



IRRIGATOR ADVICE GUIDE

*Insights for farmers and growers
On preparedness for wind storms*

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Example of how to anchor your irrigator.

FMG would like to acknowledge Pivot Anchors Ltd for their photos on the cover of this report and pages 3 and 6.

INTRODUCTION

In spring 2013 Canterbury was hit with gale force winds that reached speeds of over 160km/h, right when farmers and growers needed their irrigators most.

The impact on irrigators and production was unprecedented, with FMG alone receiving over 260 irrigator claims.

In responding to these claims and by working alongside industry stakeholders, FMG noticed that farmers and growers took varying approaches in trying to prevent damage.

Given this, and in support of FMG's philosophy to give rural New Zealand a better deal, FMG partnered with Lincoln University to research what it was that irrigator owners did in the days and hours leading up to the storms, to learn from this event and reduce the impact of future events.

This guide looks at the report's findings and will cover:

- practical steps you can take to protect your irrigator once storms are forecast
- the effectiveness windbreaks can have on helping keep your irrigator safe, and
- the importance irrigation design and installation can have.

The information contained within this guide was gained by inviting more than 400 farmers and growers in the Canterbury region who experienced

the spring storms to share their experiences. FMG would like to thank all those who contributed.

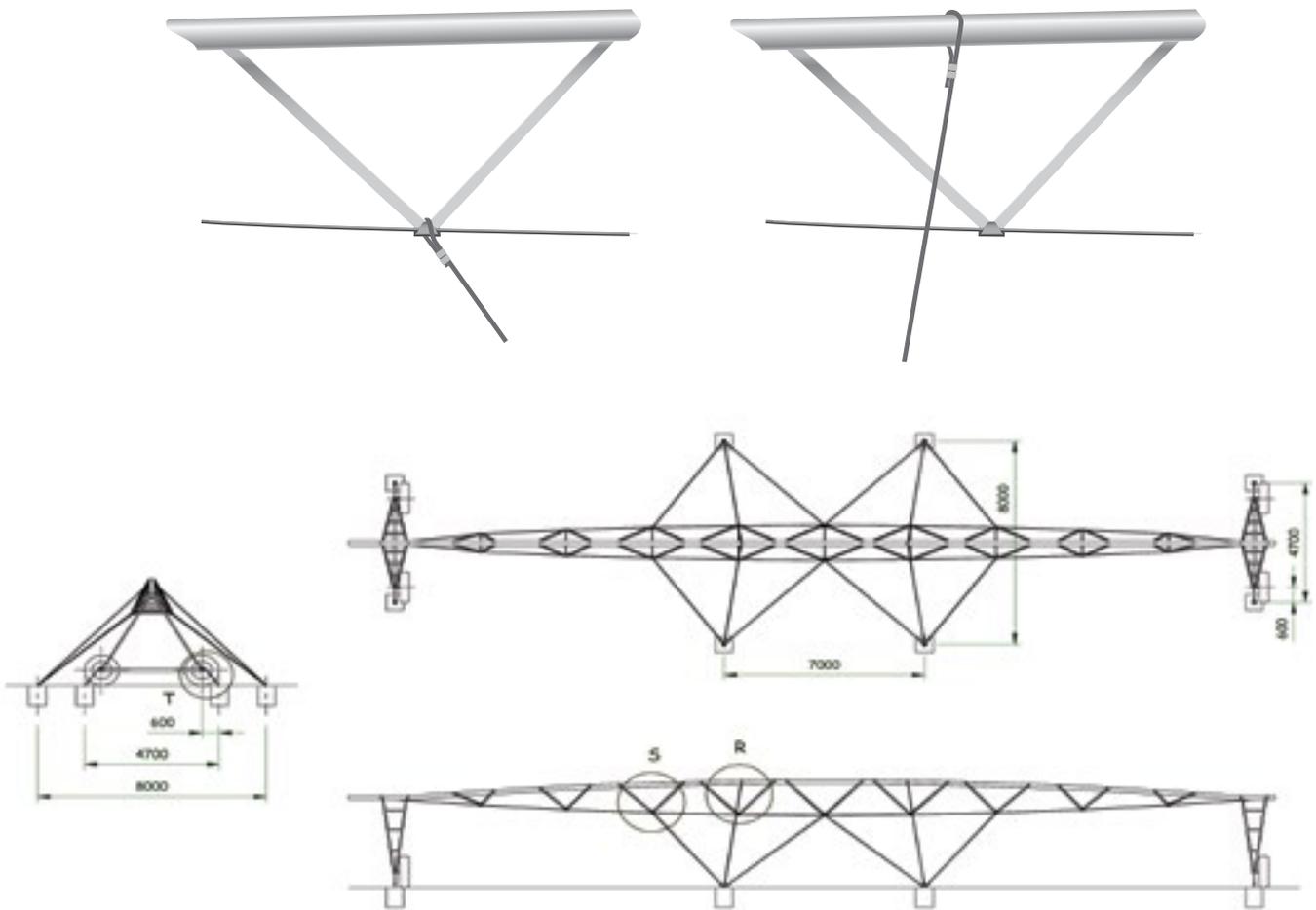
FMG currently offers advice to clients around irrigator protection and views this guide as an extension of that work. Lincoln's findings have, in some cases, reinforced the advice FMG already offers, and in other instances raised new information to share.

This guide is not designed to be a 'manual' on what you should or shouldn't do to protect your irrigator. It will also have no bearing on any future irrigator claim an FMG client may make.

We see this guide as a starting point in generating a wider discussion on best practice, and encourage readers to take from it the tips and advice they feel would work best for them if/ when the next wind storm hits.

While we can't guarantee the findings will stop irrigators from blowing over, as an advice-led insurer FMG sees significant value in analysing past events to give farmers and growers research-based advice to help avoid future wind damage.

FMG and Lincoln welcome the irrigation industry to take these findings to the next level with further research. If any individual or organisation has further information, research or data to help farmers and growers, we encourage them to contribute by contacting Irrigation New Zealand.



Examples of how to anchor your pivot irrigator ahead of a wind storm as recommended by Waterforce.

RESEARCH HIGHLIGHTS

The survey and research confirmed the importance of being prepared by taking three key steps:

<p>POINT THE IRRIGATOR INTO THE PREVAILING WIND</p>	<p>PARK IT THERE UNTIL THE WINDS DISSIPATE</p>	<p>ANCHOR IT DOWN BY TYING AND PROTECTING ANY MOVING PARTS</p>
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While Point, Park and Anchor are the main pieces of advice to come from our research, this guide will also look at other steps respondents took.

1. POINT

Three quarters of research participants who didn't make a claim for irrigator damage said they turned their machines to face downwind. Pointing the irrigator longitudinally downwind reduces the surface area exposed to the wind. Very few irrigators parked in this position were damaged.

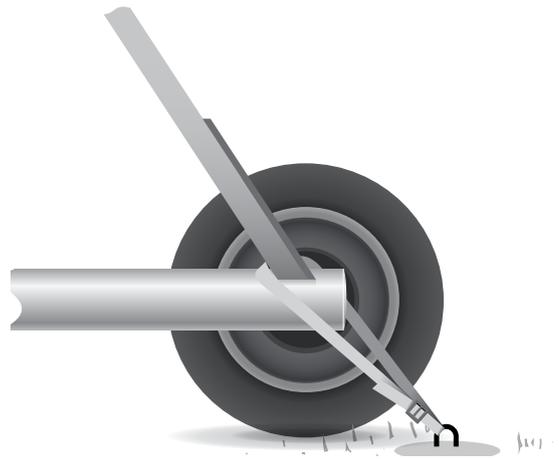
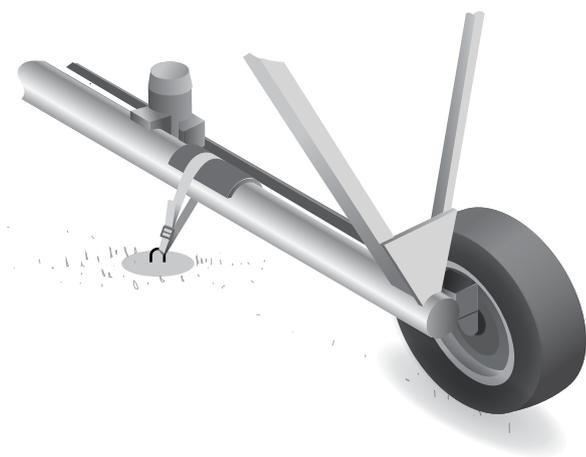
It's also the best way to protect centre pivot irrigators. When pointing downwind the corner arms should be in line with the rest of the machine, (which understandably will be very difficult to achieve in some paddocks). As many respondents noted, the worst angle for the corner arms to be left at is at 90 degrees of the wind direction

2. PARK

When installing an irrigator think about where it will lie according to the wind. A liner/lateral irrigator should be installed so that it is pointed down the dominant wind direction. For pivot irrigators, one or two parking spaces should be established that are facing downwind.

Permanent concrete blocks and other anchoring methods may limit farm activities such as cultivation, spraying and fertiliser distribution. A good tip for those who have lateral irrigation systems is to set up permanent anchors at the end of the paddocks.

A suggestion from Irrigation New Zealand is if a permanent parking space with anchors is not an option, or returning to the park position is not possible, moveable anchors can be used to secure your irrigator.



Examples of tie-downs to support base beams.

3. ANCHOR

This section looks at the best way and place to anchor your irrigator.

Watch the bounce

Respondents reported seeing their irrigator's bounce, before watching them fall over. Once an irrigator starts to bounce further wind gusts increase the bouncing, which in turn can raise the chances of it being picked up and flipped. Finding somewhere to tie the irrigator to an anchor can be a challenge because they don't have designated places for straps to be attached.

Despite this, respondents talked about tying irrigators down at the base beam of each tower and mid-way across the span. This section will look at this in greater detail.

Tying at the base beam

Tying from the base beam to the ground is the fastest approach but should be done in combination with tying to the span. Further research is needed to understand what force the beam can support as irrigator beams may not be strong enough and there isn't a clear point where they should be tied. See above for two examples.

Tying across the span

Tying at the wheels should also reduce bouncing but the spans can still roll over in big gusts. In current irrigator models, respondents felt the only places for attaching tie-downs are truss rod brackets or main pipes, which need mechanical testing to find whether they can support the weight of the irrigator during wind storms and gusts.

Talk with your supplier

The strength of each truss rod bracket in different models and brands is unknown. We strongly suggest you talk with your supplier about your specific model so you know how many ties are needed to keep the span stable. If this is a safety step you'd like to explore, we strongly suggest you talk with your supplier to get further, expert advice.

The strop

Advice from Irrigation New Zealand notes that strops or tie-downs should not be 'over' tensioned to allow some, but not excessive, movement.

Irrigation supplier Waterforce recommends using a concrete anchor approximately 0.6m x 0.6m x 0.8m, dug into stable soil. The research team recommend you test anchor size before use. The minimum recommended cable size from Waterforce is 6mm structural steel cable – again, field test first.

Options

Currently, companies such as Pivot Anchors Ltd have anchoring systems available which can help reduce the potentially damaging effects of high winds.

Furthermore, the Foundation for Arable Research (FAR) commissioned a project with Canterbury University students to develop a system that can be safely and rapidly deployed to stabilise irrigators irrespective of where the irrigator is parked. More information in regards to this is available from FAR.



4. SECURE THE CORNER ARM

If there is one big lesson that came out of the October 2013 storms it's protect your corner arm.

Corner arms are the most valuable part of the centre pivot system and repairing them can take a long time. If the corner arm is left at the 90 degree angle, it will have more exposure to wind, inviting more risk of damage during wind storms.

Based on the feedback we received in the research, owners should park the arm in line with the irrigator as much as possible and then anchor.

Irrigators with long and heavy overhangs are prone to wind storm damage, so it pays to lightly stop the end of the overhang to an anchor to reduce any bouncing and prevent overstressing.

5. OTHER ACTIONS TAKEN IN CANTERBURY

While the findings around Point, Park and Anchor, were the most prominent to come from the research – the study noted some other tips, outlined below, which you may also want to consider.

Running water through the irrigator during windstorms

Some farmers said they left the irrigator running (but not moving) so that it filled with water during the storm. This action needs to be carefully thought through as the extra water weight can have both positive and negative effects on the irrigator's

stability. Prolonged running of irrigators in one place can also have major issues with bogging of wheels in certain soil types.

The study pointed out that if the cross sectional area of the farm is on an incline and the wind is blowing downhill, the extra weight will contribute to overturning the irrigator. Of the survey respondents 82% said filling the irrigator with water was not effective.

Deflating tyres or placing objects on wheels

The survey found that some farmers thought centre pivots with air-filled tyres could easily roll away in strong winds and that deflating the tyres would make it harder for the centre pivot to do this. While deflating the tyres could be an option, Lincoln couldn't find any technical evidence to prove that doing this could reduce damage.

Deflating tyres in a windstorm may not be practical, and may be dangerous. Turning irrigators into the wind is likely to be more effective, and safer. Another idea mentioned was placing objects on the wheels and filling tyres with water to lower the centre of gravity. This is time consuming and doesn't significantly change the centre of gravity. Pivots with air-filled tyres can easily roll away in strong winds, and deflating the tyres would make it harder for the centre pivot to do this.

6. TIME

MetService accurately predicted the Canterbury wind storms and most respondents felt they had sound warning of the storm's arrival. The sections below offer some quick tips on what you could do if you had very short notice, or none at all, of an impending storm.

With a few days' notice

If you have a few days' notice, move your irrigator to its parked position as soon as you can and protect the most vulnerable parts such as overhangs and corner arms. If it can't be moved, make sure it's facing down the predominant wind.

Anchor the irrigator at the base beam of each tower and mid-way across the span, move the corner arm

into line with the irrigator, and anchor the corner arm or overhang securely. Because of the increased likelihood of power outages during storms, acting fast to protect your irrigator makes a difference as they are almost impossible to move.

Little to no warning

The first tip here is that if you have little warning and want to act, check your own safety first. If you feel it's too risky to go on the farm, then stay away. If you do go out you may not be able to move your irrigator in line with the prevailing wind. Anchor it as best you can, ensuring the corner arm is anchored and protected.

7. YEAR-ROUND TIPS AND ADVICE

Installation

The correct installation of an irrigation system is important in helping reduce the potential damage of a wind storm. Below are some of the study's key observations on installation.

Land

Many elements need to be considered with the installation of a new irrigation system: the aspect of your farm, topography, slope, undulating hills and location. Irrigation systems close to rivers suffered severe damage in the Canterbury wind storms as the wind funnelled down the river beds.

Irrigation New Zealand has two excellent resources to help support good design decisions - the Irrigation Development Guide and the Irrigation Development Checklist. Head to irrigationnz.co.nz for more information. Various research projects analysed during the study

showed the effect of sloping ground on pivot stability. One experiment showed that when pivot systems operate on a uniform uphill slope of 7%, the elevation variation could affect the stability of the pivot system.

Windbreaks

The effectiveness of windbreaks in reducing wind speed depends on the density, height and orientation of the windbreak. Shelterbelt position is also influential. Windbreaks affect temperature and humidity, which interfere with air movement.

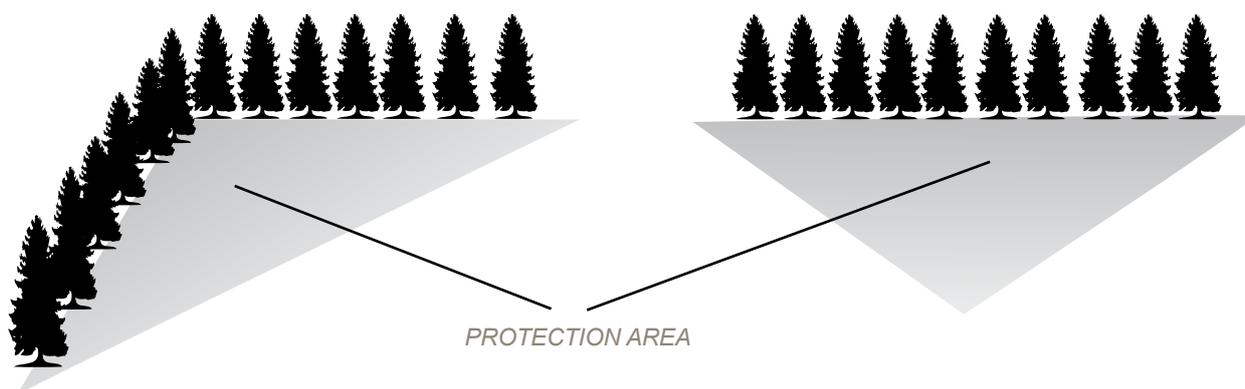
Studies analysed by Lincoln found that a protection zone of medium porosity – allowing some wind to pass through – is better than a solid windbreak. As windbreak density decreases, the amount of air passing through the windbreak increases, moderating the pressure differences between the windward and leeward sides and reducing the level of turbulence created by the dense windbreak.

Unkempt shelter belts suffered greater levels of damage when compared to well-maintained ones.

Gaps in a windbreak become funnels that generate wind flow, creating areas on the downwind side of the gap where wind speeds often exceed open field velocities. Where there are gaps, the effectiveness of the windbreak is diminished.

Height also has a role to play as the height of a windbreak determines the extent of the protected area downwind. The windbreak's length determines the amount of total area receiving protection.

For maximum efficiency, the length of a windbreak should be at least 10 times its height. Multiple-leg windbreaks provide a larger protected area.



The illustration on the left shows a two-leg windbreak. The illustration on the right shows a one-leg windbreak. The two-leg windbreak offers greater protection to the field.

8. IRRIGATION DESIGN INFLUENCES RESILIENCY IN STORMS

In terms of strength against storms, not all irrigators are created equal. The difference is in the design.

The study found that:

- the pivot point can affect the stability of the centre pivot system in extreme weather
- the broader the base support plate, the more stable the system
- a larger pivot tower central angle results in more stable towers
- a wider wheelbase gives more stability for rough ground applications, and for rolling and windy conditions
- the overturning threshold of water loaded irrigators could be considerably higher.

Besides different design specifications, other factors such as the original orientation of the pivot and whether the pivot has a braking system influence an irrigator's resistance to overturning in high winds. A centre pivot is designed for a specific field slope and each centre pivot has slope limitations.

When you are thinking about installing irrigation, you should first assess your farm's requirements and suitability. Obtain site assessment services to ensure you're getting a system that meets your requirements.

Ask manufacturers to install and commission your equipment and to provide you with full documentation including the system specifications, results of testing and commissioning and how to operate and maintain the system safely and effectively.

Irrigation New Zealand has excellent resources on good design decisions and best practice. See www.irrigationnz.co.nz.

9. THE IMPORTANCE OF HAVING A PLAN

Above all else, what this guide shows is the need to be aware of the risks to your irrigator and planning what works best for you should a wind storm strike.

Your plan could include ensuring you have enough strops and weights to anchor your irrigator(s) down, an idea of where best to park the irrigator, and a back-up option if you have short notice.

If you have staff, ensure they know what they need to do, and go through a trial run. This will help ensure not only the protection of the irrigation

system but more importantly the safety of your staff. If you're by yourself, what action will you take first? Is there someone you'll be able to call to support you?

Warning systems work

Keeping in touch with weather warnings is vital. Most farmers felt they were well warned about the spring storms, by radio, TV, websites and apps such as our own FMG Rural Weather App.

10. IRRIGATION ISSUES IN NEW ZEALAND

The survey highlighted a range of wider issues impacting rural operators who rely on irrigation, from weather extremities to water scarcity and resourcing limitations. Here's a snapshot.

Irrigation - Increases in irrigated areas will increase the pressure on water resources necessitating efficient irrigation schemes. More research is needed into protecting irrigators on hill country.

Irrigation NZ has a Hill Country Irrigation guidebook that outlines the best irrigation systems for hill country properties and provides advice to minimise run-off and improve water retention on slopes with high gradients.

Weather - NIWA predicts an increase in the frequency of extreme winds this century in almost all regions in winter, especially the South Island. If farmers receive wrong warnings or several warnings for weak storms they will lose their sensitivity to the warning system.

Industry - The fall-out from the Canterbury windstorms required irrigator parts to be imported, which took 60-90 days. Overseas technicians were also brought in to help fix damaged irrigators. FMG applauds the industry's response and is also aware of the risks for farmers who are reliant on irrigation systems.

CONCLUSION

While we can't guarantee that the findings in this guide will stop irrigators from blowing over, as an advice-led insurer FMG sees significant value in analysing past events to give farmers and growers all over New Zealand research-based advice to help avoid future wind damage.

There is a need for further research. FMG sees this guide as a starting point for others to enter the conversation and provide more information that will benefit the primary sector and in turn – the economy.

The research team found that many of the Canterbury farmers who didn't need to file damage claims had taken three simple steps to protect their irrigators: Point, Park and Anchor.

The research also highlighted how important it is for farmers and growers to understand the value of their irrigation system and ensure the right covers are in place. Your local FMG representative can talk through these issues and provide guidance on valuations or cover options.

Perhaps most pertinently, the study reminds us that wind storms are a fact of life in rural New Zealand, and having a field-tested response plan is your best line of defence.