

SA Water Guidelines for Recycled Water Storage in the Northern Adelaide Plains



Government
of South Australia



SA Water

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SA Water acknowledges the community and other stakeholders that contributed towards the development of these guidelines. These include the members of the NAIS Community Committee for Recycled Water Storage, Northern Adelaide Plains landowners, growers and community, Local Government (City of Playford, District Council of Mallala and Light Regional Council), industry associations (including HortEx, Virginia Irrigators Association, Vietnamese Farmers Association, Horticulture Coalition of SA, AusVeg SA) and relevant Government of South Australia agencies.

THE NORTHERN ADELAIDE IRRIGATION SCHEME

NAIS FALLS UNDER THE UMBRELLA OF THE PIRSA-LED NORTHERN ADELAIDE PLAINS AGRIBUSINESS INITIATIVE AND WILL BE DELIVERED BY SA WATER. IT WILL SEE THE EXPANSION OF RECYCLED WATER USE TO SUPPORT SIGNIFICANT ECONOMIC DEVELOPMENT OPPORTUNITIES AND JOBS GROWTH IN THE NORTHERN ADELAIDE REGION.

On 27 August 2015, SA Water released an Expression of Interest to the market for the proposed Northern Adelaide Irrigation Scheme (NAIS).

The scheme represents an opportunity for an additional 20 GL of recycled water from Bolivar Wastewater Treatment Plant (WWTP) to be made available for primary production in the Northern Adelaide Plains. Storage of recycled water is likely to be an important part of NAIS.

The SA Water Guidelines for Recycled Water Storage in the Northern Adelaide Plains has been produced as a result of a robust stakeholder engagement process and obligations set by regulators: the Department of Health and Ageing (DHA), the Environment Protection Authority (EPA), and the Department for Environment

Water and Natural Resources (DEWNR).

The purpose of this document is to provide information to the Northern Adelaide Plains community and summarise SA Water's commitments. It will guide irrigation planners, managers and those that have put forward proposals for NAIS (proponents) to identify appropriate sites for recycled water storage.

Site selection for storages will occur after a proponent has been selected and feasibility studies completed.

THE CRITERIA OUTLINED IN THESE GUIDELINES WILL BE CONTRACTUALLY BINDING FOR ALL NAIS PROPONENTS.

NAIS IN CONTEXT

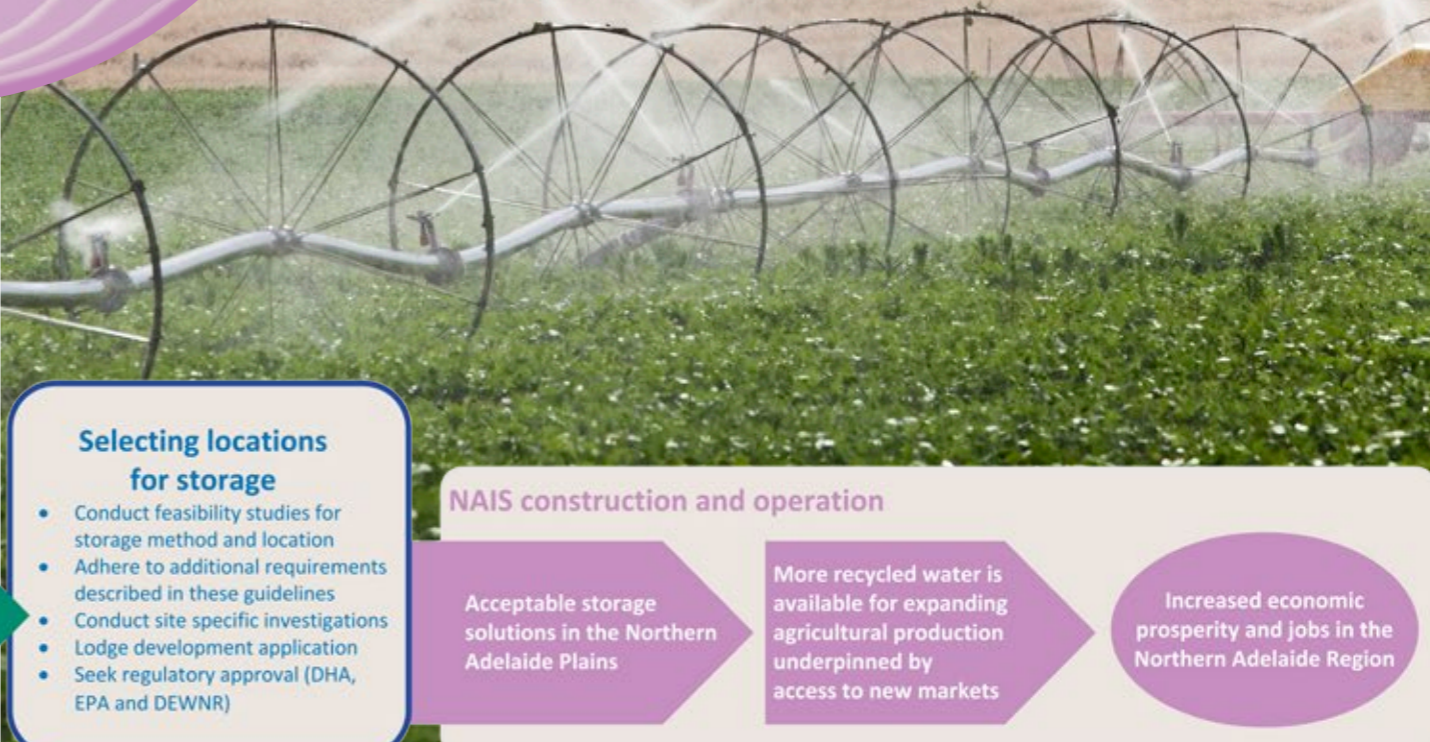


NAIS WILL SEE THE EXPANSION OF RECYCLED WATER USE TO SUPPORT SIGNIFICANT ECONOMIC DEVELOPMENT OPPORTUNITIES AND JOBS GROWTH IN THE NORTHERN ADELAIDE REGION

Stakeholder Engagement Process

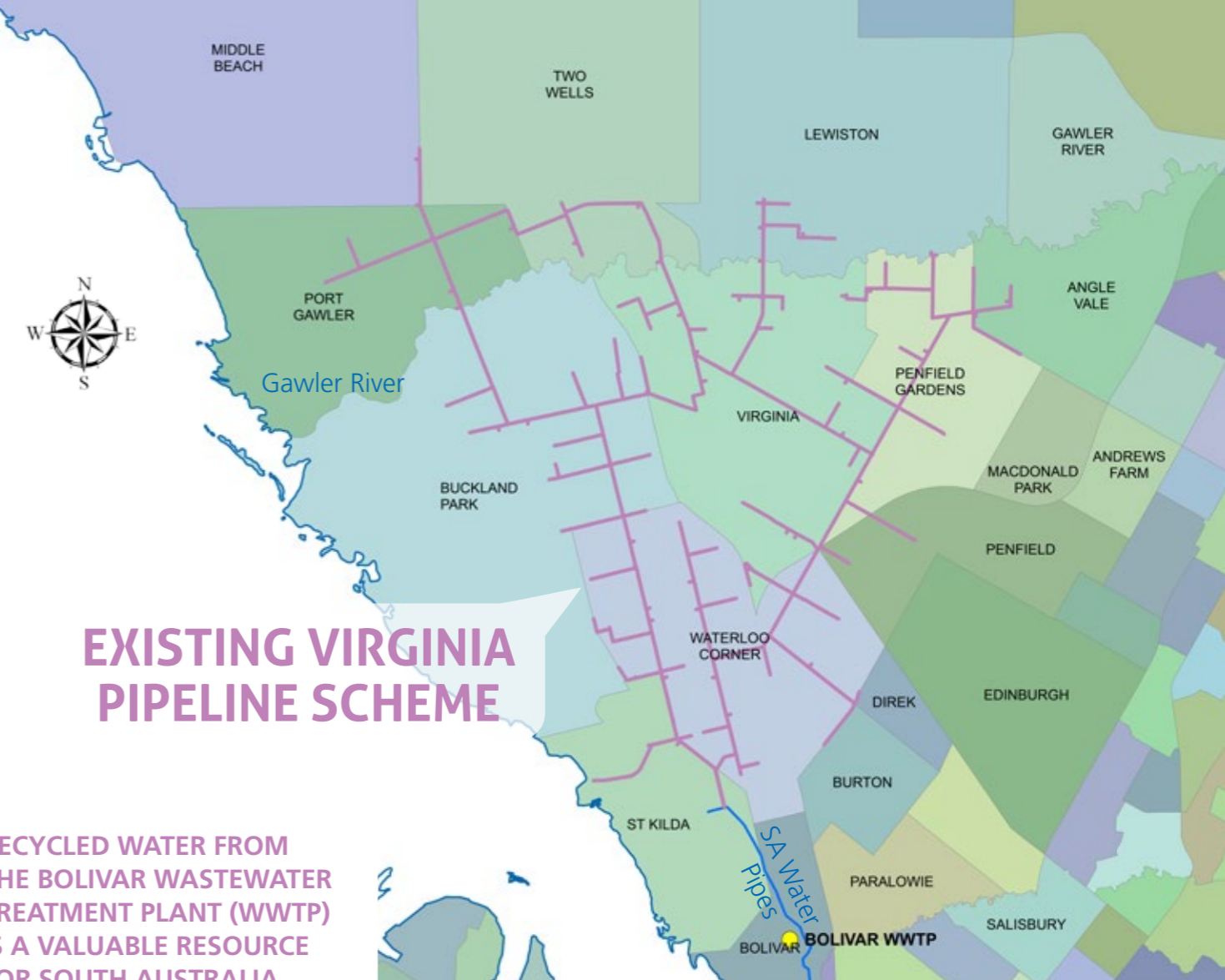


NAIS Selection Process



RECYCLED WATER IN THE NORTHERN ADELAIDE PLAINS

WITHOUT NEW INFRASTRUCTURE
AND STORAGE, ADDITIONAL
RECYCLED WATER CANNOT BE
DELIVERED TO THE REGION



EXISTING VIRGINIA PIPELINE SCHEME

RECYCLED WATER FROM
THE BOLIVAR WASTEWATER
TREATMENT PLANT (WWTP)
IS A VALUABLE RESOURCE
FOR SOUTH AUSTRALIA
AND ITS USE HAS MANY
ENVIRONMENTAL, SOCIAL
AND ECONOMIC BENEFITS.

Recycled water schemes are used worldwide to assist with meeting the growing demand for water. Increasing use of recycled water from the Bolivar WWTP will decrease the discharge to the Gulf St Vincent, safeguarding South Australia's marine environment.

The Northern Adelaide Plains region produces approximately one third of South Australia's Gross Domestic Product (\$350M per year) for agricultural produce (PIRSA, 2015).

The existing Virginia Pipeline Scheme (VPS) currently delivers approximately 17 GL from an available 19.5 GL of recycled Bolivar water per year to 350 irrigators in the region.

NAIS will seek investment in new infrastructure to treat and transport an additional **8 GL** of recycled water produced during the drier months to the Northern Adelaide Plains. A further **12 GL**, produced during the wetter months when irrigation demand is low, will require storage if it is to be used when irrigation demand is high.

There are **two methods** of storage that have been explored in detail with the community and other key stakeholders:

- **Below-ground** storage, in the local aquifer (likely to be the T2 aquifer), through a process called Managed Aquifer Recharge (MAR).
- **Above-ground** storage, which may consist of a number of lagoons.

LISTENING TO THE COMMUNITY

An engagement process with the Northern Adelaide Plains community commenced in July 2015 to raise awareness and address the community's concerns about above-ground and below-ground recycled water storage options.

After a thorough selection process, the *NAIS Community Committee for Recycled Water Storage* was established and included representation from industry groups, local government and community members. The Committee was asked to work with us to develop these guidelines and they made it clear that ongoing consultation was essential in finding a storage solution.

WE ARE COMMITTED TO ENSURING THAT NAIS PROPONENTS UNDERTAKE EFFECTIVE CONSULTATION AND COMMUNICATION WITH STAKEHOLDERS DURING THE PLANNING AND CONSTRUCTION STAGES OF STORAGE SOLUTIONS.

This will ensure transparency during the project's progression and allow for two-way communication to identify changes in community expectations and project outcomes.

NAIS proponents must follow the usual development approval process, which involves community consultation.

WE WILL ENSURE THAT NAIS PROPONENTS UNDERTAKE ADDITIONAL COMMUNITY CONSULTATION AS DESCRIBED IN THIS DOCUMENT.

The community will continue to be consulted during the site selection process for recycled water storage. The method of engagement may include surveys and face-to-face conversations with affected members of the community, information sessions, mail-outs, industry and Council briefings, public notices and media releases. The extent of engagement will depend on the potential impacts of proposed storage locations.

WHAT IS IMPORTANT TO THE COMMUNITY?

- CONSULTATION ON THE SITE SELECTION PROCESS
- BEING INFORMED ABOUT WHAT IS HAPPENING AND WHERE



PUBLIC AND ENVIRONMENTAL HEALTH

WHAT IS IMPORTANT TO THE COMMUNITY?

- MAKING SURE THAT PUBLIC HEALTH IS PROTECTED
- PROTECTING ENVIRONMENTAL RESOURCES FOR FUTURE GENERATIONS

PROTECTING THE HEALTH AND WELLBEING OF THE COMMUNITY REMAINS ONE OF SA WATER'S UTMOST COMMITMENTS IN DEVELOPING ANY RECYCLED WATER SCHEME.

Recycled water currently provided through the Virginia Pipeline Scheme is suitable for *commercial food crop* irrigation. It will continue to meet strict requirements for water quality, control and monitoring. The *multiple barrier* treatment process reduces viruses and bacteria by 99.9999% and protozoa by 99.999% to protect public health.

The DHA, in conjunction with the Local Government Association, EPA, DEWNR, PIRSA, SA Water and Renewal SA developed the *South Australian Recycled Water Guidelines (2012)*. These were developed to assist proponents in recycled water scheme development and provide guidance on best practice for recycled water management and use.

SA Water is committed to the principles of sustainable use of recycled water outlined in the *SA Recycled Water Guidelines*:

'While the use of recycled water is strongly supported, it is crucial that it is undertaken in a manner that maintains protection of public and environmental health. Application of preventive measures and requirements for water quality should be commensurate with the source of recycled water and intended use'.

If new pollutants of concern are identified, SA Water works closely with regulators to ensure the safety of the community. We have a world class laboratory (AWQC) and linkages with national and international research organisations to keep abreast of emerging issues.

The *Australian Guidelines for Water Recycling (AGWR): Managing Health and Environmental Risks - Phase 1* must be addressed to gain approval from regulators to supply, store and use recycled water. Approval from the DHA is compulsory for the supply and use of recycled water, and approvals will only be issued if the proposal is assessed as being safe. Applicants must submit a detailed risk management plan that meets the *AGWR Recycled Water Management Framework*, and includes:

- intended use and prevention of unintended use
- health and environmental risk assessment
- management of incidents and contingency plans

NAIS PROPONENTS SEEKING TO STORE RECYCLED WATER MUST ADHERE TO THE RELEVANT GUIDELINES, LEGISLATION, PLANNING APPROVALS AND REGULATORY REQUIREMENTS while also accounting for community views, in relation to:

- public safety and health
- environmental protection
- natural resource management
- land use planning

BELOW-GROUND STORAGE

There are a number of Managed Aquifer Recharge (MAR) schemes in South Australia that have been operating for over two decades, storing recycled water for a variety of uses including irrigation of parklands, ovals and golf courses, primary production and domestic dual reticulation. The role of MAR schemes is to store water until it is needed in drier months.

The most common type of MAR used in South Australia is Aquifer Storage and Recovery (ASR), which involves injecting and extracting from the same bore. This is the main method of aquifer storage being considered as part of NAIS.

It is a cost effective storage solution that requires very little land and can be increased gradually as demand grows. Approval for ASR requires a comprehensive understanding of the aquifer and current groundwater users; this is enforced through approval from the DHA, EPA and DEWNR.

SOUTH AUSTRALIA LEADS THE WORLD IN ASR TECHNOLOGY.

Extensive trials in partnership with the Commonwealth Scientific and Industrial Organisation (CSIRO) took place at Bolivar WWTP from 1996 to

2010 to test and understand the dynamics of using MAR to store recycled water. These trials provided major input to the development of the nation-wide *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) Managed Aquifer Recharge*.

The Tertiary 2 (T2) aquifer is very deep, made primarily of limestone and separated from other aquifers by thick clay layers. It extends under most of the Northern Adelaide Plains. It is preferred for ASR storage because the salinity, aquifer thickness and other physical characteristics mean that it has a greater ability to safely and cost effectively store water.

The EPA Water Quality Policy (2015) defines groundwater with less than 1,200 mg/L total dissolved solids (TDS) as suitable for drinking water supplies.

THE EPA PLACES STRICT CONDITIONS ON ALL MAR SCHEMES TO PROTECT THE ENVIRONMENTAL VALUE OF AN AQUIFER.

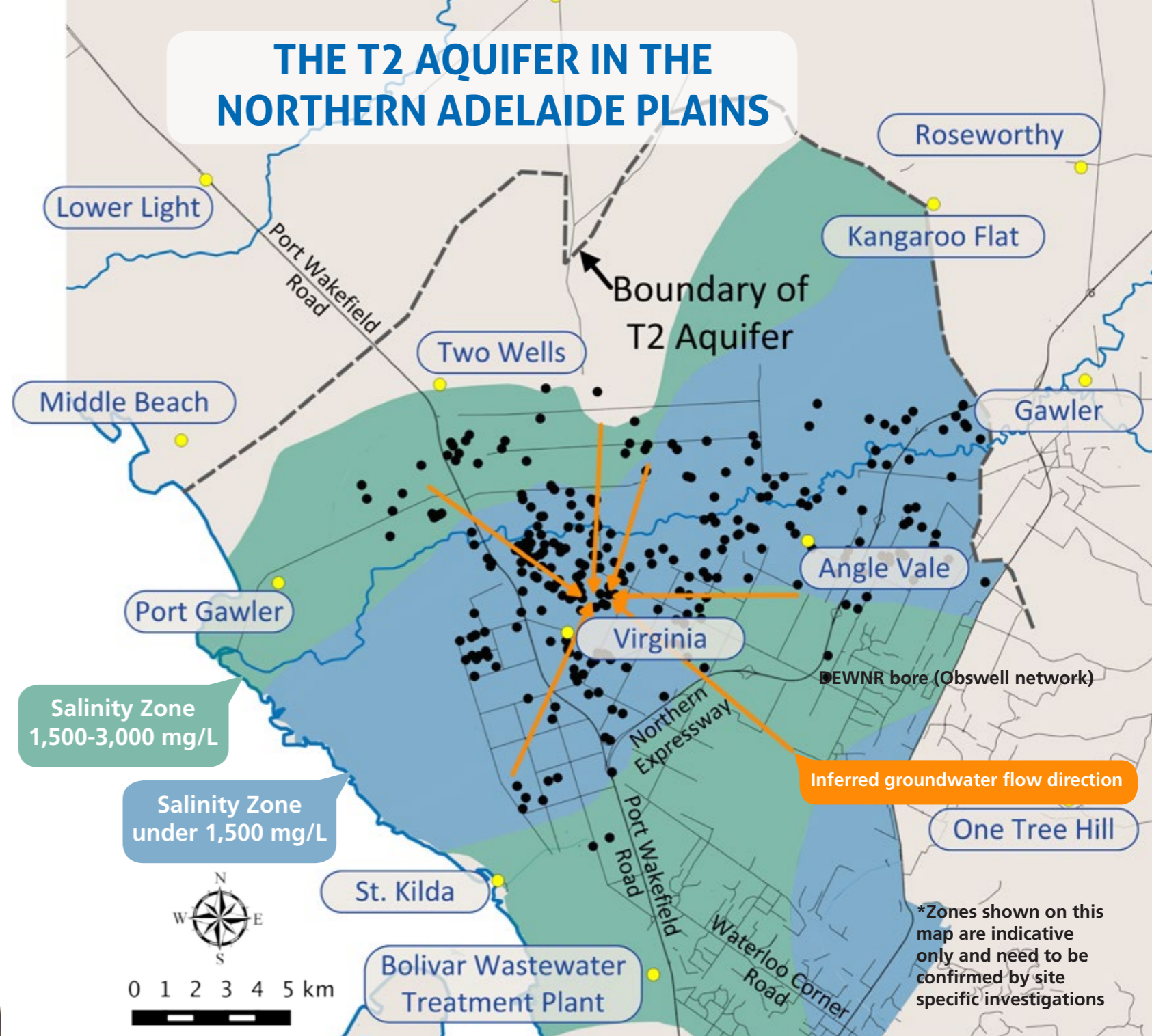
Storages proposed in areas that may impact on groundwater that is used for domestic purposes are unlikely to gain approval.

The map opposite shows general salinity trends in the T2 aquifer. This can be used as a guide to identify areas for further investigation.

WHAT IS IMPORTANT TO THE COMMUNITY?

- SUSTAINABLE GROUNDWATER SUPPLIES
- MAINTAINING AQUIFER HEALTH
- WATER QUALITY AFTER EXTRACTION

THE T2 AQUIFER IN THE NORTHERN ADELAIDE PLAINS



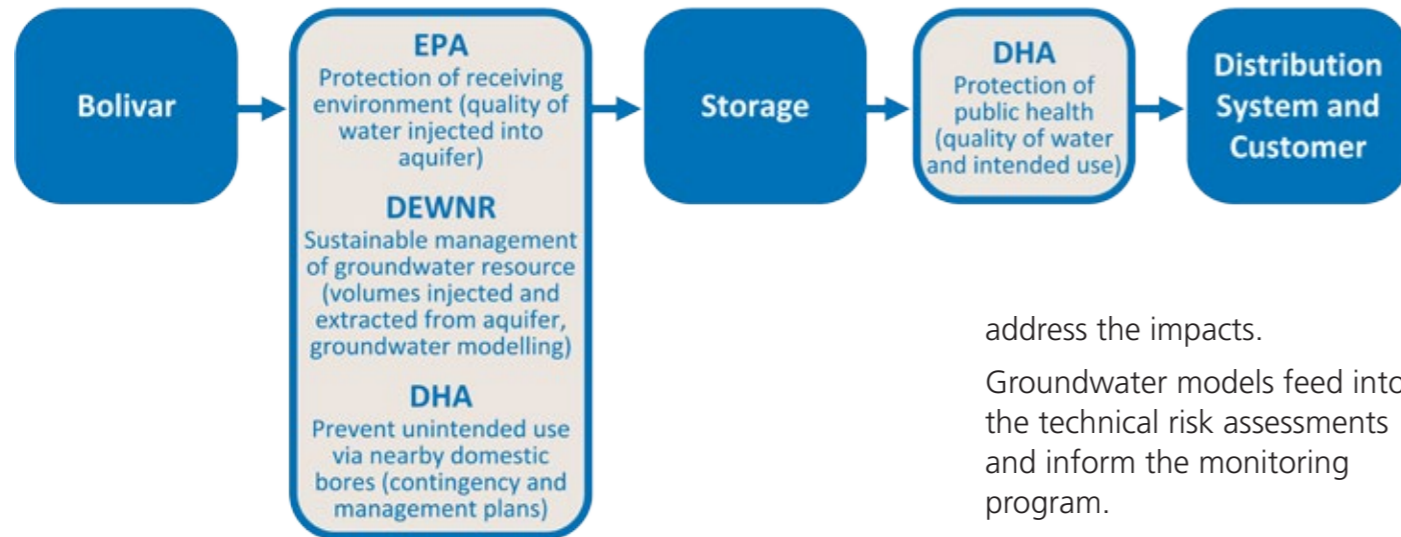
THE FOLLOWING CONDITIONS WILL BE CONTRACTUALLY BINDING FOR ALL NAIS PROPONENTS THAT ARE INVESTIGATING ASR STORAGE IN AREAS WITH GROUNDWATER SALINITY THAT IS BELOW 1,500 mg/L TDS. THIS IS IN ADDITION TO REGULATORY AND LEGISLATIVE OBLIGATIONS.

- Groundwater used for domestic purposes must not be adversely affected; monitoring and contingency needs to be put in place to ensure long term sustainability of drinking water supplies.
- Localised site investigations must find out whether recycled water could reach bores used for domestic purposes, the time it would take (in years) and the expected changes to water quality.
- During the site selection process, mitigation measures and monitoring must be agreed with bore owners that are within the "water quality impact zone" (see page 13) if modelling shows that they would experience changes in water quality that would not comply with the *Australian Drinking Water Guidelines (2011)*. These bore owners have the **power of veto**, which means that proposed storages will not proceed without their endorsement.
- Independent peer review of groundwater models that assess the impact on existing bores.

BELOW-GROUND STORAGE

THE DYNAMICS AND STRUCTURE OF THE LOCAL AQUIFER NEED TO BE WELL UNDERSTOOD FOR ANY MAR SCHEME

Regulatory interest and control for below-ground storage



THERE ARE COMPULSORY OBLIGATIONS THAT ARE REQUIRED TO GAIN APPROVAL FOR A RECYCLED WATER MAR SCHEME REGARDLESS OF THE AQUIFER SALINITY IN AN AREA.

These are in place to protect public health and the sustainability of the aquifer, which includes ongoing monitoring to protect the quality of groundwater and structure of the aquifer and clay barriers.

Test bores need to be constructed and pump testing carried out. This involves

extracting groundwater and measuring flow and pressure in multiple locations (which may involve using existing bores). It enables a model of the characteristics and structure of the aquifer in the local area to be developed. It is important to define the direction and speed of groundwater flows and possible pressure or water quality impacts on nearby users.

Changes in aquifer pressure during the operation of a ASR scheme may raise or lower water levels in nearby bores. Affected bore owners will be identified through groundwater modelling and consulted to

address the impacts.

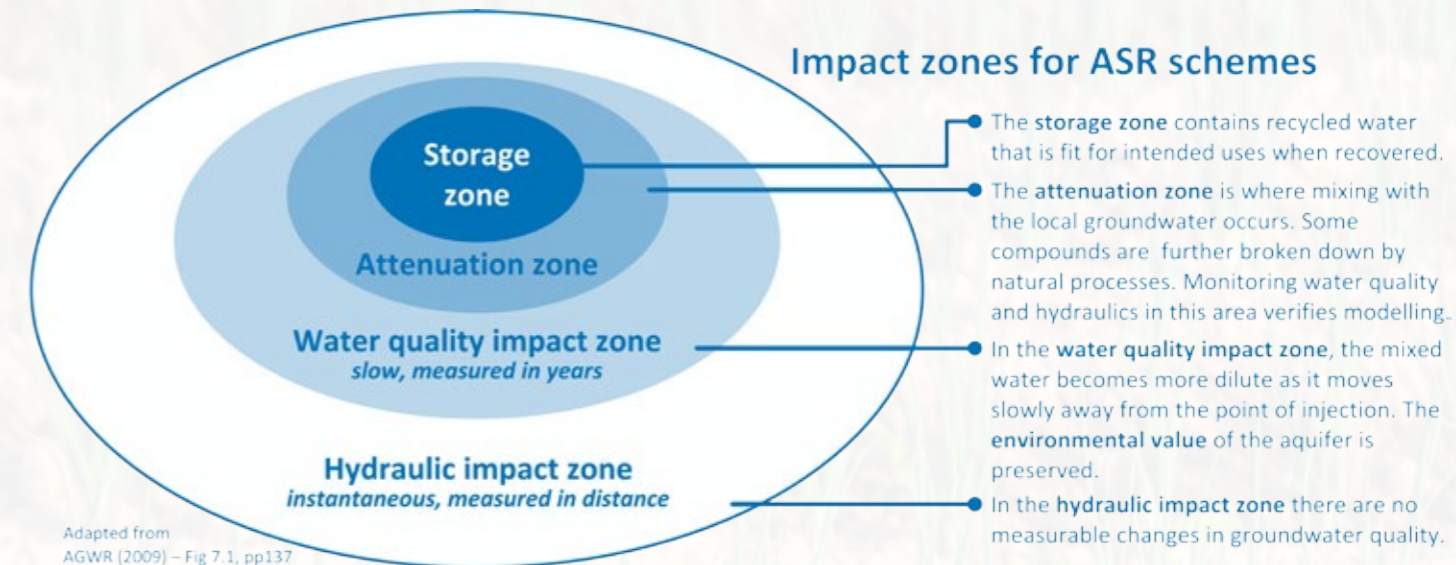
Groundwater models feed into the technical risk assessments and inform the monitoring program.

Monitoring and contingency plans must be in place to protect public safety and the aquifer, this includes testing water before injection to protect the environmental value of the aquifer.

A qualified hydrogeologist must:

- supervise any drilling
- undertake pump testing and analysis of results
- prepare and use groundwater models

Groundwater modelling will be independently peer reviewed, verified with monitoring data during operation and revised if necessary. Results will be made publicly available through the consultation process.



Adapted from AGWR (2009) – Fig 7.1, pp137

Note:

Distances and time are dependent on aquifer characteristics and ASR operation, which are determined from pump testing and modelling, then verified by ongoing monitoring.

Desktop studies use existing data to calculate approximate zones of hydraulic and water quality impact. These will be used to identify bore and land owners that need to be involved in site specific consultation. Once drilling and pump tests have been carried out, approximate zones are refined and validated by groundwater modelling.

ABOVE-GROUND STORAGE

Above-ground storages are common and there is extensive industry experience in constructing, operating and managing them. Storing 12 GL would require a large number of tanks, lagoons or one very large lagoon. 12 GL of above-ground storage is the equivalent of 4,800 olympic size swimming pools.

Regulatory interest and control for above-ground storage



The EPA has published *Guidelines for Wastewater Lagoon Construction (2014)*. Basic lagoon construction can make use of local materials if the local soil is suitable. Synthetic liners and leak detection systems may be required depending on assessment by the EPA.

The shallow groundwater table in the Northern Adelaide Plains limits the depth that lagoons can be safely constructed. This may lead to dam walls being prominent features in the landscape.

Large areas of land are needed for above-ground storages. The impact on current and future land uses need to be considered during site selection. Planned development and agricultural production areas will influence where storages are located.

Storages may need to be covered to limit the effect of evaporation, algae and insect pests on water quality. Uncovered storages need to manage the impacts on water quality as well as potential nuisances to residents in the local area. These include odour, amenity and insect pests, such as midge flies.

WHAT IS IMPORTANT TO THE COMMUNITY?

- ALGAE AND PEST INSECT LARVAE DON'T NEGATIVELY IMPACT WATER QUALITY AND DAMAGE IRRIGATION EQUIPMENT
- PESTS ARE CONTROLLED TO PROTECT NEARBY RESIDENTS
- PRIME AGRICULTURAL LAND IS PRESERVED
- IMPACT OF STORAGES ON VISUAL AMENITY AND NEARBY LAND VALUE

SA Water recycled water storage lagoon at Aldinga, it stores 0.8 GL, is 13 metres deep and covers 7 hectares.

ABOVE-GROUND STORAGE

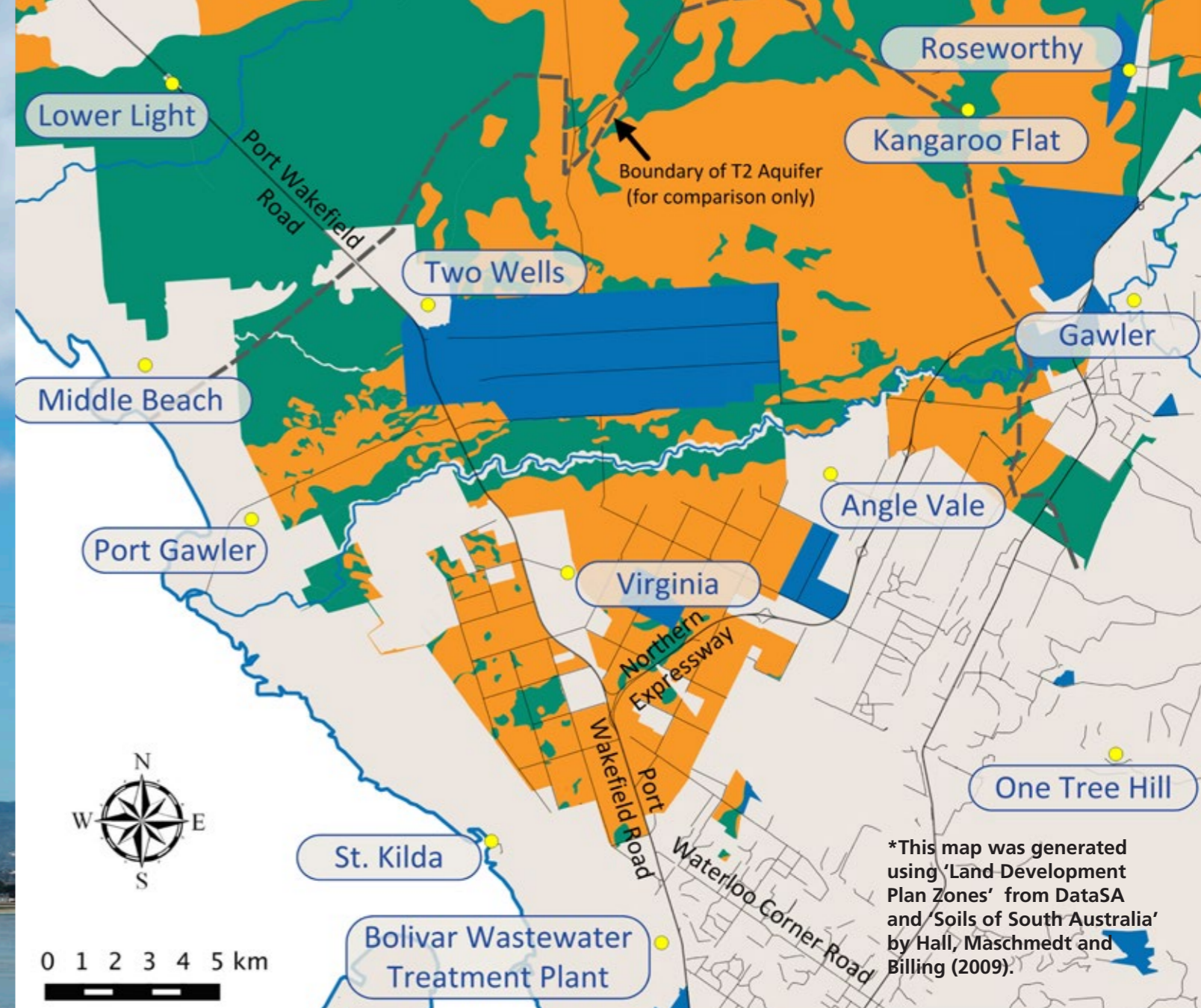
POTENTIAL AREAS FOR ABOVE-GROUND STORAGE

Semi-agriculturally used soils
Areas worth investigating

Agriculturally used soils
Areas worth investigating but the trade off with soil resources in Northern Adelaide Plains needs to be considered

Rural Living Zones
Less likely to pursue these areas due to higher land cost, smaller parcels and proximity to houses

N/A
Above-ground storage unlikely to be permitted or unfavourable soils (e.g. urban, deferred urban, environment protection areas, saline soils, subsurface stone, etc.)



WHEN A SITE FOR LAGOON STORAGE IS PROPOSED, THE FOLLOWING GUIDELINES MUST BE CONSIDERED.

- Geotechnical investigations are required to find out the depth of the shallow groundwater table and soil structure.
- Development approval considerations include appropriate zoning, susceptibility to flooding, potential impacts on surface water flows in the area, safety measures for large dam walls (over 5m), control of public access and impacts on cultural heritage sites and native vegetation.
- The land must not be contaminated from any previous use; it is essential that both desktop studies and soil sampling are undertaken.
- Any lagoon storage must minimise leakage and have compliant leak detection systems with a regular monitoring program to satisfy EPA requirements.
- Constructing storages on prime agricultural land must be avoided wherever possible.
- Uncovered lagoon storages must have an effective strategy to manage pest issues and minimise the impacts to the public.
- Results of odour modelling will be shared with affected residents.
- Lagoons should not be located where they significantly detract from the surrounding aesthetic environment.

SUPPORTING SOUTH AUSTRALIAN GROWTH

The original VPS infrastructure was underpinned by government funding that allowed the recycled water to be priced without the need to recover the initial cost of the assets. SA Water and the Government of South Australia continue to subsidise the cost of recycled water that is provided through the VPS.

WE ARE MINDFUL OF ENSURING THE PRICE OF NAIS WATER REMAINS AFFORDABLE FOR THE END USER AND WE ARE PURSUING STATE AND COMMONWEALTH FUNDING TO SUPPORT THE SCHEME. THIS NEEDS TO BE UNDERPINNED BY COST EFFECTIVE STORAGE AND INFRASTRUCTURE SOLUTIONS.

A number of industry associations are focused on finding new markets and increasing opportunities for their growers. The Government of South Australia is committed to supporting the existing food and wine industry by providing opportunities to increase productivity and efficiency, while increasing market access and development. South Australia has a strong focus on the export of premium food and wine, this is critical for the State's economic growth and job creation.

WHAT IS IMPORTANT TO THE COMMUNITY?

- AFFORDABILITY OF RECYCLED WATER
- MAINTAINING THE VIABILITY OF EXISTING GROWERS
- GOVERNMENT SUPPORT TO DEVELOP AND REACH EXPORT MARKETS

WHAT IS IMPORTANT TO THE COMMUNITY?

- RECYCLED WATER IS FIT FOR PURPOSE AFTER STORAGE
- IMPROVED WATER QUALITY FOR IRRIGATION

THE ABILITY OF NAIS TO STIMULATE ECONOMIC GROWTH IS HEAVILY RELIANT ON WHAT GROWERS CAN PRODUCE WITH THE QUALITY OF WATER PROVIDED.

NAIS proponents must have monitoring in place to ensure that quality of recycled water is fit for purpose and safe after it is stored.

Results of regular water quality testing (after storage) will be made available to the public to improve transparency.

Water quality monitoring is likely to include salinity, organics and metals, as well as public health risks, such as pathogens and relevant persistent chemical compounds.

NAIS proponents should seek cost-effective opportunities through storage and treatment that improve the quality of water available to irrigators.

SUMMARY

The Northern Adelaide Irrigation Scheme may incorporate a combination of both storage types and there are advantages and disadvantages for each.

Impacts and considerations for storage options	Above-ground	Below-ground
Evaporation	High	None
Algae	High	None
Midges and mosquitos	High	None
Water quality required before storage	Low	High
Odours	Possible	None
Regulatory approvals	Low	High
Land required (approximate, for 12 GL)	more than 300 ha	less than 4 ha (40 bore sites)
Cost for construction (excluding land purchase)	High	Low
Ongoing operational cost	Low	High

These guidelines highlight additional criteria to address community concerns when planning recycled water storage in the Northern Adelaide Plains. The successful proponent from the NAIS selection process will be contractually bound to follow these guidelines, along with all regulatory guidelines for recycled water set by the Department of Health, EPA and DEWNR.

SA Water is committed to acting in the best interest of our customers and the community. The sustainability of groundwater supplies and public health must be safeguarded; the Northern Adelaide Plains community has made it clear that this needs to be supported by ongoing community engagement.

WE WILL WORK TOWARDS STORAGE SOLUTIONS FOR NAIS THAT ARE SUPPORTED BY THE COMMUNITY IN ORDER TO BOOST THE GROWTH OF SOUTH AUSTRALIA AND DELIVER ECONOMIC PROSPERITY FOR THE REGION.



Guidelines referred to in this document are:

- Australian Guidelines for Water Recycling
 - Managing Health and Environmental Risks - Phase 1
 - Managed Aquifer Recharge - Phase 2Available on the Department of Environment website:
<http://www.environment.gov.au/water/publications>
- South Australian Recycled Water Guidelines
Available on the SA Health website:
<http://www.sahealth.sa.gov.au/wps/wcm/connect/Public+Content/SA+Health+Internet/Protecting+public+health/Water+quality/Recycled+water/Recycled+water>
- Wastewater Lagoon Construction
Available on the EPA website:
http://www.epa.sa.gov.au/files/4771372_guide_lagoon.pdf

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