COMMUNITY BORE
Guide

Information for implementing community bore schemes in residential developments in Western Australia.

Preface

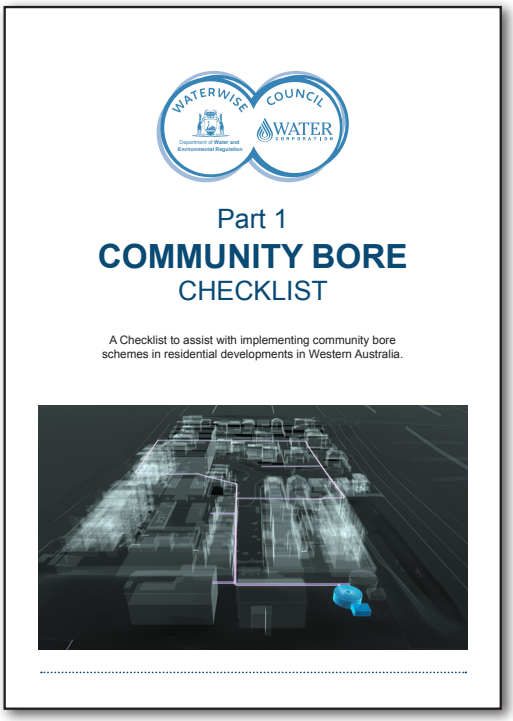
Community bores can provide a centralised, well-managed, fit-for-purpose alternative water supply for both public and private irrigation, if implemented in an appropriate site with available groundwater, and as part of a suite of integrated urban water management options and water efficiency measures.

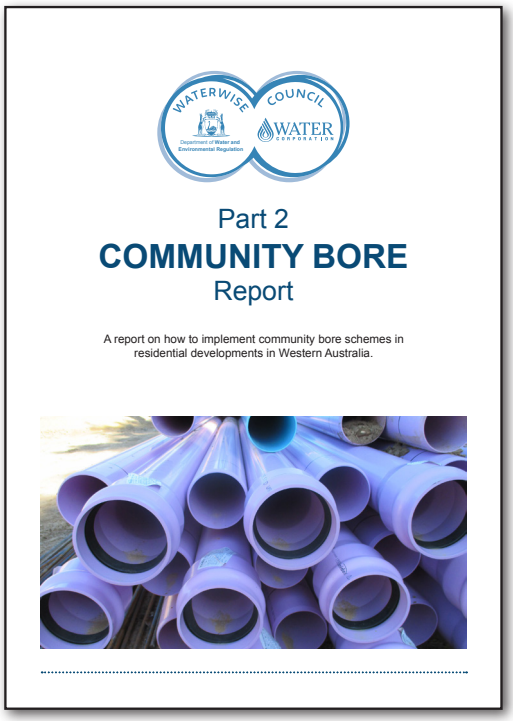
This Guide has been developed by Josh Byrne & Associates (JBA) to provide information for developers, local governments or other service providers on the planning, technical, operational and governance aspects of community bores. This information is to ensure that community bores are designed, implemented and managed to suit site specific conditions and prevent overuse of Perth's precious groundwater.

This Guide consists of two parts:

Part 1: A Community Bore Checklist. This is a succinct summary document that provides an introduction to community bores and a suggested four stage process to assist in site specific implementation. These stages include: planning, design, installation and operation. The Checklist can be used as a stand-alone document or read in conjunction with the detailed Part 2: Community Bore Report, as each component of the four stages directly corresponds to sections and headings in the report. The Community Bore Checklist can be distributed to practitioners and stakeholders involved in implementation.

Part 2: Community Bore Report. The report contains additional detail on the suggested four stage process, as well as a 'Concept to Operation' flowchart, a developer to service provider handover procedure, insights into stakeholder experiences from previous community bore implementation and Appendices examples to support the process of implementation.





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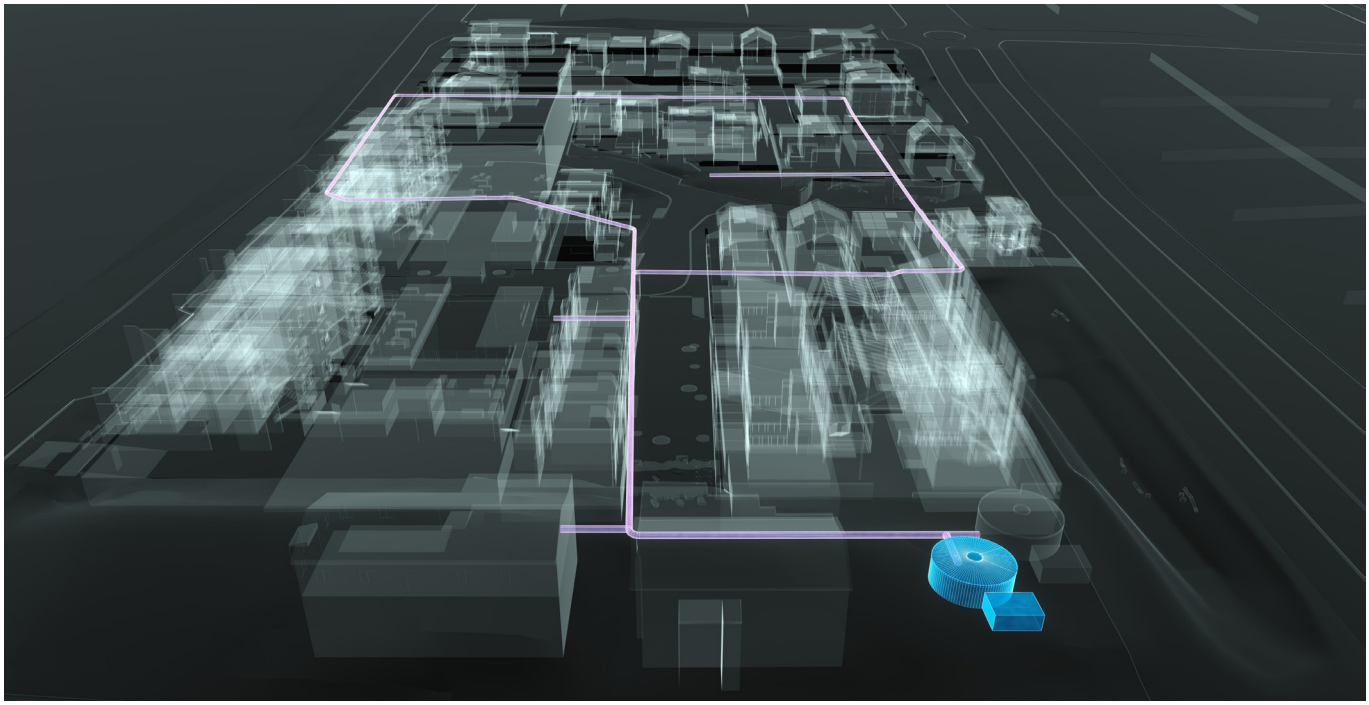
Images, graphics and designs provided by LandCorp, Water Corporation, JBA and Total Eden.

Part 1

COMMUNITY BORE CHECKLIST

A checklist to assist with implementing community bore schemes in residential developments in Western Australia.



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Introduction

As the population of Perth grows and our climate dries, it is becoming more important than ever that we manage urban water resources efficiently.

We need to think carefully about how we use water in our homes, buildings and suburbs so we can sustain green space in private and public areas.

This is what makes Perth so liveable.

It is no longer sufficient to view solutions to water scarcity in isolation. A holistic approach integrates water sensitive urban design (WSUD) with water efficient technologies, diverse water sources and water efficient behaviours.

Most of Perth's scheme water is used in our homes and more than 40% of this is used to water our gardens (Water Corporation, 2018). One of the ways to reduce this reliance on scheme water is the option to use alternative localised non-potable water sources, such as recycled water; and groundwater abstraction for community bores, provided there is enough groundwater available and water efficiency measures are adopted.

These alternate water sources can be implemented in a sustainable manner as part of an integrated and balanced water management strategy.

Previous experience shows that the implementation of a community bore can be a complex process that requires the involvement of numerous stakeholders and consideration of various planning, technical and operational requirements.

When read in conjunction with the Community Bore Report, this resource should assist with the implementation of non-drinking groundwater schemes in residential developments and help ensure community bores are well planned, designed and operated.

Groundwater Bores

Bores are used to abstract groundwater for irrigation.

Bores have long been used in Perth as alternative water sources. There are around 177,000 private bores in the Perth-Peel metropolitan region (DWER, 2018), typically drawing from the superficial aquifer for garden irrigation, with many of these unlicensed and unregulated.

Groundwater is also used by many local governments to irrigate public open space (POS) and it is the major source of irrigation supply for local government areas on the Swan Coastal Plain. While groundwater provides an alternative to scheme water, it also needs to be used efficiently, meaning that water abstraction can not exceed infiltration, usually provided by rainfall.

A community bore is a “bore or multiple bores supplying groundwater via a reticulated network to a number of properties in urban developments for non-drinking uses including private garden watering and/or for irrigation of communal green spaces within the development” (DWER, 2018). The water is delivered via a third pipe (or purple pipe) network and is closely monitored to ensure optimal delivery.

Before a community bore can be implemented, there needs to be an understanding of the amount of groundwater available, whether the draw on this supply is sustainable in the long term and whether there will be enough stormwater infiltration back into the system to create a healthy localised water balance.

A community bore needs to be implemented as part of a holistic approach to water management, and in conjunction with appropriate waterwise landscape design, efficient irrigation systems and metering.

Benefits of implementing community bores as part of Integrated Urban Water Management (IUWM)

- Potential to provide a well-managed, fit-for-purpose alternative water supply.
- Maintain or increase urban greening and improve local amenity.
- Maximised water efficiency if implemented with individual metering, efficient irrigation systems and water efficient landscape design.

Process

Stakeholders

There are a variety of stakeholders involved in the implementation of a community bore and each has their own responsibilities and role to play during the life of the project.

No single stakeholder should be seen as being responsible for the project, all parties need to work together towards a common goal - the successful delivery and operation of a community bore.

Stakeholders

Proponent/Developer
Overall concept for development and suitability of a community bore.

Residents
Understand community bore operation and management. Implementation of design guidelines for water efficient behaviour.

Irrigation Specialists
Install bore, pumps, irrigation network and meters.

Project Engineers
Design and implement a third pipe system.

Manager: Local Government, Developer or Water Service Provider
Commitment to a community bore scheme and terms of agreement for operation and maintenance.

State Government
Department of Water and Environmental Regulation, Department of Health: confirmation of groundwater, operating license, relevant approvals.

Urban & Landscape Design
Site design, location of bore and concept for delivery of a community bore (e.g. design of POS).

Stages

To ensure that the necessary planning, design, installation, operation and governance components of community bores are addressed, it is suggested that the process is broken into stages.

Simplifying the process will help facilitate successful implementation of a community bore and support the journey towards creating liveable, productive, sustainable and happy local communities.

On the following pages checklists have been provided for each of the four stages. Further information can be found on each of the stages in the comprehensive Community Bore Report.

1. Planning

2. Designing

3. Installing & Commissioning

4. Operating & Maintaining

Planning

Implementing a community bore may present challenges, particularly given the number of stakeholders, each with their own roles and responsibilities.

Planning is therefore a crucial first step to achieving a successful community bore. The first part of the planning process is to determine whether there is an available supply of groundwater.

The purpose of having a community bore, for example to achieve greater site wide water efficiency, needs to be clearly defined and articulated to all stakeholders to ensure a consistent message.

Understanding the site water requirements and availability is an important part of the planning process and necessary to ensure the correct bore water installation and abstraction licenses are provided.
It is also helpful here to consider the cost of water, the preferred cost recovery mechanism and who will ultimately own and operate the community bore.

The following checklist will ensure the appropriate planning procedures are addressed to ensure a smoother community bore implementation journey.

Planning Stakeholders

Planning Checklist

☐ ***Groundwater availability***
Seek confirmation of available water supply from Department of Water and Environmental Regulation (DWER), and determine whether the area is suitable for abstraction.

☐ ***Community bore stakeholder working group***
Establish a community bore stakeholder working group (with chair) to ensure all necessary stakeholders are included in the process from the very beginning and documentation protocols put in place.

☐ ***Community bore concept & proposed site design***
Determine the purpose for implementing a community bore and confirm the composition of the development such as no. of lots, mix of housing typologies, public open space (POS) size and landscape design.

☐ ***Commitment from a community bore service provider/manager***
Discuss the proposed scheme with local government representatives to ascertain their position and seek their support and approval.
(Approval should be documented, not just a verbal agreement.)

☐ ***Hydro geological considerations***
Complete analysis of the current and projected water demand to ensure a holistic understanding of the site-specific system.

☐ ***Water balance***
Understand water requirements for POS, private residential & environmental management. Engage project engineers for specific irrigation demands.

☐ ***Approvals required***
Gain appropriate approvals to install & operate a bore:
- DWER: License to install bore and license to abstract water.
- License to operate bore*.
- Department of Health (DoH): Adhere to DOH public health requirements.

☐ ***Operating & ownership principles***
Identify all key stakeholders and ensure all parties adhere to the terms of agreement with clearly defined roles and responsibilities.

☐ ***Cost recovery mechanisms***
Detailed cost estimates and cost benefit analysis to understand all capital and ongoing costs.

☐ ***Local water strategies***
Ensure that proposed community bore scheme aligns with existing local government water, environment and climate change agendas and requirements (e.g. landscape design, water efficient irrigation).

☐ ***Risk assessment***
Undertake a detailed risk assessment to minimise any unintended risks.

* Exemption may be granted if the scheme is not contrary to public interest

Designing

A community bore needs to be designed to fit the projected water requirements for the site.

The developer needs to mandate connection to the community bore to ensure the scheme is effective. It is important here to ensure that future residents will be provided with Design Guidelines that specify landscape and irrigation recommendations, ensuring the design of individual lots is water efficient and compatible with the community bore.

The design stage is where the specific technical requirements of the community bore system are determined, and where opportunities to integrate with broader water sensitive urban design principles are explored.

The following checklist will assist in making sure all design components are included.

Designing Stakeholders

Designing Checklist

☐ ***Site requirements and master planning***
Incorporate the community bore into the site masterplan and ensure it is designed to meet the site irrigation requirements.

Ensure allocated space for community bore facilities.

☐ ***Site design guidelines***
Create site design guidelines to ensure residents are informed of the site specifications and include community bore information as well as recommendations for landscape design and irrigation systems.

☐ ***Integrated water management***
Incorporate a variety of WSUD and water efficiency elements to ensure the community bore is operating as part of an integrated approach to water management.

☐ ***Technical design***
Identify the specific technical requirements such as size and type of tanks, pumps and pipes.

Installing and Commissioning

Installing the bore is a priority for the site operations.

All technical components previously identified in the planning and design stages now need to be installed by qualified professionals. These professionals may have already been identified at the commencement of the project when all project stakeholders were considered.

Those involved with the installation stage may not be involved during the community bore operation. Therefore it is recommended that all products used and installation procedures undertaken are clearly documented to assist with any future handover.

Installing and Commissioning Stakeholders

Installing and Commissioning Checklist

☐ ***Installation of civil infrastructure***
Qualified professionals to undertake and document required site works to ensure appropriate and effective installation of civil infrastructure.

☐ ***Installation of bore, pumps and POS irrigation infrastructure***
Qualified professionals to install bore, pumps, storage tank, filters, irrigation controllers, distribution network of pipes and meters to ensure appropriate and effective installation of irrigation infrastructure. Lot irrigation systems also need to be determined. Refer to the Australian Drilling Industry Association (www.adia.com.au) and Irrigation Australia (www.irrigationaustralia.com.au) to ensure qualified professionals are used.

Operating and Maintaining

A community bore can be managed by a developer, local government or water service provider.

Identifying who will operate and manage the bore during the planning phase ensures a clear understanding of roles and responsibilities. Handover from those involved in previous stages to those in charge of operating and maintaining the community bore needs to take place here and any manuals and maintenance procedures passed on.

The preferred billing procedures are now to be implemented. This will need to be reviewed annually to ensure the billing accurately reflects the water consumption data collected by the meters.

During the ongoing life of the community bore, each stakeholder will continue to have varying roles and responsibilities. For example; residents need to ensure they are using water efficiently and the bore operator needs to ensure a safe and effective community bore water supply is being delivered and maintained.

Key operating and maintenance considerations are detailed in the checklist.

Operating and Maintaining Stakeholders

Operating and Maintaining Checklist

☐ ***Maintenance procedures***
Conduct water quality, water supply pressure and flow testing.
Develop protocols for effective handover to ensure appropriate maintenance of community bore for effectiveness and longevity.

☐ ***Metering***
Metering procedures to be clearly communicated and understood by both the operator, local council and residents to capture data on use and cost.

☐ ***Billing of consumers***
Billing system to be determined at the planning stage. SAR or alternative model decided & implemented.

Residents informed of system.

☐ ***Roles and responsibilities (Operation & management)***
To ensure a safe and effective community bore is installed and in operation:

- Inspection, servicing, meter reading, data logging and reporting.
- Ongoing resident support.

☐ ***Ongoing monitoring and assessment***
Monitoring of consumption, health risks, reliability of supply, operational performance, environmental objectives and compliance with all licensing conditions.

☐ ***System failure responses***
A method for responding to system failure needs to be developed and communicated with residents.

End of Checklist

Department of **Water and Environmental Regulation**

Part 2
COMMUNITY BORE
Report

A report on how to implement community bore schemes in residential developments in Western Australia.

PROJECT NO. 1710

This document has been prepared by Josh Byrne & Associates and may only be used for the purpose for which it was commissioned in accordance with the Terms of Engagement.

INTERNAL REVIEW PROCESS

Date Of Issue	Rev #	Purpose Of Review	Author	Reviewed By	Approved By
30/10/2017	0	Author	MM	SD/JB/MG	MG
2/11/2017	0	Design	MM	DH	JB
20/11/2017	1	Content review	MM	MG	JB
4/12/2017	2	Design review	MM	DH/JB	JB
27/3/2018	3	Post stakeholder input review	MM	DH/JB	JB
6/4/2018	4	Document finalisation review	MM	DH/JB	JB

CLIENT REVIEW & APPROVAL

Date Of Issue	Purpose Of Review	Author	Reviewed By	Approved By
2/11/2017	Client Review - Rev 0	MM/SD/JB	JB	JB
4/12/2017	Updated Draft - Rev 1 Circulated to stakeholders	MM/SD/JB	MM/JB	JB
20/02/2018	Stakeholder review meeting with DWER/WC - Rev 2	MM/SD/JB	MM/JB	JB
28/03/2018	Rev 3 - Sent to DWER for review	MM/SD/JB	MM/JB/DH	JB
6/4/2018	Rev 4 - Project Delivery to client	MM/SD/JB	MM/JB/DH	-

Executive Summary

A community bore is a "bore or multiple bores supplying groundwater via a reticulated network to a number of properties in urban developments for non-drinking uses including private garden watering and/or for irrigation of communal green spaces within the development" (DWER, 2018).

The groundwater used in a community bore scheme is a non-drinking water supply and therefore requires its own pipe network, separate from scheme water. As Perth is currently experiencing urban growth and a changing climate, namely reduced rainfall, community bores can offer an alternative fit-for-purpose non-drinking water source, provided there is enough groundwater available and water efficiency measures are adopted. A community bore offers an opportunity for improved water management as compared to the use of multiple unregulated backyard bores, particularly with the use of individual metering, and implementation and monitoring of usage targets. When implemented alongside water efficient landscape design and effective irrigation systems, a community bore can maximise water efficiency and assist with urban greening in new developments to benefit community wellbeing and ecosystem functioning.

The implementation of community bore schemes may present some new challenges, particularly for those ultimately in charge of operation, monitoring, maintenance, and enforcing compliance with consumption limits/targets. This Report has been developed by Josh Byrne & Associates (JBA) to provide information on the planning, technical, operational and governance aspects of community bores to facilitate successful implementation, as part of an integrated water management system. JBA's involvement in establishing a community bore at LandCorp's WGV precinct in White Gum Valley, located in the City of Fremantle, has provided valuable insight and experience that can be shared. The information in this report is intended for those interested in implementing or managing a community bore, such as developers, local governments and water service providers. As well as WGV, other case study examples are referred to throughout this report to provide on-ground examples and learnings, including Evermore Heights, City of Rockingham; and The Green at Brighton, City of Wanneroo.

This Report includes:

- An introduction to water management challenges and opportunities for community bores in Perth.
- A 'Concept to Operation' process flowchart to provide an overview of implementation stages.
- Explanation of all aspects of community bore implementation: planning, design, installation and commissioning, and operating/maintenance.
- Developer to service provider handover procedure.
- Insights into stakeholder experiences: requirements for success and governance arrangements.
- Appendix 1: Example of Water Licence
- Appendix 2: WGV Community Bore Reticulation Design.
- Appendix 3: A sample fact sheet for residents (as developed for residents of WGV).

While community bores may provide an alternate water source for irrigation, it is important that they are implemented in areas with an adequate groundwater supply and as part of a suite of integrated urban water management options and water efficiency measures.

Perth's groundwater supply is in decline and ongoing use needs to be carefully planned and monitored to ensure long term supply for both environmental needs and human wellbeing.

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1 Introduction

The establishment of community bores can provide a centralised, well-managed, fit-for-purpose alternative water supply for both public and private irrigation, if implemented in an appropriate site with available groundwater, and as part of a suite of alternative supply and water efficiency options.

A community bore is a "bore or multiple bores supplying groundwater via a reticulated network to a number of properties in urban developments for non-drinking uses including private garden watering and/or for irrigation of communal green spaces within the development" (DWER, 2018). As a community bore scheme provides a non-drinking water supply, it requires its own pipe network for delivery, often referred to as a 'third-pipe' or 'purple-pipe' network, with the use of purple pipes to clearly alert people that the water is not fit for consumption.

The implementation of a community bore can be a complex process that requires the involvement of numerous stakeholders and consideration of various planning, technical, operational and governance requirements. This Guide has been developed by Josh Byrne & Associates (JBA) to provide both technical guidance as well as suggestions on how to navigate the process of implementation to equip managers and users with the necessary information to facilitate successful implementation; without placing additional pressure on Perth's groundwater sources and unique aquifer system. It is intended for those interested in implementing or managing a community bore, at an appropriate site, such as developers, local governments and water service providers.

There have been a number of examples of community bore schemes implemented across Perth, with varying degrees of success. Case study examples are referred to throughout this report to provide on-ground learnings around key areas of community bore implementation.

These include:

- WGV, City of Fremantle. WGV is a 2.3ha mixed residential infill development and showcases precinct-scale design excellence by incorporating a diverse range of building types, climate sensitive considerations, creative urban greening and leading edge water management strategies. A 60-70% reduction in scheme water consumption is proposed via Integrated Urban Water Management (IUWM) initiatives (see Box 1), including a community bore, and the efficient use of water (LandCorp, 2016). The overall site philosophy is underpinned by strong sustainability principles and One Planet Living (OPL) framework was selected to guide the design process and provide an independent assessment of results (www.bioregional.com/oneplanetliving/). WGV is also one of LandCorp's 'Innovation by Demonstration' sites with many of the key sustainability initiatives promoted to enhance knowledge sharing amongst industry, government and the public.
- Evermore Heights, City of Rockingham, is a 374 lot estate co-developed by Satterley Property Group Pty Ltd and LandCorp. The community bore was conceptualised in 2008 as a trial and ceased operation in 2016 due to a number of unresolved challenges regarding governance, cost of the scheme, and water efficiency measures (Evermore Heights New Water Ways fact sheet; Water Corporation, 2017a).
- The Green at Brighton, located in the City of Wanneroo, has a third pipe scheme to deliver water to approximately 1150 properties and 10 public open spaces to irrigate gardens via five centrally controlled community bores (The Green at Brighton New Water Ways fact sheet; Water Corporation, 2017b). The groundwater supply scheme was a combined initiative of Satterley, the Water Corporation and the City of Wanneroo and has been operating as a trial since 2006. Challenges in institutional roles and responsibilities and consumer expectations have been identified (Dhakal, 2012) with the Water Corporation recently taking over from Satterley as the scheme owner and operator and individual metering expected to commence next year.

1.1 Current Water Management Challenges in Australia and Perth

Many urban areas of Australia strive to create more productive, liveable, sustainable and resilient cities. As part of this, a model of Integrated Urban Water Management (IUWM) is preferred to protect against water stresses and accommodate population growth, economic growth and environmental balance. IUWM aims to reduce the strain on centralised sources with alternative sources such as rainwater harvesting; stormwater harvesting; groundwater abstraction and treatment; greywater collection and treatment; and wastewater collection and treatment (Byrne 2016; Sharma et al. 2012). These options have considerable benefit in promoting a natural water cycle, local source diversification, resource efficiency and providing decentralised solutions, and require additional financial considerations, engineering and technological complexity, and an informed and consenting public (Marlow, Moglia, Cook, & Beale 2013)

Increasingly in Australia, urban developments are incorporating IUWM with Water Sensitive Urban Design (WSUD) at a range of development scales such as greenfield, infill and retrofit (Sharma et al. 2012). WSUD is the approach to deliver IUWM and is the integration of urban planning with the management, protection and conservation of the urban water cycle whilst ensuring sensitivity to hydrological and ecological processes, as well as social and cultural values, and managing risks to human life (Furlong, Gan and de Silva 2016; New Water Ways, 2017). This broad framework also includes increased landscape aesthetic and amenity which can add to the distinct character, identity and sustainability of an area (Centre for Water Sensitive Cities, 2011; Lehmann, 2010) and assist in managing public health, urban micro climates and heat mitigation (Johnstone et al. 2012). For WSUD initiatives and IUWM to be a success, attention must be given to the planning, design and operation of such initiatives and appropriate guidelines developed to inform future schemes. A number of studies have also emphasised the importance of community engagement with WSUD initiatives and the need for agreement between communities, governments and businesses on how water should be managed, often termed the 'hydro-social contract' (Brown, Keath and Wong, 2008).

Perth stakeholders have expressed a desire to become a more water sensitive city, with traditional approaches to water management no longer sufficient to meet competing demands (Rogers, Hammer, Werbeloff, and Chesterfield, 2015). The South West of Australia is experiencing a significant drying trend with reduced rainfall, particularly between May and July and a reduction in the number of cold fronts (BOM and CSIRO, 2016). The majority of Perth's scheme water supply is sourced from groundwater, with a small amount of surface water, and given the impacts of climate change, both of these sources are set to decline in the future. Whilst the uptake of desalination may supplement some of Perth's scheme water supply in a drying climate (Water Corporation, 2017c), it is an energy intensive source of water. Changes are needed to overhaul the centralised infrastructure and poor waterway health; and to ensure resilience to the impacts of climate change with solutions that are viable in the long term (Rogers et al., 2015). The Water Corporation (2017d) states that over 40% of water use in Perth is on gardens, therefore indicating a need to change behaviours and focus on using sources other than drinking water.

Alongside a changing climate, Perth is also experiencing urban growth, where it is estimated that by 2050 the Perth and Peel regions, stretching along the Swan Coastal Plain, will be home to 3.5 million people. The draft suite of strategic land use planning frameworks, *Perth and Peel@3.5million* (DoP, 2018) aim to provide guidance on how to accommodate the proposed population growth. A key component of planning for Perth is to ensure sustainable, efficient and innovative water supply systems, that reduce demand on both scheme and groundwater supplies. DWER are currently developing a specific water supply planning strategy as part of this: 'Perth Peel Water @ 3.5 million'.

Groundwater is a commonly used source of water for irrigation in Perth, with an estimated 177,000 private bores in the Perth-Peel metropolitan region (DWER, 2018). Many private bores used to irrigate domestic gardens are unlicensed and unregulated. Groundwater use via licensed bores is the major source of irrigation supply for local government parks and gardens on the Swan Coastal Plain. Whilst groundwater provides an alternative to scheme water, it also needs to be used efficiently and sustainably as it is a precious resource that plays an important role in the natural environment. Therefore, it is recommended that community bores are only implemented in areas with an available allocation and use is accompanied by efficient irrigation systems, waterwise plantings, adherence to watering schedules and winter sprinkler bans.

1.2 Benefits of Installing a Community Bore

Benefits from installing a community bore may include:

- Potential to provide a well-managed, fit-for-purpose alternative water supply for both public and private irrigation.
- Maintain or increase urban greening and improve local amenity.
- Reduced reliance on scheme water consumption and deferred capital expenditure on centralised infrastructure.
- Maximised water efficiency for developments if metering is in place, consumption limits are enforced and if implemented alongside WSUD principles.
- Maximised water efficiency at the household scale if implemented alongside water efficient landscape design and effective irrigation systems. Provision of information to residents from local council or via development 'Design Guidelines' can assist with this.
- Installation of a third pipe system/'purple-pipe' infrastructure can be used for climate independent recycled water should there be insufficient groundwater supplies in the future.

Box 1. Building on Existing Best Practice: WGV by LandCorp

WGV is a 2.2ha mixed residential infill development located in the City of Fremantle and is the first Western Australian residential project to achieve national recognition for One Planet Living. Key to this is the implementation of WSUD and water efficiency measures which together are aiming to achieve a 60-70% reduction in scheme water consumption. (LandCorp, 2016).

The efficient use of water is the primary foundation upon which all other IUWM initiatives at WGV build. In addition to a community bore, other key initiatives include water-wise irrigation systems, integrated stormwater management (with 100% infiltration on site), rainwater harvesting systems for internal use, water efficient fixtures/appliances, real time monitoring and low water use landscaping. The suite of initiatives were selected at the structure planning phase and derived after consideration of a broad range of possible options at both lot and precinct scales that took into account factors such as cost, biophysical suitability, sustainability, social acceptability, ease of implementation, maintenance considerations, water savings, and economies of scale, as part of a high-level business case.

A site water balance was undertaken and using recent annual rainfall statistics from the Bureau of Meteorology, the quantity of water to fall on the site in an average year was calculated to be 16,112kL. The recommended recharge factor for residential sites in Perth of 0.5 was applied to account for evaporation, plant root use and water held in soil (DoW, 2009). After an assumed volume of 840kL was deducted for rainwater intercepted by rainwater tanks, a positive net recharge to the local aquifer of 2,216kL per annum is anticipated after the annual demand of 5,000kL from the community bore is met. This is a positive desired outcome for the area given the previous irrigation demand for the former school site was estimated between 15,000-20,000kL/yr. Infiltration of stormwater has been achieved through a combination of drainage cells, flush kerbs, ephemeral winter wet depressions, damp-land native plants, micro swales and vegetated basins.

Design Guidelines for the development require residential dwellings to be installed with dual-plumbing and to include waterwise plant selections and landscaping techniques to reduce irrigation requirements.

The performance of the various water-based initiatives will be critically assessed via real-time data capture, data analysis and reporting, with performance findings to be shared with industry, local government and the community.

1.3 Where Does this Guide Apply?

Perth has a unique location on the Swan Coastal Plain underlain by two principal groundwater systems, Gnangara and Jandakot, which have been in decline for the last 40 years due to a combination of declining rainfall, increasing groundwater abstraction, and expanding pine plantations (DWER, 2017). Ongoing use of Perth's groundwater needs to be carefully monitored as it is a shared resource and plays an important role in providing environmental benefits and supporting the natural ecosystem, as well as providing an alternative source for irrigation. Population growth, an increased demand for resources and the ongoing impacts of climate change provide a further imperative to ensure groundwater use is carefully planned and monitored.

While the implementation of community bores can provide an efficient, well-managed, and fit-for-purpose alternative water supply for both public and private irrigation, there are limited circumstances in which a community bore would be considered suitable. Community bore schemes will not be approved in areas that are fully allocated or in areas deemed unsuitable on the Perth Groundwater Map (available on the DWER website: www.dwer.wa.gov.au) – Areas suitable for garden bores (layer). Thus, community bores must be designed and implemented to suit site specific conditions. This Report, specifically Section 3 Planning, provides advice on how to determine whether a community bore is an appropriate option. In some instances, non-drinking groundwater can be used inside the house for toilet flushing and clothes washing, however this requires more complex governance arrangements and approvals, and is beyond the scope of this report.

It is important that community bores are not implemented in isolation and instead are incorporated into a well-planned integrated water supply system, existing alongside a number of water supply options, including recycled water schemes; and accompanied by guidance on appropriate water use behaviour and water efficient irrigation and landscape design.

2 Concept to Operation

The implementation of a community bore can be a complex process that requires the involvement of numerous stakeholders and consideration of various planning, technical and operational requirements.

This Report has been developed to ensure community bores are planned, designed and operate well; without placing additional pressure on Perth's groundwater sources and unique aquifer system. Based on feedback from previous experiences, it is recommended that a number of stages are followed, each with specific requirements, to ensure the successful implementation of a community bore. A summary of these stages is provided here in the implementation Process Flowchart, with additional detail on how to effectively address each stage provided in the corresponding sections of the report.

The community bore implementation Process Flowchart includes stages of planning, design, installation and commissioning, and operating and maintenance. Key to the overall success is planning and therefore this stage consists of a number of requirements that need to be sequentially addressed.

Each stage of the implementation process involves specific stakeholder roles and responsibilities, including:

- Proponent (developer): overall concept for the development, including rationale for community bore and identification of, and agreement by, the proposed service provider.
- Management of the community bore scheme by local government, developer, water service provider or private supplier: commitment to a community bore scheme and terms of agreement for operation, maintenance and cost recovery.
- Relevant state departments such as Department of Water and Environmental Regulation (DWER) and Department of Health (DoH): confirmation of groundwater, operating licence, relevant approvals.
- Urban design and landscape design team: site design, location of bore and concept for delivery of community bore (e.g. design of POS).
- Project civil engineers: design plan for third pipe system.
- Irrigation designers: design of water source and pump infrastructure.
- Irrigation specialists: Install bore, pumps, irrigation network and meters.
- Residents: adherence to design guidelines, ongoing engagement with community bore manager about operation of community bore. Even when future residents are unknown there needs to be consideration of the service agreement and handover of information.

Planning Check List

- Confirmation of available groundwater
- Stakeholder working group
- Concept and proposed site design
- Commitment from manager (local government, developer or water service provider)
- Hydro-geological conditions
- Water Balance
- Approvals required (DWER, DoH)
- Operating and ownership principles and framework
- Cost recovery mechanisms
- Local water strategies
- Risk Assessment

Designing Checklist

- Site requirements and master planning
- Site Design Guidelines
- Integrated water management
- Technical design

Installing & Commissioning Checklist

- Installation of civil infrastructure
- Installation of bore, pumps and POS infrastructure

Operating & Maintaining Checklist

- Maintenance procedures
- Metering
- Billing of consumers
- Roles and responsibilities
- Ongoing monitoring and assessment and compliance to all licencing conditions
- System failure responses

3 Planning for a Community Bore

The first step in planning for a community bore is to seek advice from DWER to "determine whether the area or proposed development is suitable for a community bore system and if a groundwater allocation is potentially available" (DWER, 2018).

Adequate planning for a community bore is important for successful implementation and the establishment of a stakeholder working group can assist with this. One of the next steps, after confirming an appropriate supply of groundwater, is ensuring commitment from the ultimate owner, operator and manager of the scheme which could be a developer, local government, or a water service provider. Planning must also consider the site-specific requirements. Each project is unique and needs to consider:

- Existing water availability and demand.
- Level of service required: water quality and supply pressure.
- Governance and operating arrangements (e.g. roles/responsibilities of service provider, operator, maintenance team, government departments, contractors, residents and others).
- Upfront and ongoing costs.
- End user behaviour (resident consumption).

Early attention to planning will enable progression through the stages and assist in the successful implementation of a community bore. In addition, consideration of these requirements will establish the necessary relationships between stakeholders, which must remain ongoing throughout the life of the project.

Key to the planning stage, and all subsequent stages, is that appropriate advice from government departments (such as DWER and DoH) and other experts is made available and can be accessed when needed.

The following section details the planning considerations for those proposing to implement a community bore.

3.1 Confirmation of Available Groundwater

The first requirement is confirmation from DWER that groundwater is available and the proposed area is suitable for abstraction. If there is no available source of groundwater or the allocation is already taken then it will not be possible to implement a community bore.

DWER will advise on the appropriate contact to provide groundwater allocation data for your area. For more information refer to: www.dwer.wa.gov.au/one-stop-shop

3.2 Community Bore Stakeholder Working Group

It is recommended that a stakeholder working group is established upfront to ensure all necessary stakeholders are included in the implementation process from the very beginning. The stakeholder working group could meet quarterly to discuss the project and process, and information from the meetings should be documented and distributed. Ideally, the working group would have a chair that is either a project champion or someone involved in the design of the community bore, such as a landscape architect or a project engineer. This process would help to negate any issues with staff turnover.

3.3 Community Bore Concept and Proposed Site Design

The community bore concept may emerge if a developer is seeking measures to reduce overall scheme water use and groundwater abstraction via alternative water management options and water efficiency measures for a site. The purpose of having a community bore needs to be clearly defined from the beginning. The proposed size and composition of the development will then be required to determine the estimated water requirements. Therefore the planned number of lots, the mix of housing typologies (single/multi residential), POS size and type, and landscape design will all need to be considered prior to the approval process (as detailed in Section 3.7). It is recommended that the Guideline for the approval of non-drinking water systems in Western Australia: Urban developments (DoW, 2013) be referred to provide information about general considerations and specific approval requirements for establishing a non-drinking water system in an urban development.

3.4 Commitment from a Community Bore Service Provider/Manager

If sufficient groundwater is available and the water is of suitable quality then commitment from an appropriate community bore manager is required. This can be a developer, local government or water service provider and needs to be identified at the planning stage as they will have responsibility throughout the life of the asset and will be dealing with multiple customers. If the community bore scheme is to be managed by the developer, then it is preferred that there is involvement or assistance from local government (pers comm. DWER, 2017).

If local government agrees to be the ultimate owner and operator of the scheme then a developer needs to present a proposal to council for endorsement. Box 2 below details an example of the local government commitment at WGV. This commitment should be formally documented and it is a necessary requirement for the progression of later stages. As part of this commitment, local government needs to consider how it will provide support to residents during the operational phase and make sure the necessary resources will be available. A method for responding to system failure should also be discussed early on as part of ensuring local government is aware of its future roles and responsibilities. Further, local government will need to consider how it goes about operating a community bore alongside its own requirements for POS irrigation.

Box 2. Local Government Commitment in WGV

On 17/12/2014 the City of Fremantle council unanimously voted for the proposed use of a community bore at the WGV site to service POS and private residence gardens. Potential issues such as maintenance, billing and monitoring were noted but overall the concept was favoured due to its alignment with resource efficiency strategies.

The following excerpt taken from the minutes states

“The Council:

- Endorses the in-principle concept of the use of a common community bore for public open space and private residence / verge water usage at the Kim Beazley development site on the basis of full cost recovery for all operational, monitoring and replacement costs related to the private component of the scheme through a specified area rate.
- Supports the inclusion of a potential option for hand-over of responsibility for and running of the currently proposed scheme to a viable co-operative or similar body after establishment of the community and costs involved with the scheme within the community bore preliminary arrangements document.”

3.5 Hydro-geological Conditions

A holistic understanding is required to assess the potential impact of the community bore on groundwater dependent ecosystems (wetlands) subject to local groundwater movement. The development will have initiated the requirement for a Local Water Management Strategy (LWMS) or Urban Water Management Plan (UWMP) as part of the normal planning process. These documents will have addressed many of the pertinent groundwater and hydro-geological conditions of the site.

An assessment of water quality is also initially required to determine nutrient levels, possible contaminants, salts/iron, and aesthetics. If there is an existing bore/s on the site then there needs to be an understanding of its condition, location, existing licence and allocation, and current use. If there is no existing bore at the site then nearby bores can be sampled to determine likely water quality.

3.6 Water Balance

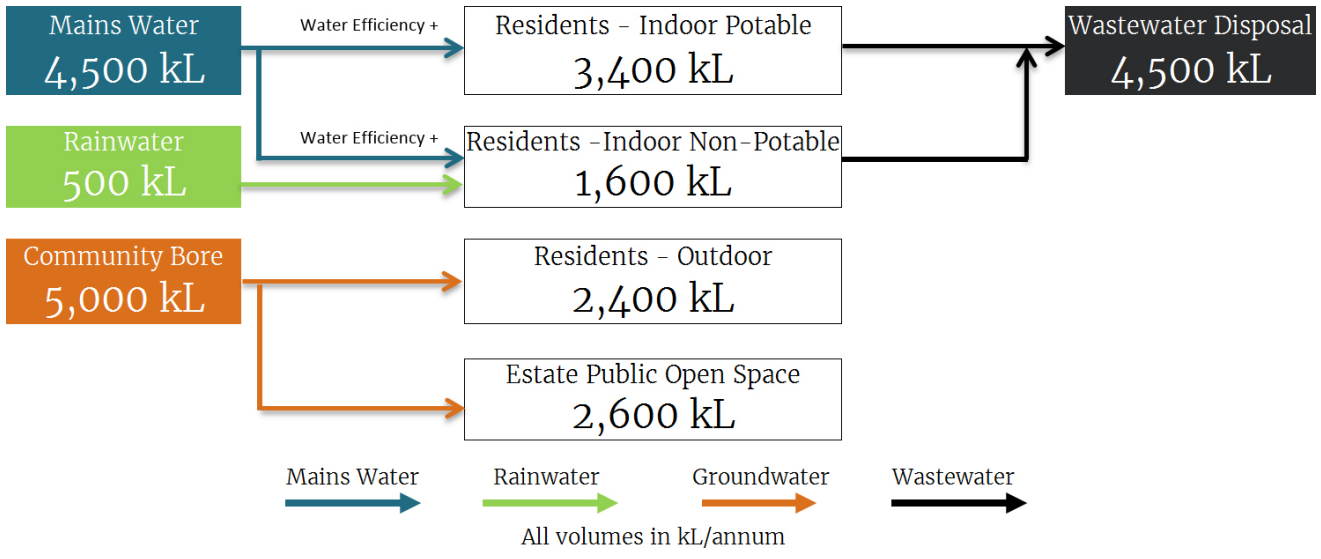
A detailed analysis of the current and projected water demand is required to ensure the bore is a sustainable and viable option, and provides the basis for the groundwater allocation sought from DWER. This includes understanding water from all sources (scheme water, rainwater, greywater and groundwater) and the estimated demand from the proposed development, including, but not limited to: POS, road reserves and verges, residential gardens, construction, and establishment needs for parks and gardens. Irrigation demand and associated calculations are dependent upon the specific site circumstances, proposed land use and development requirements.

Box 3. WGV Hydro-geological Conditions & Projected Irrigation Demands

The site's sandy soils, typical of the Swan Coastal Plain, are conducive to infiltration and allow all stormwater up to the 1 in a 100 year storm event to be infiltrated on site. Groundwater at the site is greater than 10 metres from the surface and good quality water had been historically drawn from an existing bore for irrigation purposes. These characteristics meant that in conjunction with a holistic approach to public and private landscape design and irrigation a sustainable water balance utilising a community bore could be achieved.

In the case of WGV, an irrigation demand of 2,000kLpa for irrigation of POS and 3,000kLpa for private irrigation was estimated, with connection to the community bore mandatory for all private lots.

Water Balance Schematic for WGV



3.7 Approvals Required

The following approvals are required from the State Government, as detailed below. These approvals are made according to each site's unique characteristics.

3.7.1 Department of Water and Environmental Regulation (DWER)

Two licences are required from DWER, one to construct a bore (if an existing bore is not present or cannot be used) and one to abstract groundwater from an area that is proclaimed under Section 5C of the Rights in Water and Irrigation Act 1914.

Prior to this, advice is needed from a DWER regional office (www.dwer.wa.gov.au/one-stop-shop) to determine whether the area is suitable and the potentially available groundwater allocation (as noted earlier in Section 3.2). Should the area be fully allocated it may be possible to purchase an entitlement from a groundwater licence holder.

Applications can be completed online at DWER's Water Online site: www.dwer.wa.gov.au/one-stop-shop or via a paper submission.

Applications must meet the assessment criteria, via an assessment process, including:

- Completion of an operating strategy, including commitments to monitoring, addressing environmental impacts, contingency plans and water use efficiency (see State-wide policy No 10 – Use of operating strategies in the water licensing process).
- Substantiate the quantity of water required (can also be broken down into usage).
- Prove you have legal access to the land where the water is to be taken.
- Provide site details such as the location and site plan.
- Specifications for bore construction.

Further detail may be required on the total water cycle for the site, proof of water availability, water quality, impact on ecosystem, hydro-geological assessment, public notification and consistency with other (government) water conservation plans.

3.7.2 Operating Licence Requirements/Water Service Provider Requirements

The developer, local government or water service provider responsible for owning and operating the community bore may be required to obtain a water services license from the Economic Regulation Authority. An exemption can be provided if the Minister for Water is satisfied that the exemption of the scheme is not contrary to public interest. Proponents can find more information in the Water Services Act 2012 and from DWER. Specifically, the DWER water services policy section will advise on whether the proponent should obtain a licence or apply for an exemption. Adequate planning will need to already be in place to communicate secured assets, ownership, management and funding arrangements, now and in the future.

3.7.3 Department of Health [1]

The Department of Health's interest in community bores that supply non-drinking water revolves around the degree to which such systems may pose a risk to public health (Risks to public health are defined as something that is known to cause or potentially cause disease or harm to the public health or wellbeing of humans). A community bore is a non-standard water supply and there may pose a risk to human health via unintended uses and the potential cross connection with drinking water supplies.

The Department of Health, through the Health (Miscellaneous Provisions) Act 1911, has been one of the responsible government agencies for ensuring that the public health risks associated with water use are properly managed and water supplied to consumers is safe. Pursuant to the new Public Health Act 2016, the Department of Health is presently reviewing its involvement in water management in Western Australia and is developing a public health risk management system and associated regulatory framework that will address all forms of water usage and exposure. It is envisaged that this work will be complete by 2021.

In the case of community bores that supply non-drinking water, matters such as accountability for the quality of the water supplied, the nature and scale of any public health risk posed, whether the water so supplied is fit for purpose, the placarding or sign-posting of any taps, conveyance of information and advice to water users, and whether the water from such systems can be confused with drinking water, are key factors that need to be considered by developers in adequately managing the level of liability.

It is also possible that community bores can be used for small-scale irrigation of edible produce such as vegetables as part of a local production or 'food-miles' minimisation program. Community bore owners, operators and managers must continually give consideration to the level of risk and potential liability posed by the use of irrigation water to prevent potential food contamination.

3.8 Operating and Ownership Principles and Framework

It is crucial to overall success that the operating and ownership requirements are considered at the initial planning stage and that certain roles and responsibilities are clearly defined. In the past, some community bore schemes have been implemented as a trial and this was not effectively communicated to residents (source: interviewee). Therefore, future schemes that are intended as trials need to be clearly communicated to all residents so they are aware that the community bore water source may not be provided in the long term.

The operating and ownership framework needs to be transparent and agreed upon by all involved stakeholders including:

- Developer
- DWER
- Local Government (if they are to be the owner and operator of the scheme)
- Water Service Provider (if they are to be the owner and operator of the scheme)
- Residents (if known).

[1] This section has been kindly provided by Department of Health (R. Theobald, personal communication, 13 December 2017)

Box 4. Approvals, Operating and Ownership in WGV: Developer and Local Council Agreement

In the case of WGV the initial planning, design and implementation, including capital costs, was undertaken by the developer, LandCorp. The City of Fremantle will take over responsibility for the operation and maintenance of the scheme after an initial two year period. This arrangement was agreed upon prior to the implementation of the bore.

The City of Fremantle was granted a water services licence exemption for WGV by the Minister for Water in 2014. An example of the exemption notice is provided here:

WATER SERVICES ACT 2012

EXEMPTION NOTICE

Exemption for the City of Fremantle for a water service on

Lot 2089 Stevens Street, White Gum Valley

In accordance with section 7 of the Water Services Act 2012, the Hon Mia Davies MLA, Minister for Water, granted an exemption from the application of section 5(1) of the Act to the City of Fremantle on 6 October 2014, in respect of the provision of a water service on Lot 2089 Stevens Street, White Gum Valley.

The water service is a non-potable water supply service provided as a community bore scheme for the residents of an infill urban development. Water is sourced from a community bore on site and used to water public open space and residential gardens.

The exemption is valid for an indefinite period.

Summary of the reasons for the decision:

- Granting this exemption is not contrary to the public interest. It is considered that –
- the regulatory burden imposed by licensing would be disproportionately high given the small scale of the service;
- the risks of the abuse of monopoly of power are low. The service is operated on a not-for-profit basis; and
- the public health aspects of the service are regulated under the Health Act 1911.

3.9 Cost Recovery Mechanisms

Cost recovery includes two major considerations: capital cost by the proponent or operator and ongoing operational costs. Conducting an initial feasibility study will provide a clear understanding of individual costs to the developer, local government and residents. This should be completed very early on in the process to eliminate unwanted surprises.

3.9.1 Capital Cost

The implementation of a community bore, as opposed to a regular council irrigation bore, includes distinguishing features such as a storage tank, pump housing, an array of extra pumps and connection to all individual lots. One model for addressing upfront costs is that they are covered by the developer who will need to see the benefit in the added value (e.g. increased urban greening, amenity and potential improved lot sales) and long term sustainability outcomes. As there is no direct cost recovery available to the developer the community bore infrastructure needs to be incorporated into lot sales and property prices. The feasibility of this should be determined at the structure plan stage alongside consideration of the amount of parks and gardens, and number of private lots. Alternatively, local government may be interested in initially funding all of the capital costs and then recovering those costs from future residents.

The community bore asset is later gifted to the local government who then commences the depreciation of the asset and at the same time collects revenue from charges to residents sufficient to implement replacement of the asset after its depreciable life.

3.9.2 Ongoing Costs

A detailed understanding of the potential ongoing costs needs to be determined prior to implementation. Cost considerations include: power consumption, infrastructure maintenance (renewal and repair of pipes, pumps, storage tank), operating (e.g. treatment and distribution), contractor call outs, water quality monitoring if required, depreciation of infrastructure, and meter data logging requirements. Further administrative costs also need to be considered such as customer service, billing, complaint management and customer education, as well as compliance costs including monitoring compliance and dealing with tampering and over-use.

A number of options are available for charging residents for their water supply and use. These include a Specified Area Rate (SAR) which is an annual charge on top of the base rate (GRV), a volumetric model charging residents based on dollar per kL of consumption, or a combination of a fixed charge and volumetric rate. Box 5 and 6 provide examples from WGV and Brighton[2].

Box 5. WGV Special Area Rate

In the case of WGV all costs associated with the monitoring, management, maintenance and depreciation of the community bore as applying to the residents of the WGV infill development will be calculated and recouped via Specified Area Rates (SAR) as per the Local Government Act (1995).

Section 6.37(1) of the Local Government Act 1995 states that:

(1) A local government may impose a specified area rate on rateable land within a portion of its district for the purpose of meeting the cost of the provision by it of a specific work, service or facility if the local government considers that the ratepayers or residents within that area —

(a) have benefited or will benefit from; or

(b) have access to or will have access to; or

(c) contributed or will contribute to the need for that work, service or facility.

[2] https://www.watercorporation.com.au/my-account/your-bill-and-charges/pricing-variations

Box 6. Brighton Estate Third Pipe Charge

Information about the fixed fee charges are provided on the Water Corporation website:

- "For the water supply scheme that supplies Brighton Estate in Butler, we operate a 'third pipe' which supplies non-potable water for use outside the home.
- If this service is available at your property you are charged a fixed fee.
- For lots less than 400m2 the charge is $80.09.
- For lots greater than or equal to 400m2 the charge is $160.18."

Ongoing costs need to be continually reassessed (e.g. annually) once the bore is in operation. This is to ensure that predicted annual pricing (e.g. SAR) is correct, particularly as there may be instances of over use, and it may take a few years of price adjustment to reach an accurate price. Price may play an important role in determining use and should not be set too low to encourage overuse. A fixed charge may also fail to send important signals on water use behaviour. Complexities around willingness to pay also need to be considered, for example residents may expect non-drinking water to be cheaper and therefore need to be aware of the various upfront capital costs as well as ongoing maintenance requirements. Further, open discussions with residents should take place to ensure they understand the chosen billing method and to ensure the operator/owner of the scheme is aware of any issues (e.g. there may be perceptions of inequality amongst residents with a SAR as individual property requirements will differ).

It is important that the SAR is clearly explained to buyers and future residents. This information needs to be included as part of the contract of sale. Box 7. provides an example of the contractual wording of SAR per lot.

Box 7: Example of Specified Area Rate (SAR) Contribution in White Gum Valley

Special Area Rates Contribution: Information for buyers

The Buyer acknowledges that LandCorp has advised the Buyer that:

a. the Land will be subject to an annual special area rates contribution to the City of Fremantle (Contribution);

b. the City of Fremantle has advised LandCorp that the Contribution payable for the 2014/2015 financial year is estimated at $279 per dwelling which may change from time to time (Contribution amount);

c. the terms of the Contribution and Contribution Amount is subject to change at any time;

d. the Buyer should make its own enquiries with the City of Fremantle in relation to the current and future obligations for the Contribution and the Contribution Amount;

e. the Buyer will be solely liable to pay the Contribution Amount for each dwelling constructed on the land; and

f. it is the Buyer's sole responsibility to confirm the current Contribution Amount payable when the Buyer undertakes the Development on the Land.

Community Bore Scheme

The Buyer acknowledges that LandCorp has advised the Buyer that:

a. the Land is subject to a community bore scheme owned and operated by the City of Fremantle for the purposes of external garden irrigation on the Land and other land (Bore Scheme);

b. further information in relation to the Bore Scheme is contained in the Development/Design Guidelines and from the City of Fremantle;

c. the Buyer should make its own enquiries with the City of Fremantle in relation to the terms of the Bore Scheme and all current and future obligations of the Buyer in relation to the Bore Scheme prior to entering into this Contract;

d. the Buyer will be solely liable to pay any contribution or costs associated with the Bore Scheme as it applies to the Land;

e. it is the Buyer's sole responsibility to confirm the obligations of the Buyer in relation to the Bore Scheme prior to the Buyer undertaking the Development on the Land; and

f. it is the Buyer's sole responsibility to confirm the current Contribution Amount payable when the Buyer undertakes the Development on the Land.

3.10 Local Water Strategies

Consideration of specific local government water strategies and conservation initiatives will ensure the proposed bore fits with broader goals. The development may be situated within a local council that is a Water Corporation/DWER Waterwise Council (or planning to become one) and therefore will have specific local planning policies and supporting documents for new developments and POS water requirements that proponents need to be aware of. Local councils may also be involved with other sustainability programs (e.g. One Planet Living) which will also need to be considered by the proponent to ensure alignment with goals and principles.

One Planet Living

3.11 Risk Assessment

A detailed risk assessment will ensure all of the above planning considerations are formally captured. In addition, a risk assessment can ensure a variety of future scenarios can be considered before implementation such as changing climatic conditions, potential health risks, environmental flows/conditions, demand, supply, house sales and any subsequent changes to a masterplan, operating and maintenance costs, regulatory requirements, and ongoing feasibility of community bore as compared to alternative options. It is vital to plan for unintended consequences to ensure the long term viability of the scheme.

Box 8. Cascade of Changes at Evermore Heights

A community bore was trialled at Evermore Heights, City of Rockingham, and has since ceased operation due to a number of unintended changes and consequences. All lots have now been reconnected to the scheme water supply for use outside the house.

Land sales were lower than originally anticipated and changes were imposed on the site such as the release of smaller blocks with less greenspace. This impacted on the original design of the community bore irrigation system and it eventually became commercially unviable.

Throughout the duration of the community bore (approx. 5yrs) there was some lack of understanding amongst residents about the scheme, resulting in unsuitable changes to the irrigation system and instances of overuse.

As the community bore was a trial there were also unclear arrangements for ownership and operation. Staff turnover meant that those originally supporting the scheme were no longer involved in the project and there was no willing service provider to take over the scheme.

Despite no longer operating, this trial provides useful learnings such as being mindful of changes to site plans, having a clearly established governance system and the need for ongoing community engagement.

4 Designing a Community Bore

4.1 Site Requirements and Master Planning

The final specifications of the site need to be determined. This includes: the number of lots, the mix of housing typologies (single/multi residential), POS size and type (irrigation requirements), and landscape design will determine the water demand and the size of infrastructure needed. Developers and community bore managers need to ensure that connection to the bore is mandatory for the scheme to be effective (note: this was achieved in WGV via the development and implementation of design guidelines for residents). The structural components such as tanks, pumps and pump housing will need to be incorporated into the site design as some of these may take up space to house the necessary infrastructure. This should be considered prior to sub-division to ensure sufficient space and easy access.

4.2 Site Design Guidelines

Effective use of the community bore is best achieved with the use of site design guidelines that provide potential buyers and residents with information about the community bore system and the necessary design protocols to ensure water efficient landscaping and behaviours. These guidelines can be provided by the developer, with input from the various stakeholders involved in the site. The design guidelines may cover a range of site specific recommendations, with the community bore specifications included. These community bore specifications may include information about:

- Mandatory connection to the community bore, with no implementation of private bores.
- Adhering to the terms of agreement as determined by the supplier.
- Demonstrating awareness of local targets to decrease water consumption.
- Allowing water consumption data and water quality data to be publicly available helps all residents stay informed of goals and initiatives.
- 'Water Conservation' design guidelines to ensure that there are efficient irrigation technologies, hydrozoning and ecozoning and waterwise/native landscape design, water monitoring sensors, central and remote irrigation control systems, and reduction in the use of turf.

Box 9: An example of Design Guidelines for WGV

10.3 WATER EFFICIENCY AND MAINTENANCE

The adoption of water efficient technologies will help you to establish a successful water efficient and low maintenance garden. All lots will be serviced by the community bore which will provide groundwater for irrigation.

DEVELOPMENT CONTROLS:

- An automatic irrigation system including a rain sensor using a programmable controller must be connected to the purple meter provided by LandCorp. The water source for the purple meter will be supplied by a community bore that will operate during set time periods. The bore will not operate during the Winter Sprinkler Ban or on days where sufficient rain has occurred.
- Water efficient in-line drip irrigation must be installed for all garden beds.
- Private water bores are not permitted.
- Any outdoor swimming pool or spa must be supplied with a cover that reduces water evaporation and is accredited under the Smart Approved Watermark Scheme.
- Indoor and outdoor taps must not to be connected to the community bore supply.
- Spray irrigation may be used on turf areas only.

DESIGN GUIDANCE:

- Consider establishing irrigation for the first two summers and then for extended dry-hot periods only.
- Consider adopting hydrozoning principles which involves grouping plants with similar water needs together in an effort to be more water efficient.
- Consider incorporating irrigation control technologies such as evapotranspiration sensors or soil moisture sensors to ensure efficient watering of landscaping when community bore system is active or operational.
- Consider grading to create micro swales and basins to help to recharge the soil moisture and reduce run off from stormwater.

10.4 BIODIVERSITY AND HABITATS

A diversity of vegetation is essential to create a habitat for wildlife within urban areas. Creating interlinked habitats will further increase the biodiversity of open spaces by enabling local migration between habitats.

DESIGN GUIDANCE:

- Consider retaining existing trees to provide habitats for local fauna, visual amenity, and shade.
- Consider a native verge garden to attract local fauna. Refer to the City of Fremantle Verge Beautification Guidelines for more information.
- Consider keeping domestic pets indoors during the night to avoid injury or death to native fauna.
- Consider establishing a frog friendly garden by installing a lined frog pond surrounded by native local rushes and sedges.

Biodiversity and Habitats: Existing trees provide habitats for local fauna, visual amenity and shade.
Image courtesy of CODA Studio.

4.3 Integrated Water Management

A water balance estimate would have already been conducted as part of the initial planning stage. This will indicate the site water requirements and hence the viability of a community bore. This estimate will be referred to throughout the design of the site and determines the specific community bore requirements.

For effective water management and improved water efficiency the implementation of a community bore needs to be incorporated as a part of broader WSUD principles. This may include:

- Centrally controlled irrigation.
- Moisture sensors to determine watering schedule.
- Weather station to control irrigation times and duration (this can also be used as an educational tool).
- Waterwise landscape design with hydro-zoning.
- WSUD design elements such as swales for infiltration, biofilters, rain-gardens, pervious paving.
- Community engagement.

4.4 Technical Design

The specific technical design will depend on the scale of the development, the development arrangement, total irrigation demand including number of lots and public open space and level of service required. The developer is likely to engage project civil engineers to design a fully detailed plan for the third pipe infrastructure. This plan should be developed in conjunction with a professional irrigation designer familiar in the design of these schemes to ensure essential infrastructure is included such as specific control wire networks, metering and valving. The design may undergo a number of iterations to ensure the correct specifications are included and that it is sensitive to the existing assets and site specifications. A more flexible type of pipe (e.g. PE pipe) may be required if the site specifications are restrictive. The local council will also need to approve the final detailed design and this need not be a long process if the council has been informed and accepting of the scheme from the beginning. Detailed surveying work will also be required to confirm the location of the as-constructed pipes.

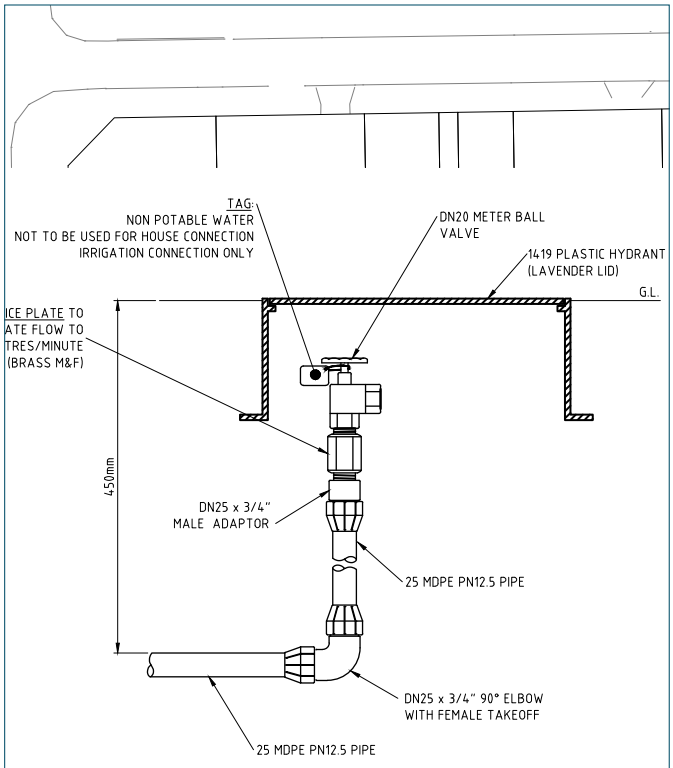
The more detailed the design, the easier for council approval. Key considerations include:

- Metered bore (in accordance with DWER metering requirements and LGA approved headwork requirements).
- Hydraulic design and distribution main type and size. All pipework, meters and fittings are to be coloured purple and all plumbing is to be in accordance with the relevant sections of AS/NZS3500.
- Control wire network, protection, type and size.
- Storage tanks (size dependent upon site requirements).
- Pump set capable of managing both high and low flow requirements at a pre-defined pressure.
- Filtration to manage any sediment, iron or bacteria.
- Any necessary treatment.
- Irrigation controller with remote access.
- Pump housing.

Box 10. Technical Design Elements for WGV

The key technical design elements of the WGV community bore system include:

- A single storage tank adjacent to the new bore to receive groundwater.
- A multi pump Variable Speed Drive (VSD) pump set capable of managing both high and low flow requirements at a pre-defined pressure.
- The WGV irrigation system is controlled by a Signal SD Irrigation Controller that is compatible with the City's current centrally controlled systems and include controls (e.g. rain sensor) to avoid irrigation during rainfall events as required by DWER. The SD also manages major meters, flows, pressures and general irrigation operations with remote access.
- Irrigation sub-meters report back to third party software via data loggers.



COMMUNITY BORE WATER CONNECTION POINT DETAIL

NOT TO SCALE

5 Installing and Commissioning a Community Bore

5.1 Installation of Civil Infrastructure

The community bore distribution pipe and protected control wires can be installed at the same time as the other civil services or pre-laid. Consideration of Water Corporation, Western Power and communications easements and infrastructure is crucial to ensure the correct alignment of services. Each site will have its own sensitivities that need to be adhered to throughout the installation, for example working with existing road verges and trees, if a community bore is to be part of an infill project. The specifications detailed in the plan will need to be followed and may include the need for boring (trenchless technology) of scheme infrastructure during installation.

5.2 Installation of Bore, Pumps and POS Irrigation Infrastructure

The technical components of a community bore include a metered bore/s, storage tank/s, delivery pump system, filters, irrigation controllers and distribution network of pipes, meters, valves, and control wires. The inclusion of a pump house is not necessary but it is a solution to safely house the equipment. There needs to be quality control at all times, including inspection of installed systems, flushing and pressure testing, which should align with Water Services Association of Australia standards.

The project engineers may also be responsible for the tender process to engage contractors to construct the work and install the infrastructure. There needs to be clear communication throughout the installation process to ensure correct placement of infrastructure (e.g. of meters) including as-constructed surveying of under road sleeves for future utilisation and a clear understanding of who can access the infrastructure once installed to avoid any unintended consequences. Each site will have its own specific team with ways of managing the installation process. Refer to the Australian Drilling Industry Association (www.adia.com.au) and Irrigation Australia (www.irrigationaustralia.com.au) to ensure qualified professionals are used.

Once construction is complete, the project engineer should ensure a copy of the surveyed as-constructed drawing/s of the community bore pipe network is lodged with Dial Before You Dig. This will ensure that the community bore is treated in a similar manner to all other buried services.

Box 11. Site Management for WGV

A knowledgeable team was responsible for the successful implementation at WGV. This included a civil engineer superintendent for the pipe network installation, landscape superintendent competent in heavy pumps and pipes, landscape construction manager, highly skilled pump infrastructure technician and two supervisors.

This team ensured weekly discussions and updates took place, fenced areas were checked daily before work commenced and existing trees were watered weekly, with penalties to be imposed if any trees were damaged during the installation phase.

5.2.1 Lot Irrigation Systems

Requirements, limitations and restrictions relating to the connection to and use of the community bore must be clearly articulated to lot developers and residential owners or occupiers. An information pack should be developed that describes any requirements such as the mandatory use of automatic controllers and the installation of water efficient sub surface drip line irrigation in gardens.

The information pack should describe any limitations on the system such as operational windows and other restrictions, such as no taps if this is a Department of Health requirement. Ensuring any external taps are connected to the scheme water supply also provides an ‘on demand’ contingency for hand watering of the landscape.

6 Operating and Maintaining a Community Bore

Management of a community bore can be undertaken by a developer, local government or water service provider (e.g. the Water Corporation or a private supplier), with the appropriate approvals (DWER, 2018).

However, it is preferred that if the community bore scheme is managed by the developer, that there is involvement or assistance from the local government (pers comm. DWER 2017). The possibility of a co-operative body taking responsibility for bore ownership and operation is a potential arrangement that requires further investigation. The forthcoming introduction of the community title scheme in WA may assist with alternative management options for such schemes.

If local government is to take responsibility then there needs to be a clear handover from the developer to the council operations team and necessary up skilling if there is no previous experience with a community bore scheme (more detail on the handover is provided in Section 7). Further, it will involve administrative effort and responsibilities outside normal local government operational sphere such as costs, billing and monitoring and management of issues.

6.1 Maintenance Procedures

An example of the monthly maintenance procedures carried out on the community bore at WGV are provided in Box 12. Manuals are to be provided for effective maintenance and to detail the requirements for supply pressure, volumes and water quality.

Water quality testing of the community bore water must be undertaken periodically. Water should be tested for pH, salinity and bacterial content to ensure a safe water supply and provide confidence to residents, the local community and the local council that the water being provided for irrigation is satisfactory. Testing will need to take place as part of the maintenance program. The cost of this testing should be included in the maintenance cost and may be recouped by inclusion in the differential rate calculation, depending on the type of charging model adopted.

Box 12. WGV Community Bore Maintenance Procedures

The monthly maintenance regime gathers the following data:

- Operating flow rates for each pump unit
- Water meter reading
- Current draw readings
- Line pressure reading
- Static water level in bore
- Pumping water level in bore

6.2 Metering

The installation of individual water meters to each lot is important to the successful implementation of a community bore scheme. Meters allow for effective leak detection and therefore better management of water. They also allow for high water users to be easily identified by the local council, or scheme operator and owner.

Box 13. Metering at WGV: A research case study in monitoring water consumption

Each lot includes two water meters: one for scheme water and one purple meter for the community bore connection.

Both meters will be data logged during a three-year CRC for Low Carbon Living research and performance monitoring phase, also supported by DWER, CRC Water Sensitive Cities and Water Corporation. Meter readings will be hosted on a web interface and accessible to residents, authorised Water Corporation and City of Fremantle staff. This information will provide valuable insight into how the community is responding to the implemented initiatives and provide further information to inform LandCorp's Innovation by Demonstration project and the Waterwise Development Exemplar initiative.

After the research phase, meter reading will become the separate responsibilities of the Water Corporation and the City of Fremantle.

6.3 Billing of Consumers

The billing arrangements (based on the initial cost calculations in the planning stage) will need to come into effect once the bore is operational. As noted previously, there are a number of ways consumers can be billed. If local government is responsible for the community bore then the use of a SAR for billing needs to be clearly communicated to residents at lot sale phase: why it is used for billing purposes, how it is calculated and when it will be applied to residents (e.g. the developer may retain responsibility of the community bore for an agreed maintenance period with the SAR commencing after this). There also needs to be consideration of when the management of the community bore will be taken over from the developer and how this impacts on the commencement of a SAR. Lot sales may also influence the implementation of the SAR as the developer may be responsible for the cost of unsold lots. Refer to Box 5 and Box 7 for the specific SAR information for WGV.

6.4 Roles and Responsibilities

The roles and responsibilities of the various stakeholders should be made explicit from the initial planning stage. Here, a list of possible roles and responsibilities to ensure efficient and effective operation and management is provided. It should be noted that various roles and responsibilities are site specific and will change depending on the development and who has been granted responsibility.

6.4.1 Operation and Management Roles and Responsibilities

The on-ground and remote operation and management will need to include:

- Reporting arrangements (e.g. from contractor to community bore manager).
- Inspection of equipment and filter cleaning frequency.
- Bore meter reading and lodgment with DWER (e.g. contractor).
- Pump servicing schedule (e.g. contractor).
- Verge maintenance if part of the scheme (e.g. Local council SAR may include irrigation and maintenance).
- POS and road reserve irrigation maintenance.
- Depreciation of bore assets (e.g. calculation estimates to be provided by supplier or contractor).
- Data logging and display.
- Roles and responsibilities associated with the SAR.

6.4.2 Ongoing Support of Community Bore Use and Water Efficient Behaviours

Consideration needs to be given as to who will provide ongoing support for residents as they will need guidance throughout the operational phase of a community bore. The bore manager may wish to nominate a department or personnel role to be the point of contact for residents should they have any queries or encounter any difficulties. As noted, this support network is a critical component of success and should have been considered at the planning stage.

Developers, local governments and scheme service providers will benefit from providing residents with information about the community bore and the expectations of community roles and responsibilities. A resident information resource is attached to this report. It should be noted that this material needs to be accompanied by ongoing efforts to engage local residents and support them throughout their use of a community bore scheme. Simply providing residents with a once-off information resource at the time of purchase may not be enough. Issues with community bore use such as over watering may be attributed to a lack of community awareness and understanding. For example, residents may not understand sub-surface irrigation or the specifics of maintaining their irrigation system and replace drip line or efficient sprinklers with less efficient varieties, resulting in ineffective and inefficient watering of their gardens. Of key importance is to consider how new owners in the future will understand how the system works and scheduled watering days and times. There will need to be consideration of the handover information pertaining to all aspects of operation relevant to residents such as guidelines for use, who to call if there is an issue, run time availability and water pressure.

6.5 Ongoing Monitoring and Assessment

Ongoing success of a community bore requires continual evaluation of the system by the owner / operator and a clear understanding of the various components to ensure effectiveness. For example:

- Consumption must be monitored to understand trends in demand.
- Monitoring of health risk, not just water quality data but also to ensure ongoing compliance with health guidelines such as appropriate signage/notification of third pipe system and water/pipe management systems.
- Reliability of supply: ensuring storage solutions and back up water supply mechanisms are appropriate.
- Understanding operational performance.
- Monitoring to ensure environmental objectives are met.

6.6 System Failure Responses

A method for responding to system failure needs to be put into place, as per the consideration of this response at the planning stage. The necessary information pertaining to this needs to be provided to residents so they know who to contact should they notice any system disturbances.

7 Developer-to-Service Provider Handover Procedure

The following section details a suggested handover procedure if local government or an alternative service provider is it to take on the responsibility of the community bore scheme.

Handover from the developer should not be onerous if the process detailed throughout this report and checklists is utilised. As noted, a key focus is ensuring that early on ongoing communication takes place with the ultimate owner and operator of the scheme.

A handover procedure needs to ensure:

- Agreement on handover timing.
- Service provider understanding of the community bore with agreed and documented processes for billing, asset management and meter reading. Many of these specifics should be determined earlier (e.g. will meter reading take place remotely? Will council manage the scheme or will they engage contractors?).
- The pre-determined billing mechanism is operationalised.
- A site visit is scheduled where the developer and other key parties (e.g. site engineers, landscape architects, irrigation consultants) walk through the specifics of the scheme with service provider representatives.
- Hard and soft copies of operating manuals and final technical/design drawings must be provided (refer to Appendix 2 for WGV examples of community bore design drawings).
- If cloud based monitoring is implemented then access (e.g. password) needs to be provided for observation of water consumption data and the irrigation schedule.
- Any keys to sheds etc. are handed over.

8 Insights into Stakeholder Experiences of Community Bore Implementation

This Community Bore Guide is focused on providing information, case study examples and learnings that can assist with future implementation.

This includes the necessary technical process and also guidance on the various roles and responsibilities required for success. To capture these learnings, we draw on the experience of key stakeholders involved with the implementation of community bore schemes in Perth: Brighton, Evermore and WGV. Specifically, their reflections upon the process and lessons learnt can provide an understanding of how to successfully implement a community bore scheme across a variety of contexts. This section provides an overview of these 'on ground' learnings.

8.1 Method

A number of semi-structured interviews were conducted with key stakeholders, including:

- LandCorp
- City of Fremantle
- Tabec engineers (WGV)
- Josh Byrne & Associates (JBA) (WGV)
- Water Corporation
- Department of Water and Environmental Regulation

Most participants were involved with WGV due to the involvement of Josh Byrne & Associates in the implementation of the community bore. Attempts were made to include multiple perspectives and experiences from Brighton and Evermore, however only two participants were able to provide insights into these schemes. Altogether seven interviews were conducted. Interviews were mostly face to face, with one telephone interview, and took between 30-60minutes to complete. Interviews were audio-recorded with the consent of participants. Questions focused on understanding the complex governance arrangements supporting the implementation of a community bore, specifically roles and responsibilities, the key drivers of success, the various barriers encountered and recommendations for future implementation.

8.2 Results

A summary of the key findings from the interviews are detailed under themed sub-headings below. Where relevant, key outcomes for the process have been highlighted.

8.2.1 Project Conception

Participants highlighted the importance of having a knowledgeable project champion to articulate the concept, "sell the story" to all involved stakeholders, and maintain project momentum. Alongside this, leadership from the developer and commitment from local government were considered crucial to the development of the scheme concept, as well as for successful implementation and ongoing management.

All participants noted that the concept needed to be included early on in discussions about the development. Initial understanding about the quality of the water and upfront discussion about potential costs were regarded as helpful for examining the possibility of including a community bore scheme.

KEY FINDING

A dedicated ongoing project champion is required to clearly communicate the process and maintain momentum for optimal success.

Box 15: WGV Community Bore Concept is Born

Water Corporation interest in water efficiency in new developments led to discussions with JBA as to what they thought might be possible. At the same time LandCorp was considering a whole range of water and energy efficiency initiatives for the site and JBA proposed a community bore scheme to service POS as well as private lots to reduce ex-house reliance on scheme water. At the time there was a limited understanding by LandCorp about the community bore, however questions about cost, operational requirements and logistics were openly discussed. It was determined that a new bore and irrigation system was required to service POS anyway so the inclusion of above ground tank, expanded pump infrastructure and extension of the irrigation mainline (third pipe) was more of an 'addition' to what would have been a normal irrigation system owned and operated by the LGA. WGV is now a demonstration project showcasing best practice in sustainable water use for a mixed density site.

8.2.2 Roles and Responsibilities

Key stakeholders appeared to have a clear understanding of their roles and responsibilities in the process. For example, development managers understood they needed to make decisions about the site features and the engineers, irrigation consultants and landscape architects understood they needed to develop detailed plans that may be subject to reviews and revisions. Other key roles included the then Department of Water (now DWER) as the groundwater regulator, Department of Health, and scheme operator.

Those that were not directly involved in the conceptual and planning stages were thought to have difficulties in understanding what was required. For example, at WGV the project engineers noted receiving queries from the on-site builders about the community bore as they were unsure about what it was. Further, at WGV the developer (LandCorp) identified that misunderstandings were also apparent at the point of sale and it was noted that site initiatives, such as the community bore, needed to be better explained to potential buyers. These discussions were largely thought to be needed on site to ensure demonstrations and adequate understanding.

KEY FINDING

There is a need for early and on-going communication to all those involved, and potentially involved, such as residents. Who will communicate to whom, and at which stage of implementation, needs to be clarified early in the project.

8.2.3 Key Working Relationships

When considering the necessary working relationships, participants were concerned about staff turnover, organisational mindset to change, and the difficulty of maintaining momentum for the scheme when those who had been involved in initial conversations had left. This appeared to be the case with the Evermore site where it was thought that relationships had started out strong but lost momentum along the way, resulting in a "poorly run" trial project from 2008-2013 and contributing significantly to the demise of the scheme.

Having a solid and ongoing working relationship with the local council was considered crucial. For WGV, the City of Fremantle were already aware of the scheme and accepting of it by the time the drawings were with them, resulting in a fast approval process. This preparation also assisted in overcoming reservations about the scheme from senior management.

Regular meetings and updates were considered crucial, particularly to ensure appropriate design (e.g. allocation of required space) and to finalise scheme specifics (e.g. location of pumps). Closely working with the civil engineers and the water consultants was also considered key.

Including information about the community bore in the contract of sale and in the design guidelines was considered important to building a relationship with residents and ensuring appropriate use.

KEY FINDING

Having a strong and ongoing working relationship with local council is important.

8.2.4 Drivers of Success

A number of drivers of success were identified and discussed by participants. These included:

- A clear and meaningful message about the reason for implementing a community bore. For example: reducing scheme water consumption and the environmental benefits of using locally sourced water and deferring the next desalination plant.
- A shared understanding of the nature and intent of the scheme (e.g. trial only). For example, WGV was regarded as a high profile project however it was thought that not all involved stakeholders understood the nature of the project.
- Leadership and willingness to trial innovative ideas from the developer and local council.
- Appropriate design of the system: sizing and location of the 3rd pipe, individual metering and monitoring, correct pricing signals.
- Open conversations about the process to recognise and address issues as they arise. For example, at WGV the developer initially had a lot of questions about how the bore works, pump requirements, water pressure and when to turn on the connection but these were openly discussed early on.
- Having "the right mix of people coming together" that understand their role in the process.
- Mainstreaming the concept with council to ensure operation and management is just like any other asset.
- Education and understanding, particularly as the community bore is still a relatively new concept for the community.
- Contribution to urban greening and having an extra watering day might be appealing to some.

Box 16: WGV commitment to sustainability

At WGV, the community bore is a part of an overall commitment to sustainability. Key to this is a focus on growing food, as part of the OPL framework, both in private lots and as part of a community garden. As growing food requires more water and the community bore allows an extra day of watering, it seemed to fit with the overall project philosophy.

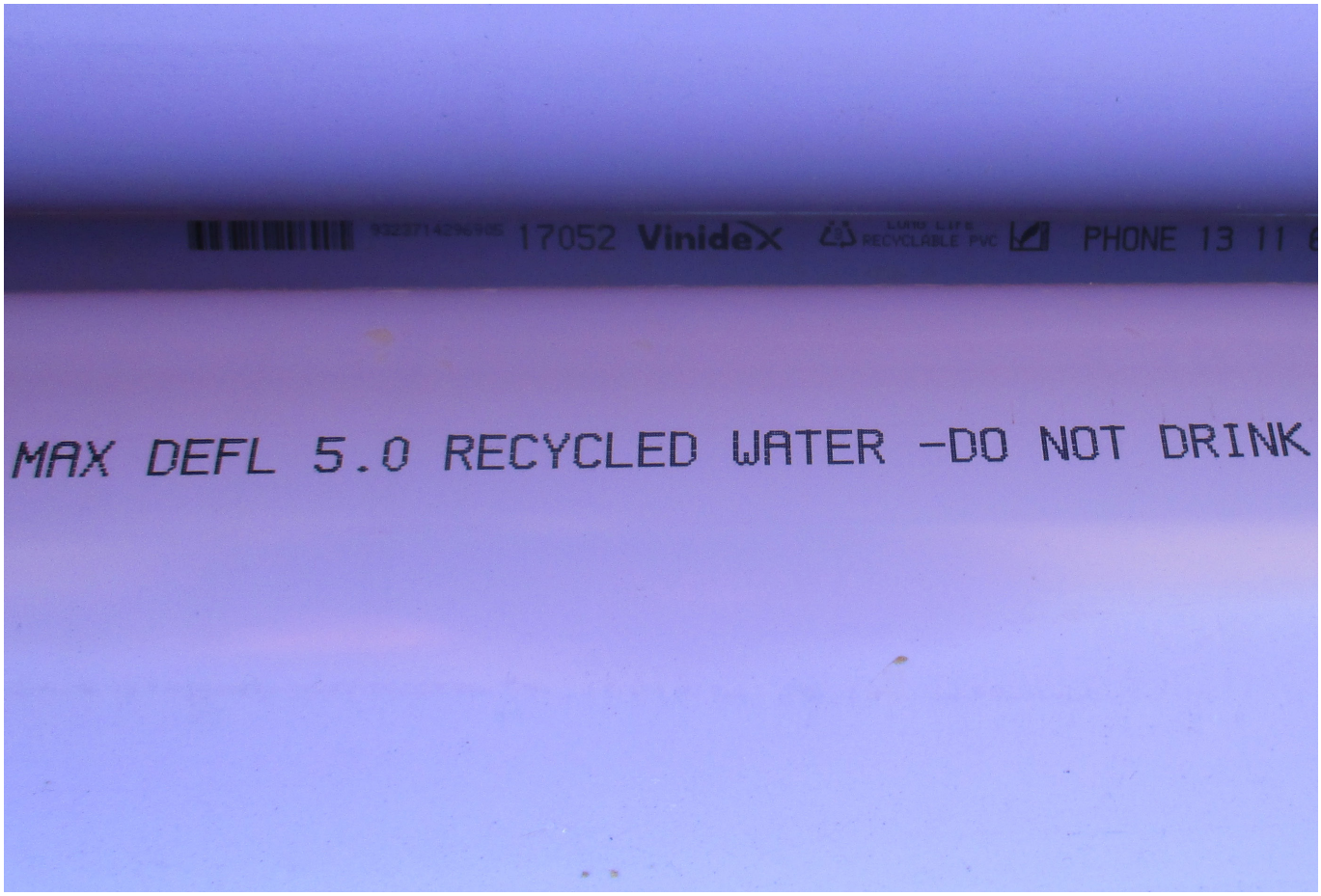
A number of water and energy initiatives were also considered early on, therefore LandCorp decided to adopt the OPL guidelines. The community bore was a huge part of achieving the OPL accreditation as well as contributing to WGV being a Waterwise Development Exemplar.

8.2.5 Barriers to Implementation

A number of barriers to the successful implementation were identified and discussed by participants. These included:

- Consideration of the community bore as a climate dependent water source.
- The cost of the additional third pipe infrastructure.
- The need to consider existing assets if implemented as part of an urban infill project e.g. road verges, pipework, trees.
- Local council a potential barrier if they are not willing to be involved or if staff are not willing to take on the responsibilities.
- Lack of clear governance. There needs to be someone to take responsibility, particularly if the bore is not operating as planned.
- Lack of consistent messaging.
- A long term barrier is the low monetary cost of mains water.
- Lack of perceived incentives and assurance for the developer.
- Lack of resident understanding, particularly around water use, timing of irrigation and the specific type of irrigation systems used. E.g. some residents in Evermore were reported to have added a surface spray for irrigation as they did not like the sub-surface irrigation.
- Lack of ongoing community support, e.g. if information about the bore is provided at the time of sale people may be in an “emotional head space” and not completely engaged. Additional support is also required for communities with a high number of tenanted properties.
- Lack of price signal for users.
- Site specific external pressures may impact on success, e.g. slower rate of land sales, changes to landscape design specifications.

The majority of participants thought that the benefits outweighed the barriers and that careful planning and design could overcome many of these. Further, the third pipe infrastructure was regarded by some to be a way of future proofing as it could be used for other alternative water sources if required.



8.2.6 Procedural Requirements

Participants highlighted a number of procedural requirements that they regarded as key to success. These included:

- Understanding the water saving potential and ensuring a sustainable water balance.
- Early inclusion of the community bore concept in the planning process and integrated into other site service discussions, particularly regarding cost.
- Early discussions and on-ongoing engagement with the community and the local council (as was the case with WGV).
- Local council approval via formal endorsement by LGA elected members to ensure a pathway through LGA officer departments. This is followed by detailed design and engagement of necessary consultants (as was the case with WGV).
- Formalised ownership and operating arrangements, with metered water use.
- Consideration of the site specific nature of the community bore, in particular the repercussions for design, water saving potential and control of the scheme.

KEY FINDING

Following a pre-determined procedure was regarded as important. However, it is important to keep everyone informed throughout, particularly as designs are constantly evolving and communication is required to ensure the best outcomes.

8.2.7 Key messages

"Great idea. Perfect for Perth"

"From little things big things grow"

"Good things take longer"

Overall the key messages about community bores were positive: trialling and adopting alternative water management systems was highly regarded. Further, there was anticipation of seeing the bore at WGV fully utilised and adopted in the future.

Participants highlighted that community bore schemes need to be site appropriate and that it may not be the best option for every site. Further, it was felt that an appropriate champion and the right technical knowledge is required to push it across the line.

Early conversations and attention to the planning phase were also highlighted. In particular, understanding maintenance and management and including all options in the site feasibility assessments and costings to ensure fewer surprises.

Possible challenges were also noted when discussing key messages: the DWER review of groundwater allocations, the already low cost of mains water and staff changes in organisations (deemed unavoidable).

KEY FINDING

Following a pre-determined procedure was regarded as important. However, it is important to keep everyone informed throughout, particularly as designs are constantly evolving and communication is required to ensure the best outcomes.

9 Recommendations and Considerations

The implementation of a community bore has many associated benefits as an alternative water supply source. However, it is important to be mindful of potential issues and risks, particularly the risk of further depleting Perth's precious groundwater.

A number of considerations are detailed here, based on the learnings from WGV and other case studies in WA.

9.1 Protecting Our Groundwater Resources

Utilisation of groundwater as a resource needs to be continually reassessed to prevent overuse. Currently there is a degree of unknown draw on the aquifer and changing infiltration rates may reduce groundwater allocations. Saltwater intrusion into the aquifer can also occur in areas, therefore ongoing water quality monitoring is required.

Consideration of how the site will respond to the possible closure of the bore is recommended. For example, changes to groundwater allocations may result in a community bore becoming unfeasible. The ability to switch to a climate independent water source such as a recycled water scheme, utilising the existing purple pipe network, would assist in future proofing.

9.2 Effective Governance Requirements

Issues regarding roles and responsibilities can occur, despite planning for effective management and handover. A clear framework with defined roles and responsibilities needs to be in place and understood by all stakeholders. Discussion over whether there will be continued reliance on the centralised governance scheme e.g. Water Corporation, or whether there will be an alternative service provider may need to take place.

Further, there needs to be early identification of the ultimate owner and operator of the scheme: either developer, local government or other service provider. Initial conversations with local government will determine whether they are willing to take on the management of the scheme or whether they decide to own the scheme and engage contractors to take care of the day to day management and operation.

Effective governance can also minimise the risks associated with the implementation of non-drinking water resources such as ensuring adherence to the use of purple pipe and community awareness about non-potable water use.

9.3 Community Engagement and Water Efficient Behaviour

Implementation of a community bore needs to ensure that the community (both new residents and adjacent residents to an infill site) and relevant stakeholders are well informed and continually engaged with the process. Providing information on the community bore at the time of sale (i.e. design guidelines) is important for new residents to understand the unique water management scheme. However, as residents design and build their house and garden they may require more information and further understanding with an on-site demonstration and explanation, particularly if specific irrigation and metering systems are in place. Anecdotal evidence suggests that all those involved with the site development, for example builders, will also benefit from a more detailed on-site explanation.

Complimentary to a community bore is water efficient behaviour. The community bore is not a sustainable solution if residents are high water users or if the development requires excessive water for POS turf. Design guidelines around water wise plantings/hydro-zoning are necessary to accompany the community bore use to ensure water efficient landscaping of both POS and domestic gardens. Individual metering is necessary to ensure residents and the operator are aware of water use. The operator will need to consider how to handle cases of excess consumption (e.g. will there be a warning system?) and whether the billing system is effective (e.g. if using a SAR is this the correct billing method?).

Continued drying of the climate may result in further water restrictions to ensure future sustainability. A ban on daytime watering (9-6) and the use of an automatic irrigation system climate controls can assist in dictating when the community bore can be used, for example at WGV the bore will not operate during the winter sprinkler ban or on days when sufficient rain has occurred. There is anecdotal evidence that some residents of 'The Green' in Butler are frustrated with the centralised control of irrigation and have converted the system or installed an individual system to run alongside the one provided. This illustrates the need for ongoing communication with residents and the importance of ensuring a community bore is the right option for the community.

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11 Appendices

End of Report

File No: RF4497-02

Government of Western Australia
Department of Water

Instrument No. GWL179828(1)

LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

Licensee(s)	City of Fremantle		
Description of Water Resource	Perth Perth - Superficial Swan	**Annual Water Entitlement**	5000 kL
Location of Water Source	Lot 2065 On Plan 190395 - Volume/Folio Lr3002/45 - Lot 2065 Hope St White Gum Valley Lot 2089 On Plan 191215 - Volume/Folio Lr3101/467 - Lot 2089 Stevens St White Gum Valley		

Authorised Activities	**Taking of water for**	**Location of Activity**
	Irrigation of up to 0.77 ha of public open space	Lot 2065 On Plan 190395 - Volume/Folio Lr3002/45 - Lot 2065 Hope St White Gum Valley Lot 2089 On Plan 191215 - Volume/Folio Lr3101/467 - Lot 2089 Stevens St White Gum Valley
Duration of Licence	From 6 October 2014 to 6 October 2024	

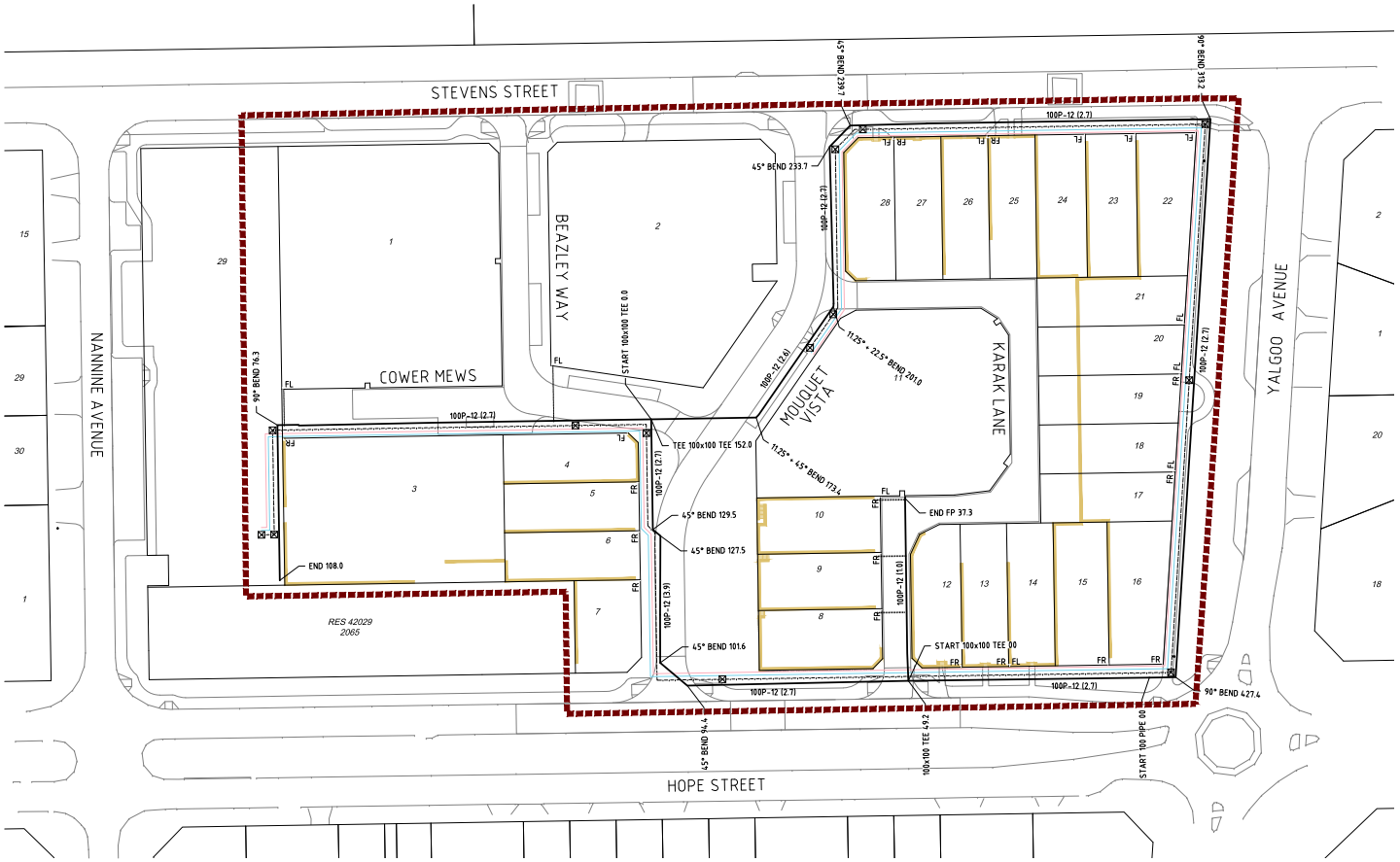
This Licence is subject to the following terms, conditions and restrictions:

1 The licensee shall not use water for lawns and gardens between 9 am and 6 pm except for the establishment of newly planted areas. For newly planted areas water may be used within these hours for a period of up to 28 consecutive days, commencing from the date of planting.

2 Between 1 June and 31 August in any year, the licence-holder must not water a lawn, garden, or grass-covered area ("turf") by reticulation, provided always that this restriction shall not apply to watering with a hand held hose; or watering, by way of reticulation: newly planted areas for a period of up to 28 days from the date of planting; for renovating turf; or for maintenance of reticulation systems.

3 That the licensee shall have the irrigation project completed by 30 October 2016.

End of terms, conditions and restrictions



CONTRACTOR'S RESPONSIBILITY

1.1 CO-ORDINATE THE INSTALLATION OF ALL SERVICES WITHIN THE SUBDIVISION. ENSURE THAT THERE IS NO CONFLICT BETWEEN THE POSITIONING OF FULLY PRE-LAID WATER SERVICES AND ANY OTHER SERVICES AND SITE FACILITIES. THESE MAY INCLUDE WESTERN POWER UNDERGROUND POWER CONNECTION PILLARS, LIMESTONE RETAINING WALLS, DRAINAGE AND SEWER ACCESS CHAMBERS.

1.2 ENSURE THAT THE LOCATION OF PRELAID SERVICES SHOWN ARE NOT UNDER BRICK PAVED AREAS OR UNDER AREAS WHICH HAVE SPECIAL VERGE TREATMENT. WHERE THERE IS NO ALTERNATIVE TO LAYING SERVICES UNDER AREAS TO BE BRICK PAVED, THEN THE CONTRACTOR AT THE TIME OF MAIN LAYING, SHOULD SEEK INSTRUCTION FROM THE SUPERINTENDENT.

1.3 REPORT ANY DISCREPANCY OR CLASH WITH OTHER SERVICES TO THE SUPERINTENDENT.

NOTES

2.1 THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE CONTRACT DRAWINGS AND SPECIFICATION.

2.2 THE CONSTRUCTION OF THE WORKS SHALL COMPLY WITH THE WATER CORPORATION'S WATER SUPPLY RETICULATION MANUAL.

2.3 ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.

2.4 THE MAINS SHALL BE LAID ON A 2.7m ALIGNMENT (U.N.O.).

2.5 THE MAIN SHALL BE FULLY PRELAID UNLESS NOTED OTHERWISE.

2.6 ALL CONNECTIONS TO LIVE RETICULATION MAINS TO BE BY THE WATER CORPORATION AT THE CONTRACTORS EXPENSE.

2.7 FL AND FR INDICATES THE SIDE OF THE LOT WHEN VIEWED FROM THE ROAD FRONTAGE WHICH IS SELECTED FOR ITS METER LOCATION.

2.8 ALL NON-POTABLE PIPEWORK AND VALVE SPINDLES TO BE COLOUR 'LILAC'

MAINS AND SERVICES

3.1 MAINLINE TO BE INSTALLED TO A MINIMUM DEPTH OF 750mm

3.2 ALL HOUSES ARE TO GET A NON POTABLE WATER SUPPLY OF 20 LPM @ 300kPa.

3.3 TWO WIRE PATH SHALL COMPRISE OF 2.5mm2 CONTROL CABLE BEING OF 2 CORE TWISTED CONSTRUCTION. THE CONTROL WIRES SHALL BE LAID IN CONDUIT ALONGSIDE, BUT NO CLOSER THAN 100mm TO THE PIPEWORK.

3.4 ALL SOLENOID CABLE JOINTS SHALL BE FITTED WITH A CRIMP AND SEALED WITH DBY CONNECTORS OR TO MANUFACTURES SPECIFICATIONS IF ALTERNATIVE METHODS OF JOINING ARE DIFFERENT.

3.5 WIRE CONNECTORS TO SOLENOID COILS AND DECODERS SHALL ONLY BE CARRIED OUT BY EXPERIENCED TRADESMEN TO MANUFACTURES SPECIFICATIONS.

3.6 ALL LOW VOLTAGE SOLENOID WIRES AND 2 WIRE PATHS AND WIRES SHALL BE INSTALLED IN 32 MD ELECTRICAL CONDUITS.

3.7 P2 CABLE PITS ARE REQUIRED EVERY 100 METERS OR CHANGE OF DIRECTION AS SHOWN ON THE PLAN. ALL CABLE PITS WILL HAVE A HOLE IN THE BASE OF 50mm MINIMUM SIZE.

3.8 NUMBER OF SERVICES :

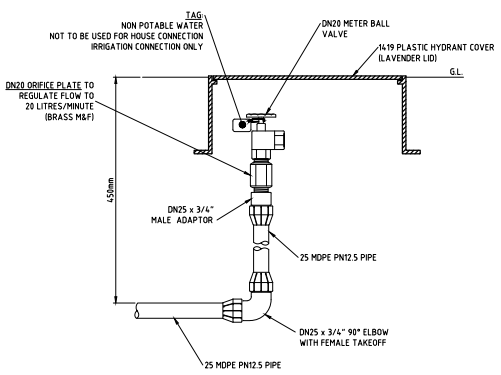
PRELAID SHORT SINGLE	14
PRELAID SHORT DUAL	6
PRELAID LONG SINGLE	2
PRELAID LONG DUAL	0
SUB-TOTAL	22
DEFERRED SERVICE(S) BY WATER CORPORATION	0
TOTAL LOTS SERVED	28

3.9 CONSTRUCT MAINS OF:

100P-12 - 547.6m

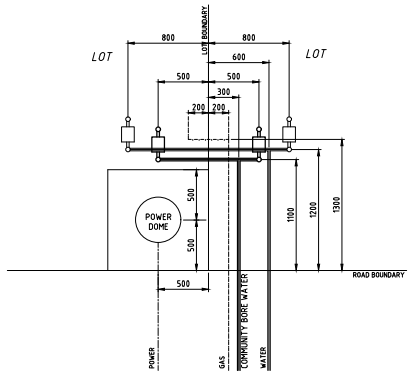
LEGEND

- PROPOSED WATER MAIN
- (2.7) PIPE ON NON-STANDARD ALIGNMENT
- SERVICE CROSSING COMPLETE
- SLUICE VALVE
- CHANGE IN PIPE SIZE / MATERIAL / ALIGNMENT
- FP FLUSHING POINT
- RETICULATION BOUNDARY
- 'D' DEFERRED SERVICE
- LOTS TO BE SERVED BUT NOT RELEASED IN THIS STAGE
- LOTS TO BE RELEASED BUT SERVED IN PREVIOUS STAGE
- RETAINING WALLS
- 32 MD CONDUIT
- WIRE PATH 1 2.5mm2 CONTROL CABLE (2 CORE TWISTED)
- WIRE PATH 2 2.5mm2 CONTROL CABLE (2 CORE TWISTED)
- P2 WIRING CABLE PIT



COMMUNITY BORE WATER CONNECTION POINT DETAIL

NOT TO SCALE



TYPICAL SERVICE ARRANGEMENT WITH COMMUNITY BORE WATER

SCALE 1:25

DIAL BEFORE YOU DIG www.1100.com.au

WAPC No. 149982

A1

SCALE 1500 0 10 20 30

No.	DATE	DRAWN	APPROVED	AMENDMENT
A	01.09.17	RDE	JBS	ISSUED FOR INFORMATION.

This plan shall not to be used for construction unless issued as rev 0 and signed as approved.

CLIENT: LANDCORP

DESIGNED	CHECKED	APPROVED
		J.SMALL
DRAWN	CHECKED	DATE
RDE	JBS	01.09.17

TABEC Civil Engineering Consultants
TABEC PTY LTD ACN 010 796 204
14 Wickham Street, East Perth WA 6004
T 08 9425 5900 E info@tabec.com.au
www.tabec.com.au

PROJECT: WGV, WHITE GUM VALLEY

TITLE: COMMUNITY BORE RETICULATION AS-CONSTRUCTED PLAN

DRAWING NUMBER: 2284-01-701-ASCON

ISSUE: A

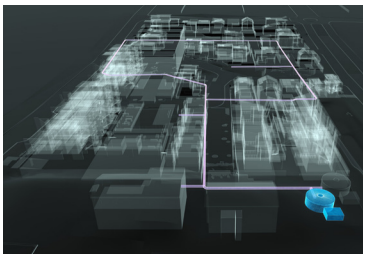
T:\Projects\2284 Design\CAD\Drawings\Stage 01\2284-01-701 ASCON.dwg 01/09/17 1:39:23 revans

LANDCORP

FACT SHEET

WGV
WHITE GUM VALLEY

INNOVATION THROUGH DEMONSTRATION



COMMUNITY BORE INFORMATION FOR RESIDENTS

A COMMUNITY BORE IS A CENTRALISED BORE THAT SUPPLIES HIGH QUALITY GROUNDWATER TO IRRIGATE BOTH PUBLIC OPEN SPACE AND RESIDENTIAL GARDENS

Water from the WGV Community Bore is a non-drinking water supply (non-potable) and it has its own underground purple pipe network running from a storage tank at the West end of WGV to all residential properties and Public Open Space (POS) across the precinct.

This centralised bore water substitutes the need for using drinking water to irrigate gardens. This is important because Perth's drinking water supply is constrained due to reduced rainfall and the demand of a growing population.

Alternative fit-for-purpose water sources, like the WGV Community Bore, can help to reduce reliance on our drinking water supplies and ensure Perth remains a liveable, productive and sustainable city.

WHERE IS THE WGV COMMUNITY BORE?

The WGV Community Bore is on the western side of the WGV site; just north of the rejuvenated landscaped stormwater infiltration basin. It consists of a bore head, large water storage tank and a small building housing various associated infrastructure, such as pumps and monitors.

The WGV Community Bore purple pipe network is installed under the verges. Like all buried services, to protect the community bore pipe from accidental damage, you must ensure that you contact **Dial Before You Dig** (www.1100.com.au) before commencing excavation works on your verges.

HOW DO I CONNECT TO THE WGV COMMUNITY BORE AND WHERE WILL I KNOW WHERE THE PIPES ARE?

All residential lots at WGV are provided with a purple in ground box located at the front or rear of the property near the Water Corporation water meter. A separate purple water meter will be housed in this box and is the connection point for your landscape irrigation system.

Once you are ready to install your private irrigation system, you will need to contact the WGV Sustainability Package Superintendent - Mark Taylor on (08) 9433 3721 for the purple meter to be installed along with a data logger for monitoring water use. The service will be activated and ready for connection as soon as the meter is installed.

HOW AND WHEN CAN I WATER MY GARDEN?

It is recommended that a Water Corporation Waterwise Specialist Garden Irrigator be used to plan and install your irrigation system.

As per the WGV Design Guidelines residential lots in WGV are required to utilise in-line drip irrigation systems in garden beds and high efficiency sprinklers in turf areas. NOTE: Drip irrigation can also be used under turf when installed correctly.

As detailed in the WGV Design Guidelines, the irrigation system must be connected to the purple meter and an automatic programmable irrigation controller with a evapotransporation sensor or rain shut off device should be installed.

The WA Department of Health's approval of the WGV Community Bore stipulates that **no above ground taps are to be connected to the system.** This helps prevent human consumption of the non-potable water supply.

It is recommended that the irrigation system should be connected and tested before the semi mature tree (see WGV Sustainability Package) is ordered for your property.

To find out when you should water your garden visit the Water Corporation website at www.watercorporation.com.au/wateringdays

HOW WILL I KNOW HOW MUCH WATER I'M USING?

The purple meter allows WGV residents and the bore operators to monitor how much water is being used for irrigation. This helps to quickly identify leaks and monitor overuse, either accidental or intentional. The data loggers enable this to be done remotely.

HOW WILL I BE CHARGED FOR MY WATER USE?

WGV Residents using the WGV Community Bore will be charged a Specified Area Rate (SAR), an annual fee that covers the cost of the operation, maintenance of the community Bore infrastructure. This fixed charge is on top of your base council rates, however the cost should be offset by the savings made through reduced scheme water use.

Contact the City of Fremantle for more information rates and billing information.

WHO DO I CONTACT IF THERE IS A LEAK OR IF THERE APPEARS TO BE A PROBLEM WITH MY CONNECTION?

The WGV Community Bore is not a Water Corporation asset. LandCorp is managing the bore until mid-2018. At that time the City of Fremantle will take over its operation and maintenance.

The contact during the initial period to mid-2018 is WGV Landscape Superintendent - Morgan Gillham on 0422 864 600.

WHERE CAN I GET MORE INFORMATION ON WATERWISE LANDSCAPING?

The WGV Design Guidelines provides key information for you to consider when designing and building your landscape.

For more information on how to achieve a Waterwise garden, visit the Water Corporation website via this link:

www.watercorporation.com.au/save-water/in-the-garden

End of Guide


WATERWISE COUNCIL
Department of Water and Environmental Regulation
WATER CORPORATION