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Municipality Munisipaliteit uMasipala

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PROTECTION SERVICES
FIRE AND RESCUE SERVICE
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Report of the Chief Fire Officer:

Knysna Fire and Rescue Service on the Fire origin and possible cause in the Elandskraal area:

Knysna on 07 June 2017

This report gives effect to the Knysna Municipality By-law Relating to Community Fire Safety Chapter 2: Administrative Provisions, (6) Authority to investigate: *Notwithstanding anything to the contrary contained in any other law, a controlling authority has the authority to investigate the cause, origin and circumstances of any fire or other threatening danger.*

Contents

EXECUTIVE SUMMARY

The Western Cape was and is currently in the firm grip of a drought which increases the risk of fires. Three days prior to the fire of 7 June 2017, Knysna experienced very warm berg wind conditions.

On 7 June 2017, the Knysna Fire station received a call at approximately 03:30, reporting a vegetation fire in the Kruisfontein area of Greater Knysna (an area approximately 2km outside of Knysna towards Plettenberg Bay). All firefighting vehicles from the Knysna Fire Station responded to assist MTO with this plantation fire. The Chief Fire Officer (CFO) and both on call fire officers responded to assist.

At approximately 04:15 on 7 June 2017, the Fire Station received the second call to attend to a vegetation fire at Lancewood near Karatara. Crews from the Sedgefield Fire Station responded to this second fire.

A third fire was reported as burning in the Barrington / Elandskraal area at approximately 06h15 on 7 June 2017. First response was from the Karatara Volunteer Fire Station at approximately 06:20.

Crews from Sedgefield Fire Station, who were already attending to the Lancewood fire responded to this third fire and arrived on scene at approximately 06:50. A fire officer was dispatched from the Knysna Fire Station to the Elandskraal fire.

This report and investigation will focus on origin and probable cause of the Elandskraal fire as the Bitou municipality is investigating the origin of the Kruisfontein fire.

We found that the fire started in a clearing below a ridge and spread to the top of that ridge where it spread by means of spotting to an adjacent ridge, just south of its origin.

In its earlier stages the fire burnt light fuels and spread as a ground fire, until the wind fanned it towards heavier fuels. It is important to note that at the time of the fire, Knysna experienced very strong winds, varying in directions with gusts speeding between 80 – 90kms per hour.

Within the hour, the fire grew out-of-control and rapidly spread towards the town of Knysna.

At approximately 11:30, the attending fire officer at the Elandskraal fire contacted the CFO reporting that the Elandskraal fire was out of control. It was at this time that the report of a family of three had lost their lives within the Elandskraal area.

The CFO withdrew from the Kruisfontein Fire and responded to the Elandskraal Fire. Upon arrival at the N2 at the Knysna White Bridge, the CFO observed the fire coming over the ridge towards Westford Ridge. The CFO immediately made contact with Western Cape Provincial Government and activated the provincial response plan.

Over the next couple of hours, the fire had increased in size, leaving the Knysna Fire and Rescue Service completely under-resourced.

Due to the prevailing conditions and the magnitude of the fire, and the limited resources, the CFO, who assumed the role of Incident Commander, focus shifted to saving lives, evacuating members of the public out of the path of this fire. In excess of 10 000 residents were evacuated during the Knysna Fires.

The wind speed did not subside, and continued spreading the fire on two separate fronts. Certain areas became cut-off as the fire continued in its path along the two fronts throughout the night of 7 June.

The following day, 8 June, the wind changed direction and blew strongly from the South East. This wind change created new fire fronts and firefighters, under a Unified Command Structure continued to battle the blaze until 14 June.

1. PREFACE

This report is drafted for the Municipal Council of Knysna Municipality in terms of the Knysna Municipality: By-law Relating to Community Fire Safety, Chapter 2: Administrative Provisions.

Section 6 of the By-law provides as follows:

"Authority to investigate: *Notwithstanding anything to the contrary contained in any other law, a controlling authority has the authority to investigate the cause, origin and circumstances of any fire or other threatening danger."*

The purpose of the report is to identify the origin, cause and circumstances of the fire which started in the Elandskraal area on 07 June 2017.

SCOPE

The scope, work and related responsibilities of this report are as follows:

1.1 The Knysna Municipality: By-law Relating to Community Fire Safety provides that the Chief Fire Officer is responsible for the administration and enforcement of this by-law. It further provides the controlling authority to investigate the cause, origin and circumstances of any fire or threatening danger. The By-law defines the controlling authority as either a Chief Financial Officer, Municipal Manager or their respective delegatee.

1.2 The Chief Fire Officer investigated the origin and probable cause of the fire of 07 June 2017 based on examining evidence from eye witnesses, reports and photos in the public domain, Knysna Municipality data, satellite data and weather data.

1.3 The report will be submitted to the Knysna Municipal Council at its council meeting

While every effort was made to verify the information (provided by eye witnesses, documents in the public domain, photographs, etc) the Knysna Municipality will not be held liable and/or responsible for any decisions and/or actions taken by parties as a result of the contents of this report, and shall be solely the responsibility of the such parties involved in such decisions and/or actions

2. THE INVESTIGATION

The purpose of this investigative report is to report on the origin and possible cause of a fire that emanated from the Elandskraal area and then spread to the Knysna residential areas.

Six lives were lost as a direct result of this Elandskraal fire. One additional life was lost due to the Kruisfontein fire.

Further, this report draws a comparison between the Knysna Municipal findings and a report widely published by an Elandskraal resident on his theory of the origin of the fire.

The Knysna Municipal Investigation followed a structured scientific methodology.

This report followed the following investigative processes:

a. To investigate the origin of the fire and to decide on tactical objectives for the next operational period, the Knysna Chief Fire Officer, Eden District Deputy CFO and Manager Southern Cape Fire Protection Association (SCFPA) flew over the Elandskraal /Barrington / Karatara area on 8 June.
b. Photographs and grid maps, supplied by an Elandskraal resident and dating back to 08 May 2017 was perused
c. The area where the fire originated was visited on numerous occasions to observe the terrain, fuel load and smouldering areas
d. On 21 June, the Knysna CFO formed part of a group who flew over the affected area, paying close attention to the possible general area of the fire origin. Dirk Smit from SCFPA photograph the general area of the fire origin.
e. On 13 July 2017 the Knysna CFO visited the area and investigated both areas of possible origin (Non V Section and V Section)
f. On 14 July 2017 the Knysna CFO flew over the general area of origin of the Elandskraal fire with a photograph to obtain still aerial footage
g. The undated much-circulated report of an Elandskraal resident was perused by the Knysna CFO
h. Knysna CFO observed the weather patterns that prevailed from 01:09 on 7 June 2017 in the Elandskraal area. These weather patterns are contained in the Elandskraal resident's report.

i. The CFO interviewed an eyewitness who observed smouldering smoke before the fire on 7 June.
j. This eyewitness did not want to make a formal statement to the South African Police Service.
k. The eyewitness resides on land where the fire originated.

3. DEFINING THE PROBLEM

a. The investigation into the general area of origin of the fire started with a helicopter flight undertaking over the Elandskraal area on the morning of 8 June.
b. The CFO observed the furthest North West area.
c. One particular area presented the “V” pattern (associated with wildfire origin), identifying the spread.
d. A photograph of the burn scar to the furthest North West
e. The area as contained in the Elandskraal resident’s report does not present a “V” pattern.
f. Firefighting ground operations were still ongoing.
g. Access to the ground was not possible due to the continuous water bombing in the area,
h. This made the area unsafe for any ground investigations to be undertaken.

4. EVIDENCE COLLECTED

A. Photographs and approximate position map of smoulder as reported between 08 and 09 May 2017.

Figure 1: Photograph showing the smouldering smoke, taken on 10 May 2017 before the fire on 07 June 2017. Note the buildings in background as a point of reference. Slope to the left is the slope depicted in Figures 14 and 19 as a burn scar.

Figure 2: Photograph taken on 10 May 2017, before the fire on 07 June 2017. Note buildings in background as a point of reference.

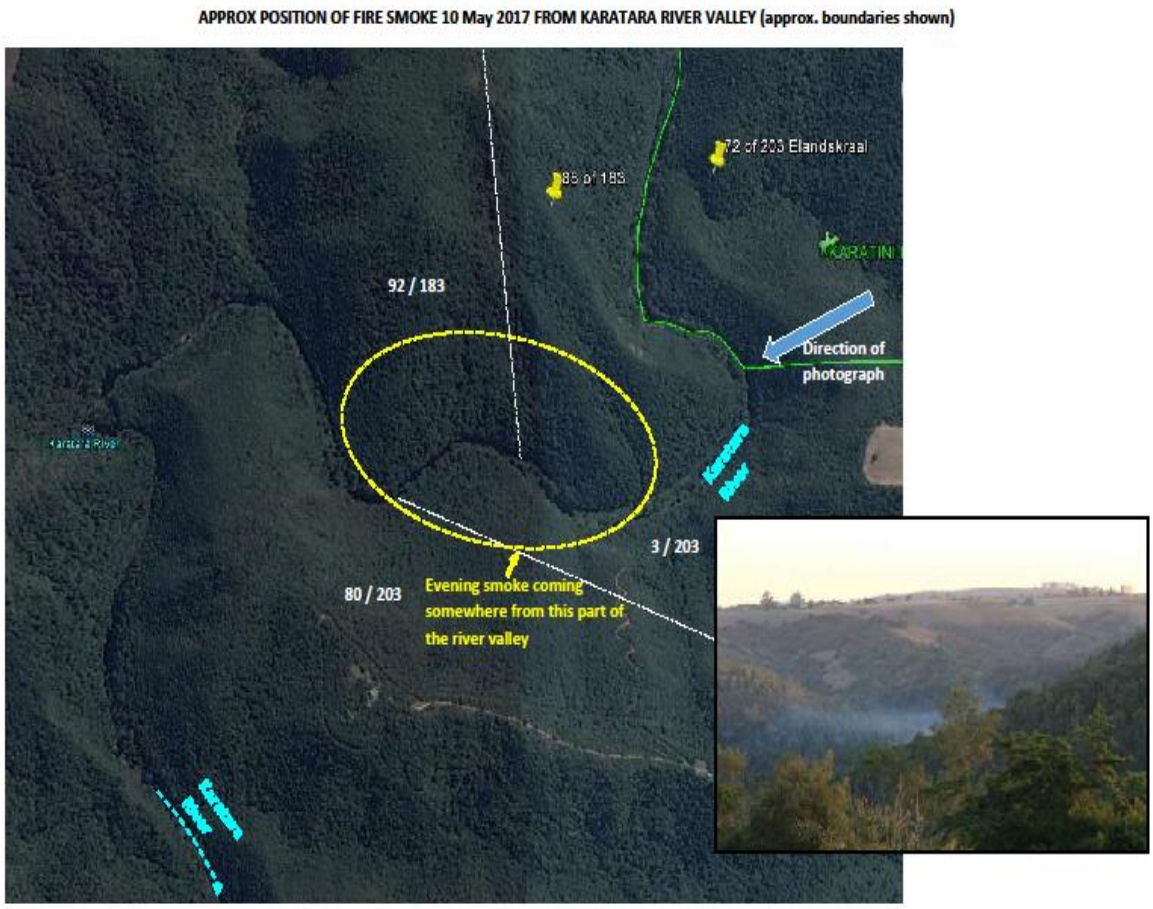

Figure 3: Google Earth photograph showing the location of smoke as at 10 May 2017. Note the position of the origin of the fire as indicated in Figures 5 and 11.

B. Photograph and grid map of smoulder as reported on 23 June 2017.

Figure 4: Photograph taken on 23 June 2017 after the fire of 07 June 2017. Note smoke coming from unburnt area and the background houses as in figures 1 and 2.

BARRINGTON – ELANDSKRAAL – ROOIKRAAL – ROODEKRAAL AREA GRID MAP. IDENTIFY A GRID, EG TENIQUA TREETOPS = D12 OR D13. Suggest you print a copy and keep with you.

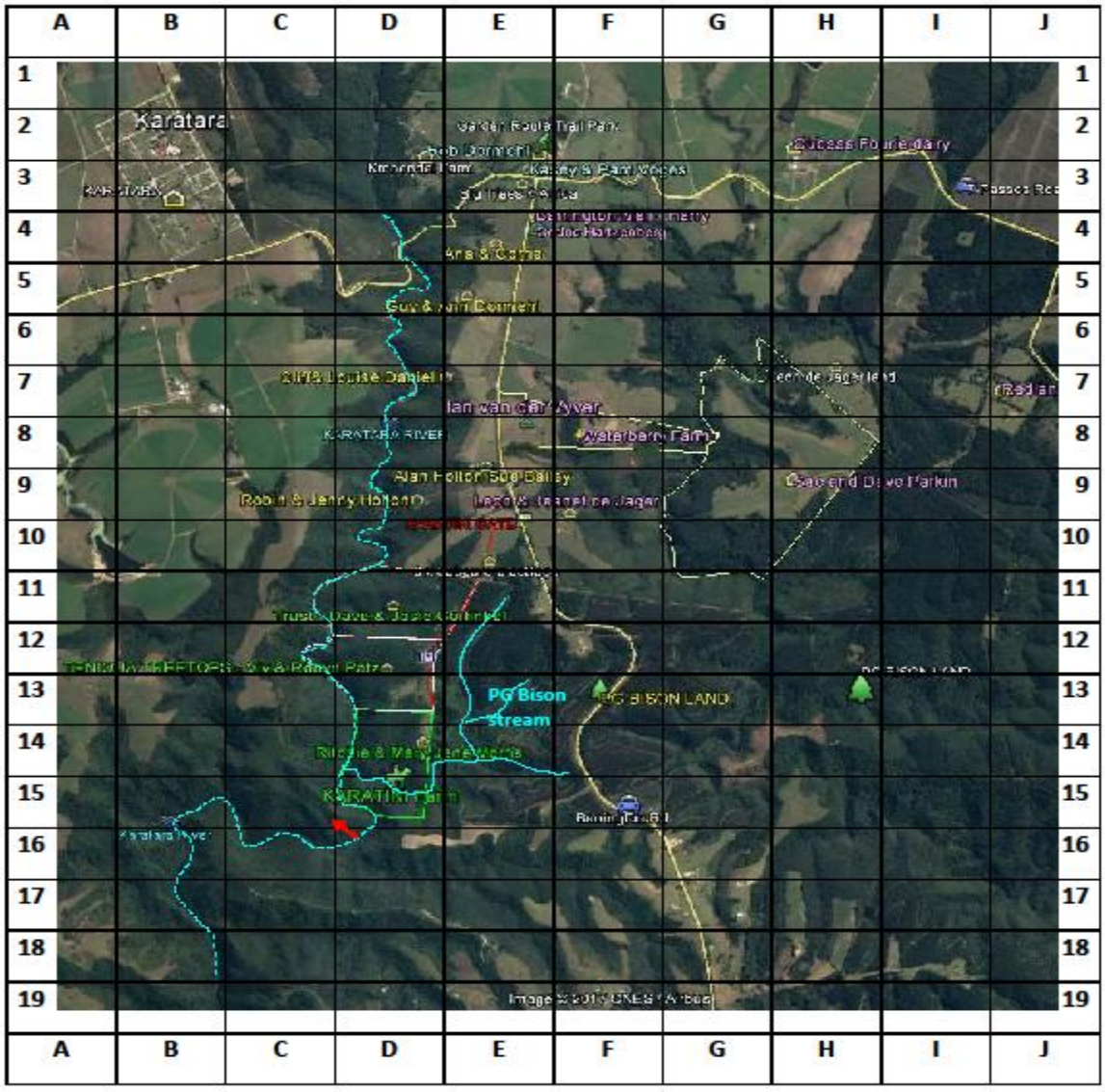

Figure 5 Grid map showing the location of smoke in figure 4 indicated as emitting from Grid C 15.

C. Photographs of smoulder as reported between 24 and 26 June 2017.

Figure 6: Smoke emitting in the same area on 24 June 2017 as Figures 1, 2 and 3. Note the burn scar on the opposite ridge and smoke coming from an unburnt area.

Figure 7: Photograph showing same smoke as in Figure 6.

Figure 8: Photograph showing smoke in the same area as in Figures 6 and 7. Note smoke travelling between the two valleys from North West to South East.

Figure 9: Photograph showing smoke in the same area as in Figures 6, 7 and 8.

BARRINGTON – ELANDSKRAAL – ROOIKRAAL – ROODEKRAAL AREA GRID MAP. IDENTIFY A GRID, EG TENIQUA TREETOPS = D12 OR D13. Suggest you print a copy and keep with you.

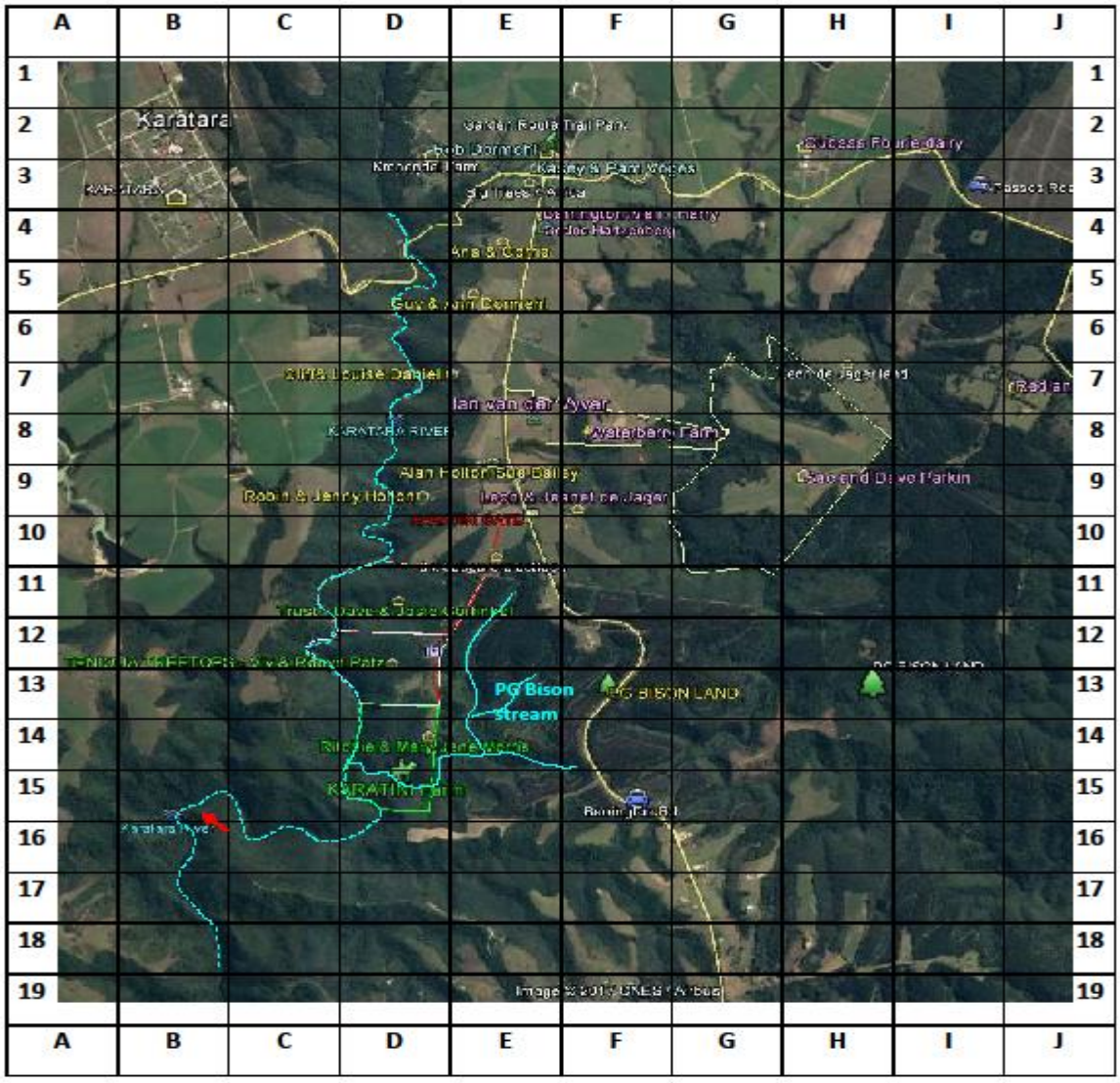

Figure 10: Note the red arrow moved from the location in Figure 3. Compare this arrow with red circles in Figure 11 and with smoke in Figures 6 - 9.

North

All red circles and red arrows = sources of smoke as at afternoon of 26 June 2017

Photos taken on 26 June 2017 below and overpage. Excuse the photo quality as it is very smokey.

Figure 11: Note the positions of the red circles and compare these to the red arrow in Figure 10, further note the inserted photograph of smouldering smoke in the unburnt area (compare with smouldering in Figure 24). See Figures 7 – 10.

D. Photographs of the smouldering in an unburnt area

Figure 12: Smoke in the area as shown in figures 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10. This photograph, taken on 14 July 2017, still shows the smouldering section in an unburnt area.

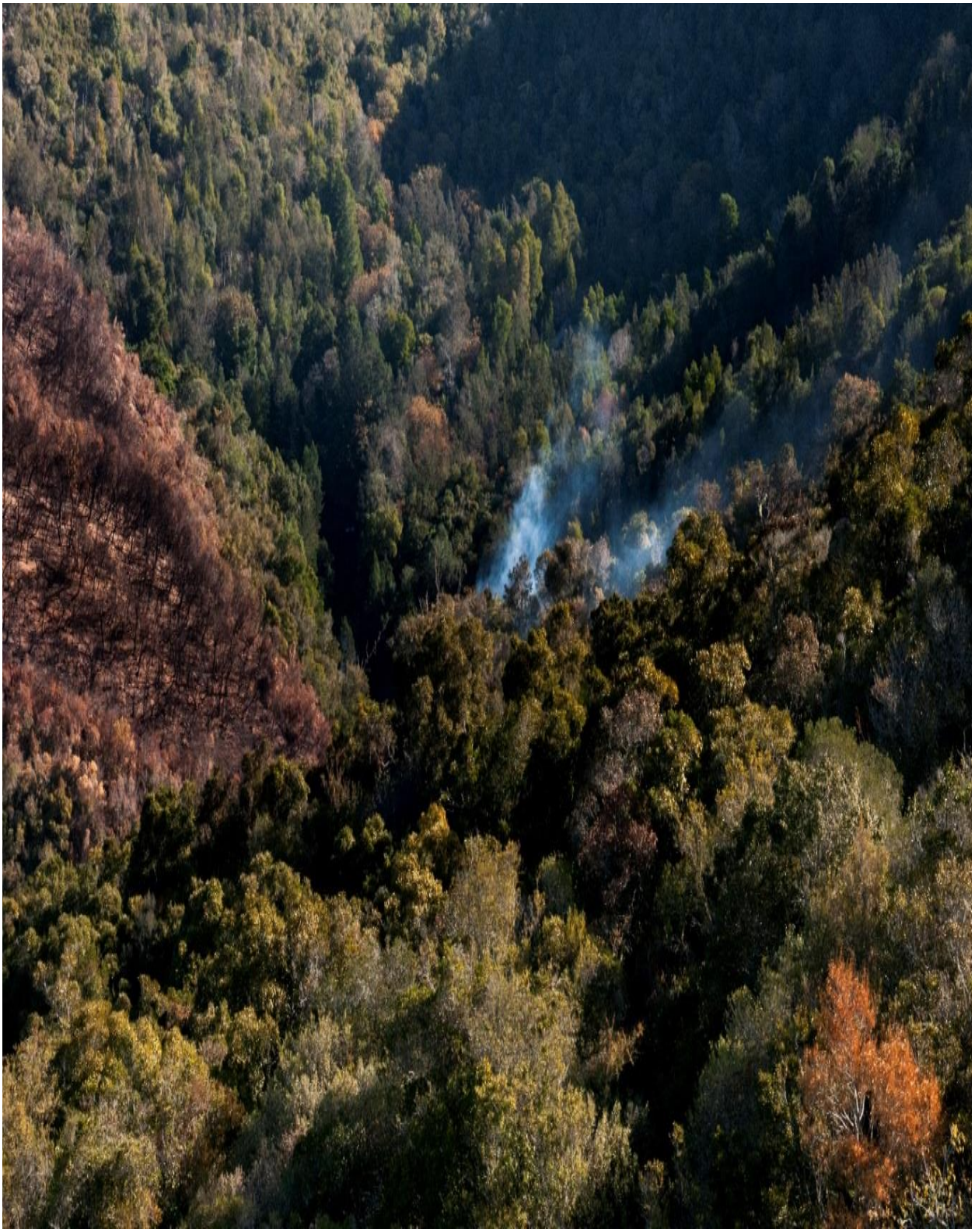

Figure 131: Same area as Figure 12

Figure 14: Same area as in Figure 12

Figure 15: Same area as in Figure 12, but from a different angle

Figure 16: Same area as in figure 12, but from a different angle

Figure 17: Same area as in Figure 12 but from a different angle. Compare this with Figure 11 (biggest red circle)

Figure 18: Same area as in Figure 12.

Figure 19: Taken from the same angle as Figure 1, 2 and 4. Note the background as reference. This enlarged photograph shows smoke traveling with wind from the Southeast.

Figure 20: Photograph taken from the opposite position to Figures 1, 2 and 19. Notice plume of smoke "C" in unburnt area. Buildings "A" and the ploughed lands marked "B" are visible from this position.

E. Aerial photographs of the area of the fire origin

Photographs of Burn Scar with no “V” pattern (Area 3)

Figure 21: No "V" Pattern on burn scar.

Figure 22: No "V" pattern on this burn scar. This is a different angle to Figures 12 and 21.

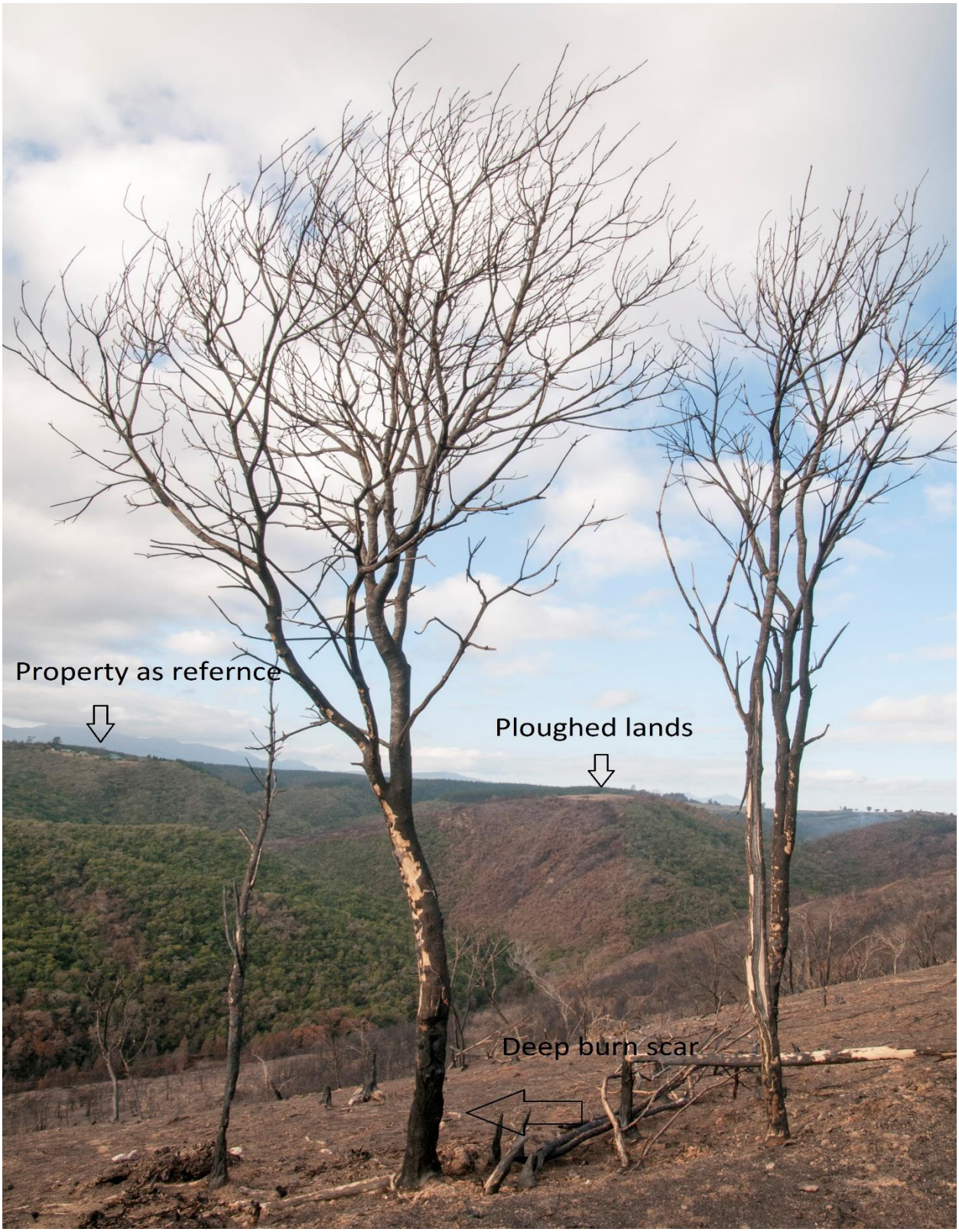

Figure 23: Deep scars from the uphill side. Note the location and use the burn scar in the background as reference.

Figure 24: Burn scar on the tree trunk from the uphill side. Note the smouldering on the opposite ridge and compare this with Figure 11- photograph insert

Figure 25: Burn scar on the tree trunk from uphill side

Figure 26: Side view of figure 25, showing the deep burn scar from the uphill side

Figure 27: Enlarged deep burn scar as in Figure 25.

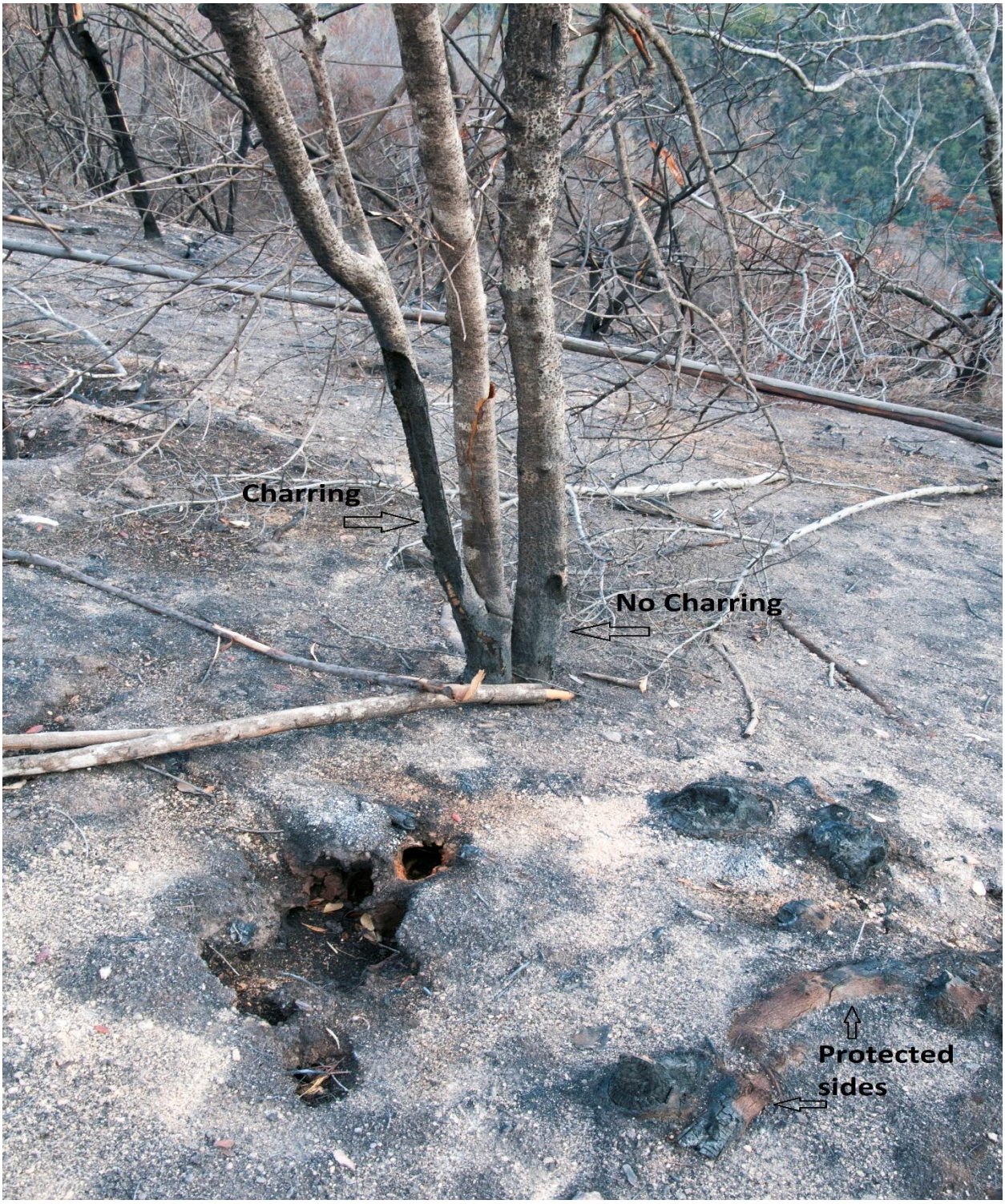

Figure 28:

Figure 29: Note the remaining leaves on this tree. Scarring from the uphill side

Figure 30: Close-up of Figure 29

Figure 31

Figure 32: Charring from the right. Note the pile of broken pottery and well-worn path leading to the pottery pile. To the left are the positions of figures 23 - 31. To the right is "Noah's Ark" shown in figure 34

Figure 33: Close-up of a pile of pottery as seen in Figure 32

Figure 34: View of "Noah's Ark" that is to the right of Figure 32

Figure 35: Access road from pottery pile leading to V-Pattern area

Figure 36: Access road

F. Photographs of the structures that shows fire spread from an Easterly direction towards the area of no “V” Pattern (Area 3)

Figure 37: "Noah’s Ark" showing the burn scar on the Easterly side.

Figure 38: West side of "Noah's Ark", Shows no burn scar.

Figure 39: A shed to the East of "Noah's Ark". No burn pattern is visible on Western side of the shed. The container in the photograph moved here after the fire of 07 June 2017. Note that no fire or heat damage on nearest metal column and roof.

Figure 40: East side of the shed. Note the heat and fire damage on the steel columns and to container.

Figure 41: The Eastern side of shed. Note the heat damage to roof. "Noah's Ark" is visible in the background

Figure 42: Logs to the west of the shed. Note the burn pattern from a westerly side

Figure 43: An electricity pole. Note the fire damage on the Eastern side

Figure 44: An electricity pole. Note the fire damage on the Eastern side

Figure 45: An electricity pole showing fire damage on the Eastern side

Figure 46: Electricity pole showing severe fire damage on the Eastern side in comparison to opposite Western side

Figure 472: The Western side of pole in Figure 46 showing less severe fire damage

G. Photographs of Burn Scar with ‘V” pattern (Area 1)

Figure 48: "V" pattern of the fire spread. Note the building in the path of the fire spread. Note the access roads/paths

Figure 49: Low Angle photograph of the "V" pattern showing the house and clearing in left hand corner

Figure 50: Clearing at lowest section of the "V" Pattern as indicated in Figure 49

Figure 51: Close-up photograph of the clearing at lowest part of the "V" pattern

Figure 52: The fire spread from its origin. Note the three examples of the "V" pattern during the fire spread. Compare these patterns with Figures 48, 49, 53 and 54

Figure 53: High altitude photographs of the fire origin and showing the two areas of the fire spread to the right.

Figure 54: Different angle of the fire origin. Note the smoke plumb in the background. Compare the location of the smoulder with Figures 11 and 24.

H. Ground photographs of the area of origin (Area 1)

Figure 55: The access road to area showing the "V" Pattern.

Figure 56: Remains of a LP Gas cylinder found in the access path

Figure 57: Remains of LP Gas cylinder in the access path

Figure 58: Presence of a metal drum found in the "V" Pattern area.

Figure 59: Close-up of the metal drum as shown in Figure 58.

Figure 60: Clearing at the lowest part of “V” pattern.

Figure 61: Burnt material found in the clearing. Note the young trees in the area slightly damaged by the fire, compared to the damage to the heavy fuel (stumps)

Figure 62: Partially burnt material in the clearing

Figure 63: Partially burnt pinecones in the clearing. Note - there are no pine trees in the nearby vicinity.

Figure 64: Partially burnt pinecone in clearing

Figure 65: Pinecone found in the clearing

Figure 66: Combustible material found stacked in the clearing. Note the pinecone position. This burnt material shows that it had burnt recently.

Figure 67: Fire damage to the tree trunk is more severe from downslope side.

Figure 68: Fire damage visible from the uphill side.

Figure 69: Fire damage from the uphill side.

Figure 70: Fire damage from the uphill side. Note the dugout area.

Figure 71: Fire remains and broken pottery. Nails were also present in the ash, indicating planks were used as fuel. Electronic photograph shows nails when enlarged.

Figure 72: Remains of a fire.

Figure 73: Evidence of a man-made fire in the area.

Figure 74: Remains of the fire in the "V" section. Note the nails which indicate that planks were used as fuel

Figure 75: Structure found in the "V" path.

Figure 76: Severe damage from the exposed side with Wind from South-South-Westerly direction.

Figure 77

5. THREE CAUSES OF THE KNYSNA FIRES ARE PUT FORWARD AND THIS REPORT EVALUATES THE EVIDENCE

A. Fire Origin and Cause by Human Activity

1. This proposes that the fire originated in the area with a “V” pattern. This area is referred to as Area 1
2. It further proposes that a person started the fire in the early hours of 7 June 2017.

B. Fire Origin and Cause by Lightning Strike (Area 2)

1. Fire origin and cause as shown in Figures 1, 2, 3, 12, 13, 14 and 18. This area is referred to as Area 2
2. This proposes that the fire originated in the area where a smoulder was still visible at 14 July 2017 and which is smouldering in an unburned section of the forest.
3. It further proposes that the fire was started by lightning before 08 May 2017.
4. This smoulder was first reported via email on 10 May 2017.
5. This fire presented itself as a smouldering fire.

C. Fire Origin and Cause by Lightning Strike (Area 3)

1. Fire origin and cause as shown in Figure 21. This area is referred to as Area 3
2. This proposes that the fire originated in the area where there is no “V” pattern.
3. It further proposes that lighting started the fire on 12 April 2017 at 15:37
4. This fire first presented itself as a smouldering fire.

6. FIRE ORIGIN AND CAUSE METHODOLOGY

A. Fire Origin and Cause by Human Activity methodology (Area 1)

Evidence testing this cause includes:

1. Photographs and grid maps of a Elandskraal resident
2. Aerial photographs
3. Fire ground inspection.
4. Simulating fire spread under prevailing wind patterns on 7 June 2017.

1. An Elandskraal resident's photographs and grid maps

1.1. A report of a smouldering fire made as early as 08 May 2017. Photographs and grid maps of this smoulder is provided.

The same smoulder was reported on:

a) 23 June 2017
b) 26 June 2017
c) 10 July 2017
d) 15 July 2017

1.2. Photographs taken before 7 June 2017 indicate that there was a smouldering fire in the Elandskraal area.

1.3. Two Elandskraal residents reported smoulder separately.

1.4. Figures 1 – 3 provide the location and the buildings in the background can be use as reference.

1.5. Photographs taken after 7 June indicate that the same smoulder remained underground.

1.6. As late as 15 July 2017 – more than a month after the fire on 07 June 2017, this smoulder remained active but still underground.

2. Aerial photographs

2.1 Photographs taken after the fire on 7 June 2017 (Figures 12 to 19) shows the smoulder.

2.2 Figure 20 shows the reverse direction. From this angel it can be seen that the smoulder at “C” in an unburnt area

2.3 An area was identified which shows the distinctive “V” pattern in which wildland fires spread. (Figure 48). This is the human activity area.

2.4 Another area was identified south- west of the area shown in the Human Activity cause (Figure 48) This area shows examples of the distinctive “V” patterns in which wildland fires spread. (Figure 52)

2.5 Clear access routes to this “V” pattern area are visible (Figures 48, 53, 54, 55, and 57).

2.6 A clearing identified at the lowest part of the “V” pattern. This clearing shows signs of soot on the ground. (Figures 49, 50 and 51)

2.7 A burn scar consistent with a fire starting to consume light fuels and then picking up intensity and consuming heavier fuels was observed in the clearing (Figure 51)

3. Fire ground inspection

On the morning of 08 June 2017, the Knysna CFO observed the “V” Pattern as shown in Figures 48, 49 and 53. This area was compared to the burn pattern to the furthest North West. The area furthest North West (Figures 21 and 22) did not present a “V” Pattern.

3.1 Figures 32, 35, and 36 shows access to the area.

3.2 Figure 53 is an area with a clear “V” Pattern that showed a clear possible origin of the Elandskraal Fire that occurred on 7 June 2017. The wind blew from a South-South-West direction between 01:09 and 01:32. This wind would have spread this fire up the slope in the “V” Pattern area.

3.3 Figure 48 shows a clear “V” Pattern with the fire spread from the lowest section of the “V” and outwards. Notice must be taken of the degree of damage to fuels. Aerial

observation included the rate of the fire spread from low vegetation to higher vegetation. Figures 49, 50 and 51, demonstrate this rate of spread. These photographs clearly indicate how the fire burnt from the underbrush and leaf litter until it reached the higher fuels. In the lower section of the “V” Pattern, there is also a clearing of approximately 4 x 6 metres. This clearing is visible on Figures 49, 50 and 51. It is important to note that there are no pine trees growing in, or near this area. This observation becomes important when identifying the possible cause of the fire.

3.4 In Figure 51 the burn scar in the clearing is visible and shows the fire burning on the ground, and from there intensifying.

3.5 Figure 49 shows the “V” Pattern and the progression of the fire towards the first building in its path. This building sits right in the “V” Pattern path and bears the full front of the fire spread. This shows the direction of most of the heat that severely damaged this building. Most heat is from the downslope along the “V” Pattern. At this stage, the fire is consuming heavier fuels, fanned by a West-North-Westerly wind that blew between 01:32 and 01:54 at approximately 40km/h. The wind changed from the North-West between 01:54 and 02:17 at speeds between 40 and 50 Km/h.

3.6 Figure 52 shows three spotting fires across the valley. These three areas display the distinctive “V” Pattern associated with wildland fire origin and spread. This spotting could have occurred when the wind came from the North West between 01:54 and 02:17 or between 03:47 and 04:55.

3.7 Figure 53 shows the same area and can be put in relation to the supposed origin in the “V” Section.

3.8 Figure 54 shows where the supposed origin is in relation to the non- “V” Pattern area. Note the access road in very close proximity to the supposed origin. On the opposite side, the smouldering fire is still visible. To the far left of the photograph, at the edge of the burn scar, it shows the non- “V” Pattern area. To the top right is the burn scar below the ploughed lands

3.9 There is also evidence of human/s having visited this area before (Figures 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 71, 72, 73 and74)

3.10 A charred log, that is inconsistent with the vegetation in the vicinity, was discovered in the clearing (Figures 60 and 61)

3.11 Stacked heavy fuels were located in the clearing where light fuels are present (Figures 60, 61, 62)

3.12 No Pine trees grow in this area, yet pinecones were found in the clearing (Figures 63, 64, 65 and 66)

3.13 Recently burnt pinecone stacked with combustible heavy fuels were located in the clearing (Figure 66)

3.14 Scorching in the clearing showing the soot of light fuels (Figure 51, 60 and 61)

3.15 The above indicates that a fire spread from the clearing, at the lowest part of the "V", uphill to consume heavier fuels. Scorching on the remaining tree trunks shows a fire burning uphill in the "V" Pattern. (Figures 67, 68, 69 and 70)

3.16 Evidence of three previous fires containing broken pottery, ash and nails (possibly from planks) were found in the area (Figures 71, 72, 73 and 74)

3.17 Remains of a building in the direct "V" path of fire spread shows extensive damage on the exposed side (Figures 75 and 76).

3.18 Wind data, as supplied in an Elandskraal resident's report is interpreted and compared with spread of fire. (Figures 88, 89 and 90)

4. Simulating fire spread under prevailing wind patterns on 7 June 2017

Figure 78


ELANDSKRAAL
WEATHER DATA
Wind SSW from 01h09 and 01h32
Wind speed: 20-40km/h
Origin of fire

Figure 79

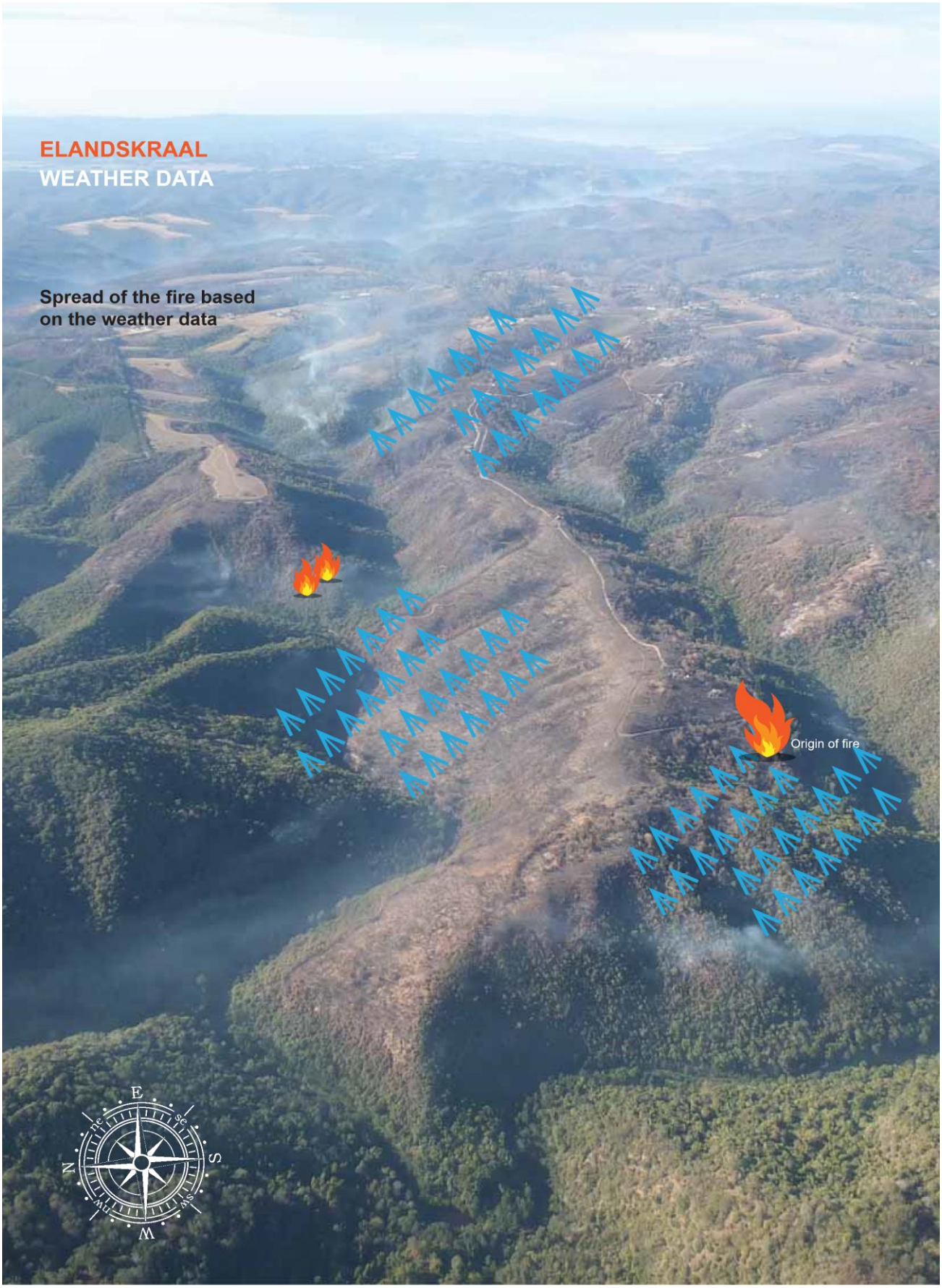
ELANDSKRAAL
WEATHER DATA
Spread of the fire based on the weather data
Origin of fire
E
S
W
N
ne
se
sw
nw

Figure 80

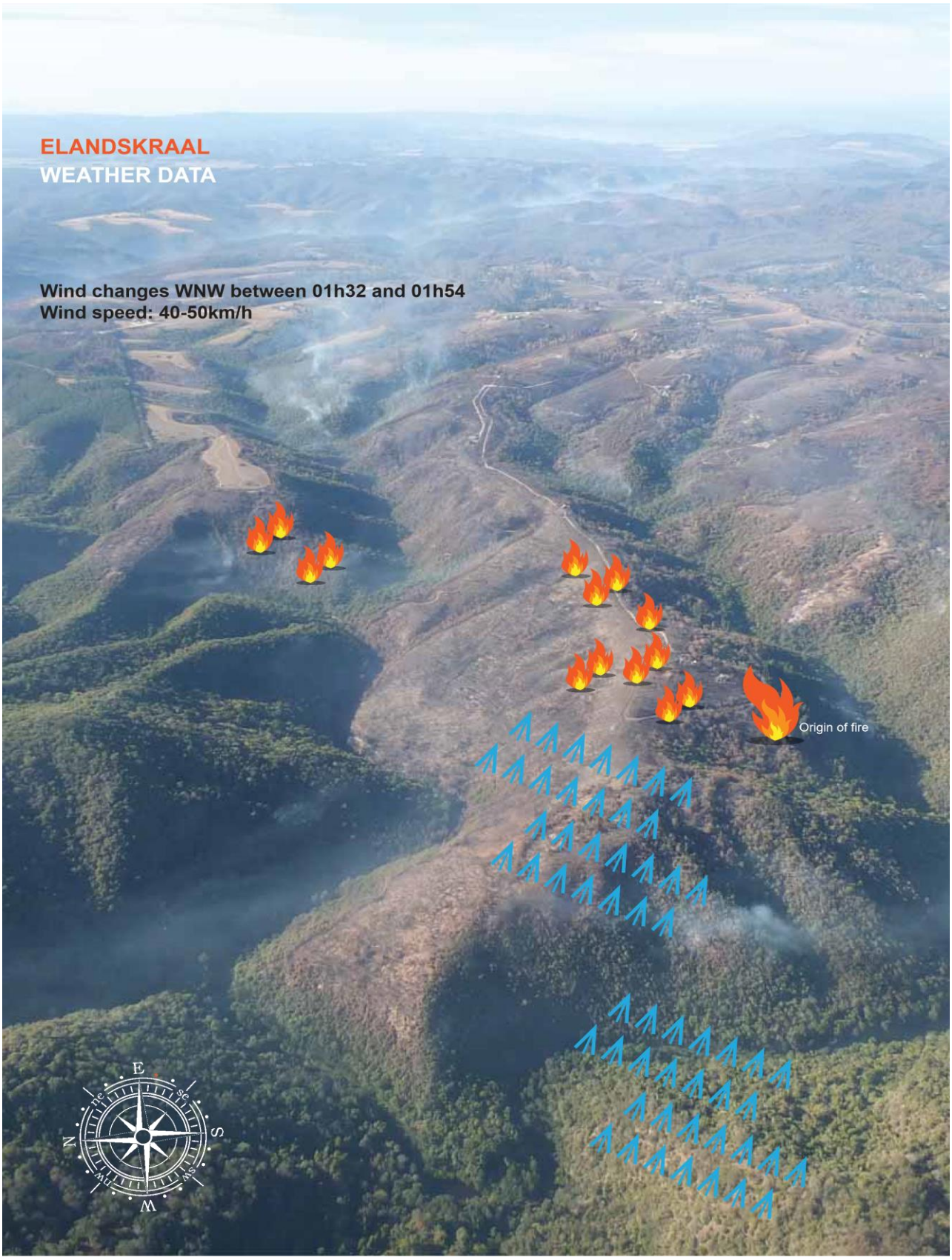
ELANDSKRAAL
WEATHER DATA
Wind changes WNW between 01h32 and 01h54
Wind speed: 40-50km/h
Origin of fire
E
S
N
W

Figure 81

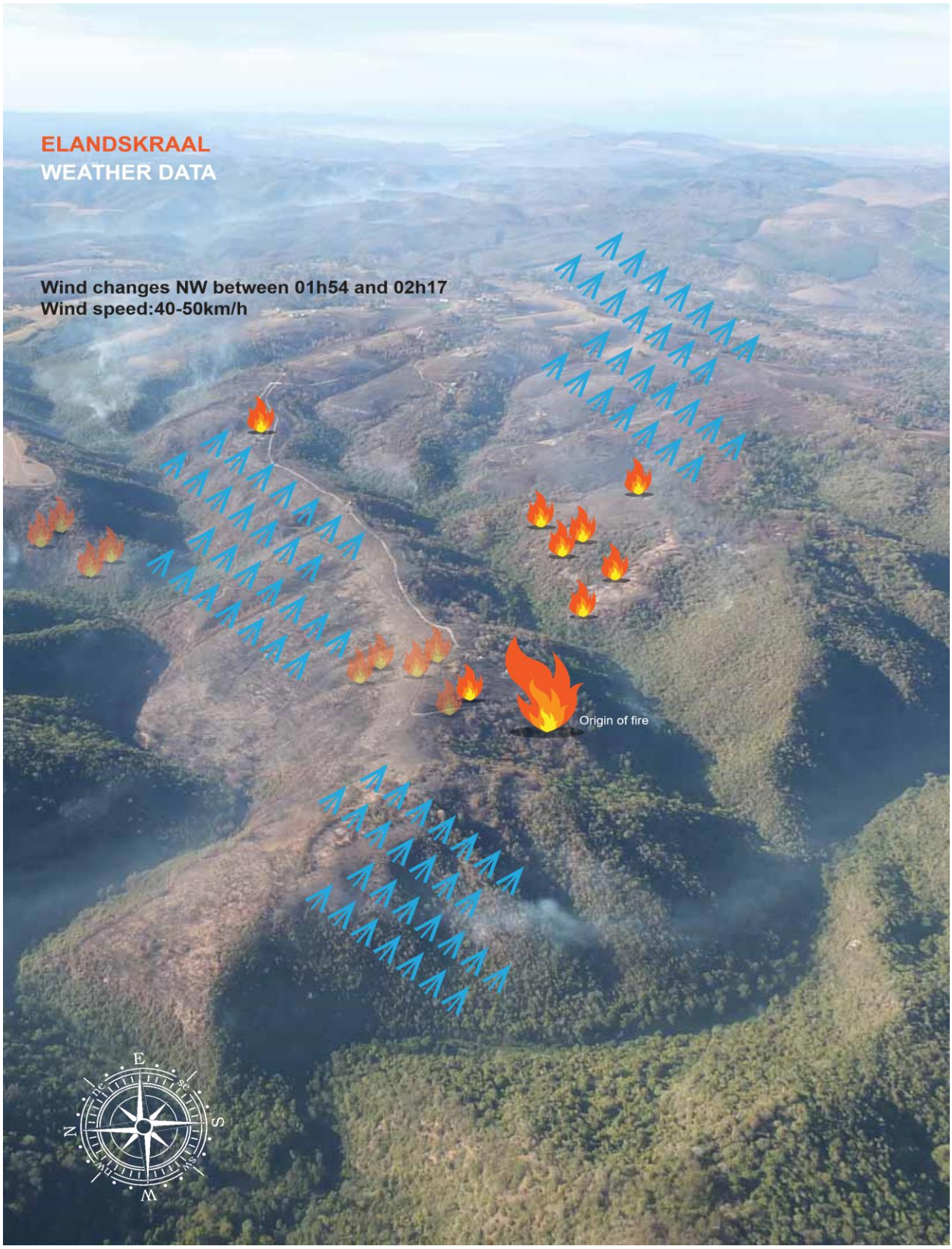
ELANDSKRAAL
WEATHER DATA
Wind changes NW between 01h54 and 02h17
Wind speed:40-50km/h
Origin of fire
E
S
W
N

Figure 82

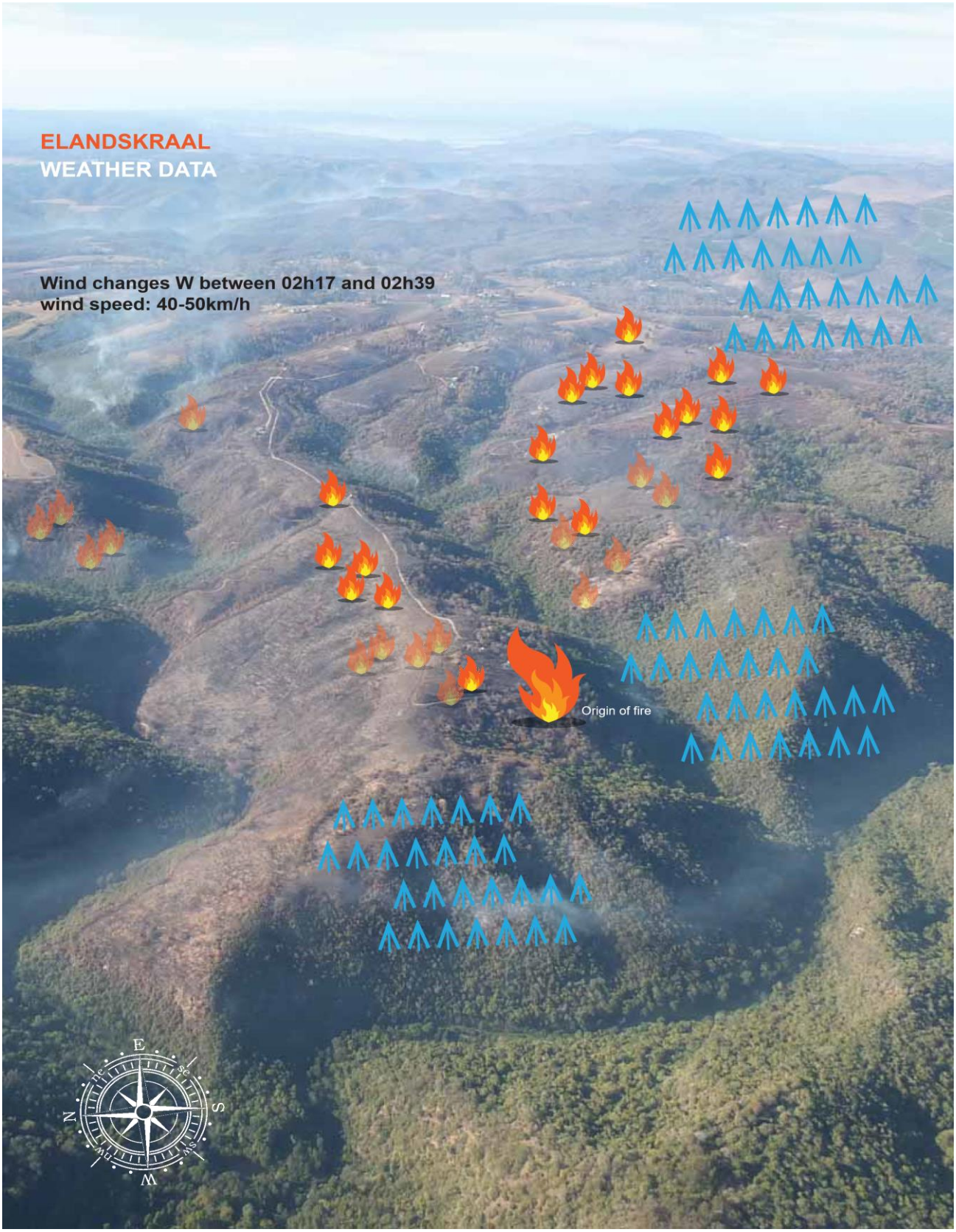
ELANDSKRAAL
WEATHER DATA
Wind changes W between 02h17 and 02h39
wind speed: 40-50km/h
Origin of fire
E
S
W
N

Figure 83

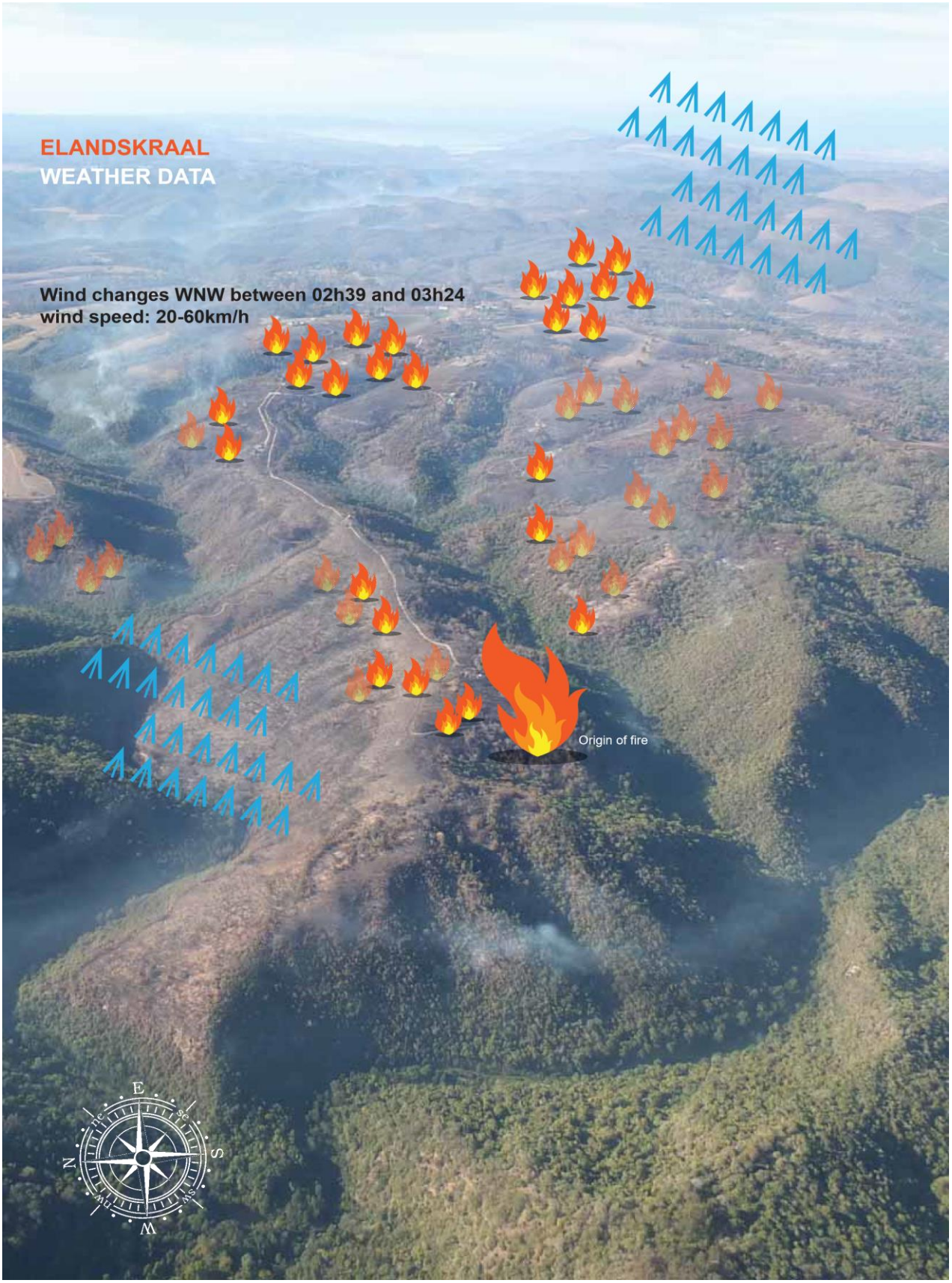
ELANDSKRAAL
WEATHER DATA
Wind changes WNW between 02h39 and 03h24
wind speed: 20-60km/h
Origin of fire
E
S
N
W

Figure 84

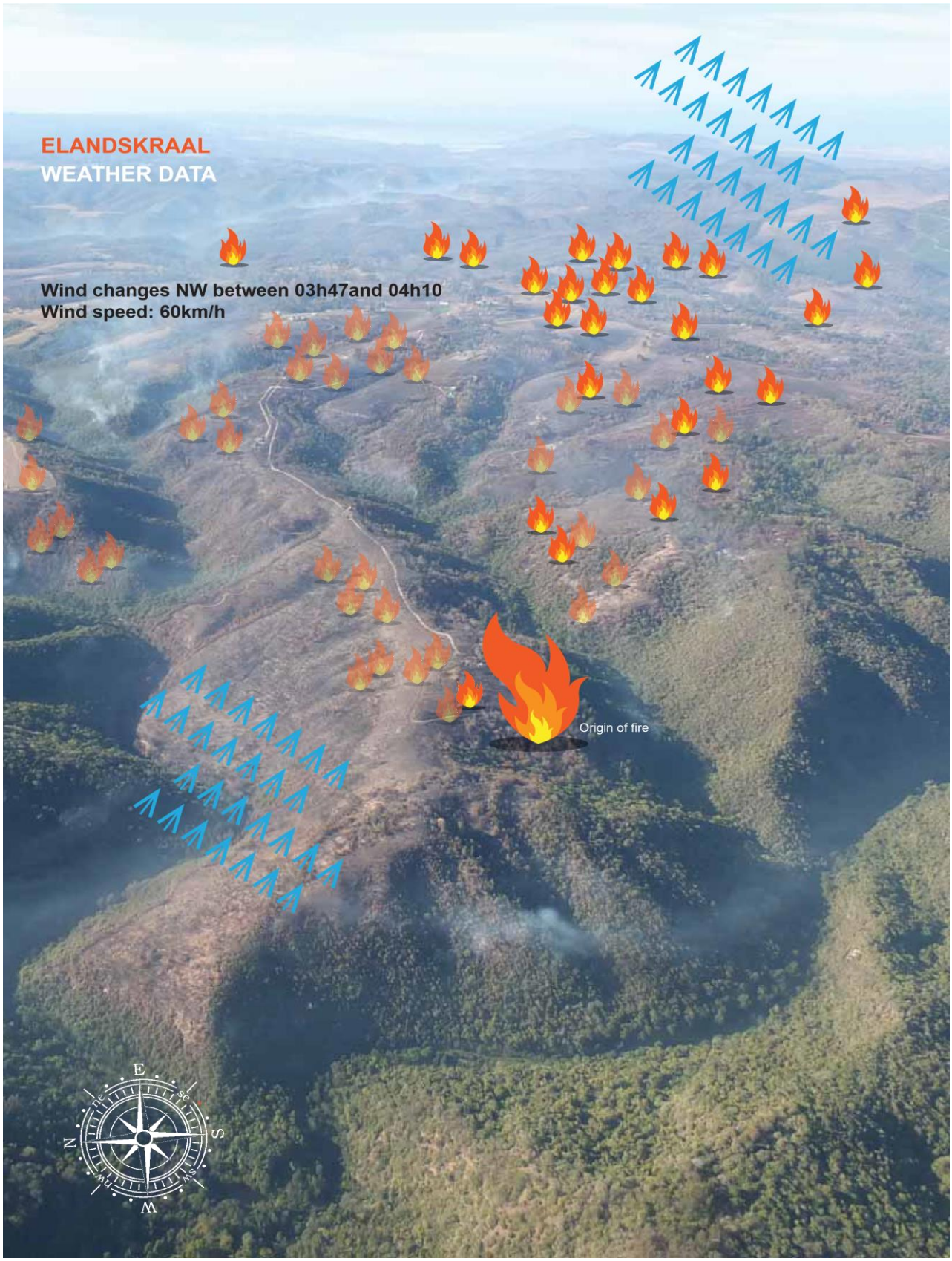
ELANDSKRAAL
WEATHER DATA
Wind changes NW between 03h47and 04h10
Wind speed: 60km/h
Origin of fire
E
S
W
N

Figure 85

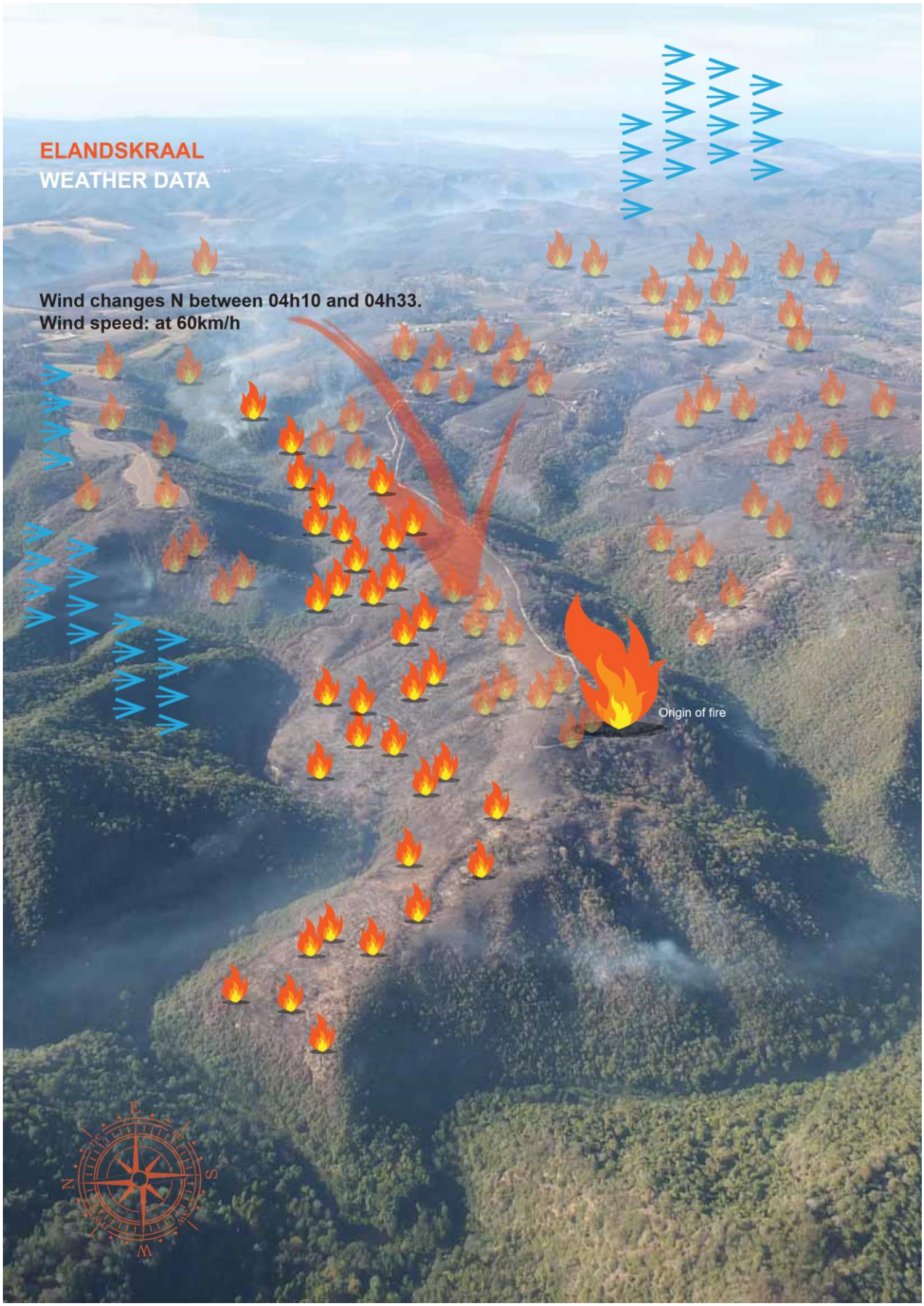
ELANDSKRAAL
WEATHER DATA
Wind changes N between 04h10 and 04h33.
Wind speed: at 60km/h
Origin of fire

Figure 86

1. Figure 78 shows where the fire originated at the bottom of the V Section.
2. Wind data indicate the wind was from the South-South- West between 01h09 and 01h32 and at speeds of 20 to 40 km/h. Figure 79 simulates this wind direction and the spread of the fire. The burn scar on the ground supports this wind direction and fire spread.
3. Figure 80 simulates how the fire spread from its origin to below the ploughed lands. A fire spreading to below the ploughed lands can only happen with the wind blowing from the South-South-West; and the fire starting and spreading from the origin as indicated in Figure 78. The burn scar on the ground supports the path of fire spread to below the ploughed lands with the wind from the South-South-West.
4. Figure 81 simulates the spread of fire when the wind changed and came from the West-North-West and at speeds from 40 to 50 Km/h. The burn scar of the area supports this fire spread.
5. Figure 82 simulates the fire spread when the wind came from the North-West between 01h54 and 02h17 and at speeds between 40 and 50 km/h. this change in the wind direction, and the speed of the wind caused it to “spot” towards the South-East. This wind caused the fire to spot and spread along two ridges. The burn scar shows where the fire spotted in two places and from there spread in a South Easterly direction.
6. Figure 83 simulates the spread of the fire when the wind was from the West between 02h17 and 02h39 and at speeds between 40 and 50 km/h. The burn scar shows clearly the spread of the fire being fanned by a Westerly wind.
7. With the wind changing from the West-North-West between 02h39 and 03h24 and at speeds of between 20 and 60 km/h the fire spread further towards the town of Knysna in a South Easterly direction. Figure 84 simulates this fire spread.
8. Figure 85 simulates the fire spread when wind came from the North-West as speed up to 60 km/h. By this time the two separate front joined as one big front.
9. The wind changed from a Northerly direction and at speeds of up to 60 km/h. Elandskraal, and in particular where the fire originated and spread from, is a mountainous area with a topography which will cause winds to swirl and change direction. Wild fires are known to form up to 90 degree vectors. With the wind from the North and considering the topography, a vector from the East was caused – see Figure 86. It was this wind from the East which caused burn scars to poles and structures from an Easterly direction (see Figures 40 to 47) It was also under these conditions when the fire burned back towards the area as suggested origin by lightning and

causing burn scars from the east and downslope. This accounts for the inverted V pattern seen in the area and the die out pattern. Figure 86 simulates this wind from the East and fire spread. The burn scar, remaining fuel, poles and structures in this area supports the wind from the North changing to an Easterly vector.

B. Fire Origin and Cause by Lightning (Area 2)

Evidence testing fire start by lightning in Area 2 included:

1. Photographs and grid maps supplied by an Elandskraal resident
2. Photographs taken on 14 July 2017
3. Fire ground inspection
4. Email correspondence between 08 and 10 May 2017 between Elandskraal residents

1. Photographs and grid maps

a. Photographs and grid map of 10 May 2017

1. Figures 1 and 2 shows the smoke reported in the Karatara Valley as “evening smoke”. Look at the direction of the smoke, it can be deduced that the smoke originated more to the North-West, as the photographs shows the smoke trailing off to the right, being dispersed by a wind coming from a North-Westerly direction.
2. A grid map (Figure 3) is also included. This grid map contains a yellow circle, placing the smoke in this circle. This circle is away from the origin as proposed by human activity theory.

3. Photographs shows smoke reported on 23 June, in the same vicinity as reported on 10 May 2017, (Figure 4). This is after the fire of 7 June 2017.

4. The grid map, (Figure 5) points to the smoulder being within the yellow circle as contained in Figure 3, circulated on 10 May 2017. This report of the smoke is also not in the area as proposed as the origin by human activity (Area 1) or in the area as proposed as the origin by lightning (Area 3)

5. Smoulder photographs taken on 24 and 26 June 2017, (Figures 6, 7, 8 and 9). The smoke is coming from the same area as shown in Figures 1 and 2 of 10 May 2017, and Figures 4, 6, 7, 8 and 9 (after 07 June 2017). The trailing of the smoke is still visible. However, the exact location of the smoke's origin cannot be seen.

6. Figure 10 shows a red arrow which points to the origin as proposed cause by an Elandskraal resident in his report. This arrow is now in a different location than shown in Figure 5.

7. Figure 11, however, places the smoke in the area of Figure 5 by means of red circles. The insert photograph on Figure 11 is the first direct sight of the smoke's origin, which is in an unburnt area. In the foreground of this insert, the burn scar is visible.

2. Photographs taken on 14 July 2017

1. Figures 12 - 19 shows the smoke clearly. The underground fire is still very active after attempts to water bomb the area using helicopters. This smoke is in an unburnt area and it is clear that the fire did not spread from this section. The burn scar does not suggest that the fire spread to, or from this location.

2. Figure 20 is a photograph taken on the reverse angle of Figures 1 and 2. Area marked "C" shows the smoke as shown in Figures 12 to 19. "A" shows the property from where Figures 1 and 2 originated. "B" is the ploughed lands shown in figure 23 and with the burn scar just below it.

3. Fire ground inspection.

1. Area 2 is inaccessible as can be seen in Figure 16, 17 and 18.
2. The underground smoulder is still active in this area even after numerous attempts to extinguish it by means of water bombing.
3. This smoulder is in an unburned area.
4. No need for further fire ground inspection was necessary.

4. Email correspondence between 08 and 10 May 2017 between Elandskraal residents

Email correspondence between Elandkraal residents was retrieved from the Knysna Municipality server. These emails were originally sent to a municipal employee who is not attached to the Knysna Fire and Rescue Service. Emails were not sent to Knysna fire and Rescue Service or any Fire and Rescue Service official. Email was sent to an ex-employee of the SCFPA and the admin address of the SCFPA.

1. Email of 8 May 2017 titled “Evening smoke from the Karatara River valley – Unknown source from uninhabited area”
2. Smoke is visible most evenings
3. Smoke is coming from the Karatara River valley downstream from the writer’s property.
4. A map showing approximate position where smoke is coming from and photos are attached.
5. Smoke could be from a new house/cottage or some bush dwellers that have taken up residency.
6. One of the recipient residents replies:
    - The fire / smoulder started sometime last week Saturday 29th April.
    - Seemed to be coming from up from Mrs Schutlz Boundary from down in the river gorge.
    - Fire department and residents have been keeping close watch on this.
    - Things seemed to have “died down” but with you mentioning there is renewed smoke coming from that area.
    - Finds it quite bazare.
    - Fire department was under impression it is coming more from the Kooboo berry farm side of the gorge (Karatara side) rather than on our (Elandskraal/Barrington side.
7. The first writer then responds:
    - My feeling is it may be the other side side of the river – ie west Karatara side.
8. Emails are then forwarded to Dirk Smith at SCFPA from the SCFPA Admin email address.

C. Fire Origin and Cause by Lightning (Area 3)

Evidence testing fire start by lightning in Area 3 included:

1. Photographs taken on 14 July 2017 and Fire Ground Inspection.
2. Weather pattern before 07 June 2017
3. Prevailing wind patterns on 7 June 2017
4. Burn scar of the area to the furthest North-West of the fire
5. Report by an Elandskraal resident which was widely circulated
6. Interview with an eye witness
7. Mr W Sternsdorf report
8. Interview with Mr Dirk Smith of Southern Cape Fire Protection Association.
9. Graphic simulation of fire spread under prevailing wind conditions

1. Photographs taken on 14 July 2017 and Fire Ground Inspection

1.1 Fire Origin by lighting, proposes that Figure 21 is the origin of the fire. This supposed origin is also indicated in Figure 88. This area does not show the “V” Pattern that is associated with the origin and spread of a wild fire. A section indicated, refers to the “Die-out” area. The burn pattern in this “die-out” area shows that the fire burnt down this slope and eventually died out.

1.2 Observed in the area were several fire direction indicators.

1.3 During the progression of the Elandskraal fire, visible markings were left on the remaining tree trunks in the area. These markings form the fire direction indicators.

1.4 In Figures 21 and 22, the burn scar shows no “V” Pattern. No evidence of an advancing fire (head or front of the fire) is visible. Fires spread by the distinctive V pattern. This V pattern is shown horizontally on the ground in wildland fires. The base of the V may be the point of origin.

1.5 The “head” will cause a “V” Pattern from its area of origin. This “V” pattern is not visible in this area.

1.6 Figure 22 is another view of this non- “V” Pattern area. In this photograph, the visible lateral line shows no sign of fire spread with the wind coming from South-South-Westerly direction (see Figures 79 and 87 for wind direction at 00:25 to 01:32).

1.7 Figure 88 indicates the fire spread direction from the origin as proposed by Fire Origin by lightning (Area 3) with the wind from the South-South-Westerly direction. It indicates the possible area where a fire which originated from Area 3 would have spread to with the wind from the South-South-Westerly direction.

1.8 Figures 23 to 32 are photographs taken on the ground in the non-“V” pattern area. When a fire spreads uphill, a burn scar on the protected side of trees becomes visible. Some photographs show very deep scaring at the lower section of tree trunks, which suggest that the fire came from the direction of the char (See Figures 25 to 27).

1.9 In Figure 28, charring from the left can be seen, and no charring from the right on the tree trunk. The left is from the downslope direction. The protected sides from the upslope side can be seen on the roots. The probability is that the fire burnt from uphill down the slope.

1.10 Figure 31 shows the exposed side on the upslope side, while the protected side is from the downslope side.

1.11 Figure 32, shows access paths to the non- “V” pattern area. Note the pottery remains. A “blunted” side on the tree is visible, suggesting that the fire came from the right (this will be the Eastern side). Figure 33 is a close-up of the pottery remains.

1.12 Figures 37 to 47, shows damage from the Eastern side to structures and poles.

1.13 Indicators in the non- “V” pattern area shows that the fire moved downhill. This fire pattern commonly referred to as the heel or rear of the fire.

2. Weather pattern before 07 June 2017

2.1 04 June 2017

On this day (four days before the fire) there is nothing untoward about the weather pattern in the Knysna area. The FDI is Moderate at 38

2.2 05 June 2017

On this day one can see the temperature rising and the FDI being indicated as “Dangerous”. One can also see the humidity is starting to drop.

2.3 06 June 2017

On this day the temperature reaches 31 degrees with the wind increasing to speeds of 37 km/h. The fire index is indicated as red, being extremely dangerous. The humidity is at its lowest with the FDI at its highest at 89.

3. Prevailing wind patterns on 7 June 2017.

An Elandskraal resident, in his widely circulated report, provides the wind direction and speeds at different times for the morning of 7 June 2017. Figure 87 indicate these wind patterns and speed.

3.1 The wind was coming from the South-South-Westerly direction between 01:09 and 01:32 and at speeds between 20 and 40 Km/h.

3.2 The fire would have spread from the proposed origin (Area 3) in the direction indicated in Figure 88, to the ridge towards the property. However, this property is unaffected.

3.3 There is no burn scar on this ridge.

3.4 The wind changed to West-North-Westerly between 01:32 and 01:54 and at speeds of between 40 and 50 Km/h.

3.5 This new wind direction would have spread the fire along the ridge where the

smoulder is still active (Figure 89)

3.6 Figure 86 shows that the wind was coming from the north at 60 km/h between 04:10 and 04:33.

3.7 It is possible that the north wind created a wind from an easterly direction because of the topography of the area. Also known as a vector.

3.8 No burn scar is visible in Figure 86 where the north wind should have spread the fire.

3.9 It is very likely that when the fire came from an easterly direction that the damage to the structures and poles was caused (Figures 37 - 47).

4. **The furthest North West area's burn scar.**

4.1 Figure 91 is a photograph of the burn scar at the origin of the fire.

4.2 During the early morning, the wind blew from the South-South-Westerly direction. This should have spread the fire to the section indicated in Figure 88.

4.3 Subsequent wind changes would have spread the fire as shown in Figures 89 and 90.

4.4 The burn scar shows no fire spread in this direction.

5. Report in the public domain

This investigation considered a report which was published and widely circulated in the public domain.

5.1 Satellite images from 9 June 2017, confirms that the catastrophic fire in Elandskraal area started and spread North West from this area.

5.2 Weather data measured close to the area, shows at about 01:00 the morning of 7 June 2017 the wind changed from South West to North West and rapidly gained strength, blowing 60 km/h

5.3 Data obtained from the Advanced Fire Information System (AFIS) and National Aeronautics and Space Administration (NASA) worldview for 7 June 2017, clearly shows how the fire in the Elandskraal area started and spread North West from this area.

5.4 Drone footage and satellite image from NASA taken on 9 June 2017 confirms that the catastrophic fire in the Elandskraal area started and spread North West from this area.

5.5 Appendix A is included as lightning verification

5.6 Still picture of drone footage is included. This footage is not referenced and as best one can place it as footage of the non- “V” pattern area but from a different angle.

5.7 Wind direction, speed and time provided.

6. Interview with eye witness

An eye witness who resides and works on the property where the fire originated and spread from was interviewed on 12 July 2017. This eye witness refused to provide the South African Police Services with a statement.

The eye witness revealed the following information:

6.1 He resides and works on the land where the fire originated.

6.2 He was on the land before the fire offered and on the 7th June 2017 when the fire occurred.

6.3 He pointed out the origin of the reported smoulder which was smouldering in the area before 07 June 2017.

6.4 The smoulder was on the opposite ridge north west of Noah’s Ark

6.5 He witnessed the fire coming from the South West.

7. Mr W Sternsdorf report

7.1 Mr Sternsdorf is the Station Commander at Sedgefield fire station.

7.2 He received a report of the smoulder on 30 April 2017 from a Elandskraal area resident.

7.3 The report was of a smouldering fire on a farm off the Barrington road.

7.4 He and a crew from Sedgefield Fire Station responded to this call on 30 April at approximately 15h36.

7.5 Incident log F-2017-4-2951 was opened for this incident

7.6 He met up with the resident and was taken to the incomplete building commonly known as Noah's Ark.

7.7 A ladder was provided against Noah's Ark and he climbed to a higher position.

7.8 He was pointed north as the location of the smoke.

7.9 He provided the resident who reported the smoke with the contact details of the Southern Cape Fire Protection Association as the smoke was in an inaccessible area.

7.10 He informed the resident to make a fire break around the property.

7.11 On 27 May 2017 he received a wattsapp message from the same resident containing drone footage of a smoulder.

7.12 Drone message read "Drone Footage from Elandskraal area where we've had this every day for the last 4 weeks – not sure if it's squatters – what do you think"

7.13 Mr Sternsdorf reply was “Looks like squatters yes”

7.14 On 31 May 2017 he received another wattsapp message from the same resident.

7.15 Message read “Hi Wayne – went to check this out – no squatters or signs or people – looks like an underground smouldering burn – area is completely burned and perimeters is still smouldering and moving. Very dense bush with no mobile access.

7.16 The drone footage had no reference point and was difficult to pin point the location.

7.17 He did not hear from any other resident again after 31 May 2017.

8. Interview with Mr Dirk Smith of Southern Cape Fire Protection Association.

8.1 Mr Smith works as Manager for Southern Cape Fire Protection Association in the Eden District.

8.2 He received a call from a resident (could not recall the name) about the smoulder in the Elandskraal area.

8.3 Resident gave him an overview of what is happening in the Elandskraal area and that the area is inaccessible.

8.4 He gave the resident two options how to deal with it.

- Option 1 was to water bomb the area using a helicopter with the hope that it will extinguish the smoulder.
- Option 2 is to let ground crews cut a path to the smouldering area and try to extinguish it using hand tools

8.5 Both options had financial commitments attached and was for the approval of the land owner before any of the options can be actioned

8.6 He did not visit the area

8.7 Received email correspondence from their admin email address about the smoulder.

8.8 He did not know who the land owner was.

8.9 He did not hear from the initial caller again and thought the matter dealt with.

9. **Graphic simulation of fire spread under prevailing wind conditions**.

Figure 88


ELANDSKRAAL
WEATHER DATA
Lighting strike origin of fires' proposed spread based on weather data
Wind changes WNW between 01h32 and 01h54
Wind speed: 40-50km/h
Lightning strike fire would have spread here based on weather data
Lightning strike origin of fire
E
S
W
N

Figure 89

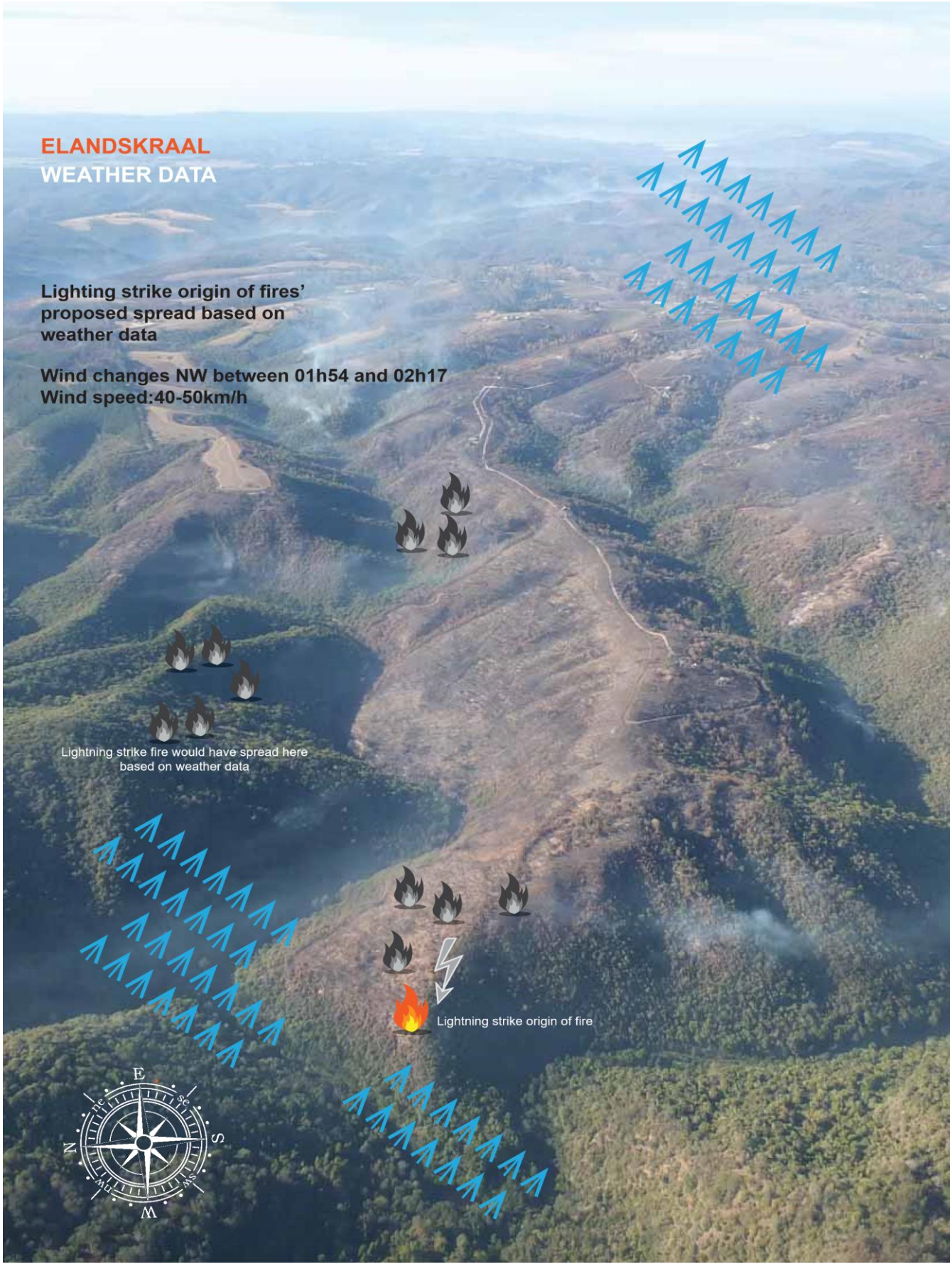
ELANDSKRAAL
WEATHER DATA
Lighting strike origin of fires' proposed spread based on weather data
Wind changes NW between 01h54 and 02h17
Wind speed:40-50km/h
Lightning strike fire would have spread here based on weather data
Lightning strike origin of fire
E
S
N
W

Figure 90

1. Figure 88 show the wind direction in Elandskraal between 01:09 and 01:32. The wind came from the South-South-Westerly direction.
2. Had the fire originated at the lightning strike position as shown in Figure 88, then the SSW wind would have caused it to spread towards the opposite ridge, as indicated.
3. This section does not show a burn scar. This section is where another Elandskraal resident's reported smoulder is still active. See Figures 12 to 20; and 24 and 78.
4. Figure 89 show the wind direction in Elandskraal between 01h32 and 01h54. The wind came from the West-North-West direction.
5. Had the fire originated at the lightning strike position as shown in Figure 88 and it spread as indicated, then one would find a burn scar on this ridge. Yet we find no burn scar to support this fire spread.
6. Figure 90 shows the wind direction in Elandskraal between 01h54 and 02h17. The wind came from the West-West direction.
7. Had the fire originated at the lightning strike position as shown in Figure 88 and it spread as indicated in Figures 88 and 89 then the next spread would have been as indicated in Figure 90. With this spread the fire would have missed the first building in its path (Figures 75 and 76) or damage to this building would have been most severe on the North West side. However, damage to the building is most severe from the South Western side.

Figure 91

8. WEATHER DATA

A graphic representation below shows the wind experienced in the Elandskraal area from 01:09 during the morning of 7 June 2017. Weather data is contained in a report in the public domain. This data is not in dispute.

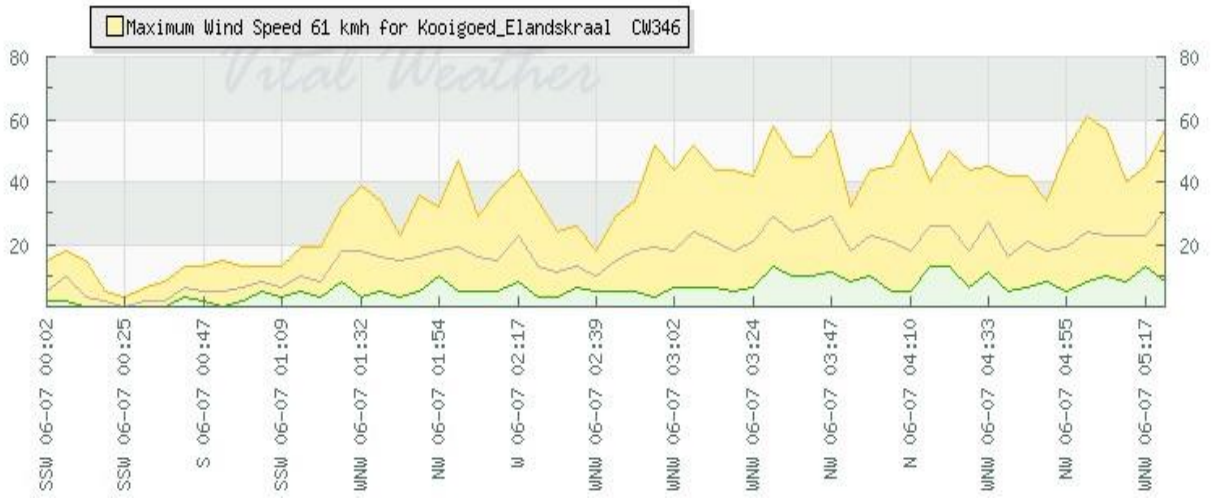

Figure 87: The wind data from report in public domain

Weather data for the period 04 to 07 June 2017 for Knysna as supplied by South African Weather service is indicated below. The Fire Danger Index (FDI) is also included.

Date	Time	Temp C	Max Hum %	Min Hum %	Wind direction	Wind speed	FDI	FDI Colour
04 June 2017	08h00	15	85	75	WSW	19 km/h	38	Green
	14h00	17			WSW	19 km/h		
	20h00	14			WSW	9 km/h		
05 June 2017	08h00	10	80	45	NNE	9 km/h	47	Yellow
	14h00	22			ESE	9 km/h		
	20h00	17			ENE	19 km/h		
06 June 2017	08h00	17	50	15	N	28 km/h	89	Red
	14h00	31			NNW	37 km/h		
	20h00	25			NNW	28 km/h		
07 June 2017	08h00	19	65	25	NW	46 km/h	77	Red
	14h00	20			WNW	65 km/h		
	20h00	18			NW	56 km/h		

Fire Danger Index.

Lowveld FDI Description	Colour	Category	Lowveld FDI Precaution
SAFE	BLUE	0 - 20	Low fire hazard. Controlled burn operations can normally be executed with a reasonable degree of safety
MODERATE	GREEN	21 - 45	Although controlled burning operations can be executed without creating a fire hazard, care must be taken when burning on exposed, dry slopes. Keep constant watch for unexpected wind speed and direction changes
DANGEROUS	YELLOW	46 - 60	Controlled burning not recommended when fire danger index exceeds 45. Aircraft should be called in at early stages of a fire.
VERY DANGEROUS	ORANGE	61 - 75	No controlled burning of any nature should take place. Careful note should be taken of any sign of smoke anywhere, especially on the upwind side of any plantation. Any fire should be attacked with maximum force at hand, including all aircraft at the time.
EXTREMELY DANGEROUS	RED	75 <	All personnel and equipment should be removed from the field. Fire teams, labour and equipment are to be placed on full standby. At first sign of smoke, every possible measure should be taken in order to bring the fire under control in the shortest possible time. All available aircraft are to be called for without delay.

9. LEGISLATIVE REQUIREMENTS

a) Knysna Municipality By-law Relating to Community Fire Safety

I. Defines a “veldfire” meaning a veld, forest or mountain fire

II. Chapter 1 (2) **“Purpose, scope and application**” (2) includes that the By-law is applicable to all persons within the jurisdiction of the Municipality and includes both formal and informal sectors of the community and economy.

III. Chapter 2: **Administrative Provisions** (14): Reporting a fire hazard and other threatening danger: “*An owner or the person in charge of premises, upon discovering any evidence of a fire hazard or other threatening danger pertaining to this by-law, must immediately notify the controlling authority.*”

IV. Chapter 5: **Veldfire Prevention through Firebreaks:** (25) Duty to prepare and maintain firebreaks: (1) *Every owner or occupier on whose land a veldfire may start or burn or from whose land it may spread must prepare and maintain a firebreak on his or her side of the boundary between his or her land and any adjoining land:*

a) for light and medium fuels the firebreak must be a minimum of three (3) metres wide; and

b) for heavy fuels the firebreak must be a minimum of six (6) metres wide.

V. Chapter 5 (27): **Additional requirements:**

“The National Veld and Forest Fire Act, Act 101 of 1998, Chapter 4, places a duty on owners or occupiers to prepare and maintain firebreaks. The requirement of Chapter 4 must be complied with as applicable, in addition to the requirements of this by-law.”

b) National Veld and Forest Fire Act 101 of 1998

a) To reform the law on veld and forest fires; to repeal certain provisions of the Forest Act, 1984; and to provide for related matters.

b) Chapter 1 (1) **Purpose**:

(*1) The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic.*

(2) The Act provides for a variety of institutions, methods and practices for achieving the purpose.

c) Chapter 4: **Veldfire Prevention Through Firebreaks**

a) Chapter 4 places a duty on owners to prepare and maintain firebreaks.

b) Duty to prepare and maintain Firebreaks:

(*1) Every owner on whose land a veldfire may start or burn or from whose land it may spread must prepare and maintain a firebreak on his or her side of the boundary between his or her land and any adjoining land.*

d) Chapter 5: **Firefighting**

a) Chapter 5 places a duty on all owners to acquire equipment and have available personnel to fight fires.

b) Chapter 5 (17): **Readiness for firefighting:**

(1) Every owner on whose land a veldfire may start or burn or from whose land it may spread must-

(a) have such equipment, protective clothing and trained personnel for extinguishing fires as are-

(i) prescribed; or

(ii) in the absence of prescribed requirements, reasonably required in the circumstances;

(b) ensure that in his or her absence responsible persons are present on or near his or her land who, in the

event of fire, will-

(i) extinguish the fire or assist in doing so; and

(ii) take all reasonable steps to alert the owners of adjoining land and the relevant fire protection

association, if any.

(2) An owner may appoint an agent to do all that he or she is required to do in terms of this section

c) Chapter 5 (18) **Actions to fight fires:**

(1) Any owner who has reason to believe that a fire on his or her land or the land of an adjoining owner may endanger life, property or the environment, must immediately-

(a) take all reasonable steps to notify-

(i) the fire protection officer or, failing him or her, any member of the executive committee of the fire protection association, if one exists for the area; and

(ii) the owners of adjoining land; and

(b) do everything in his or her power to stop the spread of the fire.

(2) Any person who has reason to believe that a fire on any land may endanger life, property or the environment, may, together with any other

person under his or her control, enter that land or land to which the fire can spread in order to prevent that fire from spreading or to extinguish it.

(3) In taking control over the fighting of a fire in terms of section 6 (1) (c), any fire protection officer may-

(a) take control from any person who has, until his or her arrival, controlled the fighting of the fire;

(b) order any person who is apparently not younger than 16 years and not older than 60 years to assist him or her.

(4) In the absence of a fire protection officer, a forest officer may-

(a) take over control of the fighting of a fire in or within ten kilometres of any State forest to the exclusion of any other person; and

(b) order any person who is apparently not younger than 16 years and not older than 60 years to assist him or her.

(5) Any person acting in terms of subsection (1), (2), (3) or (4) may, if he or she considers it necessary for the protection of life, property or the environment or for preventing a fire from spreading or for extinguishing it-

(a) enter any land;

(b) destroy trees, grass, crops or other vegetation;

(c) enter or break and enter any premises;

(d) prevent any person from entering any premises;

(e) forcibly remove from the scene any person who is in danger or who obstructs him or her in the performance of his or her duties; and

(f) remove or order to be removed any vehicle or other thing.

(6) Whenever a fire spreads or may spread across a boundary of a fire protection association, the fire protection officer must-

(a) inform the fire protection officer of the area to which the fire spreads or may spread;

(b) take all steps needed to co-ordinate the fire -fighting operation in accordance with the fire management strategy referred to in section 5 (1) (a) and (b).

c) Local Government Municipal Structures Act No 117 of 1998

To provide for the establishment of municipalities in accordance with the requirements relating to categories and types of municipality; to establish criteria for determining the category of municipality to be established in an area; to define

the types of municipality that may be established within each category; to provide for an appropriate division of functions and powers between categories of municipality; to regulate the internal systems, structures and office-bearers of municipalities; to provide for appropriate electoral systems; and to provide for matters in connection therewith.

1. Division of functions and powers between district and local municipalities

A district municipality has the following functions and powers:

Fire fighting services serving the area of the district municipality as a whole, which includes –

I. Planning, co-ordination and regulation of fire services;
II. Specialised fire fighting services such as mountain, veld and chemical fire services;
III. Co-ordination of the standardisation of infrastructure, vehicles, equipment and procedures
IV. Training of Fire officers

10. CONCLUSION

Wildland fires spread in two phases. Firstly, convected heat causes fire to spread from low vegetation such as grasses, underbrush and leaf litter (ground fuels) to higher vegetation, such as tree branches. In this phase, the fire grows vertically. Ground fuels include all flammable materials lying on the ground.

As a fire intensifies, involving fuels at all levels, radiant heat becomes the primary method of spread at both the aerial and ground fuel levels. The fire then grows laterally.

Both these patterns are visible in the “V” Pattern area (Area 1).

Vegetation type, geography, topography and wind contribute to the fire spread. During the Elandskraal fire, the dense vegetation, topography, together with strong changing winds played a major contributing factor.

Area 1

Figure 48 shows a clear V Pattern which is evident of fire origin and spread. In Figures 48 and 49 one can clearly see the path of fire spread in this area. Severe damage of fuel, distinct V pattern, clear lateral lines all indicate to the origin and spread of a fire.

Below this V Pattern is a clearing (Figures 49, 50, 51) The ground at the clearing shows evidence of light fuels having burned first and then spreading to heavier fuels. This initial spread on the ground is also in the direction with the wind from the South South West.

Compare this V Section with similar sections of fire spread displaying the V pattern in figures 52 and 53). In Figure 53 one can also see the V pattern below the ploughed lands burn scar with its very clear lateral lines. Note that the lowest point of the V below the ploughed lands indicates that the fire spotted from the South South West direction and is in line with the origin in the V pattern in Area 1

Ground fuels, discovered in the clearing below the “V” Pattern (Area 1), should not be in the vicinity. These fuels included logs, pinecones, stacked combustible material and remains of burnt planks.

Figures 60 and 61 shows burnt logs, which is inconsistent with the vegetation growing around it. The only explanation for finding these in the area is that they were brought there. Also slightly burnt, were the young trees found growing in the area. Found in the same area as the burnt light fuels, were the heavy fuels - logs. The presence of these logs, suggests that previous fires were lit in the clearing before. The young trees are slightly damaged and could not be the contributor of the logs being severely charred. This area shows the distinctive light fuels (leaf litter) having burned. The light fuel (young trees) shows slight damage and did not burn. Note that the young trees are dry and would have made perfect fuel. The area to the left in the photo shows very dry material but these are untouched by fire. The fire could thus not have come from lower down the slope to the left.

In Figure 62 and 66, fuels are stacked together. This is an indication that humans started fires in the clearing. These stacked fuels are also out of place in the clearing. They appear to have been broken into smaller sections. The dry leaves on top of it indicates that the fuel was there before the trees starting dropping their leaves. On the ground one can clearly see the evidence of light fuel burning in this area.

The pine cones in the area is out of place as no pine trees grow in the area or nearby. They could only have entered the area by means of having been transported there. Not all the pine cones found was burned. Some only showed little signs of being burned. The pine cone in figure 65 shows no sign of burning.

The presence of the pinecone, together with the stacked combustible material (Figure 66) appears to be the most recent man made fire. There are no pine trees in the area, and the only conclusion as to the presence of pinecones, is that they were brought into the area. Pinecones found and photographed were in the clearing at the bottom of the “V” Section. The clearing shows light fuel scorching, which is consistent with a fire starting in an area. Figure 51 shows the clearing from above and the scorch is clearly visible. Examining figure 66 leads one to the conclusion that the pine cone is the most burned of all the pine cones located in this area. It is also stacked amongst broken fuel which shows charring consistent with the pine cone. The ground beneath the pine cone is blackened which suggest that the pine cone was burned in this particular location and not placed there after the fire. The leaves dropped and fell on the pine cone and stacked fuel after the fire.

There are clear access paths leading to the area, and definite signs of humans having been in the area before (remains of gas cylinder and drum, pottery piles, burnt plank remains, pinecones, logs, stacked heavy fuels). The paths are well travelled in some areas and shows no signs of vegetation growth. These paths are also well compacted. This would indicate regular travel along these paths.

The remainder of tree trunks found in Area 1 shows that the fire spread upslope. One can gauge the direction and fire intensity by the degree of damage to fuels. One can also see on the rocks (Figure 67) that the heat intensity came from the upslope side.

Having moduled the fire spread with the wind coming from the South-South-West it shows the fire spread was towards the first building (Figure 80). This building is severely damaged by fire from the direction of the fire spread from the V Section. It sits square in the path of the fire spread. From this direction, it also spread towards the burn scar below the ploughed lands (Figure 77). The clear V Pattern observed in area 1 shows the direction of fire spread. At the bottom point of the V one finds the clearing. It is in this clearing one finds the possible cause – the pine cone together with stacked fuel.

I can find no plausible explanation for a fire to have started in Area 1 (V Section) by means of a fire “spotting from Area 3 or any other area. The wind direction does not support this. Figure 80 shows fire spread with the wind coming from the South South West between 01h09 and 01h32. Clearly the fire could not have spotted to Area 1 with this wind.
Figure 81 shows the wind from the West North West direction between 01h32 and 01h54. Had Area 1 been ignited with this wind spreading the fire to it then the burn scar of area 1 would have shown a burn spread consistent with the wind from the West North West. The fire could thus not have spotted from area 3 to Area 1 with a West North West wind spreading it. The burn scar shows a pattern of fire spread with a South South West wind behind it.
The next wind was from the North West between 01h54 and 02h17. Once again the burn scar in Area 1 does not show fire spread from Area 3 caused by this wind. The burn scar of Area 1 is evident of fire spread with the wind coming from South South West. The North West wind could not have caused Area 1 to burn.

The possibility of Area 1 being started by means of fire spread from Area 3 with the wind from the West between 02h17 and 02h39 is impossible to have occurred.

Between 02h39 and 04h10 the wind came from the West North West. The possibility that the fire spotted from Area 3 to Area 1 with this wind is equally impossible.

Between 04h10 and 04h33 the wind was from the North. This could have caused a spot fire in Area 1. However, the burn scar and the direction of fire spread should have indicated the spread of fire towards the West, but it does not. The burn scar shows that the fire originated in the area towards the South South West and from spreading in a North Easterly direction. This is the pattern the burn scar shows.

Figure 81 shows the burn scar below the ploughed lands. When one analyse the wind pattern which prevailed in the Elandskraal area then the only possibility for the fire to spread to this area is with the wind coming from the South South West. Has the fire originated at Area 3 then the fire spread from a South South Westerly wind would have been towards the area indicated in figure 78. One then would have found an entirely different burn scar if the fire firstly spread to this area, and secondly, had it spread from this area with the changing winds. The property visible in Figure 78 would have either been affected or threatened. However, we do see from the burn scar that this property is totally unaffected and was under no threat from fire.

The wind came from the West between 02h17 and 02h39. This wind could also have spread the fire to the ploughed lands scar, but this is only possible if the fire started in Area 1. Had the fire originated in Area 3 and spread to the area indicated in Figure 81, then the spread with the wind from the West would have spread the fire to the building shown in figure 81. Figure 81 shows the fire did not affect these buildings. Vegetation immediately below this property and to the west is also untouched by fire.

The burn scar of the area, damage to the first structure in the V path together with the wind on the morning of 7 June 2017 points to the possible origin being from the “V” Pattern area.

The areas (both non- “V” Pattern and “V” Pattern) was examined, and further evidence of material that should not be in the “V” Pattern area was found. Further found, were the remains of previous fires. The material found in the clearing below the V Section in Area 1, indicates strongly the possible cause of the fire and that it started at this particular point.

The only probable origin, backed by examining the burn scar and prevailing winds, is that the fire originated in the clearing below the V Pattern in Area 1.

Area 2

Fire spread from Area 2 is not possible as the smouldering fire was still smouldering as at 14 July 2017. There is no evidence that the fire spread from this area and there is no burn scar to support fire spread from this area. Photographs and grid maps, which were supplied shows that the smouldering fire was still active as at 14 July 2017.

Fire caused by lightning and spread from Area 2 is not supported by evidence and is dismissed as a possible origin and cause of the devastating fire which spread to the town of Knysna on 07 June 2017.

Area 3

Further considered, was the possibility that there was a smouldering fire in this area.

Figure 21 shows Area 3 and no V pattern is visible. The lateral lines which identifies the spread of fire from a point outwards are also not contained. This area actually shows an upside down V. When viewed as an upside down V then the lateral lines showing fire spread from a point outwards.

A “Die-out” area is clearly visible down the slope and indicates that the fire burned in this direction and eventually died out. Also see figure 22 of this “die-out” area.

One must compare Figure 21 which shows no V pattern, with Figures 48, 49, 52 and 53 where one can clearly identify as many as five origins due to spotting and all showing the distinctive V shape with lateral lines showing fire spread from a point outwards. The question is why would five different areas show this V pattern which it is well-known as an indication of fire origin and spread, and one area (Figure 21) clearly does not display the well-known V pattern with lateral lines

This same moduling shows the fire spread, should the fire have started in a different location (Area 3). The burn scar on the ground does not support the fire spread from this location. (Figures 78 and 80). In Area 3 one also find that evidence that the fire was burning back down the slope. There is no V pattern visible in this area. The building in the path of the fire would not present such severe damage on the South Western side if the fire originated and spread from Area 3

The weather pattern explains the spread of the fire towards Knysna and the burn scars on the easterly side of structures and poles.

The weather patterns from 04 to 06 June 2017 was also considered. On 06 June 2017 an Extremely Dangerous FDI was issued. The FDI is also circulated to members of the FPA. The wind was strong at 37 km/h and temperature peaked at 31 degrees. Under such conditions an existing smoulder would have caused a fire to spread. But there was no report of a fire in the Elandskraal area on this day. Had there been a fire then the community failed to report this fire. When one compares the weather of 06 June 2017 with the weather of early morning 0n 07 June 2017 then the weather on 06 June 2017 was more conducive to the spread of runaway fires. Yet we don't find a report of a fire on the 6th of June 2017. The wind and temperature on 07 June 2017 was less severe than the wind and temperature of 06 June 2017 at 14h00. I can find no feasible explanation how a smouldering fire did not spread under the conditions perfect for the spread of runway fires of 06 June 2017. Yet it spread during the early hours of 07 June 2017 under conditions less conducive to runaway fires. The only deduction one can make is that a fire was started in the early hours of 07 June 2017. The smouldering fire in Area 3 was underground and protected from the wind of 06 and 07 June 2017 and could not have contributed to the runaway fire of 07 June 2017 – the burn scar does not support the fire spreading from this area.

Compared was the behaviour of the smoulder, reported on 10 May 2017, which is still smouldering in Area 2. This smoulder remained underground during the conditions of both 6 and 7 June 2017.

The verbal account of the eye witness must be taken into account even though he refuses to give SAPS a written statement. He observed the smoulder before the fire, but places it in Area 2 – a smoulder which was still smouldering on the day I interviewed him. His report of the smoulder is consistent with the report of the smoulder by an Elandskraal resident on 10 May 2017.

The account of Mr Sternsdorf of where he was pointed to be the origin of the smoulder on 30 April 2017 by a different Elandskraal resident also indicates that it was in the vicinity of Area 2. He was taken to Noah's Ark as the best view and access. Noah's Ark is a distance away from Area 3 and does not offer the best view had a smoulder been present in this area. Area 3 has access roads to it and it would have been more advantageous if Mr Sternsdorf was taken to Area 3 if a smoulder was in this vicinity. Access roads lead from Noah's Ark all the way to Area 3 and one would have been in a position to view the smoulder more clearly. A decision regarding firefighting could also have been taken from a position in Area 3. The smoulder which Mr Sternsdorf was shown was on the opposite ridge across the river and was inaccessible. This location places it in the vicinity of Area 2. The inaccessibility of it is also applicable to Area 2. Area 3 was very accessible with access paths.

Fire behaviour requires the three elements of combustion to be present, namely, heat, oxygen and fuel. With underground fires, heat and limited oxygen and fuel are present, therefore presenting as a smouldering fire. These fires remain “protected” underground, and will not surface on their own accord.

The behaviour of underground fires can be compared with green waste dump fires. These smouldering fires will smoulder for months. The best way to extinguished them is by covering them with sand to exclude the oxygen.

Underground fires do not have the fuel to progress to a flaming fire. This is why the current smoulder in Area 2 is still smouldering underground, and has remained an underground smouldering fire since prior to 10 May 2017. The same behaviour can be applied to a smouldering fire, which could have occurred in Area 2 with the Non- “V” Pattern.

From examining the evidence one can conclude that the devastating fire which spread to the town of Knysna did not originate from Area 3. It is accepted that there could have been a smoulder in this area, but the evidence shows no proof of a fire having spread from this area.

One must also consider the legislative requirements of the National Veld and Forest Fire Act. The area had no firebreaks in place and landowners was not capacitated to stop fires from spreading from their land to neighbouring land. Creating fire breaks is a responsibility placed on landowners.

The Local Government Municipal Structures Act clearly defines the responsibilities of the District Municipality. In this instance the District Municipality had an absolute competency to attend to specialised fires such as veld fires but was not the first response to the Elandskraal fire. The B Municipality, Knysna Fire and rescue Service was the first response and battled this fire for more than three weeks with the assistance from the Eden District Municipality.

11. FINDING

Considering all the evidence presented in this report, it is extremely probable that the fire started in the “V” Pattern area (Area 1) depicted in Figure 48. All evidence points to the origin of the Elandskraal fire to be in this area, originating in the clearing below this section. The degree of damage to the first structure and remaining fuel in Area 1 indicate that the fire was most intense along its path in this area.

It is highly unlikely that the fire could have started in any other area other than this “V” Pattern area (Area 1), as the burn scar does not support this. The conditions which existed on 06 June 2017 was very conducive to the spread of a runaway fire. The smouldering fires of both Areas 2 and 3 survived the conditions of 06 June 2017. Area 2 survived the conditions of 07 June 2017. Area 3 was burned from the easterly direction as the burn scar and damage to fuels in this area shows. It could be this back burn which caused damage to structures and poles in the area from the Eastern side. There remains no other feasible explanation for the damage pattern to these structures other than a fire coming from the easterly direction.

The pinecone with stacked heavy fuel is the most probable cause of this devastating fire. There exists no other explanation for this fuel to be stacked in this way, other than someone lighting a fire in that clearing in the early hours of 07 June 2017 or late evening of 06 June 2017. This fire becomes a new fire which is above ground and exposed to the wind. It had all the dry fuel in its path to quickly become a runaway fire

The possibility of the lightning strike is real, and the smoulder, which is still active on an opposite ridge (Area2), is more like to be the underground fire caused by lightning. It is also accepted that a smoulder could have been in Area 3. However, the evidence does not show that the devastating fire was caused by this smoulder.

I can find no other explanation for the burn pattern as shown in Figures 48 and 49. Examining all possibilities using the wind patterns which prevailed at the time one cannot come to an acceptable explanation other than the fire originated from this area and from here it spread to other areas.

It is thus my finding, based on examining all the evidence that the fire originated in Area 3 and was most probably started by a human being making a fire using the pine cone and stacked combustible material found in the clearing.

This devastating fire quickly spread out of control from this location towards the town of Knysna.

18 August 2017

KNYSNA
Municipality Munisipaliteit uMasipala