



**Increasing Resilience to Climate Change (IRCC)  
Project**

***Climate Change Adaptive Private  
Domestic Water Supplies for Rural  
and Remote Properties***

**Volume 1**

**Demonstration Project Report**

**December 2021**



**Planning,  
Industry &  
Environment**



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## *ACKNOWLEDGEMENT OF COUNTRY*

*Council acknowledges the traditional Custodians of the lands and waters within our Shire and recognises their ongoing responsibility to care for Country and of teaching and learning.*

*We pay our respects to Elder's past, present and emerging and extend our respects to all Aboriginal and Torres Strait Islander First Nations Peoples.*



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## Disclaimers

The collation of data and the presentation of the results of the 2020-21 Questionnaire Survey and Pilot Water Quality Screening has been undertaken to ensure that privacy and confidentiality is strictly maintained.

The interpretations of the analysis undertaken together with the commentary provided on the results of the and the questionnaire survey and 'do-it-yourself' water quality screening rest with the authors of this document. It does not rest with the Balranald Shire Council (BSC), Management Solutions Queensland, (Mansol), the SEGRA Foundation, the Institute for Land Water and Society, Charles Stuart University (ILWS-CSU) or any other partners to the research collaborative.

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## **BSC Increasing Resilience to Climate Change (IRCC) Project**

### **BACKGROUND**

#### ***Setting the scene***

Currently the sufficiency and quality of water resources used for domestic purposes in rural and remote regional Australia is largely unknown and the potential health risks arising from this situation are poorly dimensioned. This deficiency has implications for economic productivity and the quality of life for people in 'the bush'. Assured supplies and reduction of health risks from unsafe water should be a priority across rural and remote regional Australia.

#### ***The policy-gap***

Australia wide little assistance is provided by any level of government to reduce potential health risks from non-scheme water in rural and remote regions. In all Australian jurisdictions, Local Governments only have statutory responsibility for the quantity and quality of scheme water provided to rural cities, towns, and settlements. People on farming and pastoral properties are left to their own devices to secure adequate and safe domestic water supplies. This inequity could be considered a serious gap in policy and practice when aiming to ensure that all Australians have adequate and safe domestic water.

#### ***Murray Darling Basin Situation***

Communities, commercial enterprises, and rural properties in current and potential development areas in the Murray Darling Basin (MDB) are largely dependent on poorly understood rainwater, surface, and ground water resources. Additionally, primary industry based economic activity along with the people living in these regional areas can be severely imperilled by extreme weather, changing climatic conditions and the adequacy and quality of the accessible water resources. More specifically, these factors impact on the provision of domestic water supplies from rainfall capture, surface flows, and shallow and deep aquifers.

Concerns have been raised over the quality of water that is available and the level of treatment for domestic use in the MDB. Poorly managed domestic water supplies for homes in settlements or for rural properties can lead to outbreaks of disease - causing serious illness that in some circumstances can lead to death. For example: considerable governmental and public concern is emerging over the potential lethal health risk from the amoeba *Naegleria fowleri*. This organism was identified as the cause of death of three children from rural properties in Queensland.

Adequate secure safe domestic water (SSDW) supplies to meet *critical human water needs* (as defined in Water Act 2007 and the 2012 Basin Plan) are seen as a priority issue in the drought stressed MDB. Changing climatic conditions and their impact on the sources, availability and quality of domestic water and the associated health risks and costs were key drivers for a proactive inter-institutional SSDW research focused response to this situation.

#### ***Responding to the challenge***

Formal genesis for this response was provided through the 2015 Sustainable Economic Growth for Regional Australia (**SEGRA**) Conference 'Regional Challenge' that asked: *How might we provide secure and safe water for rural and remote regions?*



Since 2016 this question has been addressed through collaborative research activities by the Institute for Land Water and Society (ILWS) Charles Sturt University (CSU), the Sustainability Research Centre (SRC) at the University of the Sunshine Coast (USC) and the SEGRA Foundation. The initiative has been endorsed by the Murray Darling Basin Authority (MDBA), the Murray Darling Association (MDA), LGAQueensland, and other institutional and community-based partners. Research has been undertaken in Etheridge Shire in the Gulf of Carpentaria, the Queensland sector of the Northern Darling Basin, and the Central-Lower Darling.

The overarching aim of the project is to: *support the sustainable provision of adequate safe domestic water supplies for people in rural and remote regions.*

The objectives to be achieved to attain the aim of the SEGGERA 2015-16 Challenge Initiative are as follows.

- Detail and evaluate the roles and responsibilities of governmental bodies with respect to the provision of public and private domestic water supplies.
- Document community attitudes, understanding and behaviour with respect to the provision of adequate secure and safe domestic water supplies.
- Provide broad quantitative and qualitative information on the sources, adequacy, quality and levels of water treatment of water being provided by Local Government Authorities (LGAs) to meet statutory water planning and services requirements.
- Document the status of sources, adequacy, quality, and treatment provisions used for private water supplies in remote towns, settlements, public facilities, commercial enterprises and isolated properties in vulnerable catchment areas.
- Propose long term integrated management measures to ensure that domestic water supplies for communities, individual homes, isolated homesteads, community facilities and business premises are adequate and safe.

For this project, domestic water is operationally defined as: *Water used day to day by people for indoor and outdoor household and commercial purposes including drinking, preparing food, bathing, washing clothes and dishes, brushing teeth, watering gardens, swimming pools and children's play.*

Securing adequate safe domestic water for rural and remote regional Australia goes beyond potable/drinking water supplies. As defined above, it encompasses all uses by which people can come into physical contact with their water resources. And, because of its quality, the water may or may not be treated and a risk to their health.

### ***Rationale for the BSC Climate Change Adaptive Private Domestic Water Supplies for Rural and Remote Properties Project***

Across the length and breadth of the MDB examples are to be found of the dimensions of the potential risks to health and lifestyle arising from inadequate and poor quality private domestic supplies. Over the past decades, this condition has been exacerbated by prolonged periods of drought. Although not statutorily empowered to take a lead role in addressing this situation, there are compelling reasons for Local Government Authorities (LGAs) to do so for two reasons. First, because it is level of government closest to people on rural and remote properties and enterprises; and second, because there is a moral responsibility to safeguard the health and wellbeing of all residents.



## EXECUTIVE SUMMARY

### ***Achieving the objectives and attaining the aim***

The BSC IRCC demonstration project aimed to identify and pilot measures to mitigate the risk of increasing temperatures and variable rainfall under climate change to the provision of adequate and safe private domestic water supplies for people on rural and remote properties in Balranald Shire.

The project had three objectives. Leadership and governance issues within BSC, poor communications and community engagement, and COVID constraints made it difficult to achieve Objective 1 and build a sustainable institutional, local government and community-based partnership in the timeframe for the project (i.e. completion in October 2021). Notwithstanding, sufficient groundwork was done to underpin the delivery of the project on time and on budget. Objective 2, to establish an 'environmental base line' for domestic supplies on rural and remote properties was completed and a baselines report prepared. Objective 3 to develop and pilot a SSDW Program for rural and remote properties has been achieved, albeit not at the scale initially envisaged for the project. Allowing for the impediments due to internal issues with the Council and COVID 19 pandemic restrictions, the objectives were achieved, and the aim of the *Climate Change Adaptive Private Domestic Water Supplies for Rural and Remote Properties Project* was attained.

### ***Questionnaire survey and water quality screening***

The questionnaire survey and water quality screening were a core focus for the delivery of the project. The survey and screening were a stepped process. Rural property holders were identified and along with town residents with water tanks were invited to participate in the survey and testing program. Participants were able to complete the questionnaire by either survey monkey or on a hard copy mailed back to the Project Team. Questionnaire responses were collated and analysed. Water sources being used on individual properties were cross referenced to the landscape conditions and land uses. These data were used to identify and prioritise properties with potential health risks from their private water sources. Residents were invited to participate in the water quality scanning for bacteria and other parameters using Do-it-Yourself (DIY) test kits provided by the Project Team who collated, analysis and reported on the results.

One hundred and six properties with contact details were found and attempts were made to contact all by either email or telephone. A total of 51 surveys were submitted. This represents a 48% response and statistically this is a satisfactory result. Twenty DIY kits were requested for water testing. Using the submitted surveys as the baseline, 39% of the respondents participated in screening for bacteria. Results were returned for 17. Again, statistically this is a satisfactory result.

The Questionnaire Survey has provided BSC with a better understanding of the dimension of domestic water quality issues being confronted on rural properties served by private drinking water supplies, and town properties using rainwater tanks.

For the survey population, 87 % had rainwater tanks for domestic supplies, 57% used surface water, and 20 % reported using more than one source of supply. Seventy-two per cent of the 47 properties who responded to this question reported that their water was untreated. Thirty four percent indicated that their water was filtered, and this included using river sand where shallow bores were sited. One property reported that they boiled the water that was used for drinking and cooking purposes and one property used chlorine or ultra-violet water treatment.



That 57% of the properties use untreated water is of concern. Twenty-seven households indicate that they do not use treated water for drinking or food preparation, and this could pose a potentially high level of health risks due exposure to pathogens in the domestic supplies. Untreated water is provided in the five businesses sampled in the survey. However, the levels of satisfaction and concern reported may also reflect acceptance of the status quo given that 43% of the respondents were over 55 years and living in a single person household.

The results of the water screening showed that over 60% had positive recordings for coliforms in the household supplies being used. This finding highlights the need for householders to take a precautionary approach and manage their rainwater harvesting tanks. NSW Health guidelines on managing private water supplies and rainwater tanks were provided to all households who responded to the questionnaire and participated in the water quality screening.

Currently, there are no commercial laboratories in the FWR where water samples can be sent for testing. DIY kits are a simple qualitative water quality screening tool that indicates the presence or absence of coliforms. Screening results are sufficient to alert householder that they may have a health risk.

Householders have been advised to adopt a precautionary approach and manage their tanks as guided by the NSW Health information if bacteria are detected. DIY screening is sufficient to confirm that the management approaches being followed are effective.

Considering the experiences with the IRCC SSDW Pilot Program, the use of questionnaire survey and water screening methodologies is questionable unless specifically supported by Council leaders, a dedicated and resourced Project Director, and two-way communications using mail-outs and face-to-face contacts.

### ***Observations and suggested actions***

Issues to be addressed to enable stakeholders to better understand the implications of climate change driven impacts on water supplies and public and environmental health include:

- Broadening the scope of SSDW activities to encompass water adequacy and quality issues in rural towns and settlements where supplies are precarious and the sources of raw water are vulnerable to the impacts of higher temperatures, greater variability in seasonal rainfall, and extreme weather events including prolonged drought conditions.
- Re-evaluating the use of on-line and hard copy questionnaire surveys as an effective way of gathering data on the sources of potable water in rural residences, storage and treatment of the supplies, level of consumption, and personal attitudes towards the source being used and its quality. The approach may be viewed by some people on rural properties as being intrusive, too strongly linked to 'government', and meddling in what are private household matters.
- Reorganising health data coding and collation at local and regional scales. Initially, it was hoped that direct co-benefits could be demonstrated by measurable reduction in costs of hospital and medical services needed to address physical and mental health issues arising from inadequate supplies and poor-quality water. With the current health data coding and regional arrangements, it is not possible to demonstrate that projects such as the SSDW initiative could reduce demand for medical services and costs.



- Optimising face-to-face contact as the best way to ensure that communications are two-way, messages are clear, and responses are understood, and that there are agreed protocols and levels of understanding of issues and how they can be resolved.

Ensuring the effectiveness of initiatives such as the IRCC SSDW project requires mechanisms to:

- Establish national and jurisdictional population and environmental health policy on the provision of domestic water from private supplies on farming and pastoral properties that is inextricably linked to the realities of changing climatic conditions in regional and remote Australia.
- Gain inter and intra-governmental policy commitment and practical support for the provision of adequate secure and safe domestic water in towns, settlements and on isolated properties in rural and remote regions
- Raise water literacy in rural and remote communities and improve climate change projections at LGA and property scales.
- Build enduring collaborations and resource actions to further multi-staged initiatives over the coming years.

### ***Applying the learnings***

As a case study, the BSC IRCC project has focused on piloting methodology rather than providing definitive answers to research questions and solutions to identified climate change and safe water issues on rural properties in the Shire. In short, the learnings from the BSC IRCC Pilot Program could be used by other LGAs to explore and document topics such as (for example):

- Viable methods for determining sources, level of consumption, treatment used, and satisfaction with quality of household water supplies on rural properties.
- Simple cost-effective processes to ensure that household water supplies on rural properties are adequate and safe.
- Practical approaches for raising community awareness of the risks to the provision of adequate and safe private domestic water supplies arising from increasing temperatures and variable rainfall under climate change.
- Communications methods that are suited to rural residents with poor or no access to web-based systems.
- Research-based principles and guidelines to ensure that any long-term SSDW initiative aimed at ensuring private household water supplies are adequate and not a health risk is:
  - strongly championed and community-led
  - citizen science informed
  - designed to have broader regional relevance.
- Climate simulation modelling systems that can be customised and maintained by users for the purpose of examining the impacts and adaptations to climatic variability and change including extreme climatic events at rural Local Government and site-specific scales and to assess the reliability of rainwater harvesting into tanks and dams.



## ***Moving forward***

The future of the BSC IRCC SSDW initiative is uncertain. Council commitment, adequate resources, enhanced professional and technical capacity, and an engaged community are essential ingredients for continuing the initiative beyond the current funding. And this situation needs to be seen in the context that ensuring private water supplies on rural properties or from rainwater tanks in towns are secure and safe is not the responsibility of Local Government.

That said, BSC could promote SSDW as a 'climate proofing' approach for a collaborative community-based partnership in the Shire and region. Climate proofing means making areas and assets more resistant and communities and individuals more resilient to changing climatic conditions. The approach is recommended by the Intergovernmental Panel for Climate Change and other international bodies such as the European Union, the World Bank, and the Asian Development Bank. Council could participate by:

- Continuing to raise community awareness of climate driven challenges and the need to increase community resilience to changing conditions
- Supporting the use of multi-media modes and community networks to disseminate ideas and information
- Identifying and mobilising local/regional organisations who could:
  - champion a SSDW initiative in Balranald Shire and beyond
  - activate public and private support and resources for focused action to ensure that private water supplies are adequate and healthy
- Assisting in garnering support for Balranald Central School (BCS) to catalyse and deliver a long-term 'citizen science' activity involving all the schools the Shire and cross-border region
- Catalysing links to like-minded bodies such as the Five Rivers Festival to celebrate success

Balranald Shire is in a desert region that historically exhibits high annual variability in rainfall. Projections of changed climates undertaken by CLIMsystems indicate that over the next fifty years and beyond rainfall across the Shire will continue to decrease and temperatures increase. Modelling of rainwater harvesting confirmed that this source of domestic supplies is unreliable, and that demand should be carefully managed to ensure that there is adequate potable water to meet household needs. This area of issue needs to be addressed at the individual property scale because of the differences in roof areas being harvested, quantity of water held in storage tanks, numbers of people in the household and the amount of water that they consume each day.

Research undertaken for this project has found that harvesting greater areas of roof and providing more tanks will not increase resilience. For Balranald Shire, increasing resilience to changing climatic conditions requires more innovative approaches to using shallow and deep underground supplies, coupled with utilising the limited rainwater supplies for drinking and cooking. And in some cases, this requires changes in attitude and behaviour towards the risks to adequate and safe domestic water supplies from changed climates, and the ways in which householders can address threats to their livelihoods, lifestyles and health.

Further communication to those dependent on rainwater harvesting should address both the threats and possible options to ensure the adequacy and safety of their domestic water supplies.



## 1. INTRODUCTION

### 1.1 The LGNSW IRCC Program

Local Government NSW (LGNSW) and the NSW Department of Planning, Industry and Environment (DPIE) are assisting councils to increase their resilience and adapt to climate change in NSW by directing financial assistance to address identified climate risks and vulnerabilities. IRCC has been established with the following objectives:

- Implementation of treatments for identified climate risks, reducing future climate impacts, and reducing potential liability for local and regional decision makers
- Regional and/or sectoral consideration of climate change impacts in decision making
- Implementation of climate change adaptation actions beyond business-as-usual projects and programs
- Enhanced adaptive capacity through the development of a community of practitioners and resources from across sectors and disciplines with practical experience in implementing adaptation responses across NSW.

### 1.2 The BSC IRCC Demonstration Project

On 12 November 2019 the NSW Minister for Energy and Environment, the Hon Matt Kean, announced successful local council IRCC grants at the AdaptNSW Forum. Balranald Shire Council (BSC) was the only Council in Western NSW to win a grant to undertake a project titled: ***Climate Change Adaptive Private Domestic Water Supplies for Rural and Remote Properties***. The 2019 proposal to NSW Department of Planning, Industry and Environment (DPIE) and Local Government NSW (LGNSW) for project funding is at **Attachment 1** of this report.

Balranald Shire (**Map 1**) is in the south-western district of NSW. The Shire is approximately 850km south-west from Sydney and 450km north of Melbourne and covers an area of approximately 21 400 square kilometres, making it the fifth largest Local Government Authority (LGA) in NSW.



**Map 1. Location Balranald Shire NSW**



### 1.3 Aim and Objectives

To quote from the 2019 BSC proposal:

*This project aims to identify and pilot measures to mitigate the risk of increasing temperatures and variable rainfall under climate change to the provision of adequate and safe private domestic water supplies for people on rural and remote properties in Balranald Shire. Rural properties are dependent on private domestic water supplies (rivers, farm dam's, aquifers, rainwater tanks) and are vulnerable to decreased adequacy and quality of supply. In the past year BSC has trucked water to some rural properties to maintain essential supplies for residents.*

*This project will establish a baseline assessment of risk to human health, identify a range of solutions to improve water sanitation and water use efficiency, address barriers to adoption and monitor success, and develop a Secure and Safe Domestic Water (S&SDW) Program to ensure that the products of the project are disseminated in Balranald Shire, the Far West-and for NSW non-scheme water users generally.*

And that the objectives to be achieved to attain the aim are:

*Objective 1. To build a sustainable institutional, local government and community-based partnership. Over two years, the collaboration would deliver and measure the effectiveness of engagement, education and community science activities that address the effects of climatic changes on the sufficiency and safety of domestic water supplies on rural and remote properties.*

*Objective 2. To establish an 'environmental baseline' for domestic supplies on rural and remote properties. Within six months, to provide: a quantitative inventory of sources of supply and infrastructure at risk from changing climatic conditions; and qualitative information on attitudes and behavior of householders towards health risks.*

*Objective 3. To develop and pilot a SSDW Program for rural and remote properties. Over eighteen months, this will address water adequacy and safety issues at properties identified as being at risk through the environmental baseline process. The program will embed community awareness, engagement, education and science and communications activities.*



## 2. METHODOLOGY

### 2.1 Methodology

The methodology for each objective in the 2019 BSC proposal to DPIE and LGNSW for project funding was as follows.

Objective 1. Actions to establish a sustainable institutional and community-based partnership include:

- Identifying and formally linking with governmental, institutional, and community-based partners.
- Holding scheduled meetings with partners, stakeholders and non-government and community-based organisations. This will ensure that the results of survey/market research that identifies potential influencers and new partners are incorporated into the project.
- Forming a steering committee and/or reference group from primary industry bodies, educational institutions, and service organisations.
- Developing and initiating a 'communications strategy and action plan' using multi-media mechanisms to engage communities across Balranald Shire.

The structured approach laid out above was largely followed. A suite of project partners was identified, and a Skilled Advisory Group (SQG) and Project Steering Committee (PSC) formed. Pursuant to the BSC Project Plan (see **Attachment 2**) submitted with the bid for funding, a four phase Action Plan was prepared for Council and implemented by the Project Team.

Phase I entailed developing and initiating an 'Action Plan' and a 'Communications Strategy' that would use multi-media mechanisms to engage communities across Balranald Shire. The Action Plan is at **Volume 3, Annex 3-A** and the Communications Strategy at **Annex 3-B**. IRCC Project Information Sheets prepared as part of the strategy are at **Annex 3-C**.

Phases II and III of the amended Action Plan of 08/05/2021 (**Annex 3-A**) were undertaken in parallel rather than sequentially. This was a practical response to the 2020-21 COVID-19 constraints on travel, broader community consultation and engagement, and householder participation. This approach was adopted to ensure that the deadline for completion of the project could be achieved.

Objective 2. Establishing the 'environmental base line' will entail:

- Mapping the location of rural and remote properties and categorising them according to dominant land use and hydrological characteristics. Properties will be identified, information provided to ratepayers privately about their risks, and they will be invited to join the project.
- Water quality sampling, questionnaire survey and market research techniques to document: sources, adequacy, quality; water treatment used; consumption patterns; and attitudes of householders to underlying climatic drivers and health risks.
- Metadata and information management protocols to maintain the project beyond the funding period. BSC will control the information management system.

The methodological approach was straight forward and successfully implemented as described in sections 2.2.2 and 2.2.3 below.



Objective 3. Developing and piloting the S&SDW Program will encompass:

- Identifying and, prioritising the properties for adaptive action using results of the questionnaire survey and water quality sampling. Potential actions will be agreed with a number of pilot householders who are at risk.
- Documenting adaptive actions in relation to the baseline conditions and determining site relevant measurements as indicators of success in reducing climate driven risks to supplies.
- Developing a range of communication products and feedback loops to stakeholders outside of the pilot group to help them understand household risks and actions to address them.

As summarized in section 3.3 below, a range of issues were encountered in identifying rural properties with residential households and prioritising them for possible adaptive action. All twenty households who had requested test kits were used as the SSDW Pilot Program population. The approach followed for the program is also outlined in section 3.3.

Materials have been collated as part of the Communications Strategy (**Volume 3, Annex 3-B**) and disseminated through the monthly on-line BSC Newsletter (see **Annex 3-C**). The 'Environmental Health Notes' at **Annex 3-F** were sent to households who participated in the Pilot Program.

## **2.2 Structure of the reporting process**

As a case study, the material generated by the project has been collated in three volumes.

- Volume 1 is the ***Demonstration Project Report*** with and focuses on the aim, objects and methodology for the project starting with the 2019 Proposal and how it was actioned in accordance with contractual obligations between: BSC and DPIE-LGNSW; and the Council and its consultant Project Team.

The approach and findings of the questionnaire survey and 'do-it-yourself' testing are reviewed. Survey and testing results were used to pilot a 'self-help' approach for increasing resilience to changing climates. This included disseminating awareness information on potential health risks from poor quality household water supplies; and guidelines on managing private water supplies and rainwater tanks. Environmental health findings and implications are reviewed.

Discussion covers impediments faced for Objective 1 and how Objectives 2 and 3 were achieved. Observations are made, lessons learnt are outlined, and recommendations proposed that could be followed if the SSDW initiative was to be taken up by other LGAs.

As demonstration project, examples are provided of Shire scale climate change projections using SimCLIM modelling and rural property site rainwater harvesting calculations. These illustrate some the tools that are available to help assess vulnerability to changing climatic conditions and develop 'climate proofing' adaptation strategies that are applicable to regional and local environmental conditions.

- Volume 2 is the ***Environmental and Social Baselines Report***. Pursuant to Australian legislation, the term environment is all encompassing and includes physical, biological, social, economic, cultural and heritage elements of the surroundings and activities of people.

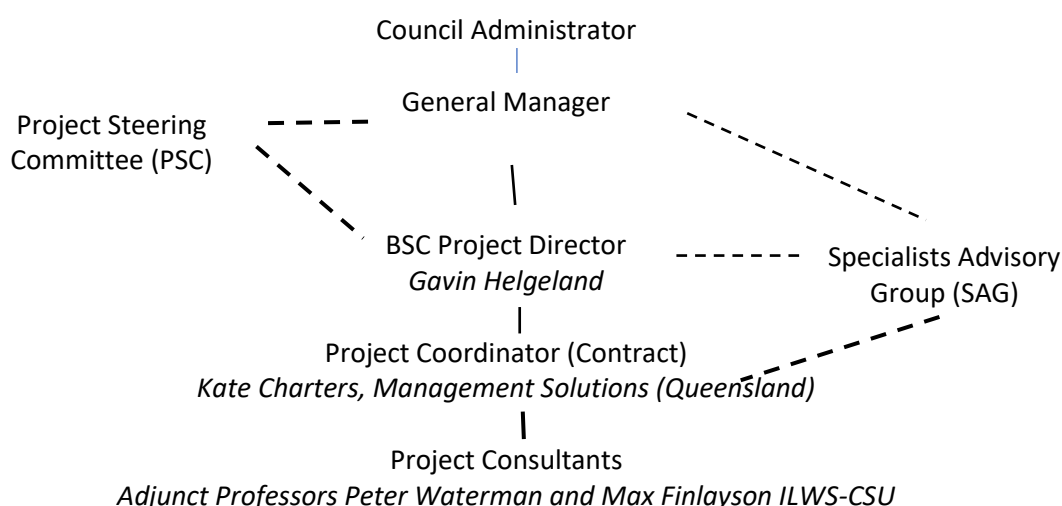


Objective 2 of the project was: *To establish an ‘environmental baseline’ for domestic supplies on rural and remote properties.* This was achieved by collating descriptive and mapped information on biophysical, socio-economic and climate change conditions and implications for Balranald Shire in its regional setting. The questionnaire survey provided data on sources of supply, levels of utilisation, conditions relating to rainwater capture and storage, and attitudes towards the quality of the water being used. These data are an integral part of the social baseline for the Shire.

- Volume 3 assembles key ***Supporting Project Documentation***.
  - Annex 3-A                      Action Plan
  - Annex 3-B                      Communications Strategy
  - Annex 3-C                      Information Sheets promulgated in the BSC Newsletter
  - Annex 3-D                      Questionnaire survey and responses
  - Annex 3-E                      Status Reports
  - Annex 3-F                      Environmental Health Notes
  - Annex 3-G                      SimCLIM Climate Change Projections

## 2.3 Operational structure

The operational structure for the project is summarised as follows.



## 2.4 Institutional and industry collaboration

Contact was established with NSW Health re community awareness and education material. Material from these sources was included in BSC IRCC Information Sheets (**Volume 3, Annex 3-C**) and disseminated through BSCs on-line Newsletter.

Published information on changing climatic conditions across the MDB was sourced on-line from AdaptNSW. These materials can be accessed from institutions and organisations engaged in climate action activities in the Far West Region. Summarised text and links from these sources were used to raise awareness of:



- projected changes in regional climatic conditions and exposure to climate induced hazards
- potential implications of these changes at property and personal scales
- vulnerabilities of water sources and the quality of supplies from drought
- adaptation strategies to ensure adequacy of supply and reduction in health risks

Water industry companies were contacted to explore:

- Cost and utility of Do-it-Yourself (DIY) test kits for water quality screening and household water treatment technologies
- Participating in a *Virtual Water Technology Expo* to show case technologies for storage and treatment of domestic water supplies
- Feasibility of demonstrating technologies for storage and treatment at selected SSDW pilot locations and private water supply provision and testing services in the Shire

Governance issues and COVID restrictions prevented the delivery of the bottom two dot points.

## 2.5 Updated climate change projections

The DPIE climate change baseline for the Far West region has been updated to provide 2021 picture for Balranald Shire. **Annex 3-G in Volume 3** is a set of climate change projections for mean annual, maximum, and minimum temperatures and mean annual rainfall for Balranald Shire for 2050, 2070 and 2090. These shire scale projections are described briefly in **Section 4 of Volume 2** and summarised in **Table 7** of that section.

This demonstration exercise was undertaken by the New Zealand company CLIMsystems using the software package SimCLIM that uses the latest CMIP5 climate data to generate maps, graphs, and charts of various aspects of climate change spatially and for sites. These provide a finer resolution for mapping than the AdaptNSW seasonal projections released by NARCLiM in 2014.

The updated projections and analysis of historical trends in annual rainfall for Ivanhoe, Balranald and Euston indicate that temperatures will increase, and rainfall will decrease across the Shire. This has implications for developing adaptive measures to increase resilience to changing climates and ensuring that water supplies on rural and remote properties are adequate and safe.

Rainwater harvesting scenarios were undertaken using a spatial risk-based assessment model for climate adaptation using the SimCLIM modelling system (Warrick et al 2012). This demonstration exposed several difficulties in trying to generate projections for sites in desert environments. The core issues being rainfall variability, the differences between properties with respect to the area of roof being harvested, storage capacity and consumption of supplies.

Specifically, in hot dry climates a considerable amount of dust and general debris accumulates on the roof. Infrequent and low rainfall events means that first flushes must be managed, and contaminated water diverted from the tank. In the context of sporadic rainfall events, the diverted volume could be considerable, and the yield reduced. The number of low rainfall events that do not lead to flushing of a roof, let alone a serious yield may increase. With climate change, this and the core issues of deficits versus demand will not be fundamentally changed at the household scale.



### 3. ACHIEVEMENT OF OBJECTIVES

#### 3.1 Building a sustainable institutional, local government and community-based partnership

The first objective of the project was: *To build a sustainable institutional, local government and community-based partnership.*

Achievement of this ambitious objective was constrained by leadership and governance issues within BSC and COVID 19 restrictions. To some extent, this was anticipated on four grounds. First, community acceptance of the reality of the impacts of changed climates on the availability and quality of household water supplies. Second, the level of personal interest and understanding of householders of the health risks from inadequate and poor-quality domestic water supplies. Third, the inherent research and community engagement complexities when working with a scattered rural population. Fourthly, the uncertainties with communications across a remote region.

The potential risks to the project and the risk management listed below were identified by BSC in the 2019 bid for project funding. They were:

- *Lack of interest and engagement from stakeholders and institutional or organisational resistance impacting on project implementation. Innovative measures to reduce this risk include:*
  - *partnering with stakeholder groups and developing a participatory approach with a steering committee that includes end users*
  - *survey and focus group work to understand barriers to engagement and adoption in the initiation phase*
  - *technical challenges and issues relating to benchmarking, supporting field and social research and outcome monitoring being addressed collaboratively*
- Overall, from informal meetings and telephone discussions with rural householders there was a low level of awareness of and interest in the links between drought induced impacts on the availability and quality of household water sources and potential health risks. Although sufficient commitment and support was garnered from stakeholders and institutions, overall, limited awareness and interest impacted negatively on project implementation.
- *Sub-optimal scheduling of activities and scope creep disrupting the delivery of project products. Realistic scheduling, project management, and clear understanding of the roles and responsibilities of partners should reduce this risk. To this end:*
  - *Planning process will anticipate potential environmental contingences and optimise arrangements for undertaking water quality monitoring and questionnaire survey work.*
  - *WHS risks that could impact on personnel such as access to private properties, extreme heat and personal hydration will be assessed and mitigated.*
  - *Budget control and review processes will follow BSC practices and State government audit requirements.*



- Within this context, the achievement of Objective 1 was affected by:
  - ✓ Unanticipated communications issues in the Phase 1 that resulted in rural householders not being aware of the IRCC project and its intentions
  - ✓ COVID 19 restrictions on community engagement activities in the towns and settlements
  - ✓ Visits to properties and active participation in water quality screening and management not being allowed due to the 2020-21 COVID 19 situation
- *Machinery of government changes and protracted decision-making impacting on the delivery of the project.*
  - Changes in governance and project direction within BSC seriously impacted on endeavors to build a sustainable institutional, local government and community-based partnership. The elected Council was disbanded, and an Administrator appointed in early 2020. There were four General Managers over the duration of the project (November 2019 to October 2021). And the BSC IRCC Project Director resigned in May 2021 and was not replaced.

### 3.2 Environmental and social baselines

The second objective of the project was *to establish an 'environmental baseline' for domestic supplies on rural and remote properties*. This objective has been achieved and the environmental and social baselines are at **Volume 2**. Key points from the process are as follows.

- Material was collated from Council and broader sources, the draft text was circulated to the SAG and Steering Committee for review, and the document has been edited and agreed as a final version.
- Illustrative maps for the baselines report were prepared by SPAN at CSU (see **Volume 2**).
- Quantitative data has been extracted from the maps for: vegetation coverage; water resources; and land use categories.
- Data on water sources, utilisation and management was extracted from the responses to the questionnaire survey.
- Project metadata has been compiled.
- An initial project data base has been assembled.

The 'environmental baseline' for domestic supplies on rural and remote properties in Balranald Shire is characterized by regional landscapes that biophysically reflect the effects of cyclic drying since the last ice age. Post European settlement, this trend has been exacerbated by periods of prolonged drought on land surfaces and drainage patterns modified for agriculture and pastoral use. In this setting, resilience and adaptations to climate change are benchmarked by the utilisation of this country by First Nations people. And there are learnings to be had from linking cultural and safe water values to ensure scarce supplies are adequate and not a health risk.

#### Survey of water sources, treatment, usage and testing for bacteria

Objective 2 also required that: *Within six months, to provide: a quantitative inventory of sources of supply and infrastructure at risk from changing climatic conditions; and qualitative information on attitudes and behavior of householders towards health risks*. The requirements of this Objective were delivered by the questionnaire survey and accompanying DIY water screening, and the water resources map and text in the environment baseline at **Volume 2**.



**Annex 3-D of Volume 3** presents the questionnaire survey instrument and the collated responses. The questionnaire is the same as the one developed in collaboration with Officers of Queensland Health and used for the SSDW survey in Etheridge Shire in Far North Queensland in 2016.

The survey applied to domestic water use only and was focused on private supplies on rural and remote properties as well as rainwater tanks in Balranald and Euston. For the survey, domestic water means tap water supplied via plumbing fittings to homes for drinking, washing, cooking, laundry, sanitation, and other household uses. The survey was commenced in September 2020 and initial findings were provided in Status Report 01/21 in January 2021 (see **3-E.01/21** in **Annex 3-E of Volume 3**). A QR Code link was used to facilitate on-line responses. The letter of transmittal, survey instrument and collated responses are at **Annex 3-D**. Raw data from the survey are held in the BSC Project Data Base.

The initial plan was to conduct a survey following the community meetings, information sessions and mail out in early 2020. The questionnaire survey was to be distributed during these activities, made accessible by QR Code on posters at strategic locations in Balranald and Euston, and mailed out to rural properties in the Shire. Due to COVID 19, this methodology was not possible. Instead, copies of the questionnaire were to be posted to all rural and remote residents as an enclosure with the rates notice in September 2020. This was to include an addressed, reply-paid envelope. Council experienced internal administrative difficulties and did not send this material to rural rate payers.

Subsequently, the SAG recommended that the survey be emailed to all households. Unfortunately, the Shire could not provide a consolidated email list of rural rate payers. In the light of this difficulty, it was agreed to maximise responses by phoning all rural properties. This was done in the later months of 2020 and the results included in Status Report 01/21 dated 26 January 2021 (see **Annex 3-E, Volume 3**).

The Project Team continued trying to increase participation in the on-line questionnaire survey, and DIY testing of household sources of drinking water for coliforms. This was progressed as follows.

- Members of the SAG and CSC again circulated emails through their networks seeking participation in the questionnaire survey and inviting people to request a DIY test kit to screen their domestic water supply for bacteria. This resulted in a further six test kits being sent to householders.
- Furthering the 'citizen science' engagement with Year 11 students from the BCS by having them distribute the BSC invitation to their parents to participate in the survey and testing. This has resulted in six additional surveys being submitted and some testing done.
- Sending letters, emails and texts to households who had responded to the questionnaire survey.

#### Determining the survey population

Determining the number of households on rural properties in the Shire who are dependent on non-scheme supplies has been vexed. The 2016 ABS Census identified 156 people in as living outside towns and settlements in the Shire. On the assumption of between two and five persons per household this could equate to somewhere between 30 to 80 properties using private water supplies.



This figure was viewed as being too low. To clarify the situation and help determine the number of households who could be involved in the questionnaire survey the Shire provided a list of the addresses of rural properties that are sent rate notices, and a PDF of a Shire Business Phone Directory circa 2014

The Project Team then:

- Converted the directory into an excel spread sheet.
- Combined the directory with the list of addresses of rural properties
- Identified properties under a single property owner or manager
- Matched station information with the Directory
- Accessed white pages on-line to search for phone numbers
- Accessed privately supplied contact numbers and email addresses.

Using this process:

- 201 rural properties were identified in the Shire
- 162 had discreet ownership/occupancy
- 106 properties with contact details were found and attempts were made to contact all by either email or telephone

Some properties were owned by the same family/company and only had one residence or one discreet water supply for all dwellings. Where there were residences on multiple properties, respondents were requested to fill in multiple surveys. Fifty-one responses (48%) were returned, and statistically this is a satisfactory result.

#### Summarising the results of the survey

The Questionnaire Survey has provided BSC with a better understanding of the dimension of domestic water quality issues being confronted on rural properties served by private drinking water supplies, and town properties using rainwater tanks. The results are at **Annex 3-D of Volume 3**.

For the survey population, 87% had rainwater tanks for domestic supplies, 57% used surface water, and 20% reported using more than one source of supply. Seventy-two per cent of the properties reported that their water was untreated. Thirty four percent indicated that their water was filtered, and this included using river sand where shallow bores were sited. One property reported that they boiled the water that was used for drinking and cooking purposes and one property used chlorine or ultra-violet water treatment.

In terms of the amount of water used per household, the data provided by respondents showed that 35% use more than 200 litres per day, 27% 100-199 litres per day and 37% consumed 10 to 99 litres per day.

When asked to rank satisfaction with water quality (where 1 is not satisfied and 10 is highly satisfied) 30 % or 15 respondents rated their supply 10 out of 10, and 30% ranked the water at 8-9. Eight percent expressed dissatisfaction with a ranking of 1-2, and 8% percent ranked satisfaction with the quality of their water at 5. Of the 32 respondents using untreated water: 8 were dissatisfied with their water (identified Dissatisfaction as a ranking of 1-4); 3 identified a neutral position on dissatisfaction; and 21 were satisfied (identified satisfaction as a ranking of 6-10).



When asked to rank concern about quality of water (where 1 is highly concerned and 10 is not at all concerned) 22.4% (11 respondents) showed that they were not at all concerned with a rating of 10 out of 10. Twenty-two per cent (11 respondents) rated their concern at 8-9 and 45% ranked between 8 and 10. At the other end of the scale a total of 11 respondents (22%) ranked their concern at 1-3.

Only one of the five town respondents was very satisfied (rating 10) with their tank water, one person ranked the satisfaction of water quality as 8 out of 10. The three other respondents ranked their satisfaction with water quality as 5,4,3 respectively. Also, only one person was not at all concerned (rating 10), one person ranked the concern of water quality as 9 and another 8. That is, they were not concerned. The two other respondents ranked their concern with water quality as 5 and 3 respectively (on a scale where 1 represented very concerned). Of the 33 respondents using untreated water: 9 were concerned (identified as a ranking of 1-4); 5 identified a neutral; and 16 were not concerned. Specifically, they identified no concern with a ranking of 6-10.

That 57% of the properties use untreated water is of concern. Twenty-seven households indicated that they do not use treated water for drinking or food preparation, and this could pose a potentially high level of health risks due exposure to pathogens in the domestic supplies. Untreated water is provided in the five businesses sampled in the survey. However, the levels of satisfaction and concern reported may also reflect acceptance of the status quo given that 43% of the respondents were over 55 years and living in a single person household.

#### Screening for coliforms

Twenty 'do-it-yourself' kits were requested for water testing and the results for total coliforms are listed in **Table 3.1**. Using the submitted surveys as the baseline, this represents a 39% response. Again, statistically this is a satisfactory result. However, of concern, is that is over 60% had positive recordings for coliforms in the household supplies being used. This is a clear indication that poor quality rainwater tank supplies on rural properties, and in the towns and settlements could be a potential health issue that requires further investigation.

**Table 3.1. 'Do-it-yourself' Water Testing Results**

<b>Private Water Tanks</b>	<b>Result</b>	<b>Rural Properties</b>	<b>Result</b>
Cally St Balranald	Positive	Hatfield	Positive
Dowling St Balranald	Negative	Lake Paika Balranald	Negative
Harben St Balranald	Positive	Gol Gol Road Arumpo	Positive
Court Street Balranald	Positive	Windomal Road Balranald	Positive
Myall Street Balranald	Negative	Kyalite-Weimby Rd Kyalite	Positive
		Brett Rd Euston	Negative
		Freshwater Rd Booligal	Positive
		Windomal Rd Balranald	Negative
		Thompson Rd Euston	Positive
		Corrong Rd Hay	Negative
		Humewood Hay	No result
		Oxley-Hay	Positive
		Bellevue Rd Ivanhoe	Positive
		Windomal Road Balranald	X2 No result



### 3.3 BSC IRCC SSDW Pilot Program

Phase II of the Action Plan (see **Annex 3-A, Volume 3**) required that 'opportunities and strategies for the Phase III SSDW Pilot Program be identified'. This task was undertaken through:

- consultations with members of the SAG and PSC
- analysis of responses to the questionnaire survey to determine the main sources and level of treatment of water being used by rural households (see **Annex 3-D**)
- reviewing the testing results in the context of the sources of household supplies being used

Additionally, material was sourced from CLIMSystems, a NZ research company who provide climate change and related projections suited to LGA scale household applications. The projections made for the Shire are at **Annex 3-G**. Also, product specifications were obtained from representatives of companies who provide household scale water treatment technologies.

The approach originally proposed in 2019 for the Phase III SSDW Pilot Program was modified because far fewer properties were involved in pilot/demonstration activities than originally envisaged for the following reasons.

- Demographic analysis used to determine the sample size for the survey found less households than were originally estimated.
- Difficulties encountered in engaging with householders on rural properties due to COVID restrictions.
- Levels of satisfaction householders had with their supplies.
- Low level of house holder participation in water testing despite repeated offers of a free test kit from Council.
- Survey responses reported very limited treatment of private household water supplies.

The fifth point made above indicates that currently there may not be a great deal of interest by rural householder in measures aimed at ensuring that non-scheme water supplies are adequate and safe, and this needs to be reversed. In short, this finding confirms the need to continue community awareness raising and engagement as well as education and citizen science to improve 'water literacy', and on-the-ground water management activities with rural and town residents.

The delivery of the BSC IRCC SSDW Pilot Program was influenced by physical environmental settings, socio-demographic conditions and personal attitudes and behaviour of residents toward climate change and related water issues. Steps taken to complete the Pilot Program were as follows.

- Water test results were used to identify demonstration properties with potential health risks from bacteria in their household supply. Where telephone numbers were available, contact was made to obtain agreement for their participation in the pilot program.
- Properties were selected in one or other of the two broad climate classes delineated across the Shire by the Bureau of Meteorology and characterised as having: uniform rainfall; and wet winter and low summer rainfall (see **Volume 2, Section 2, Map 3**). Consideration was also given biophysical and land use settings.
- Environmental Health Notes at **Annex 3-F, Volume 3** were sent to households participating in the Pilot Program providing them with:



- ✓ Advice on the potential health hazards posed by bacteria in domestic water supplies
  - ✓ NSW Health information on managing private household water supplies
  - ✓ Water treatment industry contacts if technology is needed to mitigate any water quality issues found with current sources of supply
- Modelling was undertaken to demonstrate the vulnerability private domestic water supplies on rural and remote properties to changing climatic conditions. Projections were made using SimCLIM (see **Annex 3-G, Volume 3**) to illustrate: Shire scale patterns of increasing temperatures and variable rainfall under climate change; and property scale implications for rainwater harvesting for household tanks with changed climates.

Currently, there are no commercial laboratories in the FWR where water samples can be sent for testing. DIY kits are a simple qualitative water quality screening tool that indicates the presence or absence of coliforms. Screening results are sufficient to alert householder that they may have a health risk. Householders have been advised to adopt a precautionary approach and manage their tanks as guided by the NSW Health information (**Annex 3-G, Volume 3**) if bacteria are detected. Follow-up DIY screening is sufficient to confirm that the management approaches being followed are effective.

As a follow-up to the SSDW Pilot Program, *Safe Water Awareness Information Sheets* could be sent out annually to all households with the BSC rate notice and provide:

- Advice on the potential health hazards posed by bacteria and other contaminants in domestic water supplies and a list of example suppliers for 'DIY test kits'
- NSW Health information on managing private household water supplies
- Broad description of a range of water treatment approaches and technology for household application
- A list of water industry contacts should consideration be given to proactively mitigate water quality issues

### 3.4 Dimensioning health risks

As stated above in the aim: *This project will establish a baseline assessment of risk to human health*-. Pursuant to the revised Action Plan of 08/05/2021 (see **Annex 3-A, Volume 3**) the health tasks were to:

- Advise and assist Council with: *Engaging with relevant health professionals to document current and potential levels of health issues and risks relating to poor quality water supplies.*
- Report on numbers presenting to medical services with physical and psychological symptoms attributable to poor quality water and adequacy of supply.

The first task was underpinned by NSW Health documents that are accessible on-line (see **Table 3.2**). The second task entailed re-establishing links with NSW Health to get an update on the policy settings and their position on the population/public health dimensions of the effects of changing climatic conditions with respect to: communities and individuals in Far West NSW; demand for medical and related health services; and the adequacy and quality of rural water supplies. NSW Health were unable to participate in the IRCC project because of their additional workloads created by the COVID pandemic.



**Table 3.2. Key NSW Health documents**

Document	Web URL
Private water supply guidelines	<a href="http://www.health.nsw.gov.au/environment/water/Publications/private-water-supply-guidelines.pdf">http://www.health.nsw.gov.au/environment/water/Publications/private-water-supply-guidelines.pdf</a>
Rainwater tank information	<a href="http://www.health.nsw.gov.au/environment/water/Documents/rainwater_tanks.pdf">http://www.health.nsw.gov.au/environment/water/Documents/rainwater_tanks.pdf</a>
NSW Health <i>Naegleria fowleri</i> Fact Sheet	<a href="https://www.health.nsw.gov.au/Infectious/factsheets/Pages/Naegleria-fowleri.aspx">https://www.health.nsw.gov.au/Infectious/factsheets/Pages/Naegleria-fowleri.aspx</a>

**Attachment 2** was prepared by Dr Teresa Lewis, and it dimensions key health implications of changing climates: poor quality water; and heat stress.

Initially, it was hoped that direct co-benefits from the BSC IRCC demonstration project could be demonstrated by measurable reduction in costs of hospital and medical services needed to address physical and mental health issues arising from inadequate supplies and poor-quality water. As shown in **Table 3.3**, because of the current health data coding and regional arrangements, it is not possible to demonstrate that projects such as the SSDW initiative could reduce demand for medical services and costs.

**Table 3.3. Focusing questions to help dimension health risks from poor quality water and heat waves**

Question	Finding	Comments
<ul style="list-style-type: none"> <li>Are the effects of <i>disease-causing microorganisms such as Giardia, Cryptosporidium, Salmonella, Shigella, Campylobacter, some strains of Escherichia coli (E. coli), cyanobacteria (blue green algae), Rotavirus, Norovirus, and Hepatitis A virus</i>, as well as many others relating to poor water quality reported to and by NSW Health?</li> </ul>	They are not coded and reported hence there is no data	Health data is collated regionally. Water related illnesses have not been reported and recorded in NSW for some decades.
<ul style="list-style-type: none"> <li>How many cases of poor water quality and heat stress illnesses are reported/known/suspected in the Far West region of NSW in general and Balranald Shire in particular?</li> </ul>	Unknown because they are not coded and recorded	Heat related illness is not coded and reported. These data re essential if the health risks and impacts from changing climates are to be dimensioned
<ul style="list-style-type: none"> <li>Are water and heat related health issues more prevalent in the Aboriginal population than non-Aboriginal communities?</li> </ul>	Unknown	An important omission in light of known kidney diseases in First Nation communities
<ul style="list-style-type: none"> <li>Are there are identifiable age-related patterns in health effects eg. Babies, young children and the frail aged?</li> </ul>	No data, unable to be answered,	An important omission considering known age-based vulnerabilities



## **4. DISCUSSION OF PROJECT DELIVERY**

### **4.1 Framework for the discussions**

The guidelines for the 2019 proposal raised a series of points that helped to focus the intent of the project. These complement materials reported in section 1.3 and provide a broader framework for evaluating the delivery and outcomes of the IRCC initiative and encompass:

- How does the proposed project increase resilience to a changing climate?
- Co-benefits
- Engagement and information dissemination
- Project Partners and their roles
- Project Learnings - How they could be applied and by whom?
- Organisational objectives and priorities
- What are the expected project outcomes and how will you know you've achieved them?

### **4.2 How does the proposed project increase resilience to a changing climate?**

The SSDW Program sought to provide a coordinating mechanism to help people on rural and remote properties in the Shire, as well as those with rainwater tanks in towns and settlements, undertake adaptive actions to increase resilience to changed climates. Specifically, that resilience to increasing temperatures and variability of rainfall and associated risk to quality and quantity of water supply for rural residents could be built by supporting the capacity of stakeholders and decision makers to:

- Assess vulnerabilities and risks using semi-quantitative and participatory approaches by quantifying the risks, assessing the drivers behind the risks, identifying current barriers and opportunities for addressing them.
- Develop practical adaptive response tailored to the risks identified for properties who have joined the program by trialing new solutions to address those barriers (e.g. better infrastructure, feedback loops to users, new partnerships, provision of water storage and disinfection resources, building skills and communicating facts).
- Monitoring the results of the risk identification methods used (e.g. site mapping, evaluation of security of water sources, testing water for bacteria) and risk reduction applied against benchmark conditions and agreed property specific responses (again with feedback to participants and other stakeholders).

Experience with the delivery of the project found that the intention outlined above was too ambitious. The inability to fully achieve the first objective of the project meant that there was no coordination mechanism in place to ensure that the actions were undertaken and confirm that outcomes were monitored. This was disappointing because no capacity was built within BSC in terms of enhanced knowledge of the effects and implications of changing climatic conditions and increasing resilience. Also, because there was no 'on-ground' action and limited support for the project by Council staff, no practical guidance could be offered with respect to issues such as (for example) screening private domestic supplies for bacteria and managing rainwater tanks.

Notwithstanding, through the SSDW Program householders were provided with information via the BSC online newsletter that was tailored to encouraged them to:

- Better understand what climate change means and the implications of the health risks.



- Increase their knowledge on enhancing water supplies and reduce health risks as outlined (for example) in the NSW Health Guidelines on Private Water Supplies.
- Conserve water by following 'fit-for-use' approaches in the way domestic supplies water are used.
- Treat all sources water used for domestic purposes.
- Seek guidance on reducing vulnerability of supply by installing or increasing the capacity of rainwater tanks, collaborating with neighbor's in developing new bore fields, and applying innovative ways of treating low saline supplies.

Although reduced in scope, the SSDW Program has sought to moderate harm to residents on properties at risk by reducing health risks and possibly demands on medical services. However, because there is no data on presentations to doctors and hospitals with illnesses attributable to poor-quality water supplies it is difficult to quantify the effectiveness of the measures (see **Attachment 3**). Nevertheless, members of the SAG and CSC recognised that with strong leadership and community-based support such actions, as raised above, could achieve adaptation and mitigation objectives over the long-term. Moreover, that these could be applied regionally with the purpose of increasing resilience to the effects of climate change induced reduction on the quantity and quality of private water supplies.

#### 4.3 Co-benefits

The BSC IRCC Project has provided a methodological framework to improve understanding of climate change impacts on communities in the Far West of NSW. As an information source and knowledge exchange, this could have biophysical and socio-economic co-benefits for local and regional stakeholders. Lessons from the delivery of the project demonstrate that awareness raising, community education, on ground adaptive projects and citizen science were essential tools for the program. Leadership and governance issues with BSC, and the implications of the COVID pandemic make it difficult to determine whether there have been any co-benefits for stakeholders.

Knowledge transfer included providing projections on changes in rainfall and temperature conditions across the region and how this information could help rural and remote property holders to better prepare for climate induced changes. Specifically, with projections of the long-term performance of roof harvesting into rainwater tanks. Physically, with improved water supply and treatment infrastructure. Psychologically by understanding the health implications of the risks from extreme conditions that could affect water sources and supplies.

The implementation of the SSDW Program initiatives at a regional scale could meet the challenges of changing climatic conditions from the 'bottom up' to complement the strategic 'top-down' approach provided by NSW Health guidelines. Of benefit to stakeholders is an enhanced knowledge base and shared experience of measured success of adaptation measures. Sustainability related benefits could include reduction in energy use, greater amenity during dry times and use of first flush water for gardens. Increasing primary producer and community knowledge of biophysical and socio-economic benefits of adopting integrated catchment management approaches to protect surface and ground water sources is another potential benefit.

A priori, with implementation over a longer timeframe, co-beneficiaries could include:

- Aboriginal communities by linking cultural water to safe water.
- Teachers and students involved in 'citizen science' water supply and safety projects.



- Township residents who use rainwater tanks to complement scheme supplies.
- Remote mine sites and tourists/recreation facility operators who are dependent on private supplies

#### **4.4 Engagement and information dissemination**

Engagement and information dissemination were seen as core to the success of the SSDW Program. These were to be undertaken as guided by the communications strategy and action plan. Changes to governance arrangements and directions from senior Council staff, together with constrained travel and access to properties across the Shire due to COVID, restricted the scope of community engagement and the modes used to disseminate information.

A great deal of effort was committed to community engagement to raise awareness of the survey and its purpose through Information Sheets in the Council Newsletter and the media. The original intent was to mail out the survey with the rate notice including a reply-paid envelope as well as direct contact with members of survey team. As explained, this was not possible.

Tools used to reach out to the community and encourage residents to use the QR Code link to the Survey Monkey included the Council Newsletter, Facebook, and the strategic placement of posters in Balranald and Euston. Hard copies of the questionnaire were placed in libraries and at the Council Office. All in all, these techniques were not overly effective because they were not linked to person-to-person engagement activities.

Direct links to rural and remote residents was difficult because of poor telecommunications and people not having email addresses. Notwithstanding, once telephone numbers became available messages were left on private numbers offering to take down survey responses. As a result, 75% of surveys were completed in response to direct telephone contact. This demonstrates the importance of person-to-person engagement.

A BSC 'Regional Knowledge ConneXion' was proposed as a network hub for engaging with regional stakeholders and disseminating information generated from piloting the SSDW Program and other Council and community based private water supply initiatives. This component was not initiated.

Governmental and civic bodies identified and used for engagement and participation in knowledge building and sharing process included: the Regional Development Australia Murray, MDA, FWJO, Local Land Services NSW, Balranald Local Aboriginal Land Council, SEGRA, Isolated Children's Parents Association, Mallee Sustainable Farming land care groups, service organisations, local churches, and Balranald Inc. Material disseminated include links to the questionnaire survey and invitations to participate in the 'do-it-yourself' water quality screening.

Balranald, Euston, and regional schools were included in the promotion of the SSDW Pilot Program engagement and network. Citizen science was used as tool for knowledge generation and information dissemination and screening tank water resources on rural and town properties. Citizen science activities involving the schools provide an effective vehicle for disseminating information to households and a great opportunity to embed SSDW approaches aimed at changing attitudes and behaviour with respect to responding the challenges of drought and heat wave conditions.



Originally, information dissemination seen as being an extensive activity, using multi-media modes. Following directions from within Council, this part of the project was limited to two press releases, two media interviews with the General Manager, posts on the Council Facebook page, and the inclusion of IRCC Information Sheets in the monthly BSC Newsletter. This level of dissemination is viewed as being far from adequate for proactive community engagement and focusing communications.

#### **4.5 Project partners and their roles**

ILWS and the SEGRA Foundation were key project partners. ILWS are a multi and trans-disciplinary Research Centre at CSU, Australia's largest regional university. In partnership with government and others, ILWS undertake biophysical, social, and economic research to address local, regional, national, and global issues. The ILWS-SEGRA partnership brought professional experience, knowledge, and skills to the program and (for example):

- Supported community and governmental engagement, information management and knowledge sharing.
- Administered questionnaire and water quality surveys to identify properties at risk.
- Assisted the piloting of adaptive measures on properties that have agreed to join the program.
- Shared information on technological and social science investigations on the viability of alternative sources, storage and sanitation of domestic supplies, and attitudes and behaviour towards adopting climate adaptive approaches to reducing health and related risks.

When the project was initiated in early 2020 the Far West Joint Organisation (FWJO) was a key partner. The FWJO has a regional coordination role with governmental and community bodies and the intention was for the Organisation to assist in networking, knowledge-sharing, and catalysing take up of the initiative in the Far West councils facing similar climate risks. Unfortunately, this Wentworth based body was unable to collaborate post mid-2020 due to staff departure and COVID constraints.

The Murray Darling Association (MDA) was a member of the SAG and has been a long-term supporter of the SSDW initiative in the MDB. The Association could be an important partner in disseminating the products of the project through the networks of their LGA membership.

#### **4.6. Project Learnings - How they could be applied and by whom?**

As indicated, BSC could work proactively with LGAs in the Far West through FWJO, the MDA, Regional Development Australia-Murray and Far West NSW and community-based organisations to share the outcomes and learnings from the SSDW Program. Specifically, they could operate as network hubs for:

- engaging with local and regional stakeholders and disseminating information gained from piloting the implementation of the SSDW Program
- communicating outcomes of similar climate change adaptation activities of LGAs and community-based organisations.



Community instigated adaptation measures could be initiated by neighbouring LGAs through:

- Sharing, scaling, replicating, and disseminating the outcomes of the project.
- Assisting with the delivery of practical measures to increase the resilience of people on properties identified as at risk from increasing temperatures and variable rainfall under climate change.
- Fostering community groups and citizen scientists to support improvements with the provision, monitoring and reporting on the effectiveness of adaptive measures for private supplies on rural and remote properties.
- Helping catalyse the raising of funds to ensure that any SSDW initiative becomes self-sustaining.
- Catalysing broad support for capacity building process within and with LGAs and communities to better mitigate the risk of increasing temperatures and variable rainfall under climate change.

#### **4.7. Organisational objectives and priorities**

The IRCC guidelines for IRCC projects advised that successful grant recipients are encouraged to include the project in their annual reports and ensure climate change adaptation and resilience is included in subsequent community strategic planning (if not already).

The 2019 project proposal (**Volume 2, Annex 3-A**) stated that Council will embed the SSDW Program in the IP&R process and inform financial planning with recommendations for adaptation measures that are either wholly funded, a co-contribution or self-funded beyond the two years of the proposed program. A fully scoped funding plan was to be prepared for the scaling and dissemination of the project findings, including funding applications and developing relationships with potential funding partners nationally. For a range of internal reasons within BSC, this has not eventuated.

#### **4.8. What are the expected project outcomes and how will you know you've achieved them?**

The development and piloting of the SSDW Program was to be phased with an initial timeline of two years for confirming initial outcomes. Qualitative and quantitative mechanisms were to be designed to measure the achievement of key performance indicators (kpi) for the project. Ideally, these could have provided a climate change assessment and adaption framework beyond the initial funding. Considering the delays in commencing the project due to staffing and related issues and travel restrictions due to COVID, this intention has been shown to be unrealistic.

Operationally, the BSC IRCC SSDW initiative was envisaged as a demonstration project with the learnings and product of the 'pilot SSDW Program' being disseminated widely in the MDB and beyond. The constraints and impediments indicated in Chapter 2 and sections 3.1 and 3.3 have made it difficult to measure and describe indicators of success for Objective 1 and 3.

The following qualitative outcomes have been realised from work undertaken to meet Objective 2. Maps and descriptive information incorporated into the *Environmental and Social Baselines Report* and encompasses:



- Spatial analysis of rural and remote properties in relation to regional surface and groundwater hydrology, range lands for grazing sheep and cattle, dryland farming; and irrigation for pasture, crops, and horticulture  
**kpi** – GIS layers covering key parameters with property identities secured to ensure privacy is maintained).
- Publicly accessible climate change projection maps of Shire and region  
**kpi** – GIS layers developed from AdaptNSW, and BoM resources

When the BSC IRCC Project Proposal was submitted in 2019 and the Action Plan was being formulated in early 2020, the on-ground outcomes of the survey driven component of the SSDW Program were optimistically expected to be as follows. New data set on quality and quantity of water sources and supplies available to rural landholders

- Network of engaged rural landholders and stakeholders  
**kpi** – 60 accessible data set's available within a six-month timeframe at 60 locations
- Collated and analysed survey results on barriers and opportunities to change  
**kpi** – 100 pilot households over project lifespan, 300 stakeholders in Balranald Shire engaged with the SSDW program over a five-year time-period
- Dissemination of learnings through network/hub  
**kpi** – 200 survey respondents in first six months, 60 people involved in focus groups
- Dissemination of learnings through network/hub  
**kpi** – 3 000 hits on project Facebook in first year and 5 000 by end of funding period

Based on the difficulties encountered in engaging with householders on rural properties and the demographic analysis outlined above, these KPI's are now seen as having been unrealistic and would need to be recast to reflect demographic, community engagement, communications, and water testing realities.

Specific improvements in the water efficiency and quality measured by metering and water quality parameters with a **kpi** of 100 litres /person/day, zero bacteria in supplies at pilot properties is achievable with an appropriate awareness raising campaign. Albeit with a lower number of participants than originally envisaged.

However, Balranald Shire is in a desert region that historically exhibits high annual variability in rainfall. Projections of changed climates undertaken by CLIMsystems indicate that over the next fifty years and beyond rainfall across the Shire will continue to decrease and temperatures increase. Modelling of rainwater harvesting confirmed that this source of domestic supplies is unreliable, and that demand should be carefully managed to ensure that there is adequate potable water to meet household needs.

This area of issue needs to be addressed at the individual property scale because of the differences in roof areas being harvested, quantity of water held in storage tanks, numbers of people in the household, and the amount of water that they consume each day.



## 5. OBSERVATIONS AND LESSONS

### 5.1. Optimising communications, raising awareness

Experience with the BSC pilot project confirmed that communication activities aimed at raising awareness were hampered by low levels of personal knowledge of (for example):

- what is climate change?
- water literacy in terms of
  - sources and types of pollutants
  - impacts of poor water quality on health and wellbeing
  - simple ways to treat water that contains bacteria
  - managing rainwater harvesting and storage tanks
- measures to ensure that rainwater tanks were free of bacteria
- how domestic supplies from rainwater tanks could be assured by understanding that changing climates could reduce the yields from roof harvesting and that tank storage may not be sufficient in the future to provide adequate potable supplies

Communication strategies should emphasise that the SSDW encompasses domestic water and its multiple uses in household environs. Drinking water is only one use. A specific focus would be on the risks from micro-organisms in all sources of domestic supplies, such as *Naegleria fowleri*, that have not previously been taken into consideration. Simple methods for reducing the health problems arising from poor quality domestic supplies, such as filtration and disinfection, should be highlighted in the communications tools and materials as illustrated by those in **Volume 3, Annex 3-B and 3-F**.

A key lesson from the communications difficulties experienced with the BSC IRCC project was that proactive measures must be taken to ensure community participation in public and environmental health awareness raising and domestic water management was sustainable and cost effective. Specifically, that:

- Leaders in participating communities need to understand the climate drivers and be committed to increasing resilience to changing conditions.
- Engagement activities should be formally led, communally inclusive, and where possible be informed by community organisation and educational institution based 'citizen science' activities.
- Awareness raising material on the health risks from unsafe domestic water supplies should be provided to household before any questionnaire surveys and water quality screening is undertaken.
- Hard copies of the materials need to be posted to household and prepaid envelopes included to enable recipients to respond.
- Reliance on one-way communications, such as on-line newsletters and social media be replaced by two-way communications. The modes selected need be technically appropriate in face of the telecommunications challenges being faced by people on many rural properties.
- Ways need to be found to ensure that people on remote agricultural and pastoral properties, where the risks are greatest, are directly involved through face-to-face contact.



LGAs have a pivotal role in this process and SSDW program activities need to be tailored to local and regional realities, including (for example):

- Maintaining accurate records and contact details of occupants of rural properties as a communications and disaster risk management tools (e.g. bushfires, severe storm events, and floods).
- Appreciating personal attitudes and behaviours in relation to health risks arising from various sources of domestic supplies.
- Assessing the reliability of local and regional water sources and infrastructure.

Community partners could work with participating LGAs and NGOs on (for example) the following.

- Determining the most appropriate approach to be taken and tools to be used for engagement and communications that accommodate the realities of their Council area.
- Enhancing understanding what climate change means using multi-media tools and optimising the networks of community organisations.
- Disseminating communications material that incorporates guidelines prepared by NSWHealth to manage private water supplies on rural and remote properties (see **Volume 2, Annex 3-F**).
- Holding workshops and other engagement activities aimed at community awareness raising on health risks and enhancing capacity to manage domestic water supplies.

Interfaith actions could provide another mechanism for getting the messages on adequate safe water out to householders in regional towns and on rural and remote properties (see section 5.4 below).

## **5.2. Testing private household water supplies for bacteria**

Considering COVID-19 restrictions on accessing private properties SAG and PSC agreed that DIY test kits for bacteria could be used. Direct mail out to rural properties should be used to invite residents to participate in the testing. Rural householders who agreed to participate would then be sent a testing kit with instructions on how to use it. And act if the test proves positive for bacteria.

Involvement of Year 11 students from BCS in 'citizen science' activities helped raise awareness of water quality issues and how to screen for bacteria with DIY kits. Parents on rural properties and with private rainwater tanks in Balranald and Euston participated in this activity. Through the questionnaire survey they contributed to inventorying the adequacy and quality of private sources of domestic water supplies.

## **5.3. Approaches for improving the quality and quantity of private sources of supply**

Conducting water supply and quality demonstrations could be improved through either organised site visits to individual properties or virtual visits using recorded information on the approaches and technology being used.

Either way, direct personal contact is needed to engage with rural property holders who are willing to demonstrate the water management technologies and procedures that they are using to ensure that their water supplies are adequate and safe. Offers have already been made by rural property holders with rain and bore water tanks to be part of the piloting activity by sharing their knowledge and experience with their supply systems.



Water supply and quality demonstrations could also be promoted and run virtually as the *BSC Safe Water Expo*. Several water industries companies have already indicated that they could be willing to be part of such an online initiative because it provides an ideal mechanism for them to bring their products to an identified market place. This idea needs further investigation.



## **6 CONCLUDING REMARKS**

### **6.1 Attainment of the aim**

The leadership, governance, and communications issues along with the COVID 19 restrictions may have constrained the delivery of the demonstration project but did not prevent the attainment of the aim. That is, measures to mitigate the risk of increasing temperatures and variable rainfall under climate change to the provision of adequate and safe private domestic water supplies for people on rural and remote properties in Balranald Shire were identified and piloted.

### **6.2. Achievement of the objectives**

Leadership and governance issues within BSC, poor communications, limited community engagement, and COVID constraints made it difficult to achieve Objective 1 and build a sustainable institutional, local government and community-based partnership in the timeframe for the project (ie completion in November 2021).

Objective 2, establish an 'environmental base line' for domestic supplies on rural and remote properties has been achieved and a baselines report prepared (see **Volume 2**).

The questionnaire survey has provided BSC and the partners in the research collaboration with a better understanding of the dimension of the water quality issues being confronted on properties that are using private potable supplies. Additionally, the results of the survey have shown that respondents may not be aware of the level of risks from untreated water and believe that their supplies are of a satisfactory standard and hence, they are of little concern. Over 60% of tanks samples returned positive results for total coliforms. Such findings need to be conveyed to the rural community as part of the rationale for any future water quality screening in Balranald Shire and beyond.

Objective 3 to develop and pilot a SSDW Program for rural and remote properties has been achieved, albeit not at the scale initially envisaged for the project. All participants in the program have been provide with advice on

- Potential health risks from poor quality private household water supplies.
- What the results of screening their potable water for bacteria could mean for them.
- Approaches for managing private water supplies, especially rainwater harvesting and storage tanks.

Participants in the SSDW Pilot program were informed that irrespective of bacteria being in their domestic water supplies, managing roof harvesting and tank storage is a prudent proactive precautionary approach that will ensure that they have enough domestic water and health risks are reduced.

### **6.3. Levels of concern**

Given the disparate sources of household water supply being used, that 57% of the properties use untreated water is of some concern. Twenty-seven households indicated that they do not use treated water for drinking or food preparation. This could pose a potentially high level of health risks due exposure to pathogens in the domestic supplies. Untreated water is also provided at businesses sampled in the survey.



The stated levels of satisfaction and concern of respondents may reflect acceptance of the status quo with respect to private water supplies. This is an attitudinal issue and had been observed previously in workshop and discussions sessions in the Northern, Central and Western regions of the MDB. Behavioural change is needed to get people to accept that their water supplies could be a health risk. Council should make this a core community engagement and health promotion action for increasing resilience to changing climatic conditions.

#### **6.4. Application of case study learnings**

As a case study, the BSC IRCC project has focused on piloting methodology rather than providing definitive answers to research questions and solutions to identified climate change and secure and safe water issues on rural properties in the Shire. In short, the intention is to use the learnings from the BSC IRCC Pilot Program to explore and document topics such as (for example):

- Viable methods for determining sources, level of consumption, treatment used, and satisfaction with quality of household water supplies on rural properties
- Simple cost-effective processes to ensure that household water supplies on rural properties are adequate and safe
- Practical approaches for raising community awareness of the risks to the provision of adequate and safe private domestic water supplies arising from increasing temperatures and variable rainfall under climate change
- Communications methods that are suited to rural residents with poor or no access to web-based systems
- Research-based principles and guidelines to ensure that any long-term SSDW initiative aimed at ensuring private household water supplies are adequate and not a health risk is:
  - strongly championed and community led
  - citizen science informed
  - designed to have broader regional relevance
- Climate change modelling systems that can be customised and maintained by users for the purpose of examining the impacts and adaptations to climatic variability including extreme climatic events at rural Local Government and site-specific scales to assess the reliability of rainwater harvesting into tanks and dams
- Introducing 'climate proofing' as a more holistic approach to climate change adaptation site, local and regional scales. Climate proofing means making areas and assets more resistant and communities and individuals more resilient to changing climatic conditions. The approach is recommended by the IPCC and other international bodies such as the European Union, the World Bank, and the Asian Development Bank.

#### **6.5. Seeing the issues in a broader context**

The future of the IRCC SSDW initiative is uncertain. Council commitment, adequate resources, enhanced professional and technical capacity, and an engaged community are essential ingredients for continuing the initiative beyond the current funding. And this situation needs to be seen in the context that in Australia ensuring private water supplies on rural properties or from rainwater tanks in towns are secure and safe is not the responsibility of Local Government.

Balranald Shire provides a microcosm of the global challenges for providing adequate healthy water to people in rural and remote areas. Frumkin, Frank, and Jackson (2004) make the point that:



*Water is the most vital resource on which humans are physically, socially and commercially dependant. We can live for weeks without food, but only days without water. Such is the importance of clean water for human health that the development of water treatment technology was hailed as having a greater impact on human health than antibiotics or vaccines.*

Reduced rainfall, prolonged droughts, heatwaves, and questionable water management in rural and remote regions highlights the importance of applying water treatment technologies at the household scale as a human health safeguard.

The Australian Institute of Health and Welfare (AIHW) noted that the United Nations (UN) specified access to safe drinking water as one of its millennium goals (AIHW 2010). They go on to say that target 7.c states, “*halve by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation*” (UN, 2010). An admirable goal and a challenge at global, regional, local and site scales. Also, the AIHW considers water quality to be one of the eleven determinates of health for the Australian population. Interestingly, water quality and exposure to tobacco smoke are the only environmental factors included in the list of monitored factors (AIHW, 2010).

In her book chapter titled *Water, An Essential Resource and Potential Health Risk! Rural Perceptions, Awareness and Knowledge of Health Risks*, Andrea Crampton emphasises that rural and regional residents, who perhaps have the most intimate connection with issues of water quantity and quality and are reliant on self-managed water sources (e.g. tanks or bores), have neither government protection nor services when it comes to identifying or addressing potential water related health risks (Crampton 2013:476).

In this context, ensuring the effectiveness of initiatives such as the IRCC SSDW project requires mechanisms to:

- Establish national and jurisdictional population and environmental health policy on the provision of domestic water from private supplies on farming and pastoral properties that is inextricably linked to the realities of changing climatic conditions in regional and remote Australia.
- Gain inter and intra governmental policy commitment and practical support for the provision of adequate secure and safe domestic water in towns, settlements and on isolated properties in rural and remote regions
- Raise water literacy in rural and remote communities and improve climate change projections at LGA and property scales.
- Build enduring collaborations and resource actions to further multi staged initiatives over the coming years.

Harvesting greater areas of roof and providing more tanks will not increase resilience. For Balranald Shire, increasing resilience to changing climatic conditions requires more innovative approaches to using shallow and deep underground supplies, coupled with utilising the limited rainwater supplies for drinking and cooking. And in some cases, this requires changes in attitude and behaviour towards the risks to adequate and safe domestic water supplies from changed climates and the ways in which householders can address threats to their livelihoods, lifestyles and health. Further communication to those dependent on rainwater harvesting should address both the threats and possible options to ensure the adequacy and safety of their domestic water supplies.



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**BALRANALD SHIRE COUNCIL**

**Increasing Resilience to Climate Change (IRCC) Project**

***Climate Change Adaptive Private Domestic Water Supplies for Rural and Remote Properties***

**1. Project Description, Demonstrated Need, How it mitigates Climate Risk**

This project aims to identify and pilot measures to mitigate the risk of increasing temperatures and variable rainfall under climate change to the provision of adequate and safe private domestic water supplies for people on rural and remote properties in Balranald Shire. Rural properties are dependent on private domestic water supplies (rivers, farm dam's, aquifers, rainwater tanks) and are vulnerable to decreased adequacy and quality of supply. In the past year BSC has trucked water to some rural properties to maintain essential supplies for residents.

This project will establish a baseline assessment of risk to human health, identify a range of solutions to improve water sanitation and water use efficiency, address barriers to adoption and monitor success, and develop a Safe and Secure Domestic Water (S&SDW) Program to ensure that the products of the project are disseminated in Balranald Shire, the Far West-and for NSW non-scheme water users generally.

**2. Project Objectives**

Objective 1. To build a sustainable institutional, local government and community-based partnership. Over two years, the collaboration would deliver and measure the effectiveness of engagement, education and community science activities that address the effects of climatic changes on the sufficiency and safety of domestic water supplies on rural and remote properties.

Objective 2. To establish an 'environmental base line' for domestic supplies on rural and remote properties. Within six months, to provide: a quantitative inventory of sources of supply and infrastructure at risk from changing climatic conditions; and qualitative information on attitudes and behavior of householders towards health risks.

Objective 3. To develop and pilot a SSDW Program for rural and remote properties. Over eighteen months, this will address water adequacy and safety issues at properties identified as being at risk through the environmental baseline process. The program will embed community awareness, engagement, education and science and communications activities.

**3. Methodology**

Objective 1. Actions to establish a sustainable institutional and community-based partnership include:

- Identifying and formally linking with governmental, institutional and community-based partners.
- Holding scheduled meetings with partners, stakeholders and non-government and community-based organisations. This will ensure that the results of survey/market research that identifies potential influencers and new partners are incorporated into the project.
- Forming a steering committee and/or reference group from primary industry bodies, educational institutions and service organisations.



- Developing and initiating a ‘communications strategy and action plan’ using multi-media mechanisms to engage communities across Balranald Shire.

Objective 2. Establishing the ‘environmental base line’ will entail:

- Mapping the location of rural and remote properties and categorising them according to dominant land use and hydrological characteristics. Properties will be identified and information provided to ratepayers privately about their risks, and they will be invited to join the project.
- Water quality sampling, questionnaire survey and market research techniques to document: sources, adequacy and quality; water treatment used; consumption patterns; and attitudes of householders to underlying climatic drivers and health risks.
- Metadata and information management protocols to maintain the project beyond the funding period. BSC will control the information management system.

Objective 3. Developing and piloting the S&SDW Program will encompass:

- Identifying and, prioritising the properties for adaptive action using results of the questionnaire survey and water quality sampling. Potential actions will be agreed with a number of pilot householders who are at risk.
- Documenting adaptive actions in relation to the baseline conditions and determining site relevant measurements for use as indicators of success in reducing climate driven risks to supplies.
- Developing a range of communication products and feedback loops to stakeholders outside of the pilot group to help them understand household risks and actions to address them.

## **5. How the Project Increases resilience to Climate Change**

The S&SDW Program will provide a coordinating mechanism to help people on rural and remote properties undertake adaptive actions to increase resilience to changed climates. Resilience to increasing temperatures and variability of rainfall and associated risk to quality and quantity of water supply for rural residents will be built by supporting the capacity of stakeholders and decision makers to:

- Assess vulnerabilities and risks using semi-quantitative and participatory approaches by quantifying the risks, assessing the drivers behind the risks, identifying current barriers and opportunities for addressing them.
- Develop practical adaptive response tailored to the risks identified for properties who have joined the program by trialing new solutions to address those barriers (eg better infrastructure, feedback loops to users, new partnerships, provision of water storage and disinfection resources, building skills and communicating facts).
- Monitoring the results of the risk identification methods used (eg site mapping, evaluation of security of water sources, testing water for bacteria) and risk reduction applied against benchmark conditions and agreed property specific responses (again with feedback to participants and other stakeholders).

Through the S&SDW Program householders will be encouraged to:



- Increase their knowledge on enhancing water supplies and reduce health risks as outlined (for example) in the NSW Health Guidelines on Private Water Supplies.
- Conserve water by following 'fit-for-use' approaches in the way domestic supplies water are used.
- Treat all sources water used for domestic purposes.
- Seek guidance on reducing vulnerability of supply by installing or increasing the capacity of rainwater tanks, collaborating with neighbor's in developing new bore fields, and applying innovative ways of treating low saline supplies.

The S&SDW Program seeks to moderate harm to residents on properties at risk by reducing health risks and reduce demands on medical services. Council recognises that such actions could achieve adaptation and mitigation objectives. Responses could be applied regionally.

## **6. Social, Economic or Environmental Co-benefits**

The S&SDW Program will provide a framework to provide broader understanding of climate change impacts on communities in the Far West. As an information source and knowledge exchange, this will have biophysical and socio-economic co-benefits for local and regional stakeholders. Awareness raising, community education, on ground adaptive projects and citizen science would be tools in the program.

Knowledge transfer could include providing projections on changes in rainfall and temperature conditions across the region and how this information could help rural and remote property holders to better prepare for climate induced changes. Physically with improved water supply and treatment infrastructure and psychologically by understanding the material and health implications of the risks from extreme conditions that could affect water sources and supplies. Direct co-benefit could be demonstrated by measurable reduction in costs of hospital and medical services needed to address physical and mental health issues arising from inadequate supplies and poor-quality water.

The implementation of the S&SDW Program initiatives at a regional scale could meet the challenges of changing climatic conditions from the 'bottom up' to complement the strategic 'top-down' approach provided by NSW Health guidelines. Of benefit to stakeholders is an enhanced knowledge base and shared experience of measured success of adaptation measures. Sustainability related benefits include reduction in energy use, greater amenity during dry times and use of first flush water for gardens. Increasing primary producer and community knowledge of biophysical and socio-economic benefits of adopting integrated catchment management approaches to protect surface and ground water sources is another potential benefit.

Co-beneficiaries could include:

- Aboriginal communities by linking cultural water to safe water.
- Teachers and students involved in 'citizen science' water supply and safety projects.
- Township residents who use rainwater tanks to complement scheme supplies.
- Remote mine sites and tourists/recreation facility operators who are dependent on private supplies



## **7. Engagement and Dissemination**

Engagement and dissemination is core to the success of the S&SDW Program and will be guided by the communications strategy and action plan.

The proposed BSC 'Regional Knowledge ConneXion' will be a network hub for engaging with regional stakeholders and disseminating information generated from piloting the S&SDW Program and other Council and community based private water supply initiatives.

Key governmental and civic bodies for engagement and participation in knowledge building and sharing process are (for example): the MDBA, MDA, FWJO, Balranald Local Aboriginal Land Council, SEGRA, service organisations, church groups and the Balranald Chamber of Commerce.

Local and regional schools and youth groups will also be included in the engagement and knowledge generation and dissemination network. Citizen science is seen as tool for monitoring the adequacy and quality of water resources on rural and remote properties.

Council will embed the S&SDW Program in the IP&R process and inform financial planning with recommendations for adaptation measures that are either wholly funded, a co-contribution or self-funded beyond the two years of the proposed program. A fully scoped funding plan will be prepared for the scaling and dissemination of the project findings, including funding applications and developing relationships with potential funding partners nationally.

## **8. Project Partners and their roles**

ILWS, SEGRA and the FWJO are key project partners. Other partners will be identified and invited to join as the program is initiated. ILWS are a multi and trans-disciplinary Research Centre at CSU, Australia's largest regional university. In partnership with government and others, ILWS undertake biophysical, social and economic research to address local, regional, national and global issues. Over the past 23 years SEGRA has come to be acknowledged as the 'voice for regional Australia'. ILWS-SEGRA bring professional experience, knowledge and skills to the program and will (for example):

- Support community and governmental engagement, information management and knowledge sharing.
- Administer questionnaire and water quality surveys to identify properties at risk.
- Assist the piloting of adaptive measures on properties that have agreed to join the program.
- Collaborate in field, technological and social science investigations on the viability of alternative sources, storage and sanitation of domestic supplies, and attitudes and behaviour towards adopting climate adaptive approaches to reducing health and related risks.

The FWJO has a regional coordination role with governmental and community bodies and will assist in networking, knowledge sharing, and catalysing take up of the initiative in the Far West councils facing similar climate risks.

## **9. Project Learnings - How will they be applied and by whom?**

BSC will work proactively with LGAs in the Far West through FWJO and the MDA and community-based organisations to share the outcomes and learnings from the SSDW Program.



In collaboration with FWJO, BSC will initiate a 'Regional Knowledge ConneXion' as a network hub for: engaging with local and regional stakeholders and disseminating information gained from piloting the implementation of the SSDW Program; and communicating outcomes of similar climate change adaptation activities of LGAs and community-based organisations.

BSC will support community instigated adaptation measures piloted in the Shire beyond initial funding by:

- Sharing, scaling, replicating and disseminating the outcomes of the project.
- Assisting with the delivery of practical measures to increase the resilience of people on properties identified as at risk from increasing temperatures and variable rainfall under climate change.
- Fostering community groups and citizen scientists to support improvements with the provision, monitoring and reporting on the effectiveness of adaptive measures for private supplies on rural and remote properties.
- Helping catalyse the raising of funds guarantee that the SSDW initiative becomes self-sustaining.
- Catalysing broad support for capacity building process within and with LGAs and communities to better mitigate the risk of increasing temperatures and variable rainfall under climate change.

## **10. Organisational Objectives & Priorities**

BSC Community Strategic Plan does not have any 'Increasing Resilience to Climate Change' focused projects or related activities. However, the proposed project is very much aligned with organizational objectives and strategies through the strategic objectives for promoting health in Council's Community Strategic Plan. The link is seen in PILLAR FIVE: OUR INFRASTRUCTURE with Objective 5.2 – Promote key health, community communications and infrastructure improvements, with Strategies 5.2.3 – "Prepare and implement plans and strategies in support of maintaining health standards in the Shire" and the priority action being "to implement public health programs".

## **11. Expected Project Outcomes and how to Measure Success**

The development and piloting of the S&SDW Program will be phased with an initial timeline of two years for confirming initial outcomes. Qualitative and quantitative mechanisms will be designed to measure the achievement of key performance indicators (kpi) for the project. These could provide a climate change assessment and adaption framework beyond the initial funding.

The ground outcomes of the S&SDW Program for the two years of funded activity areas follows.

- Spatial analysis of rural and remote properties in relation to: regional surface and groundwater hydrology; range lands for grazing sheep and cattle; dryland farming; and irrigation for pasture, crops and horticulture (kpi – GIS layers covering key parameters with property identities secured to ensure privacy is maintained).
- Publicly accessible climate change projection maps of Shire and region (kpi – GIS layers developed from NSW and BoM resources)



- New data set on quality and quantity of water sources and supplies available to rural landholders (kpi – 60 accessible data set available within a six month timeframe at 60 locations);
- Network of engaged rural landholders and stakeholders (kpi –100 pilot households over project lifespan, 300 stakeholders in Balranald Shire engaged with the SSDW program over a five-year time period);
- Collated and analysed survey results on barriers and opportunities to change (kpi – 200 survey respondents in first six months, 60 people involved in focus groups).
- Specific improvements in the water efficiency and quality at pilot households measured by metering and quality parameters (kpi – 100 litres /person/day, zero bacteria in supplies at pilot properties).
- Dissemination of learnings through network/hub (kpi – 3 000 hits on project Facebook in first year and 5 00 by end of funding period
- Reduced numbers presenting to medical services with physical and psychological symptoms attributable to poor quality water and adequacy of supply (kpi – 50 percent reduction from baseline numbers).

## 12. Potential Risks to Project and its Management

BSC has identified the following risks that may impact on the delivery of the Program.

- Lack of interest and engagement from stakeholders and institutional or organisational resistance impacting on project implementation. Innovative measures to reduce this risk include:
  - partnering with stakeholder groups and developing a participatory approach with a steering committee that includes end users
  - survey and focus group work to understand barriers to engagement and adoption in the initiation phase
  - technical challenges and issues relating to benchmarking, supporting field and social research and outcome monitoring being addressed collaboratively
- Sub-optimal scheduling of activities and scope creep disrupting the delivery of project products. Realistic scheduling, project management, and clear understanding of the roles and responsibilities of partners should reduce this risk. To this end:
  - Planning process will anticipate potential environmental contingences and optimise arrangements for undertaking water quality monitoring and questionnaire survey work.
  - WHS risks that could impact on personnel such as access to private properties, extreme heat and personal hydration will be assessed and mitigated.
  - Budget control and review processes will follow BSC practices and State government audit requirements.
- Machinery of government changes and protracted decision-making impacting on the delivery of the project.



### Project Plan Submitted with 2019 BSC Proposal

**Project title:** Climate Change Adaptive Private Domestic Water Supplies on Rural and Remote Properties

1. Established partnerships to drive adaptive change: Governmental, institutional and community groups

(a) [Shire] Through various social media and publications, put together a notification of the program receiving funding and outline key objectives.

*Program commencement announced and objectives broadcasted to all community stakeholders within the Shire: All non-scheme households within Shire being the focus.*

b) [Shire] Establish Skilled Advisory Team - State Agencies (DPIE - NSW Health, Adapt NSW) and institutional representatives (RDA Murray, MDA - Region 4, ILWS-SEGRA).

*Skilled Advisory Team established (Shire Officers, State agency delegates and water health & safety specialists) - quarterly meeting schedule established to measure progress and update strategic direction of project.--Meeting minutes recorded, any actions entered into Action Register.*

(c) [Shire] Recruiting "on-ground" 2x part-time Project Officers (equiv. 5 days/month total) to drive consultation/collaboration, manage data generation, attend meetings and write reports throughout project. They will work collaboratively with the Steering Group, community stakeholders and leverage the collective knowledge of the Skilled Advisory Team to deliver key outputs.

*Two part-time contract project officers recruited to start work once Skilled Advisory Team established.*

d) [Shire] Forming a Steering Group from primary industry bodies (rural and remote residents) education (schools, TAFE, ILWS) and Councillors.

*Steering Group established - Project Program Objectives communicated and understood. Steering Group meetings will be coordinated at key milestones to ensure effective communication as the Project progresses.--Meeting minutes recorded, any actions entered into Action Register*

(e) [Project Officers] Working with Skilled Advisory Team drafts "Communications Strategy and Action Plan"

*Communications Strategy and Action Plan document completed and shared with Steering Group.*

(f) [Project Officers] to establish quarterly meetings with Skilled Advisory Team; workshops and community information sessions scheduled and communicated to steering group

*Quarterly meeting schedule circulated; information sessions scheduled and circulated*



## 2. Establish Environmental & Social Baselines

(a) [Shire, Project Officers] In consultation with Steering Group, geospatial mapping and categorisation of rural and remote properties.

*Baseline map and metadata complete by Shire and Project Officers using Shire GIS and property database resources.*

(b) [Project Officers] Information compiled and provided privately to rural/remote residents outlining potential private water risks, addressing social barriers to participation and an invitation to join the Project

*Resident's responses to invitation are compiled and a register of participants established*

(c) [Shire, Project Officers] Water quality sampling and questionnaire survey provided to participants to complete.

*Working with Skilled Advisory Team and Shire Officers, Project Officers establish the Project Database that includes: property categorization, questionnaire survey answers and water quality sample results.*

(d) [Project Officers] Model data from Project Database; write report outlining social and environmental baselines and identification of piloting opportunities and strategies

*Environmental & Social Baselines Report completed by Project Officers and key outcomes shared with all stakeholders.*

## 3. Developing and Implementing Safe and Secure Domestic Water (SSDW) Pilot Program

(a) [Project Officers] Using Environmental & Social Baseline Report and database, develop SSDW pilot strategy.

*SSDW Pilot Program strategy completed by Project Officers.*

(b) [Shire, Project Officers] Using Data modelling, identify and prioritise properties for adaptive action - residents at significant risk.

*Invitations to participate in SSDW Pilot Programs sent, responses received and pilot locations/residents list established by Shire Officers.*

(c) [Shire, Project Officers, Skilled Advisory Team] Pilot Group Engagement: Adaptive actions scoped and agreement between members of Skilled Advisory Team and residents established.

*In consultation with Skilled Advisory Team, Project Officers concurrently scope Pilot Group Programs, agree and finalise with participants - ready for action.*

(d) [Project Officers] SSDW Pilot Program roll-out: Guiding investment (brokering price-competitive purchases according to available innovation/technologies), supporting implemented adaptive actions and, in relation to the baseline conditions, determining site relevant measurements for use as indicators of success in mitigating/reducing climate driven risks (18 months).



*Pilot Group adaptive actions and behaviours will be measured by Project Officers (In consultation with Skilled Advisory Team) at regular intervals and residents interviewed to quantify/qualify benefits. Steering Group and broader community will be engaged at key stages to communicate learnings/benefits as they are realised/prioritised.*

e) [Project Officers] Develop a range of communication products and feedback loops to stakeholders outside of the pilot group to help them understand household risks and actions to address them.

*Benefits are realised through SSDW Pilot Program and communicated effectively throughout Shire resulting in improved awareness and take-up of proved adaptive actions.*

4. Final SSDW Climate Change Adaptation Report (including associated communication products) delivered to Stakeholders and Organisations

*Final Report is published and disseminated broadly to Shire communities, FWJO and state agencies. Ongoing community support from Shire Officers in their newly-established role as Drinking Water advisors - specialising in Climate Change adaptive measures for our rural/remote residents.*



### Dimensioning the Health Risks

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#### Purpose

As stated in the aim: *This project will establish a baseline assessment of risk to human health-*. Pursuant to the revised Action Plan of 08/05/2021 (see **Annex 3-A**). The health tasks are to:

- Advise and assist Council with: *Engaging with relevant health professionals to document current and potential levels of health issues and risks relating to poor quality water supplies.*
- Report on numbers presenting to medical services with physical and psychological symptoms attributable to poor quality water and adequacy of supply (Goal *kpi* – 50 percent reduction from baseline numbers).

#### Approach

The first task, to advise and assist Council, was underpinned by NSW Health documents that are accessible on-line (see **Table 3.1**). A list of contacts for health professionals is at **Appendix 3.1** and indicates the best sources, places, and people to consult to answer the focusing questions listed below.

**Table 3.1. Key NSW Health documents**

Document	Web URL
Private water supply guidelines	<a href="http://www.health.nsw.gov.au/environment/water/Publications/private-water-supply-guidelines.pdf">http://www.health.nsw.gov.au/environment/water/Publications/private-water-supply-guidelines.pdf</a>
Rainwater tank information	<a href="http://www.health.nsw.gov.au/environment/water/Documents/rainwater_tanks.pdf">http://www.health.nsw.gov.au/environment/water/Documents/rainwater_tanks.pdf</a>
NSW Health <i>Naegleria fowleri</i> Fact Sheet	<a href="https://www.health.nsw.gov.au/Infectious/factsheets/Pages/Naegleria-fowleri.aspx">https://www.health.nsw.gov.au/Infectious/factsheets/Pages/Naegleria-fowleri.aspx</a>

The second task entailed re-establishing links with NSW Health to update the policy setting and their position on the population/public health dimensions of the effects of changing climatic conditions with respect to:

- communities and individuals in Far West NSW
- demand for medical and related health services
- the adequacy and quality of rural water supplies.

NSW Health were a member of SAG for the IRCC project. However, they were unable to participate fully because of their additional workloads created by the COVID pandemic.

#### Knowledge baseline

Information Sheets in the BSC Newsletter (**Annex 3-C**) were used to disseminate material from the publication <https://www.health.nsw.gov.au/environment/water/Publications/private-water-supply-guidelines.pdf> informing householders that:



*Water contamination affects people in different ways. What causes a minor stomach upset in some people can cause serious illness in others. In some cases, visitors can become sick after consuming water while people who use it regularly will remain healthy. The people most at risk of health effects from unsafe water are those with weakened immune systems such as the elderly, the very young, transplant recipients, dialysis patients, cancer patients, and some people with HIV and AIDS. People with skin wounds or burns may need to be careful about the quality of water in which they bathe.*

*Water can be contaminated with a wide range of disease-causing microorganisms such as Giardia, Cryptosporidium, Salmonella, Shigella, Campylobacter, some strains of Escherichia coli (E. coli), cyanobacteria (blue green algae), Rotavirus, Norovirus, and Hepatitis A virus, as well as many others. Most of these can cause diarrhoea, vomiting, or other gastrointestinal (gut) upsets. Some of them can also lead to more serious illnesses and even death.*

*The health effects from microorganisms generally occur quickly. Health effects from water contaminated with heavy metals or other chemicals may take much longer to become apparent. It is important that you ensure that the supply system is not contaminated with chemicals.*

*Disinfection kills most disease-causing microorganisms in water but does not remove or inactivate chemicals. Treatment other than disinfection may be necessary to manage chemicals that may present a risk to health.*

However, what is not known is:

- How are the effects of *disease-causing microorganisms such as Giardia, Cryptosporidium, Salmonella, Shigella, Campylobacter, some strains of Escherichia coli (E. coli), cyanobacteria (blue green algae), Rotavirus, Norovirus, and Hepatitis A virus*, as well as many others relating to poor water quality reported to and by NSW Health?
- How many cases of illness from poor water quality and heat stress are reported/known/suspected in the Far West region of NSW in general and Balranald Shire in particular?
- Whether water and heat related health issues are more prevalent in the Aboriginal than non-Aboriginal communities?
- Are there any identifiable age-related patterns in health effects e.g., babies and young children and the frail aged?

Another question raised was could pharmacies be a source of data because some people would get standard across the counter medicines to address *diarrhoea, vomiting, or other gastrointestinal (gut) upsets*.? Travel and privacy factors have prevented this question from being answered.

### **Health implications associated with waterborne diseases in FWR NSW**

The National Health and Medical Research Council (NHMRC) provides guidelines to consumers throughout Australia on the good management of potable water supplies (NHMRC, 2021). This means that when potable water becomes contaminated the guidelines become implemented. However, health departments, regulators, local health authorities including water utilities in each State and Territory determine when this guideline comes into force. In other words, the guidelines are not mandatory or legally enforceable (NHMRC, 2021).



Galletta and Volkofsky (2019) reported that several Menindee locals near Broken Hill in Far-West Region (FWR) New South Wales (NSW) stated that they were subjected to enduring water ‘that made them unwell’. Essential water are the suppliers of water and sewerage to FWR New South Wales including Menindee (Essential Water, n.d.). Four types of water services noted in their website are presented in **Table 3.2**.

**Table 3.2. Examples of water services and areas served**

<b><i>Treated water</i></b>	Broken Hill and Menindee
<b><i>Untreated water</i></b>	Selected areas of Broken Hill and Menindee all pipeline customers
<b><i>Chlorinated water</i></b>	Silverton and Sunset Strip
<b><i>Effluent water</i></b>	Selected areas of Broken Hill

Adapted from Essential Water (n.d.)

Despite locals airing their concerns of water discolouration to Galletta and Volkofsky (2019), Essential water (n.d.) defended the quality of their water stating that the incident was an isolated event, and that samples taken complied with the Australian Water guidelines.

Cryptosporidiosis and Giardia are diseases that can be spread through drinking contaminated water (NSWG, 2018a; 2018b). Statistical data is coded via tools such as the Practice Incentive Program Quality Improvement and CAT Plus (PenCS, 2019). This guide contains 10 improvement measures however, not one measurement specifically targets waterborne diseases. K. Manning (personal communication, September 13, 2021), a clinical coder for the lower Far West Region NSW stated that waterborne diseases such as those mentioned above were not on a specific list to monitor despite being a very interesting factor for observation of which she was keen to activate if required.

The New South Wales disease reporting list for doctors follows the Public Health Act 2010, this list revised in September 2020 reveals that foodborne illnesses are notifiable, whilst waterborne diseases are not evident on the list (NSWG, 2020a) despite Cryptosporidiosis being on the Australian National Notifiable Diseases Surveillance System since 2004 (Department of Health [DoH], n.d.).

Statistical data for specific diseases in the NSWG’s (2020b) ‘*Hospitalisation by cause and Aboriginal*’ does not specifically break down diseases that are related to waterborne disorders. Data on waterborne diseases due to untreated water is difficult to ascertain due to the variants of coding in which diseases are classified. However, the statistics for Far West Local Health District shows that hospitalisation for the year 2016-2017 and updated in 2020 was lower across all statistical data for Aboriginal peoples than non-Aboriginal people (NSWG, 2020b). Further research on tools used by the medical profession once again provided a sketchy picture of coding for waterborne diseases.

‘Medical Director’ is a GP software with inbuilt coding that apparently allows General Practitioners a ‘free text’. Upon placing waterborne diseases in the ‘search string’ no valid response was generated; however, the clinical coding system does allow for two ways to enter past medical history items in their MD3 (MedicalDirector, n.d.).

The MD3 has a multitude of software system applications to search which are not readily accessible to all. Unless au fait with the applications waterborne diseases such as Cryptosporidiosis may go unnoticed as they become coded under different diagnoses.



According to the New South Wales Government (NSWG) (2021) the Far West Region of New South Wales has an ageing population, and it is estimated that by 2036 approximately 11,950 will be greater than 65 years. This means that chronic illnesses will become more prevalent especially within the Indigenous community (NSWG, 2021). Along with the prospect of the increase of chronic illnesses due to ageing, coding of waterborne diseases may become a necessity especially when adverse weather events produce prolonged periods of drought within the communities in the FWR of NSW. Along with the necessity of monitoring waterborne diseases heat related illnesses may also become a requirement.

### **Collecting statistical data on temperature-related illnesses**

Geographical areas such as FWR NSW are experiencing higher temperatures. According to the Western New South Wales Local Health District (WNSWLHD), climatic changes are being experienced through increased intensity and frequency of heat waves (New South Wales Government [NSWG], 2020; WNSWLHD, 2020). This means that the health of humans become impacted upon causing heat related morbidity and mortality.

New South Wales Government has defined heatwaves as abnormally hot periods of weather that last for several days basing the period over a three-day minimum and maximum of forecasted temperatures (NSWG, 2020). The website reiterates the importance of remaining hydrated as well as preparation planning for those who are experiencing their first heatwave (NSWG, 2020). Interestingly, the website contains information on heat and COVID-19, stating that it is important to remain vigilant regarding the signs and symptoms of heat stress as some of the symptoms may be mistaken for the COVID-19 virus. Even though Australia is only now entering into its early Springtime, some medical centres have been forewarning their communities about staying heat stress aware.

For example, on the 21/09/2021, Balranald Medical Centre (BMC) placed on its website information regarding heat stress safety (aiea.org.au, 2021). The website echoes how serious heat related illnesses can be, by worsening already existing underlying conditions, and putting extra strain on the body (aiea.org.au, 2021).

Obtaining data for temperature-related illnesses from Balranald District Hospital is difficult due to there being no navigation system for statistical data. However, the NSW Government has a new interactive tool containing good statistical data on the Far West Local Health District (LHD) including Balranald (NSWG, n.d.). Despite including LHDs data retrieval and reporting remains difficult, and variations occur as various computer programs are utilised.

Due to the reporting system statistical data is collected and reported on which ED a person presents to, and not necessarily where a person may reside. The closest statistical data for temperature-related issues are therefore combined into NSW data (NSWG, n.d.). The most presentations to ED seem to be centred on when NSW temperatures are around 30°C-32°C, the number of presentations range from 98 to 229 based on a period from 2010 to 2019 with presentations to 84 different emergency departments (NSWG, n.d.).

Data collected on temperature-related issues, however, is underestimated as not all emergency departments are included due to geographical areas, this may preclude analysis by LHDs such as Balranald, remoteness, LGAs, and other health related services (NSWG, n.d.).



## Meeting the purposes of the review

Initially, it was hoped that direct co-benefits could be demonstrated by measurable reduction in costs of hospital and medical services needed to address physical and mental health issues arising from inadequate supplies and poor-quality water. With the current health data coding and regional arrangements, it is not possible to demonstrate that projects such as the SSDW initiative could reduce demand for medical services and costs.

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## Appendix 3.1

### Contacts for Health Professionals in Far West NSW

1. Far West Local Health District NSW

Far West Health Broken Hill

Member Specialist Advisory

Unable to participate due to workload with COVID 19 pandemic.

Telephone: 08 8080 1333

Far West Health is responsible for the hospitals and medical services for all towns in the region. Data is collected by them on a regional basis. No data is available on water or heat related illness.

2. Balranald Multipurpose Service

Public Hospital

Telephone: 03 5071 9800

This facility is located with the local medical practice.

3. Maari Ma Health Aboriginal Corporation

<https://www.maarima.com.au/maari-ma-balranald>

Bes Murray Community Centre

Telephone: 0409 495 487

4. Broken Hill University Department of Rural Health

<https://www.bhudrh.com.au>

Telephone: 08 8080 1200

Email: [info@bhudrh.com.au](mailto:info@bhudrh.com.au)

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### NSW Health District Map

