Charles Sturt University

Revision 1.0

Infrastructure Design Standards

Module S14: Irrigation

Division of Finance (Strategic Infrastructure)
Charles Sturt University

Document Control

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1. Introduction

1.1. Overview

The Charles Sturt University Infrastructure Design Standards (the Standards) outline the University's expectations for its built forms to achieve consistency in the quality of the design and construction of those built forms.

The Standards have been developed to provide guidance to the design team and to assist Facilities Management to drive a consistent approach to the design, construction, commissioning, handover, and operation of new capital projects to ensure the new asset is fully integrated into campus life and conforms to the University's standards and policies.

The successful integration of any new project into the day-to-day operation of campus life cannot be underestimated and is vital to ensuring the new asset provides a fully functional platform for Facilities Management clients and the University. The Standards will ensure Facilities Management is successful in supporting the University's strategic objectives now and into the future. The pitfall of viewing any new project as a standalone entity must be avoided as any new project is an extension of the existing campus.

The Standards are aligned with Charles Sturt's requisites for aesthetic appeal, life cycle maintenance and environmental sustainability, while ensuring that there is sufficient scope for innovation and technological advancements to be explored within each project.

1.2. The University

The history of Charles Sturt University dates to 1895, with the establishment of the Bathurst Experiment Farm. Formed progressively through the merge of regional institutions in south-western and western NSW, Charles Sturt was formally incorporated on 19 July 1989 under the Charles Sturt University Act 1989. As one of Australia's newer universities, Charles Sturt has been built on a tradition of excellence in teaching and research spanning more than 100 years.

With over 40,000 current students studying both on-campus and online, Charles Sturt University is the largest tertiary education institution in regional Australia. The University operates six main campuses across New South Wales in Albury-Wodonga, Bathurst, Dubbo, Orange, Port Macquarie, and Wagga Wagga, alongside specialist campuses in Canberra, Parramatta, and Goulburn. Charles Sturt University is structured around three Faculties: Arts and Education; Business, Justice and Behavioural Sciences; and Science and Health.

1.3. University Vision and Values

Charles Sturt University is committed to building skills and knowledge in its regions by offering choice and flexibility to students, while collaborating closely with industries and communities in teaching, research, and engagement. As a significant regional export industry, the University brings both strength and learning back to

its regions, positioning itself as a market-oriented institution. Its goals are to remain the dominant provider of higher education in its regions and a sector leader in flexible learning.

Charles Sturt University believes that wisdom has the power to transform communities. With perseverance and dedication, the University contributes to shaping resilient and sustainable regions for the future. Acknowledging the deep culture and insight of First Nations Australians, the University's ethos is encapsulated by the Wiradjuri phrase *yindyamarra winhanganha,* which translates to "the wisdom of respectfully knowing how to live well in a world worth living in." Through its values, Charles Sturt University fosters a welcoming community and learning environment that supports innovation, drives societal advancement, and gives back to the regions it serves.

1.4. Using the Infrastructure Design Standards

The Infrastructure Design Standards are written to advise Charles Sturt University performance requirements and expectations that exist above and beyond existing industry codes and standards.

The Infrastructure Design Standards do not repeat codes and standards.

Performance to Codes and Standards are a non-negotiable regulatory minimum of any design solution, to be determined for each project by the design team.

The Standards are to be used by all parties who are engaged in the planning, design, and construction of Charles Sturt's facilities. This includes external consultants and contractors, Charles Sturt's planners, designers, and project managers as well as faculty and office staff who may be involved in the planning, design, maintenance, or refurbishment of facilities. All projects must comply with all relevant Australian Standards, NCC, EEO as well as Local Government and Crown Land Legislation.

1.5. Modules

The Standards are divided into the following modules for ease of use, but must be considered in its entirety, regardless of specific discipline or responsibilities:

- S01 Overview and Universal Requirements
- S02 Active Transport
- S03 Acoustics
- S04 Building Management System
- S05 Electrical and Lighting
- S06 Energy Management
- S07 Ergonomics
- S08 Fire and Safety Systems
- S09 Floor and Window Coverings
- S10 Furniture
- S11 Heritage and Culture
- S12 Hydraulic

- S13 Information Technology
- **S14 Irrigation**
- S15 Mechanical Services
- S16 Roof Access
- S17 Termite Protection, Vermin Proofing and Pest Management
- S18 Security Systems
- S19 Signage
- S20 Sustainable Building Guidelines
- S21 Waste Management
- S22 Project Digital Asset and Data Requirements
- S23 Commissioning, Handover and Training

1.6. Related Documents

1.6.1. University Documents

The Standards are to be read in conjunction with the following relevant University documents, including but not limited to:

- Facilities and Premises Policy along with supporting procedures and guidelines
- Charles Sturt University Accessibility Action Plan 2020 - 2023
- Relevant operational and maintenance manuals
- Charles Sturt University Asbestos Management Plan
- Charles Sturt University Signage Guidelines
- Charles Sturt University Modern Slavery Statement
- Charles Sturt University Sustainability Statement
- Charles Sturt University Work Health and Safety Policy
- Charles Sturt University Risk Management Policy
- Charles Sturt University Resilience Policy
- Charles Sturt University Health, Safety and Wellbeing Policy

1.6.2. Federal Legislation

The planning, design and construction of each Charles Sturt University facility must fully comply with current relevant Federal legislation, including but not limited to:

- National Construction Code (NCC)
- Disability Discrimination Act 1992 (DDA)
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC)
- Work Health and Safety Act 2011

1.6.3. NSW State Legislation

The planning, design and construction of each Charles Sturt University facility must fully comply with current relevant Federal legislation, including but not limited to:

- Work Health and Safety Act 2011
- Environmental Planning and Assessment Act 1979 (EP&A Act)
- Building and Development Certifiers Act 2018
- Heritage Act 1977
- Protection of the Environment Operations Act 1997 (POEO Act)
- Design and Building Practitioners Act 2020
- State Environmental Planning Policies (SEPPs)
- Local Government Act 1993

1.6.4. Federal Regulations and Standards

- Relevant Australian or Australian/New Zealand Standards (AS/NZS)
- Safe Work Australia Model Codes of Practice
- Work Health and Safety Regulations 2011
- Disability (Access to Premises – Buildings) Standards 2010
- National Environment Protection Measures (NEPMs)

1.6.5. NSW State Regulations and Standards

- SafeWork NSW Codes of Practice
- Disability (Access to Premises – Buildings) Standards 2010
- Building and Development Certifiers Regulation 2020
- NSW Work Health and Safety Regulation 2017
- Protection of the Environment Operations (General) Regulation 2022
- NSW State Environmental Planning Policies (SEPPs)
- Fire and Rescue NSW Fire Safety Guidelines
- NSW Local Council Development Control Plans (DCPs)

1.6.6. Manufacturer Specifications and Data Sheets

All installation must be carried out in accordance with manufacturer specifications and data sheets to ensure product performance over its intended life and so as not to invalidate any warranties.

1.6.7. Project-Specific Documents

Requirements specific to a particular project, campus, or other variable, will be covered by project specific documentation, such as client briefs, specifications, and drawings. These Standards will supplement any such

project specific documentation. The Standards do not take precedence over any contract document, although they will typically be cross-referenced in such documentation.

Extracts from the Standards may be incorporated in specifications; however, it must remain the consultant's and contractor's responsibility to fully investigate the needs of the University and produce designs and documents that are entirely 'fit for purpose' and which meet the 'intent' of the project brief.

1.7. Discrepancies

The Standards outline the University's generic requirements above and beyond the above-mentioned legislation. Where the Standards outline a higher standard than within the relevant legislation, the Standards will take precedence. If any discrepancies are found between any relevant legislation, the Standards and project specific documentation, these discrepancies should be highlighted in writing to the Manager, Capital Works.

1.8. Departures

The intent of the Standards is to achieve consistency in the quality of the design and construction of the University's built forms. However, consultants and contractors are expected to propose 'best practice / state of the art' construction techniques, and introduce technological changes that support pragmatic, innovative design. In recognition of this, any departures from relevant legislation, or the Standards, if allowed, must be confirmed in writing by the Manager, Capital Works. Any departures made without such written confirmation shall be rectified at no cost to the University.

1.9. Professional Services

All projects at Charles Sturt University require the involvement of adequately skilled and experienced professionals to interpret and implement the Standards. Consultants or contractors lacking proper qualifications and licenses are not permitted to conduct any work.

1.10. Structure of Document

This document is structured into 4 sections:

Section 1 Introduction (this Section).

Section 2 General Requirements – outlines the general requirements or design philosophies adopted at Charles Sturt University.

Section 3 Supporting Documentation – Legislation, Standards, Codes of Practice, University Policies, and other applicable technical references.

Section 4 Specifications (if applicable) – materials specifications and/or preferred lists for materials, processes or equipment used by Charles Sturt University.

2. General Requirements

2.1. Irrigation Water Supply

Irrigation systems must prioritise sustainability and water efficiency. The primary source of irrigation water will be groundwater pumped directly from bores to the irrigation system or non-potable sources such as water harvesting and dam storage along with water obtained through existing licence agreements. Where alternative water sources such as treated wastewater or potable water are necessary, these sources must be used only with prior approval from the Manager, Sustainability at Charles Sturt University.

All irrigation systems that utilise non-potable water sources, such as recycled or treated wastewater, must comply with state health department regulations and be clearly marked with lilac-colored pipes in accordance with Australian standards. The use of potable water for irrigation will only be approved when no other sustainable water source is available.

Flow tests must be conducted before the installation of any new system or component, particularly for areas using bore water or potable mains. Flow and pressure tests should be carried out in line with Australian industry standards to ensure that systems meet required performance metrics.

2.2. Irrigation Pipework

All irrigation pipework must adhere to Australian standards for PVC and polyethylene (PE) piping systems. For mainlines, the use of unplasticized polyvinyl chloride (uPVC) pipes with a minimum Class 12 pressure rating is mandatory, with rubber ring joints used for pipes of 80mm or larger. Lateral pipework must be Class 9 PVC, with solvent weld joints used for smaller pipes. The maximum allowable pipe velocity is 1.5m/s for mainlines and 2.0m/s for lateral lines.

To ensure durability and ease of maintenance, all fittings and joints for PVC pipes must be solvent-welded or rubber-sealed, with all components adhering to Australian Standard AS 1477:2017 for PVC pressure applications. HDPE (High-Density Polyethylene) pipes may be used in special cases with approval and must comply with AS/NZS 4130:2018 requirements for pressure applications.

2.3. Irrigation Equipment

Sprinkler systems must be designed for maximum water efficiency and uniformity of distribution. Sprinkler layouts must be planned to use an equilateral triangular pattern for large turf areas to ensure even coverage. The minimum distribution uniformity (DU) for sprinklers with a spacing of 8m or greater is 75%, ensuring efficient water use. For areas requiring different levels of irrigation (hydrozones), sprinklers must be grouped according to plant type (e.g., turf, garden, trees) to allow for separate scheduling. Full-circle sprinklers must be separated from part-circle sprinklers, with zones designed to avoid over-spraying onto hard surfaces or buildings.

Sprinklers must be fitted with check valves to prevent water wastage through drainage and must be installed on rigid articulated risers, ensuring that they are protected from damage and set at the correct height (300mm

from paved surfaces and 500mm from buildings). For lawn areas, a 100mm pop-up height is required, while garden areas need a 150mm pop-up height. Drip irrigation systems are not preferred but may be approved on a project-by-project basis. In such cases, drip emitters must have a minimum emission uniformity (EU) of 90% and flow variation (FV) of less than 20%.

2.4. Large Scale Irrigation

For large-scale irrigation systems such as those used on sports ovals and other high-demand areas, the use of high-capacity irrigation pumps is critical to ensuring reliable water delivery and coverage. These systems must be designed to provide adequate flow and pressure to meet the needs of extensive turf areas while minimising energy use and water waste.

The pump selection and design must be based on the specific requirements of the site, including the size of the area, water source, soil types, and the types of grass or plants being irrigated. Pumps used in these systems must be durable, energy-efficient, and compliant with relevant Australian standards.

The pump capacity should be calculated based on the peak demand during the warmest months (January) and must allow for a system flow rate sufficient to irrigate the entire area within the shortest possible irrigation window. For sports ovals, this typically means providing a flow rate of up to 100L/sec or more, depending on the field size and type of turf.

To maintain even water distribution across sports ovals, pumps must provide consistent pressure throughout the irrigation system. The required pressure will depend on the type of sprinklers used, but typical operating pressures for large rotors or gear-driven sprinklers are in the range of 200 to 450 kPa. The pump system must be capable of maintaining this pressure at all points within the irrigation network, even at the farthest distances from the pump station. A pressure-regulated valve should be installed to prevent over-pressurisation of sprinklers, which can cause misting and inefficient water use.

The installation of irrigation pumps must be completed by qualified contractors with experience in large-scale irrigation systems. Pumps must be housed in weather-protected pump stations that allow easy access for maintenance. The installation must comply with relevant Australian Standards and manufacturer specifications.

2.5. Site Requirements

Before commencing any excavation for irrigation installations, thorough site marking, and trench layout inspections must be conducted to avoid conflicts with existing services. Trench construction for mainlines must provide at least 500mm of cover over the pipes, with 450mm of cover over lateral pipes in turf areas and 300mm in non-turf areas. Road crossings must be executed via under-road boring where feasible, with pipe sleeves set at a depth of 600mm.

Trenches must be kept free of sharp objects and debris that could damage the pipes, and bedding material should be used where soil conditions require additional support. Backfilling must be done with appropriate material, and compaction is mandatory to prevent future subsidence. Trenches will be inspected and tested to ensure compliance with compaction requirements.

2.6. Testing, Commissioning, and Maintenance

Upon completion of installation, the irrigation system must undergo testing and commissioning, including flow tests, pressure checks, and verification of system operation at all sprinkler and valve points. Practical completion cannot be granted until all components are satisfactorily tested, and training on system operation has been provided to the local Facilities Management Operations team.

All new irrigation installations must include a detailed "As-Constructed" drawing, showing the layout of the irrigation system, including the location and depth of all pipes, valves, and sprinklers. All major control elements of the installation must be tagged with a GPS location with a preference for the entire installation to be provided in a geo-rectified CAD plan. A defects liability period (DLP) of one year is required for all workmanship and materials, with additional warranties of five years for gear drive sprinklers.

Where pumps have been installed, during the defects liability period (DLP), the contractor must return to the site to adjust pump settings, check system performance, and address any issues that may arise. Final pump system testing should include a full pressure and flow performance test, with results recorded and provided as part of the "As-Constructed" documentation.

2.7. Irrigation Controllers

Irrigation control systems must utilise advanced, multi-zone controllers that allow for precise management of different hydrozones. Each controller should be equipped with weather-based adjustments or smart irrigation technologies to optimise water usage based on real-time environmental conditions. Controllers for new systems must be capable of operating solenoid valves and providing adjustments based on each campuses' unique requirements for landscaping, turf, and gardens.

Any new controllers must be installed with the capacity for future expansion to handle additional zones or sensors if required. Standalone controllers should be equipped with remote communication capabilities to ensure efficient system management. All new installations will be programmed to meet peak irrigation needs, with settings that can be adjusted as required during different seasons. At the time of practical completion, a full operational guide for programming and maintenance will be provided to the Facilities Management Operational team, along with training.

3. Supporting Documentation

These below lists are not all-inclusive and those associated with the project are responsible for identifying and complying with all standards relevant to the scope of works.

3.1. Supporting Legislation

Work Health and Safety Act 2011 (NSW)

Work Health and Safety Regulation 2017 (NSW)

Work Health and Safety Act 2011(ACT)

Work Health and Safety Regulation 2011(ACT)

Water Act 1912 (NSW)

Plumbing and Drainage Act 2011 (NSW)

NSW Local Government Local Environmental Plans (LEP)

3.2. Supporting Standards

Standard Number	Standard Title
AS 1345:1995	Identification of the contents of pipes, conduits and ducts
AS/NZS 1477:2017	PVC pipes and fittings for pressure applications
AS/NZS 1546.1:2008	On-site domestic wastewater treatment units, Part 1: Septic tanks
AS/NZS 1546.2:2008	On-site domestic wastewater treatment units, Part 2: Waterless composting toilets
AS/NZS 1546.3:2008	On-site domestic wastewater treatment units, Part 3: Aerated wastewater treatment systems
AS 1546.4:2016	On-site domestic wastewater treatment units, Part 4: Domestic greywater treatment systems
AS 1646:2007	Elastomeric seals for waterworks purposes
AS/NZS 2845.1:2022	Water supply - Backflow prevention devices, Part 1: Materials, design and performance requirements
AS/NZS 3500.1:2021	Plumbing and drainage, Part 1: Water services
AS/NZS 3500.2:2021	Plumbing and drainage, Part 2: Sanitary plumbing and drainage
AS/NZS 3500.3:2021	Plumbing and drainage, Part 3: Stormwater drainage
AS/NZS 3500.4:2021	Plumbing and drainage, Part 4: Heated water services
AS/NZS 4130:2018	Polyethylene (PE) pipes for pressure applications

3.3. Industry Codes of Practice

Plumbing Code of Australia (PCA)

https://ncc.abcb.gov.au/editions/ncc-2022/adopted/volume-three/5-new-south-wales

3.4. University Documents

LiFE Framework: Water - Best Practice

https://www.csu.edu.au/sustainability/life-framework/facilities-and-operations/water

3.5. Other Resources

Energy Australia Natural gas safety

https://www.energyaustralia.com.au/home/electricity-and-gas/energy-saving-and-safety/natural-gas-safety

Master Plumbers Code of Ethics

https://plumber.com.au/code-of-ethics/

Plumbing Code of Australia (PCA) Resources

https://ncc.abcb.gov.au/sites/default/files/resources/2022/PCA-Resources-booklet.pdf

NSW Fair Trading Regional plumbing and drainage inspections

https://www.fairtrading.nsw.gov.au/trades-and-businesses/construction-and-trade-essentials/plumbers-and-drainers/regional-plumbing-and-drainage-inspections