



# INDEPENDENT OPERATIONAL REVIEW

Port Hills fires — February 2017

Prepared for Fire and  
Emergency New Zealand  
(previously New Zealand  
Fire Service and the National  
Rural Fire Authority).





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#### **ACKNOWLEDGEMENTS**

The Review Team would like to reflect on a quote from Christchurch City Council's mayor Lianne Dalziel

***"We look back to understand and improve, not blame."***

That quote reflects the approach of the Review Team.

The Review Team would like to thank those individuals who gave freely of their time and spoke openly with the Review members. The Review Team benefitted from the input of residents and the community affected by the fires, representatives of the New Zealand fire agencies, representatives of supporting agencies that assisted with the management of the fires, officials from local Government and representatives of organisations with an interest in promoting the values of the Port Hills Area. The manner of participation was supportive of the aim of this Review to establish areas of good practice and identify opportunities for progressive improvement.

The input of these individuals in preparing this document was of great benefit to the Review Team. However, the content of this report and its conclusions remain the joint responsibility of the Review Team.

Alan Goodwin

AFAC, July 2017

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# 1. EXECUTIVE SUMMARY

1. On Monday 13 February 2017, fires broke out in Early Valley Road and Marleys Hill on the Port Hills area of Canterbury. These fires met the definition for an extreme fire event and occurred during what is known as the 'fire season', with the fire risk ranging between high and extreme.
2. The Port Hills fires covered an area of 1661 hectares, with a perimeter of 61 kilometres and resulted in the loss of nine dwellings with a further five suffering fire damage.
3. The terms of reference require the review to assess the operations and performance of the fire agencies with reference to their statutory duties, including an assessment of their readiness, initial response, extended response and post incident management. The review focused on the leadership and management of the incident over the first five days of the fires.
4. The principal fire agencies involved were the New Zealand Fire Service (NZFS) and National Rural Fire Authority (NRFA), [who from 1 July 2017 now comprise Fire and Emergency New Zealand], the Selwyn District Council (SDC), the Department of Conservation (DOC) the Christchurch City Council (CCC) and the New Zealand Defence Force (NZDF). Local authorities are for the purposes of this Review referred to as fire agencies.
5. The Review Team acknowledges the great work done by fire and emergency teams and individuals during this incident. They were committed to keeping people safe as they combated the fires and should be commended for this. Given the size and complexity of this event, there are inevitably lessons that can be learned and applied in the future for community engagement and incident management.
6. Themes emerging from the review included:
  - a. the need for fire agencies to be interoperable and work to a single management system that is well rehearsed and practiced
  - b. that resourcing must be provided that is commensurate to the size and scale of the event
  - c. information must be timely and accurate and in fire emergencies a comprehensive and well-staffed information and communications operation is required
  - d. the community must be at the heart of the way fire agencies operate in an emergency
  - e. Fire and Emergency New Zealand must be forward looking and contemporary in its approach
  - f. more must be done to ascertain how fire agencies might better support communities to recover from major fire events such as the Port Hills fires.
7. The Review Team believe that Fire and Emergency NZ creates a real opportunity to create a stronger integrated organisation that is future focused, seeking to achieve a change in culture and community engagement.

## READINESS

8. Concerned about the seasonal conditions and elevated fire danger in the Port Hills during the summer of 2016/17, fire agencies and land owners implemented a mix of formal and informal fire management planning and preparedness measures. These included pre-season interagency meetings and instituting total fire bans. The SDC held six weekly meetings to assess the fire situation and communicate the dangers to communities, although other fire agencies were not involved in this. While having no discernible impact on what occurred, there was no joint agency fire condition awareness information communicated to the community in a structured way.

9. The previous legislation required fire plans for rural areas set out the policies and procedures to be followed where fires occur (DOC and the SDC were the responsible fire agencies for the Port Hills area and had audited the fire plans). To support the Fire Plan DOC facilitated the development of the Strategic and Tactical Fire Management Plan (STFMP). Unfortunately, the STFMP was not utilised to its intended capacity, resulting in lost opportunities in the preparedness, reduction and readiness phases. In addition, the STFMP was not formally referred to by the Incident Management Team (IMT) responsible for managing the response.
10. While the NZFS, NRFA and fire agencies participated in pre-fire season exercises and planning, their adoption of the Coordinated Incident Management System (CIMS) was less effective because the CIMS terminology and its application was used inconsistently or in some cases misunderstood between these two and the other fire agencies. This problem continued through the initial and extended response phases. The review also found a lack of pre-season exercises and planning among the broader range of agencies responsible for the Port Hills area.
11. While the NZ CIMS model and the Australasian AIIMS model used for emergency management are similar at the ground level, the Review Team feel there is a unique opportunity for Fire and Emergency New Zealand to move to the Australasian Inter-Service Incident Management System (AIIMS). The reason for this conclusion is that Australia and New Zealand would be able to share ideas and operate together on a common operating platform. AIIMS is an Australasian system supported by AFAC, and all of the states in Australia and Fire and Emergency New Zealand already contribute to AIIMS through its membership of AFAC. AIIMS has a well-resourced steering committee that supports its development and is able to be updated based on worldwide best practices and experiences gained through participation in overseas deployments. The system was developed to meet community needs as well as the needs of the emergency services using it. Another advantage it offers for Fire and Emergency New Zealand is that all the training material required to be competent in using the system is included in the AIIMS package, and training material is updated as the system is reviewed. Therefore, there is negligible cost for Fire and Emergency New Zealand in moving to AIIMS; as a new organisation it presents a unique opportunity to support a unified organisation.

## INITIAL RESPONSE (13-14 FEBRUARY)

12. The initial response to the Early Valley Road Fire was fast, with the first units arriving within minutes of receiving the 111 callout. While NZFS units arrived first and took immediate command of the sector, this was soon passed on to the SDC as the fire agency responsible for the area. The initial response to the Early Valley Road fire was appropriate and timely. The concentration on life as the first priority, followed by structure and asset protection, was well executed given the nature of the topography and fuels being engulfed by the fire as it rapidly spread through the terrain.
13. The initial response to the Marleys Hill fire reported at approximately 7.00pm was by NZFS followed by a team from DOC. The fire response was under the direction of NZFS in the first instance until later in the evening when control was handed to DOC as the responsible fire agency. The initial operations and management of the Marleys Hill fire was appropriate and above what could be expected in the early stages of a fire of this scale.
14. The decision made on Monday night to manage both the Early Valley Road and Marleys Hill fires as one incident, under one incident management team was an appropriate one which proved insightful as both fires spread and eventually merged as one.
15. An important way to assess fire risk is through an incident action plan (IAP) which was produced for both fires on Monday night. While the IAP was timely, it was limited in its detail and did not meet the expectations of a comprehensive plan. The IAP was important for the direction of overnight operations, but a lack of consistent information from the ground and in general poor and sporadic intelligence flows reflected in the detail in the IAP. The quality of the IAP did not assist those tasked with the control and command of the fire during the initial response period.

16. There was no holistic provision for public warnings or managed fire information and no apparent instructional information for those impacted by the fires or its path, other than through a texting tool used by the SDC for members of the communities it serves. Residents were reliant on face-to-face contact with firefighters, police or from friends and neighbours for information on which to make decisions. Moreover, there was confusion, compounded by the darkness, amongst those involved on the ground from all responding agencies as to what information had been given to the public and back to those in command positions.

#### EXTENDED RESPONSE (14-18 FEBRUARY)

17. Good work was done on fire suppression activities by all the fire agencies and individuals involved, but a holistic joint strategy was never truly achieved. The IMT processes were hampered by a lack of information and coordination, especially in the first few days of the fires. This led to the self-deployment of resources without the knowledge of the IMT, a matter of concern given the complex nature and behaviour of the fires.
18. Through not adopting formal predictive analysis services or timely fire spread modelling, the IMT missed the opportunity to enhance its ability to estimate spread and therefore better manage resource allocation and keep communities better informed. The predictive mapping toolkit produced earlier in the STFMP was not referenced, reducing the ability of the IMT to take a more strategic approach to combat the fires.
19. The IMT was adequately structured but lacked sufficient resourcing of support positions to underpin the functional roles and key outputs it was required to deliver. Although NZFS personnel were present at the EOC in liaison roles, and some resources were provided to assist the IMT, NZFS senior officers did not assume formal roles in the IMT once it was established. This meant that key fire ground information and suppression activities the NZFS were involved in were not always immediately available for consideration by IMT. The problems experienced with CIMS (e.g. lack of common understanding of terminology and incorrect application) in the initial response phase continued.
20. A planning team led by a Planning and Intelligence Manager was appointed. Its primary role during the developing fires stage was to accurately identify and record the resources on the fire ground so they could be used to the best effect. Incident action plans (IAP) were prepared over this period and over the first five days were informative but in some key areas lacked any real strategic planning, and were relatively benign in their commitment to assign resources to different sectors. The plans seemed to be driven by air operation inputs and supporting ground operations rather than being based on robust operational planning discussions. Compounding this was an apparent lack of situational awareness by the planning and IMT teams.
21. An Operations Officer was appointed for the duration, responsible for the Port Hills fires and positioned himself at one set point. The role was a challenging one due to the fire behaviour and complexity of access and terrain, size and numbers involved. All of these factors meant the Officer did not meet with sector supervisors/commanders and other leaders on a regular basis to evaluate or review the situation, and as a result the full picture could not be relayed to the leaders in the IMT who, with the planning team, were developing the suppression strategies.
22. The safety of firefighters was well understood and considered in the tasking of all agencies at both fires. While some activities were raised with the Review Team as being questionable, these were not substantiated.
23. A Logistics Manager was appointed and, though under-resourced for a fire of this complexity, was able to deliver within the manager's limited resources. Consideration might be given for similar future events were to: engage a communications unit to provide information on activities such as crew accommodation and aviation logistics; a plant manager, given the multiple types and uses for machinery.

24. The Selwyn District Council activated a Public Information Management Team (PIM) on the morning of Tuesday 14 February 2017. The PIM organised and managed media releases and briefings and the dissemination of information through channels such as social media and news media. The rapid escalation of the incident presented significant challenges for the PIM team and coupled with the struggle to get timely information from the ground, at times challenged its ability to provide new and accurate information.
25. Incident record management was of a high standard and records kept and available as appropriate.
26. With the benefit of hindsight some elements could have been done better. Overall, the actions of the fire agencies and individuals to keep people safe and combat the fires is to be commended.

#### COMMUNITY

27. Leading up to the Port Hills fires, residents were aware of the high and extreme fire risks presenting and given the history of fires on the Port Hills, the residents took some measures themselves to mitigate risks (although not all joined in these). Communities were generally alert to the warnings from the SDC and the CCC about fire restrictions. They did not during this period observe any urban or rural fire agency personnel in their communities and were unaware of the existing fire plans.
28. Residents found communication and the ability to obtain timely and accurate information about the fires varied and was at times poor. It was frustrating and worrying, as it meant they were not able to form an accurate picture of what was happening near to their properties, which meant they were not as prepared as they might have been. They felt there was a disconnect between the rural and urban firefighters.
29. Being confident everything has been done that can be done and that fire agencies are managing risks to communities are important components to assisting community and individuals to recover from fire events. The recovery process is an important element that must not be lost sight of when managing fire events. This was acknowledged during the review by fire agencies, who must continue to work with appropriate agencies to build a strong recovery aspect to strategy and planning work.

## 2. RECOMMENDATIONS

### Recommendation 1

Fire and Emergency New Zealand adopts a single doctrine, the Australasian Inter-Service Incident Management System (AIIMS), for incident management. That the new organisation use this doctrine to train/exercise and develop people.

### Recommendation 2

Fire and Emergency New Zealand, along with other agencies who also work in New Zealand communities, implements an annual multi-agency exercise programme to ensure that all personnel involved in IMTs fully understand their roles and can operate at a high level of competency.

### Recommendation 3

That Fire and Emergency New Zealand develop a Community Based Risk assessment methodology, to be developed and implemented along the process of the previously prepared STFMP.

### Recommendation 4

Fire and Emergency New Zealand develops a genuine community engagement model to implement planning strategies including reduction, readiness, response and recovery.

### Recommendation 5

Current fire plans be reviewed and aligned with new Fire and Emergency New Zealand legislation.

### Recommendation 6

A public warning system be developed as the single source of truth for all incidents and that this system be supported with a comprehensive warning system and public information strategy.

### Recommendation 7

Predictive services be utilised to define strategic management, consequence management, and options analysis for both incident and community advisories.

### Recommendation 8

In the developing stages of the fire, complete a risk assessment (with partner agencies) that profiles initial attack, values at risk, monitoring and patrol requirements as well as community expectations.

### Recommendation 9

All future traffic cordons be managed as a functional sector under the Incident Controller.

### Recommendation 10

All intelligence relevant to the operation and planning functions of the fire be routed through a single point to assure relevant and timely distribution of information to the Incident Management Team.

### Recommendation 11

A single process be adopted and implemented for incident or 'near miss' reporting, which includes reporting and monitoring of actions and outcomes.

### Recommendation 12

Fire and Emergency New Zealand develops and implements a comprehensive and measurable plan to put these recommendations in place.

## 3. INTRODUCTION

The 2017 Port Hills fires were one of the biggest and most severe in recent New Zealand history. They covered an area of 1661 hectares, with a perimeter of 61 kilometres and caused mass evacuations and significant threat or loss to infrastructure, such as major power lines, radar, communications networks, Sugarloaf tower and Christchurch Adventure Park. The fires also resulted in the loss of nine homes with a further five damaged. This occurred during a fire season where New Zealand lost 20 homes to fires, the greatest number in 100 years.

The size of the Port Hills fires made it one of the largest fires since the Wither Hills fires of 2000 and Alexandra fires in 1999. For the Canterbury region, it would be one of the largest, if not the largest, since the 1955 Balmoral forest fire.

The Port Hills fires met the definition for an extreme fire event. The event escalated suddenly, spread rapidly and with high intensity, threw embers ahead of the fire front, with fire whirls occurring. Normally fires burn fast uphill and slower downhill. The wind swinging from westerly to north easterly on Wednesday 15 February 2017 changed that. The fire turned and began to burn downhill on several fronts, in the direction of the city.

The mop up and management of this fire continued for over three weeks and had a significant impact on the affected communities.

### OPERATIONAL REVIEW

This review was initiated by the New Zealand Fire Service (NZFS) and National Rural Fire Authority (NRFA), Selwyn District Council (SDC) and the Department of Conservation (DOC), to assess the operations and performance of the fire agencies with reference to their statutory duties. In the terms of reference, the Review Team was requested to include an assessment of the fire agencies *readiness, initial response, extended response and post incident management*. The review focused on the leadership and management of the incident over the first five days of the fires.

It is important in the context of this review to note that from 1 July 2017, a new single responsible organisation - Fire and Emergency New Zealand was established, for whom the review report has been prepared. This organisation combines NZFS and the NRFA. Overall direction for the review was provided by the Australasian Fire and Emergency Service Authorities Council (AFAC) office.

### REVIEW TEAM

The Review Team was made up of:

- Alan Goodwin, AFAC
- Bryan Cartelle, Regional Manager, Rural Region 1, Fire and Emergency New Zealand (previously Principal Rural Fire Officer, Auckland Rural Fire District, NRFA)
- Trevor Brown, National Manager Operational Efficiency, Fire and Emergency New Zealand (previously NZFS).

The Review Team contained broad and varied experience of urban fire, rural fire, land management and aviation operations in both New Zealand and Australia. The Review Team carried out an independent review of operational performance by industry peers and endeavoured to bring together technical understanding of the subject matter to bear on their conclusions. Their aim is to highlight both positive learnings and focuses for improvement in the future, both from an organisation and community perspective.

## METHODOLOGY

The Review Team met with fire agency staff, personnel from other agencies, government and representative agencies, consisting of over 70 stakeholders, in Christchurch between 3 May and 5 June 2017. The Review Team viewed the fire ground, visited key sites and discussed the strategies and tactics adopted in the environment the fires occurred. The team considered documentation relevant to preparedness, initial response, extended response and recovery. A public submission process was undertaken, including an open invitation for submissions from people or organisations who had provided contact details to the recovery agencies during the course of following the fire. The Review Team have also met with most submitters.

This report should be read as the expert professional opinion of the Review Team, but does not claim to reach conclusive findings on factual issues. There was no comprehensive audit of New Zealand fire agency records as the team's methodology was speaking with, and reviewing, what it regarded as a representative sample of sources.

## BASIS OF REVIEW

While the Review Team did not have formal statutory powers of compulsion of witnesses or documents this did not cause any difficulty, as the team received full support and cooperation from those who could help the Review Team better understand the context of the fires. All documents requested from the fire agencies were provided willingly.

The Review Team's approach has been to recommend improvements that Fire and Emergency New Zealand can adopt as it evolves. It does not elaborate on specific fire activities but focuses on the leadership and management of the critical period given the nature of fire activity and its impact on communities and infrastructure (first five days).

The Review Team may use language in this report such as 'we were told', which sets the context for the conclusions that follow, but this does not imply that the Review Team investigated and confirmed what it was told. When the Review Team uses phrases such as 'we found' or 'we conclude', these should be taken as conveying the Review Team's opinion on the matter based on the best evidence available to it.

The Review Team understands it is up to the agencies to prioritise the recommendations in this report how they see fit. In this report we have made comments or suggestions that we have not wished to elevate to the status of recommendations, but we invite the agencies to take account of in their future business planning and operations.

Important issues raised during the review that contribute to better preparedness for future emergencies but which fall outside of the terms of reference will be formally conveyed to the appropriate agencies.

## SCOPE

The scope of the review is as follows:

<b>Readiness</b>	a. Fire management planning	
	b. Fire readiness measures	
	c. Provision for multi-agency interoperability	
<b>Initial Response</b>	a. Notification and initial response: <ul style="list-style-type: none"> <li>(i) Initial size-up</li> <li>(ii) Risk assessment</li> <li>(iii) Incident action plan</li> </ul>	
	b. Public information management	
	c. Communication and coordination with relevant agencies	
	<b>Extended response</b>	a. Communication and coordination with relevant agencies
		b. Application of risk management principles
c. CIMS command and control: <ul style="list-style-type: none"> <li>(i) Control</li> <li>(ii) Intelligence</li> <li>(iii) Planning</li> <li>(iv) Operations</li> <li>(v) Logistics</li> <li>(vi) Public information management</li> </ul>		
d. Incident action plan compilation/ implementation		
e. Incident record maintenance		
f. Logistics section establishment and maintenance		
g. Control, containment, suppression of fire(s)		
<b>Post-incident Management</b>	a. Assessment and reporting of damage, loss, and rehabilitation requirements	
	b. Completion of post-incident reporting	

## RELATIONSHIP TO OTHER REVIEW ACTIVITIES

Out of scope for the review (except to the extent that they are directly relevant to the purpose and the objectives of the review) are:

- The origin and cause of the fires (which are subject of an investigation being jointly undertaken by SDC and DOC).
- The circumstances of a helicopter accident that occurred on 14 February 2017 (subject of an investigation being undertaken by the Traffic Accident Investigation Commission).
- Any aspects of the civil defence response to the fires that are the subject of review or investigation by the Ministry of Civil Defence and Emergency Management.
- Any aspects of the response to the fires that are the principal subject of other reviews or investigations by agencies or organisations more closely connected with those matters (including New Zealand Police, Traffic Accident Investigation Commission, Civil Aviation Authority, WorkSafe New Zealand and/or the Coroner).

## NEW ZEALAND LEGISLATION

### *Fire Service Act 1975*

At the time of the fire and up to 30 June 2017 the NZFS and the NRFA were operating under two separate and somewhat dated pieces of legislation.

Under the Fire Service Act 1975 the NZFS duties included the effective, efficient, and economical management of its functions and activities, providing effective cooperation between all fire services, and cooperation with territorial authorities and regional councils.

The NRFA had functions, duties and powers conferred upon it under the Fire Service Act 1975 and Forest and Rural Fires Act 1977. This included: co-ordinating all matters relating to national rural fire control; ensuring effective regional coordination of rural fire authorities; setting certain minimum standards for rural fire authorities; monitoring and evaluating the performance of rural fire authorities, and facilitating effective regional rural fire coordination. The National Rural Fire Officer could take charge at a serious fire emergency.

As the Port Hills Fires originated from two ignitions in separate rural fire districts under the authority of SDC and DOC, they had, as the 'lead fire agencies' under the Forest and Rural Fires Act 1977, primary responsibility for fire control in their respective rural fire districts. Under the Act the Principal Rural Fire Officers in each district had a duty to respond to fires and endeavour by all practicable means to extinguish the fire, to prevent spread and save lives and property in danger.

In addition, a number of the fire agencies have duties pursuant to the Civil Defence Emergency Management Act 2002 and the National Civil Defence Emergency Management Plan 2015.

To support the above legislation, numerous local agreements were put in place, e.g. agreements between the NZFS and rural fire authorities, agreements between voluntary rural fire forces and rural fire authorities, and resource availability and supply agreements. All of these local agreements have been referred to in this report as 'interagency arrangements'.

### *Fire and Emergency New Zealand Act 2017*

The Fire and Emergency New Zealand Act 2017 came into force on 1 July 2017. Under the new legislation, the NZFS and most rural fire authorities were amalgamated into Fire and Emergency New Zealand. The provision of fire and certain other emergency services are now provided by this single entity.

Fire and Emergency New Zealand has an Operational Service Agreement with DOC to provide fire and other emergency services on public conservation land and other land managed by DOC. It will have an Operational Service Agreement with the NZDF for the fire and emergency services the organisations will provide to each other. Fire and Emergency New Zealand will also enter agreements with forest owners and managers for fire services to be provided by the parties on forestry land.

## INTERAGENCY ARRANGEMENTS

At the time of the Port Hills fires the legislative responsibility for the management of fires in rural areas sat with each respective fire authority. In the case of these fires this was DOC and SDC. The NZFS provided the initial response to rural fires in conjunction with the rural fire authorities. Rural fire authorities were expected to provide additional resources for any extended response. The NZFS could also be part of any extended response. These expectations and associated arrangements were covered by legislative obligations and informal agreements.

## SUMMARY TO THIS PART

We have briefly summarised the rather complex set of legislative arrangements in place at the time of the Port Hills fires. The legislative arrangements have now changed. Our comments and recommendations are intended to support the continuous improvement of the delivery of fire and emergency services in New Zealand under the newly established entity Fire and Emergency New Zealand to fulfil its functions under the Fire and Emergency New Zealand Act 2017.

It is important to note that in those instances where we have discussed possible improvements that could be applied to future operations, this should not be read as a criticism of the way in which the fires were managed. Working with the benefit of hindsight, most reviews of fire or other emergency incidents would identify learning points for the future. This is the primary reason why reviews of this nature are commissioned.

# 4. INCIDENT SUMMARY

## FIRE ENVIRONMENT (Weather, topography and fuel)

This summary should be read in conjunction with the Significant Fire Progression Event Chronology to better understand the correlation between the daily fire behaviour, the topography and fire progression. This chronology is attached as Appendix 1.

### FIRE WEATHER

Due primarily to the seasonal drying winds and very low monthly rainfall recorded at the Christchurch Airport weather station, February 2017 received less than half of the historical average.

In the 30 days prior to the Port Hills fires only 20 mm of rain was recorded, with less than 3 mm falling in the 20 days prior to the fires. Grass curing varied across the Port Hills, however it was considered to be 80% cured (dried) or above, and in many places 100% cured.

At the time of the fires, the underlying fire danger was Very High to Extreme. Averaging the indices/codes from three representative local weather stations namely Bottle Lake, Christchurch Aero and Motukarara (all within a 20 km radius of the Port Hills) establishes the following fire weather picture on the day the fires started, Monday 13 February 2017.

Fine Fuel Moisture Code (FFMC)	87	Duff Moisture Code (DMC)	65
Drought Code (DC)	555	Build Up Index (BUI)	100

These indices/codes show that a fire would ignite easily, be extremely difficult to control and that mop-up would be difficult and extensive. An important point to take from these figures is that with such high DMC, DC and BUI figures (all into extreme) on a day with such high average temperatures and low humidity, whenever the wind speed was predicted to be above 30 km/hr, all three Fire Danger Classes (forest, scrub and grass) would be extreme (see Appendix 2).

This gives us an instant benchmark with which to establish fire danger context for any given forecast or situation.

### TOPOGRAPHY

The Port Hills are a range of hills in Canterbury, New Zealand, so named because they lie between the city of Christchurch and its port at Lyttelton. The range includes a number of summits between 300 and 500 metres above sea level. The range is of significant geological, environmental and scenic importance.

Considered an outstanding natural feature and landscape of national importance, there are a number of internationally significant geological features within them, including prominent rock outcrops and a number of volcanic dykes.

The slope factors can be summarised as follows. Slopes of 1 to 10 degrees covered 15.8% of the total area burnt, slopes of 10 to 20 degrees covered 43.1%, and slopes of 20 to 30 degrees covered 34%.

The area burnt within the Port Hills can be categorised as a series of moderate to steep ridges and gullies running roughly northwest to southeast. These features start at near sea level at the north-western base of the Port Hills and rise up to around 500 m at the summit overlooking Lyttelton harbour.

The aspect of much of the burnt area was north to northwest facing. Fire growth and intensity were significantly reduced where the fires encountered a more southerly aspect.

## VEGETATION (FUEL)

As the economic fortunes of sheep and cattle farming have declined, so has the viability of pastoral farming on the Port Hills. For some, farming is simply uneconomic and farmers have sought ways to maintain economic viability from their land. One of the ways they have done this is through the planting of exotic forest.

Much of the exotic grasslands also had an elevated fire danger due to lack of grazing, lack of maintenance or a change in land use, due in part to the Christchurch Earthquake of 2011. Much of the north-facing grasslands had a grass curing of 80% to 100%. The south facing aspects were considerably greener and as low as 30% in some of the wet gullies, as was evident from the fire progression.

According to the Land Cover Database v4.1 2015, the vegetation types burnt by the Port Hills fires were, for the greater part, a mix of exotic forest (35.7%), exotic grassland (29.9%), gorse/broom (22.8%) and broadleaved hardwood scrub (10.7%). The exotic forest was predominantly Pinus radiata 20 years old or greater, with some small stands of Douglas fir, Pinus nigra (Corsican) and Eucalyptus.

Although the Port Hills contains pockets of indigenous forest, the fire conditions were such that areas like Kennedys Bush did not burn.

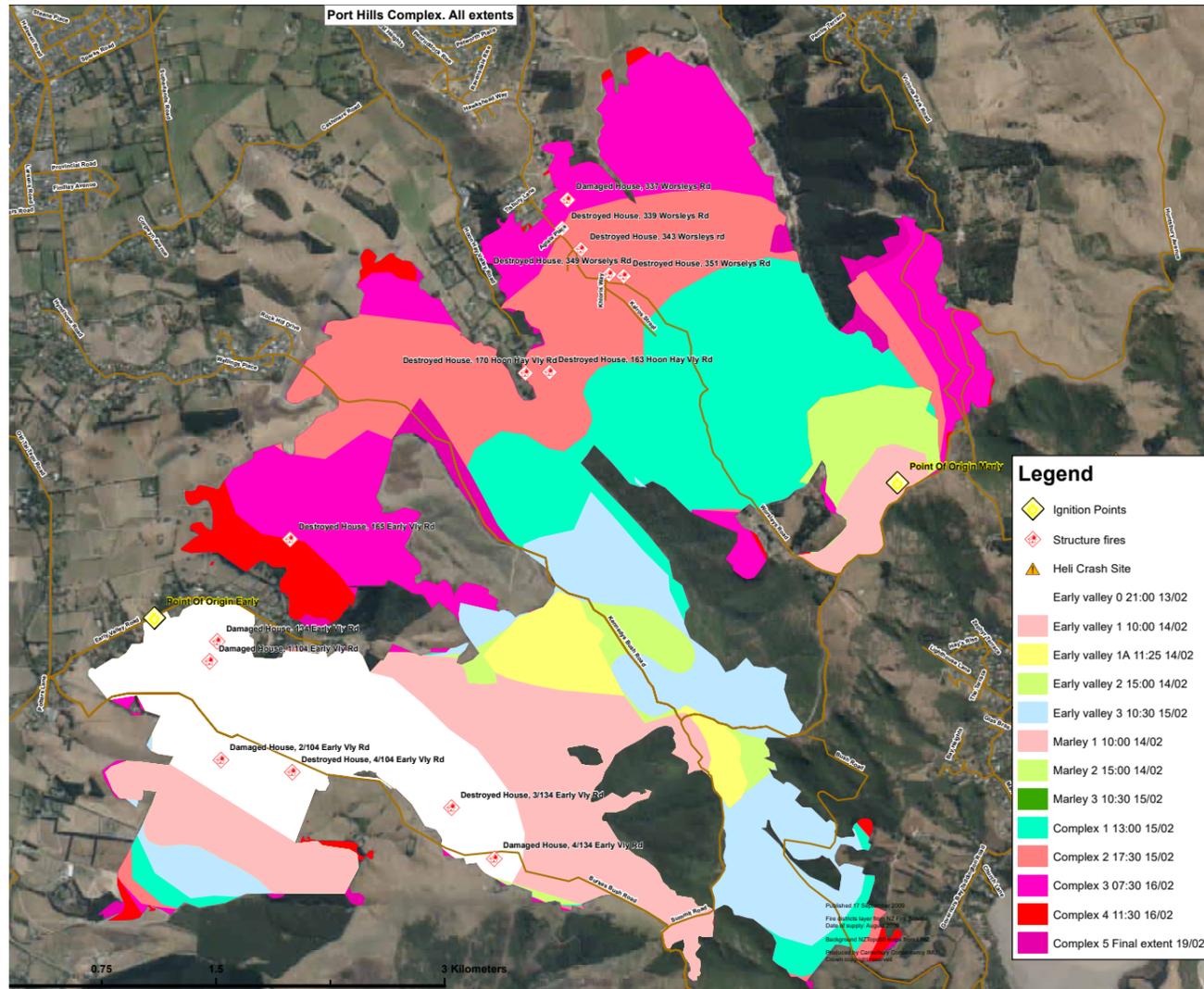
Large areas of the gorse/broom and some of the finer fuels and grass on the Port Hills had been sprayed or were 100% cured. This would have made an already flammable species even easier to ignite.

LCDB2012 (Updated 2015)	Land Use	Area (Ha)	% Total Area
Exotic Forest	Forest	594.31	35.77%
High Producing Exotic Grassland	Grassland, Sedge and Saltmarsh	496.77	29.90%
Gorse and/or Broom	Scrub and Shrubland	379.27	22.83%
Broadleaved Indigenous Hardwoods	Scrub and Shrubland	179.03	10.78%
Low Producing Grassland	Grassland, Sedge and Saltmarsh	6.07	0.37%
Short-rotation Cropland	Cropland	3.65	0.22%
Manuka and/or Kanuka	Scrub and Shrubland	1.37	0.08%
Orchard, Vineyard or Other Perennial Crop	Cropland	0.61	0.04%
Indigenous Forest	Forest	0.40	0.02%
Built-up Area (settlement)	Artificial Surfaces	0.03	0.00%

A map of the vegetation types for Port Hills is attached as Appendix 2.

## TIMELINE (first 5 days of the fires)

The map below, shows the fire progression over the first five days of the fires. The different colours on the map shows the fire progression for each 24-hour period.



## OUTLINE OF THE FIRE INCIDENT

At 17:44 hours on Monday 13 February 2017 the first of many 111 calls were received by the NZFS Southern Communications Centre (SouthCom) to a fire in scrub at Early Valley Road, Christchurch. A fire appliance from Addington fire station and a water tanker from the city fire station were dispatched. The first fire appliance responded from its station less than two minutes after it was alerted. While still responding to the incident the Officer in Charge (OIC) could see a large fire in the vicinity of Early Valley Road and transmitted a priority message requesting three additional fire appliances and another water tanker.

When the Addington fire appliance arrived the officer could see a fast-developing fire and requested helicopters with monsoon buckets to be put on standby. A short time later he requested two helicopters to respond.

Sockburn was the next arriving fire appliance and the officer immediately assumed command as the incident controller (IC) and requested additional fire appliances. A short time later the Canterbury Area Commander arrived and provided support to the OIC Sockburn, but did not formally take over command. When the NZFS command unit arrived, it established a command point in Early Valley Road.

Initial tactics were implemented using ground crews to attack the fire. Advice from the public that there were people trapped at a property in the path of the fire raised concern with the IC. Fortunately, the first arriving helicopter had not yet connected its monsoon bucket and was able to land near the property and evacuate the people. This action appears to be an initiative of the pilot who had seen the people at the property while on route to the incident.

The Christchurch PRFO had been notified and quickly established that the fire was in the Selwyn jurisdiction, therefore the Selwyn PRFO was subsequently notified. The Deputy Principal Rural Fire Officer (DPRFO) for the Selwyn rural fire authority responded to the incident while the PRFO began to establish an incident management team in the Council chambers at Rolleston.

At 19:11:54 hours another 111 call was received by SouthCom advising of a new fire at Marleys Hill. This was at first thought to be in the Christchurch City Council jurisdiction but it was quickly established that it was within DOC's jurisdiction. A fire appliance and a support vehicle from Governors Bay fire station, and a rural appliance from Victoria Park were dispatched. Although initially assessed as a relatively small fire it quickly developed before crews could gain safe access to the seat of the fire and further resources were requested. The initial strategy was to stop the fire crossing the Summit Road, fairly assuming the fire would travel uphill, and that progress downhill would be relatively slow and able to be contained.

During the evening significant efforts were made to contain the fire and there were a large number of people and equipment resources (from urban and rural) deployed to Marleys Hill.

Around 20:00 hours the DPRFO for Selwyn arrived at the incident in Early Valley Road. After a discussion with the NZFS commander they went for a flight over the fire. When they came back he advised NZFS commanders on scene that he wanted to withdraw ground crews and use last available light to do extensive monsoon bucket drops on properties threatened by, or already, on fire. As the light faded he discussed with the fire service commanders his intent to withdraw ground crews overnight, maintain a fire patrol until the morning and only recall fire service resources if the need arose. This tactic was agreed with the senior fire service commander on scene.

During the evening the Incident Controller at SDC chambers considered advice to treat both fires as a single event on the basis that it would better coordinate firefighting and management resources. This advice was duly implemented. Over the evening work was done to establish the IMT so it would be ready to fully function from first thing on Tuesday morning, noting many of the team were having to travel from outside of Canterbury.

Firefighting continued on the Marleys Hill fire through the evening and when DOC personnel arrived a transition began to remove (NZFS and NRFA) fire service resources and replace with DOC personnel. This was completed around 03:15 hours when the (NZFS) fire service commander left the incident.

At around 02:03 hours the night patrol advised SouthCom that the fire in Early Valley Road was now threatening properties and requested a fire appliance to respond. Shortly after this appliance arrived, the night patrol transmitted a priority message that several houses were being threatened and to respond further pumps and water tankers. The NZFS urban crews, supported by NRFA rural crews, were able to conduct aggressive external protection of the properties threatened and stop them being destroyed by the fire. At around 07:00 hours in the morning fire service resources were withdrawn from Early Valley Road and an extensive aerial attack was to be utilised supporting limited ground crews.

From the morning of Tuesday 14 February 2017, the only NZFS resources on the incident ground were water tankers. The IC felt that the fires were contained and although there would be a few more days involved in firefighting and mop up that the resources available could manage. Therefore, urban fire resources were not requested for Tuesday.

Around 14:00 hours on Tuesday 14 February 2017 one of the firefighting helicopters crashed, resulting in the death of the pilot. All aerial activity was suspended at this point. Prior to this SouthCom were receiving multiple 111 calls to fires that were threatening properties. Essentially both the IMT and officers in the field thought that the fire was reasonably contained and that the fire crews were on top of things. Helicopter firefighting activity recommenced within two hours after the accident. This obviously had an impact on fire development and growth, as well as distracting some firefighting resources who were required to respond to the accident.

Although it was well known that the fire conditions may escalate on the Wednesday due to changing wind direction no additional plans were implemented that would ensure the IMT was fully prepared. As it transpired Wednesday turned out to be the worst of the 'fire' days with concerted efforts required from urban and rural crews to control the spread of the fire, and protect houses and infrastructure. Wednesday was the day when most of the houses on Worsleys Road were lost. Early efforts on the Wednesday were centred around property protection in Hoon Hay Valley, reducing fire spread over the summit into Govenors Bay, and slowing fire growth in the Adventure Park.

Around 14:08 hours a resident on Worsleys Road became very concerned about the threat to residents' properties and a call was placed through the 111 system. The caller requested a fire appliance to their street as their properties were being threatened by the fire and there was not a fire appliance in sight. He gave a detailed description of where the fire appliance needed to go to but unfortunately the call taker did not verify the street address. At 14:11 the next available appliance was dispatched to Worsleys Rd.

Unfortunately, the appliance only travelled on the lower part of Worsleys Road, not up near the top of the road as the caller had intended them to go. The crews' view was obstructed by smoke and the terrain as they could see flames lower in the valley headed to the Adventure Park. The appliance called again at 14:21 advising they were at the entrance to the Adventure Park, nothing was showing, and wanted confirmation of where they were meant to be responding to. The dispatcher advised that they would call the 111 caller back. This occurred immediately and the call taker in the ComCen endeavoured to get an exact location of where the resident was calling from. The address was clarified, and the CommCen operator assured the resident that they would pass this information on. Before this could occur the appliance called the Comcen through the appliance radio advising they were now with the caller and responding to spot fires in the Adventure Park. Unfortunately, this was not the caller in Worsleys Rd but another 111 caller also trying to get fire service assistance. However, the dispatcher wrongly assumed that because both the 111 caller and the appliance were now in contact with each other, there was no further action required as there was now an appliance on Worsleys Road.

A second fire appliance was requested to respond by the 1st arriving appliance to assist at the Adventure Park. Adding to the confusion, as viewed on the Comcen screens, it appeared that the two appliances (which have Automatic Location Positioning (ALPs) technology) had arrived at Worsley Road. This is because the map on the Comcen screen showed the appliance, which was in the Adventure Park, and the location they should have responded to, which was on the ridge in Worsleys Road, looked almost identical. As they were extremely busy answering many 111 calls and dispatching any available appliances to both the Port Hills and South Island wide incidents, they did not immediately notice that fire appliances had not arrived at the location requested by the initial caller. This confusion created the delay in having a fire appliance arrive at Worsley Road.

It was over an hour (from the first call at 14:08 hours) when the first fire appliances arrived in Worsleys Road and by this time the fire had spread from the Adventure Park and was threatening several properties. Despite concerted efforts from fire crews taking significant risk, they were unable to protect all of the houses. They were restricted by both water supply issues, smoke, significant ember transfer and radiant heat. The firefighters used a significant number of breathing apparatus sets in an effort to remain in the street to protect the properties that were safe to remain at. But when power transmission wires fell onto the road the commander present was faced with a difficult decision. If the power was cut to make it safe to access the properties further up the road, this would result in losing the water supply and therefore restrict the crew's capability to make a difference. He elected to take a defensible position further down the road and protect the properties they could from there. From this point crews remained on Worsley Road all night protecting the houses they could protect safely. The last house to be lost on this road was early on Thursday morning. The power lines and poles on the road were still considered potentially alive. This physically reduced safe access further up the road and therefore the ignition of this property was not noticed. The Air Attack Supervisor did notice the house was on fire as he did his first fly over in the morning (Thursday 16 February 2017 around 07:30 hours). Crews were present on Worsley Road and had worked throughout the night and protected a significant number of properties. Yet, the commander had given a clear instruction that crews were not to go past the forward command point that he had established lower down the road. They therefore did not notice when the last property caught fire as that house was obscured from their view as it was uphill and around the corner from the agreed forward command point.

The changing wind direction on the Wednesday had also fuelled the fire around Early Valley Road and the fire merged with the Marleys Hill fire and created a single large fire with extreme fire behaviour. The change of wind direction also resulted in the fire around Early Valley Road changing direction and destroying another house above Early Valley Road but on the opposite side of the valley to where the houses were lost on the first evening of the fire.

During the day on Wednesday concerted efforts were being made to control the fire spreading from Marleys Hill toward the Adventure Park. There were significant numbers of urban and rural fire crews working hard in this sector of the fire. The staff in the Adventure Park were concerned about the potential loss of the chairlift infrastructure and in particular, the haul rope. They were concerned that if the haul rope had let go/released there could have been casualties if any people, including emergency staff, had been in the vicinity of the chair or the haul rope. Fire conditions were extremely difficult with steep hills to contend with. This not only impacted ground crews but air operations were restricted by the 'zip lines' and overhead transmission lines crossing the Park. Another issue was that there was a lot of logging slash from tree felling and pruning operations lying on the ground significantly increasing the potential fuel loading.

The standard operating procedure (from the manufacturer) of the chairlift is that the main wire that controls the chairlift is to be kept running so it won't overheat, so the staff were doing this. Prior to the fire the Christchurch Adventure Park management had engaged both the NZFS and Rural Fire Authorities on their fire plan. From the bottom station, they were able to remove a number of chairs but the task was too big to be completed in a timely manner. When it was noticed that the chairs on the chairlift were on fire the Operations Manager instructed the chairlift to be put in reverse and sent the chairs back up into the fire area / top station. Chairs that had caught fire appeared to be dropping hot embers off the chairlift and starting spot fires below the main fire. This line ignition brought the fire lower in the valley into the heavier fuels.

Around 17:00 hours on Wednesday the SDC and CCC Mayors agreed to declare a state of emergency to support the emergency services. The declaration was implemented around 18:00 hours. Throughout the incident the evacuation of residents was managed by NZ Police in liaison with the IMT in the first instance and Civil Defence once the declaration was implemented.

Fire agencies were provided great support from both NZDF personnel based at Burnham Military Camp and from St John Ambulance personnel who set up to manage injury and health issues that might emerge from both emergency service personnel and residents.

By Thursday afternoon the fire was contained and then brought under control. The Incident Management Team was boosted with additional and fresh personnel and was able to settle in to a regular 'battle rhythm'. There were no more properties lost or infrastructure damaged. The incident continued for another couple of weeks to fully extinguish hot spots and ensure the Port Hills area was safe for residents to return. This was also influenced due to steep and unstable ground and large rocks being exposed that had the potential to become a significant hazard to people and property.

Selwyn District and Christchurch City Council's provided excellent support to the IMT. The IMT were able to utilise the great facilities at the SDC offices in Rolleston where people were very well catered for, and the councils provided a lot of personnel to support the incident.

## 5. FINDINGS

### READINESS

#### FIRE MANAGEMENT PLANNING AND READINESS MEASURES

It was apparent that fire agencies were aware of and concerned about the seasonal conditions and elevated fire danger in the Port Hills. For the summer of 2016-17 fire authorities and land owners implemented a mix of formal and informal preparedness arrangements. For example, a pre-season interagency briefing was held in the SDC on 7 January 2017. The briefing included the surrounding Rural Fire Authorities, the NZFS and local contractors. A total fire ban was subsequently declared by the CCC from Saturday 11 February 2017. On Monday 13 February 2017 the SDC RFA met to reassess the restricted fire season in place and decided to remain at this level. The National Rural Fire Officer declared a total fire ban for all of Canterbury on 16 February 2017 at the request of the RFAs. People spoke of removing vegetation around houses and farmers spoke of heavily grazing some of the paddocks.

Selwyn District Council has a comprehensive fire season meeting and communication process. It held six weekly Regional Fire Committee meetings. Annual preparedness meetings were held at the start of the fire season with Fire Chiefs and their Deputies.

There were weekly preparedness meetings conducted by the SDC at the start of the week to assess the coming week's weather and discuss management issues. This is a good initiative but was not complemented with input from the surrounding fire agencies/authorities. There was also a good community communication process implemented by the SDC through an email and text process that went to a variety of contractors, industry representatives and community members. It relied on registration by interested parties.

There was no evidence of a strategic approach where informative fire season condition awareness information was communicated to the community in a structured process (other than what was witnessed from SDC). While this had no influence on the impact of these fires it is an important part of joint preparedness for communities and the fire agencies going forward under the leadership of Fire and Emergency New Zealand.

#### FIRE PLANS

Fire plans are statutory documents prepared under the Forest and Rural Fires Regulations 2005 and set out the policies and procedures of the fire authority to manage rural fires for the area under its jurisdiction.

The high-level contents of these plans cover Reduction, Readiness, Response and Recovery and the policies to support those headings.

The Review Team audited the fire plans of the SDC and DOC (being the fire authorities for the two separate fires on the Port Hills) and found that they met the requirements of the regulations.

#### STRATEGIC AND TACTICAL FIRE MANAGEMENT PLANS

To support the Reduction and Readiness sections of the fire plans DOC facilitated the development of a Strategic and Tactical Fire Management Plan (STFMP). This plan covered the fire jurisdiction areas of DOC, CCC, SDC and the urban fire districts of Lyttleton, Diamond Harbour, Governors Bay and Lincoln. An area of some thirty-four thousand hectares.

The STFMP assisted fire authorities to meet, or in this case exceed, the requirements of the National Standard, Assessing Fire Hazards, (NRFA 2010).

The STFMP identified six zones. Two of these zones were impacted by the February fires. The STFMP, given the fire environment, informed appropriate response levels. While the resources deployed to the initial 111-call were aligned to the guidance under the STFMP, the rapid development of the fire minimised the ability to deploy the resources other than the structure protection and vegetation control directly adjoining Early Valley Road.

The document, appropriately named the 'Strategic and Tactical Fire Management Plan', should be the guiding and reference document for any Reduction, Readiness or Response into this area, or with the communities, or key stakeholders of the area.

During the interview process it became clear that the STFMP document has not been utilised to its intended capacity, resulting in many opportunities being lost in the preparedness, reduction and readiness phases. These are lost opportunities for the organisations that developed the plan and the communities covered by it.

The STFMP was not formally referred to by the IMT during the planning process. While some of the IMT members had a good working understanding of the plan, the opportunity to align strategies and tactics with the planning principles was not truly taken.

## PROVISION FOR MULTI-AGENCY INTEROPERABILITY

There were good examples of the NZFS meeting with the Rural Fire Authorities and participating in pre-season exercising. There was also a lot of commentary from those interviewed about knowing each other from the different agencies in a local context. However, this seems to be more about general relationships and information sharing and not to be comprehensive in terms of interoperability and response processes.

It was apparent that the Coordinated Incident Management System (CIMS) has been adopted in the urban and rural fire agencies/authorities. Most staff who find themselves in incident management roles during an incident have been trained in the use of CIMS. Pre-arranged structures for major incident management follow the structures prescribed by CIMS.

However, throughout the interview process it became apparent that CIMS terminology was used inconsistently or, in some cases, clearly misunderstood. Members of the different supporting agencies 'interchange' the description of their role and the title of the position they hold. The description of individual roles did not always correspond to the CIMS roles and functions or that of the Incident Action Plan (IAP).

Fire agencies along with the land management agencies and contractors meet on a semi-regular basis but there was limited evidence of any accountable exercising amongst the agencies. Having said this, the Canterbury Regional Rural Fire Challenge is a long-running annual exercise well patronised by Rural Fire Authorities across the upper South Island, and at times from further afield. It included both DOC and NZDF. This was a significant contributor to establishing good working relationships across a wide geographical area, which certainly aided in large-scale fire incident responses such as Port Hills. However, this is still only rural fire agencies practicing and it does not practise the interoperability with urban colleagues.

It is the view of the Review Team that more exercises to prepare for fire emergencies involving all fire agencies (urban and rural) and relevant contractors would have helped the organisations and individuals in terms of interoperability and the understanding of the CIMS system, and how to interact in a multi-agency response.

## INITIAL RESPONSE

### NOTIFICATION, INITIAL RESPONSE AND SIZE UP

#### *Early Valley Road fire*

Initial fire reports (from local residents) for the Early Valley Road Fire came in at approximately 17:30 hours on Monday 13 February 2017, through 111 calls. The fire was approximately 500 m along Early Valley Road from the junction with Old Tai Tapu Road and in the jurisdiction of the SDC as the Rural Fire Authority. The fire took hold very quickly and spread in an easterly direction running up slope.

While the fire ignition was within the SDC area of responsibility, it was very close to the boundary with CCC. This caused some confusion in the early stages of the fire at a fire authority level but had no bearing on the quality or timing of the response. Despite this, the CCC PFRD responded by deploying Rural Fire Authority (RFA) resources immediately to Early Valley Road. Indeed, the fire was to have a major impact on the CCC area into the coming days.

NZFS units responded to the fire immediately, with the first units arriving within minutes. A NZFS Hazmat command unit was called and on arrival was established as a Forward Control Point (FCP). This was set up by the NZFS with a SSO taking command of that sector supported by an Area Commander. When the Deputy Principal Rural Fire Officer (DPRFO) from SDC arrived he joined the NZFS commander, along with other senior officers from the NZFS, on site at the FCP. The Area Commander took charge of the response for this early period by agreement with the DPRFO.

The intense fire behaviour and dry available fuels, meant the priority strategy around the suspected point of ignition was site protection and along Early Valley Road was for asset protection. As Early Valley Road is a narrow dead end road the ability to have multiple fire appliances working from the road was limited. Firefighter safety was also a key factor in preventing unlimited access to the assets along the road or indeed up on to the ridge, as the fire rate of spread was significant. The suppression activities and access were managed from the FCP, given it was in a position to regulate egress and ingress.

Firefighters were tasked along Early Valley Road while RFA personnel were guided on to the ridge where structures were being impacted by the fire. Hose lines were placed around houses along Early Valley Road for the houses adjoining the road.

The Officer in Charge (OIC) at Early Valley Road was liaising with NZ Police to manage evacuations from the properties along Early Valley Road. The evacuations were conducted in an orderly fashion and all residents catered for. Information to the fire managers regarding the detail of the fire spread and impact was very limited at this point.

Helicopters had started to work over the fire shortly after 18:00 hours - one with a monsoon bucket doing suppression work around the houses at risk higher up on the ridge, and the other assisting residents in the path of the fire to evacuate. The pilot showed great skill and understanding to land and assist people given the pace and ferocity of the fire as it climbed uphill in an aggressive manner. At around 20:00 hours two senior fire officers, one from NZFS, the other from the RFA, joined with an Air Attack Supervisor from the CCC to do reconnaissance of the fire and assess the impact of the fire as it progressed up the slope towards houses. This flight assisted with the confirmation of the fire suppression strategies for the first night.

Aircraft had increased to four helicopters and they worked on asset protection with monsoon buckets slung below the machines dropping water secured from local dams. The aircraft worked until last light finishing at approximately 21:30 hours.

At approximately 22:00 hours the fire had progressed over 2 km in a southeast direction, driven by the northwest wind and up-slope topography. Several houses had been impacted at this point, four damaged and two (4/104 and 3/134 Early Valley Road) were destroyed. Residents had been evacuated as the fire moved across the ridge at a rapid rate. Firefighters were unable to access the properties for structure protection in the path of the fire due to safety concerns with such a fast moving fire and without aerial support.

At this time the fire activity above the suspected point of ignition had settled down to a low intensity backing fire moving down slope behind the houses along Early Valley Road. The head, or front of the fire had spread up and across the ridge to the southeast from the point of ignition towards Summit Road.

On Monday evening at approximately 23:00 hours, there was a meeting between the Area Commander in control and the DRPFO. Several other senior NZFS officers were also in attendance. It was agreed that due to firefighter safety, resources would not be deployed deep into the fire ground overnight. Steep terrain, smoke and unburnt vegetation meant patrols along Early Valley Road would be left to the Rural Fire Authority personnel and that the NZFS unit would not remain and would be recalled should the need arise. Two rural fire crews were left to manage the patrol around the houses and all other personnel left the fire ground. The rural fire crews also patrolled the fire to the southeast as best the access and safety would allow.

At 02:00 hours on Tuesday morning the NZFS Area Commanders and the DPRFO were recalled to the Early Valley Road due to increased fire intensity around the houses along the road. The backing fire had progressed towards the houses in a low intensity fashion and then had increased due to reaching a tree line, and igniting the dry, unburnt fuels at the back of the houses. NZFS units were responded and established asset protection operations in the following few hours through to daylight.

A decision was made to send the NZFS home prior to midnight and would be recalled if needed. There were no adverse effects from this decision. However, it is the view of the Review Team that, as the fire was still very visible through the night and as the fire had started late in the day a different decision would have improved community confidence. As crews were required to reattend the community lost further confidence. Several of the officers interviewed agreed, in hindsight, that the decision for the NZFS to leave was not in the best interest of the local home owners, the firefighters and the greater fire suppression needs. However, the decision to leave the fire ground did not contribute to the damage to assets impacted by the fire in the early hours after ignition.

This commentary under Initial Response is in reference to the first 12 hours from the ignition of the fires. We acknowledge the work done to form a Regional Incident Management Team (RIMT) in the early hours of the fire and the statutory obligations of the Councils in their role as Rural Fire Authority Agencies. Details regarding communications, Incident Action Planning and strategy are covered under other sections of the terms of reference.

In summary, the Review Team found the initial fire agency response to the Early Valley Road fire was appropriate and timely. The concentration on life as a first priority, followed by structure and asset protection, was well executed given the nature of the topography and fuels being engulfed by the fire as it spread rapidly through the terrain. Safety of firefighters was well understood and considered in the tasking of all agencies at both fires.

### *Marleys Hill fire*

At approximately 19:00 hours on the same day, Monday 13 February 2017, a fire was reported at Marleys Hill just off Summit Road, approximately 500 m from the junction with Dyer's Pass Road. This fire was 'below' the road burning up toward Summit Road and backing down hill away from the road. The fire activity was observed to be 'low' or 'quiet' by the Air Attack Supervisor flying overhead after the initial fire report. While this fire occurred within the CCC area, it was determined to be within the fire jurisdiction of the DOC.

The first responders were the NZFS from Governors Bay followed by a team from DOC. The fire response was under the direction of the NZFS in the first instance until later in the evening when control was handed to DOC as the responsible agency.

Helicopters supported the firefighters prior to dark using water monsoon buckets in rotation. The fire behaviour was observed to be 'quiet' and generally pushing uphill towards Summit Road. Crews from the NZFS and the Rural Fire Authority worked through the night along Summit Road southwest from the junction with Dyer's Pass Road to prevent the fire coming up slope, breaching the road and travelling to the southeast. The fire was also backing downhill through pine plantation at a low intensity. It was deemed unsafe to send firefighters off the road and down into the pine forest through the night. All suppression activity took place from the Summit Road.

The interviewees consistently described this fire as low intensity, 'not doing a lot, quiet', and generally not progressing in an aggressive manner. During the night, it progressed towards Summit Road in a consistent manner that was 'surprising' to those on the fire ground. They expected the fire intensity to die right down overnight with lower temperatures and higher relative humidity.

This level of sustained overnight fire activity should have been a 'warning' regarding the potential of the fire if not contained at an early stage. Given the dry fuels, topography and fire behaviour there was reason to believe this fire would increase in size and become difficult to contain.

The aircraft operations and management were fitting and, indeed, above what could be expected in the early stages of a fire situation of this scale.

A decision was made early on the Monday night to manage both the Early Valley Road fire and the Marleys Hill fire as one incident, under one incident management team. It is the view of the Review Team that this was a good decision that contributed to better resourcing and management to both fires.

### **RISK ASSESSMENT**

A senior NZFS Area Commander and the DPRFO joined the Air Attack Supervisor (an officer from the CCC) to fly a reconnaissance of the fire. Their task was to gather intelligence regarding the situation, including fire spread and particularly the impact on life and property. As the Marleys Hill fire had also been reported at this time the reconnaissance flight included a flyover of this site. This aerial observation and the safety aspects constituted a major part the risk assessment for the initial hours of the fire and indeed through the night.

The first Incident Action Plan (IAP) directed a mix of direct and indirect attack strategies for the overnight resources on site. This, and the direction given by those in charge, was very much reflective of what was observed of the fire behaviour, fire ground conditions and the ability to work at night for both fires. The strategy described a 'Patrol' mission and this was agreed by those 'in charge' on the fire ground.

### **INCIDENT ACTION PLAN**

An Incident Action Plan (IAP) was produced on Monday night at 23:00 hours and signed by the Selwyn Principal Rural Fire Officer as the Incident Controller. This IAP was limited in its detail and did not meet the expectations of a comprehensive plan. It was delivered in a timely manner, given the rapid-fire movement and intensity and the fact that night fell soon after ignition, but lacked consistent information from the fire ground. In general, the intelligence flow was poor and sporadic in the first few hours and this was reflected by the detail expressed in the IAP. The direction set by the IAP was upheld on both fires overnight but the IAP was not delivered to leaders responsible for the overnight strategy.

Producing an IAP that covered the early hours of the fire through to the next morning, even with limited information, was important for the direction of the overnight operations. The IAP covered both fires as there had been a discussion and decision made about 23:00 hours to combine the management of the two fires, Early Valley Road and Marleys Hill. This was a pivotal decision and led to a comprehensive incident management process being put in place.

### **PUBLIC INFORMATION MANAGEMENT**

Both fires started late in the day and the Early Valley Road fire progressed with ferocity. Evacuations were a key focus for this fire along with asset protection. Night-time grounded the aircraft and limited the ability of the ground crew to gather sound intelligence to send back to the FCP or the Incident Controller located at the SDC Emergency Operations Centre (EOC). There was a shortage of timely and accurate information being disseminated to the wider or directly affected communities, which was largely reduced to direct contact, primarily by the police. During this period the SDC email/txt message system 'Selwyn Gets Ready' that residents signed on to was operating and the Selwyn PIM team provided updates via social media on the evening of Monday 13 February 2017 with two further updates in the evening and through Tuesday in multiple channels.

However, other than this, there was no holistic provision for public warnings or managed fire information. Some of the residents interviewed advised that there were general radio announcements regarding 'fires in the area' but no specific instructional information for those impacted by the fire or in its path. Residents were reliant on face-to-face contact with firefighters or police for information on which to make decisions. There was confusion, compounded by the darkness, amongst those involved on the fire ground from all responding agencies as to what information had been given to the public and in a command and control process back to those in management positions.

## COMMUNICATION AND COORDINATION WITH RELEVANT AGENCIES

The main communication and coordination point was established at the FCP, on Early Valley Road shortly after the fire ignition. This established a management point for the Early Valley Road fire and was separate in the initial response phase to that of the Marleys Hill fire. Coordination for Marleys Hill was accepted to be at the junction of Summit Road and Dyers Pass Road, referred to as the 'Sign of the Kiwi'.

The Early Valley Road fire communication between the NZFS and the rural fire authorities was centred around the FCP. The Area Commander from the NZFS was based there and was joined by the DPRFO. Fire units from both agencies were tasked from there in the first hours of the fire response. Communication from the FCP back into the Incident Controller was sporadic and verging on non-existent.

As part of standard communication process the NZFS was reporting through the Forward Command Point (FCP) but this information was not passed to other agencies or authorities involved. This was true for both fires, though it was amplified at the Early Valley Road fire due to the complexity of this fire. Information on fire service units was not forwarded to the fire authority and the fire authority unit management was not linked to the FCP system. This meant there was no cohesion for the best tasking of all units and managers on the fire ground in the first hours of the fire.

## EXTENDED RESPONSE

In the context of this report the extended response refers to the period 14 - 18 February 2017.

Throughout, the continued management of the fire communication and coordination between the fire agencies remained an issue. The IMT had very little understanding of the tasking of the NZFS resources. There was opportunity to better prepare areas at risk prior to the forecast weather change on the Wednesday, and while this was done to some degree by the strategies adopted by the IMT, it was not as comprehensive as it could have been. Good work was evident throughout the fire suppression activities by all the combating agencies, but a solid, holistic joint strategy was not truly achieved.

This separation of coordination remained for most part for the duration of the response activities. The Review Team found that there was some great connection, communication and coordination between different agency individuals, but this did not translate into a formal approach. The Review Team also believes that the IMT processes and priorities were hampered by the lack of both information and coordination, particularly in the first days of the fire.

This was exasperated due to the large number of messages, often using the 111 system, that were passed to and from the ComCen via mobile phones. This meant that a lot of valuable intel was not passed to the IMT and resourcing did not follow CIMS protocols.

One of the key concerns raised during the interview process was the self-deploying of resources onto the fire ground without the knowledge of the IMT. This is of particular concern given the complex fire environment and potential fire behaviour. The unsupported process of self-deploying resources impacts the ability to have confidence that the work is being undertaken in a safe and considered manner. This also distracts operations when they are located, and this happened on numerous occasions.

## APPLICATION OF RISK MANAGEMENT PRINCIPLES

### *Fire behaviour analysis*

While the Situation Officer in the planning team undertook some initial fire behaviour and rates of spread predictions, limited predictive or consequential management strategic planning was applied in the first three days of the fire. Some of the prediction tools required additional information to generate outputs, and it was noted by several people during the interview process that it would have been better to have predictions with a reasonably high level of confidence than waiting, somewhat longer, to have them absolute.

The lack of formal predictive services or timely fire spread modelling made risk assessment and supporting strategies inadequate, considering the weather and amount of active fire on Tuesday 14 February 2017 and through the following days. There was an opportunity to better estimate the fire spread and therefore more directly inform the community and manage resource allocation, and apply some strategic considerations. The predictive fire mapping produced in the STFMP was not referenced.

During the review we heard a lot of evidence about the use of fire behaviour analysis to support strategic and incident planning. We endorse the importance that the Rural Fire Authority have clearly applied to fire behaviour analysis, and support this being further developed under Fire and Emergency New Zealand.

Other people discussed how fire behaviour models were not always successful in the course of fires and the reasons for this, such as unprecedented dryness in the fuel conditions. An overestimation of fire spread because New Zealand fuels do not always behave in the same way as the fuels used to develop the fire behaviour models. The people we spoke to with expertise in this area clearly understood the limitations of what fire behaviour analysis can do, and the need for further research based on the outcomes of this fire season to improve the fire behaviour models. We think it is useful to highlight that fire behaviour analysis provides a forecast, which still requires expert interpretation to make best use of it.

While we expect that fire behaviour analysis will continue to play an important role, we agree that users need to understand its limitations and support ongoing research which will improve the quality of the fire behaviour analysis outputs available in the future.

## COORDINATED INCIDENT MANAGEMENT SYSTEMS COMMAND AND CONTROL

As noted in the initial response phase a IMT took over control from 07:00 hours on Tuesday 14 February 2017. Both Early Valley Road and Marleys Hill fires were managed by the IMT as one incident.

The IMT was established following the principles of the Coordinated Incident Management Systems (CIMS). The members of this incident management team were well-known to each other and had deployed previously in the various roles that they were assigned to. The incoming incident controller, as part of the incident hand over briefing, had a flyover of the incident ground early on the first morning.

Post that flyover the IMT were briefed of the incident and the incident developments to date. The Incident Controller appointed the key functional managers.

While it was a great initiative to have an IMT in place early to manage both the fires, its true potential was never met in the first few days of the fires. The IMT was well structured but lacked enough resourcing of support positions to underpin functional roles and key outputs. The fact that IMT did not include NZFS resources, firmly embedded, meant that all key fire ground information and suppression activities were not considered by the IMT. While there was good acknowledgement of the connection between all the emergency services at the SDC offices, this did not translate to the fire ground and the IAP did not reflect the NZFS resources that were active throughout the fire ground.

The CIMS model, in terms of structure, was in the main applied effectively by the IMT for the duration of the fire. During the interview process it was widely observed that the CIMS terminology on the fire ground was poorly understood, used in various ways and applied incorrectly. While this had no adverse effect on the individual's ability to perform their role, it is again an example of the 'lack of practice' of individuals in the CIMS system. Understanding the roles and what is required is fundamental to successful application of incident management systems in to the future.

On Wednesday 15 February 2017 at approx. 18:00 hours, the SDC and CCCs declared states of local emergency for their areas. This had no direct bearing on the ground operation or the functioning of the IMT. However, it did trigger a more detailed media process regarding fire ground information. It required that public information came under the coordination of the group controller. It was agreed by the respective PIM managers that fire operations public information would continue to be coordinated by the Selwyn team with all information approved and released by Group EOC. It also meant traffic management (cordons) was being coordinated by the local Controller. This led to cordons being manned by a varying array of people from NZ Police through to contractors. Information for the community was poor at the checkpoints and the opening and closing of the cordons was not always timely or consistent with the direction from the IMT. While the cordons generally worked well in terms of stopping and allowing traffic through, their management was inconsistent for the individuals with pecuniary interest and there was a lack of ability to consistently provide up to date and relevant fire ground information.

## PLANNING INTELLIGENCE, INCIDENT ACTION PLAN COMPILATION/IMPLEMENTATION

A Planning and Intelligence Manager, Management Support Unit Leader, Situation Unit Leader and Fire Behaviour Specialist were all appointed. No Resource Unit or advanced planning roles were noted in the Incident Action Plans. Typical of this stage of a developing fire, the primary job of the planning team was to accurately identify and record the current resources on the fire ground. A roving resource was tasked to go around the various sections to gather resource data. The resource tracking templates used initially were foreign to some people. A secondary function of the planning team was to understand the incoming resources and have the operations section confirm appropriate task allocations.

An IAP was developed for Tuesday 14 February 2017. This IAP was unsigned and had no time noted as to when it had been completed. Given some of the prepared times on the supporting documents, the Review Team believe the IAP completion to be at about 14:00 hours on 14 February 2017. The Review Team note the late development time is of concern. The Review Team did not view the IAP distribution list. All this was happening about the time of the helicopter accident so the focus would have shifted significantly.

The IAP developed for the nightshift of the 14 February 2017 was more informative than the previous IAP, with additional information covering weather summary, general fire behaviour, pressure points and safety considerations. Again this IAP was unsigned and had no completion time noted.

The IAPs developed for the days of Wednesday and Thursday were informative in some of the key areas, but they lacked any real strategic planning, and were relatively benign in their commitment to Sector Assignments. The Review Team felt that the operations were being driven by Air Operations inputs, and ground operations applied tactics around those discussions rather than having robust operations/planning discussion with some 'What If?' with strategic principles applied.

It was not until the Thursday IAP that the NZFS was mentioned or given a sector assignment and this was only Governors Bay. This was consistent in the Friday IAP.

No IAPs had any heavy machinery noted or associated sector assignments.

The Review Team would like to recognise the comprehensive Safety Plan and the links to the Fire Behaviour Forecast notes.

During the interview process it was noted by many on the fire ground and within the IMT, the difficulty in understanding situation awareness. This was due to a range of factors, including the scale of the incident, the impact of smoke in the vicinity, all communications, and a dual network recording fire ground movements and key information. Additional to this some of the communication gaps on the fire ground necessitated a lot of communication by cell phone. This principle further restricts often critical information to two people, and others on the fire ground are significantly limited in the ability to gain situational awareness.

It was also raised by many people that the situation on the fire ground seemed to be disconnected from what was portrayed at the SDC (EOC) where the incident management team was based.

The Review Team again noted that while many opportunities to improve information, systems and communication were noticed and voiced during this period, many people failed to escalate such observations or assist to mitigate these.

In considering the above points, it is clear to the Review Team that some very good work was achieved within the Planning Section, but this section was significantly under-resourced during the period of extended response to Friday 17 February 2017.

## OPERATIONS

Operations were established from the initial response phase and remained a key function of the IMT throughout the fire response. In the early part of the fires on the Monday evening and overnight, the crew leader assumed the role of operations officer. There was an operations officer appointed as a formal part of the IMT for the Tuesday for the entire fire ground. (covering both fires). Sectors were created due to complexity aligning to the Early Valley Road area, Marleys Hill area and Governors Bay area.

The Early Valley Road fire had crossed the summit road on the Monday night, backing down towards Governors Bay in a slow but consistent fashion. This was a large area with many strategies being implemented at various locations. It is the view of the Review Team that the operations officer was faced with a challenging task given the amount of active fire and difficult access. The span of control (direct reports) exceeded what would be expected of this role rendering communication and strategic operational management undeliverable. The operations officer based himself mostly at the ICP at Early Valley Road for the Tuesday and Wednesday, with limited access to the fire ground and to the sector commanders. This, along with often compromised communications, restricted the situational awareness, operational intelligence and detailed fire ground information flow back to the IMT.

Although initially sectors were created by the planning team they were focused around the initial points of ignition. Due to the aggressive fire growth of this via the sectors the situation clearly became very complex and further impacted the capability of operations. The radio links between the NZFS and the rural fire sector were restricted. A lot of the conversation from the fire ground was on the cell phone as opposed to the wider radio communications network, and this restricted other people's understanding of the developing incident.

While the fire had been sectorised in the early stages, further consideration to the implementation of divisions was not actioned and this resulted in large geographical areas being managed by sector supervisors/commanders with little ability to cover the operational area they were responsible for. This was particularly important in the first days as the two fires merged and impacted on the Adventure Park and other properties.

It was apparent from the Operations Officers we interviewed that in hindsight their tasking was overwhelming due to the fire behaviour and complexity of access and terrain. It was also meant that they didn't get to meet with the sector supervisors/commanders and other leaders on a regular basis to evaluate or review the risk and the combating strategies.

There was also a disconnect between the operations officer working as a part of the IMT and the commanding officers from the NZFS. This led to a lack of complete and comprehensive information being supplied to the planning team in the IMT. The complete picture of the fire, the impact and the good work being completed around the fire ground was never fully relayed to the leaders in the IMT who were developing the suppression strategies.

The Review Team credits the people involved in the aviation management from the initial evacuations and through the following days of high fire activity. The aerial operations were conducted safely and efficiently for the duration from a fire control point of view. We do acknowledge the helicopter accident on Tuesday 14 February 2017, in the afternoon on the fire ground. The determination of this incident is being dealt with in a separate process and outside of the scope of the review. The team also believes that the management of the rest of the operational aircraft following the accident was handled in a quick and precise manner. The leadership displayed by the Air Attack Supervisor and those in the IMT was outstanding under the circumstances. The standing down of all aircraft following the accident was a necessary precaution and standard procedure for all involved. Proper consideration was given to the pilots and ground crews before recommencing aerial operations.

It is also the belief of the Review Team that in the mid-afternoon on the Tuesday when the aircraft were grounded, the fire spread on the Marleys Hill fire was significant. The fire at the lower end of the slope, deep into the forest was being controlled at the time by the aerial suppression activities. With the fire conditions at their most variable in the afternoon period, with no aircraft available, post the accident, this allowed the fire growth and fire behaviour to be unabated. This led to the fire being harder to control later on the Tuesday and indeed through the night and into Wednesday morning.

Overall the aerial suppression works, and while it is effective, it could have been better aligned and in support of the on-ground strategies and tactics. The Review Team heard that good work was done with on the ground and aerial support. However, this was not reflected well in the IAPs and the areas where fire services units were operating independently.

## SAFETY

Firefighter and community safety was a critical factor to be managed for the entire fire duration. It was fundamental in the IAPs, reinforced at the field briefings and was at the forefront of decision making by those in the IMT. Establishing strategies and tactics in the forest areas was of particular concern to those involved and there were varied views on the manageable safety limits in executing them. This was particularly evident in regard to the attitudes expressed by urban and rural firefighters to each other's fundamental fire ground philosophies. This manifested during the fire with no clear incident ground safety officer being appointed who understood they were responsible for all fire ground safety. Although there was a safety advisor appointed who had two safety officers in the field supporting him, this did not tie in with the urban safety officers appointed in the sectors.

The amount of machinery used in the on-ground operations also presented a high level of risk given the fire behaviour, smoke and terrain. There were also no clear safety briefings given to the machinery operators.

Aviation activities presented a significant safety concern, and the Review Team acknowledge the tragic loss of life due to an aviation accident during suppression activities. Considerable attention was paid to aviation safety before, during and after the accident by all involved. The welfare of aviation crews and firefighters was well demonstrated through decision-making and actions taken by those in all leadership roles.

The Review Team heard of particular suppression actions that were 'questionable' when it comes to safety, but could not obtain any real evidence to substantiate. The Review Team were able to substantiate at least 70 'salmon cards' (safety incident notifications). No incident or near misses were recorded by the urban firefighters despite evidence of some activities that would fit the description of the 'near miss'.

## LOGISTICS

The Logistics Manager was appointed, and the only other position appointed was that of the Supply Unit leader. The logistics section was under-resourced for a fire of this complexity, as acknowledged by those in the IMT for the first four days. However, the unit met the basic requirements and worked well to deliver with its limited ability. Managing crew accommodation and aviation logistics was pivotal, and managed within timeframes and location requirements. Given some of the communication complexities, a Communications Unit may have assisted. The primary network for recording NZFS information and vehicle movements is through the SouthCom. Urban fire began using the ComCen as a logistics function. This was not linked to an FCP or more importantly to the IMT. Therefore, Planning and Intel was not aware of many of the vehicle movements and resources deployed by the NZFS commander. The primary network for recording rural fire ground movements and information is through a mobile command unit. Apparently neither of these networks shared all information with the incident management planning team in Selwyn or with each other.

Another consideration would have been to have a plant (contractor) management role undertaken as a part of the logistics team. There were multiple types of and uses for machinery used in the early days of the fire and a more comprehensive process would have benefited the IMT in its overall management role.

## PUBLIC INFORMATION MANAGEMENT

The Selwyn District Council activated the Public Information Management Team (PIM) on the morning of Tuesday 14 February 2017. This team establishes under a Standard Operating Procedure, and was based out of the Selwyn EOC. Two people were initially appointed to the PIM function. The Selwyn EOC was seen to be the appropriate place to locate the team. The team quickly advised the media of scheduled media briefings. As the scale of the incident escalated on Tuesday, a third person was engaged to manage the social media and council website while a fourth was seconded from Christchurch city on Wednesday. On Thursday and Friday, the day shift PIM team comprised of five staff.

During the first day a number of media briefings, media releases and advisory notes were sent out as well as the social media and website interactions. Interviews were arranged for the following morning to advise overnight developments, and they included radio, written media and TV. The Selwyn District Council managed the media with the support of Christchurch City Council staff until the declaration at 18:00 hours, Wednesday 15 February 2017. From that point the media was managed by the Christchurch Group EOC. The Selwyn PIM team continued to gather and provide information to the Christchurch team. Selwyn managed the fire ground information and the Christchurch group managed the cordon information, welfare and all other civil defence-related matters.

The rapid escalation of the incident placed significant pressure on the PIM team, and coupled with the struggle to get timely information from the fire ground at times challenged their ability to provide new and accurate information.

The Selwyn District Council PIM function operated under existing SOPs, while a full operational PIM plan was in place from 19 February 2017, setting out key operational goals, resources and roles and responsibilities. This plan would allow structured escalation of the team if needed. The PIM acknowledge the issues re the interface with the public outside the standard media. There was both overlap, often a lack of information, and confusion to the general public. This was mentioned at most of the community interviews.

## INCIDENT RECORD MANAGEMENT

The Review Team visited the Selwyn District Council to source relevant information. It was clear that records were processed and filed under the day of the incident. While the Review Team requested additional information not filed under the respective day, this information was sourced and provided in a timely manner.

## CONTROL, CONTAINMENT, SUPPRESSION OF FIRES

The Review Team acknowledge the effort of many people over the first five days to suppress the fire and bring about relief and recovery to the affected community members. This fire has provided the opportunity to learn and understand what is operationally required for Fire and Emergency New Zealand as the new contemporary organisation for fire and emergency management in the future. The role played by all the agencies and individuals in trying to keep people safe and combat and recover from a large and complex fire was, and is, to be commended. There is a lot to understand, learn, appreciate, challenge and admire by agencies, Councils and communities. It is the intent of the authors of this report to start the learning process and create the platform for all to gain knowledge and understanding and improve the way emergency management is conducted in New Zealand.

## COMMUNITY

Residents of the Port Hills were given an opportunity to provide written submissions as well as meet with the Review Team. The majority of residents who lost their homes took this opportunity, wanting to understand why their homes were destroyed, as did several other residents who had provided written submissions. Some of these residents were still quite emotional about this event, coming six years after the devastating earthquake, and having lost significant personal items that are not replaceable.

Early in the process the Review Team met with the Christchurch City Council 'Port Hills Recovery Team'. They had held meetings with community groups affected by the fire as part of the recovery process. The Review Team were handed a letter outlining the main concerns residents had provided as feedback to the Recovery Team. The letter included three recommendations that the recovery team wanted specifically referred to the Review Team:

1. Issues and concerns raised at the various community recovery meetings are forwarded to the Review team
2. Significantly affected by the fires have the opportunity to meet with the Review Team to discuss their concerns.
3. Review conclusions are shared with those property owners most affected by the fires prior to the conclusions being released to the public.

The letter also listed as bullet points the feedback received at the various community meetings. The Review Team fully accepted the three recommendations above and committed to ensuring that they happen. While addressing the terms of reference of the review the report attempts to answer the majority of the issues raised by the community, but notes some issues need to be addressed by other agencies. These issues will be raised by the Review Team.

## CONDITIONS LEADING UP TO FEBRUARY 2017

The Port Hills have had many fires over the years. Since records were made they show nearly 700 fires in total, but this year has seen the most destructive in land area and properties lost or damaged. There is a range of communities that have made the Port Hills their home. Some are purely residential dwellings, some are lifestyle blocks, and some are serious farmers or forestry plantations. A lot of residents have lived on the Port Hills for many years and are therefore very aware of the threat from fire.

The Review Team were impressed by the range of measures some residents had taken to try to protect their properties and those of their neighbours. One group in Early Valley Road had established a community fire party, a land owner in Hoon Hay Valley had brought an old fire truck to utilise the pump on it, for irrigation and fire protection. Land owners in the upper part of Worsleys Road had also created ground sprinkler systems on their properties, and there was also a large water catchment above the upper most property on this road. The Adventure Park had developed a fire plan, and it was noted that the Operations Manager had an extensive background in rural fire in his home country, Canada. He had invited urban and rural officers to inspect their facilities and invited suggestions to be included in their fire plan prior to the park opening to the public.

As the dry weather increased over the summer some residents began taking extra precautions ensuring grass was short and they had defensible space around their house. This was achieved through either grazing or mowing, but some frustration was aired around a few landowners who were not taking similar precautions and were letting vegetation grow unchecked. Some of these properties did not have resident owners. Generally, the communities were alert to the warnings from Selwyn and Christchurch about fire restrictions on the Port Hills. Residents did not visibly observe any urban or rural fire personnel in their communities over the period preceding the fire. They were also unaware of fire plans as referred to in the report by the Review Team.

## DURING THE FIRST DAYS OF THE FIRE

The residents we spoke to generally had a belief that they were adequately prepared. They also felt that as they had a large urban fire service on their doorstep, they were relatively protected and felt reasonably safe if there was an outbreak of fire. When the first fire started, followed a short time later by the second fire on Marleys Hill, many watched its progress overnight to ensure they were not going to be threatened by it. Most struggled to find any up to date information about the fire from any of the agencies involved. This trend continued throughout the incident, especially in the first few days when the fire was at its worst. Many of the residents who were displaced feel they were given little notice to evacuate.

Some residents who did feel threatened by the fire on the first night began preparations for evacuation by loading valuable and precious items into vehicles in case an evacuation was ordered. But the first morning after the fire commenced public communication indicated the fire was contained. The visible threat appeared to be less, so many residents unpacked their vehicles thinking the worst was over.

With the messaging that the fire was contained and little visible sign of firefighting activity on the ground the residents naturally thought all was well. The only visible activity on the Tuesday was helicopters overhead that were being used as the main firefighting attack strategy. But late in the day the fire did not look like it was contained, and residents began their own fire watches, some setting alarms to ensure they woke up during the night to check the fire's progress in relation to their homes. Residents, who were later required to evacuate, found roads were often blocked and there were many Christchurch residents who came for a closer look at the fire and blocked roads and exit routes.

Most residents interviewed told the Review Team they received their most up to date information from neighbours and from friends and family through texts and phone calls. There was a common frustration expressed around the lack of information available at the cordons, and even for those that went to the recovery centres. While they found that in the main the people on the cordons were very polite, the lack of information they could provide proved frustrating for all concerned.

The community expressed that it was public knowledge that there was a disconnect between the urban and rural fire managers and they seemed to be operating independently. This probably stemmed from firefighters interviewed by the media expressing frustration at not being used at times when they felt they should be. The residents in Worsleys Road were particularly frustrated that there was not a significant NZFS presence as it became obvious to them on the Wednesday that the fire was becoming more threatening to their properties. Even when 111 calls were transmitted during the Wednesday afternoon it was nearly an hour before a fire appliance was visible on the road. As one resident emphatically stated, "Did we actually need to call 111? Wasn't it obvious to all who could see the Port Hills that there was a significant fire happening?"

The Review Team found the residents they interviewed very polite and simply desperate to understand why their properties were destroyed. They were appreciative of the opportunity to speak to the Review Team and none of their criticism was directed at the firefighters on the ground. All agreed they did a great job. The frustrations were around areas such as:

- why there were not earlier warnings so residents had time to gather valuables
- why there was so little up to date information for the public
- why resources were pulled on the first evening of the fire
- why it took so long before firefighting activity occurred
- why there were so few firefighters on the ground
- why there wasn't a more visible Fire Service presence in Worsleys Road and Hoon Hay Valley on the day that weather predictions indicated would be a high fire risk day and they seemed to be obvious communities at risk
- what does 'contained' and 'controlled' mean.

Not all of their questions may be fully answered through this report. The Review Team has endeavoured to provide an evidence-based description of the events through the first few days of the fire to assist this understanding.

The Review Team also acknowledges the role and the anxiety of the community through the fire event. Many individuals were affected, displaced, and in some instances lost their homes. Thanks goes to those families who gave their time to the Review Team and contributed to this report. It is always traumatic for those impacted by fire and we believe that working with the community in terms of fire preparedness will be vital into the future. Making the focus of 'community at the centre' will be an important learning for future planning, response and recovery.

## RECOVERY

There is increasing recognition in the fire and emergency management sector that recovery is as important as incident response – and may be a much longer and more expensive process than the initial phase of mitigating and making safe the hazard. IMTs need to take account, as soon as possible, the potential needs of the recovery phase and find a way of integrating recovery needs into the incident management team and incident action plan.

The agency responsible for recovery may not be the agency responsible for response, so a managed way of transitioning to a formally constituted recovery team (perhaps, operating in parallel with the IMT to start with) needs to be identified. The recovery team will be best placed to establish its current and ongoing need for information and intelligence on which to base long-term recovery planning.

Firstly, while recognising the need to prioritise recovery issues early, we think there is a difference between the sort of immediate information that an IMT requires (damage to infrastructure, casualties, ongoing hazards such as dangerous trees and structures) and the broader societal recovery information that the responsible recovery agency might require. We agree that it is entirely appropriate for an IMT to commission information gathering and analysis directed to the former, but we would encourage some further thought to be given to who should commission a broader study of impacts such as that represented by the report we have seen.

We would suggest that a good starting point is to identify, as early as possible, who will be responsible for directing (and funding) recovery activities once the response phase of an incident is complete. We do not think that it will usually be the IMT that is directing response. The recovery agency should then take control of giving direction to any information gathering and analysis exercise that is intended to inform future recovery activities.

## 6. CONCLUSION

We wish to finish this report as we started it, by paying tribute to the many people who went the extra mile to deliver a safe, effective response to the Port Hills fires of early 2017.

Much about the 2017 fires were, literally, unprecedented. The weather conditions, the focus on the scale of National assistance, and the interest from sections of the public in firefighting objectives and tactics were all novel.

The firefighting agencies in New Zealand have shown their intent to learn from this event, both in commissioning this report and in their willingness to contribute to it. There are things to learn that are inevitable in an event of this scale. But we think that if the same incident had occurred elsewhere, similar learnings could have been identified regardless of the jurisdictions involved.

The fundamental learnings from the Port Hills fires are:

- Interoperability is essential for emergency services. A single incident management system, well-rehearsed and practised, is critical to the success of Fire and Emergency New Zealand.
- The fire and emergency sector should never under-estimate the hunger for information in this information age. 'Dealing with the emergency' is not a reason for not running a comprehensive and well-staffed information and communications operation.
- Community must be at the heart of the way that we operate in emergency management.
- Fire and Emergency New Zealand is forward-looking and contemporary in its approach.

The Review Team would like to thank all organisations and individuals that made the time to assist us with our work.



# 7. GLOSSARY

## ABBREVIATIONS

The following abbreviations may have been used in the report text.

AA	Assembly area	IMT	Incident Management Team
AAC	Assistant Area Commander	ISO	Incident safety officer
AAS	Attack Supervisor	LMR	Land mobile radio
AC	Area Commander	LPD	Low pressure delivery
AFAC	Australasian Fire and Emergency Service Authorities Council Limited	NRFA	National Rural Fire Authority
ANC	Assistant National Commander	NZFS	New Zealand Fire Service
BA	Breathing apparatus	NZPFU	New Zealand Professional Firefighters Union
BUI	Build Up Index	OIC	Officer in charge
CCC	Christchurch City Council	PIM	Public Information Management team
CFBT	Compartment fire behaviour training	PPE	Personal protective equipment
CIMS	Coordinated Incident Management System	PRFO	Principal Rural Fire Officers
ComCen	Communication Centres	RFA	Rural Fire Authority
DC	Drought Code	RIMT	Regional Incident Management Team
DMC	Duff Moisture Code	SDC	Selwyn District Council
DNC	Deputy National Commander	SFP	Safe forward point
DOC	Department of Conservation	SHEP	Significant Hazard Exposure Protocol
DPRFO	Deputy Principal Rural Fire Officer	SHURTS	Size-up, Hazards, Using, Requirements, Tactics, Structure
ECP	Entry control point	Sitrep	Situation report
EOC	Emergency Operations Centre	SMS	Station Management System
eIAP	Electronic incident action plan	SO	Station Officer
FCP	Forward control point	SOP	Standard operating procedure
FENZ	Fire and Emergency New Zealand	SouthCom	NZFS Southern Communications Centre
FFMC	Fine Fuel Moisture Code	SSO	Senior Station Officer
FSA	Forward staging area	STFMP	Strategic and Tactical Fire Management Plan
HAULET	Height, Area, Used as, Location of fire, Equipment, Tactical mode	TLO	Technical Liaison Officer
HCU	Hazmat/command unit	ToR	Terms of Reference
HPD	High pressure delivery	VRFF	Voluntary Rural Fire Forces
IAP	Incident action plan		
IC	Incident Controller		
ICAD	Intergraph Computer Aided Dispatch		
ICAM	Incident Cause Analysis Method		
IGC	Incident ground communications		

# 9a. APPENDIX 1

## SIGNIFICANT FIRE PROGRESSION EVENT CHRONOLOGY

### Port Hills Complex Wildfire, 13 February 2017, Christchurch, New Zealand

*The scope of this report was to detail the fire progression and chronology of significant events relative to the Port Hills fires spread and behaviour.*

*This report contains information and maps derived from helicopter fire progression GPS logs, 111 calls, NZFS ICAD reports, time referenced photos, Prometheus fire behaviour calculations, interviews and logs. This report is in draft form and was prepared as an introduction to the Selwyn District Council debrief process. It is expected that the debrief process will lead to alterations to this report as further information becomes available. Information from several sources including NZ Police, Department of Conservation, Firefighters, Christchurch City Council, Civil Defence, NZ Defence Force, contractors and other agencies has not been collected/interrogated at the time this report was prepared, as such it must be accepted that this report is the best representation of the fire progression and chronology given the information available and assessed at this time.*

*Dependant on the terms of reference for the Operational Review process, it may be necessary to further detail this report based on the factors identified above.*

### Introduction

- 1) The Port Hills fires was one of the biggest in recent New Zealand history and the most severe in terms of the number of houses burned and people evacuated. Significant infrastructure was either threatened or lost (Christchurch Adventure Park, major powerlines, radar, Sugarloaf tower).
- 2) The 2016/17 fire season has seen the greatest loss of houses to wildfires in 100 years, with approximately 20 homes lost in fires across the country. The Port Hills Complex contributed to nine dwellings destroyed and a further five damaged (Appendix 1). The final extent of the Port Hills fire is 1661 ha with a perimeter of 61 km. This area makes it one of the largest fires since the Wither Hills fires of 2000 and Alexandra fires in 1999. For the Canterbury region, it would be one of the largest, if not the largest, since the 1955 Balmoral forest fire.
- 3) The Port Hills complex fire met the definition for an extreme fire. It escalated suddenly, spread rapidly and with high intensity, threw embers ahead of the fire front, and the formation of fire whirls were observed. Normally fires burn fast uphill and slower downhill. The wind swinging from westerly to north easterly on Wednesday 15th changed that. The fire turned and began to burn downhill on several fronts, in the direction of the city.
- 4) The mop up and management of this fire continued for over three weeks and had a significant impact on this community.

## CHRONOLOGY

### Early Valley Fire

- 5) At 17:44 hours on Monday the 13th of February 2017 a scrub fire was reported burning on the uphill side of the road just to the east of Rapid number 60 Early Valley Road. Under hot dry windy conditions the fire quickly spread upslope and to the south east through 100% cured grass and gorse.
- 6) Fire behaviour predictions based on an uncalibrated scenario using data from the Lincoln weather station are as follows. The initial Head Fire Intensity (HFI) is calculated to have been around 300 to 1000 kw/m<sup>2</sup> with a Rate of Spread (ROS) of 3 to 10 m/min (0.18 to 0.6 km/h) in the grass fuels and HFI 15,000 to 35,000 kw/m<sup>2</sup> with a ROS of 15 to 20 m/min (0.9 to 1.2km/hr) in the gorse fuels (photos have the Rate of Spread closer to 30m/min in the gorse fuels).



*(Uncalibrated prediction using data from the Lincoln weather station. Image supplied by Scion Rural Fire Research)*



Early Valley Fire, taken at 17:48 hours 13/02/17



Also taken at 17:48 hours 13/02/17 from a different view point

**EARLY VALLEY FIRE INITIAL PROGRESSION.** (approx. 4 min intervals, ROS approx. 30 m/min)



**17:44**



**17:48**



**17:52**



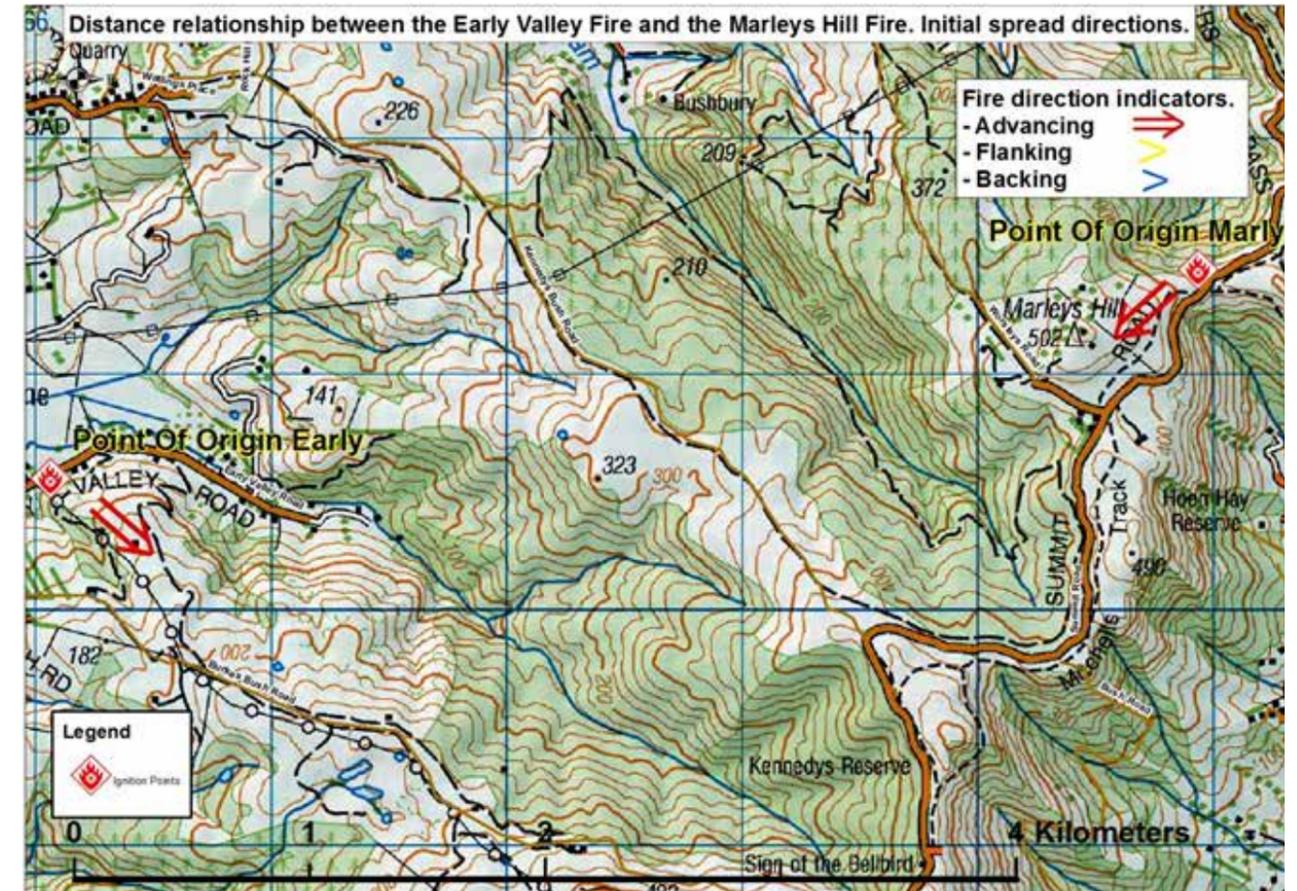
18:01

- 7) By 18:40 hours (approx. 1 hour from ignition) the head fire had travelled approximately 1.5 km, damaging three homes and destroying another. It was still running up the ridge to the south east and flanking to the north and south into pasture, gorse, pine plantations and threatening more homes.
- 8) The contributing factors to the speed and intensity of the initial Early Valley fire runs were:
  - (a) Daily Fire Weather (Motukarara) : FPMC 86, DMC 58, DC 462, ISI 5.7, BUI 88, FWI 20.1
  - (b) Hourly Fire Weather at 1900 (Motukarara): FPMC 86, DMC 58, DC 462, ISI 13, BUI 88, FWI 35,
  - (c) Estimated weather: Temp: 20.3 C , RH: 36% , Wind speed: 13 – 33.5 k/hr
  - (d) Slope: Av 12 degrees (over first 500 m)
  - (e) Fuel: Gorse and 100% cured grass
  - (f) Minimal ability for suppression given the access, intensity of the fire and lack of aircraft in the first hour.

### Marleys Hill Fire

- 9) At 19:11 hours a second wildfire fire was reported around 5 km away to the east-northeast on Summit Road.

**Map 1** – Shows the distance relationship and initial spread directions of the two fires.



- 10) This fire was below Summit Road and under the same hot dry windy conditions (differing wind direction) as the Early Valley fire it escalated quickly burning uphill and up wind to the southwest through gorse and 80% to 90% cured grass, and back down hill to the northeast into a pine plantation.
- 11) Fire behaviour predictions based on an uncalibrated scenario using data from the Christchurch Aero weather station as follows. The initial Head Fire Intensity (HFI) is calculated to have been around 300 to 1000 kw/m<sup>2</sup> with a Rate of Spread (ROS) of 1 to 5 m/min (0.06 to 0.3 km/h) in the grass fuels. HFI 3,000 to 15,000 kw/m<sup>2</sup> with a ROS of 1 to 10 m/min (0.06 to 0.6 km/h) in the gorse fuels. HFI 500 to 2,500 km/m<sup>2</sup> with a ROS of 0.5 to 1 m/min (0.03 to 0.06 km/h) in the pine fuels.



(Uncalibrated prediction using data from the Christchurch Aero weather station. Image supplied by Scion Rural Fire Research)

- 12) The start of the Marleys Hill fire was captured by this photo taken at 19:09 hours. The smoke column from the Early Valley fire is visible in the background.



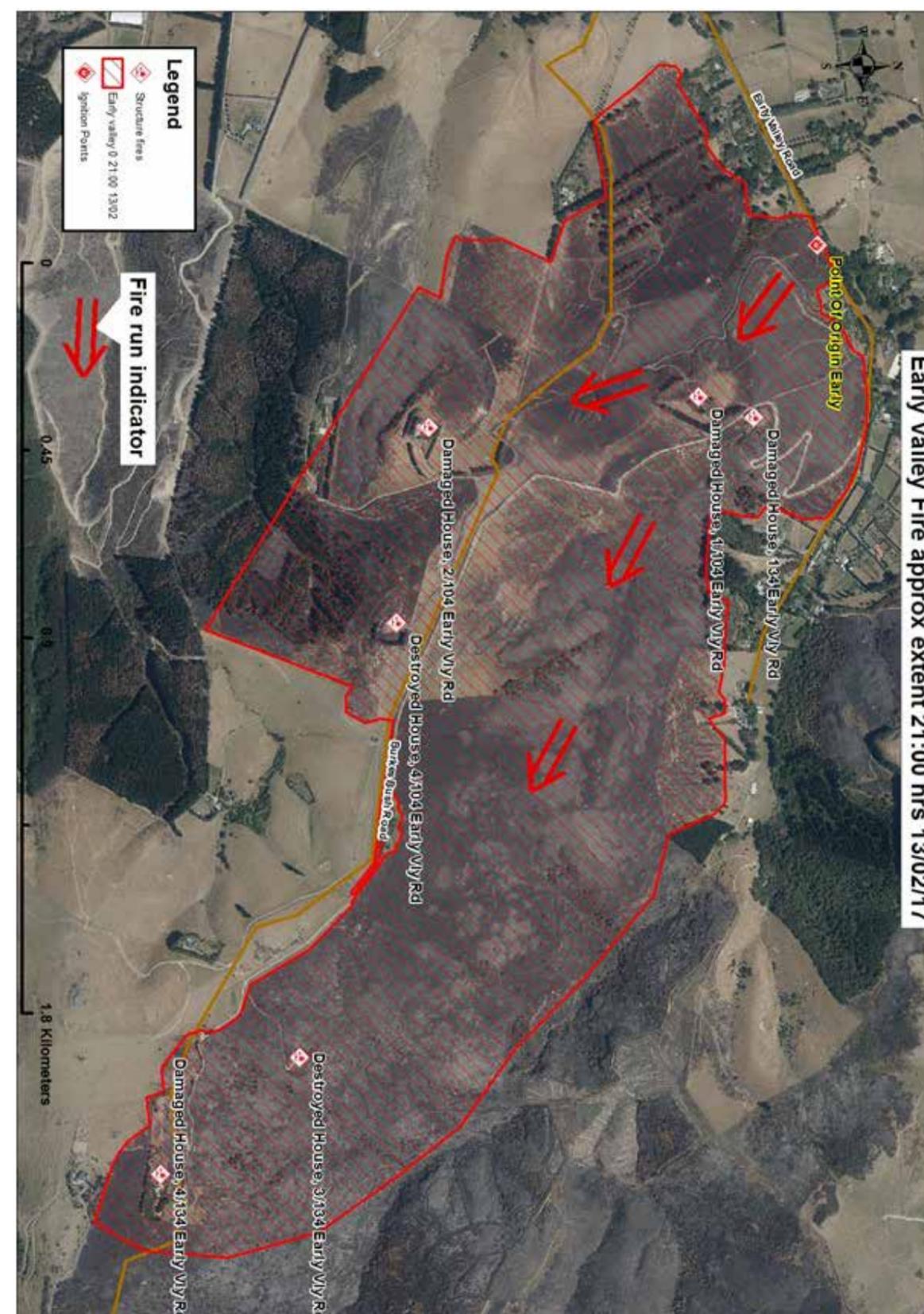
Smoke column from the Early Valley fire driven by a north westerly wind.

Marley Fire taken at 19:09. Wind from the northeast.

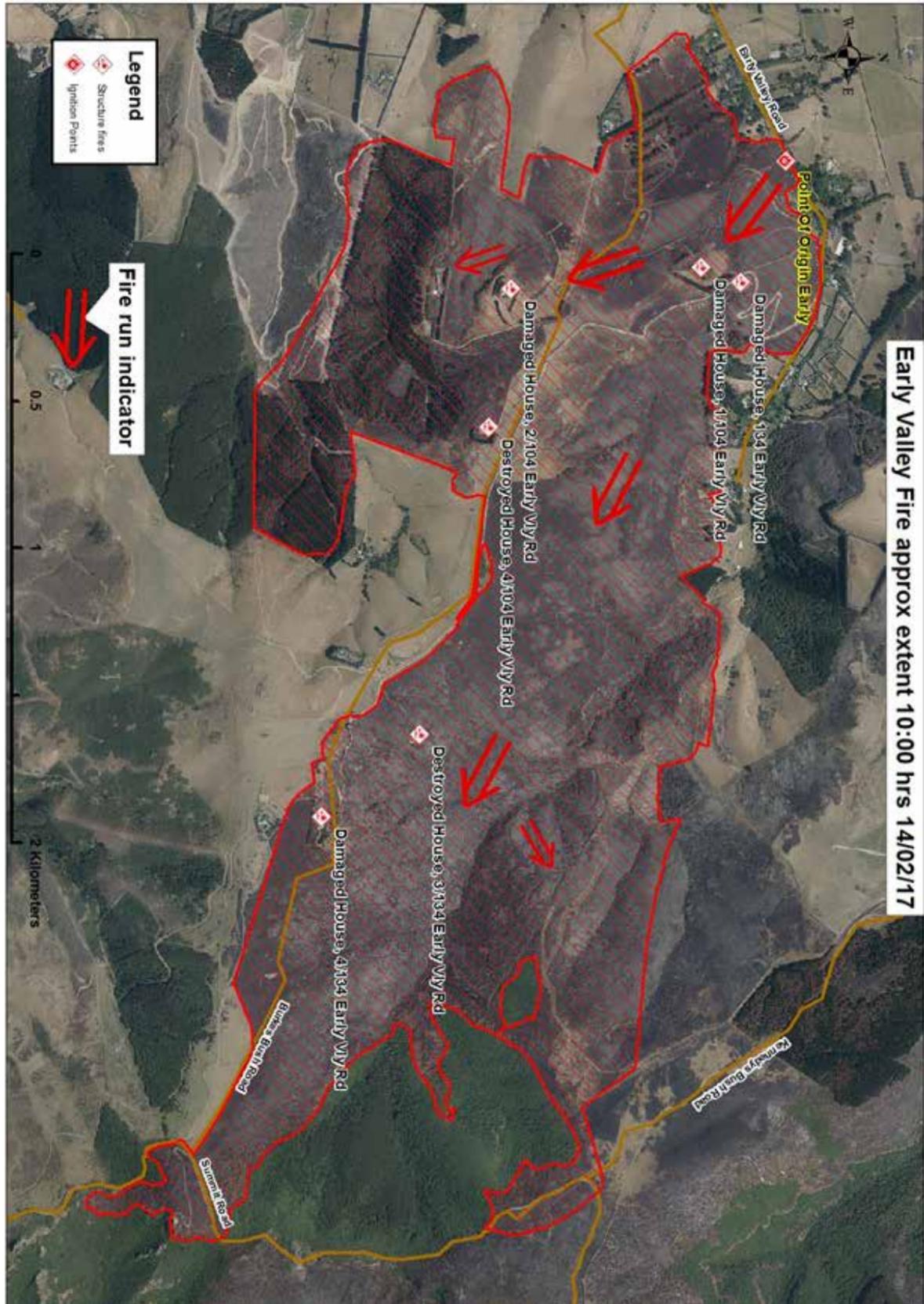
- 13) Marleys Hill fire in the minutes after it started actively burning.



- 14) The contributing factors to the speed and intensity of the initial Marleys Hill fire runs were:
  - a) Daily Fire Weather (Sugarloaf) : FPMC 84, DMC 56, DC 461, ISI 6.8, BUI 86, FWI 22.5
  - b) Hourly Fire Weather at 1900 (Sugarloaf): FPMC 85.3, DMC 56, DC 461, ISI 24.9, BUI 88, FWI 49,
  - c) Estimated weather: Temp: 19.6 C , RH: 38% , Wind speed: 18 – 40 km/h
  - d) Slope: Av 10 degrees (over first 500 m)
  - e) Fuel: Gorse and 90% cured grass
  - f) Eastern flank was harder to suppress due to fuel and access.
  
- 15) Both fires continued to run into the evening with helicopters and ground crews working on containment. At approximately 21:00 hours the helicopters stood down (lack of light) on the Early Valley fire, by this stage it had travelled around 3 km, covered 230 ha, damaging three homes and destroying another. Two more houses were now surrounded by flames and within the next few hours one was destroyed and the other damaged. The fire was still running up the ridge to the south east and flanking to the north and south into pasture, gorse and pine plantations (**See Map 2**). By 10:00 hours the following morning (Tuesday, 14 February) the Early Valley fire had reached the top of the ridge, crossed Summit Road (08:00 to 09:00 hours) and was backing down towards Governors Bay (**See Map 3**).

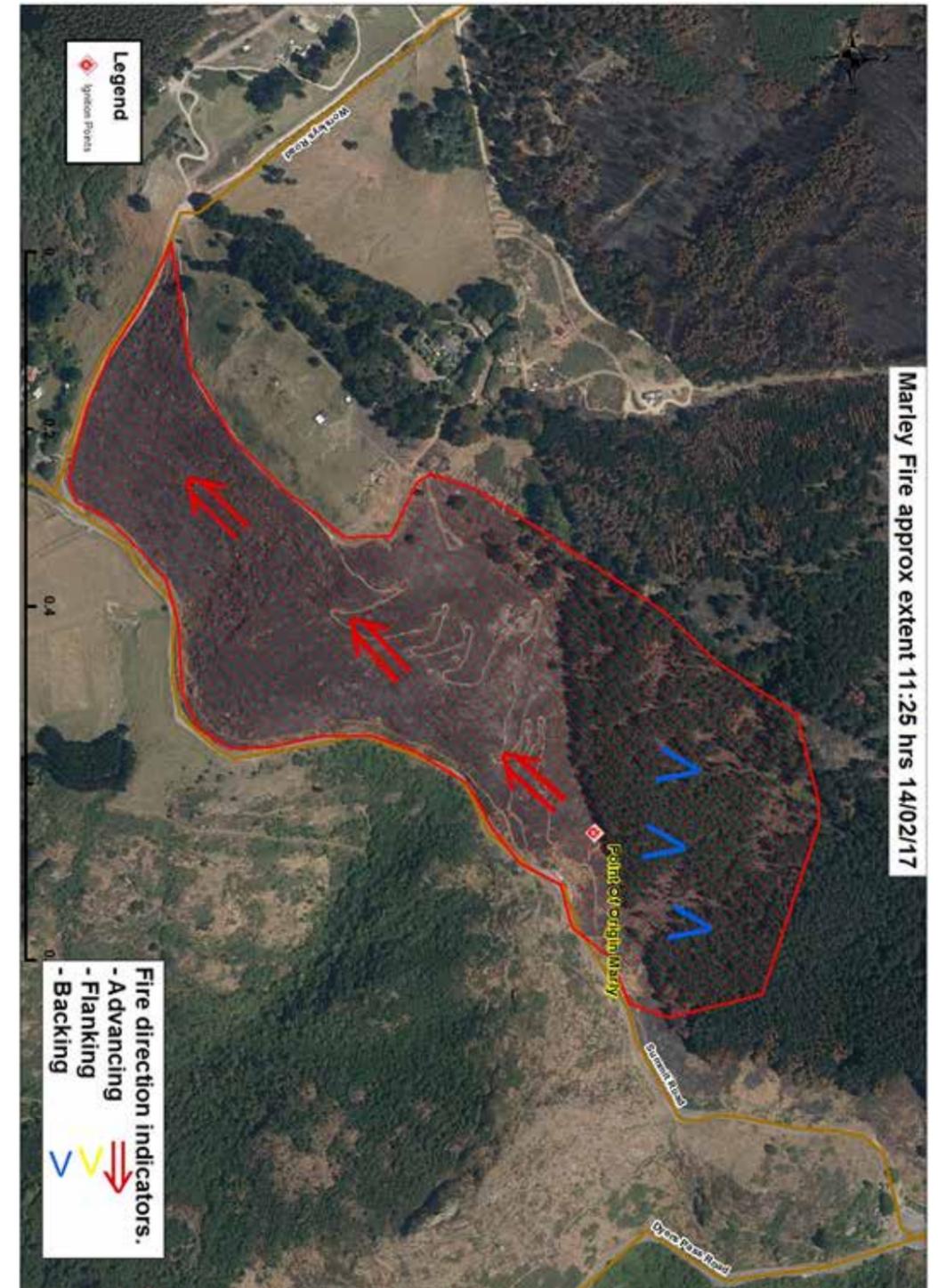


Map 2



Map 3

- 16) The Marleys Hill fire was actively fought overnight and by 11:25 hours the following morning (Tuesday, 14/02/17) it was contained to the southwest and backing very slowly downhill into a pine plantation to the northeast. It had travelled approximately 1 km and covered 28 ha.

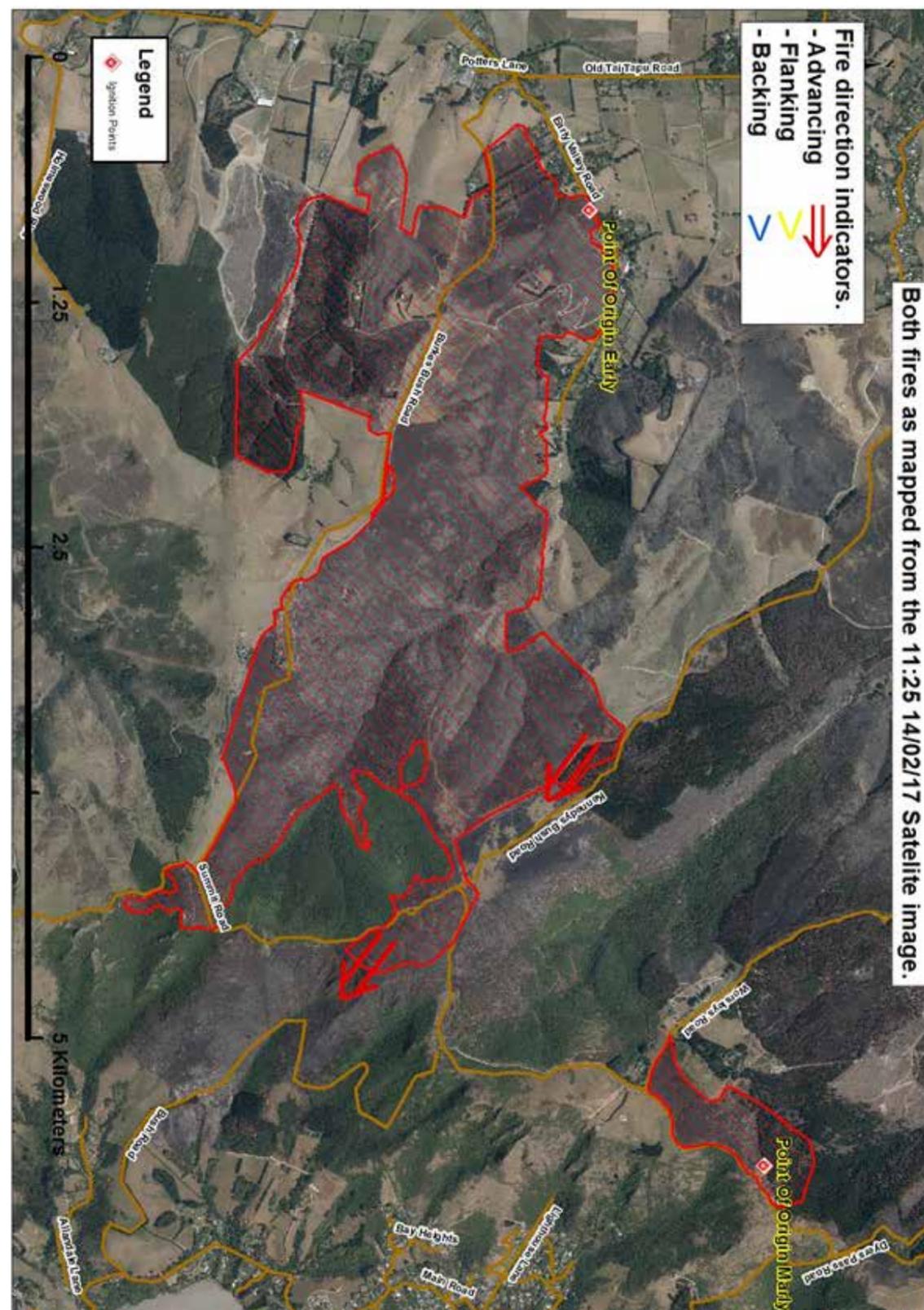


Map 4

- 17) A passing satellite captures the extent and activity of both fires at 11:25 hours on Tuesday, 14/02/17. Note the Marleys Hill fire is showing very little activity and the Early Valley fire is showing two main runs and a few scattered hot spots. Early Valley 496 ha, Marleys Hill 28 ha.



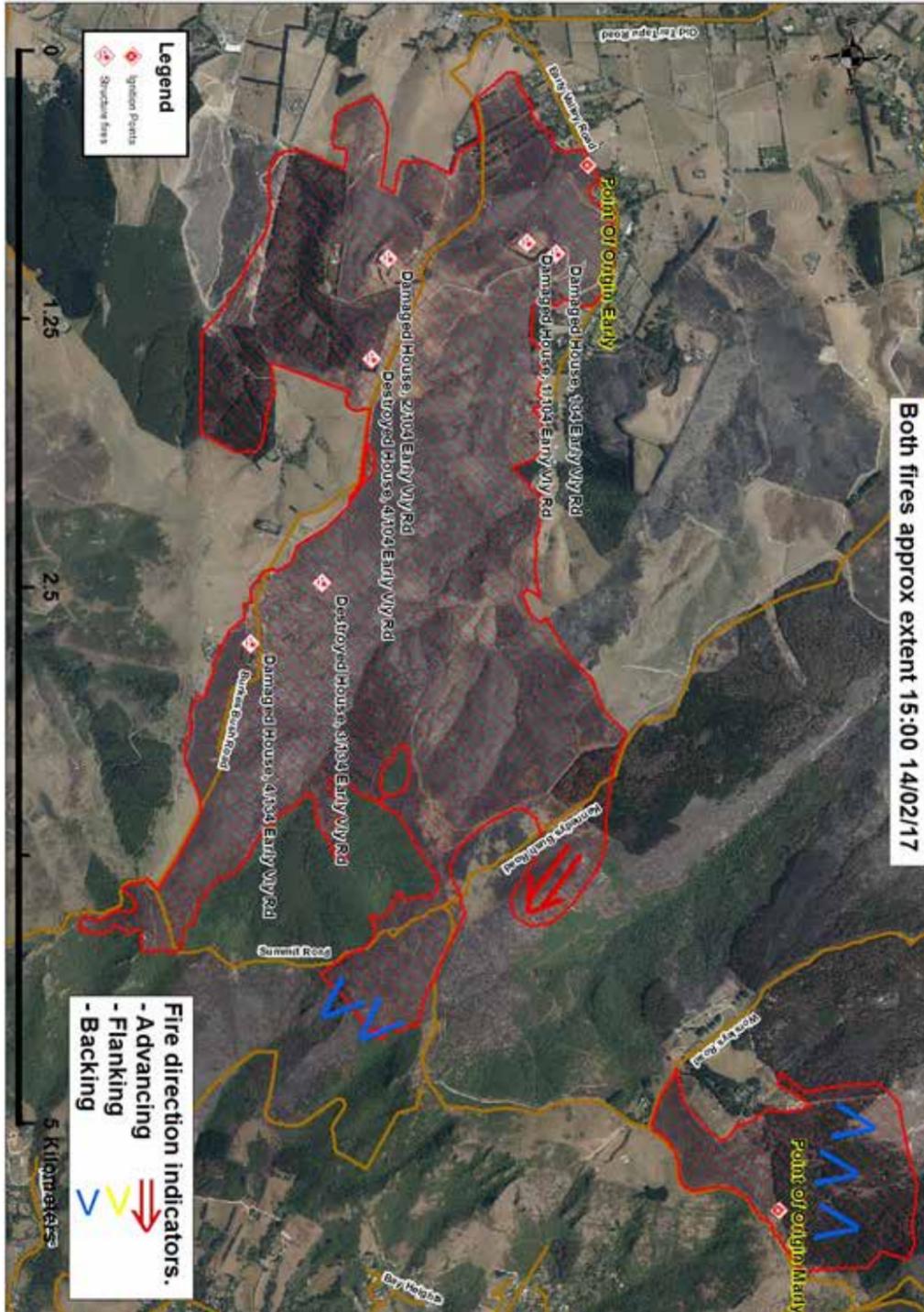
Satellite 1



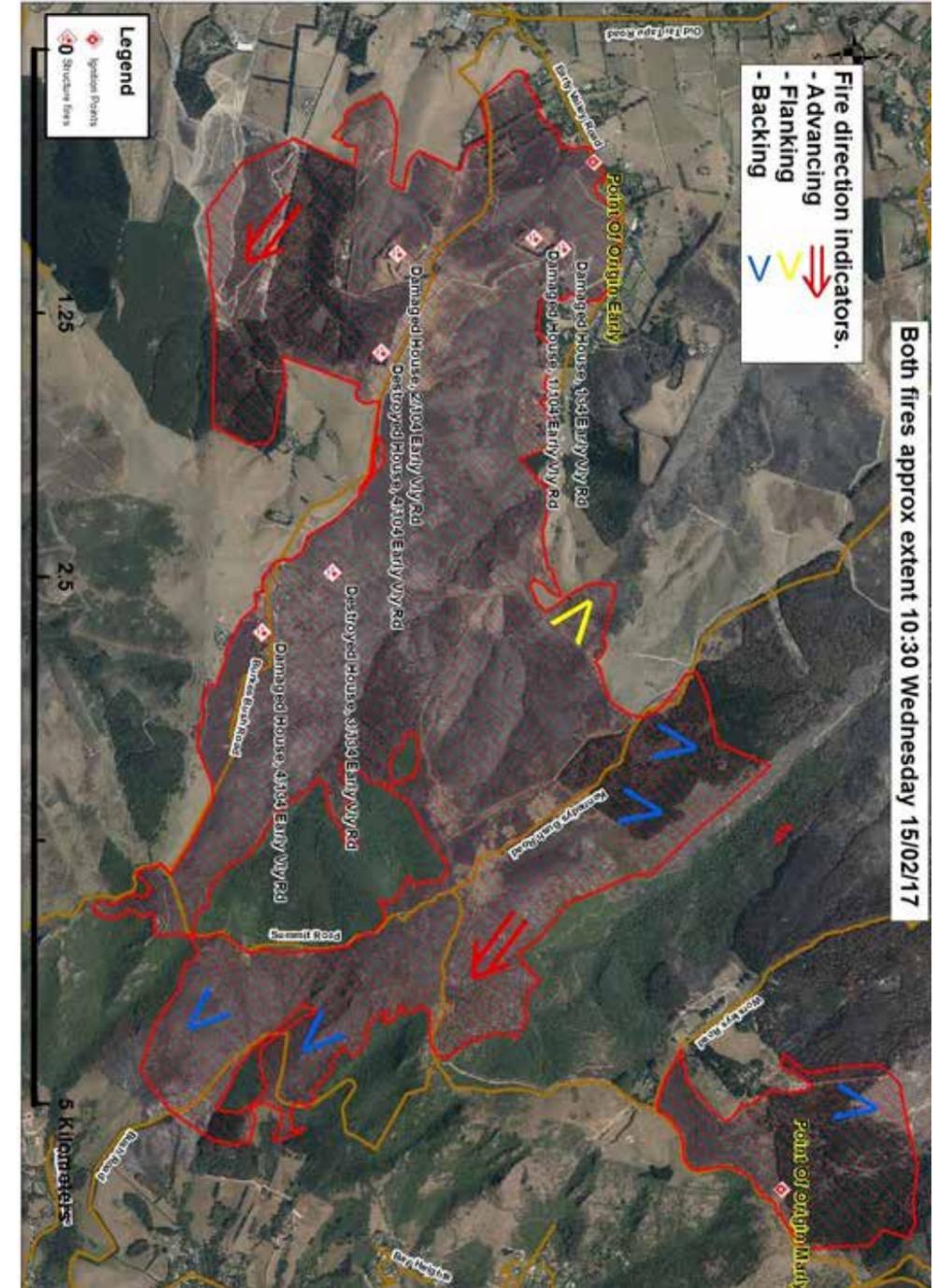
Map 6

- 18) Later that day (Tuesday) at 15:00 hours under moderate fire conditions the Early Valley fire was still making small growth on the north-eastern flank and had also started backing down towards Governors Bay. The Marleys Hill fire was backing slowly down into the pine plantation to the north.

- 19) By 10:00 hours the following morning, Wednesday the 15/02/17, the Marleys Hill fire had not grown overnight and the Early Valley fire had continued backing down towards Governors Bay to the east and backed into the pine plantation to the north. It was shortly after this time that a significant wind shift from the north east would join the two fires and start a series of devastating downslope runs to the north and west that would eventually destroy or damage a further eight homes in the next 24 hours.

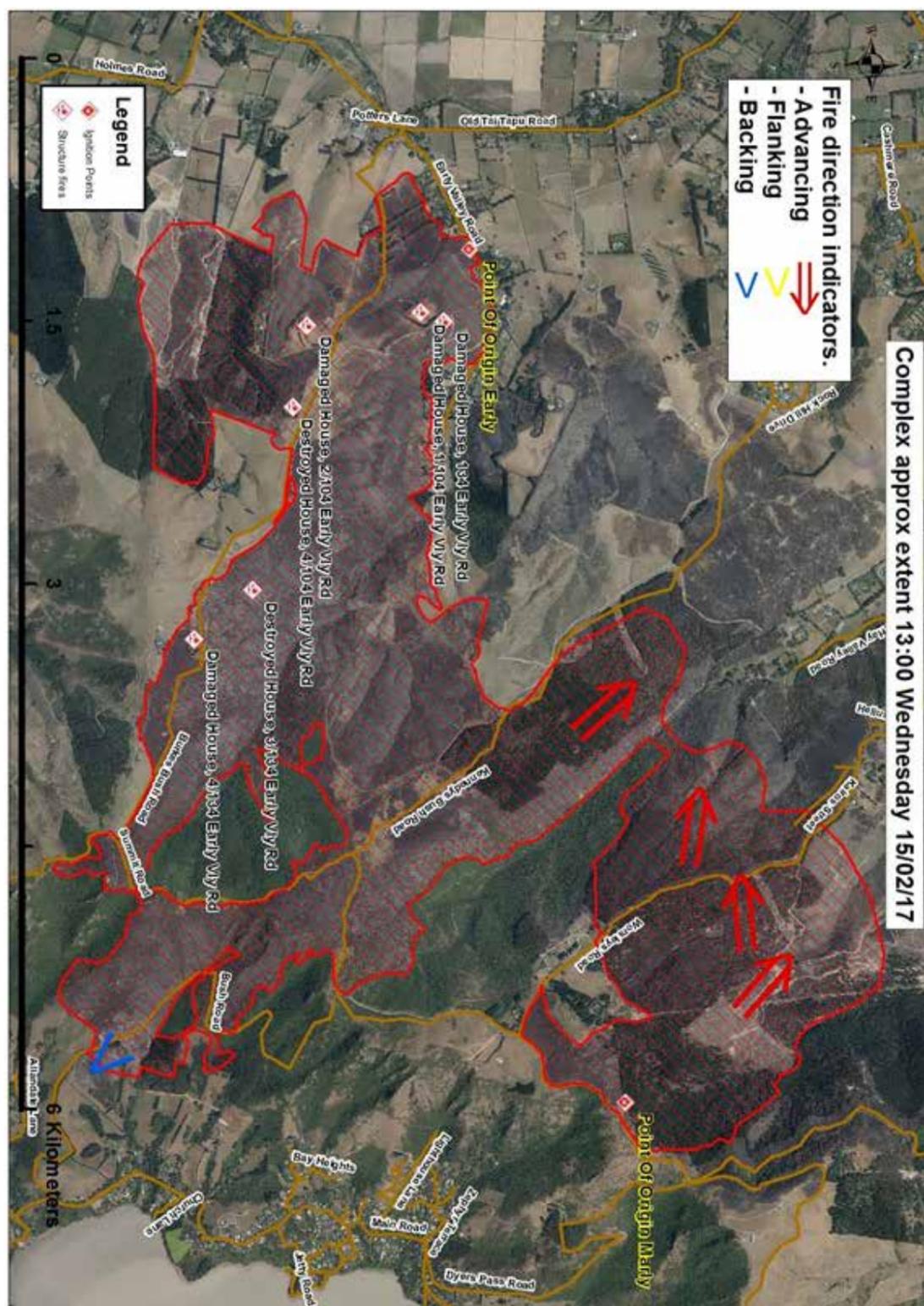


Map 7



Map 8

- 20) By 13:00 hours, Wednesday the 15/02/17, both fires had commenced runs to the north and west and had joined into what was to be known as the Port Hills Complex. A limited amount of backing was still occurring on the lower slopes to the east above Governors Bay. The complex now covers approximate 1000 ha and has a perimeter of 40 km.



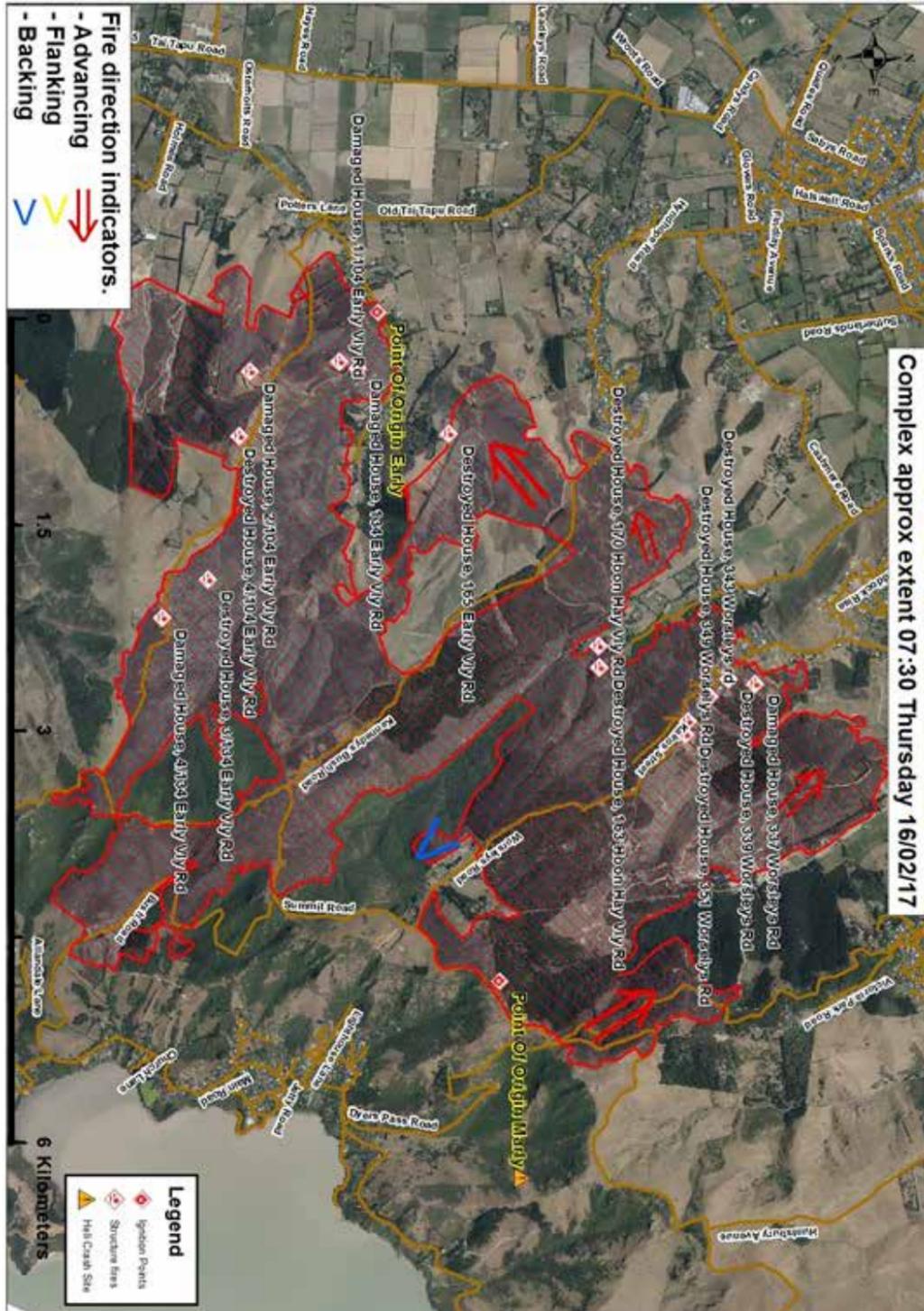
Map 9

- 21) Four and a half hours later at 17:30 hours, Wednesday 15/02/17 the complex has pushed down the gully to the north of Worsleys Road and had made a series of up slope runs back to the southwest into the homes situated on Worsleys spur. At this time houses are already being lost and in the next few hours it will have destroyed three homes in this area. The fire had also run down slope into the Hoon Hay Gully destroying two homes. By 18:30 hours a fire run, from the Hoon Hay side down a gully back into Early Valley Road destroys another home. The exact timing (within 30 mins) of the loss of some of these properties is unknown due to firefighters being evacuated from this area, lack of information and/or visibility at the time.



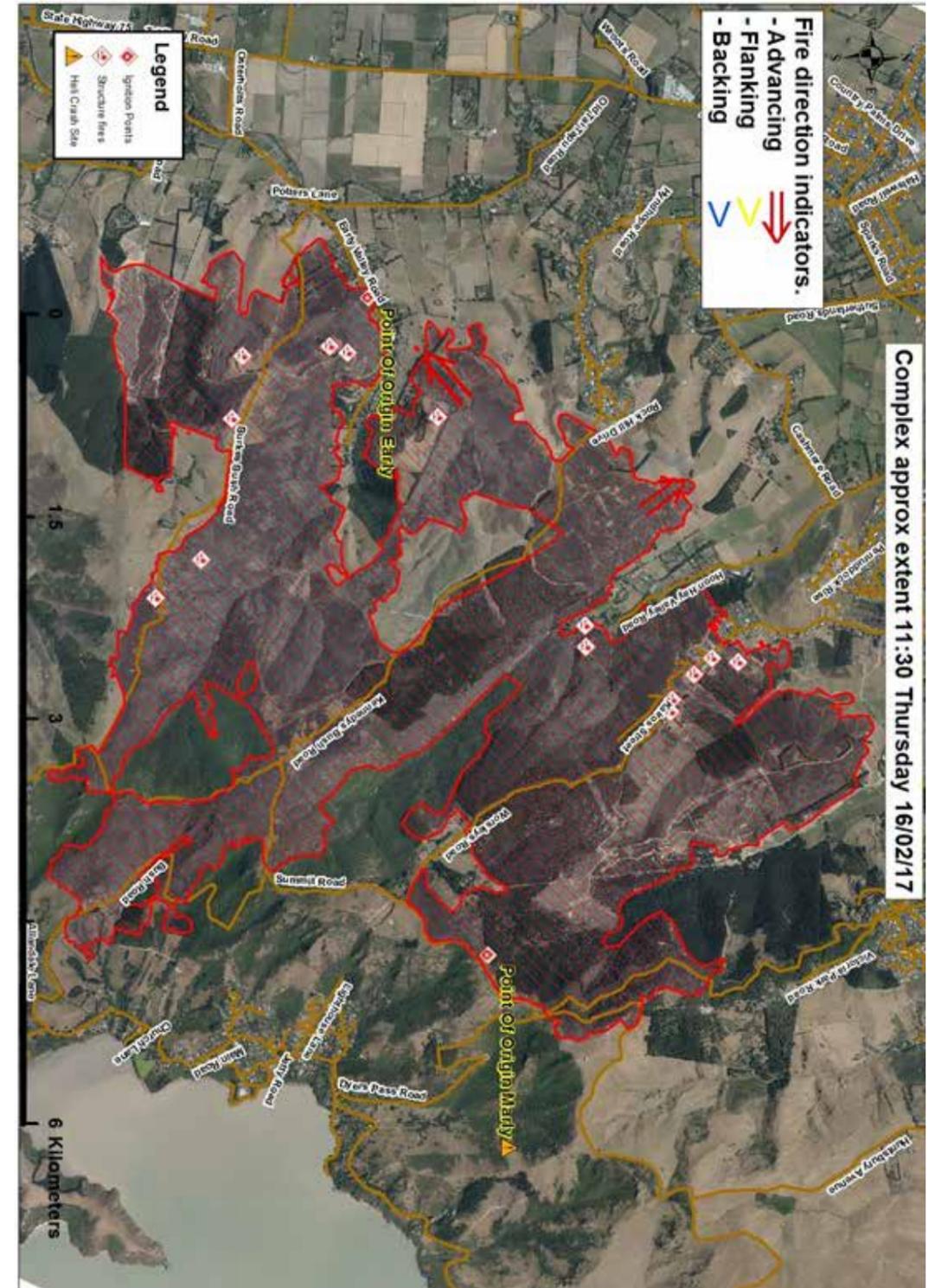
Map 10

- 22) By 07:30 hours the following morning, Thursday the 16/02/17, the complex has claimed another two properties on Worsleys Road, one damaged around midnight and another destroyed the next morning. This was to be the last home claimed by the fires. The complex now covered approximately 1600 ha and had a perimeter of 57 km.



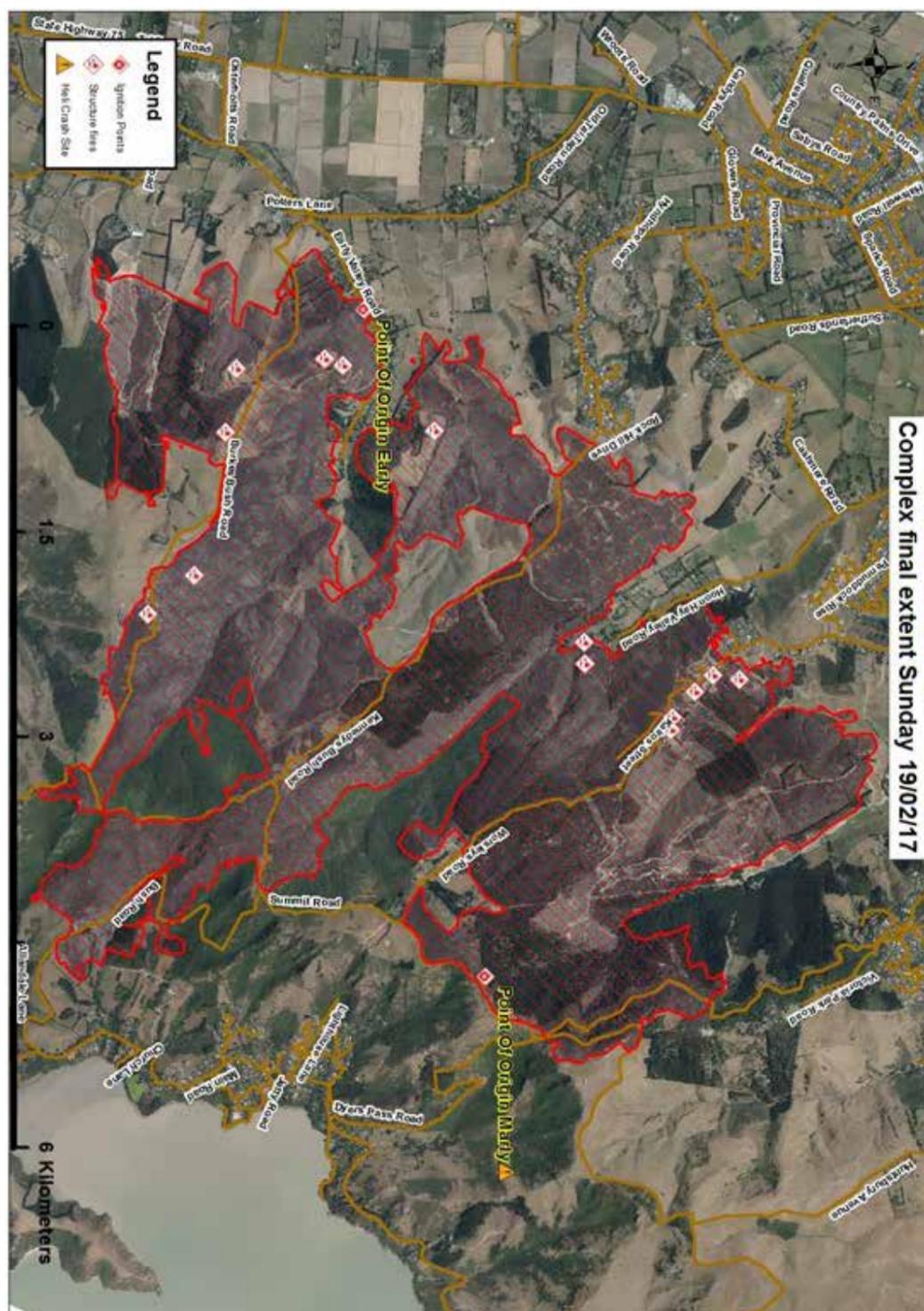
Map 11

- 23) By 11:30 hours on the Thursday the fire had stopped running with only a small amount of growth back towards Early Valley Road and off the spur to the southwest of Hoon Hay Valley Road.



Map 12

- 24) The final extent of the Port Hills Complex was mapped from aerial photography taken on the 24/02/2017. The fire did not make any more runs and the only growth was from a couple of small escapes. The final area covered is 1661 ha with a perimeter of 61 km.



Map 13

## 9b. APPENDIX 2

### PORT HILLS TOPOGRAPHY AND VEGETATION REPORT - 13 JUNE 2017

The scope of this report was to provide a summary on the Topography and Fuels present in the areas burnt by the Port Hills Fires 2017.

Port Hills (Model)



#### OVERVIEW

The Port Hills are a range of hills in Canterbury, New Zealand, so named because they lie between the city of Christchurch and its port at Lyttelton. They are an eroded remnant of the Lyttelton volcano, which erupted millions of years ago.

The hills start at Godley Head, run approximately east-west along the northern side of Lyttelton Harbour, and continue running to the south, dividing the city from the harbour. The range terminates near Gebbies Pass above the head of the harbour. The range includes a number of summits between 300 and 500 metres above sea level. The range is of significant geological, environmental and scenic importance.

Considered an outstanding natural feature and landscape of national importance, there are a number of internationally significant geological features, including prominent rock outcrops and a number of volcanic dykes, within them. The area is also important in terms of scenic value for residents and visitors to Christchurch, with road access along the Summit Road, walkway networks and through the operation of Mt Cavendish gondola.

As the economic fortunes of sheep and cattle farming have declined, so has the viability of pastoral farming on the Port Hills. For some, farming is simply uneconomic and farmers have sought ways to get a better income from their land. One of these is the introduction of exotic forest.

## VEGETATION

According to the Land Cover Database v4.1 2015, the vegetation types burnt by the Port Hills fires were for the greater part a mix of exotic forest 35.7%, exotic grassland 29.9%, gorse/broom 22.8% and broadleaved hardwood scrub at 10.7%. The exotic forest was predominantly *Pinus radiata* 20 years old or greater, with some small stands of Douglas fir, *Pinus nigra* (Corsican) and eucalyptus.

Although the Port Hills contains pockets of indigenous forest, the fire conditions were such that areas like Kennedys Bush did not burn.

Large areas of the gorse/broom and some of the finer fuels and grass around them had been sprayed and were 100% cured. This would have made an already flammable species even easier to ignite.

Much of the exotic grasslands also had an elevated fire danger due to lack of grazing, lack of maintenance or a change in land use, due in part to the Christchurch earthquake of 2011. Much of the north facing grasslands had a grass curing of 80% to 100%. The south facing aspects were considerably greener and as low as 30% in some of the wet gullies as was evident from the fire progression.

## TOPOGRAPHY

The area burnt within the Port Hills can be categorised as a series of moderate to steep ridges and gullies running roughly northwest to southwest. These features start at near sea level at the north-western base of the Port Hills and rise up to around 500 m at the summit overlooking Lyttelton Harbour.

The aspect of much of the burnt area was north to northwest facing. Fire growth and intensity were significantly reduced where the fires encountered a more southerly aspect.

The slope factors can be summarised as follows. Slopes of 1 to 10 degrees covered 15.8% of the total area burnt, slopes of 10 to 20 degrees covered 43.1% and slopes of 20 to 30 degrees covered 34%.

## WILDFIRE THREAT ANALYSIS

Wildfire threat analysis outputs from the Canterbury Wildfire Threat Analysis Project were deemed to be too low (Port Hills STFMP) and as such were redefined. Using the normalised threat value levels, the area burnt can be generalised as medium to high threat. The north-eastern (Marleys Hill fire) side of the Complex is predominantly higher than the south-western side. (Scale, 350 – 700 medium, 700 – 1233 high).

This report was researched and prepared by

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## SECTIONS IN THIS REPORT

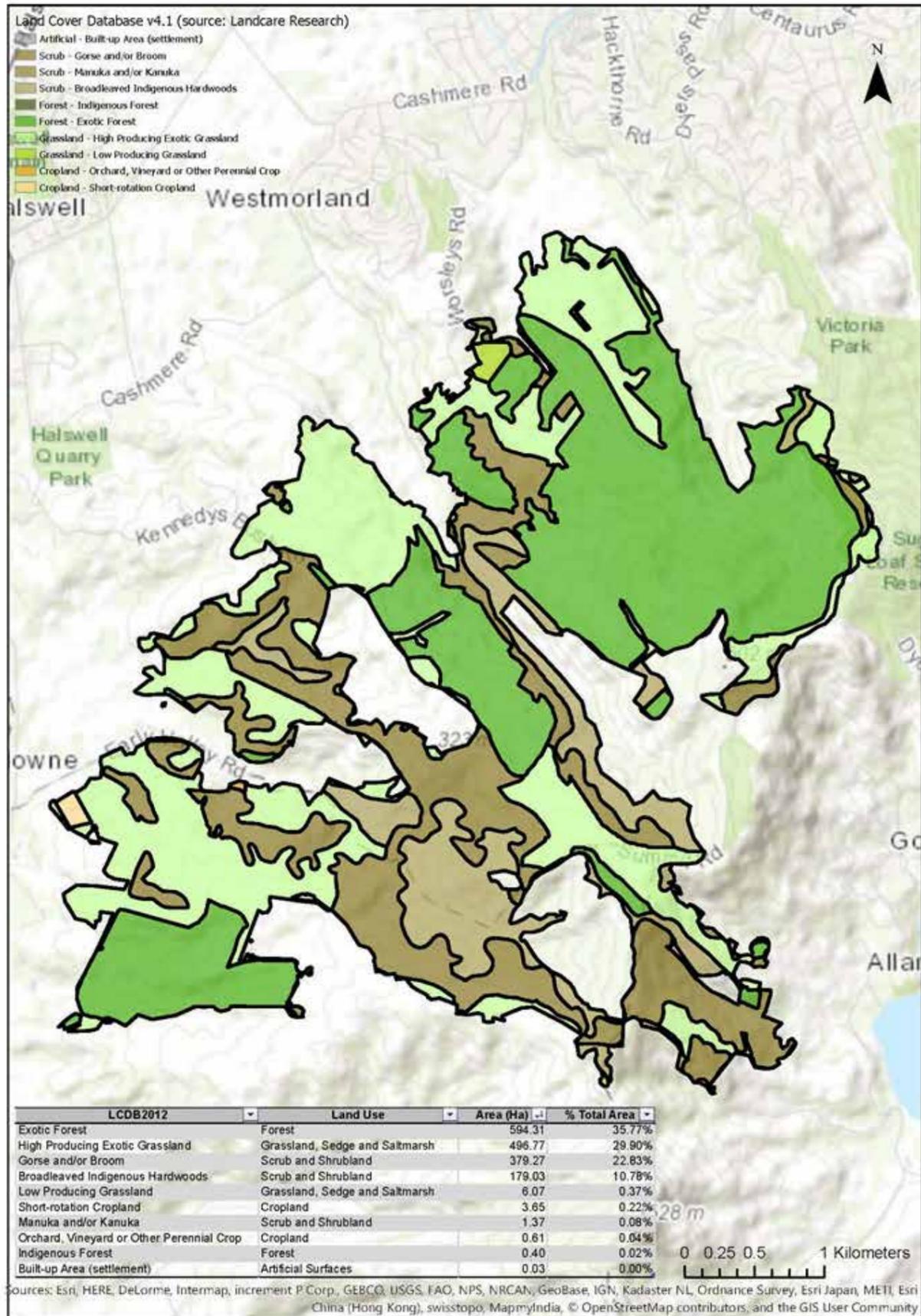
1. Summary of Landcover Database, fuel types
2. Map of Landcover Database, fuel types
3. Map of slope
4. Threat map from Canterbury WTA 2011

Data used in this report was sourced from Landcare Research in the form of the Land Cover Database v4.1 2015, wildfire threat analysis outputs from the Canterbury Wildfire Threat Analysis Project 2011, Christchurch City Council website and information taken from the Port Hills and Lyttelton Harbour Basin Strategic Tactical Fire Management Plan 2013-2015 (Draft).

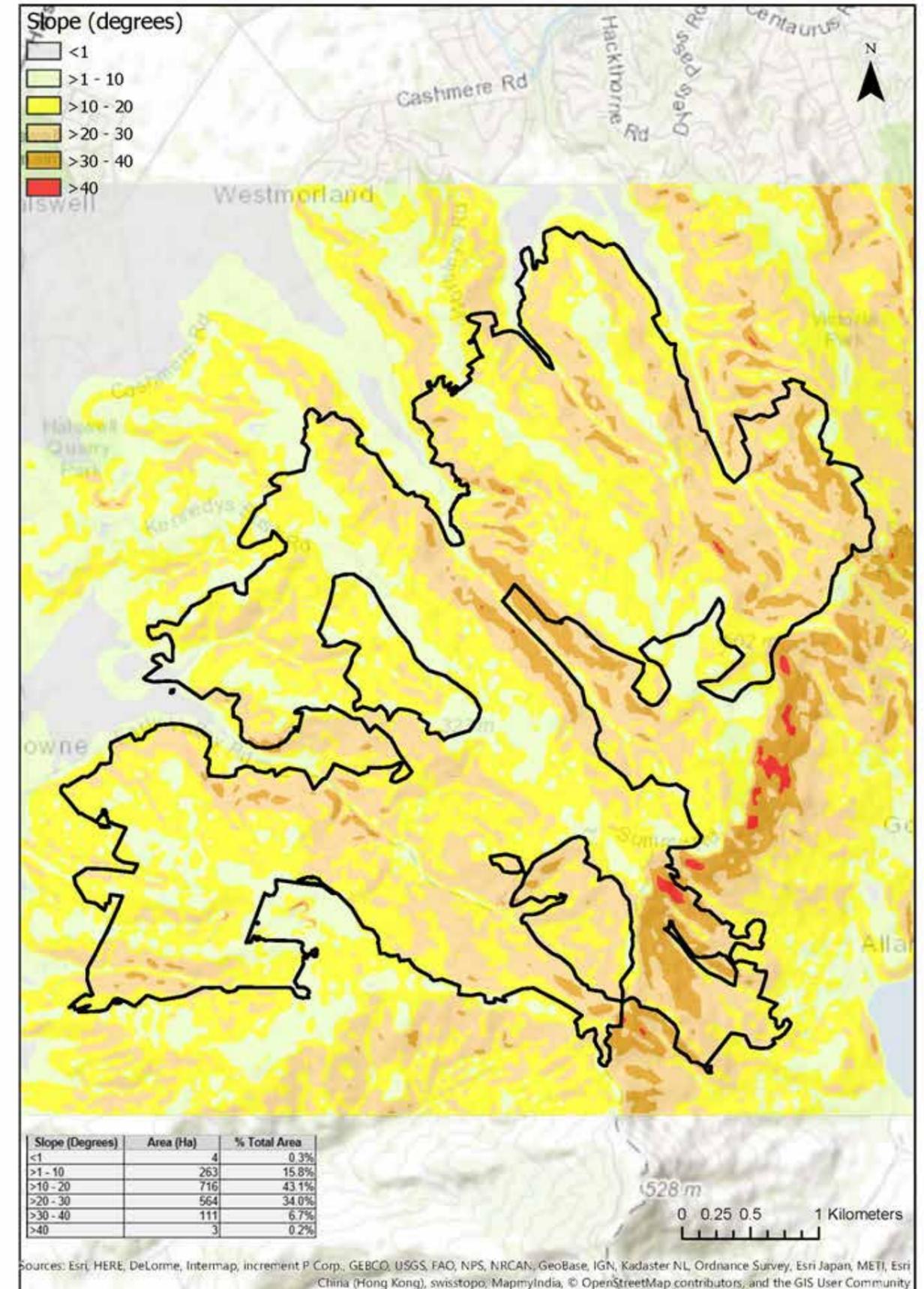
LCDB2012 (Updated 2015)	Land Use	Area (Ha)	% Total Area
Exotic Forest	Forest	594.31	35.77%
High Producing Exotic Grassland	Grassland, Sedge and Saltmarsh	496.77	29.90%
Gorse and/or Broom	Scrub and Shrubland	379.27	22.83%
Broadleaved Indigenous Hardwoods	Scrub and Shrubland	179.03	10.78%
Low Producing Grassland	Grassland, Sedge and Saltmarsh	6.07	0.37%
Short-rotation Cropland	Cropland	3.65	0.22%
Manuka and/or Kanuka	Scrub and Shrubland	1.37	0.08%
Orchard, Vineyard or Other Perennial Crop	Cropland	0.61	0.04%
Indigenous Forest	Forest	0.40	0.02%
Built-up Area (settlement)	Artificial Surfaces	0.03	0.00%

### SECTION 1 - Summary of LCDB v4.1 2015 covering the final extent of the Port Hills Fires

SECTION 2 - Map of Landcover Data Base, Fuel types



SECTION 3 - Map of slope



# NOTES

SECTION 4 - Map of WTA THREAT (normalised)

