Bridgeport Energy

UWIR 2015-2018

PL 214

Oilwells Inc. Of Kentucky Pty Ltd
ABN 18 062 619 774
Registered Operator Number: 601240

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ACRONYM	DEFINITION
ANZECC	Australia New Zealand Environment and Conservation Council
AS/NZS	Australia New Zealand Standard
BEL	Bridgeport Energy Limited
DEHP	Department of Environment & Heritage Protection
DNRM	Department of Natural Resources and Mines
ML	Megalitres
PL	Petroleum Lease
OWK	Oilwells Inc. Of Kentucky
STB	Stock Tank Barrel
UWIR	Underground Water Impact Report

This UWIR Annual Report for PL 214 is issued by authority of Oilwells Inc. of Kentucky, under the authority of the Bridgeport Energy Limited CEO and will be renewed again in November 2018

November 2015

CHRIS WAY

1. Background

In 2011, the Department of Environment and Resource Management (DERM) introduced a requirement that operators of petroleum production report on the impact that their production of subsurface fluids has on the water in underground aquifers.

The first UWIR for PL 214 was approved effective 21st of November 2012 (at Appendix A), which responded to the regulatory requirement under section 370(2)(c) of the Water Act 2000 which provides that: “An underground water impact report must… be given within 10 business days after each third anniversary of the day the first underground water impact report for the…petroleum tenure took effect”. This required the UWIR to be reviewed every 3 year period and this UWIR is therefore due by 7 Dec 2015.

The tenement PL 214 was awarded in May 2006 to Oilwells Inc. of Kentucky (OWK) and Bridgeport Energy Limited (BEL) acquired OWK in August 2009. Since UWIR reporting commenced in November 2012 to December 2015 approximately 86.34ML of associated water has been produced. The reporting of the total amount of water produced in this report complies with the requirement of S376(a)(i) of the Water Act.

1.1 Location

The Utopia Oil Field, PL 214 was excised from the original ATP 560P permit, it encompasses an area of 216km^2 and is located in Western Queensland southwest of Quilpie and north of Thargomindah. It is approximately 65km south east of the town of Eromanga in the local area of Quilpie Shire Council, Queensland.

The approximate coordinates of the Utopia Oil Field are 27.03.52 south, 143, 36, 26 east. The production field measures an area of 0.091222km^2.

The infrastructure in PL 214 consists of a camp and office accommodation, flow-lines, production manifold, separation tank, oil storage and load out facilities and storage and a series of ponds for produced for water. Bridgeport Energy currently produces oil from the Murta formation in the PL 214 Utopia Oil field.

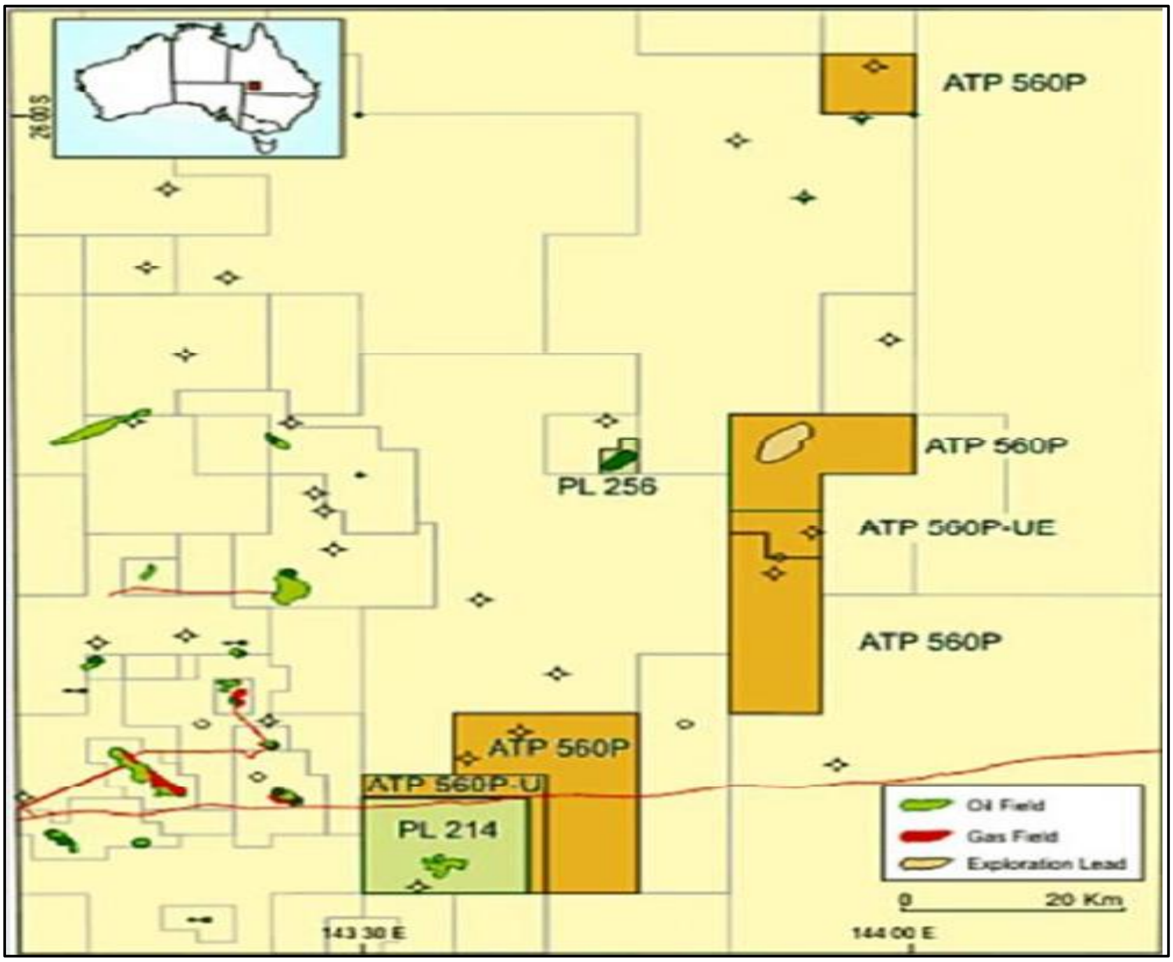

Figure 1 - Utopia Oilfield

1.2 Geological Setting

The Utopia feature is an anticlinal structure, the geological section is a standard Eromanga sequence overlying a thin undifferentiated Triassic package of sediments. Current production is from a total of 9 wells located within a radius of three kilometres of the production facility. The field produces only from the Cretaceous Murta Member. Oil production occurs between the depth of 1000 and 1400 meters subsea.

It should be emphasised that all Bridgeport wells in this oilfield have been drilled to depths below 1000m which is well below the drawdown level of the irrigation and potable water sources. There is no evidence of water decline in any of the Utopia wells, nor is there any decline expected elsewhere in the area of the field as a result of the Utopia oil production.

Interbedded low permeability sandstones, siltstones and claystones of the lower part of the Murta Formation form a seal between the Murta and the Namur Sandstone. These seals are not always effective, as water from the Namur Sandstone can migrate upwards into the Murta Formation. This means that the water in the Murta is constantly replenished from the Namur and consequently the impact of OWK activities continues to be insignificant on the water within the Murta reservoir. Above the Murta is a large regionally thick seal which ensures that there is no migration of fluids of any type above this Murta formation.

Groundwater take by the landholders and other users within the PL 214 area is relatively small due to the depth of the formations. Use is currently limited to stock and domestic, settlements with some small irrigation developments mainly targeted at drought preparedness. Many of the existing bores within the area are converted petroleum exploration wells.

The Cooper Basin covers a total area of 130,000 km^2 and can generally be described as arid with a uniform climate. It contains a wide diversity of land and ecosystem values that are defined by geological, geomorphological and hydrological influences. The Eromanga and Cooper basins are located in central and eastern Australia. The Eromanga Basin extends over one million square kilometres across Queensland, New South Wales, South Australia, and the south-east of the Northern Territory. Figure 2 below depicts the location of the Utopia Oilfield.

The Eromanga Basin is overlain by the Lake Eyre Basin, a succession of Tertiary and Quaternary age sediments occurring extensively throughout central Australia. In the north east of South Australia, the Lake Eyre, Eromanga Basin sediments were deposited during the Jurassic-Cretaceous period, and reach a maximum thickness of between 1200 m and 2700 m over the Cooper Basin. These sediments were deposited under fluvial, lacustrine and (later) shallow-marine conditions, and are broadly continuous across the basin.

These sediments are gently folded in some areas and contain a succession of aerially-extensive sandstone formations that serve as oil reservoirs and regional aquifers. The Eromanga Basin is the largest of the group of basins that constitute the Great Artesian Basin (GAB). The Eromanga Basin lies within South Australia, the other components being in Queensland and in part in New South Wales. Beneath, and entirely covered by the Eromanga Basin, is the Jurassic – Triassic Cooper Basin, limited in its distribution by bounding faults and pinch-out edges.

The tectonic history of the Cooper and Eromanga basins is complex and has been characterised by several periods of rift-related subsidence and compressional uplift and erosion. This history has resulted in the Cooper Basin being subdivided into a number of large scale sub-troughs separated by fault bounded ridges.

Figure 3 below depicts the stratigraphic column of the Eromanga sequence.

1.3 Description of each aquifer

Murta Member, McKinlay Member and Namur Sandstone (Warrego West 3) - The formations in Warrego West 3 are described in the *Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan Area* 2005 as follows:

> *"The Hooray sandstone and its hydrogeological equivalents are generally the shallowest major artesian aquifer intercepted by water bores in the GAB in Queensland. The Late Jurassic Hooray Sandstone aquifer is defined only within the Eromanga Basin." (Qld DNRM 2005, p15).*

"Basin margin facies of the Jurassic and early Cretaceous sandstones and siltstones occur in…the Eromanga (Namur Sandstone, McKinlay member and Murata Formation). These basin margin facies are hydrogeologically equivalent to the Hooray sandstone aquifer." (Qld DNRM 2005, p15).

The detailed description from the wells follows as per the requirement in S376(b)(i). The Murta Member is a very fine to fine grained sandstone with interbedded hard siltstone. The sandstone is subangular to subrounded, moderate to well sorted with a moderate to abundant clay matrix. Moderate amounts of silica cement are present and it is moderately hard with poor porosity. The Warrego West 3 unit ranges in thickness from approximately 120-130m.

The McKinlay Member is a fine to medium grained siltstone with minor firm siltstone. The sandstone is subangular to subrounded, moderately sorted with occasionally carbonaceous laminae. There is a moderate clay matrix that is slightly calcareous and moderate silica cement. The formation is moderately hard with poor to occasionally fair porosity. This unit is nonproducing in the Utopia field and is mentioned purely for completeness of summarizing the unit because it is part of the Warrego West 3 unit.

The Namur Member is sandstone with interbedded siltstone. The sandstone varies from very fine to coarse. It’s moderately sorted with clay matrix and moderate silica and calcareous cement and ranges from friable to moderately hard. Poor to fair with occasional good porosity has been observed. This siltstone is argillaceous with firm with moderately to abundant carbonaceous material. This unit is nonproducing in the Utopia field and is mentioned purely for completeness of summarizing the unit because it is part of the Warrego West 3 unit.

Elevations and relative position - The Murta Member is an Early Cretaceous sedimentary unit (Figure 8). The depth ranges across the field from -790 to -795 mSS. Within the Utopia Oilfield the range is 1071 to 1097 mSS. The wells that have tested or perforated the formations in Warrego West 3 are shown in Figure 2-3 below.

Location of water bores screened within these aquifers - As per S376(d), Bridgeport has identified 8 water bores within PL 214, but none of them are screened in Warrego West Unit 3 (Figure 12). The wells are screened across the Winton Formation which is approximately 950-1000 m above the Warrego West Unit 3 (Murta Member). The Winton formation is between 188 and 225 mAMSL. The stratigraphic column in Figure 8 shows the relative position of these two units.

Of these 8 water bores, one of them being the shut-in well Ufouria-1 in the Utopia Oilfield which has been classified in the DERM database as water bore 23593. This well was drilled in December 1987, shut-in in January 2008 with very little water production and plugged back to 900m. The Ufouria-1 well was drilled to a total depth of 1395 m in the metasediment basement rock. The well history is outlined in Appendix 1 of the 2012 UWIR (at Appendix A). In general, “Groundwater take within this management area is relatively small due to the depth of the formations…..Many of the existing bores are converted petroleum explorations wells” (Qld DNRM)

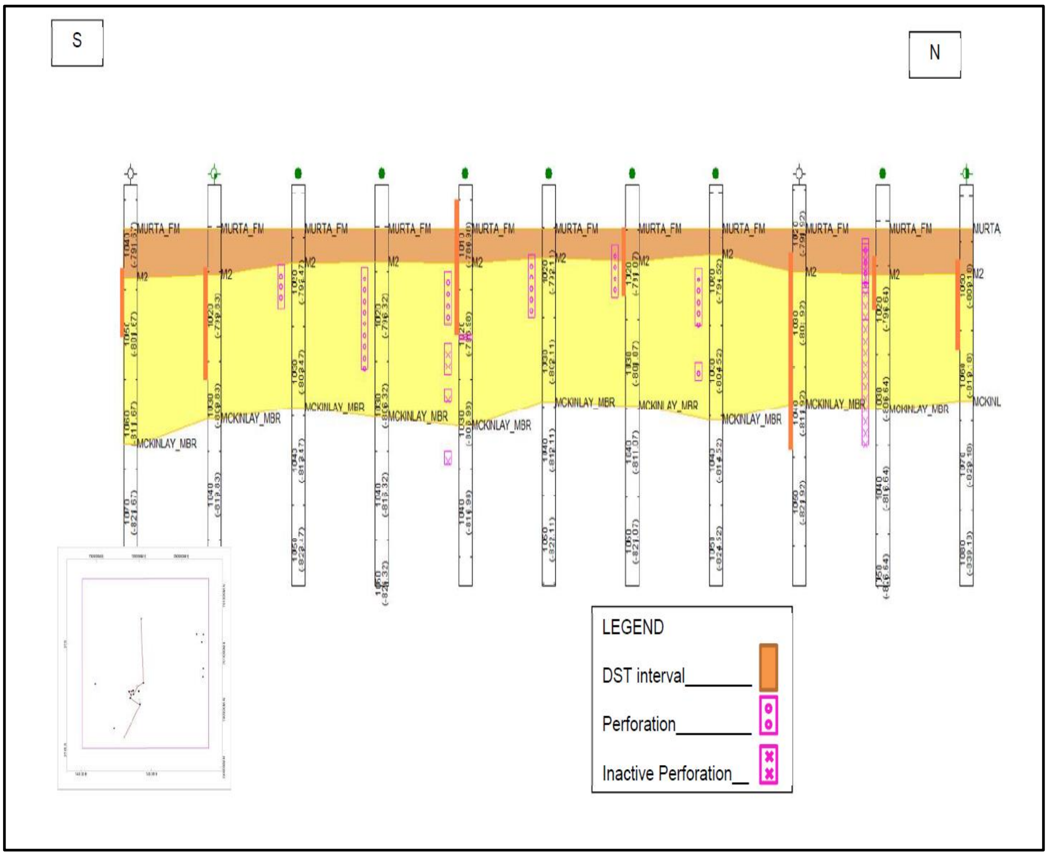

Figure 2 - Schematic Cross-section of Warrego West 3 across the Utopia Oilfield (flattened on Murta Member)

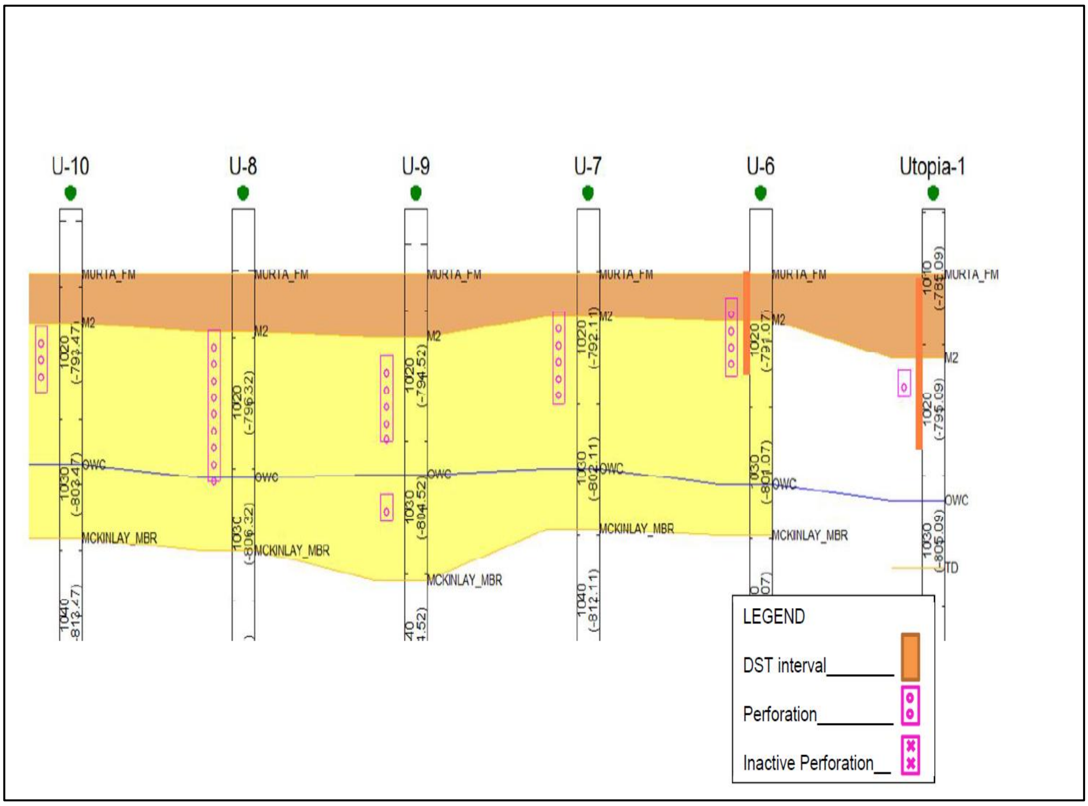

Figure 3 - Cross-section of wells that have tested and/or perforated Central 3 reservoirs

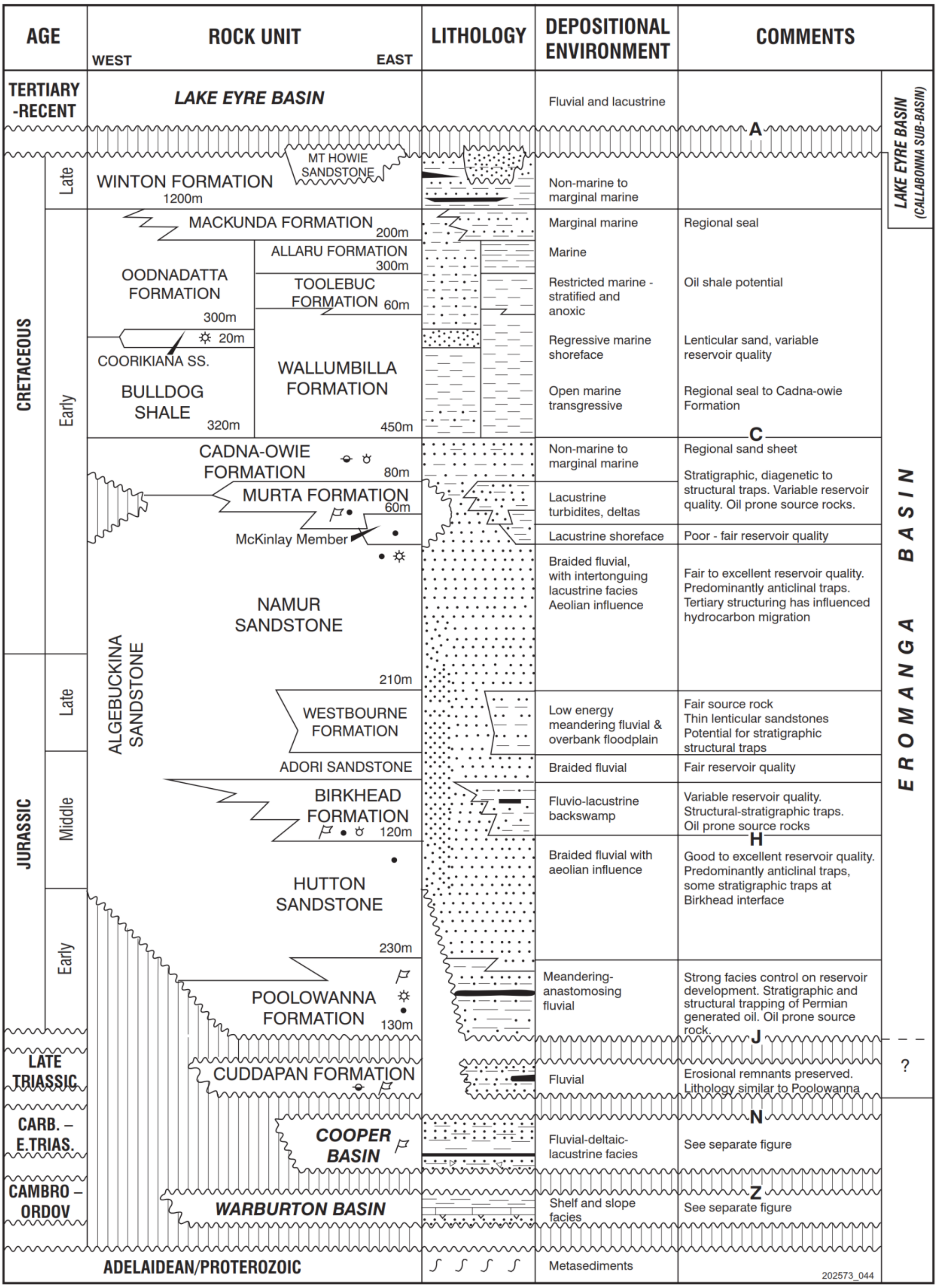

Figure 4: Stratigraphic column of the Eromanga Sequence

1. Legislation

The primary legislative requirements for the management of groundwater with respect to petroleum tenure holders for PL214 are summarised below.

1.1 Petroleum and Gas (Production and Safety) Act 2004

The Water and Other Legislation Amendment Act 2010 amends the Water Act 2000 (Water Act) and other relevant legislation with the aim of improving the management of impacts associated with groundwater extraction that form part of petroleum activities. These amendments transfer the regulatory framework for underground water from the Petroleum Act 1923 and the Petroleum and Gas (Production and Safety) Act (P&G Act) to the Water Act.

The P&G Act originally provided all rights of water extraction to a petroleum activity. However, through recent updates of the P&G Act and the Water Act, a petroleum tenure holder has an obligation to identify impact, establish baseline conditions and maintain groundwater supplies in private bores in the vicinity of petroleum operations. Where a bore owner can demonstrate reduced access to groundwater supplies, or a reduction in beneficial use class due to water quality changes, as a result of petroleum operations, “make good” provisions are available to address the loss incurred by an affected bore owner. Under the P&G Act, the make good obligation for affected bores also applies to petroleum tenure obtained under the Petroleum Act 1923 and are further defined in the Water Act.

1.2 Water Act 2000 (Qld)

The Water Act 2000 (Qld) (as amended 2010):

- Provides a comprehensive regime for the planning and management of all water resources (including vesting to the State the rights over the use, flow and control of all surface water, groundwater, rivers and springs) in Queensland.
- Regulates water use and the obligations of petroleum tenure holders in relation to groundwater monitoring, reporting, impact assessment and management of impacts on other water users.
- Provides a framework and conditions for preparing a Baseline Assessment Plan and outlines the requirements of bore owners to provide information that the petroleum holder reasonably requires to undertake a baseline assessment of any bore.
- Sets out the process for applying for a Water Licence (where water is utilised outside of a petroleum lease or not on adjacent land owned by the same person).
- Sets out the process for assessing, reporting, monitoring, and negotiating with other water users regarding the impact of petroleum production on aquifers.

1.3 Other relevant water regulations

The following statutes are also applicable to the oil production within PL 214:

- Environmental Protection Act 1994 (Qld)
- Environmental Protection (Water) Policy 2009 (Qld)
- Great Artesian Basin Resource Operations Plan 2006
- Water Resource (Cooper Creek) Plan 2000 (Qld)

2. Water Production History

2.1 Well Histories

The Utopia Oilfield covers an area of approximately of 0.091km^2 within PL 214. The PL214 permit comprises a total area of 220km^2. The structure of the Utopia Field has been mapped within this PL from the interpretation of 3D seismic data. The free water level at the producing Murta reservoir has been measured through petrophysical studies of the wells from wireline logs and from water associated with oil production into wellbore perforations.

The field produces from the Murta Formation. To date approximately 86.34ML of water have been produced from the Utopia Oilfield, and no decline in water levels has been observed (see figure 5 below oil-water contact map). In fact, over time, it is expected that the water table within the bounds of the field will rise. As oil is produced, down dip formation water within the Warrego West 3 unit will move into the structure, replacing the oil and resulting in a rising oil water contact.

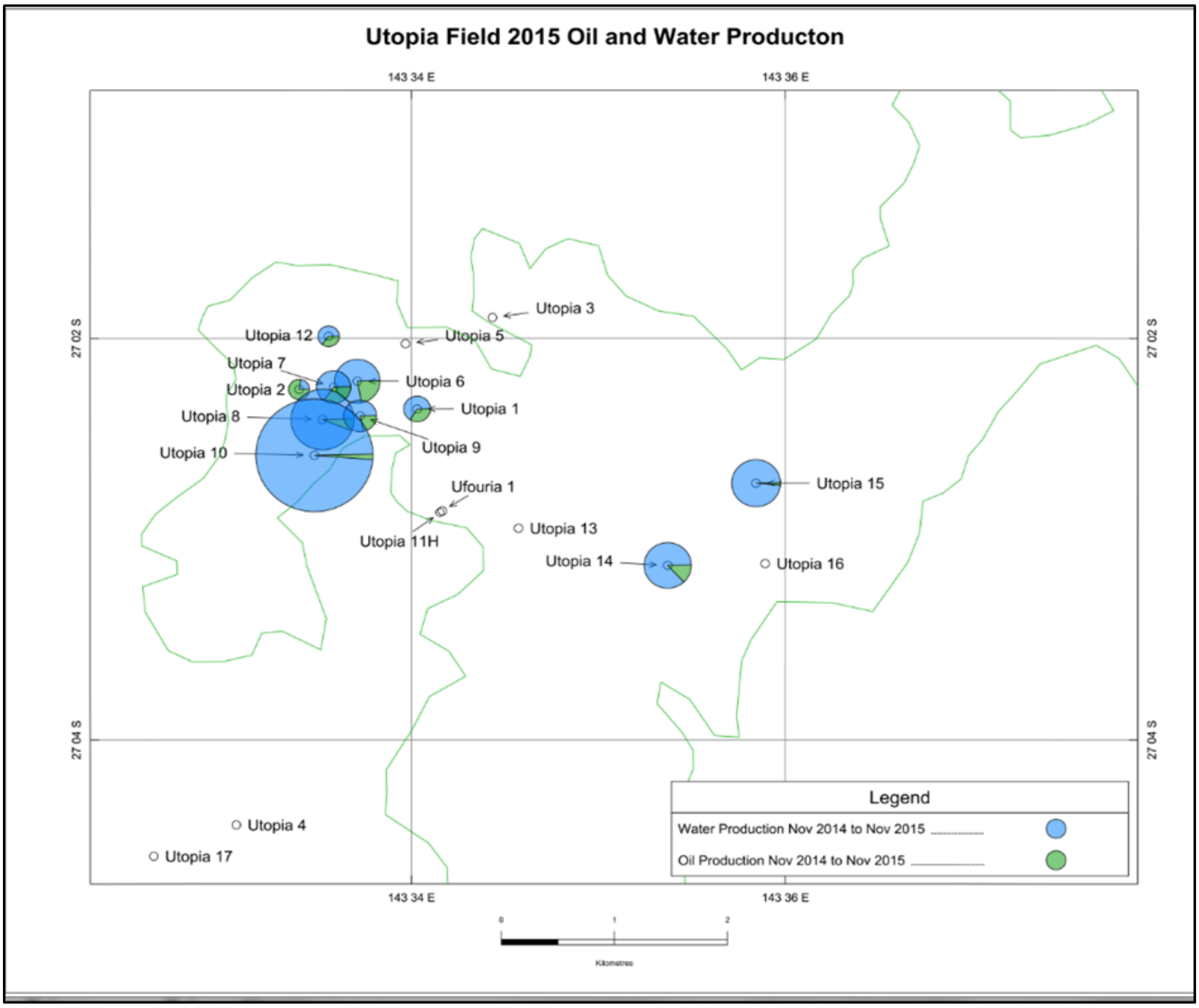

Figure 5- Oil Water Production 2015

2.2 Methods for Measuring Extracted Water Volumes

Conventional oil production is unlikely to deplete local or regional groundwater supplies due to large vertical separation and low permeability between the overlying aquifers and the sandstone oil reservoirs as depicted in section 1 above. Measurement of oil in produced water is required from an operational point of view, because process optimisation is increasingly being implemented by operators so that less oil is discharged, less chemicals are used, process capacity is increased, and oil and gas production is maximised.

Since April 2009, Bridgeport Energy (OWK) has measured oil and water production from each oil well by utilising a chemically treated dip stick in a test tank. Bridgeport Energy's monitoring strategy is based on three primary parameters. These are:

a) Formation water production history,
b) reservoir oil/water level depth and
c) water quality.

By closely monitoring and keeping good records of these parameters, Bridgeport Energy has developed a monitoring strategy that meets the requirements of Section 376(f) of the Water Act. The following section provides more specific details of how these parameters are collected.

In order to effectively evaluate the impact of water extraction on the aquifer, it is vital to know the volume of water that has been extracted. As such, Bridgeport Energy has implemented a water production monitoring system that allows the volume of water that has been produced from the reservoir to be calculated. The following is a summary of this system.

Within the field, each well is flow tested into an isolated test tank. After a settlement period, the contents of the tank are volumetrically measured by means of a dip-stick and water-indicating paste. Volumes of both produced oil and water are obtained from this measurement as per S378(a):

- With the volumes and the time period known, a daily production rate for oil and water is calculated as per S378(c).
- Daily water rates from all wells are then cross-referenced with daily uptime data and from this, the quantity of water produced by a given well in a given day can be calculated as required by S378(b).

As a result of this process, historical water production statistics are available for the field and on a per-well basis. Consequently, Bridgeport Energy has a thorough understanding of the quantity of water that has been extracted as well as extraction rates throughout the field's history. Produced water from the separator is produced to a wash tank (skimmer) where coalesced oil is skimmed off to the separator. From the wash tanks, produced water flows into an interceptor pond where any bypass oil is regularly skimmed off. It then passes from this pond to a series of three evaporation ponds. The water quality in these ponds is tested quarterly including ultra-sensitivity test for benzo(a)pyrene as required by the landowner for his cattle watering QA requirements. The following table 3 represents an update of all wells drilled within the Inland Oilfield to October 2015.

2.3 Underground water level depth

The second parameter that Bridgeport monitors is the depth of the underground water level. Since a significant portion of the requirements under S376 of the Water Act pertain directly to the relationship between water extraction and underground water level depth, this parameter is also essential. Bridgeport has adopted two chief methods of evaluating this aspect.

The first of these is through analysis of current wells and their production status. As has been described above, the general trend for the underground water level is that it rises as oil is depleted. Consequently, when an existing well waters out (ceases to produce oil and only produces water), it can be inferred that in the immediate localised area, the underground water level depth has risen to the depth of the well's perforations. In Bridgeport's case this can be 1.4 kms from surface. The second of these is through identification of the oil/water contact in new wells as they are drilled.

When new wells are drilled, the oil-water contact at the time of drilling can be identified by log analysis. Since the depth of the oil/water contact is defined as the top of the aquifer water level, identification of the oil/water contact through log analysis also allows aquifer water level depths to be understood. As with the water production history, maintaining good records of these parameters as they become available has resulted in a firm understanding of the original reservoir water level depth as well as how this depth might change over the production life of the Utopia Oilfield as water displaces oil.

The aquifer volume of the Warrego West 3 unit (Murta and Namur formations) in the Utopia Oilfield area is significant. The unit is 100m thick and the total pore volume within the Petroleum Lease (220 km^2) is approximately 3,630,000ML. Clearly this aquifer volume dwarfs the amount of water (86.3ML) produced from the Murta reservoir to date.

The following table 1 represents an update of production history from all wells drilled within the Utopia Oilfield. This is based on the current and projected lease development plan.

Table 1: Well Histories to December 2015

WELL	HISTORY
Ufouria-1 (Abandoned)	• December 1987drilled • January 1988 plugged back to 990 m, little water production, shut in • November 2010 Well transferred to landowner for irrigation purposes.
Utopia-1 (Producing)	• March 1997 drilled, production string run and well was suspended • June 1997 Murta was perforated in two intervals, a bridge plug was then set above the lowest interval • April 2009 work over replacing rods in the hole • December 2014 work over replacing rods in the hole, still on production.
UTA-1 (Abandoned)	• May 1997 • DST recovered 167.6 m of predominantly muddy water. the well was plugged and abandoned

WELL	HISTORY
Utopia-2 (Producing)	• September 1997 drilled • October 1997 completed in the Murta • June 2004 workover, rod pull and change • January 2013 workover: tubing pulled and replaced. Still on production.
Utopia-3 (Shut In)	• November 1997 drilled, completion string run and well suspended • October 2001 perforated • October 2005 workover, rod pull and change • April 2007 well was shut in due to wellhead problems • Scheduled for repair or redrill
Utopia-4 (Abandoned)	• December 1997 drilled • DST recovered 79 L (7.9x10-5 ML) mud and 842.6L (8.4x10-4 ML) water in the drill string, sample chamber collected 3.5 L (3.5x10-6 ML) of water. The well was plugged and abandoned
Utopia-5 (Abandoned)	• August 2005 drilled • September 2005 DST recovered 0.0029 ML of formation water. The well was plugged and abandoned
Utopia-6 (Producing)	• September 2005 drilled • DST 1 recovered mud and filtrate; DST 2 recovered oil and mud, no water • October 2005 the Murta was perforated and is still producing to date
Utopia-7 (Producing)	• December 1997 drilled and perforated. • September 2013 workover, tubing and rod string were replaced. Still on production. • Currently suspended.
Utopia-8 (Producing)	• December 2009 drilled • January 2010 perforated and completed • October 2014 workover, replaced parted rods. Still on production. • Currently suspended
Utopia-9 (Producing)	• January 2010 drilled and perforated and still producing to date
Utopia-10 (Producing)	• December 2010 drilled, perforated, fracced to enhance flow • October 2014 work over, replaced parted rods. Still on production.
Utopia-11H (Producing)	• May 2011 drilled, short radius horizontal well, completed with perforated casing • October 2014 work over, replaced rod string. Still on production
Utopia-12 (Producing)	• February 2013 drilled • June 2013 completed, perforated in the Murta and still producing to date.
Utopia-13 (Suspended)	• February 2013 drilled, logged cased and suspended.
Utopia-14 (Producing)	• February 2013 drilled • June 2013 completed, perforated in the Murta and still producing to date.

WELL	HISTORY
Utopia-15 (Suspended)	• November 2013 drilled • January 2014 completed with perforation in the Murta • Production ceased in July 2015
Utopia-16 (Suspended)	• November 2013 drilled • Competed and suspended May 2014
Utopia-17 (Shut In)	• November 2013 drilled • December 2013 completed with perforation into the Hutton. Free flow with water however no signs of oil • January 2014 re-completed with perforation into the Murta. Put on production for a month and no signs of oil. Shut in.

2.4 Water Quality

Since 2009, OWK has measured oil and water production from each well by means of a test tank. The water that is produced is associated water from oil production, which is moved to evaporation ponds and used for stock watering in drought periods.

Produced water from the separator is produced to a wash tank (skimmer) where coalesced oil is skimmed off to the separator. From the wash tanks, produced water flows into an interceptor pond where any bypass oil is regularly skimmed off. It then passes from this pond to a series of evaporation ponds. The water quality in these ponds is tested quarterly including ultra-sensitivity test for benzo(a)pyrene as required for utilisation as stock water. During 2015 the production facility has had a number of modifications which included the interceptor pond as depicted below in Figure 6.

Figure 6 – Interceptor pond upgrade

2.5 Groundwater Dependent Ecosystems

The review of Environmental values included the Groundwater Dependent Ecosystems (GDEs), groundwater users and social and cultural environmental values. Within Bridport operating tenements there are no endangered regional ecosystems 10 kms from the boundary of PL 214.

The closest State forest is the Welford National Park, near Jundah which is 295 kms north east from PL214 Similarly no GAB springs were found within the tenement, the closest GAB discharge spring is approximately 90 kms away.

2.6 Environmental Values

The Queensland's Wild Rivers legislation was repealed in August 2014 and the 13 rivers in Cape York and in the state's western Channel Country will now be protected under the new Regional Interest Planning Act 2014 to prevent inappropriate development going forward. Under this new framework, planning decisions will now be made through either local government planning schemes, or regional interest development approvals at the state level, to reduce complexity for development and maintain environmental values. Bridgeport Operations on PL 214 continue to comply with world best practice and the requirements of Environmental Approval conditions.

Water quality at Utopia has been consistently in compliance with limits for ANZECC environmental quality, and drinking water limits as well as Environmental licence conditions. The ESA map below depicts the geographic location of PL 214 within the identified environmentally sensitive areas. It’s notable that only ESAs Category C exists within the tenement boundary or 5-10 kms in diameter of the boundary.

The Murta Sandstone is not a reliable groundwater source due to its discontinuous distribution, generally poor water quality and depth. The only water bore in the area of influence, as there is no immediately affected area for this UWIR, is the Ufouria-1 well, water bore number 23593 (S376 (d)).

The other 7 water bores contained in PL 214, are screened across the Winton Formation and are not in the notional area of influence (see figure 4 below). The Uforia-1 well was drilled for oil exploration under ATP 289P in 1987. It was shut in from 1988, abandoned in 2010 and handed to the landowner for use as a surface water bore. Attempts were made by the owner to extract water at circa 80m depth with limited success.

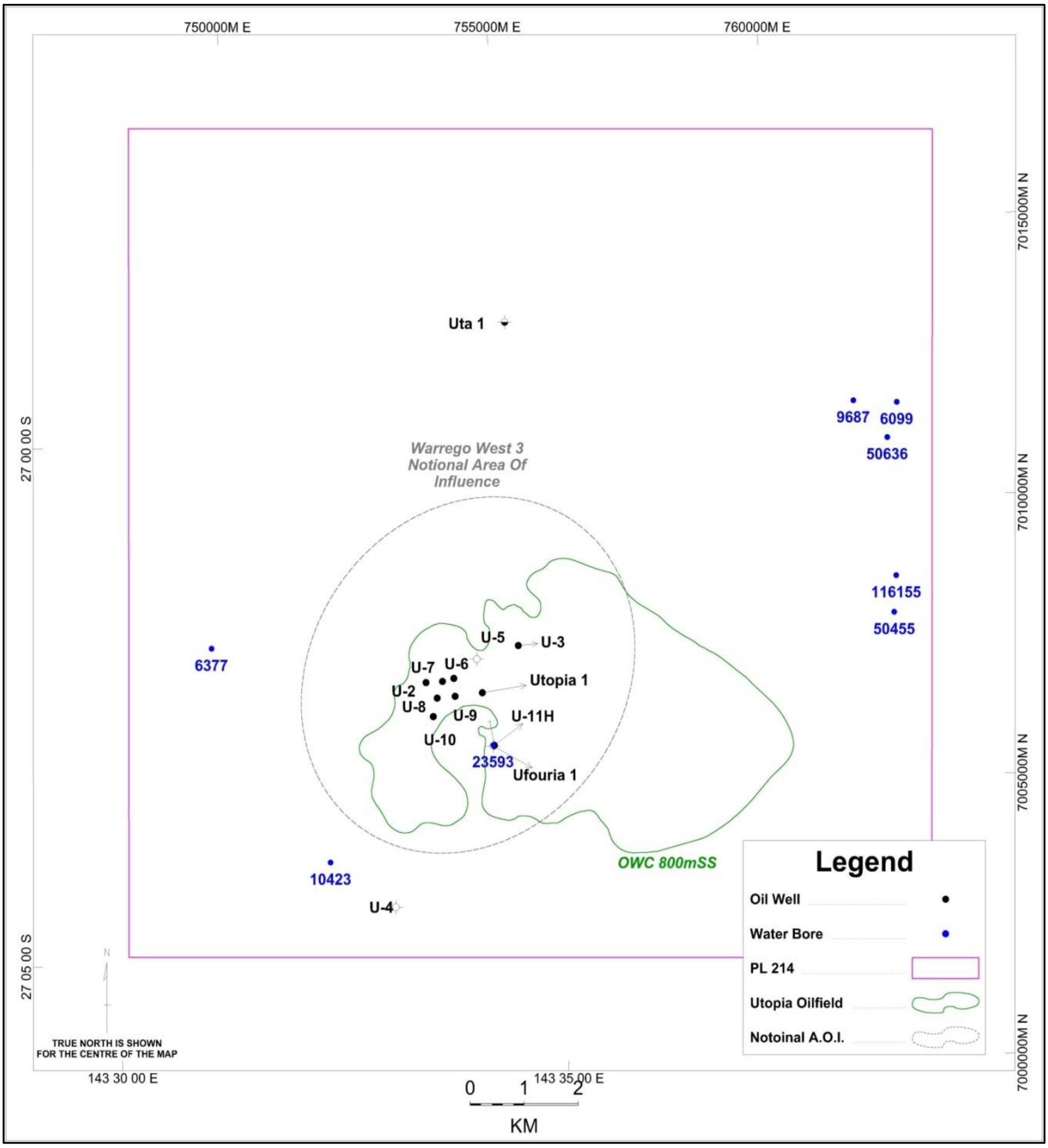

Figure 7: Notional Area of influence of any Aquifer

The ESA map below depicts the geographic location of PL214 within the identified environmentally sensitive areas. It's notable that no ESAs of category A B exist within the tenement boundary or 10 kms in diameter of the boundary.

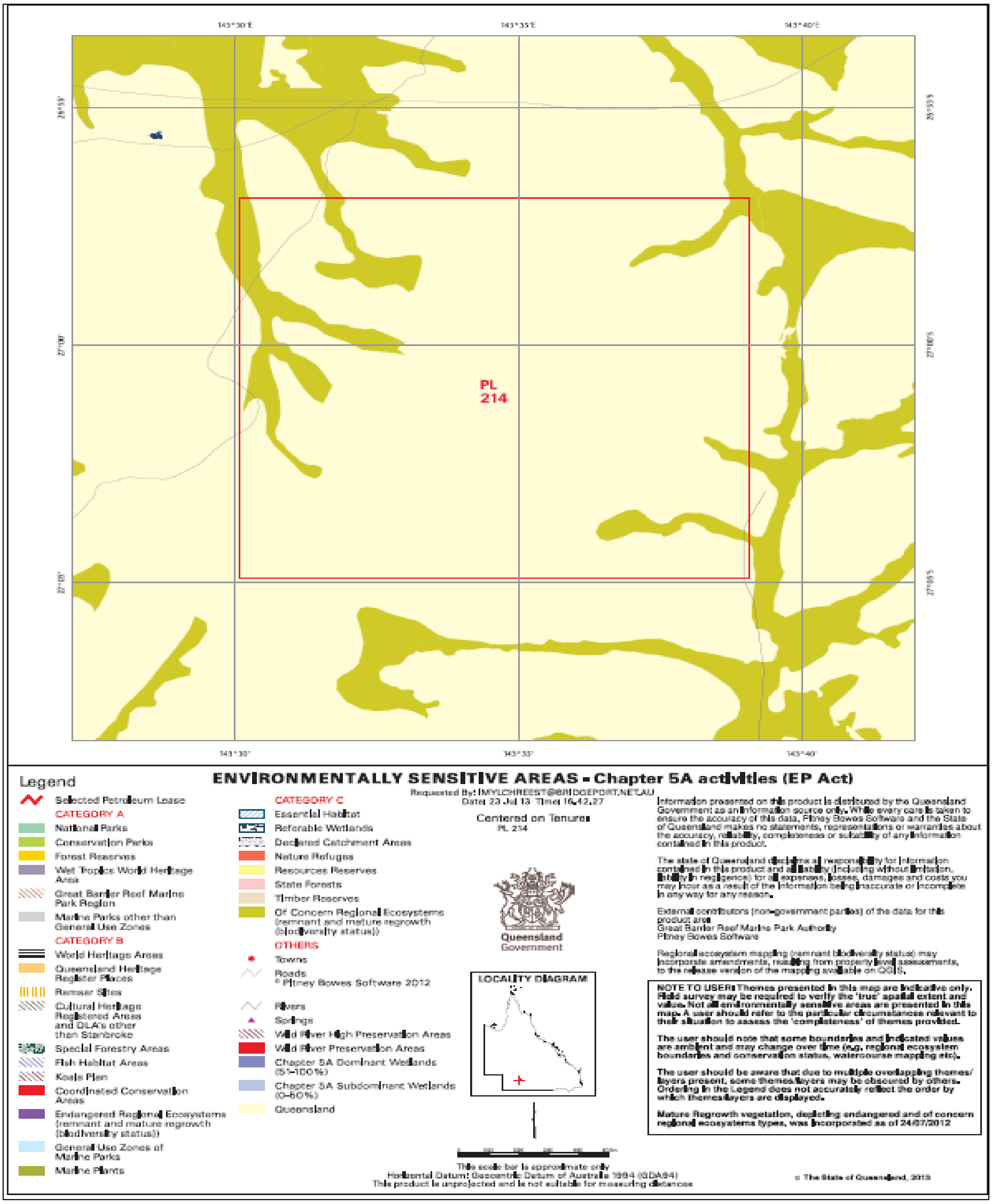

Figure 8 – Environmental Values at PL 214

3. Water Monitoring

3.1 Monitoring

The Approval Conditions for the PL 214 UWIR on 21 November 2012 specified the monitoring of produced water:

i. All monitoring required of the responsible tenure holder under the UWIR must be undertaken by a suitably qualified person.
ii. All laboratory analyses and tests of monitoring undertaken under the UWIR must be carried out by a laboratory that has NATA accreditation for such analyses and tests, except as otherwise agreed to in writing by the Chief Executive.
iii. The methods of groundwater sampling required by the UWIR must comply with the latest edition of the Queensland Monitoring and Sampling Manual, AS/NZS 5667:11 1998 Water Sampling Guidelines – Part 11 Guidance on sampling groundwater, and the Australian Government's Groundwater Sampling and Analysis - A Field Guide (2009:27 GeoCat #6890.1) as relevant and as may change from time to time.

Bridgeport monitoring programs currently being employed at all our operated assets are adequate to collect the data required to effectively monitor the relevant underground water properties and that there are no critical gaps in data. The monitoring strategy currently being employed by Bridgeport includes the measurement of production and associated data relating to the volumes of water extracted from the reservoir.

This allows Bridgeport to understand rates of water extraction over time but does not measure changes in the aquifer's water level over time because the regional aquifer is so large (extending well beyond the lease boundary). In addition to the subsurface aquifer water levels, large amounts of data are acquired pertaining to water quality. This data acquisition is undertaken on a quarterly basis and as such, the water quality can be assessed at various stages throughout the production life.

Having the water quality analysed at these different stages, will facilitate historical comparisons of water quality and underground water extraction. These comparisons will significantly enrich the levels of understanding of the impacts of underground water extraction on aquifer water quality and if any impact does exist, this process will ensure that it can be easily identified.

Groundwater taken by local landholders within this management area is relatively small due to the depth of the formations. Use is currently limited to stock and domestic, urban with some small irrigation developments mainly targeted at drought preparedness Bridgeport drills its exploration and production wells far below any regional aquifers and ensure that the shallower aquifers and reservoirs are protected behind cemented steel casing and have no possible access to the surface via the well.

3.2 Groundwater bores

Bridgeport has identified 8 water bores within PL 214; the wells are screened across the Winton Formation which is approximately 950-1000m above the Murta Formation. The Winton formation is between 188 and 225 mAMSL. Of these 8 water bores, one of them being the shut-in well Ufouria-1 in the Utopia Oilfield which has been classified in the DERM database as water bore 23593.

This well was drilled in December 1987, shut-in in January 2008 with very little water production and plugged back to 900m. In November 2010, Bridgeport Energy transferred the well to the landowner who attempted to flow the well; however the well did not make enough water and burned out the pump and the landowner has left the well suspended. Note that the Uforia well was abandoned with cement below this 80m level. The Ufouria-1 well was drilled to a total depth of 1395m in the metasediment basement rock Table 2 below details the bore locations in PL 214.

Table 2 - Identified Water Bores PL 214

Ref No.	Location	Lot/Plan	Property Name	Aquifer Screen	Depth/ Thickness	Distance from Utopia Field	Name	Remarks
6099	143 38 40 E 26 59 33 S	4/G051	Congie	Winton	32/	5.6 km	Boothera	Existing
6377	143 30 60 E 27 01 56 S	447/ SP196201	Mt Margaret	Winton	15.2/	3.3 km	Boothera 10	Existing
9687	143 38 11 E 26 59 32 S	4/G051	Congie	Winton	17.1/	5.2 km	Bloodwood	Abandoned and Destroyed
10423	143 32 20 E 27 04 00 S	447/ SP196201	Mt Margaret	Winton	19.8/	1.2 km	Daleys Bore 17	Existing
23593	143 34 09 E 27 02 51 S	447/ SP196201	Mt Margaret	Winton	4.8/312.8	In field	Uforia-1	Existing
50455	143 38 39 E 27 01 34 S	4/G051	Congie	Winton		2.8 km	Congie Well	Abandoned and Destroyed
50636	143 38 34 E 26 56 53 S	4/G051	Congie	Winton		5.0 km	Boothera Replacement	Abandoned and Destroyed
116155	143 38 40 E 27 01 13 S	4/G051	Congie	Winton	100/	3.3 km	Congie Replacement	Existing

There is no immediately affected area for this UWIR and the only water bore in the notional area of influence is the Ufouria-1 well, water bore number 23593 (S376 (d)). The other 7 water bores contained in PL 214, summarized in the table above, are screened across the Winton Formation and are not in the notional area of influence. This well was drilled for oil exploration under ATP 289P in 1987.

The absence of water bores producing from the Murta Formation in PL 214 means that there is no feasible way to assess changes in water levels, although Bridgeport Energy does measure water quality in the evaporation ponds routinely as per DEHP operating conditions for the permit.

3.3 Water Quality

The final parameter that comprises Bridgeport's monitoring strategy is that of water quality. In accordance with the Environmental Authority associated with PL 214, Bridgeport Energy performs quarterly analyses of its produced water. This water is taken from the evaporation ponds and is sent to a NATA accredited laboratory where it is analysed for a wide range of contaminants. With the results of these analyses, Bridgeport is able to consistently monitor the quality of its produced water and combined with the water production history, can also analyse changes in water quality for relationships with the quantity of water extracted.

For water production monitoring, Bridgeport provides oil and water production statistics to the Queensland DNRM on a six-monthly basis. For water quality, Bridgeport conducts ultra-sensitivity testing on a quarterly basis for benzo(a)pyrene to satisfy landowner cattle watering QA requirements

For aquifer water levels, Bridgeport obtains petrophysical data by reference as new wells are drilled. As the OWC movement is only constrained within the reservoir this form of data is not relevant to water extraction levels (i.e. they do not change substantially over the 20 year life of a well). Further reporting to the Queensland the Office of Groundwater Impact Assessment (OGIA) has not been implemented as **these regional aquifers are below any known extraction points for irrigation or domestic use, as detailed above**. This means that Bridgeport is required to comply with the EA conditions.

Water quality at Utopia has been consistently in compliance with limits for ANZECC environmental quality, and drinking water limits as well as Environmental licence conditions.

3.4 Cumulative Assessment of water already produced

It is the nature of aging oilfields that the water component of the oil/water content rises as the wells age. From date of initial UWIR reporting commenced November 2012 to December 2018, the forecast would be to produce 222.14ML. (Note year 2012 comprises 2 months from November 2012 to December 2012)

Year	Cumulative Water (STB)	Cumulative p.a Water (ML)
2012	4,841	0.76
2013	123,754	19.67
2014	207,328	32.96
2015	207,201	32.94
2016	225,585	35.86
2017	286,911	45.61
2018	341,661	54.32
Total to November 2018		**222.14**

The cumulative water production per annum (in ML) for the existing wells for the period January 2005 – November 2018 in the Utopia Oilfield is depicted in the Tables and bar charts below.

Table 3 – Cumulative water production to 2018

Well	Cumulative Water (ML) Nov 2015 – Nov. 2018		Well	Cumulative Water (ML) Nov 2015 – Nov 2018
Utopia 1	1.720		Utopia 16	0.000
Utopia 2	0.481		Utopia 17	0.000
Utopia 3	0.000		Utopia New Well A	7.751
Utopia 6	6.119		Utopia New Well B	7.504
Utopia 7	2.760		Utopia New Well C	7.266
Utopia 8	15.012		Utopia New Well D	4.849
Utopia 9	3.410		Utopia New Well E	4.603
Utopia 10	51.357		Utopia New Well F	4.364
Utopia 11	4.700		Utopia New Well G	1.948
Utopia 12	1.132		Utopia New Well H	1.701
Utopia 14	7.660		Utopia New Well I	1.463
Utopia 15	0.000			

3.5 Reporting Program

For water production monitoring, Bridgeport provides water production statistics to the Queensland Department of Natural Resources and Mines on a six-monthly basis. For water quality, Bridgeport provides water samples to the landowner on a quarterly basis in compliance with the CCA requirements. For aquifer water levels, Bridgeport Eromanga obtains petrophysical data by reference as new wells are drilled. As the OWC movement is only constrained within the reservoir this form of data is not relevant to water extraction levels – this means that they do not change substantially over the 20 year life of a well.

Further reporting to the Queensland Office of Groundwater Impact Assessment (OGIA) has **not been implemented as these regional aquifers are well below any known extraction points** for irrigation or domestic use, as detailed above.

This UWIR will be updated annually as required with accurate water use and predictions for the following year recorded, any changes in the monitoring strategy, goals and site conditions will be reported. However predicted impacts are not anticipated to change as Bridgeport Operations of the Inland Oilfield have no material impact on the potable aquifers or aquifers of environmental value, no drop in aquifer pressure has been observed and as such our impact is minimal.

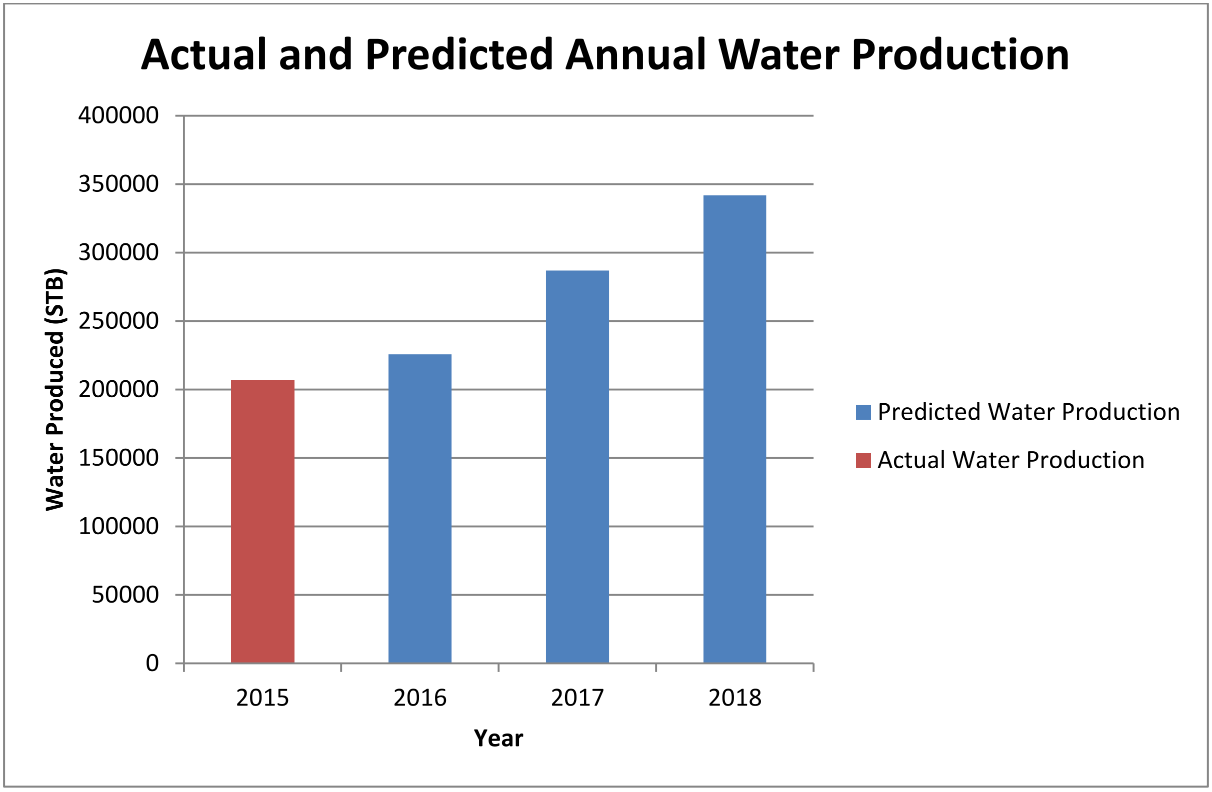

Figure 9- Annual Projected Water Production

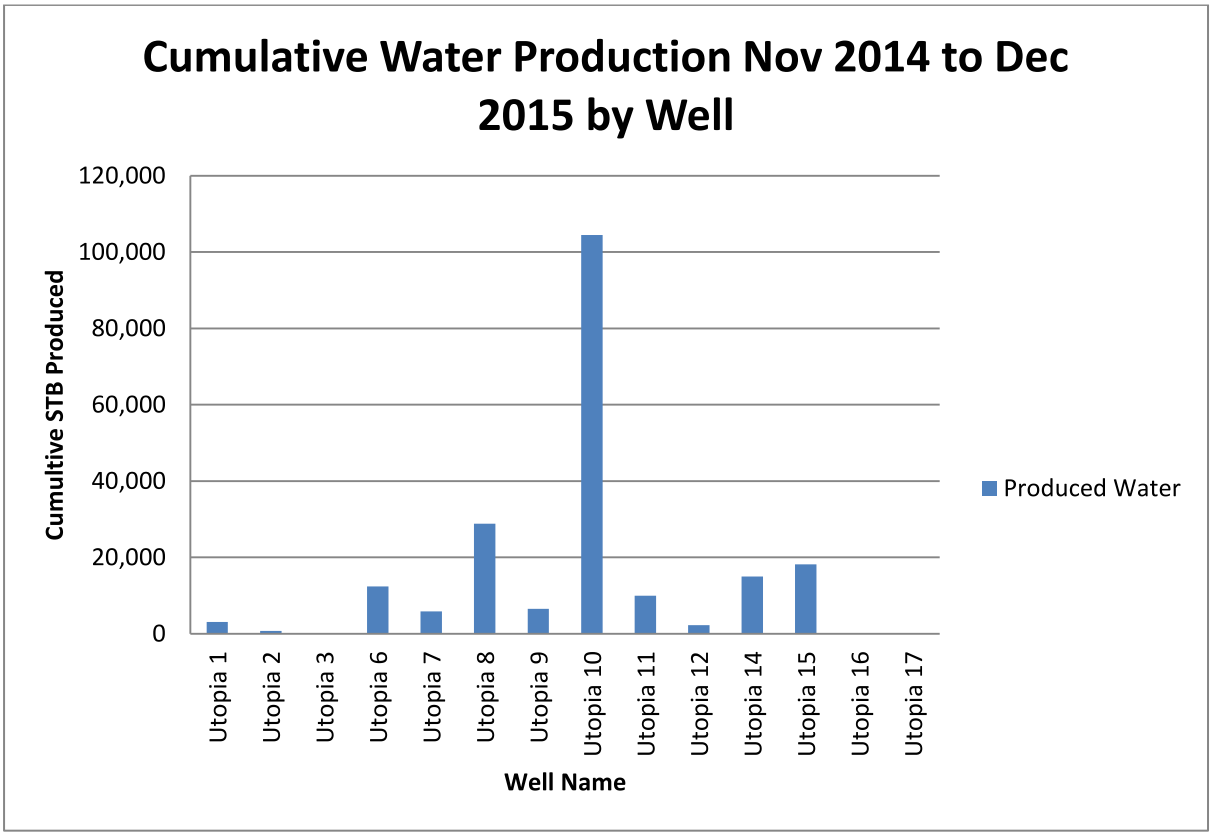

Figure 10 – Cumulative water by well

The Bubble map below represents the volumes of produced water for the reporting 2015-2016 period per well, the actual versus projected water figures will be reported in future UWIR annual updates.

In addition to the subsurface aquifer water levels, data acquired pertaining to water quality is handed to the landowner on request. This data acquisition is undertaken on a quarterly basis and as such, the water quality can be assessed at various stages throughout the production life. Having the water quality analysed at these different stages, facilitates historical comparisons of water quality and underground water extraction.

These comparisons can significantly enrich the levels of understanding of the impacts of underground water extraction on aquifer water quality and if any impact does exist, this process will ensure that it can be easily identified.

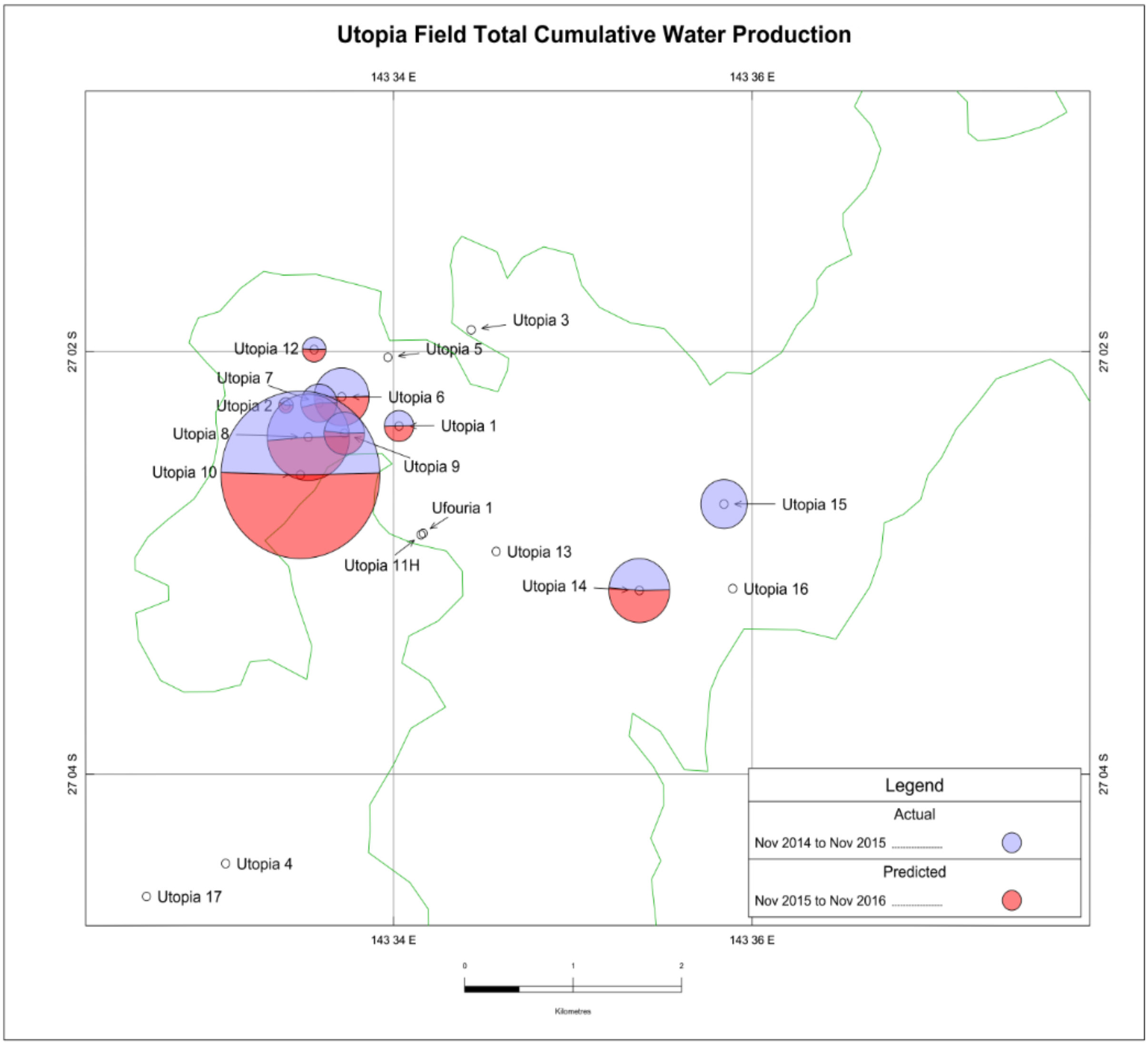

Figure 11 – Utopia field cumulative water production

Table 4 - Forecast – 2015 to 2016 in STB

Well Name	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Annual
Utopia 1	0.050	0.052	0.045	0.041	0.045	0.043	0.049	0.048	0.049	0.049	0.050	0.052	0.573
Utopia 2	0.015	0.015	0.009	0.008	0.012	0.012	0.015	0.014	0.015	0.015	0.014	0.015	0.160
Utopia 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Utopia 6	0.167	0.173	0.173	0.156	0.173	0.167	0.174	0.168	0.174	0.174	0.168	0.174	2.040
Utopia 7	0.000	0.000	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.081	0.812
Utopia 8	0.000	0.000	0.442	0.442	0.442	0.442	0.442	0.442	0.442	0.442	0.442	0.442	4.415
Utopia 9	0.095	0.099	0.094	0.085	0.094	0.091	0.094	0.095	0.099	0.099	0.095	0.099	1.137
Utopia 10	1.407	1.454	1.454	1.313	1.454	1.407	1.454	1.407	1.454	1.454	1.407	1.454	17.119
Utopia 11	0.129	0.133	0.133	0.120	0.133	0.129	0.133	0.129	0.133	0.133	0.129	0.133	1.567
Utopia 12	0.031	0.032	0.032	0.029	0.032	0.031	0.032	0.031	0.032	0.032	0.031	0.032	0.377
Utopia 14	0.210	0.217	0.217	0.196	0.217	0.210	0.217	0.210	0.217	0.217	0.210	0.217	2.553
Utopia 15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Utopia New Well A	0.000	0.000	0.000	0.000	0.246	0.238	0.246	0.238	0.246	0.246	0.238	0.246	1.948
Utopia New Well B	0.000	0.000	0.000	0.000	0.000	0.238	0.246	0.238	0.246	0.246	0.238	0.246	1.701
Utopia New Well C	0.000	0.000	0.000	0.000	0.000	0.000	0.246	0.238	0.246	0.246	0.238	0.246	1.463
Total	**2.10**	**2.17**	**2.68**	**2.47**	**2.93**	**3.09**	**3.43**	**3.34**	**3.43**	**3.43**	**3.34**	**3.44**	**35.87**

4. CONCLUSION

In accordance with sec.376 (e)(ii) Giving the chief executive a …statement of whether there has been a material change in the information or predictions used to prepare the maps. Bridgeport Energy has stated elsewhere in this report that we are operating at depths far greater than the artesian water table. Although the Utopia field is a mature oilfield with increasing water production and decreasing oil production, the total voidage volume of oil being replaced by water in the reservoir is insignificant relative to the total water volume in these deep reservoirs. At some point the field will completely water out and be abandoned, but even by then the total column of water ingressing from the deeper Namur and along trend with the Murta is a minor component of the total volume in the basin. Thus it can be clearly stated that our impact on the regional aquifer from PL 214 operations is insignificant.

The OWK UWIR approved in November 2012 (at Appendix A) detailed and assessed the impacts of our oil operations in the Cooper/ Eromanga area of South West Queensland. Within the Bridgeport tenements in this region there are no Groundwater Dependent Ecosystems (GDE), significant groundwater users or social and cultural environmental values.

Furthermore no GAB springs were identified in close proximity to the PL 214 tenement, it is estimated that the closest GAB spring is 200km South East of the tenement, therefore OWK's operation in the Utopia Oilfield cannot have any material impact on GAB discharge springs or any other GDEs.

The OWK Oilfield in SWQ is located within the Cooper GAB basin, groundwater extraction associated with oil production is carried out at great depths (1010 -1030mts) and does not generally compete with groundwater extraction for domestic, agricultural or other stakeholder uses. The risk to groundwater bores is considered to be negligible considering their distance and the depth at which Bridgeport Energy operates its wells.

The predicted impacts on the GAB aquifers are limited to the close proximity of the oil production wells and the impacts based on current and historical evidence pose a very low risk to the integrity of the GAB. As noted previously the oil water ratio increases as the wells age and as can be seen from the data in this document our forecast water content by well is likely to rise between 2015 to 2018.

The positioning of our oilfield juxtaposed against the ecosystem and groundwater values in the area poses insignificant risk to any aquifers or surrounding bores, nevertheless Bridgeport Energy has implemented best well construction practices to eliminate the possibility of groundwater impacts on the surrounding area.

A water monitoring strategy has been developed which goes beyond the requirements of the PL 214 Environmental Approval and demonstrates that Bridgeport activities pose a minimal risk to surrounding ecology or stock watering activities. This updated UWIR supplements our approved 2012 UWIR and demonstrates Bridgeport due diligence with water management in all its operations on PL 214.

APPENDIX A – 2012 UWIR PL 214

Underground Water Impact Report

UTOPIA OIL FIELD (PL 214)

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August 2012
Revision 3

Contents

1 Executive Summary

In 2011, the Department of Environment and Resource Management (DERM) introduced a requirement that operators of petroleum production report on the impact that their production of subsurface fluids has on the water in underground aquifers. This report is submitted in accordance with the *Water Act 2000* (Water Act) and it shows that petroleum operations at the Utopia Oilfield in Petroleum Lease 214 (PL 214) have had negligible impact on underground water in the region. This applies to both the reservoir unit from which production has been extracted and to the shallower aquifers that landholders might use boreholes from which to extract water.

2 Introduction

2.1 Purpose

The following is the initial Underground Water Impact Report (UWIR) for Bridgeport Energy Limited, and its subsidiary Oilwells of Kentucky Inc. (OWK), for PL 214.

This report contains water production information from previous years' production as well as a forecast of water production for the next three (2012-2014, inclusive).

This report complies with Section 376 of the Water Act 2000.

In relation to the Management Units outlined in the *Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan Area* (Qld DNRM, 2005), the Strategic Management Zone is 14 (Warrego, Figure 1). The GAB WRP Management zone is 17 (Warrego West, Figure 2) and the unit relevant to this report are Warrego West 3 (Figure 3). "Groundwater take within this management area is relatively small due to the depth of the formations" (Qld DNRM, p123).

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2.2 Current status

The Utopia Oilfield is located in PL 214 (Figure 4) adjacent to the south-western corner of ATP 560P. The permit is approximately 220 km^2 in area. The field is in the Eromanga Basin approximately 40 kms SW the town Eromanga. The Utopia feature is an anticlinal structure. The geological section is a standard Eromanga sequence overlying a thin undifferentiated Triassic package of sediments.

Field development to date consists of 11 wells on the Utopia field and two wells outside the field (Figure 5). A total of 10 completed wells were drilled between 1987 and 2011. Bridgeport acquired OWK in 2009. Current production is from a total of 8 wells located within a radius of three kilometres of the production facility. The field produces only from the Cretaceous Murta Member. Oil production occurs between the depth of 790 and 802 meters subsea. Current production rates for the field average 70 barrels of oil (0.01 ML) per day and 500 barrels of water per day (0.08 ML). A history of the wells can be found in Appendix 1.

3 Part A: Underground water extractions

3.1 Quantity of water already produced

Bridgeport Energy currently produces oil from the Murta Member. The PL was awarded in May 2006. Prior to the PL being awarded permission was granted for an extended production test. Bridgeport Energy acquired OWK in August 2009. Since the award date, approximately 42.1 ML of associated water has been produced (Figure 6) and a well-by-well summary of cumulative production is shows in Figure 13. The reporting of the total amount of water produced complies with the requirement in S376(a)(i) of the Water Act.

The estimated associated water production is based on records from OWK for the period 2005 to 2009. After August 2009, Bridgeport Energy measures oil and water production from each well by means of a test tank and dipstick. The tables in Appendix 2 are a year by year summary of water produced in the Utopia Oilfield.

3.2 Quantity of water to be produced in the next three years

Typical average water production is approximately 0.003 ML of water per day from the Murta Member of Warrego West 3 unit. Based on Bridgeport Energy's Later Development Plan, Bridgeport proposes to drill 6-12 new Murta member wells in the next three years. Using the average production rates of current Murta member producers, the maximum additional associated water production is forecasted, as per S376(a)(ii), is summarized in the table below:

Number of Wells	Dates online	Incremental Production @ 31-Dec-14 (ML)	Forecast Production from Existing Wells (ML)	Total Forecast Water Production (ML)
4	Sept-Oct 2012	40.42	95.75	136.17
4	Jun-Jul 2013			
4	Jun-Jul 2014			

To calculate these figures, the water cut was plotted against time using production data from Utopia 6, 7 and 9 to form a forecast water-cut profile for new Murta Member wells in the field. This line of best fit was combined with Bridgeport's forecast of oil production rate from the Murta for new wells. From this combination, forecast water rates for new Murta wells were created and presented in Figure 7.

3.3 Currently Producing Zones

Bridgeport currently produces from the Utopia Oilfield in SMP Zone 14, GAB WRP Zone 17 which is approximately 64 500 km^2 in area (Figures 1 & 2). Warrego West 3 (Murta) is currently the only produced unit in the zone. Water produced is associated water from oil production. Bridgeport does not use this water for water flooding activities and, at the time of this report, has no plans to do so. However, there may be future beneficial advantage to consider water flooding (injection) in this reservoir to minimise the output of water under existing discharge rights in the Environmental Authority.

4 **Part B: Aquifer information and underground water flow**

To comply with the S376(b), the aquifer affected by water extraction is Warrego West 3. Under the previous operator, Warrego West 3 was sporadically recorded and Bridgeport can only confidently report on oil and water production from August 2009 when Bridgeport energy acquired OWK, Bridgeport was supplied limited data from 2005-2009 and no records of any production pre 2005.

4.1 Description of each aquifer

4.1.1 Murta Member, McKinlay Member and Namur Sandstone (Warrego West 3)

The formations in Warrego West 3 are described in the *Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan Area* 2005 as follows:

> “The Hooray sandstone and its hydrogeological equivalents are generally the shallowest major artesian aquifer intercepted by water bores in the GAB in Queensland. The Late Jurassic Hooray Sandstone aquifer is defined only within the Eromanga Basin.” (Qld DNRM 2005, p15).
>
> “Basin margin facies of the Jurassic and early Cretaceous sandstones and siltstones occur in…the Eromanga (Namur Sandstone, McKinlay member and Murata Formation). These basin margin facies are hydrogeologically equivalent to the Hooray sandstone aquifer.” (Qld DNRM 2005, p15).

The detailed description from the wells follows as per the requirement in S376(b)(i). The Murta Member is a very fine to fine grained sandstone with interbedded hard siltstone. The sandstone is subangular to subrounded, moderate to well sorted with a moderate to abundant clay matrix. Moderate amounts of silica cement are present and it is moderately hard with poor porosity. The Warrego West 3 unit ranges in thickness from approximately 120-130m.

The McKinlay Member is a fine to medium grained siltstone with minor firm siltstone. The sandstone is subangular to subrounded, moderately sorted with occasionally carbonaceous laminae. There is a moderate clay matrix that is slightly calcareous and moderate silica cement. The formation is moderately hard with poor to occasionally fair porosity. This unit is nonproducing in the Utopia field and is mentioned purely for completeness of summarizing the unit because it is part of the Warrego West 3 unit.

The Namur Member is sandstone with interbedded siltstone. The sandstone varies from very fine to coarse. It’s moderately sorted with clay matrix and moderate silica and calcareous cement and ranges from friable to moderately hard. Poor to fair with occasional good porosity has been observed. This siltstone is argillaceous with firm with moderately to abundant carbonaceous material. This unit is nonproducing in the Utopia field and is mentioned purely for completeness of summarizing the unit because it is part of the Warrego West 3 unit.

4.1.1.1 **Elevations and relative position**

The Murta Member is a Late Jurassic to Early Cretaceous sediments (Figure 8). The depth ranges across the field from -790 to -795 mSS. Within the Utopia Oilfield the range is 1071 to 1097 mSS. (Figure 9). The wells that have tested or perforated the formations in Warrego West 3 are shown in Figure 10.

4.1.1.2 **Location of water bores screened within these aquifers**

As per S376(d), Bridgeport has identified 8 water bores within PL 214, but none of them are screened in Warrego West Unit 3 (Figure 12). The wells are screened across the Winton Formation which is approximately 950-1000 m above the Warrego West Unit 3 (Murta Member). The Winton formation is between 188 and 225 mAMSL. The stratigraphic column in Figure 8 shows the relative position of these two units.

Of these 8 water bores, one of them being the shut-in well Ufouria-1 in the Utopia Oilfield which has been classified in the DERM database as water bore 23593. This well was drilled in December 1987, shut-in in January 2008 with very little water production and plugged back to 900m. In November 2010, Bridgeport Energy attempted to flow the well; however the pump became stuck at 80m depth and the well was abandoned with no production from the Winton. The Ufouria-1 well was drilled to a total depth of 1395 m in the metasediment basement rock. The well history is outlined in Appendix 1.

In general, “Groundwater take within this management area is relatively small due to the depth of the formations…..Many of the existing bores are converted petroleum explorations wells” (Qld DNRM 2005, p123). The table below details the bore locations in PL 214 and status as per S376(d).

Ref No.	Location	Lot/Plan	Property Name	Aquifer Screen	Depth/ Thickness	Distance from Utopia Field	Name	Remarks
6099	143 38 40 E 26 59 33 S	4/G051	Congie	Winton	32/	5.6 km	Boothera	Existing
6377	143 30 60 E 27 01 56 S	447/ SP196201	Mt Margaret	Winton	15.2/	3.3 km	Boothera 10	Existing
9687	143 38 11 E 26 59 32 S	4/G051	Congie	Winton	17.1/	5.2 km	Bloodwood	Abandoned and Destroyed
10423	143 32 20 E 27 04 00 S	447/ SP196201	Mt Margaret	Winton	19.8/	1.2 km	Daleys Bore 17	Existing
23593	143 34 09 E 27 02 51 S	447/ SP196201	Mt Margaret	Winton	4.8/312.8	In field	Uforia-1	Existing
50455	143 38 39 E 27 01 34 S	4/G051	Congie	Winton		2.8 km	Congie Well	Abandoned and Destroyed
50636	143 38 34 E 26 56 53 S	4/G051	Congie	Winton		5.0 km	Boothera Replacemen t	Abandoned and Destroyed
116155	143 38 40 E 27 01 13 S	4/G051	Congie	Winton	100/	3.3 km	Congie Replacemen t	Existing

4.1.1.3 Location of any significant faults that intersect aquifer

There are no significant faults in the Utopia Field (Figure 11).

4.1.1.4 Available data on current underground water levels

The Murta was first tested in the Ufouria-1 well in 1987, It didn’t flow and the well was plugged back and converted to a water well. The well never flowed water and was then abandoned. The Murta formation started flowing oil form the Utopia-1 well in 1997.

A field wide petrophysical study was conducted in June 2010. This indicates that most wells are in the Utopia field are in agreement that the original oil water contact (OOWC) is at 800 mSS. Utopia 8 indicates that the contact may have been deeper (802 mSS). The issue with most of the wells is that the contact is not straight forward and is typically a lithology break (shale) rather than an OWC. Utopia 2 and 8 are less of a lithology break than the other wells and can be classed as an OWC. As this is a thinly laminated reservoir, the OWC is more likely to be variable from well to well. From the study, the OWC can range from 800 mSS to 802 mSS.

Given that very little fluid production has come from this reservoir as it is a low permeability unit and that the overall extent of Warrego West 3 is enormous, it is concluded that the aquifer water levels, referred to in S376 (b)(iv), will remain unchanged in the area of the lease.

4.2 Underground water flow and aquifer interactions

Bridgeport acquired OWK in 2009. At the time of this report, Bridgeport is continuing to interpret the data provided by OWK in order to develop an understanding of the relationship and interaction between petroleum reservoirs and water aquifers. However, the affected strata lie within a depth range of 1010 m and 1030 m. All shallower aquifers and reservoirs are behind casing pipe and have no access to the surface via the oil well.

4.2.1 McKinlay Member and Namur Sandstone (Central 3)

> "The Hooray Sandstone is the most important and developed aquifer in the Warrego West Management Area. Water quality ranges from 750 to 6000 μS/cm with artesian supplies of up to 40 L/s. This unit supports the majority of take for stock and domestic purposes as well as urban use for the townships of Quilpie, Eromanga and Adavale. Groundwater extraction, including form a number of older bores with uncontrolled flow, has resulted in artesian pressure drops of up to 60m. However, in recent times there have been significant pressure increases in the managements unit because of the cap and pipe programs" (Qld DRNM 2005, p122).
>
> "In the Central Eromanga Depocentre (Cooper Basin Region) the combined Namur Sandstone, McKinlay member and Murta Formation are laterally continuous with the Hooray Sandstone. These formations are restricted to subsurface and are recharged from connecting Hooray Sandstone in the east and Algebuckina Sandstone in the west. Confined aquifers are found in all three members, which are connected" (Qld DNRM 2005, p17).

The Murta Member produces at the time of this report from Utopia 1, 2, 6, 7, 8, 9, and 11. The Murta was tested in UTA-1 and recovered 167.60 m of muddy water before the well was plugged and abandoned. Utopia 4 tested the Murta and recovered 0.0008 ML water in the drill sting and 3.5 L of water in the sample chamber. This well was plugged and abandoned. Utopia 5 also recovered a total of 0.003 ML of water from the Murta before it too was plugged and abandoned.

The Murta Member provides a top seal for the M2 sand, McKinlay and Namur formations. The Murta is predominantly siltstone with a few fine to very fine grained sand stringers (M2). Above the Murta is the base Cadna-owie Formation, which is a regional seal unit in the Copper-Eromanga Basin.

"These formations are restricted to subsurface and are recharged from connecting Hooray Sandstone in the east and the Algebuckina Sandstone to the west. Confined aquifers are found in all three members, which are connected." (Qld DRNM 2005, p17). However, there is intra formational seals interpreted form log character with the Warrego West 3 reservoirs within the Utopia Oilfield.

The Westbourne Formation lies between the Namur and Adori sandstone and it has a very thick sealing silt sitting at its top. This provides a base seal for the Warrego West 3 sandstones ensuring no communication with deeper reservoirs.

The table below presents the some of the key properties of the water analyses for the various well's recoveries from the Murta Member. The full chemical analyses for these samples are in Appendix 3. Note these are samples that have been produced in a drill stem test and have interacted with oil and drilling fluid. These are therefore not representative of true groundwater chemistry drill stem test recoveries are contaminated by drilling muds.

Well	Ph	Resistivity @25C (ohm.m)	Conductivity @25C (μS/cm)	Total Cations (meq/L)	Total Anions (meq/L)	Total Dissolved Solids (mg/L)
Utopia 1	7.7		7392			4902
Utopia 2	7.9	2.99	3340	28.37	20.58	2137.6
Utopia 4	7.55	0.19	53330	66.59	58.02	34131.2
Utopia 5	8.0	1.73	5770	52	55	3750
Utopia 6	8.1	4.67	2140	26	27	1390
Ufouria 1	7.3	0.75	13300	121.3	118.8	8325

4.3 Underground water level trend analysis

"Groundwater take within this management area is relatively small due to the depth of the formations. Use is currently limited to stock and domestic, urban with some small irrigation developments mainly targeted at drought preparedness. Many of the existing bores are converted petroleum exploration wells. the bulk take for all purposes is drawn from the Hooray Sandstone" (Qld DNRM 2005, p123).

It is not possible to generate maps of these depth of aquifers as no regional closure is possible to identify given they are present throughout the Eromanga Basin which "is the largest of the main [Great Artesian Basins] and extends across Queensland, New South Wales, South Australia and the Northern Territory (650 000km2 in area in Queensland)" (Qld DNRM 2005, p4). Depths of the aquifers preclude verifying regional extent. Bridgeport will continue to research literature and as field development continues, more information regarding the rise in the water table will be collected.

What is known about the aquifers so far has been acquired through the drilling of development wells in the field. The oil production comes from this Murta Member. Well data in the field suggests that reservoir seals provide an element of separation between known oil reservoirs and aquifers as it is a working petroleum system. Based on drilling and production data it's not possible to quantify the degree of communication between the reservoirs.

5 Part C: Predicted water level declines for the affected aquifers

5.1 Maps of the affected area

The Utopia Oilfield covers an area of approximately 25.4 km^2 in PL 214, which is 220 km^2 (Figure 18). The structure of the Utopia Field has been mapped from the interpretation of 3D seismic data. The free water level has been determined through petrophysical studies of the wells from wireline logs and from water encroaching into wellbore perforations.

The field produces from the Murta Member. To date, approximately 18.8 ML of oil and 42.1 ML of water have been produced from the Utopia Oilfield. No decline in water levels has been observed as is the concern of S376(b)(iii). In fact, over time, it is expected that the water table within the bounds of the field will rise. As oil is produced, down dip formation water within the Warrego West 3 unit will move into the structure, replacing the oil and resulting in a rising oil water contact.

5.2 Methods and techniques used

The map in Figure 12 shows a notional area of water recharge for oil produced (S376(b) (iv and v)). The notional area of influence based on the 3D seismic mapped area, the low permeability of the Murta Member and the interpreted OWC. Applying the following Murta reservoir parameters to this area results in a gross rock volume of 503 million cubic metres and a net reservoir volume of 18 million cubic metres.

Area (Km^2)	Thickness (m)	Net/Gross	Porosity (%)	Recovery (%)
28.6	17.6	0.3	16.5	0.27

The aquifer volume of the Warrego West 3 unit (Murta, McKinlay and Namur members) in the Utopia Oilfield area is significant. The unit is 100 m thick and the total pore volume with in the Petroleum Lease (220 km2) is approximately 3,630,000 ML. Clearly this aquifer volume dwarfs the amount of water (42.1 ML) and oil (36.6 ML) produced from the Murta Member reservoir to date.

The notional area of affected aquifer volume relates to the total Warrego West 3 unit; however, it is only the Murta Member that is being produced. Figure 14 has been added to graphically show how much water has been produced from each well.

There is no evidence of water decline in any of the Utopia wells, nor is there any decline anticipated elsewhere in the area of the field as a result of the utopia oil production. The Warrego West 3 unit is a regionally extensive aquifer and contains varied quality sands. The sands in the Murta Member in the Utopia area are good porosity but low permeability which produced both oil and associated water with a water cut of 95%. The Murta sands are connected to the lower members (McKinlay and Namur, still in Warrego West 3 unit) which also regionally extensive and water bearing in this area. This allows water to move readily move updip to displace any produced oil.

The Warrego West 3 unit is regionally extensive in the Eromanga basin which “is the largest of the main [Great Artesian Basins] and extends across Queensland, New South Wales, South Australia and the Northern Territory (650 000km2 in area in Queensland)” (Qld DNRM 2005, p4).

5.3 Water bores within the Immediately Affected Area

The only water bore in the notational area of influence, as there is no immediately affected area for this UWIR, is the Ufouria-1 well, water bore number 23593 (S376 (d)). The other 7 water bores contained in PL 214, summarized in the table on page 4, are screened across the Winton Formation and are not in the notional area of influence (Figure 12). This well was drilled for oil exploration under ATP 289P in 1987. It was shut in from 1988 and abandoned in 2010 (Appendix 1).

5.4 Review of maps produced

As this is the first UWIR produced, there are no maps to review as required by S376(e)(i).

For future reviews, Bridgeport will conduct annual reviews in January to report production from the wells as per s376(e)(i). These reviews will note any significant increases or decreases in volumes and comment as to why the occurred (i.e., additional wells) and what the expected effect on the aquifer will be (i.e., changes in local water levels/oil water contact).

From these reviews, cross sections and maps will be produced to demonstrate what the changes represent and will be summarized annually and provided to DEHP as per s376(e)(ii) and discussed with local land owner(s) as par to four normal practice of public disclosure. These reviews will be incorporated and elaborated on in the relevant section in future UWIR's.

6 Part D: Water Monitoring strategy

6.1 Rationale

The purpose of this document is to provide the details of how Bridgeport Energy currently conducts water monitoring operations as per S376(f) and more detailed in S378. Further to this, it also explains how the information acquired from these operations is applied to assess changes in aquifer properties, particularly water levels and water quality.

6.1.1 Assessment of changes in water levels and water quality because of relevant underground water rights

Due to the massive regional extent of these aquifers there is excellent pressure support during the entire period that oilfield production has occurred. A drop in water levels has not been observed, and indeed, a rise in the water/oil contact has been seen during production operations. Water level is monitored through producing oil wells. When a producing well reaches an uneconomical percentage of water cut, it is because the water level has risen locally around the well. Future infill wells are located to optimise oil production and minimize the percentage of water produced.

The absence of water bores producing from the Murta Member in PL 214 means that there is no feasible way to assess changes in water levels, although Bridgeport Energy does measure water quality in the evaporation ponds routinely as per DERM operating conditions for the permit.

6.1.2 Supplementation of existing monitoring programs to fill any critical gaps in data

At the present time, it is the position of Bridgeport Energy that the monitoring programs currently being employed are adequate to collect the data required to effectively monitor the relevant underground water properties and that there are no critical gaps in data. Consequently, it has not been deemed necessary to conduct any such supplementation of Bridgeport's existing monitoring programs as suggested in S378 (3).

6.1.3 Explanation about how it will improve the understanding about the impacts of underground water extractions on aquifers

The monitoring strategy currently being employed by Bridgeport Energy includes that acquisition of data relating to the volumes of water extracted from the reservoir. That is, the strategy allows Bridgeport to understand rates of water extraction over time but does not measure changes in the aquifer's water level over time because the regional aquifer is so large (extending well beyond the lease boundary). As noted in Part C, the regional aquifer is more than 100 times larger than the volume of the oilfield.

In addition to the subsurface aquifer water levels, large amounts of data are acquired pertaining to water quality. This data acquisition is undertaken on a quarterly basis and as such, the water quality can be assessed at various stages throughout the production life. Having the water quality analysed at these different stages, will facilitate historical comparisons of water quality and underground water extraction. These comparisons will significantly enrich the levels of understanding of the impacts of underground water extraction on aquifer water quality and if any impact does exist, this process will ensure that it can be easily identified.

6.2 Monitoring Strategy

Bridgeport Energy's monitoring strategy is based on three primary parameters. These are formation water production history, reservoir oil/water level depth and water quality. By closely monitoring and keeping good records of these parameters, Bridgeport Energy has developed a monitoring strategy that meets the requirements of Section 376(f) of the Water Act. The following section provides more specific details of how these parameters are collected.

6.2.1 Formation Water Production History

In order to effectively evaluate the impact of water extraction on the aquifer, it is vital to know the volume of water that has been extracted. As such, Bridgeport Energy has implemented a water production monitoring system that allows the volume of water that has been produced from the reservoir to be calculated. The following is a summary of this system.

- Within the field, each well is flow tested into an isolated test tank. After a settlement period, the contents of the tank are volumetrically measured by means of a dip-stick and water-indicating paste. Volumes of both produced oil and water are obtained from this measurement as per S378(a).

- With the volumes and the time period known, a daily production rate for oil and water is calculated as per S378(c).

- Daily water rates from all wells are then cross-referenced with daily uptime data and from this, the quantity of water produced by a given well in a given day can be calculated as required by S378(b).

As a result of this process, historical water production statistics are available for the field and on a per-well basis. Consequently, Bridgeport Energy has a thorough understanding of the quantity of water that has been extracted as well as extraction rates throughout the field's history.

6.2.2 Underground water level depth

The second parameter that Bridgeport monitors is the depth of the underground water level. Since a significant portion of the requirements under S376(f) of the Water Act pertain directly to the relationship between water extraction and underground water level depth, this parameter is also essential. Bridgeport has adopted two chief methods of evaluating this.

The first of these is through analysis of current wells and their production status. As has been described above, the general trend for the underground water level is that it rises as oil is depleted. Consequently, when an existing well waters out (ceases to produce oil and only produces water), it can be inferred that in the immediate localised area, the underground water level depth has risen to the depth of the well's perforations.

The second of these is through identification of the oil/water contact in new wells as they are drilled. When new wells are drilled, the oil-water contact at the time of drilling can be identified by log analysis. Since the depth of the oil/water contact is defined as the top of the aquifer water level, identification of the oil/water contact through log analysis also allows aquifer water level depths to be understood.

As with the water production history, maintaining good records of these parameters as they become available has resulted in a firm understanding of the original reservoir water level depth as well as how this depth might change over the production life of the Inland Oilfield as water displaces oil.

6.2.3 Water quality

The final parameter that comprises Bridgeport's monitoring strategy is that of water quality. Bridgeport Energy performs routine analyses of its produced water. This water is taken from the evaporation ponds and is sent to a professional chemical analysis organisation where it is analysed for a wide range of contaminants. With the results of these analyses, Bridgeport is able to consistently monitor the quality of its produced water and combined with the water production history, can also analyse changes in water quality for relationships with the quantity of water extracted.

6.3 Timetable

All parameters monitored as part of the monitoring strategy are also monitored for reasons of good oil reservoir management practice. Hence, Bridgeport reports water and oil production quarterly to DERM, annual National Pollutant Inventroy (NPI) reporting, and quarterly water testing.

In some cases monitoring is done daily, in other cases monitoring takes place during particular events such as the drilling of a new well. Furthermore, some measurements are applicable to the field as a whole and as such, these measurements are not strictly applicable to any individual well. The following table depicts the monitoring timetable according to which, Bridgeport will be operating.

Well Name	Tenure	Location	Water Production Monitoring	Aquifer Level	Water Quality
Utopia-1	PL 214	143 34 01.85 E 27 02 21.14 S	Daily	N/A	N/A
Utopia-2	PL 214	143 33 24.01 E 27 02 15.28 S	Daily	N/A	N/A
Utopia-6	PL 214	143 33 42.67 E 27 02 12.84 S	Daily	N/A	N/A
Utopia-7	PL 214	143 33 35.08 E 27 02 1461 S	Daily	N/A	N/A
Utopia-8	PL 214	143 33 31.50 E 27 02 24.28 S	Daily	N/A	N/A
Utopia-9	PL 214	143 33 43.56 E 27 02 23.21 S	Daily	N/A	N/A
Utopia-10	PL 214	143 33 28.89 E 27 02 34.98 S	Daily	N/A	N/A
Utopia-11	PL 214	143 34 09.93 E 27 02 51.63 S	Daily	N/A	N/A
Field Level Measurements	PL 214		Daily	As new wells are drilled if they intersect the OWC above the current mapped depth/ As an existing well waters out as oil production declines.	Quarterly (From testing of Evaporation Pond Water)

6.4 Reporting Program

For water production monitoring, Bridgeport Energy provides water production statistics to the QDME on a six-monthly basis.

For water quality, Bridgeport Energy conducts water samples on a quarterly basis.

For aquifer water levels, Bridgeport Energy obtains petrophysical data by reference as new wells are drilled. As the OWC movement is only constrained within the reservoir this form of data is not relevant to water extraction levels (i.e. they do not change substantially over the 20 year life of a well).

7 Part E: Spring impact management strategy

A spring is defined in the *Water Act 2000* Schedule 4 as "the land to which water rises naturally from below the ground and the land over which the water then flows".

7.1 Spring inventory

There are no springs within PL 214 as per s376(g) or s379. This was confirmed with ESRI Shape Files supplied by the Queensland Government Information Service website. From this data, it was confirmed that the nearest spring is 130 km to the SE of the PL 214 tenure.

7.2 Connectivity between the spring and aquifer

N/A

7.3 Spring values

N/A

7.4 Management of impacts

N/A

7.5 Timetable for strategy

N/A

7.6 Reporting program

N/A

8 Part F: For a CMA assign responsibilities to petroleum tenure holders

PL 214 is not part of a CMA as per s376(i).

9 **References**

Water Act (2000) Reprint 8F effective March 2012

Queensland Department of Natural Resources and Mine (2005) *Hydrogeological Framework Report for the Great Artesian Basin Water Resources Plan Area,* Version 1.0

Queensland Department of Environment and Resource Management (2012) *Guideline: Underground Water Impact Reports and Final Reports* Energy Resources, Environment and Natural Resource Regulation

Queensland Government Information Service: www.dds.information.qlg.gov.au Queensland Wetland Data – Spring ESRI Shape File

Well Completion Reports:

- Ufouria-1
- Utopia-1
- Utopia-2
- Utopia-3
- Utopia-4
- Utopia-5
- Utopia-6
- Utopia-7
- Utopia-8
- Utopia-9
- Utopia-10
- Utopia-11H
- UTA-1

10 Figures

Figure 1: **Strategic Management Plan Zones**

Figure 2: **GAB WRP Management Areas**

Figure 3: **Correlation of the management Units in the Eromanga Basin**

Figure 4: **Tenement Location Map**

Figure 5: **PL 214 Base Map**

Figure 6: **Yearly Associated Water Production**

Figure 7: **Water Production Graph**

Figure 8: **Stratigraphic Column**

Figure 9: **Schematic Cross Section of Warrego West 3**

Figure 10: **Wells that perforated or tested Warrego West 3**

Figure 11: **McKinlay (Warrego West 3) Depth Structure Map**

Figure 12: **Notional Area of Aquifer Affected**

Figure 13: **Cumulative Water Production for Individual Inland Wells (in Dec ’11)**

Figure 14: **Bubble map showing relative water production from each well (to Dec ’11)**

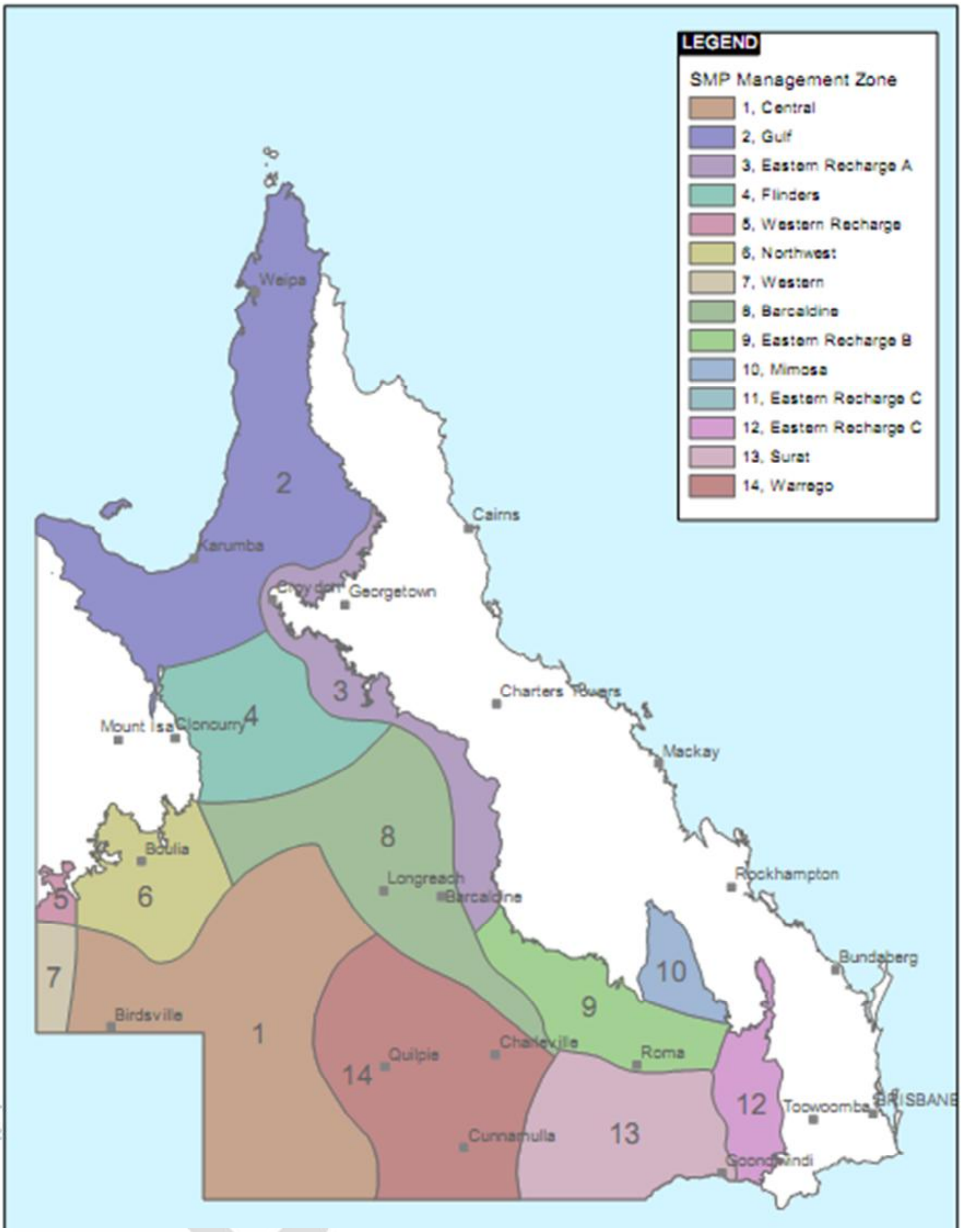

Figure 1: Strategic Management Plan Zones
(Qld DNRM, 2005)

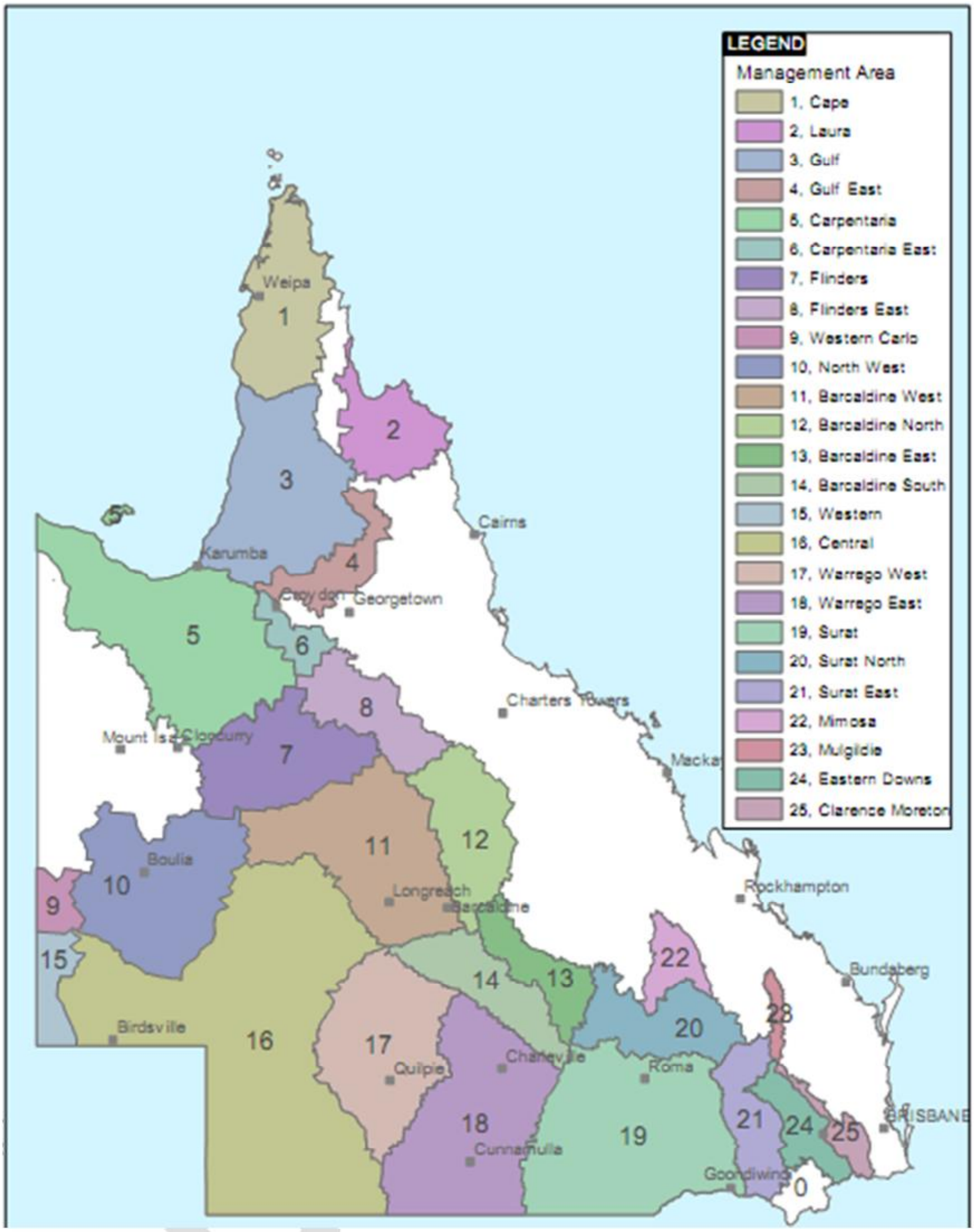

Figure 2: GAB WRP Management Areas

(Qld DNRM, 2005)

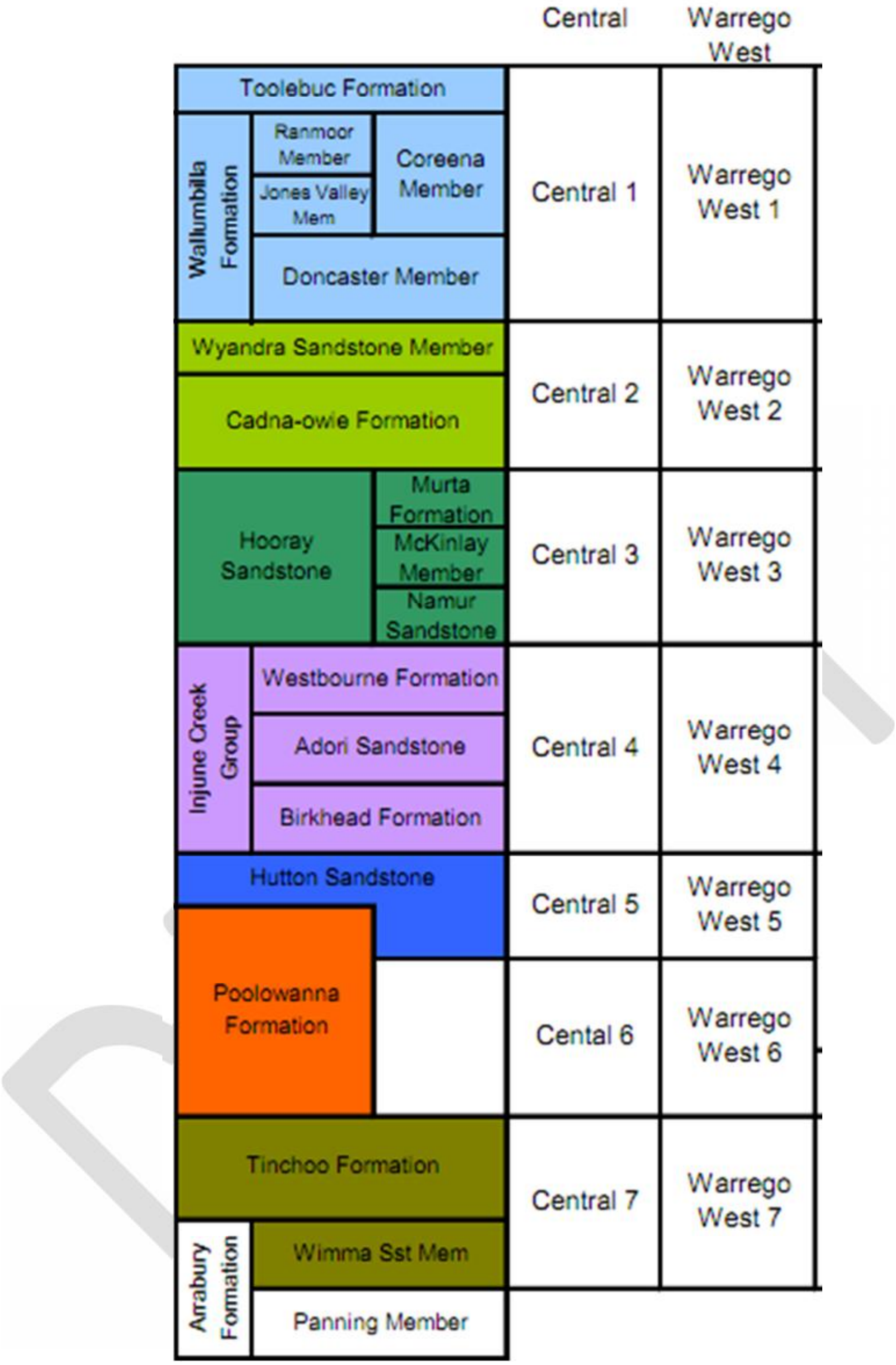

Figure 3: Correlation of the Management Units in the Eromanga Basin

(Qld DNRM, 2005)

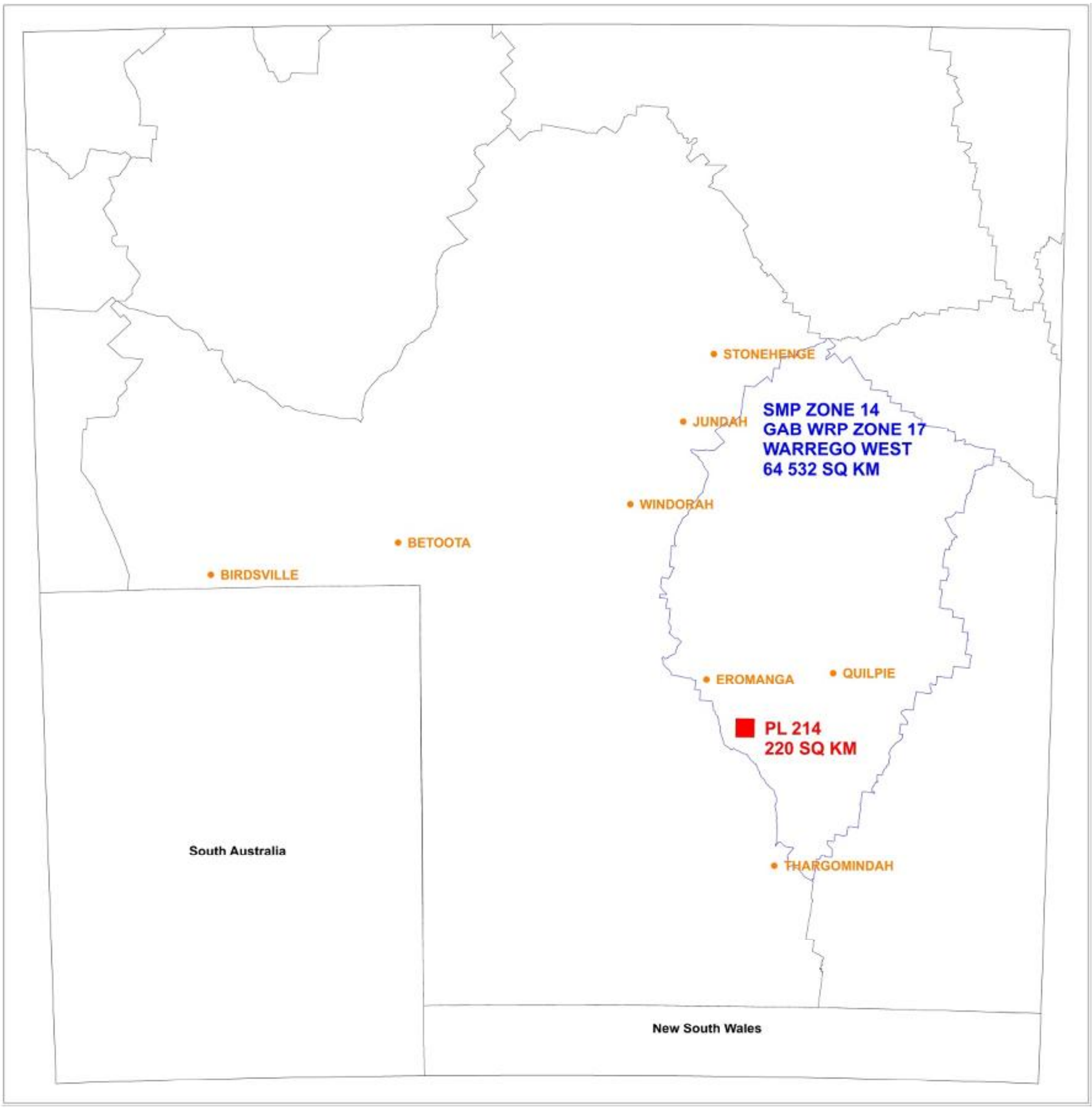

Figure 4: Tenement Location Map

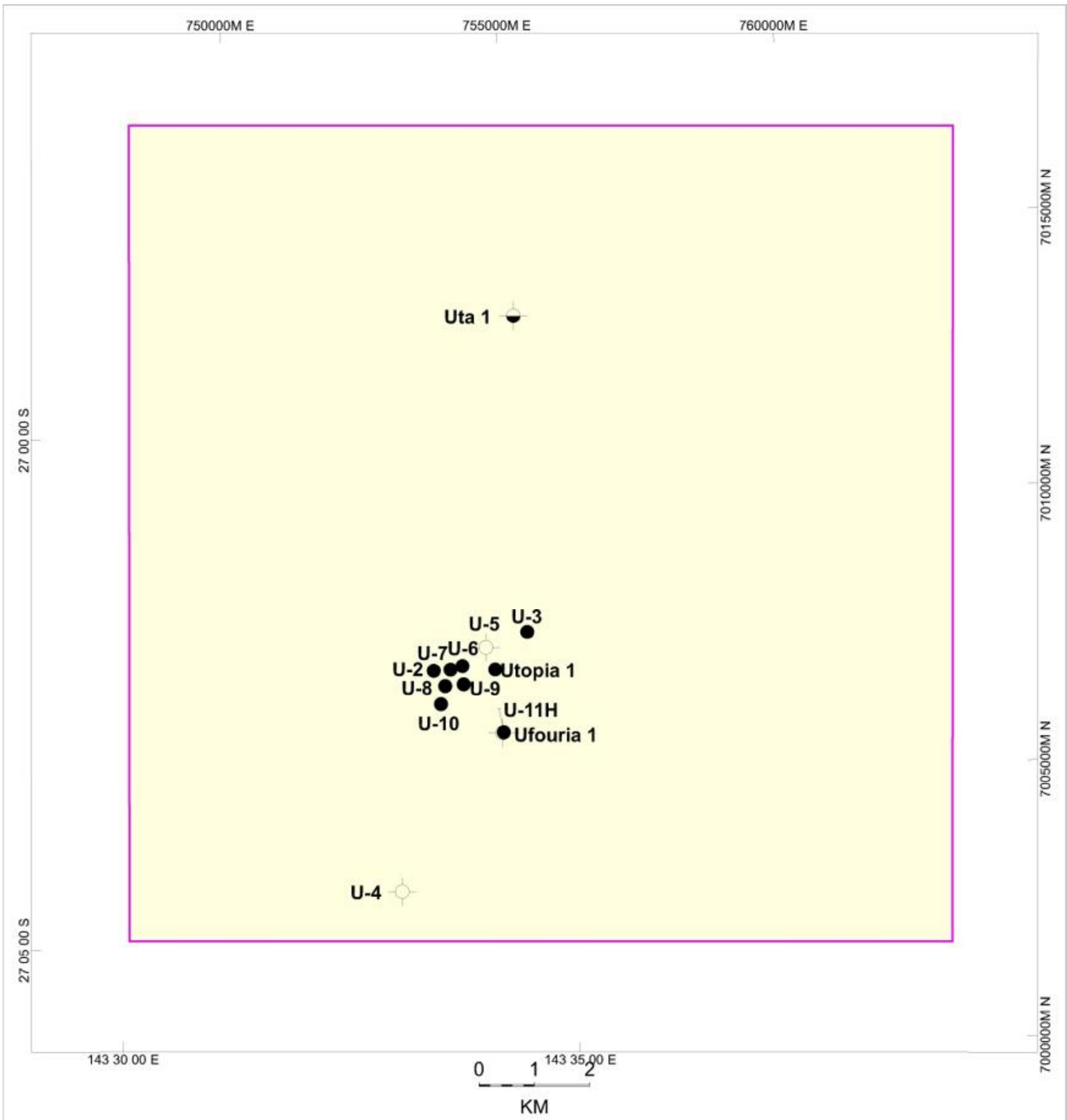

Figure 5: PL 214 Base Map

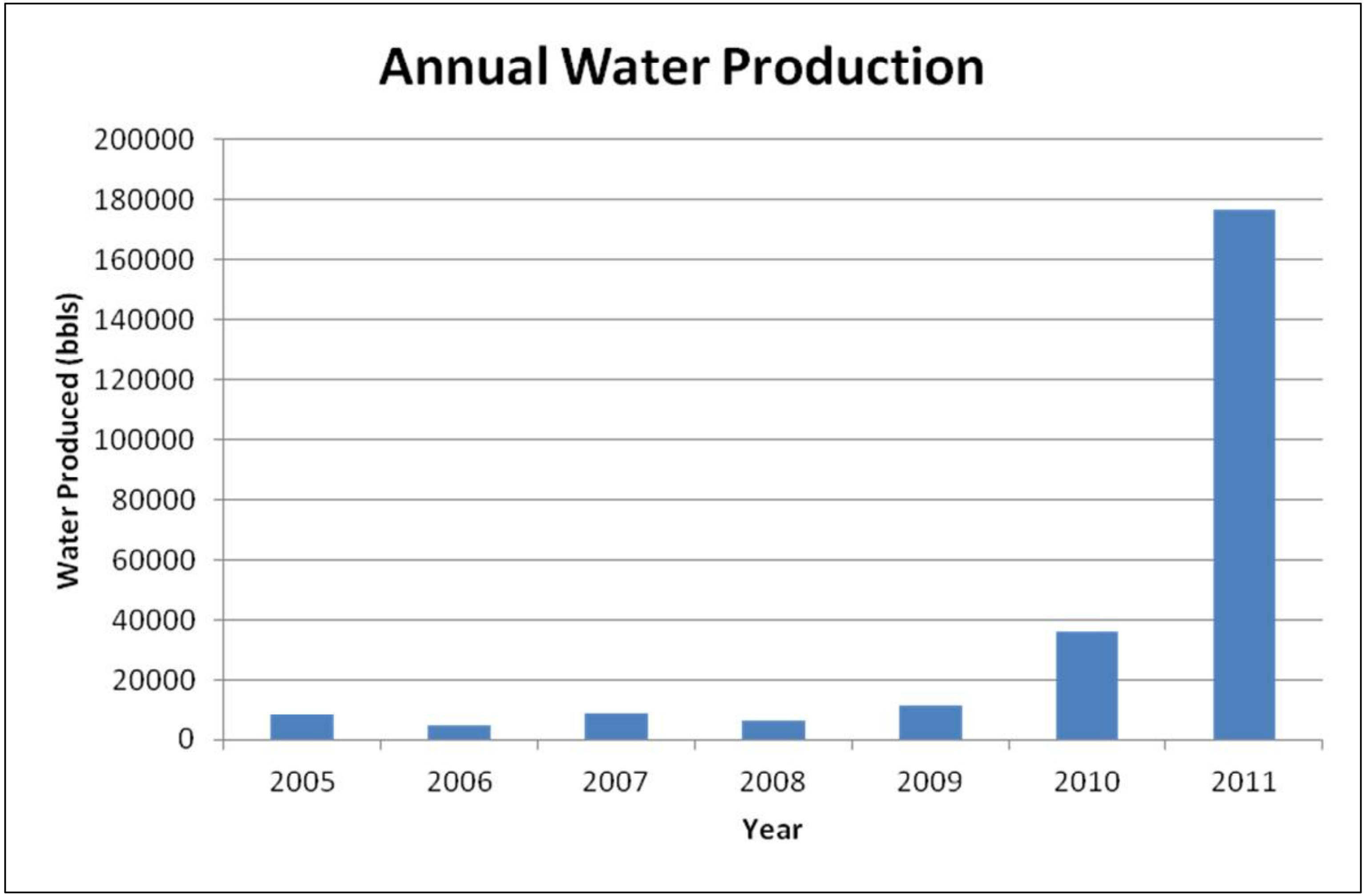

Figure 6: Yearly Associated Water Production

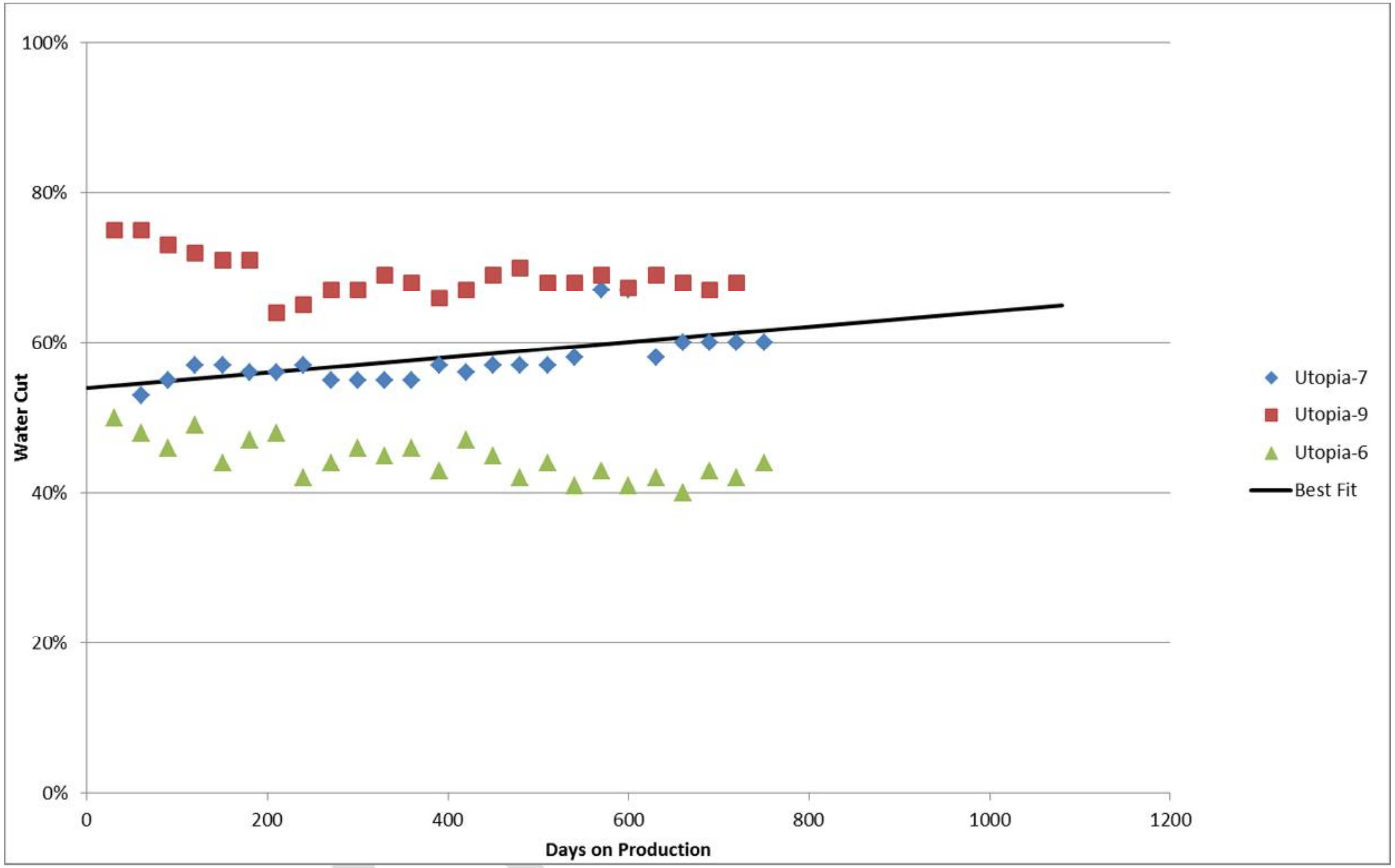

Figure 7: Water Production Graph

Water rates from the three Murta oil wells were used to predict future water production rates.

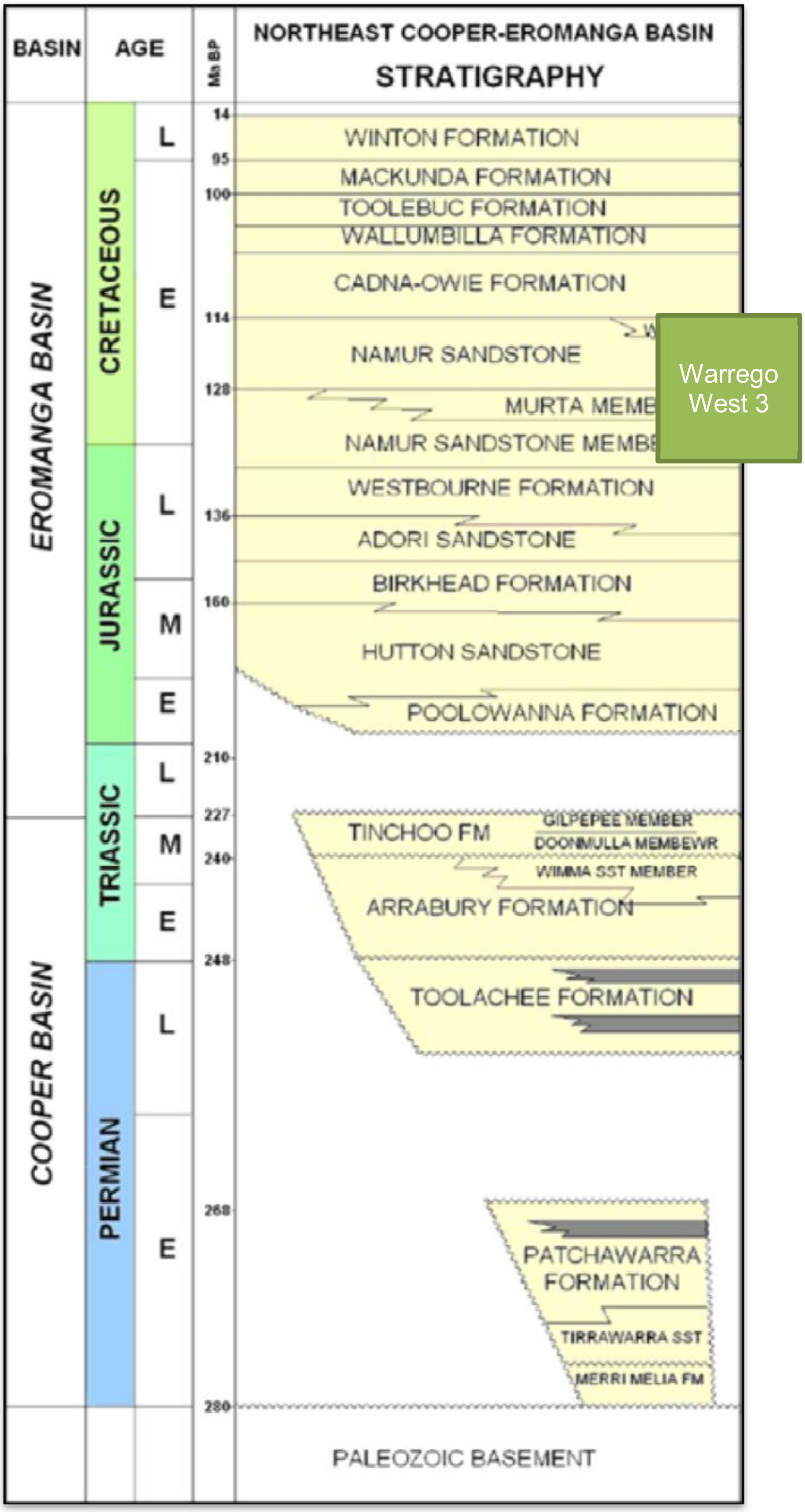

Figure 8: Stratigraphic Column

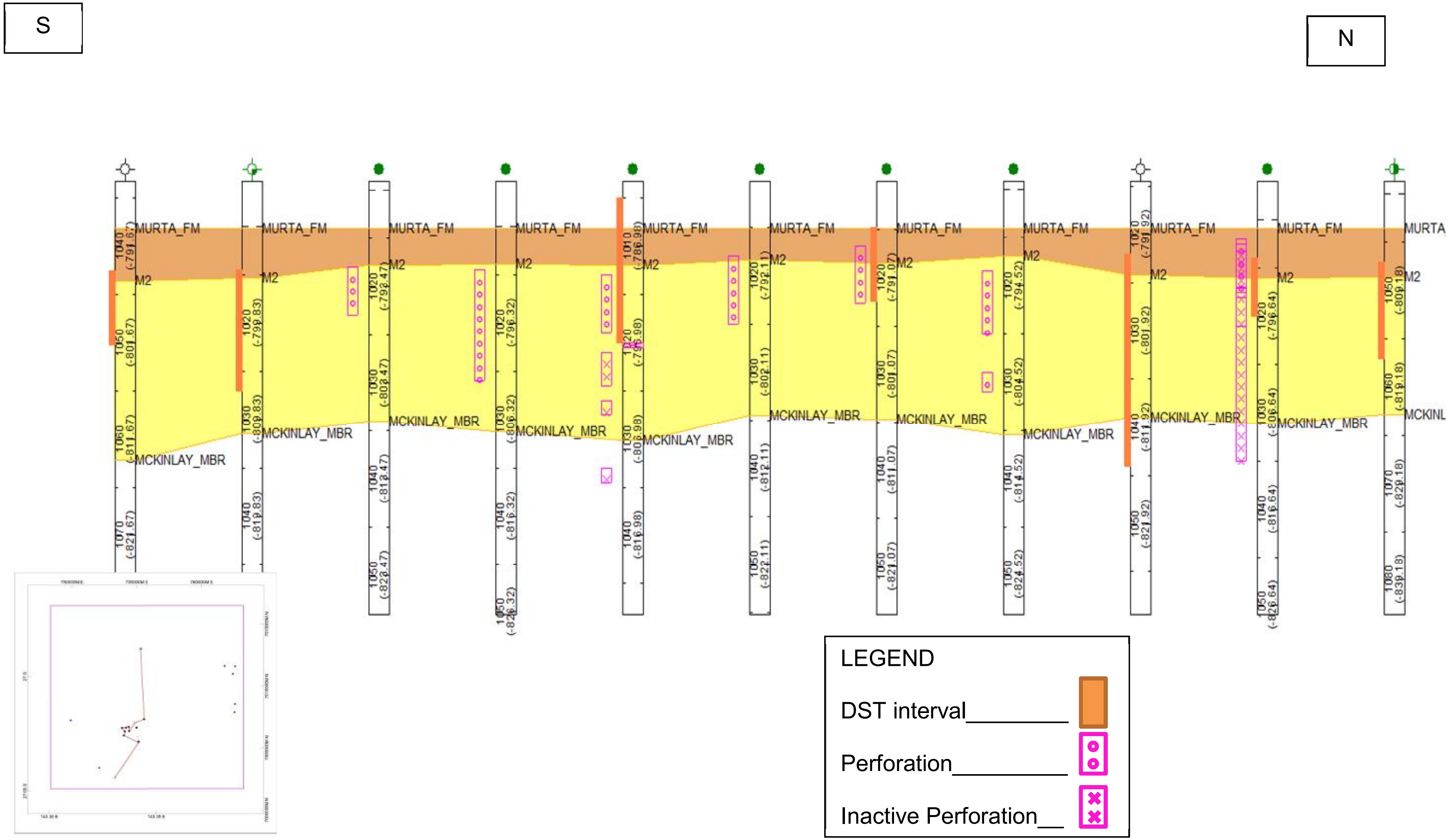

Figure 9: Schematic Cross-section of Warrego West 3 across the Utopia Oilfield (flattened on Murta Member)

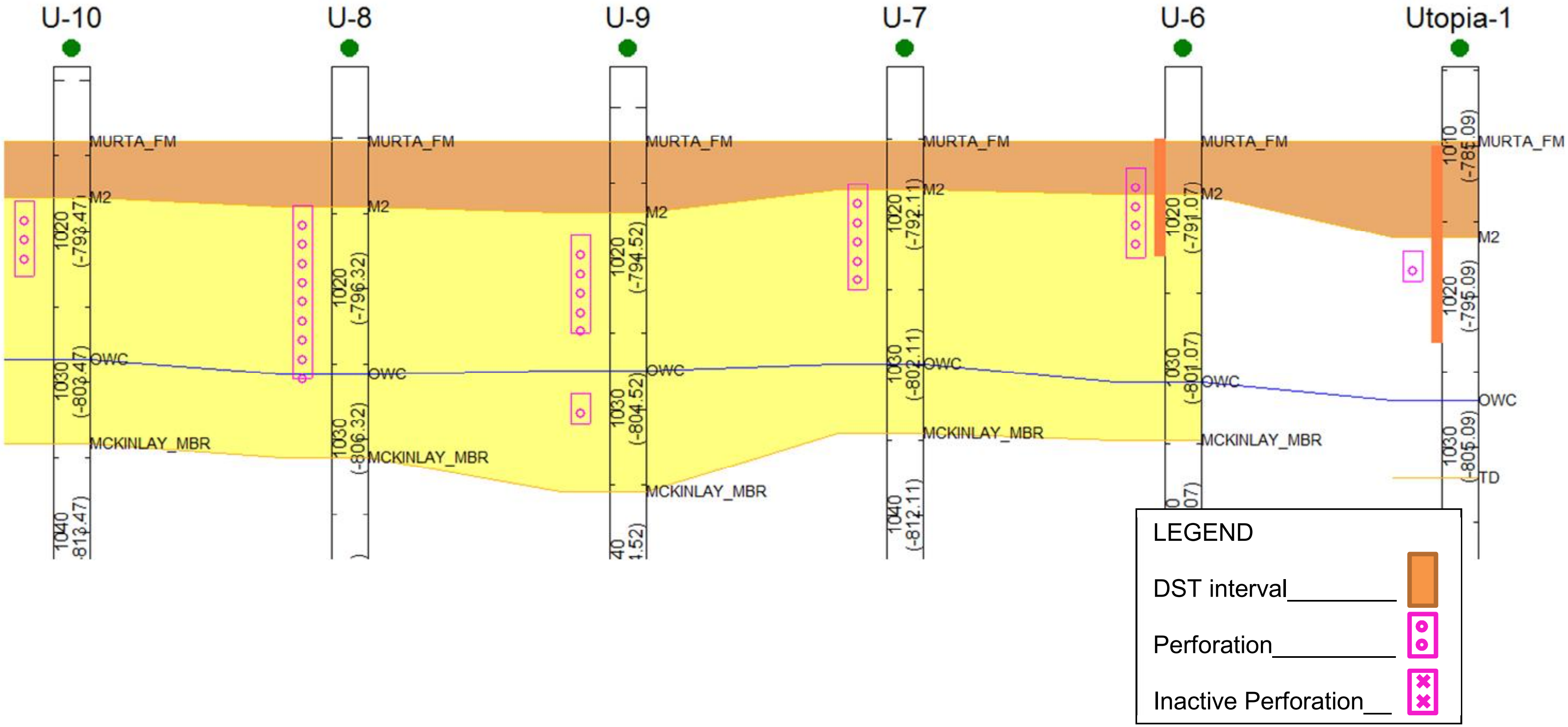

Figure 10: Cross-section of wells that have tested and/or perforated Central 3 reservoirs

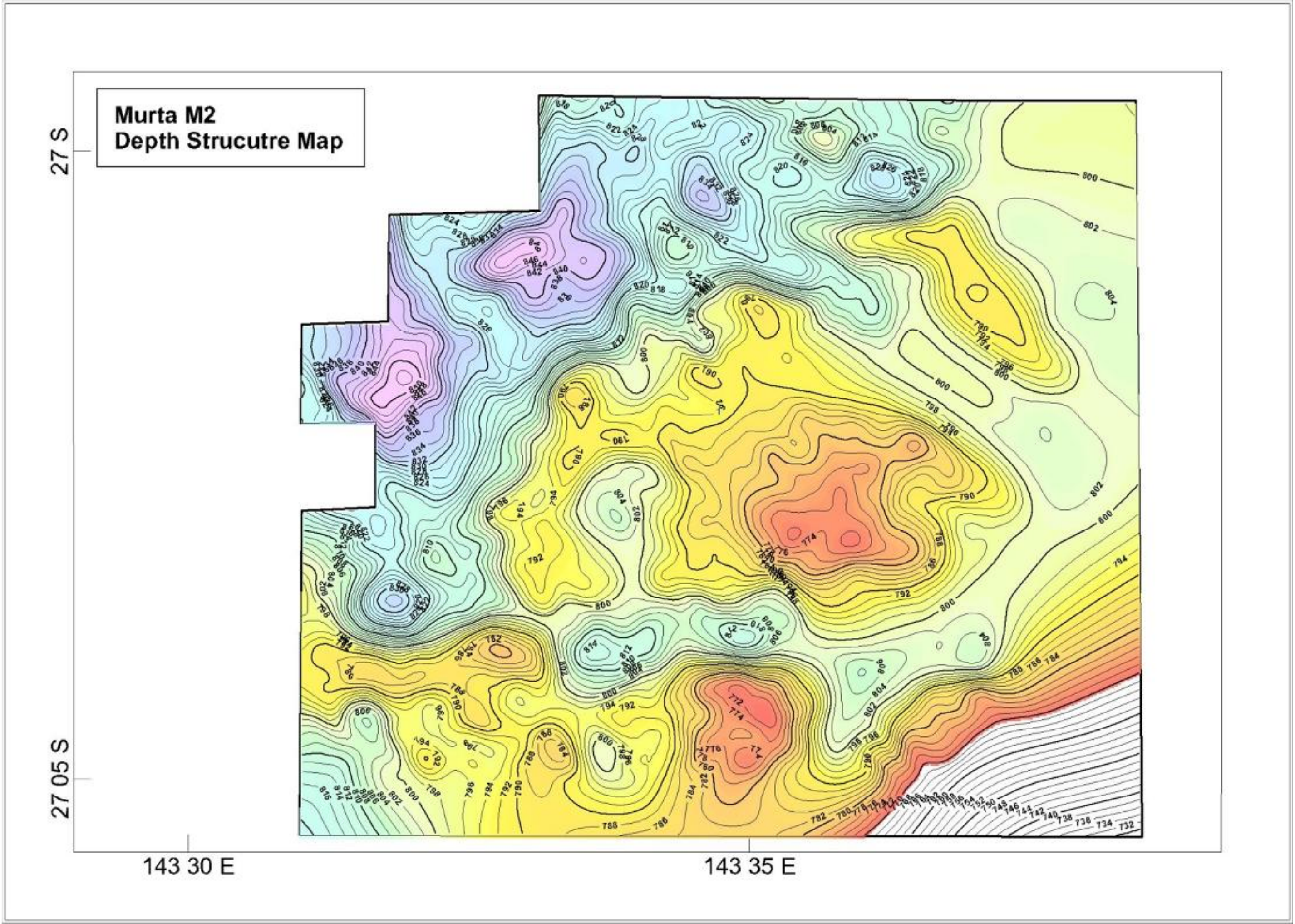

Figure 11: Murta M2 Depth Structure Map

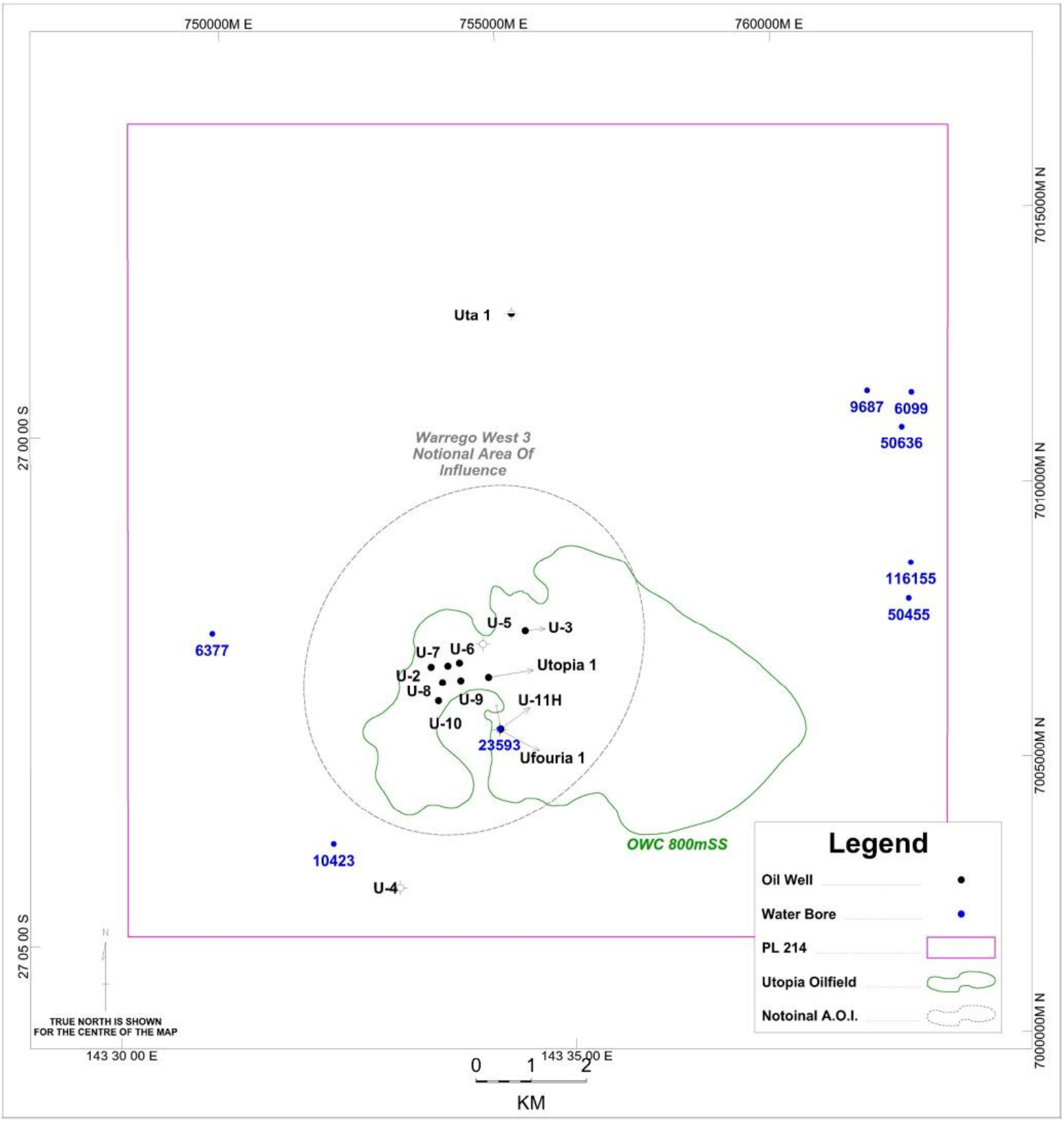

Figure 12: Notional Area of Affected Aquifer

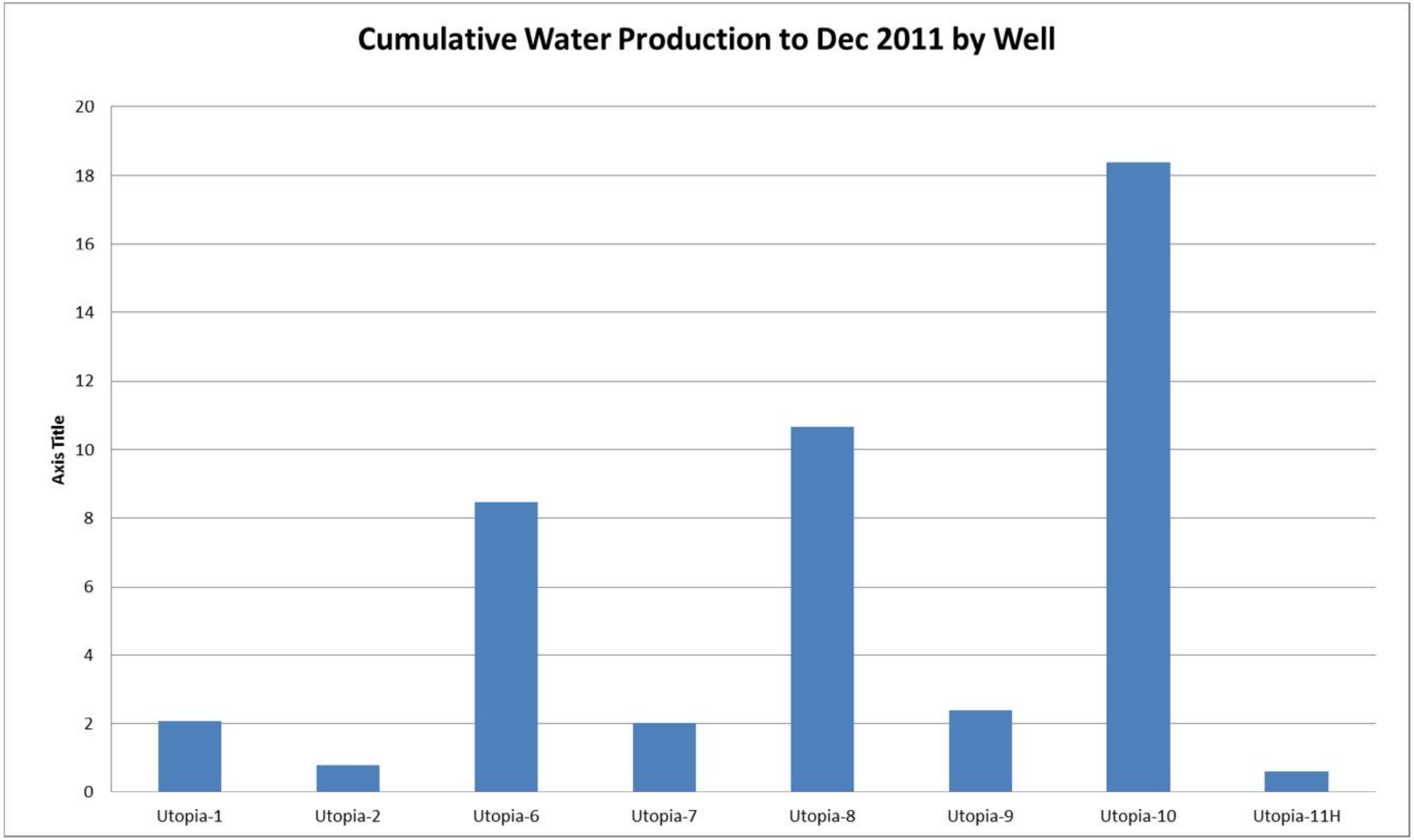

Figure 13: Cumulative Water Production for Individual Utopia Wells (to Dec'11)

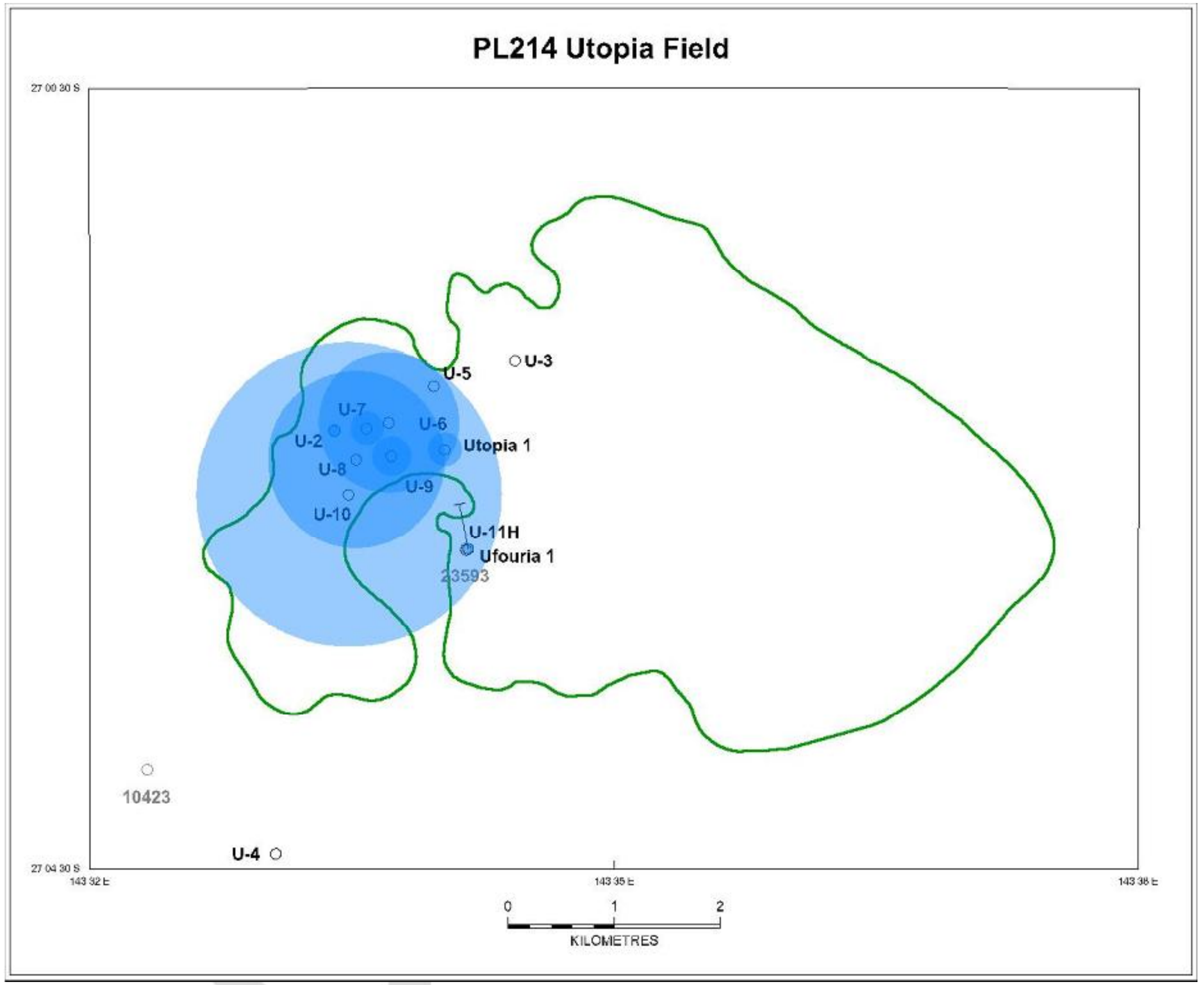

Figure 14: Bubble map showing relative water production from each well (to Dec'11)

Appendix 1 – Well Histories

Ufouria-1

- December 1987drilled
- January 1988 plugged back to 990 m, little water production, shut in
- November 2010, Bridgeport endeavoured to induce water flow from the well, but was unsuccessful. A pump was installed and became stuck at 80 m depth and failed. the well was abandoned.

Utopia-1

- March 1997 drilled, production string run and well was suspended
- June 1997 Murta was perforated in two intervals, a bridge plug was then set about the lowest interval
- April 2009 work over replacing rods in the hole, still in production

UTA-1

- May 1997
- DST recovered 167.6 m of predominantly muddy water. the well was plugged and abandoned

Utopia-2

- September 1997 drilled
- October 1997 completed in the Murta
- June 2004 workover, rod pull and change

Utopia-3

- November 1997 drilled, completion string run and well suspended
- October 2001 perforated
- October 2005 workover, rod pull and change
- April 2007 well was shut in, watered out

Utopia-4

- December 1997 drilled
- DST recovered 79 L (7.9×10^{-5} ML) mud and 842.6L (8.4×10^{-4} ML) water in the drill string, sample chamber collected 3.5 L (3.5×10^{-6} ML) of water. the well was plugged and abandoned

Utopia-5

- August 2005 drilled
- September 2005 DST recovered 0.0029 ML of formation water. the well was plugged and abandoned

Utopia-6

- September 2005 drilled
- DST 1 recovered mud and filtrate; DST 2 recovered oil and mud, no water
- October 2005 the Murta was perforated and is still producing to date

Utopia-7

- December 1997 drilled and perforated and is still producing to date

Utopia-8

- December 2009 drilled
- January 2010 perforated and completed and still producing to date

Utopia-9

- January 2010 drilled and perforated and still producing to date

Utopia-10

- December 2010 drilled, perforated, fracced to enhance flow, watered out, shut in

Utopia-11H

- May 2011 drilled, short radius horizontal well, completed with perforated casing and still producing to date

Appendix 2 – Historical Water Production

Six monthly water production by year.

Table 1: 2005

Months	Associated Water Produced (ML)
Jan-Jun	0.726
Jul-Dec	0.577

Table 2: 2006

Months	Associated Water Produced (ML)
Jan-Jun	0.160
Jul-Dec	0.577

Table 3: 2007

Months	Associated Water Produced (ML)
Jan-Jun	0.900
Jul-Dec	0.500

Table 4: 2008

Months	Associated Water Produced (ML)
Jan-Jun	0.500
Jul-Dec	0.500

Table 5: 2009

Months	Associated Water Produced (ML)
Jan-Jun	0.500
Jul-Dec	1.287

Table 6: 2010

Months	Associated Water Produced (ML)
Jan-Jun	2.295
Jul-Dec	5.501

Table 7: 2011

Months	Associated Water Produced (ML)
Jan-Jun	14.489
Jul-Dec	13.601

Appendix 3 – Water Analysis

Uforia-1

Water Analysis Report Job No. 2242/88 Method W2/1 Page W1

Sample ID. UFOURIA 1 DST 3 WATER SAMPLE

Chemical Composition

		mg/L	me/L
Cations			
Calcium	(Ca)	50.0	2.495
Magnesium	(Mg)	5.0	0.412
Sodium	(Na)	1310.0	56.981
Potassium	(K)	2400.0	61.381
Anions			
Hydroxide	(OH)		
Carbonate	(CO3)		
Bi-Carbonate	(HCO3)	1144.9	18.769
Sulphate	(SO4)	130.0	2.707
Chloride	(Cl)	3451	97.215
Nitrate	(NO3)	5.0	0.081

Other Analyses

Reaction - pH	7.3
Conductivity (E.C) (micro -S/cm at 25°C)	13300
Resistivity Ohm.M at 25°C	0.752

Derived Data

	mg/L
Total Dissolved Solids	
A. Based on E.C.	8325
B. Calculated (HCO3=CO3)	7924
Total Hardness	145
Carbonate Hardness	145
Non-Carbonate Hardness	
Total Alkalinity (Each as CaCO3)	1070

Totals and Balance

Cations (me/L)	121.3	Diff=	2.50
Anions (me/L)	118.8	Sum =	240.04

ION BALANCE (Diff*100/Sum) = 1.04%

Sodium / Total Cation Ratio 47.0%

Remarks

Note: mg/L = Milligrams per litre
me/L = MilliEqivs.per litre

Name:	B. LARUE	Formation	MURTA
Address:	COMMAN PETROLEUM	Type	
	LEVEL 24, 60 MARGARET STREET	Point	
	SYDNEY 2000	Time	
		Interval	1016-1027
		Geologist	
		Depth	

Date Collected
Date Received 1-2-88
Collected by

Utopia-1

SIMMONDS & BRISTOW PTY LTD
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Fax: (07) 3892 3345

Central Queensland
Ph: 1800 620 690

TAMARK PTY LTD

REF NO: 35348 CR30044A

WATER ANALYSIS REPORT

Sampled By: CLIENT

REGD NO	SAMPLE DESCRIPTION	COLLECTED	RECEIVED	TESTED
A:128677 B: C:	UTOPIA 1		14/04/97	14-28/04

S&B METHOD	PHYSICAL ANALYSIS			SAMPLE A	SAMPLE B	SAMPLE C
WP100.	Total Dissolved Salt (Calc'd)		mg/L	4902.		
WP040.	Conductivity @ 25 C		uS/cm	7392.		
WP090.	pH Value			7.7		

S&B METHOD	CHEMICAL ANALYSIS			SAMPLE A	SAMPLE B	SAMPLE C
	MAJOR ELEMENTS					
WC025.111	Calcium	as Ca	mg/L	610.		
WC055.111	Magnesium	as Mg	mg/L	10.		
WC090.111	Sodium	as Na	mg/L	1120.		
WC075.111	Potassium	as K	mg/L	1050.		
WC205.	Hydroxide	as OH	mg/L	<1.		
WC205.	Carbonate	as CO3	mg/L	7.		
WC205.	Bicarbonate	as HCO3	mg/L	1215.		
WC280.4	Sulphate	as SO4	mg/L	30.		
WC220.4	Chloride	as Cl	mg/L	860.		
	MINOR ELEMENTS					
WC250.24	Nitrate	as N	mg/L	<2.		
WC250.34	Nitrite	as N	mg/L	<2.		
WC270.1	Orthophosphate	as P	mg/L	1.9		
	CARBONATE EQUILIBRIUM					
WC205.	Hydroxide Alkalinity	as CaCO3	mg/L	<1.		
WC205.	Carbonate Alkalinity	as CaCO3	mg/L	12.		
WC205.	Bicarbonate Alk'y	as CaCO3	mg/L	996.		
WC205.	Total Alkalinity	as CaCO3	mg/L	1008.		
WC215.	Free Carbon Dioxide	as CO2	mg/L	25.		
WP010.	pHs at CaCO3 Sat'n @ 25 deg			5.82		
WC215.	Free CO2 at Sat'n	as CO2	mg/L	1914.		
WC215.	Aggr. Carbon Dioxide	as CO2	mg/L	<1.		
WC025.	Calcium Hardness	as CaCO3	mg/L	1523.		
WC055.	Magnesium Hardness	as CaCO3	mg/L	41.		
WC247.	Total Hardness	as CaCO3	mg/L	1564.		
	SUM(ANIONS - SUM(CATIONS)					
	Actual		mEq/L	-61.68		
	Acceptable +/-		mEq/L	0.81		
WP130.	Sodium Adsorption Ratio			12.31		
WP105.	Residual Alkali		mEq/L	<0.1		
WP055.	Irrigation Classification			C5-S3		

The results obtained for 'IRRIGATION CLASSIFICATION' are interpretative results and therefore not subject to NATA Certification

Per ....
06/05/97

UTA-1

SIMMONDS & BRISTOW PTY LTD

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Fax: (079) 361 788

TAMARK PTY LTD
CLIENT REF: UTA #1

REF NO: 35851

WATER ANALYSIS REPORT

Sampled By: CLIENT

REGD NO	SAMPLE DESCRIPTION	COLLECTED	RECEIVED	TESTED
A:130927	MIDDLE REC OWI 2		02/06/97	06-17/06
B:130928	SAMPLE CHAMBER OWI 5		02/06/97	02-17/06
C:				

S&B METHOD	PHYSICAL ANALYSIS			SAMPLE A	SAMPLE B	SAMPLE C
WP100.	Total Dissolved Salt (Calc'd)		mg/L	11438.	6868.	
WP040.	Conductivity @ 25 C		uS/cm	12000.	9180.	
WP090.	pH Value			7.6	7.6	

S&B METHOD	CHEMICAL ANALYSIS			SAMPLE A	SAMPLE B	SAMPLE C
	MAJOR ELEMENTS					
WC025.111	Calcium	as Ca	mg/L	180.	90.	
WC055.111	Magnesium	as Mg	mg/L	20.	20.	
WC090.111	Sodium	as Na	mg/L	1100.	890.	
WC075.111	Potassium	as K	mg/L	4000.	1900.	
WC205.	Hydroxide	as OH	mg/L	<1.	<1.	
WC205.	Carbonate	as CO3	mg/L	5.	5.	
WC205.	Bicarbonate	as HCO3	mg/L	883.	1063.	
WC280.4	Sulphate	as SO4	mg/L	50.	150.	
WC220.4	Chloride	as Cl	mg/L	5200.	2750.	
	MINOR ELEMENTS					
WC250.22	Nitrate	as N	mg/L	0.15	0.11	
WC250.31	Nitrite	as N	mg/L	0.01	<0.01	
WC270.1	Orthophosphate	as P	mg/L	0.01	0.01	
	CARBONATE EQUILIBRIUM					
WC205.	Hydroxide Alkalinity	as CaCO3	mg/L	<1.	<1.	
WC205.	Carbonate Alkalinity	as CaCO3	mg/L	9.	9.	
WC205.	Bicarbonate Alk'y	as CaCO3	mg/L	724.	871.	
WC205.	Total Alkalinity	as CaCO3	mg/L	733.	880.	
WC215.	Free Carbon Dioxide	as CO2	mg/L	20.	27.	
WP010.	pHs at CaCO3 Sat'n @ 25 deg			6.52	6.72	
WC215.	Free CO2 at Sat'n	as CO2	mg/L	247.	208.	
WC215.	Aggr. Carbon Dioxide	as CO2	mg/L	<1.	<1.	
WC025.	Calcium Hardness	as CaCO3	mg/L	449.	225.	
WC055.	Magnesium Hardness	as CaCO3	mg/L	82.	82.	
WC247.	Total Hardness	as CaCO3	mg/L	532.	307.	
	SUM(ANIONS - SUM(CATIONS)					
	Actual		mEq/L	1.42	4.76	
	Acceptable +/-		mEq/L	2.62	1.63	
WP130.	Sodium Adsorption Ratio			20.73	22.07	
WP105.	Residual Alkali		mEq/L	4.01	11.45	
WP055.	Irrigation Classification			UNSUIT	UNSUIT	

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Petroleum Services

CR31234A

TABLE 1 - WATER ANALYSIS

JOB NUMBER: LQ6459

WELL / ID: Utopia-2
SAMPLE TYPE: Water
SAMPLE POINT: Perforation water sample
DATE COLLECTED 29/10/97
DATE RECEIVED: 15/11/97

FORMATION: Zone-3
INTERVAL: 1021-1024.5
COLLECTED BY: Client

PROPERTIES:

pH (measured) = 7.9
Resistivity (Ohm.M @ 25°C) = 2.99
Electrical Conductivity (µS/cm @ 25°C) = 3340
Specific Gravity (S.G. @ 20°C) = na
Measured Total Dissolved Solids(Evap@180°C) mg/L = na
Measured Total Suspended Solids mg/L = na

CHEMICAL COMPOSITION

CATIONS		mg/L	meq/L	ANIONS		mg/L	meq/L
Ammonium	as NH_4	na	na	Bromide	as Br	na	na
Potassium	as K	247	6.32	Chloride	as Cl	340	9.58
Sodium	as Na	494	21.49	Fluoride	as F	na	na
Barium	as Ba	na	na	Hydroxide	as OH	nd	nd
Calcium	as Ca	8	0.40	Nitrite	as NO_2	na	na
Iron	as Fe	na	na	Nitrate	as NO_3	nd	nd
Magnesium	as Mg	2	0.16	Sulphide	as S	na	na
Strontium	as Sr	na	na	Bicarbonate	as HCO_3	1192	19.54
Boron	as B	na	na	Carbonate	as CO_3	nd	nd
				Sulphite	as SO_3	na	na
				Sulphate	as SO_4	70	1.46
Total Cations		751	28.37	**Total Anions**		1602	30.58

DERIVED PARAMETERS

a) Ion Balance (Diff*100/Sum) (%) = 3.74
b) Total Alkalinity (calc as $CaCO_3$) (mg/L) = 977
c) Total of Cations + Anions = 2353
(measured dissolved salts)

d) Theoretical Total dissolved salts = 2137.6
(From Electrical Conductivity)

QUALITY CONTROL COMMENTS

Item	Actual Value	Acceptance Criteria	Satisfactory? (Yes/No)
Ion Balance (%) =	3.74	5%	Yes
Undetected ions % =	-10.08	10%	Yes
(from comparison of measured vs theoretical salts derived from measured conductivity)			
Expected pH range		< 8.3	Yes
% difference between measured total dissolved solids and calc total dissolved salts (from ionic comp) =	na	5%	na

na = not applicable
nd = not detected
is = insufficent sample

If No - what action is recommended by Amdel

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TABLE 1 - WATER ANALYSIS

JOB NUMBER: LQ6671

WELL / ID: UTOPIA-4
SAMPLE TYPE: Formation Water
SAMPLE POINT: Sample Chamber
DATE COLLECTED:
DATE RECEIVED: 09/02/98

FORMATION: Murta
INTERVAL: 1042.5-1050.2m
COLLECTED BY: Client

CR31232A

PROPERTIES:

pH (measured) = 7.55
Resistivity (Ohm.M @ 25°C) = 0.19
Electrical Conductivity (µS/cm @ 25°C) = 53330
Specific Gravity (S.G. @ 20°C) = na
Measured Total Dissolved Solids(Evap@180°C) mg/L = na
Measured Total Suspended Solids mg/L = na

CHEMICAL COMPOSITION

CATIONS		mg/L	meq/L
Ammonium	as NH_4	na	na
Potassium	as K	1125	28.77
Sodium	as Na	725	31.54
Barium	as Ba	na	na
Calcium	as Ca	55	2.74
Iron	as Fe	na	na
Magnesium	as Mg	43	3.54
Strontium	as Sr	na	na
Boron	as B	na	na
Total Cations		1948	66.59

ANIONS		mg/L	meq/L
Bromide	as Br	na	na
Chloride	as Cl	1253	35.30
Fluoride	as F	na	na
Hydroxide	as OH	nd	nd
Nitrite	as NO_2	na	na
Nitrate	as NO_3	nd	nd
Sulphide	as S	na	na
Bicarbonate	as HCO_3	1386	22.72
Carbonate	as CO_3	nd	nd
Sulphite	as SO_3	na	na
Sulphate	as SO_4	nd	nd
Total Anions		2639	58.02

DERIVED PARAMETERS

a) Ion Balance (Diff*100/Sum) (%) = 6.88
b) Total Alkalinity (calc as $CaCO_3$) (mg/L) = 1136
c) Total of Cations + Anions = 4587
(measured dissolved salts)

d) Theoretical Total dissolved salts = 34131.2
(From Electrical Conductivity)

QUALITY CONTROL COMMENTS

Item	Actual Value	Acceptance Criteria	Satisfactory? (Yes/No)
Ion Balance (%) =	6.88	5%	No - Recommend further testing
Undetected ions % =	86.56	10%	Yes
(from comparison of measured vs theoretical salts derived from measured conductivity)			
Expected pH range		< 8.3	Yes
% difference between measured total dissolved solids and calc total dissolved salts (from ionic comp) =	na	5%	na

na = not applicable
nd = not detected
is = insufficent sample

If No - what action is recommended by Amdel

Utopia-5

WATER ANALYSIS

Client :	Oil Wells Inc. of Kentucky
Well:	Utopia-5
Sample:	Utopia-5, DST#1

CHEMICAL COMPOSITION

	Cations			Anions	
	mg/L	meq/L		mg/L	meq/L
Sodium (Na):	658	28.6	Chloride (Cl):	1130	31.8
Calcium (Ca):	23	1.1	Bi-Carbonate (HCO_3):	1080	21.6
Magnesium (Mg):	2	0.2	Sulphate (SO_4):	80	1.7
Iron (Fe):	0.05	0.0	Carbonate (CO_3):	1	0.0
Potassium (K):	865	22.1	Fluoride (F):	2.6	0.1
			Hydroxide (OH):	1	0.0

Note: Bi-Carbonate, Carbonate and Hydroxide ions measured as $CaCO_3$

DERIVED DATA

Total Dissolved Solids:	mg/L
Based on E.C.	3750
Calculated (HCO_3 = CO_3)	3400
Total Hardness (as $CaCO_3$)	66
Total Alkalinity (as $CaCO_3$)	1080

OTHER ANALYSES

Resistivity	1.730 ohm.m @ 25 °C
Conductivity (E.C.)	5770 µS/cm @ 25 °C
Reaction - pH	8.0
Density (g/cm^3)	1.0064

TOTAL AND BALANCE

Cations	52
Anions	55
Ion Balance (Diff*100/sum)	2.968
Sodium Adsorption Ratio	35
Difference (Anions - Cations)	3
Sum (Anions + Cations)	107

Utopia-6

WATER ANALYSIS

Client : Oil Wells Inc. of Kentucky
Well: Utopia-6

CHEMICAL COMPOSITION

	Cations			Anions	
	mg/L	meq/L		mg/L	meq/L
Sodium (Na):	568	24.7	Chloride (Cl):	86	2.4
Calcium (Ca):	3	0.1	Bi-Carbonate (HCO_3):	1160	23.2
Magnesium (Mg):	<1	0.0	Sulphate (SO_4):	51	1.1
Iron (Fe):	1.09	0.0	Carbonate (CO_3):	<1	0.0
Potassium (K):	24	0.6	Fluoride (F):	2.7	0.1
			Hydroxide (OH):	<1	0.0

Note: Bi-Carbonate, Carbonate and Hydroxide ions measured as $CaCO_3$

DERIVED DATA

Total Dissolved Solids:	mg/L
Based on E.C.	1390
Calculated ($HCO_3 = CO_3$)	1430
Total Hardness (as $CaCO_3$)	8
Total Alkalinity (as $CaCO_3$)	1160

TOTAL AND BALANCE

Cations	26
Anions	27
Ion Balance (Diff*100/sum)	2.471
Sodium Adsorption Ratio	89
Difference (Anions - Cations)	1
Sum (Anions + Cations)	52

OTHER ANALYSES

Resistivity	4.670 ohm.m @ 25 °C
Conductivity (E.C.)	2140 µS/cm @ 25 °C
Reaction - pH	8.1
Density (g/cm^3)	1.0062