Shale Gas Prospectivity Potential

Prepared for:

Australian Council of Learned Academies (Acola)

Prepared By: Kane Rawsthorn

Date: 23rd January 2013

Revision No: Final

1 Executive Summary

The 19 potential Shale Gas Plays in Australia with very variable rock type have been screened by AWT to be classified as a Shale Gas Play and Prospective resource numbers have been calculated for each of these plays. They range in age from Paleoproterozoic (1600+ million years ago (ma)) to Cretaceous (150 ma). The extent of the Plays range from 150 km^2 to 145,000 km^2 and are widely scattered across the Australian continent. The size of Australia, with the identification so far of 19 Shale Gas Plays, is similar in overall size and number of plays to the US, where at least 33 separate Shale Gas Plays have been discovered, suggesting that the current analysis is not unreasonable. The organic source material ranges from marine Type I through to terrestrial Type III which in many cases is different from the Shale Gas Plays in North America, which are almost entirely marine source rocks (Type I / II).

The REM Shale Gas Play in the Cooper Basin is considered by AWT to be the most advanced play in Australia, the source rock sequences in the active Cooper Basin petroleum system, may be commercially developed in a gradual way by the major operators in the basin through the extensive gas gathering system already in place. By comparison, many of the other basins are quite remote and, should exploration prove a viable gas potential, it will take many years to mature and transport to a market.

Nevertheless, large companies are positioning themselves to secure large gas resources for the future and there is potential to create significant acreage value increase by discovering large contingent resource volumes. We consider Australia to be a good place to carry out this type of exploration and development, given small population concentrated in coastal cities, tolerance of mining in general. Fracture stimulation could be more easily carried out in remote areas where there is little effect on community. The country is developing a network of gas pipelines to major LNG ports.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

2 Scope

Australian Council of Learned Academies (Acola) requested that AWT International Pty Ltd (AWT) undertake an assessment of likely shale gas resources in Australia based on proprietary and publicly available information. AWT has provided for each of the major basins a Best Estimate (P50) of Prospective Resource numbers. AWT has also provided both wet gas area and dry gas area and hydrocarbon volumes for each of 19 shale gas plays (Figure 1) screened in the AWT Shale Gas Atlas 2012. AWT has also provided 19 maps (Appendix 1) of the shale pod distribution of the wet and dry gas areas as we have described them, with existing infrastructure.

3 DEFINITION OF A SHALE GAS PLAY

3.1 SPE guideline for a Shale Gas Play

SPE has defined the terminology for the Shale Gas Play as described below

"Shale gas is produced from organic-rich mudrocks, which serve as a source, trap, and reservoir for the gas. Shales have very low matrix permeabilities (hundreds of nanodarcies), requiring either natural fractures and/or hydraulic-fracture stimulation to produce the gas at economic rates. Shales have diverse reservoir properties, and a wide array of drilling, completion, and development practices are being applied to exploit them. As a result, the process of estimating resources and reserves in shales needs to consider many different factors and remain flexible as our understanding evolves.

Shales are complex rocks that exhibit submillimeter-scale changes in mineralogy, grain size, pore structure, and fracturing. In thermogenic shale gas reservoirs (like the Barnett shale in the US and the REM play in Australia), the organic matter has been sufficiently cooked to generate gas, which is held in the pore space and sorbed to the organic matter. In biogenic shale gas reservoirs (like the Antrim shale in the US and the Toolebuc Fm in Australia) the organic matter has not been buried deep enough to generate hydrocarbons. Instead, bacteria that has been carried into the rock by water has generated biogenic gas that is sorbed to the organics. TOC (Total Organic Content) values are high in biogenic shales (often > 10 wt%), but relatively low (> 2 wt%) in thermogenic shales where most of the TOC has been converted to hydrocarbons.

A common feature of productive thermogenic shale gas plays is brittle reservoir rock containing significant amounts of silica or carbonate and "healed" natural fractures. Relative to more clay-rich rock, the brittle rock shatters when hydraulically fracture stimulated, which maximizes the contact area. Thermogenic shales are often referred to as "fracturable" shales instead of "fractured" shales. In contrast, biogenic shales are commonly less brittle and rely on the existence of open natural fractures to provide conduits for water and gas production. "

Shale gas reservoirs are often the source rocks for conventional gas and oil accumulations (Figure 2). However, based on a review of the characteristics of shale gas plays in the US, it has been realised that there is a wide variety in many of the play parameters beyond the reservoir being fine-grained and of low permeability.

4 METHODOLOGY FOR DEFINING SHALE GAS PLAY

4.1 Shale Gas Play Screening Criteria

The evaluation of the potential Shale Gas Plays for each basin takes place in 4 steps:

1. Regional source rock assessment (degree of thermal maturity)
2. Play screening criteria
3. Play description
4. Resource assessment

After initial evaluation of the regional data to identify the mature source rocks in the basin (Step 1), a Shale Gas Play screening test (Step 2) is applied to each of these units. The screening test compares the data available against common factors in successful US Shale Gas Plays:

- Lithotype - fine-grained lithology with evidence of sufficient TOC concentration
- Thickness - greater than 30m (100 ft)
- Maturity - Wet Gas window 0.8 - 1.2 VRo and Dry Gas window greater than 1.2 VRo
- Moderate to low clay content less than 40% with very low mixed layer content
- Brittle composition (low Poisson's ratio and high Young's Modulus)
- Has a rock fabric (natural fractures) that enhances productivity
- High lateral continuity of reservoir conditions
- The organic matter is not oxidised

Where data is unavailable for a potential play, an evaluation of the regional information was made to decide if it is likely that the screening condition can be met.

In the US, a storage capacity that exceeds 3 m^3/tonne (100 scf/ton) is considered a critical factor for commercial success and a lot of effort and expenditure is put into accurately evaluating this parameter. However, due to the lack of Shale Gas exploration drilling and appropriate measurements to calculate storage capacity in the Australian Plays this parameter cannot be used as a screening criteria at this time.

AWT has examined 26 Basins in onshore Australia and have identified 19 individual Shale Gas Plays (Table 1) that meet the above screening criteria. Section 5.1 shows a listing of screened basin that did not fit the current criteria to be included as Shale Gas plays. Individual maps with Shale Gas Play extents and existing infrastructure are attached as an appendix in this report. Reference listing has also been provided for each of the Shale Gas Plays.

5 Shale Gas Play Prospective Resource Estimates

AWT has examined 26 Basins in onshore Australia and have identified 19 individual Shale Gas Plays (Table 1) that meet the above screening criteria. High level overview was undertaken to identified these 19 Shale Gas Plays, with increased exploration and mapping in many of these basins, additional Shale Gas Plays may become known.

Table 1. Prospective Resource estimates of Shale Gas Plays that meet screening criteria.

Basin	Play	Gas Pod	Area (km^2)	Best Estimate Recoverable Resource (Tcf)	BOE volume (MMbls)	BOE/km^2	Recoverable Resource bcf/km^2
Amadeus	Horn Valley	Dry	7,267	**16**	**2777**	**0.38**	**2.19**
Beetaloo	Kyalla	Dry	898	**3**	**467**	**0.46**	**2.62**
	Velkerri	Dry	6,092	**16**	**2796**	**0.46**	**2.62**
Bonaparte	Milligans	Dry	2,752	**6**	**1090**	**0.28**	**1.60**
Bowen	Black Alley	Dry	51,252	**97**	**16979**	**0.33**	**1.89**
Canning	Goldwyer	Wet	147,305	**409**	**71306**	**0.48**	**2.77**
		Dry	139,321	**387**	**67444**	**0.48**	**2.77**
	Laurel	Wet	48,285	**106**	**18459**	**0.38**	**2.19**
		Dry	28,704	**63**	**10973**	**0.38**	**2.19**
Carnarvon	Byro Group	Dry	6,162	**9**	**1575**	**0.25**	**1.46**
Clarence-Moreton	Koukandowie	Dry	4,407	**11**	**1901**	**0.43**	**2.48**
	Raceview	Dry	4,407	**10**	**1677**	**0.38**	**2.19**
Cooper	Roseneath, Epsilon, Murteree (REM)	Wet	3,604	**14**	**2385**	**0.66**	**3.79**
		Dry	9,106	**35**	**6026**	**0.66**	**3.79**
Eromanga	Toolebuc	Dry	93,263	**82**	**14244**	**0.15**	**0.87**
Georgina	Arthur Creek	Dry	14,433	**50**	**8731**	**0.51**	**2.91**
Gunnedah	Watermark	Dry	8,631	**13**	**2185**	**0.25**	**1.46**
Maryborough	Cherwell	Dry	3,264	**7**	**1289**	**0.41**	**2.33**
McArthur	Barney Creek	Wet	2,867	**7**	**1304**	**0.51**	**2.91**
		Dry	158	**0.4**	**72**	**0.51**	**2.91**
Otway	Eumeralla	Dry	4,109	**9**	**1563**	**0.38**	**2.19**

Pedirka	Purni	Dry	29,357	**43**	**7470**	**0.25**	**1.46**
Perth	Kockatea	Wet	5,818	**7**	**1184**	**0.20**	**1.17**
		Dry	14,123	**16**	**2874**	**0.20**	**1.17**

5.1 Basins that didn't meet Screening Criteria

Whilst screening the onshore sedimentary basins in Australia, numerous formations did have some characteristics of a potential Shale Gas Play. However to be classified as a Shale Gas Play they had to meet all screening criteria outlined in section 3.1, the three main reasons why the potential play didn't meet the criteria are outline below and summarised in Table 2.

- Lack of sufficient thickness (criteria to be reached >30m of formation).
- Formation lacks thermal maturity greater than 0.8 Vitrinite Reflectance (VRo). However, sometimes there was limited data and no contoured VRo maps to define the Play extent. In these cases, a number of other methods were used including, though not limited to, minimal thermal maturity data, depth contours, geothermal gradients and ideas expressed in publications.
- A lack of available data to make an informed decision on Shale Gas Play parameters.

It should be noted that with increased data from exploration, some of these basins could possibly meet the screening criteria to be classified as a Shale Gas Play

Table 2. Basins that didn't meet Screening Criteria.

Basin	Reason
Adavale	Classified as Tight Sand stratigraphic play
Arckaringa	Insufficient maturity data available, to determine if shales have potential
Darling	Data from cores shows the shale sections appear to be heavily oxidised thus TOC preservation is poor
Drummond	Evidence from Mooga 1 the most complete section available indicates the Drummond Basin sediments have low TOC < 0.5% – no source rocks. This is backed up by regional descriptions of the Drummond Basin as being deposited in shallow water and oxidizing environments.
Galilee	Toolebuc Formation included in Eromanga Basin
Gippsland	Lack of sufficient older lacustrine shale's of the Emperor Subgroup maturity extending onshore.
Officer	Is classified as having a Tight Sands Gas play as opposed to a Shale Gas play
Simpson	Unknown at this stage, but appears to be due to the absence of laterally thick shale sequences
Surat	Insufficient maturity and thickness in the Evergreen Fm
Sydney	TOC data extremely lean and extent of Shale unknown with respect to depth.

	Wells in area currently targeting shallower CSG plays
Warburton	Currently no known indigenous source rocks; gas and oil from down dip Cooper Basin source rocks.

6 Methodology for Calculating Prospective Resource

6.1 Best Estimate Calculation

The method of resource estimation employed by AWT has been guided by industry practices in the US. The calculation has been undertaken where ranges for Shale Gas Play parameters were developed by reviewing well, seismic, geological data, and US analogues. A Best Estimate approach to the calculation of Prospective Resources for the 19 Shale Gas Plays identified by AWT has been undertaken using the following calculation in Table 3 (parameters from the REM Wet Gas play in the Cooper Basin are shown in this calculation).

Table 3. Best Estimate calculation of Prospective Resource

Parameter	Input	Unit
Area km^2	3,610	km^2
Height m	130	m
Bulk Rock Volume	469,300,000,000	m^3
Shale Density	2.5	g/cc
Mass of shale	1,420,575,000,000	t
Net to Gross of total thickness	100%	%
Total Gas capacity	2.20	cc/g
Total Gas capacity	2.20	m3/t
Total gas in place	3.13	tcm
Total gas in place (TGIP)	**91.1**	tcf
Recovery factor	15%	%
Recoverable Volume	**13.7**	tcf
Barrels of Oil Equivalent (BOE) volume	**2385**	MMbls

A recovery factor was applied to the best estimate in-place volumes to estimate the recoverable volume of hydrocarbon from each reservoir (Table 1). The recovery factor used was determined by analysing production data from US Shale Gas Plays. It was determined that an average recovery factor of 15% was the best fit for the majority of production from Shale Gas Plays.

6.2 SPE guideline for Best Estimate

The input parameters for each Shale Gas Play assessment were selected using the SPE 2011 Guidelines of the "Best Estimate". The SPE Guideline for Best Estimate is outlined below.

With respect to resource categorisation, this is considered to be the best estimate of the quantity that will actually be recovered from the accumulation by the project. It is the most realistic assessment of recoverable quantities if only a single result were reported. If probabilistic methods are used, there should be at least a 50% probability (P50) that the quantities actually recovered will equal or exceed the best estimate.

6.3 Justification for Best Estimate calculation

At this early stage in the evaluation of Australian Shale Gas Plays, estimates of the Prospective Resource have high uncertainty, as plays are as not yet adequately explored. Additionally the ranges of uncertainty are too high and the high and low sides values would be unrealistic using a Monte Carlo calculation.

7 SPE Definition of Prospective Resource

7.1 SPE guideline for Prospective Resource

The SPE Guideline for Prospective Resource is outlined below.

Prospective resources are estimated volumes associated with undiscovered accumulations. These represent quantities of petroleum which are estimated, as of a given date, to be potentially recoverable from oil and gas deposits identified on the basis of indirect evidence but which have not yet been drilled. This class represents a higher risk than contingent resources since the risk of discovery is also added. For prospective resources to become classified as contingent resources, hydrocarbons must be discovered, the accumulations must be further evaluated and an estimate of quantities that would be recoverable under appropriate development projects prepared.

Some petroleum will be classified as "unrecoverable" at this point in time, not being producible by any projects that the company may plan or foresee. While a portion of these quantities may become recoverable in the future as commercial circumstances change or technological developments occur, some of the remaining portion may never be recovered due to physical or chemical constraints in the reservoir. The volumes classified using the system represent the analysis of the day, and should be regularly reviewed and updated, as necessary, to reflect changing conditions.

A project may have recoverable quantities in several resource classes simultaneously. As barriers to development are removed, some resources may move to a higher classification. One of the primary distinctions between resources and reserves is that while resources are technically recoverable, they may not be commercially viable. Reserves are always commercially viable and there is intent development them.

8 Potential Shale Gas Play Sweet Spots

Potential Shale Gas Play sweet spots are plays that have an alignment of positive criteria, based on a review of the characteristics of commercial Shale Gas Plays in the US.

Shale Gas success is dependent on finding the most prospective areas, or the "sweet spots," and aligning the well for maximum borehole exposure to these zones. In Shale Gas Plays this means placing the well in the zones most conducive to fracturing. This requires a thorough understanding of the shale gas reservoir characteristics. Aiming for the middle is rarely a successful strategy, as shales can have significant variance in thickness and composition.

Fluid composition and reservoir pressure are essential elements in the assessment of Shale Gas Plays. The sweet spot part of the Shale Gas Play is often defined by the intersection of high reservoir pressure with the right gas-oil ratio. Review of US Shale Gas Plays, indicates that operators are utilising production data to validate the sweet spot, however as no Australia Shale Gas Plays currently have production data using this method isn't an option in identifying Shale Gas sweet spots in Australian Basins.

TOC and porosity are also key indicators of Shale Gas Play sweet spot zones. TOC sample data and log curve data from previously drilled wells in the basin are needed to calculate a TOC-calibrated model to indentify these zones. Limited open file TOC sample data is available in Australia, however in many basins this data is extremely sparse because of lack of exploration or that current exploration in the basin has to date not targeted Shale Gas Plays.

The REM Shale Gas Play is the only play that has sufficient information to be classified as being a Shale Gas Play sweet spot. The REM is sufficiently mature for hydrocarbon generation, with laterally extensive thick intervals and a lithotype that is organic-rich (usually more than 2% organic matter) with low clay content.

The play is in an established hydrocarbon province with significant existing infrastructure. It has direct pipeline access to the gas markets of NSW, QLD and SA, and hence potential for domestic or export use and off all the prospective shale gas basins in Australia, is likely to be the most readily developed.

The brittleness and natural fracture network are known to be critical to the commercial success of a Shale Gas Plays in the US. Recent information on fracture mapping by Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE) 2012 identified an orthogonal natural fracture system oriented N-S and E-W in the Nappamerri Trough, Cooper Basin that can assist in orientating future horizontal wells and fracture stimulations.

These natural fracture systems may have been naturally enhanced by the mineralogy of the clays in these lacustrine shales. Beach Energy has publicly discussed the mineral composition of the shales which are high in silica and illite and absence of swelling clays which collectively are conducive to brittleness and ideal for fracture stimulation. Beach Energy have successfully performed 7 fracture stimulations and flowed gas from the REM play with their Holdfast 1 well.

9 Potential Shale Gas Play Roadblocks

The Australian domestic gas market is relatively small. Coal Seam Gas (CSG) resources are now so large that significant infrastructure is being built at Gladstone (QLD) on the east coast of Australia to feed LNG into a growing world market coming online in 2014/2015. Shale Gas has similar potential in Australia. Australia is in an ideal place in which to develop this type of resource, however potential hazards exist which could impact the development of Shale Gas exploration in Australia. These roadblocks have been identified by AWT and are listed below are not ranked in any particular order.

- Several basins are extremely isolated in central Australia
- No established infrastructure, including but not limited to, pipelines, processing plants road and/or rail infrastructure
- Close proximity of Shale Gas Play to capital cities and major towns which may present landowner and drilling issues relating to fraccing operations
- Native Title and possible environmental issues
- Water availability, use and disposal in drilling and fracturing operations
- Depth of target Shale Gas Plays increasing exploration and development costs
- Commercialisation costs much greater when compared to US, due to exploration and development costs
- Extent of Shale Gas Play is under tenure and is predominantly held by a few key players that are focussed on Conventional or CSG exploration. They may be unlikely to be receptive to farm-in offers though the possibility exists that they would be willing to farm out shale gas activities to allow them to remain focussed on other operations
- Lack of available equipment, specific to Shale Gas exploration (i.e. large fraccing spreads)

10 Conclusions

More work is required to quantify the areas identified as potential Shale Gas Plays having suitable depth, maturity, lithology, and thicknesses. Exploration is the key, practically drilling and coring of these shales is required to accurately define the lateral extent and limits of any of these potential plays within Australia.

To commercialise, Shale Gas Plays require fracture stimulation. The effectiveness of fracture stimulation depends on the reservoir's brittleness. If the reservoir contains a high quantity of ductile materials like clay, mudstones and tuff, it may make fractures difficult to generate. The design effectiveness and commercial prospects of fracture stimulating for the 19 identified Shale Gas Plays requires further investigation.

Lack of infrastructure will mean that even a successful play will require a very long time to achieve a reasonable gas volume to be developed and transported to market. To date in many of the Shale Gas plays identified there is little to no published desorption tests from core or cuttings and no published tight rock analyses. This information would greatly increase the level of understanding and reduce the uncertainty. Seismic across some of the basins is also minimal, though is not required for early exploration and proof of concept.

The Shale Gas Plays screened by AWT located within the Cooper, Perth, Canning and Bowen Basins are considered the most prospective plays for exploration. This is based the presence of the following

- large number of well and seismic data
- hydrocarbon discoveries
- size
- locality to infrastructure and market
- relative ease of locating wells and lower cost to complete and tie wells into existing pipelines.

11 REFERENCES

11.1 GENERAL REFERENCES

- US Energy Information Administration (EIA) (2011). Review of Emerging Resources: US Shale Gas and Shale Oil Plays. Published online by US Department of Energy.

- Sondergeld C.H., Newsham, K.E., Cominsky M.C. and Rai C.S. 2010. Petrophysical Considerations in Evaluating and Producing Shale Gas Resources; *SPE* 131768 presented at the Unconventional Gas Conference held in Pittsburgh, Pennsylvania, USA, 23-25 February 2010.

- Pegum, D.M., 1997, *An Introduction to the Petroleum Geology of the Northern Territory of Australia*, Department of Mines and Energy: Northern Territory Geological Survey.

- I NTEK Inc. (2010). Review of Emerging Resources: US Shale Gas and Shale Oil Plays

11.2 AMADEUS BASIN

- Ambrose, G and John Heugh. The Petroleum Geology of the Amadeus Basin, Central Petroleum report.

- Ambrose, G, 2006. The Amadeus Basin. *Northern Territory Geological Survey*. Amoco Australia Petroleum Company. 1982. *Results of the 1982 Field Program, McArthur River, Permits OP191/OP198, Northern Territory, Australia*; (company report), V.1-7.
- Berry M D, D W Stearns and M Friedman. The Development of a Fractures Reservoir Model for the Palm Valley Gas Field. APPEA Journal.

- Marshall TR, 2003. Petroleum systems and source rocks in the Amadeus Basin, Northern Territory: in Cowie M (editor*) 'Queensland 2003 exploration and development.'*

- Vu Thi Anh Tiem, Brian Horsfield amd Roland di Primio. Gas Shale Potential of the Amadeus and Georgina Basins, Australia. Australian Government, Geoscience Australia. Record 2011/10 GeoCat #71541.

- Warburton J, Murray T and Marshall TR, 2005. Importance of fault seal and strategic assessment of future petroleum exploration potential of the Amadeus Basin. *Northern Territory Geological Survey, Record* 2005-004.

- Young IF, Ambrose GJ and Marshall TR, 2005. Structure and petroleum geology of the SE Amadeus Basin: the ongoing search for sub-salt hydrocarbons: in *'Proceedings of the Central Australian Basins Symposium, Alice Springs, Northern Territory, 16–18 August, 2005.' Northern Territory Geological Survey, Special Publication* 2.

- Wells, A.T., Forman, D.J., Ranford, L.C., & Cook, P.J., 1970. Geology of the Amadeus Basin, Central Australia. Bureau of Mineral Resources, Australia, Bulletin 100.

• Jackson, K.S., McKirdy, D.M., & Deckelman, J.A., 1984. Hydrocarbon generation in the Amadeus Basin. The APEA Journal, 24(1), 42.65.

• Lindsay, J.F., & Korsch, R.J., 1991. The evolution of the Amadeus Basin, central Australia. In Korsch, R.J., & Kennard, J.M. (Editors). Geological and geophysical studies in the Amadeus Basin, central Australia. Bureau of Mineral Resources, Australia, Bulletin 236, 7-32.

• Ozimic,S., Passmore, V.L., Pain, L., & Lavering, I.H., 1986. Amadeus Basin, central Australia. Bureau of Mineral Resources, Australia, Australian Petroleum Accumulations Report 1.

• Shaw, R.D., 1991. The tectonic development of the Amadeus Basin, central Australia. In Korsch, R.J., & Kennard, J.M. (Editors). Geological and geophysical studies in the Amadeus Basin, central Australia. Bureau of Mineral Resources, Australia, Bulletin 236, 429-461.

• Shaw, R.D, Korsh, R.J., Wright, G., & Goleby, B.R., 1991. Seismic interpretation and thrust tectonics of the Amadeus Basin, central Australia, along the BMR regional seismic line. Bureau of Mineral Resources, Australia, Bulletin 236.

• Burgess, J.M., Johnstone, A.L., Schaefer, B.F., Brescianini, R.F., & Tingate, P.R., 2002. New perspectives of the Amadeus Basin, Northern Territory. PESA Journal, 29, 14-23.

11.3 BEETALOO BASIN

• Falcon Oil & Gas Ltd., 2011, *Falcon Oil & Gas Ltd. Announces Completion of Testing in Shenandoah-1*. TSX Venture Exchange Release.

• Dutkiewicz A, Volk H, Ridley J and George S, 2003. Biomarkers, brines, and oil in the Mesoproterozoic, Roper Superbasin, Australia. *Geology* 31, 981–984.

• Crick IH, Boreham CJ, Cook AC and Powell TG, 1988. Petroleum geology and geochemistry of Middle Proterozoic McArthur Basin, Northern Australia II. Assessment of source rock potential. *AAPG Bulletin* 72(12), 1495–1514.

• Lanigan K, Hibbird S, Menpes S and Torkington J, 1994. Petroleum exploration in the Proterozoic Beetaloo Sub-basin, Northern Territory. *APEA Journal* 34(1), 674–691.

• Law BE, 2002. Basin-centered gas systems. *AAPG Bulletin* 86(11), 1891–1919.

• Powell TG, Jackson MJ, Sweet IP, Crick I.H, Boreham CJ and Summons RE, 1987. Petroleum geology and geochemistry, Middle Proterozoic McArthur Basin. *Bureau of Mineral Resources, Australia, Record* 1987/048.

• RobSearch, 1997. *Technical review of EP 18 and EP(A) 70,Beetaloo Basin, Northern Territory, Australia, prepared for Mataranka Oil LN*. RobSearch Project No 3972.

• Silverman MR, Landon SM, Leaver JS, Mather TJ and Berg E, 2007. No fuel like an old fuel: Proterozoic oil and gas potential in the Beetaloo Basin, Northern Territory, Australia: in Munson TJ and Ambrose GJ (editors) *'Proceedings of the Central Australian Basins*

Symposium (CABS), Alice Springs, Northern Territory,16–18 August, 2005.' Northern Territory Geological Survey, Special Publication 2

- Taylor D, Kontorovich AE, Larichev AI and Glikson M, 1994. Petroleum source rocks in the Roper Group of the McArthur Basin: source characterisation and maturity determinations using physical and chemical methods. *APEA Journal* 34, 279–296.

11.4 BONAPARTE BASIN

- Barrett, A.G., Hinde, A.L., & Kennard, J.M., 2004. Undiscovered resource assessment methodologies and application to the Bonaparte Basin. In: Ellis G.K., Baillie P.W. and Munson T.J. (Eds) Timor Sea Petroleum Geoscience. Proceedings of the Timor Sea Symposium, Darwin, Northern Territory, 19-20 June 2003. Northern Territory Geological Survey, Special Publication 1.

- Gorter, J.D., Mckirdy, D.M., Jones, P.J., & Playford, G., 2004. Reappraisal of the Early Carboniferous Milligans Formation source rock system in the southern Bonaparte Basin, northwestern Australia. Australia . *In: Ellis G.K., Baillie P.W. and Munson T.J. (Eds) Timor Sea Petroleum Geoscience. Proceedings of the Timor Sea Symposium, Darwin, Northern Territory, 19*-20 June 2003. Northern Territory Geological Survey, Special Publication 1.

- Kennard, J.M., Deighton, I., Edwards, D.S, Boreham, C.J., & Barrett, A.G., 2002. Subsidence and thermal history modelling: New insights into hydrocarbon expulsion from multiple petroleum systems in the Petrel Sub-basin, Bonaparte Basin. The Sedimentary Basins of Western Australia 3: Proceedings of the Petroleum Exploration Society of Australia Symposium, Perth, WA, 2002, 409-437.

- Miyazaki, S., 1997. Australia's southeastern Bonaparte Basin has plenty of potential. Oil & Gas Journal, 95 (16), 78-81.

11.5 BOWEN BASIN

- Al Arouri, K. R., 1996, Petroleum geochemistry, source rock evaluation and modelling of hydrocarbon generation in the southern Taroom trough, Queensland: Ph.D. thesis, University of Adelaide, Adelaide, Australia, 277 p.

- Al Arouri, K., Boreham, C.J., McKirdy, D.M., Lemon, N.M., 1998a. Modeling of thermal maturation and hydrocarbon generation in two petroleum systems of the Taroom Trough, Australia. American Association of Petroleum Geologists Bulletin 82, 1504 – 1527.

- Beeston, J.W., Dexon, O., Green, P.M., 1995. Depositional history of the southern Taroom Trough, Queensland. Australian Petroleum Exploration Association Journal 35, 344 – 357.

- Boreham, C. J., 1995, Origin of petroleum in the Bowen and Surat basins: geochemistry revisited: Australian Petroleum Exploration Association Journal, v. 35, no. 1, p. 579–612.

- Carmichael, D., and C. J. Boreham, 1997, Hydrocarbon generation potential and source rock distribution in Permian and Triassic rocks, southern Taroom trough, Queensland, *in* P. M. Green, ed., The Surat and Bowen basins, south-east Queensland: Queensland Minerals and Energy Review Series, Queensland Department of Mines and Energy, p. 193–226.
- Elliott, L., 1989. The Surat Bowen Basin. Australian Petroleum Exploration Association Journal 29, 398 – 416.
- Hawkins, P. J., K. S. Jackson, and Z. Horvath, 1992, Regional geology, petroleum geology, and hydrocarbon potential of the southern Taroom trough, Bowen basin, Queensland: Queensland Geology 3, 42 p.
- Korsch, R. J., C. J. Boreham, T. S. Loutit, J. M. Totterdell, M. G. Nicoll, and R. D. Shaw, 1996, Petroleum systems of the Bowen and Surat basins: AGSO Research Newsletter 25, p. 12–14.
- Mallett, C. W., N. Russell, and T. McLennan, 1990, Thermal history of the Bowen basin: Proceedings of the Bowen Basin Symposium, Geological Society of Australia, Queensland Division, p. 15–20.
- Totterdell, J. M., A. T. Wells, A. T. Brakel, R. J. Korsch, and M. G. Nicoll, 1992, Sequence stratigraphic interpretation of seismic data in the Taroom region, Bowen and Surat basins, Queensland: Bureau of Mineral Resources, Australia, Record 1991/102, 61 p.
- Thomas, B. M., D. G. Osborne, and A. J. Wright, 1982, Hydrocarbon habitat of the Bowen/Surat basin: Australian Petroleum Exploration Association Journal, v. 22, no. 1, p. 213–226.

11.6 CANNING BASIN

- BENTLEY, J., 1984. Petroleum potential of the central Broome Platform. In PURCELL, P. G., (Ed)., The Canning Basin, W.A.: Proceedings of the Geological Society of Australia and Petroleum Exploration Society of Australia Symposium, Perth, 1984. p. 157-168.
- BROWN, S. A., BOSERIO, I. M., JACKSON, K. S., and SPENCE, K. W., 1984. The geological evolution of the Canning Basin – implications for petroleum exploration. In PURCELL, P. G., (Ed). The Canning Basin, W.A.: Proceedings of the Geological Society of Australia and Petroleum Exploration Society of Australia Symposium, Perth, 1984. p. 85-96.
- Cadman, S. J., Pain, L., Vuckovic, V. & le Poidevin, S. R., 1993 – Canning Basin, W.A. *Bureau of Resource Sciences, Australian Petroleum Accumulations Report* 9, 1993.
- Foster, C.B., O'Brien, G.W., & Watson, S.T.,1986 - Hydrocarbon source potential of theGoldwyer Formation, Barbwire Terrace, CanningBasin, Western Australia. APEA Journal, 26,p142-155.

• Horstman, E.L. 1984 - Source rocks in theCanning Basin : a review. In Purcell, P.G.,(Editor), The Canning Basin, W.A., Proceedingsof the Geological Society of Australia and Petroleum Exploration Society of Australia Symposium,Perth, 1984, p345-352.

• KENNARD, J. M., JACKSON, M. J., ROMINE, K K., SHAW, R. D., and SOUTHGATE, P. N., 1994b. Depositional sequences and associated petroleum systems of the Canning Basin, WA. In P. G. & R. R. PURCELL, (Eds)., The Sedimentary Basins of Western Australia: Proceedings of the Western Australian Basins Symposium, Perth, WA, PESA, p. 657-676.

• SCOTT, J., 1994. Source rocks of Western Australia – distribution, character and models. In P. G. & R. R. PURCELL, (Eds)., The Sedimentary Basins of Western Australia: Proceedings of the Western Australian Basins Symposium, Perth 1994, PESA, p. 141-155.

• Taylor, D. A review of Ordovician source rocks, Canning Basin, Western Australia. *Bureau of Mineral Resources, Report 43*, 1992.

• WARRIS, B. J., 1993. The hydrocarbon potential of the Palaeozoic basins of Western Australia. APEA Journal, v. 33, p. 123-137.

• Yeates, A.N., Gibson, D.L., Towner, R.R., &Crowe, R.W.A., 1984 -Regional geology of theonshore Canning Basin, W.A. In Purcell, P.G,(Editor), The Canning Basin, W.A., Proceedingsof the Geological Society of Australia and Petroleum Exploration Society of Australia Symposium,Perth, 1984, p23-55.

• Mory, A.J. & Hocking, R.M. (Compilers) 2011- Permian, Carboniferous and Upper Devonian Geology of the Northern Canning Basin, Western Australia - a Field Guide. Geological Survey of Western Australia, Record 2011/16, 36p.

• Ghori, K.A.R. & Haines, P.W. 2006 - Petroleum Geochemistry of the Canning Basin, Western Australia: Basic Analytical Data 2004-5. Western Australia Geological Survey, Record 2006/7, 66p.

• Buru Energy ASX announcement (June 1, 2011). Canning Superbasin - Unconventional Resource Assessment.

11.7 CARNARVON BASIN

• Ghori, K.A.R. , 1998. Petroleum Generating Potential and Thermal History of the Palaeozoic, Carnarvon Basin, Western Australia, in Purcell, P.G. & R. R. (Eds), 1998, The Sedimentary Basins of Western Australia 2: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1998.

• Gorter, J., Mory. A. & Nicoll, R., 1998, Sequence Stratigraphy and Hyrdocarbon Potential of the Middle to Upper Devonian Sequences in the Southern Carbarvon Basin, WA in Purcell, P.G. & R. R. (Eds), 1998, The Sedimentary Basins of Western Australia 2: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1998.

- Keep, M. & Moss, S.J. (Eds), 2002. The Sedimentary Basins of Western Australia 3: Proceedings of the Petroleum Exploration Society of Australia Symposium, Perth, WA, 2002.
- Iasky, R., Mory, A. & Shevchenko, S., 1998. A Structural Interpretation of the Gascoyne Platform, Southern Carnarvon Basin, WA, in Purcell, P.G. & R. R. (Eds), 1998, The Sedimentary Basins of Western Australia 2: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1998.
- Mory, A.J., Nicoll, R.S. & Gorter, J., 1998. Lower Palaeozoic Correlations and Thermal Maturity, Carnarvon Basin, WA, in Purcell, P.G. & R. R. (Eds), 1998, The Sedimentary Basins of Western Australia 2: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1998.
- Purcell, P.G. & R. R. (Eds), 1994, The Sedimentary Basins of Western Australia: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1994.
- Purcell, P.G. & R. R. (Eds), 1998, The Sedimentary Basins of Western Australia 2: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1998.
- Warris, B.J., 1994, The Hydrocarbon Potential of the Onshore Carnarvon Basin, in Purcell, P.G. & R. R. (Eds), 1994, The Sedimentary Basins of Western Australia: Proceedings of Petroleum Exploration Society of Australia Symposium, Perth, WA, 1994.

11.8 CLARENCE-MORETON BASIN

- Bradshaw et al 2009. Queensland carbon dioxide geological storage atlas. Greenhouse Gas Storage Solutions, Canberra.
- Cadman, S.J., Pain, L. & Vuckovic, V., 1998. Bowen and Surat Basins, Clarence-Moreton Basin, Gunnedah Basin and other minor onshore basins, Queensland, NSW and NT. Australian Petroleum Accumulations Report 11, Bureau or Resource Sciences, Canberra.
- Haselwood, R., Deighton, I. & Hamilton, L., 2004. An appraisal of the hydrocarbon potential of the south-east Clarence-Moreton Basin in Queensland. In: Boult, P.J., Johns, D.R. & Lang, S.C. (Eds), Eastern Australasian Basins Symposium II, PESA Special Publication, 331-337.
- Lockwood, K., 1978. A summary of the regional geology, geophysics and petroleum potential of the Clarence-Moreton Basin. Bureau of Mineral Resources Record 1978/109.
- Martin, A.R. & Saxby, J.D., 1982. Geology, source and hydrocarbon generation in the Clarence-Moreton Basin. The APPEA Journal, 22(1), 5-16.
- O'Brien, P.E., Korsch, R.J., Wells, A.T., Sexton, M.J. & Wake-Dyster, K., 1994. Structure and tectonics of the Clarence-Moreton Basin. In: Wells, A.T. & O'Brien, P.E., (Eds), Geology and petroleum potential of the Clarence-Moreton Basin, New South Wales and Queensland, Australian Geological Survey Organisation Bulletin 241, 72-137.

• O'Brien, P.E., Wells, A.T., 1994. Sedimentary of the Bundamba group, Clarence-Moreton Basin. In: Wells, A.T. & O'Brien, P.E., (Eds), Geology and petroleum potential of the Clarence-Moreton Basin, New South Wales and Queensland, Australian Geological Survey Organisation Bulletin 241, 72-137.

• Ties, P., Show, R.D. & Geary, G.C., 1985. The petroleum prospectivity of the Clarence-Moreton Basin in New South Wales, the APPEA Journal, 25 (1), 15-33.

• Wells, A.T. & O'Brien, P.E., 1993. Fluvial architecture of Triassic-Jurassic sediments of the Bundamba Group in the northern part of the Clarence-Moreton Basin, Queensland. Australian Geological Survey Organisation Record 1993/45.

11.9 COOPER BASIN

• Alexander, E.M. and Hibburt, J.E. (Eds), 1996. The petroleum geology of South Australia. Vol. 2: Eromanga Basin. *SouthAustralia. Department of Mines and Energy. Report Book,*96/20.

• Alexander. E.M., 1998. Lithostratigraphy and Environments of Deposition. *In:* Gravestock, D.I., Hibburt, J.E. and Drexel, J.F (Eds), 1998, The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• Boreham, C.J. and Hill, A.J., 1998. Source rock distribution and hydrocarbon geochemistry. *In:* Gravestock, D.I., Hibburt, J.E. and Drexel, J.F (Eds), 1998, The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• Chopra, P., and Holgate, F., 2005. A GIS analysis of temperature in the Australian crust, Proceedings of the World Geothermal Congress 2005, Antalya, Turkey, 24-29 April 2005.

• Deighton. I. & Hill. A.J., 1998. Thermal and Burial History. *In:* Gravestock, D.I., Hibburt, J.E. and Drexel, J.F (Eds), 1998, The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• Geological Survey of Queensland. Roseneath, Epsilion and Murteree shale isopach maps, Figures 19-22.

• Gravestock, D.I., Hibburt, J.E. and Drexel, J.F. (Eds), 1998. The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• Gravestock, D.I., and Jensen-Schmidt. B., 1998. Structural Setting. *In:* Gravestock, D.I., Hibburt, J.E. and Drexel, J.F (Eds), 1998, The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• Hunt, J.W., Heath, R.S. and McKenzie, P.F., 1989. Thermal maturity and other geological controls on the distribution and composition of Cooper Basin hydrocarbons. *In:* O.Neil, B.J. (Ed.), *The Cooper and Eromanga Basins, Australia*. Proceedings of the Cooper and Eromanga Basins Conference, Adelaide, 1989. Petroleum Exploration Society of Australia, Society of Petroleum Engineers, Australian Society of Exploration Geophysicists (SA Branches), pp.510-523.

• Kantsler, A.J., Prudence, T.J.C., Cook, A.C. and Zwigulis, M., 1983. Hydrocarbon habitat in the Cooper/Eromanga Basin, Australia. *APEA Journal,* 23(1):75-92.

• Michaelsen, B.H. and McKirdy, D.M., 1996. Source rock distribution and hydrocarbon geochemistry. *In:* Alexander, E.M. and Hibburt, J.E. (Eds), The petroleum geology of South Australia. Vol 2: Eromanga Basin. *South Australia. Department of Mines and Energy Resources. Report book,* 96/20:101-110.

• Moseby. G., 2010. Cooper Basin Shale Gas Presentation. Beach Energy Limited – IIR March 2010 Shale Gas Briefing, Brisbane.

• Morton. J.G.G., 1998. Undiscovered Petroleum Resources. *In:* Gravestock, D.I., Hibburt, J.E. and Drexel, J.F (Eds), 1998, The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• O.Neil, B.J., 1996. History of petroleum exploration and development. *In:* Alexander, E.M. and Hibburt, J.E. (Eds), The petroleum geology of South Australia. Vol. 2: Eromanga Basin. *South Australia. Department of Mines and Energy. Report Book*, 96/20:11-31.

• O'Neil, B.J., 1998. History of Petroleum Exploration and Development. *In:* Gravestock, D.I., Hibburt, J.E. and Drexel, J.F (Eds), 1998, The petroleum geology of South Australia. Vol. 4: Cooper Basin. *South Australia. Department of Primary Industries and Resources. Report Book*, 98/9.

• O'Neil, B.J., (ed), 1989. The Cooper and Eromanga Basins Australia. Proceedings of Petroleum Exploration Society of Australia, Society of Petroleum Engineers, Australian Society of Exploration Geophysicists (SA Branches), Adelaide.

• Pitt, G.M., 1986. Geothermal gradients, geothermal histories and the timing of thermal maturation in the Eromanga. Cooper Basins. *In:* Gravestock, D.I., Moore, P.S. and Pitt, G.M. (Eds), Contributions to the geology and hydrocarbon potential of the Eromanga Basin. *Geological Society of Australia. Special Publication,* 12:323-351.

• Beach Energy ASX Release (10 August 2011). Initial 2 TCF Resource Booking Following Successful Shale Gas Evaluation.

11.10 EROMANGA BASIN

• Boreham, C.J. & Powel, T.G. (1984). The Toolebuc Oil Shale: An Organic Geochemical Investigation. Proceedings Second Australian Workshop on Oil Shale.

• Ozimic, S.(1982). Depositional Environment of the Oil Shale-bearing Cretaceous Toolebuc Formation and its Equivalents, Eromanga Basin, Australia, Oil Shale Symposium, Proceedings 15, 137-148.

• Riley and Saxby (1983), *Organic Matter and Vanadium in the Toolebuc Formation of the Eromanga Basin* in: Oil Shale Methodology: Eromanga and Carpentaria Basins.

• McDonagh, G.P. And McDonagh, R.J. (2009) Independent Report Prepared fro Exoma Energy Limited o nthe Hydrocarbon Geology of Queensland ATPs 991, 996, 999, 1005 & 1008, Online report.

11.11 GEORGINA BASIN

• Ambrose GJ, Kruse PD and Putnam PE, 2001. Geology and hydrocarbon potential of the southern Georgina Basin, Australia. *APPEA Journal* 41, 139–163.

• *Ambrose GJ, 2002. 'New ideas on the petroleum potential of the southern Georgina Basin'. PESA (Qld) Symposium 2002, Brisbane, 75–81.*

• Ambrose G, 2006. Northern Territory of Australia, onshore hydrocarbon potential, 2006. *Northern Territory Geological Survey, Record* 2006-003.

• Baraka Petroleum Limited, 2010, *Ryder Scott Report on Potential Resource Estimates*, ASX Release.

• Boreham, C.J. and Ambrose, G.J., 2005,*Cambrian petroleum systems in the southern Georgina Basin, Northern Territory, Australia*, Central Australia Basin Symposium, Special Publication 2.

• Boreham and Ambrose 2005. Oil families from the Middle–Late Cambrian, southern Georgina Basin, Australia. *Central Australian Basins Symposium, petroleum and minerals potential, Alice Springs, 16–18 August 2005, Handbook*, 11–12 (abstract).

• Draper,J. 2007. Georgina Basin – an early Palaeozoic carbonate petroleum system in Queensland. Appea Journal Part 1, pp107-126.

• Dunster JN, Kruse PD, Duffett ML and Ambrose GJ, 2007. Geology and resource potential of the southern Georgina Basin: a GIS package. *Northern Territory Geological Survey, Digital Information Package* DIP007.

• Haines PW, 2005. Neoproterozoic to Early Cambrian stratigraphy and depositional history of the southwest margin of the Georgina Basin, central Australia. *Central Australian Basins Symposium, petroleum and minerals potential, Alice Springs, 16–18 August 2005, Handbook*, 13–15 (abstract).

• PetroFrontier, 2011, *PetroFrontier Corp. Announces Successful Drilling of Baldwin-2 Horizontal Well in the Georgina Basin, Australia*. TSX Release.

• Questa, 1994. *Georgina Basin. Northern Territory Geological Survey, Petroleum Basin Study*. Northern Territory Geological Survey, Darwin and Alice Springs.

• Volk H, George SC, Kempton RH, Liu Keyu, Ahmad M and Ambrose GJ, 2005. Petroleum migration in the Georgina Basin: Evidence from the geochemistry of oil inclusions and bitumens. *Central Australian Basins Symposium, petroleum and minerals potential, Alice Springs, 16–18 August 2005, Handbook*, 12–13 (abstract).

11.12 GUNNEDAH BASIN

• Etheridge, L.T., 1987. New stratigraphic and structural data from the Surat and Gunnedah Basins and implications for petroleum exploration. Geological Survey of New South Wales, Quarterly Notes 66, 1 –21.

• Gurba, L. Ward, C.R. 1998. Vitrinite reflectance anomalies in the high-volatile bituminous coals of the Gunnedah Basin, New South Wales, Australia. International Journal of Coal Geology 36 ,111-140.

• Gurba, L. Ward, C.R. 2001. Effects of igneous intrusions on coalbed methane potential, Gunnedah Basin, Australia. International Journal of Coal Geology 46, 113-131.

• Hamilton, D.S., 1993. Upper Watermark –Lower Black Jack/Arkarula depositional episode. In: Tadros, N.Z. (Ed.), The Gunnedah Basin, New South Wales. Geological Survey of New South Wales Memoir Geology 12, 213– 244.

• Hamilton, D.S., Beckett, J., 1984. Permian depositional systems in the Gunnedah region. Geological Survey of New South Wales Quarterly Notes 55, 1 – 19.

• Hamilton, D.S., Newton, C.B., Smyth, M., Gilbert, T.D., Russell, N., McMinn, A., Etheridge, L.T., 1988. The petroleum potential of the Gunnedah Basin and overlying Surat Basin sequence, New South Wales. Australian Petroleum Exploration Association Journal 28, 218–241.

• Othman, R., Ward C.R. 2002. Thermal maturation pattern in the southern Bowen, northern Gunnedah and Surat Basins, northern New South Wales. Australia International Journal of Coal Geology 51. 145–167.

• Othman, R., Ward, C.R., 1999. Stratigraphic correlations in the southern Bowen and northern Gunnedah Basins, northern New South Wales. In: Diessel, C., Swift, E., Francis, S. (Eds.),Proceedings of 33rd Newcastle Symposium on Advances in the Study of the Sydney Basin. Department of Geology, University of Newcastle, N.S.W. Australia, pp. 23–30.

• Smyth, M., Jian, F.X., Ward, C.R., 1992. Potential petroleum source rocks in Triassic lacustrine-delta sediments of the Gunnedah Basin, eastern Australia. Journal of Petroleum Geology 15, 435–450.

• Tadros, N.Z., 1993. Introductory notes. In: Tadros, N.Z. (Ed.), The Gunnedah Basin, New South Wales. Geological Survey of New South Wales, Memoir Geology 12, pp. 3–18.

• Tadros, N.Z., 1995. Gunnedah Basin. In: Ward, C.R., Harrington, H.J., Mallett, C.W., Beeston, J.W. (Eds.), Geology of Australian Coal Basins. Geological Society of Australia, Coal Geology Group, Special Publication 1, pp. 247–298.

11.13 MARYBOROUGH BASIN

• Cranfield, L. C., 1982. Stratigraphic Drilling in the southern Maryborough Basin, 1978-1980, Queensland Government Mining Journal, 83, 963, 15-29.

• Cranfield, L.C., 1993. Stratigraphic units of the Maryborough Basin, southeast Queensland. Queensland Geology, 5, 18-43.

• Day, R.W, Whitaker, W.G., Murray, C.G., Wilson, I.H. and Grimes, K.G., 1983. Queensland geology: a companion volume to the 1: 2500,000 scale geological map, 1975. Geological Survey of Queensland, Publication 383.

• Ellis, P.L., 1966. The Maryborough Basin. APPEA, 30-36.

• Ellis, P.L., 1968. Geology of the Maryborough 1:250,000 sheet region. Queensland Department of Mines, Geological Survey of Queensland, Report 26.

• Ellis, P.L and Whitaker, W.G., 1976. Geology of the Bundaberg 1:250,000 sheet area. Queensland Department of Mines, Geological Survey of Queensland, Report 90.

• Gray, A. R. G., 1990. A summary of the petroleum potential of the offshore Queensland continental margin. Queensland Government Mining Journal, v.91, 489-494.

• Harrington, H.J. and Korsch, R.J., 1985. Late Permian to Cainozoic tectonics of the New England Orogen. Australian Journal of Earth Sciences, 32, 181-203.

• Hill, P.J., 1994. Geology and geophysics of the offshore Maryborough, Capricorn and northern Tasman Basins: results of AGSO Survey 91. Canberra, Australian Geological Survey Organisation, Record 1994/1.

• Lipski, P., 2000. Petroleum geology of the onshore Maryborough Basin. Extended Abstracts, Second Sprigg Symposium: Frontier Basins, Frontier Ideas. Geological Society of Australia Abstracts, 60, 50-52.

• Magellan Petroleum Australia Limited, 1999. ATP 613P Maryborough Basin Queensland, Australia. 1998 Maryborough Basin seismic survey operations report. Unpublished report held by the Queensland Department of Mines as CR 31112A.

• Petroleum Resources Assessment and Development Sub-program, 1990. Petroleum Resources of Queensland (Review to June 30, 1989). Queensland Resource Industries Review Series. Department of Resource Industries, Queensland.

• Ridley, W.F., 1960. Geological studies in the Maryborough Basin, south-east Queensland. Proceedings of the Royal Society of Queensland, 72, 83-99.

• Roe, L., 1994. Maryborough Basin Exploration. Australian Petroleum Production and Exploration Association (APPEA)(Queensland Branch), 59-66.

• Siller, C.W., 1961. The geology and petroleum prospects of the Maryborough Basin, Queensland. APPEA Journal, 1, 30-36.

11.14 McARTHUR BASIN

• Crick, I.H., Boreham, C.J., Cook, A.C. & Powell, T.G. (1988). Petroleum Geology and Geochemistry of Middle Proterozoic McArthur Basin, Northern Australia 11: Assessment of Source Rock Potential. AAPG: V.72, No. 12.

• Davidson, G.J., and Dashlooty, S.A., 1993, *The Glyde sub-basin; a volcaniclastic-bearing pull-apart basin coeval with the McArthur River base-metal deposit, Northern Territory.* Australian Journal of Earth Sciences, 40, 527-543.

• Jackson, M.J., Sweet, I.P. & Powell, T.G. (1988). Studies on Petroleum Geology and Geochemistry, Middle Proterozoic, McArthur Basin, Northern Australia 1: Petroleum Potential. The APEA Journal, 28, 283-302.

• McDougall I, Dunn P.R., Compston, W., Webb, A.W., Richards, J.R. and Bofinger, V.M., 1965*. Isotopic age determinations on precambrian rocks of the carpentaria region, Northern territory, Australia*. Australian Journal of Earth Sciences, 12: 1, 67 — 90. Northern Territory Geological Survey, 2006, *Mount Drummond SE 53-12, 250,000 Surface Geology Map.*

• *Petroleum Exploration Society of Australia (Qld/NT) 2003 Symposium*, 37–42.
Rawlings, D.J., Korsch, R.J., Goleby, B.R., Gibson, G.M., Johnstone, D.W., and Barlow, M., 2004, *The 2002 Southern McArthur Basin Seismic Reflection Survey*. Geoscience Australia, Record 2004/17, 78pp.

• Rawlings, D.J., Sweet, I.P. and Kruse, P.D., 2006. *Mount Drummond, Northern Territory (2nd ed). 1:250 000 geological map series, SE 53-12*. Northern Territory Geological Survey, Darwin.

• Powell, T.G., Jackson, M.J., Sweet, I.P., Crick, I.H., Boreham, C.J. & Summons, R.E. (1987). Petroleum Geology and Geochemistry, Middle Proterozoic McArthur Basin; Bureau of Mineral Resources, Geology and Geophysics, Record, 1987/48.

11.15 OTWAY BASIN

• Alexander, E.M., 1992. Geology and petrophysics of petroleum reservoirs from the Otway Group, Otway Basin. ERDC Project 1424, SENRAC Project 3/89. End of grant report. *South Australia. Department of Mines and Energy. Report Book,* 92/70.

• Boult, P.J., Ramamoorthy, R., Theologou, P.N, East, R.D, Drake, A.M.and Neville, T., 1999. Use of neclear magnetic resonance and new core analysis technology for determination of gas saturation in Petty Hill sandstone reservoirs, onshore Otway Basin. *APPEA Journal,* 39(1):437-450.

- Chatfield, K., 1995. The impact of volcanism on petroleum exploration, Otway Basin, South Australia. *South Australia. Geological Survey. Quarterly Geological Notes,* 127:2-13.
- Cockshell, C.D., O'Brien, G.W., McGee, A., Lovibond, R., Perincek, D. and Higgins, R., 1995. Western Otway Crayfish Group Troughs. *APPEA Journal,* 35(1):385-404.
- Felton, E.A. and Jackson, K.S., 1987. Hydrocarbon generation potential in the Otway Basin Australia. *BMR Journal of Australian Geology and Geophysics,* 10:213-224.
- Glenie, R.C. (Ed.), 1986. *Second South-Eastern Australia Oil Exploration Symposium.* Petroleum Exploration Society of Australia Symposium, Melbourne, 1985.
- Kopsen, E. and Scholefield, T., 1990. Prospectivity of the Otway Supergroup in the central and western Otway Basin. *APEA Journal,* 30:263-278.
- Lovibond, R., Sutthill, R.J. and Skinner, J.E., 1995. The hydrocarbon potential of the Penola Trough, Otway Basin. *APPEA Journal*, 35(1):358-371.
- Morton, J.G.G., 1990. Revisions to stratigraphic nomenclature of the Otway Basin, South Australia. *South Australia. Geological Survey. Quarterly Geological Notes,* 116.
- Morton, J.G.G. and Drexel, J.F. (Eds), 1995. The petroleum geology of South Australia. Vol. 1: Otway Basin. *South Australia. Department of Mines and Energy. Report Book,* 95/12.
- Parker, K.A., 1992. The exploration and appraisal history of the Katnook and Ladbroke Grove gas fields, onshore Otway Basin, South Australia. *APPEA Journal,* 32:67-85.
- Perincek, D. and Cockshell, C.D., 1995. The Otway Basin: Early Cretaceous rifting to Neogene inversion. *APPEA Journal*, 35(1):451-466.
- Woodllands, M.A. & Wong, D., (Eds), 2001. Petroleum Atlas of Victoria, Australia. The State of Victoria, Department of Natural Resources and Environment, 2001.

11.16 PEDIRKA BASIN

- Alexander, E.M. and Jensen-Schmidt, B., 1995. Eringa Trough exploration opportunity. *South Australia. Department of Mines and Energy. Report Book,* 95/36.
- Alexander, E.M., Pegum, D., Tingate, P., Staples, C.J., Michaelsen, B.H. and McKirdy, D.M., 1996. Petroleum potential of the Eringa Trough in South Australia and the Northern Territory. *APEA Journal,* 36(1):322-349.
- Ambrose G, 2006. Northern Territory of Australia, onshore hydrocarbon potential, 2006. *Northern Territory Geological Survey, Record* 2006-003.
- Ambrose GJ, Liu K, Deighton I, Eadington PJ and Boreham CJ, 2002. New petroleum models in the Pedirka Basin, Northern Territory, Australia. *The APPEA Journal* 41, 139–163.

• Cotton, T.B., Scardigno, M.F. and Hibburt, J.E. (Eds), 2006. The petroleum geology of South Australia. Vol. 2: Eromanga Basin. 2nd edn. *South Australia. Department of Primary Industries and Resources. Petroleum Geology of South Australia Series*.

• Middleton MF, Barker CE and Heugh J, 2005. The Geology of the western part of the Pedirka Basin: Madigan and Eringa troughs. *Central Australian Basins Symposium, petroleum and minerals potential, Alice Springs, 16–18 August 2005, Handbook*, 16.

• Youngs BC, 1975. The Early Permian Purni Formation of the Pedirka Basin. *Geological Survey of South Australia, Quarterly Geological Notes* 54, 5–12.

11.17 PERTH BASIN

• Cadman, S. J., Pain, L. and Vuckovic, V. (1994) *Perth Basin, W.A.*, Australian Petroleum Accumulations Report 10, Bureau of Resource Sciences, Canberra.\

• Crostella, A., and Backhouse, J., 2000, Geology and petroleum exploration in the central and southern Perth Basin: Western Australia Geological Survey, Report 57.

• Crostella, A., 1995, An evaluation of the hydrocarbon potential of the onshore northern Perth Basin, Western Australia: Western Australia Geological Survey, Report 43, 67p.

• DEPARTMENT OF MINERALS AND ENERGY WESTERN AUSTRALIA, 1999, Petroleum in Western Australia, mid-1999 edition: Perth, Department of Minerals and Energy, Petroleum Division, 57p.

• Lane, C. M., and Watson, R. J., 1985, Development of the Woodada gasfield: APPEA Journal, v. 25(1), p. 316–328.

• Mory, A. J., and Iasky, R. P., 1996, Stratigraphy and structure of the onshore northern Perth Basin, Western Australia: Western Australia Geological Survey, Report 46, 101p.

• Owad-Jones, D.L., and Ellis, G.K., 2000, Western Australia atlas of petroleum fields, Onshore Perth Basin: Petroleum Division, DMEWA. Volume 1.

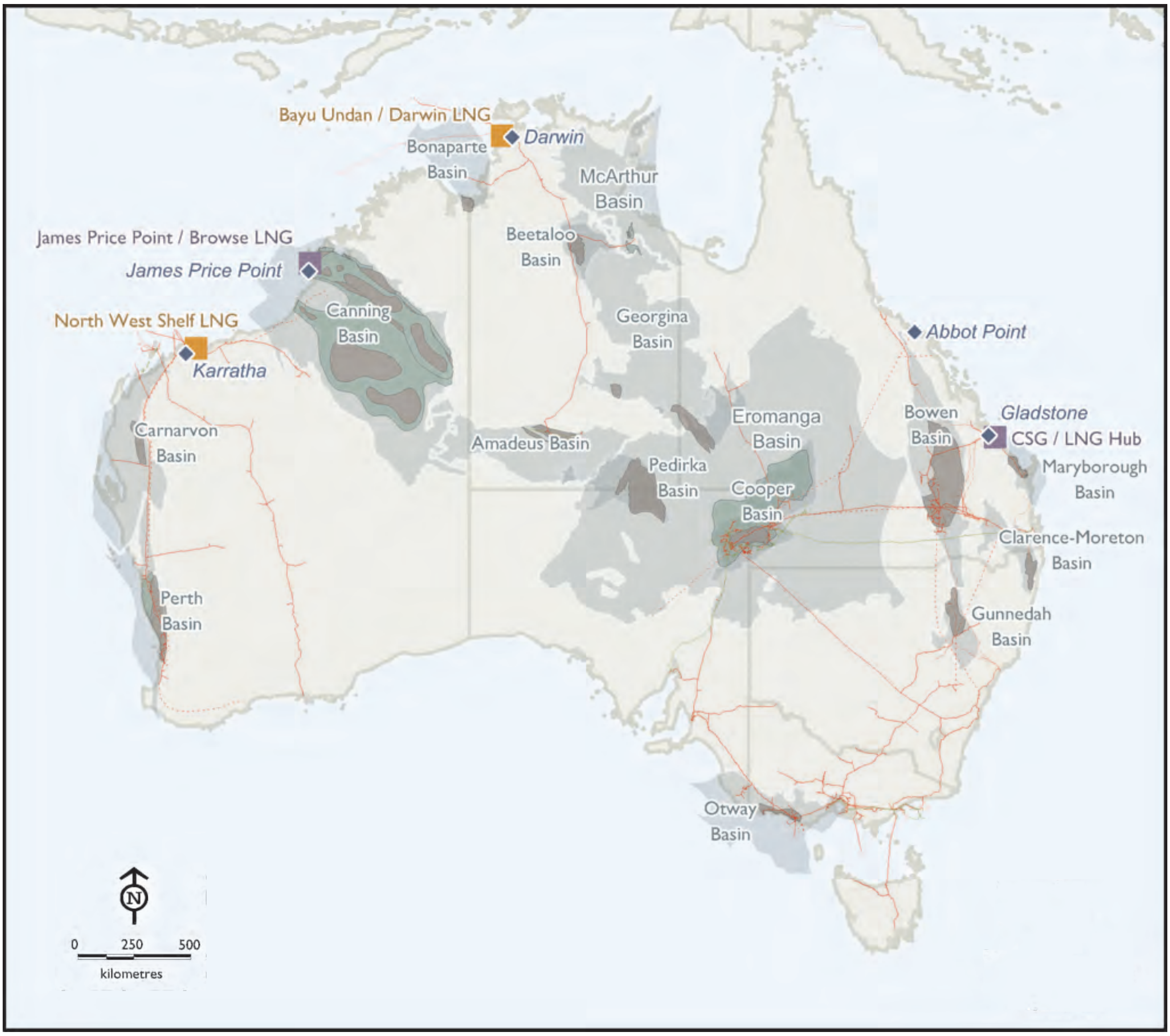
• Skinner, J. 1991. The tectonic elements of the Perth basin. SAGASCO Resources Ltd. Structure Map

12 DISCLAIMER

AWT INTERNATIONAL has relied on publicly available data to compile the Shale Gas Plays. Information consisted of seismic data, well completion reports, geological and geochemical studies, and published technical papers and studies. These were compiled and written by various industry and government bodies. The material was reviewed for its quality, accuracy and validity and was captured and modified to suit this basin by basin analysis of Shale Gas Plays. However, the level of review of such information does not amount to an audit, verification or due diligence, save to the extent necessary to satisfy ourselves that it is reasonable for us to rely on that information. No warranty can be given that this report has analysed all parameters which a more extensive examination might reveal. We give no warranty that reliance upon the report will accomplish any particular result. However, the opinions and statements in this report are made in good faith and in the belief that such opinions and statements are not misleading.

This report has been prepared based on information available up to and including 30 November 2012.

FIGURES



◆	Town		Gas Pipeline
	Existing LNG Terminal		Proposed Gas Pipeline
	Proposed LNG Terminal		Oil Pipeline
	Wet Gas Play		Proposed Oil Pipeline
	Dry Gas Play		

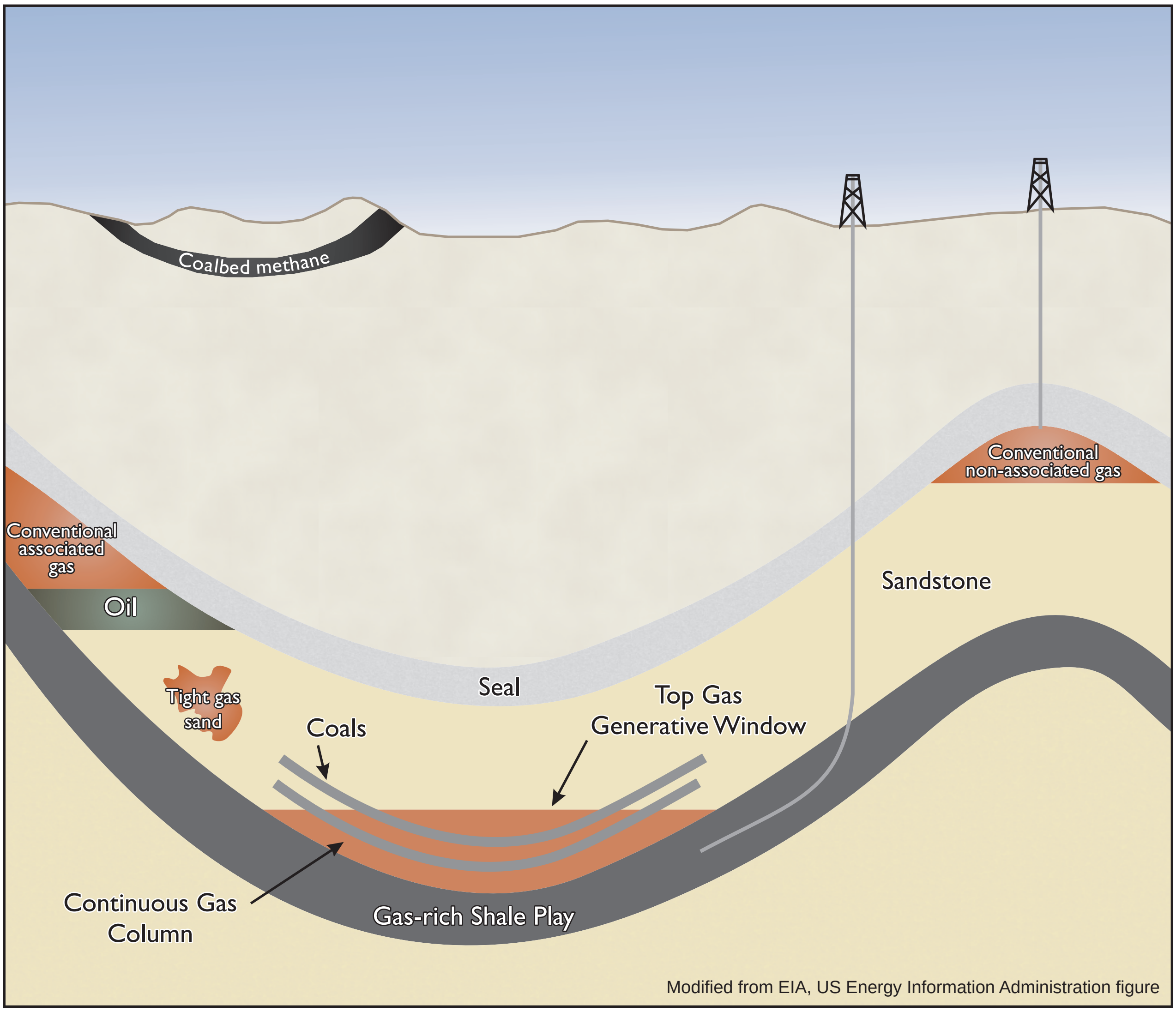
Australia

Major Shale gas basins & plays

Author:KR Date: 06 Dec 2012
Drafted: JW Date: 06 Dec 2012 Drawing No.: J7724

AWT INTERNATIONAL
www.awtinternational.com/

FIGURE 1



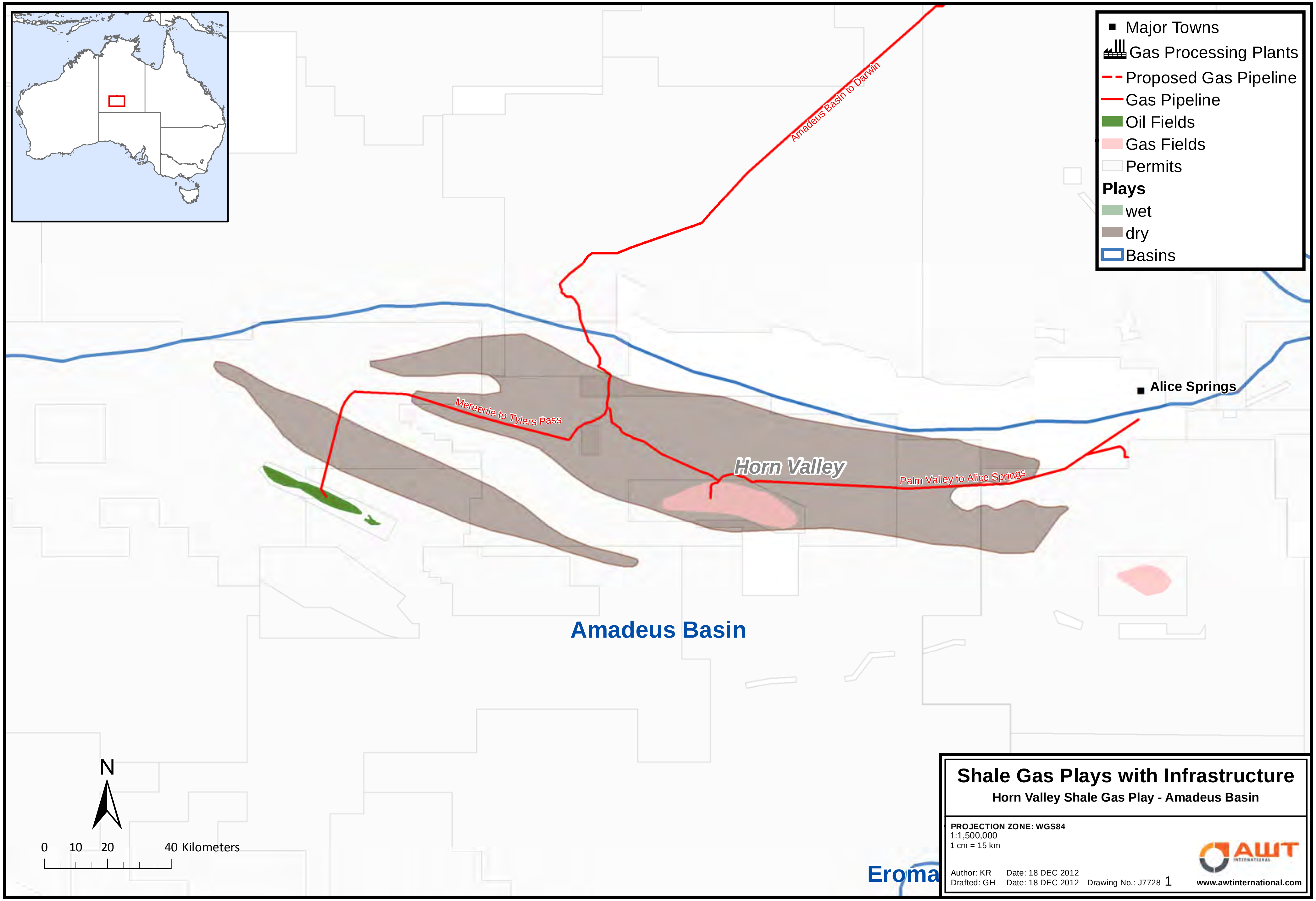
SCHEMATIC CROSS-SECTION

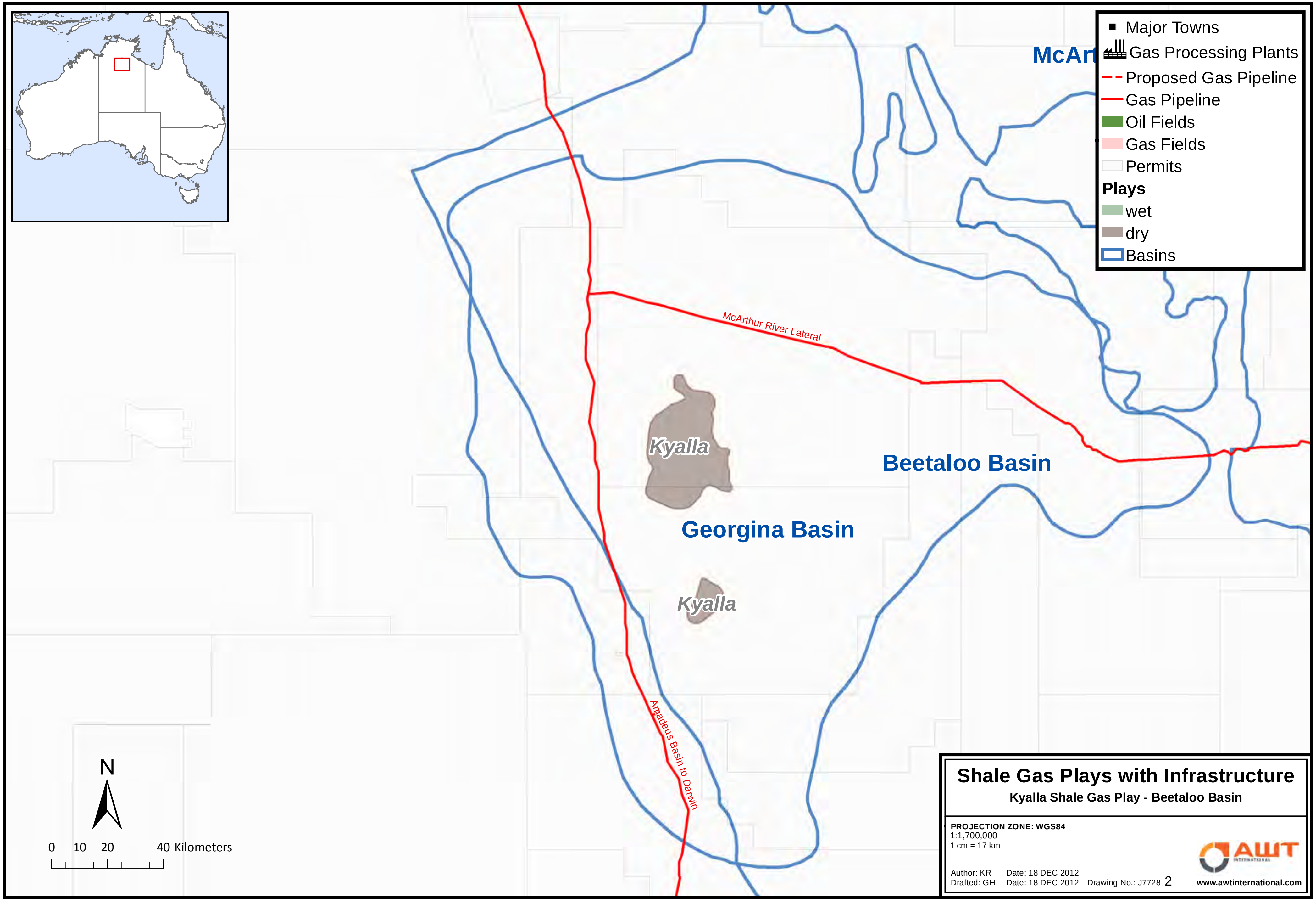
Shale Gas Play and Continuous Gas Play Schematic (USGS)

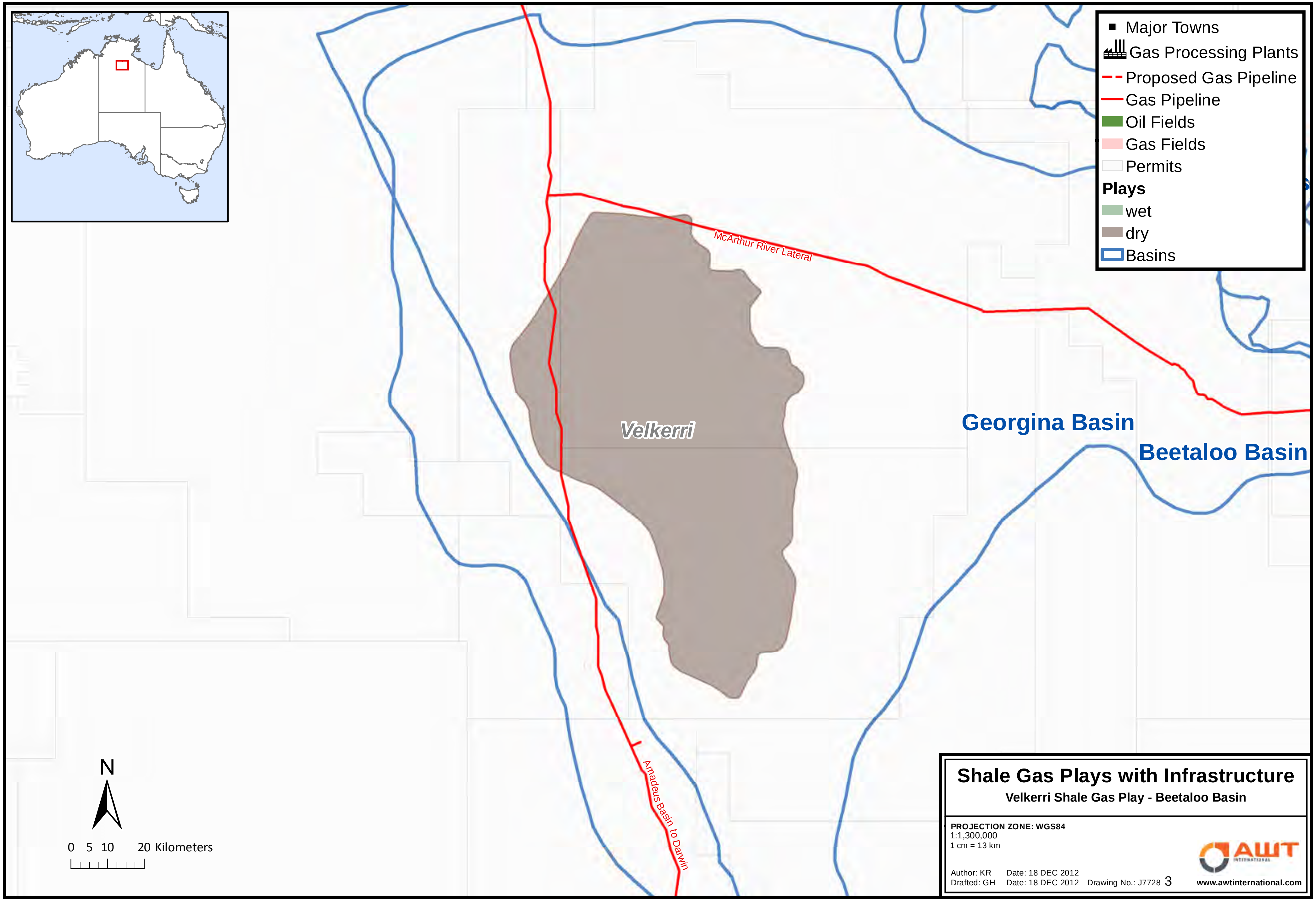
Drafted: WR | Date: 14 Nov 2012 | Drawing No.: J7694 | www.awtinternational.com/

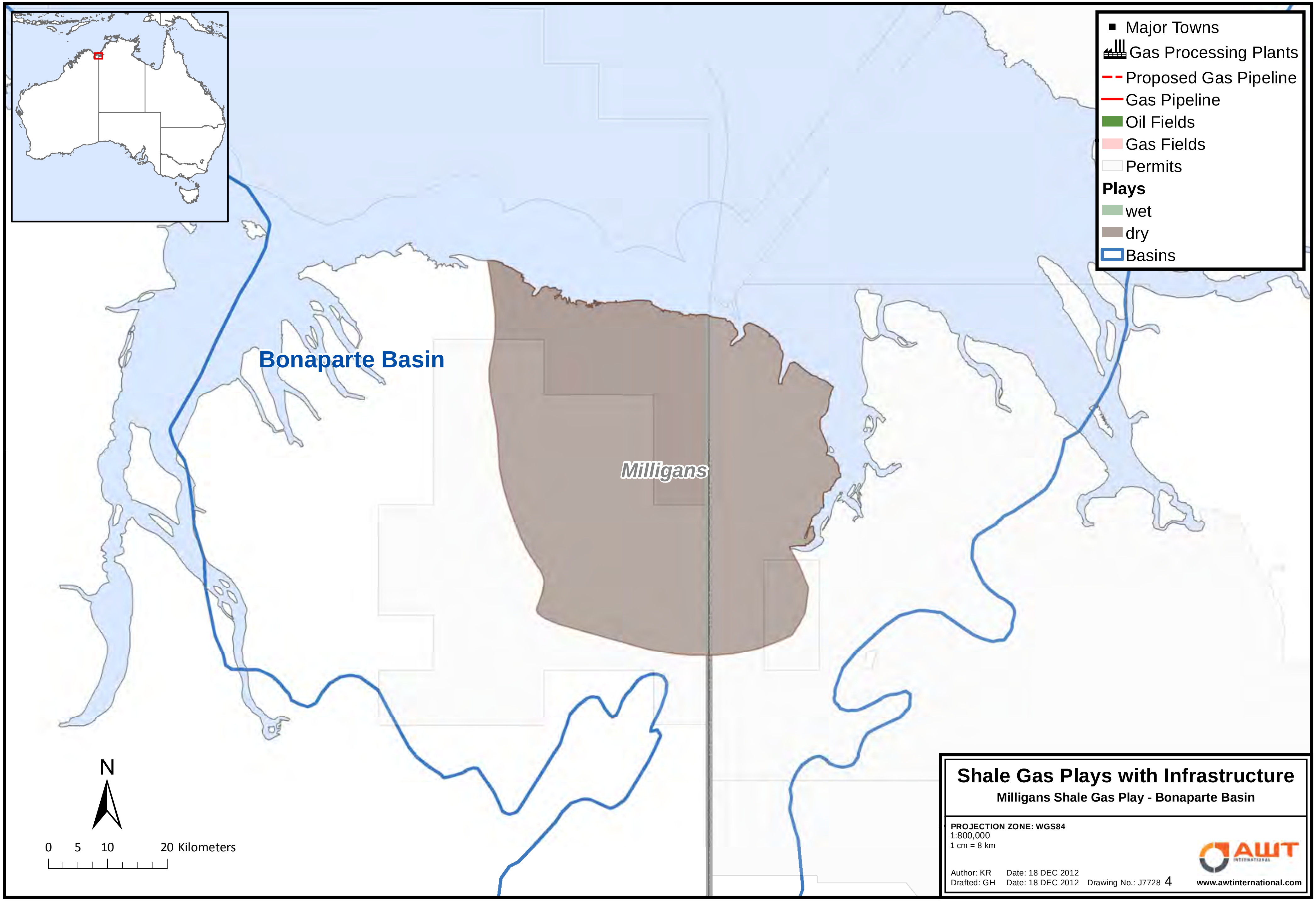
FIGURE 2

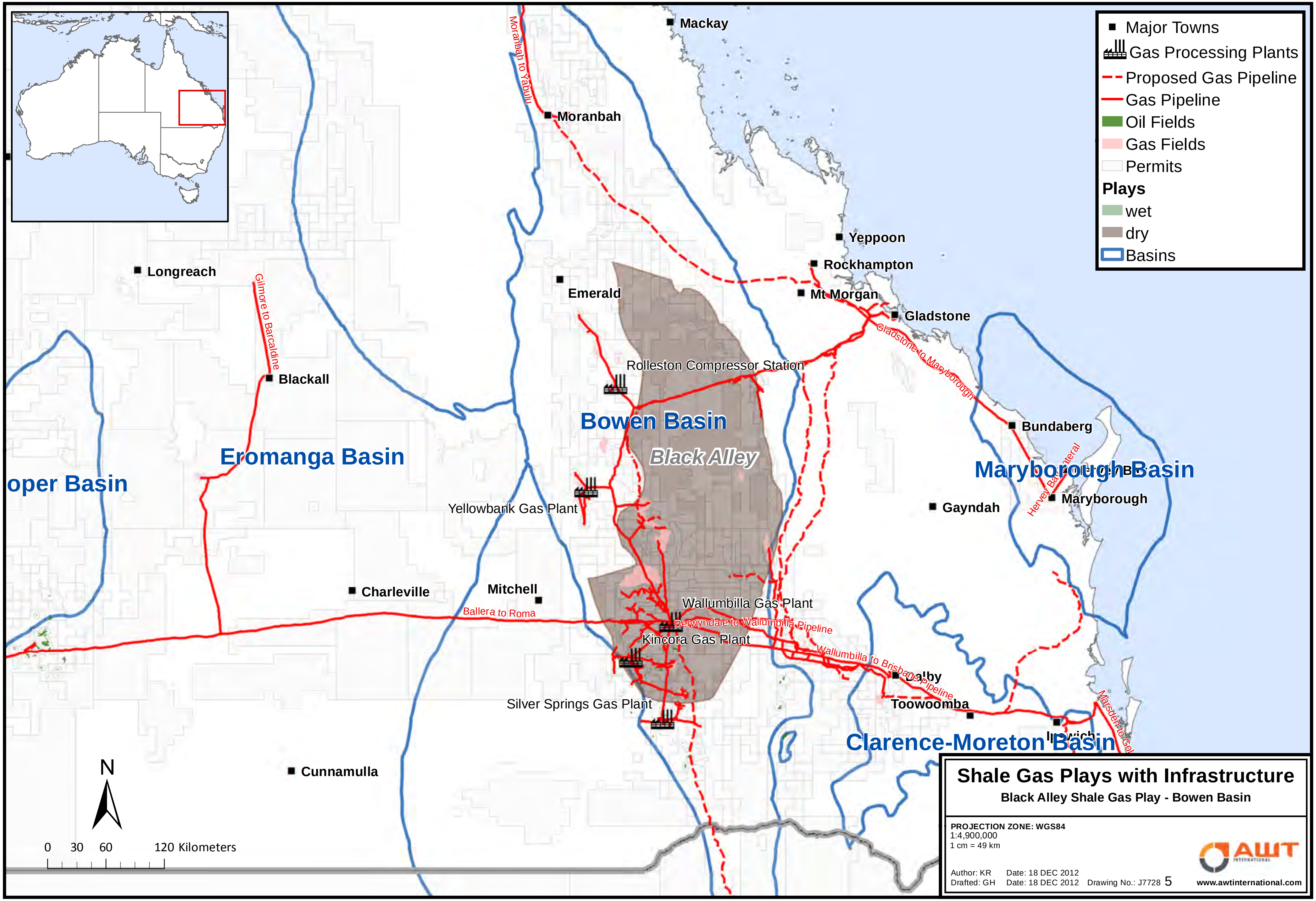
APPENDICES


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Amadeus Basin to Darwin
Mereenie to Tylers Pass
Horn Valley
Palm Valley to Alice Springs
Alice Springs
Amadeus Basin
Eroma
N
0 10 20 40 Kilometers
Shale Gas Plays with Infrastructure
Horn Valley Shale Gas Play - Amadeus Basin
PROJECTION ZONE: WGS84
1:1,500,000
1 cm = 15 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 1
AWT INTERNATIONAL
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
McArt
McArthur River Lateral
Kyalla
Beetaloo Basin
Georgina Basin
Kyalla
Amadeus Basin to Darwin
N
0 10 20 40 Kilometers
Shale Gas Plays with Infrastructure
Kyalla Shale Gas Play - Beetaloo Basin
PROJECTION ZONE: WGS84
1:1,700,000
1 cm = 17 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 2
AWT INTERNATIONAL
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
McArthur River Lateral
Velkerri
Georgina Basin
Beetaloo Basin
Amadeus Basin to Darwin
N
0 5 10 20 Kilometers
Shale Gas Plays with Infrastructure
Velkerri Shale Gas Play - Beetaloo Basin
PROJECTION ZONE: WGS84
1:1,300,000
1 cm = 13 km
Author: KR
Drafted: GH
Date: 18 DEC 2012
Date: 18 DEC 2012
Drawing No.: J7728 3
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Bonaparte Basin
Milligans
N
0 5 10 20 Kilometers
Shale Gas Plays with Infrastructure
Milligans Shale Gas Play - Bonaparte Basin
PROJECTION ZONE: WGS84
1:800,000
1 cm = 8 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 4
AWT
www.awtinternational.com

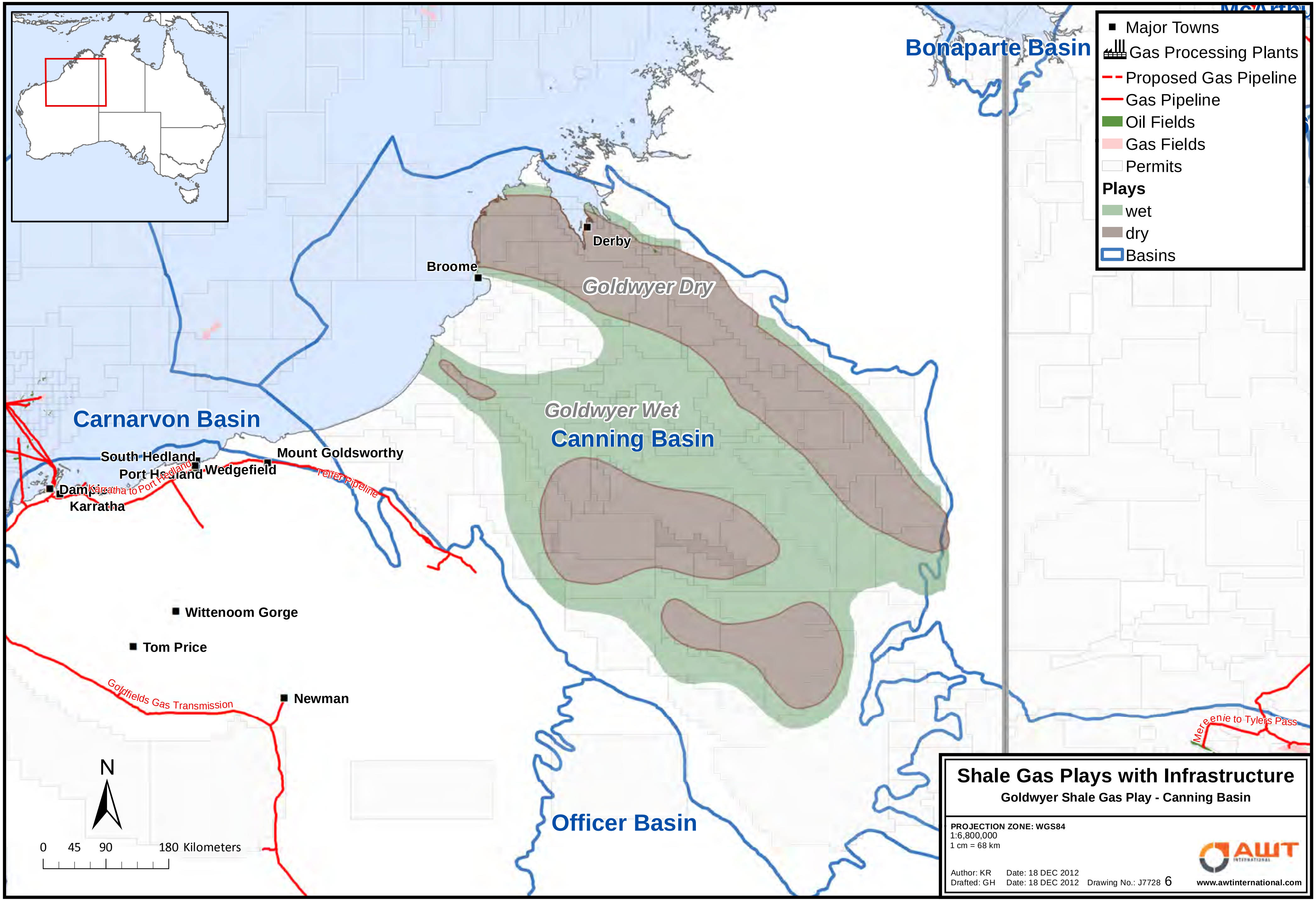


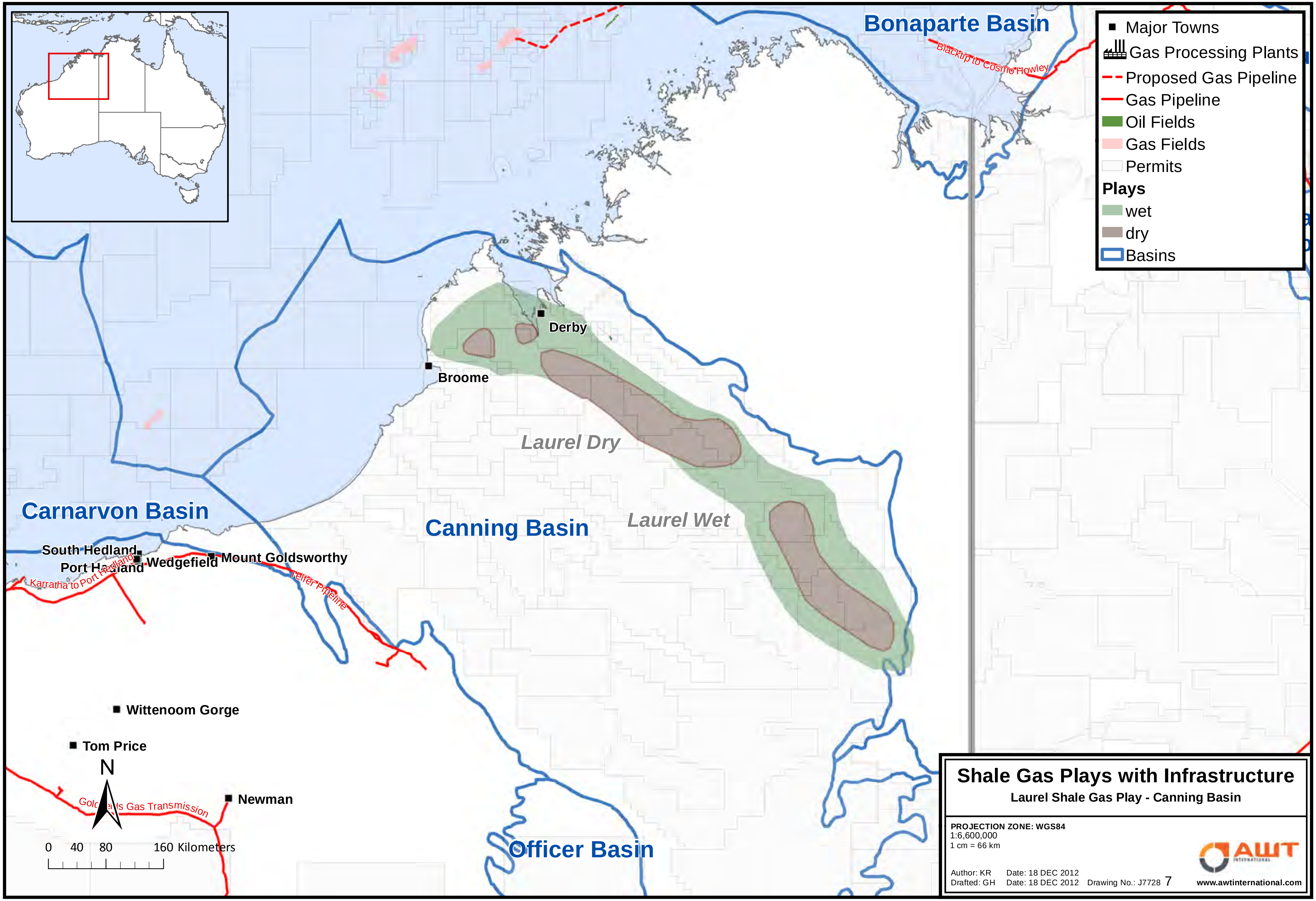
Shale Gas Plays with Infrastructure
Black Alley Shale Gas Play - Bowen Basin

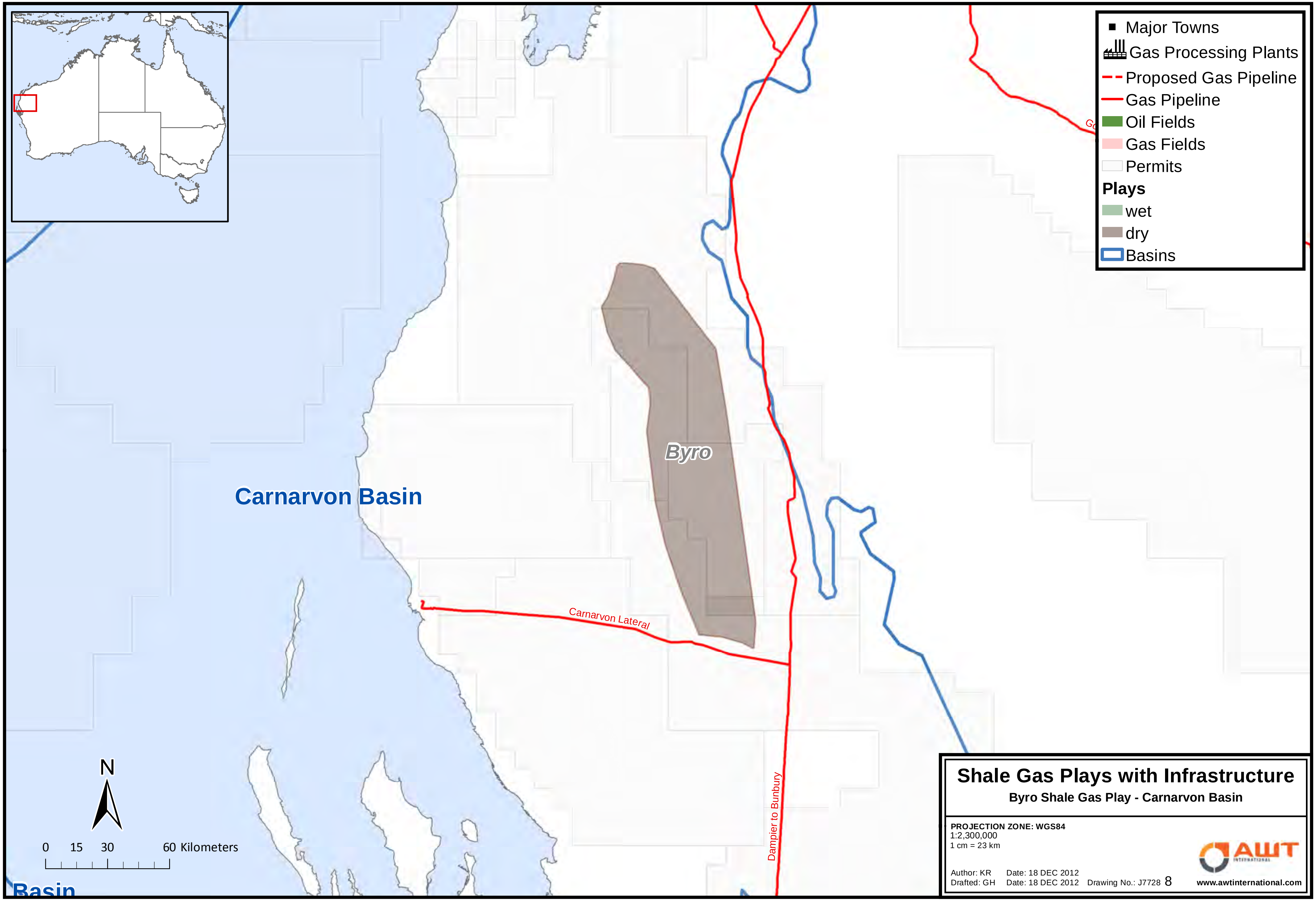
PROJECTION ZONE: WGS84
1:4,900,000
1 cm = 49 km

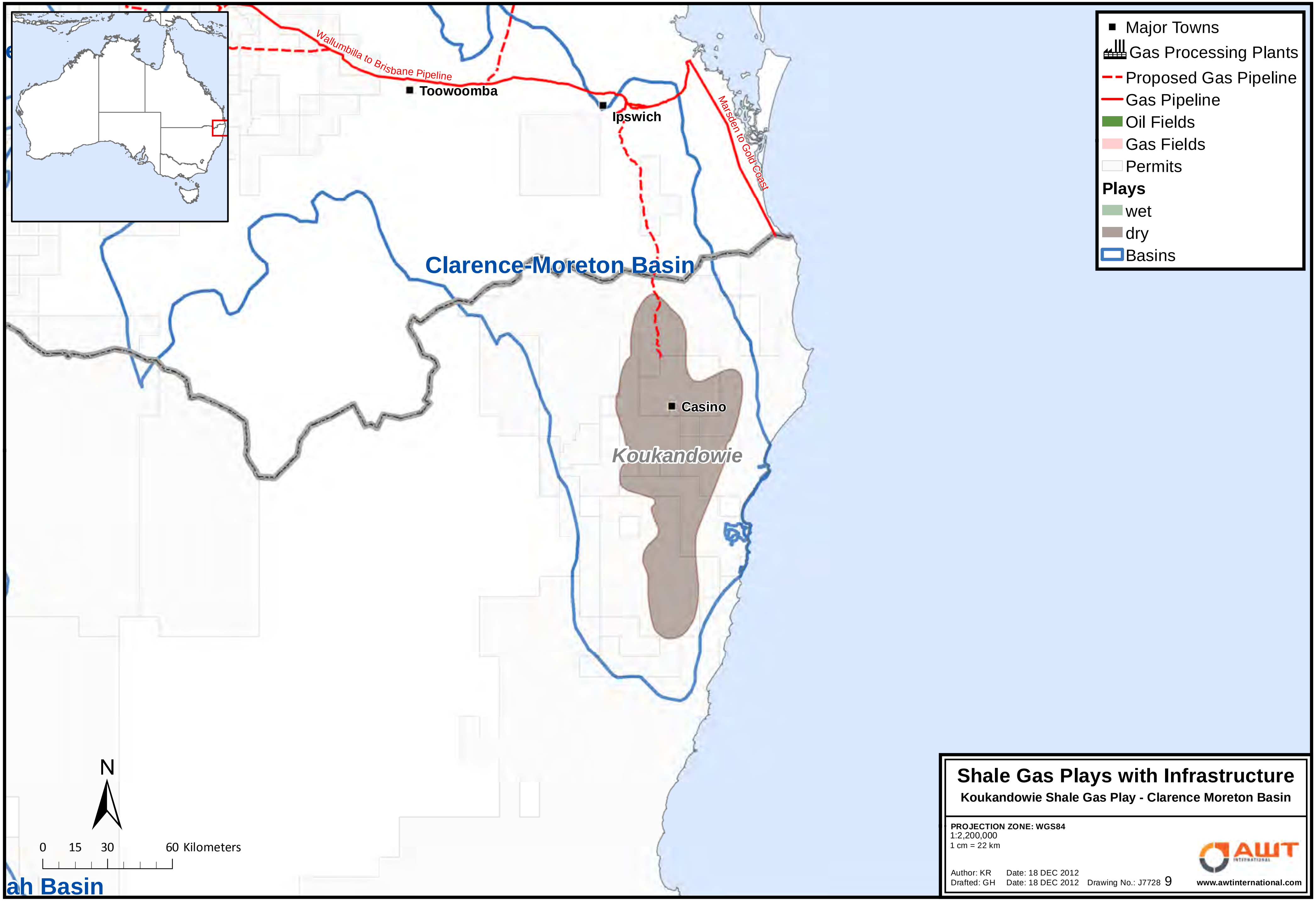
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 5

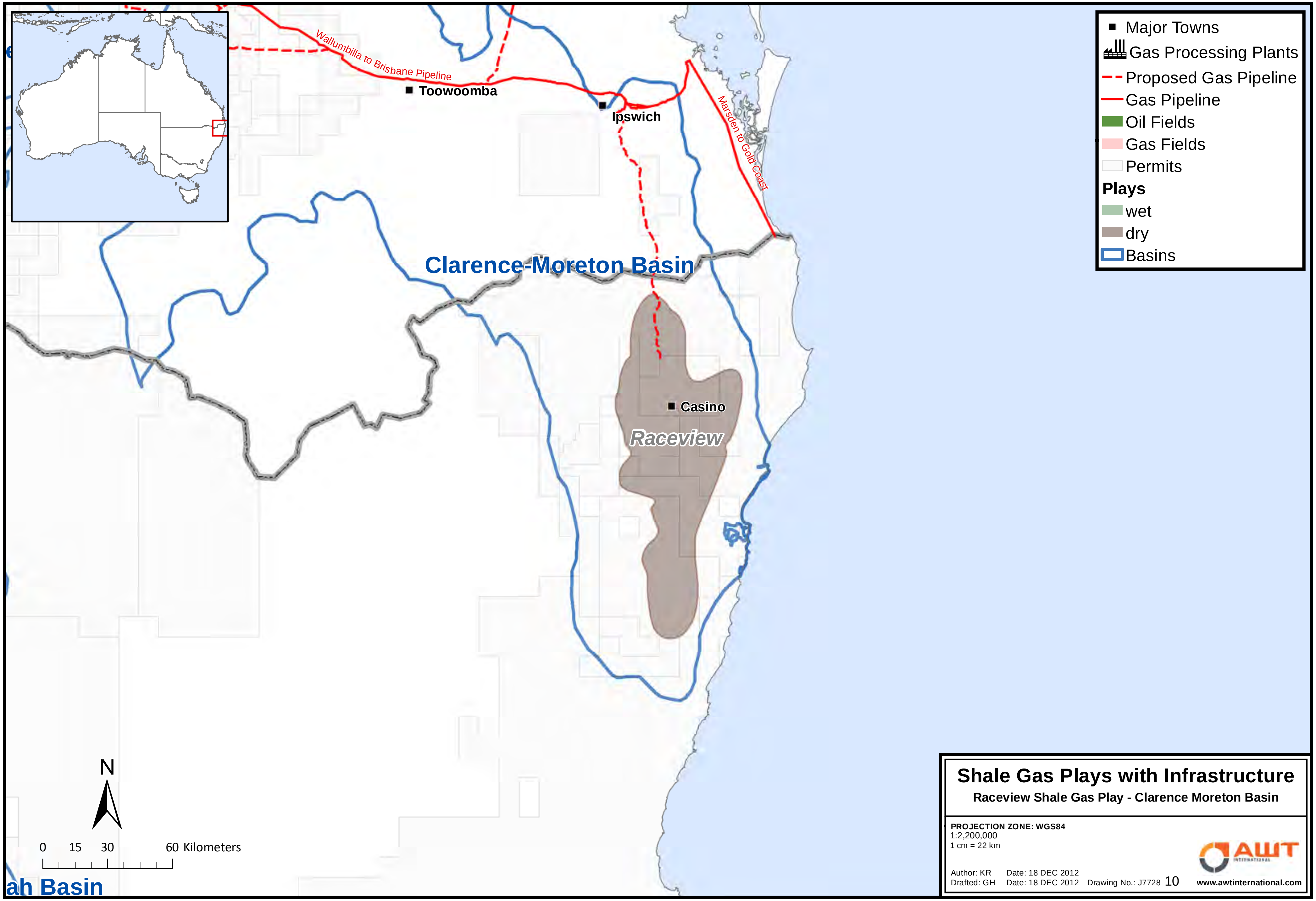
AWT INTERNATIONAL
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Bonaparte Basin
Carnarvon Basin
Canning Basin
Officer Basin
Goldwyer Dry
Goldwyer Wet
Derby
Broome
South Hedland
Port Hedland
Wedgefield
Mount Goldsworthy
Dampier
Karratha
Karratha to Port Hedland
Telfer Pipeline
Wittenoom Gorge
Tom Price
Newman
Goldfields Gas Transmission
Mereenie to Tylers Pass
N
0 45 90 180 Kilometers
Shale Gas Plays with Infrastructure
Goldwyer Shale Gas Play - Canning Basin
PROJECTION ZONE: WGS84
1:6,800,000
1 cm = 68 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 6
www.awtinternational.com


Bonaparte Basin
Blacktip to Cosmo Howley
Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Derby
Broome
Laurel Dry
Laurel Wet
Carnarvon Basin
Canning Basin
South Hedland
Port Hedland
Wedgefield
Mount Goldsworthy
Karratha to Port Hedland
Telfer Pipeline
Wittenoom Gorge
Tom Price
N
Newman
Goldfields Gas Transmission
0 40 80 160 Kilometers
Officer Basin
Shale Gas Plays with Infrastructure
Laurel Shale Gas Play - Canning Basin
PROJECTION ZONE: WGS84
1:6,600,000
1 cm = 66 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 7
AWT INTERNATIONAL
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Carnarvon Basin
Byro
Carnarvon Lateral
Dampier to Bunbury
N
0 15 30 60 Kilometers
Basin
Shale Gas Plays with Infrastructure
Byro Shale Gas Play - Carnarvon Basin
PROJECTION ZONE: WGS84
1:2,300,000
1 cm = 23 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 8
AWT INTERNATIONAL
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Wallumbilla to Brisbane Pipeline
Marsden to Gold Coast
Toowoomba
Ipswich
Clarence-Moreton Basin
Casino
Koukandowie
ah Basin
N
0 15 30 60 Kilometers
Shale Gas Plays with Infrastructure
Koukandowie Shale Gas Play - Clarence Moreton Basin
PROJECTION ZONE: WGS84
1:2,200,000
1 cm = 22 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 9
www.awtinternational.com



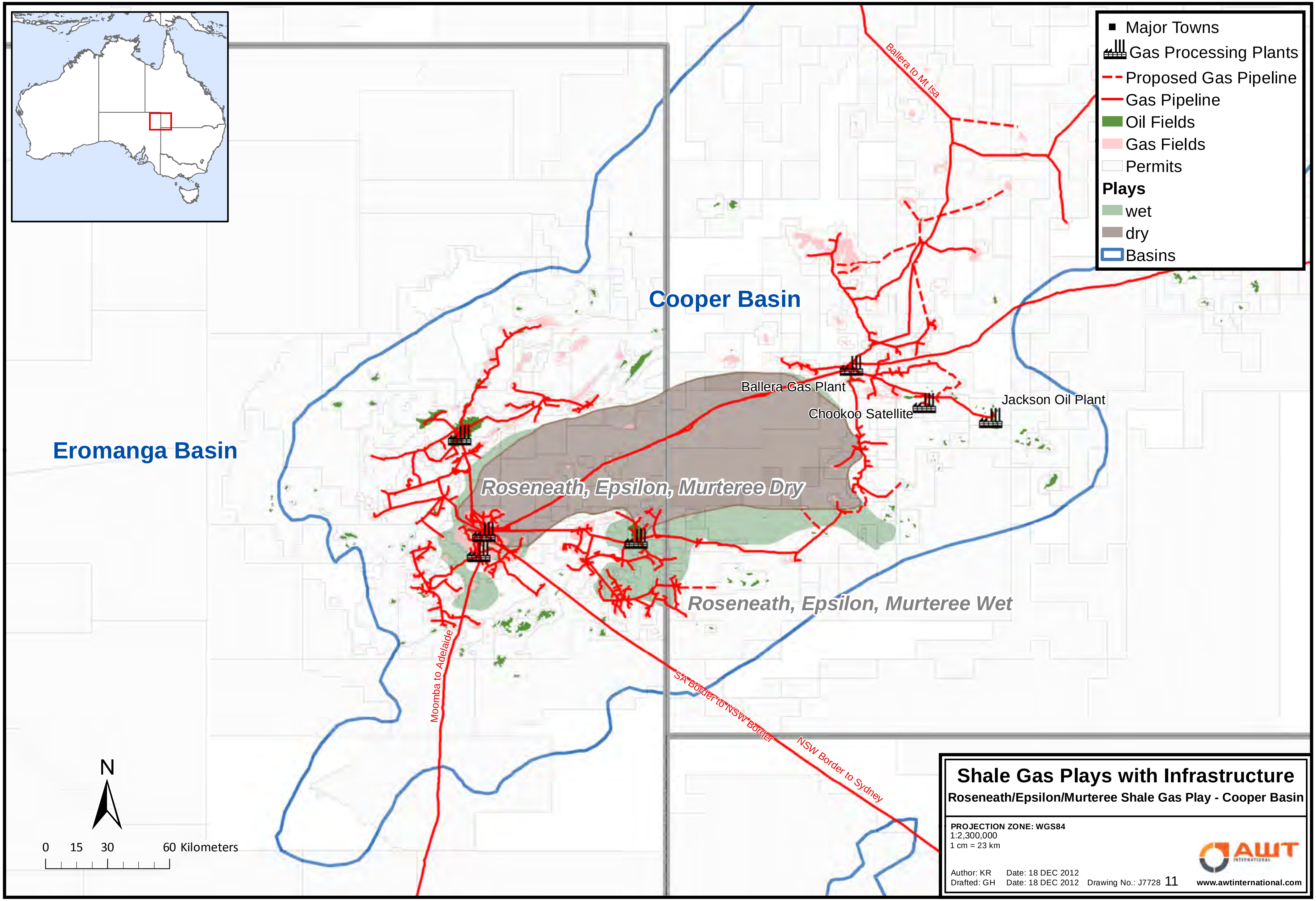
Shale Gas Plays with Infrastructure

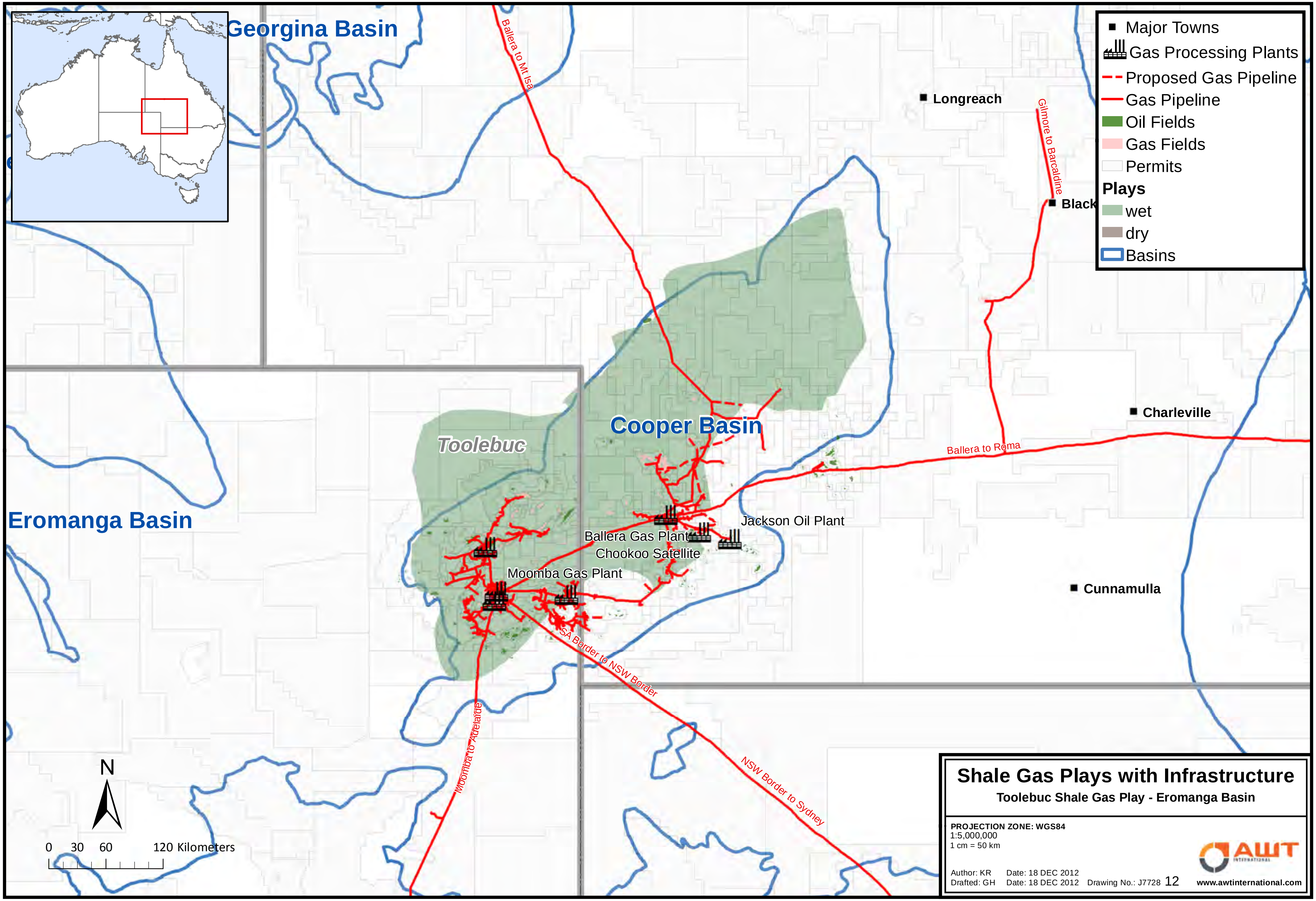
Raceview Shale Gas Play - Clarence Moreton Basin

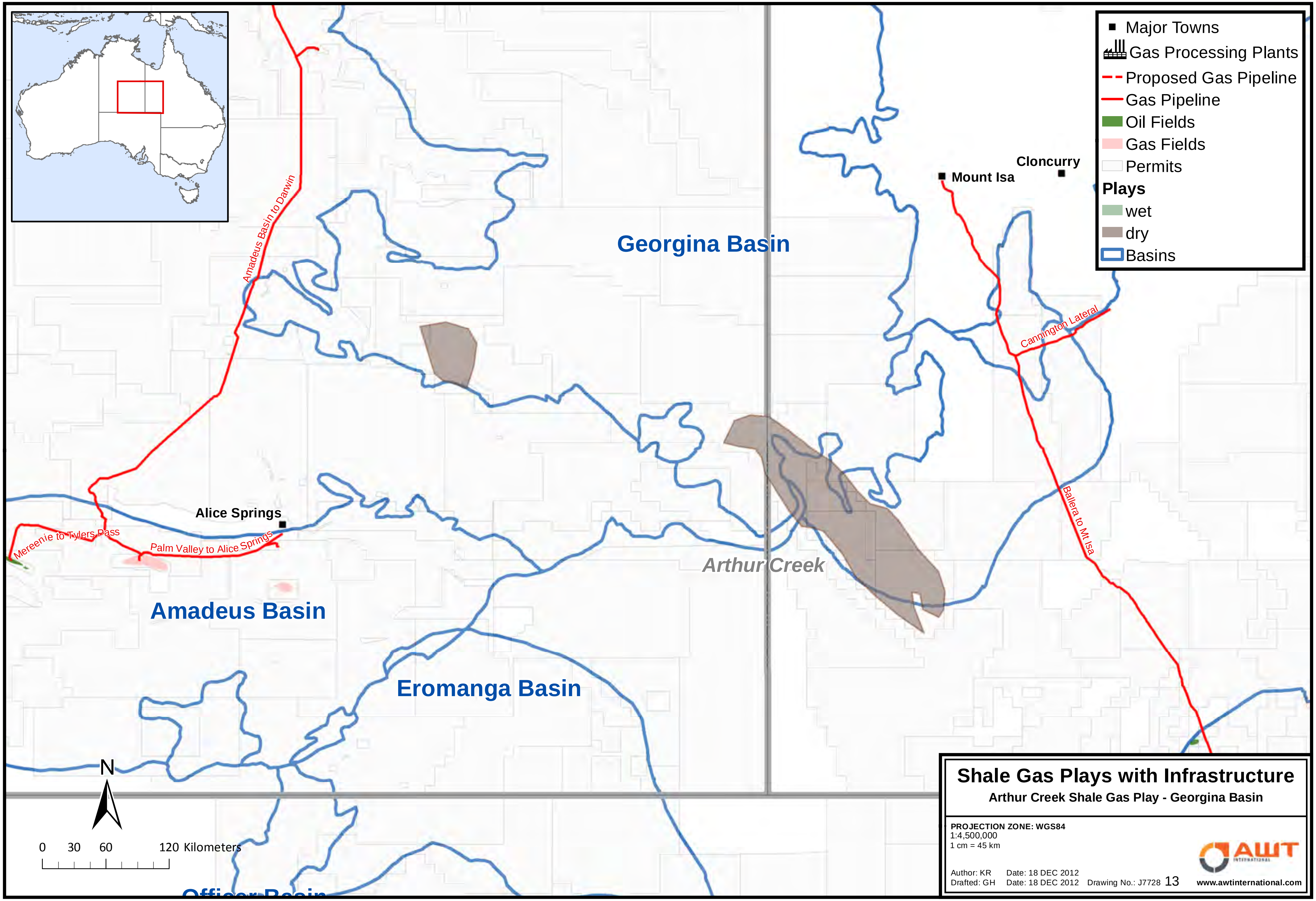
PROJECTION ZONE: WGS84
1:2,200,000
1 cm = 22 km

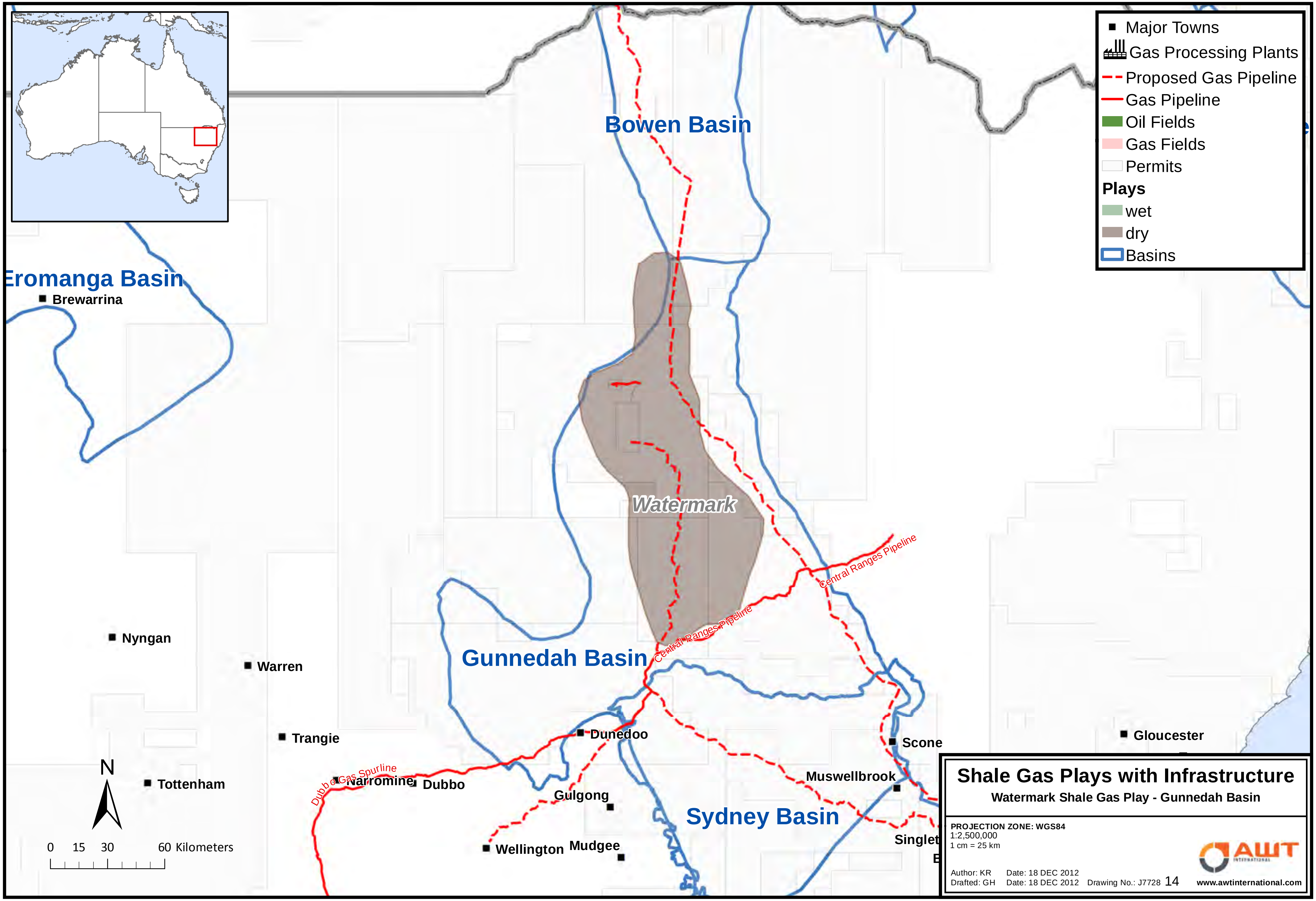
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 10

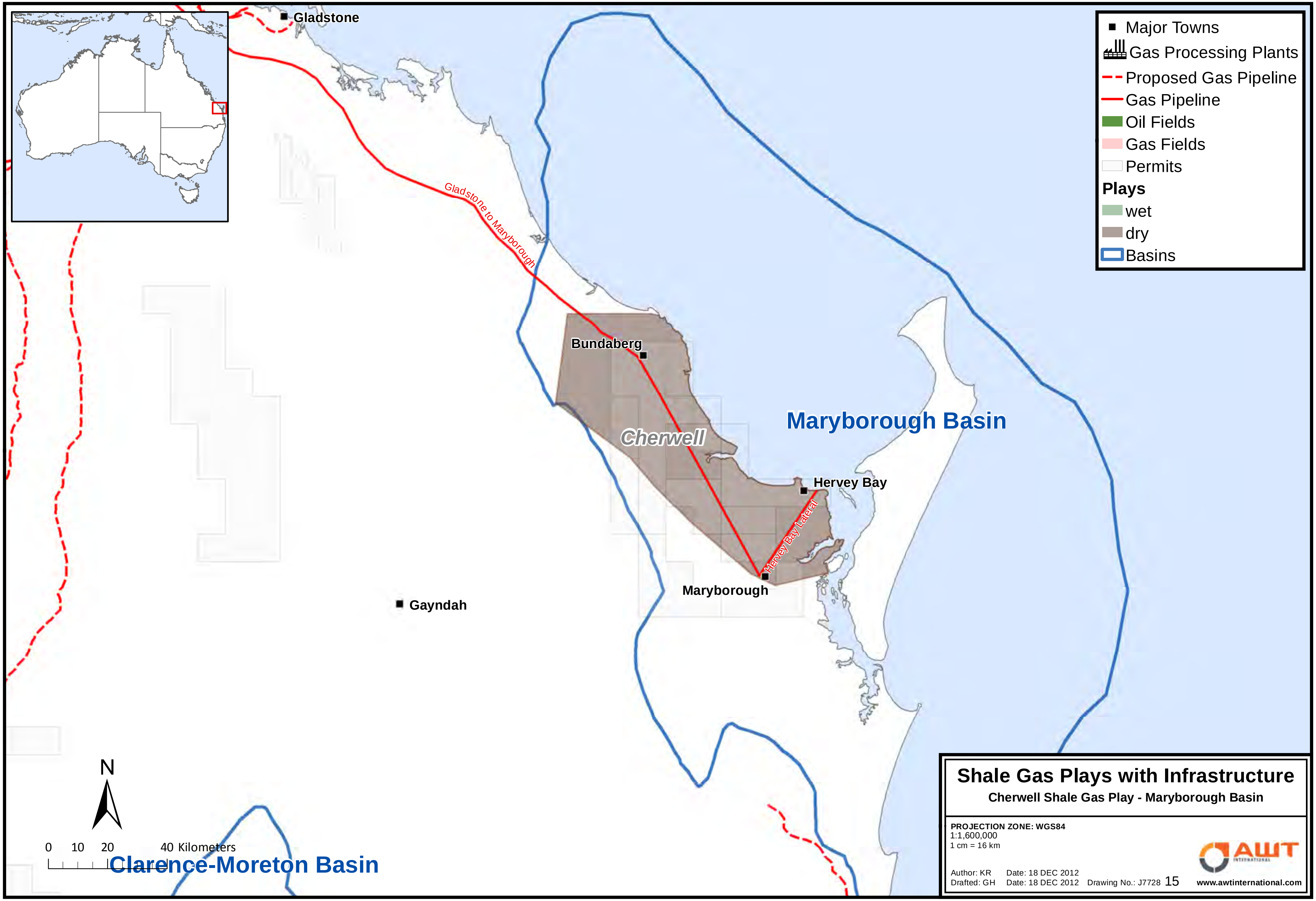
AWT INTERNATIONAL
www.awtinternational.com

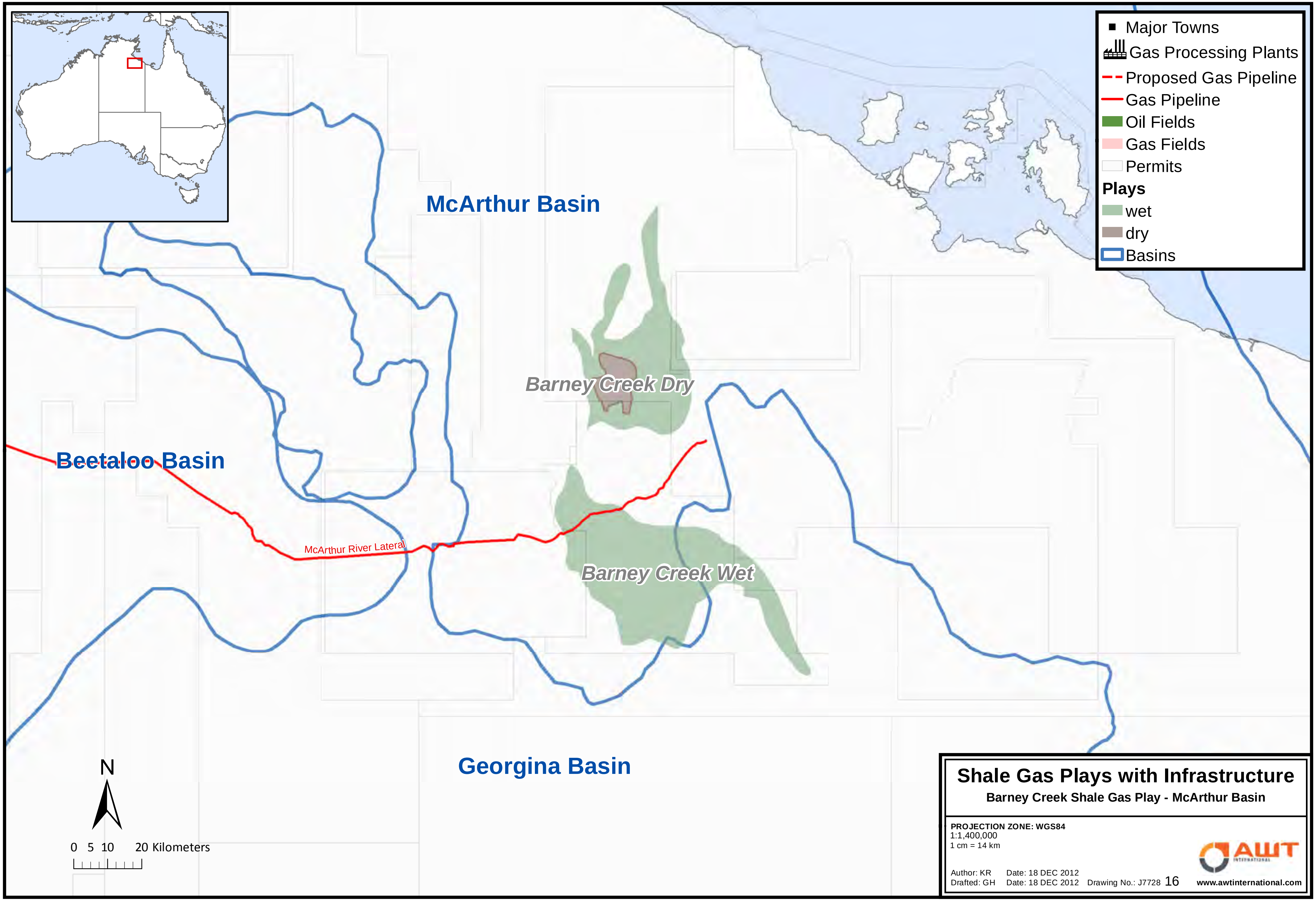

Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Cooper Basin
Eromanga Basin
Roseneath, Epsilon, Murteree Dry
Roseneath, Epsilon, Murteree Wet
Ballera Gas Plant
Chookoo Satellite
Jackson Oil Plant
Ballera to Mt Isa
Moomba to Adelaide
SA Border to NSW Border
NSW Border to Sydney
N
0 15 30 60 Kilometers
Shale Gas Plays with Infrastructure
Roseneath/Epsilon/Murteree Shale Gas Play - Cooper Basin
PROJECTION ZONE: WGS84
1:2,300,000
1 cm = 23 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 11
www.awtinternational.com

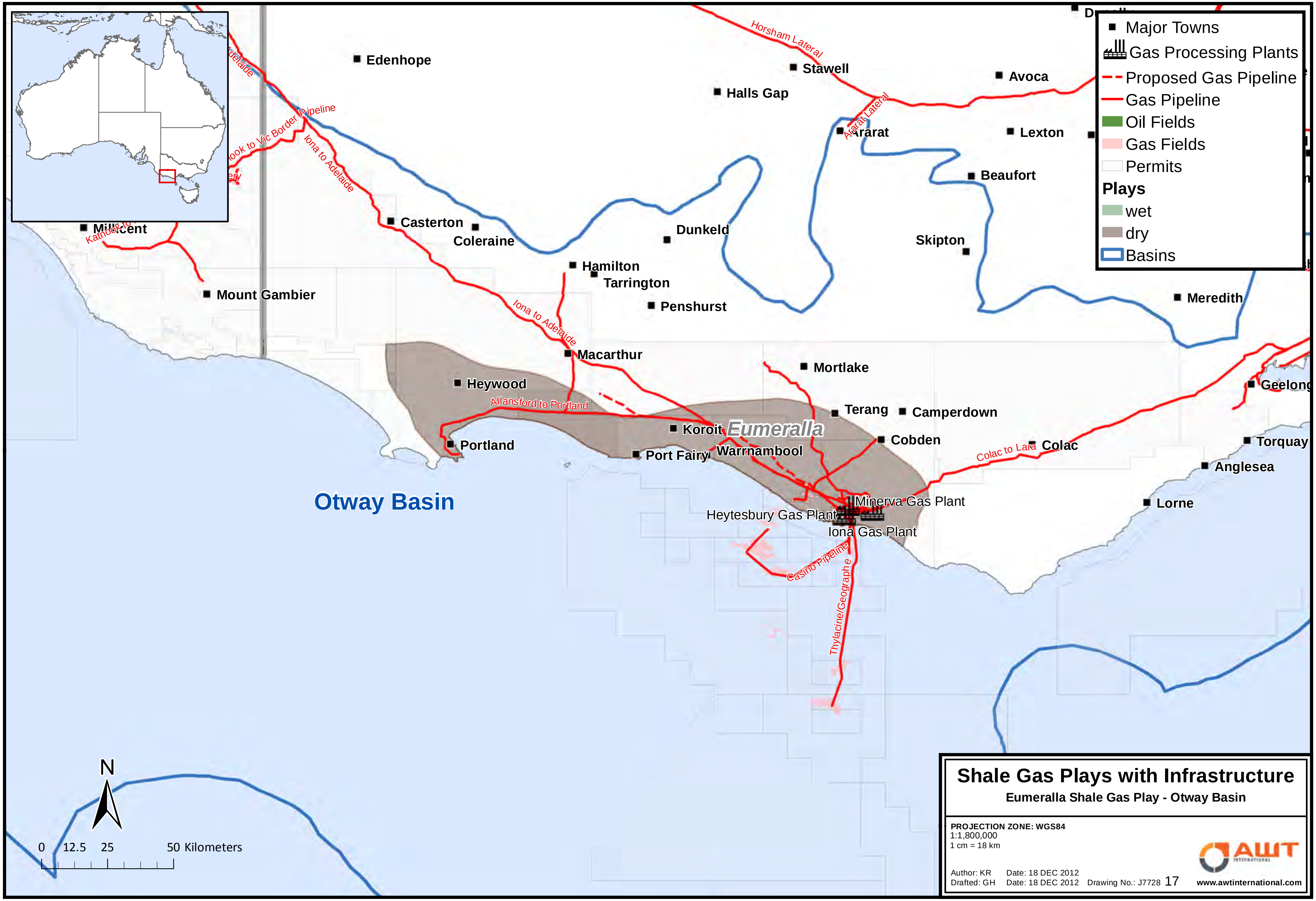

Georgina Basin
Eromanga Basin
Cooper Basin
Toolebuc
Longreach
Black
Charleville
Cunnamulla
Ballera to Mt Isa
Gilmore to Barcaldine
Ballera to Roma
Jackson Oil Plant
Ballera Gas Plant
Chookoo Satellite
Moomba Gas Plant
SA Border to NSW Border
NSW Border to Sydney
Moomba to Adelaide
Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
N
0 30 60 120 Kilometers
Shale Gas Plays with Infrastructure
Toolebuc Shale Gas Play - Eromanga Basin
PROJECTION ZONE: WGS84
1:5,000,000
1 cm = 50 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 12
www.awtinternational.com

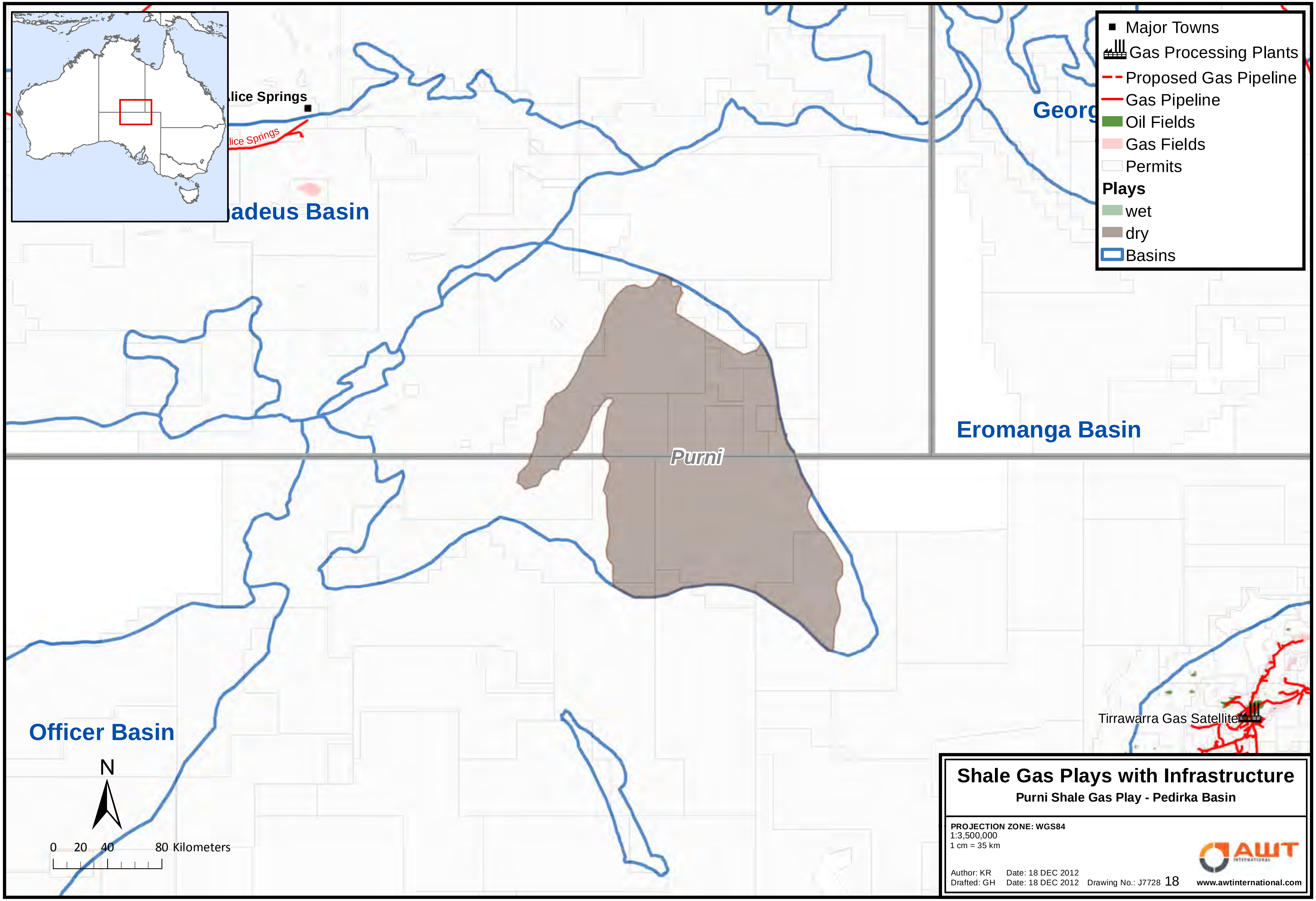

Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Georgina Basin
Amadeus Basin
Eromanga Basin
Officer Basin
Arthur Creek
Alice Springs
Mount Isa
Cloncurry
Amadeus Basin to Darwin
Mereenie to Tylers Pass
Palm Valley to Alice Springs
Cannington Lateral
Ballera to Mt Isa
N
0 30 60 120 Kilometers
Shale Gas Plays with Infrastructure
Arthur Creek Shale Gas Play - Georgina Basin
PROJECTION ZONE: WGS84
1:4,500,000
1 cm = 45 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 13
AWT INTERNATIONAL
www.awtinternational.com

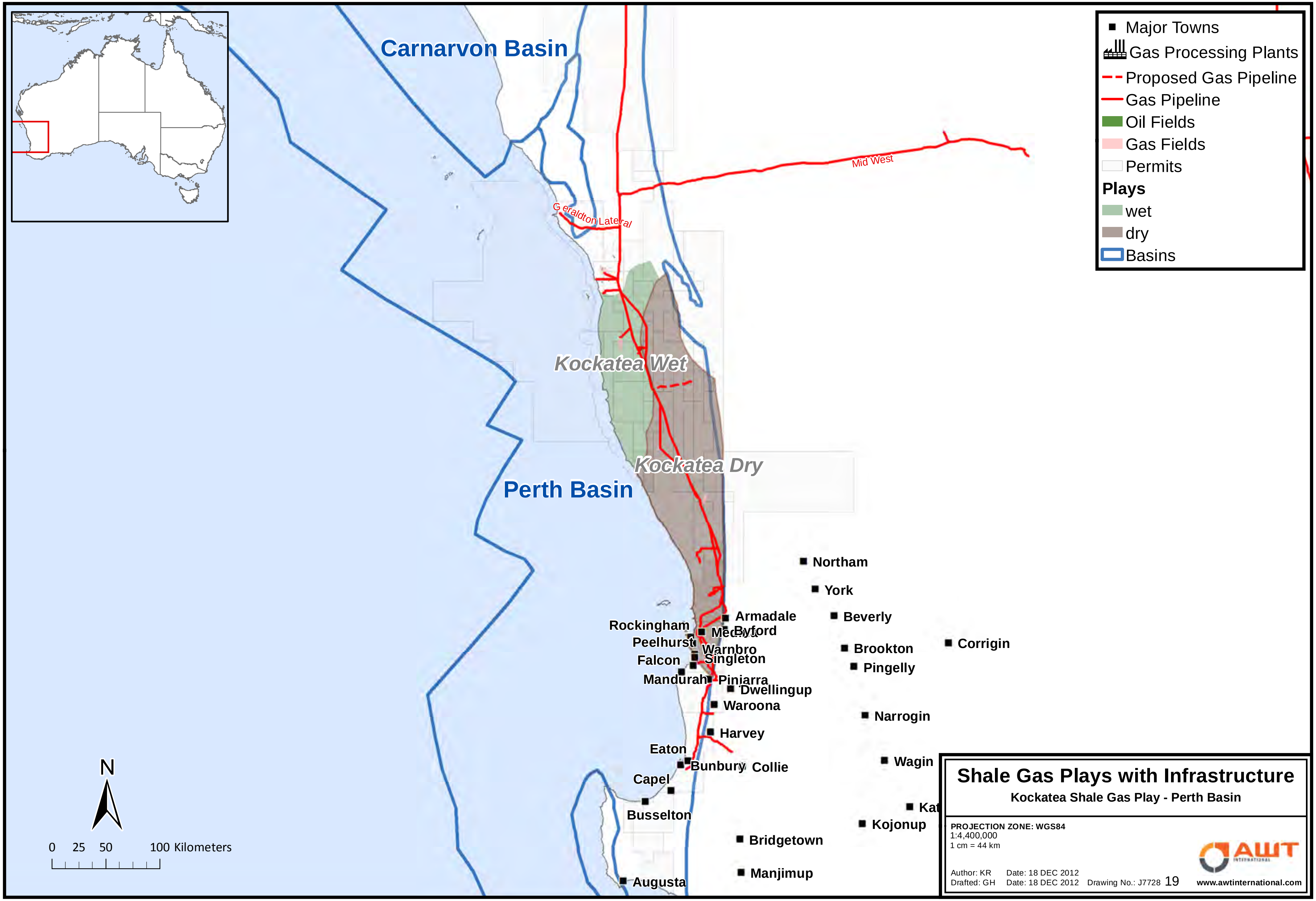

Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Bowen Basin
Eromanga Basin
Gunnedah Basin
Sydney Basin
Watermark
Central Ranges Pipeline
Central Ranges Pipeline
Dubbo Gas Spurline
Brewarrina
Nyngan
Warren
Trangie
Tottenham
Narromine
Dubbo
Dunedoo
Gulgong
Wellington
Mudgee
Scone
Muswellbrook
Gloucester
N
0 15 30 60 Kilometers
Shale Gas Plays with Infrastructure
Watermark Shale Gas Play - Gunnedah Basin
PROJECTION ZONE: WGS84
1:2,500,000
1 cm = 25 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 14
www.awtinternational.com


Gladstone
Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Gladstone to Maryborough
Bundaberg
Cherwell
Maryborough Basin
Hervey Bay
Hervey Bay Lateral
Maryborough
Gayndah
N
0 10 20 40 Kilometers
Clarence-Moreton Basin
Shale Gas Plays with Infrastructure
Cherwell Shale Gas Play - Maryborough Basin
PROJECTION ZONE: WGS84
1:1,600,000
1 cm = 16 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 15
AWT
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
McArthur Basin
Beetaloo Basin
Georgina Basin
Barney Creek Dry
Barney Creek Wet
McArthur River Lateral
N
0 5 10 20 Kilometers
Shale Gas Plays with Infrastructure
Barney Creek Shale Gas Play - McArthur Basin
PROJECTION ZONE: WGS84
1:1,400,000
1 cm = 14 km
Author: KR
Drafted: GH
Date: 18 DEC 2012
Date: 18 DEC 2012
Drawing No.: J7728 16
AWT INTERNATIONAL
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Edenhope
Stawell
Halls Gap
Avoca
Ararat
Lexton
Beaufort
Skipton
Casterton
Coleraine
Dunkeld
Hamilton
Tarrington
Penshurst
Meredith
Mount Gambier
Macarthur
Mortlake
Heywood
Terang
Camperdown
Geelong
Koroit
Eumeralla
Cobden
Portland
Port Fairy
Warrnambool
Colac
Torquay
Anglesea
Lorne
Otway Basin
Minerva Gas Plant
Heytesbury Gas Plant
Iona Gas Plant
Horsham Lateral
Ararat Lateral
Iona to Adelaide
Allansford to Portland
Colac to Lara
Casino Pipeline
Thylacine/Geographe
N
0 12.5 25 50 Kilometers
Shale Gas Plays with Infrastructure
Eumeralla Shale Gas Play - Otway Basin
PROJECTION ZONE: WGS84
1:1,800,000
1 cm = 18 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 17
www.awtinternational.com


lice Springs
lice Springs
adeus Basin
Georg
Eromanga Basin
Purni
Officer Basin
Tirrawarra Gas Satellite
Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
N
0 20 40 80 Kilometers
Shale Gas Plays with Infrastructure
Purni Shale Gas Play - Pedirka Basin
PROJECTION ZONE: WGS84
1:3,500,000
1 cm = 35 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 18
www.awtinternational.com


Major Towns
Gas Processing Plants
Proposed Gas Pipeline
Gas Pipeline
Oil Fields
Gas Fields
Permits
Plays
wet
dry
Basins
Carnarvon Basin
Perth Basin
Kockatea Wet
Kockatea Dry
Geraldton Lateral
Mid West
Northam
York
Beverly
Armadale
Byford
Rockingham
Peelhurst
Warnbro
Singleton
Falcon
Mandurah
Pinjarra
Dwellingup
Waroona
Harvey
Eaton
Bunbury
Collie
Capel
Busselton
Augusta
Bridgetown
Manjimup
Brookton
Pingelly
Corrigin
Narrogin
Wagin
Kojonup
N
0 25 50 100 Kilometers
Shale Gas Plays with Infrastructure
Kockatea Shale Gas Play - Perth Basin
PROJECTION ZONE: WGS84
1:4,400,000
1 cm = 44 km
Author: KR Date: 18 DEC 2012
Drafted: GH Date: 18 DEC 2012 Drawing No.: J7728 19
AWT INTERNATIONAL
www.awtinternational.com