ANNUAL REPORT 2019

WATER MANAGEMENT PLANS FOR APPROVALS EPBC 2008/4398 AND EPBC 2013/7047

October 2019
QCLNG-BE99-WAT-RPT-000028

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1.0 INTRODUCTION

In accordance with condition 49 (i) of QGC's Environment Protection Biodiversity Conservation (EPBC) Approval 2008/4398, and Condition 34 of EPBC Approval 2013/7047, QGC is required to develop an annual report to be submitted to the Department of Environment and Science (the Department) each year. The following report fulfils this requirement and demonstrates QGC's progress and performance against the Conditions within its approved Stage 3 Water Monitoring and Management Plan (WMMP) and Surat North Water Resource Management Plan (WRMP).

This report demonstrates progress and insights to protect Matters of National Environmental Significance (MNES). Any technical documents, reports and interpretative analysis required to support the progress indicated are included in the WMMP/WRMP or associated technical studies. Key areas of discussion include:

- Associated water and Brine management;
- Well stimulation activities;
- Groundwater monitoring;
- Springs monitoring and management;
- Ground motion assessment;
- Connectivity studies; and
- Updates on action taken under Exceedance Response Plans.

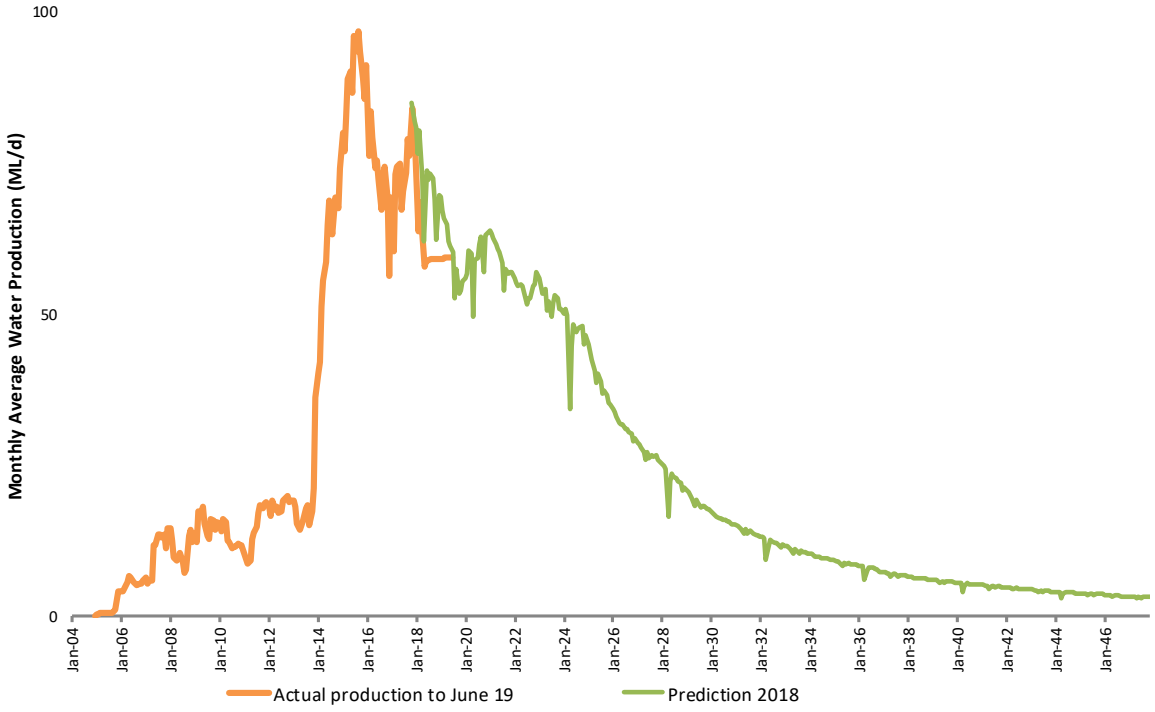
The timescale covered by this document is August 2018 to August 2019, although pertinent information outside this period has also been included.

2.0 PRODUCED WATER & BRINE MANAGEMENT

2.1 Produced Water Management

QGC measures flows throughout the water management system. The graph below illustrates the total upstream produced water profile since 2004 (orange line) and a more recent prediction for volumes made in 2018 (green). These figures indicate that QGC's operations are tracking to produce approximately half of the water volumes predicted in 2010 (maximum rate of 200 Ml/d). This decrease is primarily driven by an enhanced understanding of the reservoir and water flow since 2010 as well as a revised development footprint.

Figure 1: Predicted and actual produced water volumes



The throughput of produced water from the two Water Treatment Plants is indicated in Table 1 below.

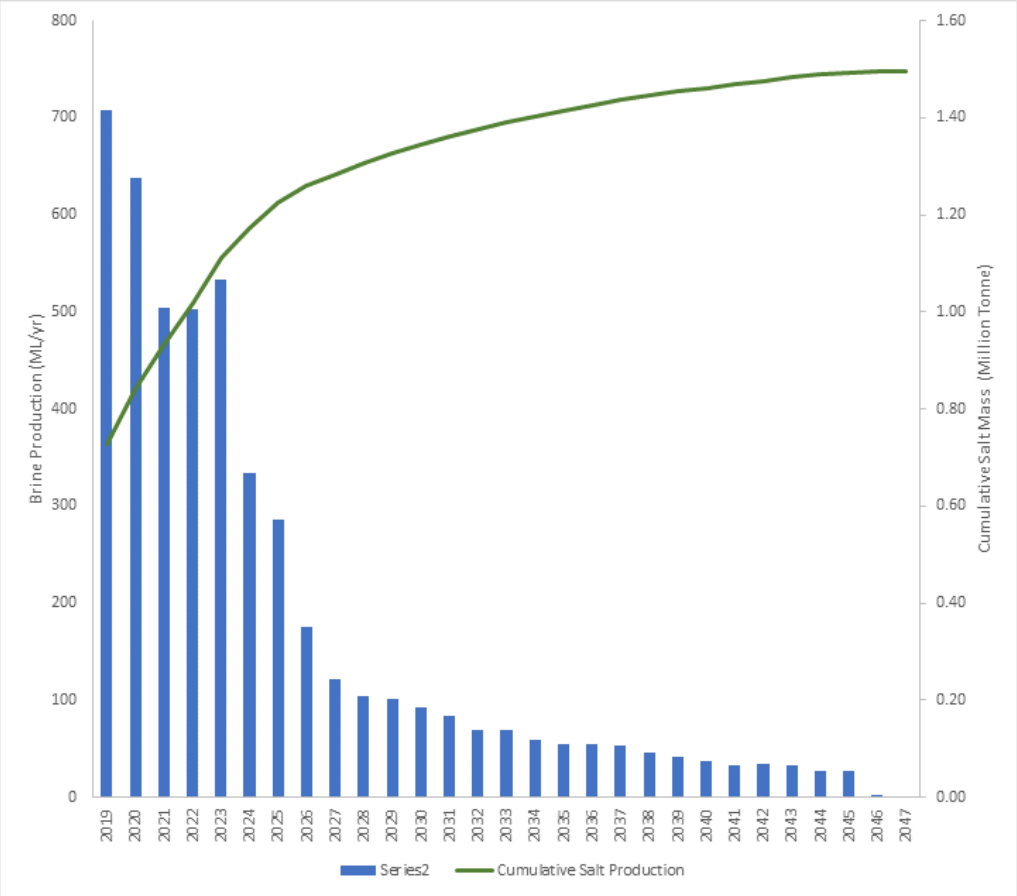
Table 1: Water volumes processed through QGC's Water Treatment Plants

Water Treatment Plant	Average daily production (to end August 2019)
Kenya	28 ML/d
Northern	17 ML/d

2.2 Brine Management

The graph below illustrates the predicted brine and salt profile to 2047. As a direct result of declining brine/salt profiles, emerging crystallization technology and renewed industry collaboration discussions, QGC has also endorsed a strategy to defer the construction of a crystallisation facility and associated regulated waste facility until 2022 (operational in 2025).

Figure 2: Predicted brine production volumes



Several options to safely manage the brine volumes long-term have been investigated. On balance, when all the safety, environmental, community and business factors are considered, crystallising brine into solid salt form and encapsulating it for long-term storage in purpose-built cells is considered the most feasible and optimum solution. QGC continues to pursue alternative uses for the brine and salt residue from the water treatment process.

3.0 WELL STIMULATION ACTIVITIES AND THE CHARACTERISATION OF STIMULATION FLUIDS

No hydraulic stimulation was carried out over the reporting period. No toxicity or ecotoxicity studies were undertaken.

QGC has no plans to undertake well stimulations in 2020.

4.0 AQUIFER MONITORING NETWORK DRILLING

All elements of the Underground Water Impact Report (UWIR) monitoring network have been completed.

Monitoring also continued at 24 shallow monitoring wells in the Charlie Project area as part of the Water Management Plan for EPBC Approval 2013/7047.

To check for departures from trends, exceedances of thresholds and triggers and the early detection of potential impacts, a formal system of assessment of monitoring data is in place. This process sets out the frequencies on which data are checked and assessed and a reporting process and a framework within which actions are tracked. The process includes:

- Weekly basis: a system health check is run on the status of well groundwater pressure gauges and telemetry units so that faults can be identified and rectified. Production Operations (who manage the network) have a KPI of 92% network availability.
- Monthly basis: the database is checked to ensure that data is being correctly delivered by the telemetry system and there are no errors or outliers. The system allows plotting of hydrographs to facilitate this process.
    - If a significant change in a trend or value is observed in the raw data or constructed hydrographs, any rectification requirement will be fast tracked, otherwise the main data assessment process will continue at quarterly intervals.
- Quarterly basis: the levels/pressures are plotted and standard corrections and compensations applied, as appropriate. As per Commitments in the Stage 3 WMMP and the WRMP, data will be uploaded to the QGC website for public viewing on a 6-monthly basis. Relevant supporting data are also collated. Possible response actions from the quarterly review are:
    - If there is no significant change in a value or trend, then there is no further action. Monitoring will continue as will the quarterly assessment events.
    - If a significant change is observed to be taking place in formations adjacent to the Walloons i.e. Springbok, Eurombah, Hutton, then a hydrogeological review will take place addressing the following matters:
        - Has there been any significant change in stress to the groundwater system (for example, has nearby pumping initiated, or a significant recharge event occurred)? and
        - Has recent data and behaviour meant a change in the conceptual model is warranted, and consequentially, are additional or alternative data correction or trend analysis required to normalise the raw data?
    - Following the hydrogeological review, a more rigorous trend analysis would be implemented if warranted.
    - If a trigger is exceeded, then the relevant response plan is initiated.

A number of additional monitoring bores were allocated to QGC as part of the 2019 Surat UWIR. These bores are to be constructed between 2020 and 2021

5.0 CONNECTIVITY STUDIES PROGRESS

Specific connectivity studies have been completed. The focus of connectivity work has moved from smaller scale trials towards the wide scale assessment of whole system response as the fields have gone into production i.e. an examination of the complete monitoring network at a specified frequency to determine impacts of CSG water production more broadly.

Connectivity characteristics within the Walloon sub-group (WSG) and in the aquifers at nested sites can be derived in a variety of ways from the water level and groundwater pressure data. This includes:

- Comparison of pressure responses within the sub-units of the WSG to assess risk and understand pressure response in adjacent formations;
- Comparison of static water levels within each bore (at the same nested site) to determine the magnitude of the vertical hydraulic gradient between units. The larger the difference in head, the less connectivity between the units;
- Monitoring the production zone and overlying and underlying aquifers and observing for signs of impact. Presence or absence of an observable impact both provide valuable information regarding the connectivity of the monitoring bore to the underlying/overlying production zone.
- Comparison of dynamic water levels: typically induced through test pumping/applying stress to one of the units and monitoring for responses within underlying and overlying units. For example, monitoring bores overlying or underlying 5 spot pilot tests. Results from this style of test are analysed by 2D Analytical Models and occasionally 3D numerical flow models.
- Comparison of water levels across spatially separated nested well sites to determine whether hydraulic gradients differ/reverse across the region, potentially giving further insight to wider scale groundwater flow.

6.0 SPRINGS MONITORING AND MANAGEMENT

In accordance with Springs Management Strategy outlined in the 2016 UWIR, QGC has been monitoring the Dawson River 8 springs on a six-monthly frequency.

In the 2019 Surat UWIR, the Dawson River 8 complex was not predicted to experience any impact as a result of CSG operations. Accordingly, the monitoring requirement has been removed from QGC by OGIA

The monitoring bores in the Joint Industry Plan (JIP) Springs Monitoring Network continue to be monitored for water pressure and quality. No exceedances of the relevant triggers have been observed.

The CSG operators in the Surat Cumulative Management Area (CMA) and State and Federal regulators, are discussing a move to a revised Joint Industry Framework (JIF) for water management.

7.0 TRIAL REINJECTION PROGRAM

To fulfil the requirements of this condition QGC has undertaken a program of work to characterise the subsurface and implement an injection trial at its Woleebee Creek site. That trial has entailed three Stages:

- Stage 1 – monitoring bore Woleebee Creek GW4 data acquisition.
- Stage 2 – construction of a trial injection bore and adjacent monitoring bore and surface infrastructure.
- Stage 3 - injection trial using water sourced from the Precipice Formation and CSG treated water.

Stage 1 and 2 has been completed. However, prior to Stage 3, major storm damage necessitated a project review. That review concluded that the body of work available from Woleebee Creek together with injection trials undertaken by APLNG were sufficient to prove the feasibility of a full-scale injection scheme for aquifer re-pressurisation. In addition, it showed that implementing an injection trial at Woleebee Creek would not add to the level of understanding needed for an injection scheme. Further, APLNG have commenced operation of a full-scale injection scheme at Reedy Creek. This 40 ML/d project is already raising Precipice Sandstone groundwater levels by a minimum of 1m over the northern tenements. Therefore, the probability of injection being required into the Lower Precipice at Woleebee Creek is very low.

The basis of the trial and purpose of these federal conditions is for QGC to be able to write a realistic development plan and schedule for the re-pressurisation of the Hutton and Precipice aquifers so that timely intervention is possible if required in the future. Based on the work undertaken to date, QGC has the knowledge and skills to fulfil this requirement. To demonstrate this assertion the Department requested that QGC prepare a revised Injection Management Plan. That was delivered to the Department and comments were received back in early 2017. QGC has revised the plan and a document has been submitted to the Department.

8.0 GROUND MOTION ASSESSMENT

A ground motion annual progress report was submitted to the Department in October 2019. In summary:

- The Stage 3 radar satellite data acquisition using RADARSAT-2 data commenced in January 2015 and terminated at the end of 2017, with final data delivery in April 2018.
- The programme post 2018 has been procured with the same provider but a different satellite platform – Sentinel. Data acquisition is on a 6 to 12-day cycle with two data deliveries from the service provider per year
- The proponents continue to work together to try to resolve the complex influences on surface ground motion and have enlisted the assistance of the University of Queensland to attempt to quantify the role played by natural forces and land-use on satellite-inferred ground motion.
- In 2018, QGC commissioned Shell technical experts to undertake a geomechanical assessment to support a revised predictive analysis. The results of this work will be included in a technical report to the Department but, in summary, the total movement over life of field is predicted to be within previously submitted estimates.
- The majority of the target sensitive areas are stable, with the exception of the areas in the central part of the Project Area, where areas of subsidence have been observed. Most of these sensitive areas were selected because of their proximity to CSG or mining activities and the assessment of the future impact of this subsidence on CSG infrastructure is ongoing. No major impacts on this infrastructure have been observed to date.
- To date no area has triggered the exceedance response plan.
- The University of Queensland has been commissioned to study the seismic baseline of the Surat Basin and to design a suitable seismic monitoring network.

9.0 SHALLOW AQUIFER AND GROUNDWATER DEPENDENT ECOSYSTEM MANAGEMENT

Under the Surat North Water Monitoring and Management Plan, Response Plan V contains a set of trigger actions for management of potential impacts to Groundwater Dependent Ecosystems (GDE) and aquatic ecosystems. The early warning trigger for the response plan is a modelled impact (no specific drawdown value). That modelled impact was communicated to the Department of Environment and Energy in November 2018. The action arising from the early warning trigger is the preparation of a GMP due in January 2020.

A number of data acquisition actions and technical studies are being collated into the overarching GDE Management Plan (GMP). The objective of the scope of works is to enable clear communication of QGC's approach to actively manage the risk to GDEs of predicted impacts resulting from CSG production. Due to the diversity of GDE types on and adjacent to the Project area and the variable nature of their dependence on groundwater, it is important to have an overarching framework, which contains a hierarchy of information and levels of assessment. This allows environmental triggers, responsive actions and mitigation measures to be clearly aligned with, and informed, by the integration of all data sources, conceptualisation and numerical modelling.

The GMP also covers actions required in support of ongoing project approvals in the same acreage. Figure 1 illustrates the workstreams that make up the GMP.

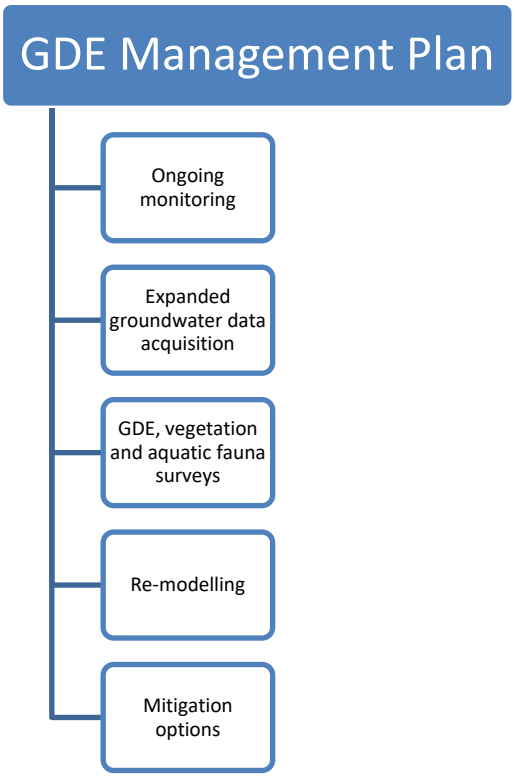


Figure 9 GDE Management Plan Structure

Actions that have been carried out the past 12 months include:

Groundwater Monitoring

The planning of 29 new bores. The new locations will include both shallow alluvium and surficial weathered sedimentary strata as well as bores into the underlying upper Walloons strata above the production horizon. Drilling commenced 23rd October 2019 with estimated completion in January 2020.

With the proposed bores, the augmented shallow groundwater monitoring program will include up to 53 shallow groundwater monitoring points specifically targeting alluvium and shallow consolidated formations associated with shallow groundwater and potential GDEs. There are approximately 40 other groundwater monitoring bores in the immediate area targeting deeper formations and characterising the impact of production in the Coal Measures.

The objectives of the monitoring are not only to characterise the systems and identify impacts but to provide early warning points to detect the onset of impacts such that any mitigation can be put in place in enough time to avoid impact on GDEs.

GDE & Aquatic Ecosystem Assessment & Monitoring

GDE condition monitoring is being undertaken at selected sites to form a holistic view of the relationships between hydrology and GDE health and to identify any negative impacts to vegetation from reduced groundwater availability. The purpose of the field program is to test the hypothesised ecohydrological relationships and conceptual models between groundwater drawdown and ecological response and to confirm groundwater use by GDEs. Key to the surveys will be to establish whether the ecosystems are dependent on groundwater, the extent of that dependence, the potential impact due to groundwater withdrawal and identification of condition markers.

Specific targeted locations have been selected that represent key mapped GDE zones in the Horse, Juandah, Canal and Eurombah Creeks and Dawson River catchments. Appropriate vegetation parameters that are sensitive to changes in groundwater availability are being identified and monitored through vegetation surveys. Initial survey results will be reported as part of the GMP, but this type of monitoring will continue if there is a risk to GDEs.

Aquatic Ecosystem Assessment & Monitoring

An aquatic ecosystem survey was undertaken in the Project Area in 2012. It is intended to revisit those locations and other creek sites co-incident with the GDE and groundwater monitoring to form a holistic view of all water assets that may be dependent on surface water or groundwater

Groundwater Modelling

QGC is undertaking a number of tasks to enhance and update the 2018 alluvial groundwater model of Horse Creek prior to a major rebuild once the 2019 UWIR model is available

Mitigation Feasibility

Mitigation of potential groundwater impacts is key to a robust GMP that will achieve the required outcomes A pre-feasibility study is underway to narrow down the feasible options for mitigation. The key requirements that are being assessed include:

The extent of impacts. This will be provided by the current Horse Creek alluvium model being finalised by Jacobs.

Whether there is a water source available to mitigate the impacts. This may include surface water, groundwater, or CSG treated water.

What options exist for delivering the water source to the impacted alluvium. Options include recharge weirs, trenches, and injection bores.

GDE Management Plan (GMP)

The various workstreams are being collated into the overarching GDE Management Plan (GMP). The objective of the GMP is to enable clear communication of QGC's approach to actively manage the risk to GDEs of predicted impacts resulting from CSG production. Due to the diversity of GDE types on and adjacent to the Project area and the variable nature of their dependence on groundwater, it is important to have an overarching framework, which contains a hierarchy of information and levels of assessment. This allows environmental triggers, responsive actions and mitigation measures to be clearly aligned with, and informed, by the integration of all data sources, conceptualisation and numerical modelling.

10.0 EXCEEDANCE AND RESPONSE MANAGEMENT

QGC has developed several Response Plans to protect the water environment and MNES in the event that threshold values are exceeded. The following list of exceedance response plans are active. Listed below is an update on actions QGC has undertaken over the reporting period.

- Response Plan iia: If Investigation or Mitigation Trigger Values or Drawdown Limits for aquifer drawdown in relation to EPBC listed springs are exceeded;

Data are examined quarterly as part of the Aquifer Surveillance Process. No triggers haven been exceeded.

- Response Plan iib: If Threshold Values for aquifer drawdown in relation to groundwater-producing bores are exceeded;

Activities are being managed under Queensland Legislation for Make Good of affected water bores. Following the publication of the 2016 UWIR, QGC has responsibility to undertake bore assessment and subsequent Make Good negotiations for 20 bores. All field investigations are complete and negotiations with affected parties are underway.

- Response Plan iic: If Threshold Values for groundwater contamination are exceeded;

Reviewed on a six-monthly basis as data are collected, no contamination identified.

- Response Plan iii: If subsidence or surface deformation occurs which impacts on surface or groundwater hydrology;

No trigger exceeded, see Section 8.

- Response Plan iv: If there are unforeseen emergency discharges.

Managed as part of operations. No response plan triggered.

- Response Plan v: define triggers for aquatic ecosystems and ecology and investigation/mitigation actions prompted by those triggers within the Surat North Development Area

As reported in Section 12, the Early Warning trigger is a modelled impact on source aquifers for potential GDEs. That trigger was reached with the 2018 alluvial modelling and the appropriate response actions are underway.