FIRE INVESTIGATION REPORT

Tiwai Point, Invercargill

Incident Information:
F4137934
Vegetation Fire
11:59 PM 29 January 2025

Report completed by:
Cameron, Scott, Fire Investigator
Fire and Emergency New Zealand, Te Kei

Table of contents

Author's brief

I have served with the New Zealand Fire Service, now Fire and Emergency, since 1994 as a volunteer firefighter. I was promoted to Chief Fire Officer 2011 - 2021. I was appointed to the role of Advisor Risk Reduction in 2021. I have been responsible for determining the origin and cause of fires since 2022. I was appointed to the role of Senior Advisor Risk Reduction in 2025.

I have completed the following training courses:
Fire Investigation 1, 2021
Fire Investigation 2, 2022

Fire Investigation Level 2 Natural Environment, 2023

As a Specialist Fire Investigator for Fire and Emergency I am required to respond to significant fires in accordance with Operational Instructions with the principal objectives being to co-ordinate, supervise or undertake investigations into major and serious fires, including fatal fires, by determining the point of origin of a fire and from this establishing the cause of a fire.

I have read the Code of Conduct for Expert Witnesses, Schedule 4 of the High Court Rules 2016, and agree to abide with them.

Executive summary

A vegetation fire was reported near the Tiwai Point Aluminium Smelter on Wednesday 29 January 2025 at 11:58 p.m.

The first arriving Fire and Emergency New Zealand appliance reported a well involved fire with strong winds driving an active fire front of 600m-1000m. Initial response (first 24 hours) comprised of 4 urban pumps, 2 rural pumps, 4 tankers, 1 command unit, 1 ops support unit, 2 Area Commanders, 1 Volunteer Support Officer and 10 helicopters.

Firefighting activity continued until the fire was confirmed out and all resources were released on the 10 February 2025.

Fire investigators Murray Milne-Maresca and Scott Cameron attended on the 30 & 31 January 2025, to conduct a scene examination.

Total area of burn was 1210.6 Ha. The fire burnt through some areas of cultural significance to mana whenua and Department of Conservation land. The area consisted of a range native flora, including native iris, and animal habitat for South Island fernbird, regenerating totara, and the critically endangered green skink. A 11kV distribution line was also damaged that affected the smelter's water supply, from bores out on the peninsular.

An event had occurred on the 11kV distribution line to the water bores on the peninsula. An electrical event had taken place on power pole number 6, resulting in a fire on the pole. It developed to the point where it spread to the vegetation below the pole. Damage to the middle insulator on the crossarm of the power pole indicated it was damaged prior to the fire allowing power from the lines to discharge through the timber crossarm over time. Resulting in pyrolysis of the crossarm, leading to combustion.

Based on evidence available at the time of this investigation, this incident will be classified as accidental.

Terms of Reference

Sponsor: Tohiariki, Julian - District Manager.

Incident Background

History of previous fires in the area. Resulting from deliberately lit fires and fires connected to power pole/lines.

The reason for the attendance of a SFI was Vegetation Fire in an area of significant local and national impact.

Objectives

Determine origin and cause of fire.

Scope

Collect and document evidence relating to the Tiwai Peninsular.

Land Use and Description

Tiwai Point New Zealand Aluminium Smelter, (NZAS) is located at the end of Tiwai road.

There is a section of land that is Tiwai land that extends east from the site boundary fence, it transitions to Department of Conservation (DOC) land.
The smelter has freshwater bores in the DOC land and has an 11kV power distribution line from the smelter that supplies power to each bore. These lines are maintained by Tiwai Point New Zealand Aluminium Smelter.

The peninsular is home to a wide range of flora including native iris, a significant South Island fernbird population, regenerating totara and the critically endangered green skink.

Mana whenua, specifically Murihiku Runaka, exercise kaitiakitanga (guardianship) over the area, including its waters, and are actively involved in the remediation and future planning of the site, due to the significant cultural importance, due to its historical and spiritual connections to the land and sea.

Property and Land Use

Property Ownership	Land Use	More Information
DOC (PCL)	Reserves, Other	PCL/DOC land, protecting bird life, lizards and tuatara in the area.
Tiwai Point New Zealand Aluminium Smelter	Commercial	Factory/manufacturing plant with shipping port.

Services	More Details
Power overhead service	Transpower, supply and maintain the transmission lines and pylons from the Tiwai site.
Power overhead service	NZAS own and manage the power distribution line to the bores on the peninsular. They are maintained and repaired by NZAS Staff and its contactors.

Overall Summary

Image 1: Tiwai Point Peninsular.

Image 2: PCL/DOC boundaries highlighted green around Tiwai Point New Zealand Aluminium Smelter.

Pre-Incident Events

Weather:

Temperature ranges 12-19 degrees throughout the day on the 29 January.

1mm of rain during the morning of the 29 January.

North-northwest winds throughout the day of the 29 January gusting to 81.6 km/h.

Previous fire in this location:

22-01-2018 7:07 p.m. - F2465494 - vegetation fire in the same general area involving 11 kV power lines, known as the bore line. The size of the fire was approximately 77 ha.

Closed-circuit television (CCTV) cameras from the NZAS site were recording prior to the incident being reported.

NZAS completed a 2 yearly inspection of the 11kV distribution line on 6 February 2023. NZAS has scheduled to complete further maintenance on the 11kV distribution line on 30 January 2025.

Discovery of Fire

Fire was discovered by New Zealand Aluminium Smelter staff.

A 111 call was received by the Fire Communications Centre at 11:58 p.m. on the 29 January 2025

Image 3: State of fire about the time it was discovered on Tiwai CCTV.

Fire and Emergency New Zealand Response

Information sourced from Fire and Emergency Computer Aided Despatch Incident Report.

Incident Number	F4137934
Incident Date Time	29 Jan 2025, 11:59:00 PM
Call Type	
Method Call Received	111
First Arriving Fire Appliance	TIWA991
First Fire Appliance Arrival Time	12:12 AM
Second Arriving Fire Appliance	INVE211
Second Fire Appliance Arrival Time	12:21 AM

On the 29 January 2025 at 11:58 p.m. Fire and Emergency communication centre received a 111-call indicating a vegetation fire near the Tiwai Point New Zealand Aluminium Smelter.

The Invercargill, Kingswell and NZAS brigades were responded, with the NZAS appliance arriving on the 30 January 2025 at 12:12 a.m. An Invercargill appliance was second to arrive at 12:23 a.m.

The first arriving Fire and Emergency NZ appliance reported a well involved fire with strong winds driving an active fire front of 600m-1000m. Initial response (first 24 hours) comprised of 4 urban pumps, 2 rural pumps, 4 tankers, 1 command unit, 1 ops support unit, 2 Assistant Commanders, 1 Volunteer Support Officer and 10 helicopters.

Firefighting activity continued until the fire was confirmed out and all resources were released on the 10 February 2025.

Fire investigators attended on the 30 and 31 January 2025, to conduct a scene examination.

Scene Examination

Scene Examination-Exterior

An examination of the surrounding area was conducted to identify fire directional indicators and any possible ignition sources.

The New Zealand Aluminium smelter was located approximately 315m to the west of the reported location of the fire. There were no reported issues at the NZAS site and no evidence of a fire coming from the facilities at the Tiwai site.

A Transpower substation was located approximately 300m southwest of the identified location, and the transmission lines ran in a northeast direction over the fire damaged area to pylons approximately 121m east of the identified location. There were no reported issues with the substation and the connected transmission lines/pylons, and there was no physical damage to any of the infrastructure associated with the pylons.

A locked gate was located approximately 526m northwest of the area. It was still locked when the first responding fire appliance (NZAS) arrived, eliminating any un-authorised entry to the area via the vehicle track.

I have eliminated spontaneous combustion as a cause as there were no piles of decaying organic matter observed in the area.

Pylons located in the fire damaged area of the vegetation located to the east of NZAS was inspected and there was no physical damage to the pylons, or the transmission lines connected to them.

A 11kV distribution line was observed amongst vegetation and the fire damaged areas, power poles were fire damaged and there were power lines down on the ground.

A location of approximately 3000m² was identified as the general area of origin. *(Refer to photos 1 and 2).*

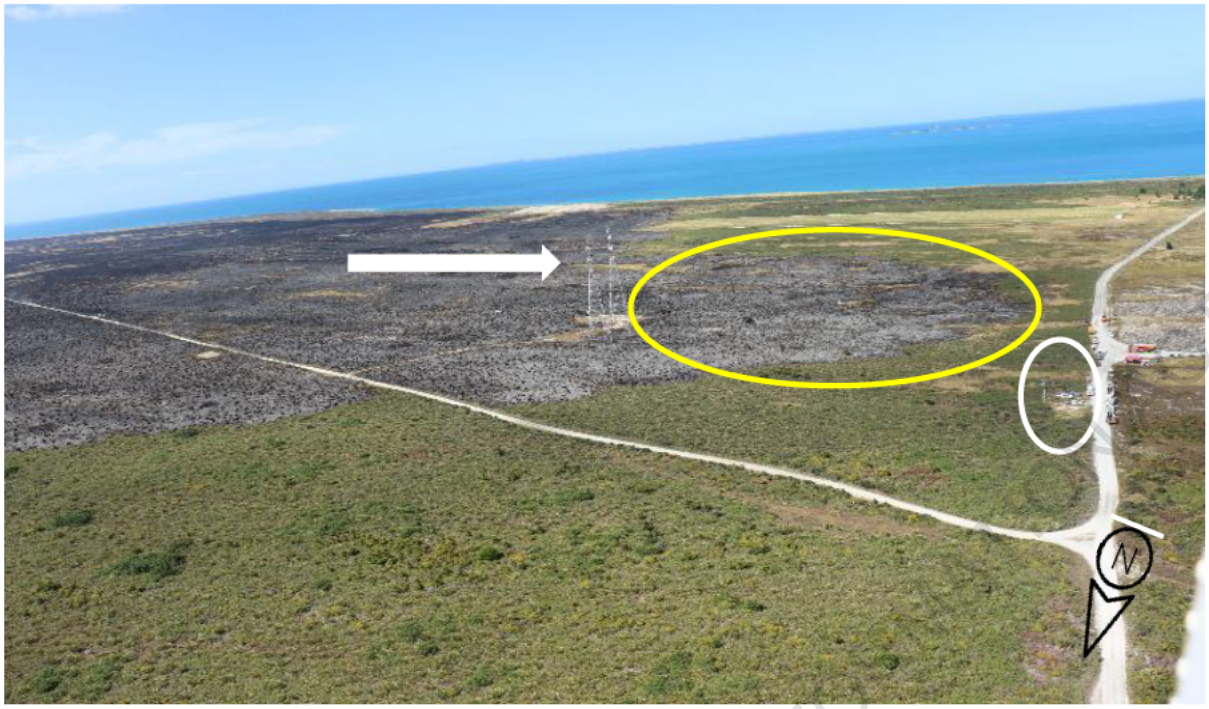

Photo 1: Yellow circle indicates the general origin area. White arrow shows the second set of pylons, white circle shows where a 11kV distribution line starts.

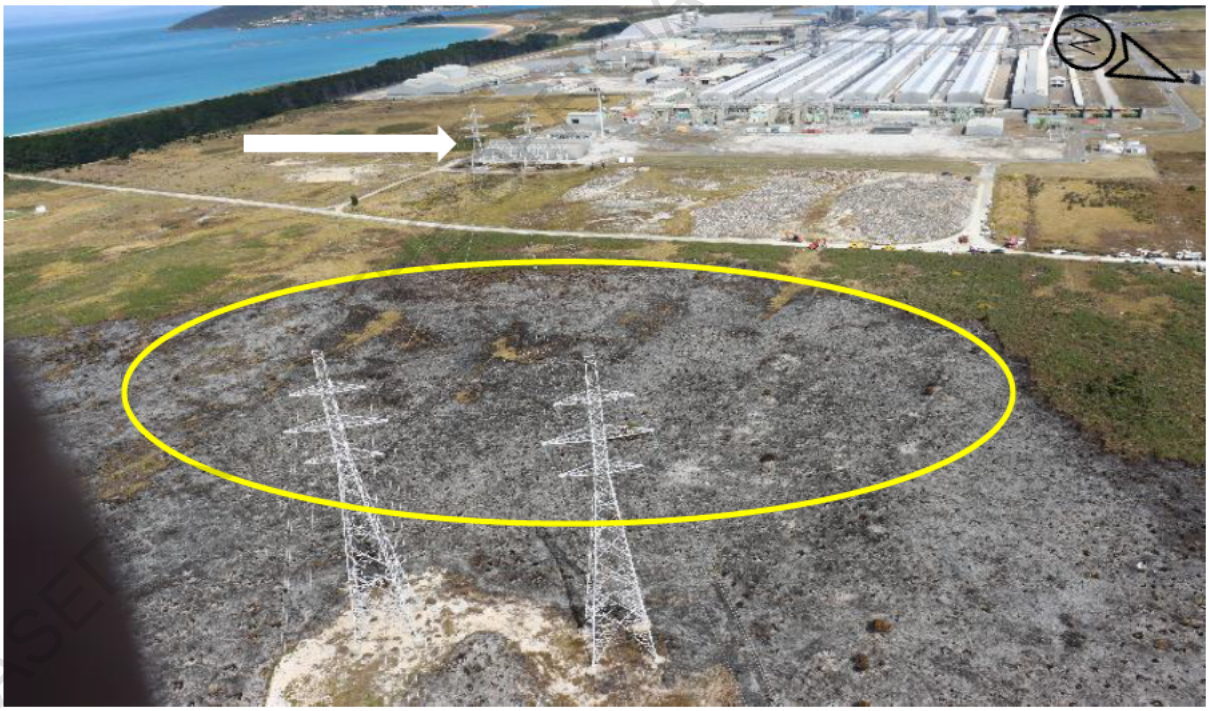

Photo 2: Yellow circle indicates the general origin area with Tiwai site in the background. White arrow shows the first set of pylons from the substation behind them.

Scene Examination-Interior

Having identified the general origin area, entry was made along the 11kV distribution line conducting visual inspections of the poles and lines. The inspection was completed by NZAS, FENZ and Power Net staff.

There were 9 poles running north to south before the lines turned and continued east. The first 8 poles were wooden, and the 9th pole was concrete. Each pole was numbered.

Photo 3: 11kv distribution line.

Poles 1 – 3 had no evidence of any damage to the poles or powerlines.

Pole 4 had fire damage around the base of the pole and no damage present to the powerlines.

Pole 5 has similar fire damage as pole 4. The 3 powerlines were in place on the crossarm, however the western line that was still connected to the crossarm had dropped to the ground towards pole 6.

Pole 6 had a large section of the top of the pole missing with evidence of burning to the top of the pole and the crossarm. One of the 3 powerlines had broken and was on the ground. One was suspended in the air and the remaining line was the middle line was caught on the crossarm. The base of pole 6 did not receive any fire damage.

Poles 7 and 8 had sustained fire damage to the pole and still had the powerlines attached but pole 7 had the western powerline dropped towards pole 6.

Pole 9 was not fire damaged but the vegetation around it had been burnt.

Photo 4: Fire damage to top of pole 6 and the crossarm.

The area around the pole was taped off as the specific origin area.

Photo 5: Specific area of origin around pole 6.

The specific origin area was reduced to about 10m².

Flags were put out as items of interest were discovered. These included damaged wires, pole cap, damaged insulators, metal bolts, metal straps, nails, chunks of burnt wood from the crossarm and/or power pole. *(Refer to photos 6 7 and 8).*

We flagged the macro and micro burn pattern indicators, and identified advancing, lateral and backing fire. We also identified a possible point of ignition. Patterns observed were a u pattern, angle of char on power poles, leaf curling, cupping, white ash, grass stem fall, grass sweep, protected areas/surfaces.

With several flags in the ground, it painted a clear picture of the fires progression as it spread from the specific origin area in a southeast direction away from power pole 6. *(Refer to photos 9 and 10).*

Site inspection found there were no opossum, cat, or bird carcasses found in the area around any of the power poles ruling out animal activity or bird strike as a cause of the fire. All the poles inspected had metal animal guards fitted.

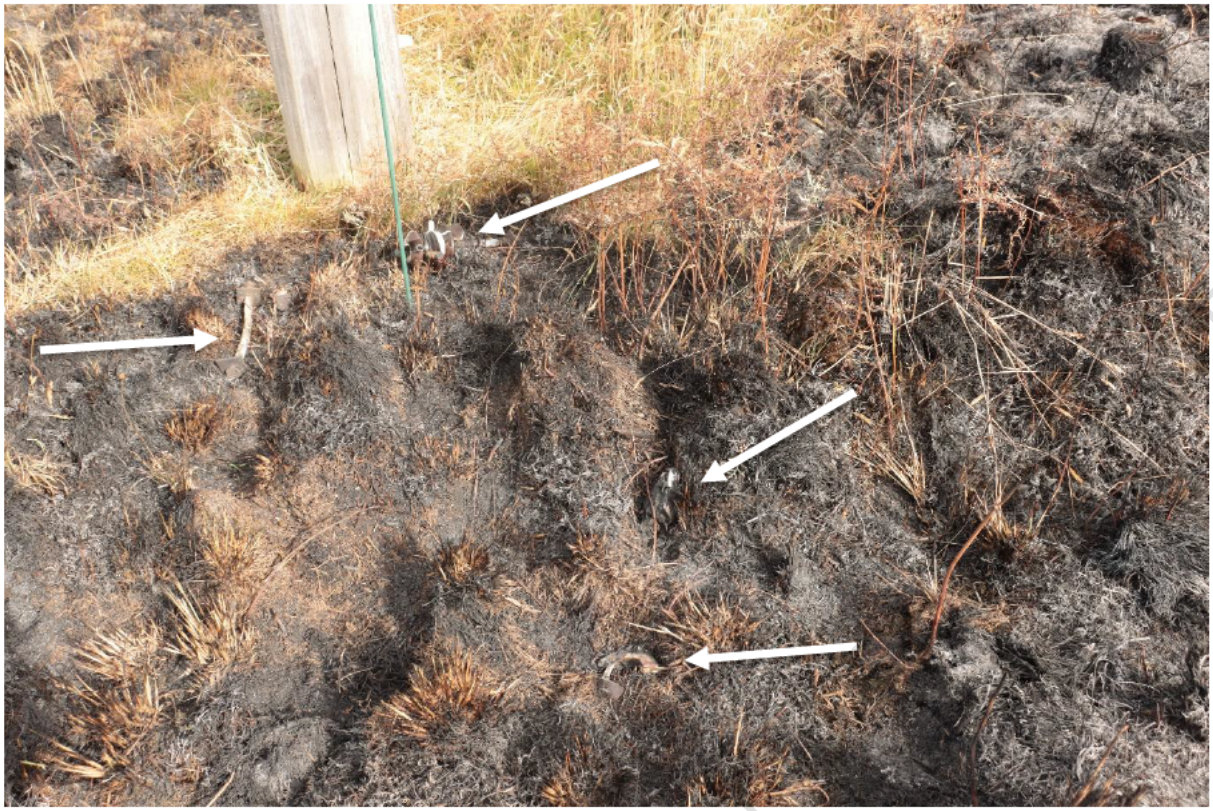

Photo 6: White arrows indicate items of interest at the base of pole 6.

Photo 7: Powerline at the point it broke. End from the power feed supply.

Photo 8: The other end of the broken powerline.

Photo 9: Red arrows indicate fire direction away from pole 6.

Photo 10: Red flags indicate fire direction away from pole 6.

Pole 6 was wooden and carried 3 lines for the 11kV distribution in a north/ south direction. There were 3 ceramic insulators on the crossarm.

The crossarm had fire damage where it had burnt through the centre of the crossarm and dropped to the side of the pole. The western powerline and its insulator had broken away from the pole and was discovered on the ground. The middle powerline and its insulator remained in place. The east powerline still had the insulator attached but hanging in midair, supported by poles 5 and 7.

All the powerlines were inspected and there was no evidence of any electrical arcing or damage to any sections of the lines apart from the western line that was broken at pole 6.

Power Net replaced damaged poles and reconnected the western powerline on the 11kV distribution line to the bores.

Photo 11 shows the path of the distribution line. The crossarms are visible to show the locations of the insulators. Damage is visible to pole 6.

Photo 11: Distribution line to NZAS bores. White arrow indicates damaged pole 6.

Photo 12: Fire damage to crossarm and top of pole. Yellow arrow indicates the middle powerline and insulator, white arrow indicated the damaged crossarm.

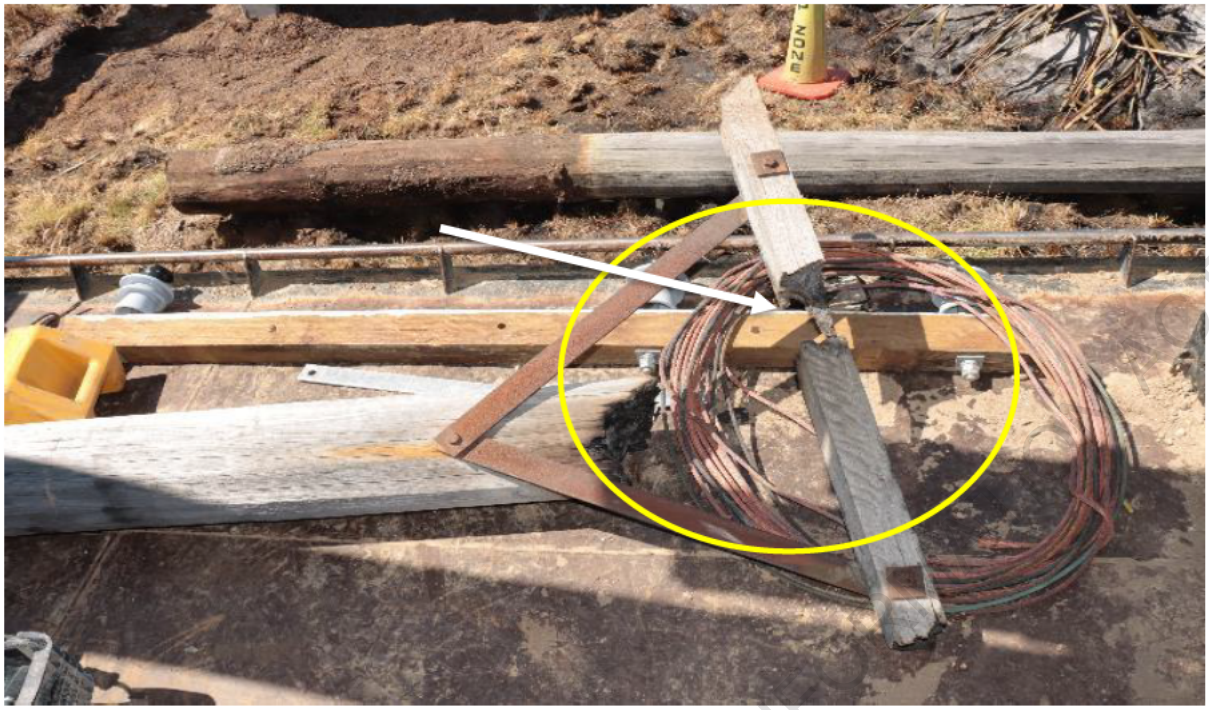

Photo 13: White arrow shows where the fire burnt through the crossarm, yellow circle indicates the burnt away section of the top of the pole.

Photo 14: White arrow indicates a damaged insulator still on the powerline. Damaged insulator resulted in a phase to earth fault.

Photo 15: Yellow circle shows where a powerline was striking the power pole after the crossarm broke. White arrow shows burnt away tips of the crossarm.

Once the crossarm had burnt through it dropped allowing the live powerline to strike the pole and tips of the crossarm.

With the live line striking the pole, electricity has flowed to earth creating significant heat igniting the tips of the crossarm and burning the pole.

Fire Spread and Behaviour

KESTREL Readings: Nil recorded.

Today's FWI Measurements

Remote Automatic Weather Station (RAWS)

Station Name: Waituna Raws **Date:** 29 Jan 2025, 1:00 PM

Fire Danger Class

Forest	Scrub	Grass	FFMC	DMC	DC	BUI	ISI	RH %	WS	GUSTING	FWI	GC %
Moderate	Extreme	Moderate	63.1	11.7	168.1	19.9	0.9	71	12	22.5	3.4	40

Up-to-date weather observations and forecasts are crucial for determining fire danger and fire behaviour. These Indices were recorded at 1pm (NZDT)

Fine Fuel Moisture Code (FFMC): 76

Numerical rating of the moisture content of the surface litter and other cured fine fuels. It indicates the relative ease of ignition and flammability of fine fuels.

The above indices were recorded at 1pm (NZDT) they are prediction figures for general fire ignition for mid-afternoon. With the fire occurring close to midnight the FFMC has been recalculated to reflect a more accurate figure.

As the days temperature increased it enabled the FFMC to rise to 76 at the time of ignition indicating there was a moderately easy chance of ignition if a competent ignition source was applied to dry vegetation.

Duff Moisture Code (DMC): 11.7

Numerical rating of average moisture content of loosely compact organic layer of moderate depth.

Drought Code (DC): 168.1

Numeric rating of the average moisture content of deep compact, organic layers. This code is a useful indicator of seasonal drought effects on forest fuels, and the amount of smouldering in deep duff layers and large logs that would occur during a fire. A DC of 300+ indicates mop up will be difficult and prolonged.

Build Up Index (BUI): 19.9

The BUI is a numerical rating of the total amount of fuel available for combustion that combines the Duff Moisture Code (DMC) and the Drought Code (DC). A BUI of >60 is considered as Very High.

Initial Spread Index (ISI): 2.4

The ISI is a numerical rating of the expected rate of fire spread shortly after ignition. It combines the effects of wind and FFMC on the rate of spread without the influence of variable quantities of fuel. An ISI of 8-15 indicates rapid spread of fire. An ISI of 16+ indicates an extremely fast-moving fire.

Relative Humidity (RH): 71

Relative Humidity is the amount of moisture in the air compared with the amount of moisture the air can hold. When the air is saturated, its RH is 100%, extremely dry air can have a reading of zero percent. Relative humidity % Below 60% contributes to fire development Below 30% contributes to rapid fire development Below 15% contributes to extremely rapid-fire development.

Wind Speed: 12.8 **Gusting:** 22.5

Fire Weather Index (FWI): 3.4

Numerical rating of fire intensity that combines ISI and BUI. It indicates the likely intensity of a fire and is suitable as a general index of fire danger.

Grass Curing: 40

Describes the seasonal die-off of grasslands. The proportion of dead material within the grass fuel complex expressed as a percentage.

Previous Day FWI Measurements

Remote Automatic Weather Station (RAWS)

Station Name: Waituna Raws **Date:**

Fire Danger Class

Forest	Scrub	Grass	FFMC	DMC	DC	BUI	ISI	RH %	WS	GUSTING	FWI	GC %

Up-to-date weather observations and forecasts are crucial for determining fire danger and fire behaviour.

Fine Fuel Moisture Code (FFMC):

Numerical rating of the moisture content of the surface litter and other cured fine fuels. It indicates the relative ease of ignition and flammability of fine fuels.

Duff Moisture Code (DMC):

Numerical rating of average moisture content of loosely compact organic layer of moderate depth.

Drought Code (DC):
Numeric rating of the average moisture content of deep compact, organic layers. This code is a useful indicator of seasonal drought effects on forest fuels, and the amount of smouldering in deep duff layers and large logs that would occur during a fire. A DC of 300+ indicates mop up will be difficult and prolonged.

Build Up Index (BUI):
The BUI is a numerical rating of the total amount of fuel available for combustion that combines the Duff Moisture Code (DMC) and the Drought Code (DC). A BUI of >60 is considered as Very High.

Initial Spread Index (ISI):
The ISI is a numerical rating of the expected rate of fire spread shortly after ignition. It combines the effects of wind and FFMC on the rate of spread without the influence of variable quantities of fuel. An ISI of 8-15 indicates rapid spread of fire. An ISI of 16+ indicates an extremely fast-moving fire.

Relative Humidity (RH):
Relative Humidity is the amount of moisture in the air compared with the amount of moisture the air can hold. When the air is saturated, its RH is 100%, extremely dry air can have a reading of zero percent. Relative humidity % Below 60% contributes to fire development Below 30% contributes to rapid fire development Below 15% contributes to extremely rapid-fire development.

Wind Speed: Gusting:

Fire Weather Index (FWI):
Numerical rating of fire intensity that combines ISI and BUI. It indicates the likely intensity of a fire and is suitable as a general index of fire danger.

Grass Curing:
Describes the seasonal die-off of grasslands. The proportion of dead material within the grass fuel complex expressed as a percentage.

Overall Fire Spread and Behaviour Summary

Looking at the recorded data at the Waituna, Tisbury, and Stewart Island RAWS the temperature, relative humidity, and wind speeds were all very similar at that time of night.

With cooler temperatures, lower wind speeds and high RH (95%) this may have all assisted in preventing a fire start from the burning cross arm as it dropped embers. The height from the ground would allow the embers to cool down by the time they landed in the vegetation, not having the energy to preheat the fuels to their ignition temperature causing a sustained ignition.

One of the biggest factors with ignition is Moisture Content (MC%) of the fine fuels. Being summer and only 0.2mm of rain recorded at Waituna RAWS on the morning of the 19 Jan at around 2am (not sure if this fell at Tiwai) and the warm weather on the day fine fuels would have dried out. Based on research by Scion with metal sparks from a grinder at 80m/s an ignition was possible with moisture levels up to 69%.

An FFMC of 76 indicates a moisture content of less than 30% gives a probability of ignition in the low 70's.

The heat and energy emitted from the molten metal when the electrical fault occurred has been enough to set the vegetation alight around the pole.

Once the ground fire started it would have burnt in a circular pattern until it was impacted by the breeze where it would have been pushed into other surrounding vegetation quickly increasing in intensity.

Fuel Height:

Scrub 2-3.5 meters high in places.

Available Fuel Load (AFL)
Height of scrub 3m = 24.5t/ha

Rate of Spread (ROS)
ROS 649m/h

Head Fire Intensity
Fire intensity 8,750 kw/m. Extreme fire class, head fire attack not likely to be effective, and it will be too dangerous for ground crews.

Due to the high available fuel loads and fast rates of spread, they combine to generate high fire intensities and flame lengths of 5-10m that were observed throughout the duration of the fire.
Flame length 5m = Fire intensity 8,595 kw/m, Flame length 10m = Fire intensity 38,788 kw/m.

Conclusions

General Origin Area

The fire has started on the Tiwai peninsular between the 2nd set of pylons from the Tiwai substation and an access road located on the east of NZAS.

Specific Area of Origin

Fire directional indicators brought investigators back to the 11kV corridor around poles 5-7 which carries the distribution line through this area out to the water bores used to supply the NZAS.

Ignition Area

Investigators reduced the specific origin area down using fire directional indicators, supported by CCTV footage to identify the ignition area to be around pole 6. Fire damage to the top of pole 6 also support this being the ignition area.

Photo 16: White circle shows the ignition area, white arrow indicates pole 6.

Point of Origin

Fire has occurred at the top of pole 6 involving the wooden crossarm and pole before dropping a live power cable and hot metal components onto the ground setting the vegetation on fire.

Ignition Source

The initial ignition of the pole was caused by the phase to earth fault created by the cracked insulator allowing power from the 11kV line to flow to earth. Wooden poles are not very conductive so with electricity trying to flow to earth through the pole there is a very high resistance that creates substantial heat. With the area being close to the sea insulators can be covered in impurities such as dirt and salt. With a high RH on the night these impurities would have become more conductive creating an easier path to earth, through the cross arm to the pole. The second ignition source was the electrical fault that occurred once the cross arm burned through allowing a live line to contact the pole eventually breaking falling onto the ground. Two other phases remained in the air contacting each other causing an electrical arc spraying out hot molten metal.

Circumstances of Ignition

A cracked insulator mounted in the centre of the wooden cross arm has enabled the high voltage current to flow to earth through the pole causing a phase to earth fault, the high resistance of the wooden pole has produced extreme heat igniting the timber cross arm.

When the burning crossarm has burnt through it has dropped away allowing powerlines to drop. One line was able to contact the power pole several times until it has broken and dropped to the ground.

As a result of the electrical event, the line has broken falling to the ground possibly causing a short circuit setting fire to the vegetation. During the arcing of the lines hot molten metal possibly as hot as 2000°C+ has been sprayed out across the dry vegetation setting it on fire as seen on closed-circuit television (CCTV).

This resulted in 3 spot fires in the vegetation around power pole number 6. The 3 sport fires have continued to grow and develop until merging as one large fire. Once the fire was established the wind has driven it in an east - southeast direction.

Due to the height of the pole being approximately 12 metres, and an FFMC of about 73, sparks and falling timber char would have difficulty igniting the fine fuels. Embers would have cooled down before landing on the ground not having enough energy to preheat and ignite the vegetation. There is no evidence on the CCTV footage that supports an earlier ground fire caused from burning debris falling from the pole, only when there is a significant electrical event on the pole probably a phase to phase / or to earth fault creating significant arcing has the ground fire occurred.

Closed-circuit television *(CCTV)* cameras from the NZAS site were recording prior to the incident being reported. A timeline has been extracted from the CCTV footage providing approximate time events as they occurred.

29 January 2025

10:55 p.m. Fire observed on the power pole and then it disappears.

11:24 p.m. Fire observed on the pole and is now in a sustained burning state.

11:28 p.m. Large flashes of light observed from the top of the power pole, burning items and sparks/embers observed falling from the pole. A flash on the ground is also observed *(potential when power line had hit the ground)*

11:30 p.m. 3 spot fires observed on the ground around pole 6.

11:36 p.m. Sport fires have now merged as one.

11:58 p.m. Camera angle moves to show actual size of fire. This is the time of the 111 call.

30 January 2025

12:12 a.m. NZAS/FENZ appliance approaches the fire.

12:21 a.m. First FENZ appliance arrives.

Cause

There appears to have been two phases to this fire the initial ignition of the pole and cross arm caused by a cracked insulator*(s)* on pole 6 of the NZAS bore line that enabled power to leak to the crossarm and power pole setting it on fire. Eventually the cross arm has burnt through causing the arm to drop allowing a line to contact the pole causing arcing and the line to break. During this process the other lines have shorted possibly creating a phase to phase to earth fault sending hot molten metal onto the ground igniting the vegetation.

Photo 17: Damaged insulator, white arrow indicates the degraded steal pin, yellow circle shows the staining to the ceramic insulator indicating electrical leakage.

Burnt Area

Image 4: Total burn area 1210.6Ha

Fire Classification

Fire Classification: Accidental

Elimination of Other Possible Causes

Ignition Source	Animal on power lines (No Damage - Non-Competent)
More Details	Opossums are known to be in the area and may try and climb power poles.
Reason for elimination	No evidence of any dead opossums in the area of origin. Poles also had guards on them.
Ignition Source	Incendiary Devices / Accelerants (No Damage - Non-Competent)
More Details	No devices discovered and no suspicious activity in the area prior to the fire.
Ignition Source	Lightning (No Damage - Non-Competent)
Reason for elimination	No recorded lightning strikes 24 hours prior to the fire.

Report Approvals

Investigation and report completed for and on behalf of Fire and Emergency by:

Investigator

Name : Cameron, Scott
Job Title : Fire Investigator
Date : 24 Jul 2025 04:36 PM

I confirm the truth and accuracy of this report. I make this statement with the knowledge that the report may be used in legal proceedings. I am aware that it is an offence to make a statement that is known by me to be false or intended by me to mislead.

A technical review of this report has been completed by:

Name : Foley, John
Job Title : Fire Research and Investigation Unit
Date : 06 Aug 2025 08:21 AM

This report has been approved by:

Name : Riley, Delia
Job Title : Community Risk Manager
Date : 26 Aug 2025 05:54 PM