NARRABRI GAS PROJECT

Site Water Balance

PHASE 1

0041-150-PLA-0017

Date	Revision	Reason for Issue	Author	Checked	Approved
24 January 2024	0D	Dewhurst 34 location change	Onward Consulting	[redacted]	[redacted]

Santos

Prepared by:

Title	Name	Date
Senior Environmental Manager Onward Consulting	S. van der Meulen	24 January 2024
Director Onward Consulting	M. Vile	24 January 2024

Reviewed by:

Title	Name	Date
Acting Manager Onshore Environment Santos Ltd	[redacted]	24 January 2024

Approved by:

Title	Name	Date
Development Manager NSW & NT Santos Ltd	[redacted]	24 January 2024

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ONWARD CONSULTING

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Document review history

In accordance with consent condition D4, this document has been reviewed as follows:

Review Date	Reason for review	Reviewed by	Revision required (Y/N)

Acronyms and abbreviations

Acronym	Description
°C	degrees Celsius
µg/L	micrograms per litre
AHD	Australian height datum
ANZECC	Australia and New Zealand Environment and Conservation Council
AS/NZS	Australian Standard/New Zealand Standard
cm	centimetre
CoC	Conditions of consent for the NGP SSD 6456
CSG	coal seam gas
D&C	drilling and completions
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DCCEEW Water	The Water Group within DCCEEW
DPE	The former NSW Department of Planning and Environment
DPIE	The former NSW Department of Planning, Industry and Environment
dS	deciSiemens
dS/m	deciSiemens per metre
EC	electrical conductivity
EMP	environmental management plan
EIS	environmental impact statement
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2021
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	environment protection licence
EQuIS	Environmental Quality Information System
GAB	Great Artesian Basin
GOB	Gunnedah-Oxley Basin
HDPE	high density polyethylene
IEA	Independent Environmental Audit
IMP	Irrigation Management Plan
kg	kilogram
L	litre
MDB	Murray Darling Basin
m	metre
ML	megalitre
ML/day	megalitre per day

Acronym	Description
ML/y	megalitre per year
mm	millimetre
NRAR	Natural Resources Access Regulator
PAL	petroleum assessment lease under the PO Act
PEL	petroleum exploration licence under the PO Act
PO Act	*Petroleum (Onshore) Act 1991* (NSW)
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
POEO Regulation	Protection of the Environment Operations (General) Regulation 2022
PPL	petroleum production lease under the PO Act
PPLA	petroleum production lease application under the PO Act
RO	reverse osmosis
SMS	Santos Management System
SSD	State significant development
SWB	Site Water Balance (this document)
WAL	water access licence
WBTP	water and brine treatment plant
WM Act	*Water Management Act 2000* (NSW)
WMP	Water Management Plan
WMS	water management system
WRP	water resource plan
WSP	water sharing plan
WTAG	Water Technical Advisory Group

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1. Introduction

1.1 Narrabri Gas Project

1.1.1 Background

Resource exploration has been occurring in the north-western area of NSW since the 1960s; initially for oil, but more recently for coal and gas. Santos NSW Pty Ltd began exploring for natural gas from coal seams in north-western NSW in 2008 and is currently conducting coal seam gas (**CSG**) exploration and appraisal activities within Petroleum Exploration Licence (**PEL**) 238, Petroleum Assessment Lease (**PAL**) 2 and Petroleum Production Lease (**PPL**) 3, located in the Gunnedah Basin about 20 kilometres (**km**) south-west of the town of Narrabri. Activities in PAL 2 have focussed on the Bibblewindi and Bohena CSG pilots, whilst recent activities in PEL 238 have focussed on the Dewhurst and Tintsfield CSG pilots.

The Narrabri Coal Seam Gas Utilisation Project (Wilga Park Power Station and associated infrastructure) operates under an existing Part 3A approval under the *Environmental Planning and Assessment Act 1979* (NSW) (**EP&A Act**). It was originally approved in 2008, with various modifications approved between 2011 and 2019. It encompasses a gas gathering system, a compressor and associated flare, a gas flow line from Bibblewindi to Wilga Park within a 10 metre (**m**) corridor with a riser at Leewood and an expansion of the existing Wilga Park Power Station from 12 to 40 megawatts.

1.1.2 Current Project

On 30 September 2020, Santos NSW (Eastern) Pty Ltd (**Santos**) obtained development consent for State significant development (**SSD**) 6456 to develop the Narrabri Gas Project (**NGP**) (**the Project**). Approval EPBC 2014/7376 under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**) was granted on 24 November 2020.

The Project includes the progressive installation of up to 850 new gas wells on up to 425 new well pads over approximately 20 years and the construction and operation of gas processing and water treatment facilities. The Project area covers about 950 square kilometres (95,000 hectares) in size and the Project footprint will only directly impact about 1% of that area.

Four phases of development are defined under the consent, including:

- Phase 1 - exploration and appraisal;
- Phase 2 - construction activities for production wells and related infrastructure;
- Phase 3 - gas production operations; and
- Phase 4 - gas well and infrastructure decommissioning, rehabilitation and closure.

Phase 1 of the Project is defined in the consent as the phase of the development comprising ongoing exploration and appraisal activities in the Project area, including:

- seismic surveys;
- core and chip holes;
- construction and operation of pilot wells (up to 25 wells on up to 25 well pads across the Project area); and
- pilot well ancillary infrastructure, including access tracks, gas and water gathering lines, water balance tanks, safety flaring infrastructure, utilities and services, and environmental monitoring equipment including groundwater monitoring bores.

Santos plans to continue exploration and appraisal of the resource in the near term until a final investment decision can be made. The exploration and appraisal activities will include continued operation of Santos' existing wells, infrastructure and facilities in PEL 238 and PAL 2, and construction and operation of new core holes, pilot wells and supporting infrastructure permitted under Phase 1.

Santos' existing exploration and appraisal activities in PEL 238 and PAL 2 include:

- Tintsfield Pilot;
- Bibblewindi East Pilot;
- Bibblewindi West Pilot;
- Dewhurst North Pilot;
- Dewhurst South Pilot;
- Dewhurst northern and southern flow lines;
- Leewood Water Management Facility including ponds, the water and brine treatment plant (**WBTP**) and the irrigation area;
- Bibblewindi Facility including gathering system, water balance tank, compressor and flare; and
- Bibblewindi to Leewood buried gas pipeline.

These exploration and appraisal activities will continue as part of the NGP. The initial, new-appraisal Phase 1 scope is a relatively minor extension to these existing exploration and appraisal activities.

The Phase 1 scope is planned to include the construction and operation of:

- 4 coreholes;
- 6 pilot wells;
- 2 deep reservoir monitoring bores (converted coreholes);
- new shallow water monitoring bores;
- associated linear infrastructure;
- seismic surveys (length and location to be determined); and
- continued operation of Santos' existing exploration and appraisal activities, including workover activities.

The full definitions of the approved activities for Phases 2, 3 and 4 of the Project are provided in the consent. Santos is not prevented from carrying out any or all of the phases concurrently, subject to the conditions of this consent.

Further details regarding the NGP, including a full overview of the regulatory framework and statutory provisions of the NGP and the current approvals, leases and licences related to the management of water are provided in the overarching NGP Water Management Plan (**WMP**). Details regarding the staging of the works and the exact scope for each phase are as per the approved Field Development Plan.

1.2 Purpose and scope of the Site Water Balance - Phase 1

This Site Water Balance (**Water Balance** or **SWB**) has been developed in accordance with the requirements of approval conditions of PEL 238; PAL 2; PPL 3; compliance conditions of Environment

Protection Licence (**EPL**) 20350 and the SSD 6456 conditions of consent (**CoC**). It describes the predicted inflows and outflows within the Project area and the associated water storage and treatment capacity during Phase 1 of the Project, as required by CoC B41(d)(ii). Santos will implement all reasonable and feasible measures and be strategic and proactive in the management of water so that any potential impacts on the environment are avoided or minimised.

This version of the Water Balance applies to activities of Phase 1 of the Project only and as such, the requirements, obligations and water inflow and outflow volumes applicable to subsequent phases of the Project have not been considered in this document. It will be updated at least annually using the most recent monitoring and production data to refine the inflows and outflows within the Project area.

This specific revision of the SWB has been prepared to reflect a location change for well pad Dewhurst 34 (DWH 34). The original site identified for DWH 34 was on a private property and discussions had been held over several years with a registered titleholder that was residing on the property. A land access agreement was provided to the titleholders, all titleholders were not agreeable to the activity progressing and the agreement was not finalised. On this basis, the location for well pad DWH 34 has been moved from private property to State forest, with any relevant amendments addressed in this SWB.

Some minor adjustments and corrections have also been made throughout the document.

Together with the other documents that form part of the suite of documents appended to the WMP, this Water Balance will assist in meeting the following 'Water management - General' performance measures listed in Table 7 of the CoC under condition B37, by identifying the volumes of water requiring management:

- maximising water recycling, reuse and sharing opportunities;
- maximising beneficial re-use of treated water;
- minimising the need for discharge of treated water to Bohena Creek; and
- designing, installing, operating and maintaining water management infrastructure in a proper and efficient manner.

Note that there will be no release of treated produced water to surface waters, including Bohena Creek, during Phase 1.

This Water Balance forms part of a suite of documents prepared as part of the WMP under condition B41, which consist of the following:

- An Erosion and Sediment Control Plan (**ESCP**), prepared in accordance with the Blue Book and identifying details including but not limited to activities that could cause soil erosion, generate sediment or affect flooding; the location, function, and capacity of erosion and sediment control structures and flood management structures; and measures to manage any effects of soil erosion, sediment transport and flooding;
- A Site Water Balance (this document);
- A Surface Water Management Plan (**SWMP**), which includes but is not limited to specific details on baseline data on surface water flows and quality of watercourses; the surface water management system; detailed plans, design objectives and performance criteria for water infrastructure; performance criteria for identifying and investigating any adverse impacts; a program and procedures for monitoring, evaluation and reporting; and a plan to respond to any exceedances of the performance measures or performance criteria, and repair, mitigate and/or offset any adverse surface water impacts of the development;
- A Groundwater Management Plan (**GMP**), which provides details including but not limited to baseline data of hydrogeology and groundwater levels, formation parameters and quality for

groundwater resources; a description of the groundwater management and monitoring system; performance criteria, trigger and response levels; a program and procedures for monitoring, evaluation and reporting; and a plan to respond to any exceedances of the groundwater performance criteria, and repair, mitigate and/or offset any adverse groundwater impacts of the Project;

- A Produced Water Management Plan (**PWMP**) that provides detailed baseline data on produced water yield and quality, and includes but is not limited to details regarding the produced water management system; performance criteria, including trigger levels; and a program and procedures for monitoring, evaluation and reporting;
- An Irrigation Management Plan (**IMP**), for managing beneficial reuse of treated water for crop irrigation and stock watering, that includes but is not limited to details regarding site selection and assessment; agreements with third parties; baseline soil and groundwater conditions and quality; a protocol for operation of the irrigation management system; and measures to manage any effects on soils structure, erosion, groundwater quality and maintain a water balance;
- A Dust Suppression Protocol for managing beneficial reuse of treated water for dust suppression and construction activities including but not limited to details of site selection and assessment; baseline soil and groundwater conditions and quality; a protocol for operation of the dust suppression system; and measures to manage any effects on soils structure, erosion, surface water runoff, groundwater quality and groundwater levels;
- A Managed Release Protocol for managing disposal of treated water to Bohena Creek, that includes but is not limited to details of water flows, quality and health; predicted plume dispersal; a protocol and detailed procedures for managed release; and measures to manage any effects of water quality, stream and riparian health, erosion and sedimentation and downstream flooding. There will be no managed release to Bohena Creek during Phase 1 of the Project and as such this protocol will be developed for Phase 2 of the Project. A summary has been provided in section 6 of the PWMP;
- A Salt Management Plan, which includes but is not limited to details of salt and other waste volumes and composition generated by the produced water management system; a program for investigating and implementing beneficial reuse options for the salt product; a protocol and procedures for the full-cycle management of salt and salt-related waste products; and measures to ensure appropriate storage and disposal of any salt waste. There will not be any salt produced during Phase 1 of the Project (only brine will be generated) and there is adequate storage in the existing facilities to manage this brine for Phase 1. Section 7 of the PWMP describes this proposed approach to salt management for the Project. A stand-alone plan will be developed for Phase 2 of the Project;
- A Pollution Incident Response Management Plan (**PIRMP**), prepared in accordance with the *Protection of the Environment Operations (General) Regulation 2009* (**POEO Regulation**) and which includes detailed procedures for responding to incidents, spills and leaks associated with the produced water management system; and a Dam Safety Emergency Plan for managing potential incidents and emergencies associated with produced water storages; and
- A protocol to report on the measures, monitoring results and performance criteria identified above, in the Annual Review referred to in CoC D8.

A full list of the conditions applicable to the Water Balance is presented in section 3.1.4. A copy of the consent conditions relevant to each of the other subplans listed above is provided in each of the individual documents.

As required by CoC B42, Santos will implement the latest revision of the WMP (including this Water Balance) once approved by the Planning Secretary.

1.3 Objectives

The objectives of this Water Balance are to:

- provide details of the relevant statutory requirements (including any relevant approval, licence or lease conditions);
- details of any relevant commitments or recommendations identified in the Environmental Impact Statement (**EIS**) for the Project
- provide details of the predicted annual inflows and outflows of water into the water management system (**WMS**);
- describe how water is used on the Project including transfers and sharing with nearby water users;
- describe the discharge points and limits;
- describe the reporting procedures including how the Water Balance will be updated annually; and
- comply with the requirements of CoC B41(d)(ii).

Note that the details regarding water storage infrastructure and associated capacity is provided in the PWMP and the SWMP.

1.4 Consultation

For Phase 1, this Water Balance, as Attachment 2 to the WMP, has been prepared by a suitably qualified and experienced person, in consultation with the Water Group within the NSW Department of Climate Change, Energy, the Environment and Water (**DCCEEW**) (generally referred to as **DCCEEW Water**), the NSW Environment Protection Authority (**EPA**) and the Water Technical Advisory Group (**WTAG**).

The comments received from the Natural Resources Access Regulator (**NRAR**) [on behalf of DCCEEW Water] on the draft Water Balance (Revision C) concentrated on water-related infrastructure, water metering and water sources. No specific comments were received from the EPA on the draft document. Further comments from DCCEEW Water on the Site Water Balance were received on 12 September 2022, at the request of DPE. DCCEEW Water was generally satisfied with the SWB (Revision 0), with a single recommendation to provide a clarification regarding the water access licences.

The comments provided by the WTAG predominantly focussed on improving the content of the document, identifying a number of discrepancies and opportunities for simplification.

All consultation correspondence and the responses to comments are provided in Appendix A.

No further consultation was required to be undertaken for this minor revision of the SWB, as the then NSW Department of Planning and Environment (**DPE**) considered the changes are relatively minor and agreed that further consultation with other agencies was not required. This is reflected in the DPE letter of approval for the revised FDP (Rev 0B), issued on 28 November 2023.

A copy of the DPE FDP approval letter is available on the Project website.

1.5 Document structure

Together with the suite of documents listed in section 1.2, this Water Balance is a supporting management plan (subplan) to the WMP. The WMP sets out the overall details how the documents are related and where information or details are located in the event of any overlap or commonality.

The structure of this document is as follows:

Section 1	Provides an introduction to the Project and the context, scope, purpose and objectives of this Plan. It further provides the performance measures related to produced water
Section 2	Defines the roles and responsibilities of personnel involved with the management of water generated and used through NGP activities, including staff, consultants, contractors and service providers
Section 3	Outlines the regulatory requirements relevant to the management of water generated and used by development of the NGP
Section 4	Describes the sources of water, including details about the quantity and quality
Section 5	Provides details on where water is used on the Project
Section 6	Describes the water storage and treatment infrastructure on the Project
Section 7	Provides details of the Water Balance including a net volume of water (if any) available for beneficial re-use or managed release
Section 8	Outlines the monitoring program implemented across the gathering, transfer and storage infrastructure and facilities
Section 9	Describes the trigger, action and response plan developed to assess and respond to abnormal conditions and to manage risks to operations, personnel and the environment
Section 10	Provides details on the process that is implemented to manage data and records in a consistent, efficient and effective manner
Section 11	Outlines the process for reporting incidents and non-compliances to the relevant agencies, and the management procedure for complaints
Section 12	Describes the reporting, evaluation, review and reporting process for the Water Balance including annual updates required for this plan
Section 13	References
Section 14	Glossary
Appendix A	Provides copies of the consultation records and responses to all comments
Appendix B	Compliance conditions directly relevant to the Site Water Balance
Appendix C	Key produced water management assets
Appendix D	Site water balance TARP

1.6 Distribution

A copy of this approved Water Balance is available to all Santos personnel via the Santos intranet. In accordance with consent condition D13, the latest copy of the Plan including all associated appendices, audits and reports, and summaries of all monitoring data (where relevant), can also be found on the

Project website, once these have been approved by the Planning Secretary. This information will be kept up to date.

In accordance with specific licence, approval or code of practice conditions, a copy of this Water Balance is available at the Santos Operations Centre located at 300 Yarrie Lake Road in Narrabri. This is where operational and field staff commence and finish each workday.

Note that any printed copies of this Water Balance are uncontrolled.

2. Roles and responsibilities

All Santos employees and contractors involved in the Narrabri Gas Project are responsible for the environmental performance of their activities and for complying with all legal requirements and obligations. Project personnel will be required to comply with approval requirements of the activities they undertake and potential environmental impacts from all activities will be managed in accordance with the Project's relevant management plan(s).

In accordance with consent condition D1, the Environmental Management Strategy (**EMS**) sets out the roles, responsibilities, authorities and accountabilities of all key personnel involved in the environmental management of the Project, including the requirements and obligations in this Water Balance. All roles, responsibilities and accountabilities have been assigned in accordance with Santos Management System *SMS-MS_14 People Management Standard*.

3. Regulatory requirements

The Project is permissible with development consent under the *State Environmental Planning Policy (Resources and Energy) 2021*, and is identified as a 'State significant development' under Section 4.38 of the EP&A Act and the *State Environmental Planning Policy (Planning Systems) 2021*.

The Project was subject to the State significant development assessment and approval provisions of Division 4.1 of Part 4 of the EP&A Act and was approved as a State significant development under the EP&A Act and the EPBC Act.

The Project will be carried out in accordance with the:

- relevant existing development consents and activity approvals;
- the conditions of relevant tenements including PEL 238, PAL 2, PPL 3, the provisions of the *Petroleum (Onshore) Act 1991* (NSW) (**PO Act**) and relevant codes of practice;
- Water access licences under the *Water Management Act 2000*, as detained in section 4.1.3;
- EPL 20350 issued by the EPA and the provisions of the *Protection of the Environment Operations Act 1997* (**POEO Act**); and the
- conditions of consent for the NGP SSD 6456.

3.1 Compliance conditions

Compliance conditions associated with the following licence(s), lease(s) and consent(s) are relevant to this PWMP:

- PEL 238, granted on 1 September 1980, most recently renewed on 12 April 2022 and varied on 5 September 2023;
- PAL 2, granted on 30 October 2007 and varied on 5 September 2023;
- PPL 3, granted on 15 December 2003 and varied on 5 September 2023;
- PPLs 13, 14, 15 and 16, once issued;
- EPL 20350, as varied; and
- SSD 6456.

3.1.1 PEL 238

There are no specific conditions or obligations in PEL 238 related to this Water Balance.

3.1.2 PAL 2 and PPL 3

Lease condition 2 of PAL 2 and PPL 3 state that activities must only be carried out in accordance with a Petroleum Operations Plan (**POP**) which has been approved by the Director-General of the Department of Primary Industries. Further, the POP must (i) identify how operations will be carried out on site in order to prevent and or minimise harm to the environment; and (ii) reflect conditions of approval under the EP&A Act, the POEO Act, and any other approvals relevant to PAL 2 and PPL 3.

This Water Balance supports the PWMP which in turn supports the POP which satisfies condition 2 of PAL 2 and PPL 3 by providing information about how Santos manages produced water resulting from the operation of its activities within PAL 2 and PPL 3.

3.1.3 EPL 20350

'Petroleum exploration, assessment and production' is a scheduled activity listed in Schedule 1 of the POEO Act. Under Section 48 of the Act, all scheduled activities are required to hold an environment protection licence. EPL 20350 is held for CSG activities in PEL 238, PAL 2 and PPL 3. There are no specific licence conditions related to this Water Balance.

3.1.4 Development consent SSD 6456

There are a number of SSD 6456 consent conditions directly relevant to this Water Balance for Phase 1, with the key condition CoC B41(d)(ii) provided in full below. Table B1 in Appendix B specifies where each of the requirements of all the relevant SSD 6456 consent conditions are addressed in this Plan.

Consent condition B41 states that Santos must prepare a Water Management Plan for the NGP to the satisfaction of the Planning Secretary and that this plan must:

(d) include a:

(ii) Site Water Balance, that includes details of:

- predicted annual inflows and outflows in the project area;
- sources and security of water supply for the life of the development (including authorised entitlements and licences);
- water storage and treatment capacity;
- water use and management in the project area, including any water transfers or sharing with neighbouring water users;
- licensed discharge points and limits; and
- reporting procedures, including the annual preparation of an updated site water balance.

Consent condition B28 states that prior to the commencement of the Project, Santos must demonstrate that it has adequate water licences to account for the maximum predicted water take for the applicable Phase (including both short term and long term direct and indirect water take) to the satisfaction of the Planning Secretary [noted that the maximum predicted water take will be based on the most recent update of the groundwater model].

3.2 Relevant codes, standards, policies and guidelines

3.2.1 Produced water code

As per consent condition B37, Santos will design, install and maintain the produced water infrastructure in accordance with the exploration *Code of Practice: Produced Water Management, Storage and Transfer* (DPE, 2017) (**Produced Water Code**).

The Produced Water Code sets out mandatory requirements and provides title holders with related guidance about the expected performance for the management, storage and transfer of produced water. It serves three purposes. It:

- provides upfront information to industry and the community;
- facilitates the assessment of exploration activities consistent with Part 5 of the EP&A Act; and
- sets out enforceable mandatory requirements related to produced water management, storage and transfer.

Further, it enables industry to:

- adopt a risk-based approach to ensure compliance with mandatory requirements related to produced water;
- commit to measurable performance;
- monitor performance and take corrective action if outcomes are not being achieved; and
- keep and maintain relevant records of activities and/or actions.

This Water Balance supports the PWMP, and the compliance with the Produced Water Code is fully addressed in the PWMP.

3.3 EIS commitments

In the EIS Chapter 31, Santos committed to implement a number of measures pending Project approval and a final investment decision. There are no specific commitments relevant to the Water Balance.

4. Sources of water

The sources of water that enter the WMS can generally be grouped into the following and have been described further in the sections below:

- direct and indirect water take from producing wells
- water for construction and operational purposes (including from licenced bores, potable (town) water and beneficial reuse of treated water); and
- run-off and rainfall.

4.1 Water take from producing wells

4.1.1 Direct take

During Phase 1 of the development, average annual extraction from appraisal wells is expected to be between approximately 300-400 ML or up to approximately 1.26 megalitre (**ML**) per day (**ML/day**).

The volume of water generated during the production phase is determined by the properties of the coal and the depressurisation targets that must be achieved to facilitate gas production.

Figure 4.1 presents the predicted produced water production volumes over time for Phase 1, showing the predicted contribution of each pilot to water production for a period of 10 years from the start of Phase 1. It is to be noted that final water production may vary depending on a range of factors, such as well operation, coal properties and Project scheduling.

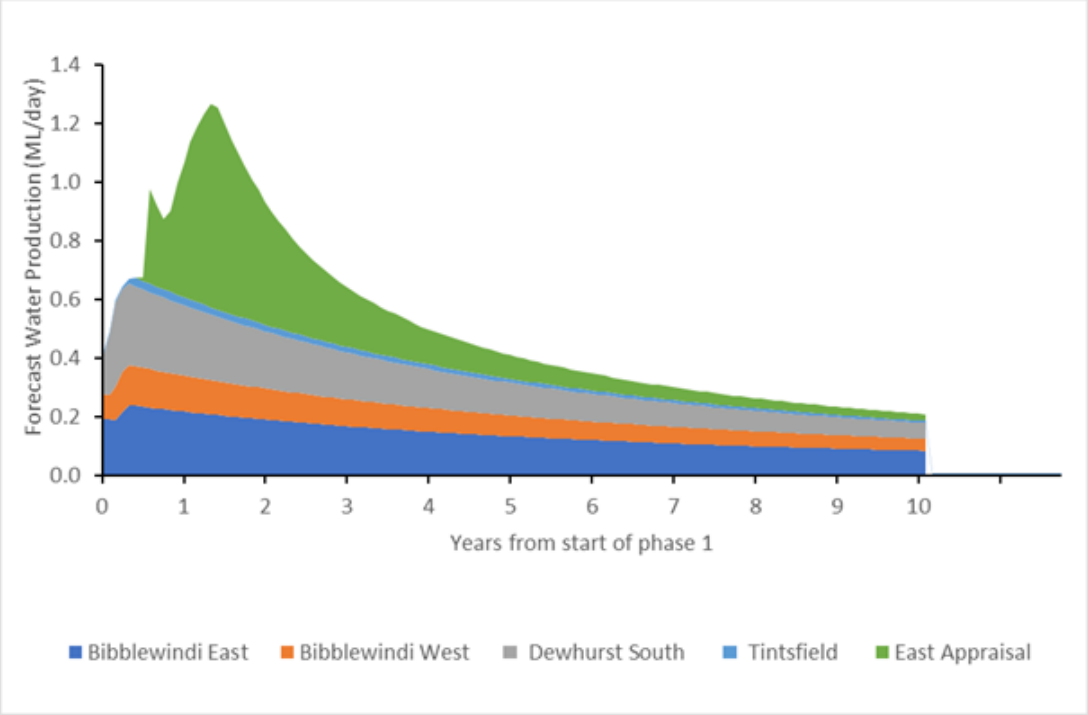


Figure 4.1 - Predicted existing and produced water production in Phase 1

4.1.2 Indirect water take (leakage)

The maximum predicted indirect water take has been computed using the CDM Smith (2016) groundwater model, updated with the most recent historical well production rates and the current Phase 1 water production forecast for the Project. A summary of the estimated maximum indirect water take of each water sharing plan is presented in Table 4.1.

Table 4.1 - Estimated maximum indirect water take

WSP	Short-term water take (ML/y)[1]	Long-term water take (ML/y)[2]
	Indirect	Indirect
Great Artesian Basin Southern Recharge	0	9
Great Artesian Basin Surat	0	0
Lower Namoi Alluvium	0	0
Upper Namoi Alluvium	0	0
Liverpool Ranges Basalt	0	0
Warrumbungle Basalt	0	0

Notes:

1 - Short-term - Phase 1 period from 2020 to 2045, reported values are rounded to the nearest whole ML/year.

2 - Long-term - after 2045, reported values are rounded to the nearest whole ML/year.

Since the date of Phase 2 commencement is not known, and the WMP is only required to address Phase 1 activities, this SWB and the GMP conservatively assume that Phase 1 will run for a minimum of 25 years. This is to enable a conservative assessment of coal seam water production.

In reality, Phase 2 is likely to commence in the next few years, prior to which the SWB will be updated to reflect water production across both Phase 1 (comprising appraisal) and Phase 2 (comprising construction and gas field development) and likely also Phase 3 (comprising gas field operation).

For Phase 1 of the Project, water licences held for long-term indirect take will be used for direct take, as listed in Table 4.2.

There is zero indirect take from the Namoi Alluvium and as such there is no requirement for a licence required under CoC B28.

4.1.3 Water access licences

Under Section 60A of the *Water Management Act 2000* (NSW) (**WM Act**) all extraction from a water source requires a water access licence (**WAL**). Therefore, all water extracted from the pilots and appraisal wells during Phase 1 must be within an allocated volume granted by a WAL in the relevant water sharing plan (**WSP**)/water source.

Table 4.2 provides the WALs held by Santos in the relevant WSP/water sources. Santos currently holds 3,650 ML of water allocation in the Gunnedah-Oxley Basin MDB[1] Porous Rock Groundwater Source

[1] MDB - Murray Darling Basin

(**GOB**) which is enough to cover water extraction from the GOB for the whole Project. Santos also holds 10 ML of water allocation in the Great Artesian Basin Southern Recharge Groundwater Source which is enough to account for indirect take (from leakage) for Phase 1 of the development.

According to the Water Sharing Plan Rules[2] up to 25 % of the total allocation can be carried over each year if unused.

Table 4.2 - Water access licences (direct and indirect take)

Water access licence	Water supply works[1]	Water source	Water extraction limit
WAL 36546	• 90MW832512 (Bibblewindi pilot wells, Tintsfield pilot wells) • 90WA832266 (Dewhurst 22-29 Pilot wells) • Phase 1 wells (Dewhurst 37-42 pilot wells)	Gunnedah-Oxley Basin MDB Porous Rock Water Source	600 ML
WAL 43553	Not used for water take during Phase 1	Gunnedah-Oxley Basin MDB Porous Rock Water Source	2650 ML
WAL 43548	Not used for water take during Phase 1.	Gunnedah-Oxley Basin MDB Porous Rock Water Source	400 ML
WAL 15819	• 90WA811395 (Bibblewindi 1)	Great Artesian Basin Southern Recharge Groundwater	5 ML
WAL 15847	• 90WA811395 (Bibblewindi 1) • 90WA811397 (Bibblewindi 5) • 90WA832041 (Leewood))	Great Artesian Basin Southern Recharge Groundwater	5 ML

Note:

1. While Santos holds a number of WSW approvals for existing petroleum wells in PEL 238 and PAL 2, WSW approvals (being a water management approval under section 90 of the *Water Management Act 2000*) are not required for State significant development that is authorised by a development consent in accordance with section 4.41(1) of the *Environmental Planning & Assessment Act 1979*.

4.2 Construction and operational water

Water for construction and operational uses will be sourced from:

- amended treated produced water, where permitted under EPL 20350;
- licenced groundwater supply bores; and
- potable town water supply.

[2] Cl. 37 of the *Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2020*.

4.2.1 Amended treated produced water

As permitted under EPL 20350, Santos will beneficially reuse amended treated produced water for construction and operational purposes including construction/civil works, drilling and completions (**D&C**) and firefighting. Approximately 1 ML of amended treated water per day is expected to be generated by the Leewood Water Treatment Plant, once operational, during Phase 1. Note that only bore water will be used for dust suppression during Phase 1.

4.2.2 Licenced bores

Santos has three water supply bores from which it has abstracted water for construction and operational purposes including for construction/civil works, dust suppression, drilling and completions (**D&C**), rehabilitation and firefighting. These bores, their water supply works (**WSWs**) approval numbers and associated WAL numbers are listed in Table 4.3. Each bore includes a metering point which is used to quantify the water take. Metering meets the requirements of the *NSW Non-Urban Water Metering Policy.* Note that only the groundwater supply bores at Bibblewindi (BBD 1 and BBD 5) will be used during Phase 1 of the Project. The locations of the two bores at Bibblewindi are presented in Figure 4.2.

Santos expects to continue abstracting water from these bores under WALs 15819 and 15847 for construction and operational purposes until Year 40 when the model predicts that induced leakage from the Great Artesian Basin Southern Recharge Groundwater Source will occur. These WALs will then be retired in the name of the Minister.

Where there is a requirement to source local groundwater for construction/operational purposes, Santos would do this under third-party lease arrangements, or would secure additional water allocation for the Great Artesian Basin Southern Recharge Groundwater Source.

Table 4.3 - Water bores

Water supply works	Water access licence	Water source	Water extraction limit
Leewood (not used for Phase 1)	N/A	Great Artesian Basin Southern Recharge Groundwater	This WSW is listed on WAL 15847
BBD 1	WAL 15819	Great Artesian Basin Southern Recharge Groundwater	5 ML (this WSW is also listed on WAL 15847)
BBD 5	WAL 15847	Great Artesian Basin Southern Recharge Groundwater	5 ML

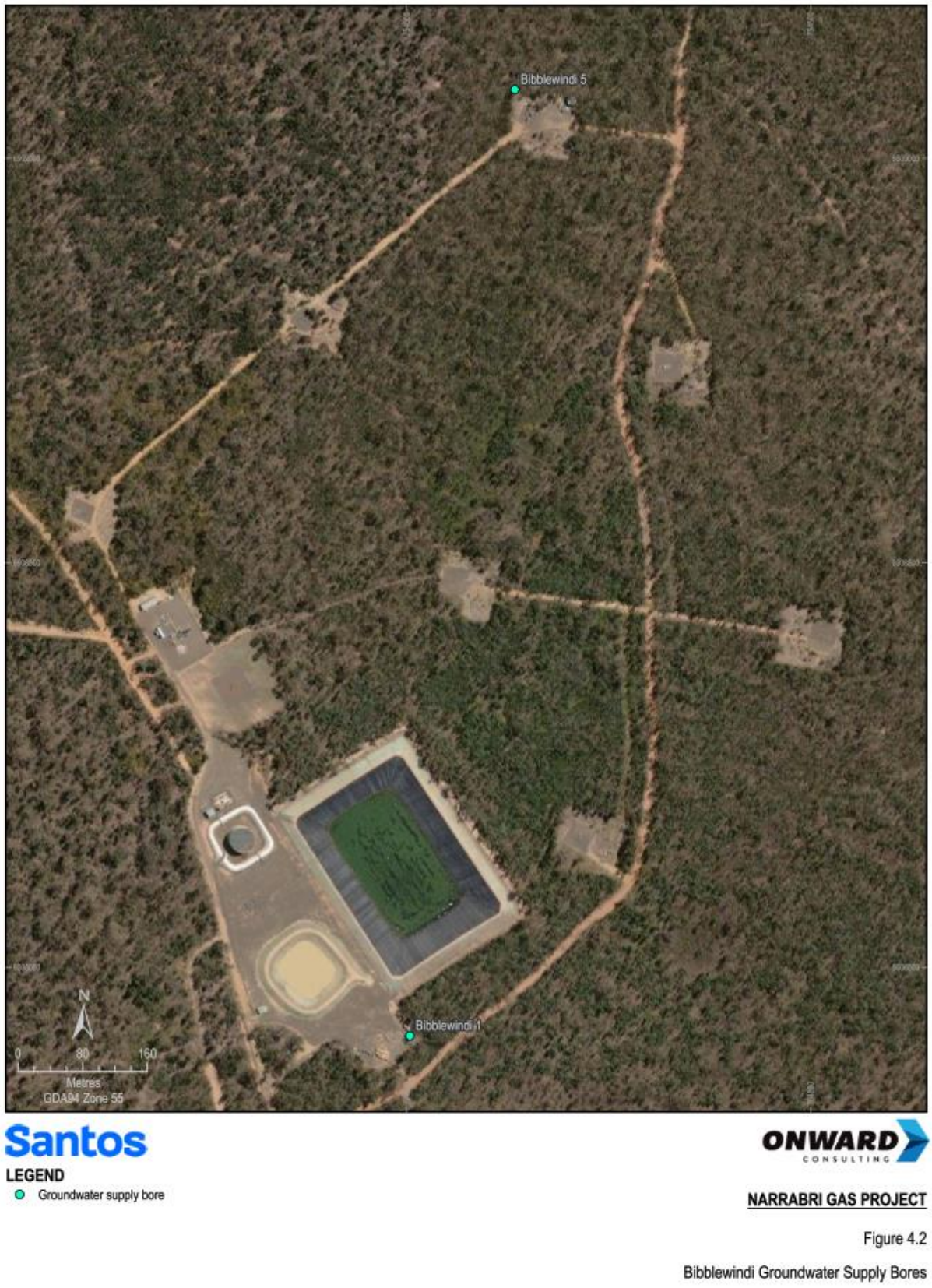


Figure 4.2 - Bibblewindi groundwater supply bore locations

4.2.3 Potable town water

For Phase 1, potable water will be trucked in from the Narrabri town water supply and stored in tanks at Leewood and Bibblewindi. The volume of potable water is negligible in comparison to the volume of produced water, and as such has not been included in the overall water balance for Phase 1.

4.3 Rainwater and run-off water sources

Incident rainfall on open water storages and sediment laden run-off from disturbed areas contribute water into the WMS. These sources of water entering the WMS have been modelled and therefore considered in the overall predicted inflows into the WMS. Open water storages have been designed with adequate freeboard to accommodate significant rainfall events.

Note that for Phase 1, there are no discharges from sediment basins entering the WMS.

5. Water uses and outflows

5.1 Beneficial reuse for operational support

5.1.1 Dust suppression

During operation of the pilot and appraisal wells in Phase 1 dust suppression will be required on access tracks and around the well pads. Only bore water will be used for dust suppression during Phase 1.

Currently this Water Balance has not modelled dust suppression volumes for 2021 to 2023. This will be updated once more data is available.

Further details are provided in the Dust Suppression Protocol.

5.1.2 Construction

During construction, water will be required for a variety of uses such as making up concrete and for compaction of soil and fill materials during earthworks. This water will be preferentially sourced from amended treated produced water, with potential limitations due to volumes required or available; water quality or distance from storage options. In these situations, bore water from groundwater supply bores BBD 1 and BBD 5 will be utilised.

5.1.3 Drilling and completions

Water is required to 'make up' drilling fluids required for efficient D&C operations. Drilling fluid is predominantly comprised of water (more than 70 %) with the balance being weighting agents and additives which are added in varying proportions depending on the geological conditions and the objectives of the D&C activity. Additives commonly used include bentonite or polymer, which are used to form a temporary filter cake on the sides of the uncased bore. This rapidly reduces the infiltration of drilling fluids into the formations through which the bore extends. The drilling fluid is pumped downhole to:

- clear rock fragments and other solids such as drill cuttings from the well and help bring them to the surface;
- prevent clays from swelling;
- keep the bore hole open until the casing has been cemented in place; and
- cool and lubricate the drilling equipment.

During Phase 1, drilling water will be preferentially sourced from amended treated produced water. Only amended treated water or bore water from the GAB Southern Recharge Water Source will be used in D&C make up water requirements. During Phase 1 there may be times when the water demand from D&C activities exceeds that which is available from treated produced water. In these situations, bore water will be utilised. Opportunities for the use of produced water pre-treatment and brine are being evaluated for subsequent phases of the Project.

5.1.4 Potable water

For Phase 1, potable water will be trucked in from the Narrabri town water supply and stored in tanks at Leewood and Bibblewindi. The volume of water is negligible in comparison the volume of produced water, and has not been included in the overall water balance for Phase 1.

5.2 Ancillary beneficial reuse

The NSW government recommends a best-practice approach for deciding the most appropriate re-uses of produced water. The most appropriate beneficial re-uses depend on the quality and quantity of produced water, local climate, soils and geology, existing land and water use, industry and employment within the region. Examples of beneficial re-use options include irrigation, dust suppression, re-injection, fire protection, D&C or a combination of several options. NSW government agencies are responsible for assessing and approving beneficial re-use options.

Multiple water treatment methods are available and can vary from simple dilution or blending to large purpose-built water and brine treatment plants. Depending on the beneficial re-use proposed, varying levels of treatment or a combination of treatments are required to ensure the water quality is fit for purpose. Some treatment options generate by-products and waste that must be disposed of in accordance with the EPA's *Waste Classification Guidelines* and EPL 20350 conditions.

The beneficial uses of amended treated water for construction and D&C have been described in section 5.1. The sections below will describe the beneficial uses of irrigation, watercourse release, stock watering and firefighting. The Leewood WBTP has the capacity to treat approximately 1.5 ML of produced water per day to produce approximately 1 ML of amended treated water per day when operational.

5.2.1 Irrigation

The irrigation site is located adjacent to and to the east of the Leewood WBTP and is approximately 49 hectares (**ha**) in size. The irrigation system has the maximum capacity to utilise up to 6.5 ML/day, with this volume incorporating approximately 49 ha of irrigation at a maximum of 12 mm on the ground per day, with a 90 % irrigation system application efficiency. Actual maximum daily application rates will be determined by daily evaporation rates i.e. the average daily rates averaged over a month can vary between 2 and 10 mm/day.

In accordance with the *Effluent Irrigation Guidelines*, the amended treated irrigation water is classified as low strength effluent and meets all the relevant ANZECC 2000 irrigation guideline values, making it suitable for long term irrigation (more than 20 years). Note however that the ANZECC guidelines for irrigation provide operational limits, and that these may be crop-specific, as Santos may not necessarily always crop Lucerne.

The irrigation schedule is driven by crop water demand and availability of amended treated water. Irrigation is managed in such manner as to ensure the capacity of the utilisation area to effectively utilise the water is not exceeded.

The opportunity of making treated water available for sharing with neighbouring water users and established irrigators will be assessed during Phase 2. Santos will at that time apply for a specific resource recovery exemption and order (**RREO**) under Part 9 of the Protection of the Environment Operations (Waste) Regulation 2014.

5.2.2 Treated produced water managed release

There will be no releases of treated produced water to surface waters, including Bohena Creek, during the Phase 1 activities. This includes amended treated water.

5.2.3 Stock watering

Stock watering will not be applied and as such has not been modelled for Phase 1 of the Water Balance. This beneficial re-use will be further investigated so that approximate volumes can be added to the Water Balance if required for subsequent phases.

5.2.4 Firefighting

Firefighting use has not been modelled in this Water Balance. It is expected that amended treated water will be used to supplement the use of bore water, and a tanker would be provided on an as-needed basis for this purpose at the Bibblewindi Facility. When more data is available this will be updated.

5.3 Loss in water storages to evaporation

The water modelling has been developed using evaporation from Leewood ponds only, with details provided in section 7.

5.4 Rainfall run-off water sediment basin discharges

The water modelling and Water Balance has been calculated with no discharges from the two sediment basins at the Leewood facility, as the EPL has no approved discharge locations. The water in these basins, located to the northeast and the southeast of the produced water ponds, is tested on an as-needs basis and they are checked during the monthly Leewood pond check (whole pond system). The water levels are managed by pumping from them following rainfall events, with the water used for dust control at the Leewood facility. Following discussion with the EPA and once an updated EPL is obtained this may change and this Water Balance will be updated accordingly. This is further addressed in section 6.5.

6. Water storage and treatment

Once produced water is brought to the surface, it is collected in above-ground storage tanks or ponds. In 2011, the NSW government banned the use of evaporation ponds as a disposal option, therefore requiring an alternative disposal method to be developed.

Produced water from CSG activities must be properly and lawfully managed, stored, transported and disposed of in a manner that protects the environment and community in accordance with the POEO Act and the associated EPL requirements.

6.1 Water management facilities

Santos' main water management facilities are located at the Leewood property on the Newell Highway, approximately 24 km south-west of Narrabri, within PAL 2. Leewood hosts the following infrastructure to manage produced water and brine from Santos' exploration and appraisal activities:

- two double-lined produced water and brine storage ponds, each pond with two cells;
- a water treatment facility to treat produced water from exploration and appraisal activities;
- a managed irrigation system, and
- a storage and utilities area, staff amenities and car parking.

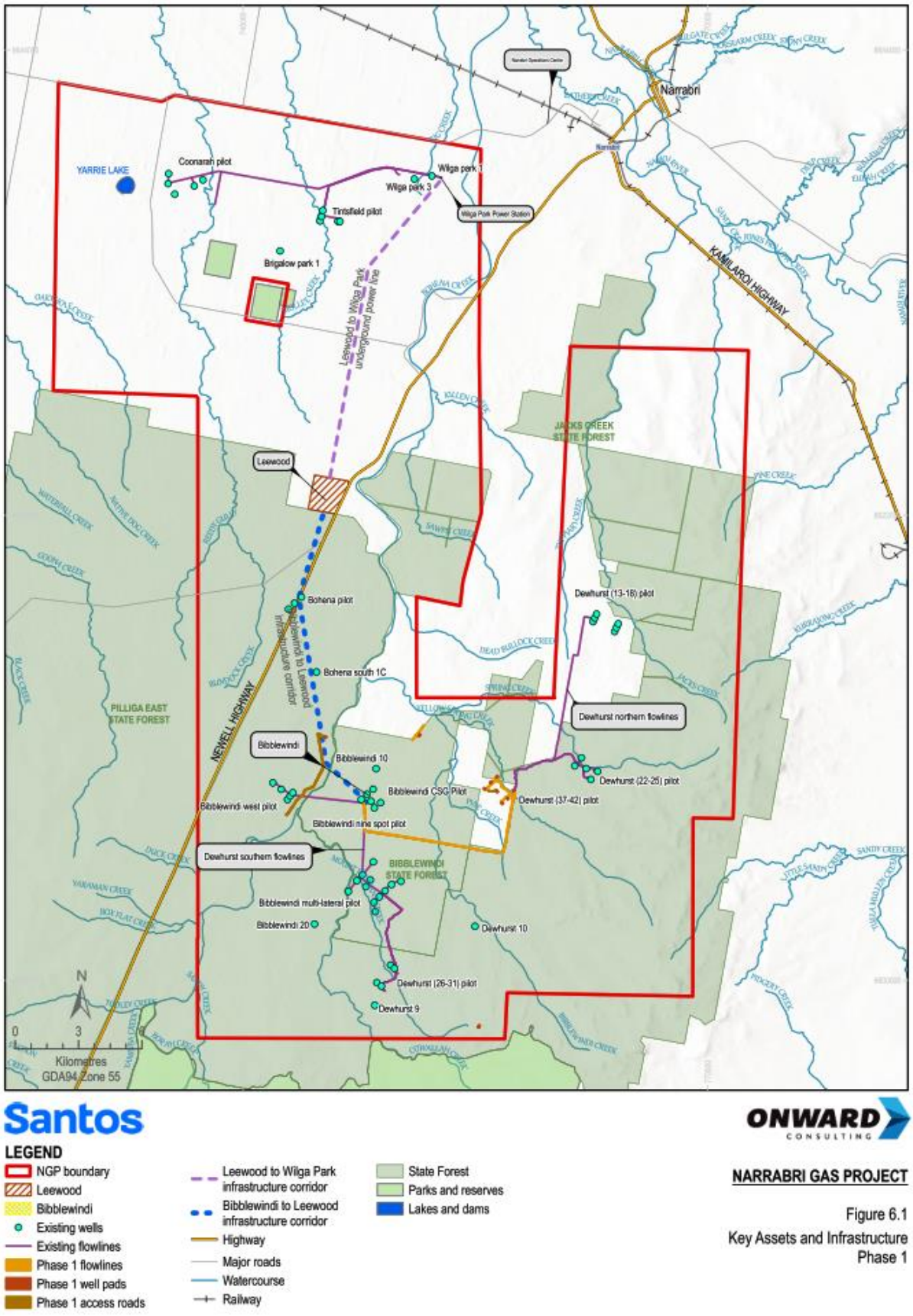
Additional water management infrastructure is located at the Bibblewindi Facility, on Garlands Road within the Bibblewindi State Forest, in PEL 238. This includes a 5 ML (4 ML full supply level) water balance tank used to manage produced water flows between the gas field and the water treatment plant at Leewood, a recently-commissioned small capacity gas compression station, a safety flare, storage and utility areas, staff amenities and car parking. The facility also has two currently disused ponds, Bibblewindi Pond 2 and Pond 3. Two groundwater bores that access water from the GAB Southern Recharge Groundwater Source are also located within the Bibblewindi complex.

Two additional produced water ponds, known as Tintsfield Pond 1 and Pond 2, are located approximately 10 km south-west of Narrabri, within PEL 238. The ponds currently do not hold any produced water. Tintsfield Pond 1 will be upgraded to the standard of the Leewood ponds before any produced water from the Tintsfield Pilot is received. There are no plans for Tintsfield Pond 2 to receive and store produced water. Table C1 in Appendix C summarises the field's key produced water assets and facilities, their status and relevant activity approvals. Figure 6.1 identifies the location of key assets and infrastructure.

There are other approved pilots that are not included in Table C1 in Appendix C which are currently not producing water or gas. These pilots are the Bibblewindi 9 Spot pilot, the Coonarah wells in PPL 3 and the Bohena Pilot. They will not be producing water for the period of this Plan.

Produced water from exploration and appraisal activities within PEL 238 and PAL 2 is managed through a network of gathering, storage and treatment infrastructure. This infrastructure has been developed after extensive environmental impact assessment and approval and is operated in accordance with the relevant conditions and commitments identified in section 3.

The produced water management infrastructure and processes are described in the sections below. Further details of each aspect of the network can be found in the relevant Review of Environmental Factors documents, all available on the Department of Regional NSW DiGS website or EIS documents available on the NSW Department of Planning, Housing and Infrastructure (**DPHI**) Major Projects website.



Santos

ONWARD CONSULTING

LEGEND

- NGP boundary
- Leewood
- Bibblewindi
- Existing wells
- Existing flowlines
- Phase 1 flowlines
- Phase 1 well pads
- Phase 1 access roads
- Leewood to Wilga Park infrastructure corridor
- Bibblewindi to Leewood infrastructure corridor
- Highway
- Major roads
- Watercourse
- Railway
- State Forest
- Parks and reserves
- Lakes and dams

NARRABRI GAS PROJECT

Figure 6.1
Key Assets and Infrastructure
Phase 1

Figure 6.1 - Key assets and infrastructure - Phase 1

6.2 Produced water gathering and transfer

At each pilot, produced water is pumped from local water gathering lines to a centralised balance tank for that pilot (where installed). Produced water is then pumped from the balance tank (or directly from the pilot well where no balance tank is installed) via flowlines to the Bibblewindi Facility balance tank and onto Leewood via the Leewood Water Pipeline. The only exception is produced water from the Tintsfield Pilot, which is transferred via flowlines to the Tintsfield Pond Facility.

The existing water pipeline and flowline network includes:

- the Leewood Water Pipeline between the Bibblewindi Facility and the Leewood Water Management Facility;
- the Dewhurst Northern Flowline between Dewhurst 22-25 Pilot and the Bibblewindi Facility;
- the Dewhurst Southern Flowline between Dewhurst 26-29 Pilot and the Bibblewindi Facility;
- water flowlines from Bibblewindi West Pilot to Bibblewindi Facility;
- water flowlines from Bibblewindi East Pilot (also known as the Multi-lateral Pilot) to the Bibblewindi Facility; and
- water flowlines from the Tintsfield Pilot to Tintsfield ponds[3].

A schematic of the existing water pipeline and flowline network is shown in Figure 6.2.

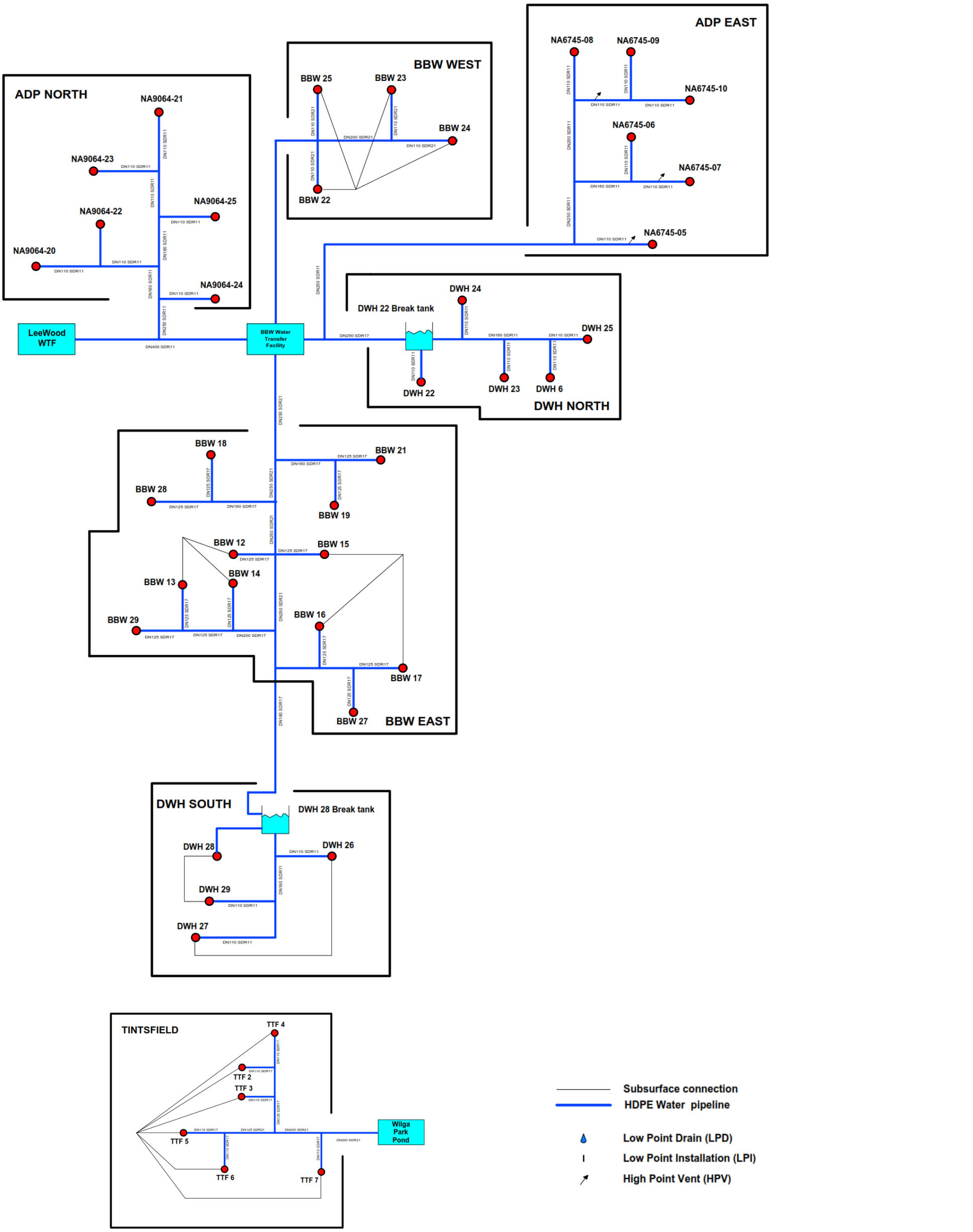
In addition, there is a buried gas pipeline between the Bibblewindi Facility and Wilga Park Power Station that has an offtake at Leewood. This pipeline can be used to transfer water between Bibblewindi, Leewood and Tintsfield.

As provided in section 1.1.2, the Phase 1 scope is planned to include the construction and operation of:

- 4 coreholes;
- 6 pilot wells;
- 1 deep reservoir monitoring bore (converted corehole);
- new shallow water monitoring bores;
- associated linear infrastructure; and
- seismic surveys (length and location to be determined).

The design, construction and operation of the high-density polyethylene (HDPE) flowlines is undertaken in accordance with the Australian Pipelines and Gas Association's *Code of Practice for Upstream Polyethylene Gathering Networks - CSG Industry* (August 2019). This includes detailed quality control measure requirements to ensure the integrity during the construction process. After construction and prior to commissioning, the entire flowline is required to be pressure tested and once operating, ongoing pressure monitoring using remote telemetry occurs.

[3] The Tintsfield ponds are located at the Wilga Park Power Station facility. They are referred to as the Wilga Park Ponds in Figure 6.2.



Note: The Tintsfield ponds are located at the Wilga Park Power Station facility. They are referred to as the Wilga Park Ponds in Figure 6.2.

Figure 6.2 - Existing water gathering network

6.3 Produced water storage facilities

A summary of the current produced water storage facilities is presented in Table 6.1. The table includes information on storage volumes of each facility and controls to prevent and minimise pollution including pond liners and monitoring equipment installed. It does not include tanks within the Leewood WBTP.

6.4 Produced water and brine treatment

The treatment and beneficial reuse of treated water from exploration and appraisal activities has previously been assessed and approved under Part 5 of the EP&A Act and the PO Act (refer also to https://search.geoscience.nsw.gov.au/report/R00070789)

The Leewood WBTP has the capacity to treat approximately 1.5 ML of produced water per day and will be delivering water to the irrigation area. Treatment processes include:

- pre-treatment to enable the removal of solids and/or scale-causing compounds from the water. To remove solids and/or scale causing compounds, produced water first undergoes microfiltration/ultrafiltration to remove solids between 0.01 - 0.1 microns within the feed water. The final pre-treatment process involves using a biocide for bio-fouling control. This step controls the growth of microorganisms, both in the microfiltration/ultrafiltration and reverse osmosis (**RO**) stages;
- treatment by RO where the produced water is pumped through a semi-permeable membrane, separating treated water into one stream and salts into another stream known as rejected concentrate or 'brine'. Feed water is pumped at high pressure through the membranes, typically separating over 99 % of the total dissolved solids from the water;
- post-treatment which involves a series of steps in order to chemically balance the treated water prior to beneficial reuse (particularly for irrigation). This includes:
  - dechlorination by sodium bisulphate addition (this is dosed prior to the RO to protect the RO membranes from oxidation by chlorine);
  - addition of calcium and magnesium to lower the sodium adsorption ratio; and
  - adjustment of pH by acid or caustic addition, if required.

Brine from the reverse osmosis plant is sent to the brine treatment plant to further recover treated water and concentrated brines beyond the limit of the water treatment plant. A membrane brine concentrator within the brine treatment plant uses a high-pressure membrane process to concentrate dissolved solids in solution by using reverse osmosis and recovering additional treated water. The main output from the membrane brine concentrator is concentrated brine which is then transferred to the brine storage cell.

All produced water is processed to meet the treated water quality criteria in Appendix 6 of the CoC, unless otherwise authorised in an EPL. This is further detailed in the PWMP.

Table 6.1 - Summary of approved produced water storage facilities

Storage name	Full supply level volume (ML)	Maximum operating level volume (ML)	Design Life	Lining and leak detection system	Facility monitoring		
					Monitoring aspect	Frequency	Monitoring at facility
Bibblewindi Transfer Tank (produced water)	4	3.75	25 years	Galvanised steel panel tank with internal polypropylene bladder. Tank is also contained within an earthen bund underlain with a HDPE liner	Water level	Continuous using sensors and remote monitoring. Tank is equipped with level instrumentation, alarms and trips, to ensure the tank does not over fill.	Network of 13 monitoring bores installed at the facility at varying depths located up-gradient, down-gradient and cross hydraulic gradient of the water infrastructure. These monitoring points were installed when there were three produced water storage ponds at Bibblewindi and pre-dated the construction of the Transfer Tank. The bores are designed to both monitor groundwater (chemical, physical and hydraulic) and intercept groundwater where this is found to be present. Additional perched water layers are monitored at a number of locations to assess any vertical migration of groundwater.
					Inflow and outflow	Continuous using flow meters and remote monitoring.	
Leewood Pond 1 Leewood Pond 2	411.4 438.4	346.1 364.5	25 years	Primary polyethylene geomembrane liner underlain by leak detection system underlain by a secondary liner. The secondary liner will be underlain by 300 mm of smooth clayey subgrade. The leak collection system transfers any produced water collected below the liner directly back into the pond. The operation of the sump pumps and sump levels is based on an alarm feedback loop and data recorded. Ponds designed by a suitably qualified engineer and constructed on stable sub-base with each liner weld tested and associated QA Documentation developed. The ponds also have a fauna proof fence installed to prevent terrestrial fauna from entering the pond area.	Water level	Continuous using sensors and remote monitoring	Network of 7 seepage detection bores (50mm diameter) installed around the Leewood ponds to a depth of 10 metres, with screening from 7 to 10 metres below ground level. Seepage detection bores are monitored biannually. Ten groundwater monitoring bores of varying depths are installed across the Leewood property. The monitoring bores are screened at a number of shallow perched water layers below the surface. Sampling of standard groundwater parameters is undertaken quarterly, and results reviewed for any unexpected changes to physical and chemical water quality parameters and water levels.
					Inflow and outflow	Continuous using flow meters and remote monitoring	
					Embankment seepage	Monthly	
					Embankment erosion	Quarterly	
					Pond crest integrity and capping	Quarterly	
					Hydraulic structures	Quarterly	
					Pipework and valves	Weekly to fortnightly	
					Pond water quality	Quarterly for pH, DO, redox potential and EC. Six-monthly grab sample for laboratory analysis in accordance with EPL 20350	
					Rainfall and evaporation	Continuous (from the weather station)	
					Pond liner condition	Monthly	
					Embankment deformation	Monthly	
					Vegetation growth	Quarterly	
					Wildlife management systems (fences etc)	Quarterly	
Tintsfield Pond 1 (not currently operational)	22.9	15.3	25 years	HDPE membrane thickness 2 mm. Leak	Water level	Continuous using sensors and remote monitoring	Network of 20 monitoring bores of monitoring bores installed at the facility at varying depths located up-gradient, down-gradient and cross hydraulic

Storage name	Full supply level volume (ML)	Maximum operating level volume (ML)	Design Life	Lining and leak detection system	Facility monitoring		
					Monitoring aspect	Frequency	Monitoring at facility
				detection via shallow groundwater monitoring network surrounding ponds. Ponds operate on a duty and standby mode to enable full inspection of one liner each year. Ponds designed by a suitably qualified engineer and constructed on stable sub-base with each liner weld tested and associated QA documentation developed. The ponds also have a fauna proof fence installed to prevent terrestrial fauna from entering the pond area.	Inflow and outflow	Continuous using flow meters and remote monitoring	gradient of the water infrastructure. The monitoring bores are screened at a number of shallow perched water layers below the surface. Sampling of standard groundwater parameters is undertaken quarterly, and results reviewed for any unexpected changes to physical and chemical water quality parameters and water levels
					Embankment seepage	Monthly	
					Pond crest integrity and capping	Quarterly	
					Hydraulic structures	Quarterly	
					Pipework and valves	Weekly	
Tintsfield Pond 2 (not currently operational)	92.0	72.6			Pond water quality	Quarterly for pH, DO, redox potential and EC. Six-monthly grab sample for laboratory analysis in accordance with EPL 20350	
					Rainfall and evaporation	Weekly	
					Pond liner condition	Monthly	
					Embankment deformation	Monthly	
					Vegetation growth	Quarterly	
					Wildlife management systems (fences etc)	Quarterly	

Table 6.2 provides indicative volumes of produced water and brine stored in the various Leewood cells for PEL 238 and PAL 2 between September 2015 and September 2022.

Table 6.2 - Volumes of produced water and brine stored in PEL 238 and PAL 2

Storage name	Volume (ML)							
	2015	2016	2017	2018	2019	2020	2021	2022
Leewood cell 1	135.1	166.5	160.1	45.45	21.9	53.2	43.4	105.8
Leewood cell 2	33.5	154.7	135.8	109.5	50.9	103.3	146.4	156.1
Leewood cell 3	12.4	173.1	105.6	103.3	94.6	69.7	109.4	133.2
Leewood cell 4	91.4	0.4	36.1	71.8	40.6	31.5	51.5	39.3
Tintsfield pond 1*	Not currently operational							
Tintsfield pond 2*	Not currently operational							
Bibblewindi 2	Not currently operational							
Bibblewindi 3	Not currently operational							

* The Tintsfield ponds are to be operated in accordance with condition E1 related to the Tintsfield Water Management Facility as set out in EPL 20350.

6.5 Licenced discharge points

There are no managed discharges into Bohena Creek planned for Phase 1.

Currently there are no licenced discharge points in EPL 20350, apart from the Leewood treated water tank (point 77 of the EPL). It is anticipated that discharge points and limits, particularly for sediment basins, will be included in a varied EPL following consultation with the EPA.

7. Water balance

7.1 Methodology of calculating inflows and outflows

A simple schematic representation of the Phase 1 water balance with the inflows, outflows and intermediate storage and treatment options is presented in Figure 7.1.

Santos have also developed a more comprehensive water balance model that incorporates the water production forecasts, current dam storage levels and rainfall as inputs and evaporation, operational use and irrigation use as outputs. It is understood that well performance will vary over time and the water balance model will be adapted and adjusted accordingly. The water balance model provides a prediction of water levels in dams over time, which can be used for predicting when additional dams or irrigation areas may be required, or conversely when water is unlikely to be available for use.

A conceptual schematic of the Project GoldSim water balance model has been presented in Figure 7.2. This figure shows that the model comprises the following key elements:

- an aggregated inflow stream from the CSG well water gathering network (the gathering network itself is not included in the model);
- two water storage dams (Leewood ponds) each of which are subject to climatic influences;
- a RO water treatment plant which includes brine treatment;
- an irrigation field; and
- interconnecting pipework.

The general operational philosophy for the WMS is as follows:

- CSG water inflows are aggregated and flow into the Leewood ponds;
- water from the Leewood ponds is fed to the Leewood WBTP, which outputs a low electrical conductivity (**EC**) permeate stream that is directed to the 5 ML Permeate Tank (amended treated water), and a high-EC concentrate stream that is directed back into the Leewood ponds;
- water from the 5 ML Permeate Tank is supplied to the irrigation area. Note the irrigation field water demand is calculated within the model as a function of climate, but the actual water and salt balance of the field is outside the scope of the model.

Rainfall and evaporation inputs to the water balance model are based on daily resolution long-term time-series data sourced from the SILO Patched Data Point system for Narrabri Bowling Club Station (54120), NSW. The time-series spans a 131-year period from January 1889. When running simulations using the water balance model, the long-term timeseries is automatically disaggregated into 131 unique sequences equal in length to the selected simulation duration. The Project water balance model is run using a daily time step and results are reported as median (P50) climate conditions. Note that evaporation rates are automatically adjusted within the model as a function of salinity.

The volumes in the water balance are predicted, inferred volumes based on the assumptions in the methodology. Therefore, they are not expected to exactly match the volumes recorded at the end of each year. They have been predicted using conservative assumptions however and therefore the volumes indicated in Table 7.1 represent a maximum volume of water to be managed.

SCHEMATIC OF PHASE 1 WATER BALANCE

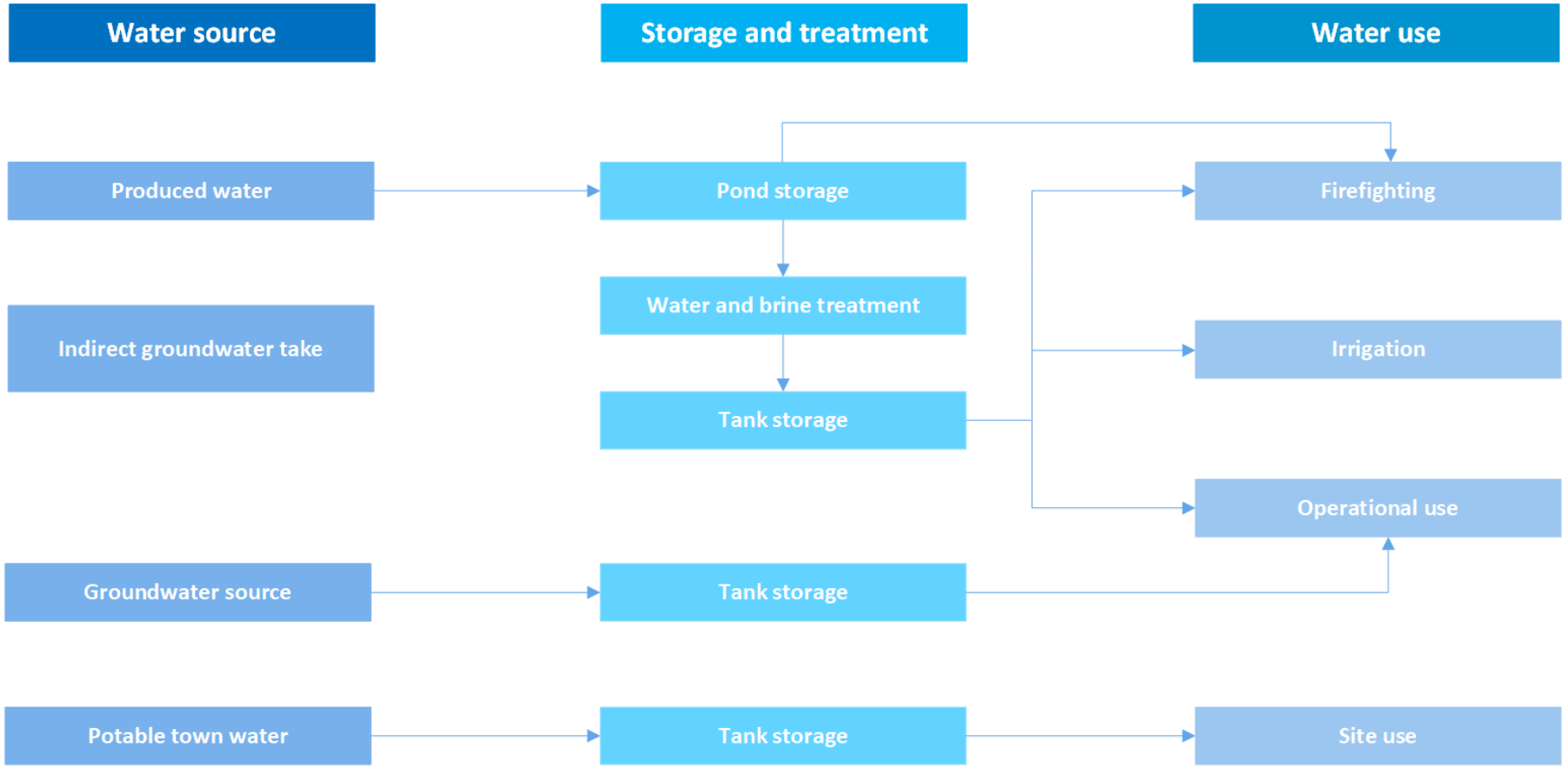
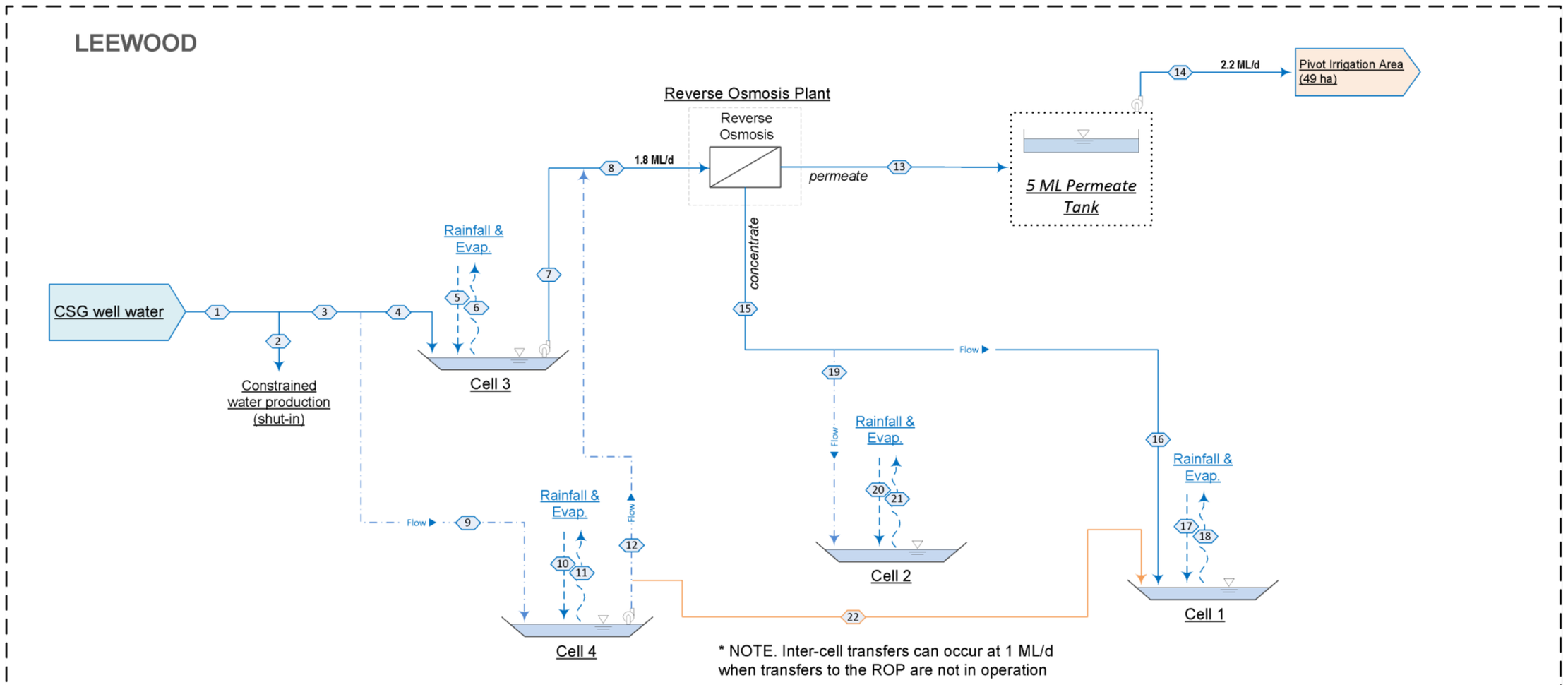


Figure 7.1 - Schematic of Phase 1 Water Balance



Note:
Stored water quality is not fixed and may change with time e.g. a cell storing produced water at one stage may store permeate or brine at a future stage.
All values are approximate. The current capacity of the water treatment plant is 1.5 ML/day but can be scaled to 1.8 ML/day or more through modular expansion.

Figure 7.2 - Phase 1 water balance conceptual model

7.2 Average water balance

Table 7.1 contains a summary of the indicative site water balance. As detailed in section 5, firefighting, stock watering, pump out from sediment dams and potable water have not been included in the model and as such are not listed in the table.

Table 7.1 - Average water balance for Phase 1

	2022	2023	2024	2025
Water inflows (ML)	**Annual total**	**Annual total**	**Annual total**	**Annual total**
Produced water (Phase 1 + Existing)	235.8	411.4	304.1	217.5
Groundwater supply	10	10	10	10
Rainfall and run-off	127.3	130.7	130.8	131.5
Total inflows	**373.1**	**552.1**	**444.9**	**359.0**
Water outflows (ML)	**Annual total**	**Annual total**	**Annual total**	**Annual total**
Dust suppression / rehabilitation	36	0	0	120
Construction	0	0	0	20
Drilling and completions	19	0	0	144
Irrigation	115.3	222.6	224.8	206.6
Evaporation from open storages	193.6	227.3	228.9	215.37
Total outflows	**363.9**	**449.9**	**453.7**	**706.0**

8. Monitoring

An infrastructure monitoring program is implemented across the produced water and brine storage facilities and gathering and transfer infrastructure. A summary of the infrastructure monitoring measures and their frequency for each storage is included in Table 6.1. Monitoring relevant to the Water balance is described in the following sections and additional monitoring is detailed in the PWMP, the Irrigation Management Plan and the Surface Water Management Plan.

8.1 Produced water storages

Produced water storage facilities are monitored in accordance with the PWMP. Water storage levels have been defined for each of the ponds for monitoring and management purposes. These definitions are based on the Queensland guidelines '*Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*' (DES, 2016), and include:

- wet season containment (**Maximum Operating Level (MOL)**) - includes a minimum spare storage capacity (Design Storage Allowance) required at the nominal start of the wet season (1 November each year) to give the regulatory agency confidence that wet season inputs can be managed without loss of containment (i.e. spillway discharge).
- storm event containment (**Emergency Reporting Level (ERL)**) - the dam level at which loss of containment could potentially occur within a single storm event (72-hour duration event) triggering notifications and further action.
- spillway capacity (**Full Supply Level (FSL)**) - sufficient spillway capacity is required to ensure that the design flood event can be conveyed by the spillway without causing overtopping of the dam embankment which could lead to catastrophic failure of the dam structure.

Water storage levels for each pond are identified in Table 8.1.

Table 8.1 - Defined pond operating levels

Produced water storage facility	Full Supply Level (FSL) (m AHD)	Emergency Reporting Level (ERL) (m AHD)	Maximum Operating Level (MOL) (m AHD)
Tintsfield Pond 1	225.84	225.46	224.57
Tintsfield Pond 2	225.84	225.53	224.85
Leewood Pond 1	250.4	249.92	249.59
Leewood Pond 2	249.85	249.41	249.03
Bibblewindi 2	NA	NA	NA
Bibblewindi 3	NA	NA	NA

Monitoring of storage levels is undertaken with the use of pressure sensors that continuously measure and record storage depth, volume and surface area based on hydrostatic pressure. These automated meters are submersed in the pond to a depth as close to the base of the pond as reasonably practicable and are used in conjunction with surveyed data to determine the water level of the pond. Telemetry is used to allow for remote real-time monitoring of the pond levels.

Field operators monitor the pond level and volume in accordance with the trigger action response plan (**TARP**) for Produced Water Pond Level Management. Other operating markers/indicators may also be used in conjunction with the pressure sensor monitoring, such as volume and MOL indicator markers on storage facility walls. The level sensors are recalibrated as per the manufacturer's requirements in order to ensure the accuracy of readings. Further information on monitoring frequencies is provided in section 5 of the PWMP.

In addition to monitoring, forecasting of predicted water production will be undertaken to identify the potential for elevated levels as early as possible to allow strategies to be implemented to minimise the potential for pond levels to exceed the MOL. Further information is provided in section 9.1 of the PWMP.

8.2 Groundwater monitoring

Santos also undertakes an extensive regional groundwater monitoring program to monitor groundwater in the region of its operations. The Groundwater Management Plan, which forms part of the WMP, provides a detailed description of the groundwater management and monitoring system. The GMP outlines a monitoring that includes monitoring coal seam water production which will be used to improve certainty of the Water Balance calculation very early in the life of the Project The Groundwater Monitoring TARP would initiate a review of the estimated indirect water take from the aquifers, listed in section 4.1.2.

9. Trigger action response plan

9.1 Water balance TARP

TARPs for Produced Water Pond Level Management [0011-465-PLA-0002] and Leewood Pond Leakage Management [7056-465-PLA-0002] are stand-alone documents included in the PWMP and therefore triggers for management of these potential impacts are not included in this Water balance.

Table D1 in Appendix D provides the Water Balance TARP, detailing the actions to achieve the performance measures listed in section 1.2 (and as per Table 7 of the CoC). The Groundwater Monitoring TARP would initiate a review of the estimated indirect water take from the aquifers, listed in section 4.1.2.

10. Record keeping

Santos has a data management plan for the NGP that outlines the policies and procedures that will be implemented to ensure that data is managed in a consistent, efficient and effective manner in order to provide accurate records of activity operations and enhance the value of the data collected. An overview of Santos' data management plan is presented in Figure C1 of Appendix C of the WMP, in the form of a data-management flow chart.

Santos uses a number of systems and platforms to manage the documentation and data associated with the activities under this Plan. These include Sharepoint for management plans, procedures and laboratory reports; Santos' EHS Toolbox for capturing inspections and field assessments; and EQuIS[4], an advanced environmental data management and decision support system, for capturing all data and any laboratory results.

The majority of records associated with produced water production and water storages are collected as part of the PWMP. Key records associated with this SWB that are stored and managed include:

- records of implementation of any trigger action response plan (**TARP**);
- records of any review of the Water Balance;
- operational monitoring and performance data for treatment systems;
- records of water extraction from production/appraisal wells and licenced groundwater bores;
- records of volumes of water use on site in operational support;
- records of water transfers to beneficial re-use;
- waste transportation and disposal certificates; and
- annual inspection reports and/or certifications of storages.

Monitoring data is subject to quality assurance (**QA**) and quality control (**QC**) protocols and procedures that ensure that data is accurate and usable. Data is subjected to consistent validation and verification procedures.

The records required to be kept and maintained according to the Produced Water Code will be kept from the time the Code applies as a term imposed on an activity approval. Records will be kept in a legible form for production to any inspector for a period of four years following the expiry or termination of a prospecting title (sections 97D and 97E of the PO Act).

Refer to the PWMP for further details on the Produced Water Code.

[4] EQuIS (Environmental Quality Information System) is a proprietary software application.

11. Incidents, non-compliances and complaints

11.1 Incidents and non-compliances

Incident reporting and non-compliance notification will be in accordance with CoC D6 and D7 respectively, as described in section 6 of the EMS. Santos will notify the DPHI and any other relevant agency via the Major Projects Portal immediately after becoming aware of an incident.

Within 7 days of becoming aware of a non-compliance with the CoC, Santos will notify the Department of the non-compliance via the Major Projects Portal. This notice will set out the non-compliance, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance. A non-compliance which has been notified as an incident will not be notified as a non-compliance.

Where incidents or non-compliances associated with this Water Balance are identified, Santos will:

- take all reasonable and feasible steps to ensure that the incident or non-compliance ceases and does not reoccur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the relevant department(s) describing options and any preferred remediation measures or other courses of action; and
- implement remediation measures as directed by the relevant department(s).

11.2 Unpredicted impact protocol

It is considered unlikely that the activities during Phase 1 will result in any unpredicted or unforeseen changes in relation to the volumes of production, transfer, storage or treatment of water, both produced water or treated water. However, in accordance with CoC D3(f), the following strategy outlined in Table 11.1 will be adopted in the event where the estimated production volumes or capacity of the infrastructure is not in accordance with this Water Balance.

Table 11.1 - Unpredicted impact protocol

Step	Strategy
1	Assess any relevant water capacity or balance activities and implement immediate corrective actions to minimise the unpredicted effect or impact
2	Review the unpredicted effect or impact and consider the following: • activities that may have triggered this event; and • activities that may not have been considered in the SWB in causing the effect or impact.
3	Notify the relevant agencies and departments
4	If appropriate, commission an investigation by an appropriate specialist
5	Based on the results of the investigation, develop the appropriate amendment and amelioration methods

Step	Strategy
6	Implement the information from the investigation to review, and if necessary, update this SWB which will include any or all of the following: • a review and where required, revision of the water uses and outflows steps in section 5; • a review and where required, revision of the water storage and treatment facilities and capacities in section 6, and the overall balance in section 7; • a review the actions that may have been taken prior to event; and • implement any relevant infrastructure or training based on the findings of the investigation to avoid any recurrence of the unpredicted impact.

11.3 Complaint management

Santos has a documented *Complaint Management Procedure* that is communicated to all relevant staff members. Complaints can be directed to Santos via phone or email 24 hours a day, 7 days a week. Contact details are publicly available on the Project website and are presented in Appendix D of the EMS.

All complaints are logged on a complaint form which includes the following details:

- date and time of the complaint;
- complainant details;
- details of the issue or complaint;
- actions taken to remediate the issue, if any;
- follow up actions required, if any;
- details of further liaison with complainant, if any; and
- closure date and time of the issue.

As per CoC D13, Santos maintains a complaint register which is updated as required and available on the Project website.

12. Reporting, evaluation and review

12.1 Annual Review

In accordance with condition D8 and as further described in section 6 of the EMS, Santos will review the performance of its water management for the previous calendar year and report the relevant results within the Annual Review, to the satisfaction of the Planning Secretary. The Annual Review will be submitted to the DPHI via the Major Projects Portal by the end of March each year, and will at minimum provide the following information regarding:

- the effectiveness of the management measures to prevent, and if prevention is not reasonable and feasible, to minimise any impact from water balance issues; and
- any water balance incidents or non-compliances.

Further, the annual review under consent condition D8 requires a number of items to be reviewed or assessed. In summary these are:

- monitoring results and complaints;
- non-compliances and incidents;
- compliance with performance measures;
- discrepancies between predicted and actual impacts; and
- measures to be implemented to improve environmental performance.

The Annual Review may also make recommendations for any additions, changes or improvements to the water balance strategy and processes. This is further addressed in section 12.4.

12.2 Independent environmental audits

In accordance with CoC D9, within one year of commencement of Phase 1 and every three years thereafter, Santos will commission an Independent Environmental Audit (**IEA**) of the operation, to be conducted in accordance with CoC D9. The audit team will be led by a suitably qualified auditor and include experts in groundwater, well integrity, hazards, and any other fields specified by the Planning Secretary.

The IEA process is further described in section 8.3 of the EMS.

12.3 Management Plan review and evaluation

As required by CoC D4, Santos will review the suitability of existing strategies, plans and programs required under this consent, within two months of:

(a) the submission of an incident report;
(b) the submission of an Annual Review;
(c) the submission of an Independent Environmental Audit;
(d) the submission of a Field Development Plan;
(e) the submission of a Groundwater Model Update; or
(f) the approval of any modification of the conditions of SSD 6456.

This is to ensure this Water Balance is updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the Project.

In view of the various conditions requiring annual reviews and updates, suitability assessments and performance evaluations, this Water Balance will also be reviewed and, if necessary, updated in at least the following circumstances:

- in accordance with any direction from the NSW EPA or the Minister administering the PO Act;
- due to any significant change to the design or operation of the water storages, inflows or outflows; or if the groundwater monitoring triggers are exceeded. If there is ambiguity in relation to whether there is a significant change, Santos will consult with the Planning Secretary to determine whether the Water Balance must be reviewed; and
- otherwise at intervals of no longer than one year.

The review history table in the front of this Plan provides the details of each review, conducted in accordance with condition D4.

As required by CoC D5, if the review under condition D4 determines that the Water Balance requires revision - to either improve the environmental performance of the development, cater for a modification or comply with a direction - then Santos will submit a revised Water Balance to the Planning Secretary for approval within 6 weeks of the review.

Further details on the reporting, evaluation and review of the Water Balance are provided in section 8 of the EMS.

12.4 Improvement measures

Santos will conduct a program to investigate and implement ways to improve the environmental performance regarding water management over time, and implement a protocol for the periodic review of the Water Balance, in accordance with CoC D3(g) and (i) respectively.

Measures to improve the environmental performance of the Project that will be implemented following review and evaluation include the following:

- audit of the water management system, reviewing the water balance inputs and outputs and the management measures;
- implementation of modifications to the Water Balance; and
- additional monitoring and inspections.

The protocol for review is set out by consent conditions D8, D4 and D5, which have been addressed in sections 12.1 and 12.3 above.

In accordance with CoC D13 and as described in section 6 of the EMS, all relevant monitoring data and associated reports will be made available on the Project website, for the duration of the Project. This information will be kept up to date.

13. References

CDM Smith (2016a). *Narrabri Gas Project EIS Appendix F: Groundwater Impact Assessment*. Prepared for Santos Ltd.

DPE (2017). *Code of Practice: Produced Water Management, Storage and Transfer*.

DPE (2022). *Guidelines for Groundwater Documentation for SSD/SSI Projects*. Technical guideline.

GHD (2017). *Narrabri Gas Project Environmental Impact Statement*. Prepared for Santos Ltd.

14. Glossary

Term	Definition[5]
Alignment	The line or lines that describe a linear-infrastructure route; it defines how linear infrastructure (such as a road, access track or pipeline) will be located in relation to the features encountered along the route
Alluvial	Sediments deposited following a decrease in velocity of flowing water
Alluvium	General term for unconsolidated fluvio-lacustrine deposits of inorganic materials (clay, silt, sand, gravel, and boulders) deposited following a decrease in velocity of flowing water
Amended treated water	Produced water that has undergone treatment and amendment, as generally described in the EIS, to enable it to be used for beneficial reuse purposes including irrigation, stock watering, drilling[6], construction and dust suppression
Aquifer	A saturated permeable geologic unit that can transmit useful quantities of water
Beneficial use	Beneficial use refers to the use of waters, including produced water from an oil or gas well, for a secondary purpose that has a positive value. Potential beneficial use options for produced water include domestic and livestock supply, industrial supply, irrigation supply, dust suppression and recreation.
Brine	Saline water with a total dissolved solid concentration of greater than 40,000 milligrams per litre. May be a wastewater produced by the desalination of coal seam water (e.g. by reverse osmosis)
Bund (or bunding)	Wall of a secondary containment system, usually in the form of an embankment, used to prevent sediment and liquids from entering the environment
Catchment	The area of land that collects and transfers rainwater into a watercourse
Cation exchange capacity	The number cations (positively charged ions) available in a soil. Cation exchange capacity can be used as a measure of soil fertility
Council	Narrabri Shire Council
Department	NSW Department of Planning, Housing and Infrastructure (DPHI)
Depressurisation	The extraction of coal seam water to facilitate gas production causes depressurisation of the target coal seams, which has the potential to propagate into surrounding formations.
Discharge spring	Occur where water that has recharged sandstone sediments that outcrop on the margins of the Great Artesian Basin discharges after having travelled underground for relatively large distances and over an extended period of time.
Drilling fluid	A fluid (sometimes referred to as a mud) made up of 70 to 80 % water that is pumped into wells during drilling to cool and lubricate the drill bit and carry drill cuttings to the surface
EIS	The Environmental Impact Statement titled Narrabri Gas Project Environmental Impact Statement, dated 31 January 2017, submitted with the development application, including the Applicant's response to submissions and supplementary response to submissions, and the additional information provided by the Applicant to the Department in support of the application

[5] The majority of the definitions are as provided in the Development Consent for SSD 6456.

[6] Note that when 'drilling' is stated in consent conditions, where relevant this has been interpreted to mean 'drilling and completions'.

Term	Definition[5]
Exploration well	A petroleum well that is drilled to: a) explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum, or b) obtain stratigraphic information for the purpose of exploring for petroleum. For clarity, an exploration well is not a production well
Feasible	Means what is possible and practical in the circumstances
Gas compression facility	A facility that houses multiple compressor units, either nodal or hub compressors or a mixture of both used to increase the pressure of gas for the purpose of transmission; may be collocated with a gas treatment facility and/or water management facility
Gas field infrastructure	All Project-related infrastructure, excluding the Leewood facility, Bibblewindi facility and the road upgrades required under SSD 6456
Gas well	Pilot wells and production wells
Gathering lines	Pipelines used to transfer gas and produced water from wells
Groundwater	Water contained in the interconnected pore spaces and voids of the saturated zone of sediments and rocks.
Groundwater monitoring network	An arrangement of groundwater monitoring bores that is usually installed to monitor groundwater quantity and quality to inform how a groundwater system is responding to some applied stress, such as irrigation pumping and application, coal seam gas development, municipal water supply and climate variability
Groundwater quality	A measure of groundwater value expressed in physio-chemical terms, such as acidity / alkalinity, dissolved oxygen, dissolved salts, ions and contaminants like hydrocarbons
Groundwater quantity	A measure of the amount of groundwater held within a groundwater system, usually expressed as groundwater head (elevation or pressure) and flux
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
Irrigation scheme	The use of water for agricultural production. In the case of the Narrabri Gas Project, amended treated water is proposed to be used for irrigation as part of the overall Produced Water Management Plan
Linear infrastructure	Project related infrastructure of a linear nature including gas and water gathering lines, gas and water pipelines, access tracks, power lines, communication lines and other service lines
Major facilities	Leewood facility and Bibblewindi facility
Managed release scheme	The managed release of treated water into Bohena Creek as one of the beneficial uses of produced water (not part of Phase 1)
Material harm	Material harm to the environment is defined in section 147 of the POEO Act
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the Project
Mitigation	Activities associated with reducing the impacts of the development
Namoi Alluvium	The Upper Namoi Alluvium, an aquifer made of coarse-grained river gravels and sands. The Lower Namoi Alluvium, a hydrostratigraphic unit made of shallow alluvial fan deposits associated with the Namoi River. These units contain a significant resource of readily accessible, good quality groundwater that is heavily utilised for irrigation, public water supply, private water supply and livestock
Non-compliance	An occurrence, set of circumstances or development that is a breach of the SSD 6456 consent

Term	Definition[5]
Petroleum Assessment Lease 2 (PAL 2)	A PAL is required to hold the exclusive right to prospect for petroleum and to assess any petroleum deposit over a specified area of land in NSW. A lease allows the holder to maintain a title over a potential area, without having to commit to further exploration. The holder can, however, continue prospecting operations and to recover petroleum in the course of assessing the viability of commercial mining. PAL 2 is held by Santos NSW Pty Ltd.
Petroleum Exploration Licence 238 (PEL 238)	Before exploring for minerals or petroleum in NSW, an explorer must first obtain a Petroleum Exploration Licence (PEL) under the *Petroleum (Onshore) Act 1991*. An exploration licence gives the licence holder exclusive rights to explore for petroleum or specific minerals within a designated area but it does not permit mining, nor does it guarantee a mining or production lease will be granted. PEL 238 is held by Santos NSW Pty Ltd.
Petroleum Production Lease 3 (PPL 3)	A petroleum production lease gives the holder the exclusive right to extract petroleum within the production lease area during the term of the lease. PPL 3 is held by the following titleholders: • Santos QNT Pty Ltd; • Santos NSW (Hillgrove) Pty Ltd; and • Santos NSW (Eastern) Pty Ltd.
Petroleum production lease application (PPLA)	A petroleum production lease gives the holder the exclusive right to extract petroleum within the production lease area during the term of the lease. Development consent under the *Environmental Planning and Assessment Act 1979* must be in place before a petroleum production lease can be granted. Santos, on behalf of its joint venture partner lodged four petroleum production lease applications under the PO Act in May 2014 for the Project area, being PPLAs 13, 14, 15 and 16. The ownership of the application is now held by Santos NSW Pty Ltd.
Pilot well	A well for gas and water extraction, for the purpose of exploration, appraisal and assessment of the gas field potential
Planning Secretary	Planning Secretary under the EP&A Act, or nominee
Produced water	Any form of groundwater that is actively extracted from a borehole, well or excavation, excluding incidental groundwater mixed with drilling fluids
Production well	A well for gas and water extraction, for the purpose of commercial gas production and/or use
Project area	The area of approximately 95,000 hectares that encompasses the Project
Project footprint	The area of surface expression being about 1,000 hectares occupied by the infrastructure components of the Narrabri Gas Project
Project-related infrastructure	All infrastructure and other structures associated with the development. This includes linear infrastructure and non-linear infrastructure, surface infrastructure and subsurface infrastructure, major facilities, wells and well pads and other gas field infrastructure
Public infrastructure	Linear and related infrastructure that provides services to the general public, such as roads, railways, water supply, drainage, sewerage, gas supply, electricity, telephone, telecommunications, etc.
Reasonable	Means applying judgement in arriving at a decision, considering mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Recharge spring	A spring supported by water that recharges sandstone sediments that outcrop on the margins of the Great Artesian Basin and discharge locally after relatively short residence times.

Term	Definition[5]
Registered bore	A water bore whose presence has been notified to Water NSW and included in its registered groundwater bore database. The database typically includes details on bore location, construction and where possible, the source aquifer.
Rehabilitation	The restoration of land disturbed by the development to ensure it is safe, stable and non-polluting over the short, medium and long term
Treated water	Produced water that has undergone treatment to enable it to be used for beneficial reuse purposes including irrigation, stock watering, drilling[7], construction and dust suppression, and/or for managed release to Bohena Creek[8]
Water sharing plan	Legislated plans under the *Water Management Act 2000* that establish rules for sharing water between the environment and water users. Water licences are issued to water users in accordance with water sharing plans
Well	Pilot wells and production wells
Well pad	An area of up to 1 hectare in size upon which the gas wells are to be located, with the area decreasing to no more than 0.25 hectares following rehabilitation[9], or other area as may be approved in the Field Development Plan

[7] Note that when 'drilling' is stated in consent conditions, where relevant this has been interpreted to mean 'drilling and completions'.

[8] Note that there will be no discharge to Bohena Creek during Phase 1.

[9] Workover activities will be contained within the operational area of the well pad area of around 0.2 ha, with an additional laydown area that could be approximately 0.2 ha in size.

Appendix A - Consultation records

Santos

Management Plan Consultation Feedback Form

DOCUMENT TITLE:	**Site Water Balance**
STAKEHOLDER:	**NSW Environment Protection Authority**
CONSULTATION RELEASE DATE:	**30 August 2021**
COMMENTS DUE DATE:	**29 October 2021**

General Feedback	
Key Issues	Apart from the issue relating to unamended effluent reuse for dust suppression (see Dust Suppression Protocol feedback form), the EPA does not have any comments on any other aspects of the SWB.
Suggestions for improvement	NIL

Section	**Type**	**Specific Feedback** *Detail specific issues with certain sections in the document*
eg Section 2	*Legislative + Regulatory reqs./ Readability / Usability /*	*Further detail is required about when a report is required and how the report is to be submitted.*

Santos

NSW GOVERNMENT | Natural Resources Access Regulator

Contact: Tim Baker
Phone: 0428 162 097
Email : Tim.Baker@nrar.nsw.gov.au

Our ref: V15/3875-5#53
File No:
Your Ref:

10 November 2021

[redacted]
Santos Limited
email: [redacted]

Dear [redacted]

Re: Narrabri Gas Project - Water Management Plans third batch

Thank you for the opportunity to provide comment on the third set of plans under the Water Management Plan requirement for Phase 1 of the Narrabri Gas Project. It is understood this consultation is in accordance with Condition B41 of Project Approval SSD 6456. The plans reviewed include the Dust Suppression Protocol, Site Water Balance and the Surface Water Management Plan. NRAR is satisfied the consultation requirements have been met in respect to the plan preparation and provides the following comments and recommendations.

Dust Suppression Protocol

- Recommend a reference to the Water Access Licences held under the *Water Management Act 2000* be included in Section 3 that are to be used to account for water take used for dust suppression. Include in Section 3.1 the need to comply with conditions on the licence.
- Include details of monitoring and reporting on the volumes of water taken for dust suppression from the various sources proposed, eg. bores, treated or amended water.
- Include a map to depict the points where water used for dust suppression is sourced from, stored and any transfer infrastructure.
- Include protocols to determine the priority of water sources used for dust suppression. It is noted relevant details are included in Section 5.1.1 of the Site Water Balance.

Site Water Balance

- It is noted two of the WALs in Table 4.2 currently do not nominate any works. If these WALs are to be used to account for water take in Phase 1, the relevant Miscellaneous Work will need to be nominated on the WAL via an application to WaterNSW. Where any WALs that currently nominate works are now not required because of the State Significant Development status, it is recommended these be amended via application to WaterNSW to nominate the relevant Miscellaneous Work.

- Include a detailed plan overlying an aerial image to a suitable scale depicting the location of water related infrastructure, including water supply bores, wells that supply water, water storage facilities (produced water, runoff capture - dirty/clean), water pipelines and monitoring bores. This information is critical to understand the locations of infrastructure to aid interpretation of system operation, monitoring and potential impacts, and to also clarify the location of extraction and storage of licensed water or where exemptions/exclusions apply. It is recommended a table be included which lists each water storage, the source of the water it receives and whether licensed entitlement or an exemption applies.
- Include locations of metering points on the water infrastructure which are to be used to quantify water take from authorised extraction points, water take from exempt sources, and/or used to inform the water balance for the site. Please note metering will need to meet the requirements of the NSW Non-Urban Water Metering Policy and associated roll out timeframes. Further information on this can be obtained at the following link: https://water.dpie.nsw.gov.au/nsw-non-urban-water-metering or email metering.reform@dpie.nsw.gov.au
- In Table 7.1 clarification is requested on the source of water that applies to the reference to "groundwater" in inflows. It is assumed this is referring to supply from bores. If correct, please add a reference to bore supply or something related in the name.

Surface Water Management Plan

- It is noted the Surface Water Management Plan doesn't include any references to management of surface water via capture in storages or diversions. Based on condition B41 which refers to the need for detailed plans, design objectives and performance criteria for these types of works this information should be included in this plan. A detailed plan overlying an aerial image is requested which depicts the surface water management infrastructure eg. sediment basins, diversions, and their design and operational objectives to mitigate impact.
- In Table 6.1 it is recommended to include in the mitigating measures for watercourse crossings a reference to the Guidelines for Controlled Activities on Waterfront Land in relation to the design, construction and rehabilitation of watercourse crossings. This is consistent with condition B37 of the consent.
- As there is a performance measure to maintain or improve baseline channel stability in affected watercourses it is recommended appropriate monitoring sites be selected downstream of potential disturbance areas such as watercourse crossings and discharge points. Disturbance areas associated with future phases of the project should also be considered for monitoring sites as this will assist in gathering required baseline data.

For further information please contact Tim Baker, Senior Water Regulation Officer on 0428162097 or **e:** Tim.Baker@nrar.nsw.gov.au

Yours sincerely

Jeremy Morice
A/Manager Licensing and Approvals – Water Regulatory Operations - West
Natural Resources Access Regulator
Department of Planning, Industry and Environment

Santos

Department of Planning and Environment

NSW GOVERNMENT

Our ref: OUT22/15346

Katie Weekes
Department of Planning and Environment
Email: katie.weekes@dpie.nsw.gov.au

12 September 2022

Subject: **Narrabri Gas Project (SSD – 6456) – Phase 1 Site Water Balance and Surface Water Management Plan**

Dear Ms Weekes

I refer to your request for advice sent on 5 September 2022 to the Department of Planning and Environment (DPE) Water about the above matter.

DPE Water has reviewed the Site Water Balance and Surface Water Management Plan (Revision O, dated 9 May 2022) prepared for Phase 1 activities of the Narrabri Gas Project. This review has included consideration of responses by the proponent in Appendix A of each plan, which are provided in response to comments provided by NRAR on an earlier version of these documents. Please note the review function of post approval plans that was previously the responsibility of NRAR has now moved to DPE Water.

DPE Water is generally satisfied with the Site Water Balance (Revision O) and the Surface Water Management Plan (Revision O) for the Phase 1 activities. The following is recommended to be confirmed prior to approval of the Site Water Balance:

- Clarification be provided in the Site Water Balance of which Water Access Licence (WAL) is to be used to account for the water take for the Phase 1 producing wells. This is not clearly stated within the document.

Should you have any further queries in relation to this submission please do not hesitate to contact DPE Water Assessments water.assessments@dpie.nsw.gov.au. or to the following coordinating officer within DPE Water:

Tim Baker – Senior Project Officer
E: Tim.Baker@dpie.nsw.gov.au
M: 0428 162 097

Yours sincerely

E Rogers

Liz Rogers
Manager, Assessments, Knowledge Division
Department of Planning and Environment: Water

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Locked Bag 5022, Parramatta NSW 2124
www.dpie.nsw.gov.au

Site Water Balance – NRAR comments received on Revision C (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1	4.1.3	Water access licences	Table 4.2 – Water access licences (direct and indirect take)	It is noted two of the WALs in Table 4.2 currently do not nominate any works. If these WALs are to be used to account for water take in Phase 1, the relevant Miscellaneous Work will need to be nominated on the WAL via an application to WaterNSW. Where any WALs that currently nominate works are now not required because of the State Significant Development status, it is recommended these be amended via application to WaterNSW to nominate the relevant Miscellaneous Work.	The two WALs (WAL 43553 and WAL 43548) will not be used for water take during Phase 1.
2	N/A	N/A	No specific text reference	Include a detailed plan overlying an aerial image to a suitable scale depicting the location of water related infrastructure, including water supply bores, wells that supply water, water storage facilities (produced water, runoff capture - dirty/clean), water pipelines and monitoring bores. This information is critical to understand the locations of infrastructure to aid interpretation of system operation, monitoring and potential impacts, and to also clarify the location of extraction and storage of licensed water or where exemptions/exclusions apply. It is recommended a table be included which lists each water storage, the source of the water it receives and whether licensed entitlement or an exemption applies.	The Site Water Balance is Attachment 2 of the Water Management Plan. Full details of all water infrastructure, and associated locations, including water supply bores, are provided in the Water Management Plan, and in the Surface Water Management Plan (as Attachment 3 to the Water Management Plan). Details of the groundwater monitoring bores are provided in the Groundwater Management Plan and its attachments, provided as Attachment 4 to the Water Management Plan.
3	N/A	N/A	No specific text reference	Include locations of metering points on the water infrastructure which are to be used to quantify water take from authorised extraction points, water take from exempt sources, and/or used to inform the water balance for the site. Please note metering will need to meet the requirements of the *NSW Non-Urban Water Metering Policy* and associated roll out timeframes. Further information on this can be obtained at the following link: https://water.dpie.nsw.gov.au/nsw-non-urban-water-metering or email metering.reform@dpie.nsw.gov.au	Section 4.2. provides details on the three water supply bores, the associated water supply works and the relevant water access licences. Each bore includes a metering point which is used to quantify the water take. Metering meets the requirements of the *NSW Non-Urban Water Metering Policy.*
4	7.2	Table 7.1 – Average water balance for Phase 1		In Table 7.1 clarification is requested on the source of water that applies to the reference to “groundwater” in inflows. It is assumed this is referring to supply from bores. If correct, please add a reference to bore supply or something related in the name.	Table 7.1 is a summary of the site water balance. The specific details regarding the source of water are provided in section 4.1.3, Table 4.2, section 4.2.2, and in Table 4.3.

Note:
The numbering of the sections and appendices between the draft and final version of the document may have changed.

Site Water Balance – NRAR comments received on Revision 0 (for approval)

Item	Section #	Section heading	Existing text	Comment	Final response
1	4.1.3	Water access licences	N/A	Clarification be provided in the Site Water Balance of which Water Access Licence (WAL) is to be used to account for the water take for the Phase 1 producing wells. This is not clearly stated within the document.	Table 4.2 has been amended to clarify which WALs are to be used to account for the water take for the Phase 1 producing wells.

Site Water Balance – WTAG comments received on Revision C (draft)

Comments received from [redacted]

Item	Section #	Section heading	Existing text	Comment	Final response
1	General		No specific text reference	[redacted] As with all Plans, the Acronyms and Abbreviations list could be more complete to cover the extensive use of acronyms	The document has been reviewed to check all acronyms and abbreviations have been added to the list.
2	General		No specific text reference	[redacted] Presenting managed disposal to stream as a beneficial use is a little awkward - See notes for 5.2.2. If it is to be a beneficial use then perhaps include a sentence or two to explain the benefit (perhaps there is something in the EIS?).	The definition of treated water in the Development Consent is as follows: *Produced water that has undergone treatment to enable it to be used for beneficial reuse purposes including irrigation, stock watering, drilling, construction and dust suppression, and/or for managed release to Bohena Creek*. Note that section 5.2.2 has been reworded to simply state the following: *There will be no releases to surface waters, including Bohena Creek, during the Phase 1 activities*.
3	4.1.1	Direct take	There is limited ability to reduce depressurisation targets (and associated water production) during appraisal testing as this impacts gas flow and volumes extracted and therefore reduces the information that can be gained during the testing period.	[redacted] Not clear what the point is or why the statement is made. Will there ever be an ability to 'reduce depressurisation targets'?	The sentence has been removed from section 4.1.1.
4	4.1.2	Table 4.1 Estimated maximum indirect water take	Notes underneath the table: 1 - Short-term - Phase 1 period from 2020 to 2045, reported values are rounded to the nearest whole ML/year.	[redacted] Is Phase 1 of the Project going to run for 25 years from 2020 to 2045?	Phase 1 will run until commencement of Phase 2. Since the date of Phase 2 commencement is not known, and the Water Management Plan (WMP) is only required to address Phase 1 activities, the Site Water Balance (SWB) (and the Groundwater Management Plan [GMP]) conservatively assumes that Phase 1 will run for a minimum of 25 years. This is to enable a conservative assessment of coal seam water production. In reality, Phase 2 is likely to commence in the next few years, prior to which the Site Water Balance will be updated to reflect water production across both Phase 1 (comprising appraisal) and Phase 2 (comprising construction and gas field development) and likely also Phase 3 (comprising gas field operation).
5	4.1.2	Indirect water take (leakage)	No specific text reference	[redacted] This section is inconsistent with Chapter 11 and Appendix F of the EIS where the same groundwater model clearly quantifies impacts. The impacts provided in this Section are for the Phase1 pumping only. However, the use of a steady state single parameter set per unit model provides estimates inconsistent with the GAB and Namoi Alluvium water sources where significant monitoring and management effort is applied.	There is a difference between the indirect water take modelled in the EIS and that which is reported in the SWB. The SWB is only required to assess water production from CSG wells proposed for Phase 1. These rates are those presented in section 4.1.1. Although the same groundwater model was used, there is less CSG water production during Phase 1 (up to 25 wells) than in the full-scale development scenario modelled in the EIS (up to 850 wells). Therefore, the indirect water take is also less. This is largely due to the smaller footprint of CSG development for Phase 1 of the NGP relative to the footprint of CSG development assessed in the EIS.
6	4.1.2	Indirect water take (leakage)	For Phase 1 of the Project, the long-term indirect take would be equivalent to the 10 ML/year licence from the GAB Southern Recharge Water Sources, as listed in Table 4.2.	[redacted]] There is no long-term indirect take for Phase 1. So I think the sentence should be 'For phase 1 of the project, water licences held for long-term indirect take will be used for direct take'.	For Phase 1 of the Project, the long-term indirect take is 10 ML/year from the GAB Southern Recharge Water Sources, as listed in Table 4.3. This is equivalent to the combined allocation of WALs held by Santos, which allow it to extract up to 10 ML/d from the GAB Southern Recharge Water Source.
7	4.1.2	Indirect water take (leakage)	There is zero indirect take from the Namoi Alluvium and as such there is no requirement for a licence required under CoC B28.	[redacted] Not sure why the Namoi is singled out from the Table 4.1 for mention in the text. There are zero impact in all the other lines other than GAB southern recharge	Correct. This is simply a statement to clarify that there is no indirect take from the alluvium in the direct vicinity of the Project.

Item	Section #	Section heading	Existing text	Comment	Final response
8	4.1.2	Table 4.1 Estimated maximum indirect water take	No specific text reference	[redacted] Hydrostratigraphic units and WSP water sources are being confused in Section 4.1.2 and page 22 of the Briefing. The GOB includes all hydrogeological units (i.e. the coal seams and surrounding sediments). The 'indirect take' is for the transfer between WSP, not all inter aquifer transfer that the EIS model will report. Water being pumped from the GOB cannot have any indirect impact on the GOB i.e. the water pumped is the sum of the water sources so GOB can never be greater than the volume being pumped	The reference to Gunnedah Oxley Basin has been removed from Table 4.1.
9	4.1.2	Table 4.1 Estimated maximum indirect water take	No specific text reference	[redacted] Depressurisation of the sediments immediately abutting the coal seams causes the indirect GAB take. The parameters that govern the timing of this impact in the EIS model are single estimates only.	The comment has been noted. No response is required.
10	4.1.3	Water Access Licences	According to the Water Sharing Plan Rules up to 25% of the total allocation can be carried over each year if unused.	[redacted]] The significance of this sentence is unclear. The carryover bank has set upper limit and carryover activation is subject to several conditions. WSP (2020) indicates '*up to a maximum of 0.25 ML per unit share*' can be banked.	Water will be abstracted in accordance licence requirements, and in accordance with water management policy at the time.
11	4.2.1	Treated and amended produced water	Where permitted and under the EPL or RREO, Santos would beneficially reused treated and amended produced water for construction and operational purposes….	[redacted] In the first sentence " … Santos would beneficially reuse …"	The correction has been made: *Where* permitted *and under the EPL ~~or RREO~~, Santos would beneficially reuse*… Reference to treated water has been deleted. No treated water is available during Phase 1.
12	4.2.1	Treated and amended produced water	Where permitted and under the EPL or RREO, Santos would beneficially reused treated and amended produced water for construction and operational purposes….	[redacted]] Bottom para – 'reuse' not 'reused'	The correction has been made: *Where permitted and under the EPL ~~or RREO~~, Santos would beneficially reuse*…
13	4.2.2	Licenced bores	Santos has three water supply bores which it has abstracted water from for construction….	[redacted] First para first line - 'from which' not 'which'	The sentence has been reworded to: *Santos has three water supply bores from which it has abstracted water for construction….*
14	4.2.2	Licenced bores	Santos will continue abstracting water from these bores under WALs 15819 and 15847 for construction and operational purposes until Year 40 when the model predicts that induced leakage from the Great Artesian Basin Southern Recharge Groundwater Source will occur. These WALs will then be retired in the name of the Minister.	[redacted] '*Santos will* ….' The GAB WSP (2019) indicates that the GABSI water savings will not be added to the Southern Recharge GAB water source LTAAEL until further studies of impacts are made. However, given the likely findings for future WSP it would be prudent to use '*may*'.	Sentence has been reworded from 'will' to 'expects to': Santos *expects to* continue abstracting water from these bores under WALs 15819 and 15847 for construction and operational purposes until Year 40 when the model predicts that induced leakage from the Great Artesian Basin Southern Recharge Groundwater Source will occur. These WALs will then be retired in the name of the Minister.
15	5.2.2	Treated produced water management release	Although there will be no release of treated produced water to surface waters during the Phase 1 activities, complementing the range of beneficial uses for treated produced water during subsequent phases will be the managed release of treated water to Bohena Creek.	[redacted]] It seems odd to include the release to stream on the back of significant flows as a 'beneficial use'. The sentence in the second para '… it is estimated that only a small proportion of treated water may require managed release' … does infer it's a 'disposal' rather than a beneficial use. Does the discussion fit better in section 6.5? Alternatively, perhaps include some argument about the benefit.	The definition of treated water in the Development Consent is as follows: *Produced water that has undergone treatment to enable it to be used for beneficial reuse purposes including irrigation, stock watering, drilling, construction and dust suppression, and/or for managed release to Bohena Creek*. Note that section 5.2.2 has been reworded to simply state the following: *There will be no releases to surface waters, including Bohena Creek, during the Phase 1 activities*.
16	6.2	Produced water gathering and transfer	No specific text reference	[redacted] WTAG understanding of the Santos developed process would be enhanced by a presentation on the Phase 1 program outlined in Section 6.2, in particular the testing of aquifer parameters on the coal seam and surrounding rock. This would be helpful in gaining a common understanding of how the information to be gathered will be applied.	Further details are provided in the Groundwater Management Plan. A briefing was provided to the WTAG on the GMP, which included the data gathering and testing Santos propose to undertake to improve groundwater model parameterisation and conceptualisation prior to Phase 2.

Item	Section #	Section heading	Existing text	Comment	Final response
17	7.1	Methodology of calculating inflows and outflows	No specific text reference	[redacted]] What is the salinity range projected for the ponds? Is it assumed that the ponds will be fully mixed or haloclines form?	The average salinity of produced water generated during exploration and appraisal activities is around 19,000 µS/cm. The salinity will vary between ponds, and the volume of return brine to specific ponds. Although haloclines would be expected to form over time unless a level of agitation or mixing was induced in the ponds, the model assumes a homogenous composition of the stored water in the ponds.
18	7.2	Average water balance	No specific text reference	[redacted] What are the parameters that have been averaged? A variable climate sequence appears to have been used. The period should be defined?	The annual volumes have been calculated on a daily average - from ML/day to ML per year. The averages are based on data as provided in the suite of groundwater management plans. Table 7.1 has been updated to align with the Groundwater Management Plan.
19	8.1	Produced water storages	No specific text reference	[redacted]] Will be pond salinity (density) have an impact on the observed hydrostatic pressure?	Increased salinity results in an increase in density, and as such the salinity will need to be taken into consideration when calibrating the gauges. Pond fill levels will be routinely calibrated against pond level markers, and salinity changes will be slow so the error is likely to remain small.
20	8.2	Groundwater monitoring	This monitoring helps inform the water model and therefore refines the calculations of the inflows into the Water Balance.	[redacted]] The current groundwater flow model is steady state with a single set of aquifer parameters for each layer. It is unlikely to provide impact predictions close to what will occur in the longer term	The current groundwater model has been approved for Phase 1, and will be updated prior to the commencement of Phase 2 (CoC B39). The wording has been amended to: *The GMP outlines a monitoring that includes monitoring coal seam water production which will be used to improve certainty of the Water Balance calculation very early in the life of the Project.*
21	8.2	Groundwater monitoring	This monitoring helps inform the water model and therefore refines the calculations of the inflows into the Water Balance.	[redacted] Suggest change ‘into the Water Balance’ to ‘into the long-term Water Balance’.	The sentence has been reworded to: *The GMP outlines a monitoring that includes monitoring coal seam water production which will be used to improve certainty of the Water Balance calculation very early in the life of the Project.*
22	Appendix C	Site Water Balance TARP	No specific text reference	[redacted]] What is ‘MOV’? Is it the same as FSL on Table 8.1?	MOV is Maximum Operating Volume, which coincides with the Maximum Operating Level (MOL).

Note:
The numbering of the sections and appendices between the draft and final version of the document may have changed.

Appendix B - Compliance conditions relevant to this SWB

Table B1 - SSD 6456 consent conditions directly relevant to this Water Balance

SSD 6456 consent conditions directly relevant to this Water Balance	Section reference
Consent condition A1 In meeting the conditions of this consent, the Applicant must implement all reasonable and feasible measures to prevent and, if prevention is not reasonable and feasible, minimise any material harm to the environment that may result from the construction, operation or rehabilitation of the development.	Section 1.2
Consent condition A5 The Applicant may only undertake the development in the following stages:	Section 1.1.2
(a) Phase 1, comprising ongoing exploration and appraisal activities;	
(b) Phase 2, comprising construction activities for production wells and related infrastructure;	
(c) Phase 3, comprising gas production operations; and	
(d) Phase 4, comprising gas well and infrastructure decommissioning, rehabilitation and mine closure.	
Consent condition A23 With the approval of the Planning Secretary, the Applicant may:	
(a) prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan or program);	Section 1.2
(b) combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined);	No combination proposed as part of this Plan
(c) update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development); and	Section 1.2 Section 12.4
(d) combine any strategy, plan or program required by this consent with any similar strategy, plan or program required by a consent	No combination proposed as part of this Plan
Consent condition B27 The Applicant must ensure that it has enough water for all stages of the development, and if necessary, adjust the scale of the development to match its available water supply.	Section 4.1.3
Consent condition B28 Prior to the commencement of each Phase of the development, the Applicant must demonstrate that it has adequate water licences to account for the maximum predicted water take for the applicable Phase (including both short term and long term direct and indirect water take) to the satisfaction of the Planning Secretary.	Section 4.1.3
Consent condition B41 Prior to commencement of Phase 1, the Applicant must prepare a Water Management Plan for the Project to the satisfaction of the Planning Secretary. This plan must:	
(d) include a	
(ii) Site Water Balance, that includes details of:	

SSD 6456 consent conditions directly relevant to this Water Balance	Section reference
• predicted annual inflows and outflows in the Project area;	Section 7
• sources and security of water supply for the life of the development (including authorised entitlements and licences);	Section 4
• water storage and treatment capacity;	Section 6
• water use and management in the Project area, including any water transfers or sharing with neighbouring water users;	Section 5 Section 5.2
• licensed discharge points and limits; and	Section 6.5
• reporting procedures, including the annual preparation of an updated site water balance.	Section 1.2 Section 12.3
Consent condition D3 The Applicant must ensure that (where relevant) the management plans required under this consent include:	
(a) a summary of relevant background or baseline data;	Section 4 Table 6.2 Also refer to the SWMP and WMP
(b) details of:	
(i) the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 1.3 Section 3
(ii) any relevant limits or performance measures and criteria; and	
(iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	
(c) any relevant commitments or recommendations identified in the documents listed in the NGP EIS;	Section 3.3
(d) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria	Section 3
(e) a program to monitor and report on the:	Section 8 Section 12.1
(i) impacts and environmental performance of the development; and	
(ii) effectiveness of the management measures set out pursuant to paragraph (d);	
(f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 11.2
(g) a program to investigate and implement ways to improve the environmental performance of the development over time	Section 12.4
(h) a protocol for managing and reporting any:	
(i) incident, non-compliance or exceedance of any impact assessment criterion and performance criterion	Section 11.1
(ii) complaint; or	Section 11.3
(iii) failure to comply with other statutory requirements; and	Section 11.1
(i) a protocol for periodic review of the plan.	Section 12.3

SSD 6456 consent conditions directly relevant to this Water Balance	Section reference
Consent condition D4 Within 2 months of: (a) the submission of an incident report; (b) the submission of an Annual Review; (c) the submission of an Independent Environmental Audit; (d) the submission of a Field Development Plan; (e) the submission of a Groundwater Model Update; or (f) the approval of any modification of the conditions of this consent, the Applicant must review the suitability of existing strategies, plans and programs required under this consent.:	Section 12.3
Consent condition D5 If the review determines that the strategies, plans and programs required under this consent require revision – to either improve the environmental performance of the development, cater for a modification or comply with a direction - then the Applicant must submit the revised document to the Planning Secretary for approval within 6 weeks of the review. ***Note**: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.*	Section 12.3
Consent condition D6 The Applicant must notify the Department and any other relevant agencies via the Major Projects Portal immediately after it becomes aware of the incident. This notice must describe the location and nature of the incident.	Section 11.1
Consent condition D7 Within 7 days of becoming aware of a non-compliance with the conditions of this consent, the Applicant must notify the Department of the non-compliance via the Major Projects Portal. This notice must set out the non-compliance, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance. ***Note**: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance*	Section 11.1
Consent condition D8 By the end of March each year, unless the Planning Secretary agrees otherwise, the Applicant must submit an Annual Review of the environmental performance of the development to the Department via the Major Projects Portal.	Section 12.1
Consent condition D9 Within one year of commencement of Phase 1 and every 3 years thereafter, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development.	Section 12.2
Consent condition D13 From the commencement of Phase 1, until the completion of all rehabilitation required under this consent, the Applicant must:	

SSD 6456 consent conditions directly relevant to this Water Balance			Section reference
(a)	make copies of the following information publicly available on its website:		Section 1.6
	(i)	the document/s listed in condition A2(c);	
	(ii)	current statutory approvals for the development;	
	(iii)	approved strategies, plans and programs;	
	(iv)	detailed plans for the Phases of the development;	
	(v)	minutes of CCC and Advisory Group meetings;	
	(vi)	regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent;	
	(vii)	a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;	
	(viii)	a summary of the current phase/s and progress of the development;	
	(ix)	contact details to enquire about the development or to make a complaint;	
	(x)	a complaint register, updated monthly;	
	(xi)	a record of all incidents and non-compliances;	
	(xii)	the Annual Reviews of the development;	
	(xiii)	audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report; and	
	(xiv)	any other matter required by the Planning Secretary; and	
(b)	keep such information up to date.		Section 1.6

Appendix C - Key produced water management assets

Table C1 - Summary of key produced water management assets within PEL 238, PAL 2 and PPL 3

Asset / facility	Tenure	Type	Status	Relevant assessment documents	Approval reference and date	Approval period expiry date
Bibblewindi West Pilot	PAL 2	Appraisal Pilot	Operating - currently dewatering	• Review of Environmental Factors (REF) Narrabri Coal seam Gas Project Bibblewindi West Lateral Production Pilot, January 2009 • The Narrabri Coal Seam Gas Project REF Bibblewindi West Lateral Gas Pilot and Water Gathering System, March 2009	• PAL 2: Approval to conduct Narrabri Coal Seam Gas Project Bibblewindi West Lateral Production Pilot. Department of Primary Industries, 30 April 2009 • PAL 2: Approval to conduct Narrabri Coal Seam Gas Project Bibblewindi West Lateral Pilot Gas and Water Gathering System (File 09/3009). Department of Primary Industries, 29 May 2009	None specified
Bibblewindi East Pilot	PAL 2	Appraisal Pilot	Operating - currently dewatering	• REF 2008 Narrabri Coal Seam Gas Lateral Program Lateral Production Pilot A • 2009 Narrabri Coal Seam Gas Project Bibblewindi Lateral Pilot Supplementary REF Bibblewindi Shield Laterals, July 2009 • The Narrabri Coal Seam Gas Project Operations and Water Management Plan, September 2008 • Supplementary REF - 2009 Narrabri Coal Seam Gas Project - Bibblewindi Lateral Pilot - ESP Installation & Extension of GGS to BW28H & 21H, May 2010	• PAL 2: Approval to conduct the Narrabri Coal Seam Gas Lateral Program, Lateral Production Pilot A, involving coal seam methane exploration well(s) Bibblewindi 18H, 12, 13, 14, 19H, 15, 16, 17. Department of Primary Industries, 12 August 2008 • PAL 2: Approval to conduct Narrabri Coal Seam Gas Project Bibblewindi Lateral Pilot – Shield Laterals Supplementary (File 09/4500). Department of Primary Industries, 20 July 2009 • PAL 2: Approval to conduct 2009 Narrabri Coal Seam Gas Project: Bibblewindi Lateral Pilot: ESP Installation & Extension of GGS to BW28H & 21H (File 09/4500). Department of Industry & Investment, 24 March 2011	None specified

Asset / facility	Tenure	Type	Status	Relevant assessment documents	Approval reference and date	Approval period expiry date
Leewood Water Management Facility (ponds)	PAL 2	Ponds	Operational	• Leewood Produced Water & Brine Management Ponds REF, December 2012	• PAL 2 Approval to construct and operate Leewood produced water and brine management ponds (INT13/23812). Department of Resources & Energy, 19 March 2013	None specified
Leewood Produced Water Treatment and Beneficial Use Project	PAL 2	Plant, treated water storage tank and irrigation infra-structure	Suspended until September 2019	• Leewood Produced Water Treatment and Beneficial Reuse Project REF, June 2015	• PAL 2 Approval to undertake Leewood Produced Water Treatment and Beneficial Reuse Project (MCV15/245#3, OUT15/16630). Division of Resources and Energy, 18 August 2015	18 August 2020; rehabilitation by 18 August 2023
Bibblewindi 5 ML tank	PAL 2	Tank	Operational	• Leewood Produced Water & Brine Management Ponds REF, December 2012	• PAL 2 Approval to construct and operate Leewood produced water and brine management ponds (INT13/23812). Department of Resources & Energy, 19 March 2013	None specified
Bibblewindi to Leewood water flow line	PAL 2	Water flow line	Operational	• Leewood Produced Water & Brine Management Ponds REF, December 2012	• PAL 2 Approval to construct and operate Leewood produced water and brine management ponds (INT13/23812). Department of Resources & Energy, 19 March 2013	None specified
Bibblewindi to Wilga Park GRE gas flowline	PAL 2	Gas flow line	Operational. Can be used to transfer produced water if required.	• Narrabri Coal Seam Gas Utilisation Project Part 3A Environmental Assessment (Project Application 07_0023)	• Project Approval for MP07_0023 (S07/00277). Minister for Planning, 2 December 2008.	None applicable as works are complete
				• Narrabri Coal Seam Gas Utilisation Project (MP 07_0023) Modification 3	• Notice of Modification to Project Approval (07_0023). Planning Assessment Commission, 18 July 2014.	

Asset / facility	Tenure	Type	Status	Relevant assessment documents	Approval reference and date	Approval period expiry date
Dewhurst Northern Water and Gas Flow Lines	PAL 2 / PEL 238	Water and gas flow lines	Water flow line installed	• Dewhurst Northern Water and Gas Flow Lines REF, June 2013	• PEL 238 and PAL 2, Approval to undertake Dewhurst Northern Water and Gas Flow Lines construction program (MCV13/369, OUT 13/25591). Office of CSG, 18 September 2013	No specified end date in amended approval
Dewhurst Southern Water and Gas Flow Lines	PAL 2 / PEL 238	Water and gas flow lines	Water flow line installed; gas flow line under construction	• Dewhurst Southern Water and Gas Flow Lines REF, June 2013	• PEL 238 and PAL 2, Approval to undertake Dewhurst Southern Water and Gas Flow Lines construction program (MCV13/370, OUT13/25677). Office of CSG, 18 September 2013	No specified end date in amended approval.
Tintsfield 2-7 Pilot	PEL 238	Appraisal Pilot	Operating – currently dewatering	• Recommencement of Tintsfield Pilot and flare PEL 238 and PPL 3, Gunnedah Basin NSW, Supplementary REF, August 2013	• PEL 238 and PPL 3, Approval to recommence Tintsfield Pilot and construct and operate associated flare (MCV13/588, OUT13/32001). Office of CSG, 25 October 2013	No specified end date in amended approval
Dewhurst 13-18H Pilot	PEL 238	Appraisal Pilot	Shut in	• REF Dewhurst-8 Lateral Production Pilot, June 2009	• PEL 238: Approval to conduct Narrabri Coal Seam Gas Project Dewhurst – 8 Lateral Production Pilot (09/4409). Department of Primary Industries, 21 July 2009	None specified
				• EIS Dewhurst Gas Exploration Pilot Expansion SSD 6038	• SSD – 6038 Dewhurst Gas Exploration Pilot Expansion Planning Assessment Commission,18 July 2014	18 July 2017
Dewhurst 22-25 Pilot	PEL 238	Appraisal Pilot	Shut in	• REF Dewhurst 22-25 Pilot Wells, March 2013	• PEL 238 Approval to undertake Dewhurst 22-25 Pilot Wells exploration program (MCV13/204, OUT13/23530). Office of CSG, 16 August 2013	No specified end date in amended approval
Dewhurst 26-29	PEL 238	Appraisal Pilot	Operating – currently dewatering	• Dewhurst 26-29 petroleum wells REF, March 2013	• PEL 238 Approval to undertake Dewhurst 26-29 Pilot Wells exploration program (MCV13/205, OUT13/23533). Office of CSG, 16 August 2013	No specified end date in amended approval

Asset / facility	Tenure	Type	Status	Relevant assessment documents	Approval reference and date	Approval period expiry date
				• EIS Dewhurst Gas Exploration Pilot Expansion SSD 6038	• SSD – 6038 Dewhurst Gas Exploration Pilot Expansion Planning Assessment Commission, 18 July 2014	18 July 2017
Tintsfield pond 1 and 2	PEL 238	Ponds	Operational	• Tintsfield Water Management Plan, Narrabri Coal Seam Gas Project, February 2010	• PEL 38: 2009 Narrabri Coal Seam Gas Program, Approval of Tintsfield CSG Pilot Water Management Plan (OUT10/7377). Department of Industry and Investment, 25 May 2010	No specified end date in amended approval for Tintsfield 2-7 pilot (which identified use of Tintsfield ponds to manage water)

Notes:
There are other approved pilots that are not included in Table C1 above which are currently not producing water or gas. These pilots are the Bibblewindi 9 Spot pilot, the Coonarah wells in PPL 3 and the Bohena Pilot. They will not be producing water for the period of this Water Balance.

Both SSD-5934 and SSD-6038 were surrendered on 1 August 2023, within 6 months of commencement of Phase 1, as required by CoC A19.

Appendix D - Site Water Balance TARP

Table D1 - Site Water Balance TARP

Trigger Level	Characteristics of Level	Relevant performance measure	Actions	Action by	Notification
NORMAL	≤75% Maximum operating volume water storage (including ponds and tanks) Beneficial re-use options available for treated water disposal	• Maximise water recycling, reuse and sharing opportunities • Maximise beneficial reuse of treated water • Minimise the need for discharge of treated water to Bohena Creek (not relevant to Phase 1)	• No remedial action necessary	NA	• N/A
LEVEL 1	>75%≤85% Maximum operating volume water storage (including ponds and tanks) One or more beneficial reuse/water disposal option unavailable, e.g. irrigation impractical due to heavy rainfall.	• Maximise water recycling, reuse and sharing opportunities • Maximise beneficial reuse of treated water • Minimise the need for discharge of treated water to Bohena Creek (not relevant to Phase 1)	• Review field production strategy • During wet season (October to February) shut-in field if necessary • Maximise storage in Bibblewindi balance tank • Maximise storage in Leewood treated water tank • Develop an appropriate remedial solution or other water reduction strategies. • Weekly review meeting	Field Supervisor	**Internal** • Water Management Review Team • Site Operators • Field Production Team
LEVEL 2	>85%≤95% Maximum operating volume water storage (including ponds and tanks)	• Maximise water recycling, reuse and sharing opportunities • Maximise beneficial reuse of treated water • Minimise the need for discharge of treated water to Bohena Creek (not relevant to Phase 1)	• Shut-in field PW production / stop the flow of water into the tanks/ponds/cells • ENSW GM notification • Finalise and implement water reduction strategy as per Level 1 • Advise EPA and DPHI • Increase review meeting frequency to daily	Operations Manager	**Internal** • Water Management Review Team • Site Operators • Field Production Team • ENSW GM **External** • EPA, DPHI, relevant land holders
UNACCEPTABLE	>100% Maximum operating volume water storage (including ponds and tanks) Water is being released to the environment from Leewood ponds	• Maximise water recycling, reuse and sharing opportunities • Maximise beneficial reuse of treated water • Minimise the need for discharge of treated water to Bohena Creek (not relevant to Phase 1)	• Activate IMT • Execute mitigation and spill containment strategies as appropriate • Adopt contingency measures from Level 2 • Daily WQ sampling (including receiving environment) and reporting • Implement Pollution Incident Response Management Plan • Daily review meeting	Operations Manager	**Internal** • Water Management Review Team • Site Operators • Field Production Team • IMT • ENSW GM **External** • EPA and other agencies as required under the PIRMP