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Information Document		Document No.	2791
Document Title	**Monitoring Program – Groundwater**		
Area	HSEC	**Issue Date**	7 June 2013
Major Process	Environment	**Sub Process**	
Authoriser	Darryl Cuzzubbo – Asset President Olympic Dam	**Version Number**	15

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1 SCOPE

This Monitoring Program (MP) describes the environmental monitoring activities undertaken by BHP Billiton Olympic Dam Corporation Pty Ltd (ODC) for the purpose of quantifying any change in the extent or significance of impacts of ODC's operations on groundwater, assessing the performance of the control measures employed to limit these impacts, and to meet relevant legal and other requirements.

This MP addresses a number of distinct elements of groundwater monitoring. For each element, the MP sets out background information, the purpose of the monitoring and the deliverables which are produced as a result of the monitoring. The MP also includes a description of the methods for measuring achievement of **compliance criteria** and the movement of trends towards **leading indicators** (where applicable).

The groundwater monitoring described in this MP relates solely to groundwater in the Olympic Dam region and Stuart Shelf (radius of approximately 50 kilometres (km)).

Groundwater monitoring relating to the Great Artesian Basin, approximately 100 km north of the Olympic Dam operation, is discussed in the Great Artesian Basin (GAB) Monitoring Program (Document No. 2789).

(State 17a)

1.1 Groundwater

There are two important groundwater systems in the Stuart Shelf: the Andamooka Limestone aquifer and the Tent Hill aquifer, each described further below. These form the overlying cover sequence at Olympic Dam and consist of Cambrian shales and limestones and Late Proterozoic quartzite, sandstone and shale members, mostly of very low permeability. A schematic cross-section of these units as they occur beneath the current operation is shown in Figure 1-1 and regionally in Figure 1-2.

The upper Andamooka Limestone aquifer is the shallowest of the aquifers in the Stuart Shelf and forms the regional 'water table' aquifer north of Olympic Dam. The water table typically occurs about 50 metres (m) below ground (i.e. 50 m Australian Height Datum (AHD), with groundwater in the aquifer moving from west of the Stuart Shelf to the northern end of Lake Torrens, where the water table typically occurs less than 10 m below ground. Groundwater salinity is typically in the range of 20,000 to 60,000 milligram per litre (mg/L) on the **Special Mining Lease** (SML), increasing to as much as 200,000 mg/L closer to Lake Torrens. For comparison, seawater salinity is generally around 35,000 mg/L.

The Tent Hill aquifer is extensive and is the most important aquifer within the southern portion of the Stuart Shelf, where the Andamooka Limestone aquifer is either very thin or absent. It includes the lower parts of the Arcoona Quartzite and the Corraberra Sandstone units of the Tent Hill Formation and is therefore sometimes referred to as the Arcoona Quartzite aquifer or the Corraberra Sandstone aquifer. The aquifer occurrences reduce north of the SML due to a deepening of the unit and reduction in permeability.

At Olympic Dam, the Tent Hill aquifer typically occurs 160 to 200 m below ground level (about -60 mAHD to -100 mAHD). The depth increases moderately to the north, west and south, with the base of the unit around 225 m below ground level (-125 mAHD) near the existing underground mine and more than 400 m below ground level (-300 mAHD) north of Olympic Dam.

Groundwater salinity in the Tent Hill aquifer is generally higher than in the Andamooka Limestone aquifer, with reported concentrations ranging from about 35,000 to more than 100,000 mg/L in the vicinity of Olympic Dam, and ranging to around 200,000 mg/L closer to Lake Torrens.

The upper section of the Arcoona Quartzite unit forms an aquitard. This is a low permeability layer that restricts the movement of groundwater between the Andamooka Limestone and Tent Hill aquifers.

The aim of this program is to manage the **environmental impacts** on groundwater associated with the existing surface and underground facilities, and in the area proposed for the future open pit and associated infrastructure, by:

- Assessing the magnitude of groundwater abstraction and groundwater discharge into the mine, and determining the mine water balance;

- Determining the changes in groundwater levels for both aquifers across site, particularly in the vicinity of the Tailings Storage Facility (TSF) the mine water evaporation pond, and around the area proposed for the future open pit;
- Determining the changes in groundwater levels for both aquifers on the Stuart Shelf associated with operation of the Motherwell Wellfield, smaller satellite saline wellfields in the vicinity of the operation, and Managed Aquifer Recharge (MAR);
- Determining any changes in spring flow at Yarra Wurta Springs, and groundwater levels in the vicinity of the springs;
- Determining any changes in radionuclide concentrations in groundwater;
- Identifying possible changes in groundwater chemistry that may occur.

To meet these objectives, data are collected on the local aquifers, and a monitoring program is conducted to measure groundwater levels and chemistry across site and regionally. Abstraction volumes from the proposed wellfields and dewatering volumes from the area of the future open pit are recorded. A program of spring flow monitoring at Yarra Wurta Springs is also undertaken.

The data are further used to update the MP, and entered into the regional groundwater model to develop and refine trigger points for actions within the EM Program (see EM Program, Document No. 49329).

(Aus 5a; State 17a, 30)

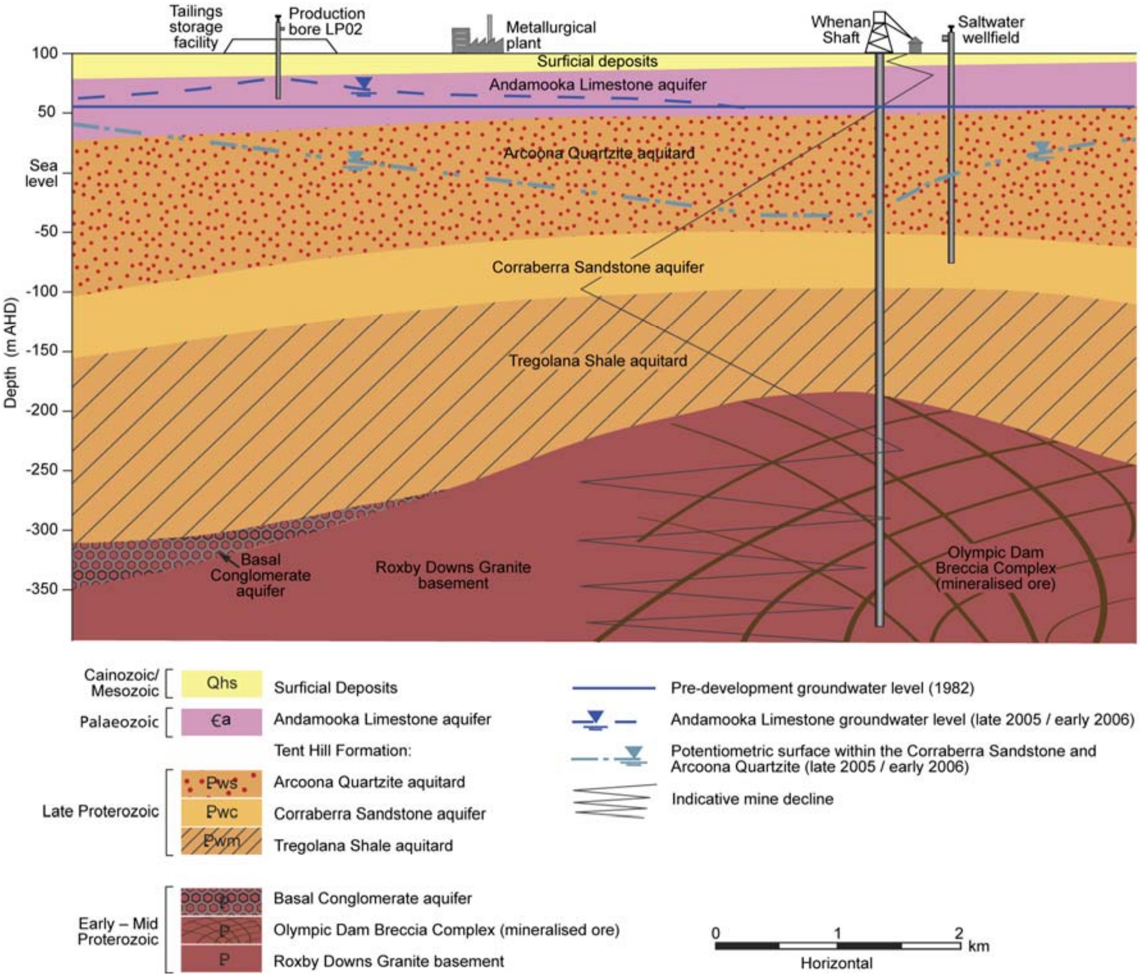

Figure 1-1: Simplified geological cross-section beneath the existing operations

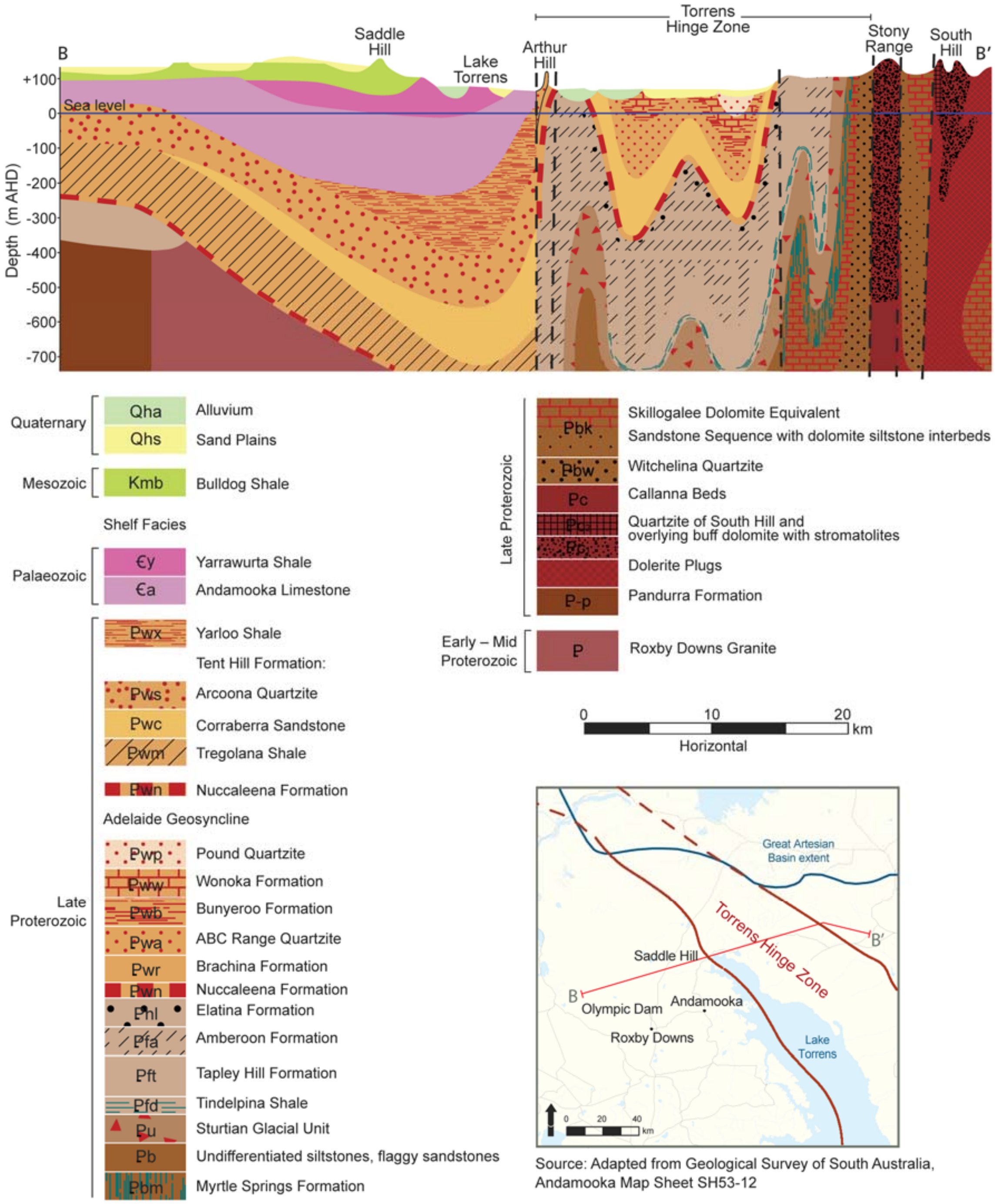

Figure 1-2: Schematic regional geological cross-section

1.2 Responsible ODC personnel

The Olympic Dam Asset President is responsible for ensuring that all legal and other requirements described in this MP are met.

ODC employs an environmental scientist and sufficient other staff with experience and qualifications to fulfil the requirements of this MP.

1.3 Review and modification

This MP is reviewed annually. The data collected as a result of this MP are used to update the MP where necessary. Major changes or amendments following the review are documented in Appendix B (see section 6) of this MP (State 30).

2 DETAILED PROCEDURE

Groundwater related data have been collected by ODC for over 25 years in the vicinity of Olympic Dam. The data provide baseline information to aid in the understanding of the natural systems. Data continues to be collected according to the schedules in section 5.

(Aus 5j; State 17kv)

2.1 Groundwater abstraction and mine water balance

2.1.1 Background

ODC abstracts groundwater from the Andamooka Limestone and Tent Hill aquifer systems within the SML. The shallow Andamooka Limestone is completely dewatered in the underground mine area with inflows into the underground mine only from the deeper Tent Hill aquifer. In the TSF area and around the process plant there is considerable saturated thickness in the limestone due to seepage-induced mounding. Local groundwater is used primarily for dust suppression, construction work, underground mining operations and in the Backfill Plant.

Current water supply facilities include:

- A saline wellfield, comprising several bores which intersect a high-permeability area of the Tent Hill aquifer;
- Underground mine dewatering, primarily from the Tent Hill aquifer;
- Production bore LP2 located north of the TSF (adjacent to LT2), producing from the TSF seepage mound in the Andamooka Limestone aquifer.

Additional activities associated with the development of the open pit which may affect groundwater include:

- Dewatering and depressurisation of the open pit area to control inflow of groundwater and reduce pressure in the future pit walls;
- Aquifer recharge associated with the MAR trial and proposed operation;
- The Motherwell saline wellfield, if required, approximately 30 km north of Olympic Dam in the Andamooka Limestone aquifer;

2.1.2 Purpose

- Derive a total groundwater extraction number for the mine area, as the basis for impact assessment and modelling input.
- Monitor abstraction rates from all saline water supply sources.
- Monitor open pit dewatering volumes resulting from dewatering activities, and injection to the MAR.
- Maintain an understanding of the mine saline water balance through measurement, derivation or estimation of key parameters.
- Estimate groundwater discharge to the underground mine workings.

2.1.3 Deliverable(s)

- A review of abstraction and injection rates and trends, and an assessment with respect to groundwater levels.
- A review of open pit dewatering rates and trends and an assessment with respect to groundwater levels.
- A definition and map of the underground mine water balance.
- An estimate of the volume of groundwater discharge to underground.

2.1.4 Method

The following monitoring and recording is undertaken in relation to groundwater:

- Average daily abstraction (kilolitres per day (kL/d)) from production bore LP2.

- Average daily abstraction (megalitres per day (ML/d)) from the Motherwell wellfield, MAR (including recharge), satellite saline wellfields and open pit dewatering wells (State 28a).
- Average daily abstraction (ML/d) from other minor saline wellfields.
- Total monthly abstraction (ML/d) from all groundwater abstraction sources.
- The abstraction rates are recorded in an on-site database for analysis and reporting.
- The mine water balance is calculated annually from a combination of measured, derived and estimated data.

(Aus 5g, 5h, 5i; State 17ki, 17kii, 17kiv) (EPA 31543.500-435)

2.2 Groundwater level

2.2.1 Background

Underground mine dewatering and seepage from surface facilities has resulted in altered groundwater levels in both the Andamooka Limestone and Tent Hill aquifers. Pre-mining the potentiometric surface was approximately 50 m below the surface. Present groundwater levels differ by between 1 m and 15 m, as shown conceptually in Figure 1-1.

In the centre of the mine area, groundwater is constantly being depleted in both aquifers, creating a cone of drawdown which extends for approximately 5 km in the Tent Hill aquifer and approximately the same distance to the north, south and east in the Andamooka Limestone aquifer.

Open pit dewatering and depressurisation will result in similar effects as the existing mine dewatering, with the drawdown cone gradually propagating outward and away from the open pit area. To the north, MAR injection will result in localised groundwater mounding. No change in flow, and hence no impact, is expected to occur at the northern boundary between the Stuart Shelf and the GAB.

Seepage from the base of the Rock Storage Facility (RSF) is expected to be around 1 per cent of rainfall. While this is five to 10 times greater than the natural recharge rate due to preferential flow paths, no groundwater mound is expected to form beneath the RSF due to very low infiltration rates and the unsaturated extent of the Andamooka Limestone. Ultimately, all seepage will be captured by drawdown from the open pit.

To the west, seepage from the TSF and old mine water pond area has created a groundwater mound in the Andamooka Limestone aquifer which has risen to a maximum height of approximately 30 m below the ground surface. The mound changed very little over extended periods, i.e. years, because of the low transmissivity in the limestone aquifer, limited hydrogeological interconnection to the Tent Hill aquifer and the limited number of man-made interconnections (exploration drill holes, ventilation shafts etc.), Abstraction from production bore LP2 since January 2000 has reduced the groundwater mound. Commissioning approval for TSF Cell 4 and Construction approval for TSF Cell 5 requires BHP Billiton Olympic Dam to ensure that groundwater levels do not rise above 80 mAHD (20 m below ground level). A contingency plan nominates remedial action that can be undertaken if required in future (BHP Billiton 2011).

The groundwater has no natural surface expression in the vicinity of the Olympic Dam operation, and is at sufficient depth as to not adversely affect native vegetation. The closest known obligate groundwater-dependent ecosystem, the Yarra Wurta Spring group, is around 50 km from Olympic Dam at the northern end of Lake Torrens. While evidence indicates that groundwater supply to the springs originates from the east, in rocks of the Adelaide Geosyncline, there is a possibility that groundwater from the Andamooka Limestone aquifer also contributes to the spring flow. Monitoring in the vicinity of the spring will be used to develop **leading indicators** for future mitigation strategies. However, no drawdown at Yarra Wurta Springs is expected during the life of operation of the open pit.

2.2.2 Purpose

- Define the extent of groundwater level changes that have resulted from Olympic Dam's activities.
- Provide information that can be used to regulate the volume of abstraction from pumping wells near the TSF, in order to maintain groundwater levels in the region of the TSF to below a level at which native vegetation could be affected.

2.2.3 Deliverable(s)

- A review of the trends in local and regional groundwater levels and a comparison with historical groundwater levels.
- Data showing the tracking of trends towards **leading indicators** for groundwater impacts, and triggering an alert to management when levels approach the **leading indicators**.

2.2.4 Method

Groundwater levels are monitored monthly, quarterly or annually, utilising a network of exploration and groundwater monitoring bores in both the Andamooka Limestone and Tent Hill aquifers (see section 5 – Appendix A).

Local groundwater levels are monitored at or adjacent the existing and expanded TSF, backfill limestone quarry, underground mine and future open pit. Regional groundwater levels are monitored at locations on the Stuart Shelf outside the SML. Groundwater levels will be monitored at the satellite saline wellfields and Motherwell Wellfield when the respective locations and associated monitoring bores have been defined (State 28a).

If for some reason a groundwater level cannot be obtained (e.g. blocked bore), the nearest suitable bore will be located and monitored if appropriate. Olympic Dam will maintain sufficient monitoring bores to satisfy the requirements of the groundwater model and for monitoring of groundwater levels around the TRS.

Groundwater levels at regional wells are used to infer any impact to third-party wells. To confirm a stable baseline groundwater level, the frequency of monitoring of regional wells in the vicinity of the Motherwell wellfield will be increased 12 months prior to commissioning of the wellfield. Regional monitoring frequency will also be increased in response to a propagating pattern of change in groundwater levels that may occur as a result of pit dewatering or other groundwater affecting activities.

The groundwater levels are recorded in a database for subsequent analysis and reporting.

(Aus 5g, 5h, 5i; State 17ki, 17kii, 17kiv)

2.3 Groundwater quality

(MC 2.8.2(e))

2.3.1 Background

Groundwater in the vicinity of the operation is of poor quality and, as defined by ANZECC (2000), is not suitable for supporting the **environmental value** categories (aquatic ecosystems; recreation and aesthetics; drinking supply; primary industry). Local groundwater is also unsuitable for ore processing at Olympic Dam.

Modification of local groundwater, such as through desalination, is not beneficial to the current mineral processing requirements at Olympic Dam. The use of local groundwater has been limited to dust suppression, soil conditioning during construction and some underground drilling activities.

For construction purposes, low-quality water is sourced from local saline supply. Water required for dust suppression for activities associated with the future open pit is sourced from a combination of saline wellfields and water extracted as a result of mine dewatering and depressurisation.

Analysis of seepage from the base of the existing TSF has shown that it undergoes a process of *in-situ* neutralisation and attenuation as it passes through the upper layers of the Andamooka Limestone. Groundwater chemistry around the TSF is similar to the regional groundwater chemistry, with the exception of slightly increased uranium concentrations and slightly reduced pH. Effects on groundwater quality as a result of the expanded TSF and the RSF are expected to be similar. ODC has been granted an exemption from certain requirements of the **Environment Protection Act** (specifically clauses 13 and 17 of the Environment Protection (Water Quality) Policy 2003). The exemption pertains and applies to an attenuation zone roughly equivalent to the expanded SML.

Groundwater dependent ecosystems are supported at Yarra Wurta Springs. While evidence indicates that groundwater supply to the spring originates from the east, in rocks of the Adelaide Geosyncline, there is a possibility that groundwater from the Andamooka Limestone aquifer also contributes to the spring flow. A change in drawdown could therefore potentially alter the mix ratio, although it is likely that any change in water quality parameters would be negligible.

Electrical conductivity (EC) is considered the most valuable water quality parameter for detecting a change in spring flow. Assessment of water quality therefore focuses on EC data. Other water quality parameters such as pH and temperature are measured but less emphasis is applied to routine assessment of these data. However, pH and temperature data may be used as part of cause analysis if a change in conductivity was evident in monitoring results.

2.3.2 Purpose

- Monitor groundwater quality in the vicinity of the operations and at Yarra Wurta Springs.
- Quantify any possible impacts of seepage from the TSF and RSF.

2.3.3 Deliverable(s)

- A review of trends in groundwater quality and a comparison to ANZECC criteria.
- A review of trends in groundwater quality at Yarra Wurta Springs and a comparison between baseline measurements and ongoing monitoring.
- Data showing the tracking of trends towards the **leading indicators** for groundwater quality, and an alert to management when levels approach the **leading indicators**.

2.3.4 Method

Aquifer-specific monitoring bores (see Appendix A – Table 5-1 and Table 5-2) are pumped or bailed in order to obtain a representative groundwater sample for quality analysis. The samples are analysed for the following analytes:

- TDS, pH, calcium, chloride, copper, iron, manganese, sulphate and uranium (State 28a).

In addition, samples from monitoring bores listed in Table 5.1 will be analysed for the following radionuclides:

- ^{238}U, ^{226}Ra, ^{230}Th, ^{210}Pb and ^{210}Po.

If for some reason a groundwater sample cannot be obtained (e.g. blocked bore), the nearest suitable bore is located and sampled if appropriate. Groundwater quality at regional wells is used to infer any impact to third-party wells.

Groundwater quality at regional wells is used to infer any impact to third-party wells. Regional wells in the vicinity of the Motherwell wellfield will be sampled 12 months prior to the commissioning of the wellfield.

Spring water quality analyses are conducted in the field. Water quality parameters assessed include pH, conductivity and temperature. These are measured in flowing water using a calibrated field lab (State 28a).

Analysis of conductivity data is used as the primary indicator of changes in water quality at Yarra Wurta Springs by comparison with baseline measurements and ongoing monitoring trends.

(Aus 5g, 5h, 5i; State 17ki, 17kii, 17kiv) (EPA 31543.500-436)

2.4 Spring flow

2.4.1 Background

Reduced flow at Yarra Wurta Springs may reduce the area of habitat that is available to organisms or it may lead to spring extinctions. However, no drawdown at Yarra Wurta Springs is expected during the life of operation of the open pit.

2.4.2 Purpose

- Monitor and review groundwater spring flow at Yarra Wurta Springs.

2.4.3 Deliverable(s)

- A review of trends in groundwater spring flow rates at Yarra Wurta Springs and a comparison between baseline measurements and ongoing monitoring.
- Data showing the tracking of trends towards the **leading indicators** for impacts to Yarra Wurta Springs, and an alert to management when levels approach the **leading indicators**.

2.4.4 Method

Since the mid-1980s ODC has carried out extensive and ongoing flow monitoring of GAB springs. This experience has shown that spring flow is naturally variable, and inherent conditions make accurate flow measurements difficult. However, regular measurements at springs over a significant period of time can provide indicative flow trends.

Spring flow is measured by dye or weir gauging. The flow measurement technique applied depends on vent and flow channel characteristics. Flow monitoring data are collected biannually (see Appendix A – Table 5-2). (State 28a)

Dye gauging of springs involves a single injection into the spring vent of a known tracer (normally 20 per cent solution Rhodamine WT). Between 15 millilitres (ml) and 200 ml of dye solution at a concentration of either 0.0392 per cent or 3.4 per cent is injected, dependent on the flow rate of the spring (Land Use Consultants, 2004). Samples are collected downstream and water samples are sent to a laboratory for assessment of minute concentrations of the tracer.

Within the literature, few toxicological reviews of tracer dyes used for hydrological monitoring have been carried out. Flury and Wai (2003) found that under normal use Rhodamine WT should not pose an environmental hazard.

(Aus 5g, 5h, 5i; State 17ki, 17kii, 17kiv)

2.5 Use of local groundwater for dust suppression

(MC 2.8.2(e))

2.5.1 Background

Sources of local groundwater are used around site for watering of roads to suppress dust. This may include water obtained from the mine as a result of underground mine dewatering or extracted from ventilation fan outflow, which may have elevated radionuclide content relative to other local groundwater sources. As noted in section 2.3.1, local groundwater is of very low quality and is unsuitable for other industrial or environmental uses. Radionuclide concentrations in locally sourced groundwater used for road watering are monitored annually.

Upper limits for radionuclide content are shown in Table 2-1, below.

Table 2-1: Upper limits for radionuclide content

Radionuclide	Upper limit (Bq/L)
^{238}U	50
^{226}Ra	5

(Aus 5g; State 17ki)

2.5.2 Purpose

- Monitor sources of local groundwater used for road watering.
- Ensure negligible long-term effects from the release of mine water.

2.5.3 Deliverable(s)

- Data demonstrating that radionuclide concentrations are below upper limits.
- A review of results and provision for increased monitoring frequency where concentrations are trending towards upper limits.

2.5.4 Method

Sources of local groundwater used for dust suppression, including raise bore ponds and storage dams, are sampled at least once a year and checked for radionuclide concentrations. Where readings for a source are close to or above upper limits, additional monitoring will be conducted more frequently. Use of water from a source found to exceed the limit will cease until the radiation level has been found to have dropped below that limit.

(Aus 5h, 5i; State 17kii, 17kiv)

3 COMMITMENTS

3.1 Reporting

The results and a discussion of the results are presented in the annual Environmental Management and Monitoring Report (EMMR) as outlined in the **Environmental Management Manual** (EMM).

3.2 Modelling

The regional Stuart Shelf groundwater model, as presented in the **EIS** and used to predict regional groundwater drawdowns, is reviewed and updated every three years (from October 2011, the EIS approval date), taking into account the data collected through the Groundwater Monitoring Program. The review is undertaken by an independent expert and in accordance with the *Murray Darling Basin Commission groundwater flow modelling guideline* (2000, or as amended) or alternative guidelines specified in writing by the Federal Environment Minister. (Aus 23a; State 26)

Updates to the model will ultimately be used to confirm that all movement of TSF and RSF seepage will be captured by the final open pit, with geochemical attenuation within the SML. (State 32) Capture of seepage will be shown by the overall modelled hydraulic gradients, developed after mining is completed, being such that they extend sufficiently beyond the TSF to capture seepage that may have migrated during mining operations. In parallel, field monitoring will be undertaken throughout the operating period to provide data for model calibration and verification, and to demonstrate that the necessary gradients are developing.

The update and review will also incorporate, when available, updates to:

- The hydrogeology and conceptual understanding of the Torrens Hinge Zone, including any revised aquifer parameters, and the existence and magnitude of the groundwater divide (Aus 23c; State 26a, 26b);
- The hydrogeology and conceptual understanding of the recharge mechanisms to the Stuart Shelf, including recharge from rainfall and inflow from the Arckaringa Basin (Aus 23d; State 26c);
- The understanding of impacts to the regional groundwater system resulting from the open pit void (Aus 23d; State 26d);
- The understanding of the hydrogeology and ecology of the Yarra Wurta Springs and the processes supporting the springs, including determining the significance that declines in groundwater levels in the Andamooka Limestone may have on the springs, and developing an understanding of the storage buffering of Lake Torrens to the drawdown of groundwater levels within the Andamooka Limestone (Aus 23b).

A report is prepared providing details of the model update, and reviewing and incorporating the items listed above (State 26).

3.3 Summary of commitments

Table 3-1: Summary of commitments

Action	Parameter	Frequency
Monitor	Groundwater abstraction and mine water balance	Daily-monthly
Monitor	Groundwater level – Andamooka Limestone and Tent Hill aquifers	As per Table 5-1 and Table 5-2
Monitor	Groundwater quality – Andamooka Limestone and Tent Hill aquifers, Yarra Wurta Springs	As per Table 5-1 and Table 5-2
Monitor	Flow rate – Yarra Wurta Springs	As per Table 5-2
Monitor	Quality of mine water used for dust suppression	Annually
Employ	An environmental scientist to undertake the requirements of the Groundwater MP	Ongoing
Report	Monitoring results in the annual EMMR to the Indenture Minister	Annually

Action	Parameter	Frequency
Review	The Groundwater MP and modify as appropriate	Annually

4 DEFINITIONS AND REFERENCES

4.1 Definitions

Throughout the EPMP some terms are taken to have specific meaning. These are indicated in bold text in the documentation and are defined in the glossary in section 5 of the EMM. Defined terms have the same meaning wherever they appear in bold text. Some other terms and acronyms are also defined in the glossary, but do not appear in bold text.

4.2 References

ANZECC 2000, 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', Australian and New Zealand Environment and Conservation Council and Agriculture Resource Management Council of Australia and New Zealand, Paper No. 4, vol. 1–3, ch. 1–9.

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BHP Billiton Olympic Dam 2011, 'Contingency measures and response plan for addressing unexpected groundwater level increase below the Olympic Dam Tailings Storage Facility (TSF) Cells 4 and 5, Report ODENV030'.

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4.3 Bibliography

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Radiation Protection and Control Act 1982.

South Australian Parliament 1996, 'Roxby Downs water leakage', 19th report of the Environment, Resources and Development Committee of the Parliament of South Australia, Adelaide.

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5 APPENDIX A: LOCATION PLANS AND GROUNDWATER BORE MONITORING FREQUENCY

(Aus 5h, 5i; State 17kii, 17kiv)

5.1 Olympic Dam existing operations

Table 5-1: Groundwater monitoring bores and frequency

Bore	Unit No.	Level	Quality	Bore	Unit No.	Level	Quality
LT1	6237-200	Quarterly	Annually	LM11		Quarterly	
LT2	6237-201	Quarterly	Annually	LM13		Quarterly	
LT3	6237-202	Quarterly		LM14		Quarterly	
LT8	6237-207	Quarterly		LM15		Quarterly	
LT9	6237-208	Quarterly		LM16		Quarterly	
LT11	6237-200	Quarterly		LM17		Quarterly	
LT13	6237-201	Quarterly		LM18		Quarterly	
LT14	6237-202	Quarterly		LM19		Quarterly	
LT15	6237-207	Quarterly	Annually	LM20		Quarterly	
LT16	6237-208	Quarterly		LM21		Quarterly	
LT17	6237-200	Quarterly	Annually	LM23		Quarterly	
LT18	6237-201	Quarterly		LM25		Quarterly	
LT19	6237-202	Quarterly	Annually	LM43		Quarterly	Annually
LT20	6237-207	Quarterly		LM46		Quarterly	Annually
LT21	6237-220	Quarterly	Annually	LR1	6237-237	Quarterly	
LT22	6237-221	Quarterly	Annually	LR2	6237-238	Quarterly	Annually
LT23	6237-222	Quarterly		LR3	6236-94	Quarterly	Annually
LT24		Quarterly		LR4	6237-21	Quarterly	
LT25	6237-224	Quarterly	Annually	LR6	6236-92	Quarterly	Annually
LT28	6237-227	Monthly		LR7	6236-91	Quarterly	
LT29	6237-228	Monthly		LR8	6237-22	Quarterly	Annually
LT31	6237-230	Monthly		LR9	6237-23	Quarterly	Annually
LT33	6237-232	Quarterly		RD66	6237-47	Annually	
LT34	6237-254	Monthly	Annually	RD80		Annually	
LT35	6237-255	Quarterly	Annually	RD115	6237-64	Annually	
LT37		Quarterly		RD125	6237-66	Annually	
LT38		Quarterly					
LT39	6237-256	Monthly	Annually	RD148	6237-77	Annually	
LT40	6237-257	Monthly		RD169	6237-82	Annually	
LT41	6237-258	Quarterly		RD172	6237-84	Annually	
LT45		Quarterly		RD194	6237-94	Annually	
LT50	6237-272	Quarterly		RD222	6237-101	Annually	
LT51	6237-273	Quarterly		RD305	6237-126	Annually	

Bore	Unit No.	Level	Quality	Bore	Unit No.	Level	Quality
LT52		Quarterly		RD315A		Annually	
LT56		Quarterly		RD436	6237-144	Annually	
LT57		Quarterly		RD503	6237-151	Annually	
LT58		Quarterly		RD591	6237-160	Annually	
LT59		Quarterly		RD1953		Annually	
LT60		Quarterly	Annually	RD2153		Annually	
LT61		Quarterly		RD2321		Annually	
LT62		Quarterly		RD2501		Annually	
LT63		Quarterly		RD2551		Annually	
LT64		Quarterly	Annually	RD2709		Annually	
LT65		Quarterly		RD2719		Annually	
LT66		Quarterly	Annually	QR1	6237-242	Quarterly	Annually
LT67		Quarterly		QR2	6237-243	Quarterly	Annually
LT68		Quarterly		QR3	6236-98	Quarterly	Annually
LT69		Quarterly	Annually	QT1	6237-233	Quarterly	
LT70		Quarterly		QT2	6237-234	Quarterly	
LT71		Quarterly		QT3	6237-235	Quarterly	
LM01		Quarterly		QT4	6237-236	Quarterly	
LM02		Quarterly					
LM05		Quarterly		PT14		Annually	
LM09		Quarterly		PT17		Annually	
				PT31		Annually	

LT – Andamooka Limestone aquifer monitoring bore in the tailings area

LM – Andamooka Limestone aquifer monitoring bore in the mine or metallurgical plant area

LR – Andamooka Limestone aquifer monitoring bore in the region

QT – Arcoona Quartzite aquifer (Tent Hill aquifer) monitoring bore in the tailings area

QR / PT – Arcoona Quartzite aquifer (Tent Hill aquifer) monitoring bore in the region

RD – Roxby Downs exploration drillhole not aquifer specific

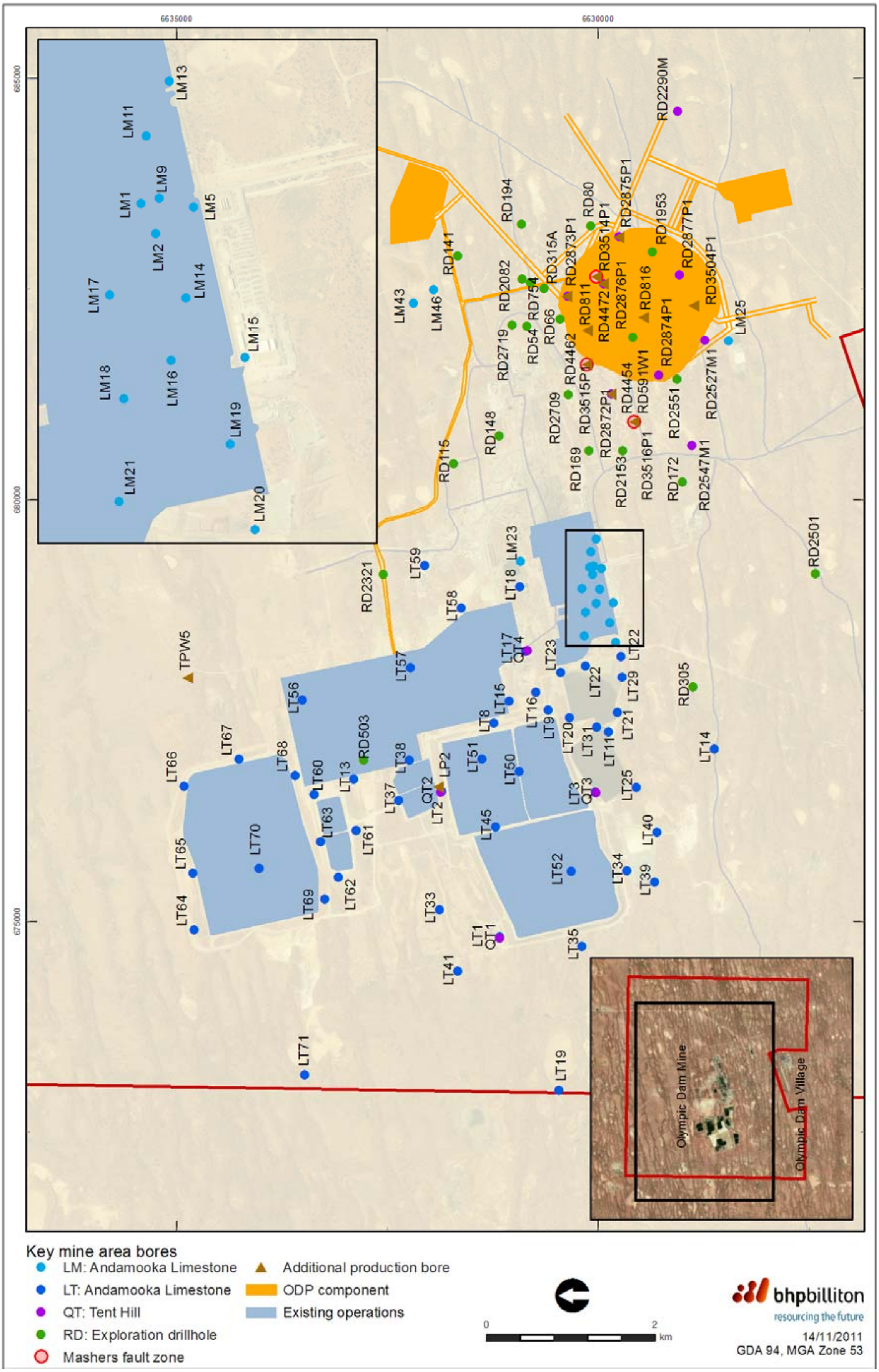

Figure 5-1: Key mine area monitoring bore locations

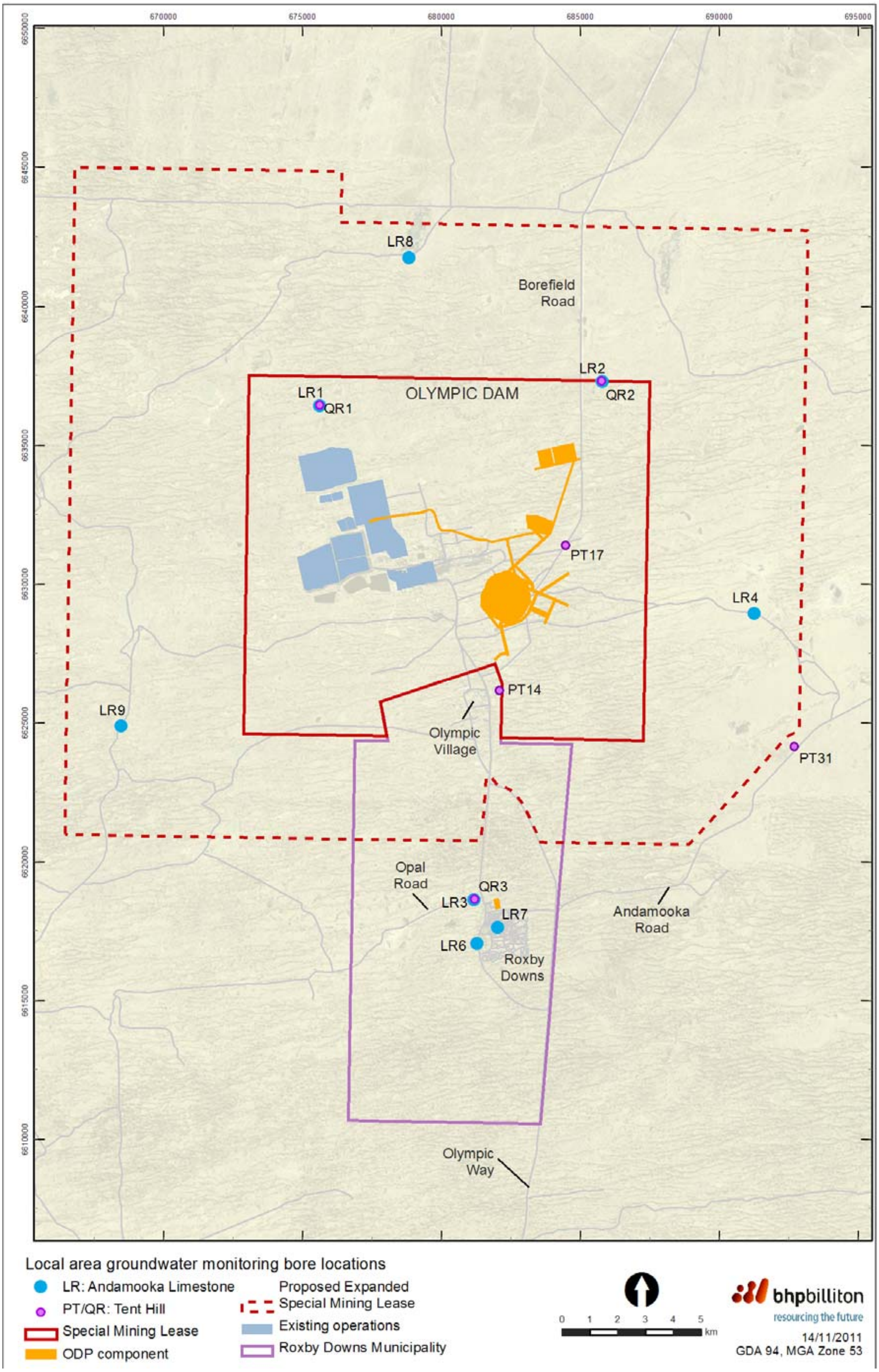

Figure 5-2: Local area groundwater monitoring bore locations

5.2 Olympic Dam Project expansion activities

Table 5-2: Groundwater monitoring bores and frequency

Bore	Geology	Level	Quality
Open pit depressurisation and dewatering monitoring bores			
RD2290M	ZWC	Quarterly	
RD2527M1	ZWC	Quarterly	
RD2547M1	ZWC	Quarterly	
RD2872P1	ZWC	Quarterly	Annually
RD2873P1	ZWC	Quarterly	Annually
RD2874P1	ZWC	Quarterly	Annually
RD2875P1	ZWC	Quarterly	Annually
RD4472	ZWC	Quarterly	Annually
RD2877P1	ZWC	Quarterly	Annually
RD3514P1	MFZ	Quarterly	Annually
RD4462	MFZ	Quarterly	Annually
RD4454	MFZ	Quarterly	Annually
MAR monitoring bores			
MAR4	ZAL	Quarterly	Annually
MAR7	ZAL	Quarterly	Annually
MAR12	ZAL	Quarterly	Annually
MAR13	ZAL	Quarterly	Annually
MAR1_10	ZAL	Quarterly	Annually
MAR3_20	ZAL	Quarterly	Annually
PT61	ZAL	Quarterly	Annually
Regional monitoring bores			
PT44	ZAL	Annually	Annually
PT45	ZAL	Annually	
PT60	ZAL	Annually	
PT66	ZAL	Annually	Annually
RT9	Brachina Formation	Annually	

Bore	Geology	Level	Quality
RT41	Brachina Formation	Annually	
RT42	Brachina Formation	Annually	
Yarra Wurta Springs monitoring locations			
Spring		Biannually (Flow)	Biannually (field quality)
RT4	ZAL	Annually	
RT5	ZAL	Annually	
RT1/LR10	ZWC	Annually	
RT7	ZWC	Annually	

ZWC – Tent Hill aquifer

MFZ – Mashers Fault Zone

ZAL – Andamooka Limestone aquifer

Locations of monitoring bores for the Motherwell Wellfield and local saline wellfields will be added when the location of the wellfields and associated monitoring bores have been defined.

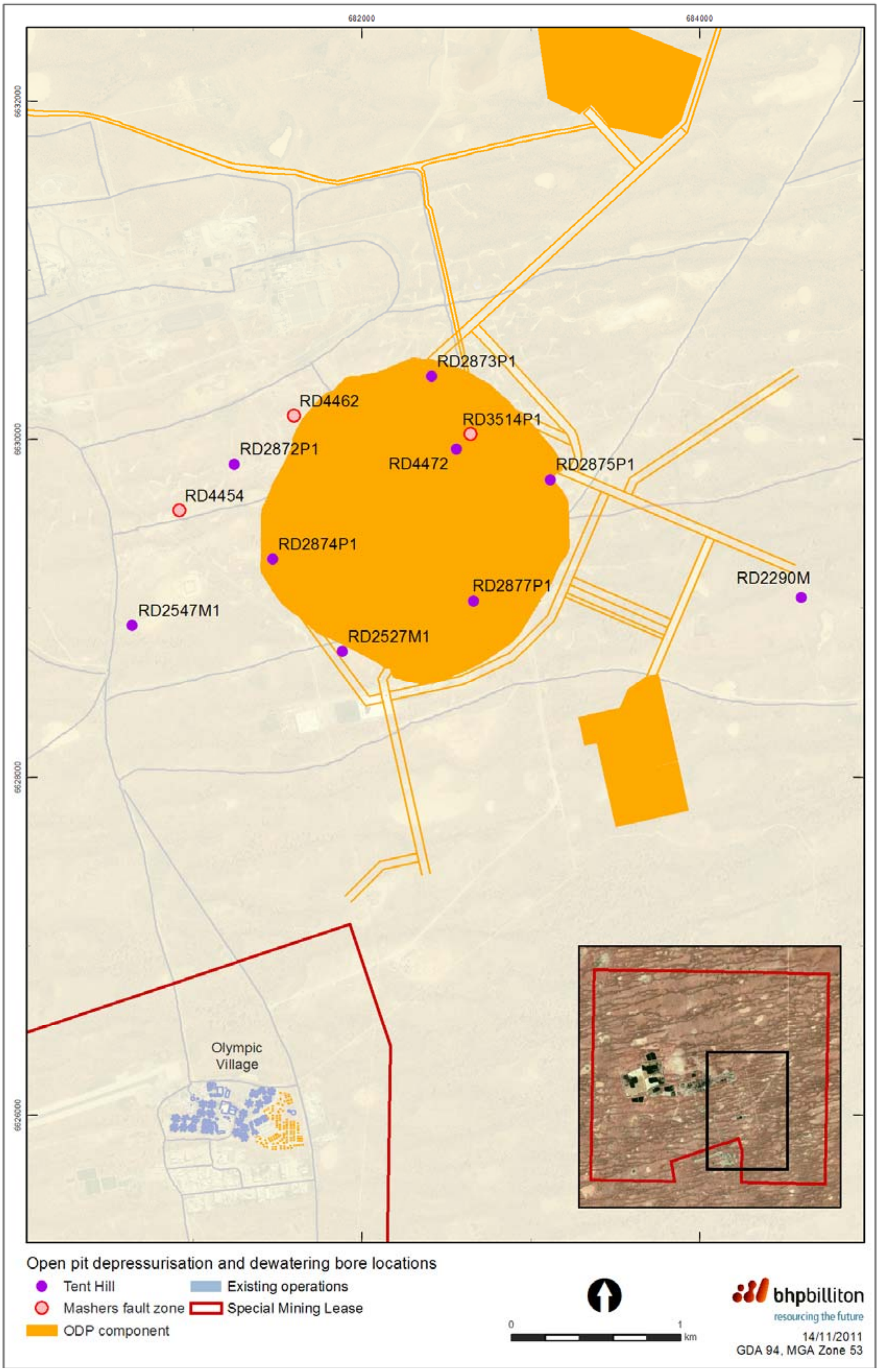

Figure 5-3: Open pit depressurisation and dewatering monitoring bore locations

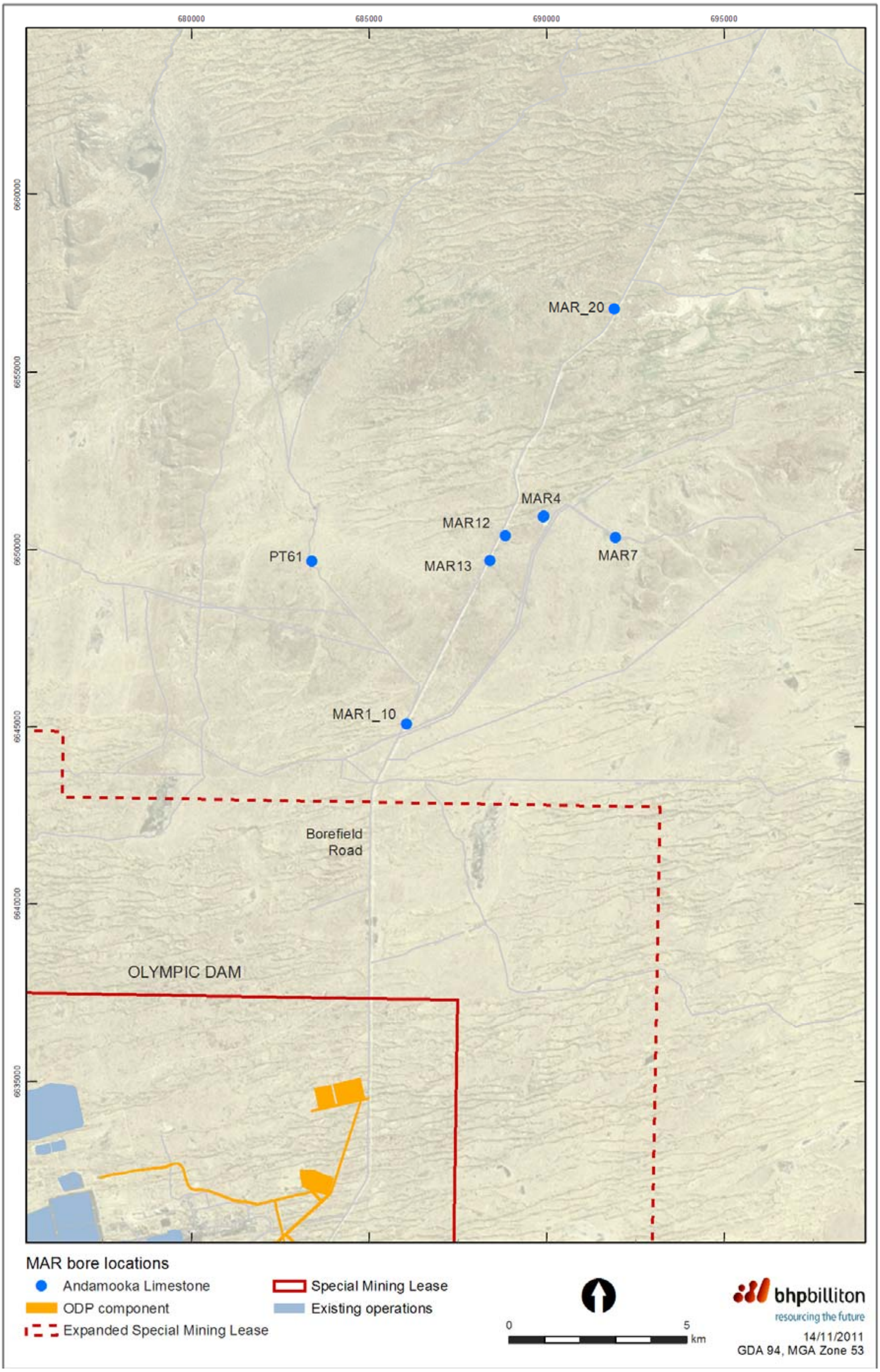

Figure 5-4: MAR monitoring bore locations

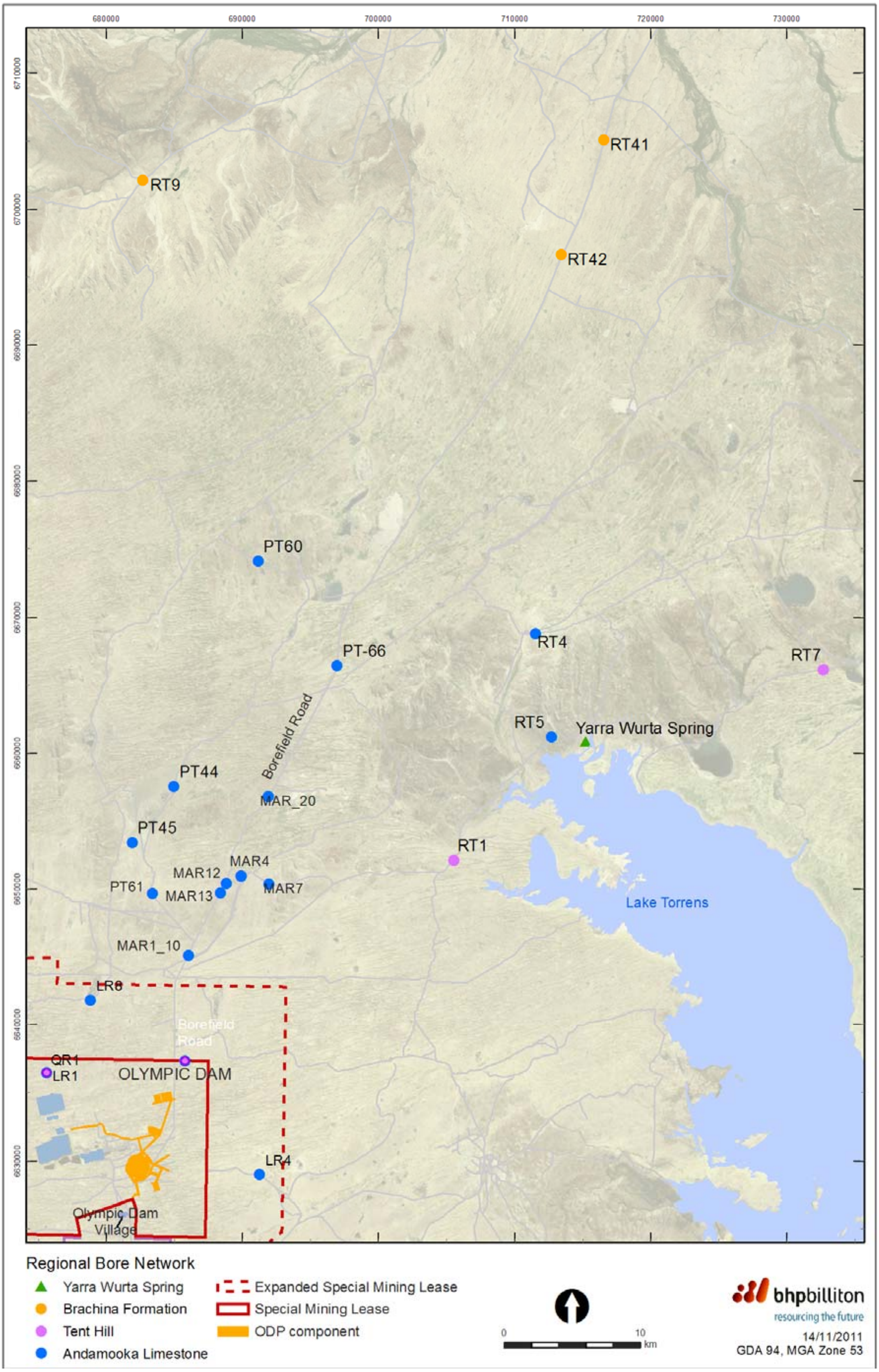

Figure 5-5: Regional monitoring bores and Yarra Wurta Springs monitoring locations

6 APPENDIX B: AMENDMENTS TO MONITORING PROGRAM – GROUNDWATER FY13

Where applicable a summary of major changes to this MP is provided. Individual changes have not been itemised.