



# Adventures in Engineering!

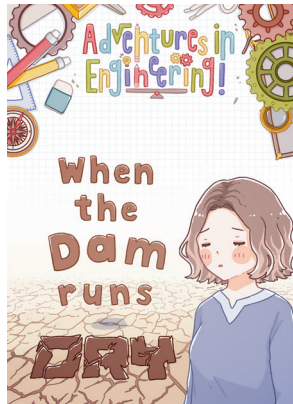
## When the Dam runs



QUEENSLAND NORTHERN TERRITORY

**IPWEA**

INSTITUTE OF PUBLIC WORKS  
ENGINEERING AUSTRALASIA



## **Adventures in Engineering: When the Dam Runs Dry**

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Our thanks to our featured public works engineer, Seren McKenzie for sharing her engineering project

Written by Juliet Schaffer, in the course of her employment with IPWEA-QNT

Illustrated by Narissa Amies



QUEENSLAND NORTHERN TERRITORY

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ENGINEERING AUSTRALASIA

# **When the Dam Runs Dry**

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Australasia, Queensland

First Edition

With thanks to the National Careers Institute

# Chapter 1

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## My New Job

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To isabel@mymail.com.au

12 Apr 2019, 13:24  

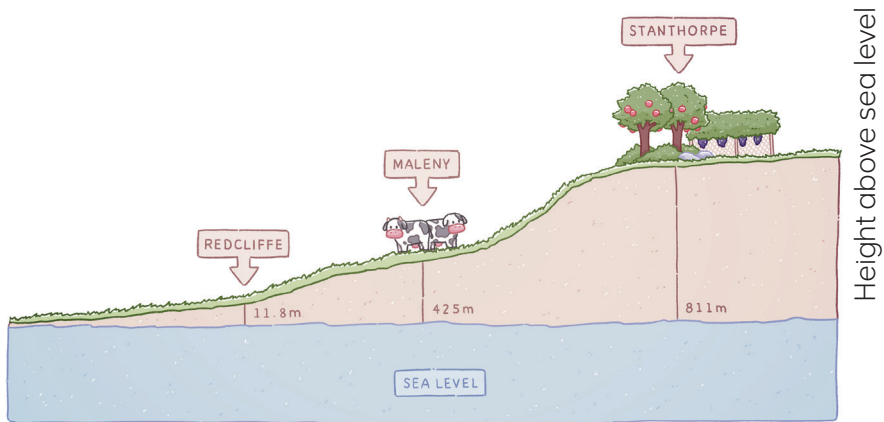
From seren@mailay.com.au

Hi Isabel,

How are you? I hope you're well and that you enjoyed the Easter holidays. What did you get up to?

Things are going well for me. I have just started a new role. I am now working at the Granite Belt Regional Council as the Manager of Water. Not really a surprise given how much I have worked with water in my previous engineering roles. There are few things as vital to living as water, so making sure residents have clean water available is an important job.

The council I work for includes a town you may have heard of called Stanthorpe. When you watch the weather on the TV news, it is often the place that records the lowest temperature in Queensland. It once got as low as  $-10.6$  C. Occasionally it even snows, which feels hard to believe in a state as generally warm as Queensland.



Stanthorpe is 811 metres above sea level, which is quite high. This helps explain why it gets so cold. It is a very pretty place. I took a drive around it the other week and saw lots of farms growing vegetables, grapes, apples, and stone fruit. Some farmers also have sheep and cattle. Being a town that has such a strong agricultural industry, water is very important.

Unfortunately, Stanthorpe hasn't had much rain and is in drought. Each year for the past several years the town has had less and less rainfall. A lot of places in Queensland have been like this. Western and Central Queensland have been in drought for a long time. Remember when your school was fundraising for Rural Aid? That was to help supply food for the cattle and sheep in these areas because there hasn't been enough rain to grow any crops. I know that you see a lot of rain every summer, living on the coast in North Queensland. Quite often though, this rain doesn't make it over the hills of the Great Dividing Range. It is a strange state Queensland – some places have too much rain and flood, while other places don't get enough rain and are in drought. Frustrating, hey?

Although the lack of rain is worrying for many towns, many of them are on a water grid. Do you remember what that is? It is dams, **reservoirs**, water treatment plants, pump stations and the pipes that carry the water all joined up together. This is where I do most of my work as an engineer. A water grid is useful for towns, because if water runs out in one place, it can be accessed from another. Stanthorpe is a little different though. It isn't connected to the water grid and relies on one dam for water for all 5,000 of its residents. It is called the Storm King Dam (great name, don't you think?).

Storm King Dam sounds big, and it is. It has a capacity of 2,000 ML. A ML or megalitre is equal to one million litres of water, making 2,000 ML (2,000 x 1,000,000) = 2 billion litres of water. Imagine your drink bottle 2,000,000,000 times! This is how much water the dam can hold when it is full, but it is far from full at the moment. In fact it is very low, and we are worried that it might run out of water altogether. It is my job as the Manager of Water to help the town get water. It's a good thing I like a challenge!

Luckily, the council and the townspeople of Stanthorpe have already been working hard to conserve water to slow down how much comes out of the dam. Students at the local school are taught to be water wise, and there is advice on the council website that people can follow. The council even gave residents a timer to help them have shorter showers. Next time you have a shower, see if you can do it in under 2 minutes – and yes, that includes using soap and washing your hair.

Every household in the town must follow water restrictions.

This means residents are restricted to using only an allocated number of litres of water per day for drinking, washing, and cleaning. Over the past year people have had to use less water as the dam levels fall. We are already at the Extreme level. There are only two more levels below that, which makes my job that bit more urgent.

<b>Date</b>	<b>Alert level</b>	<b>Litres allowed per person per day</b>
June 2018	Medium	200
November 2018	High	170
March 2019	Extreme	120

I have been told that in the 60 years since Storm King Dam was built, it has never run out of water. This may be true, but unless we get heavy rains soon it just might!

Anyway, I thought I would let you know more about my new job and where I am working. I'll keep you up-to-date with this important project. If you have any good ideas – let me know!

Take care,

Seren.

## Chapter 2

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# THE Granite Belt GAZETTE

VOL .. No.1,507

STANTHORPE, SATURDAY, JUNE 1, 2019

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## LACK OF WATER CONCERNS RESIDENTS

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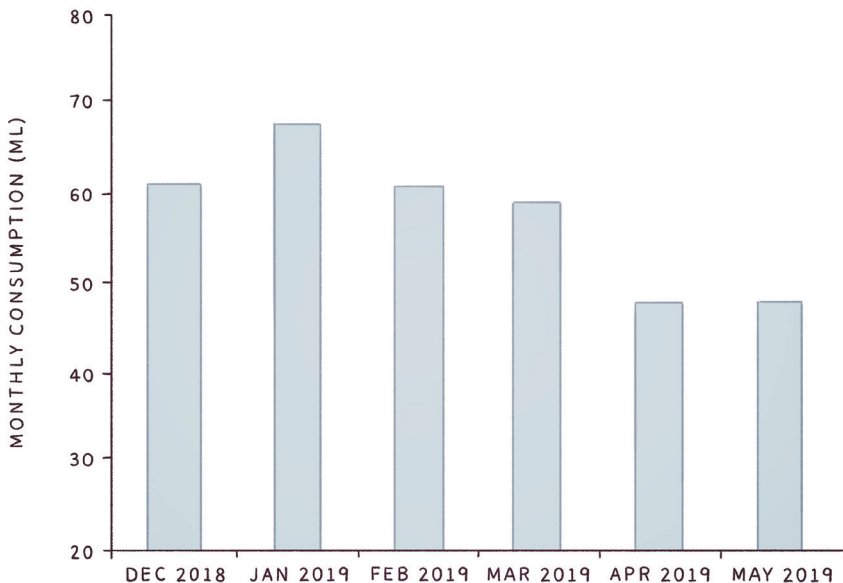
**Stanthorpe:** Tensions were high at the Stanthorpe local hall last night as worried residents attended the information session held by the Granite Belt Regional Council.





New Manager for Water, Seren McKenzie, updated residents on the water level at the Storm King Dam. Ms McKenzie praised residents for their continued efforts in reducing their water use. She said that water use had been down again from the previous month and that she was proud of the community for working so well together.

However, despite the excellent efforts of the townspeople, the continuing lack of rainfall over the dam, meant that it was unlikely further restrictions could be avoided. The Bureau of Meteorology advised that they were not expecting any rainfall over Stanthorpe in the foreseeable future.



'If we don't have any rain over the dam in the next few months,' said Ms McKenzie, 'then we will have to **impose** water restriction at the **Critical** level of 100 litres per person per day.'

The anxiety in the audience was clear.

An unnamed resident spoke up. 'The media is saying we'll reach Day Zero when we will run out of water completely. How can we live in a place with no water? What will we drink? How will we wash?'

Local grazier, Jennifer Nolan added, 'I'm already planting fewer crops because I haven't got enough water to **irrigate** what I have already planted. If we can't grow food, then there is less food available for the citizens of Queensland. What will happen without any water?'

The audience applauded showing their agreement with the speakers.

Local bakery owner, Dan Thompson said, 'Walking around it is very clear that there are fewer visitors in the town. Thanks to the news stories, tourists feel that they are being considerate by not coming and using our water. My bakery has seen a significant downturn in sales. Not only do I have less water, but I am also making less money.'

The council representatives attempted to calm the residents by reassuring them that they were working on a solution to this significant problem. Aerial and land based surveys were being conducted on the Storm King Dam to understand its storage capacity more accurately. Residents were reminded that in the meantime, they were still able to visit the local drought charities and collect bottled water for free. They could also use the showers at the local fitness centre if they were worried about their water use at home.

One of the positive elements of this situation for Stanthorpe is the outpouring of generosity from fellow Queenslanders and Australians who have donated bottled and bulk water in significant amounts. Up to 20 truckloads of water have been arriving in the town, which is distributed to residents for drinking and cooking. Although times are tough here in Stanthorpe, having the support of so many people across the state and the country is making coping with life a little easier.

With no rain predicted, and the finite supply of water in the dam running out, it is unsurprising the residents of Stanthorpe are worried. Further updates will be provided as they come to hand.

# Chapter 3

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*July 2019*

Excerpt from report from Seren to Council.

## 4.0 Conclusion

As discussed in the Results section of this report investigating the capacity of the Storm King Dam, the following has been determined:

- Using aerial and land-based methods, the survey has found the equivalent of 115 ML (megalitres) of silt along the dam floor.
- This mixture of rock and minerals is finer than sand and is not able to be made drinkable in our current water treatment plant. Therefore, there is 115 ML less capacity in the dam for **potable** water, resulting in less usable water than first assumed.
- The Department of Natural **Resources**, Mines and Energy scientists have collated information on the Storm King Dam. They have conducted computer modelling showing historical levels of **evaporation, seepage** and rainfall. This information was used to estimate the future water capacity of the dam using various scenarios of water consumption.
- The graph showing rainfall over Stanthorpe over the 55 years from 1964 to 2019 indicates that Stanthorpe is likely to experience its lowest level of rainfall since the dam was constructed.

- Forecasts by the Bureau of Meteorology show no significant rainfall is predicted in the coming months. It estimates that in the worst-case scenario, Storm King Dam is likely to run out of water by January 2020.

Given the seriousness of this problem for the township of Stanthorpe, I propose that a team of engineering and water science experts be contracted to investigate ways to ensure a consistent and safe emergency water supply. This will be necessary until sufficient rain falls to increase the water level at Storm King Dam.

# Chapter 4

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## Water Supply Options for Stanthorpe

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To engineeringteam@gbrca.gov.au

24 Aug 2019, 14:37  

From seren@gbrca.gov.au

Hi Team,

Thank you all for your effort in developing a solution for Stanthorpe's water supply issue.

As discussed, our research showed that using the existing rail line between Stanthorpe and Warwick to transport water would not be suitable. There are two reasons for this:

- a) a lack of water tank **rolling stock** and,
- b) the distance between the station and the water treatment plant is too far. I am glad, though, that we are coming up with ideas. The more ideas we have, the better our chance of finding the best solution.

Following our meeting this morning, we agree that our best option is to transport the untreated **raw water** by road using water carting trucks. Water will be taken from Connolly Dam to tanks to be built adjacent to the Storm King Dam, near the water treatment plant. As Jack pointed out, should Connolly Dam run out of water, the trucks could then access water from Leslie Dam.

As always in engineering, now that we have a solution for a safe water supply for Stanthorpe, we must conduct more research. This should include:

- Where should the tankers fill up and do we need to build facilities to make this happen?
- With a predicted 15 water trucks doing 45 trips back and forth each day, what would be the safest route for them to use between Connolly Dam and Storm King Dam?
- Once the safest route is chosen, would the roads need to be upgraded to cope with the weight of tankers full of water?
- Once the water from Connolly Dam is at the water treatment plant, will it need to be treated differently to the water from Storm King Dam?

Let's conduct further research to answer these questions and discuss at our team meeting next week.

Regards

Seren

Director **Infrastructure** Services

# Chapter 5

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## Another Natural Disaster

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To isabel@mymail.com.au

8 Sep 2019, 10:42  

From seren@mailay.com.au

Hi Isabel,

Thank you for your last email. I agree that it's weird to see me appearing in newspaper articles and on social media. I'm finding it odd myself. I never thought as an engineer that I would have to spend so much time talking to the media. There is a lot of interest from people in Queensland and other parts of Australia. Having a town at risk of running out of water is the kind of dramatic story that makes the news. I think there are also many who are worried that this long-running drought might mean that their towns may also run out of water. I am often getting asked for advice from other engineers about what they should do in their towns to help with their lack of water.

Since I last spoke to you, Stanthorpe has suffered from another natural disaster. A bushfire this time. As you can imagine, the lack of rain has made all the trees and undergrowth very dry. Unfortunately, ashes from someone's campfire hadn't been extinguished properly and a bushfire started. This was at about 3 pm on Friday 6th September, and by 6 pm residents were told to evacuate their properties because the fire had grown so large, fast, and powerful. It was very nerve wracking watching



the path of the fire and seeing it jump the highway and head towards Stanthorpe.

Normally, when a bushfire is happening in the bush, the Rural Fire Service uses water from the town's supply and water from people's own dams and rainwater tanks to fight the fires. Unfortunately, there was not much water in the Storm King Dam to spare. Luckily, we were able to work with the Rural Fire Service and helped them to access water from some nearby private dams. This prevented any extra water being taken out of Storm King Dam, and was quite fortunate, as we had just moved to **Critical** level water restrictions of only 100 litres per person per day. If we had used this water to fight the fires, then there was a good chance we would have had to move to Emergency level almost immediately.



The Rural Fire Service worked very hard but still seven homes and several structures such as sheds were burned down in this bushfire.

It has been a really hard time for the residents of Stanthorpe. The drought and the water restrictions were already making their lives challenging, but to have bushfires come through and homes burn down was upsetting. It has been great to see the townspeople support those affected by the fires.

My team and I are working long hours to ensure a consistent and safe water supply. The bottled water being donated is helpful for people to drink, cook and brush their teeth. I know it is getting expensive for farmers who are having to buy water by the tanker load, so they have water for their houses and for any livestock that they have left. I think we all spend a lot of time checking the Bureau of Meteorology app to see if there are any rain clouds on the radar.

I am confident that we'll be able to come up with a solution until we have good rains again.

Keep working hard at school. Well done on that Math test. You might just take after me!

Take care,

Seren

# Chapter 6

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11 September 2019



[HOME](#)   [LIFE HERE](#)   [BUSINESS](#)   [SERVICES](#)   [COUNCIL](#)

## Storm King Dam Emergency Water Infrastructure Commences Construction

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11 September 2019

The Granite Belt Regional Council is pleased to advise its residents that following the completion of the 1.5 km gravity-fed pipeline between the Storm King Dam and our water treatment plant at Mt Marley, that two x 1 ML (megalitre) water storage tanks will soon be built at Storm King Dam. With residents restricted to using only 1.5 ML of water collectively per day, reduced following a series of increasingly stricter water restrictions, these tanks will ensure a consistent water supply to the town of Stanthorpe.

Following plans designed by the now Director of **Infrastructure Services**, Seren McKenzie, and her team of highly skilled council and consulting engineers, water carting tankers will be filling up at Connolly Dam. They will transport this water to the tanks before it is treated to ensure it is of a drinkable quality. Approximately 15 trucks are expected to make up to 45 trips a day to ensure these tanks remain full.

To allow multiple trucks to be able to fill up at the same time, council is working with engineers and construction teams to

build a filling station site on the road to Stanthorpe, close to the Connolly Dam. Construction teams are widening the roads to allow the trucks safer access to and from the filling station. A route has been designed to minimise the time that trucks are traveling through residential streets to ensure safety and to reduce noise for residents.

Also, when driving along the highway, please note that the speed limit before and after the turn off to the filling station has reduced from 100 km/hour to 80 km/hour to allow trucks to safely access this site.

With no rain forecast for the foreseeable future, this emergency water project is scheduled to be completed by November 2019, two months before Storm King Dam is predicted to run out of water.



# Chapter 7

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## Project Progress

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To isabel@mymail.com.au

12 March 2019, 13:24  

From seren@mailay.com.au

Hi Isabel,

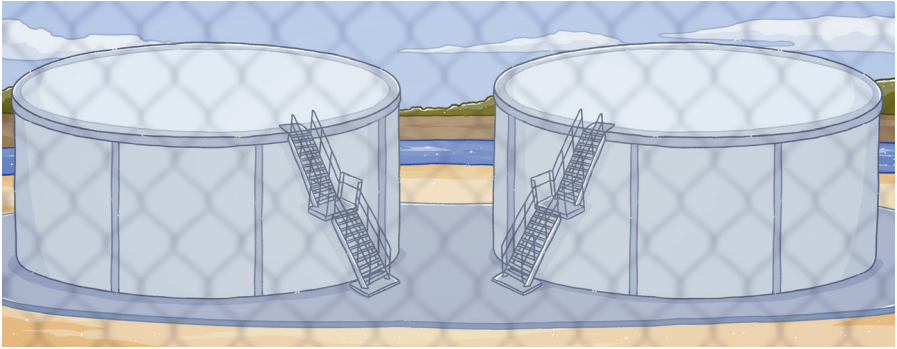
How are you? Another school term is almost over. Are you excited for the holidays? I miss my school days when I could have six weeks off over Christmas and New Year!

Although work has been very busy and a little stressful recently, I am really pleased with what my team has achieved. Are you keeping an eye on the council website and social media for updates?

The not-so-good-news is that we still haven't had much rain and the town has had to go to Emergency level water restrictions of only 80 litres per person per day.

The good news though is that the filling station on the road to Stanthorpe is complete, as well as the storage rainwater tanks next to the Storm King Dam (I have attached a photo of the finished tanks). The other day we did a trial run with 14 water tanker trucks, which made a total of 42 trips safely back and forth from Connolly Dam to Storm King Dam. In just one day we were able to deposit 1.3 megalitres of water into the tanks.

What a relief!



This means that we can slowly increase the water carting – we’ll do half the amount we think we’ll need next week, and then full water carting by the middle of January next year.

Fingers crossed that this summer’s wet season will bring rain. If it doesn’t, then I am confident that our engineering solution will make sure that the people of Stanthorpe have enough water.

Being an engineer at a council is great. You should try it!

Enjoy your holidays. Write soon!

Seren

## Chapter 8

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# THE Granite Belt GAZETTE

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VOL . . No. 1, 689

STANTHORPE, WEDNESDAY, MARCH 24, 2021

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## IT'S OVER THE TOP!

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**Stanthorpe:** There were cries of relief as water flowed over the banks of the Storm King Dam during this current wide-ranging low-pressure system.

With a massive 140 mm of rain falling over Stanthorpe in the previous 24-hours, the Storm King Dam is now at 100% capacity. This comes after the council had been carting in 40-50 trucks of water per day for over a year to supply water to the town.

Over the week of rain, locals observed water levels reaching ever increasing heights. From barely a puddle, through to seeing water overflowing the weir, locals cheered as they watched on.

'I am so relieved that I will finally be able to turn on the tap without having to worry about how many litres of water I am using. I am sure my kids will be very happy not to have me reminding them to have shorter showers every morning,' said local Liz Appleyworth.



'I can't wait for the surrounding landscape to become green and lush again. I look forward to welcoming tourists back to my restaurant. The whole town will feel so much happier. There are smiles on everyone's faces,' declared restaurant owner, Vinnie Nguyen.

According to Seren McKenzie, who was **instrumental** in creating the carting and tank **infrastructure** that kept the residents of Stanthorpe with safe drinking water, 'The town of Stanthorpe has come through a very difficult 18 months with very tight restrictions on a resource that most of us take for granted. The town has earned the right to celebrate the rain and how well they pulled together in hard times. The people of Stanthorpe should be very proud of themselves.'



# Glossary

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<b>critical</b>	(adj) extremely important because a future situation will be affected by it
<b>evaporation</b>	(n) the process of a liquid changing or being changed into a gas
<b>infrastructure</b>	(n) the basic systems and services that are necessary for a country or an organisation to run smoothly, for example, buildings, transport water and power supplies
<b>impose</b>	(v) to introduce a new law, rule, tax, etc.; to order that a rule, punishment, etc. be used
<b>instrumental</b>	(adj) important in making something happen
<b>irrigate</b>	(v) to supply water to an area of land, typically through pipes or channels, so that crops will grow
<b>potable</b>	(adj) safe to drink
<b>raw water</b>	(n) water that has not been purified
<b>reservoir</b>	(n) a natural or artificial lake where water is stored before it is taken by pipes to houses, etc.
<b>resources</b>	(n) a supply of something that a country, an organisation, or a person has and can use
<b>rolling stock</b>	(n) the engines, trains, etc. that are used on a railway
<b>seepage</b>	(n) the process by which a liquid flows slowly and in small quantities through something

Glossary definitions sourced from  
<https://www.oxfordlearnersdictionaries.com/>

# Activities

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## Chapter 1

Research what Rural Aid does in Australia. What groups do they aim to help and why?

Having quicker showers is one way that Stanthorpe residents tried to reduce their use of water. What other ways can people use less water?

## Chapter 3

The text type in this chapter is a business report. How does a business report look different to the text types in Chapters 1 and 2? Can you think of reasons why it might be written differently? Why might writing in dot points be useful for the reader?

## Discuss

Draw a timeline of events that occurred across this story, using the dates in the illustrations and the content of the various text types.

What tasks did Seren perform in her job as a civil engineer in water management?

What skills did Seren use to help solve the problem?

Are there any aspects of Seren's job you think you would like to do?



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biggest challenges in the areas of water,  
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# Adventures in Engineering!

Stanthorpe relies on one dam for its water supply. What will the town do when the dam runs dry and there is no water for the people of Stanthorpe? How can Seren use her engineering skills to save the town and its people from drought?



QUEENSLAND NORTHERN TERRITORY

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