best suited for initial attack crew personnel.

9.4.3 Fire Category Declaration and Out-of-Area resource response

DEC assessed early that Goldfields Fire 13 would required extended attack operations and promptly mobilised out-of-area (from the wheat belt and coastal districts) IMT, fire crews and equipment, and aerial fire reconnaissance resources. These were tasked, prepared and underway within 2 to 3 hours of the fire being reported and the helicopter was dispatched at first light. This was a strong, prompt and very well executed mobilisation of firefighting resources noting the timing within the traditional Christmas/New Year holiday break. Some procedural matters relating to fire classification and declaration can be improved.

	Identified learning point: Fire Operations Guideline 83 promulgates the requirements for incident declaration. Any fire that will require out-of-area resources and will take longer than one shift to contain cannot be correctly classified as a Level 1 incident. A relatively simple incident (low complexity and low numbers of field resources) that may take longer than one shift to contain, but does not warrant dispatch of a pre-formed IMT cannot be correctly classified as a Level 2 incident. Therefore, particularly for remote regions, there are a range of fires that will take longer than one shift to control but do not require a pre-formed IMT that do not fit within the current fire classifications (for further detail refer to section 7.1.4 of this report).
14	**Recommendation:** DEC should review Fire Operations Guideline 83 to provide greater clarity for fire status classification, and improved decision triggers (risk and incident complexity level related) for personnel responsible for classifying fire status. The role of the State Duty Officer in fire status classification should also be clarified.

	Identified learning point: Fire situations arise (particularly in remote regions) where local resources available for incident management roles are not sufficient, but dispatch of a full pre-formed incident management team is not warranted. In such situations it becomes necessary to make decisions regarding what out-of-area incident management resources are required to supplement local resources. Such decisions hinge on levels of incident complexity for various IMT functions and sub-functions associated with a particular fire. Decisions made regarding what IMT supplementation is dispatched to an incident can have a critical bearing on the incident management capacity and effectiveness. Currently DEC has no guidelines to guide this important decision making process. .
15	**Recommendation:** DEC should review the decision making process for selecting which IMT resources to send to a fire to supplement local resources, and document procedures developed from the review. The review should identify the suite of positions (and competency levels) that are essential for effective IMT functioning, and those that are risk or situation complexity triggered. DEC may wish to consider whether there is a case to have a different (different from the standardised pre-formed IMT's used for complex, coastal region fire incidents) IMT composition for remote region fires.

9.4.4 Establishing the Operations Point

The initial attack crew had foreseen and prepared for the contingency that extended attack operations would be required, and they would need to establish an Operations Point. They took a computer, communication equipment, maps, fire planning and contact information, resource boards and other Operations Point equipment with them and established a functional Operations Point and staging area during the first shift. This was well executed, and facilitated prompt and productive commencement of operations during the second shift as out-of-area fire crews and equipment progressively arrived at the fire. Some system improvements can be made, particularly to communications planning when selecting and establishing Operations Points, which can further improve outcomes for establishing Operations Points.

	Identified learning point: The Operations Point is a vital operational command and control point, and communication hub between resources at the fireground and the IMT in the ICC. Units commanded from the Operations Point play a key role in identifying fire location and extent, features in the landscape (man made and natural) suitable for controlling the fire, and recommending or validating strategy options to the ICC. Therefore it is important that personnel at the Operations Point have access to good maps and information about the area where the fire is located (for navigation, safety and incident potential appreciation). With the trend over recent years away from use of hardcopy maps toward the generation of tailor-made maps using GIS technology, gaining access to quality maps (or the spatial data required to generate them) at fires in their initial stages is a very important operational consideration for the Operations Point (for further detail refer to section 7.2.1 of this report).
16	**Recommendation:** DEC review current procedures for making operations maps and spatial data for map-generation available at the Operations Point from the time it is established. Options for consideration include production of hardcopy fire map atlases, and external hard-drives (or DVD's containing regional spatial information relevant for fire management (that can be plugged into an Operations Point laptop computer), that are taken to the fire by an Initial or Extended Attack crew as part of an Operations Point grab kit.

	Identified learning point: The Operations Point is the communications hub for fire suppression operations. Establishing effective communications early on in large multi-agency fires is a challenging task, made more difficult when operating in remote areas, distant from the Incident Control Centre. As good communications is vital for effective operational command and control, incident communications arrangements require planning and mobilisation from the outset of an incident, when the Operations Point location is being selected and established. The communications planning function requires a specialised suite of skills and knowledge. Communications planners need to have (or have ready access to) knowledge about who needs to communicate with who and what kind of communication (eg. voice, video, data), the capabilities and limitations of the different mobile communications infrastructure operated by DEC, and a practical understanding of how to deploy combinations of communications infrastructure across large firegrounds (potentially with topography related coverage issues), and inter-operability issues with other agencies. DEC will need to carefully consider the best way to ensure that the suite of communications planning competencies are available at fires in the early stages when radio and communications networks are being designed and established (for further detail refer to section 7.5 of this report).
17	**Recommendation:** DEC should review the knowledge and skills requirements required for communications planning and identify the most appropriate means generating improved communications planning capacity within IMTs. Consideration should be given to the position being Operations Point based.

9.4.5 Incident Management – Control and Coordination

In general, the Incident Control System being applied at the fire was consistent with the national AIIMS model. It was clear within the command structure that the Incident Controller was in charge of incident management operations. Functional delegations (Control, Planning, Operations and Logistics) within the IMT followed a conventional AIIMS ICS structure. Fundamental incident management processes such as preparation of an Incident Action Plan for the approval of the Incident Controller were undertaken in accordance with routine DEC practice.

The firefighting component of Incident Management at Goldfields Fire 13 was well handled with a robust and aggressive 'safety first' approach. Firefighter safety management was a strength throughout the operation. Initial liaison and coordination functions were conducted in a timely and pre-emptive manner with the appropriate range of stakeholder agencies. Although this initial liaison was appropriate, subsequent liaison and coordination actions needed to be more persuasive and forceful (and OAMG activation triggered) when it became apparent that some authorities were reluctant or unable to commit appropriate resources to the incident. Whilst control of the firefighting component was generally proactive and well executed, incident management attention to potential 'consequences management' was more reactive. With the remote location, local resource shortages, and fast developing nature of the incident that changed from a fire control incident to a consequences management incident (traffic management and asset protection), this rapidly overwhelmed the Incident Control resources. Some of the higher priority incident management learning points arise from these matters of inter-agency liaison and the importance of consequence management planning.

	Identified learning point: The scope of activities to be managed by the IMT extend well beyond the activities involved in controlling the fire. Many of an IMT's operational management activities will relate to 'consequences management' incorporating preparing assets and communities for fire impact, and managing the consequences of fire impacts as these occur. In Goldfields Fire 13, there were significant fire impact consequences to prepare for and manage, due to the concentration of a national highway (GEH), high and low voltage power infrastructure, goldfields water pipeline infrastructure and communications facilities running through the fire area. The scale of incident complexity and management resources required is driven by this range of fire control and consequences management issues. In geographic areas remote from where incident management resources are available, lead times on mobilising resources can take many hours. Resources for consequence management need to be mobilised in timeframes that allow adequate preparation for the potential consequences. In the initial phases of Goldfields Fire 13, fire control resources were proactively mobilised however resources for consequences management were reactively mobilised and encountered significant non-availability issues when they were urgently required (for further detail refer to section 7.3.3 of this report).

18	**Recommendation:** DEC's (and other agencies) incident appraisal process used for determining IMT resourcing requirements should be reviewed to ensure appropriate attention is given to the consequences management component of incident control, and due consideration is given to worst case scenario requirements.
	Identified learning point: Section 5.4 of the WA State Bushfire Emergency Management Plan (Westplan – Bushfire) details the considerations and triggers for appointment of an OAMG. It provides a high degree of discretion to an Incident Controller as to when an OAMG should be convened, with the only situation where it is mandatory to convene an OAMG being when there are multiple Level 3 fires burning in an area. At Goldfields Fire 13 the initial convening of the OAMG was on 31 December 2007, after the fatalities had occurred. During DEC's After Action Reviews and the Post Incident Analysis workshop it was raised that for future incidents it may be beneficial to request the appointment of an OAMG earlier. In discussion it was raised that activating an OAMG may serve to improve commitment to the timely supply of local and out-of-area resources from support agencies to support the firefighting operation (for further detail refer to section 7.4.2 of this report).
19	**Recommendation:** DEC should establish appropriate trigger points for their Incident Controllers and IMT staff for future fire events; if it is then it is recommended that a Fire Operations Guideline on OAMG trigger thresholds be developed. Alternatively, a process of jointly developing improved OAMG appointment triggers with FESA, for incorporation into WESTPLAN – BUSHFIRE, may be worthy of consideration.

9.4.6 Incident Management – Planning

Incident Action Planning resources commenced their planning efforts during the 'transition stage' of the incident on Saturday 29 DEC 07, as resources began to arrive at the fire and commence operations. Having set up the planning unit after arrival at the ICC and encountering some difficulties with incident mapping and communications during the transition phase, the planning unit succeeded in developing an IAP that included identification of the intended containment strategies. Planning did not extend to considering the consequences of the preferred strategy failing. The 'transition phase' which is always a challenge for incident planning, was immediately followed by a 'blow-up' day and the failure of the preferred strategies, rendering all previously planned containment strategies redundant, and with inadequate planning in place for consequences management. This placed severe pressure on the planning unit which was under-resourced to deal with the range of planning functions and level of incident complexity and tempo it now had to deal with.

Subsequent to 30 DEC 07, when a fully staffed planning unit was established (and it should be noted that incident tempo had reduced) planning functions were generally well executed for the remainder of the incident. Some of the more important learning points identified from Goldfields Fire 13 relate to incident management planning, particularly ensuring appropriate planning attention is given to current, next shift, and longer range incident development and to consequences management if containment is not possible or is unsuccessful.

	Identified learning point: The Incident Action Plan (promulgated within DEC via FOG 03) is the key tool used in the incident action planning process. A key function of the IAP is to document the incident objectives and strategies, which are developed as a product of the incident action planning process. It is important that incident objectives and strategies give due consideration to how the fire is likely to develop in the future. One of the key issues emerging from the incident planning for Goldfields Fire 13 is a need to review the situation analysis component and improve the focus on predicted and potential fire development before deciding incident objectives and strategies (for further detail refer to section 7.2.4 of this report).
20	**Recommendation:** It is recommended that the Situational Analysis IAP forms (ICS 1.1 – 05/05 and ICS 1.2 – 9/01) and the Fire Behaviour Forecast (ICS 1.8 – 05/05) be reviewed and an improved incident objective and strategy development process that takes account of predicted fire development and incorporates a more robust, risk-based assessment of the factors which may cause the strategy to fail, and provide contingency planning for the possibility that preferred strategies fail.

	Identified learning point: The Planning Unit within the IMT needs to deal with incident planning at a range of different time horizons. At the shorter end of the timescale is how implementation of the current IAP is going and whether the objectives and strategies remain the most appropriate. At the longer end of the time scale is how the incident is likely to develop several days ahead. The IAP format is very much focussed on the 'next shift' timescale, with the potential that if incident planning staff become overly process focussed they may become 'blinkered' in the 'tomorrow' component of the time scale and potentially to not appropriately consider the shorter and longer term time scales (for further detail refer to section 7.3.3 of this report).
21 **22**	**Recommendations:** Improvements to DEC's IAP template should be considered which may assist in avoiding the potential for Incident Action Planning to be overly focussed on the 'next shift'. ICS 1.1 "Situation Analysis – Background and Objectives" could be enhanced by the provision of timescale prompts that encourage the planning unit to undertake incident potential projections for times both within and beyond the next shift (eg. consider prompts for 12, 24, 48 and 72 hours ahead). These would be particularly relevant to the Values at Risk, Safety Risks and Hazards, Weather and Incident Behaviour sections. To promote planning unit attention to current timescales, it is recommended that DEC review current procedures and training for the conduct of IMT meetings and planning unit meetings to ensure that appropriate planning attention is given to current shift situation, objectives and strategy implementation.
	Identified learning point: Incident planning, particularly the situation unit, has become reliant on GIS tools for access to and production of high quality incident maps. This reliance has reached the point where many personnel in Planning Officer or Situation Unit Leader positions do not have the GIS skills necessary to efficiently generate incident maps. As high quality incident maps and community information maps are required as early as possible during the development of an incident, personnel with appropriate GIS map production competence, are required during the initial scaling up of an incident from initial to extended attack (for further detail refer to section 7.2.1 of this report).

23 24	**Recommendations:** For IMT's in which the Situation Unit Leader does not possess appropriate GIS map production competence, a specialist 'Situation Unit Mapper' should be assigned to all incidents escalating beyond initial attack. IMT's need to have mapping redundancy arrangements in place for situations where as GIS qualified situation mapper is not available or when power or IT network failures prevent GIS map production.
	Identified learning point: A rapidly escalated incident tempo, which typically can arise following a significant change in the incident situation, has the potential to disrupt the flow of incident planning processes. The need for good communication between the four functional units of the IMT (and with providing incident support) is even greater during such periods. A systemised approach to incident planning needs to be maintained through such periods.
25	**Recommendation:** DEC review its incident planning process and tools (eg. Incident planning meeting schedules and agenda formats) with a view to providing system triggers that ensure planning and incident information communication processes are maintained through high-tempo operational periods.
	Identified learning point: Important 'significant wind change' forecast information contained in the 17:09 BoM Spot forecast, received by the IMT during the late afternoon of 30 DEC 07, was missed by all IMT personnel who received it. This is a matter of concern, for which corrective action to ensure greater emphasis is given to weather forecast interpretation is required. Further, the spot forecast and its contents were not communicated to the Operations Point until more than 4 hours after it was received. Because weather forecasts can contain information of key relevance to incident decision making and fireground safety, there is a need to put in place a more systematic approach to disseminating and acknowledging receipt of routine and spot weather forecasts, to eliminate the potential for recurrences of spot forecast handling and interpretation errors that occurred at Goldfields Fire 13.

26	**Recommendation:** DEC should develop a new Fire Operations Guideline specifically addressing BoM spot weather forecast ordering, access, receipt, distribution, interpretation and acknowledgement aspects, with appropriate emphasis given to ensuring forecasts are distributed to field operations locations in a timely manner. New procedures should emphasise the importance of reading the whole forecast and considering the implications of weather for fire behaviour. Any changes to procedures will need to be incorporated into relevant DEC training.
	Identified learning point: Learning and experience emerging from Goldfields Fire 13 is that for fires that have the potential to impact key infrastructure, communities or industries, significant Information function workloads are likely to arise. In such situations the situation unit and planning officer are likely to be fully occupied projecting the location, scale and timeframes for these potential impacts and planning for their management, and therefore not able to effectively carry out information functions (for further detail refer to section 7.3.3 of this report).
27	**Recommendation:** It is recommended that for fires that have the potential to impact key infrastructure, communities or industries, an Information Officer should be mobilised to perform Information Unit functions.

9.4.7 Incident Management – Operations

Operations functions at Goldfields Fire 13 in general were very well executed, despite the very challenging physical conditions and the communications difficulties that arose from the remote location of the fire. A feature of the operational management at Goldfields Fire 13 was the efficiency with which operations were executed, and their productivity, and above all the proactive and well executed attention to firefighter safety throughout the incident. Units of the Operations section assisted with traffic management, which is addressed at section 9.4.9. A range of learning points have been identified to further improve the implementation of operations functions at fires.

	Identified learning point: For the Goldfields Fire 13 IMT, gaining good situational awareness, particularly during the high operational tempo period on 30DEC07, was made more difficult than usual by the lack of a radio link with the fire. In less remote regions, the geographic area of the region typically has a network of radio repeaters that link back to the Regional Office. This means that real-time fireground radio traffic at the fire can be monitored in the Incident Control Centre (ICC). This provides a key means by which members of the IMT are able to maintain their awareness of the operational situation at the fire, reducing the level of enquires made from the IMT to the Operations Point to find out what is going on. Due to the large geographic area covered by the Goldfields region, it is not economically viable to provide radio coverage across the region or linkage back to the Regional Office. As the field based Operations Officer will usually be kept very busy managing operational resources, monitoring performance of tasks and the tactical situation, dealing with operational problems as they arise, and making changes to resource deployments on the fireground as the tactical situation changes, the situation is usually too busy during high operational tempo periods for the Operations Officer to effectively communicate a regular and adequate flow of fireground information to the IMT (this would require a substantial amount of time on the phone which detracts from the Operations Officer's ability to perform other functions). Remote operations require additional measures to be taken to overcome the challenges that arise with distance from the fire and lack of radio communication with the fire(for further detail refer to section 7.2.3 of this report).
28	**Recommendation:** It is recommended that at all level 2 and 3 fires, the Operations Officer in the field be provided with assistance at the Operations Point (with operational experience) to assist with maintaining good information flow between the operations point and the IMT, and carry out operations support functions. For further detail refer to section 7.2.3 of this report.

	Identified learning point: Staging areas will often need to provide sufficient room for prime movers with low loaders to turn in, around, and out. In Goldfields Fire 13, long vehicle turn around issues arose when the crew transport bus was manoeuvring to depart for Kalgoorlie and became stuck on an obstruction delaying the departure of crews (for further detail refer to section 7.2.3 of this report).
29	**Recommendation:** It is recommended that when establishing staging areas, turn in, turn around and turn out alignment and dimensions be considered and any necessary improvements made early during establishment of the staging area.
	Identified learning point: The usual flank attack tactics for heath-scrub fires is to closely follow the fire edge with earthmoving machinery (supported by heavy duty fire tankers) to construct a mineral earth containment line immediately adjacent to the fire edge. This flank attack tactic was found to be effective where the heath-scrub fire had been wind driven, leaving a relatively straight burnt edge to follow. However, significant problems were encountered attempting to implement this tactic along sections of heath-scrub fire which had not been wind-driven leaving a meandering and patchy fire edge (for further detail refer to section 7.2.3 of this report).
30	**Recommendation:** It is recommended that a review of flank attack tactics in sandplain heath fuel types be conducted which takes account of the improved fire behaviour knowledge arising from Goldfields Fire 13.
	Identified learning point: Water is a very scarce resource in the Goldfields region and substantial travel distances may be involved for tankers needing to replenish their water tanks. Tanker replenishment may be required relatively frequently where tankers are working in support of earthmoving machinery conducting direct flank attack operations along the flanks of actively running fire (for further detail refer to section 7.2.3 of this report).
31	**Recommendation:** It is recommended that whenever extended operations with light and heavy tankers are envisaged, large bulk water tankers also be deployed to each staging area. The installation of hydrants/standpipes providing access to water from the Goldfields water pipeline for fire/emergency authorities should also be considered.

	Identified learning point: Heavy and light tanker tyre punctures became a significant problem at Goldfields Fire 13. It can be expected that similar problems may be encountered at any fires where flank attack through heath-scrub vegetation is involved due to occurrence of hard, sharp woody stakes left during line construction (for further detail refer to section 7.2.3 of this report).
32	**Recommendation:** It is recommended that light and heavy units deploying to Goldfields fires deploy with extra spare tyres, and the logistics unit give early consideration to the potential for frequent tyre punctures during fires in sandplain heath-scrub.
	Identified learning point: On 31 DEC 07, the Operations Point was relocated from Koorarawalyee to Yellowdine. This required the preparation of a Operations Point relocation plan. Personnel planning the relocation identified that a relocation plan was not something they had done before and expressed that an Operations Point relocation planning template or checklist would be useful for the future.
33	**Recommendation:** It is recommended that DEC develop a procedure incorporating a planning template or checklists or both, for use when relocating Operations Points during fires.

9.4.8 Incident Management – Logistics

Logistics functions at Goldfields Fire 13 were in general well planned and executed. Incident logistical support to field units, facilities, and catering, which more often than not is an area of criticism at fires, attracted generally favourable comments from fire crews. The main issue arising in relation to logistics, that arose as an issue during Goldfields Fire 13 at this point is a policy issue for DEC rather than a current management issue for Logistics Units at fires. The key issue is the best means of providing quality accommodation and catering for fire crews at remote area fires whilst not adversely impacting on operational efficiency and fatigue management. This issue is dealt with in some depth at section 7.6 of this report.

	Identified learning point: The relatively remote location of Goldfields Fire 13 created significant challenges for managing firefighter fatigue whilst optimising their productive time at the fire. Travel time between the fire and accommodation was the main issue. Fire camps offer DEC a means of reducing travel time at fires, and are likely to have considerable benefits for fatigue management at remote fires, however, heading down the path of providing fire camps for remote fires will necessitate organisation level commitment (management and employees) to the fire camping concept, and significant investment in fire camp infrastructure, and developing staff capacity to deploy, establish and manage camps. Making the necessary investment in fire camping capability first requires policy decisions and frameworks (addressing such issues, among others, as identifying the situations in which fire camps should be used; the minimum standards for fire camp infrastructure; dealing with any industrial issues that may arise in fire camp use; addressing any inter-agency issues to establishing the IMT at fire camp locations, considering the environmental issues of establishing fire camps, etc) to be established to support it (for further detail refer to sections 7.2.5 and 7.6 of this report).
34	**Recommendation:** It is recommended DEC complete a feasibility analysis considering the pros and cons of field fire camps for remote fires, and develop policy and guidelines identifying the appropriate circumstances and standards (relevant for WA conditions) for accommodating crews in the field at remote area fires. These standards could then provide the basis for developing mobile fire camp infrastructure specifications, enabling the development of a 'business case', with appropriate cost estimates, for investment in mobile fire camping infrastructure. Subject to the feasibility analysis and business case supporting an investment in mobile fire camping capacity, it is further recommended that DEC seek the support of the WA Government to invest in and build mobile fire camping capacity appropriate for WA conditions, recognising that it may have significant potential for use in response to other (non-fire) remote area emergency response operations.

9.4.9 Road closure/opening and traffic management

Road closure, opening and traffic management became the key issue of Goldfields Fire 13. It is an area already identified by WA authorities as requiring significant attention to improve planning and procedures for future incident management operations. The identified learning points relating to traffic management are among the most important learning points arising from Goldfields Fire 13.

	Identified learning point: One of the key lessons emerging from Goldfields Fire 13, for DEC, WA Police, Main Roads WA (and their Term Network Contractors) and FESA is the need to consider what the nature of potential fire impacts on roads might be during an incident, what traffic management strategies and resources will be required to manage the potential impacts, and make the appropriate arrangements for the necessary resources to be available and prepared to respond. If local resources are insufficient to meet identified requirements, then out-of area resources need to be sourced and mobilised (as is done for the fire suppression component of the operation). Traffic management can become a complex and potentially hazardous activity (as it did at Goldfields Fire 13) and thus requires inter-agency planning and response. Accordingly, personnel from the appropriate agencies need to be made available to participate in the IMT's process of developing an incident traffic management plan (for further detail refer to section 7.3.1 of this report).
35	**Recommendation:** For all fire events which are assessed to have the potential to impact roads and/or traffic within the next 72 hours, the Incident Controller should contact the relevant road manager, WA Police and FESA, requesting their attendance at the ICC to assist with the preparation of an Incident traffic management plan. This request should be made as soon as practicable after it becomes apparent that fire has the potential to impact roads and/or traffic. This requirement should be incorporated in inter-agency fire and emergency incident road and traffic management procedures (see recommendation 32).

	Identified learning point: DEC's Fire Operations Guideline 75 provides guidance to DEC staff on their powers and the exercise of these in the emergency closing of a road in a fire. However, it does not provide guidelines beyond the road closure process and notification requirements. It appears at the time of Goldfields Fire 13 there were no other relevant road closure/opening and traffic management guidelines made available to DEC from other authorities. As road closure, opening and traffic management can be complex and potentially hazardous operation, comprehensive inter-agency guidelines for road and traffic management during fires would be of significant assistance to personnel who may become involved in road closure/opening decisions and operations (for further detail refer to section 7.2.3 of this report).
36	**Recommendation:** DEC's Fire Operations Guideline 75 should be replaced by comprehensive inter-agency procedures which address: 1. The roles and responsibilities of each agency in executing a road closure, and managing vehicle control points, 2. How the risk of road impact by fire and smoke should be assessed, 3. Traffic management planning guidelines for the IMT (planning process and format; factors for consideration in selecting roadblock locations), 4. The decision process and operational procedures for the planned closure of a road, 5. The decision process and operational procedures for the emergency (unplanned) closure of a road, 6. The decision process and operational procedures for relocating a vehicle control points, 7. The decision process and operational procedures for regulating traffic through a vehicle control points, 8. Managing the welfare and safety of the public held at vehicle control points, 9. The decision process and authority for declaring a road safe to re-open, and 10. The operational procedures for re-opening a road.

	Identified learning point: The decision to re-open a road when it has been closed for a period of time due to fire risk, is one that DEC personnel who staff IMTs can expect to have a leading role in during inter-agency fire control operations. A decision to re-open a road is one that will involve a risk assessment process involving assessment of fire spread and behaviour potential, and what time frames and operational resources are involved in re-closing a road should the need arise. A similar decision process is relevant for a decision to leave a road open when a fire is burning in proximity to a road. At the time of Goldfields Fire 13, there were no DEC or inter-agency guidelines or procedures to guide decision making processes for road closure/opening (for further detail refer to section 7.3.2 of this report).
37 **38**	**Recommendations:** It is recommended that DEC,develop a road re-opening risk assessment process (intended for implementation by an IMT) that uses current and forecast weather, uses the appropriate physical attributes based fire behaviour prediction model, applies worst case predicted weather and fuel factors, and applies a reasonable additional precautionary time factor to allow for contingencies that may arise in effecting the road re-closure. The road re-opening risk assessment process should address the factors identified in section 7.3.2 of this review. It is further recommended that the application of such a risk assessment process utilise BoM spot weather forecast information, and that the risk assessment prepared by the Planning Unit be considered by the IMT (including agencies responsible for implementing and maintaining the road closure).
	Identified learning point: Goldfields Fire 13 has highlighted a range of road closure/opening and traffic management training and competency issues, not just for DEC but for FESA, WA Police, Main Roads WA (and their Term Network Contractors) and Local Government. The introduction of new inter-agency road closure/opening and traffic management guidelines will generate the need for a suite of new training and exercising requirements for all agencies involved in road closures/opening and traffic management, and potentially also for new equipment.

	Recommendations:
39	The recommended review and development of new inter-agency road closure/opening and traffic management guidelines should include training specialists at appropriate stages to facilitate identification of the various road closure/opening and traffic management training requirements that will arise.
40	Development and delivery of relevant training modules will need to be implemented promptly, and thereafter supported by inter-agency exercising on a regular basis.

9.5 Communications

Currently, DEC operates five communications buses which are fitted with a radio suite capable of HF, VHF (mid and high bands) and UHF CB radio communication. Each is also fitted with a satellite dish facilitating satellite phone communication (to provide phone communication outside mobile coverage areas. DEC also has two trailer mounted portable VHF repeaters which are deployed to fires where fixed repeater networks do not provide adequate VHF radio coverage. At the time of Goldfields Fire 13, DEC was building a prime mover hauled communications trailer which is now nearing completion. This trailer has an extensive radio, satellite enabled phone and data communications suite. DEC's investment in mobile communications infrastructure has positioned it well to enable the rapid enhancement of fire ground communications in areas where fixed infrastructure does not provide adequate coverage. The chief issue remaining for DEC to address is to enhance the fit-out of the existing mobile repeaters and buses to improve communication at remote area fires where HF and VHF radio traffic integration is desirable, and a means of communicating fireground radio traffic back to the ICC is required (for further detail refer to section 7.5 of this report).

	Identified learning point:
	In DEC's remote regions, vehicles are fitted out with HF radios as there is no fixed infrastructure to support a VHF radio network in these areas. DEC vehicles and firefighting resources deployed from coastal, south-west forests and wheatbelt regional areas are fitted with VHF radios which are currently not compatible with HF radios. DEC and FESA are currently implementing a major radio upgrade program. The fitting of new generation UHF and high-band VHF cross-banded radios in DEC's vehicles operating in remote regions can overcome the present radio incompatibility issues.

41	**Recommendation:** It is recommended that DEC's vehicles used for fire management in remote regions be fitted with new generation UHF and high-band VHF cross-banded radios.
	Identified learning point: At remote area fires fixed radio repeater infrastructure networks are not available to relay VHF fireground radio traffic over long distances to the ICC. To optimise the effectiveness of the investment already made in DEC's mobile communication platforms it will be necessary to upgrade existing units such that radio traffic at the fireground (analog) can be converted to digital format and transmitted to the ICC via existing wireless telecommunications networks or satellite communication technology. With currently available 'radio over IP' technology, the potential exists for DEC to overcome the problems of relaying remote fireground radio communications to an Incident Control Centre many hundreds of kilometres away.
	Recommendations:
42	It is recommended that DEC investigates what upgrading is required for their current fleet of communications trailers and buses, to incorporate 'radio over IP' capability.
43	It is recommended that a 'radio over IP' technical solution be developed and available for trialing by the 2008/09 fire season.

9.6 Fatigue Management

DEC has in place fatigue management guidelines which are comparable to those used in other States. It also has in place a firefighter health and fitness program, which is important because fitness has a significant bearing on fatigue. DEC went to considerable lengths to implement their fatigue management guidelines at Goldfields Fire 13. There were periods during the fire when work:rest ratio guidelines were not achieved and these were mostly associated with IMT transition periods and on 30 DEC 07 when critical incident response extended well beyond the planned end of shift. The remote nature of the fire, with the long travel distances between the fire and crew accommodation location, made balancing fatigue management with optimising operational shift periods to the most suitable periods for firefighting very challenging. For further detail on fatigue management at Goldfields Fire 13 refer to section 7.6 of this report.

	Identified learning point: Fire camps may offer DEC a means of reducing travel time at fires, and are likely to have considerable benefits for fatigue management at remote fires. However, heading down the path of providing fire camps for remote fires will necessitate organisation level commitment (management and employees) to the fire camping concept, and significant investment in fire camp infrastructure, and developing staff capacity to deploy, establish and manage camps. Making the necessary investment in fire camping capability first requires policy decisions and frameworks (addressing such issues (among others) as identifying the situations in which fire camps should be used; the minimum standards for fire camp infrastructure; dealing with any industrial issues that may arise in fire camp use; addressing any inter-agency issues to establishing the IMT at fire camp locations, considering the environmental issues of establishing fire camps, etc) be established to support it. See recommendation 34 at section 9.4.8 of this report.
	Identified learning point: The Incident Controller, supported by the IMT is responsible for implementing fatigue management guidelines at fire incidents. For effective implementation monitoring of the periods being worked by personnel at the incident is required. Additional steps that could encourage greater scrutiny and application of fatigue management guidelines is a process of monitoring and reporting compliance during IMT meetings. For example, an activity which could be undertaken by incident safety officers is to prepare a daily report on fatigue management compliance for both the IMT and field divisions, which tracks start and finish times and rest period lengths. Such a report need not be onerous to prepare, and could provide incident personnel with the comfort that fatigue is being monitored, the monitoring and open reporting may provide a disincentive for individuals to work beyond maximum shift length parameters, and provides the IMT with a satisfactory information base from which to manage fatigue effectively.

44	**Recommendation:** It is recommended DEC develop a structured system for daily monitoring and reporting of fatigue management guideline compliance for daily consideration by IMT's. Any resulting procedures should be incorporated into FOG 12.

9.7 Aviation Management

At Goldfields Fire 13, DEC's contract aerial reconnaissance helicopter with pilot and Air Observer were mobilised early with the initial out-of-area resource mobilisation. It has not been common practice in the past for helicopters to be dispatched to Goldfields fires. The helicopter proved a most valuable resource in the management of Goldfields Fire 13, providing regular, accurate assessments of fire location and behaviour to support incident planning and operational decision making. The value provided by the helicopter was commented upon favourably in a number of staff interviews and After Action Reviews.

	Identified learning point: Search and Rescue (SAR) watch procedures for DEC's contract helicopter are routinely carried out over DEC's VHF radio network. As a VHF radio network is not a practical option in the Goldfields region, the Goldfields region office did not have VHF radios communication with the helicopter to carry out mandatory SAR watch procedures. A system of using SMS text messages was used overcome the lack of radio communication. While this was the best that could be done at the time, a better system needs to be developed to meet mandatory SAR watch procedures for future operations.
45	**Recommendation:** It is recommended that DEC Fire Management Services and DEC Goldfields Region review the available options for conducting SAR watch procedures when aircraft are operating in Goldfields region and develop procedures that fully comply with SAR watch requirements. The system/procedures developed are likely to have application for other remote areas that do not have VHF radio network coverage and should be adopted with any necessary local customising in those areas.

	Identified learning point: In recent years, emerging technology is providing alternative means for Air Observers to map fires, and electronically download their maps to ground locations such as Operations Points and ICCs without the need to land. The key technology components to recently emerge that facilitate these new methods of mapping and downloading are Toughbook Tablet style Personal Computers, with external hard drives (terabyte capacity) for storage of spatial data, and “Next G” network communications. Current technology enables an Air Observer to hand draw fire perimeters on to a Tablet style PC screen displaying map information of similar quality as hardcopy printed maps prepared using air photo or satellite images. DSE and CFA in Victoria are currently trialing Tablet PCs with Next G modems for aerial mapping of fires, and downloading over the internet without the need to land. The systems being developed are likely to be of interest to DEC.
46	**Recommendation:** It is recommended that DEC investigate the air observation electronic mapping and download systems being developed and trailed in Victoria to determine their potential application in WA.

9.8 Potential application of Thermal Imaging technology

Thermal imaging technology was not used (not available) at Goldfields Fire 13, however with the operating conditions with heath-scrub fires, thermal imaging technology application has the potential to improve fire mapping, containment line construction optimisation, and mop-up/patrol effectiveness.

	Identified learning point: One of the significant challenges in controlling heath-scrub fires is identifying hotspot and active fire locations and prioritising areas for containment action. As a result, because it can be extremely difficult to differentiate areas with undetectably active hotspots from areas where the fire has extinguished, fire containment action, and mop-up and patrol resources are sometimes applied to the full fire perimeter (as they were in Goldfields Fire 13), with the consequence that scarce resources are expending effort on sections of fire that have no re-ignition risk. Thermal Imaging Camera (TIC) technology has significant potential for application in heath-scrub fires. TICs detect heat (infra-red light spectrum radiation) which is invisible to the human eye. This provides a means of differentiating active hotspots from burnt out/extinguished areas. Thermal Imaging technology can be used at both the strategic and tactical level of incident management, and is currently used to good effect in NSW and Victoria. FESA in WA have helicopter mounted Forward Looking Infra Red (FLIR) camera capability presently. For further detail on the potential application of for thermal imaging technology for WA, refer to section 7.8 of this report.
	Recommendations:
47	It is recommended that DEC, in partnership with FESA, examine the potential applications and benefits of combined infra-red/ multi-spectral line scanners (such as those used in NSW and Victoria) for fire management in WA, and develop an operational trial program for an appropriate line scanning system.
48	It is recommended that DEC trial use of the FESA helicopter mounted FLIR unit in a range of forest, woodland and heath vegetation fires, to identify the operational applications in which FESA's current FLIR capacity may be of benefit during DEC operations.
49	It is further recommended that DEC investigate the potential for current generation hand-held TIC's to improve the prioritising and targeting of mop-up operations and develop an operational trial program to evaluate one or more units.

9.9 Fire Training Programmes

Although review of DEC's fire training programs was not within the scope of this operaional review, the review has made a number of recommendations which have consequences for DEC's suite of fire training programmes.

	Identified learning point: The primary purpose of this operational review is to identify lessons that can be learnt from Goldfields Fire 13, and make improvements to operational practices. A range of actions to improve operational practices have been identified in this review which will require implementation. Many of these will further require the review and amendment of training materials relating to the improved operational practice. A systematic approach to this task will need to be taken to ensure the full range of issues requiring amendments to training packages are attended to.
	Recommendations:
50	It is recommended that DEC's fire training specialists review the suite of accepted recommendations in this report, to identify the range of training packages that will require updating to reflect any changes to operational practice arising from this review.
51	As training packages may take some considerable time to review and update, it is further recommended that DEC conduct a series of workshops aimed at disseminating lessons learnt during Goldfields Fire 13 prior to the onset of the 2008/09 fire season. In order for DEC's firefighting workforce to learn the lessons arising from Goldfields Fire 13 before the next fire season, suggested priority areas for workshops to focus on are: » Road closure, opening and traffic management at fires » The fire appreciation process and situation analysis in planning » Fire behaviour prediction and the decision trap of over-reliance on generalised anecdotal based understandings of fire behaviour; also, the implications of drought affected fuels » Fire incident communications planning » Operations – particularly tactics for control of heath type fires.

9.10 Recovery

The main recovery activities to be undertaken for Goldfields Fire 13 were Critical Incident stress counselling for personnel at the fire, and the implementation of After Action Review (AAR) and Post Incident Analysis (PIA) processes after the fire. Both these activities were done well, and comprehensively.

	Identified learning point: The fatalities which occurred during the evening of 30 December 2007 resulted a range of staff suffering differing levels of critical incident stress. Critical incident counselling resources were dispatched to the fire to undertake the process of post-incident stress management and counselling. The prompt arrival of critical incident counselling specialists to the fire, the efficient organisation for involved staff to receive counselling, and the manner in which the counselling was conducted was praised by staff and found to be of value. Beyond this general reflection that the procedures implemented were efficient and well received there was no more detailed analysis or post-incident review of the arrangements. This is possibly due to post-incident counselling not being listed as an agenda item for consideration during After Action Reviews and Post Incident Analysis.
	Recommendations:
52	It is recommended that FOG 31 be reviewed to include critical incident response/counselling as a specific item for consideration under the 'recovery' section.
53	It is further recommended that consideration should be given to reviewing the arrangements successfully implemented at Goldfields Fire 13 and incorporating these into a Fire Operations Guideline on critical incident response.

	Identified learning point: After Action Reviews and Post Incident Analysis procedures were followed to review and learn from DEC's management of Goldfields Fire 13. Both AAR and PIA processes were applied and documented in each case, and have provided DEC management with a detailed list of incident management activities and processes that went well and areas and suggestions for improvement. What is not clear in existing guidelines (Fire Operations Guideline 31 – After Action Review and Post Incident Analysis) is the process to be followed in analysing and responding to the matters raised in DEC's AAR and PIA process. Additionally, DEC has commissioned and independent operational review of Goldfields Fire 13 (resulting in this review). .
54	**Recommendations:** For completeness, it is recommended that DEC review FOG 31 with a view to providing clarification and guidance on the following: » A monitoring and review process to ensure that the matters raised during AAR's and PIAs are appropriately responded to, » Guidance on how to avoid duplication of effort in the PIA process that follows the AAR process, and » How independent operational reviews fit in to the incident review and continuous improvement process.
	Identified learning point: After Action Reviews and Post Incident Analysis procedures implemented for Goldfields Fire 13 were not able to consider post-fire rehabilitation planning and implementation as these ahd not been completed at the time.
55	**Recommendation:** It is recommended that an After Action Review be undertaken to consider the things done well and areas for improvement in the rehabilitation of Goldfields Fire 13.

10. Acknowledgements

In preparing this report, GHD has received tremendous assistance from DEC staff involved in the fire management operations for Goldfields Fire 13, and staff of DEC's Fire Management Services Unit. In particular, I would like to acknowledge the openess and frankness with DEC staff involved in the fire willingly shared their knowledge, observations and experiences at the fire, despite the fact that for many, this was undoubtedly a difficult experience given the tragic circumstances of the fire. The staff of DEC's Fire Management Services Unit conducted an extremely comprehensive collection and compilation of fire records and information to facilitate the review, and responded promptly to all requests for fire data and information from GHD. Without this willing and well organised contribution it would not have been possible to develop a clear and discriminating chronology of the fire's development and the operational response.

I wish to acknowledge in particular Ryan Butler, Rick Sneeuwjagt and Lachie McCaw who accompanied me during field investigations to observe first hand the landscape features, vegetation/fuels and post-fire evidence, and Terry Maher, Bob Chandler, Anna MacDonald and Jennifer de Bono who organised and coordinated the provision of fire information and arranged the extensive schedule of staff interviews.

I am most grateful for the review of the final draft of this report, undertaken by Mr Ross Smith, and the wise, very practical comments provided which drew on his considerable depth of knowledge and long experience of fire management operations in Australia.

Lastly, I wish to acknowledge the contributions of fellow GHD staff who assisted me with the preparation of this report; Craig Wilson for his assistance in creating fire maps; and Peter Moore who assisted with preparation for, and conduct of DEC staff interviews and draft reviews.

Appendix A

Goldfields Fire 13 – Operational Review: Terms of Reference

CONTRACT BRIEF - GOLDFIELDS FIRE 13 OPERATIONS REVIEW

VERSION 140208

BACKGROUND

A wildfire known to the Department of Environment and Conservation (DEC) as Goldfields Fire 13 burnt 43,000 ha of natural woodlands and heath vegetation in the period 28th December 2007 to 8th January 2008 in the vicinity of the Boorabbin National Park on the Great Eastern Highway between the towns of Coolgardie and Southern Cross.

The fire was fought by a multiagency team lead by the Department of Environment and Conservation as the agency responsible for fire management and suppression in national parks.

On 30th December 2007 two trucks were incinerated when the fire intercepted them on the Great Eastern Highway. Three occupants of the trucks were killed. A coronial inquiry will be conducted into the circumstances of the fire.

DEC is undertaking a series of reviews of the fire and related matters (see diagram attached) to determine the facts and to identify lessons that might improve future fire suppression. The reviews will be made available to the Coroner.

Independent professionally qualified consultants will undertake two of the reviews, namely the *Fire Development and Chronology* and the *Operational Review*. This call for tender relates to the second component, the *Operational Review.* The two reviews are related as an understanding of the behavior of the fire explains the context in which the fire suppression activities were conducted.

SCOPE

The objective of the review is to give an accurate and discriminating account of the operational management of the fire sufficient to identify and explain the causes and contributing influences that resulted in significant fire outcomes. The review will cover two time frames during the course of the active fire; from the start of the fire until 0600 hrs on 31st December 2007 and from 0600 hrs on 31st December to the fire being declared controlled and mopped up on 9th January. The intensity of the review for each period will be that required to meet the objective of the study. The consultant will also consider aspects of fire planning and preparation in

the Goldfields Region prior to the Boorabbin fire. A brief commentary on the status of fire planning and fire preparedness in the Department at large will also be required.

The Review will be done in the context of the *Australian Inter-service Incident Management System (AIIMS)* that is the operational methodology used by DEC and associated agencies for wildfire management. The preparation of plans, objectives and strategies for the management of the fire as described by the AIIMs procedures, particularly with respect to the safety of fire fighters and the public, will be relevant. The contractor will employ a *'Prevention, Preparedness, Response, Recovery' (PPRR)* approach so the report presents a strategic and regional context for DEC's management of wildfire whilst elucidating the specific details of this fire incident. Subject to the scope of the review, the contractor will broadly adopt the principles and procedures outlined in DEC's Fire Operational Guideline 31 (FOG 31 – see attached) that sets out the Department's approach to After Action Review (AAR) and Post Incident Analysis (PIA). The contractor will review the application of DEC's *Standard Operational Procedures (SOP)* and *Fire Operational Guidelines (FOG)* relevant to the incident (attached), and recommend any improvements or changes that in their professional opinion might be warranted as a result of this fire experience. Only those SOPs and FOGs deemed relevant to this incident need be reviewed. It is expected that an examination of the efficacy and application of DEC's SOPs and FOGs in the context of AIIMS will constitute the main body of work for the Operational Review.

The consultant will produce a statement of 'conclusions' from the review that links to a set of 'recommendations'. This section of the report to be titled 'Lessons Learnt'. The conclusions, recommendations and lessons learnt may in part be qualified and conditional as determined by the scope of the review and available information. Specific limitations that can be reliably anticipated will be specified in the contract where possible, otherwise they will be explained in the report.

The consultant will use the *Fire Development and Chronology Review* to inform the *Operational Review,* and vice versa as necessary.

The consultant will make a brief comparison of DEC's wildfire management with comparable best practice in Australia relevant to, and limited to, the principal findings in the Review. The purpose of the comparison is to highlight the practices of other wildfire management jurisdictions that might be instructive for DEC or for other State emergency management authorities, or the Coroner. The comparison is not intended to be an exhaustive analysis, but rather to identify key issues and point to further lines of enquiry that might contribute to DEC's 'Lessons Learnt' document.

At an earliest possible stage of the review the consultant will discuss their initial key findings with DEC to provide an opportunity to refine the critical lines of enquiry and define the ongoing scope of the review. DEC's purpose will be to ensure the consultant is focused on the essential aspects of the enquiry so that all of the facts and information necessary for the proper and complete elucidation of the event emerge. A final draft of the Review Report will also be provided to DEC in order to allow checking for factual accuracy.

As this review is likely to be material to the Coroner's enquiries, DEC will expect the consultant to exercise complete professional integrity and independence from DEC's reviews and findings, notwithstanding that all information about the fire in DEC's possession will be made available to the consultant. It is expected that much of the information that is a matter-of-fact required by the consultant will be available from the AAR and PIA processes undertaken by DEC. Whenever possible, the consultant will attend DEC's debriefings and reviews as an observer. The consultant will indicate the origin and status of key information or views in the Review Report. It is expected the consultant will employ various methods for gathering information that will include direct interview of DEC staff, reference to operational records from the fire, post fire statements and documents, direct field observations, DEC SOPs and FOGs, national AIIMS documentation, DEC policy statements and other related documents, fire management published documents from other sources, and professional knowledge, judgment and experience. DEC will assist the consultant with the provision of documents, maps and records as needed, and full access to DEC staff as required. The consultants will have access to DEC offices and workspace as needed by arrangement.

The prime focus of the review is on DEC's operational management of the incident and DEC's formal responsibilities in these situations. The review will also examine the multi agency interaction at this fire and consider its efficacy at the operational level. The interagency aspects of the Review will be conducted through interviews with relevant IMT leaders prior to the 31st December, the DEC Goldfields Regional Manager and the ICs from Gold and Black preformed teams. The consultant may wish to interview a limited number of non DEC personnel (subject to availability) who may be able to contribute to this aspect of the review.

Whilst it is expected that the Coroner will find the review very helpful, the scope of the review will not cover the whole likely ambit of the Coroner's enquiries and interests, particularly with respect to the interview of people not employed by DEC. Likewise, the statements, documents and information gathered by the Coroner through the police and others might not necessarily be available to the contractor. Specific information needed by the consultant might be requested from the Coroner on advice from the State Solicitors Office (e.g. Coroner's Bureau of Meteorology Report). The consultant should be prepared for the possibility they will be called by the Coroner to give evidence and explain aspects of their Review Report.

REVIEW SUBJECTS

This list of subjects is provided as a guide to the consultant and is essentially chronological. The list aims to capture an adequate strategic context for this fire event whilst concentrating on the operational management of the fire in relation to the efficacy and application of DEC's wildfire management SOPs and FOGs in the AIIMS environment. The intensity and scope of enquiry into each aspect and phase of the fire will be progressively assessed to ensure the most informative and useful outcome is achieved in the public interest.

<u>Prevention</u>

1. **DEC's fire management function, organization and operations**
2. **DEC's fire management organization and traditional practice in the Goldfields Region**
3. **DEC's Widlfire Threat Analysis (WTA) and Fire Prevention Plan for Crown Lands Between Coolgardie and Southern Cross**
4. **Interactions with other Emergency Management Authorities at State and Goldfields Regional level**
5. **Identification of hazards and assessment of threats to the environment, human life, public and private assets**

<u>Preparedness</u>

1. **Implementation of the Goldfields WTA Plan**
2. **General fire management strategies and operations in the Goldfields Region, including sufficiency of resources, level of staff experience and availability of assistance if required**
3. **Seasonal fire management 2007/2008 in Goldfields Region**
4. **DEC fire management context for 2007/2008 season**
5. **DEC fire situation pertaining in December 2007 and January 2008**
6. **DEC fire preparation 28th December 2007 and outlook**

Response

Initial phase

1 **Initial fire report and immediate actions**

2 **Initial dispatch and fire appreciation**

3 **Initial strategies and tactics**

4 **Setting up IMT**

5 **Fire behavior, development, and intelligence**

6 **Assessment of fire potential: regional and Departmental**

7 **Resourcing**

8 **Sectorisation of fire, operations point, allocation of resources**

9 **Safety assessment: hazards, risks, priorities**

10 **Strategies and actions for management of risks to fire suppression personnel and members of the public**

Escalation phase north of Great Eastern Highway

1 **Fire behavior, projected development and weather forecasts**

2 **Fire line production and fire containment**

3 **Fire planning, intelligence, mapping, IAP**

4 **Strategy and objectives for containment north of the Great Eastern Highway**

5 **Operations on shifts 1 to 3 (28th & 29th December): progress and issues**

6 **Safety management strategies and operational application**

7 **Specifics of traffic management on the Great Eastern Highway: intended and actual**

8 **Shift changes and overnight situation**

9 **Night time firefighting in the Goldfields**

10 **Fatigue management and firefighting conditions**

Escalation phase south of the Great Eastern Highway 30th December 2007

1 **Strategy and IAP for 30th December**

2 **Weather forecast and fire development risks**

3 **Deployments of resources on 30th December**

4 **Fire breakout to south and crossing of the Highway: cause and progress**

5 **Response to fire breakout**

6 **Strategy and implementation of strategy to pursue the fire**

7 **Fire behavior in woodland fuels, low fuels (fire scars, salt lakes) and against firebreaks**

8 **Traffic management on the Highway in periods AM and PM to nightfall: intended and actual**

9 **Management and support of travelers at road blocks**

10 **Public reaction to road closures and influence on IMT and IAP based on IMT interviews and news media reports**

11 **Intelligence: ground and air**

12 **Fire line production and efficacy of strategy**

13 **Safety of fire crews**

14 **Deployment and function of other agencies, role of OAMG**

15 **Functionality of the IMT and its components**

16 **Public information produced by the IMT**

17 **Observed fire behavior: afternoon and in evening and wind influence**

18 **Predicted fire behavior: afternoon and evening and influence of weather forecast**

19 **Traffic management on the Highway after nightfall and departure of helicopter: intended and actual**

20 **Overnight fire management strategy**

21 **Knowledge of fire position, extent and fuels**

22 **Revisions and amendments of the IAP on 30th December**

23 **Decision to send more resources and upgrade fire status**

24 **Traffic management at the time of the fatalities**

25 **Fire behavior at the time of the fatalities**

26 **Response of agencies to the fatalities in relation to fire management and Highway management overnight.**

Post 30th December Fire Phase – Shifts 5 – x

1 **Apply selected components of the DEC Post Incident Analysis process (Fire Operations Guideline 31) as required**

2 **Focus on aspects that relate to any key pre 30th December matters**

3 **Identify any significant issues or outcomes that might improve DEC's fire management practices**

4 **Review ongoing management of the fire and functionality of the IMTs**

5 **Give an account of the ongoing management of traffic on the Highway to the conclusion of the fire**

6 **Review fire strategies implemented after 30th December including alternative or fall-back strategies**

Recovery

1 **Note the recovery process for the restoration of Highway traffic.**

2 **DEC has implemented a process of After Action Review (AAR) and Post Incident Analysis (PIA) as indicated in the attached diagram. Comment on the efficacy of the process and any improvements as appropriate.**

REVIEW REPORT

1 **The Review Report will be structured to clearly show the chronology of events and the relationship of key outcomes in time.**

2 **The Review Report will be structured in two parts to distinguish the events prior to the deaths of three members of the public on the Great Eastern Highway and those events coming after to ensure there is a suitable concentration on key issues.**

3 **The Review Report will necessarily focus on DEC staff and DEC activities but will as far as possible within the resources and information available to the consultant also cover other people and agencies that had a significant role in the fire. It is appreciated that the extent of access to non DEC staff and to documents or information held by other parties cannot be predetermined.**

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Document Status

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