PLANNING PROPOSAL

- Lot 120, DP:752455, 11 Long Gully Road, WATTLE PONDS
- Lot 138, DP: 752455, 6 Long Gully Road, WATTLE PONDS
- Lot 142, DP: 752455, 36 Long Gully Road, WATTLE PONDS
- Lot 140, DP: 752455, 8 Long Gully Road, WATTLE PONDS
- Lot 22, DP582824 and Lot 221, DP823112, 502 Bridgman Road Wattle Ponds

Version:	0.2.
Date:	17/11/2011
Council File Reference:	LA42/2005

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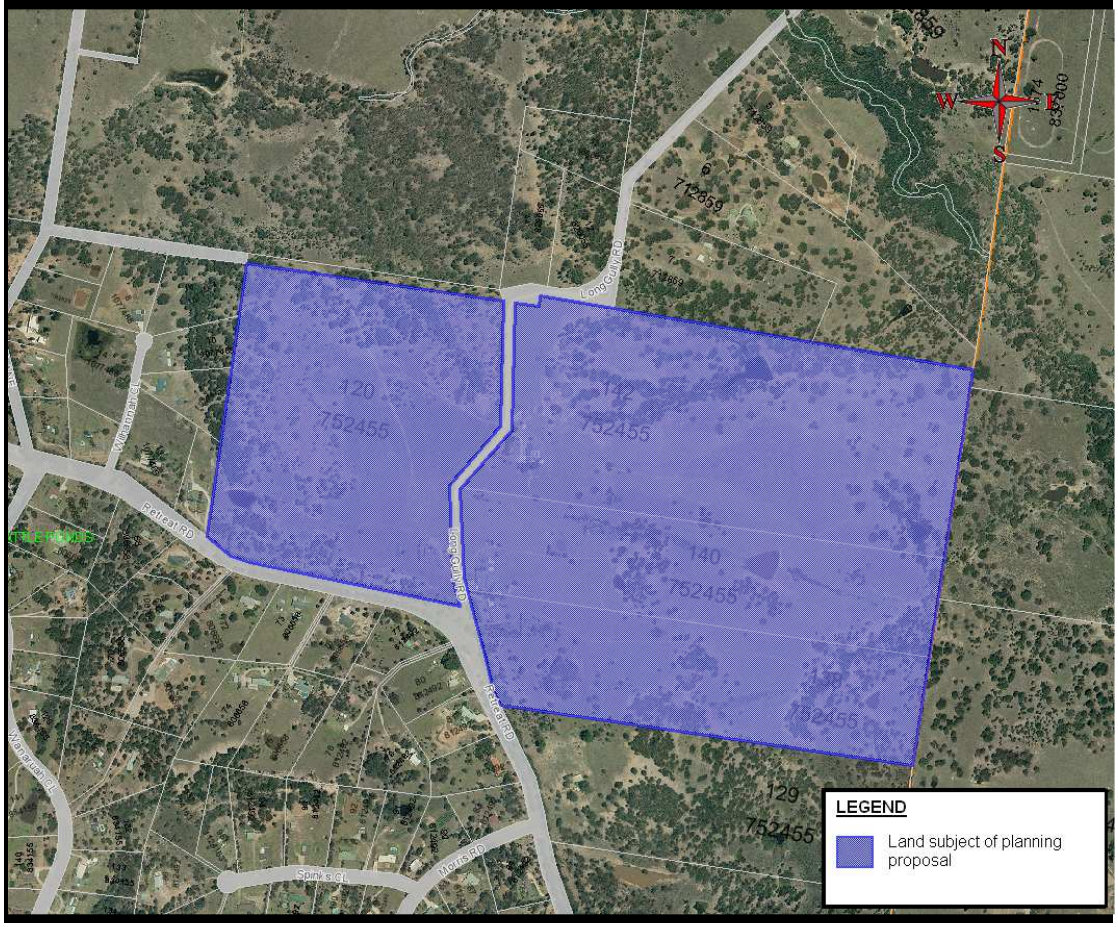
SITE DESCRIPTION

The site subject of this planning proposal is identified in the plan which follows.

Land Subject of Planning Proposal

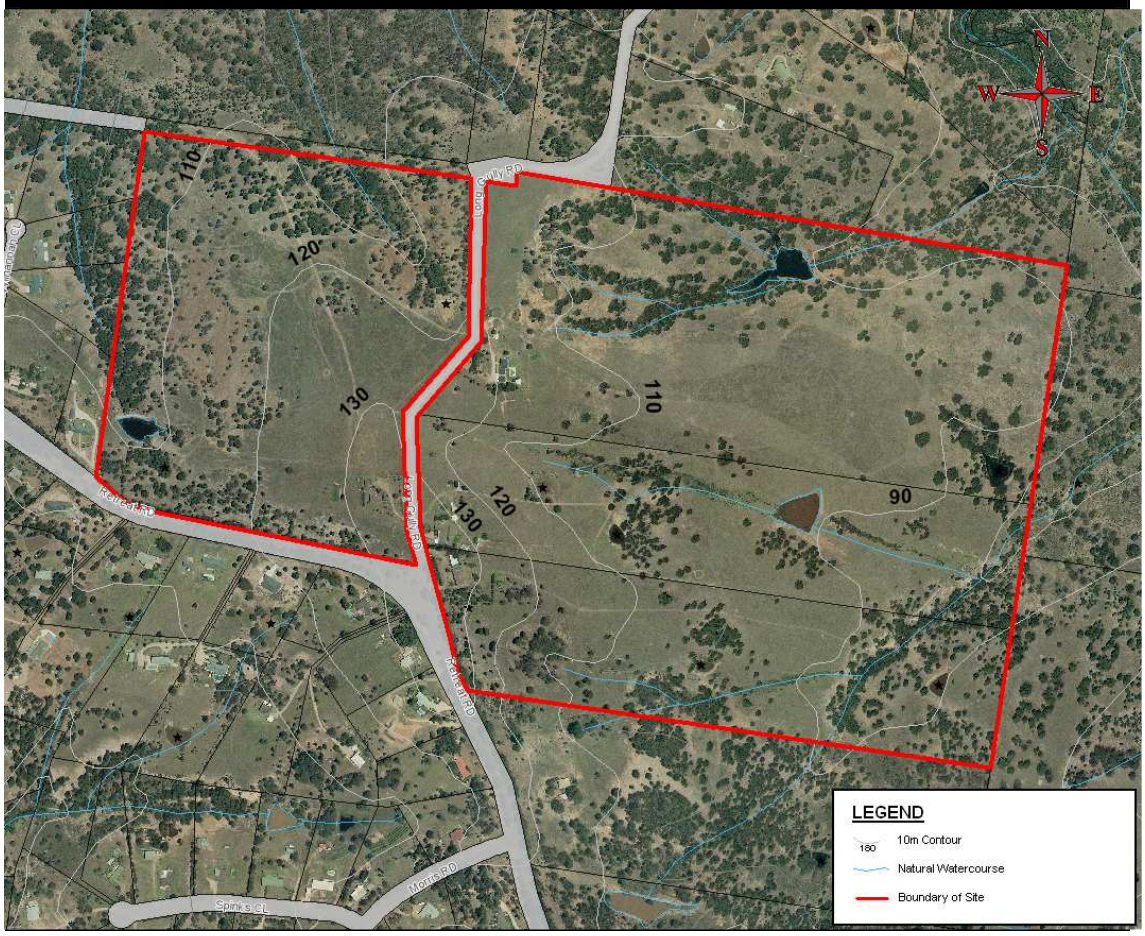


The following parcels of land make up the site:

- Lot 120, DP:752455, 11 Long Gully Road, WATTLE PONDS (approximately 25.19Ha in area);
- Lot 138, DP: 752455, 6 Long Gully Road, WATTLE PONDS (approximately 16.19Ha in area);
- Lot 142, DP: 752455, 36 Long Gully Road, WATTLE PONDS (approximately 29.75Ha in area);
- Lot 140, DP: 752455, 8 Long Gully Road, WATTLE PONDS (approximately 16.19Ha in area);

The site has a predominantly hilly topography and is dissected by an intermittent natural watercourse. It comprises unimproved grassland and scattered groups of trees. Each of the allotments comprise dwelling-houses and sheds.

Contour Plan



PART 1 – OBJECTIVES OR INTENDED OUTCOMES

This planning proposal (Council file reference: LA10/2011) seeks to:

(a) Rezone lots 120, 138, 140 and 142; DP752455 to "7(b) (Environmental Living Zone)" if the amendment occurs to the *Singleton Local Environmental Plan 1996* or "E4 Environmental Living Zone" if the amendment occurs to Council's Standard Instrument Local Environmental Plan.

(b) Require Development Control Plan (DCP) provisions to be prepared for the site to the satisfaction of Council.

(c) Implement a Lot Size Map for the site which is consistent with the DCP plans for the site.

PART 2 – EXPLANATION OF THE PROVISIONS

Amendment of Singleton Local Environmental Plan 1996 (SLEP 1996)

If the amendment sought by this planning proposal occurs to the SLEP 1996, the intended outcomes/objectives would be achieved by:

- **Amendment to the definition of "the map" to include a zoning map for the subject site.**

  The zoning map is to show the site as being zoned 7(b) (Environmental Living Zone).

- **Requiring a Development Control Plan (DCP) to be prepared for the site prior to being able to issue development consent for development on the land.**

  This requirement is to be implemented as an amendment to the Singleton DCP and shall (*inter alia*):

  (a) Contains a concept subdivision layout plan, which:
  - provides a lot layout with lots having a minimum lot size of 8,000m^2 and a minimum average lot size of 1Ha;
  - demonstrates compliance with the relevant provisions of the Singleton DCP; and
  - avoids the need to remove remnant vegetation (i.e. to provide for roads, dwelling-house development, hazard management etc).

  (b) Contain a concept staging plan that makes provision for necessary infrastructure and sequencing to ensure that development occurs in a timely and efficient manner.

  (c) Contain a concept movement hierarchy plan which shows the major circulation routes and connections to achieve a simple and safe movement system for private vehicles and public transport.

  (d) Contain a concept vegetation plan for the site and provide details of landscaping and biodiversity conservation/improvement works to be undertaken as part of any development of the site. Such works are to achieve maintained or improved biodiversity outcomes.

  (e) Contain a concept water servicing plan, which complies with the requirements of the responsible servicing authority;

  (f) Contain stormwater and water quality management controls.

(g) Identify significant development sites which require special consideration and controls (including measures to conserve any identified heritage and habitat).

(h) Provide for the amelioration of natural and environmental hazards, including bushfire, flooding, landslip and erosion, and potential site contamination.

(i) Contain measures to minimise the potential for land use conflict.

- **Amendment to the definition of "Lot Size Map" to include a lot size map for the subject site.**

  The Lot Size Map for this planning proposal is to be prepared subsequent to undertaking consultation with public authorities and preparing DCP provisions for the site, but prior to public exhibition of this planning proposal.

  Preparation of the Lot Size Map, after suitable DCP concept plans have been prepared, will provide for the Lot Size Map to be drafted such that it is consistent with the likely subdivision pattern for the site (i.e. provide for the boundaries of different lot size areas to align with road/lot boundaries).

  The DCP concept plans are to demonstrate how the site is able to be effectively developed, such that lots are no less than 8,000m^2 in area and the average size of lots across the site is 1Ha or greater. This is consistent with the recommendations of the Singleton Land Use Strategy.

  The DCP concept plans need to be prepared in consideration of the requirements of Council and Public Authorities. Therefore preparation of the associated draft Lot Size Map should not occur until such consultation has been undertaken.

  This planning proposal and the DCP amendment proposal should be exhibited concurrently to enable the public to understand how the site is likely to be developed if rezoned. The draft Lot Size Map is to be provided with the exhibition material as an attachment to this planning proposal.

Amendment to Standard Instrument Local Environmental Plan (SI LEP)

If the amendment sought by this planning proposal occurs to the SLEP 1996, the intended outcomes/objectives would be achieved by:

- **Amendment to the definition of "the map" to include a zoning map for the subject site.**

  The zoning map is to show the site as being zoned E4 (Environmental Living Zone).

- **Requiring a Development Control Plan (DCP) to be prepared for the site prior to being able to issue development consent for development on the land.**

  This requirement is to be implemented as an amendment to the Singleton DCP and shall (*inter alia*):

  (j) Contains a concept subdivision layout plan, which:

  - provides a lot layout with lots having a minimum lot size of 8,000m^2 and a minimum average lot size of 1Ha;
  - demonstrates compliance with the relevant provisions of the Singleton DCP; and
  - avoids the need to remove remnant vegetation (i.e. to provide for roads, dwelling-house development, hazard management etc).

  (k) Contain a concept staging plan that makes provision for necessary infrastructure and sequencing to ensure that development occurs in a timely and efficient manner.

  (l) Contain a concept movement hierarchy plan which shows the major circulation routes and connections to achieve a simple and safe movement system for private vehicles and public transport.

  (m) Contain a concept vegetation plan for the site and provide details of landscaping and biodiversity conservation/improvement works to be undertaken as part of any development of the site. Such works are to achieve maintained or improved biodiversity outcomes.

  (n) Contain a concept water servicing plan, which complies with the requirements of the responsible servicing authority;

  (o) Contain stormwater and water quality management controls.

(p) Identify significant development sites which require special consideration and controls (including measures to conserve any identified heritage and habitat).

(q) Provide for the amelioration of natural and environmental hazards, including bushfire, flooding, landslip and erosion, and potential site contamination.

(r) Contain measures to minimise the potential for land use conflict.

- **Amendment to the definition of "Lot Size Map" to include a lot size map for the subject site.**

  The Lot Size Map for this planning proposal is to be prepared subsequent to undertaking consultation with public authorities and preparing DCP provisions for the site, but prior to public exhibition of this planning proposal.

  Preparation of the Lot Size Map, after suitable DCP concept plans have been prepared, will provide for the Lot Size Map to be drafted such that it is consistent with the likely subdivision pattern for the site (i.e. provide for the boundaries of different lot size areas to align with road/lot boundaries).

  The DCP concept plans are to demonstrate how the site is able to be effectively developed, such that lots are no less than 8,000m^2 in area and the average size of lots across the site is 1Ha or greater. This is consistent with the recommendations of the Singleton Land Use Strategy.

  The DCP concept plans need to be prepared in consideration of the requirements of Council and Public Authorities. Therefore preparation of the associated draft Lot Size Map should not occur until such consultation has been undertaken.

  This planning proposal and the DCP amendment proposal should be exhibited concurrently to enable the public to understand how the site is likely to be developed if rezoned. The draft Lot Size Map is to be provided with the exhibition material as an attachment to this planning proposal.

PART 3 – JUSTIFICATION

Section A - Need for the Planning Proposal

1. Is the planning proposal a result of any strategic study or report?

Section 7 of the Singleton Land Use Strategy (**Attachment 1**) identifies candidate areas potentially suitable for rural-residential development. The land subject of this planning proposal is within the Wattle Ponds North East Candidate Area (WPNE Candidate Area). The WPNE Candidate Area is proposed to be serviced with reticulated water but not sewer.

In cases where reticulated water is provided and sewer is not provided, the Singleton Land Use Strategy (SLUS) "Strategic Actions" for rural-residential development, indicate that the absolute minimum size of lots should be no less than 8,000m^2. Table 12 of the SLUS details that such lots should have a minimum average area of 1Ha. These lot size provisions are considered to be suitable for the subject site.

Based on the proposed 1Ha average lot size, topographical constraints on the site and assuming that approximately 15% of the site is likely to be utilized for roads; subdivision of the land is expected to yield approximately 70 allotments. The prospective lot yield would be clarified further as part of the Development Control Plan (DCP) master-planning process.

Table 12 of the SLUS proposes a Large Lot Residential zoning for the WPNE Candidate Area. The site comprises Central Hunter Ironbark-Spotted Gum-Grey Box Forest, which was listed as an Endangered Ecological Community under the *Threatened Species Conservation Act 1995* in 2010 (i.e. subsequent to endorsement of the SLUS in 2008).

In recognition of the environmental importance of the land, this planning proposal seeks to rezone the land to an environmental living zoning. The 7(b) (Environmental Living Zone) under the SLEP 1996 and the E4 (Environmental Living Zone) under the SI LEP provide for low-impact residential development in areas with special ecological, scientific or aesthetic values. It is an objective of the zones to ensure that residential development does not have an adverse effect on those values.

In addition using an environmental living zone for the land, this planning proposal seeks to require DCP provisions to be developed for the site. This is recommended by sections 7 and 9.4. of the SLUS. The proposed DCP provisions shall encourage retention and rehabilitation of vegetation and aim to ensure that development of the site results in no net loss of biodiversity.

2. Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

Placing land use and minimum lot size provisions for subdivision in Council's LEP, in conjunction with appropriate design controls in Council's DCP; is considered to be the most appropriate method for managing subdivision and land use in the locality. This method is supported by the adopted SLUS (2008) and is consistent with the method of managing land use for similar proposals in the Singleton LGA.

3. Is there a net community benefit?

No net community benefit test has been provided by the proponent; however Council envisages that this planning proposal will result in a net community benefit.

The SLUS identifies the need to provide lots with a minimum lot size of 8,000m^2 and a minimum average lot size of 1Ha, in proximity to the Singleton Township. The subject proposal will benefit the community by providing lots to meet such demand.

Because the lot size provisions sought by this planning proposal are consistent with the SLUS, it is not expected to create an unfavourable precedent or change the expectations of the landowner(s). The proposal will not result in a loss of employment lands.

The site is located on the fringe of the existing Wattle Ponds rural-residential area. The main transport corridor in the vicinity of the site is the New England Highway. The site has access to reticulated water supply infrastructure and is not proposed to be serviced by sewer. Some road upgrades may be required to provide for the additional traffic generated by the development. The costs associated with infrastructure provision are not considered to be cost prohibitive to development of the site. Given the rural-residential nature of the area, pedestrian paths and cycle ways are not intended to be provided as part of the development of the site.

The Development Control Plan (DCP) provisions required by the proposed LEP are intended to contain requirements to conserve, enhance and encourage the regeneration of the native vegetation on the site. While the site is not within a floodplain, some areas of the site may be subject to localized flooding (stormwater) impacts from the natural watercourses during heavy storm periods. DCP provisions are to address such impacts.

Overall, the proposal is considered to generate benefits to the community.

Section B - Relationship to Strategic Planning Framework

4. Is the planning proposal consistent with the objectives and actions contained within the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?

The land subject of this planning proposal is not within a regional strategy endorsed by the NSW Department of Planning and Infrastructure.

5. Is the planning proposal consistent with the local Council's Community Strategic Plan, or other local strategic plan?

Council does not have a Community Strategic Plan. This planning proposal is however, consistent with Council's Management Plan 2011/12 – 2014/15. Preparation of the LEP will involve community consultation and will help manage potential environmental impacts associated with development of the land.

The land subject of this planning proposal is identified by the SLUS potentially being suitable for lots with a minimum lot size of 8,000m^2 and a minimum average lot size of 1Ha for rural-residential development. Such lots are required to help meet demand identified by the SLUS. The proposal is consistent with the SLUS.

6. Is the planning proposal consistent with applicable state environmental planning policies?

The proposal is therefore considered to be consistent with State Environmental Planning Policy No. 55 – Remediation of Land.

Urban Capability Assessments (Attachment 3) have been conducted for the site. The assessments indicate that there is not a risk to rural-residential development of the site on the basis of contamination. The proposal is therefore considered to be consistent with *State Environmental Planning Policy No. 55 – Remediation of Land*.

The flora and fauna assessment that has been prepared for the proposal has not identified any koala habitat on the site. No suitable habitat has been identified on the subject land and the majority of vegetation on the site is intended to be protected; therefore State Environmental Planning Policy No. 44 – Koala Habitat Protection does not apply.

7. Is the proposal consistent with applicable Ministerial Directions (s.117 directions)?

The table which follows contains a response to each of the s117 directions in relation to the planning proposal.

Compliance with Section 117 Directions			
Ministerial Direction		**Relevance** (Yes/No)	**Consistency and Implications**
No.	**Title**		
1.1	**Business and Industrial Zones**	No	This planning proposal does not affect land within an existing or proposed business or industrial zone.
1.2	**Rural Zones**	No	The planning proposal does not seek to rezone the land to a residential, business, industrial, village or tourist zone.
1.3	**Mining, Petroleum Production and Extractive Industries**	No	The proposal would not have the effect of prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials. The proposal is not viewed to restrict the potential development of resources of coal, other minerals, petroleum or extractive materials which are of State or regional significance.
1.4	**Oyster Aquaculture**	No	The planning proposal does not seek a change in land use which could result in adverse impacts on a Priority Oyster Aquaculture Area or a "current oyster aquaculture lease in the national parks estate". The planning proposal does not seek a change in land use which could result in incompatible use of land between oyster aquaculture in a Priority Oyster Aquaculture Area or a "current oyster aquaculture lease in the national parks estate" and other land uses.
1.5	**Rural Lands**	Yes	This planning proposal affects land within an existing rural zone. It also seeks to change the existing minimum lot size for subdivision of the land. The proposal is considered to be generally consistent with the Rural Planning Principles and Rural Subdivision Principles listed in *State Environmental Planning Policy (Rural Lands) 2008* (Rural Lands SEPP). Any perceived inconsistencies with this direction are considered to be justified by the Singleton Land Use Strategy (SLUS). The SLUS considered the issues raised by the objectives of this direction, which are to: • protect the agricultural production value of rural land, and

			• facilitate the orderly and economic development of rural lands for rural and related purposes. The SLUS identifies the site subject of this planning proposal as a candidate area for rural-residential development. The SLUS was approved by the Director-General on the 8 June 2008 and is still in force as at the date of preparation of this planning proposal. This planning proposal seeks confirmation from the Director-General (or delegate) that any inconsistency with this direction is justified and of minor significance.
2.1	**Environment Protection Zones**	Yes	This planning proposal includes requirements which facilitate the protection and conservation of environmentally sensitive areas through the proposed Environmental Living zoning and Development Control Plan (DCP) provisions. This planning proposal does not reduce the environmental protection standards that apply to the land. This planning proposal is considered to be consistent with the direction.
2.2	**Coastal Protection**	No	This direction does not apply to the planning proposal because it does not affect land in the coastal zone.
2.3	**Heritage Conservation**	Yes	The planning proposal is considered to be consistent with this direction. It requires preparation of DCP provisions which incorporate measures to conserve any identified heritage. Any perceived inconsistencies with this direction are considered to be of minor significance and justified by the fact that: • The *Singleton Local Environmental Plan 1996* (SLEP 1996) and draft Standard Instrument Local Environmental Plan (SI LEP) comprise provisions to protect items of environmental heritage. • The *National Parks and Wildlife Act 1974* comprises provisions to protect objects and places of Indigenous heritage. This planning proposal seeks confirmation from the Director-General (or delegate) that any inconsistency with this direction is justified and of minor significance.
2.4	**Recreation Vehicle Areas**	No	This planning proposal does not seek to enable land to be developed for the purpose of a recreation vehicle area within the meaning of the *Recreation Vehicles Act 1983*.
3.1	**Residential Zones**	No	This planning proposal does not affect land

			within an existing or proposal residential zone.
3.2	**Caravan Parks and Manufactured Home Estates**	NO	This planning proposal is not for the purposes of identifying suitable zones, locations or provisions for caravan parks or manufactured home estates.
3.3	**Home Occupations**	Yes	The mandatory provisions of the SI LEP make home occupations exempt from requiring development consent in the *E4 Environmental Living Zone*. "***Home activity***" is the equivalent definition for "***home occupation***" in the SLEP 1996. Home activities are exempt from requiring development consent in the *7(b) (Environmental Living zone)*. The objectives of this direction are considered to be addressed by this planning proposal. This planning proposal seeks confirmation from the Director-General (or delegate) that any inconsistency with this direction is justified and of minor significance.
3.4	**Integrating Land Use and Transport**	No	This planning proposal does not seek to create, alter or remove a zone or a provision relating to urban land.
3.5	**Development Near Licensed Aerodromes**	No	This planning proposal does not seek to create, alter or remove a zone or a provision relating to land in the vicinity of a licensed aerodrome.
3.6	**Shooting Ranges**	No	This planning proposal does not seek to create, alter or remove a zone or a provision relating to land adjacent to and/or adjoining an existing shooting range.
4.1	**Acid Sulfate Soils**	NO	This planning proposal does not apply to land having a probability of containing acid sulfate soils as shown on the Acid Sulfate Soils Maps held by the NSW Department of Planning and Infrastructure.
4.2	**Mine Subsidence and Unstable Land**	NO	The land subject of this planning proposal is not within a designated mine subsidence district and is not identified as being unstable.
4.3	**Flood Prone Land**	NO	The site is not within a designated floodplain. During significant storm events, water may overflow the banks of the intermittent natural watercourses (drainage gullies) dissecting the site. The site, however, is not considered to be flood prone land as defined by the *Floodplain Development Manual 2005*.
4.4	**Planning for Bushfire Protection**	Yes	This planning proposal is considered to be consistent with this direction. The land subject of this planning proposal is mapped as being bushfire prone land on

			Council's bushfire prone land mapping. This planning proposal seeks to consult with the NSW Rural Fire Service subsequent to gateway determination being issued and prior to undertaking community consultation. A large proportion of the land is cleared of significant vegetation. The site is considered to be capable of providing for development that complies with *Planning for Bushfire Protection 2006*. The planning proposal requires preparation of DCP provisions which incorporate measures to ameliorate bushfire. Such measures would include avoiding placing inappropriate development in hazardous areas. Bushfire hazard reduction is not intended to be prohibited as part of this planning proposal.
5.1	**Implementation of Regional Strategies**	No	The regional strategies do not apply to the land subject of this planning proposal.
5.2	**Sydney Drinking Water Catchments**	No	The land subject of this planning proposal is not within the Sydney Drinking Water Catchment.
5.3	**Farmland of State and Regional Significance on the NSW Far North Coast**	No	This direction does not apply to Singleton Council.
5.4	**Commercial and Retail Development along the Pacific Highway, North Coast**	No	This direction does not apply to the Singleton Local Government Area.
5.5	**Development in the vicinity of Ellalong, Paxton and Millfield (Cessnock LGA)**	No	This direction has been revoked.
5.6	**Sydney to Canberra Corridor**	No	This direction has been revoked.
5.7	**Central Coast**	No	This direction has been revoked.
5.8	**Second Sydney Airport: Badgerys Creek**	No	The land subject of this planning proposal is not within the boundaries of the proposed second Sydney airport site or within the 20 ANEF contour as shown on the map entitled "Badgerys Creek–Australian Noise Exposure Forecast–Proposed Alignment–Worst Case Assumptions".
6.1	**Approval and Referral Requirements**	Yes	This planning proposal is considered to be consistent with this direction. This planning proposal does not include provisions that require the concurrence, consultation or referral of development applications to a minister or public authority and does not identify development as designated development.

6.2	**Reserving Land for Public Purposes**	Yes	This planning proposal is considered to be consistent with this direction. It does not seek to create, alter or reduce existing zonings or reservations of land for public purposes.
6.3	**Site Specific Provisions**	Yes	This planning proposal is considered to be consistent with this direction. The proposal does not intend to amend another environmental planning instrument in order to allow a particular development proposal to be carried out. The planning proposal does not refer to drawings for any such development.
7.1	**Implementation of the Metropolitan Plan for Sydney 2036**	No	This direction does not apply to the Singleton Local Government Area.

Section C - Environmental, Social and Economic Impact

8. Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

Threatened Flora

Flora and Fauna Assessment reports have been conducted for the site and are appended as "**Attachment 2**" to this planning proposal. They indicate that the following regionally significant flora species exist on the land:

- Acacia falcate (tall perennial shrub)
- Goodenia rotoundifolia (perennial herb)

Some occurrences of Eucalyptus tereticornis (Forest Redgum) were identified on Lot 138, DP752455, however the assemblages of this vegetation were not considered to constitute the Hunter Lowland Redgum Forest community, listed under the *Threatened Species Conservation Act 1995*.

No threatened flora species were identified on the site, however there could be potential habitat for:

- Eucalyptus glaucina - Slaty Red Gum
- Thesium australe - Austral Toadflax
- Bothriochloa biloba - Red Leg Grass

The assessment report indicates that rural-residential development of the site may result in the removal of a small amount of marginal habitat, but given the low likelihood of occurrence on site, this action is considered unlikely to have a significant adverse effect on the lifecycle of any viable local population.

The proposed DCP provisions (Refer to Part 2 of this Planning Proposal), intend to prevent adverse impacts on vegetation and biodiversity and achieve an improved or maintained biodiversity outcome. It is believed, that development of the site should be able to occur without adversely impacting upon threatened flora.

Threatened Fauna Species

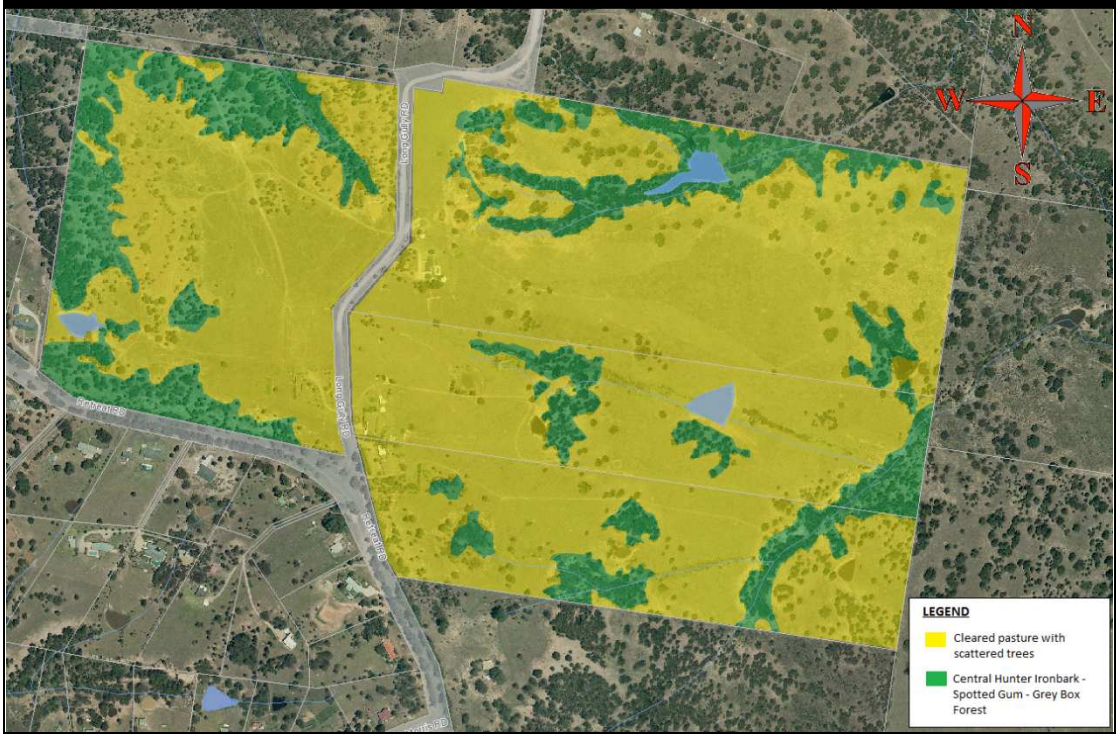
The Flora and Fauna Assessment (**Attachment 2**) details that *Pomatostomus temporalis temporalis* (Grey-crowned babbler) was identified on the site. It also indicated that 16 other threatened fauna species had been identified within 10kms of the site.

The proposed DCP provisions (Refer to Part 2 of this Planning Proposal), intend to prevent adverse impacts on biodiversity and achieve an improved or maintained biodiversity outcome. It is believed, that development of the site should be able to occur without having a significant adverse impact upon threatened fauna.

Endangered Ecological Communities (EECs)

The plan which follows shows the flora assemblages existing on the site and has been adapted from the Flora and Fauna Assessment Report that has been prepared and lodged for the proposal.

Flora Assemblages



The site comprises areas of the Central Hunter Spotted Gum – Ironbark – Grey Box Forest vegetation assemblage. This vegetation community is listed as being an Endangered Ecological Community (EEC) under the *Threatened Species Conservation Act 1995*.

The Development Control Plan (DCP) provisions, required by planning proposal (Refer to Part 2 of this Planning Proposal), are intended to encourage conservation, enhancement and regeneration of the EEC.

Habitat

The vegetation on the site provides for faunal movement and comprises a number of hollow bearing trees which provide potential habitat for species such as the Brush-tailed Phascogale, Squirrel Glider and Michrochiropteran bats.

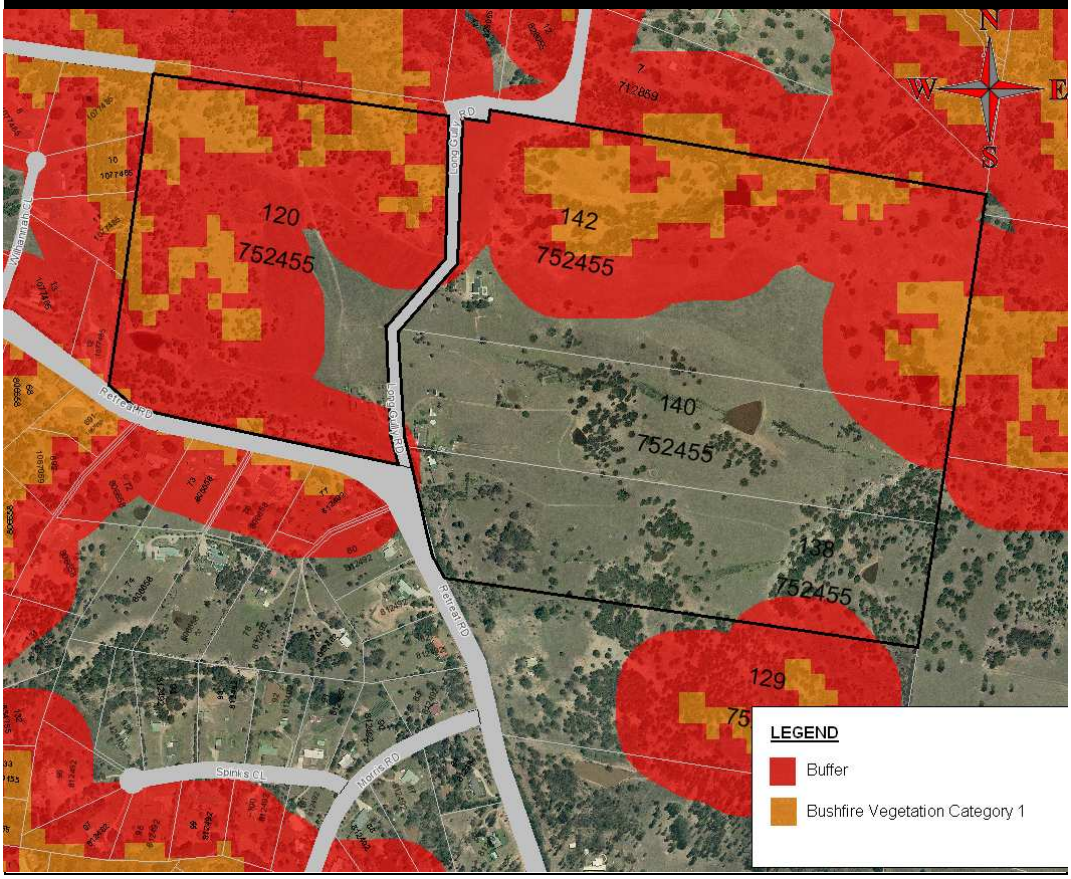
The vegetation conservation provisions of the proposed DCP will help minimize impacts on vegetation and thus minimize impacts on habitat trees. Other provisions can also be incorporated into the DCP provisions regarding habitat, such as requiring provision of nesting boxes.

9. Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

Bushfire

The site is identified on Council's Bushfire Prone Land mapping as being bushfire prone land.

Bushfire Prone Land Mapping (Excerpt)



A large portion of the site is cleared of significant vegetation. The site is considered to be capable of providing for development which complies with *Planning for Bushfire Protection 2006*.

A Bushfire Impact Assessment Report is considered to be required for this planning proposal. Such a report would be used as the basis for preparation of DCP provisions relating to the amelioration of bushfire impacts.

This planning proposal seeks to consult with the NSW Rural Fire Service subsequent to gateway determination being issued and prior to undertaking community consultation.

The proposal should not have a significant adverse impact in regard to bushfire.

Flooding and Drainage

During significant storm events, water may overflow the banks of the intermittent natural watercourses (drainage gullies) dissecting the site. A Hydrology Report is considered to be required for this planning proposal. Such a report can be used to guide the design of the DCP concept subdivision layout, so that concept lots comprise land suitable for dwelling-house development that is not subject to inundation.

The proposal should not have a significant adverse impact in regard to flooding and drainage.

Native Vegetation

Impacts on biodiversity should be avoided. A Biodiversity Impact Assessment Report prepared in accordance with the *Environmental Outcomes Assessment Methodology of the Native Vegetation Regulation 2005*; is considered to be required for this planning proposal.

The Biodiversity Impact Assessment Report can be used as a basis for preparing the DCP "Concept Vegetation Plan" for the site and associated biodiversity conservation/improvement provisions. The report should demonstrate how maintained or improved biodiversity outcomes will be achieved.

This planning proposal seeks to consult with the NSW Office of Environment and Heritage subsequent to gateway determination being issued and prior to undertaking community consultation.

Soils

Urban Capability Assessments (Attachment 3) have been conducted for the site.

The assessments indicate that the site is suitable for rural-residential style development from a geotechnical perspective, subject to appropriate design and construction. The DCP concept subdivision layout will need to provide concept lots with suitable areas for onsite effluent disposal.

The reports indicate that there is not a risk to rural-residential development of the site on the basis of contamination. The planning proposal should not have a significant adverse impact in regard to soils.

Loss of Rural Lands

The site is situated within the Wattle Ponds North East Candidate Area as identified by the Singleton Land Use Strategy (SLUS). The need for lots with a minimum lot size of 8,000m^2 and a minimum average lot size of 1Ha was identified by the SLUS as a result of a demand and supply analysis.

The SLUS candidate areas were identified in consideration of a constraints analysis which considered the need to protect agricultural land of high production value. The planning proposal is not considered to result in a significant loss of rural lands.

Traffic Access and Transport

A Traffic Impact Assessment Report, which demonstrates compliance with the general development provisions of the Singleton Development Control Plan and relevant RTA and Austroads guidelines, is considered to be required for this planning proposal.

Traffic Impact Assessment Report would help inform preparation of the DCP Concept Movement Hierarchy Plan.

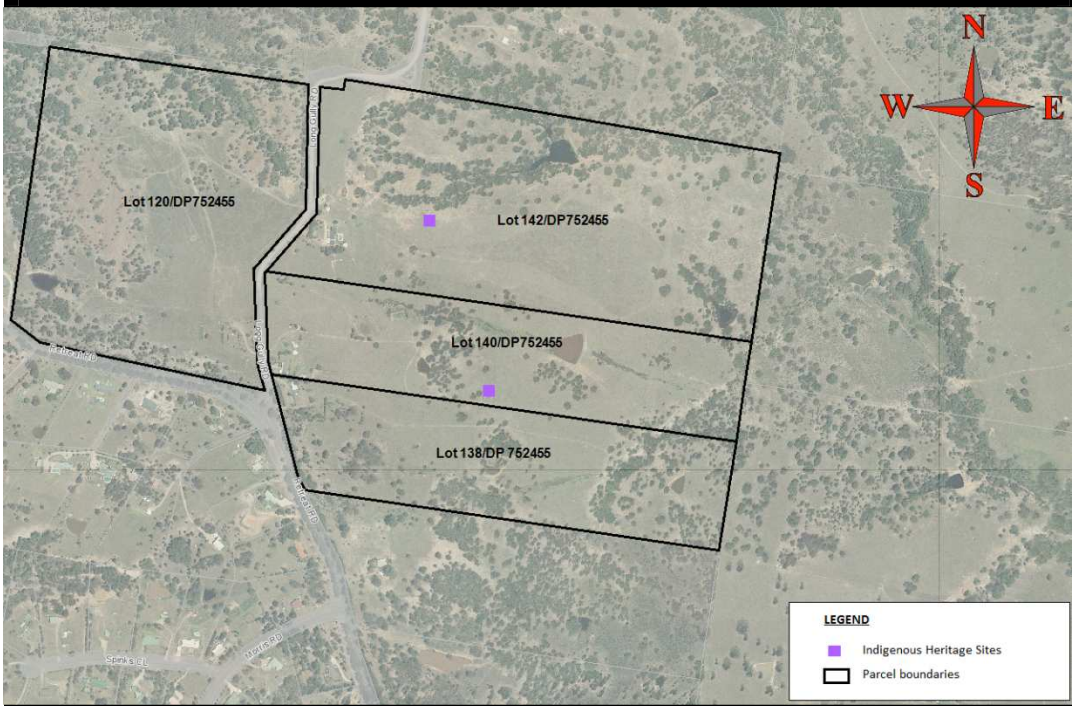
European Heritage

No items of European heritage significance have been identified on the site.

Indigenous Heritage

Two (2) sites comprising Aboriginal Cultural Heritage have been identified on the land subject of this planning proposal. One (1) of these sites is situated on Lot 142, DP 752455. The other site is situated on Lot 140, DP752455, in proximity to the dividing boundary between that lot and Lot 138, DP752455.

Identified Indigenous Heritage Sites



This planning proposal recommends preparation of DCP provisions for the site which include measures to conserve any identified heritage. As such, the planning proposal is unlikely to have any significant adverse impacts in regard to indigenous heritage.

10. How has the planning proposal adequately addressed any social and economic effects?

The planning proposal is not expected to generate any significant adverse social or economic impacts. The proposal forms a logical extension to the existing rural-residential area. The low density and large amount of vegetation retention provides sufficient buffering between neighbouring properties. No significant adverse economic impacts have been identified as likely to result due to the proposal.

Section D - State and Commonwealth Interests

11. Is there adequate public infrastructure for the planning proposal?

The site subject of this planning proposal has access to electricity, telecommunications, road and reticulated water supply infrastructure. Sewer is not available in the subject area and as such, onsite disposal of effluent would be required (i.e. septic).

A Reticulated Water Servicing Strategy, which demonstrates compliance with the general development provisions of the Singleton Development Control Plan, is considered to be required for this planning proposal. The strategy should demonstrate how concept lots are able to be serviced effectively and efficiently.

It is recommended that Ausgrid be consulted in regard to electricity infrastructure and Telstra be consulted in regard to telecommunications infrastructure.

12. What are the views of State and Commonwealth public authorities consulted in accordance with the gateway determination?

The following public authorities should be consulted in relation to this planning proposal:

- Ausgrid
- Telstra
- NSW Office of Environment and Heritage
- NSW Rural Fire Service

PART 4 –COMMUNITY CONSULTATION

The public would have the opportunity to view and comment on the planning proposal once the NSW Department of Planning and Infrastructure endorses the proposal to go on public exhibition. It is submitted that the proposal does not fit the definition of a "Low impact Planning proposal" and as such, it should be exhibited for a period of not less than 28 days.

It is recommended that community consultation occur subsequent to public authority consultation and after suitable DCP provisions have been prepared for the site. This will enable the planning proposal and DCP amendment proposal to be exhibited concurrently.

RECOMMENDATION

It is recommended that this planning proposal be supported and that the following studies be prepared prior to undertaking consultation with public authorities:

- Bushfire Impact Assessment Report
- Hydrology Report
- Biodiversity Impact Assessment Report (prepared in accordance with the *Environmental Outcomes Assessment Methodology of the Native Vegetation Regulation 2005*)
- Traffic Impact Assessment Report
- Water Servicing Strategy

Following public authority consultation and prior to community consultation, it is recommended that a Development Control Plan (DCP) amendment proposal be prepared for the site. The DCP proposal should demonstrate compliance with the requirements of Council and relevant public authorities.

Note:

Given the need to prepare studies, it is expected that it will take approximately 18 months to finalize this planning proposal. This estimation is based on the expectation that the studies will be completed by the proponent and lodged with Council within 6 months of the date of issue of the gateway determination and that no significant matters arise during public authority and community consultation.

Attachment 1 – Singleton Land Use Strategy

SINGLETON
LAND USE STRATEGY

SINGLETON COUNCIL

Adopted by Council: 21 April 2008

Endorsed by Department of Planning: 8 June 2008

SINGLETON
LAND USE STRATEGY

PREPARED FOR
SINGLETON COUNCIL

The Singleton Land Use Strategy (April 2008) has been prepared for Singleton Council by Planning Workshop Australia, in association with Land and Environment Planning.

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FIGURES

1 INTRODUCTION

The Singleton Land Use Strategy has been prepared for Singleton Council.

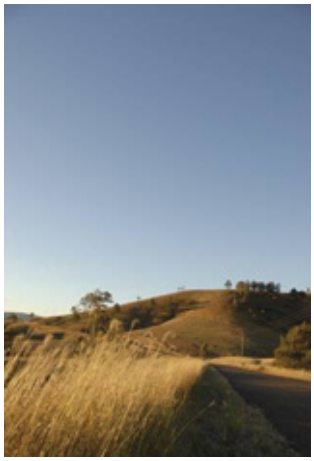
The Strategy outlines key land use policies and principles for the Singleton local government area (LGA), and provides the planning context for the preparation of local environmental plan provisions. The Strategy has a time frame of 25 years, to 2032. The area to which the Strategy applies is shown in Map 1.1.

The intent of the Strategy is to:

- Recommend actions for achieving the land use objectives of the Singleton community, consistent with the Council vision.
- Recommend changes to Singleton Local Environmental Plan (LEP) 1996 to reflect the Singleton Council and community vision, the adopted 2030 Strategy, and the land use objectives, consistent with NSW Government planning requirements, including the Standard LEP provisions.

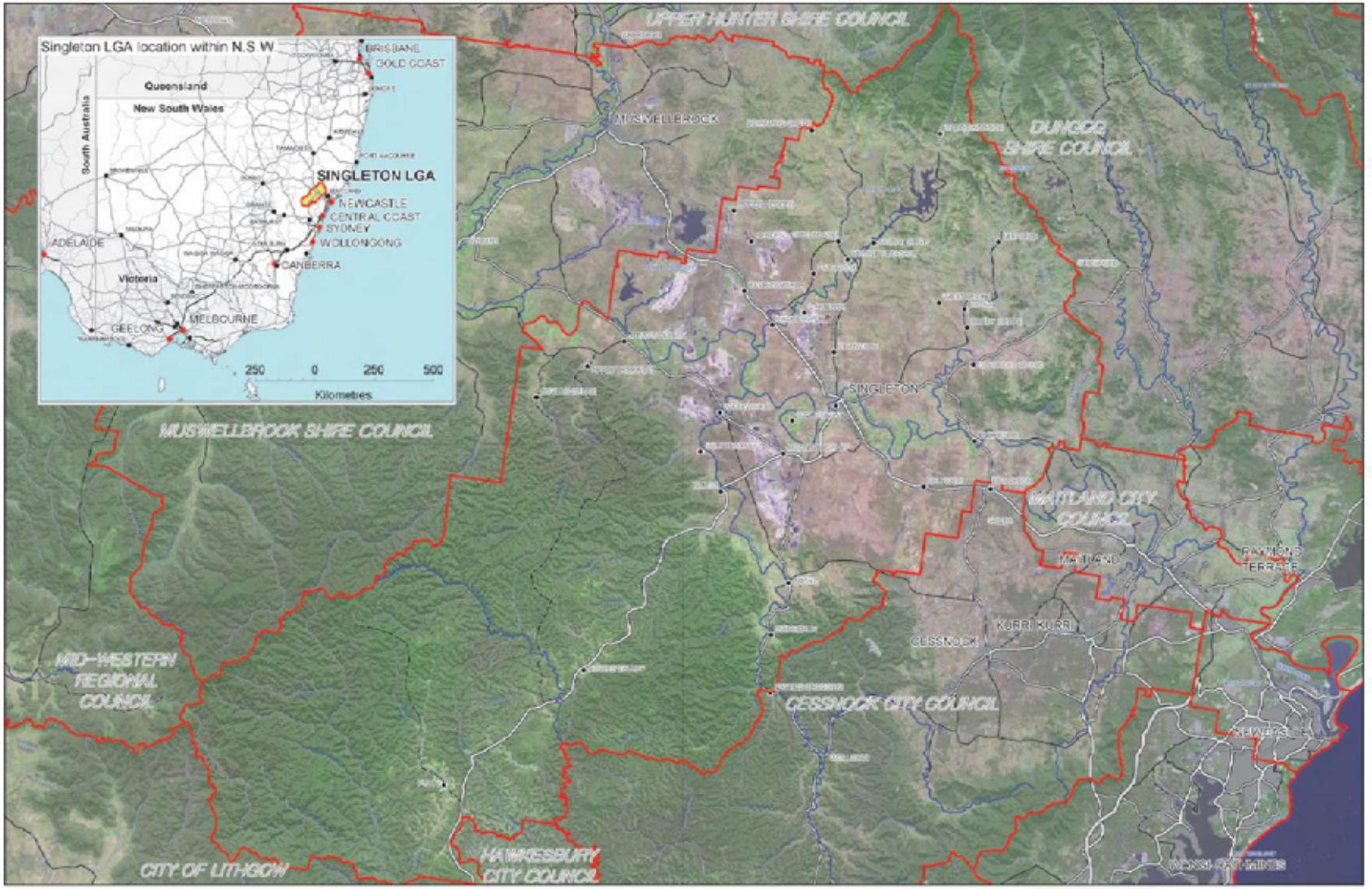
The Strategy identifies where growth and change is expected to occur, and land use planning objectives and strategies to guide this growth and change. It also identifies infrastructure requirements to support development, and will help inform local and state government budget processes.

The Strategy has been prepared with funding under the NSW Department of Planning's *Planning Reform Funding Program*. Preparation of the Strategy has been overseen by representatives from the Council and the Department, and has involved the following steps:



1. Review of the key planning issues
2. Consultation with Council and relevant NSW Government agencies
3. Preparation of a *Situation Analysis* report
4. Community consultation workshops
5. Preparation and public exhibition of the draft Strategy.

The Situation Analysis report provides a profile of Singleton LGA. It has established the key land use planning issues and strategic priorities and actions to be considered in the preparation of the Strategy and subsequent local environmental plan. A summary of the information in the Situation Analysis has been included in relevant sections of the Strategy.



Singleton Land Use Strategy

LOCATION MAP & TOPOGRAPHY

Source: Singleton Shire Council 2007

prepared by planning workshop australia

Fig 1.1

2 VISION

The Strategy aims to provide clear direction for Council and NSW Government agencies to guide decisions relating to future use of land within the Singleton LGA, and to inform the preparation of a comprehensive local environmental plan (providing regulatory land use controls). It establishes a policy framework to facilitate opportunities as they emerge in the future.

The proposed vision for the Strategy is 'to create a progressive community of excellence and sustainability'. This is based on the vision statement outlined in Singleton Council's Management Plan, and complements Council's adopted 2030 Strategy. The Strategy takes into account the objects of Section 5A of the *Environmental Planning and Assessment Act 1979* in identifying proposed actions to implement the vision. This legislation provides the legal framework for the preparation of local environmental plans.

3 STRUCTURE OF STRATEGY

The Strategy is based on the information and land use planning issues identified in the Situation Analysis and during the consultation process. Its priority is those issues that are within the scope of local environmental plan (LEP) provisions.

Key land use planning issues for the Strategy were identified in the Situation Analysis, and were classified according to whether they were mainly urban or rural issues, as follows:

URBAN ISSUES

- Catering for settlement needs
- Providing and maintaining urban infrastructure
- Reviewing development on highway frontage land
- Providing for industrial and commercial development
- Planning for risks and economic vulnerability to flooding
- Providing for social infrastructure and urban amenity

RURAL ISSUES

- Catering for rural residential subdivision and development
- Promoting agricultural development, protection of employment opportunities and the natural resource base
- Planning for rural servicing requirements (costs and maintenance)
- Planning for rural highway frontage development
- Identifying environmental values, constraints and protection requirements

The omission of reference to an issue does not mean that it has not been considered in the Strategy or is not of importance. While it may not be regarded as a key issue, it is likely to have been considered in conjunction with another issue.

The themes used in structuring the Strategy take into account the key land use planning issues, and are as follows:

- Urban settlement
- Villages and rural residential development
- Rural areas
- Environmental values and constraints.

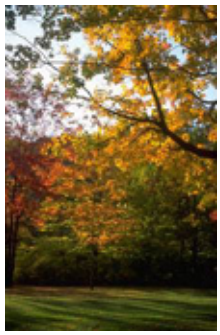
A summary of the present situation is presented for each theme, followed by background information on each issue and objectives that can be considered for the subsequent local environmental plan. This is followed by a policy indicating how the Council should respond to each issue in a consistent manner, and strategic actions which would direct future planning and identify implementation responsibilities. Further background detail on each of the planning issues and themes can be found in the accompanying Situation Analysis report.

4 PLANNING CONTEXT

This section summarises important attributes of the LGA, and key characteristics which will affect future land use. It includes information on what is important about the area, and an overview of existing strategies and land use planning provisions.

Information is provided for the whole LGA as well as for 11 planning areas which enable spatial differences to be identified. This information is based on the Situation Analysis report, and more detailed information is included in that report.

Singleton is a large LGA with an area of 4,896km^2, comprising about 16% of the Hunter Region. It had an estimated resident population of 23,258 persons on 30 June 2007 (around 3.5% of the regional population) and has shown a steady growth. The increase in population over the previous year was 253 persons, representing a growth rate of 1.1%.



Important characteristics of Singleton LGA in 2008 which will influence future land use are summarised in Table 1, focusing on demographic and economic factors. These show that Singleton is a relatively prosperous area with a diverse economic and natural resource base, and has a relatively young population.

Table 1: Important existing characteristics of Singleton LGA

Characteristic
Outside the urban areas the main land uses are agriculture, national parks, and coal mining
Prosperous economy and employment opportunities (high dependence on coal mining and metropolitan spillover)
Compared to the Hunter Region and NSW, population is relatively well off and a relatively young average age
Adequate urban water and sewer infrastructure, and provision adequate for maintenance (in existing service areas)
Over the last 20 years new housing development has occurred at about 160 dwellings per year, with about 40% in residential areas and balance rural/rural residential.
Locational and transport advantages through location on New England Highway and Main Northern Railway Line. Increasing traffic flows (mainly New England Highway, Singleton town, and areas SE and E of Singleton), and high level of commuting by car to work. Rural road infrastructure improvement and maintenance pressures
Potential new infrastructure provision (F3 Freeway extension, gas supply)
Relatively poor public transport accessibility

Characteristic
Decline and uncertainty in agricultural sector
Identification of important remnant native vegetation within LGA, including endangered ecological communities (e.g. floodplain vegetation, Lower Hunter Spotted Gum Ironbark Vegetation, Warkworth Sands, and Weeping Myall Woodland)
Uncertainty in relation to industrial land demand and supply (largely driven by Lower Hunter situation)
Limits on availability of water supplies at the regional level
Significant area of land in LGA subject to natural hazards (flooding and bush fires)

The distribution of population within the Singleton LGA is shown on Map 4.1, together with the planning areas used for demographic analysis in the Situation Analysis.

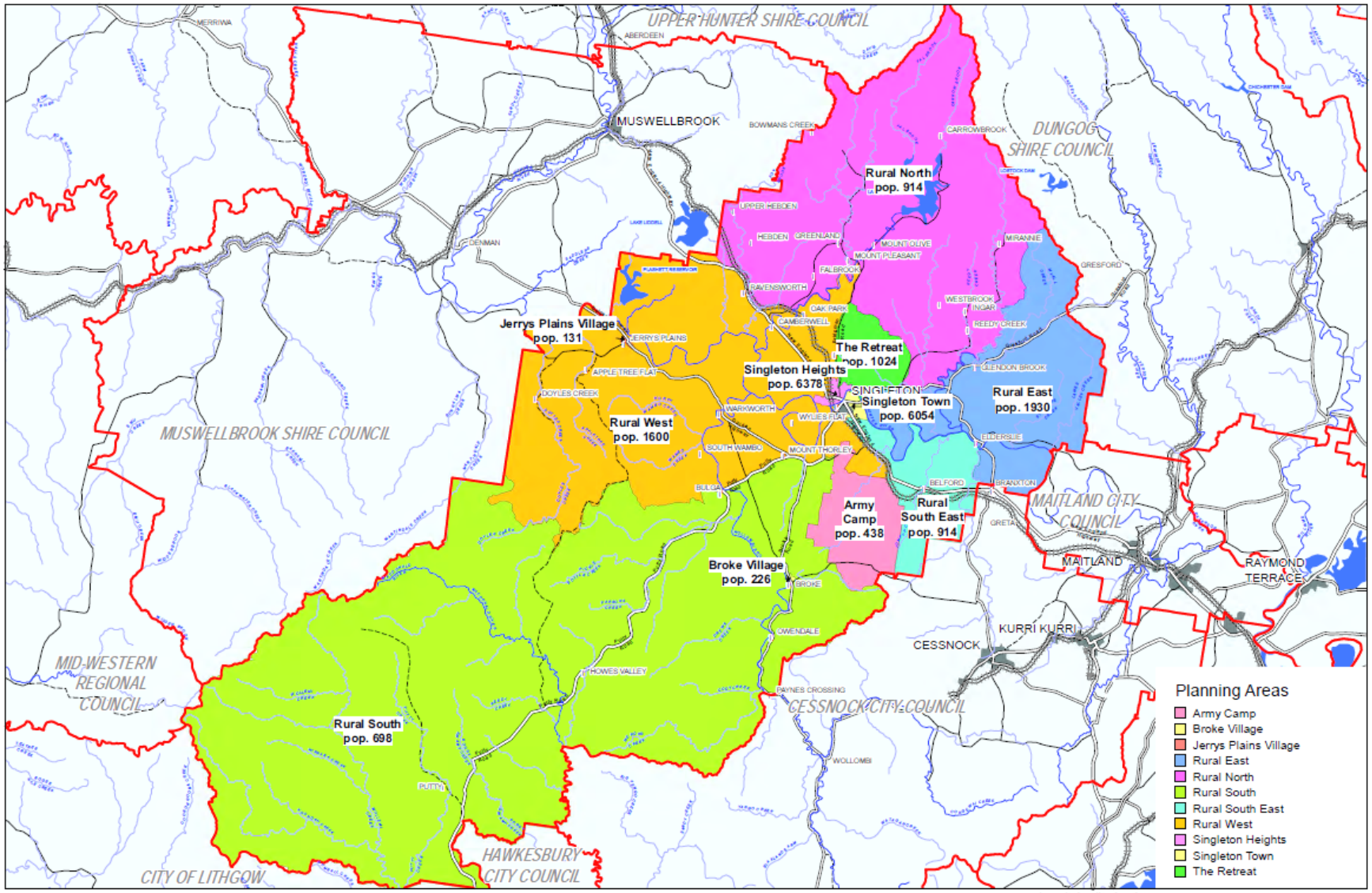
The planning areas have been used to differentiate between varying social, economic and land use characteristics occurring within the LGA. The boundaries of these planning areas are shown on Map 4.1, and are based on ABS Census Collection Districts amalgamated to group areas that have common characteristics. These planning areas correspond with those identified in the Singleton Community Social Plan, except that urban areas have been consolidated.

There are significant variations in the characteristics of each planning area, and land use issues vary between the areas as summarised in Table 2. Overall, in urban areas there is continuing pressure for urban development. Urban areas have accommodated about 50% of population growth over the last 10 years. Pressure for rural residential development is primarily within 20 km of Singleton and near Branxton, while more distant rural areas are stable.

Table 2: Singleton LGA planning areas and key land use issues

Planning area name	Description and key land use issues (e.g. growth expectations, land use constraints)
Urban	
Singleton Town	Focus of ageing population, flood liable land, commercial areas and consolidation of CBD, major transport and services, limited expansion potential, heritage issues, urban infill development, servicing and infrastructure issues (especially urban stormwater). Provision of industrial land.
Singleton Heights (North Singleton)	Relatively young population. Future urban growth will be concentrated in this area. Long term residential land opportunities need to be provided for and sites need to be identified for urban support uses (e.g. schools, health and social facilities).

Planning area name	Description and key land use issues (e.g. growth expectations, land use constraints)
	Consideration needs to be given to provision of retail areas and potential for additional industrial land. Transport accessibility is largely reliant on private transport, and there is limited accessibility to major transport links and Singleton Town.
Villages, rural residential and other	
Retreat	Relatively young, well off rural residential population. High car dependency. Increasing population requiring services. Some demand for additional rural residential development.
Broke Village	Reticulated water supply soon available. Lack of reticulated sewer limits development potential. Some flood liable land. Potential for mining impacts.
Jerrys Plains Village	Stable or slightly declining population with low urban growth, limited facilities and services. Potential land available for further urban development, but little land use change expected. Heritage issues for infill development. Potential coal mining in the vicinity.
Army Camp	Commonwealth land outside Council control.
Rural	
Rural North	Most stable planning area in LGA in terms of agriculture, land use and population change. Includes most important grazing enterprises and largest rural landholding sizes.
Rural East	Greatest pressure for rural residential development and small rural subdivision.
Rural South East	Pressure for more rural and rural residential development due to accessibility to Maitland, Cessnock and Greater Sydney Metropolitan area. Limited water availability. Lower Hunter Regional Strategy identifies potential for urban development in part of this area.
Rural South	Many absentee landowners due to accessibility to Greater Sydney Metropolitan area. Pressure for more rural and rural residential subdivision. Some mining impacts. High bush fire hazards on land in vicinity of Wollemi and Yengo National Parks.
Rural West	Stable population, with considerable open cut mining activity and associated land use change and environmental impact. A large proportion of the area is in mining ownership. Includes areas of Wollemi National Park.



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

PLANNING AREAS & POPULATION DISTRIBUTION (2006)

prepared by planning Workshop australia

0 A3 is 1:400,000 10 km

issued 9 Oct 07

Fig 4.1

Projected or anticipated changes, trends or pressures for the next 15 years which should be taken into account are summarised as follows:

- Pressure for extension to existing urban infrastructure (especially water service areas)
- Continuing coal mining production, and rehabilitation of coal mining areas with potential for subsequent post mining uses
- Increasing urban development pressure (including rural residential) around Branxton and near areas with transport accessibility and services (Singleton)
- Increasing pressure for improved public transport and accessibility to Newcastle for services
- Continuing population growth, with further ageing of population
- Increasing inadequacy of housing suited to ageing of population and reduced number of persons per dwelling (possible mismatch in housing supply and demand)
- Pressure for increasing intensive agriculture and consolidation of agricultural holdings (where this has not been prevented by subdivision and development)
- Increasing cost pressures for services (provision of roads and service infrastructure in rural/rural residential areas, transport costs) leading to less commuting
- Increasing demand for maintaining environment and amenity and 'tree change' lifestyle
- Reduced population 0 – 24 years, requiring fewer services and measures to maintain population and skills
- Requirement to improve landscape connectivity for biodiversity and maintain native vegetation (increased pressure from non-native species)
- Climate change leading to more variability in climate and reduced water security

Key matters that will affect land use in the area are the ability to maintain viable economic activities; the ability to maintain an attractive lifestyle; and the ability to attract new residents to the region. This will primarily be affected by providing and maintaining high quality key infrastructure and reasonable cost of provision (transport, water, and urban), community services (especially education and health), and amenity (landscape and environment).

4.1 Growth trends

Singleton's growth scenario anticipated for the 25 years to 2032 is for a population increase in the range 1.0 – 1.5% per annum. This Strategy adopts a population growth forecast of 1.5% per annum, and forecasts new dwelling demand averaging 200 dwellings per year. Growth is expected to substantially result from in-migration for

lifestyle and employment reasons. Dwelling requirements are expected to grow faster than population growth, based on lower dwelling occupancy rate trends. A large proportion of the workforce is employed in the mining industry which is expected to maintain its employment level over the Strategy period.

The population in most areas of the Singleton LGA is expected to increase, but some parts of the area will grow more quickly, especially Singleton Heights/North Singleton and the Rural East Planning Area. The increasingly ageing population structure reflects regional and national trends and contributes to a reduction in the dwelling occupancy rate. This is expected to result in additional demand for housing. An increasing proportion of the population is expected to live in urban areas. New dwellings in rural areas are expected to decline from up to 70% of all dwellings (e.g. 2000 and 2001) to about 35% of all dwellings, largely as a result of a reduction in the supply of rural lots, adequate supply of residential lots in Singleton, and trends towards increasingly expensive transport costs. These estimates do not take into account demand and supply in the Branxton area, since no timing is available for land supply in this area, and it is unlikely that this would occur within 5 years.

4.2 Planning framework

The Singleton LGA's existing planning framework is outlined in the Situation Analysis. There is a single existing local environmental plan (Singleton LEP 1996) and a range of development control plans.

The current regional planning framework for Singleton LGA is provided by Hunter Regional Environmental Plan 1989. This outlines a range of land use objectives and principles at the regional scale.

The Lower Hunter Regional Strategy 2006, prepared by the NSW Department of Planning, provides a broad land use planning framework for the Lower Hunter Sub Region, focusing on projected land requirements for housing and employment generating development. This Strategy is a policy document which updates the strategy and population projections outlined in the Hunter Regional Environmental Plan 1989, but does not replace the objectives, strategies and statutory requirements of the Plan. Under a Section 117 direction, LEPs are required to be consistent with a regional strategy.

The Lower Hunter Regional Strategy has implications for the Singleton Land Use Strategy, as follows:

- Growth projections for the Lower Hunter sub region can be expected to affect parts of Singleton LGA because the area forms part of a larger regional housing market. Historical data has shown that Singleton is substantially aligned to Lower Hunter trends.
- It identifies additional urban expansion areas south of Branxton, including up to around 2000 lots in Singleton LGA as part of a new urban area having around 7000 lots, and a new overall potential population of 15-20,000 people. It indicates a national park proposal within Singleton LGA south west of Branxton, which forms part of a separate agreement between a private land owner and the NSW Government to allow urban development.

- It limits rural residential development within the Lower Hunter Region to existing zoned areas, potentially leading to greater demand for this type of development within Singleton LGA in the longer term.
- It identifies adequate medium to long term industrial land supply within the sub region, with large areas currently zoned industrial. This supply may reduce industrial land requirements elsewhere in the region, including Singleton.

This Strategy supports the implementation of a consistent planning framework for Singleton and has taken into account relevant State planning policies and directions under Section 117 of the *Environmental Planning and Assessment Act 1979*.

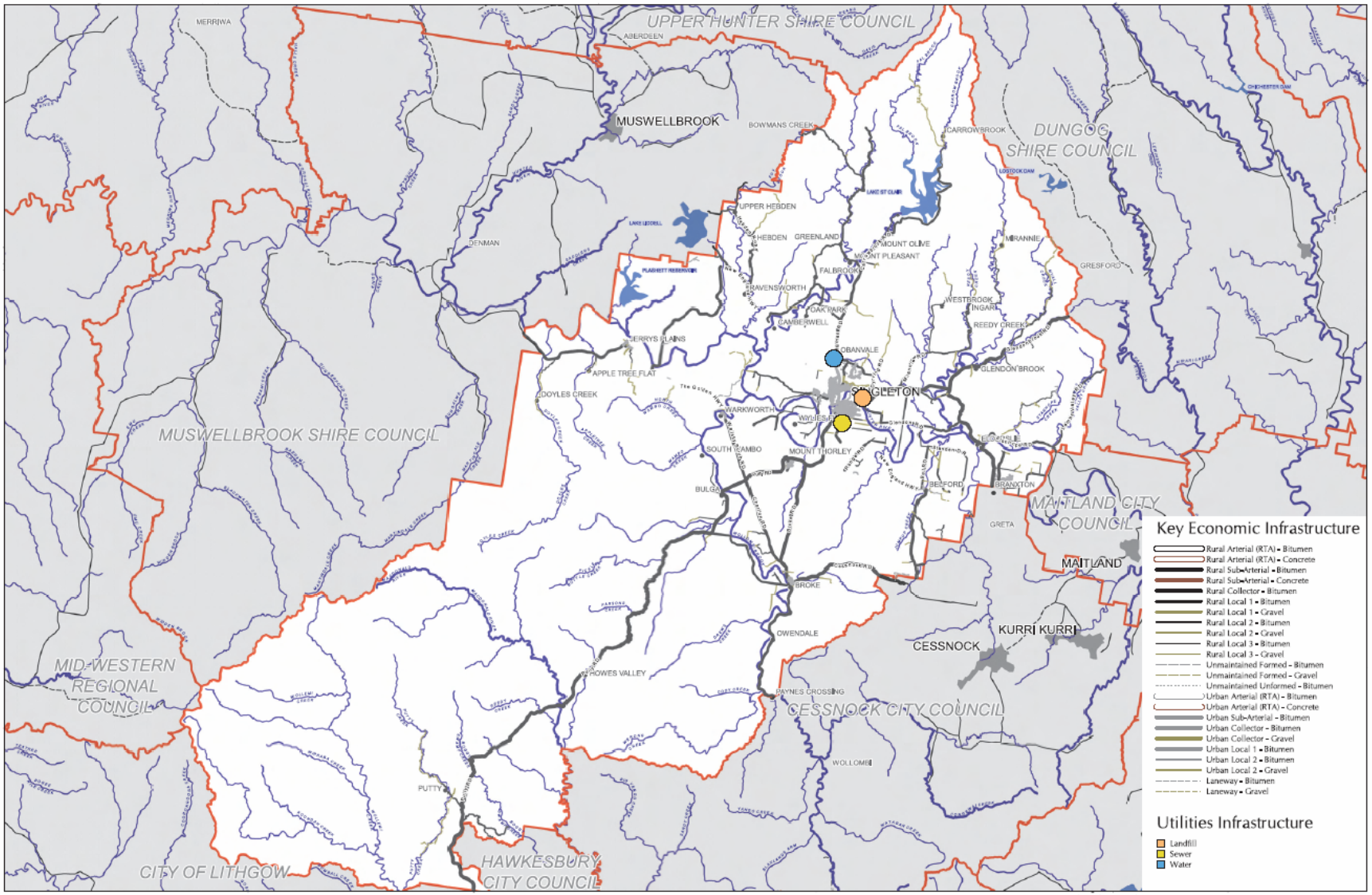
The format and content of the LEP resulting from the Strategy will be substantially determined by the NSW Government standard provisions for plans. Other specific agency requirements will also affect the LEP provisions.

4.3 Settlement structure and infrastructure

Major economic activities within the LGA are coal mining, agriculture, defence and tourism, in addition to urban support activities such as business and industrial land. Information on the characteristics, economic value and land use requirements of these activities are included in the Situation Analysis report. Background information on these and other infrastructure and settlement structure issues identified in the Situation Analysis, such as climate and infrastructure, is presented in the relevant sections of the Strategy.

Housing characteristics and availability are important for future land use and development. ABS Census data for 2006 shows a total of 8374 private dwellings within the Singleton LGA, with an average increase of around 160 per year over the last 25 years. About 9% of the dwellings were unoccupied, which is average for NSW, but lower than the Hunter Region average. In 2001, separate dwelling houses accounted for 80.5% of all dwellings and there were 0.38 dwellings per capita, which is lower than most LGAs in the Hunter Region. Shortages of rental accommodation have periodically occurred in Singleton, and there are potential issues associated with provision of affordable housing, and changes in housing requirements associated with the overall ageing of the population.

Singleton LGA is well accessed by roads and transport routes and is adequately serviced with infrastructure. The Situation Analysis report reviewed key infrastructure issues within the Singleton LGA, including water supply, sewer, transport, stormwater, waste management, bushfire facilities and open space. Summary information is presented in Maps 4.2 to 4.4 and Table 3.



Singleton Land Use Strategy

Source: Singleton Shire Council 2007

RURAL ROAD INFRASTRUCTURE & UTILITIES

prepared by planning workshop australia
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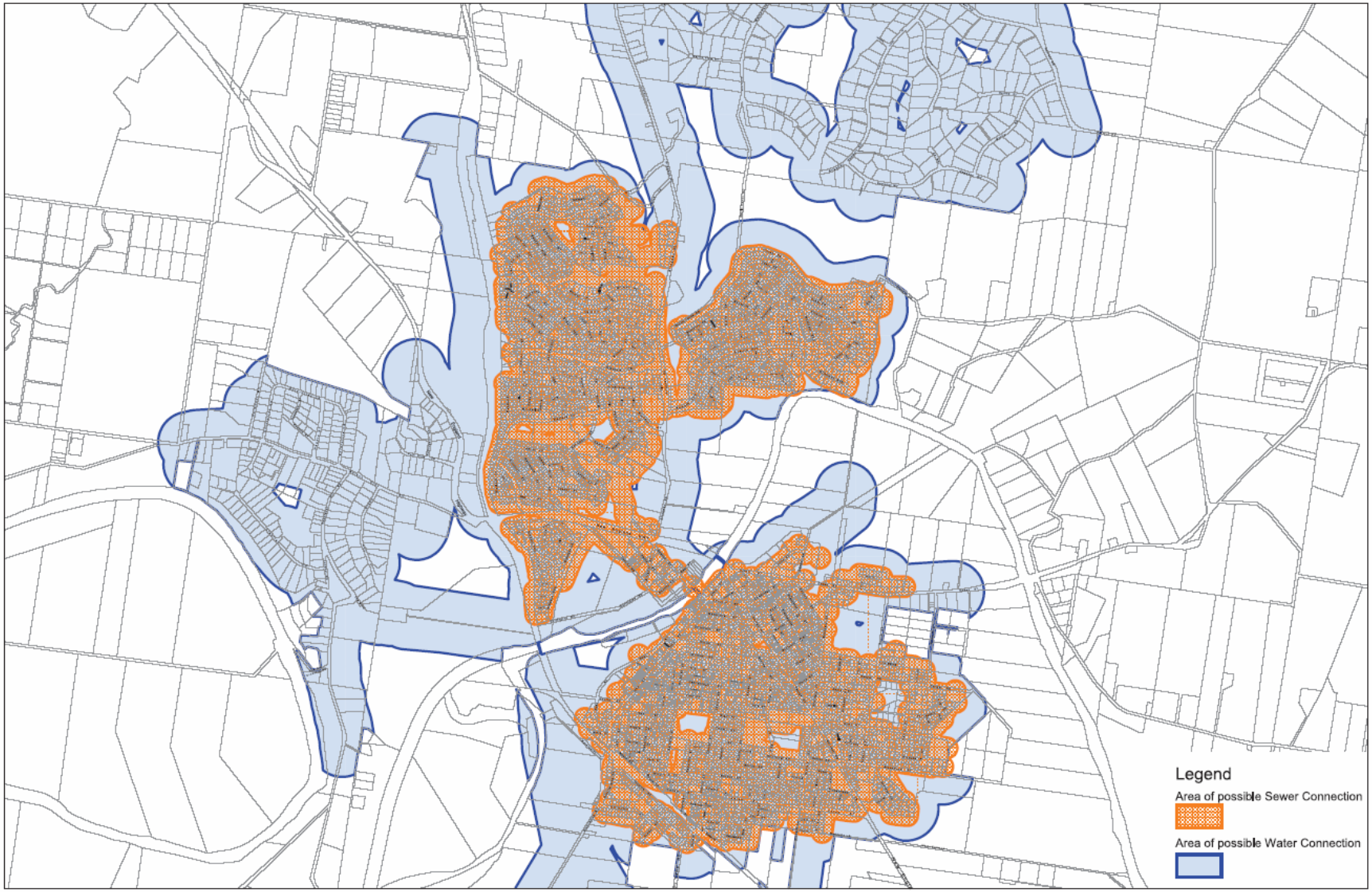
issued 11 June 07

Fig 4.2



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

WATER AND SEWER SERVICE AREA - SINGLETON

prepared by planning workshop australia
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0 A3 is 1:25,000 1000 m

issued 11 June 07

Fig 4.3A

Singleton Land Use Strategy

Source: Singleton Shire Council 2007

WATER SERVICE AREA - JERRYS PLAINS

prepared by planning workshop australia

0 A3 At 1:7500 250 m

Issued 11 June 07

Fig 4.3B

Source: Singleton Shire Council 2007

Singleton Land Use Strategy

WATER SERVICE AREA - BROKE

prepared by planning workshop australia
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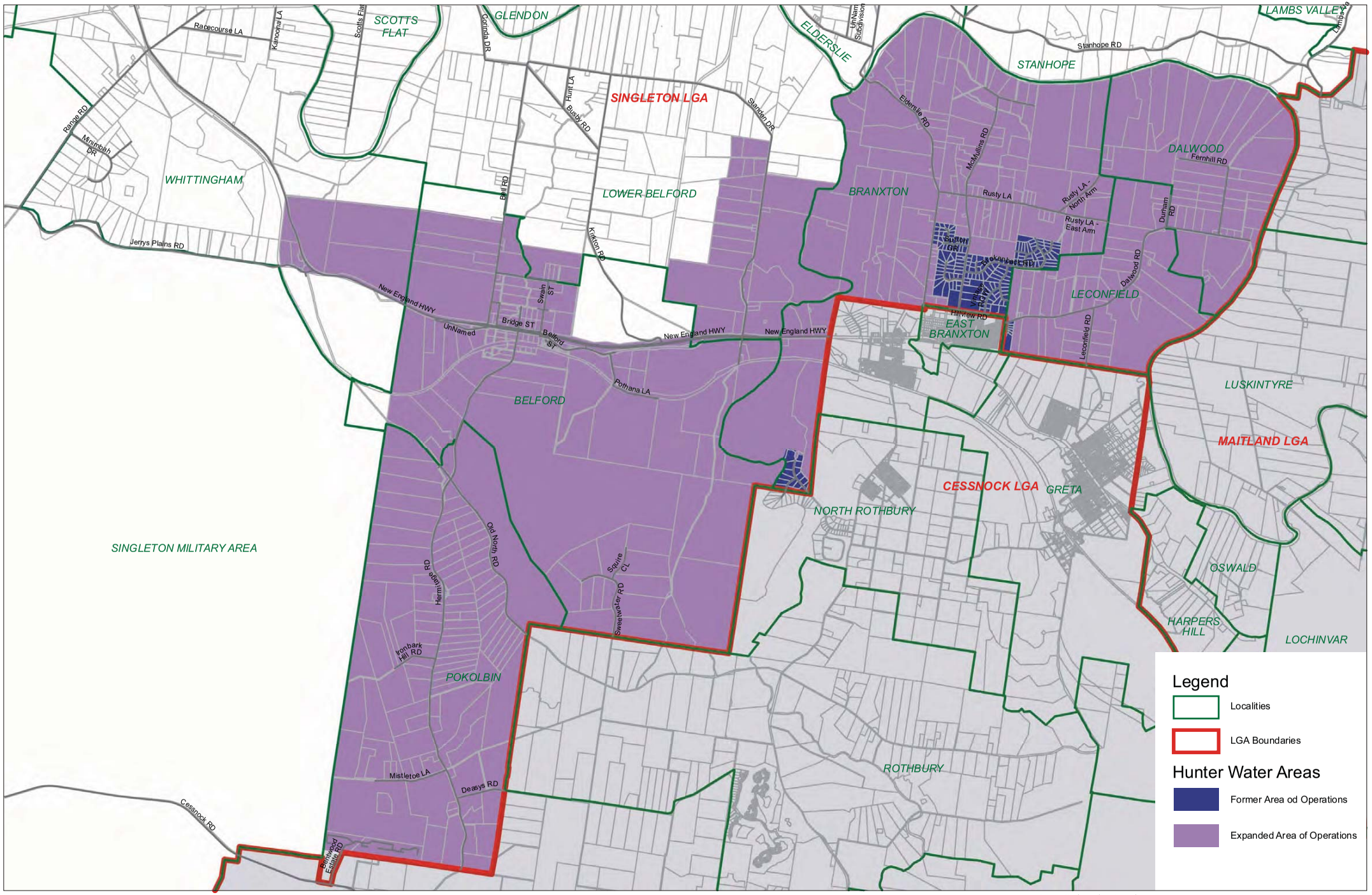
0 A3 is 1:7500 250 m

issued 11 June 07

Fig 4.3C



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

WATER AND SEWER SERVICE AREA - BRANXTON

0 A3 is 1:65,000 2.5 km

prepared by planning workshop australia
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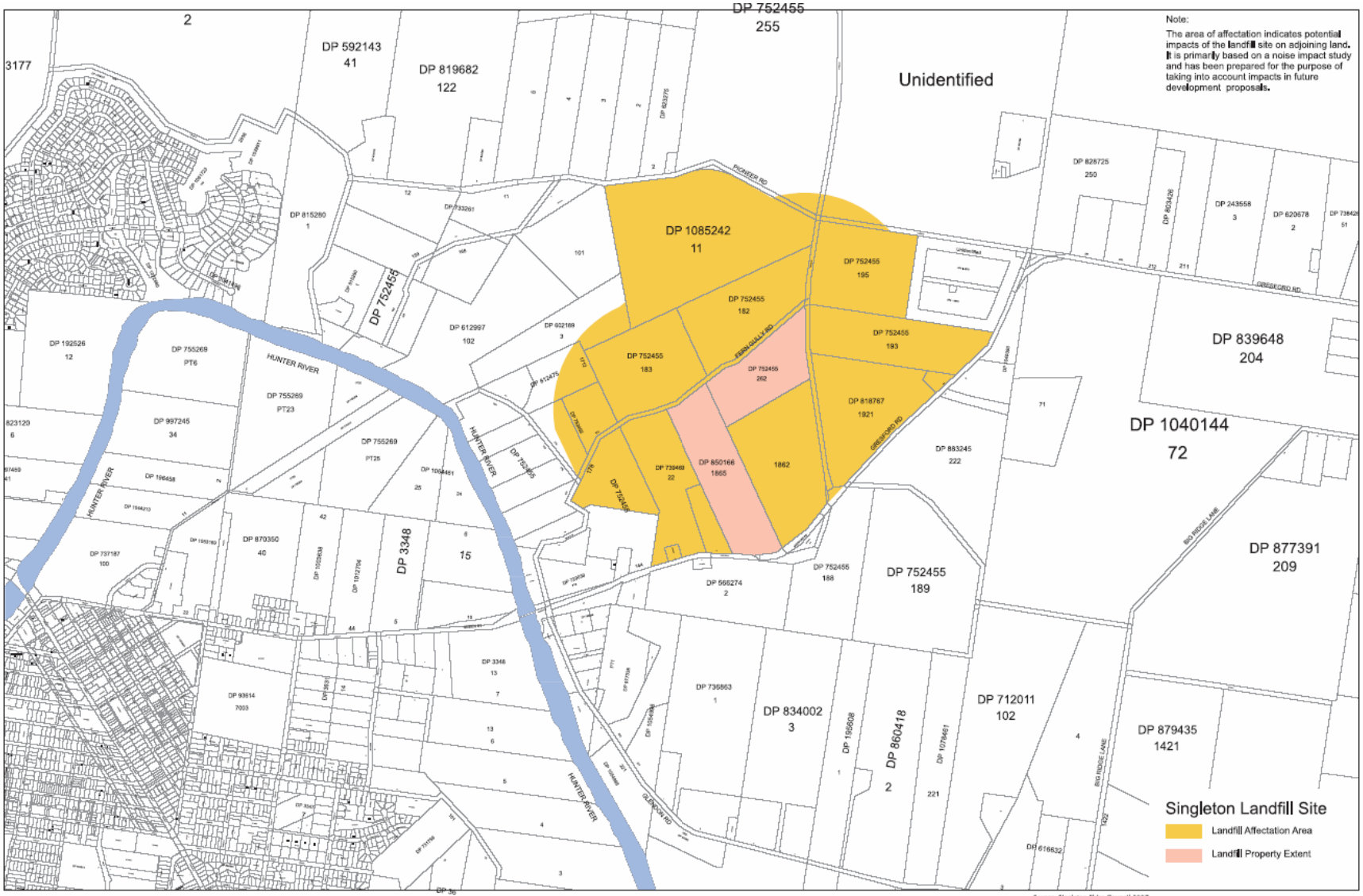
issued 20 Sep 08

Fig 4.3D



Singleton Land Use Strategy

SINGLETON WASTE DISPOSAL AREA INFRASTRUCTURE

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0 A3 is 1:15,000 500 m

issued 18 June 07

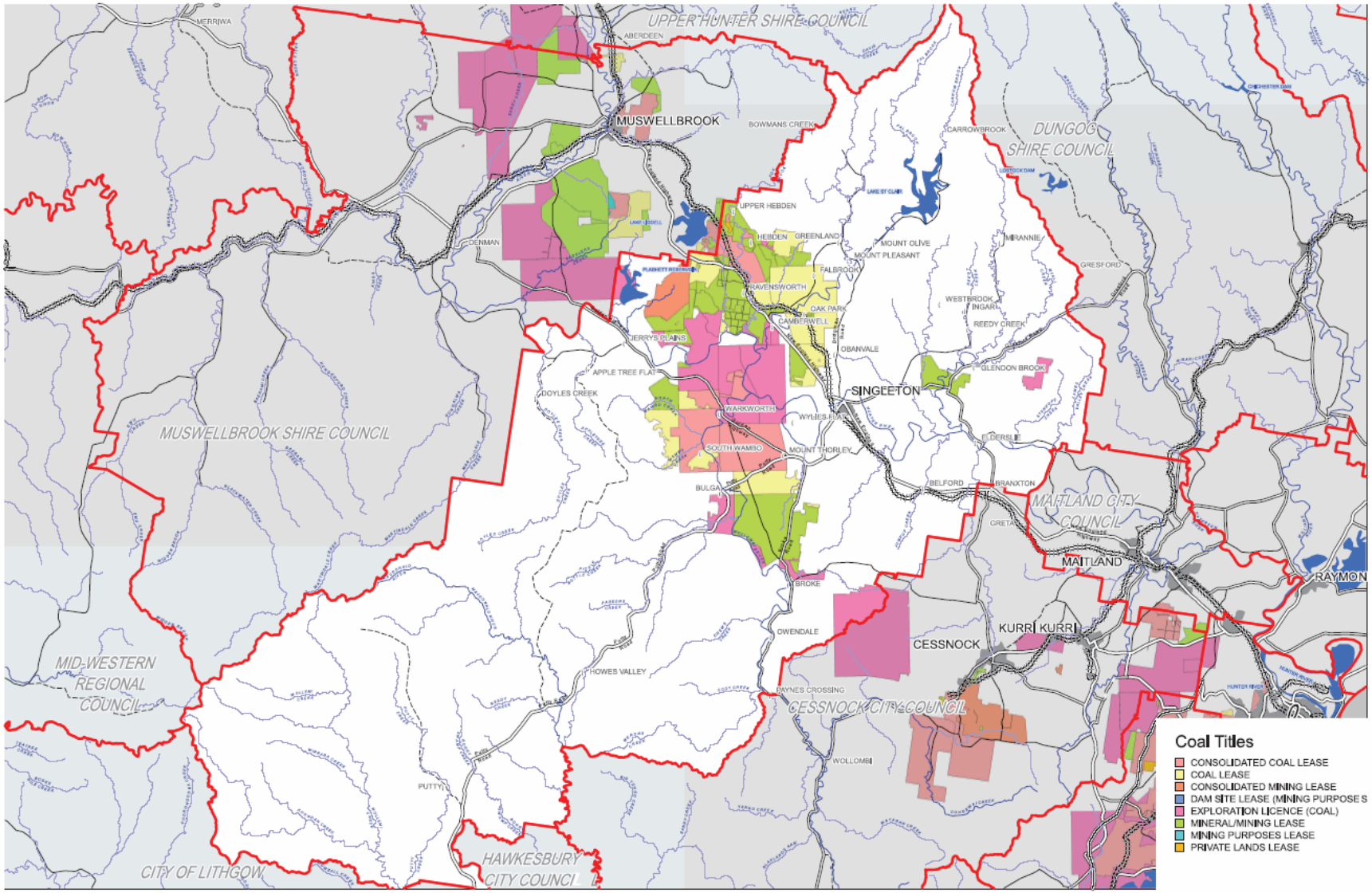
Fig 4.4

Table 3: Summary of key infrastructure issues

WATER SUPPLY	
Singleton	The town of Singleton is well placed in relation to existing urban water supply, and potential future demands with a supply from the Glennies Creek Dam via a pipeline. Residential and surrounding rural residential areas currently have an adequate water supply of good quality. All existing residences in the town area are supplied with treated water, plus some outside but close to the boundary. A non potable water supply is provided to some properties along the Glennies Creek Dam pipeline route.
Mt Thorley	A potable water supply is provided to the Mt Thorley Industrial Estate from Obanvale Water Treatment Plant via trunk mains.
Jerrys Plains	A potable supply was provided to the Jerrys Plains Village area, only, in 2004.
Broke	A potable water supply for Broke was provided in July 2007 from Obanvale Water Treatment Plant, via trunk mains.
Branxton (rural residential)	Water supply to rural residential allotments is provided by Hunter Water Corporation under an agreement with Singleton Council. The Hunter Water Corporation area of operations within Singleton LGA has been extended. The extension of the area of operation will not guarantee that land will be serviced.
SEWERAGE	
Singleton	Sewerage is connected to all dwellings within the town boundaries where economically feasible, and only a small number of properties are not connected. Council operates one sewage treatment plant at Doughboy Hollow south of Singleton. Sewage is now collected from Maison Dieu Industrial Estate and surrounding rural residential areas via a low pressure pump out system. Limited private pump out systems available to town sewerage immediately adjoining town boundaries.
Branxton	Sewerage service to some rural residential allotments is provided by Hunter Water Corporation under an agreement with Singleton Council. The future boundary of sewerage supply has not been determined, and is subject to further agreement.
ACCESSIBILITY AND TRANSPORT	
Highway	The sections of National and State Highway within the Singleton LGA are the responsibility of the Roads and Traffic Authority (RTA). Singleton Council maintains sections of these roads under contract to the RTA. Consideration needs to be given to proposing a Singleton bypass for the New England Highway.
Urban roads	Urban roads are in reasonable condition, although there are some limitations on capacity. A traffic and parking study and plan is in the process of being undertaken to determine a plan to address these issues, and will assist in determining the future road hierarchy and traffic management measures. A proposal for a link road concept is in the process of implementation. This is an important infrastructure link which will connect future urban development opportunities.

Rural roads	Existing road network adequate to cater for expected demand with ongoing sealing program for gravel roads, and developer upgrading associated with individual development proposals. The main issues relate to the provision of adequate carriageway width, sealing of unsealed roads and level of service of intersections. Growth in traffic volumes on rural roads is primarily limited to areas in the east and south of the LGA, especially in the Branxton/Stanhope and Broke/Fordwich areas.
Public transport	Public transport includes limited rail services and regional and interstate buses provided by private providers. A limited private town bus service operates, together with an extensive school bus network servicing a large proportion of the LGA.
Bikeways	A small network of recreational bikeways exists, which is proposed to be progressively extended in accordance with the Singleton Bike Plan.
STORMWATER	
Singleton	Issues with stormwater infrastructure are ageing capacity and water quality. Works are underway to improve provision of stormwater infrastructure.
Villages	Generally no formal trunk reticulated stormwater drainage system. Relies on natural drainage and soil infiltration.
WASTE MANAGEMENT	
Whole LGA	Provision of waste management facilities is a Council function in the Singleton LGA. Singleton Council operates one licensed waste management facility off Dyrring Road, about 5km from Singleton. The Council's Capital Works Program includes provision for new landfill extensions, together with a range of resource recovery services over a period of several years, to 2015. Waste services will continue on the current landfill site potentially to at least 2025, although the makeup and extent of services on the site may be modified. A building exclusion zone around Singleton landfill has been proposed to provide a buffer to prevent incompatible uses. Council has advised that it now intends to establish a residential dwelling exclusion zone within the "Landfill Affectation Area" identified in Figure 4.4.
BUSHFIRE FACILITIES	
Whole LGA	Reasonable provision exists for bushfire service provision within the LGA. This is provided by the NSW Rural Fire Service in conjunction with Singleton Council.
OPEN SPACE	
Singleton	Active and passive open space needs are currently well catered for. Key issue is the quality of the open space and maintenance costs. In new development areas, future consideration needs to be given to protection of biodiversity values on Council open space land (need for adequate size, shape and connectivity).
Rural areas	Active and passive open space needs are currently well catered for in rural areas.

The substantial coal resources within Singleton LGA significantly affect land use and settlement structure. Current mining titles and Mine Subsidence Districts are shown on Map 4.5.



Singleton Land Use Strategy

COAL MINING TITLES & MINE SUBSIDENCE DISTRICTS

prepared by planning workshop australia
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issued 10 June 07

Fig 4.5

Climate conditions are an important factor for settlement and are closely related to economic development opportunities. Over the life of the Strategy, there is an identified need for the community to adapt to climate change, and also to respond to the causes of climate change. Overall, Singleton LGA is poorly adapted to cope with climate change, for the following reasons:

- The urban structure is relatively dispersed, relies on high energy use (primarily motor cars), and there is a high degree of long distance commuting for employment.
- Water availability is limited but demands for all land uses are increasing. Agriculture on prime agricultural land is largely dependent on irrigation.
- The economic structure of the area is highly dependent on high carbon emission industries (coal mining and electricity generation).
- Anticipated new developments are not greenhouse gas neutral.

Combined with other initiatives, the Singleton Land Use Strategy can provide a framework for responding and adapting to climate change. In particular, to respond to climate change and reduce greenhouse gas emissions caused by the present economic and land use structure, it would be desirable to implement targets and approaches including:

- Support and provide incentives for new industrial and commercial development that is located close to the town, is carbon neutral, and provides onsite water servicing.
- Support enhanced public transport and accessible access networks (including pedestrian and cycle networks).
- Require future urban development and subdivision design to ensure that 100% of lots provide suitable orientation for passive energy efficiency.
- Ensure that economic impacts of rural residential development areas are fully costed, and that costs are recovered through financial contributions arrangements at the subdivision stage.
- Proactively promote a greenhouse gas neutral approach to coal mining within the LGA, including limiting further geographic extension of coal mining to present approved areas.

4.4 Biodiversity and natural ecosystems

Singleton LGA supports extensive biodiversity as a result of its topography, geology and climate. It includes parts of the North Coast and Sydney Basin Bioregions and supports extremely diverse biodiversity as a result of its varied topography, geology and climate. The area is botanically significant because it represents a zone of transition between the coast and inland, and between northern and southern botanical regions. As a consequence, it includes the eastern limit of distribution of some species, and the northern and southern limits of distribution of other species.

Significant proportions of some vegetation communities have been cleared, with the result that much of the remaining native vegetation is of significance (especially in the central Hunter Valley Lowlands). Although approximately 34% of the total area of

the Singleton LGA is included within dedicated conservation reserves (mainly in Wollemi, Yengo and Mt Royal National Parks), this protects only a limited range of the vegetation types and ecosystems occurring within the area.

Some significant characteristics of biodiversity and natural ecosystems occurring within the Singleton LGA are as follows:

- Seven listed endangered ecological communities, 53 fauna species, and 15 flora species listed as threatened under the Threatened Species Conservation Act 1997 (NSW).
- Three of the national parks have World Heritage listing (Central Eastern Rainforest Reserves and the Greater Blue Mountains World Heritage areas).
- Two listed threatened ecological communities and 45 flora and fauna species listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).

The number of listed threatened species and threatened/endangered ecological communities has progressively increased over time, and this trend is expected to continue. Land use responses require improved and regularly updated information, especially in areas likely to be subject to land use change and development pressure. Land use and development are required by State and Commonwealth legislation to take into account environmental impacts on biodiversity, including threatened species and endangered ecological communities.

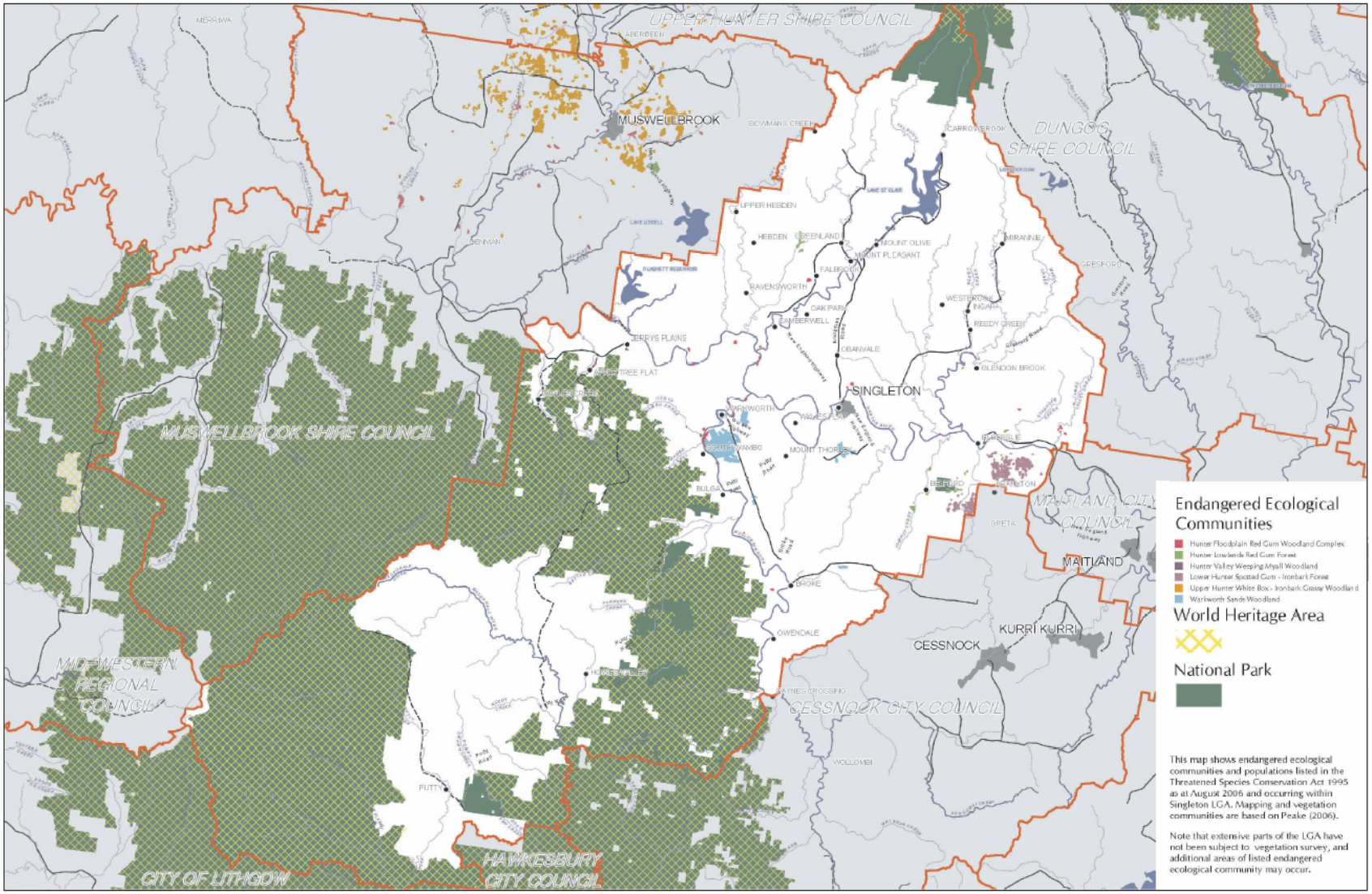
Map 4.6 shows key biodiversity constraints including conservation areas, and some areas identified as endangered ecological communities in the central Hunter Valley Lowlands geographic areas of the Singleton LGA.

4.5 Land and water

Land and water issues are closely related to land use, especially economic activities such as agriculture and urban settlement. In affecting land use change, the Strategy must consider important issues including land capability and land degradation, water availability and quality, flooding and bushfires. The characteristics of the LGA are summarised in the Situation Analysis report, and some of the key characteristics (river sub-catchments, land capability, and bushfire prone vegetation) are shown on Maps 4.7 and 4.8. Separate mapping of flood prone land is also available for some areas.

4.6 Design issues

Design issues apply primarily at the site development scale, and in the Strategy are secondary in importance to the issues of settlement structure and infrastructure, biodiversity and natural ecosystems, and land and water. Background to these issues is included in the Situation Analysis report, and the framework for consideration of these issues needs to be included within the Strategy. Important design issues include heritage conservation and environmental design, and Maps 4.9A and 4.9B show the boundaries of heritage conservation areas recognised in urban areas of the LGA. Heritage conservation issues have been included in relevant sections of the Strategy, as they apply to the key issues.



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

CONSERVATION AREAS & ENDANGERED ECOLOGICAL COMMUNITIES

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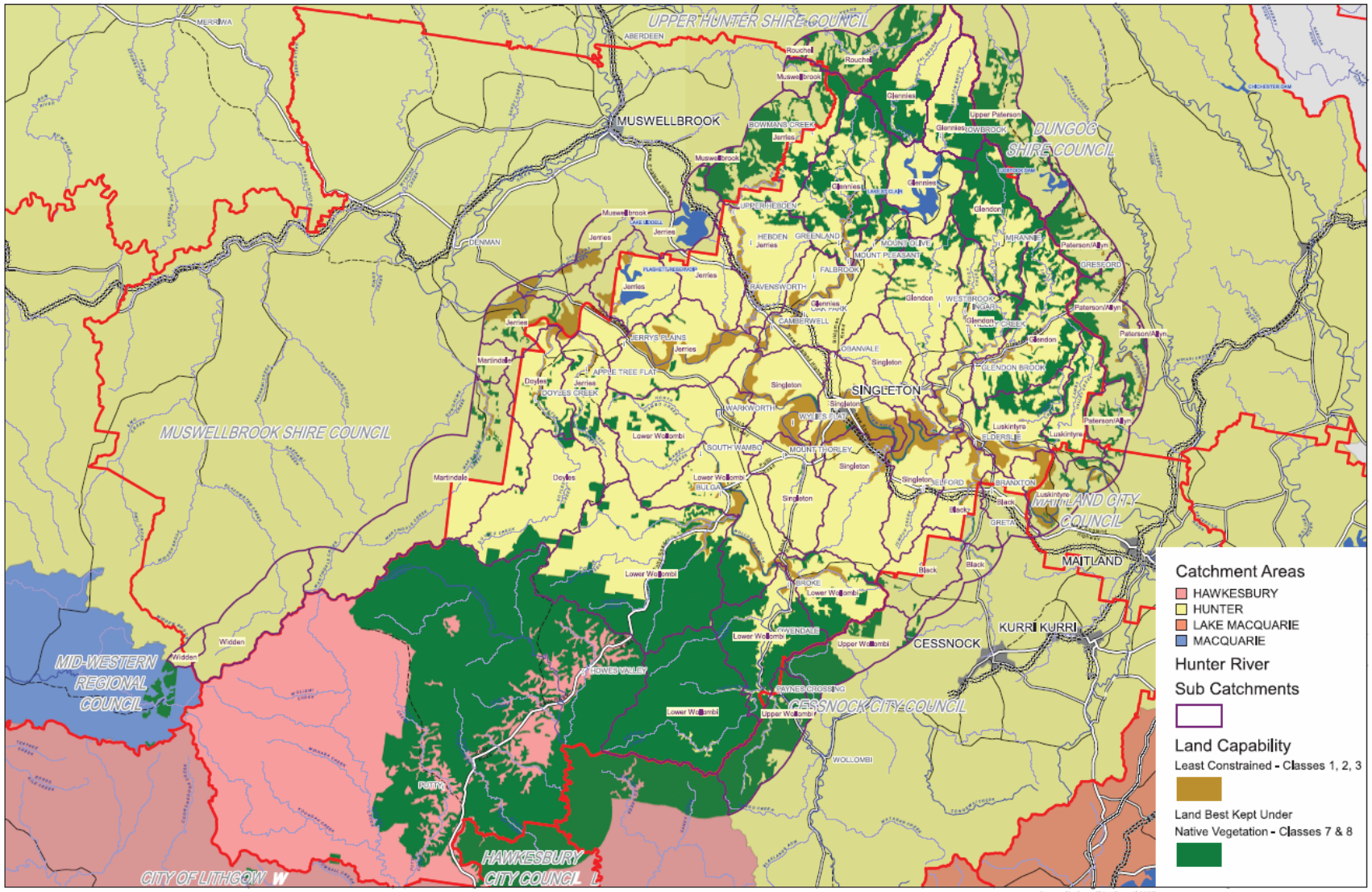
issued 10 June 07

Fig 4.6



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

WATER CATCHMENTS AND LAND CAPABILITY

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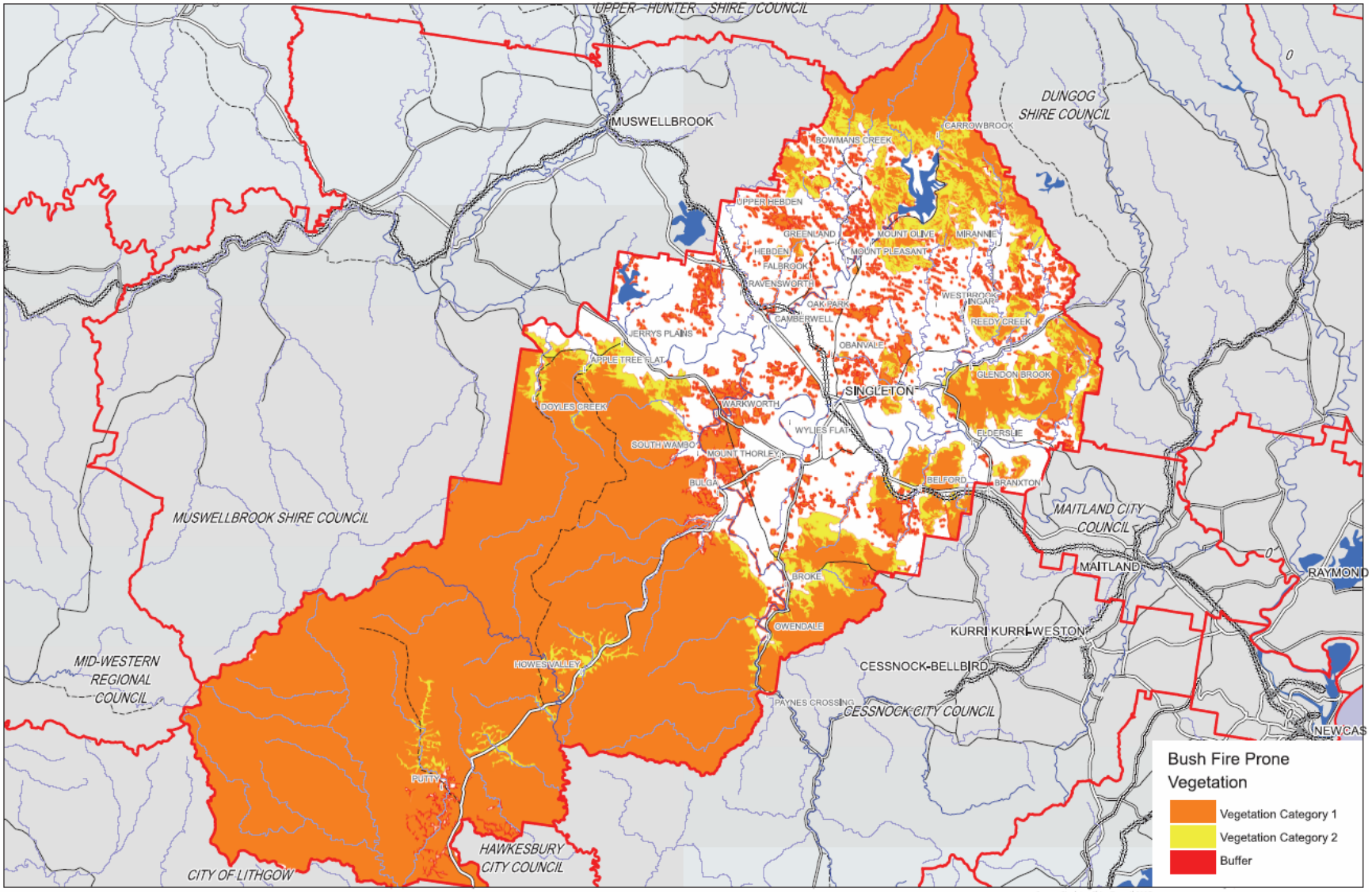
Fig 4.7



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

BUSH FIRE PRONE VEGETATION

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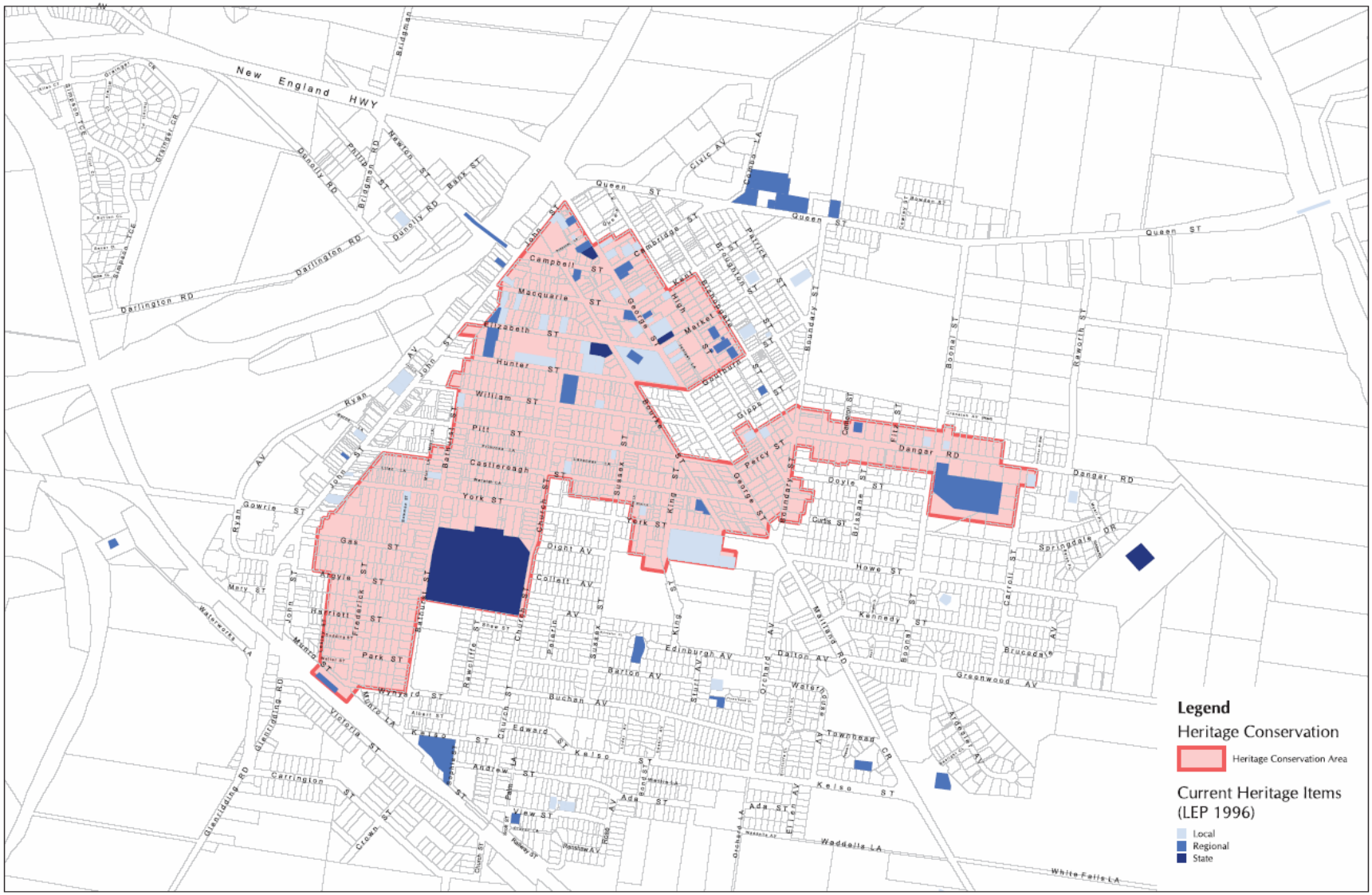
Fig 4.8



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

HERITAGE CONSERVATION AREA - SINGLETON

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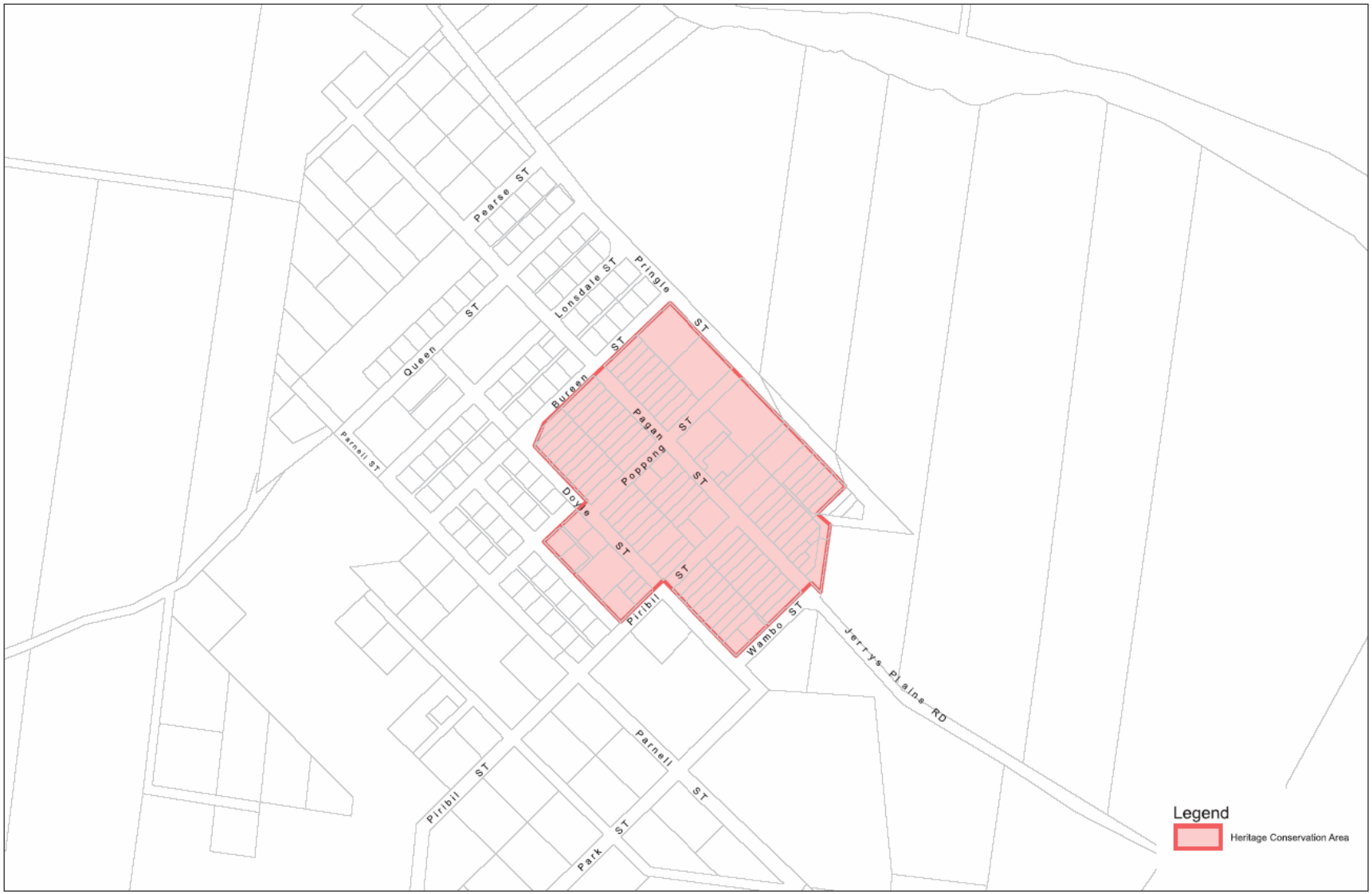
Fig 4.9A



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

HERITAGE CONSERVATION AREA - JERRYS PLAINS

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0 A3 is 1:7500 250 m

issued 11 June 07

Fig 4.9B

5 GENERAL AIMS AND OBJECTIVES

General aims and objectives for land use within Singleton are outlined in this section. These aims and objectives take into account the vision expressed by the Council, the strategic objectives of existing plans applying within the LGA, and the objects of the *Environmental Planning and Assessment Act 1979*.

The Strategy provides a consistent direction for land use and community decision-making, and allows flexibility to respond and adapt to variations in the actual growth rate over time.

The Strategy's general aims and objectives are outlined below. These are largely based on the Singleton LEP 1996 objectives. They have been prepared in a form to enable incorporation into subsequent LEP provisions, and to align with Council's 2030 Strategy. The aims and objectives are:

(a) to provide a framework for controlling and co-ordinating development within the Singleton local government area

(b) to ensure the most appropriate and efficient use or management of land and natural resources

(c) to co-ordinate economic development so that there is optimum and equitable economic and social benefit to the local community

(d) to ensure that the environmental impact of development is adequately assessed, including the consideration of alternatives

(e) to establish a pattern of broad development zones as a means of:

  (i) separating incompatible uses

  (ii) minimising the cost and environmental impact of development

  (iii) maximising efficiency in the provision of utility, transport, retail and other services

(f) to retain options for alternative land use strategies so that flexibility to allow economic, social and environmental change can be accommodated

(g) to encourage adoption of land management practices which are sustainable over long periods of time without degradation of natural environmental systems

(h) to provide adequate protection and minimise risk for the community (as far as possible) from environmental hazards, including flooding, soil erosion, bush fires and pollution

(i) to enable public involvement and participation in environmental planning and assessment

(j) to progress development in an ordered and economic manner.

In addition to the general aims and objectives outlined above, local environmental plans are required to have specific objectives for each land use zone identified within the scope provided by the NSW Government standard plan provisions.

6 URBAN SETTLEMENT

This part outlines the land use policies and strategies for urban settlement, and requirements for accommodating urban growth and change. Key issues are the provision of additional urban land, suitable housing to cater for the ageing population, and provision of industrial land and service infrastructure. The population of Singleton LGA is expected to increase in the Strategy time frame (25 years to 2032), and housing and settlement requirements are also expected to change. The population forecasts used in the Strategy are for a 15 year time frame, within the context of a 25 year Strategy, to provide sufficient infrastructure and urban land for future long term requirements. The population forecasts should be reviewed and updated after 5 to 10 years. The approach taken in the Strategy will affect how large Singleton will grow, and its long term structure.

Growth will be influenced by national and Sydney metropolitan conditions and trends, as well as growth in local and regional employment and changes in commuting patterns. It could be expected that factors influencing commuting patterns (e.g. increasing transport costs) may affect housing demand, and the spatial location of this demand within the LGA (e.g. the relative proportion located within residential and rural locations). As family sizes decline, it is likely that a higher growth rate for smaller sized dwellings will occur, including single storey dwellings for aged persons.

Additional residential zoned land is expected to be available in the near future following the amendment of the existing LEP provisions in Singleton Heights. This relates to the Huntergreen, Bridgman Ridge, and Gowrie Links proposals, and will ensure an adequate supply of residential land for at least 10 to 15 years. The Strategy needs to consider development options for the town over a longer period as well.

There is currently reasonable provision of urban infrastructure and services (e.g. roads, electricity, water and sewer) for the town of Singleton. Water supply limits and economic limits on service extensions have been taken into account in formulating the Strategy. Minimal growth is expected in villages, and there are servicing limits in all village areas.

Social infrastructure, community services and recreational facilities are reasonably well catered for within Singleton, although the trend for increasing centralisation of many specialist services means that these are located in Maitland and Newcastle, and transport must be available to access these. Housing affordability and providing adequate suitable aged persons accommodation are expected to continue to be significant issues over the life of the Strategy. These and other matters relating to housing needs were reviewed in the Singleton Community Housing Forum held in November 2006, which emphasised the importance of taking into account the full range of community housing needs in future planning for residential development. The Forum recommended strategies and ongoing actions which have been taken into account in the preparation of this Strategy.

A significant issue over the life of this Strategy is the proposed urban area identified south of Branxton by the Lower Hunter Regional Strategy, including some land within Singleton LGA. While this has potential for around 2000 residential lots in Singleton, planning processes have been established to determine a structure plan, and the urban boundaries are to be defined through future local planning. Planning and

development within this area will primarily be aligned to growth within the Lower Hunter Region, and is not expected to significantly impact on growth and demand projections for Singleton identified in this Strategy. Policies and strategies for the South Branxton area are included in Section 8.8.

The following estimates in Table 4 are adopted/assumed for the purposes of the Strategy. These estimates are based on the Situation Analysis report, and it should be noted that these are for the LGA as a whole, and that there is considerable variability between different planning areas.

Table 4: Summary of Singleton LGA projections and trends

Strategy forecast	Estimate (25 years to 2032) - update	Comment
POPULATION CHANGE	Estimated 1.5% per annum growth (average 300 persons per year). Approximate population 27,500 in 2021.	Significant fluctuations from year to year would be expected. Most growth would occur in Singleton Heights (North Singleton).
Dwelling occupancy rate	Decline from 2.8 persons per dwelling to 2.5 persons per dwelling	Ongoing decline in occupancy rate, alone, creates demand for an average additional 43 dwellings per annum.
RESIDENTIAL DEMAND	Average 170 to 230 new dwellings per year	Depends substantially on dwelling occupancy rate and dwelling type availability.
Changes in type of dwellings required	Increase in small single dwellings, aged persons accommodation (especially single storey), and units/townhouses	Lower demand for large houses (i.e. 3 to 4 bedrooms) likely in long term
Urban/rural split	By 2021, urban Singleton is expected to have a population of 17,750 with 9,750 in rural areas.	It is anticipated that 60% of additional dwellings provided to 2021 will be in the Singleton Heights/North Singleton urban area, 5% in Singleton town area, and 35% in rural areas.
INDUSTRIAL LAND	Projected annual demand for light industrial land (3 to 6 ha per annum).	Variable depending on regional demand and supply.
URBAN WATER DEMAND	Average yearly urban water demand is 350kl/annum	Long term trend in water use is not clear, but usage has been reduced by recent water restrictions.

Strategy forecast	Estimate (25 years to 2032) - update	Comment
AVERAGE URBAN TRANSPORT ACCESSIBILITY (index of people within walking distance of bus route or CBD)	Figures currently unavailable, but trend is for declining transport accessibility.	Continuing relative population dispersal (especially in rural areas) is expected to increase reliance on car transport, and reduce opportunities for viable public transport.

Key land use planning issues regarding urban settlement in the Singleton LGA were identified in the Situation Analysis as follows:

- Projected residential land requirements
- Identification of areas for long term urban expansion around Singleton
- Town infill development opportunities and constraints
- Water and sewer capacity and service areas
- Road hierarchy, transport links and accessibility
- New England Highway Bypass for Singleton
- Development guidelines for highway frontage land
- Adequacy of land for industry and commerce, and requirements for additional land and services
- Floodplain development and management
- Availability of suitable sites for future institutional use

Objectives, policies and strategies for each of these are presented individually below.

6.1 Projected residential land requirements

This section relates to how much residential land and housing will be required, its type and characteristics. Section 6.2 relates to where future urban land is best located.

Housing in Singleton is principally in the form of individual detached dwellings, representing 88% of the housing stock in 2006. This contrasts with NSW as a whole where 70% of dwellings were separate dwellings. The NSW proportion of medium density housing is 29% with Singleton having a much lower 10% of dwellings in this category. The dwelling occupancy rate for the LGA has shown a steady decline and was estimated at 2.9 persons per dwelling in 2006, slightly above the NSW figure of 2.7.

Future dwelling approvals of between 170 and 230 per year could be anticipated for the next 10 - 15 years assuming a continuation of current economic conditions.

Approximately 60% of total LGA population growth would be expected to occur within Singleton Heights/North Singleton and 5% in Singleton Town.

A local environmental plan amendment which has recently been finalised zones additional land for residential purposes in North Singleton is expected to ensure an adequate supply of zoned residential land for the next 15 years. Existing local environmental plan zones are shown on Map 6.1. The Huntergreen and Bridgman Ridge residential areas are located to the north of the existing Hunterview area, and have a combined area of approximately 240 ha, and an expected residential lot yield of between 1,100 and 1,200 lots. In addition, the proposed Gowrie Links residential area could supply an additional 450 to 550 lots. However, there are potential limits on water and sewer provision to service these residential areas which will require investment and upgrading of infrastructure, and may limit the land actually available to the market.

While a key feature of the Strategy is to provide for additional residential development in the urban area of Singleton, there are also a range of other housing issues that need to be considered in conjunction with this, that relate to housing affordability and suitability for anticipated demographic changes. These are considered in Section 6.3.

Objectives – residential land requirements

- Singleton will have urban land that is zoned and serviced to meet projected housing needs up to 2032.
- Housing will vary in size and form to meet changing household formations and the needs of an ageing population.

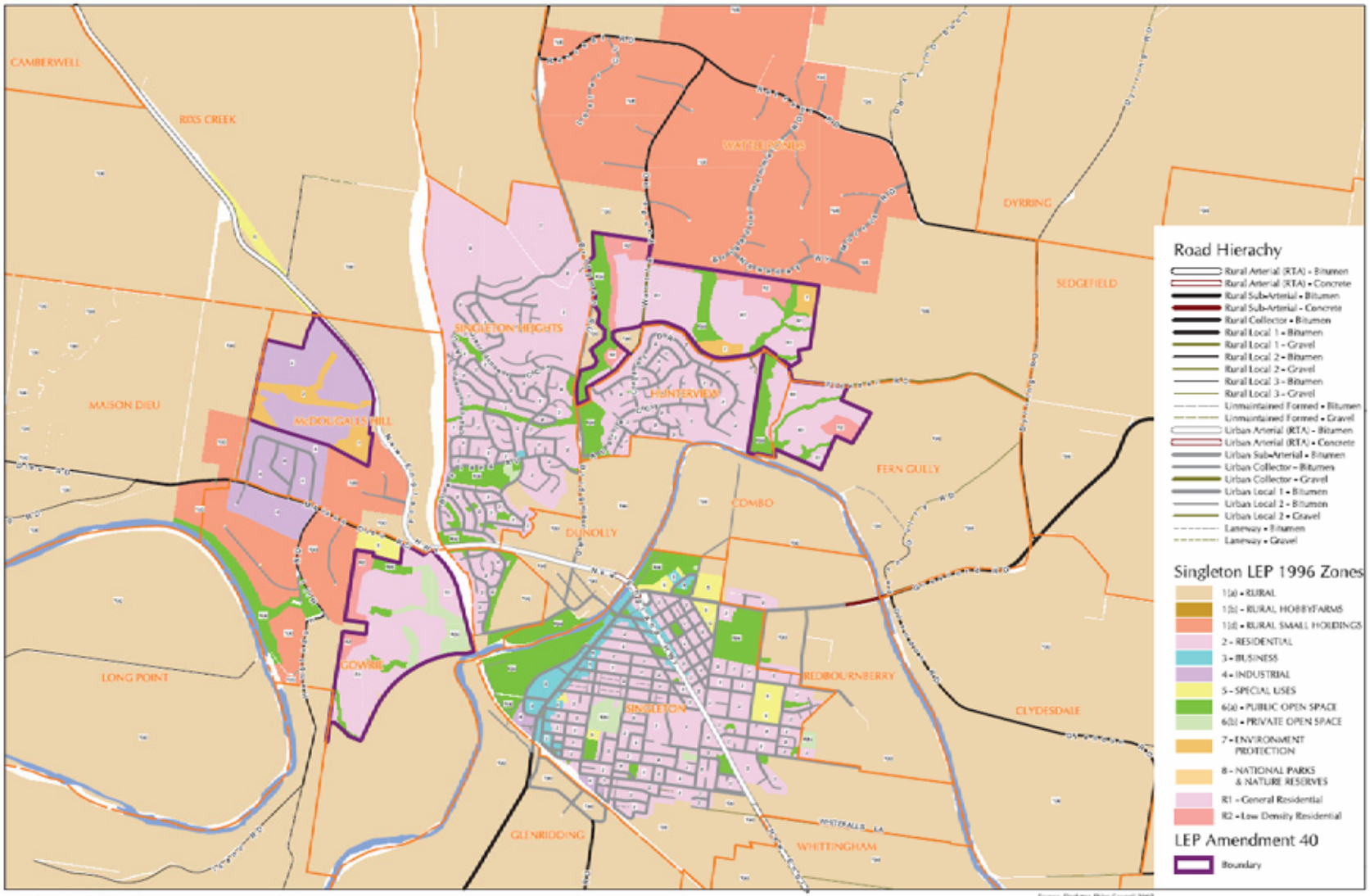
Policies – residential land requirements

- Maintain a minimum of 5 years supply of zoned residential land.
- Encourage aged persons accommodation (with suitable style, location and access to services).
- Support the provision of affordable housing requirements by maintaining adequate residential land.
- Facilitate medium density in existing residential areas, subject to accessibility, urban design, amenity and sustainability criteria.
- For new greenfield residential development, consider seeking planning agreements with developers to provide for residential development of a certain type, and/or affordable housing (e.g. medium density and single storey aged persons accommodation).
- Recognise the need to cater for different sectors (youth, aged persons and construction workforce accommodation).
- Ensure public transport accessibility for all residential development, and provision of shopping and other facilities within walking distance.

- Urban sustainability issues will be considered in the determination of new areas for urban expansion (e.g. future water recycling, protection of biodiversity values, road and subdivision layout to provide optimum orientation for solar access).
- Maintain existing residential character by limiting subdivision.

Strategic Actions – residential land requirements

- Facilitate LEP amendments to supply a minimum of 5 years of residential development potential through zoning based on demand/supply analysis undertaken.
- Ensure demand and supply analysis also considers available infill opportunities.
- Implement zoning consistent with Standard LEP recommended zones.
- Undertake periodic review and updating of growth projections to coincide with the release of ABS Census data.
- Ensure appropriate LEP provisions to encourage/enable smaller, single storey residential development in close proximity to transport and facilities, and located on flatter sites.
- Prepare a DCP to identify appropriate sequencing of development.
- Recognise Aboriginal heritage protection requirements in LEP provisions.
- Take into account future limits on water availability and anticipated requirements for increased energy efficiency by adopting sustainability criteria (e.g. 100% energy efficiency lot orientation, and suitable street layout) in LEP or DCP
- Provide for parks within walking distance of all homes in accordance with Open Space and Recreation Needs Study (2002).
- Maintain existing residential character by including minimum subdivision area requirements in LEP provisions. Resubdivision is to be consistent with existing character (e.g. 450m^2, 1200m^2, and 2500m^2 minimum areas in Bridgman Ridge area).
- Ensure appropriate LEP provisions to enable smaller, single storey residential development in close proximity to transport and facilities on flatter sites.
- Consider introducing sustainability targets for new buildings (e.g. energy efficiency, onsite renewable electricity generation, building recyclability and durability, carbon neutrality etc.



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

SINGLETON - CURRENT ZONING

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Issued 11 June 07

Fig 6.1

6.2 Identification of areas for long term urban expansion around Singleton

As outlined in Section 6.1, there is adequate existing provision for residential land within the time period of the Strategy. While there is no immediate need for further residential land in the Strategy time frame, it is essential to review the long term (25 to 50 year) urban expansion opportunities for Singleton, and to ensure that these are not prejudiced by short term development. This section focuses on the future urban structure of the town, major servicing and accessibility requirements, and the criteria that should be applied to future development proposals that may arise in long term urban growth areas.

The town of Singleton is particularly constrained by its physical setting, and surrounding land uses (i.e. coal mining and army camp). While the future long term growth of Singleton cannot be predicted, there are options that would provide for substantial future urban growth if this was ever required (e.g. doubling of the urban population in 50 years). These options are reviewed in Table 5 and could secure future land in the event that this is ever required. No detailed investigations have been undertaken.

Table 5: Summary of long term urban expansion options

Option	Comments
Singleton North East	The 1974 Singleton Planning Study found that north east expansion was the best long term urban expansion option. Since that time, this option has been made more difficult by land fragmentation, and is affected by the Singleton Waste Management facility. Physical constraints include undulating slopes, salinity and erodible soils, and presence of native vegetation. Development of this area would require improved road links, including upgrading Pioneer Road to Dyrring Road. This area has reasonable potential for servicing with water and sewer. It also may be affected by the continuation of or future land use on the current Singleton Landfill site.
Singleton West	The Singleton Planning Study ruled out urban expansion to the west as a result of proposals for open cut mining. Mining commenced in about 1990 and could be expected to be substantially completed within 20 – 30 years. This would make land potentially available for urban development. Advantages of this option are that land is generally flatter and would have better highway access, with opportunities for commercial development sites.

Option	Comments
Town infill	Although there are larger sites with potential for additional residential development, substantial increases in density within Singleton Town should be discouraged as a result of flooding potential. Heritage conservation issues also would support retaining existing density. Opportunities exist for increased densities and alternative housing types in Singleton Heights, but may require reconsolidation of existing lots. Further investigation would need to be undertaken, but it appears that there are limited opportunities available.
Singleton North	Urban expansion to the north between the railway line and Bridgman Road is a possibility, but would result in a narrow, linear urban area. As a long term option with an additional New England Highway link, and the opportunity of providing a future railway station, there may be some accessibility benefits arsing from this proposal. It would also allow incremental growth and future expansion to the west of the railway line. Location of suitable commercial land and schools represents a challenge. Council has also advised that the area may be impractical to sewer due to limited mains capacity through existing residential areas back to the treatment works.

Map 6.2 shows the conceptual location of the long term urban expansion options for Singleton. Map 6.3 shows current and proposed accessibility and transport links, and additional desirable links for investigation. This map does not include a long term highway bypass for Singleton, which is discussed in Section 6.6. Water, sewer and servicing are key issues requiring further investigation, and future access requirements and locations of commercial and industrial land also need to be taken into consideration.

The Strategy addresses this issue as outlined below, and should identify a preferred concept for long term urban expansion.

Objectives – Identification of areas for long term urban expansion around Singleton

- To limit the exposure of the town to major flood events, by preventing additional land being developed for residential purposes on the floodplain.
- To consolidate existing urban areas and increase the density within existing flooding and infrastructure capacity constraints.
- To identify land which should be investigated for long term future expansion and to zone this appropriately to prevent subdivision and inappropriate land use.

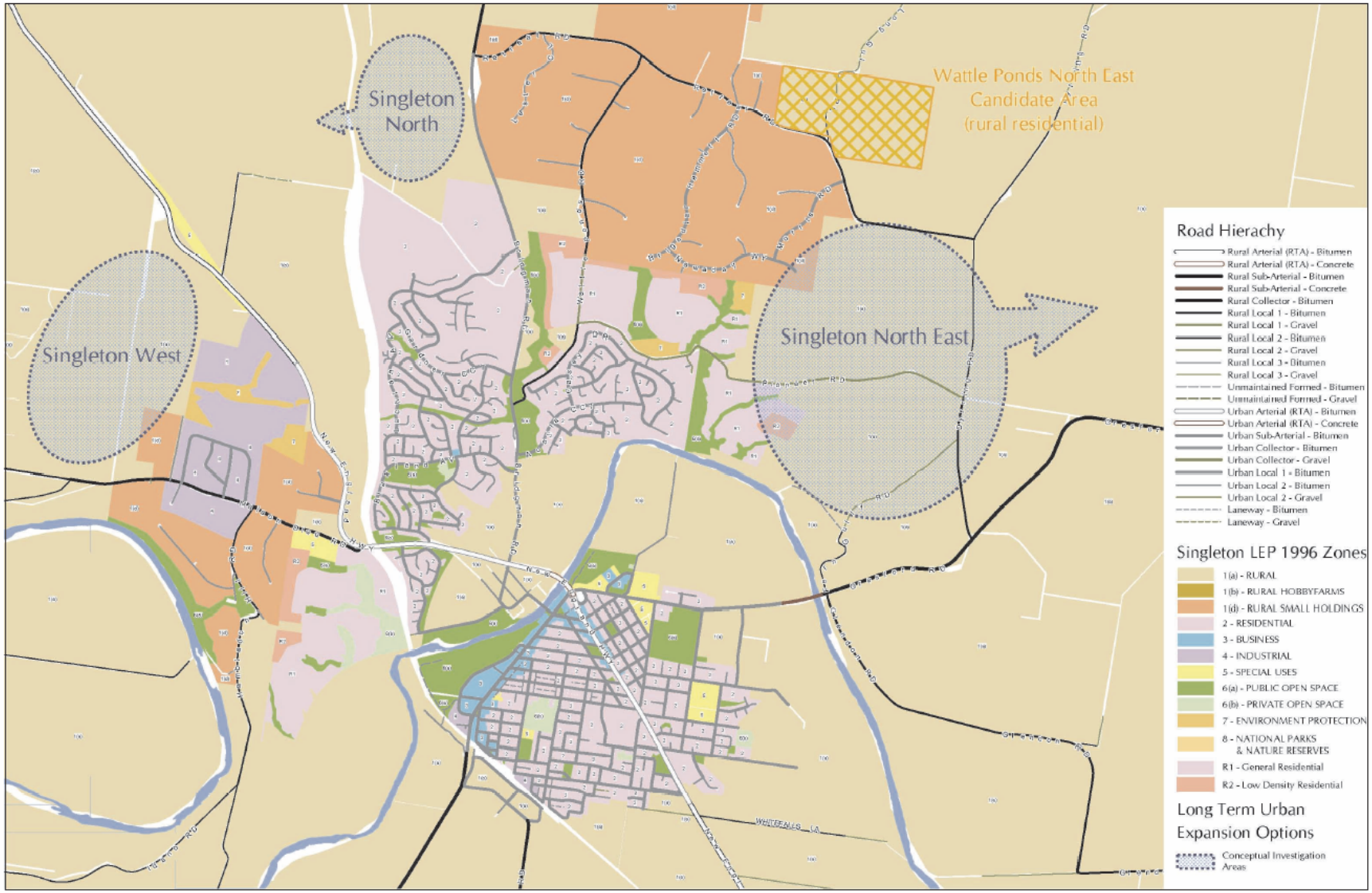
Policies – Identification of areas for long term urban expansion around Singleton

- Potential urban expansion areas shown on Map 6.2 should be investigated, with preference given to the Singleton North East option.
- Review and finalise transport hierarchy and accessibility proposals based on Map 6.3.
- Provide land for residential development (to ensure 5 years supply) based on following attributes:
    - Flat-moderate grades
    - Service and infrastructure capacity/staging
    - Access to community services and facilities
    - Access to convenience/other retail
    - Road access
- Direct urban growth to areas where effective use could be made of existing urban infrastructure/reserve where capacity is available (see also sections 6.3 and 6.4).
- Maintain a minimum of two development fronts to maintain competition.
- Prevent further subdivision or non-reversible land use within the identified preferred investigation area for future urban expansion.
- Maintain a future urban growth corridor. Prevent subdivision and limit development within the possible future corridors for urban expansion as identified on Map 6.2.

Strategic Actions – Identification of areas for long term urban expansion around Singleton

- Make detailed investigations of each of the potential urban expansion shown on Map 6.2 and listed in Table 5 by 2010.
- Review LEP zoning options within potential urban areas.
- Consider desirable LEP provisions to limit subdivision within potential urban investigation areas to prevent future fragmentation of land.
- Finalise future transport hierarchy and accessibility requirements based on Map 6.3.
- Determine criteria limiting consideration of future proposals for urban rezoning, unless it is in an identified long term investigation area, and facilitates economic water and sewer servicing, and supports future transport hierarchy and accessibility requirements.
- Review Section 94 plans to ensure that long-term growth is financially sustainable and facilitates the preferred urban structure.

- Prepare policies for facilitating planning agreements for large development proposals which support the preferred long term urban structure.
- Identify a buffer around the Singleton waste management facility, and review options for future long term urban/industrial use. As an interim measure, implement a residential exclusion zone within the "Landfill Affectation Area" shown in Figure 4.4.
- By 2015, undertake detailed investigation for long term urban development options/town boundary in the north-west, taking into account future coal mining prospects and impacts.
- Consider the following LEP zones and minimum lot sizes for residential development:
    - R1 General Residential with a minimum lot size of 450m^2
    - R2 Low Density Residential with 2 minimum lot sizes (indicated on the lot size map), being 1200m^2 and 2500m^2.



Singleton Land Use Strategy

SINGLETON - LONG TERM URBAN EXPANSION OPTIONS

prepared by planning workshop australia
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Fig 6.2

6.3 Town infill development opportunities and constraints

Although there is still a clear market preference for conventional detached housing on the fringe of the existing urban area, infill residential development is an important consideration. Key issues related to infill are:

- Urban design and development scale (especially for 2 or 3 storey development).
- Heritage.
- Infrastructure servicing (especially water, sewer and stormwater).
- Minimum subdivision size and dimensions, and opportunities to facilitate consolidation of existing lots.
- Dual occupancy design and siting guidelines.
- Potential for integration into mixed use commercial/residential developments.
- Flood issues.

Singleton Council's Heritage Advisory Committee has reviewed and updated the schedule of heritage items listed in the existing local environmental plan, and is also undertaking a review of heritage conservation area boundaries.

Objectives – urban infill development

- Support urban infill development subject to an appropriate planning framework.
- Ensure planning controls allow appropriate residential infill development, taking into account important issues including flooding, adequacy of servicing, streetscape and urban character, heritage, and water sensitive urban design.

Policies – urban infill development

- Residential infill development in Singleton Heights will be encouraged in addition to further greenfield development outside the existing urban area.
- Residential infill development in Singleton Town will be subject to ensuring that the number of dwellings subject to flooding potential will not be increased, heritage conservation guidelines are to be implemented.
- Development should recognise existing infrastructure constraints (e.g. sewer and drainage) and ensure that best use is made of current infrastructure provision.
- Infill development should recognise the character and scale of existing development.

- Future development will take into account policies developed as part of any future housing strategy, including type size, affordability and locational requirements for housing to meet demands.

Strategic Actions – urban infill development

- As part of any proposed infill development, ensure that servicing capacities are assessed and are adequate, particularly water supply, sewerage and stormwater drainage.
- Undertake a review of infill potential and identify constraints to infill development (e.g. flooding, heritage).
- Review minimum lot sizes and DCP controls on infill development to ensure the protection of urban character and residential amenity.
- Establish a significant tree register, and include appropriate tree preservation provisions in the LEP.
- Update heritage registers and information, and incorporate an overlay map in the LEP.

6.4 Water and sewer capacity and service areas

Singleton Council holds a surface water town and water supply licence totalling 5,000 megalitres per annum. The current commitments to supply water, plus an estimate of additional commitments for existing and proposed development areas expanding at current growth rates, indicates that in 10 to 15 years time further water entitlements and alternative sources may be needed.

Short to medium term urban growth areas are catered for in respect of the provision of water and sewer services.

Augmentation of the Waste Water Treatment Works is scheduled for 2010 to 2012, subject to growth rate assessment and a final demand analysis study.

The Council has resolved to investigate supplying the Village of Bulga with water in the longer term, but is yet to commit to providing such services.

The Council has also resolved to investigate supplying sewer services to the Villages of Jerry's Plans and Broke in the long term, but has made no commitment to provide such services.

The recent extension of the Hunter Water Corporation area of operations in the Singleton LGA (Map 4.3d) has potentially significant implications for future urban growth opportunities, and for rural development, particularly around Branxton. Singleton Council should actively be involved in planning for future infrastructure servicing in this area to ensure that future land use is appropriately planned for.

Objectives – water and sewer services

- Provide high quality water and sewer services to urban areas of Singleton (including residential, commercial and industrial land) to meet reasonable demands.

- Provide town water services to the unserviced villages in Singleton LGA, where practical and financially sustainable, and investigate provision of sewer services.
- Ensure provision of additional water and sewer services is financially sustainable.
- Ensure adequate security of water supply by securing additional water entitlements and alternative sources prior to existing allocations becoming fully committed.

Policies – water and sewer services

- Limit the extension of existing water and sewer services around Singleton to areas identified in the Strategy for future urban development.
- Investigate securing additional water entitlements and alternative sources of water to provide for the medium to long term.
- Manage water and sewer services in a financially sustainable manner.

Strategic Actions – water and sewer services

- Investigate the establishment of an agreement between Hunter Water Corporation and Singleton Council in regard to the following:
    - Interconnection of the Hunter Water Corporation and Singleton water supply systems for the purpose of providing drought security and additional water to the Singleton Local Government Area; and
    - Coordination of infrastructure staging to meet the land and settlement policies and actions identified in the Strategy.
- Investigate provision of alternative water yield for Singleton in the long term.
- Investigate the feasibility of supplying the villages of Jerrys Plains and Broke with reticulated sewer in the longer term.

6.5 Road hierarchy, transport links and accessibility

The Situation Analysis report identified the current situation relating to roads, transport and accessibility and noted important matters requiring consideration. While existing roads and access links are satisfactory overall, there are long term capacity limitations and measures need to be taken to support improved accessibility in the long term.

Table 6 outlines major proposals for implementation or investigation over the life of the strategy. These are shown on Map 6.3 and support the proposed long term settlement structure for Singleton as outlined in section 6.2.

The proposals identified in this section do not include consideration of a New England Highway bypass of Singleton which would significantly impact on transport and accessibility in the long term. Intersection upgrading works and other measures to improve road capacity have been separately investigate in the Singleton Traffic and Parking Study and are consistent with the proposals in the table.

Table 6: Road, transport and accessibility proposals

Proposal	Priority/Importance	Strategy
Singleton Heights Link Road (Pioneer Road extension)	High. Important to support long term future urban growth in Singleton Heights	Implement adopted Council proposal
Identify bus routes as part of future public transport strategy	Medium. Important	Identify and plan for bus routes as part of implementation of urban structure plan
Dedicated cycle and pedestrian link from Singleton Heights to Singleton via Combo Land	Medium. Important in providing alternative local transport options	Update Singleton Bike Plan
Singleton North – New England Highway Link Road to the west	Medium. Relatively high strategic importance. Provides alternative flood free link to New England Highway via Rix's Creek Lane	Investigate and determine preferred routes, and integration with potential new long term railway station location
Passenger rail service improvement	High. Important for providing long term access to Sydney and Newcastle	Investigate mechanisms to improve frequency of passenger rail services
New railway station for Singleton Heights	Low. Important for long term accessibility	Investigate suitable locations, and plan future road hierarchy to accommodate preferred site
Links to improve cycle and pedestrian movement	Medium. Important.	Update Singleton Bike Plan
Pioneer Road – Fern Gully Road Link	Low. Medium importance. Long term potential to support urban development.	Investigate possible options in medium term in conjunction with review of long term urban expansion options

Objectives – road hierarchy, transport links and accessibility (Singleton and Singleton Heights)

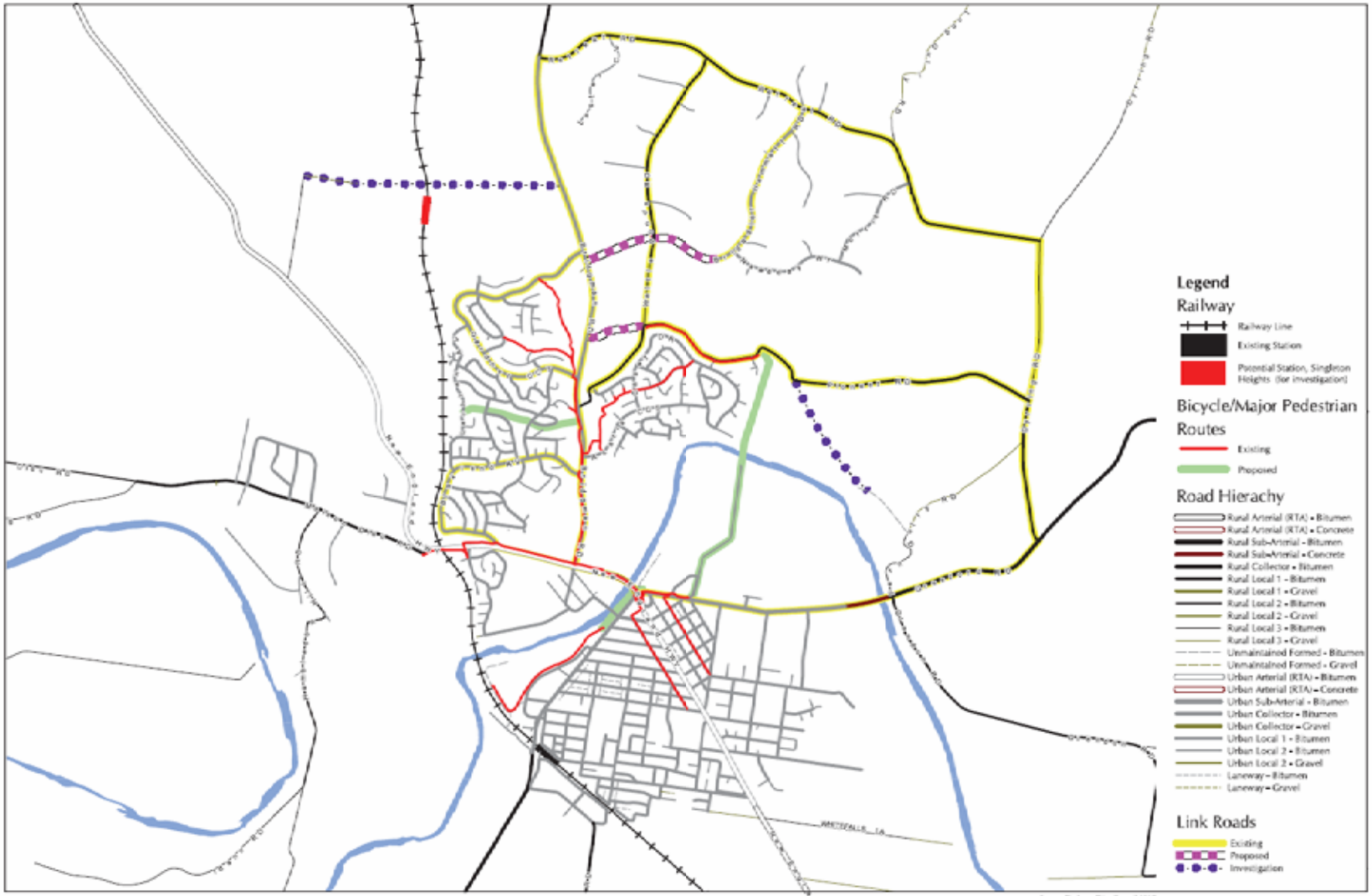
- Provide a system of roads, transport and access links to support existing and future land use and social needs.
- Ensure that access provision is economically efficient, and enables provision of public transport in the long term.
- Facilitate the provision of telecommunications infrastructure in the LGA to provide accessible, high speed communications technology.

Policies – road hierarchy, transport links and accessibility (Singleton and Singleton Heights)

- The long term transport and accessibility concepts and road hierarchy will be implemented as shown on Map 6.3.
- Implement mechanisms to ensure that costs for the provision of roads, transport and access are equitably shared by the community. Suitable mechanisms include developer contributions towards facilities using Section 94 plans or planning agreements.
- Ensure land use decisions consider and support the long term transport and accessibility concept for Singleton.
- Promote early introduction of accessible, high bandwidth telecommunications infrastructure across the LGA to facilitate economic development opportunities.

Strategic Actions – road hierarchy, transport links and accessibility (Singleton and Singleton Heights)

- Implement the road, transport and accessibility proposals outlined in Map 6.3 and Table 6.
- Recognise classified roads in the LEP map and include relevant clause (28) from Standard Instrument relating to classified roads.
- Develop principles and mechanisms for implementing transport and accessibility concepts, including funding through Section 94 contributions.
- Implement measures identified in Singleton Traffic and Parking Study.



Singleton Land Use Strategy

Source: Singleton Shire Council 2007

SINGLETON - TRANSPORT HIERARCHY AND ACCESSIBILITY

prepared by planning workshop australia

Issued 11 June 07

Fig 6.3

6.6 New England Highway Bypass for Singleton

Traffic volumes on the New England Highway through Singleton are increasing at a much higher rate than the rate of population growth, and are expected to continue growing with the completion of the F3 Freeway extension to Branxton. Increased traffic will affect the adequacy and safety of existing traffic arrangements within Singleton, and consequently options for a New England Highway Bypass of Singleton require consideration.

Bypass options are expected to be considered as part of the Singleton Traffic and Parking Study and Plan currently being undertaken. A highway bypass would have significant implications for future land use, and ongoing growth and development of the town.

While no routes have been determined for a possible bypass, potential options are summarised in Table 7. As a result of land use constraints, limited options are available, and all have significant engineering, economic, social and land use limitations and implications.

The benefits of determining a suitable bypass route are that provision can be made in future planning, particularly in determining the location and layout of future residential and commercial land. Future commercial and industrial development in Singleton will depend on providing certainty in relation to long term transport accessibility. Facilitating a decision on a highway bypass is therefore an important element of the Singleton Land Use Strategy.

Table 7: Potential options for Singleton highway bypass

Potential option	Comments
A Whittingham – Glenridding (From Cemetery Lane along railway to McDougalls Hill)	Shortest option. Disadvantages include engineering problems traversing major floodway, adverse impact on agricultural land, and amenity impacts to large number of existing residential properties. Requires railway overpass and Hunter River bridge.
B Western Route 1 (Mitchell Line Road, Putty Road, Hambledon Hill Road to McDougalls Hill)	Longer option, with 3km additional distance. Major benefit of route is minimal distance affected by flooding. Adverse effects on existing rural residential properties. Difficulty in route selection at McDougalls Hill due to existing development pattern. Requires relocation of Putty Road/Mitchell Line road junction and Hunter River bridge.
C Western Route 2 (Mitchell Line Road, Putty Road, Glenridding railway line to McDougalls Hill)	Longest realistic route option, with 5 km additional distance. Disadvantages include engineering problems traversing floodway and extensive flood liability. Primarily utilises existing road alignment. Relatively poor alignment, with adverse impacts on agricultural and rural residential properties as a result of development pattern. Requires relocation of Putty Road/Mitchell Line road junction and Hunter River bridge.
D Northern Route (North of existing town)	Major relocation of transport arrangements, increasing travel distance significantly. No suitable alignment apparent which would avoid conflict with potential future development.

Potential option	Comments
	Requires railway bridge and new Hunter River bridge. Most suitable route to avoid flood liable land would be via Elderslie or Belford. Not considered feasible. Requires Hunter River bridge.
E Upgrade existing alignment (New England Highway widening)	Major impacts on town amenity, and does not resolve accessibility and transport problems within Singleton. Significant adverse impact on Singleton commercial areas and residential amenity, including heritage. Retains existing problems of flood liability and traffic capacity.

Flood liability and risk is a significant cost and implication in determining the preferred route, and will be a key factor in determining a route alignment. The western routes appear to offer the most significant land use and development benefits to Singleton, and potentially provide some commercial and residential expansion opportunities that are not available with other routes.

Objectives – New England Highway Bypass for Singleton

- To ensure that regional and interstate traffic is provided with a suitable highway bypass of Singleton.
- To provide a bypass to enable improvements to road accessibility and safety within Singleton, and to maintain urban amenity.

Policies – New England Highway Bypass for Singleton

- To include highway bypass investigation routes in the Singleton Land Use Strategy concept map, and to indicate a preferred concept.
- To encourage NSW and Commonwealth Government support for the concept of a New England Highway Bypass of Singleton, and to secure necessary funding for its implementation.

Strategic Actions – New England Highway Bypass for Singleton

- To undertake a joint feasibility study of the potential route options identified, in conjunction with the NSW Roads and Traffic Authority with a view to reaching agreement on a preferred alignment.
- To provide funding for voluntary acquisition of land to facilitate the bypass.
- To recognise the preferred highway bypass alignment in the Singleton Local Environmental Plan.

6.7 Development guidelines for highway frontage land

There has been progressive land use change on highway frontage land within Singleton, and increasing demand for commercial development. Planning controls should encourage and provide for future uses which maintain the level of safety and service required of the National Highway, and accommodate adverse environmental and amenity impacts from highway traffic.

Based on current trends, it is likely that traffic volumes on the New England Highway will significantly increase in the future. An important consideration in determining the planning controls for highway frontage land will be the feasibility and timing of any highway bypass of the town. Until this matter is resolved, it is appropriate to limit further intensification of development and especially traffic generating development.

The provisions in the Standard LEP prepared by the NSW Government allow for flexible use within the R1 General Residential zone, and is the most appropriate zone for existing residential areas. An option for current commercial zones would be the B2 Local Centre zone or the B4 Mixed Use zone along some sections of the urban highway frontage.

Suitable land uses would include existing residential scale development, serviced apartments, motels, 1 - 2 storey residential flat buildings with suitable noise attenuation and traffic and parking arrangements, adaptive reuse of heritage buildings, use of existing residences for professional consulting rooms, mixed use office/residential development and community facilities.

Objectives – Development guidelines for highway frontage land

- To maintain the level of safety and service required of the National Highway, by encouraging new development which does not increase traffic demands.
- To allow new development subject to criteria which limits traffic impacts and maintains urban amenity.

Policies – Development guidelines for highway frontage land

- Maintain built form scale and character of existing highway frontage land and development by applying criteria set out in Table 8.
- Prevent adverse impacts of new development on adjacent rear residential properties (e.g. height, privacy, noise, overshadowing and other amenity impacts).
- Support consolidation of existing lots and provision of non-highway frontage road access (e.g. via side road or rear lane).
- Ensure no additional highway accesses.
- Consult with Roads and Traffic Authority in relation to new development proposals that do not meet the criteria.

- Shops or similar commercial uses should be consolidated within existing commercial zones. Highway frontage land is not recommended for bulky goods retailing or shopping centres.

Strategic Actions – Development guidelines for highway frontage land

- Develop specific DCP/development guidelines for land uses that comply with the criteria proposed in Table 8.

The following criteria (provided in Table 8 below) are proposed to be applied to determine appropriate uses for highway frontage land. Land use proposals should comply with the location and design criteria outlined. These criteria may be incorporated into LEP zone objectives or further clarified by preparing DCP guidelines and standards as appropriate. It would be appropriate to retain a residential zoning, but to allow additional uses subject to specified the criteria listed in Table 8.

Table 8: Criteria for appropriate uses for highway frontage land within Singleton

Broad Location Criteria	Comment
Water and sewer services for commercial uses over and above residential levels would be subject to availability.	Intensification of development would be limited to availability of existing public utility services.
Existing buildings or items with heritage values are to be retained.	Heritage values and the scale of development contribute to the special character and quality of the town at its entry points.
Traffic generation shall not be greater than equivalent residential use of the land unless no direct highway access can be provided (e.g. rear lane or side street).	Additional traffic generation with direct highway access is to be discouraged, to provide an incentive for alternative rear access. This results in traffic safety and management benefits.
The existing scale, character and density of development shall be generally retained.	Although desirable to maintain existing scale and character, opportunities exist for higher density and mixed use redevelopment, where this is high standard and results in other criteria being met. A general 2 storey height limit should apply. New development should not adversely affect privacy of the adjoining rear yards of residential properties by ensuring adequate design, setbacks and landscaping.
Use of land should be based on both traffic generation potential and the type of land use.	A range of small scale development types may be appropriate where these do not have high traffic generation.
Allow mixed use development which is designed to take into account sensitivity of land uses to air quality	For example, residential development may be compatible as a second storey with rear outlook above, or at the rear of ground floor small office or

Broad Location Criteria	Comment
and traffic noise impacts.	commercial space. Commercial development should not intrude into adjoining residential areas.
Large commercial and illuminated advertisements should be prohibited.	Clear advertising sign guidelines need to be developed which retain residential amenity.
Current lot sizes should not be reduced by further subdivision.	Incentives could be provided to consolidate lots to increase their size and provide greater future development opportunities.

6.8 Adequacy of land for industry and commerce, and requirements for additional land and services

Provision of adequate and appropriate industrial and commercial land is important in catering for future economic activity within the town. A number of studies have been undertaken in the past, which have been taken into account in the preparation of the Strategy, together with the response to community consultation undertaken in relation to the Situation Analysis review.

Commercial land

Commercial development in Singleton as a whole is well catered for under existing zonings. However, sectors that need consideration in future land use planning are the provision of land for bulky goods retailing, and provision for long term commercial land requirements in future urban areas in North Singleton.

Commercial land use in Singleton is concentrated within the town CBD area, with additional local shopping facilities in Singleton Heights. There is a need to provide additional local commercial areas to service future urban development in Singleton Heights, and demand exists for suitable sites with highway exposure for bulky goods retailing on larger sites.

A Review of Options for an Additional Local Retail Facility in North Singleton (Hirst Consulting Services 2007) evaluated 6 location options based on criteria including convenience, commercial attractiveness, investment optimisation, separation from CBD, site size, exposure and character. The review concluded that the only suitable sites are located along the proposed Pioneer Road link to Bridgman Road in North Singleton.

Future investigation on the suitability of, and options for, small scale non-residential facilities within the Clubhouse Precinct of the Gowrie Links Urban Release Area may occur. This will require a formal study.

Bulky goods retailing land options are extremely limited in Singleton. In the short term, this type of development can best be provided for in the Maison Dieu and McDougalls Hill Industrial Areas (an area with appropriate lot sizes and services close to the town), and in the long term by the provision of a specific bulky goods retailing

area. This will require local environmental plan provisions which support mixed use light industrial development in this specific area only. Some uses that occupy large areas of zoned commercial land in the Singleton CBD may be able to relocate to larger sites in the Maison Dieu/McDougalls Hill area. This may free up sites within the CBD and provide commercial redevelopment opportunities. A decision on the preferred long term site for bulky goods retailing development should await finalisation of the route of a future highway bypass, but would be located on the northern approach to the town. Although there has been interest in providing for this type of land on the New England Highway along the southern approaches to the town, sites in this location are not suitable, for the following reasons:

1. Adverse affect on nearby agricultural activities, noting that any development in this area will be on prime agricultural land which should not be developed.
2. The land is subject to significant flood impacts (being part of a floodway), and any development has potential to adversely affect urban areas as a result of changes to flood flows.
3. This area provides the gateway to Singleton for visitors and tourists, and it is essential to retain a high degree of amenity and rural character to be able to market Singleton as a destination with a unique and identifiable character, and as a community of excellence and sustainability.
4. Any premature development on this land has the potential to prejudice and prevent a future New England Highway bypass of Singleton.

Industrial land

The requirements for industrial land within the Singleton LGA are complex, and also require consideration within a regional context. Key elements to be considered in the Strategy are the types of industrial land and services required, existing and projected land supply and demand, the options for future provision for industry, and criteria for the location of new industrial development. The Strategy may also identify and promote employment generating activities for which Singleton is particularly suited.

Future employment generating opportunities where Singleton has locational advantages and which offer high potential to contribute to sustainable employment generation are as follows:

- Tourism
- Development related to transport infrastructure (e.g. railways and highways)
- Home based businesses and clusters
- Energy sector related
- Local and regional food processing and agriculture related (e.g. abattoir)

Regional demand for industrial land has been considered in the Lower Hunter Regional Strategy. Projected demand for general purpose industrial land needs in the Lower Hunter for the 25 years to 2031 is 825 ha and the Lower Hunter Regional Strategy states that there are currently 503 ha for the whole Lower Hunter Region. There is also around 1,200 ha of specialised industrial land available for specialised activities. Five main types of industrial land can be identified in Singleton and are summarised in Table 9.

Table 9: Industrial land types

Industrial land type	Comment
Light industrial/warehouse/bulky goods retailing (up to about 2 ha lot size)	Provided for in existing industrial areas, this comprises the predominant demand.
Large lot/heavy industrial	Generally equates to heavy industrial. Comprises uses requiring separation from other activities. Provided for in Mt Thorley Industrial Area.
Small scale, mixed use or rural industries able to be integrated with other uses (e.g. rural, residential or rural residential)	Includes transport and earthmoving, businesses, processing of rural produce, and small businesses associated with residential use or rural, with few or no non resident employees. Often conducted with no development consent or planning control.
Specialised employment areas (e.g. airport or transport related, and Macquarie Generation land)	Provide specific attributes, but are subject to limitations related to the specialised activities that can be carried out.
Adaptive reuse of sites having suitable infrastructure (e.g. former coal mines)	Have existing infrastructure (e.g. water allocation and supply), wastewater treatment, roads, rail access, electricity, etc.) and are separated from urban areas. Limited by current rural zoning.

Selmon and Broyd (2006) note that the Industrial and Commercial Lands Study of the Cessnock City Wide Settlement Strategy identifies an undersupply of light industrial land, with an additional 50 ha required to provide adequate supply for the next 15 years. Industrial land supply in Newcastle LGA is considered adequate for the short to medium term. Maitland is estimated to have industrial land supply for at least 10 years, but existing land available does not meet all demand characteristics of the market. Muswellbrook has a relatively small land supply and appears to have minor impact on demand and supply issues in Singleton LGA, with the exception of specialised industrial land opportunities around Bayswater and Liddell Power Stations.

Table 10: Summary of current zoned employment/industrial land in Singleton LGA

Name	Characteristics (total area, lot sizes, zoning and occupation)	Infrastructure limitations	Comments
Mt Thorley Industrial Area	115.2 ha zoned 4 Industrial, predominant lot sizes 0.5 to 2.0 ha, 80% of lots occupied	No sewer, water supply at capacity limits. Separated from residential uses.	Currently 20% of land is vacant, but is subject to constraints that limit development with 15.9 ha realistically available, including some large lots. Suited to heavy industrial uses and those with a mining focus
Maison Dieu Industrial Area	64.2 ha zoned 4 Industrial, with 87% occupied, no large lots with predominant sizes 0.3 to 0.5 ha	Low pressure sewer	Vacant land which could realistically be available is 6.7 ha. Site restricted to small and medium users, with no large sites
McDougall's Hill Industrial Area	53 ha zoned 4 Industrial, proposed 0.2 to 0.8 ha lot size, not subdivided or developed	Low pressure sewer	Proposed for development in near future. Some biodiversity constraints
Industrial areas in Singleton town area	Small lots zoned 4 Industrial, all occupied	Sewered	Some lots are occupied by residential uses

Source: Urbis JHD, Selmon and Broyd 2006

Selmon and Broyd (2006) suggest that there is currently about 5 years supply remaining at current development rates at Mt Thorley and Maison Dieu, plus McDougalls Hill. This study suggests planning for additional land provision of 60 ha for next 10 to 20 years. However, the industrial lands analysis prepared by Urbis JHD to support the Whittingham industrial proposal indicates that land sales and demand have been steady, with a significant rise since 2003.

Selmon and Broyd (2006) identified 3 options for provision of additional industrial land:

1. Defer until growth potential of LGA is established in Singleton Land Use Strategy (particularly considering infrastructure requirements and options and locations for industrial growth).
2. Investigation of potential for additional land at Mt Thorley for large lot industrial development.
3. Give further consideration to the Whittingham proposal, noting that this should provide for general industrial uses rather than light industrial, and that bulky goods retailing should be prohibited.

There is a high degree of uncertainty in relation to the demand for large lot medium and heavy industrial land uses. The uptake for these sites in the Hunter Employment Zone and Macquarie Generation lands has historically been very slow, and these uses typically will have a wide range of locational options, both within the region and Australia. To supply current demands, there is no immediate need to rezone further industrial land or to commit to the supply of additional infrastructure. However, the benefit of rezoning additional industrial land would be to provide a more competitive market for industrial land by increasing the number of developers, and to provide an opportunity to attract development by reason of land supply. It should be noted that this situation already exists in the Lower Hunter which currently has a supply of industrial land available, and proposals for additional rezoning of industrial lands appear likely to proceed. Accordingly, the Land Use Strategy proposes to rezone approximately 250 hectares in the Whittingham area as a "land bank" for heavy industrial purposes over a 25 year period. The rate of development of this area during the 25 year Strategy period should be staged to ensure that sequencing occurs in an orderly manner, and that adequate infrastructure such as water and sewer is available prior to subdivision and development taking place.

Proposed criteria for considering land use changes to allow new industrial areas are outlined in Table 11. These take into account the strategic principles proposed by Selmon and Broyd (2006).

Table 11: Criteria for location of additional industrial zonings

Broad location criteria
Located within or adjacent to an existing urban area (or within reasonable proximity to Singleton or Branxton) on relatively flat land which is not visually prominent.
Proximity to major transport facilities such as major roads and with railway access.
No direct access for individual industrial developments to the New England or Golden Highway, but otherwise convenient, suitable standard access.
Must have direct connection to water and sewer, provision for adequate electricity. Require water allocation and reticulated water supply and sewer for all new industrial lots.
Availability, or possible extension, of essential infrastructure such as water, sewer, electricity, sealed road access.
Must support an industrial land hierarchy, with industrial service land located close to town, and large lot industrial/mining related development separated from town.
Located so as to not have any adverse environmental impacts (e.g. visual impacts).
All large new areas for heavy industrial to be serviced by rail access.
Not subject to development constraints such as flooding, bushfire hazard, or biodiversity issues.
Access to industrial areas should avoid traversing residential areas and areas are to be accessible by public transport (if available).

Objectives – Industrial and commercial land

- Provide adequate industrial land bank to meet demand for development and enable employment opportunities.
- Provide adequate land for commercial development in Singleton in suitable locations, while maintaining compact, walkable centres.
- Encourage and support future employment generating opportunities which will contribute to sustainable employment generation.

Policies – Industrial and commercial land

- The LEP will provide adequate industrial zoned land to meet demand for development and enable employment opportunities.
- Additional land adjacent to that currently zoned for industrial purposes to be retained with planning provisions that safeguard adjacent land for prospective industrial zoning for longer term development.
- Support in-principle future heavy industrial development to be located on suitable former mine sites, where significant infrastructure already exists and/or new development can be collocated with existing mines.
- Maintain existing commercial zoned land, and strengthen the integrity of the CBD by adopting planning controls that consolidate commercial development.
- Ensure planning provisions for industrial areas do not support inappropriate commercial development, but allow bulky goods retailing in the Maison Dieu and McDougalls Hill Industrial Areas.

Strategic Actions – Industrial and commercial land

- Provide for medium/heavy industrial zonings, with up to 250 ha of additional zoned industrial land to be provided as a 25 year land bank. Staged release would be subject to demand and provision of infrastructure and services.
- Provide the additional zoned industrial land principally at the proposed Whittingham industrial site, allowing the site to be developed for heavy industrial purposes, subject to the following LEP provisions:
    - Provision and funding of reticulated water and sewer, as well as road transport infrastructure.
    - Establishment of an environmental conservation zoning to protect significant ecological areas of the site.
    - Provisions requiring the land to be directly accessible to the rail network.

    - Prohibit bulky goods retailing.
    - Prohibit light industry unless it supports or is ancillary to the medium/heavy industrial purposes.
- Apply criteria in Table 11 in considering any additional rezoning proposals for industrial purposes.
- Establish an industrial land monitor/database.
- Investigate the potential for encouraging infill development or facilitating more efficient use of existing industrial land supply.
- Undertake further assessment of the opportunities to expand the existing Mt Thorley Industrial Area.
- Initiate discussions with Rix's Creek Mine about the future of the Singleton N-W land use opportunities, primarily for large industrial sites.
- Ensure that available zoned industrial land is not in a single ownership, by enabling at least 2 development fronts.
- Consider including a specific LEP provision to allow industrial use of coal mining sites.
- Implement a Council policy or DCP for bulky goods to limit retailing in industrial areas.
- Implement LEP provisions to allow compatible home businesses in residential zones.
- Review CBD boundaries in preparation of draft LEP to ensure commercial areas are appropriately zoned and avoid oversupply of commercial zoned land. Zoned commercial land in CBD should be expanded to include Department of Housing land on southern end of Ryan Avenue (behind Franklins) and the former Telstra Depot off York Street.
- Consider 'core' and 'peripheral/supporting' commercial zones, subject to Standard LEP template.
- Implement recommended options of Hirst Consulting Services 2007 report on additional local retail facilities in North Singleton.
- Ensure the permissibility of community and cultural facilities in commercial zones.
- Encourage a compact town through infill and mixed use developments.
- Implement CBD Strategic Improvement Project through DCP provisions.

6.9 Floodplain development and management

Extensive areas of the LGA are subject to flooding, including the town of Singleton, parts of Branxton village and surrounds, Broke, Jerrys Plains and rural areas forming part of the Hunter River floodplain. The Floodplain Management Manual 2005 prepared by the NSW Government provides guidance on approaches to floodplain development and management.

The town of Singleton is economically vulnerable to flood impacts, and future new development should seek to reduce this vulnerability by measures such as restricting additional urban zoned land to flood free locations, supporting flood free road links, and limiting infill density within the flood liable areas of the existing town.

Singleton town is located on the natural flood plain. While the constructed levee system can reduce flood impacts from minor to moderate floods, it is not feasible to prevent major flood events impacting on the Singleton town area. As a consequence, the preferred strategy is to minimise further development on the floodplain to prevent impacts. Development in floodways such as at Dunolly and Glenridding is particularly vulnerable to flood impacts which cannot be mitigated except by limiting land use.

Objectives – Floodplain development and management

- To minimise development on the floodplain, especially in areas identified as of high hazard.
- To apply minimum standards to new development on flood liable land, based on the level of hazard.

Policies – Floodplain development and management

- Adopt the 1 in 100 year (1%) flood as the flood standard for Singleton LGA. New residential development and substantial extensions and alterations to existing residential development will be required to have a floor level above this standard.
- A flood hazard and management study is required prior to any future changes to land use (i.e. zoning) being considered by Council. Any study is to have regard to the above objectives.
- Prevent erection of additional new dwelling houses on the floodplain in rural areas.
- Confirm existing policy to prevent additional development at Glenridding, owing to its flood liability and hazard.

Strategic Actions – Floodplain development and management

- Consider formal adoption of the Singleton Floodplain Management Plan 2003.
- Update the Singleton Floodplain Management DCP in conjunction with the new Singleton LEP.

- Undertake data review, mapping and flood modelling to prepare more detailed spatial data showing the extent of the floodplain and estimated flood levels in rural areas of the LGA.
- Include LEP provisions to prevent development on unsuitable sites, to consider risks, and to ensure appropriate design and management.

6.10 Availability of suitable sites for future institutional use

As the population and economy in Singleton grows, it is critical for suitable land to be set aside for the needs of institutional uses, such as aged persons accommodation, health facilities and education facilities.

Key uses which may be anticipated/required as the town expands should be in appropriate locations (e.g. medical facilities, educational facilities, community facilities, nursing homes, childcare etc.). Important sites include Singleton Hospital surplus land which should be retained for institutional use.

Objectives – sites for future institutional use

- To provide suitable land for the future needs of institutional uses (e.g. aged persons accommodation, health facilities and education facilities).

Policies – sites for future institutional use

- Seek to maintain sites with a minimum area of 1 ha in suitable locations for future institutional use.
- Identify future school sites in North Singleton as a priority in the short term.

Strategic Actions – sites for future institutional use

- Reach agreement with Department of Education and Training in relation to future school site requirements in North Singleton.
- Include LEP provisions allowing integration of institutional uses.
- Identify future sites for institutional and nursing home/hostel development and maintain these at an adequate size.
- Ensure new subdivision and development proposals consider retaining suitable sites which are adaptable to a range of future purposes.

7 PROPOSED RURAL RESIDENTIAL DEVELOPMENT AND SUBDIVISION

Current villages within Singleton LGA are Broke, Bulga, Jerrys Plains and Camberwell, which are currently zoned 1(d) Rural Small Holdings under Singleton LEP 1996. There are also areas in rural locations zoned for rural residential development. Villages and rural residential areas currently zoned 1(d) have a total area of about 2,052 hectares, of which the 4 villages referred to above comprise about 30%. Villages and rural residential areas comprise around 7% of the total population of the LGA.

Apart from villages, which were created as part of historic subdivision patterns, current demand exists for two broad types of general rural residential development:

- Rural fringe, generally in estates adjacent to an urban area with services such as sealed roads, water and reticulated sewer, and lot sizes of 4,000 square metres to 2 ha (e.g. Retreat, Hambledon Hill and Branxton rural residential areas);
- Rural living lots comprising residential use within a rural environment, generally with no services and lots 2 ha or larger (e.g. 'concessional' and other lots of less than the current general 40 ha minimum area subdivided since 1966 in rural areas generally, and 1(d) zoned land at Bulga and land off Wine Country Drive south of Branxton with access through Cessnock City Council area).

Purchasers of rural lifestyle lots are seeking lifestyle rather than productive attributes of the land and are generally persons relying on employment in Singleton and adjoining LGAs, or moving from outside the area. Rural residential subdivision and land use is often considered to be in conflict with commercial agriculture, and separation from agriculture is normally desirable.

Rural residential subdivision and development is a key land use planning issue in the Singleton LGA. Demand for small rural subdivision is primarily related to road accessibility, specifically proximity to Singleton, Broke, Branxton and Maitland and to mining related employment opportunities west of Singleton. Its development can affect agricultural land uses and viability, and the provision of services and infrastructure. It can also result in a range of environmental impacts including water availability, traffic, and biodiversity impacts.

The Singleton Rural Residential Strategy has identified short term candidate areas for development and has formed the basis for the proposals in this Strategy for new areas to be identified for rural residential subdivision. As part of the community consultation undertaken in relation to the Situation Analysis, additional further areas for rezoning have also been proposed and require evaluation.

As outlined in Section 6, for planning purposes it is anticipated that around 35% of new dwellings to 2021 will be in rural areas (around 70 per year), but this proportion is substantially dependent on the provision of land for rural residential development. The current demand for rural lifestyle development suggests that demand for rural residential land will exceed supply in the short term, with little further land available under the current LEP and DCP provisions. Singleton Council (December 2005) has estimated a demand for rural residential allotments (as distinct from new dwellings) of 75 per year.

Key land use planning issues were identified in the Situation Analysis as follows:

- Provision of adequate land for rural residential development in suitable locations.
- Future use and development of villages and all 1(d) zoned land.
- Village service provision and maintenance (including roads, water, sewer, groundwater and surface water runoff).

Strategic directions for each of these issues are presented in the sections below.

Appropriate zones for rural residential purposes need to be determined, taking into account the Standard LEP requirements implemented by the Department of Planning. The available zonings need to be considered in conjunction with minimum subdivision sizes. Zone options are RU4 Rural Small Holdings (objectives mainly relate to primary production), RU5 Village (flexible zone allowing uses incompatible with existing rural residential character), R5 Large Lot Residential (primarily supports residential use), and E4 Environmental Living (for areas with special ecological, scientific or aesthetic values). The Large Lot Residential zone most closely reflects the character of most existing rural residential areas in Singleton.

7.1 Provision of adequate land for rural residential development in suitable locations

It is important to provide for certainty in relation to the location of rural residential development to prevent adverse impacts on primary production land and flow on effects of increasing land values for other rural land.

The Strategy recognises the need to provide additional land within the LGA to cater for rural residential purposes. It provides the framework for:

(1) Determining areas for further investigation and rezoning.

(2) The preferred LEP zones (Rural Small Holdings where intensive agricultural production is a key objective, Large Lot Residential, or Environmental Living).

(3) Staging of rural residential development.

(4) Providing criteria for future rezoning requests for rural residential development outside current investigation areas.

(5) Flow on DCPs and Section 94 contributions plans required following rezoning.

The Situation Analysis identified demand and supply issues and future planning options. It is important to note that the drivers of rural residential differ between

Singleton and Branxton, and development rates may vary over the life of the Strategy depending on the availability of suitable land supply.

The Strategy determines what additional areas should be zoned for rural residential development, and the infrastructure servicing requirements for these areas. The proposed areas for rural residential development are shown on Maps 7.1A and 7.1B and in Table 12. These are based on the *Singleton Rural Residential Development Strategy 2005* and subsequent agreements between the Council and the Department of Planning. Based on the estimates in this table, there is a potential yield of 670 lots within these candidate areas, which would provide for just under 10 years demand based on 75 rural residential lots per year.

There is potential for expansion of the identified candidate areas, or for increasing the subdivision density to increase lot numbers. On this basis the Council would not need to consider additional candidate areas for rural residential development over the life of the Strategy.

The objectives, policies and strategic actions for rural residential development in Singleton LGA are as outlined below. This section includes infrastructure provision guidelines for new rural residential areas.

Table 12: Proposed candidate areas – rural residential

Candidate areas	Description
Lower Belford	Total area 277 ha in 17 existing lots. Proposed zoning Environmental Living, minimum average subdivision area 5 ha. Maximum potential approximately 30 lots. Potential occurrence of listed endangered ecological community requires detailed ecological investigation. Within proposed extension of Hunter Water Corporation service area and subject to service agreement. Consideration should be given to lower minimum lot size and potential reticulated water servicing, which would increase lot yield.
Jerrys Plains	Total area 20 ha. Proposed zoning Large Lot Residential, with minimum average subdivision area of 1 ha. Reticulated water available. Maximum potential 17 lots. Potential occurrence of nationally listed endangered ecological population may require detailed ecological investigation.
Wattle Ponds North East	Total area 88 ha in 4 existing lots. Proposed zoning Large Lot Residential, with minimum average subdivision area of 1 ha. Reticulated water to be provided. Maximum potential approximately 70 lots.
Wattle Ponds North West	Total area is 167 ha in 8 existing parcels. Proposed zoning Large Lot Residential, with minimum average area of 1 ha. Reticulated water to be provided. Maximum potential approximately 134 lots.
Sedgefield	Total area is 922 ha in 57 existing lots. Proposed zoning Environmental Living, minimum average area 5 ha. Maximum potential approx. 100 lots. Reticulated water not available. Rezoning should not progress until master planning of the area,

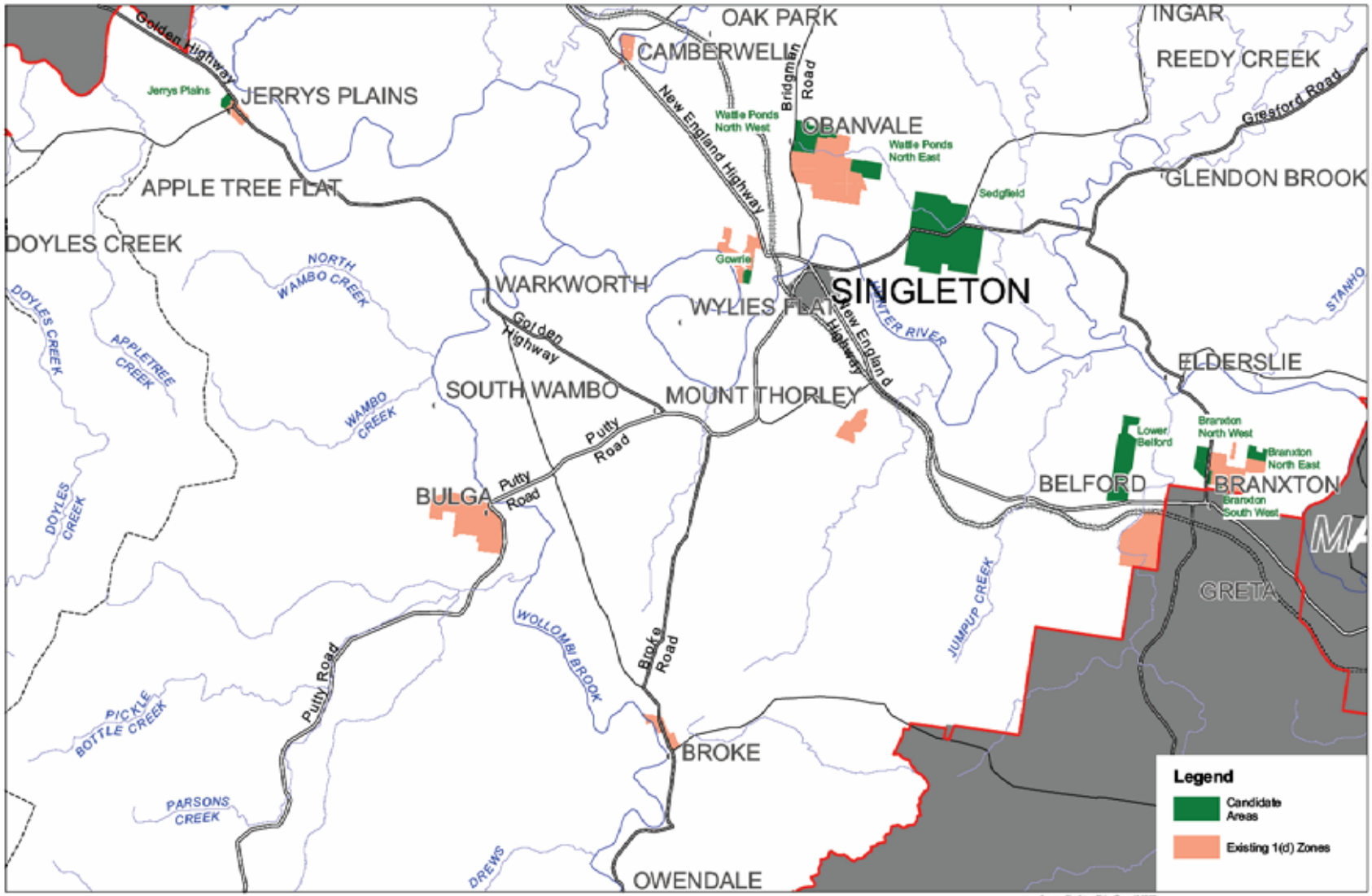
Candidate areas	Description
	required by DoP, is completed.
Gowrie	Total area 18 ha in 2 existing lots. Proposed zoning Large Lot Residential, with minimum average subdivision area of 4,000m^2 with reticulated water and sewerage provided. Maximum potential approximately 35 lots.
Branxton North West	Total area 88 ha in 7 existing lots. Proposed zoning Large Lot Residential, with minimum average subdivision area of 4,000m^2 (if sewer available). Full urban services required to be provided subject to service agreement with Hunter Water Corporation. Potential occurrence of listed endangered ecological community requires detailed ecological investigation. Maximum potential approximately 180 lots. Land adjoining to the south may have potential for rezoning to "Environmental Living" to provide a transition to agricultural lands.
Branxton North East	Total area 41 ha in 5 existing lots. Proposed zoning Large Lot Residential, with minimum average subdivision area of 4,000m^2 (if sewer available). Full urban services required to be provided subject to service agreement with Hunter Water Corporation. Maximum potential approximately 87 lots. Potential occurrence of listed endangered ecological community requires detailed ecological investigation.
Branxton South West	Total area 8 ha in 8 existing lots. Proposed zoning Large Lot Residential, with minimum average subdivision area of 4,000m^2. Full urban services required to be provided subject to service agreement with Hunter Water Corporation. Maximum potential approximately 17 lots. Potential occurrence of listed endangered ecological community requires detailed ecological investigation.

Objectives – Rural residential development

- Provide opportunities for additional rural residential subdivision and development in suitable locations, and enable a range of different types of rural residential development.
- Ensure that adequate services are available for rural residential lots.
- Ensure that the supply of zoned rural residential land does not unreasonably exceed demand.
- Apply criteria to identify the best location for rural residential estates and balance socio-economic goals associated with new rural residential development with the need to preserve areas of high agricultural, scenic or environmental value.
- Identify appropriate development controls for rural residential areas through DCP provisions.

Policies – Rural residential development

- Provide for a supply of up to 75 rural residential lots per year split 60/40% between Singleton fringe and Branxton.
- Zone adequate land for between 5 and 10 years supply (i.e. up to 400 lots around Singleton and 350 lots around Branxton), with review of land supply being undertaken every 3 years.
- New rural residential areas must relate to the long term preferred settlement structure (i.e. not be located on land with potential for urban development in the long term – 50 year + time frame), and provide adequate transport accessibility.
- The staging and sequencing of new rural residential areas shall be dependent upon the provision of adequate water supply, reticulated sewer (smaller lots less than 8,000m^2) and other infrastructure such as electricity, telecommunications and bush fire services.
- Consolidate further rural residential development of this type of land use in only two locations for each locality within the LGA, so that further services are potentially economic to provide in the long term if sufficient demand exists (i.e. do not disperse areas).
- Propose additional LEP objectives for rural residential under the proposed Standard LEP zoning provisions.
- No rezonings for rural residential in identified constraint areas (use map layers as an overlay for LEP).
- All rural residential development should have a good quality and secure water supply.
- Smaller lots (less than 8,000m^2) shall have reticulated sewer provided.
- Biodiversity and water and sewer infrastructure reviews be undertaken prior to determining final zoning boundaries and minimum lot sizes.
- Subdivision for the purposes of rural residential development should be undertaken in a manner that will not increase the potential for water extraction from streams or groundwater and comply with harvestable water rights requirements.

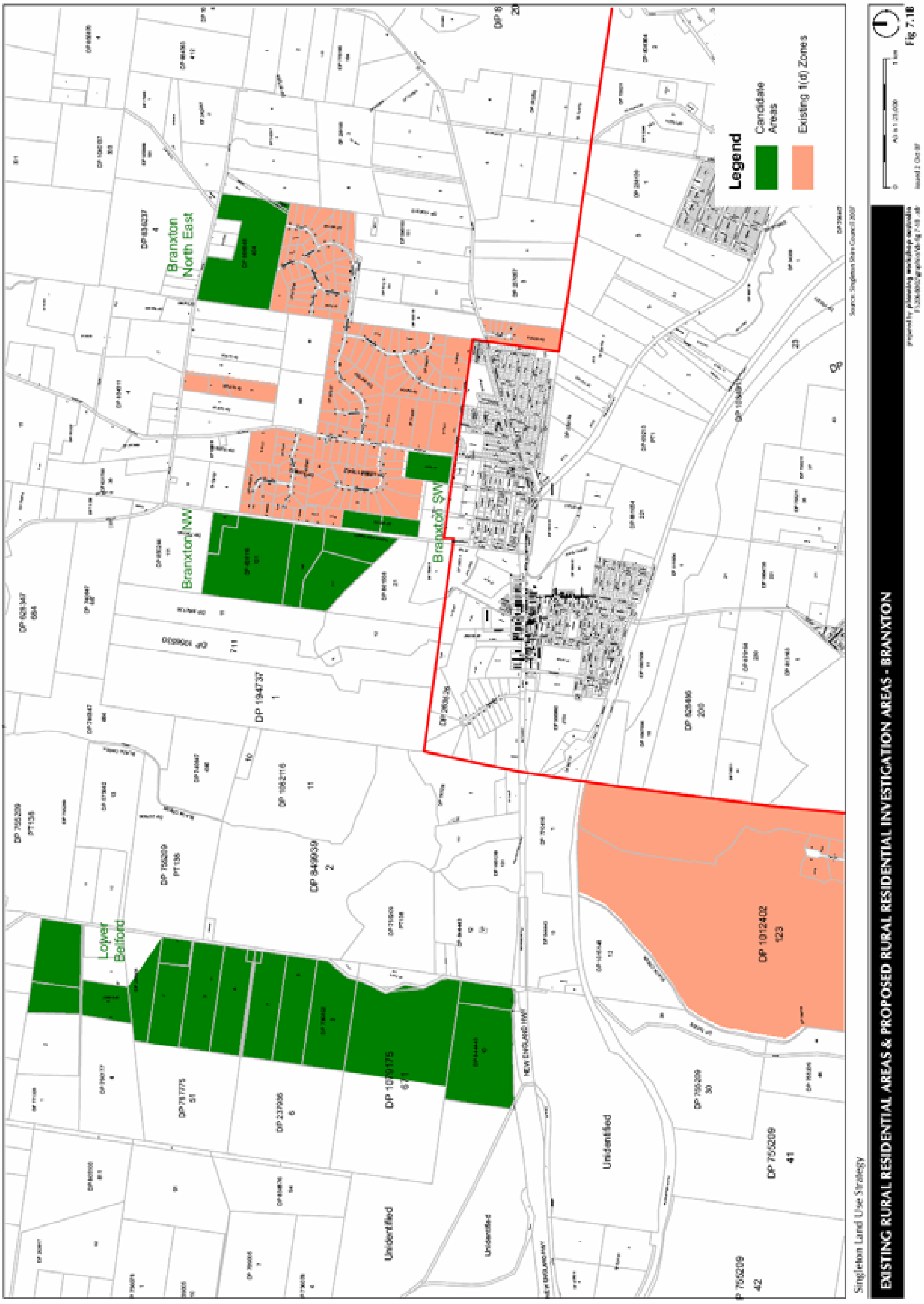


Singleton Land Use Strategy

EXISTING RURAL RESIDENTIAL AREAS & PROPOSED RURAL RESIDENTIAL INVESTIGATION AREAS - SINGLETON LGA

Source: Singleton Shire Council 2007

Fig 7.1A



EXISTING RURAL RESIDENTIAL AREAS & PROPOSED RURAL RESIDENTIAL INVESTIGATION AREAS - BRANXTON
Singleton Land Use Strategy
Fig 7.18
Legend
Candidate Areas
Existing 1(d) Zones
Branxton North East
Branxton NW
Branxton SW
Lower Belford
Unidentified
NEW ENGLAND HWY
DP 1012402
123
DP 194737
1
DP 849939
2
DP 1079175
DP 237936
6
DP 755209
41
DP 755209
42
DP 755209
30
DP 628486
220
DP 755209
PT138
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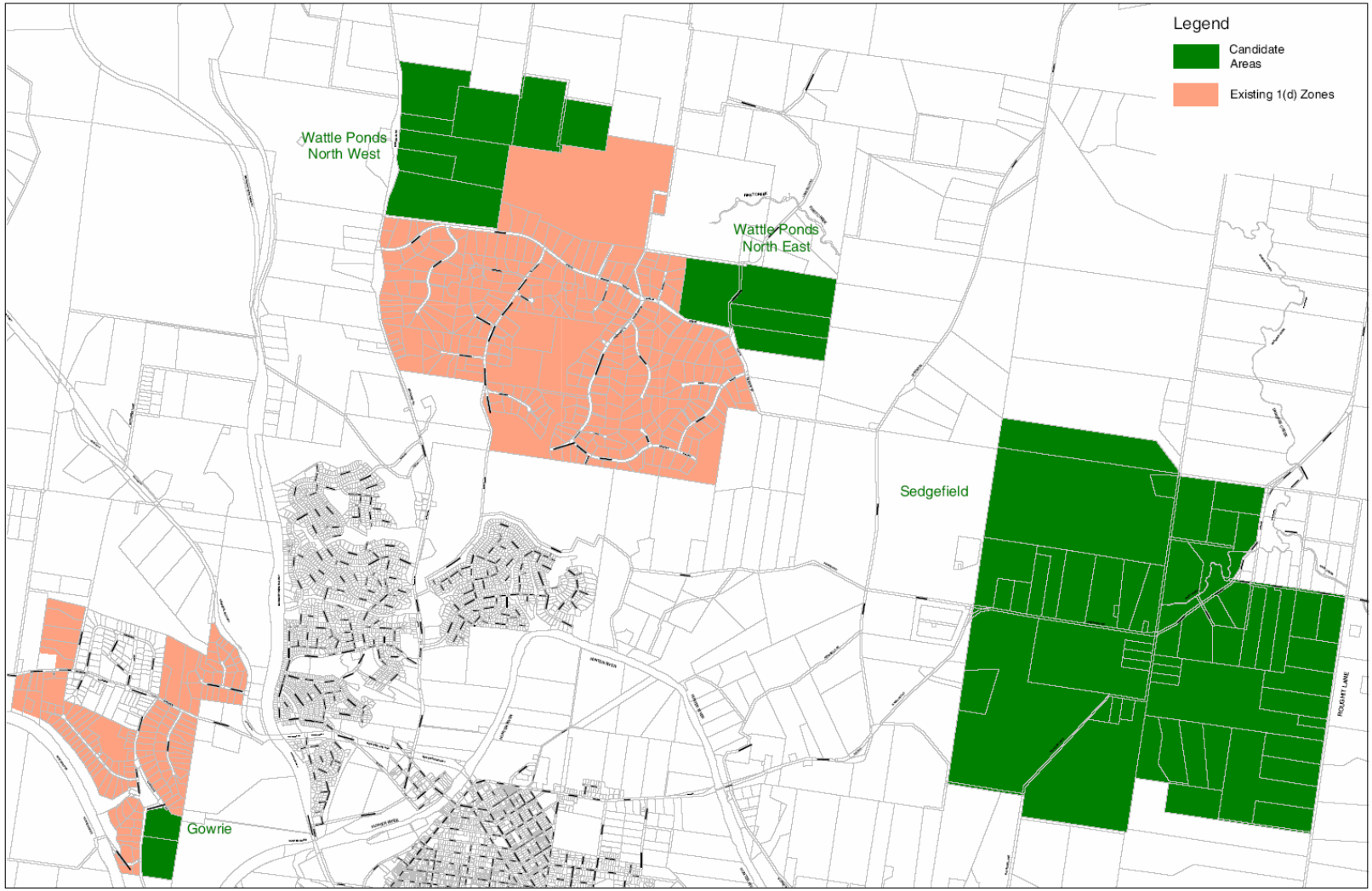
11
DP 1036011
DP 838237
4



Source: Singleton Shire Council 2007

Singleton Land Use Strategy

EXISTING RURAL RESIDENTIAL AREAS & PROPOSED RURAL RESIDENTIAL INVESTIGATION AREAS - SINGLETON

prepared by planning workshop australia
F:\2068002\graphics\ds\fig 7-1C..cdr

0 A3 is 1:30,000 1 km

issued 2 Oct 07

Fig 7.1C

The following criteria (provided in Table 13) have been used to identify potential land for rural residential development under the Strategy. The application of these criteria satisfies requirements identified by the Department of Primary Industries for a strategy for rural residential development.

Table 13: Criteria used in identifying potential rural residential land

Broad Location Criteria	Comment
Distance from town	Land should be within a reasonable travel distance/time from the centre of an urban area (e.g. 10 km or 15 minutes from centre of Singleton or Branxton).
Provision of services	Ability to provide reticulated water, sewer, electricity, telecommunications, bush fire services should be considered.
Location	Avoid 'stand-alone' rural residential development unless it is a logical extension of an existing significant rural residential subdivision area that will contribute to achieving a critical mass to support basic services.
Capacity for onsite water storage	This relates to the ability to have supplementary dam water supplies. Additional dam storage may not be feasible due to water resource limits and harvestable water rights.
Minimal impact on existing infrastructure	Sufficient reserve capacity should exist in power, school bus and telecommunications services.
Good sealed road access	Efficient use needs to be made of the existing road network. In general, this is relatively lightly trafficked apart from the New England Highway and some major roads leading to Singleton.
Exclude environmentally sensitive land	This land often has good visual outlooks, vegetation and privacy, all of which are in demand.
Exclude areas of high bushfire hazard	Vegetated land is in demand, but is subject to bushfire hazard constraints.
Exclude known mineral and extractive resources	Includes appropriate buffers to extractive and other non-compatible land uses.
Exclude areas near non-compatible land uses	Includes appropriate buffers to uses such as sewerage treatment works, etc.
Exclude water supply catchment land	This issue predominantly relates to avoiding contamination from onsite treatment systems, but may also relate to water access rights and usage.
Avoid areas with threatened species or	Remaining areas of native vegetation are expected to have biodiversity and ecological values. Presence of endangered ecological communities and threatened species needs

Broad Location Criteria	Comment
EECs	identification.
Avoid areas with high soil erosion risk	Primarily relates to steeper lands, and land with soil characteristics that make it more prone to erosion.
Avoid forestry land and contaminated land	Relates generally to former orchard areas, stock dip areas, and areas with identified forestry resources.
Avoid saline land and areas with soils unsuitable for onsite effluent disposal	Although not an absolute constraint, development of these lands would require reticulated sewer or alternative on site effluent treatment systems.
Avoid flood prone land	Acceptable only if flood free access and building sites/waste disposal areas are available.
Avoid Aboriginal and European heritage areas and sites	Examples include the curtilage surrounding historic dwellings.
Avoid areas with high groundwater tables	Potential problems with on site wastewater disposal, and salinity.
Avoid land with slopes greater than 18 degrees	Increased erosion potential, including from vehicle access.

Strategic Actions – Rural residential development

- Rural residential around Singleton must ensure that future urban growth options are not constrained by rural residential development, and that the road hierarchy allows flexibility for future growth of the town (e.g. maintains options for highway bypass and link roads).
- Determine arrangements with Hunter Water Corporation for provision of water and sewer to service all Branxton Rural residential areas, and Lower Belford candidate area.
- With Cessnock City Council and DoP, review the need for further areas for urban expansion within Singleton LGA adjacent to the Branxton urban area prior to rezoning any additional land for rural residential purposes.
- Adopt criteria for considering further applications for rural residential areas that are not in the currently identified candidate areas (as outlined in Table 13).

- Prepare Section 94 Contributions Plans prior to gazettal of LEP providing for additional rural residential land.
- Establish a land monitor to review rural residential supply and demand, dwelling and subdivision approvals. This monitor represents a compilation of subdivision and development approvals, dwelling completions, land releases and land sales within the rural residential candidate areas.
- Consider sunset clause provisions for rural residential zoned areas. Will prevent long term vacant developable land around villages and urban areas which may hinder future land use options, and also promotes supply of developed land.
- Maintain existing development limits within Village of Camberwell (as per existing Clause 19).
- Consider both minimum and average lot size (and possibly maximum) as a requirement. Allows for more flexible design to reflect environmental and planning constraints.
- Relate minimum subdivision size to servicing and to soil capacity for onsite disposal.
- Ensure appropriate minimum areas for onsite disposal depending upon soil type, slope, proximity to watercourse, and amount of effluent likely to be generated.
- Avoid reliance on groundwater sources as the primary water supply for rural industry or potable uses for dwellings.
- Ensure adequate water supply for fire fighting by way of dams and 20,000 litres minimum dedicated supply for this purpose.
- Consider the following LEP zones and minimum lot sizes for rural residential development:
    - R5 Large Lot Residential where town water is provided, with two minimum average lot sizes (indicated on the lot size map), being 4,000m^2 where both sewer and water are provided, and 1 ha where water only is provided. The absolute minimum lot sizes for these areas being 2,000m^2 and 8,000m^2 respectively.
    - Use of RU5 Village zone is not proposed.
    - Large unserviced rural residential lots (4 ha minimum with 5 ha minimum average) could be an E4 Environmental Living zone, although in most cases provision of services is preferable taking into account the criteria in Table 13.
- Prepare a DCP to identify appropriate sequencing of rural residential development and associated road, water, sewer, electricity, and telecommunications infrastructure. Subdivision layout is to be master planned and investigation made to create

certainty for future residents by use of the LEP Lot Size Map provisions of the Standard Instrument.

7.2 Future use and development of existing villages and all existing 1(d) zoned land

This section addresses the development potential and future zoning of existing rural villages and other existing 1(d) zoned land. There are 9 distinct areas currently zoned 1(d) Rural Small Holdings under Singleton LEP 1996.

The villages of Broke, Bulga, Jerrys Plains and Camberwell villages have individual character and planning issues, and provide alternative residential opportunities to larger urban areas. Villages currently have minimal infrastructure services and historic subdivision patterns with not all lots having a dwelling entitlement under the current planning controls. Section 7.3 reviews infrastructure service provision for these areas.

Other areas currently zoned 1(d) are primarily rural residential subdivisions approved by Singleton Council.

An analysis of lot availability and demand undertaken by Singleton Council (December 2005) found that existing 1(d) zones have little potential to provide further rural residential lots to meet anticipated demands based on historic trends. This analysis assumed that lots of less than 5 ha are unlikely to be developed, notwithstanding the existing LEP minimum subdivision area within 1(d) zones of 1 ha. This was largely due to native vegetation and topographic constraints. The situation for each of the existing zoned areas is summarised in Table 14 and these are shown on Map 7.1.

Table 14: Situation for existing villages and existing 1(d) zoned land

Village or area	Description
Camberwell	Special provisions apply in current LEP (Clause 19) which should be continued. No significant development potential, subject to coal mining impacts.
Jerrys Plains	No significant development potential, subject to possible future coal mining impacts. Potential infill development. Reticulated water supply provided.
Broke	No significant development potential, parts are subject to flooding. Reticulated water supply provided.
Bulga	No significant development potential due to development constraints. Generally has rural small holding character, rather than residential. Environmental Living zone appropriate.
Whittingham	Unlikely to yield significant new infill lots. Currently serviced by low pressure water supply at limit of capacity. Environmental Living zone appropriate.
Branxton	Serviced by Hunter Water Corporation reticulated water supply and pump out sewer system, but no further pump out systems will be approved. Potential for an additional 6 to 15 lots.
Hanwood Estate	Subject to significant development constraints, and unlikely to be

Village or area	Description
	further developed in short term. Included in urban investigation area under Lower Hunter Regional Strategy. Under current planning controls there is potential for an additional 310 rural residential lots to be subdivided.
North West Singleton	Potential for up to 5 additional lots. Subject to servicing constraints, and close proximity to industrial area.
Retreat	Potential for around 50 additional lots.

The following objectives, policies and strategic actions are derived from the Situation Analysis. Strategic directions for issues are presented in the sections below. Future LEP provisions (including zoning) are proposed for existing 1(d) zoned land, and infill or additional development potential should be considered in villages.

Objectives – Development of villages and existing 1(d) zoned land

- Generally retain existing subdivision and development provisions for existing 1(d) zoned land, within the framework provided by the Standard LEP. Provide for 1 ha minimum average lot size and 4,000m^2 minimum average if sewered.
- Review options for infill and consolidation of existing areas (except Camberwell).

Policies – Development of villages and existing 1(d) zoned land

- Review options for consolidating additional rural residential development within existing zones to facilitate more efficient infrastructure utilisation.
- Maintain and enhance the distinctive character and landscape setting of existing villages, and ensure that the character of villages is identified in DCP or LEP supplementary objectives.
- Prepare draft outline for the security of villages from further underground and open cut mining with an emphasis on a buffer zone and the way forward for growth for these villages.
- Seek to maintain or encourage at least two development options in terms of land ownership for each rural residential area where growth is anticipated and provided for.
- Put in place strong controls on incompatible land uses in rural residential zones, including the use of supplementary objectives.
- Minimum lot sizes for each village are to take into account existing lots, character requirements, on-site wastewater servicing requirements, and separation distances from existing dwellings.

Strategic Actions – Development of villages and 1(d) zoned land

- Zone existing 1(d) zones (except Bulga and Whittingham) R5 Large Lot Residential. Retain current 8,000m² minimum subdivision area but implement a 1 ha minimum average.
- Zone Bulga and Whittingham 1(d) zones E4 Environmental Living with 4 ha minimum subdivision area and 5 ha minimum average.
- Update DCPs to reflect updated LEP provisions.

7.3 Village service provision and maintenance (including roads, water, sewer, groundwater and surface water runoff)

This section addresses the infrastructure capacity and maintenance of the rural villages of Broke, Bulga, Jerrys Plains and Camberwell. A review of infrastructure issues relating to each of the villages within the LGA was included in the Situation Analysis report (Table 69).

The Village of Broke is being provided with a reticulated water supply, and is the only village where substantial demand for additional development could be anticipated. There is currently minimal land available for subdivision at Bulga under current LEP and DCP provisions. Further development at Camberwell is restricted by LEP provisions, and historic trends show little demand for new development at Jerrys Plains.

Objectives – Village service provision and maintenance

- Provision of limited urban services within villages (e.g. water, and waste) where demand for growth is identified and service provision is economic.

Policies – Village service provision and maintenance

- Reticulated water is available to Broke and Jerrys Plains, but not Bulga, Camberwell or any other village type areas.
- Reticulated sewer will not be provided to any village, and minimum lot sizes for subdivision and construction of dwelling houses is to be based on on-site wastewater disposal requirements.

Strategic Actions – Village service provision and maintenance

- Review potential for further development at Broke and current Section 94 contributions plan provisions.
- Maintain current level of development potential in LEP provisions for all villages to relate to service provision.

8 RURAL AREAS

Agriculture is one of the main rural land uses within Singleton LGA and continues to significantly contribute to local economic activity. The main agricultural activities are beef cattle grazing, dairying, viticulture, horticulture and equine activities. Singleton has substantial alluvial areas with high levels of agricultural productivity, with 2% of the LGA (over 8,500 ha) identified as Class 1 agricultural suitability. This land is significant at a regional and state level.

The 2001 ABS agricultural census indicates that the economic value of agriculture for the year was $34 million and there were around 600 producers. Average farm size for the Singleton LGA in 2001 was estimated at 356 ha and has been declining, and the total number of farms has been increasing. This does not take into account small holdings on which there is limited agricultural production.

A significant proportion of the LGA is used for coal mining or part of mining company land holdings, predominantly in the Rural West Planning Area. There are land use issues related to the impact of transport of coal and road access, as well as mining impacts on surrounding land and the need for appropriate buffers. Coal mining production and employment are expected to be stable or increase during the period of the Strategy.

The Singleton Military Area comprises an area of about 12,500 ha south of the town. This houses the Infantry Centre and other units, and provides economic benefits. There are also potential adverse impacts on land surrounding this area, primarily from noise and vibration.

Rural tourism is increasingly significant in Singleton LGA, with pressure for diversified tourism development particularly in vineyard areas (e.g. Hermitage Road and Broke Fordwich). Vineyards have a high agricultural and tourism value. There is a range of potential land use conflicts relating to agricultural use and impacts, development potential for dwellings, traffic impacts, scenic amenity and commercial activities in rural areas. Future planning should take these issues into account.

Key land use planning issues for the rural areas of Singleton were identified in the Situation Analysis as follows:

- Minimum rural subdivision size
- Protection of agricultural land and viability
- Coal mining lands and buffers
- Defence lands and buffers

- Climate change implications for land use
- Rural water quality and availability and protection of catchments and resources
- Rural servicing costs and requirements
- Branxton-Whittingham corridor development options

Each of these issues is presented below. In addition, the *Central West Rural Lands Inquiry* conducted for the Minister for Planning and concluded in August 2007 has potentially significant impacts for rural planning in NSW. The findings of the Inquiry are discussed in Section 8.9.

8.1 Minimum rural subdivision size

Singleton Council has a significant regulatory influence over future rural land use through controls over the subdivision of rural land. The Strategy and subsequent local environmental plan identify the requirements that will apply to future rural subdivision. Minimum subdivision size affects agricultural viability, enables effective provision of infrastructure servicing, and prevents land use conflicts which may arise from allowing residential uses on small lots in rural areas. Other provisions relating to maintaining and protecting agriculture within the LGA are referred to in Section 8.2.

The demand for rural subdivision is primarily affected by the dwelling entitlement on subdivided lots. Although planning provisions in the LEP could separate dwelling entitlements from lot sizes, the Strategy does not propose this. Proposed minimum rural lot sizes will generally retain existing character and entitlements, with the objective of ensuring that LEP subdivision provisions will be unlikely to change land use significantly.

A minimum area of 150 ha is proposed for the Rural North and Rural West planning areas where the predominant land use is grazing and where larger holdings are common. This is anticipated to have the effect of supporting the retention of commercial grazing activities. In parts of the LGA where the predominant land use is other than grazing and where lot sizes are less than this already, the 40 ha minimum should be retained (e.g. parts of the Rural South, Rural South East and Rural East planning areas).

The standard local environmental plan provisions include a primary production zone, within which a range of minimum lot sizes can apply. The NSW Department of Planning has developed a methodology for determining rural lot sizes which is substantially based on Department of Primary Industries methodology, but which is not readily applicable to the range of land use and existing subdivision pattern within the Singleton LGA. The Department of Primary Industries has indicated a preference for a minimum 150 ha property size to enable effective cattle grazing enterprises in the Hunter Valley which may be considered in determining minimum subdivision area where grazing is a predominant agricultural use.

LEP provisions could provide for a rural small holdings zone, permitting smaller subdivision sizes with the objective of providing for agricultural production. Holdings analysis within selected areas of Singleton LGA shows that there are enough small lots currently in existence to provide for this purpose, and no specifically identified rural small holding areas should be identified for agricultural purposes. Future

investigation may be warranted in the medium term (e.g. in vineyard areas) but water is a significant limitation and at the present time a specific provision cannot be justified. Holding the current 40 ha minimum area in areas with rural small holding potential provides adequate opportunities and prevents land values increasing due to speculation that may occur with such a zone.

Objectives – Minimum rural subdivision size

- Minimum rural subdivision sizes within Singleton LGA will be of sufficient size to accommodate and maintain a range of commercial agricultural production (predominantly grazing enterprises).
- Minimum allotment sizes will take into account land capability and agricultural suitability.

Policies – Minimum rural subdivision size

- LEP provisions for subdivision of rural land should reflect land use capability and the requirements for maintaining commercial agriculture.
- minimum lot sizes (with a dwelling entitlement) are to reflect broad scale land capability/suitability.
- Additional rural subdivision should ensure that adequate infrastructure and services are provided to new lots (including roads, electricity and telecommunications).
- The retention of 'concessional allotments' allowing subdivision of land less than the general minimum area is not supported, recognising that these have resulted in rural residential development in inappropriate locations.
- Adopt a differential minimum rural lot size within the LGA based on predominant land use and existing subdivision pattern.
- New subdivision is not to result in the creation of a right or expectation of additional water rights (e.g. by ensuring no creation of additional lots with river frontage, requiring onsite water provision, or by prior purchase of water entitlement).
- Farm or property management plans should be recognised as an LEP consideration in determining rural subdivision requirements.
- Recognise that production systems now often utilise multiple properties when setting minimum lot sizes.

Strategic Actions – Minimum rural subdivision size

- Consider the following minimum rural lot sizes (with input from DPI):
    - general minimum 40 hectares throughout rural areas of LGA (except where the predominant land use is grazing

on larger holdings and/or mining, and/or the retention of existing land use and subdivision pattern is desirable);

- broad acre grazing, 150 hectares in those parts of LGA where there is currently a predominant rural subdivision size of greater than 40 ha and/or where retention of existing land use and subdivision pattern is desirable (e.g. Rural North and Rural West planning areas).

- Consider permitting agricultural subdivision to occur without dwelling rights or without minimum lot sizes. Could be linked to consolidations, boundary adjustments, property management plans, etc.
- Consider smaller minimum subdivision areas for horticultural areas on an individual basis, where the land use is established prior to subdivision.
- Consider a farm adjustment clause (as per standard LEP).

8.2 Protection of agricultural land and viability

Significant employment in the LGA is generated by agriculture and related activities. Tourism in agricultural areas is also economically important, and needs to be taken into account and provided for. The importance of maintaining commercial agriculture is essential from both an economic and environmental point of view, and has been particularly emphasised by the NSW Department of Primary Industries.

Important ways in which the Strategy and LEP can influence agriculture are in determining suitable locations for rural residential subdivision and development; supporting the provision or improvement of infrastructure (such as roads or telecommunications); specifying minimum sizes for subdivision of rural land (dealt with in Section 8.1) and the erection of dwellings, affecting the permissibility of agriculture-related activities (e.g. rural worker dwellings, sheds and buildings, farm based industries, etc.); and restriction of uses that may be incompatible with agriculture. The most significant mechanisms relate to separation of rural subdivision entitlements from dwelling entitlements, zoning (including whether there should be more than one rural zone), permissible uses within the zone and exempt and complying development.

Certain measures proposed in the Hunter-Central Rivers Catchment Action Plan to support agricultural land use, and improved environmental management practices may be able to be linked to the Strategy and LEP.

Objectives – Protection of agricultural land and viability

- The Singleton LGA will have agricultural land that:
  - Is sufficient in size and quality to accommodate and maintain a range of commercial agricultural production in accordance with land capability and suitability.
  - Maintains a significant share of the local labour force.

- Rural production areas will be clearly identified by LEP zoning and uses in rural areas should be compatible with agricultural production.
- Other environmental values in rural areas which support agriculture should be maintained (including protection of biodiversity and natural ecosystems, rural landscapes, and water quality).

Policies – Protection of agricultural land and viability

- Recognise catchment management authority catchment action plan objectives and priorities as a matter of consideration in LEP provisions.
- Ensure water availability is considered in new development proposals and that adequate supplies are maintained for existing agriculture.
- Rural residential areas will be clearly identified and separated from rural production areas to reduce potential land use conflicts.

Strategic Actions – Protection of agricultural land and viability

- Consider using RU1 Primary Production, RU2 Rural Landscape, and E3 Environmental Management zones in the LEP (These zones are from the DoP Standard LEP provisions).
- Ensure that water supply for non-residential rural development is appropriately considered, including necessary water licences and appropriateness of ground water usage.
- Introduce LEP provisions to ensure that incompatible land uses and activities in agricultural zones are not permitted.
- In conjunction with the CMA, implement performance-based outcomes for the quality of water being discharged.
- In conjunction with the CMA & DPI, develop a framework for requiring farm and property management plans to address water quality and availability.
- Develop policies for dwellings erected in conjunction with intensive agricultural production.
- Review zoning options to enable diversified tourism and accommodation, especially in the Hermitage Road and Broke Fordwich areas.

8.3 Coal mining lands and buffers

Coal mining is probably the most significant land use and economic activity affecting the future of the LGA. In Singleton, coal production and employment is reaching its expected peak, and is likely to be stable or increase for the next 10 – 15 years and then progressively decline as easily accessible coal resources are depleted.

Within the LGA, coal mining directly employed about 4,000 persons in 2004 and produced about 52 million tonnes of coal. Mining has a range of environmental and social impacts which need to be taken into account in future land use planning.

Objectives – Coal mining lands and buffers

- Recognise that coal mining will remain a major land use within the Singleton LGA for the foreseeable future, especially in the Rural West planning area.
- Ensure that incompatible land uses are not permitted within coal mining areas, and appropriate buffers to protect environmental amenity are applied.

Policies – Coal mining lands and buffers

- Recognise that coal mining will remain a major land use within the Singleton LGA for the foreseeable future, especially in the Rural West planning area.
- Ensure that incompatible land uses are not permitted within coal mining areas, and appropriate buffers to protect the environmental amenity of adjacent uses are applied.
- Ensure that the environmental impact of new coal mining developments is to be fully assessed, including the planning context and regional scale impacts (especially relating to water, air quality and biodiversity).

Strategic Actions – Coal mining lands and buffers

- LEP to include objectives for coal mining, provide for mining as a permitted use in rural zones, and contain principles and criteria for the development of coal mining proposals.
- Support a strategic review by the NSW Government of future coal mining proposals within the Upper Hunter Region, including rehabilitation, infrastructure and land use options, and an update of the DPI (Minerals) Synoptic Plan for rehabilitation of mined landscapes.

8.4 Defence lands and buffers

The Singleton Military Area comprises an area of about 12,500 ha and is an important Army training facility. The area is a major land use and contributes substantially to the Singleton economy. Activities within the area include a live firing range, which may periodically result in noise and vibration impacts on land in the vicinity.

Objectives – Defence lands and buffers

- Recognise Defence lands as an important land use within the LGA and provide adequate buffers to surrounding land uses to maintain environmental amenity.

Policies – Defence lands and buffers

- Consult with Defence in relation to future land use change and major development proposals in the vicinity of the Singleton Military Area.

Strategic Actions – Defence lands and buffers

- Consider LEP provisions and/or overlay map to require consideration of noise and vibration impacts on land uses in the vicinity of the Singleton Military Area.
- Consider identifying principles for the use of lands around the perimeter of the Singleton Military Area, for inclusion in DCP provisions.

8.5 Climate change implications for land use

Climate change has potentially significant implications for water supply, agriculture and rural land use generally in the medium term. It also has significant implications for urban land use. There is a long term likelihood of greater frequency of extreme events (affecting natural hazards such as bush fires and flooding), increasing temperatures, evaporation, and potential changes in seasonal patterns.

Climate change is expected to have implications for agricultural viability. The three major implications of climate change for agriculture will be change to the growing season (and number of frosts), the impacts on the availability of water (including total rainfall and higher evaporation), and lower predictability of climate. A longer growing season and higher temperatures may benefit the introduction of new crops, while lower effective water availability may increase the frequency of drought conditions.

Climate change predictions indicate that there may be opportunities for new types of enterprises in the future, and that rural subdivision policy should seek to protect current water entitlements and availability.

Objectives – Climate change implications for rural land use

- Take into account the best available information on climate change scenarios for Singleton in making strategic land use decisions, especially for uses with sensitivity to climate change.

Policies – Climate change implications for rural land use

- Review impacts of climate change on water supply and security.

- Review responses to climate change periodically as further information becomes available.

Strategic Actions – Climate change implications for rural land use

- No specific land use response is identified. However there may be implications for the growth potential of areas utilising town water supplies (e.g. limited availability), and climate change may exacerbate some natural hazards with potential to require higher building construction standards. Flooding and bush fires may also become more intense, suggesting a conservative approach in critical areas.
- Promote energy efficient settlement through appropriate urban structure, transport systems and design.
- Periodic review through State of the Environment reporting.
- Rural water quality and availability and protection of catchments and resources

8.6 Rural water quality, availability and protection of catchments and resources

Many land uses are affected by the availability of adequate water of suitable quality. Water entitlements for rural subdivisions have the potential to reduce general water availability and security, although access to water is primarily the responsibility of the NSW Department of Environment and Climate Change under the provisions of the Water Management Act 2000.

In some instances, particular land uses or activities may have the potential to impact on water availability, and consideration should be given to whether these may require consent (e.g. rural industries, farm dams, plantation forests, and aquaculture) or whether special requirements may be desirable.

Protection of urban water supply catchments is a priority. Measures to identify and protect Singleton's urban water supply catchment may be implemented through the LEP and should take into account the recommendations of the Glennies Creek Total Catchment Management Study.

Objectives – Rural water quality, availability and protection of catchments and resources

- Maintain adequate water quality and availability to enable sustainable rural land use within the area.
- Ensure water availability, quality and protection of catchments and water resources is recognised in land use decision-making.

Policies – Rural water quality, availability and protection of catchments and resources

- Recognise Department of Natural Resources water sharing plan provisions for sub-catchments in land use decision-making.
- Rural rezoning or subdivision proposals shall be required to provide details of existing and proposed provision for water entitlements. Subdivisions which create additional basic water right entitlements on rivers or streams, or within catchments subject to high stress will not be supported.

Strategic Actions – Rural water quality, availability and protection of catchments and resources

- Include consideration of water implications of development as a general LEP objective.
- Include specific water quality and use objectives for rural zones (e.g. reference to Catchment Action Plan provisions and Hunter Water Sharing Plan).
- Consider including an LEP overlay identifying sub catchments and stressed streams.
- Include LEP provisions which require consideration of water entitlements and access in the determination of development applications for subdivision (except consolidation of lots).
- Prepare DCP provisions to provide guidelines on water availability and utilisation for development proposals.

8.7 Rural servicing costs and requirements

Important rural servicing requirements include roads, electricity, telecommunications, garbage services, bush fire services, and mail delivery. While these are adequately provided in most areas at present, further upgrading and ongoing maintenance are generally expensive and may be uneconomic for service providers.

Service provision is primarily an issue for Singleton Council and other agencies who are service providers, and is an important consideration in rural subdivision proposals, and other development proposals. The land use planning system provides a means of ensuring that community costs are taken into account in new rezoning proposals and development projects.

Objectives – Rural servicing costs and requirements

- Maintain adequate services and infrastructure for rural land use within the area.
- Ensure rural servicing costs and requirements are taken into account in land use decision-making.

- Generally limit extensions to current rural service areas to minimise ongoing maintenance costs.

Policies – Rural servicing costs and requirements

- Prepare clear Council policy guidelines (or DCP provisions) relating to service standards and requirements.
- Development within rural areas should not adversely affect rural infrastructure or existing service levels such as roads or electricity.
- Developers to be responsible for paying the full costs of capital upgrading for necessary services required by Council policy.
- Develop contributions plans or planning agreements to provide for necessary upgrading to rural infrastructure and services.
- Prepare a policy and requirements regarding use of non Council maintained roads for access in subdivision and development proposals, including agreement with the Department of Lands in relation to use of Crown roads for access.

Strategic Actions – Rural servicing costs and requirements

- Prepare a DCP and updated Section 94 contributions plan relating to rural servicing provision and costs. This may identify current levels of service in rural areas and areas where services will not be provided.
- Develop a policy on use of planning agreements to provide for infrastructure and services.
- Finalise agreement between Singleton Council and the Hunter Water Corporation in relation to the proposed future area of operations of the Corporation within Singleton LGA as outlined in Map 4.3.
- Seek to enter into a joint Section 94 contributions plan with Cessnock City Council to provide for road upgrading for roads that cross the LGA boundary.

8.8 Branxton-Whittingham corridor development options

Singleton Council anticipates pressure for a range of commercial, industrial, rural residential and residential development in the area generally between Branxton and Whittingham. This affects approximately 15 km of New England Highway frontage, and is primarily related to the foreshadowed extension of the F3 Freeway to Branxton and the identification in the Lower Hunter Regional Strategy of significant areas of land for investigation for potential urban development near Branxton.

The Department of Planning has held several meetings with Cessnock and Singleton Councils during 2007. One issue addressed in these meetings concerned planning and development in the Branxton area. In this respect, the Department in July 2007 advised as follows:

- *Cessnock Council has stated that it has no intention of pursuing new residential development in the vicinity of Branxton other than those already identified in the Lower Hunter Regional Strategy: Huntlee New Town (7200 dwellings), Greta Migrant Camp (up to 2000 dwellings) and Greta Wydham Street Precinct (approx 300 dwellings).*
- *Following initial consideration, there does not seem to be a need for an additional cross-LGA boundary strategic planning project. Apart from Huntlee (which has been declared State Significant and will be assessed under Part 3A) planning in the vicinity of Branxton is essentially a local scale planning exercise to be undertaken by each Council.*
- *Given the land supply provided by the above developments, there is unlikely to be a need for additional residential sites around Branxton for a considerable number of years.*
- *Via its local strategy, Singleton Council should consider opportunities for intensifying (or making minor adjustments to) existing and proposed rural residential zones close to Branxton.*

There will be ongoing consultation with Singleton and Cessnock Councils in respect of the Huntlee site, including the need for provision of local infrastructure in the Branxton/Huntlee area (this is not seen as a matter to be resolved in the current local strategy projects).

Accordingly, no additional residential land in the vicinity of Branxton will be provided for in Singleton LGA, other than south of the railway line as provided under the Lower Hunter Regional Strategy.

The demand for highway frontage land development in this location is primarily related to its location and relative accessibility by road to Newcastle and the Lower Hunter region, the advantages of sites having highway exposure, and projected growth in the Lower Hunter.

While recognising the potential demand for this type of development within the corridor in the future, determination to proceed with encouraging or allowing more intensive development in this location is premature at this time and during the Strategy timeframe. There are significant development constraints which would preclude any change to existing land use in the short to medium term, including the uneconomic provision and unavailability of necessary services (especially water), presence of listed endangered ecological communities and threatened species in the vicinity, the presence of Belford National Park in the area, and the desirability of consolidating commercial and industrial development in centres such as Singleton or Mount Thorley. In addition, ribbon urbanisation along the highway would detract from the scenic eastern entry to Singleton and detract from the identity of the town.

The land use planning priorities for this corridor should be as follows:

1. Retain the existing land use and subdivision pattern along the New England Highway frontage and in the vicinity.
2. Limit further subdivision of land fronting the New England Highway, based on current planning controls.

3. Maintain safe traffic conditions and scenic amenity by preventing development other than existing permissible dwelling houses or agricultural activities.
4. Not provide water reticulation, or other services which will support development.
5. Support consolidation of urban land uses within or adjacent to existing towns.
6. Reduce car and road dependence of development by locating commercial and industrial areas in more central locations where alternative public transport is available.
7. Review of these planning priorities for the area following the completion of construction of the F3 Freeway extension, in the context of the implementation of the Lower Hunter Regional Strategy.

The objectives, policies and strategic actions identified in this section should be read in conjunction with the Strategy proposals identified in Part 6 – Urban Settlement (especially Sections 6.1, 6.2, 6.4, 6.6, 6.7, and 6.8).

Objectives – Branxton-Whittingham corridor development options

- Maintain safe traffic conditions and scenic amenity along the New England Highway by retaining existing rural zonings and planning provisions.
- Limit further subdivision of land fronting the New England Highway.

Policies – Branxton-Whittingham corridor development options

- Adopt the priorities identified above for land between Branxton and Whittingham.
- No additional urban land to be rezoned within Singleton LGA in the Branxton-Whittingham corridor, including Belford.

Strategic Actions – Branxton-Whittingham corridor development options

- Include provision in LEP for the F3 freeway extension by inclusion of an acquisition zone, with consideration being given to identification of a noise exclusion overlay.
- Reach agreement with Hunter Water Corporation in relation to future for land use zoning and service provision in the Branxton-Whittingham corridor, taking into account the objectives and provisions of the Strategy.

8.9 Central West Rural Lands Inquiry

In February 2007, the Minister for Planning appointed an Independent Panel to investigate, report and make recommendations on land use planning in the Central West region of the State, having particular regard to balancing the protection of agricultural lands with other competing interests including, but not limited to, subdivision and rural residential development. The Panel met with a stakeholder reference group established by the Minister and consulted with a broad range of stakeholders and received submissions from interested persons.

A key recommendation contained in the Independent Panel's report release in August 2007 is the introduction of a new SEPP for Rural Lands containing provisions to guide new planning controls. The new SEPP would:

- *Set out the Government's policy direction and principles for rural planning including social, environmental and economic principles;*
- *Provide separate controls, including zones and requirements for buffers where necessary for Rural Residential, Small Farms and General Rural Zones in accordance with land capability, demand for rural lifestyle lots, potential for land use conflicts etc.*
- *Identify a comprehensive range of permissible uses in rural zones that would reflect recent trends in rural industry related tourism, restaurants, bed and breakfasts etc.*
- *Allow intensive agriculture on land zoned specifically for this purpose or in General Rural zones on merit where appropriate buffers are provided within the allotment to be developed for the intensive agricultural purposes;*
- *Remove provisions for Concessional Allotments;*
- *Rename 'minimum allotment sizes' as 'Lot Size for a Dwelling Entitlement' to make the intent of the development standard clearer;*
- *Maintain the existing 'Lot Size for a Dwelling Entitlement' development standard in General Rural zones in the LGAs unless good cause can be shown why the allotment size should be varied.*
- *Require that where a Council seeks to vary the 'Lot Size for a Dwelling Entitlement' development control in the General Rural zone, the proposed new allotment size shall be determined based on local circumstances and actual trends including the existing pattern of farming, existing pattern of holdings, current pressure for subdivision/dwellings, current pressure for change, reasons for change etc. and in consultation with the Department of Planning as the lead government agency with other government agencies inputting in an advisory capacity;*
- *Include SEPP 1 like clause that allows variation of the 'Lot Size for a Dwelling Entitlement' development control in exceptional circumstances where recommended by the Regional IHAP (refer below);*

- *Allow farm adjustment by boundary adjustment/land amalgamation etc (but with no additional dwelling entitlements);*
- *Preserve dwelling entitlements on existing allotments with separate title; and*
- *Require that new LEPs contain provisions that recognise the changing face of agriculture e.g. smaller farms, share farming, leasing, farms that are not necessarily contiguous and may be made up of a number of holdings many kilometres apart etc.*

(pp 18-19 *Review of Land Use Planning in the Central West*, Central West Rural Lands Inquiry, August 2007.)

Advice from the Department of Planning indicates that release of the Draft SEPP is imminent. At such time as details become available it will be necessary for the Draft Strategy's directions in respect of rural areas in Singleton to be reviewed.

9 ENVIRONMENTAL VALUES AND CONSTRAINTS

Many areas within Singleton have important environmental values and/or are subject to constraints which may limit development opportunities and need to be taken into account in planning. These areas should be identified in LEP provisions, and may require specific development control guidelines.

Key land use planning issues for Singleton relating to environmental values and constraints were identified in the Situation Analysis as follows:

- Natural hazards
- Land capability
- Catchment health
- Biodiversity and natural ecosystems
- Maintaining rural character and scale

These issues are presented below.

9.1 Natural hazards

Natural hazards are accepted as constraints to land use in order to limit damage to life and property. Within the rural areas of Singleton, these are primarily flooding and bushfires. Policy for natural hazards is primarily determined by NSW Government guidelines. A summary of available information and references is included in the Situation Analysis.

Various parts of Singleton are subject to flooding, but little information exists for areas other than for urban areas of Singleton, or the villages of Broke and Jerrys Plains.

Existing residential areas are relatively isolated from bushfire prone land, although significant areas of bushfire prone land in the LGA will impact upon the location of rural residential areas and other rural development.

Objectives – Natural hazards

- Ensure that natural hazards are considered when making development decisions, and that hazards are minimised wherever possible.
- Maintain current and accurate flooding and development data that guides land use planning decisions to limit damage to life and property.
- Identify land with potential for bush fire hazard and implement systems to minimise danger to life and property.

Policies – Natural hazards

- Adopt a consistent flood standard for Singleton, in accordance with floodplain management studies. Refer to Section 6.9.
- Recognise the need to appropriately consider bushfire, flooding and salinity as natural hazards in LEP provisions.

Strategic Actions – Natural hazards

Upgrade and maintain spatial information systems on natural hazards for planning overlay maps to be included in proposed LEP provisions:

- Include current bushfire mapping as an overlay.
- Include land with flooding limitations or requiring further investigation as an overlay.

9.2 Land capability

Regional scale rural land capability mapping exists for the whole LGA and provides information on limits to land use potential and management issues. This primarily focuses on soil erosion and slope stability.

Objectives – Land capability

- Ensure that future subdivision of land has regard to the capability of the land for future use, and that boundaries are located appropriately having regard to water catchments and capability considerations

Policies – Land capability

- Take into account land capability limitations in planning controls and development proposals (e.g. construction of roads and subdivision).

Strategic Actions – Land capability

- Upgrade and maintain spatial information systems on land capability for planning overlay maps to be included in proposed LEP provisions:
  - Identify rural land capability as an overlay.
  - Identify areas of environmental sensitivity through overlays, including attributes such as slope, vegetation, fauna, and identified 'at risk' communities and species habitat.
  - Map areas with identified salinity problems through an overlay.

9.3 Catchment health

Water supply catchments in rural areas provide essential urban water supplies and the maintaining of important agricultural activities.

Objectives – Catchment health

- To protect the quality and security of urban water supplies, by preventing incompatible land uses within water catchment areas.

Policies – Catchment health

- Development within urban water supply catchments is to maintain or improve water flow and quality.
- The priorities and provisions of the Hunter-Central Rivers Catchment Action Plan are to be taken into account in making decisions relating to future land use.

Strategic Actions – Catchment health

- Consider LEP provisions to restrict incompatible land uses, limit subdivision or impose development criteria to protect water supply.
- Map catchment boundaries in LEP and establish development criteria within catchments through LEP/DCP.
- Implement performance-based controls on environmental evaluation of all development within water supply catchments.
- Discourage further residential, industrial and/or rural residential development within water catchments.
- Ensure rural dwellings have a high standard of waste disposal.
- Link subdivision potential in rural areas to water availability and licensing under the Water Management Act 2000.

9.4 Biodiversity

Important areas for biodiversity which potentially may be impacted upon by further development and land use change are around Jerrys Plains and Branxton. Areas subject to coal mining and potentially suitable for residential expansion and rural residential development are likely to have biodiversity values which would be impacted upon by development. The strategy needs to take biodiversity values and the potential land use constraints into account.

Objectives – Biodiversity and natural ecosystems

- Maintain the ecological values of conservation reserves, and recognise their other economic benefits, including their role in supporting tourism.

- Zone conservation reserves appropriately in LEP.
- Minimise adverse impacts of development on land adjoining or affecting existing conservation reserves by establishing buffer areas and appropriate LEP provisions and development guidelines.
- Maintain or improve biodiversity values in Singleton. This includes protection and recovery of threatened species, communities and populations and their habitat, and endangered ecological communities.
- No net loss of native vegetation within the LGA.
- Consider opportunities to reverse the effect of Key Threatening Processes for threatened species, as identified under the *Threatened Species Conservation Act 1995* and the *Fisheries Management Act 1994*, when determining planning provisions and development proposals.

Policies – Biodiversity and natural ecosystems

- The value of biodiversity in Singleton will be recognised where decisions are made about land use.
- Areas of high biodiversity value will be protected in a network of reserves with buffers between them and incompatible land uses or activities.

Strategic Actions – Biodiversity and natural ecosystems

Proposed LEP provisions:

- Appropriate zoning of existing conservation reserves (E1 National Parks and Nature Reserves using Standard LEP provisions).
- Matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are to be recognised in LEP provisions, including Ramsar wetlands, world heritage areas, migratory species, and Commonwealth-listed threatened species and threatened ecological communities. These matters should be identified on an LEP overlay map and be considered when determining zoning, permissible land uses in environmental protection zones, and buffer zone provisions.
- Consult with DECC as to whether any land should be reserved in the LEP for acquisition to be incorporated within existing reserves.
- Consult further with DECC in relation to suggested E2 and E3 zones. Investigate issues and management implications associated with recent mapping work and identified remnant areas of native vegetation.

- Include appropriate zoning for proposed conservation reserve at Branxton South, as provided for in the Lower Hunter Regional Strategy.

Additional actions:

- Seek updating of the *Synoptic Plan - Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley* prepared by Department of Primary Industries (Minerals) to take into account biodiversity values.
- Consider introducing or encouraging use of financial incentives to support appropriate management of areas buffering conservation reserves.
- Consider identifying important regional, sub-regional and local wildlife and habitat corridors and incorporating these within an LEP overlay map, with appropriate provisions and/or environment zonings with suitable permissible and prohibited uses.
- Where significant natural values exist on private land, the Council will encourage the voluntary adoption of conservation agreements, the establishment of Private Protected Areas under the Natural Heritage Trust National Reserve System, Nature Conservation Trust Agreements and/or management plans. Consideration may be given to zoning land E2 Environmental Conservation.
- Request Department of Planning, Department of Environment and Climate Change and the Department of Environment and Water Resources to undertake or fund regional scale surveying and mapping of high quality native vegetation areas and the distribution of endangered ecological communities, for the purpose of including this information as an overlay map forming part of the LEP.
- Ensure consideration and implementation of appropriate threatened species legislation during determination of development applications (*Threatened Species Conservation Act 1995*, *Fisheries Management Act 1994* and the *Environment Protection and Biodiversity Conservation Act 1999*). Guidelines for the application of these provisions could be included in DCP provisions.
- Consider the incorporation of provisions within Development Control Plans to address and consider impacts upon threatened species, environmental conservation zone areas, wildlife corridors and areas of high quality native vegetation when applying for development consent. DCP provisions could include provisions for minimum ecological survey standards, and define local biodiversity values and policy to determine local interpretation of *maintaining or improving* biodiversity values.

- Prepare a policy or DCP provisions to identify mechanisms to be used to protect lands of conservation value (e.g. planning agreements or land dedication).
- Prepare and implement a policy framework for council acquisition of land requiring management for conservation purposes.

9.5 Maintaining heritage, rural character and scale

The Singleton rural area contains many sites of heritage significance. There are also landscapes with scenic and cultural values, which provide important social and economic benefits. Part of the protection of rural character relates to environmental amenity, including maintaining air quality and a quiet acoustic environment. Some scenic conservation areas have been identified by the National Trust of Australia, and planning measures could be considered for protecting these.

The need to conserve Singleton rural area's built heritage is important for tourism and maintaining identity and cultural history. There is a significant number of heritage items identified in the area and these are currently identified in the local environmental plan.

Singleton Council's Heritage Advisory Committee has reviewed and updated the schedule of heritage items and heritage conservation areas listed in the existing local environmental plan.

The Aboriginal Heritage Management System is maintained by the NSW Department of Environment and Climate Change, and is subject to confidentiality policies to protect sites. It identifies 2,654 sites of Aboriginal significance in Singleton LGA, most of which are in rural areas. There is also potential for many more to be identified.

Objectives – Maintaining heritage, rural character and scale

- Singleton will be a place where the rural landscape is valued as an important vista to the open, treed character of its urban neighbourhoods.
- European heritage is identified, protected and valued.
- Agencies will be encouraged to identify and protect Aboriginal heritage.

Policies – Maintaining heritage, rural character and scale

- Heritage and landscape will be taken into account by implementing standard LEP provisions and DCP guidelines.
- Where there is lack of information on these issues, further investigation will be required prior to zoning amendments or development consent.

Strategic Actions – Maintaining heritage, rural character and scale

- Implement Standard LEP clauses.
- Identify conservation areas and heritage items with overlays. Overlay maps will provide a trigger for further investigations.
- Separately distinguish built heritage from sensitive environmental areas through overlays.
- Consider using Standard Instrument rural landscapes zone, and/or include a map of scenic areas as an LEP map overlay.

10 PLANNING ADMINISTRATION AND STRATEGY IMPLEMENTATION

10.1 Implementation

The Strategy will be implemented by the Council through its normal administrative and planning processes. The following strategic actions relate to planning administration and implementation:

- It is desirable to prepare an LEP with common provisions to implement the Land Use Strategy in a consistent and uniform manner across Singleton.
- Ensure future service demands are integrated with Council financial and infrastructure planning.
- A combined land monitor for Singleton to be developed by the Council, particularly for residential, rural residential and industrial land.
- Clarify CMA role in determination of development proposals (especially in relation to native vegetation clearing and water entitlements), consistent with Standard LEP provisions.

The Land Use Strategy provides a land use structure and policy framework for Singleton. It closely relates to a range of other formal and informal plans and documents, such as council management plans, LEPs in adjoining LGAs, catchment action plans, road and utility infrastructure planning, tourism development, state of the environment reporting programs, etc. Key plans and documents are shown in table 15.

Table 15: Strategy relationship with other plans and programs

Plan or program	Relationship to strategy	Comment
Council management plan	Identifies council visions and priorities, and administrative framework	Council management plan must complement the Land Use Strategy
Council 2030 Strategy	Sets long term administrative and social objectives for LGA	Complements the Singleton Land Use Strategy.
Local environmental plans	Key instrument for regulating land use and implementing Strategy	Development control plans may be made by the council to identify land use guidelines for matters not included in LEP provisions
Catchment action plans	CAPs identify investment priorities for catchment management authority funding, but	Relationship with LEP is not clear

Plan or program	Relationship to strategy	Comment
State of the environment report (SoE)	Enables monitoring of achievement of strategy objectives and environmental indicators	Information from the Situation Analysis may be included and updated in SoE

Implementing the Strategy requires the preparation of draft LEP provisions under the *Environmental Planning and Assessment Act 1979*. This provides the regulatory framework for land use, and where possible should not duplicate other approval processes (e.g. native vegetation clearing, water use, etc).

Strategy implementation also requires further strategic land use analysis of some issues and the preparation of land use guidelines through the preparation of development control plans (DCPs). DCPs are considered in the assessment of development proposals for which consent is required by a LEP. Table 16 shows the scope of future strategic work program priorities. It is anticipated that the program can be built upon with subsequent studies and information.

Table 16: Future strategic work program priorities

Issue	Proposed action
Preparation of development control plans	DCP provisions should be prepared for the following where required: • Infill residential subdivision, development and urban sustainability guidelines • Industrial development guidelines • Rural residential subdivision and development guidelines
Strategic biodiversity review of proposed development areas	Undertake further review of biodiversity information for the Sub-region and detailed assessment of issues relating to proposed development areas. Investigate opportunities for biodiversity certification of LEP and flora and development fauna survey requirements
Contributions plans	Update contributions plans based on the strategy and LEP provisions, and prepare guidelines for use of planning agreements within Singleton

10.2 Monitoring and Review

The Singleton Land Use Strategy outlines the key land use policies and directions for the LGA. It provides the planning context for the preparation of a Shire wide local environmental plan. The Strategy has a time frame of 25 years, to 2032, but also provides a broad planning framework for the long term future of the LGA to 50 years plus.

Singleton Council will monitor the implementation of the Strategy in its annual State of the Environment Report, prepared under the Local Government Act 1993. This monitoring and review of the Strategy will be closely undertaken with the Department of Planning and other relevant agencies. Importantly, also, the assumptions on housing demand, population growth, industrial land demand, and economic development affecting the LGA, generally, will be the subject of a major review undertaken jointly every 3 years by the Council and the Department of Planning. The major reviews will also be undertaken to update as necessary the Strategy's Objectives, Policies and Strategic Actions. The LEP and other documents, such as the DCP and Section 94 Plans, will then be appropriately amended. In this way, the Singleton Land Use Strategy will become a dynamic document, able to be refined and updated over time, but able to always maintain its fundamental strategic planning direction in guiding the future growth and change of the LGA.

Attachment 2 – Flora and Fauna Assessment

Flora & Fauna Assessment
For
Proposed Rezoning for Residential Development
Wattle Ponds, Retreat Rd, Singleton, NSW

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EXECUTIVE SUMMARY

INTRODUCTION

RPS has been commissioned by Long Gully Investments to prepare a Flora & Fauna assessment of the Retreat Rd, Wattle Ponds Investigation Area, Singleton, NSW for possible rezoning from Zone 1(a) (Rural Zone) to Zone 1(d) (Rural Small Holdings) under the Singleton Local Environment Plan. This assessment has been undertaken over Lot 120 DP 752455, Lot 138 DP 752455, and Lot 140&142 DP 752445, referred to herewith as the 'site'. Ecological assessments (HSO 2005; Orbit Planning 2008; Ecovision Consulting 2009; Wildthing Environmental Consultants 2009) have been undertaken concerning the site as part of three separate rezoning applications for this site. This assessment utilises a number of information sources, including the previous ecological investigations, to inform the current rezoning application, hence ensuring holistic environmental outcomes.

This report is to address specifically potential impacts on terrestrial ecology as a result of the proposal over the site. This report considers the potential constraints in relation to any threatened species, populations or Endangered Ecological Communities (EECs) listed within the *Threatened Species Conservation Act 1995* (TSC Act 1995). The report recognises the relevant requirements of the EP&A Act 1979 as amended by the EP&AA Act 1997. Consideration of potential constraints has also been undertaken in relation to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

FLORA ASSESSMENT

Two distinct vegetation communities have been delineated on the site, namely Central Hunter Ironbark - Spotted Gum - Grey Box Forest (CHISGGBF) (EEC) and Cleared/Mainly Cleared Land.

One Endangered Ecological Communities (EECs) listed under the TSC Act 1995 occurred within the site, being:

- The Central Hunter Ironbark Spotted Gum Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (CHISGGBF).

The most intact sections of this community are located along the site's boundary edges and among several drainage lines within the site. In these areas, a more intact canopy structure was noted and a greater diversity of species was recorded at each structural level. Small remnant patches of native vegetation are also found scattered throughout the site.

The cleared land assemblage dominates the majority of the central areas on site. This 'community' is likely to have formerly occurred as CHISGGBF and is dominated by a wide

range of native and/or pasture grasses, associated herb and forb species, occasionally interspersed with scattered trees.

No regionally significant or threatened flora species or populations listed under the TSC Act 1995 and EPBC Act 1999 was detected within the site during targeted surveys. Whilst individual species of *Eucalyptus tereticornis* (Forest Redgum) were observed on site, the assemblage of this vegetation was not considered to constitute the Hunter Lowland Redgum Forest community, which is listed as an endangered ecological community under the *TSC Act 1995*.

FAUNA ASSESSMENT

The fauna species recorded within the site during these investigations are considered typical of the habitats present within the study area and in the vicinity of Singleton. Species recorded were predominantly common avifauna, although a small number of native arboreal mammals and microchiropteran bat species were also recorded.

Eight threatened fauna species listed under the TSC Act 1995 and/or EPBC Act 1999 have been recorded on site or treated as subject species due to past records/or fieldwork undertaken as part of earlier assessments in the locality:

- *Pomatostomus temporalis temporalis* Grey-crowned Babbler
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Petaurus norfolcensis* Squirrel Glider
- *Miniopterus schreibersii* Eastern Bentwing-Bat
- *Mormopterus norfolkensis* Eastern Freetail-Bat
- *Myotis adversus* Large-footed Myotis
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Scoteanax rueppellii* Greater Broad-nosed Bat

A further four threatened fauna species were considered to have a moderate or high chance of occurring on site, being

- *Dasyurus maculatus* Spotted-tailed Quoll
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Nyctophilus timoriensis* Greater Long-eared Bat
- *Pteropus poliocephalus* Grey-headed Flying Fox

The remainder of the threatened species assessed were considered to either have no potential habitat present, or to only have marginal opportunity to occur within the site.

HABITAT ASSESSMENT

Greatest habitat potential and seasonal foraging opportunities exist within Ironbark Spotted Gum Grey Box Forest communities, particularly within the drainage lines and the various dams on site. These areas potentially provide suitable resources for a number of

terrestrial and arboreal fauna guilds. The presence of hollows in some mature trees, occurring within this community and isolated patches of vegetation also adds habitat value. A diminished understorey has reduced habitat value for terrestrial fauna with some scope for small reptiles. Some opportunities for amphibious species may exist within the dams and creeklines where dense vegetation and/or pooling water may exist.

Habitat opportunities within the site for native flora and fauna are limited within cleared/disturbed lands, which occupy the majority of the site, suiting only those species tolerant of open spaces. Previous clearing and under-scrubbing practises have severally depleted structural and floristic complexity and limited the incidence of mature hollow bearing trees which has reduced habitat potential. However recovery potential exists within CHISGGBF, evident by several *Eucalypt sp* saplings apparent throughout this community.

Forested areas can also be considered important habitat connection for proximate areas of similar habitat that occurs to the west, north, east and southeast of the site. The creeklines, in particular provides possible biodiversity linkages to remnant forest habitat within these areas.

KEY THREATENING PROCESSES

KTP's are listed in Schedule 3 of the TSC Act. Six KTP's have the potential to affect the site as a consequence of the proposal, namely:

- Clearing of Native Vegetation;
- Predation by Feral Cats;
- Human Caused Climate Change;
- Invasion of native plant communities by exotic perennial grasses;
- Removal of dead wood and dead trees; and
- Loss of hollow-bearing trees.
- Invasion, Establishment and Spread of Lantana

Whilst any future development proposal would potentially contribute to stated KTP's, the extent to which the proposal can be expected to contribute to this processes is not considered significant provided that ameliorating actions are followed.

SEPP 44 KOALA HABITAT PROTECTION

One species of tree listed in Schedule 2 of the above policy as a 'Koala Feed Tree Species' occurs on site, namely *Eucalyptus tereticornis* (Forest Red Gum). This species occurs at a density less than 15% of the total tree canopy and consequently the site is not considered to constitute 'Potential Koala Habitat' as defined within the SEPP. Furthermore, no previous records or attribute evidence of resident populations of Koalas was found on site and as such the site does not constitute "Core Koala Habitat". No further provisions of this policy apply.

EPBC ACT 1999 CONSIDERATIONS

No Matters of National Significance of note will be affected by any development actions on the site and as such is not considered that a referral to DEWHA is warranted for this proposal.

KEY RECOMMENDATIONS

The rezoning of the subject site from Zone 1(a) (Rural Zone) to Zone 1(d) (Rural Small Holdings) under the Singleton Local Environment Plan at the Wattle Ponds Investigation area has the potential to reduce biodiversity. However, if the recommendations outline below are implemented the impacts can be reduced. These recommendations are as follows:-

- Retain where possible the Central Hunter Ironbark Spotted Gum Grey Box Forest EEC as listed under the TSC Act 1995 that occurs on site. The retention of the CHISGGBF within the site in a high condition will facilitate the conservation of biodiversity and protects areas of high conservation value. Future development should aim to retain or minimise the amount of EEC to be removed during the concept and detailed design phases and this should be demonstrated to authorities;

- Retain and regenerate remnant native vegetation should be considered. Particular emphasis should be placed on retaining and improving canopy connectivity across the site and understorey complexity which could potentially occur along site boundaries and drainage lines. This would maintain and enhance the integrity of wildlife corridors and provide habitat for threatened species and a number of other native terrestrial and arboreal fauna guilds;

- Retain fallen timber, particularly within vegetative areas. Dead timber should be retained in situ or if dead wood is to be removed then it should be relocated to a suitable area outside development envelopes to enhance habitat for fauna species, in particular the threatened Grey-crown Babbler.

- Retain as many hollow bearing and mature trees as possible to provide habitat for hollow dependent species.

- Installation of artificial nestboxes to replace natural hollows removed as a result of future development should be considered;

- Implementation of weed control measures to minimise weed invasion particularly for species such as *Lantana camara* (Lantana) and *Opuntia stricta* (Prickly Pear);

- Implementation of strict control measures on domestic pets, particularly cats, should be considered;

- Riparian corridors of 20m (1st order stream) and 30m (2nd order stream) to be incorporated along the Wattle Ponds Creek tributaries to protect riparian vegetation and water quality. These widths are recommendations and will require consultation with the proponent and the Department of Water and Energy to gain approval for any proposed development;

- Minimise potential impacts associated with erosion and sedimentation during construction through the inclusion of appropriate erosion and sediment controls;

- Any future landscaping should aim to utilise locally occurring native trees and shrubs to provide potential foraging resources for threatened species and other native species; and

- Consideration should also be given to providing future land holders with information on the native vegetation value associated with their property, its regional context, threatened species of the area and potential actions that could impact of native flora and fauna.

In conclusion it is considered that if the recommendations outlined above are incorporated into the proposal then it is unlikely to result in a significant impact upon any threatened species, populations or endangered ecological communities listed within the TSC Act 1995 and EPBC Act 1999. A development outcome that minimises the amount of remnant vegetation removal should be supported.

TERMS AND ABBREVIATIONS

Abbreviation	Meaning
API	Aerial Photograph Interpretation
CRZ	Core Riparian Zone
DECCW	Department of Environment and Climate Change and Water
DEWHA	Department of Environment, Water and Heritage
DoP	Department of Planning
EEC	Endangered Ecological Communities
EP&A Act 1979	*Environmental Planning and Assessment Act 1979*
EPBC Act 1999	*Commonwealth Environment Protection and Biodiversity Conservation Act 1999*
LGA	Local Government Area
LHCCREMS	Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping; Lower Hunter and Central Coast Region
KTP	Key Threatening Process
NPWS	National Parks and Wildlife Service
ROTAP	Rare or Threatened Australian Plants
SEPP 44	*State Environmental Planning Policy No. 44*
TSC ACT 1995	*Threatened Species Conservation Act 1995*
VB	Vegetation Buffer
VMP	Vegetation Management Plan
WM Act 2000	*Water Management Act 2000*

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APPENDICES

1.0 INTRODUCTION

RPS has been commissioned by Long Gully Investments to prepare a Flora & Fauna assessment of the Retreat Rd, Wattle Ponds Investigation Area, Singleton, NSW for possible rezoning from Zone 1(a) (Rural Zone) to Zone 1(d) (Rural Small Holdings) under the Singleton Local Environment Plan. This assessment has been undertaken over Lot 120 DP 752455, Lot 138 DP 752455, and Lot 140&142 DP 752445, referred to herewith as the 'site'. Ecological assessments (HSO 2005; Orbit Planning 2008; Ecovision Consulting 2009; Wildthing Environmental Consultants 2009) have been undertaken concerning the site as part of three separate rezoning applications for this site. This assessment utilises a number of information sources, including the previous ecological investigations, to inform the current rezoning application, hence ensuring holistic environmental outcomes.

This report is to address specifically potential impacts on terrestrial ecology as a result of the proposal over the site. This report considers the potential constraints in relation to any threatened species, populations or Endangered Ecological Communities (EECs) listed within the *Threatened Species Conservation Act 1995* (TSC Act 1995). The report recognises the relevant requirements of the EP&A Act 1979 as amended by the EP&AA Act 1997. Consideration of potential constraints has also been undertaken in relation to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

1.1 Site Particulars

Locality – The Retreat Rd, Wattle Ponds Investigation Area is located approximately 5km from the township of Singleton, comprising land to the north and east of Retreat Road and land east and west of Long Gully Rd (Figure 1-1).

LGA – Singleton

Title(s) – Lot 120 DP 752455, Lot 138 DP 752455, and Lot 140&142 DP 752445

Area – The site covers approximately 90ha.

Zone – 1(a) Rural Zone

Boundaries – The site is bound by Retreat Rd to the south and west. To the north-west, north and east are private properties. Long Gully Rd runs through the centre of the site.

Current Land Use – The site is predominantly being utilised for agricultural purposes.

Vegetation – The site consists of largely cleared and managed land. Fragments and corridors of Central Hunter Ironbark-Spotted Gum-Grey Box Forest are also found in the site.

Topography - The site is characterised by gently undulating terrain. A number of ephemeral drainage lines and dams are present throughout the site.

26432\DRAFT\ARCH
FIG 1 SITE LOC A A4

TITLE: FIGURE 1 SITE LOCATION
LOCATION: WATTLE PONDS
DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)
DATE: 8/4/2010
PURPOSE: ECOLOGY ASSESSMENT
LAYOUT REF:
VERSION (PLAN BY): A (A.P-P.S)

CLIENT: LONG GULLY INVESTMENTS
JOB REF: 26432

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1.2 Scope of the Study

The scope of this Flora & Fauna Assessment report is to:

- determine, through desktop research, the potential for threatened species, populations and endangered ecological communities to occur within the site;
- identify vascular plant species found on the site;
- identify and map existing vegetation communities;
- assess the status of identified plant species and vegetation communities under relevant legislation;
- identify existing habitat types on the site and assess the habitat potential for threatened species, populations, or ecological communities known from the proximate area; and
- identify threatened flora and fauna potentially using the site.

Whilst survey work has been undertaken wholly within the bounds of the site, consideration has been afforded to areas off the site in order to appreciate the environmental context of the site.

The purpose of this report is to:

- document and map the findings from the field work and identify potential ecological constraints within the site.
- ensure planning, management and development decisions are based on sound scientific information and advice by documenting the presence of any biodiversity components or potential significant impacts that may exist on the site;
- provide information to enable compliance with applicable assessment requirements contained within the *TSC Act (1995), EP&A Act (1979)*, the Commonwealth *EPBC Act (1999)*;
- consider any other relevant state, regional and local environmental planning instruments such as SEPP 44 Koala Habitat Protection, *Native Vegetation Act 2003, Water Management Act 2000* and any other strategic policies.
- enable the provision and analysis of ecological data that is comparable with data for other sites within the region, based on NPWS Wildlife Atlas Data to ensure continuity and consistency for survey and results.

1.3 Qualifications and Licensing

1.3.1 Qualifications

The Flora and Fauna Assessment Report was undertaken by the following ecologists from RPS:

- Matt Doherty
- Steve Roderick
- Susan Horrocks

The academic qualifications and professional experience of all RPS staff is documented in Appendix 3.

1.3.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2010);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2010);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2010); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2011).

1.4 Certification

As the principal author, I, Matthew Doherty, make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;
- Commonwealth, state and local government policies and guidelines formed the basis of project surveying methodology, or where the survey work has been undertaken with specified departures from industry standard guidelines, details of which are discussed and justified in Section 2; and

- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995*, *National Parks and Wildlife Act 1974* and the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*.

Signature of Principal Author and Certifier:

Matthew Doherty
RPS Newcastle
March 2010

2.0 FAUNA AND FLORA ASSESSMENT METHODOLOGY

A variety of techniques were employed over the course of desktop and fieldwork to describe, record and assess the potential impacts of the proposal upon fauna and flora communities and their habitats present and potentially present on the site.

2.1 Desktop Assessment

Preliminary assessments were utilised to assist in identifying distributions, suitable habitats and known records of threatened species. Assessments drew on a number of information sources and included:

1. Aerial Photograph Interpretation (API) and literature reviews to determine the broad categorisation of vegetation within the site;

2. Department of Environment, Climate Change and Water (DECCW) database of Threatened Species, Populations and Ecological Communities (accessed January 2010); DEWHA EPBC Act 1999 Protected Matters Search (accessed January 2010);

3. Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) mapping (NPWS 2003).

4. Preliminary Ecological Assessments including:

    - Harper Somers O'Sullivan (2005), *Flora and Fauna Assessment- For a Combined Rezoning and Development Application.* Prepared for Hunter Development Brokerage, April 2005.

    - Ecovision Consulting (2009), Addendum *Report – Ecology, Proposed Rezoning – rural residential subdivision, Long Gully Road, Wattle Ponds,* September 2009.

    - Wildthing Environmental Consultants (2009), *Vegetation Significance Assessment for a proposed rezoning at Lot 120 DP 752455, Retreat Rd, Wattle Ponds NSW*. Prepared for Hunter Valley Planning, June 2009.

    - Orbit Planning (2008), *Environmental Study Proposed Rezoning Amendment Lot 140&142 DP752455 8&36 Long Gully Road, Wattle Ponds*, February 2008.

2.2 Preliminary Assessment Methodology

The preliminary assessments (HSO 2005; Orbit Planning 2008; Ecovision Consulting 2009; Wildthing Environmental Consultants 2009) were prepared to inform three rezoning applications that concerned four separate allotments within the site. As such, timings, objectives and methodology of each assessment differed for each report. To aid readability the preliminary assessments have been categorised into three areas to delineate where possible, the methodology undertaken for each allotment, being:

Area 1: (West of Long Gully Rd) Lot 120 DP 752455 (Wildthing Environmental Consultants 2009) ;

Methodology included: Vegetation Significance Assessment

- Desktop Analysis
- Field Survey conducted 2 Jun 2009
- Vegetation mapped and targeted threatened species surveys
- Hollow bearing trees mapped
- Incidental observations of threatened fauna recorded
- Habitat assessment
- Vegetation Assessment

Area 2: (Northeast of Long Gully Rd) Lot 140 & 142 DP 752455 (Orbit Planning 2008; Ecovision Consulting 2009)

Methodology: Generally in accordance with Department Environment and Climate Change working draft '*Threatened Biodiversity Survey and Assessment: Guidelines dor Development Activities'* (Ecovision 2009).

- Desktop Analysis (10km Search)
- Field Survey conducted 2-6 October 2007
- Systematic and Nonsystematic Flora Survey
- Diurnal and nocturnal sampling regimes
- Incidental observations of threatened fauna recorded
- Habitat assessment
- Vegetation Assessment
- Fauna Assessment

Area 3: (Southeast of Long Gully Rd) Lot 138 DP 752455 (HSO 2005).

Methodology:

- Desktop Analysis
- Field Surveys conducted 24-28 May 2004 and 4 Jun 2004
- General and Significant Flora Survey
- Arboreal & Terrestrial Trapping
- Bat Call Detection
- Hair-tube Analysis
- Herpetofauna Survey
- Spotlighting
- Call Playback
- Incidental observations of threatened fauna recorded
- Habitat assessment
- Vegetation Assessment

Data gathered during the preliminary assessments was utilised to assist in identifying distributions, suitable habitats and known records of threatened species and ecological communities so that site constraints and opportunities could be determined.

2.3 Vegetation and Habitat Survey

Vegetation mapping and habitat survey was conducted on 27-29 January 2010 as follows:

- Aerial Photograph Interpretation (API) to map the community(s) extent into definable map units;
- Vegetation extent was mapped using D-GPS capable to sub-metre accuracy;
- Vegetation condition and habitat attributes were recorded; and
- Confirmation of the community type(s) present (dominant species) via undertaking flora surveys on site, or by “over the fence” observations where possible on additional lands adjacent to the site.

- Additional assessment of vegetation condition and potential vegetation loss within the site relative to expected development was also undertaken.

2.3.1 Habitat Survey

An assessment of the relative habitat value present on site was undertaken. This assessment focused primarily on the identification of specific habitat types and resources on the site favoured by known threatened species from the region. The assessment also considered the potential value of the site (and surrounds) for all major guilds of native flora and fauna.

Habitat assessment was based on the specific habitat requirements of each threatened fauna species in regards to home range, feeding, roosting, breeding, movement patterns and corridor requirements. Key habitat attributes targeted during ecological surveys were: structural complexity of vegetation communities; incidence of hollow-bearing trees; presence of blossom-producing trees; and shrubs and levels of understorey forest debris. Consideration was also given to contributing factors including, topography, soil, light and hydrology for threatened flora and assemblages. As such assessment of potential faunal movements within and across the site to offsite habitat could be predicted.

2.3.2 Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Such indicators included:

- Distinctive scats left by mammals.
- Scratch marks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Feeding scars on Eucalyptus trees made by Gliders;
- Whitewash, regurgitation pellets and prey remains from Owls;
- The calls of fauna;
- Skeletal material of vertebrate fauna; and
- Footprints left by mammals.

Any other incidental observations of fauna were recorded during all phases of fieldwork.

2.4 Agency Consultation

A meeting with the Department of Environment, Climate Change and Water (DECCW) was held on 12th November 2009 with the proponent and RPS HSO project team to discuss the proposal and environmental characteristics over the site. The following issues were discussed:

- Creekline impacts
- Regional ecological setting
- Connectivity throughout the site including the possible rehabilitation of areas to strengthen linkages
- Maintain and improve outcome

The DECCW were generally supportive of appropriate development of the site given that environmental outcomes of maintain and improve can be achieved and assured in perpetuity.

2.5 Limitations

Limitations associated with this Flora and Fauna Assessment Report is presented herewith. The limitations have been taken into account specifically in relation to threatened species assessments, results and conclusions.

In these instances, a precautionary approach has been adopted; as such 'assumed presence' of known and expected threatened species, populations and ecological communities has been made where relevant and scientifically justified to ensure a holistic assessment.

2.5.1 Seasonality

The flowering and fruiting plant species that attract some nomadic or migratory threatened species, often fruit or flower in cycles spanning a number of years. Furthermore, these resources might only be accessed in some areas during years when resources more accessible to threatened species fail. As a consequence threatened species may be absent from some areas where potential habitat exists for extended periods and this might be the case for the above-mentioned species.

The seasonality of the surveys places limits on the number of flora species identified in the study area. Some species that have flowering periods outside survey times are often difficult to detect. Thus the flora species list cannot be considered to be complete when one survey has been completed, due to seasonality of flowering.

2.5.2 Data Availability and Accuracy

The collated threatened flora and fauna species records provided by the DECCW for the region are known to vary in accuracy and reliability. Traditionally this is due to the reliability of information provided to the NPWS for collation and/or the need to protect specific threatened species locations. For the purposes of this assessment this information has been considered to have an accuracy of ± 1km.

Threatened flora and fauna records within the region were predominantly sourced from the DECCW Atlas of Wildlife Database and DEWHA Protected Matters Search. Limitations are known to exist with regards to these data sources and their accuracy.

2.5.3 Fauna Presence

The presence of fauna within a particular area is not static over time. This may be in response to the availability of a particular resource, seasonal and/or climatic variance or natural population fluctuations. As such, where survey effort targeting particular threatened fauna species did not specifically met guidelines recommended by DECCW, habitat assessment coupled with assumed presence of the occurrence of threatened fauna species has been applied.

3.0 RESULTS

3.1 Vegetation Communities

For the purposes of this assessment, the vegetation communities have been condensed into the categories consistent with the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) mapping (NPWS 2003). This has been deemed appropriate to enable more informed assessments to be made with regard to the sub-regional distribution of the identified communities. Vegetation community mapping was refined using GPS positioning during field survey in conjunction with current aerial imagery, with community extent shown in Figure 3-1: Vegetation Map.

The following vegetation communities were recorded on site:

- Central Hunter Ironbark - Spotted Gum - Grey Box Forest (CHISGGBF), (EEC) [MU 18]
- Cleared/Mainly Cleared Areas.

Note that the distinction between the CHISGGBF community and the Cleared/Mainly Cleared Areas was subjective due to the significant fragmentation of the forested community that has occurred on site. Indeed, the vast majority of the site appears to have been cleared at some stage and many areas contain only scattered trees. As a 'rule of thumb', those areas that currently contain only scattered trees and which have been extensively grazed/underscrubbed, and/or regenerating shrubs, or that contain no trees, have been referred to as 'Cleared/Mainly Cleared'. Such an interpretation has been largely based upon aerial photography interpretation and vegetation mapping surveys.

There are two additional EEC's that could potentially occur in the region, which is similar to the vegetation assemblages found to occur within the site, being Lower Hunter Spotted Gum Ironbark Forest and Hunter Redgum Forest (HLRF) as listed under the TSC Act. Whilst the vegetation is similar to LHSGIF, its highly disturbed state does not allow a full comparison of structure and understorey indicator species. The vegetation contained *Eucalyptus mollucana* (Grey Box) which is common within CHISGGBF. Additionally, Peak (2006) states that the Sedgefield area is a stronghold for CHISGGBF and that the closet LHSGIF mapped occurs almost 20km to the south-east near Branxton. Therefore it is considered unlikely that the vegetation within the site constitutes LHSGIF EEC.

A small number of *Eucalyptus tereticornis* (Forest Red Gum) occurred within CHISGGBF community, scattered predominantly along the drainage lines and may be an indicator of HLRF. However, the scattered, highly disturbed and relative isolated occurrence of *E. tereticornis* in these locations and lack of

understorey species makes it difficult to determine whether the site once contained HLRF or whether the areas were CHISGGBF which contained occasional *E.tereticornis* on drainage lines, or ecotones with HLRF without necessarily constituting HLRF EEC. Due to the small and highly disturbed nature of the locations it is considered that the vegetation did not constitute HLRF EEC.

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FIG 3-1 VEGETATION MAP A-A

TITLE: FIGURE 3-1: VEGETATION MAP	LOCATION: WATTLE PONDS	DATUM: DATUM PROJECTION: MGA ZONE 56 (GDA 94)	DATE: 8/4/2010 PURPOSE: ECOLOGY ASSESSMENT	LAYOUT REF: VERSION (PLAN BY): A (MD)

CLIENT: LONG GULLY INVESTMENTS
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Central Hunter Ironbark - Spotted Gum - Grey Box Forest (CHISGGBF)

The Central Hunter Ironbark Spotted Gum Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (CHISGGBF) is an endangered ecological community (EEC) under the Threatened Species and Conservation Act 1995 (TSC Act). The most intact sections of this community are located along the site's boundary edges and among several drainage lines within the site. In these areas, a more intact canopy structure was noted and a greater diversity of species was recorded at each structural level.

In general, this community is dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. fibrosa* (Broad-leaved Ironbark) and *Corymbia maculata* (Spotted Gum). Other Eucalypts found within this community included *E. mollucana* (Grey Box) and *E. tereticornis* (Forest Red Gum).

The understorey throughout this community is sparse and highly disturbed, most likely owing to past clearing, underscrubbing and subsequent grazing activities. Occasional shrub layer species found within this community were *Eucalypt sp.* regrowth, *Allocasuarina luehmannii* (Bull-oak), *Casuarina cunninghamiana* (River She-oak) and other shrub species such as *Bursaria spinosa* (Blackthorn), *Acacia parvipinnula, Acacia falcata* and *Daviesia ulicifolia.* Greatest complexity of understorey within this community occurred within the drainage lines on site.

The ground cover is dominated by a wide range of native and/or introduced pasture grasses, associated herb and forb species including species such as *Cymbopogon refractus* (Barbed-wire grass), *Themeda triandra* (Kangaroo grass), *Austrodanthonia linkii* (Wallaby Grass), *Chrysocephalum apiculatum* (Yellow Buttons), *Axonopus affinis* (Narrow-leaved carpet grass), *Bromus cartharticus* (Prairie grass),*Cynodon dactylon* (Common couch) and leaf litter. The groundcover also contains incursions of the weed species *Opuntia vulgaris* (Prickly Pear).

Plate 1: Central Hunter Ironbark - Spotted Gum - Grey Box Forest (EEC) within the drainage line in western sector of the site.

Cleared/Mainly Cleared Areas

The cleared land assemblage dominates the majority of the central areas on site. This 'community' is likely to have formerly occurred as CHISGGBF with a small number of *Eucalyptus tereticornis* (Forest Red Gum) also present largely within the ephemeral drainage areas on site. This community is dominated by a wide range of native and/or pasture grasses, associated herb and forb species, occasionally interspersed with scattered trees. Typical ground species include *Austrodanthonia linkii* (Wallaby Grass) and *Cymbopogon refractus* (Barbed-wire Grass).

Plate 2: Cleared/Mainly Cleared Area within the eastern sector of the site

3.2 Threatened Species and Communities

3.2.1 Threatened Flora

The results of a desktop search indicated that four threatened flora species have been previously recorded within 10km of the site (the locality) and/or have potential habitat within the site (DECCW 2010; DEWHA 2010; Briggs and Leigh 1996). These include:

- *Angophora inopina* Charmhaven Apple
- *Eucalyptus glaucina** Slaty Red Gum

- *Cryptostylis hunteriana** Leafless Tongue-orchid
- *Prasophyllum* sp. *Wybong (C.Phelps ORG 5629)** A Leek Orchid

One Endangered Population was identified under the TSC Act to potentially occur on site, being:

- Eucalyptus camaldulensis population in the Hunter Catchment (E*)

An assessment of likelihood of occurrence of these threatened species/ populations within the site is provided in Table 3-1.

No regionally significant or threatened flora species or populations listed under the TSC Act 1995 and/or EPBC Act 1999 were detected within the site during targeted surveys.

3.2.2 Threatened Fauna

The results of a desktop search indicated that 36 threatened fauna species have been previously recorded within 10km of the site (the locality) and/or have potential habitat within the site (DECCW 2009; DEWHA 2009; Briggs and Leigh 1996). These are:

- *Litoria aurea** Green and Golden Bell Frog
- *Litoria booroolongensis* Booroolong Frog
- *Mixophyes balbus** Stuttering Frog
- *Mixophyes iteratus** Giant Barred Frog
- *Ephippiorhynchus asiaticus* Black-necked Stork
- *Erythrotriorchis radiatus ** Red Goshawk
- *Rostratula australis** Australian Painted Snipe
- *Callocephalon fimbriatum* Gang-gang Cockatoo
- *Calyptorhynchus lathami* Glossy Black Cockatoo
- *Lathamus discolour** Swift Parrot
- *Pyrrholaemus saggitatus* Speckled Warbler
- *Neophema pulchella* Turquoise Parrot
- *Anthochaera phrygia** Regent Honeyeater
- *Pomatostomus temporalis temporalis* Grey-crowned Babbler
- *Climacteris picumnus* Brown Tree Creeper
- *Ninox connivens* Barking Owl
- *Ninox streua* Powerful Owl
- *Tyto novaehollandiae* Masked Owl
- *Chalinolobus dwyeri** Large-eared Pied Bat
- *Chthonicola sagittate* Speckled Warbler
- *Grantiella picta* Painted Honeyeater
- *Melanodryas cucullate* Hooded Robin
- *Dasyurus maculatus maculatus** Spotted-tailed Quoll

• *Petrogale pencillata**	Brush-tailed Rock Wallaby
• *Phascogale tapoatafa*	Brush-tailed Phascogale
• *Petaurus norfolcensis*	Squirrel Glider
• *Phascolarctos cinereus*	Koala
• *Pseudomys oralis**	Hastings River Mouse
• *Chalinolobus dwyeri**	Large-eared Pied Bat
• *Falsistrellus tasmaniensis*	Eastern False Pipistrelle
• *Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat
• *Mormopterus norfolkensis*	Eastern Freetail-bat
• *Nyctophilus timoriensis**	Greater Long-eared Bat
• *Pteropus poliocephalus**	Grey-headed Flying-fox
• *Scoteanax rueppellii*	Greater Broad-nosed Bat
• *Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat

(*) indicates species listed under the EPBC Act 1999.

An assessment of likelihood of occurrence of these threatened species within the site is provided in Table 3-1.

The following eight threatened species have been recorded on site or treated as subject species due to past records/or fieldwork undertaken as part of earlier assessments in the locality:

• *Pomatostomus temporalis temporalis*	Grey-crowned Babbler
• *Phascogale tapoatafa*	Brush-tailed Phascogale
• *Petaurus norfolcensis*	Squirrel Glider
• *Miniopterus schreibersii*	Eastern Bentwing-Bat
• *Mormopterus norfolkensis*	East-coast Freetail-Bat
• *Myotis adversus*	Large-footed Myotis
• *Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat
• *Scoteanax rueppellii*	Greater Broad-nosed Bat

3.2.3 Endangered Communities

Seven Endangered Ecological Communities were identified under the EPBC Act & TSC Act to potentially occur on site, being:

- Central Hunter Ironbark Spotted Gum Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived Grasslands (CE*; EEC)
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions (EEC)
- Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion (EEC)

- Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Warkworth Sands Woodland in the Sydney Basin Bioregion

An assessment of likelihood of occurrence of these endangered communities within the site is provided in Table 3-1.

3.3 Habitat Assessment

Habitat within the site was assessed for its potential to support native fauna species including threatened fauna for which records occur within the wider locality. The habitat present throughout the site may be classified as two broad habitat types, being Open Forest/Woodland and cleared/disturbed areas.

Open forest/woodland communities provide habitat for a number of terrestrial and arboreal mammals however the limited understorey complexity and high densities of immature trees, lowering the incidence of hollow-bearing trees, moderates suitability. The myrtaceous canopy species potentially provides seasonal foraging opportunities in the form of foliage, pollen, nectar and invertebrates for nectivorous, insectivorous birds and mammals. Foraging potential for migratory nectar seeking species such as Lathamus discolour (Swift Parrot) and Anthochaera phrygia (Regent Honeyeater) exists within winter flowering Eucalypts such as the Spotted Gum.

Hollow bearing trees located within the site provides roosting and den habitat for micro-chiropteran bats and other hollow-dependent mammals. Deep fissures that occur within the bark of mature Ironbark sp may also provide further roosting opportunities for some micro-chiropteran bats. There are no rocky outcrops, overhangs or other cave like structures that occur on site and therefore the site would represent only potential foraging habitat for cave roosting bat species. Larger hollowed trees and dead stags that occurred on site were suitable as breeding or roosting sites for owls, larger parrots or cockatoos and a suite of arboreal species including Petaurus norfolcensis (Squirrel Glider) and Phascogale tapoatafa (Brush-tailed Phascogale). Common arboreal mammal species Trichosurus vulpecula (Common Brushtail Possum) are present within the site and may provide hunting opportunities for a variety of forest owl species including Ninox strenua (Powerful Owl).

The woodland forest communities provide foraging resources, nesting and roosting opportunities for a range of sedentary woodland bird species such as the

threatened species Pomatostomus temporalis (Grey Crowned Babbler) that were observed on site. Habitat potential for these species seemed restricted to areas of greater understorey complexity, predominately within drainage areas on site, where native understorey vegetation and fallen forest debris were retained.

Reptile species have only low shelter and foraging opportunities within the cleared central areas on site. Again, the greatest habitat potential for these species occurs within woodland forest communities, in areas with increased understorey complexity and forest debris, apparent within drainage lines and surrounds of the dams located on site. Some habitat opportunities exist for amphibious species within the ephemeral drainage lines and also within the various small to medium sized dams located within the site, particularly those containing aquatic vegetation.

Disturbed cleared areas with a low diversity and density of eucalypt species hold limited to no habitat for arboreal species however do provide suitable habitat for common native browsers, such as various macropod species which were observed on site, and birds adapted to open spaces. They also provide habitat for pest species such as Oryctolagus cuniculus (Rabbit).

The habitats that occur throughout the site are commonly represented within the locality and in abundance throughout the region. Having said this, these habitat types have been highly fragmented in the broader locality of the site to the point that the greatest concentrations of such habitat occur in large, protected areas to the north (i.e. within the Barrington Range). These areas exist on higher elevated land and as such, may preclude the existence of species that prefer drier clines on the valley floor. As such, it is likely that the forested habitats found on the site, although fragmented, are important in reagards to local connectivity.

Overall habitat opportunities within the site for native flora and fauna are limited within cleared/disturbed lands, which occupy the majority of the site, suiting only those species tolerant of open spaces. Previous clearing and under-scrubbing practises have severally depleted structural complexity and limited the incidence of mature hollow bearing trees reducing habitat potential. Greatest habitat potential and seasonal foraging opportunities exist within Ironbark Spotted Gum Grey Box Forest communities, particularly within the drainage lines, riparian and the various dams on site.

3.3.1 Connectivity

Forested areas of the site can be considered important habitat connection for proximate areas of similar habitat that occurs to the west, north, east and southeast of the site. The creeklines, in particular provides possible biodiversity linkages to remnant forest habitat within these areas.

26432\DRAFT\ECO
FIG 3-2 LOCAL CONNECTIVITY

TITLE:	FIGURE 3-2: LOCAL CONNECTIVITY	LOCATION:	WATTLE PONDS	DATUM:	DATUM	DATE:	8/4/2010
				PROJECTION:	MGA ZONE 56 (GDA 94)	PURPOSE:	ECOLOGY ASSESSMENT

LAYOUT REF:
VERSION (PLAN BY): A (MD)

CLIENT: LONG GULLY INVESTMENTS
JOB REF: 26432

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3.4 Legislative Constraints Assessment

3.4.1 Identification of Subject Species and Communities

Threatened flora and fauna species (listed under the *TSC Act 1995* and/or the *EPBC Act 1999*) that have been gazetted and recorded within a 10 km radius of the site have been considered within this assessment (DECCW 2009). Endangered Ecological Communities (EEC's) known from the broader area have also been addressed. Each species / community is considered for its potential to occur on the site and the likely level of impact as a result of the proposal. This assessment deals with each species / community separately and identifies the ecological parameters of significance associated with the proposal.

This assessment deals with the following heads of consideration in tabulated form (refer below):

'Species/Community'/Population – Lists each threatened species/EEC's known from the vicinity. The status of each threatened species under the *TSC Act (1995)* and the *Commonwealth EPBC Act (1999)* are also provided.

'Habitat Description' – Provides a brief account of the species/community/ population and the preferred habitat attributes required for the existence / survival of each species / community.

'Chance of Occurrence on Site' – Assesses the likelihood of each species / community to occur on or within the immediate vicinity of the site in terms of the aforementioned habitat description and taking into account local habitat preferences, results of current field investigations, data gained from various sources (such as Atlas of NSW Wildlife) and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

Key:
(V) = Vulnerable Species listed under *Threatened Species Conservation Act 1995* (TSC Act 1995).
(E) = Endangered Species listed under *TSC Act 1995*.
(EP) = Listed as an Endangered Population under the *TSC Act 1995.*
(V*) = Vulnerable Species listed under *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act 1999).
(CE*) = Critically Endangered Species listed under *EPBC Act 1999.*
(M*) = Listed as a Migratory species under the *EPBC Act 1999.*

Table 3-1: Threatened Species and Communities Considered and their Potential Occurrence on Site

Species / Community	Habitat Description	Chance of Occurrence On Site
PLANTS		
Angophora inopina (V,V)* Charmhaven Apple	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah). *A. inopina* is found in open dry sclerophyll woodland of *Eucalyptus haemastoma* and *Corymbia gummifera* with a dense shrub understorey. The woodland occurs on deep white sandy soils over sandstone, often with some gravelly laterite.	**Low –** This species was not observed during field surveys and any habitat considered marginal due to past practices. Habitat for this species is considered unlikely due to the absence of associative vegetative communities.
*Cryptostylis hunteriana (V*V),* Leafless Tongue-orchid	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically, when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. This species is known to occur within a range of habitats including woodlands to swamp heaths. Within the Hunter region, larger populations have been typically found in woodland dominated by Eucalyptus racemosa (Scribbly gum), and prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests.	**Low –** This species was not observed during field surveys and any habitat considered marginal due to past practices. Habitat for this species is considered unlikely due to the absence associative vegetative communities and appropriate soil conditions.
Eucalyptus castrensis population in Hunter Catchment *(E Pop)*	*Eucalyptus camaldulensis* is the most widespread eucalypt in Australia occurring in all mainland states and territories. In NSW it largely occurs in western flowing river systems and only occurs in one coastal catchment, the Hunter. It occurs in the Hunter at 19 sites encompassing approximately 100ha, the largest of which is 15 – 20ha in extent. Its previous Hunter distribution is estimated at between 10,000 and 20,000ha in those areas of the Hunter and Goulburn Rivers where water persisted after flooding. It has been known to associate with *E. tereticornis* (Forest Red Gum), *E. melliodora* (Yellow Box), *Casuarina cunninghamiana subsp. cunninghamiana* (River She-oak), *and Angophora floribunda* (Rough-barked Apple). In the Hunter it occurs in the west at Bylong and south of Merriwa and in the east at Hinton in the Port Stephens LGA. It has also been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Singleton and Upper Hunter.	**Low - Moderate** This species was not recorded within the site during flora surveys. Some potential habitat exists however within the CHISGGBF community, particularly within ephemeral drainage lines, where commonly associated species *E. tereticornis* (Forest Red Gum), were recorded.
Eucalyptus glaucina Slaty Red Gum (V, V*)	Red Gum species that grows in grassy woodland on deep, fertile and moist soils. Recorded within Hunter Lowland Redgum Forest and Central Hunter Ironbark Spotted Gum Grey Box Forest communities in the lower Central Hunter. Interbreeding known to occur between this species and *E. tereticornis* (Forest Red Gum)	**Low - Moderate** – Some potential habitat exists within the CHISGGBF community where commonly associated species were recorded. Only two records within 20km of the site exist on the Atlas of NSW Wildlife database and records are known from Hermitage Road, approximately 15km to the south-east of the site (T. Peake *pers. comm.*).
Prasophyllum sp. Wybong (C.Phelps ORG 5269) (CE)* a Leek-orchid	This species is a terrestrial orchid that grows to approximately 30cm high. It is generally found in shrubby and grassy habitats in dry to wet soil and is known to occur in open eucalypt woodland and grassland. It has a single, tubular, fleshy dull green leaf and a single flower spike with numerous fragrant flowers. It appears as a single leaf over winter and spring. It is known from seven populations in eastern NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield.	**Low –** This species was not observed during field surveys and any habitat considered marginal due to past practices. Habitat for this species is considered unlikely due to the absence associative vegetative communities and appropriate soil conditions.

Species / Community	Habitat Description	Chance of Occurrence On Site
HERPETOFAUNA		
Litoria aurea Green and Golden Bell Frog (E, V*)	*Litoria aurea* was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that it is no longer found on sites above an altitude of 300m above sea level. *L. aurea* species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. *L. aurea* is thought to be displaced from more established sites by other frog species thus explaining its existence on disturbed sites. Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins, particularly those water-bodies containing diurnal shelter such as bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites.	**Low** – Preferred habitat is generally absent, although some limited habitat may exist within the creekline areas and dams located throughout the site.
Litoria booroolongensis (E, E*) Booroolong Frog	The species is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Most recent records are from the south-west slopes of NSW. It is found along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
Mixophyes balbus Stuttering Frog (E, V*)	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Breeds in streams during summer after heavy rain, outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing streams.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
Mixophyes iteratus (E, E*) Giant Barred Frog	Mostly restricted to wet sclerophyll forest and rainforest, including Antarctic Beech (*Nothfagus moorei*) forest. Usually found within close proximity to permanent running water (Robinson, M, 1996). Occur within damp leaf litter.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
BIRDS		
Anthochaera phrygia Regent Honeyeater (E, E*)	After breeding *Anthochaera phrygia* disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Two main breeding areas occur in NSW, that being the Barraba District and Capertee Vallley. Within its range it is mostly recorded in Box-Ironbark Eucalypt associations along creek flats, river valleys and foothills. Common western feed trees include *Eucalyptus alba* (White Box), *E. melliodora* (Yellow Box) and *E. sideroxylon* (Mugga Ironbark). Movements eastward sees the food sources change to include *Corymbia maculata* (Spotted Gum), *E. firbrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark) and various Stringybark sp. Coastal swamp forests are used when more western or near coastal resources fail and may be critical refuges during these times, the sought after tree species in this habitat is *E. robusta* (Swamp Mahogany). *A. Phrygia* has been recorded in a variety of flowering sp. not normally associated with normal feed patterns., probably a result of a lack of their preferred food source. Nesting attempts have occurred at other sites such as Quorrobolong in the Hunter Valley.	**Moderate -** (on a seasonal basis) – Not recorded during field surveys although potential habitat exists on site, predominantly in the form of winter-flowering Eucalypts such as *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-Leaved Ironbark).

Species / Community	Habitat Description	Chance of Occurrence On Site
Callocephalon fimbriatum Gang-gang Cockatoo	Found in the summer months in tall mountain forests and woodlands, and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier open eucalypt forests and woodlands, particularly box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Also occurs within sub-alpine Snow Gum *Eucalyptus pauciflora* woodland and occasionally in temperate rainforests. Nest in hollows and favours old growth communities.	**Moderate -** (on a seasonal basis) – Not recorded during field surveys although potential habitat exists on site, predominantly in the form of winter-flowering Eucalypts such as *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-Leaved Ironbark).
Calyptorhynchus lathami Glossy Black-Cockatoo (V)	Occurs in forests and woodlands where it forages predominantly on *Allocasuarina* cones. Requires large Eucalypt tree hollows for nesting.	**Low – Moderate** – Limited foraging or roosting habitat exists on the site for this species. *Allocasuarina luehmannii* is unlikely to be utilised by this species. Unlikely to inhabit such fragmented habitat in any case. Not recorded during field surveys.
Chthonicola sagittata Speckled Warbler (V)	Occupies Eucalypt and Cypress woodlands in drier coastal areas and on the western slopes of the Great Dividing Range. Appears unable to persist in districts where no forested fragments larger than 100ha remain.	**Low – Moderate** – Although the site contains some small areas of suitable habitat for this species, it is considered that such habitat both on the site and in the close vicinity are too fragmented to provide a preferred habitat resource for this species.
Climacteris picumnus Brown Treecreeper (V)	Frequents drier forests and woodlands, particularly open woodland lacking a dense understorey. Also found in grasslands in proximity to wooded areas where there are sufficient logs, stumps and dead trees nearby. Feeds on invertebrate larvae and small insects, particularly ants. Utilises hollows for roosting/nesting. Appears not to persist in remnants less than 200ha.	**Low – Moderate** – Although the site contains some small areas of suitable habitat for this species, it is considered that such habitat both on the site and in the close vicinity are too fragmented to provide a preferred habitat resource for this species.
Erythrotriorchis radiatus Red Goshawk (CE, V*)	Occupies a range of habitats in northern and eastern Australia, including coastal and subcoastal tall open forests and woodlands. However, within these habitats *Erythotriorchis radiatus* are sparsely distributed. In NSW *E. radiatus* favours water courses in swamp forest and woodlands on the coastal plain. Is known to occur with dense forest interspersed with open woodland and often frequents forest edges. Habitats required by *E. radiatus* for breeding are very specific. They will only nest in trees taller than 20 m, and these must be within 1 km of water.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
Ephippiorhynchus asiaticus Black-necked Stork (E)	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
Grantiella picta Painted Honeyeater (V)	Nomadic Honeyeater that lives in dry forests and woodlands and is a specialist feeder on the fruit of Mistletoes.	**Low** – The near absence of Mistletoe on site reduces the potential for this species to occur on site and was not encountered during surveys.
Lathamus discolor Swift Parrot (E, E*)	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year as a consequence of varying eucalypt blossoming cycles. Preferred winter flowering species in NSW include *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-Leaved Ironabrk), *E. sideroxylon* (Mugga Ironbark), *E. albens* (White Box) and *E. tereticornis* (Forest Red Gum). *Lathamus discolour* also uses these species for lerping. Such species include *E. fibrosa* (Broad-leaved Ironbark), *E. moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum). Nests only in Tasmania during spring/summer. *L. discolor* uses some of these tree species for roosting purposes as well.	**Moderate -** (on a seasonal basis) – Not recorded during field surveys although potential roosting and foraging habitat exists on site, predominantly within winter-flowering Eucalypts such as *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Broad-leaved Ironbark), *E. crebra* (Narrow-Leaved Ironbark).

Species / Community	Habitat Description	Chance of Occurrence On Site
Melanodryas cucullata Hooded Robin (V)	Primarily known from Eucalypt forest, woodland and scrub, although has been known to use cleared paddocks with regrowth or stumps in close proximity to wooded areas. Favours areas with sparse shrub cover and fallen timber. Appears unable to persist in remnants less than 100-200ha	**Low** – Although the site contains some potentially suitable habitat for this species, it is considered that such habitat on the site is too fragmented to provide a preferred habitat resource for this species. Not recorded during fieldwork.
Neophema pulchella Turquoise Parrot (V)	Inhabits forests and woodlands with suitable nest hollows and grassy foraging areas.	**Low – Moderate** – Habitat on site could be utilised by vagrant individuals of this species. The site is unlikely to represent a significant habitat resource due to the fragmented nature of the habitats on site and in the vicinity. Not recorded during field surveys on the site.
Ninox connivens Barking Owl (V)	Occurs mainly in dry sclerophyll woodland. Nests in large Eucalypt hollows, and roosts in hollows or thick vegetation. Hunts a range of prey species including birds and both terrestrial and arboreal mammals.	**Low – Moderate** – Potential habitat may exist on the site. Limited nesting habitat within the site however may be present within the site. Not recorded during field surveys on the site
Ninox strenua Powerful Owl (V)	Occurs in sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Roosts in dense vegetation within such areas.	**Low – Moderate** – Some hunting habitat may exist on the site with the presence of arboreal mammals. Nesting habitat occurs marginally on site within trees or dead stags with larger hollows. Not recorded during field surveys on the site.
Pyrrholaemus saggitatus Speckled Warbler (V)	Occupies Eucalypt and Cypress woodlands in drier areas and on the western/eastern slopes of the Great Dividing Range. More commonly found on the western slopes, mainly due to habitat. Requires a grassy understorey, a sparse shrub layer and an open canopy. Most foraging takes place on ground around tussocks, around bushes and trees. Appears unable to persist in districts where no forested fragments larger than 100ha remain.	**Low - Moderate** – Although the site contains some small areas of suitable habitat for this species, it is considered that such habitat both on the site and in the close vicinity are too fragmented to provide a preferred habitat resource for this species.
Pomatostomus temporalis temporalis Grey-crowned Babbler (V)	Occupies open forests and woodlands, *Acacia* shrubland and adjoining farmland. Also Box-Gum Woodlands on the divide slopes and Box-Cypress Pine and open Box Woodlands on the plains. They feed on terrestrial invertebrates and insects on lower trunks and branches. Generally they prefer wooded areas with an intact ground cover, although in such areas as the Hunter Valley they occur in sparsely vegetated areas such as properties and golf courses. Appears unable to persist in cleared and highly fragmented habitats. Nest comprise of a dome shape stick nest which is often only a couple of metres from the ground in shrubs or Eucalypt saplings.	**High** – This species was recorded on site during field surveys.
Rostratula australis (E,V*) Australian Painted Snipe	A small freshwater and estuarine wader, which prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
Tyto novaehollandiae Masked Owl (V)	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate / preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well.	**Low** – Some hunting habitat may exist on site, although the site's limited or absence of understorey complexity reduces potential habitat for terrestrial prey species and therefore may reduce resourse availability. Nesting and roosting habitat occurs marginally on site within trees or dead stags with larger hollows. Not recorded during field surveys on the site.
MAMMALS		
Dasyurus maculatus maculatus Spotted-tailed Quoll (V, E*)	Found in a variety of forested habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development.	**Moderate** – Some potential habitat exists for this species on the site, be it diminished due to underscrubbing and clearing practises. A record of this species (2001) is known from the vicinity of the site (Atlas of NSW Wildlife data). The current status of the species in the Singleton area is not known, though it must be said that the species has a moderate chance of occurring on the site.

Species / Community	Habitat Description	Chance of Occurrence On Site
Chalinolobus dwyeri (V,V*) Large-eared Pied Bat	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of *Hirundo ariel* (Fairy Martin), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.
Phascogale tapoatafa Brush-tailed Phascogale (V)	Inhabits dry open forest and woodlands, often in areas with sparse groundcover. It is one of the most arboreal Dasyurids and hunts mainly invertebrates, although some vertebrate prey is taken on occasion. Prefers to hunt on rough-barked trees. Utilises small tree hollows for nesting and refuge sites.	**High –** Trapping revealed that this species exists on the site. Records of this species also exist within the vicinity of the site (Atlas of NSW Wildlife Data; HSO Ecologists pers comm.).and therefore a resident –population is likely to exist in the area.
Phascolarctos cinereus (V) Koala	Occurs in forests and woodlands where it requires suitable feed trees (particular *Eucalyptus* spp.) and habitat linkages. It feeds on the foliage of more than 70 *Eucalypt* sp. and more than 30 non-*eucalypt* sp., but will select preferred feed within its home range. Home range varies according to available habitat. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions.	**Low - Moderate –** This species was not recorded within the site during flora surveys however potential habitat exists within the CHISGGBF communities where a small number of the preferred feed tree species *Eucalyptus tereticornis* (Forest Red Gum) was also recorded.
Pseudomys oralis (E, E*) Hastings River Mouse	Inhabits open forests and woodlands with a diverse cross section of grass, sedge, rush, ferns or herbs or heath understorey on the mid-north to north coast in NSW. Tends to favour areas with access to seepage zones, creeks and gullies. Also requires permanent shelter such as rocky outcrops. Nests in either gullies, ridges or slopes.	**Low** – Preferred habitat is generally absent, although some limited habitat may exist within the drainage areas throughout the site.
Petaurus norfolcensis (V) Squirrel Glider	Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. This species is generally absent from rainforest and closed forest. A wide range of forest types have been recorded as habitat for *Petaurus norfolcensis,* these include, *Euaclyptus camldulensis* (River Red Gum) Forest, Box-Ironbark Forests in the west, *E. pilularis* (Blcackbutt), *E. tereticornis* (Forest Red Gum) and *Corymbia gummifera* (Red Bloodwood) Forest, *Banksia integrifolia* (Coastal Banksia) Heathland and *E.punctata* (Grey Gum)/*C. maculata* (Spotted Gum)/ *E. paniculat* ssp. *paniculata* (Grey Ironabrk) Forests. In these areas tree hollows are utilised for nesting sites. Also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. As such *P.norfolcensis* requires habitat with a mix of *eucalyp*t, *acacia* and *bansksia* sp. with winter and summer flowering species and smooth/rough barked Eucalypts.	**High** – This species was recorded on site during field surveys.
Petrogale penicillata Brush-tailed Rock Wallaby (E, V*)	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with suitable caves and rocky overhangs for shelter.	**Low** – This species was not recorded within the site during fieldwork. It is unlikely to occur within the site due to the lack of appropriate habitat.

Species / Community	Habitat Description	Chance of Occurrence On Site
Falsistrellus tasmaniensis Eastern False Pipistrelle	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Hunts beetles, moths, weevils and other flying insects below or just above the canopy.	**Moderate –** This species was not detected during field surveys on site at the time of survey. Habitat exists within the site and therefore this species has the potential to occur within the site.
Miniopterus schreibersii oceanensis Eastern Bentwing-Bat (V)	Utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat.	**Moderate – High** This species may utilise the wooded parts of the site as foraging habitat. Previous surveys of nearby areas have revealed that this species occurs in the vicinity (HSO Ecologist pers comm.) No potential roosting habitat exists on the site. Not recorded on the site during field surveys however records exists of this species within the vicinity of the site (Atlas of NSW Wildlife Data).
Mormopterus norfolkensis Eastern Freetail-bat (V)	Forages predominantly in dry forests and woodlands east of the divide. It roosts in tree hollows, under bark and within man-made structures.	**High** – This species has been recorded with a 'definite' level of confidence on the site (HLA Envirosciences 2001). As such, a local population may exist in the area and foraging habitat does occur on site. Some potential roosting habitat also exists in the form of hollow-bearing trees.
Myotis adversus Large-footed Myotis (V)	Prefers to reside and forage in close proximity to water. Predominantly roosts in caves and other similar man-made structures.	**Moderate – High** – This species has been recorded with a 'possible' level of confidence approximately 1.6km east of the study area. Some limited preferred foraging habitat might exist on the site within the small farm dams or along the creekline. Roosting habitat is generally absent on the site.
Nyctophilus timoriensis (V,V*) Greater Long-eared Bat	Inhabits a variety of vegetation types, including mallee, bulloak (*Allocasuarina leuhmanni)* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roots in tree hollows, crevices, and under loose bark.	**Moderate –** This species was not detected during field surveys on site at the time of survey. Habitat exists within the site and therefore this species has the potential to occur within the site.
Pteropus poliocephalus (V, V*) Grey-headed Flying Fox	Forages over a large area for nectar / fruits etc. Occurs across subtropical and temperate forest, sclerophyll forest and woodlands, heaths, swamps, urban gardens and cultivated crops. Frequently observed to forage in flowering Eucalypts. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforest. These camps are usually located within 20km's of their food source. Frequently observed to forage in flowering Eucalypts.	**Moderate -** Due to its largely generalist habitat requirements, this species could potentially occur within any wooded habitat in the region. No potential roosting habitat exists on site. Not recorded on the site during field surveys however records exists of this species within the vicinity of the site (Atlas of NSW Wildlife Data)
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat (V)	Occurs in a range of habitats from rainforest to arid shrubland. Roosts in tree-hollows and sometimes in mammal burrows when no hollows available. Seasonal movements are unknown, may migrate to southern Australia in late summer and autumn. Flies high and fast over the forest canopy when foraging for insects, but lower in more open country and arid shrubland.	**Moderate – High** - This species has been recorded with a 'highly likely' level of confidence on the site (HLA Envirosciences 2001). As such, a local population may exist in the area and foraging habitat does occur on site. Some potential roosting habitat also exists in the form of hollow-bearing trees.
Scoteanax rueppellii Greater Broad-nosed Bat (V)	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces/ ecotones, most commonly found in tall wet forest. Open woodland and habitat and dry open forest suits the direct flight of this species as it searches for beetles and other larvae. This species roosts in tree hollows, although has been recorded in buildings.	**Moderate** – This species has been recorded with a 'possible' level of confidence on the site (HLA Envirosciences 2001). Some potential roosting habitat is also found on the site.
Endangered Ecological Communities		
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and derived Grasslands (CE* EEC)	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: *Eucalyptus albens* (White Box), *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses	**Low** Floristic composition commensurate to this EEC was not identified on site during previous Flora assessment (RPS 2005, ECOVISION Consulting 2009; Wildthing Environmental Consultants 2009 & Orbit Planning 2008)

Species / Community	Habitat Description	Chance of Occurrence On Site
	and a very high diversity of herbs. The community also includes a range of mammal, bird, reptile, frog and invertebrate fauna species. Intact stands that contain diverse upper and mid-storeys and groundlayers are rare. Modified sites include the following: 1. areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the groundlayer is predominantly composed of exotic species; and 2. sites where the trees have been removed and only the grassy groundlayer and some herbs remain.	
Central Hunter Ironbark Spotted Gum Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion (EEC)	This EEC typically forms an open forest to woodland. Species that form this EEC are *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. molucanna* (Grey Box) and *Corymbia maculata* (Spotted Gum). *E. tereticornis* (Forest Red Gum) and *E. fibrosa* (Broad-leaved Ironbark) are both occasionally present as dominant or co-dominant species. Shrub layers can be absent, sparse to dense. Species present can include *Allocasuarina leuhmanii* (Bulloak) or *Acacia parvipinnula* (Silver Streamed Wattle) as tall shrubs. Middle layer species include *Bursaria spinosa* subsp. *spinosa* (Blackthorn), *Breynia oblongifolia* (Coffee Bush), *Pultenaea spinosa* (Grey Bush Pea) and *Daviesia ulicifolia* subsp. *ulicifolia* (Gorse Bitter Pea).Sparse to moderately dense groundcover can occur. Common species that can occur are *Cymbopogon refractus* (Barbed Wire Grass) *Pratia purpurascens* (White Root), *Pomax umbellate* (Pomax), *Dianella revoluta* (Blue-flax Lilly), *Crhysocephalum apiculatum* (Common Everlasting), *Themeda australis* (Kangaroo Grass) and *Whalenbergia communis* (Tufted Bluebell).	**High –** This vegetation community was identified on site as commensurate to this CHISGGBF (EEC).
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions (EEC)	Found on gentle slopes arising from depressions and drainage flats on permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions. Dominant canopy species include *Eucalyptus tereticornis* (Forest Red Gum), *E. amplifolia* (Cabbage Gum) and *E. moluccana* (Grey Box) with scattered other Eucalypt species also present. Classified by the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) as Map Unit (MU) 19.	**Low- Moderate –** A small number of *E. tereticornis* (Forest Red Gum) was found within CHISGGBF community and may be an indicator HLRF EEC. However, due to the small and highly disturbed nature of the locations it is considered that the vegetation did not constitute HLRF EEC.
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (EEC)	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (Forest Red Gum), *E. amplifolia* (Cabbage Gum), *Angophora floribunda* (Rough-barked Apple) and *A. subvelutina* (Broad-leaved Apple). Correlates with LHCCREMS communities - 'Central Hunter Riparian Forest' Map Unit (MU) 13, 'Wollombi Redgum-River Oak Woodland' MU14 and 'Redgum Roughbarked Apple Swamp Forest' MU38.	**Low** Floristic composition commensurate to this EEC was not identified on site during previous Flora assessment (RPS 2005, ECOVISION Consulting 2009; Wildthing Environmental Consultants 2009 and Orbit Planning 2008)
Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion (EEC)	This community is widespread throughout the central to lower Hunter Valley, with forests between Cessnock and Beresfield forming the core of its distribution. This community is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) with occasional occurrences of *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark). Classified by the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) as Map Unit (MU) 17.	**Low –** The LHSGIF is a coastal variant to the CHISGGBF (EEC) vegetation community. As rainfall increases towards the coast there is a reduced frequency and abundance of *Eucalyptus crebra* relative to *E. fribrosa and E. molucanna* appears only as an occasional canopy species under these conditions (ECOVISION Consulting 2009). Previous ecological assessments determine floristic composition was commensurate CHISGGBF (EEC) as opposed to this EEC (RPS 2005, ECOVISION Consulting 2009; Wildthing Environmental Consultants 2009 and Orbit Planning 2008)

Species / Community	Habitat Description	Chance of Occurrence On Site
Warkworth Sands Woodland in the Sydney Basin Bioregion (EEC)	Occurs on aeolian (carried by wind) sand deposits south east of Singleton in the Hunter Valley. It may occur elsewhere in the Bioregion. This EEC is made of woodland to low woodland structure with species such as *Angophora floribunda* (Rough-barked Apple) and *Banksia integrifolia* (Coastal Banksia) as an upper stratum and a shrub and ground layer of *Imperata cylindrica* (Blady Grass), *Melaleuca thymifolia* (Thyme Honey-myrtle), *Acacia filicifolia* (Fern-leaved Wattle) and *Pteridium esculentum* (Bracken). Small drainage lines within the community can alter the abundance of certain species.	**Low** Floristic composition commensurate to this EEC was not identified on site during previous Flora assessment (RPS 2005, ECOVISION Consulting 2009; Wildthing Environmental Consultants 2009 and Orbit Planning 2008)
Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions	This EEC typically is a woodland dominated by species such as *Euclyptus crebra* (Narrow-leaved Ironbark), *E. moluccana* (Grey Box) and *Brachychiton populneus* subsp. *populneus* (Kurrajong). *Angophora floribunda* (Rough-barked Apple) and *Callitris endlicheri* (Black Cypress Pine) may be present being co-dominant or dominant. Common shrub species include *Bursaria spinoas* subsp. *spinosa* (Blackthorn) *Cassinia quinquefaria* (Cough Bush), *Breynia oblongifolia* (Coffee Bush), *Notelaea nicrocarpa var. macrocarpa* (Native Olive) and *Dodonaea viscosa* (Hop Bush). Ground covers commonly found include *Cymbopogon refractus* (Barbed Wire Grass), *Aristida ramose* (Three-awned Wire Grass), *Dichondra repens* (Kidney Weed) and *Lomandra muiltflora subsp. multiflora* (Mat-rush), *Chrysocephalum apiculatum* (Common Everlasting) and *Glycine tabacina* (Variable Glycine).	**Low** Floristic composition commensurate to this EEC was not identified on site during previous Flora assessment (RPS 2005, ECOVISION Consulting 2009; Wildthing Environmental Consultants 2009 and Orbit Planning 2008).

3.4.2 Key Threatening Processes

A key threatening process (KTP) is defined in the TSC Act as a process that threatens, or could threaten the survival or evolutionary development of species, population or ecological communities. A process is considered threatening if it:

- *Adversely affects two or more threatened species, populations or ecological communities; or*
- *Could cause species, populations or ecological communities that are not currently threatened to become threatened.*

KTP's are listed in Schedule 3 of the TSC Act. Six KTP's have the potential to affect the site as a consequence of the proposal, namely:

- Clearing of Native Vegetation;
- Predation by Feral Cats;
- Human Caused Climate Change;
- Invasion of native plant communities by exotic perennial grasses;
- Removal of dead wood and dead trees; and
- Loss of hollow-bearing trees.
- Invasion, Establishment and Spread of Lantana

Clearing of Native Vegetation

The proposed development will require the removal of native vegetation and as such could contribute to the KTP "Clearing of Native Vegetation". The development proposal occurs largely within areas previously cleared for agricultural purposes. Some accumulative effects of clearing native vegetation is likely, however this KTP is not believed to be of significance to the threatened species addressed due to the minimal amount of vegetation to be removed and the close proximity similar habitat adjoining the area.

Predation by Feral Cats

The proposal is likely to contribute to the KTP "Predation by the Feral Cat" as a result of residential development. This may lead to increased predation upon native species, in particular threatened bird species identified on site. To counter such as possibility, it is recommended that cat ownership only be permitted if it can be demonstrated that appropriate containment of the animal can be achieved, particularly at night.

Human Caused Climate Change

The proposal is likely to contribute to the KTP "Human Caused Climate Change" as a result of clearing vegetation. The proposal is considered to have only a small cumulative contribution of this KTP due to the small amount of native vegetation to be removed.

Invasion of native plant communities by exotic perennial grasses

The proposal is likely to contribute to the KTP "Invasion of native plant communities by exotic perennial grasses" as a result of understorey removal and the creation of expanses of bear soil. The extent to which the proposal can be expected to contribute to this process is considered insignificant if weed control measures are implemented to minimise the spread of weeds within the site.

Removal of Dead Wood and Dead Trees

The proposed development will require the removal of ground debris and as such could contribute to the Key Threatening Process "Removal of Dead Wood and Dead Trees". Due to the use of dead wood debris on the ground for foraging, removal has the potential to impact any local population of dependant species. Therefore, retention of dead standing trees, trees with hollows and fallen wood debris wherever possible would aid to mitigate any impact.

Removal of Hollow Bearing Trees

The proposed development will require the removal of some hollow-bearing trees and as such will contribute to the KTP "Removal of Hollow-bearing Trees". Due to the use of hollow-bearing trees by threatened fauna, particularly arboreal fauna, birds and microchiropteran bats, removal of these resources has the potential to impact any local population of dependant species. The retention of hollow-bearing trees would aid to mitigate potential impacts of this KTP.

Invasion, Establishment and Spread of Lantana

The proposal is likely to contribute to the Key Threatening Process "Invasion, establishment and spread of *Lantana camara* (Lantana)". The clearance of native vegetation for the residential development will create bare soil which is vulnerable to weed invasion. Provided great care is taken when clearing commences, so as to not allow the spread of Lantana, on the existing site or on surrounding sites, the opportunities for weed invasion will be minimised as a result of the proposal.

3.4.3 Other Considerations under EPBC Act

Considerations have been made under the Commonwealth *EPBC Act (1999*). An EPBC Act Protected Matters Search was undertaken within the Department of the Environment, Water, Heritage and the Arts (DEWHA 2010) on-line database to generate a list of those matters of National Environmental Significance (NES) from the area, which may have the potential to occur within the site. This data, combined with other local knowledge and records, was utilised to assess whether the type of activity proposed on the site will have, or is likely to have a significant impact upon a matter of (NES), or on the environment of Commonwealth land*.

* The site is not land owned by the Commonwealth, and hence this portion of the Act is not applicable. The matters of NES and site-specific responses are listed below.

- **World Heritage areas:**

The site is not a World Heritage area, and is not in close proximity to any such area.

- **Wetlands protected by international treaty (the RAMSAR convention):**

The site is not part of any RAMSAR Wetland area, and is not in close proximity to any such area.

- **Nationally listed threatened species and ecological communities:**

A total of 16 nationally listed threatened species under the *EPBC Act (1999)* were listed as being relevant within the proximate region of the site (See Section 3.1).

- *Eucalyptus glaucina* Slaty Red Gum
- *Cryptostylis hunteriana* Leafless Tongue-orchid
- *Prasophyllum* sp. *Wybong* *(C.Phelps ORG 5268)*
- *Lathamus discolour* Swift Parrot
- *Hoplocephalus bungaroides* Broad-headed Snake
- *Rostratula australis* Australian Painted Snipe
- *Anthochaera phrygia* Regent Honeyeater
- *Litoria aurea* Green and Golden Bell Frog
- *Litoria booroolongensis* Booroolong Frog
- *Mixophyes balbus* Stuttering Frog
- *Mixophyes iteratus* Giant Barred Frog
- *Dasyurus maculatus maculatus* Spotted-tailed Quoll
- *Petrogale pencillata* Brush-tailed Rock Wallaby
- *Pseudomys oralis* Hastings River Mouse
- *Pteropus poliocephalus* Grey-headed Flying-fox
- *Chalinolobus dwyeri* Large-eared Pied Bat

A total of 12 Nationally listed migratory species were identified from DEWHA search (2009):

- *Ardea modesta* Eastern Great Egret
- *Anthochaera Phrygia* Regent Honeyeater
- *Ardea ibis* Cattle Egret
- *Haliaeetus leucogaster* White-bellied Sea Eagle
- *Rostratula australis* Australian Painted Snipe
- *Apus pacificus* Fork-tailed Swift
- *Hirundapus caudactus* White-throated Needletail
- *Merops ornatus* Rainbow Bee-eater
- *Anthochaera Phrygia* Regent Honeyeater

- *Monarcha melanopsis* Black-faced Monarch
- *Myiagra cyanoleuca* Satin Flycatcher
- *Rhipidura ruffifrons* Rufous Fantail

It is considered that the proposal is not likely to cause any significant impact to those migratory species potentially occurring in the vicinity of the site.

- **All nuclear actions:**

No type of nuclear activity is proposed for the site.

- **Commonwealth marine areas:**

The proposed activity on the site will not have a significantly adverse effect on any Commonwealth marine area.

3.4.4 Considerations under SEPP 44 – Koala Habitat Protection

Schedule 2 of *State Environmental Planning Policy* (SEPP) No. 44 – 'Koala Habitat Protection', lists 10 tree species that are considered indicators of 'Potential Koala Habitat'. The presence of any of the species listed on a site proposed for development triggers the requirement for an assessment for 'Potential Koala Habitat'.

SEPP 44 defines potential Koala Habitat as:

> *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component".*

SEPP 44 defines core Koala habitat as:

> *"an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population".*

To determine if this site is "Potential Koala Habitat" or "Core Koala Habitat" a site assessment with identification of all canopy trees was conducted. It was found that the site contained a Schedule 2 feed tree species *Eucalyptus tereticornis* (Forest Red Gum). This tree species did not constitute 15% of the total number of trees in the canopy. No previous records or attribute evidence of resident populations was found on site. Therefore the site did not represent 'potential' or 'core' Koala habitat.

4.0 ECOLOGICAL CONSTRAINTS AND OPPORTUNITIES

A discussion of the potential ecological constraints and opportunities for development is given below. Figure 4-1 has incorporated potential constraints into an ecological constraints map, based on field and desktop assessments.

4.1 Endangered Ecological Communities

One Endangered Ecological Communities (EECs) listed under the TSC Act 1995 occurred within the site, being Central Hunter Ironbark Spotted Gum Grey Box Forest in the NSW North Coast and Sydney Basin Bioregion. This community occurs predominately along the site boundary and within drainage line throughout the site. Fragmented remnants occur in patchy distribution throughout the site. The forest on site is generally of an immature age class, particularly in the western sector of the site, however some mature species remain within drainage areas and scattered throughout cleared areas of the site. Although previous clearing and under-scrubbing practises have severally depleted structural and floristic complexity, reducing its ecological function, recovery potential of vegetation exists within this community.

Where possible, the project should aim to retain or minimise the amount of EEC to be removed during the concept design and detailed design phases and this should be demonstrated to authorities. However, future development could potentially result in the removal of some EEC. It is likely that any proposal resulting in vegetation removal will be required to meet 'the improve or maintain policy' of DECCW. Furthermore the DECCW is likely to require a formal mechanism be implemented to protect retained vegetation on site. Such mechanisms include:

- User restrictions on title
- Positive environmental covenants
- Potentially a Voluntary Conservation Agreement (VCA)

The final details of the abovementioned will be derived via direct negotiation with the DECCW.

4.2 Threatened Species

No regionally significant or threatened flora species or populations listed under the TSC Act 1995 and/or EPBC Act 1999 were detected within the site during targeted surveys.

Eight threatened fauna species listed under the TSC Act 1995 and/or EPBC Act 1999 have been recorded on site or treated as subject species due to past records/or fieldwork undertaken as part of earlier assessments in the locality:

- *Pomatostomus temporalis temporalis* Grey-crowned Babbler
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Petaurus norfolcensis* Squirrel Glider
- *Miniopterus schreibersii* Eastern Bentwing-Bat
- *Mormopterus norfolkensis* Eastern Freetail-Bat
- *Myotis adversus* Large-footed Myotis
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Scoteanax rueppellii* Greater Broad-nosed Bat

A further four threatened fauna species were considered to have a moderate or high chance of occurring on site which would represent varying degrees of constraint should they occur on site, being

- *Dasyurus maculatus* Spotted-tailed Quoll
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Nyctophilus timoriensis* Greater Long-eared Bat
- *Pteropus poliocephalus* Grey-headed Flying Fox

Although similar habitat does exist adjoining the area, removal of forest vegetation, particularly mature hollow bearing tress, would impact these species. Where possible, the project should aim to minimise the removal of this vegetation community and retain mature hollow bearing tree as much as possible during the concept and detailed design phases of potential development to reduce any direct impact on this species.

4.3 Riparian Areas

Riparian corridors will need to be considered in terms of the Water Management Act 2000. This Act will apply when any development is proposed within a distance of 40m from a river, lake or estuary. The drainage lines which are present within the site are first and second order streams which are defined as channels which water flows intermittently or permanently. A Core Riparian Zone (CRZ) of 10 metres is required for first order streams and 20m for second order streams. In addition to a CRZ and vegetation buffer (VB) is required with the usual recommended width is 10 metres. Any Asset Protection Zones (APZ) for bushfire protection and secondary uses (Roads, Public Open Space etc) is to be located outside both the CRZ and the VB. These widths are recommendations and will require consultation with the proponent and the NSW Office of Water (NOW) to gain approval for any proposed development.

In conclusion a buffer of 20-30 metres may be required from the top of the bank for any riparian corridors which are present within the subject site, depending on order class of the stream. These corridors have been incorporated in the constraints map (Figure 4-1). A vegetation management plan (VMP) maybe required which outlines the establishment and management of a riparian corridor and to be submitted to the NOW.

4.4 Habitat Connectivity

Open forest/woodland communities provide habitat for a number of terrestrial and arboreal of fauna guilds. Forested areas of the site can be considered important habitat connection for proximate areas of similar habitat that occurs to the west, north, east and southeast of the site. The creeklines, in particular provides possible biodiversity linkages to remnant forest habitat within these areas. Where possible, the project should aim to minimise the removal open forest/woodland communities, particularly remnant riparian vegetative corridors and retain mature hollow bearing tree as much as possible during the concept and detailed design phases of potential development to maintain biodiversity linkages within the area. Refer to Figure 3-2: Local Connectivity.

4.5 Constraints Conclusions

Key potential constraints to rezoning development include:

- Removal of Central Hunter Ironbark Spotted Gum Grey Box Forest EEC as listed under the TSC Act 1995, identified on the site;

- Removal of hollow-bearing trees which represent potential breeding habitat for a number of threatened hollow-dependent fauna species such as *Petaurus norfolcensis* (Squirrel Glider), *Phascogale tapoatafa* (Brush-tailed Phascogale), *Mormopterus norfolkensis* (Eastern Freetail Bat), *Scoteanax rueppelli* (Greater Broad-nosed Bat), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat) and *Falsistrellus tasmaniensis* (Eastern False Pipistrelle*) and Nyctophilus timoriensis* (Greater Long-eared Bat).

- Removal open forest/woodland areas and asscociated understorey and forest debris on site that currently provides habitat for the observed threatened species *Pomatostomus temporalis temporalis* (Grey-crowned Babbler).

- Removal of winter flowering canopy species that represent important foraging habitat for a number of threatened bird and mammal species;

- Removal of potential habitat for 12 threatened species that persist or have the moderate to high potential to occur within the subject site.

- Removal of open forest/woodland communities and mature hollow bearing trees, particularly within remnant riparian vegetative corridors, which provide habitat connectivity within the region.

- First and second order streams have been identified within the site which will require a Core Riparian Zone and Vegetation Buffer of 20m (1st order) and 30m (2nd order) from the top of the bank for each stream.

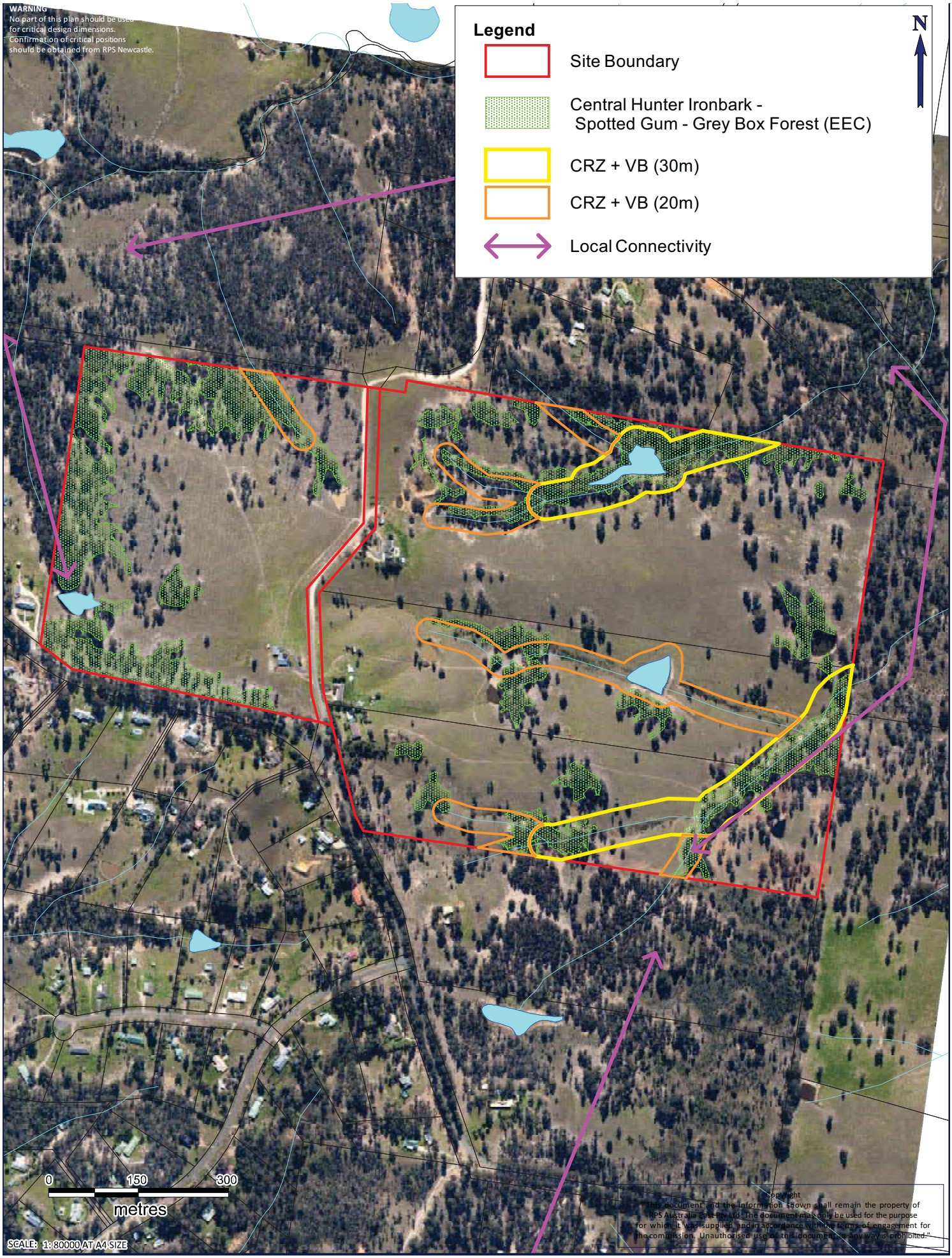

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FIG 4-1 CONSTRAINTS MAP A-

TITLE:	FIGURE 4-1: CONSTRAINTS MAP	LOCATION:	WATTLE PONDS	DATUM:	DATUM	DATE:	8/4/2010
				PROJECTION:	MGA ZONE 56 (GDA 94)	PURPOSE:	ECOLOGY ASSESSMENT

LAYOUT REF:
VERSION (PLAN BY): A (MD)

CLIENT: LONG GULLY INVESTMENTS
JOB REF: 26432

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RPS

5.0 SUMMARY AND RECOMMENDATIONS

The rezoning of the site from Zone 1(a) (Rural Zone) to Zone 1(d) (Rural Small Holdings) under the Singleton Local Environment Plan at the Wattle Ponds Investigation area is likely to reduce biodiversity. However, if the recommendations outline below are implemented the impacts can be reduced. These recommendations are as follows:-

- Retain where possible the Central Hunter Ironbark Spotted Gum Grey Box Forest EEC as listed under the TSC Act 1995 that occurs on site. The retention of the CHISGGBF within the site in a high condition will facilitate the conservation of biodiversity and protects areas of high conservation value. Future development should aim to retain or minimise the amount of EEC to be removed during the concept and detailed design phases and this should be demonstrated to authorities;

- Retain and regenerate remnant native vegetation should be considered. Particular emphasis should be placed on retaining and improving canopy connectivity across the site and understory complexity which could potentially occur along site boundaries and drainage lines. This would maintain and enhance the integrity of wildlife corridors and provide habitat for threatened species and a number of other native terrestrial and arboreal fauna guilds;

- Retain fallen timber, particularly within vegetative areas. Dead timber should be retained in situ or if dead wood is to be removed then it should be relocated to a suitable area outside development envelopes to enhance habitat for fauna species, in particular the threatened Grey-crown Babbler.

- Retain as many hollow bearing and mature trees as possible to provide habitat for hollow dependent species.

- Installation of artificial nestboxes to replace natural hollows removed as a result of future development should be considered;

- Implementation of weed control measures to minimise weed invasion such as *Lantana camara* (Lantana) and *Opuntia stricta* (Prickly Pear);

- Implementation of strict control measures on domestic pets, particularly cats, should be considered;

- Riparian corridors of 20m (1st order stream) and 30m (2nd order stream) to be incorporated along the Wattle Ponds Creek tributaries to protect riparian vegetation and water quality. These widths are recommendations and will require consultation with the proponent and the Department of Water and Energy to gain approval for any proposed development;

- Minimise potential impacts associated with erosion and sedimentation during construction through the inclusion of appropriate erosion and sediment controls;

- Any future landscaping should aim to utilise locally occurring native trees and shrubs to provide potential foraging resources for threatened species and other native species; and

- Consideration should also be given to providing future land holders with information on the native vegetation value associated with their property, its regional context, threatened species of the area and potential actions that could impact of native flora and fauna.

In conclusion it is considered that if the recommendations outlined above are incorporated into the proposal then it is unlikely to result in a significant impact upon any threatened species, populations or endangered ecological communities listed within the TSC Act 1995 and EPBC Act 1999. A development outcome that minimises the amount of remnant vegetation removal should be supported.

6.0 REFERENCES

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APPENDIX 1

Flora Species List

FAMILY	Common Name
Scientific Name	
CLASS FILICOPSIDA (FERNS)	
SCHIZACEAE	
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
DENNSTAEDTIACEAE	
Hypolepis muelleri	Harsh Ground fern
CLASS MAGNOLIOPSIDA (FLOWERING PLANTS)	
SUBCLASS MAGNOLIIDAE (Dicotyledons)	
APIACEAE	
Centella asiatica	
ASCLEPIADACEAE	
*Gomphocarpus fruiticosus	Narrow-leaf Cotton Bush
APOCYNACEAE	
Parsonsia straminea	Common Spikepod
ASTERACEAE	
Brachycome sp.	
Calotis lappulacea	Yellow blur Daisy
Calotis cuneifolia	Purple Burr Daisy
Cassinia arcuata	Sifton Bush/Chinese Shrub
Chrysocephalum apiculatum	Yellow Buttons
**Cirsium vulgare*	Spear Thistle
**Conyza bonariensis*	Flaxleaf Fleabane
Epaltes australis	
Euchiton involucratus	Star Cudweed
**Hypochoeris radicata*	Cat's Ear
**Senecio madagascariensis*	Fireweed
**Sonchus sp.*	
**Taraxacum officinale*	Dandelion
Veronia cinerea var. *cinerea*	
Vittadina cuneata	Fuzzweed
CACTACEAE	
**Opuntia aurantiaca*	Tiger Pear
**Opuntia stricta*	Prickly Pear
CAMPANULACEAE	
Wahlenbergia gracilis	Native Bluebell
CASUARINACEAE	
Allocasuarina luehmannii	Bull-oak
Casuarina glauca	Swamp She-oak
Casuarina cuninghamiana	River She-oak

CHENOPODIACEAE	
Einadia nutans	Climbing Saltbush
Enchylaena tomentosa	Ruby Saltbush
CONVOLVULACEAE	
Dichondra repens	Kidney Weed
DILLENIACEAE	
Hibbertia linearis	
Hibbertia riparia	
Hibbertia sp.	
EPACRIDACEAE	
Lissanthe strigosa	Native Cranberry
Leucopogon ericoides	Bearded Heath
Melichrus urceolatus	Urn-heath
EUPHORBIACEAE	
Breynia oblongifolia	Coffee Bush
Phyllanthus gasstroemii	Spurge
ss	
FABOIDEAE	
Daviesia ulicifolia	Gorse Bitter-pea
Glycine clandestina	Love Creeper
Glycine tabacina	Love Creeper
Hardenbergia violacea	False Sarsaparilla
Pultenaea cunninghamii	
Pultenaea microphylla	
Zornia microphylla	Zornia
GENTIANACEAE	
Centaurium tenuiflorum	
GOODENIACEAE	
Goodenia hederacea	Violet-leaved Goodenia
LOBELIACEAE	
Pratia purpurascens	White Root
LORANTHACEAE	
Dendropthoe vitellina	Mistletoe
Amyema pendulum	Mistletoe
MALVACEAE	
**Sida rhombifolia*	Paddy's Lucerne
MELIACEAE	
Melia azedarach var. *australasica*	White Cedar
MIMOSOIDEAE	

Acacia falcata	Falcate Wattle
Acacia parvipinnula	Silver-stemmed Wattle
MYOPORACEAE	
Eremophila debilis	Winter Apple
Myoporum montanum	Western Boobialla
MYRTACEAE	
Corymbia maculata	Spotted Gum
Eucalyptus crebra	Narrow-leaved Ironbark
Eucalyptus fibrosa ssp. *fibrosa*	Broad-leaved Ironbark
Eucalyptus moluccana	Grey Box
Eucalyptus tereticornis	Forest Red Gum
OLEACEAE	
Olea europaea	Common olive
ONAGRACEAE	
Ludwigia peploides ssp. *montevidensis*	Water Primrose
OXALIDACEAE	
Oxalis radicosa	
PITTOSPORACEAE	
Bursaria spinosa	Blackthorn
PLANTAGINACEAE	
**Plantago lanceolata*	Lamb's Tongues
RANUNCULACEAE	
Clematis glycinoides	Forest Clematis
RUBIACEAE	
Pomax umbellata	Pomax
SANTALACEAE	
Cheilanthes seiberi	Rock Fern, Mulga fern
Exocarpus cupressiformis	Native Cherry
SOLANACEAE	
**Lycium ferocissimum*	African Boxthorn
Solanum prinophyllum	Forest Nightshade
VERBENACEAE	
**Lantana camara*	Lantana
**Verbena rigida*	Veined Verbena
VIOLACEAE	
Viola hederacea	Native Violet
VITACEAE	

Cayratia clematidea	Slender Grape
SUBCLASS LILIIDAE (Monocotyledons)	
CYPERACEAE	
Fimbristylis dichotoma	Old Mate
Schoenoplectus mucronatus	
JUNCACEAE	
Juncus acutus	Sharp Rush
Juncus planifolius	Broad-leaf Rush
Juncus usitatus	Common Rush
LOMANDRACEAE	
Lomandra longifolia	Spiny Mat Rush
Lomandra multiflora	
LUZURIAGACEAE	
Eustrephus latifolius	Wombat Berry
PHORMIACEAE	
Dianella longifolia var. *longifolia*	
POACEAE	
Aristida ramosa	Three-awn Speargrass
Botriochloa dicpiens	Red Leg Grass
Cynodon dactylon	Common Couch
Cymbopogon refractus	Barbed-wire Grass
Danthonia linkii	Wallaby Grass
Entolasia stricta	Wiry Panic
Eragrostis brownii	Brown's Love Grass
Imperata cylindrica var. *major*	Blady Grass
Oplismenus aemulus	Basket Grass
Sporobolus creber	Slender Rats Tail
Stipa scabra	Rough Spear Grass
Themeda australis	Kangaroo Grass

APPENDIX 2

Expected Fauna Species List

Known and Expected Bird List

Appendix Key: ✓ = Species Detected
= introduced species
(C) = listed as CAMBA species
(J) = listed as JAMBA species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(EV) = Species listed under the Commonwealth EPBC Act as Vulnerable
(EE) = Species listed under the Commonwealth EPBC Act as Endangered
(EM) = Species listed under the Commonwealth EPBC Act as Migratory
Species indicated in **BOLD** font are those threatened species known from within 10km of site (NPWS, 2010)

Family Name	*Scientific Name*	Common Name	Recorded
Casuariidae (Emu)	*Dromaius novaehollandiae*	Emu	
Megapodiidae (Mound Builders)	*Alectura lathami*	Australian Brush-turkey	
Phasianidae (True Quails, Pheasants and Fowls)	*Coturnix pectoralis*	Stubble Quail	
	Coturnix ypsilophora	Brown Quail	
Anseranatidae (Magpie Goose)	***Anseranas semipalmata***	**Magpie Goose (V)**	
Anatidae (Swans, Geese and Ducks)	*Anas castanea*	Chestnut Teal (EM)	
	Anas gracilis	Grey Teal (EM)	
	Anas platyrhynchos	*Mallard	
	Anas superciliosa	Pacific Black Duck (EM)	
	Aytha australis	Hardhead (EM)	
	Chenonetta jubata	Australian Wood Duck (EM)	✓
	Cygnus atratus	Black Swan (EM)	
	Oxyura australis	**Blue-billed Duck (V, EM)**	
	Stictonetta naevosa	**Freckled Duck (V, EM)**	
Podicipedidae (Grebes)	*Tachybaptus novaehollandiae*	Australasian Grebe	
	Podiceps cristatus	Great Crested Grebe	
Anhingidae (Darters)	*Anhinga melanogaster*	Darter	
Phalacrocoracidae (Cormorants)	*Phalacrocorax carbo*	Great Cormorant	
	Phalacrocorax melanoleucos	Little Pied Cormorant	
	Phalacrocorax sulcirostris	Little Black Cormorant	
	Phalacrocorax varius	Pied Cormorant	
Pelecanide (Pelicans)	*Pelecanus conspicillatus*	Australian Pelican	
Ardeidae (Herons, Bitterns and Egrets)	*Ardea alba*	Great Egret (C,J, EM)	
	Ardea ibis	Cattle Egret (C,J, EM)	
	Ardea intermedia	Intermediate Egret	
	Ardea pacifica	White-necked Heron	
	Botaurus poiciloptilus	**Australasian Bittern (V)**	
	Butorides striatus	Striated Heron	
	Egretta garzetta	Little Egret	
	Egretta novaehollandiae	White-faced Heron	
	Ixobrychus flavicollis	**Black Bittern (V)**	
	Nycticorax caledonicus	Nankeen Night Heron	

Threskiornithidae (Ibises and Spoonbills)	*Platalea flavipes*	Yellow-billed Spoonbill	
	Platalea regia	Royal Spoonbill	
	Threskiornis molucca	Australian White Ibis	
	Threskiornis spinicollis	Straw-necked Ibis	
Ciconiidae (Storks)	***Ephippiorhynchus asiaticus***	**Black-necked Stork (E)**	
Accipitridae (Hawks, Kites and Eagles)	*Accipiter fasciatus*	Brown Goshawk (EM)	
	Accipiter cirrhocephalus	Collared Sparrowhawk (EM)	
	Accipiter novaehollandiae	Grey Goshawk (EM)	
	Aquila audax	Wedge-tailed Eagle (EM)	
	Aviceda subcristata	Pacific Baza (EM)	
	Circus approximans	Swamp Harrier (EM)	
	Circus assimilis	Spotted Harrier (EM)	
	Elanus axillaris	Black-shouldered Kite (EM)	
	Haliaeetus leucogaster	White-bellied Sea-Eagle (C, EM)	
	Haliastur sphenurus	Whistling Kite (EM)	
	Hamirostra melanosternon	**Black-breasted Buzzard (V)**	
	Hieraaetus morphnoides	Little Eagle (EM)	
	Pandion haliaetus	**Osprey (V)**	
Falconidae (Falcons)	*Falco berigora*	Brown Falcon (EM)	
	Falco cenchroides	Nankeen Kestrel (EM)	
	Falco longipennis	Australian Hobby (EM)	
	Falco peregrinus	Peregrine Falcon (EM)	
	Falco subniger	Black Falcon	
Rallidae (Crakes, Rails and Gallinules)	*Fulica atra*	Eurasian Coot	
	Gallinula philippensis	Buff-banded Rail	
	Gallinula tenebrosa	Dusky Moorhen	
	Porphyrio porphyrio	Purple Swamphen	
	Porzana fluminea	Australian Spotted Crake	
	Porzana pusilla	Baillon's Crake	
	Porzana tabuensis	Spotless Crake	
	Rallus pectoralis	Lewin's Rail	
Turnicidae (Button-Quails)	*Turnix varia*	Painted Button-quail	
Rostratulidae (Painted Snipe)	***Rostratula benghalensis***	**Painted Snipe (EM, V)**	
Jacanidae (Jacanas))	***Irediparra gallinacea***	**Comb-crested Jacana (V)**	
Burhinidae (Stone-curlews))	***Burhinus grallarius***	**Bush Stone-curlew (E)**	
Charadriidae (Lapwings, Plovers and Dottrels)	***Charadrius mongolus***	**Lesser Sand Plover (EM) (V)**	
	Vanellus miles	Masked Lapwing (EM)	✓
Haematopodidae (Oystercatchers)	***Haematopus longirostris***	**Pied Oystercatcher (V)**	
	Erythrogonys cinctus	Red-kneed Dotterel (EM)	
	Elseyornis melanops	Black-fronted Dotterel (EM)	
Columbidae (Pigeons and Doves)	*Columba livia*	Rock Dove #	
	Chalcophaps indica	Emerald Dove	
	Columba leucomela	White-headed Pigeon	
	Geopelia humeralis	Bar-shouldered Dove	
	Geopelia striata	Peaceful Dove	✓

	Leucosarcia melanoleuca	Wonga Pigeon	
	Macropygia amboinensis	Brown Cuckoo-Dove	
	Ocyphaps lophotes	Crested Pigeon	✓
	Phaps chalcoptera	Common Bronzewing	
	Phaps elegans	Brush Bronzewing	
	Ptilinopus magnificus	**Wompoo Fruit-dove (V)**	
	Streptopelia chinensis	Spotted Turtle-Dove #	✓
Cacatuidae (Cockatoos)	*Calyptrohynchus funereus*	Yellow-tailed Black-Cockatoo	
	Calyptorhynchus lathami	**Glossy Black-Cockatoo (V)**	
	Cacatua roseicapilla	Galah	✓
	Cacatua tenuirostris	Long-billed Corella	
	Cacatua sanguinea	Little Corella	
	Cacatua galerita	Sulphur-crested Cockatoo	✓
	Callocephalon fimbriatum	Gang-gang Cockatoo	
Psittacidae (Parrots)	*Alisterus scapularis*	Australian King Parrot	
	Glassopsitta pusilla	**Little Lorikeet (V)**	
	Lathamus discolor	**Swift Parrot (E, EE)**	
	Neophema pulchella	**Turquoise Parrot (V)**	
	Platycercus elegans	Crimson Rosella	
	Platycercus eximius	Eastern Rosella	✓
	Psephotus haematonotus	Red-rumped Parrot	
	Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	
	Trichoglossus concina	Musk Lorikeet	
	Trichoglossus haematodus	Rainbow Lorikeet	
Cuculidae (Old World Cuckoos)	*Cuculus saturatus*	Oriental Cuckoo (C,J, EM)	
	Cacomantis flabelliformis	Fan-tailed Cuckoo	
	Cacomantis variolosus	Brush Cuckoo	
	Chrysococcyx basalis	Horsfield's Bronze-Cuckoo	
	Chrysococcyx lucidus	Shining Bronze-Cuckoo	
	Cuculus pallidus	Pallid Cuckoo	
	Eudynamys scolopacea	Common Koel	
	Scythrops novaehollandiae	Channel-billed Cuckoo	
Centropodidae (Coucals)	*Centropus phasianinus*	Pheasant Coucal	
Strigidae (Hawk Owls)	***Ninox strenua***	**Powerful Owl (V)**	
	Ninox connivens	**Barking Owl (V)**	
	Ninox boobook	Southern Boobook	
Tytonidae (Barn Owls)	*Tyto alba*	Barn Owl	✓
	Tyto capensis	**Grass Owl (V)**	
	Tyto novaehollandiae	**Masked Owl (V)**	
Podargidae (Frogmouths)	*Podargus strigoides*	Tawny Frogmouth	
Caprimulgidae (Nightjars)	*Eurostopodus mystacalis*	White-throated Nightjar	
Aegothelidae (Owlet-nightjars)	*Aegotheles cristatus*	Australian Owlet-nightjar	
Apodidae (Typical Swifts)	*Hirundapus caudacutus*	White-throated Needletail (C,J, EM)	✓
	Apus pacificus	Fork-tailed Swift (C,J, EM)	
Alcedinidae (True Kingfishers)	*Alcedo azurea*	Azure Kingfisher	
Halcyonidae (Kingfishers and Kookaburras)	*Dacelo novaeguineae*	Laughing Kookaburra	✓
	Todiramphus sanctus	Sacred Kingfisher	✓

	Todiramphus macleayii	Forest Kingfisher	
Meropidae (Bee-eaters)	*Merops ornatus*	Rainbow Bee-eater (J,EM)	
Coraciidae (Typical Rollers)	*Eurystomus orientalis*	Dollarbird	
Menuridae (Lyrebirds)	*Menura novaehollandiae*	Superb Lyrebird	
Climacteridae (Australo-Papuan Treecreepers)	*Cormobates leucophaeus*	White-throated Treecreeper	✓
	Climacteris picumnus	**Brown Treecreeper (V)**	
Maluridae (Fairy-Wrens and Emu-Wrens)	*Malurus cyaneus*	Superb Fairy-wren	✓
	Malurus lamberti	Variegated Fairy-wren	
	Stipiturus malachurus	Southern Emu-wren	
Pardalotidae (Pardalotes, Scrubwrens, Thornbills)	*Pardalotus punctatus*	Spotted Pardalote	✓
	Paradalotus striatus	Striated Pardalote	✓
	Sericornis frontalis	White-browed Scrubwren	
	Chthonicola sagittata	**Speckled Warbler (V)**	
	Gerygone mouki	Brown Gerygone	
	Gerygone olivacea	White-throated Gerygone	✓
	Acanthiza pusilla	Brown Thornbill	✓
	Acanthiza reguloides	Buff-rumped Thornbill	
	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	✓
	Acanthiza nana	Yellow Thornbill	
	Acanthiza lineata	Striated Thornbill	
	Hylacola pyrrhopygia	Chestnut-rumped Heathwren	
Meliphagidae (Honeyeaters)	*Anthochaera carunculata*	Red Wattlebird	
	Plectrhyncha lanceolata	Striped Honeyeater	
	Anthochaera chrysoptera	Brush Wattlebird	
	Philemon corniculatus	Noisy Friarbird	✓
	Philemon citerogularis	Little Friarbird	
	Xanthomyza phrygia	**Regent Honeyeater (E, EE, EM)**	
	Manorina melanophrys	Bell Miner	
	Manorina melanocephala	Noisy Miner	✓
	Meliphaga lewinii	Lewin's Honeyeater	
	Lichenostomus chrysops	Yellow-faced Honeyeater	✓
	Lichenostomus melanops	Yellow-tufted Honeyeater	
	Lichenostomus fuscus	Fuscous Honeyeater	
	Lichenostomus penicillatus	White-plumed Honeyeater	
	Melithreptus brevirostris	Brown-headed Honeyeater	
	Melithreptus lunatus	White-naped Honeyeater	
	Melithreptus gularis	**Black-chinned Honeyeater (V)**	
	Entomyzon cyanotis	Blue-faced Honeyeater	
	Lichmera indistincta	Brown Honeyeater	
	Phylidonyris novaehollandiae	New Holland Honeyeater	
	Phylidonyris nigra	White-cheeked Honeyeater	
	Acanthorhynchus tenuirostris	Eastern Spinebill	✓
	Myzomela sanguinolenta	Scarlet Honeyeater	
	Epthianura albifrons	White-fronted Chat	
Eopsaltriidae (Robins)	*Microeca fascinans*	Jacky Winter	
	Petroica multicolor	**Scarlet Robin (V)**	
	Petroica phoenicea	**Flame Robin (V)**	
	Petroica rosea	Rose Robin	
	Eopsaltria australis	Eastern Yellow Robin	

	Melanodryas cucullata	**Hooded Robin (V)**	
Pomatostomidae (Australo-Papuan Babblers)	***Pomatostomus temporalis***	**Grey-crowned Babbler (V)**	✓
Cinclosomidae (Quail-thrushes and allies)	*Psophodes olivaceus*	Eastern Whipbird	
	Cinclosoma punctatum	Spotted Quail-thrush	
Neosittidae (Sittellas)	*Daphoenositta chrysoptera*	Varied Sittella	
Pachycephalidae (Whistlers, Shrike-tit, Shrike-thrushes)	*Falcunculus frontatus*	Crested Shrike-tit	
	Pachycephala pectoralis	Golden Whistler	
	Pachycephala rufiventris	Rufous Whistler	✓
	Colluricincla harmonica	Grey Shrike-thrush	
Dicruridae (Monarchs, Fantails and Drongo)	*Monarcha melanopsis*	Black-faced Monarch	
	Myiagra cyanoleuca	Satin Flycatcher	
	Myiagra rubecula	Leaden Flycatcher	
	Myiagra inquieta	Restless Flycatcher	
	Grallina cyanoleuca	Magpie-lark	✓
	Rhipidura rufifrons	Rufous Fantail	
	Rhipidura fuliginosa	Grey Fantail	✓
	Rhipidura leucophyrs	Willie Wagtail	✓
	Dicrurus bracteatus	Spangled Drongo	
Campephagidae (Cuckoo-shrikes and Trillers)	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	✓
	Coracina papuensis	White-bellied Cuckoo-shrike	
	Coracina tenuirostris	Cicadabird (EM)	
	Lalage sueurii	White-winged Triller	
Oriolidae (Orioles and Figbird)	*Oriolus sagittatus*	Olive-backed Oriole	
	Sphecotheres viridis	Figbird	
Artamidae (Woodswallows, Butcherbirds,Currawongs)	*Artamus leucorynchus*	White-breasted Woodswallow	
	Artamus cyanopterus	Dusky Woodswallow	
	Cracticus torquatus	Grey Butcherbird	
	Cracticus nigrogularis	Pied Butcherbird	✓
	Gymnorhina tibicen	Australian Magpie	✓
	Strepera graculina	Pied Currawong	
Corvidae (Crows and allies)	*Corvus coronoides*	Australian Raven	✓
Cororacidae (Mud-nesters)	*Corcorax melanorhamphos*	White-winged Chough	✓
Ptilinorhynchidae (Bowerbirds)	*Ptilonorhynchus violaceus*	Satin Bowerbird	
Motacillidae (Old World Wagtails,Pipits)	*Anthus novaeseelandiae*	Richard's Pipit	
Passeridae (Sparrows, Weaverbirds, Waxbills)	*Passer domesticus*	House Sparrow #	
	Taeniopygia guttata	Zebra Finch	
	Taeniopygia bichenovii	Double-barred Finch	
	Neochmia temporalis	Red-browed Finch	
	Lonchura castaneothorax	Chestnut-breasted Mannikin	
Dicaeidae (Flowerpeckers)	*Dicaeum hirundinaceum*	Mistletoebird	

Hirundinidae (Swallows and Martins)	*Hirundo neoxena*	Welcome Swallow	✓
	Hirundo nigricans	Tree Martin	✓
	Hirundo ariel	Fairy Martin	
Sylviidae (Old World Warblers)	*Acrocephalus stentoreus*	Clamorous Reed Warbler	
	Cincloramphus mathewsi	Rufous Songlark	
	Cisticola exilis	Golden-headed Cisticola	
	Megalurus gramineus	Little Grassbird	
	Megalurus timorensis	Tawny Grassbird	
Zosteropidae (White-eyes)	*Zosterops lateralis*	Silvereye	
Muscicapidae (Thrushes)	*Zoothera lunulata*	Bassian Thrush	
	Zoothera heinei	Russet-tailed Thrush	
Sturnidae (Starlings and allies)	*Sturnus vulgaris*	Common Starling #	
	Acridotheres tristis	Common Myna #	

Known and Expected Mammal List

Appendix Key: ✓ = Species Detected
= introduced species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(EV) = Species listed under the Commonwealth EPBC Act as Vulnerable
(EE) = Species listed under the Commonwealth EPBC Act as Endangered
Species indicated in **BOLD** font are those threatened species known from within 10km of site (NPWS, 2010)

Family Name	*Scientific Name*	Common Name	Recorded
Tachyglossidae (Echidnas)	*Tachyglossus aculeatus*	Short-beaked Echidna	
Family Ornithorhynchidae (Platypus)	*Ornythorhynchus anatinus*	Platypus	
Dasyuridae (Dasyurids)	*Antechinus flavipes*	Yellow-footed Antechinus	
	Antechinus stuartii	Brown Antechinus	
	Antechinus swainsonii	Dusky Antechinus	
	Dasyurus maculatus	**Tiger Quoll (V) (EV)**	
	Phascogale tapoatafa	**Brush-tailed Phascogale (V)**	✓
	Planigale maculata	**Common Planigale (V)**	
	Sminthopsis murina	Common Dunnart	
Peramelidae (Bandicoots and Bilbies)	*Isoodon macrourus*	Northern Brown Bandicoot	
	Peremeles nasuta	Long-nosed Bandicoot	
Phascolarctidae (Koala)	***Phascolarctos cinereus***	**Koala (V)**	
Vombatidae (Wombats)	*Vombatus ursinus*	Common Wombat	
Petauridae (Wrist-winged Gliders)	*Petaurus breviceps*	Sugar Glider	
	Petaurus norfolcensis	**Squirrel Glider (V)**	✓
	Petaurus australis	**Yellow-bellied Glider (V)**	
Pseudocheiridae (Ringtail Possums, Greater Glider)	*Petauroides volans*	Greater Glider	
	Pseudocheirus peregrinus	Common Ringtail Possum	

Acrobatidae (Feathertail Glider)	*Acrobates pygmaeus*	Feathertail Glider	
Phalangeridae (Brushtail Possums and Cuscuses)	*Trichosurus vulpecula*	Common Brushtail Possum	✓
Potoroidae (Potoroos and Bettongs)	***Potorous tridactylus***	**Long-nosed Potoroo (V) (EV)**	
Macropodidae (Wallabies and Kangaroos)	*Macropus giganteus*	Eastern Grey Kangaroo	✓
	Macropus robustus	Common Wallaroo	
	Macropus rufogriseus	Red-necked Wallaby	✓
	Petrogale penicillata	**Brush-tailed Rock-Wallaby (E) (EV)**	
	Wallabia bicolor	Swamp Wallaby	
Pteropodidae (Flying-foxes, Blossom-bats)	***Pteropus poliocephalus***	**Grey-headed Flying-fox (V) (EV)**	
	Pteropus scapulatus	Little Red Flying-fox	
Rhinolophidae (Horseshoe-bats)	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	
Emballonuridae (Sheathtail-bats)	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtail-bat (V)**	✓
Molossidae (Freetail-bats)	***Mormopterus norfolkensis***	**East Coast Freetail-bat (V)**	✓
	Mormopterus sp.1	Little Freetail-bat	
	Mormopterus sp.2	Eastern Freetail-bat	
	Tadarida australis	White-striped Freetail-bat	
Vespertilionidae (Vespertilionid Bats)	***Miniopterus australis***	**Little Bentwing-bat (V)**	
	Miniopterus schreibersii	**Common Bentwing-bat (V)**	
	Nyctophilus geoffroyi	Lesser Long-eared Bat	
	Nyctophilus gouldii	Gould's Long-eared Bat	
	Chalinolobus dwyeri	**Large-eared Pied Bat (V) (EV)**	
	Chalinolobus gouldii	Gould's Wattled Bat	
	Chalinolobus morio	Chocolate Wattled Bat	
	Falsistrellus tasmaniensis	**Eastern Falsistrelle (V)**	
	Myotis adversus	**Large-footed Myotis (V)**	✓
	Scoteanax rueppellii	**Greater Broad-nosed Bat (V)**	✓
	Scotorepens greyii	Little Broad-nosed Bat	
	Scotorepens orion	Eastern Broad-nosed Bat	
	Vespadelus darlingtoni	Large Forest Bat	
	Vespadelus regulus	Southern Forest Bat	✓
	Vespadelus pumilus	Eastern Forest Bat	
	Vespadelus vulturnus	Little Forest Bat	
Muridae (Murids)	*Hydromys chrysogaster*	Water Rat	
	Melomys burtoni	Grassland Melomys	
	Mus musculus	House Mouse#	
	Pseudomys novaehollandiae	New Holland Mouse	
	Rattus fuscipes	Bush Rat	
	Rattus lutreolus	Swamp Rat	
	Rattus norvegicus	Brown Rat#	
	Rattus rattus	Black Rat#	
Canidae (Dogs)	*Canis familiaris*	Dog #	
	Canis familiaris dingo	Dingo	
	Vulpes vulpes	Red Fox#	
Felidae (Cats)	*Felis catus*	Feral Cat#	
Leporidae			

(Rabbit and Hare)	*Oryctolagus cuniculus*	European Rabbit#	
	Lepus capensis	Brown Hare#	
Equidae (Horse and Donkey)	*Equus caballus*	Horse#	
Suidae (Pigs)	*Sus scrofa*	Pig#	
Bovidae (Horned Ruminants)	*Bos taurus*	Cow#	
	Capra hircus	Goat#	
Cervidae (Deer)	*Cervus timorensis*	Rusa Deer #	

Known and Expected Reptile List

Appendix Key: ✓ = Species Detected
= introduced species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(EV) = Species listed under the Commonwealth EPBC Act as Vulnerable
(EE) = Species listed under the Commonwealth EPBC Act as Endangered
Species indicated in **BOLD** font are those threatened species known from within 10km of site (NPWS, 2010)

Family Name	*Scientific Name*	Common Name	Recorded
Cheloniidae (Turtles)	***Chelonis mydas***	**Green Turtle (V) (EV) (EM)**	
Chelidae (Tortoises)	*Chelodina longicollis*	Long-necked Tortoise	
Agamidae (Dragons)	*Amphibolurus muricatus*	Jacky Lizard	
	Amphibolurus nobbi	Nobbi	
	Physignathus lesuerii	Eastern Water Dragon	
	Pogona barbata	Eastern Bearded Dragon	✓
Pygopodidae (Legless Lizards)	*Lialis burtonis*	Burton's Snake Lizard	
	Pygopus lepidopus	Common Scaly-foot	
	Delma plebeia	Leaden Delma	
Gekkonidae (Geckoes)	*Diplodactylus vittatus*	Wood Gecko	
	Phyllurus platurus	Southern Leaf-tailed Gecko	
	Oedura lesueurii	Lesueur's Velvet Gecko	
	Underwoodisaurus milii	Thick-tailed Gecko	
Varanidae (Monitors)	*Varanus gouldii*	Gould's Monitor	
	Varanus varius	Lace Monitor	
Scincidae (Skinks)	*Carlia tetradactyla*		
	Cryptoblepharus virgatus		
	Ctenotus taeniolatus	Copper-tailed Skink	
	Ctenotus robustus	Striped Skink	
	Cyclodomorphus casuarinae	She-oak Skink	
	Egernia cunninghamii	Cunningham's Skink	
	Egernia major	Land Mullet	
	Egernia modesta		
	Egernia striolata	Tree-crevice Skink	
	Egernia saxatilis	Black Rock Skink	
	Egernia whitii	White's Skink	
	Eulamprus quoyii	Eastern Water Skink	
	Eulamprus tenuis		
	Lampropholis delicata	Grass Skink	
	Lampropholis guichenoti	Garden Skink	
	Lygisaurus foliorum	Tree-base Litter-skink	
	Morethia boulengeri	South-eastern Morethia	
	Pseudomoia platynota	Red-throated Skink	
	Saiphos equalis		
	Saproscincus mustelinus	Weasel Skink	
	Tiliqua scincoides	Eastern Blue-tongued Lizard	
Typhlopidae (Blind Snakes)	*Ramphotyphlops bituberculatus*	Prong-snouted Blind Snake	
	Ramphotyphlops weidii	Brown-snouted Blind Snake	
	Ramphotyphlops nigrescens	Black Blind Snake	

Family Name	*Scientific Name*	Common Name	Recorded
Boidae (Pythons)	*Morelia spilota*	Diamond Python	
Colubridae (Tree Snakes)	*Boiga irregularis*	Brown Tree Snake	
	Dendralaphis punctulata	Green Tree Snake	
Elapidae (Venomous Snakes)	*Furina diadema*	Red-naped Snake	
	Acanthopis antarcticus	Death Adder	
	Cacophis krefftii	Dwarf Crowned Snake	
	Cacophis squamulosus	Golden Crowned Snake	
	Demansia psammophis	Yellow-faced Whip Snake	
	Furina diadema	Red-naped Snake	
	Notechis scutatus	Eastern Tiger Snake	
	Pseudonaja textilis	Eastern Brown Snake	
	Rhinoplocephalus nigrescens	Eastern Small-eyed Snake	
	Vermicella annulata	Bandy Bandy	
	Hemiaspis signata	Black-bellied Swamp Snake	
	Pseudechis porphyriacus	Red-bellied Black Snake	

Known and Expected Frog List

Appendix Key: ✓ = Species Detected
= introduced species
(E) = listed as Endangered in NSW.
(V) = listed as Vulnerable in NSW.
(EV) = Species listed under the Commonwealth EPBC Act as Vulnerable
(EE) = Species listed under the Commonwealth EPBC Act as Endangered
Species indicated in **BOLD** font are those threatened species known from within 10km of site (NPWS, 2010)

Family Name	*Scientific Name*	Common Name	Recorded
Hylidae (Tree Frogs)	***Litoria aurea***	**Green and Golden Bell Frog (E, EV)**	
	Litoria caerulea	Green Tree Frog	
	Litoria dentata	Bleating Tree Frog	
	Litoria fallax	Eastern Dwarf Tree Frog	✓
	Litoria latopalmata	Broad-palmed Frog	
	Litoris nasuta	Rocket Frog	
	Litoria peronii	Peron's Tree Frog	
	Litoria tyleri	Tyler's Tree Frog	
	Litoria verreauxii	Verreaux's Frog	
Myobatrachidae (Ground Frogs)	*Adelotus brevis*	Tusked Frog	
	Crinia signifera	Common Eastern Froglet	
	Limnodynastes dumerilli	Eastern Banjo Frog	
	Limnodynastes ornatus	Ornate Burrowing Frog	
	Limnodynastes peronii	Striped Marsh Frog	
	Limnodynastes tasmaniensis	Spotted Grass Frog	
	Pseudophryne coriacea	Red-backed Toadlet	
	Pseudophryne bibronii	Brown Toadlet	
	Uperoleia fusca	Dusky Toadlet	
	Uperoleia laevigata	Smooth Toadlet	

APPENDIX 3

Personnel CV's

Curriculum Vitae

Name: Matthew Doherty

Office: RPS Harper Somers O'Sullivan

Position in Company: Environmental & GIS Manager

Qualifications / Memberships:

BLMC (Land & Water Conservation Major)
Bush Regeneration Cert II
Spikeless Tree Climbing Techniques
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority
Senior First Aid
Fire Protection Association Australia (FPAA)

Areas of Expertise:
Project Design and Management, Environmental Impact Assessment and reporting. Liaison and Mediation with Clients, Stakeholders and Governing Bodies, Archaeological (European / Aboriginal Heritage) coordination and negotiation, Expert GIS/GPS for Project Design and Mapping, Ecological Flora, Fauna & Habitat Surveys, Interpretation and Application of Legislation and Policy, Property Vegetation Assessment and Plans, Bushfire Planning, Assessment and Negotiation, Tree Climbing to install, monitor and maintain supplementary habitat (nest boxes).

Recent Experience Includes:
Matt has seven years experience in the environmental industry with key skills in project management, survey design, GIS and client relations. In his position as Environment & GIS Manager, Matt manages environment department including the day to day running of projects, verification of reports and other outputs and ensures clients are well informed of project progress and key findings. Matthew's background in local government, state government and private consultancy gives him a high level of appreciation of the environmental and consultancy sector, thus allowing him to take a pragmatic approach to providing successful conservation and development outcomes whilst meeting the aims and objectives of clients and determining authorities.

Matt has excellent communication, management, marketing and negotiation skills as developed over the course of his varied work experience spanning numerous disciplines. Coupled with a high level of efficiency, solid work ethic and genuine commitment to self improvement and development, Matt's contributions continue to provide an asset to his company, staff and clients.

Matt has project managed and/or participated in numerous large-scale land development, mining, energy and infrastructure projects including Queensland Hunter Gas Pipeline (850km); Hunter Gas Pipeline; Rio Tinto Lower Hunter Lands Project; GIS biodiversity, large scale vegetation, habitat and predicative modelling mapping works; wind farms and coordination of environmental monitoring programs for mines.

Curriculum Vitae

Name:	Susan Horrocks
Office:	RPS East Coast
Position in Company:	Graduate Ecologist
Qualifications / Memberships	B. Environmental Science Waterways Authority Boating Licence NSW Driver's Licence (Class C) OH&S Induction Training (Green Card)

Areas of Expertise:

- Conducting field surveys for flora, fauna and habitat identification
- Delineation and mapping of vegetation communities
- Geographical Information Systems (GIS) mapping
- Report preparation including fauna & flora assessments
- Ecological monitoring and reporting
- Nestbox installation & maintenance
- Understanding of environmental legislation

Recent Experience Includes:

Sue is a graduate ecologist with a range of ecological assessment reporting and ecological field experience. Experience within the consultancy industry has primarily included flora, fauna and habitat surveys and assessments, including targeted surveys for threatened flora and fauna species. Sue has a grounding in threatened species, populations and endangered ecological communities throughout NSW and has experience in GIS mapping to delineate and map vegetation communities.

Curriculum Vitae

Name: Steve Roderick

Office: RPS Harper Somers O'Sullivan

Position in Company: Ecologist

Qualifications / Memberships:
Butterfly and Other Inverebrates Club
Birds Australia
Hunter Bird Observers Club
NSW Drivers Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Ornithological Surveys and Research
- Terrestrial Flora and Fauna Surveys
- Flora and Fauna Assessment and Reporting
- GPS Surveys
- Site and Logistics Management

Recent Experience Includes:

Steve Roderick has extensive ornithological survey and research experience having been employed in the past as the Hunter Regent Honeyeater/Swift Parrot Survey Coordinator and in the Gould's Petrel Banding Program. Steve is an avid birdwatcher who enjoys competitive birdwatching in his free time.

Steve also have a certificate in Horticulture and has gained experience undertaking flora and fauna survey while employed with RPS HSO. Experience has included targeted threatened flora and endangered ecological community survey in NSW as well as fauna and ornithological survey in the NSW and Southern Queensland.

Attachment 3 – Urban Capability Assessments

GEOTECHNICAL ASSESSMENT OF URBAN CAPABILITY

LOT 120
DP752455

RETREAT ROAD, SINGLETON HEIGHTS

Prepared for

Hunter Development Brokerage Pty Ltd

On behalf of

Fame Cove One Pty Ltd

Prepared by

RCA AUSTRALIA

RCA ref: 3766-002/1

August 2004

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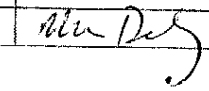
/1	Final	M Delaney	M Allman	M Delaney		03/08/04

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GENERAL SOIL DESCRIPTION SHEET
GENERAL ROCK DESCRIPTION SHEETS

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ON SITE EFFLUENT DISPOSAL PRELIMINARY NUTRIENT LOADING AND WATER BALANCE ASSESSMENT

RCA ref: 3766-002/1

3 August, 2004

Fame Cove One Pty Ltd,
C/o- Hunter Development Brokerage Pty Ltd,
PO Box 40,
MAITLAND NSW 2320

Attention: Mr Bryan Garland

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

Geotechnical Engineering
Engineering Geology
Hydrogeology
Environmental Audits
Contamination Assessment
Earthworks Testing
Materials Evaluation
Construction Quality Control

GEOTECHNICAL ASSESSMENT OF URBAN CAPABILITY PROPOSED SUBDIVISION LOT 120 RETREAT ROAD, SINGLETON HEIGHTS

1 INTRODUCTION

This report presents a geotechnical assessment of urban capability and on-site effluent disposal on Lot 120 (DP 752455) Retreat Road at Singleton Heights for Fame Cove One Pty Ltd.

Work was commissioned by Mr Bryan Garland of Hunter Development Brokerage Pty Ltd, who provided a 1:2500 contour plan of the site with a conceptual lot and internal road arrangement.

The site comprises rural land about 25Ha in size that is located at the north-east corner of Retreat Road and Long Gully Road at Singleton Heights.

It is understood that rural – residential subdivision of the site into 0.5Ha allotments is proposed and that geotechnical studies have been undertaken for the purpose of supporting a rezoning application and establishing a rural-residential layout design.

Key geotechnical issues that are addressed in the report are:

- Urban capability of the land in terms of slope stability, foundation support for structures and construction of roads.
- Suitability of the proposed development for on-site effluent disposal.

The level of investigation undertaken is considered appropriate for development application / rezoning purposes and to provide input for concept design and layout.

Once rezoning is approved it is expected that a more detailed investigation for subdivision pavements, site classification and allotment effluent disposal design would be undertaken.

2 INVESTIGATION METHODOLOGY

2.1 EXISTING DATA

No previous data relating to geotechnical investigation of the site was available at the time of investigation.

A review of available topographic plans, geological plans and soil landscape studies was undertaken prior to field activities.

2.2 FIELDWORK

Fieldwork was undertaken on the 27th February 2004 by a Principal Engineering Geologist and involved:

- Mapping of site conditions;
- Logging and sampling of the subsurface profile at 8 locations. This involved drilling of 4 hand auger bores and logging of 4 existing soil and rock exposures.

Subsurface profile locations were set out from features shown on the contour plan and are approximate only. Engineering logs of the bores / subsurface profiles are attached with approximate locations shown on Drawing 1 together with the results of mapping.

2.3 LABORATORY TESTING

Physical laboratory testing was undertaken on soil samples recovered from the boreholes to assess the following soil properties:

- pH and electrical conductivity (1:5 soil / water extract),
- soil erodibility (Emerson aggregate dispersion test) and
- phosphorous sorption.

Results are attached and are discussed in Section 6.

3 SITE DESCRIPTION

3.1 LOCATION

The site comprises rural land about 25Ha in size that is located at the north-east corner of Retreat Road and Long Gully Road at Singleton Heights.

3.2 TOPOGRAPHY

Topographically the site is situated in an area of undulating hillside on the broad rounded crest and upper slopes of a ridge line.

The south-east corner of the lot and the existing residence are located at the high point of the ridge with an elevation of about RL 135m, AHD. From the high point the axis of the broad rounded ridge trends to the north-west across the lot to the north-west corner of the site as shown on Photograph 1.

Photograph 1 Broad rounded crest line looking to the south-east.

Surface slopes across the majority of the site are gentle with gradients of 5° or less falling to the west, north-west and north. Localised steeper slopes ranging 10° to 15° occur above a prominent gully across the north-eastern part of the site, with incised gully banks locally up to 30° to 35°. Surface gradients across the site are shown on Drawing 1.

3.3 DRAINAGE

Drainage is to the north-west along two watercourses. The heads of both watercourses are located within the site.

A significant north-west trending gully occurs across the north-eastern corner of the site as shown on Photograph 2. The gully has convex banks and is incised up to 3m in depth. The gully banks are generally steep with gradients up to 30° to 35°. Localised outcrop of rock occurs along the gully banks and floor. The depth of the gully and the gradient of the bank slopes decrease up slope with a small farm dam situated at the head of the gully.

Photograph 2 Gully across north-east corner of site.

A smaller north-west trending gully occurs across the south-western corner of the site. The gully has convex banks and is incised up to 2m in depth. The gully banks are generally steep with gradients up to 30°. Localised outcrop of rock occurs along the gully banks and floor. A farm dam is situated near the head of the gully. A small off-shoot of the gully crosses the western boundary and extends up to 70m onto the site.

Erosion along the gullies is discussed in Section 3.6.

3.4 GEOLOGY

Geologically the site is situated in the Permian Age Maitland Group with the Muree Sandstone Formation over the higher and central to eastern part of the site and the Mulbring Siltstone Formation over the lower western part of the site.

The Muree Sandstone is characterised by fine to coarse sandstone and conglomerate rock types and the Mulbring Siltstone by siltstone, claystone and minor fine grained sandstone rock types.

Significant surface exposure of sandstone rock (Muree Sandstone) was noted along the crest of the ridge line as shown in Photograph 3, in the gullies and in excavations for Long Gully Road and dams. Localised exposure of siltstone (Mulbring Siltstone) rock was observed in gullies across the western part of the site. The approximate location of rock outcrop is shown on Drawing 1.

Photograph 3 Surface exposure of sandstone rock along ridge crest.

3.5 SOIL LANDSCAPE

Soil landscapes are areas of land that have recognisable and specifiable topographies and soils that allow integration of soil and landscape constraints.

The Soil Landscapes of the Singleton 1:250,000 Sheet (1991) notes that the site and surrounding area is situated in the Sedgefield soil landscape unit.

On the upper to midslope areas (as occurs on the site), the Sedgefield soil landscape is characterised by yellow Soloth soils with the following typical soil profile:

- Topsoil – sandy loam with weak structure, hard setting, over
- Bleached sandy loam, massive (no structure), over
- Medium clay with strong structure.

The soils are characterised by a hard setting surface, a low permeability subsoil, a moderate water holding capacity and a low chemical fertility.

The soils are noted as having a high salinity and this is associated with a marine deposition origin of the underlying rock formation.

The topsoil materials are noted as having a moderate erodibility with the underlying subsoil having a high erodibility.

The above soil conditions are based on a regional assessment and provide a general outline of regional soil conditions and constraints. Reference should be made to the site specific soil investigation undertaken for this report.

3.6 EROSION

No evidence of surface sheet or rill erosion was noted across the site.

Evidence of erosion was confined to the gullies and comprised:

- Minor gully head erosion with localised scarps up to 0.5m in height as shown in Photograph 4.
- Minor gully side slope erosion, in particular where shallow soil cover occurs over rock.

Photograph 4 Minor gully head erosion.

Scour erosion up to 1m in depth has occurred along the spillway for the dam located across the south-eastern corner of the site. Photograph 5 shows the scour erosion together with exposure of siltstone rock.

Photograph 5 Dam spillway scour with siltstone rock exposure.

In general the site soils appear to be susceptible to erosion where concentration of surface water occurs and where topsoil is disturbed.

3.7 GROUNDWATER

Groundwater within the study area is expected to occur at depth, in the rock strata that underlies the site. Shallow perched water will occur in the sandy topsoil / slopewash soils above the lower permeability clay and weathered rock base following wet periods. No direct connection of the shallow perched water with the regional groundwater table is expected.

3.8 LAND USE

The site comprises cleared open grass together with treed areas. Existing development comprises:

- Single storey brick veneer residence and associated sheds.
- Two earth embankment dams.

The site appears to have been used for rural purposes.

3.9 PROPOSED LAND USE

It is understood that proposed development involves subdivision into 0.5Ha rural-residential lots with construction of an access road off Retreat Road.

4 SUBSURFACE CONDITIONS

In general the soils encountered on the site comprise sandy topsoil and slopewash materials overlying clayey residual soils that have weathered in situ from the underlying rock strata. The profile encountered can be summarised as:

- Topsoil – silty sand, 0.1m to 0.15m thick, over
- Slopewash – clayey sand and clayey gravelly sand, wet, bleached, massive, to depth ranging 0.2m to 0.25m, over
- Residual clay, very stiff, moist becoming drier with depth, massive, with some sandstone rock fragments, to depth ranging 0.3m to greater than 1m, over
- Rock – sandstone and minor siltstone.

The subsurface conditions encountered are detailed on the attached logs. A summary of the approximate depths to rock and the depth to the clay base is presented in Table 1, together with general comments.

Table 1 Summary of Subsurface Conditions

Test Location	Approximate Depth to Rock (m) *	Depth to clay base (m)	Comment
1	0.4	0.25	Minor seepage above clay base
2	>1.0	0.25	Minor seepage above clay base
3	0.8	0.25	Minor seepage above clay base
4	0.8	0.25	
5	0.4	0.1	Cutting for dam
6	0.3	0.2	Road cutting (Long Gully Road0
7	0.9	0.2	Dam spillway scour
8	0.6	0.15	Gully scour

* *Depth to rock approximate only and based on observation of rock structure.*

Minor seepage into bore excavations was noted from the wet sandy soils that occur above the lower permeability clay base. Field work was undertaken after a period of rain which resulted in saturation of the sandy soils.

5 URBAN CAPABILITY ASSESSMENT

5.1 SLOPE STABILITY

No evidence of slope instability was observed on the site at the time of field investigation. Based on the site conditions, the site is considered to have a very low risk of overall instability as defined in Table 2 taken from Walker B. et al (1985) Geotechnical Risks Associated With Hillside Development.

The steep banks along the incised watercourses across the south-western and north-eastern corners of the site are considered to have a medium risk of localised slope instability. It is recommended that development along these areas be avoided where practicable. Where development is required, specific geotechnical assessment should be undertaken.

Provided development is carried out in accordance with good engineering practice and the recommendations and advice of this report, the risk of local instability associated with cuts, fills and retaining walls is assessed to be low.

Table 2 Classification of Risk of Slope Instability

Risk of Instability	Explanation	Implications for Development
Very High	Evidence of active or past landslips or rock face failure; extensive instability may occur	Unsuitable for development unless major geotechnical work can satisfactorily improve the stability. Extensive geotechnical investigation necessary. Risk after development may be higher than usually accepted.
High	Evidence of active soil creep or minor slips or rockface instability; significant instability may occur during and after extreme climatic conditions.	Development restrictions and/or geotechnical works required. Geotechnical investigation necessary. Risk after development may be higher than usually accepted.
Medium	Evidence of possible soil creep or a steep soil covered slope; significant instability can be expected if the development does not have due regard for the site conditions.	Development restrictions may be required. Engineering practices suitable to hillside construction necessary. Geotechnical investigation may be needed. Risk after development generally no higher than usually accepted.
Low	No evidence of instability observed; instability not expected unless major site changes occur.	Good engineering practices suitable for hillside construction required. Risk after development normally acceptable.
Very Low	Typically shallow soil cover with flat to gently sloping topography.	Good engineering practices should be followed.

Australian Geomechanics Society Journal, vol 10, 1985; Geotechnical Risks Associated With Hillside Development.

5.2 SOIL EROSION

The magnitude of erosion that can occur at a particular location is dependent on the potential of erosive agents such as wind, rain and runoff to erode soils and the erodibility of the soil. Assessment of soil erodibility takes into consideration soil properties such as texture, structure, dispersion, depth and infiltration and generally provides a general indication of relative resistance to water erosion.

The soils on the site are considered to have a moderate to high erosion hazard for concentrated water flows and this is confirmed by the presence of gully head and bank erosion along the existing watercourses.

The Emerson crumb dispersion test results indicate that the clay soils tested are non-dispersive. This indicates that the erosive nature of the clay soils is related to soil structure and texture rather than dispersiveness.

Soil types encountered on the site have been classified in accordance with the Department of Housing publication "Managing Urban Storm Water". The publication provides methods for classification soil types into three broad categories for the purpose of sedimentation control design, which comprise:

- Type C soils, which are coarse-grained and will settle relatively quickly in a sedimentation basin;
- Type F soils, which are fine grained and therefore require a longer time to settle in a sedimentation basin; and
- Type D soils, which are fine grained but which also contain a significant proportion of dispersive clay material which requires a flocculating agent for settlement in a detention basin.

In accordance with Table 6.1 of "Managing Urban Stormwater", the topsoil and residual soil types encountered in the test pits are judged to be:

- coarse grained, type C in the sandy topsoil and slopewash materials encountered to a depth of about 0.2m to 0.25m; and
- non-dispersive, fine grained soils, Type F in the residual clayey soils below a depth of about 0.2m to 0.25m.

To minimise the impact of erosion and sedimentation, development should be undertaken in accordance with an erosion and sediment control plan.

5.3 FOUNDATIONS

From a geotechnical viewpoint, there are no constraints on the type of residential or lightweight commercial structures that may be constructed on the site, provided all foundations are designed and constructed in accordance with AS2870 - 1996, Residential Slabs and Footings. The site conditions do not preclude larger structures, however they would require detailed assessment.

Site classification in accordance with AS2870 – 1996 should be undertaken at the appropriate stage of development. Based on the subsurface conditions noted at the site and the general shallow depth to rock, it is expected that site classification would predominantly comprise Class M, moderately reactive. Some Class H areas can be expected in areas of deeper soil profiles.

Foundation design should be undertaken in accordance with AS2870 – 1996 Residential Slabs and Footings. AS2870 – 1996 establishes performance requirements and specific designs for common foundation conditions as well as providing guidance on the design of footing systems using engineering principles.

5.4 EARTHWORKS

Development of the site is likely to involve some reshaping of surface contours which will involve excavation and filling.

Excavatability problems are likely to occur where rock is encountered in earthworks. Rock will predominantly comprise sandstone that locally occurs as sheet like surface exposures on the site. The sandstone rock exposed is judged to be of medium to high strength with widely spaced joints.

Allowance for hydraulic rock hammer excavation and heavy ripping by large bulldozer should be made where rock excavation is required.

Conceptual design should take potential excavatability constraints into consideration. This would involve limiting the depth of cut.

Soil (apart from topsoil) and weathered rock materials won from excavations on site are suitable for re-use as engineered fill. The excavated rock would require reprocessing to allow for use in roads and other engineered fill.

Any filling on the site should be placed and compacted in accordance with AS 3798 – 1996, Guidelines on Earthworks for Commercial and Residential Development. The methods, control and testing of site earthworks can have a major impact on the design of foundations and pavements and advice should be sought in relation to this during the design phase.

Excavation slopes in soils and fill slopes should be battered at maximum slopes of 2H:1V and protected from erosion. Steeper batter slopes may be applicable in rock materials on specific assessment.

Retaining walls should be designed for surcharge loading from slopes and structures above the wall. Adequate subsurface and surface drainage should be provided behind all retaining walls. All retaining walls constructed as part of the subdivision development should be engineer designed.

Design of road alignments and levels will need to consider rock excavatability constraints and should preferably be located to avoid the construction of deep fills across the incised watercourse / gullies.

5.5 PAVEMENTS

Subgrade conditions for pavements over most of the site will comprise residual clayey soils and weathered sandstone and conglomerate rock.

Site preparation for road construction would comprise the stripping of all sandy topsoil and slopewash materials to expose a clay subgrade.

The site soils are generally well drained and suitable for pavement subgrade formation. However it should be noted that due to the relatively shallow depth of rock in areas and the propensity for water to become perched in the sandy topsoil and slopewash materials, trafficability problems could be anticipated during wet periods.

Specific geotechnical investigation for pavement design should be undertaken at the appropriate stage of development.

As noted in Section 5.4, conceptual design should take potential excavatability constraints into consideration.

5.6 DRAINAGE AND WATER DETENTION STRUCTURES

It is understood that stormwater detention and water sedimentation ponds are likely to be required as part of the development.

Once the locations of these structures are known it is recommended that specific geotechnical investigation be undertaken for the design of water holding structures. Specific issues that need to be addressed include;

- Depth to rock and excavatability. Shallow rock occurs over significant areas of the site and the construction of detention ponds may require a combination of cut and impervious fill embankments.

- On-site availability of materials that can be compacted to form an impervious embankment. As a guideline, suitable soils should have clay contents in excess of about 30% and be non-dispersive. The clay soils encountered on the site are likely to meet this criteria, however the sandy topsoil and slopewash materials would be unsuitable.

5.7 SERVICES

Trenching for services is likely to encounter sandstone rock over significant areas of the site.

The sandstone rock is generally characterised by a medium to high strength with widely spaced jointing. Allowance for hydraulic rock hammer excavation should be made where rock excavation is required.

Trench excavations in the residual soils and weathered rock are unlikely to require shoring or battering back from a short term stability viewpoint. Workcover requirements in relation to personnel working in trenches will need to be adopted.

6 ON SITE EFFLUENT DISPOSAL ASSESSMENT

6.1 BACKGROUND

A preliminary site and soil assessment has been undertaken on the site to assess the suitability for on-site wastewater disposal.

Work has been undertaken in accordance with the guidelines of On-site Sewage Management for Single Households, 1998, prepared by the Department of Local Government and Australian Standard AS1547, 2000 On-site Domestic Wastewater Management.

An assessment of the site's suitability for on-site sewage management is based on:

- physical site features such as flood potential, landforms and slopes, the presence of rock and erosion potential,
- soil features such as texture, depth to rock, groundwater level and permeability,
- soil properties such as susceptibility to dispersion (Emerson test), pH and electrical conductivity, and
- site features such as area available, existing developments and set back from waterways etc.

This report provides an assessment of land capability in terms of effluent management systems:

For appropriate systems, the report estimates irrigation/adsorption area and wet weather storage requirements. The report does not assess the suitability of various waste treatment devices such as septic tanks, aerated wastewater treatment systems, grey water tanks or composting toilets.

6.2 PROPOSED DEVELOPMENT

Proposed development involves rural-residential subdivision with conceptual lot sizing in the order of 0.5Ha.

The potential for future connection to a reticulated sewage system is considered to be low.

6.3 SITE ASSESSMENT

The suitability of a site for on site disposal of treated effluent is contingent on a number of site factors that will specify the disposal method to be adopted.

The following site assessment is based on Tables 4, 5, and 6 in *On-site Sewage Management for Single Households*. Recommended buffer distances are set out in Table 3.

Details of the site assessment are presented in Section 3.

Site assessment was undertaken following a period of rainfall.

Limiting site factors for on site effluent disposal are:

- Shallow depth to rock.
- Presence of intermittent watercourses and dams.

Table 3 Recommended Buffer Zones

SYSTEM	RECOMMENDED BUFFER DISTANCES
All land application systems	100m to permanent surface waters (eg. river, streams, lake, etc), 250m to domestic ground water well, **40m to other waters (eg. farm dams, intermittent waterways and drainage channels, etc)**
Surface spray irrigation	6m if area up-gradient and 3m if area down-gradient of driveways and property boundaries, 15m to dwellings, 3m to paths and walkways, 6m to swimming pools.
Surface drip and trickle irrigation	6m if area up-gradient and 3m if area down-gradient of swimming pools, property boundaries, driveways and buildings
Subsurface irrigation	6m if area up-gradient and 3m if area down-gradient of swimming pools, property boundaries, driveways and buildings
Absorption system	12m if area up-gradient and 6m if area down-gradient of property boundaries, 6m if area up-gradient and 3m if area down-gradient of swimming pools, driveways and buildings.

6.4 SOIL ASSESSMENT

Details of the soil profiles encountered on the site are presented in Section 4.

Soil test results indicate that the site soils have the following properties:

- pH of 5.2 to 6.2 (acidic - soils with a pH of between 4.5 and 8.5 should pose no constraints for land application areas).,
- low salinity (electrical conductivity less than 0.13dS/m indicates that the soils are not saline and capable of promoting long term vegetation growth),
- non dispersive (Emerson aggregate test value of 5) and
- a phosphorous sorption of 890mg P/kg soil (high capacity for soil to bind phosphorous).

On the basis of the preliminary testing undertaken, the soils encountered on the site are suitable for on site effluent disposal in terms of both texture (soil type) and chemical and physical attributes.

Based on textural soil classification, the soils are assessed as having the following representative permeability values:

- Topsoil and slopewash (loams, weakly structured) - 0.5 to 1.5m/day,
- Clay base (moderately structured light clays) - 0.06 to 0.12m/day.

6.5 Site Suitability For On Site Effluent Disposal

The site is considered to be suitable for on site effluent disposal provided the following site limitations can be addressed at both a design and lot development stage:

- Shallow depth to rock.
- Presence of intermittent watercourses and dams.

The depth to rock encountered on the site ranged from 0.3m to 0.9m with some areas of surface exposure as shown on Drawing 1.

Where depth to rock in the land application area is 0.5m or less, options are:

- Import soil to the application area to achieve a minimum soil depth of 0.5m. The imported soil should comprise loamy sand, sandy loam, loam or clayey loam. As a guideline the soil should have a minimum fines content (passing 75-micron sieve) of 10% and a maximum of 50%. It is expected that the existing sandy topsoil and slopewash materials on the site would be suitable.
- Use of an amended soil system or mound. These systems are applicable on relatively flat sites that have restrictions such as shallow depth to rock and limited area. Primary treated effluent is dose-loaded into the mound where biological treatment of the effluent predominantly occurs in the amended soil material (ie sand or similar).

It is recommended that additional investigation is undertaken to define the areas of the site where the depth to rock is less than 0.5m.

The design of the subdivision should ensure that allotments have a sufficient area available to allow for a 40m setback of the land application area from the existing watercourses and dams.

Positioning of land application areas within 40m of the watercourses and dams would require the use of a specific system that treats effluent to achieve a low phosphorous, nitrogen, BOD, faecal coliform and suspended solid level. Suitable systems would include secondary treatment with an amended soil system or mound land application system.

6.6 System Selection and Land Application Area

Due to the presence of clay soils and shallow to moderate depth to rock, trench or absorption systems are not recommended for this site. Pump-out of partly treated domestic wastewater is not considered as an option for this site.

Based on the site and soil assessment, aerated wastewater treatment systems (AWTS) with either subsurface irrigation and surface spray/drip application methods are considered suitable for this site. These systems rely on biological activity for proper system operation. Sudden changes to the hydraulic loading may result in poor system performance. To achieve the expected treated wastewater quality and for general operating requirements, it is recommended that AWTS must be operated continuously and that power to the system must not be turned off.

A preliminary assessment of the land application area for AWTS has been estimated on the basis of nutrient and hydraulic loading. Nutrient loading rates have been assessed on the basis of modern AWTS values of 10mg/litre nitrogen and 8mg/litre phosphorous respectively (typically quoted values for the Envirocycle 10NR system).

The area required on the basis of a treated wastewater flow of 1000 litres/day (based on a 3 bedroom house with 5 occupants) is:

- $650m^2$ on the basis of monthly water balance (refer to attached calculation sheet) and
- $400m^2$ and $300m^2$ on the basis of nitrogen and phosphorous loading.

The monthly water balance establishes a minimum area of $650m^2$ with a minimum wet weather storage capacity of $3m^3$ (3000 litres) based on a minimum of three days storage.

Amended soil systems or mounds are acceptable provided they are designed for the site conditions. Mounds are typically about 8m by 5m in area with two mounds used in rotation. Details on mound systems can be obtained from Ecomax Management Systems Pty Ltd

7 CONCLUSION

The site is considered suitable for rural-residential development from a geotechnical engineering point of view. Development should be undertaken in accordance with the geotechnical advice and recommendations of this report.

The geotechnical constraints on development as noted in Table 4 are considered to be of a limited nature and can be managed by appropriate design and construction.

Table 4 *Summary of Geotechnical Constraints*

Issue	Constraint on Development
Slope stability	None , provided development is in accordance with guidelines of the report. No development on steep gully side slopes unless subject to specific geotechnical investigation.
Foundations	Minor - specific investigation at design stage
Earthworks	Minor – shallow depth to rock, site soils suitable for re-use as engineered fill.
Pavements	Minor - design should take potential excavation constraints associated with shallow rock into consideration.
Services	Minor - shallow rock may require localised hydraulic rock hammer excavation.
On-site effluent disposal	Minor – allotment layout to allow for sufficient buffer distance to existing watercourses and dams. Moderate – shallow depth to rock over large areas of the site is expected to require use of amended soil / mound systems or importation of soil.
Erosion	Minor - provided development undertaken in accordance with erosion and sedimentation control plan and measures undertaken to minimise concentration of stormwater discharge.

8 FURTHER INVESTIGATION

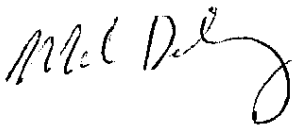
The level of investigation undertaken for this report is considered appropriate to allow assessment of project feasibility on the basis of geotechnical engineering issues and to undertake conceptual design.

A geotechnical review of the proposed development should be undertaken and depending on the nature of the development, more detailed work will be required to provide design parameters for:

- pavement and drainage works; and
- on-site effluent disposal

It is recommended that further investigation is undertaken at the appropriate stage to assess the depth to rock on the proposed lots. The aim would be to define which lots are likely to require importation of soil for on site effluent disposal areas or the requirement for an amended soil / mound system.

Yours faithfully
RCA AUSTRALIA



Mark Delaney
Principal Engineering Geologist

REFERENCES

[1] Australian Standard AS1547, 2000 "On-site Domestic Wastewater Management".Department of Housing, 1998, "Managing Urban Stormwater."

[2] Australian Standard AS2870-1996, "Residential Slabs and Footings – Construction", Standards Association of Australia.

[3] Australian Standard AS3798-1996, "Guidelines on Earthworks for Commercial and Residential Development", Standards Association of Australia.

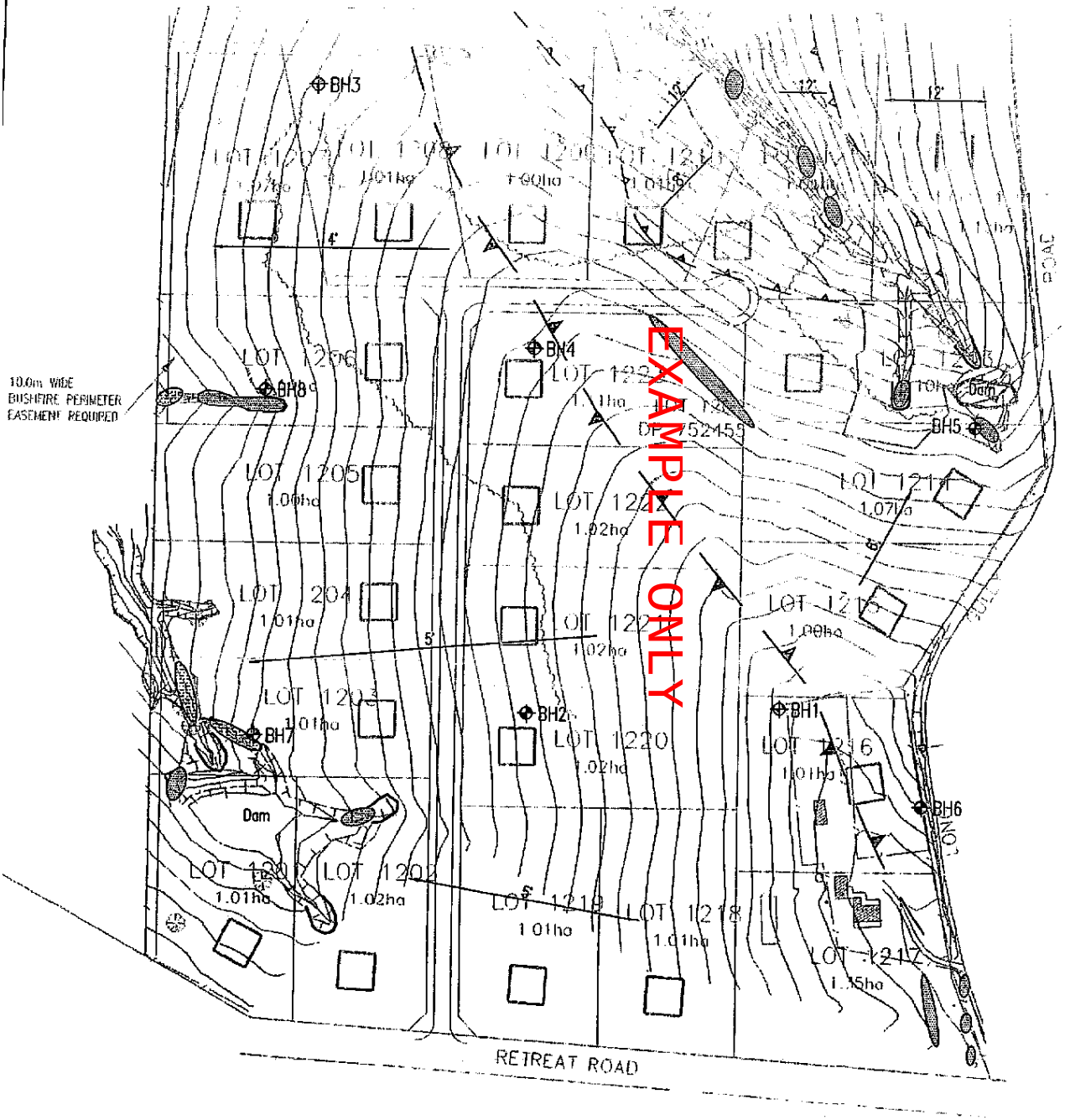
[4] Department of Local Government, 1998 "On-site Sewage Management for Single Households".

[5] Kovak M and Lawrie J.(1991), "Soil Landscapes of the Singleton 1:250000 Sheet", Soil Conservation Service of NSW.

[6] Walker B. et al (1985). "Geotechnical Risks Associated With Hillside Development", Australian Geomechanics Society.

Appendix A

Drawing 1

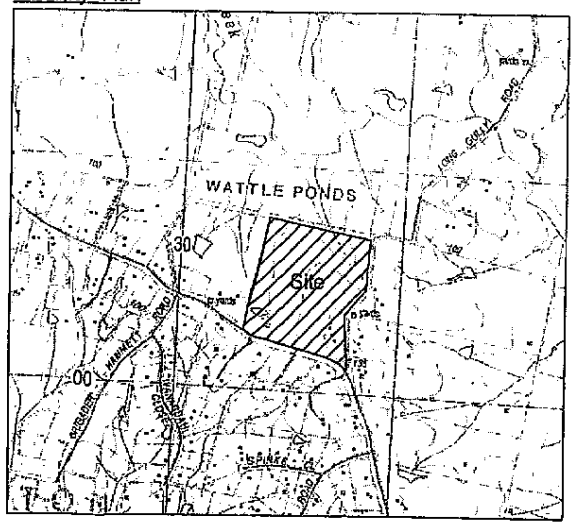


LEGEND

- Approximate bore hole location
- 6° Approximate slope angle and degrees
- Gully head erosion
- Crest of ridge
- Convex break of slope
- Sandstone rock exposure
- Siltstone rock exposure

NOTE:
Drawing adapted from plan supplied by Hunter Development Brokerage Pty Ltd Job No 04/02, Dwg No 03, Rev A

Locality Plan



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SITE PLAN
PROPOSED SUBDIVISION
RETREAT ROAD, SINGLETON HEIGHTS

CLIENT	Hunter Development Brokerage P/L	PROJECT No	3766
DRAWN BY	LJD	SCALE	1 : 2500

Appendix B

Bore Logs

Symbols Index Sheet

General Soil Description Sheet

General Rock Description Sheets

RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH1

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Hand Auger

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
		0.1		TOPSOIL, Silty SAND, moist, grey/brown
Minor Seepage				Clayey Gravelly SAND, medium to coarse sand, wet, grey, gravel up to 20mm, SLOPEWASH
		0.25		Gravelly Sandy CLAY, very stiff, moist, massive, mottled orange/ brown and grey, sandstone rock fragments, RESIDUAL
				End Bore Hole BH1 at 0.4m at sudden hand auger refusal on sandstone rock

0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
2.25

LOGGED: MD
CHECKED: MOD
DATE: 9/3/04

CRS-TBL-A4V-001/1

RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH2

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Hand Auger

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
Minor Seepage	D @ 0.1	0.15		TOPSOIL, Silty SAND, moist, grey/brown
0.25		0.25		Clayey SAND, fine to coarse grained, wet, grey, with some gravel, with some gravel, SLOPEWASH
	D @ 0.4			Sandy CLAY/Clayey SAND, fine to coarse grained, moist, very stiff, orange/brown mottled grey, massive, RESIDUAL
0.5				
		0.7		
0.75				Sandy CLAY, very stiff, dry to moist, light grey, RESIDUAL
1.0				End Bore Hole BH2 at 1.0m
1.25				
1.5				
1.75				
2.0				
2.25				

LOGGED: MD | CHECKED: MOD | DATE: 9/3/04

CRS-TBL-A4V-001/1

RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH3

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Hand Auger

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
Minor Seepage		0.1		TOPSOIL, Silty SAND, moist, grey/brown
		0.25		Clayey Gravelly SAND, medium to coarse sand, wet, grey, gravel up to 20mm, SLOPEWASH
		0.5		Sandy CLAY, stiff to very stiff, moist, massive, mottled orange/ brown and grey, RESIDUAL
				Sandy CLAY, friable, hard, dry to moist, light grey/brown, RESIDUAL
				End Bore Hole BH3 at 0.8m at hand auger refusal (rock?)

0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
2.25

LOGGED: MD | CHECKED: MGD | DATE: 9/3/04

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RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH4

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Hand Auger

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
		0.1		TOPSOIL, Silty SAND, moist, grey/brown
	D @ 0.2			Clayey Gravelly SAND, medium to coarse sand, wet, grey, gravel up to 20mm, SLOPEWASH
0.25	D @ 0.3	0.25		Sandy CLAY, very stiff, moist, massive, mottled orange/brown and grey, RESIDUAL
0.5				
0.75				End Bore Hole BH3 at 0.8m at hand auger refusal on rock
1.0				
1.25				
1.5				
1.75				
2.0				
2.25				

LOGGED: MD | CHECKED: MOD | DATE: 9/3/04

CRS-TBL-A4V-001/1

RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH5

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Existing Exposure

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
None Encountered		0.1		TOPSOIL, Silty SAND, moist, grey/brown
		0.4		Gravelly Sandy CLAY, very stiff, moist, massive, mottled orange/ brown and grey, sandstone rock fragments, RESIDUAL
				ROCK, SANDSTONE, medium grained, grey and orange/brown, with some pebbles, massive, estimated medium to high strength
				Base of existing cutting for dam at 0.5m

0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
2.25

LOGGED: MD
CHECKED: MOO
DATE: 9/3/04

CRS-TBL-A4V-001/1

RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH6

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Existing Exposure

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
None Encountered		0.1		TOPSOIL, Silty SAND, moist, grey/brown
		0.2		Clayey SAND, medium to coarse grained, moist, light grey brown
0.25		0.3		Sandy CLAY, moist, very stiff, orange/brown, RESIDUAL
				SANDSTONE, medium to coarse grained, massive, orange/brown
0.5				Base of existing road cutting at 0.45m
0.75				
1.0				
1.25				
1.5				
1.75				
2.0				
2.25				

LOGGED: MD | CHECKED: MOD | DATE: 9/3/04

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RCA AUSTRALIA
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TEST BORE LOG
BORE No: BH7

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Existing Exposure

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
None Encountered		0.2		TOPSOIL, Silty Sandy GRAVEL, sub angular to sub rounded gravel, 5mm to 40mm, dry to moist, grey/brown
				Sandy CLAY, very stiff, moist, massive, mottled orange/brown and grey, RESIDUAL
		0.9		becoming Gravelly Sandy CLAY, weathered rock fragments
				ROCK, SILTSTONE, grey and orange/brown, highly weathered
				Base of dam spillway erosion scour at 1.1m

0.25
0.5
0.75
1.0
1.25
1.5
1.75
2.0
2.25

LOGGED: MD
CHECKED: MCD
DATE: 4/3/04

CRS-TBL-A4V-001/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH8

CLIENT: Hunter Development Brokerage P/L
PROJECT: Proposed Subdivision
LOCATION: Retreat Road, Singleton Heights

PROJECT No: 3766
DATE: 27/2/04
SURFACE LEVEL: Existing
SHEET 1 of 1
METHOD OF ADVANCE: Existing Exposure

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
		0.15		TOPSOIL, Silty SAND, moist, grey/brown
0.25				Sandy CLAY/Clayey SAND, stiff to very stiff, moist, grey and orange/brown, RESIDUAL
0.5 Minor Seepage		0.6		ROCK, SANDSTONE, medium grained, massive, estimated high strength
0.75				End Bore Hole BH8 at 0.65m at base of existing exposure
1.0				NOTE: Minor seepage at soil/rock interface
1.25				
1.5				
1.75				
2.0				
2.25				

LOGGED: MD | CHECKED: MBD | DATE: 9/3/04

CRS-TBL-A4V-001/1

SYMBOLS INDEX SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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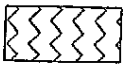
SOIL SYMBOLS

Primary Components


Clay


Topsoil


Bitumen


Silt

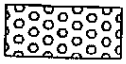

Peat/Organic Soil

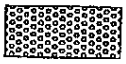

Concrete/ road pavement


Sand


Cobbles/boulders (>60mm in size)


Fill


Gravel

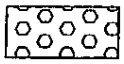

Ironstone gravel, laterite

Secondary Components


Clayey


Silty


Sandy

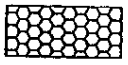

Gravelly

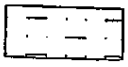
NOTE: Primary soil component shown in capitals and preceded by secondary components. Minor components noted in description. For example Sandy CLAY, with some gravel. The main component is clay with secondary sand and minor gravel. Laboratory classification testing should be undertaken where quantitative soil description is required.

ROCK SYMBOLS

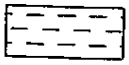
Sedimentary


Claystone

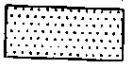

Conglomerate


Siltstone


Coal

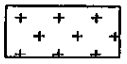

Shale/Laminite


Limestone

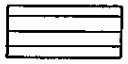

Sandstone

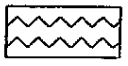
Igneous


Volcanic (fine grained–basalt)


Plutonic (coarse grained–granite)

Metamorphic


Low grade (slate, schist)


High grade (gneiss, quartzite)

SYMBOLS

Testing and Sampling

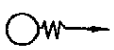
D	Disturbed sample
B	Bulk sample
U50	Undisturbed tube sample (50mm diameter)
SPT	Standard penetration test
N	SPT blows per 300mm
R	SPT refusal
PP	Pocket penetrometer value (kPa)
Sv	Shear vane, peak undrained shear strength (kPa)
O	Point load test (axial)
●	Point load test (diametrical)
PID	Photoionisation detector reading (ppm) (note: comments regarding odour are based on olfactory evidence)

Groundwater


Groundwater level at time of measurement


Water outflow (loss)


Water inflow (make)


Seepage

Groundwater levels unless otherwise indicated refer to the level of free water encountered in the bores or test holes at the time of measurement. The actual groundwater level may differ depending on material permeability, climate, tides etc.

Well Construction


Screened interval


Filter zone


Hole collapse


Bentonite seal


Lockable cover

GENERAL SOIL DESCRIPTION SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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SOIL DESCRIPTION

Descriptive Terms

Cohesive	–	Soils that exhibit cohesion or bonding between particles (ie clay, silt).
Granular	–	Soils that have little cohesion or bonding between particles (ie sand, gravel).
Dry	–	Looks and feels dry. Dry cohesive soils are hard, friable or powdery and dry granular soils are cohesionless and free running.
Moist	–	Soil feels cool and looks dark in colour. Moist cohesive soils can be moulded and moist granular soils tend to cohere.
Wet	–	Free water present.
Cemented	–	Secondary bonding between soil particles. Weakly cemented soils are easily broken up by hand.

SOIL GRAIN SIZE

CLAY	SILT	SAND			GRAVEL			COBBLES	BOULDERS
		Fine	Medium	Coarse	Fine	Medium	Coarse		
0.002mm	0.06mm	0.2mm	0.6mm	2mm	6mm	20mm	60mm	200mm	

SOIL STRENGTH

Consistency of Cohesive Soils[1]

Term	Pocket Penetrometer Value (kPa)	Field Guide
Very soft	<25	Surface Penetrated by fist
Soft	25-50	Easily penetrated by thumb
Firm	50-100	Penetrated by thumb with effort
Stiff	100-200	Indented by thumb
Very stiff	200-400	Surface only marked by thumbnail
Hard	>400	

Density of Granular Soils[2]

Term	Density Index (%)
Very loose	<15
Loose	15-35
Medium dense	35-65
Dense	65-85
Very dense	85-100

NOTE: 1. Consistency can be assessed based on insitu testing or laboratory testing on undisturbed samples. Undrained shear strengths can be estimated from field pocket penetrometer values by dividing by 2. Quantification of undrained shear strength should be based on insitu or laboratory testing.

2. Density can only be assessed on the basis of insitu testing

SOIL ORIGIN

Weathered in Place Soils

Residual soil	–	Rock completely broken down to soil, no rock structure visible.
Extremely weathered material	–	Rock predominantly broken down to soil with some relict rock structure present.

Transported Soils

Alluvial soil	–	Deposited by streams and rivers.
Slopewash soils	–	Deposited on slopes by gravity and sheet flow.
Aeolian soils	–	Deposited by wind.
Lacustrine soils	–	Deposited in lakes.
Marine soils	–	Deposited in bays, beaches and estuaries.
Slide debris	–	Deposited by mass movement (colluvium).
Fill	–	Deposited by man

GENERAL ROCK DESCRIPTION SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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The following rock description is intended for the geotechnical logging of diamond drill core and is also applicable for the mapping of natural exposures and cuttings.

In most rocks the presence of defects and the effects of weathering have a significant influence on the engineering behaviour of the rock mass.

The term **rock substance** refers to the description of material characteristics such as rock type, grain size, colour, strength and weathering.

The term **rock mass** refers to the properties of the overall rock mass/body and involves description of defects (discontinuities or fractures in the rock substance such as joints, faults bedding partings etc), weathering and structure.

ROCK SUBSTANCE – DESCRIPTIVE TERMS

Rock name : Simple rock names are used rather than precise geological classifications.

$I_s(50)$: Point load strength index.

Grain size/ type : The grains of a rock can be described in terms of size (mm) and shape on the basis of appropriate terms used in the General Soil Description Sheet. Where identified, individual minerals should be described.

Strength : Strength is estimated on the basis of tactile appraisal and confirmed by point load strength testing where shown. The rock strength description refers to the strength of the rock material and not to the strength of the rock mass which may be considerably weaker due to the effect of rock defects. Unconfined compressive strength testing should be undertaken where rock strengths need to be quantified.

Term	Symbol	$I_s(50)$ MPa	Field Guide (The core refers to 150mm long x 50mm dia. sample)
Extremely Low	EL	<0.03	Soil strength property description appropriate
Very Low	VL	0.03-0.1	May be crumbled in the hand. Sandstone is 'sugary' and friable.
Low	L	0.1-0.3	The core may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
Medium	M	0.3-1.0	The core may be broken by hand with considerable difficulty. Readily scored with knife
High	H	1.0-3.0	The core cannot be broken by unaided hands, can be slightly scratched or scored with knife.
Very High	VH	3.0-10.0	The core may be broken with hand held hammer. Cannot be scratched with knife.
Extremely High	EH	>10.0	The core is difficult to break with hand held hammer. Rings when struck with hammer.

*I_s (50) = Point load strength index

Weathering :

Term	Symbol	Definition
Extremely Weathered	EW	The rock exhibits soil-like properties though the texture of the original rock is still evident.
Highly Weathered	HW	Limonite staining or colour change affects the whole of the rock mass. Signs of chemical or physical decomposition is evident throughout the whole of the rock mass.
Moderately Weathered	MW	Staining extends throughout the whole of the rock mass and the original colour is no longer recognisable.
Slightly Weathered	SW	Partial staining or decolouration of the rock mass, usually by limonite, has taken place.
Fresh	F	Rock mass unaffected by weathering.

The assignment of rock weathering terms is subjective and is used for identification purposes only

GENERAL ROCK DESCRIPTION SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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ROCK MASS – DESCRIPTIVE TERMS

Defects : Defects are fractures in the rock mass and include joints, faults, shear planes, cleavages and bedding partings. Description of defects is important as defects generally control the overall engineering behaviour of the rock mass.

Defect spacing refers to the degree of fracturing or spacing of all natural fractures. Artificial fractures induced by drilling, boxing or transport of rock core are not included in the defect spacing log. The delineation of artificial fractures is subjective.

Defect Description

Type	:	Parting	(along rock layering/bedding)
		Joint	(across rock layering/bedding)
		Shear	(zone or seam of rock movement resulting in crushing/fracturing)
		Clayey seam	(infilled or extremely weathered layer)
		Vein	(secondary mineralisation along a fracture)
Shape	:	Planar	
		Curved	
		Undulose/Stepped	
		Irregular	
Roughness	:	Rough	
		Smooth	
		Striated	(slickenside, indicative of shear movement)
Infill	:	Clean	(defect surfaces clean)
		Stained	(surfaces stained by limonite (iron–oxide) or similar)
		Veneer	(thin surface coating ≤1mm thick)
		Coating	(surface coating 1mm–5mm thick)
		Seam	(5mm–100mm thick)
		Zone	(>100mm thick)

Orientation of defects is described relative to the horizontal.

Dip = the maximum angle of a defect plane relative to the horizontal surface

Strike = orientation relative to magnetic north of the line of intersection of a defect plane and the horizontal surface

Structure : Structure refers to larger scale rock mass features such as bedding, folding, lineation and flow banding etc. Where no structure is discernible the term massive is used.
In sedimentary rocks the following terms can be used to describe the spacing of bedding/stratification.

Term	Spacing of Bedding (mm)
Laminated	<20
Thinly bedded	20–200
Medium bedded	200–600
Thickly bedded	600–2000
Very thickly bedded	>2000

Appendix C

Laboratory Results

ALLIED TESTING PTY LIMITED

A.C.N. 080 629 698

51 Darling Street,
CARRINGTON, NSW 2294
Phone : (02) 4969 4979
(02) 4961 3793
Fax: (02) 4962 1850
P.O. Box 51
CARRINGTON, NSW 2294

SOIL ANALYSIS

Origin: RCA Australia

Report No: 10186

Description : Soil Samples Project: 3766
Received: 27-Feb-04

Date : 02-Mar-04

Report To : Mark Delaney

Copy to: File

Sample No.	Description	pH (water)	Electrical Conductivity dS/m	P Sorption mg P/kg Soil	Exchangeable Cations Ca Mg Na K meq/100g	Sample Mass (ar) (g)	Moisture %	Emmerson Aggregate Test
95592	BH2 0-0.1m	5.2	0.106			599.8	17.3	
	Calculations: Calcium - Magnesium Ratio			C.E.C. :	Sodium % (E.S.P.):			
95593	BH2 0.4m	5.3	0.065	890		472.0	11.7	5
	Calculations: Calcium - Magnesium Ratio			C.E.C. :	Sodium % (E.S.P.):			
95594	BH4 0.2m	6.2	0.040			717.7	11.7	
	Calculations: Calcium - Magnesium Ratio			C.E.C. :	Sodium % (E.S.P.):			

Note : Exchangeable Cations (Ca, Mg, Na, K) - 1M Ammonium Chloride at pH 7.0
CEC calculated from Ca, Mg, Na, K (Aluminium not analysed)
P Sorption based on Rayment & Higginson Method 9I, (1000mg P/kg addition)
Soil Sampling by client
Moisture % - Determined after drying sample at 40 C
Analysis reported on dried sample
** SAR5 Water used for E.A.T.*

Reported By : M. Caughlan

ALLIED TESTING PTY LIMITED

A.C.N. 080 629 698

51 Darling Street,
CARRINGTON, NSW 2294
Phone : (02) 4969 4979
(02) 4961 3793
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95595	BH4 0.3m	5.9	0.130						463.1	13.9	5
Calculations:	*Calcium - Magnesium Ratio*			*C.E.C. :*	*Sodium % (E.S.P.):*						

Note : Exchangeable Cations (Ca, Mg, Na, K) - 1M Ammonium Chloride at pH 7.0
CEC calculated from Ca, Mg, Na, K (Aluminium not analysed)
P Sorption based on Rayment & Higginson Method 9I, (1000mg P/kg addition)
Soil Sampling by client
Moisture % - Determined after drying sample at 40 C
Analysis reported on dried sample
** SAR5 Water used for E.A.T.*

Reported By : M. Gamble

Appendix D

On Site Effluent Disposal Preliminary Nutrient Loading and Water Balance Assessment

RCA AUSTRALIA
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ON-SITE DOMESTIC-WASTEWATER MANAGEMENT

NUTRIENT & ORGANIC MATTER BALANCE

CLIENT: Hunter Development Brokerage
PROJECT: Proposed Subdivision Retreat Road
LOCATION: Singleton

DATE: 4.3.04
RCA REF: 4-Mar-04
CLIENT REF:

ORGANIC MATTER (BOD)

BOD, C =	20 mg/L	*(EHPG)*
Treated wastewater flow rate, Q =	1000 L/day	
Critical loading rate, L_O =	3000 $mg/m^2/day$	*(EHPG)*

Area of land based on BOD loading = 7 m^2

NITROGEN LOADING

Concentration of nitrogen, C =	10 mg/L	*(EHPG)*
Treated wastewater flow rate, Q =	1000 L/day	
Critical loading rate of nutrient, L_n =	25 $mg/m^2/day$	*(EHPG)*

Area of land based on nitrogen loading = 400 m^2

PHOSPHOROUS LOADING

Phosphorous Design Period/Loading Time Period = 50 yrs *(EHPG)*

Amout of phosphorus abosrbed without leaching over loading time period

Phosphorus sorption capacity =	kg/ha	
OR		
Phosphorus sorption capacity =	890 mg/kg soil	
Soil bulk density =	1440 kg/m^3	
Active depth of phosphorous sorption =	1.0 m	*(EHPG)*
Proportion of actual phosphorus adsorbed in field =	0.333	*(EHPG)*

$P_{absorbed}$ = 0.4 kg/m^2

Vegetation uptake over loading time period

Uptake capacity, L_p = 3 $mg/m^2/day$ *(EHPG)*

P_{uptake} = 0.055 kg/m^2

Phosphorus generated over loading time period

Total phosphorus concentration in wastewater =	8 mg/L	*(EHPG)*
Volume of wastewater produced =	1000 L/day	

$P_{generated}$ = 146 kg

Area of land required based on phosphorus loading = 303 m^2

LIMITING NUTRIENT = Nitrogen

MINIMUM AREA REQUIRED BASED ON NUTRIENT LOADING = 400 m^2

RCA Australia	**Calculated by:MD**	**Date: 4/3/04**
Office:	**Checked by: MD**	**Date: 4/3/04**

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ON-SITE DOMESTIC-WASTEWATER MANAGEMENT

MONTHLY WATER BALANCE AND WET WEATHER STORAGE ESTIMATION

CLIENT: Hunter Development Brokerage
PROJECT: Proposed Subdivision Retreat Road
LOCATION: Singleton

DATE: 4.3.04
RCA REF: 4-Mar-04
CLIENT REF: -

Rainfall data: Singleton Army base **Period:**
Evaporation data: Paterson (Tocal) **Period:**

Application Area: 653 m^2 **Field Depth:** 0.1 m **Percolation Rate:** 1.5 mm/day
Wastewater application rate: 1000 litres/day **Void Factor:** 0.15

Month	Days	Mean Rainfall mm/month	Runoff Coefficient	Mean Evaporation mm/month	Crop Factor	Evapotranspiration mm/month	Wastewater Application Rate mm/month	Soil Percolation mm/month	Application Area Capacity for Wastewater mm	Wastewater Storage Required mm	Cumulative Wastewater to be Stored mm	Cumulative Wastewater to be Stored m^3	Wastewater Stored by Soil m^3	Wet Weather Storage m^3
Jan	31	146	0.00	186	0.70	130.2	47.5	46.5	30.7	16.8	16.8	10.9	9.8	1.1
Feb	28	88	0.00	145.6	0.70	101.9	42.9	42.0	55.9	-13.1	3.7	2.4	2.4	0.0
Mar	31	47	0.00	130.2	0.65	84.6	47.5	46.5	84.1	-36.7	0.0	0.0	0.0	0.0
Apr	30	43	0.00	102	0.65	66.3	45.9	45.0	68.3	-22.4	0.0	0.0	0.0	0.0
May	31	30	0.00	74.4	0.60	44.6	47.5	46.5	61.1	-13.7	0.0	0.0	0.0	0.0
Jun	30	17	0.00	66	0.60	39.6	45.9	45.0	67.6	-21.7	0.0	0.0	0.0	0.0
Jul	31	17	0.00	77.5	0.60	46.5	47.5	46.5	76.0	-28.5	0.0	0.0	0.0	0.0
Aug	31	42	0.00	105.4	0.60	63.2	47.5	46.5	67.7	-20.3	0.0	0.0	0.0	0.0
Sep	30	43	0.00	132	0.65	85.8	45.9	45.0	87.8	-41.9	0.0	0.0	0.0	0.0
Oct	31	82	0.00	161.2	0.65	104.8	47.5	46.5	69.3	-21.8	0.0	0.0	0.0	0.0
Nov	30	70	0.00	177	0.70	123.9	45.9	45.0	98.9	-53.0	0.0	0.0	0.0	0.0
Dec	31	88	0.00	217	0.70	151.9	47.5	46.5	110.4	-62.9	0.0	0.0	0.0	0.0
SUM	**365**	**713**		**1574.3**		**1043.4**	**558.8**	**547.5**	**877.9**					

Wet weather storage (maximum cumulative storage): 1 m^3
1,149 litres

Robert Carr & Associates Pty Ltd	**Calculated by:MD**	**Date: 4/3/04**
	Checked by: MD	**Date: 4/3/04**

Douglas Partners

Geotechnics • Environment • Groundwater

REPORT

on

PRELIMINARY URBAN CAPABILITY ASSESSMENT

PROPOSED REZONING

LOT 138 DP 752455

RETREAT ROAD

SINGLETON HEIGHTS

PREPARED FOR

HUNTER DEVELOPMENT BROKERAGE PTY LTD

On behalf of

HARDIE SINGLETON PTY LTD

PROJECT 39169

MARCH 2005

Douglas Partners Pty Ltd
ABN 75 053 980 117

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TABLE OF CONTENTS

ATTACHMENTS

MJB:GT:lm
Project 39169
P:\39169\Docs\39169.doc
11 March 2005

REPORT ON
PRELIMINARY URBAN CAPABILITY ASSESSMENT
LOT 138 DP752455
RETREAT ROAD, SINGLETON HEIGHTS

1. INTRODUCTION

This report presents the findings of a preliminary urban capability assessment for proposed rezoning of Lot 138, DP 752455, Retreat Road, Singleton Heights. The investigation was undertaken at the request of Mr Bryan Garland of Hunter Development Brokerage Pty Ltd (HDB) on behalf of Hardie Singleton Pty Ltd.

The purpose of the preliminary urban capability assessment was to provide the following:

- summary of subsurface conditions;
- geotechnical constraints to development (areas of steep topography, low lying areas, areas of potential soil erosion, areas of potential salinity);
- preliminary on-site effluent disposal assessment in accordance with AS 1547-2000;
- recommendations on effluent disposal options;
- comments on the suitability of the site for on-site effluent disposal;
- estimates on minimum areas required for effluent disposal.

The effluent disposal assessment was undertaken with reference to the current Environmental and Health Protection Guidelines: "On-Site Sewage Management for Single Household" (Ref 1), and AS 1547-2000 "On-Site Domestic-Wastewater Management" (Ref 2).

For the purposes of the investigation HDB provided a site plan showing the proposed subdivision layout.

2. SITE DESCRIPTION AND GEOLOGY

The site is identified as Lot 138 DP 752455 Retreat Road, Singleton Heights. The site is bounded by farm land to the north, south and east and by Retreat Road to the west.

At the time of the investigation vegetation over the site comprised a medium dense grass cover, and scattered semi-mature to mature trees. The eastern portion of the site was more heavily vegetated that the western portion, see Photo 1.

Photo 1 – Site Looking North-East

The dominant topographical feature of the site was a large forked gully located in the south-western portion of the site which drained to the east. Slopes into this gully were around 6° to 12° with the steeper slopes localised to the head of the gully near Retreat Road. The remainder of the site sloped toward the creek at between 2° and 5°. General site photos are in Photos 2 to 5 below.

Photo 2 – Looking Across The Head Of The Main Gully Looking South

Photo 3 – General Site Area And Slopes

Photo 4 – Looking East Down The Main Gully

Two creeks enter the site on the southern boundary. One draining to the north-east and one draining to the north. The creek draining to the north-east is part of the main gully which then joins with the eastern most creek via a broad gully. The creeks were vegetated by a medium dense tree cover and were observed to comprise a series of pools of water. The creek banks, particularly the eastern most creek line, were affected by erosion with scars up to 2.5 m deep observed (Photo 5).

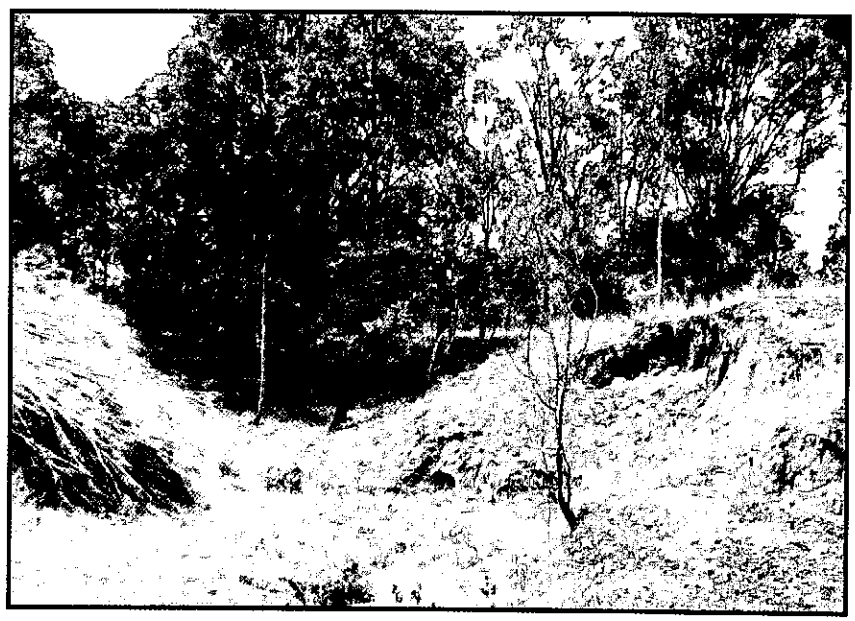

Photo 5 – Erosion Scars In The Eastern Creek Line

An existing residence was located in the north-western corner of the site near the Retreat Road boundary. The dwelling was a single storey brick construction with a small garden located around the perimeter.

Five dams were observed on the site. One dam, located to the west of the house was almost dry. Two dams located to the east of the house were associated with the on-site septic system. The fourth dam was located towards the middle of the site and the fifth dam was located to the east of the main creek alignment. Slopes on the dam walls ranged between 19° and 27°. The steeper slopes were associated with the dam located to the west of the house at the top of the main gully formation.

A hay shed and scattered rubbish was located just downslope of the septic system dams, see Photo 6. The rubbish generally comprised timber, and sheet metal with no evidence of gross contamination. An isolated 20 L waste oil container was located on the banks of the main creek in the eastern portion of the site. There was some evidence of surficial hydrocarbon staining in the immediate vicinity of the container, see Photo 7.

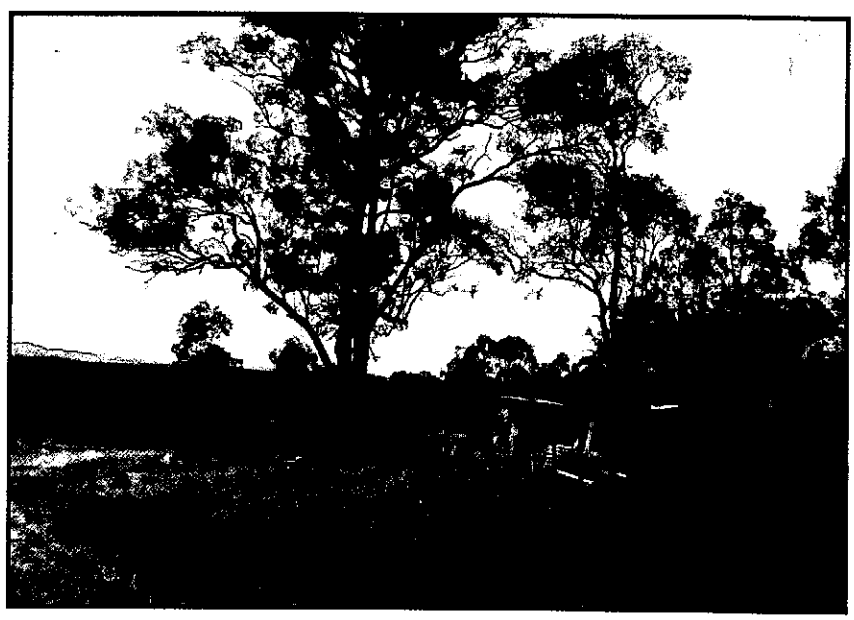

Photo 6 – Hay Shed And Rubbish

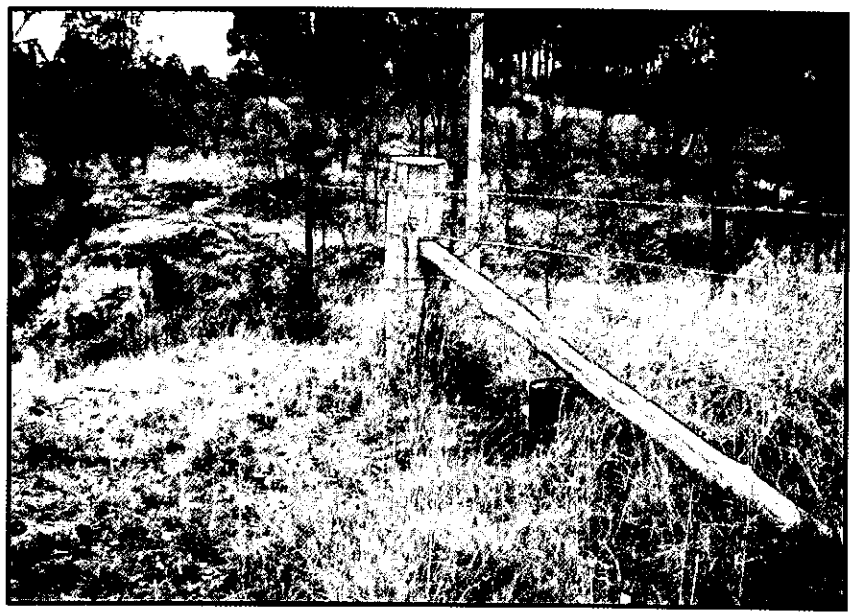

Photo 7 – Waste Oil Container

3. DESKTOP REVIEW

Topography

Reference to the 1:25,000 topographical map for Singleton indicates a watercourse flows to the north-east and a second creek line flows to the north through the site. The site has surface levels in the range 130 m and 80 m AHD, and the topography is indicated by the surface contours shown on Drawing 1.

Drainage

The predominant surface water drainage path within the site comprises the main gully system located in the south of the site which then joins the north flowing creek, as shown on Drawing 1. At the time of investigation, the main gully was observed to be dry and the creek line was observed to comprise a series of stagnant ponds.

There were five dams located across the site as discussed in Section 2.

Geology/Hydrogeology

Reference to the 1:100 000 Hunter Coalfield Regional Geology Sheet indicates the site is underlained by the Middle Permian Aged Branxton Group, comprising conglomerate siltstone, and sandstone.

The regional groundwater flow regime is believed to be towards First Creek approximately 800 m to the north-east of the site.

Soil Landscape

Reference to the 1:250,000 Soil Landscape Series Sheet (Sheet S1 56-1) prepared by the Soil Conservation Service of NSW (now DIPNR) indicates the soil landscape for the site forms part of the Sedgefield Landscape. The soils in this group generally consist of Permian mudstone, sandstone, conglomerate, siltstone, shale and coal seams. The landscape generally comprises undulating low hills, local relief to 40 m to 60 m and slopes to 6%. Some salting is present in drainage lines. Soils are generally moderately to highly erodable and the soil salinity is high, (ie only a few species of salt-tolerant plants survive and much of the ground is bare with a surface crust).

Acid Sulphate Soils

Acid sulphate soils are not expected to be encountered within the site, based on the elevation of the site. Acid Sulphate Soil Risk Maps have not been published for the Singleton area.

4. FIELD WORK

4.1 Methods

The field work was undertaken on 25 January 2005 and comprised the excavation of ten test pits (Pits 1 to 10) to depths between 0.8 m and 2.5 m below the existing ground level were generally discontinued due to slow progress within bedrock. Approximate test locations are shown on Drawing 1 attached. In-situ pH and electrical conductivity (EC) measurements of surface waters were also undertaken at selected locations.

The pits were set-out by a geo-environmental engineer, who also logged the subsurface profile and collected regular samples for laboratory testing and identification purposes.

4.2 Results

The subsurface conditions encountered at the test locations are presented in detail in the attached test pit report sheets. These should be read in conjunction with the general notes preceding them, which explain the descriptive terms and classification methods.

Subsurface conditions generally comprised the following:

TOPSOIL	Silty sand topsoil was encountered in all pits from the surface to between 0.05 m and 0.15 m depth.
CLAY/SILTY CLAY/SANDY CLAY	Very stiff to hard clays were observed beneath the topsoil to between 0.6 m and 1.9 m depth in all pits.
CLAYEY SAND	Alluvial clayey sand was encountered in Pit 8 from beneath clay at 0.7 m to termination at 2.5 m depth.
SANDSTONE / SILTSTONE	Extremely low to low strength sandstone and/or siltstone was observed beneath the clay in all pits except Pit 8.

Groundwater was not encountered in any of the test pits during excavation. It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

The results of the surface water pH and EC measurements are summarised below in Table 1.

Table 1 – Surface Water pH and EC Measurements

Location	pH	EC(µS/cm)	Comments
11	**5.6**	98	Dam on western boundary, turbid water
12	**6.3**	290	Septic dam, heavy algal growth
13	7.3	300	Dam in middle of site, turbid water
14	**5.8**	185	Upstream end of main creek, ponded water
15	**6.1**	**2930**	Downstream end of main creek, ponded water
16	7.3	205	Dam on eastern portion of site, turbid water
Trigger Value[1]	6.5-8.0	125-2200	

Notes to Table 1:
1 – ANZECC 2000 trigger values for low land rivers (Ref 3)
Bold indicates levels outside trigger values

The results of the in-situ surface water measurements have been compared to ANZECC 2000 guidelines (Ref 3) and indicate that the surface waters on the site are generally fresh and slightly acidic. An EC measurement however was measured at the downstream end of the main creek indicating slightly brackish conditions. This may be due to the stagnant nature of the creek.

5. LABORATORY TESTING

Laboratory testing comprised the following:

- 32 soil pH and EC tests to assess potential soil salinity;
- four soil samples submitted for tests to assess the site's suitability for effluent disposal.

The results of the laboratory testing are summarised in Tables 2 and 3 below. Testing undertaken by ACRIC Quality Testing Pty Ltd are presented in the laboratory report sheets (Appendix C).

The pH and EC testing to assess potential soil salinity was undertaken in-house within the DP Laboratory. EC results have been multiplied by an appropriate soil texture conversion factor in accordance with Reference 4, to give the Extract Electrical conductivity (EC_e).

Table 2 – Results of Soil pH and EC Testing

Pit	Depth (m)	Description	Soil pH	EC_e dS/m
1	0.05	Silty Sand	6.2	0.51
	0.4	Sandy Clay	5.3	0.37
2	0.4	Clay	6.6	0.18
	0.75	Sandy Clay	8.2	0.43
3	0.4	Clay	4.9	1.67
4	0.5	Clay	5.4	1.16
	1.2	Silty Clay	5.3	0.95
5	0.5	Clay	5.4	1.51
	1.2	Silty Clay	4.8	2.26
6	0.5	Clay	5.0	1.28
	0.9	Sandy Clay	4.9	1.72
7	0.3	Clay	5.3	0.51
	0.6	Sandy Clay	5.4	1.99
	0.9	Sandy Clay	5.8	1.38
8	0.4	Clay	5.5	0.43
	1	Clayey Sand	4.8	2.66
	1.7	Clayey Sand	4.6	1.56
9	0.5	Sandy Clay	5.2	0.34
	1	Silty Sandy Clay	4.8	0.97
10	0.05	Silty Sand	5.4	0.18
	0.5	Clay	5.8	0.20

Notes to Table 2:
Shaded results indicates slightly saline soils (Ref 4)

Laboratory testing for effluent disposal assessment was performed by ACRIL Quality Testing Pty Ltd and comprised measurement of various soil parameters, as suggested for subdivision developments by the NSW Government Guidelines (Ref 1) on the predominant / controlling soil types within the site.

The results are shown in Table 3 below and have been marked where the results indicate possible limitations to suitability for effluent application (Ref 1). The results of the effluent disposal suitability testing are discussed in Section 7 below.

Table 3 – Laboratory Test Results

Test Location	Pit 1	Pit 3	Pit 7	Pit 8
Depth (m)	0.4	0.4	0.6	1.0
Description	Sandy Clay	Clay	Sandy Clay	Clayey Sand
Bulk Density (t/m^3)	1.18	1.11	1.15	1.19
pH in water	5.3	4.9	5.4	4.8
pH in CaCl	4.1	3.7	4.3	3.6
ESP (%)	**7.5**	19.7	18.7	27.4
CEC (Cmol/kg)	**7.3**	**14.5**	**12.2**	**8.6**
ECe (ds/m)	0.37	1.67	1.99	2.66
Phosphorus Sorption [1] (kg/ha)	8732	11766	6900	**4760**
Modified Emerson Class [2]	5	5	5	5

Notes to Table 3:
ECe – Electrical Conductivity (Laboratory results EC (1soil:5 water) converted to ECe using soil correction factor (Ref 4)
CEC – Cation Exchange Capacity
ESP – Exchangeable Sodium Percentage
1 – Based on 1 m soil profile
2 – Modified Emerson Class carried out using SAR 5 solution, which replicates domestic effluent
Bold results indicate a moderate limitation as defined by Reference 1
Shaded results indicate a major limitation as defined by Reference 1

6. URBAN CAPABILITY

6.1 Slope Stability

Site slopes were generally 2° to 5° with localised slopes of up to 13° were observed within site gullies in the south-western corner of the site. Slopes up to 27° were observed within dam embankments, particularly the dam located near the western boundary at the head of the gully. Development in the south western corner of the site should be undertaken with reference to good hillside engineering practice, including limiting the depth of cuts and fills, adoption of safe batter slopes and provision of adequate drainage. Further more specific advice should be sought at the design stage.

No evidence of previous or active deep-seated instability were observed within the site. Some erosion and scouring was however observed within the banks of the creek lines and minor erosion in dam embankments. The site is considered to have an overall low risk of slope instability, with localised areas of potential instability associated with the embankments of the existing dams and steeper areas of the gullies.

Further assessment of the long term stability of on-site dams (if dams are proposed to be retained) and gully areas will be required prior to re-development.

6.2 Rock Outcrops

Although no rock outcrops were observed on the site low strength sandstone was observed within 1 m of the surface in Pit 1. Shallow bedrock will have implications with regard to effluent disposal systems as discussed in Section 7.5.1, and should also be taken into consideration for footing design, earthworks procedures and location of structures.

6.3 Foundations

Based on site observations and soil landscape, it is anticipated that footings for residential structures for the majority of the site will comprise shallow footings in residual soils. Footing design should be confirmed, however, by subsurface investigation prior to development of the site. Classification of the site to AS 2870-1996 (Ref 5) would facilitate the use of standard footing designs given in the code.

Soft saturated soils are likely to be present beneath and adjacent to the on-site farm dams. Should development be proposed within the areas currently occupied by farm dams, appropriate moisture conditioning or removal will be required prior to development.

Soft saturated soils are also likely to be encountered within the creek bed, however it should be noted that no residential development is proposed within 20 m of the creek centreline. Detailed geotechnical advice should be sought from this office in regard to the construction of roadways over the potentially soft soils within the gullies if required.

6.4 Erosion Potential

Heavy erosion of soils was observed within the gully in the eastern portion of the site and some moderate erosion within the main gully. Some minor erosion was also observed within the dam walls. The soils observed within the areas of erosion were of a higher sand content than those observed within the test pits.

The results of Emerson testing on selected samples indicates that the soils within the test pits are Emerson Class 5, which is typical of non-dispersive soils. Exchangeable Sodium percentage (ESP) analysis on selected samples however indicates highly sodic soils which are prone to dispersion on wetting. Erodable soils are readily amenable to standard mitigation measures for erosion control, which should be undertaken during and following construction.

It is recommended that additional erosivity analysis be undertaken in areas with observed erosion to assess the potential severity of future erosion for the proposed development. The erosivity analysis will include soil sampling and laboratory testing for a range of parameters including dispersivity and grading.

6.5 Salinity Potential

Discussions with the DIPNR indicates salinity outbreaks have been mapped in the general Singleton Heights area, primarily within gullies. DIPNR has also identified salinity outbreaks primarily within gullies within the site.

Preliminary soil testing within 1.5 m of the surface indicated the site soils near the main gully to be slightly saline. The walkover survey, however, identified no visible indicators of salinity within the site (i.e. vegetation scars and salt scalds). Extensive erosion was however observed within the main gully, which may be attributed to saline influences.

Based on the above information, there is some potential for salinity issues at the site. As such, additional assessment including soil sampling and testing is recommended to further assess the salinity potential of the site. If saline soils are encountered, specific management techniques should be incorporated into the conceptual plan for the development including provision for through drainage of groundwater/surface waters across the creek bed (i.e. gravel drains/culverts beneath roads), and selection of construction materials suitable for use in a saline environment.

6.6 Mine Subsidence

Discussions with the Mine Subsidence Board and reference to published mine subsidence maps indicate that the site does not lie within a proclaimed mine subsidence district, and there is no record of mining beneath the site.

7. PRELIMINARY EFFLUENT DISPOSAL ASSESSMENT

7.1 Site Information

Site-specific information relevant to the assessment is outlined in Table 4 below:

Table 4 – Site Information

Address:	Retreat Roads, Singleton Heights
Lot/DP:	Lot 138 DP 752455
Client:	Hunter Development Brokerage Pty Ltd
Site Area:	16 ha. Proposed to be subdivided into 1 ha allotments
Intended water supply (i.e. reticulated or non-reticulated):	Reticulated
Special Considerations:	Final allotment layout not finalised

7.2 Site Features

Various relevant site features are listed in Table 5 below and have been compared to the requirements of Ref 1 in terms of possible limitations to effluent disposal.

Table 5 – Site Features

Site Feature	Rating	Limitation
Flood potential	Rare. Above 1 in 100 year flood contour	Minor
Exposure	Generally high.	Minor
Slope	Site slopes generally 4% to 8%, with steeper slopes within gullies and in the eastern portion of the site up to 23%	Minor to Major
Land form	Slopes and gullies	Minor to Major
Run-on and upslope seepage	Generally low run-on potential	Minor
Erosion Potential	Extensive erosion observed within the main gully on the east of the site and within the gully on the southern boundary.	Moderate
Site Drainage	No visible signs of surface dampness across the site, surface water within creek bed	Minor
Fill	None observed on the site except for dam walls	Minor
Depth to Bedrock	Observed between 0.6 m to >2.5 m depth, generally around 1.5 m depth	Minor to Moderate
Rock outcrops	None observed	Minor
Buffer distances	See Section 7.5.2 for detail. Specifically designed lot layout and disposal area placement may be required in some areas	Minor to Moderate
Land availability	1 ha allotments	Minor

Notes to Table 5:
Limitation as defined by the NSW Government Environmental and Health Protection Guidelines (Ref 1).

Typical site features are shown in Photos 1 to 7, Section 2. Refer to Drawing 1 attached for additional site features including site contours, creeks and site slopes.

7.3 Subsurface Conditions

Field work and subsequent laboratory testing has been undertaken to assess the site's suitability for effluent disposal. A summary of the field work test methods and results is shown below in Table 6.

Table 6 – Field Work

Date Sampled	16 September 2004
Test Method	Test pits
Number of Pits [2]	Ten across the site for the assessment of general subsurface conditions
Depth of Investigation	0.8 m to 2.5 m (generally discontinued due to slow progress on bedrock)
Summary of Subsurface Conditions [1]	Generally heavy clays overlying bedrock (sandstone and siltstone) from 0.6m to greater than 2.5 m depth, generally around 1.5 m depth.
Groundwater Observations	No free groundwater observed during field work

Notes to Table 6:

1 Detailed test pit report sheets are attached and should be read in conjunction with the general notes preceding them.

2 Refer to Drawing 1 attached for approximate test pit locations.

7.4 Disposal Area Requirements

Estimated land areas required for both irrigation (spray, trickle or subsurface) and evapotranspiration absorption (ETA) systems have been provided based on typical effluent quality as published in Ref 1 for the following effluent treatment systems:

- Standard Septic Treatment System;
- Standard Aerated Wastewater Treatment System (AWTS);
- Enhanced Aerated Wastewater Treatment System (i.e. Treatment system such as an 'Envirocycle', which reduced the nitrogen output to 10 mg/L).

Minimum disposal areas have been calculated by taking account of both the hydraulic capability of the land to accept effluent as well as the ability of the land to accept nutrients. The main parameters used in these calculations are outlined in Table 7 below:

Table 7 – Model Parameters

Effluent Treatment System	Standard AWTS	Enhanced AWTS	Septic System
Nitrogen loading (mg/L) [2]	37	10	55
Phosphorus loading (mg/L) [2]	10		
Rainfall data [1]	Singleton [4]		
Evaporation data	Lostock Dam [4]		
DIR (mm/week)	15		
DLR (mm/day)	5		
Design Period (years) [3]	50		

Notes to Table 7:
DIR – Design Irrigation Rate in accordance with AS 1547-2000 (Ref 2)
DLR – Design Loading Rate (ETA systems) in accordance with AS 1547-2000 (Ref 2)
1 – Median (50th percentile or 5 Decile) monthly rainfall supplied by the Bureau of Meteorology
2 – Typical nutrient loading rates as published in Reference 1
3 – In accordance with Reference 1
4 – Nearest available weather station with appropriate data

Based on the intended water supply being reticulated the minimum disposal areas have been calculated for a reticulated development.

The minimum plan areas noted in Table 8 below are the limiting areas based on consideration of the hydraulic and nutrient (nitrogen and phosphorus) balance estimates.

Table 8 – Minimum Plan Area (m^2) Required for Both ETA and Irrigation Disposal Systems

No of Bedrooms	Daily Effluent Load (L/day)	Effluent Treatment System		
		Septic [1, 2]	Standard AWTS [1]	Enhanced AWTS [3]
2	600	1222	822	517
3	900	1833	1233	775
4	1200	2444	1644	1034
5	1500	3056	2056	1292

Notes to Table 8:

1. Minimum plan areas for both septic and standard AWTS treatment systems were found to be governed by the nitrogen balance.
2. It should be noted that septic treatment systems should **only** be used in conjunction with ETA disposal systems and not used in conjunction with irrigation disposal systems. Subsoil application is required for septic systems due to the highly infectious nature of the effluent (Ref 1).
3. The minimum plan area for an enhanced AWTS system, however, was found to be governed by the phosphorus balance, due to variable phosphorus balance areas (i.e. variable phosphorus sorption capacities and depth to bedrock across the site). Additional site-specific investigation is recommended for lots proposing to use enhanced AWTS systems.

During periods of rainfall, the nutrient levels in the effluent would be diluted, increasing the importance of the hydraulic capability of the soil. Wet weather storage should be provided for prolonged heavy rainfall events. A minimum storage capacity of three days is recommended based on NSW EPA guidelines (Ref 1), subject to council requirements.

7.5 Effluent Disposal Recommendations

7.5.1 Site Improvements

The site is considered to be generally suitable for on-site disposal of domestic effluent provided that the limitations previously mentioned are addressed, as discussed below:

Soil pH

Laboratory testing has indicated some slightly acid soil conditions within the site. While the current site vegetation appears to have relatively good growth, agricultural lime could be added to the disposal area to enhance plant growth.

Sodic Soils/Erosivity

The soil within each disposal area should be treated with an appropriate application of gypsum. Adding gypsum to the soil increases the salinity of the soil moisture without increasing the sodium level, thereby reducing the Sodium Adsorption Ratio (SAR). This will improve the soil structure and reduce the potential for dispersion and erosion.

Shallow Bedrock

The minor to moderate limitation caused by the presence of shallow rock in some test pits within site could be improved by mounding suitable clay loam filling within the disposal area to achieve a minimum depth of 1 m to bedrock. The material should be moderately permeable and have a high nutrient uptake. This would reduce the potential for effluent resurfacing and increase the soil's ability to take up phosphorus.

The requirements for this would be subject to the treatment and disposal system proposed, and the depth to rock within the lot-specific disposal area.

If imported clays are to be used for additional filling, it is recommended that further laboratory testing be undertaken to assess the phosphorus absorption capacity and general suitability.

Low Phosphorus Sorption Capacity

The moderate limitation caused by the presence of low phosphorus sorption soils could be improved by importing suitable clay loam filling within the disposal area. The material should be moderately permeable and have a high nutrient uptake. This would reduce the limitations caused by the soils inability to uptake phosphorus.

If imported clays are to be used, it is recommended that further laboratory testing be undertaken to assess the phosphorus sorption capacity and general suitability.

Buffer Distances

Appropriate buffer distances should be kept between the effluent disposal area and sensitive areas such as gullies/creek lines and dwellings. Reference should be made to Section 7.5.2 for detail regarding recommended buffer distances. Provision of adequate bunding systems would also minimise the potential exposure of sensitive areas to the effluent disposal area. Not withstanding this disposal areas should not be located within drainage lines or the immediate upslope area.

Steep Slopes and Run-on/Run-off

Catch drains / bunds upslope and downslope of the disposal areas are recommended to prevent rainfall run-on and run-off of the effluent respectively. This is particularly important on steeper areas of the site where irrigation disposal systems are proposed. On steeper slopes, some benching/terracing may be required within the disposal area. If possible, irrigation disposal should be avoided on slopes greater than 12% and ETA disposal should be avoided on slopes greater than 20% due to the potential for run-off/erosion.

Terraces should be constructed using suitable clay loam filling within the disposal area and should maintain an average depth of soil of at least 1.0 m. The existing surface vegetation layer (topsoil) should be removed, and the filling placed and mixed with the underlying soil, possibly by rotary hoeing or ploughing. The topsoil should be replaced on the surface of the filling.

Care should be taken to limit the batters between terraces to less than 3H:1V, otherwise a retaining system may be required. In order to prevent uncontrolled drainage of effluent, subsoil drainage is not recommended behind retaining walls. Therefore retaining walls for terraced ETA beds should be limited to no greater than 1.0 m and should be engineer designed for hydrostatic loading on the wall.

Flood Potential

In accordance with Reference 1, all components of the effluent disposal system including electrical components, vents and inspection openings of wastewater treatment devices should be located above the 1 in 100 year probability flood contour. However the 1 in 20 year probability flood contour may be used as a limit for land application areas.

General

Disposal areas should be planted with high nutrient uptake vegetation, and lawn clippings should be removed.

Maintenance of the effluent disposal area is important and should be conducted regularly. The attached pamphlet titled "Your Land Application Area" produced by the Department of Local Government provides recommendations on maintenance procedures. Additionally, all disposal areas should be constructed in accordance with AS 1547-2000 (Ref 2).

7.5.2 Location of Disposal Systems

Buffer zones should be kept between on-site systems and sensitive environments on and off-site. It is suggested that the buffer distances given in Reference 1 for land application systems be adopted for locating disposal area on this site. The buffer distances from Reference 1 are reproduced below.

Table 9 – Recommended Buffer Distances for On-site Systems

System	Recommended Buffer Distances
All land application systems	• 100 m to permanent surface waters (eg. river, streams, lakes, etc) • 250 m to domestic groundwater well • 40 m to other waters (eg. farm dams, intermittent waterways and drainage channels, etc)
Surface spray irrigation	• 6 m if area up-gradient and 3 m if area down-gradient of driveways and property boundaries • 15 m to dwellings • 3 m to paths and walkways • 6 m to swimming pools
Surface drip and trickle irrigation and subsurface irrigation	• 6 m if area up-gradient and 3 m if area down-gradient of swimming pools, property boundaries, driveways and buildings

7.5.3 General

It is noted that the above assessment is preliminary only, and has been undertaken to assess general site conditions. Additional specific investigation of allotments may therefore be required once the proposed lot layout has been finalised to confirm geotechnical conditions and effluent disposal area requirements.

8. CONCLUSIONS

The results of the assessment confirm that the site is generally suitable for future rural residential development, subject to appropriate investigation, design, and construction. Future development over the site should address the issues identified above, namely:

- site improvements recommended in Section 5.5 to increase the effectiveness of effluent disposal across each allotment, and
- implementation of standard erosion control measures during and following construction.

The above requirements are considered to be minor, and readily amenable to standard construction methods and design.

The following recommendations relate to further investigation to enable more detailed design for future development:

- lot classification to AS 2870-1996 (Ref 5) for footing design;
- slope stability assessment of the site in particular of the dams;
- additional assessment of potential salinity risk;
- earthworks procedures and specifications;
- pavement thickness design for new internal roads.

The above investigations could be undertaken concurrently, and would involve subsurface investigation, in situ testing, laboratory testing of soil samples and engineering analysis.

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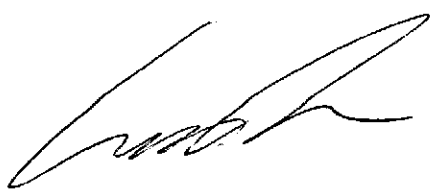


Greg Taylor
Environmental Engineer

Reviewed by:

Stephen Jones

Stephen Jones
Principal

REFERENCES

1. Environment & Health Protection Guidelines On-Site Wastewater Management Systems for Single Households, NSW EPA, NSW Department of Health", NSW Department Land & Water Conservation, NSW Department of Local Government, January 1998.

2. Australian Standard AS 1547-2000, "On-site domestic – wastewater management", Standards Australia.

3. ANZECC (2000), "Australia & New Zealand Guidelines for Fresh & Marine Water Quality", October 2000.

4. Department of Infrastructure Planning and Natural Resources, "Site Investigations for Urban Salinity", 2002.

5. Australian Standard AS 2870-1996, "Residential Slabs and footings – Construction", Standards Australia.

NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in

clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

This classification system provides a standardized terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Under this system rocks are classified by Rock Type, Degree of Weathering, Strength, Stratification Spacing, and Degree of Fracturing. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc.) where these are relevant.

ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2 mm) fragments.
Sandstone :	More than 50% of the rock consists of sand sized (.06 to 2 mm) grains.
Siltstone:	More than 50% of the rock consists of silt-sized (less than .06 mm) granular particles and the rock is not laminated
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated.
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated.

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g., clayey sandstone, sandy shale.

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties – i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fr	Rock substance unaffected by weathering.

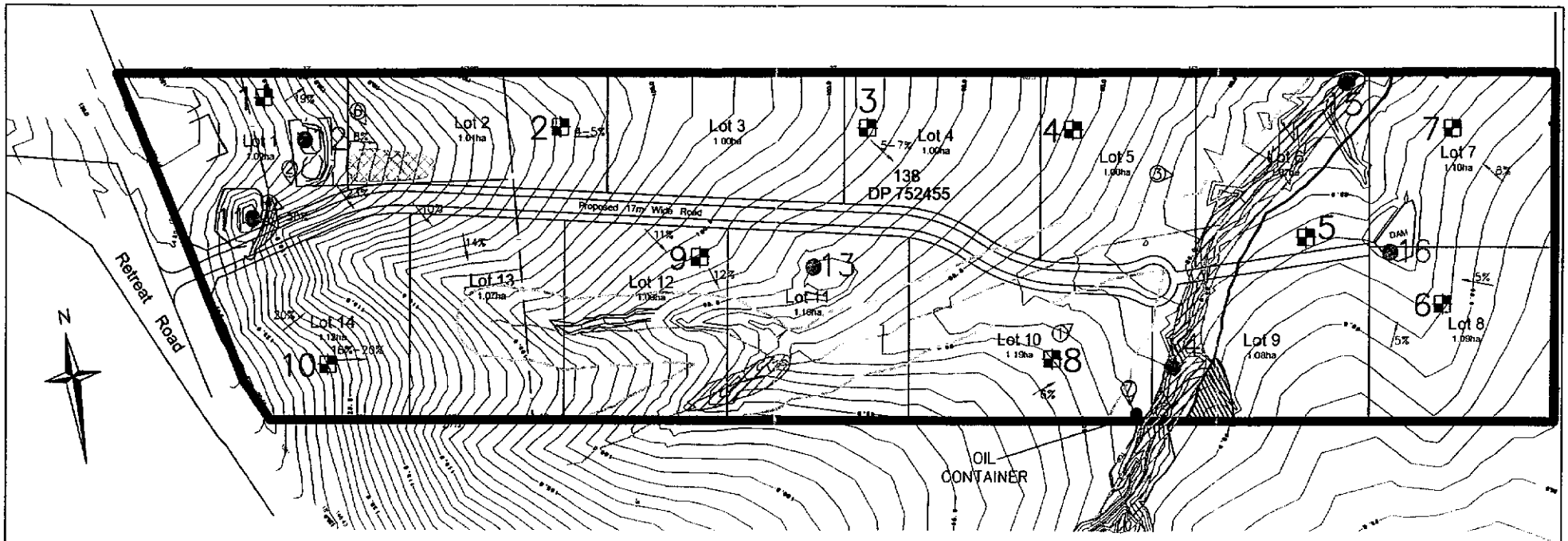
STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2m

REFERENCE

- International Society of Rock Mechanics, Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1. Final Draft October 1972.

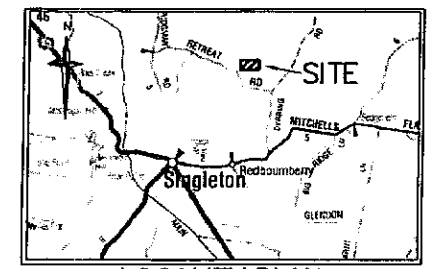
Prepared by the Sydney Group of the Australian Geomechanics Society, January, 1975.



EXAMPLE ONLY

LEGEND

- APPROXIMATE TEST PIT LOCATION
- 10% APPROXIMATE SLOPE ANGLE AND DEPTH
- AREA WITH OBSERVED RUBBISH
- APPROXIMATE WATER TEST LOCATION
- APPROXIMATE AREA WITH OBSERVED EROSION
- (1) APPROXIMATE PHOTO LOCATION AND DIRECTION
- SITE BOUNDARY
- EXISTING CREEKLINE
- 20m CREEKLINE BUFFER
- RESTRICTION TO USER. NO CLEARING PERMITTED



LOCALITY PLAN

DRAWING ADAPTED FROM CONCEPTUAL SUBDIVISION PLAN SUPPLIED BY CLIENT, UNREFERENCED, UNDATED

0 50 100 150m

SCALE 1:2500 (A3 sheet)

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: TEST LOCATION PLAN
PRELIMINARY URBAN CAPABILITY ASSESSMENT
LOT 138, DP 752455 RETREAT ROAD, SINGLETON

CLIENT: HUNTER DEVELOPMENT BROKERAGE PTY LTD			REF: P:\39169\Drawings\39169-01
DRAWN BY: PLH	SCALE: 1:2500	PROJECT No: 39169	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1

TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 1
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL: Brown silty sand topsoil with abundant rootlets, dry		D	0.05				
		SANDY CLAY: Hard, light brown mottled orange and light grey sandy clay with trace gravel, M<Wp		D,pp	0.4		>600kPa		
	0.6	SANDSTONE: Low strength, highly weathered, brown sandstone with trace gravel		D	0.7				
	0.8	Pit discontinued at 0.8m, slow progress							
	1								1
	2								2

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ∓ Water level

CHECKED
Initials: MTB
Date: 11/3/05

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 2
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL: Brown silty sand topsoil with abundant rootlets and some gravel, dry		D	0.1				
	0.15	CLAY: Hard, red brown clay with some sand, M<Wp		D,pp	0.4		>600kPa		
	0.6	SANDY CLAY: Hard, light brown sandy clay with some gravel, M<Wp (extremely weathered sandstone)		D	0.75		>600kPa		
	0.8	SANDSTONE: Extremely low strength, extremely weathered, light brown sandstone							
	0.9	Pit discontinued at 0.9m, slow progress							
	1								1
	2								2

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: MJB
Date: 11/3/05

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TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 3
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.05	TOPSOIL: Brown silty sand topsoil with abundant rootlets and some gravel, dry							
		CLAY: Very stiff to hard, red brown clay with trace sand, M>Wp		D,pp	0.4		350-450kPa		
	0.7	SILTSTONE: Extremely low strength, extremely weathered, orange, brown and light grey siltstone		D	0.9				
	1								1
	1.1	Pit discontinued at 1.1m, slow progress							
	2								2

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials:	AJB
Date:	11/3/05

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TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL:--
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 4
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL: Brown silty sand topsoil with abundant rootlets and some gravel, dry							
		CLAY: Hard, red brown clay with trace sand, M>Wp		D,pp	0.5		>600kPa		
	0.9	SILTY CLAY: Hard, light grey mottled red silty clay, M>Wp							1
	1			D,pp	1.2		450->600kPa		
		With trace extremely weathered siltstone from 1.6m depth		D,pp	1.7		>600kPa		
	1.9	SILTSTONE: Very low strength, extremely weathered, light grey, red and brown sandy siltstone							
	2			D	2.0				2
	2.1	Pit discontinued at 2.1m, slow progress							

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: MJB
Date: 11/3/05

Douglas Partners
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TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 5
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.1	TOPSOIL: Brown clay with some gravel and rootlets, dry							
		CLAY: Hard, red brown clay, M<Wp		D,pp	0.5		>600kPa		
	1.0	SILTY CLAY: Hard, grey mottled orange silty clay, with trace siltstone gravel/cobbles, M<Wp		D,pp	1.2		>600kPa		
	1.5	SILTSTONE: Very low strength, extremely weathered, grey siltstone		D	1.6				
	1.7	Pit discontinued at 1.7m, slow progress							

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20; 1, 2

RIG: 13t rubber tyred excavator
LOGGED: Taylor
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: MOB
Date: 11/3/05

Douglas Partners
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TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 6
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL: Brown silty sand topsoil with some rootlets, dry							
		CLAY: Hard, light grey mottled brown clay with some sand, M<Wp		D,pp	0.5		>600kPa		
	0.7	SANDY CLAY: Hard, light grey mottled brown sandy clay with some silt and trace gravel, M<Wp		D,pp	0.9		>600kPa		1
	1.1	SILTY CLAY: Hard, light grey silty clay with trace sand, M<Wp		D,pp	1.3		>600kPa		
	1.5	SILTSTONE: Very low strength, extremely weathered, light grey siltstone		D	1.6				
	1.7	Pit discontinued at 1.7m, slow progress							2

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6 3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: KOB
Date: 11/3/05

Douglas Partners
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TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: –
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/–

PIT No: 7
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL: Brown silty sand topsoil with some rootlets, dry							
		CLAY: Very stiff, red brown clay, M>Wp		D,pp	0.3		200-250kPa		
	0.5	SANDY CLAY: Hard, light brown sandy clay with some silt, M<Wp		D,pp	0.6		>600kPa		
		From 0.7m depth, slightly cemented		D,pp	0.9		>600kPa		
1	1.0	SILTY CLAY: Hard, light grey mottled red and orange silty clay, M>Wp		D,pp	1.2		>600kPa		1
	1.5	SILTSTONE: Very low strength, extremely weathered, light brown grey sandy siltstone		D	1.6				
	1.7	Pit discontinued at 1.7m, slow progress							
2									2

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials:	MJB
Date:	11/3/05

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 8
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL: Brown silty sand topsoil with abundant rootlets, dry							
		CLAY: Hard, brown clay, M>Wp		D,pp	0.4		>600kPa		
	0.7	CLAYEY SAND: Light grey mottled red and orange clayey sand, damp to moist		D	1.0				1
		From 1.6m depth, with trace gravel		D	1.7				
		Gravel content increasing with depth							2
	2			D	2.3				
	2.5	Pit discontinued at 2.5m							

RIG: 13t rubber tyred excavator
LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: KCB
Date: 11/3/05

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 9
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL: Brown silty sand topsoil with abundant rootlets							
		SANDY CLAY: Hard, grey mottled brown and red sandy clay, M<Wp		D,pp	0.5		>600kPa		
	0.7	SILTY SANDY CLAY: Hard, light grey mottled red and orange, silty sandy clay, M<Wp		D,pp	1.0		>600kPa		1
	1.4	SANDSTONE: Very low to low strength, extremely weathered, red, brown and light grey silty sandstone		D	1.5				
	1.6	Pit discontinued at 1.6m, slow progress							2

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials	
Date	11/3/05

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Hunter Development Brokerage
PROJECT: Preliminary Urban Capability Assessment
LOCATION: Lot 138, DP 752455, Retreat Road, Singleton

SURFACE LEVEL: –
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/–

PIT No: 10
PROJECT No: 39169
DATE: 25 Jan 05
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.1	TOPSOIL: Brown silty sand topsoil with abundant rootlets, dry		D	0.05				
		CLAY: Hard, orange brown clay with trace gravel, M<Wp		D,pp	0.5		>600kPa		
	1.0	SANDSTONE: Extremely low to low strength, light brown sandstone		D	1.2				
	1.4	Pit discontinued at 1.4m, slow progress							

RIG: 13t rubber tyred excavator

LOGGED: Taylor

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: MJB
Date: 11/3/05

Douglas Partners
Geotechnics · Environment · Groundwater

ACIRL Quality Testing Services Pty Ltd

(ABN 66 003 451 876)
51 Darling Street, CARRINGTON, NSW 2294
Phone : (02) 4969 4979 (02) 4961 3793
Fax: (02) 4962 1850

ACIRL QUALITY TESTING SERVICES

SOIL ANALYSIS

Origin: Douglas Partners - N'cle

Report : NNW04-7037-02

Description : Soil Samples - Project No. 39169
Received: 28-Jan-05

Date : 07-Feb-05

Report To : Greg Taylor

Copy to: File

Sample No.	Description	pH (Water)	pH (CaCl2)	Electrical Conductivity dS/m	P Retention mg P/kg Soil	Exchangeable Cations Ca cmol/kg	Mg	Na	K	Al	Sample Mass (ar) (g)	Moisture %	Emmerson Aggregate Test
24756	TP1 0.4m	5.3	4.1	0.062	740	2.03	4.33	0.55	0.43		1210.2	7.0	Modified 5 *
Calculations:	*Calcium - Magnesium Ratio*		*0.5*	*C.E.C. :*	*7.3*		*Sodium % (E.S.P.):*		*7.5*				
Dry Bulk Density:	1.18 g/cm 3												
24757	TP3 0.4m	4.9	3.7	0.279	1060	0.99	10.07	2.86	0.57		834.3	12.2	Modified 5 *
Calculations:	*Calcium - Magnesium Ratio*		*0.1*	*C.E.C. :*	*14.5*		*Sodium % (E.S.P.):*		*19.7*				
Dry Bulk Density:	1.11 g/cm 3												
24758	TP7 0.6m	5.4	4.3	0.331	600	0.57	9.10	2.29	0.27		640.2	10.0	Modified 5 *
Calculations:	*Calcium - Magnesium Ratio*		*0.1*	*C.E.C. :*	*12.2*		*Sodium % (E.S.P.):*		*18.7*				
Dry Bulk Density:	1.15 g/cm 3												

Note *Exchangeable Cations (Ca, Mg, Na, K) - 1M Ammonium Chloride at pH 7.0*
CEC calculated from Ca, Mg, Na, K (Aluminium not analysed)
P Retention based on Rayment & Higginson Method 9H (5000mg P/kg soil addition) (1:5 Soil Solution)
Soil Sampling by client
Moisture % - Determined after drying sample at 40 C
Analysis reported on dried sample
** SAR 5 Water used for E.A.T.*
Dry Bulk Density determined on dried sample after preparation.

Reported By

MANAGER

ACIRL Quality Testing Services Pty Ltd
(ABN 66 003 451 876)
51 Darling Street, CARRINGTON, NSW 2294
Phone (02) 4969 4979 (02) 4961 3793
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SOIL ANALYSIS

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Sample No.	Description	pH (Water)	pH (CaCl2)	Electrical Conductivity dS/m	P Retention mg P/kg Soil	Exchangeable Cations cmol/kg Ca	Mg	Na	K	Al	Sample Mass (ar) (g)	Moisture %	Emmerson Aggregate Test
24759	TP8 1.0m	4.8	3.6	0.295	400	1.16	4.79	2.35	0.28		632.5	8.7	Modified 5 *

Calculations: *Calcium - Magnesium Ratio* 0.2 *C.E.C.* 8.6 *Sodium % (E.S.P.)* 27.4

Dry Bulk Density: 1.19 g/cm ^{3}

Note *Exchangeable Cations (Ca, Mg, Na, K) - 1M Ammonium Chloride at pH 7.0*
CEC calculated from Ca, Mg, Na, K (Aluminium not analysed)
P Retention based on Rayment & Higginson Method 9H (5000mg P/kg soil addition) (1:5 Soil Solution)
Soil Sampling by client
Moisture % - Determined after drying sample at 40 C
Analysis reported on dried sample
** SAR 5 Water used for E.A.T*
Dry Bulk Density determined on dried sample after preparation

Reported By

MANAGER

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- × Don't erect any structures, construct paths, graze animals or drive over the land application area.
- × Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- × Don't plant trees or shrubs near or on house drains.
- × Don't alter stormwater lines to discharge into or near the land application area.
- × Don't flood the land application area through the use of hoses or sprinklers.
- × Don't let children or pets play on land application areas.
- × Don't water fruit and vegetables with the effluent.
- × Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- ∧ Overloading the treatment system with wastewater.
- ∧ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- ∧ The application area has been poorly designed.
- ∧ Stormwater is running onto the area.

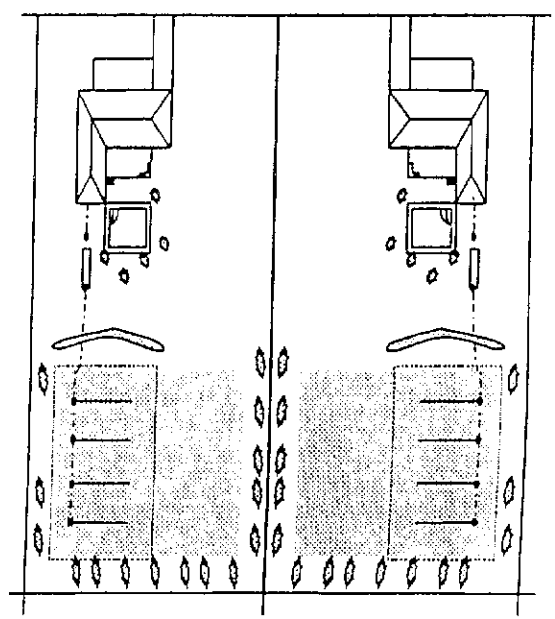
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

NSW Government, Environment & Health Protection Guidelines: On-site Sewage Management for Single Households, January 1998.

Your Land Application Area



APPENDIX 7
VEGETATION SUITABLE FOR LAND APPLICATION AREAS

Botanical Name	Approximate Height	Common Name or Variety
Grasses		
Carex spp.		
Lomandra longifolia		
Microlaena stipoides		
Oplismenus imbecillis		
Pennisetum alopecuroides	40 - 80 cm	Available as lawn turf
Poa lab		
Stipa spp.		
Ground cover/climbers		
Hibbertia scandens		Snake vine
Hibbertia stellaris		
Isotoma fluviatalis	Prostrate	
Kennedia rubicunda	Climber	Dusky coral pea
Scaevola albida		
Scaevola ramosissima		
Veronica plebeia		
Viola hederacea		Native violet
Sedges/grasses/small plants		
Anigozanthus flavidus	2m	Kangaroo Paw
Baumea acuta		
Baumea articulata	Sedge	
Baumea juncea	Sedge	
Baumea nuda	Sedge	
Baumea rubiginosa	Sedge	
Baumea teretifolia	Sedge	
Blandfordia grandiflora	30-90cm	Christmas Bell
Blandfordia nobilis	30-90cm	Christmas Bell
Brachyscome diversifolia	Clump	Native Daisy
Carex appressa	Sedge	
Cotula coronopifolia	10-20cm	Waterbutton
Crinum pedunculatum	<2m	Swamp Lily
Cyperus polystachyos	Sedge	
Dianella caerulea	Low plant	Blue Flax Lily
Epacris microphylla	50cm -1m	
Ferns		
Gahnia spp	Tall Grass	
Juncus spp.	0.5 m Rush	
Lobelia trigonocaulis	5-10cm	
Lomandra spp.	Grass	
Patersonia fragilis		Native Iris
Patersonia glabrata		Native Iris
Patersonia occidentalis		Native Iris
Ranunculus graniticola	5cm	
Restio australis	Reed	
Restio tetraphyllus	1m	
Sowerbaea juncea	Sedge	Rush Lily
Tetratheca juncea	<30cm	
Xyris operculata	<1m	Tall Yellow Eye

Botanical Name	Approximate Height	Common Name or Variety
Shrubs		
Agonis flexuosa nana		
Baekea linifolia	1 - 2.5 m	
Baekea utilis	1-2.5 m	
Baekea virgata	< 4 m	
Banksia aemula	1 - 7 m	
Banksia robur	0.5 - 2 m	
Bauera ruboides	0.5 - 1.5 m	
Callistemon	2 - 3 m	Burgundy
Callistemon	2 - 4 m	Eureka
Callistemon	3 - 4 m	Harkness
Callistemon	3 - 4.5 m	Kings Park Special
Callistemon	2 - 3 m	Mauve Mist
Callistemon	1 - 2.5 m	Red Clusters
Callistemon	2 - 3 m	Reeves Pink
Callistemon citrinus	50 - 80 cm	Austraflora Firebrand
Callistemon citrinus	2 - 4 m	Splendens
Callistemon citrinus	60cm - 1m	White Ice
Callistemon linearis	1 - 3 m	
Callistemon macropunctatus	2 - 4 m	
Callistemon pachyphyllus	2 - 3 m	
Callistemon pallidus	1.5 - 4 m	
Callistemon paludosus	3 - 7 m	
Callistemon pinifolius	1 - 3 m	
Callistemon rigidus	1.5 - 2.5 m	
Callistemon salignus	3 – 10m	
Callistemon shiresii	4 - 8 m	
Callistemon sieberi	1.5 - 2 m	
Callistemon sieberi	50 - 80 cm	Austraflora Little Cobber
Callistemon subulatus	1 - 2 m	
Callistemon viminalis	1 - 2 m	Captain Cook
Callistemon viminalis	5 - 10 m	Dawson River
Callistemon viminalis	3 - 5 m	Hannah Ray
Callistemon viminalis	50 cm - 1 m	Little John
Callistemon viminalis	1.5 - 2 m	Rose Opal
Callistemon viminalis	2 - 3 m	Western Glory
Goodenia ovata	1 1.5 m	
Hibiscus diversifolius	1 - 2 m	Swamp hibiscus
Kunzea capitata	1 - 2 m	
Leptospermum flavescens	< 2 m	Tea tree
Leptospermum juniperinum	1 m	Tea-tree
Leptospermum lanigerum	1 - 2 m	Woolly tea-tree
Leptospermum squarrosum	< 2 m	Tea-tree
Melaleuca alternifolia	4 7 m	
Melaleuca decussata	1 - 2 m	Cross-leaved honey myrtle
Melaleuca lanceolata	4 - 6 m	
Melaleuca squamea	1 - 2 m	
Melaleuca thymifolia		

Botanical Name	Approx Height	Common Name or Variety
Trees		
Acacia elongata	> 2 m	
Acacia floribunda	2 - 4 m	Gossamer wattle
Agonis flexuosa	5 - 6 m	Willow myrtle
Allocasuarina diminuta	1 5 m	
Allocasuarina paludosa	0.5 - 2 m	
Angophora floribunda	Large tree	
Angophora subvelutina	Large tree	
Callicoma serratifolia	< 4m	
Casuarina cunninghamiana	10 - 30 m	River she-oak
Casuarina glauca	6 - 12 m	Swamp oak
Elaeocarpus reticulatis	Large tree	Blueberry ash
Eucalyptus amplifolia	Large tree	
Eucalyptus botryoides (coastal areas)	10 - 30 m	
Eucalyptus camaldulensis (west of ranges)	15 - 20 m	River red gum
Eucalyptus deanei	Large tree	Blue Mountains blue gum
Eucalyptus elata	Large tree	River Peppermint
Eucalyptus grandis	10 - 20 m	Flooded gum
Eucalyptus longifolia	20 m	Woollybutt
Eucalyptus pilularis	30 - 40 m	Blackbutt
Eucalyptus punctata	< 35 m	Greygum
Eucalyptus robusta	20 - 30 m	Swamp mahogany
Eucalyptus saligna (coastal)	30 50 m	Sydney blue gum
Eucalyptus tereticornis	30 - 40 m	Forest red gum
Eucalyptus viminalis (ranges)	20 - 40 m	Ribbon gum
Acmena smithii	10 - 20 m	Lilli pilli
Flindersia australis	< 40 m	Native teak
Hymenosporum flavuum	3 - 6 m	Native frangipani
Melaleuca armillaris	3 - 4 m	Bracelet honey myrtle
Melaleuca decora	4 - 7 m	
Melaleuca ericifolia	6 m	
Melaleuca halmaturorum	4 - 6 m	
Melaleuca hypericifolia	2 - 3 m	
Melaleuca linariifolia	4 - 8 m	Snow in summer
Melaleuca quinquenervia	5 - 7 m	Broad paperbark
Melaleuca squarrosa	6 m	
Melaleuca stypheloides	6 - 15 m	
Melia azedarach	15 - 20 m	
Pittosporum spp.		
Syzgium paniculatum	8 - 10 m	Bush cherry
Tristania laurina	5 - 15 m	Kanuka
Viminaria juncea	2 - 3 m	Golden spray

Source: Australian Plants Society

Preliminary Contaminated Site Investigation and Urban Capability Assessment

At

Lots 140 and 142 DP752455
Long Gully Road, Singleton

For

Orbit Planning Pty Ltd

4 October 2007
BH Ref: 70768

Table of Contents

Barker Harle
Consulting Engineers

4 October 2007
BH Ref: 70768

Orbit Planning
PO Box 28
SINGLETON NSW 2330

Attention: Ms Sally Flannery

Dear Madam,

Preliminary Contaminated Site Investigation and Urban Capability Assessment

Re: Proposed Land Rezoning: Lots 140 and 142 DP752455 Long Gully Road, Singleton

1. Introduction

It is proposed that the land identified as Lots 140 and 142 DP752455 Long Gully Road, Singleton be rezoned from the current land zoning of 1(a) – Rural (Rural Zone) to a rural residential zone, possibly 1(d) – Rural (Small Holdings Zone). The land rezoning is to be undertaken in accordance with Singleton Shire Council's "Local Environmental Plan (1996)", "Rural Residential Development Strategy (2005)" and the "Draft Subdivision and Infrastructure Development Control Plan (2005). The land identified above is to be known as "the site".

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216 Macquarie Road, Warners Bay

This Preliminary Contaminated Site Investigation and Urban Capability Assessment describes the current site conditions and land uses as well as consultation undertaken with regulatory authorities and service providers with regard to the lands. Photographs 1 – 12 shown attached to this document show the current site layout.

2. Site Description

2.1. Current Ownership

At the time of the investigation, two separate owners, Mr Brad and Sharon Schultz and Mr Scott and Melinda Bailey, owned the investigation area. Mr Brad Schultz owns Lot 140 DP752455 (the northern potion of the investigation area) and Mr Scott and Melinda Bailey owns Lot 142 DP752455 (the southern portion of the site). For the extent of this report, both Lot 140 and 142 will be identified as the "subject site".

2.2. Physical Description

The subject site is located on the eastern side of the Long Gully Road, Singleton. The site is bordered by Long Gully Road to the west and by open grassland paddocks with scattered intermediate to mature trees the remaining sides. The subject site is approximately 46 hectares in size.

At the time of the investigation, the site supported a number of structures. Two residential dwellings and a number of associated structures such as above ground concrete rainwater tanks had been constructed near the western boundary of the site. A number of dog kennels were located in the southeastern portion of the site.

Three earth embankment dams had been constructed across the subject site. The dams were located in the northern, southern and eastern portions of the site. All dams contained varying depth of stored water at the time of the investigation.

Several possible contaminant source locations were identified across the site. An empty steel drum, which was believed to have contained hydrocarbon fuels and/or oils, was located in the eastern portion of the site (TP2). A stripped car body frame was located in the northwestern portion of the site. A visual assessment of the stripped car body identified that all potential sources of hydrocarbon contaminant locations on the vehicle had been removed from the car body. An uncontrolled fill pile which contained residential construction materials (including concrete, timber and steel) was located in the northwestern portion of the site adjacent to the

stripped car body. At all of the locations, no visual signs of contamination were identified. Photographs 9 and 10 show the steel drum and the stripped car body.

An aerial photograph of the subject site can be seen in drawing 70768/1.

2.3. Topography

The site contained undulating hills with site elevations varying from 78m to 122m AHD. Average site slopes were estimated to be approximately 6° with slopes varying between 1 and 13°.

Two drainage lines and one ridgeline ran in a general west – east direction through the site. A second ridgeline, which was located to the south of the subject site, also ran in a general west – east direction. Slopes on the site generally sloped down from the ridgelines to the north and south towards the drainage lines.

Drawing 70768/2 shows a topographic survey of the subject site.

2.4. Vegetation

At the time of investigation, the site contained a sparse grass cover and a few scattered young to intermediate trees within open paddocks, more common in the northern and eastern portions of the site.

Native vegetation is believed to consist of an ironbark community (including narrow-leaved red ironbark, red ironbark and broad-leaved red ironbark) with some grey box and rough-barked apple.

As part of the proposed land rezoning application, Ecovision is undertaking an ecology assessment.

2.5. Soils

The site falls within the Sedgefield Soil Landscape (sf) as identified on the "Soil landscapes of the digital Singleton 1:250 000 Sheet" published by the SOILCON Natural Resource Mapping. The Sedgefield Soil Landscape comprises of yellow Soloths on the upper to midslopes with yellow Solodic Soils on lower slopes and in drainage lines. Black Soloths may also occur in areas of seepage on the slopes.

Drawing 70768/3 shows an extract from the "Soil landscapes of the digital Singleton 1:250 000 Sheet" and the approximate location of the subject site.

2.6. Soil Erosion

Moderate gully erosion was identified in the both the northern and southern drainage lines. Erosion gullies were up to 1.5m wide and 1m deep.

The "Soil landscapes of the digital Singleton 1:250 000 Sheet" published by the SOILCON Natural Resource Mapping describes the Sedgefield Soil Landscape (sf) as containing "severe gully and sheet erosion on many slopes and in drainage lines. The Soloths in particular have highly dispersive subsoils".

Photographs 11 and 12 show typical gully erosion on the site.

2.7. Site Access

Access to the subject site is available from Long Gully Road which is currently a sealed all weather flexible pavement.

2.8. Stormwater

Kerb and guttering is not present on either side of Long Gully Road. Stormwater from road surfaces is captured and conveyed using grass lined open swale drains.

3. Land Zonings

Singleton Council's "Local Environmental Plan (LEP) 1996" was adopted on 5 July 1996. The Singleton LEP - 1995 identified the site as being located within the land zoning 1(a) – rural Zone.

It is proposed that the land zoning of the subject site be changed to facilitate development for small holdings rural residential purposes subject to support by Singleton Council and the Minister for Planning.

4. Interview with Site Owners

4.1. Mr Brad Schultz - Lot 140 DP752455

An interview was undertaken with Mr Brad Schultz on 6 September 2007. During the interview, Mr Schultz stated that:

- He had owned the land since 2004. When purchased, the existing improvements including the existing residence were already constructed on the site.
- Mr Schultz stated that he had undertaken fertilisation of grassed paddocks once a year since owning the property. No other fertilisers had been used.
- Mr Schultz has not used or stored pesticides or fuels on the site during his ownership of the land.
- Mr Schultz was not aware of any potential contaminant spills or any areas of contamination.

4.2. Mr Scott Bailey - Lot 142 DP752455

An interview was undertaken with Mr Scott Bailey on 6 September 2007. During the interview, Mr Bailey stated that:

- He had owned the land since 2004. When purchased, the existing improvements including the existing residence were already constructed on the site.
- When Mr Bailey purchased the land, a stripped car body was located in an existing erosion gully in the northwestern portion of the site.
- Since purchasing the lot, Mr Bailey had stockpiled previously used building materials such as steel, timber and concrete in the northwestern portion of Lot 142. No visible signs of contamination or materials that could potentially cause contamination were identified within the stockpile. Photograph 8 shows the stockpile.
- Pesticides, herbicides and fertilizers had been used across Lot 142 while the property had been owned by Mr Bailey. The previous use of pesticides, herbicides and fertilizers prior to the could not be established.
- Mr Bailey was not aware of any potential contaminant spills or any areas of contamination.

5. Present Site Use

At the time of investigation, the majority of the subject site had been cleared of trees and supported a moderate grass ground cover.

The primary use of the site was for residential purposes with grazing cattle used to minimise vegetation growth on the site. Due to recent weather conditions and the resulting reduction in vegetation growth, the majority of cattle had been removed from the site. At the time of the investigation, the subject site supported approximately 7 head of cattle.

6. Preliminary Contaminated Site Investigation

A Preliminary Contaminated Site Investigation was undertaken on the site to determine potential soil contamination from historical land uses. Fieldwork for the soil investigation was undertaken on 6 September 2007.

6.1. Soil Investigation

Nine testpits were excavated on the site and one soil sample was recovered approximately 50mm below the existing surface level within each excavated testpit.

It was considered that the car body located within the drainage line was no risk to contamination as the car body did not contain any potential sources of contamination. The stockpile of building materials was also considered to contain no risk of contamination based on the materials which had been placed in the stockpile.

Laboratory test results can be seen in Table 1 below.

Table 1 – Soil Laboratory Test Results

Testpit	Limit of Results	TP1	TP2	TP2A	TP3	TP4	TP5	TP6	TP7	TP8
Sample Depth (mm)	-	50	50	50	50	50	50	50	50	50
C6-C9	5	-	<5	-	-	-	-	-	-	-
C10-C14	10	-	<10	-	-	-	-	-	-	-
C15-C28	20	-	<20	-	-	-	-	-	-	-
C29-C36	20	-	29	-	-	-	-	-	-	-
Benzene	0.2	-	<0.2	-	-	-	-	-	-	-
Toluene	1	-	<1	-	-	-	-	-	-	-
Ethylbenzene	1	-	<1	-	-	-	-	-	-	-
Xylene	1	-	<3	-	-	-	-	-	-	-
OC Pesticides	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
OP Pesticides	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH	0.1	6.5	-	6.2	5.8	6.3	6.0	6.1	5.9	5.4
EC	20	31	-	20	<20	<20	31	<20	47	<20

6.2. Threshold Limits

Table 2 below shows the threshold limits as defined by the following New South Wales Environment Protection Agency guidelines:

(i) "Guidelines for Assessing Service Station Sites"

(ii) "Orchard and Market Garden Contamination"

Threshold limit is the contaminate concentration that determines whether further action is required. Should contaminate levels exceed threshold limits, either further investigation to determine the extent of contaminate levels that exceed threshold limits should be undertaken or remedial action is required.

Table 2 – NSW EPA Threshold Limits for Residential Land/Cultivated Areas

Substance	Guideline 1	Guideline 2
C6 – C9	65	-
C10 – C14	1000	-
C15 – C28	1000	-
C29 – C36	1000	-
Benzene	1[a]	-
Toluene	1.4[b]/130[e]	-
Ethylbenzene	3.1[c]/50[f]	-
Total Xylene	14[d]/25[f]	-
OCP	-	10
OPP	-	10

Guideline 1 – "Guidelines for Assessing Service Station Sites"

Guideline 2 – "Orchard and Market Garden Contamination"

a – A lower benzene threshold concentration may be needed to protect groundwater.
b – The toluene threshold concentration is the Netherlands MPC to protect terrestrial organisms in soil. This value was obtained by applying a US EPA assessment factor to terrestrial chronic No Observed Effect Concentration (NOEC) data. The MPC is an 'indicative' value (Van de Plassche et al. 1993; Van de Plassche & Bockting 1993).
c – The ethyl benzene threshold concentration is the Netherlands MPC for the protection of terrestrial organisms in soil. No terrestrial ecotoxicological data could be found for use in the Netherlands criteria derivation. Therefore, equilibrium partitioning has been applied to the MPC for water to obtain estimates of the MPC for soil. The MPC for water has been derived from aquatic ecotoxicological data (Van de Plassche et al. 1993; Van de Plassche & Bockting 1993).
d – The xylene threshold concentration is the Netherlands MPC for the protection of terrestrial organisms in soil. No terrestrial ecotoxicological data could be found for use in the Netherlands criteria derivation. Therefore, equilibrium partitioning has been applied to the MPC for water to obtain an estimate of the MPC for soil. The MPC for water has been derived from aquatic ecotoxicological data. The concentration shown applies to total xylenes and is based on the arithmetic average of the individual xylene MPCs (Van de Plassche et al. 1993; Van de Plassche & Bockting 1993).
e – Human health and ecologically based protection level for toluene. The threshold concentration presented here is the Netherlands intervention value for the protection of terrestrial organisms. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion.
f – Human health based protection level for ethyl benzene or total xylenes as shown. The threshold concentration presented here is the Netherlands intervention value. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion.

6.3. Discussion of Results

As can be seen in Table 1 above, the majority of laboratory test results did not register detectable levels of contaminants. None of the recovered soil samples exceed threshold limits.

The only sample which identified a detectable contaminant level was recovered from testpit TP2 at a depth of 50mm. This sample was recovered from the base of an existing steel drum which was anticipated to have previously contained hydrocarbon material. The contaminant identified at this location was hydrocarbon (C29-36) and was consistent with the previous use of the steel drum.

7. Onsite Effluent Dispersal Investigation

An on-site effluent dispersal geotechnical investigation has been undertaken on the above property in accordance with AS 1547-2000 On-site Domestic Wastewater Management (AS 1547) and the Environment and Health Protection Guideline On-site Sewage Management for Single Households.

This report provides details of the investigation and recommendations for on-site dispersal of treated sewage effluent. A Site and Soil Evaluation, Dispersal Area Calculation Sheet and Soil Profile Sheet addressing specific matters required by AS 1547, are attached.

7.1. Investigation and Subsurface Conditions

The fieldwork investigation was undertaken on 6 September 2007. The fieldwork comprised a visual assessment of the proposed dispersal area and surrounds, logging of the subsoil profile at 9 locations and the recovery of 4 bulk soil samples to assess the characteristics of the sub-surface soil profile. All fieldwork was conducted in accordance with the methodology outlined in AS 1547 and On-site Sewage Management for Single Households.

Soil samples were analysed for: Cation Exchange Capacity, Sodium, Potassium, Calcium, Magnesium, Aluminium, Phosphorus Absorption Capacity, Emerson Aggregate Test and Electrical Conductivity.

Neither groundwater nor surfacewater were encountered during the investigation.

Laboratory test results can be seen in Table 3 below.

Table 3 – Laboratory Test Results

Laboratory Test	Sample ID			
	TP1 (150mm)	TP2 (200mm)	TP4 (350mm)	TP7 (200mm)
EC	0.22	0.18	0.06	0.26
pH	6.1	5.7	6.1	6.1
CEC (me/100g)	17.8	18.1	25.7	22.6
Na (me/100g)	2.6	2.3	1.3	1.6
K (me/100g)	0.7	0.5	1.2	0.8
Ca (me/100g)	0.8	1.0	5.5	4.5
Mg (me/100g)	10.7	10.6	12.4	11.6
Al (me/100g)	<0.1	<0.1	<0.1	<0.1
Psorp (mg/kg)	162	322	372	178
Psorp index	1.6	2.6	2.8	1.7
EAT	2(2)	2(2)	2(2)	2(2)

7.2. Dispersal Area Calculations

Five methods were used to calculate the required dispersal area. They were:

- Nitrogen Loading Method
- Phosphorus Loading Method
- Minimum Area Method, and
- Nominated Area Method
- Australian Standard - AS 1547 Sizing of Dispersal Area Method

Each method uses different physical and chemical site characteristics to determine the required effluent dispersal area. The most suitable dispersal area sizing method will be determined with consideration to site specific limitations. Typically the method that produces the largest area is selected to enable the most effective on-site dispersal of effluent.

Each of the above methods is described below in Table 4.

Table 4 – Methodologies Used for Calculating the Area Required for Effluent Dispersal

Method	Description
The Nitrogen Loading Method (NLM)	Calculations are based upon treated effluent with a total nitrogen content of 30mg/L and 10mg/L, and an average maximum vegetation take up rate of 25mg/m^2/day. The average maximum take up rate for the vegetation is based on the ability of the vegetation to use the nutrient before it passes through the root zone.
The Phosphorus Loading Methods (PLM)	Calculations are based upon treated effluent with a total phosphorus content of 12mg/L and 8mg/L, and an average maximum soil take up rate of 3mg/m^2/day. The average maximum take up rate for the soil is based on the ability of the soil to bind the phosphorus and prevent it being washed through the soil profile (where it can become a source of pollution).
The Minimum Area Method	Uses a combination of regional climatic records, weekly effluent volume and the designed irrigation rate to determine the minimum required dispersal area and the corresponding wet weather storage volume.
The Nominated Area Method	Calculates the minimum dispersal area required reducing the wet weather storage to zero. The Nominated Area Method uses the largest area calculated by the previous 3 methods to determine the required wet weather storage volume for a nominated effluent dispersal area.
The Australian Standard - AS 1547 Dispersal Area Sizing Method	Calculates the required dispersal area by dividing the weekly effluent produced by the residence in question, by the permeability of the soil.

It should be noted that the Minimum Area and Nominated Area Methods do not take into account nutrient loading rates except when an area calculated by the nutrient loading methods is used as the starting value in the Nominated Area Method.

7.3. Results

The on-site effluent dispersal area calculated by each of the 5 methods described above, for both a 3-bedroom, 4-bedroom and 5-bedroom residence, is summarised below in Table 5. All calculations are based on all properties being supplied by town water. Worked examples of each calculation are shown in the Dispersal Area Calculation Sheet in the attachments.

Table 5 – On-site Effluent Dispersal Irrigation Areas & Storage Volumes

Method	3-Bedroom Dwelling		4-Bedroom Dwelling		5-Bedroom Dwelling	
	Required Irrigation Area (m^2)	Wet Weather Storage Volume (m^3)	Required Irrigation Area (m^2)	Wet Weather Storage Volume (m^3)	Required Irrigation Area (m^2)	Wet Weather Storage Volume (m^3)
Nitrogen Loading Method 30mg/L	870	0	1045	0	1395	0
Nitrogen Loading Method 10mg/L	290	2	350	2	465	2
Phosphorus Loading Method 12mg/L	590/1075	0	710/1290	0	945/1715	0
Phosphorus Loading Method 8mg/L	395/715	0	475/860	0	630/1145	0
Minimum Area Method	305	0	370	0	495	0
Nominated Area Method	210	19	250	23	335	33
AS 1547 Method	255	5	305	6	410	8

The On-site Sewage Management for Single Households guideline recommends that wet weather storage be provided to store run-off that will occur when the combination of rainfall and effluent exceeds the capacity of the site to absorb water.

Section 7.5 describes the above results in relation to the treatment and dispersal systems recommended for the site.

These figures may be revised upon receipt of effluent treatment data from accredited systems with different total nitrogen and phosphorus contents. Council may chose to reduce or waive the requirement for wet weather storage.

7.4. The Limitations to on-Site Effluent Dispersal

Table 6 of The Environment and Health Protection Guideline On-site Sewage Management for Single Households provides a soil assessment rating system for on-site effluent dispersal systems. When the results from the site investigations and soil analysis are compared with

this table, a number of minor, moderate or major limitations to the on-site irrigation of treated effluent on the subject site can be identified. These limitations are given in Table 6 below.

Table 6 – Minor, Moderate and Major Limitations to the On-site Irrigation of Treated Effluent.

Soil Feature	Limitation
pH	Moderate
Depth to bedrock or water table	Moderate
Cation Exchange Capacity (CEC)	Moderate
Exchangeable Sodium Percentage (ESP)	Minor
Electrical Conductivity (EC)	Minor
Permeability	Minor
EAT	Minor

The dispersal areas for the site will require remedial work to overcome the above moderate and major limitations.

7.4.1 pH

The soil across the entire site has a low pH. By raising the pH and therefore reducing the acidity of the soil improved plant growth can be achieved. The pH may be adjusted by an annual application of lime at 400 g/m^2.

7.4.2 Exchangeable Sodium Percentage (ESP)

The soil has displayed high clay dispersion properties, which can lead to the blockage of pores by the dispersed clay particles, reducing the soil permeability. This may be overcome by an application of gypsum at 1kg/m^2 during construction. It has been estimated that the gypsum will be effective for about 10 yrs at this application rate.

7.4.3 Permeability

The moderately low soil permeability on the subject site cannot be improved through remedial works. As such a maximum design irrigation rate of 3mm/day should be adopted for effluent dispersal in order to avoid waterlogging or re-surfacing of dispersed effluent.

7.5. Conclusions - Treatment and Dispersal Options

Based on our evaluation of the site and the identified soil profile, the investigation area is suitable for the on-site dispersal of effluent from:

(a) An aerated waste water treatment system

(b) A septic tank with aerobic sand filter system

All systems should be installed and managed in accordance with the requirements of AS 1547 and On-site Sewage Management for Single Households.

Subject to the treatment systems limitations, effluent may be dispersed directly to surface spray irrigation, surface drip and trickle irrigation or subsurface irrigation.

The systems described below each require a reserve effluent dispersal area. A reserve effluent dispersal area is recommended by AS 1547 and is equivalent to 100% of the area of the primary dispersal area. The purpose of the reserve dispersal area is to rest the primary dispersal area, or for duplication of the dispersal area if unforeseen circumstances require this at some time in the future. The reserve dispersal area is to be protected from any development that would prevent its use in the future.

The reserve dispersal area may be able to be reduced or even eliminated if improved waste water treatment systems are installed or alternative land application systems are used.

Each of the treatment and dispersal options considered suitable for the site are described below.

7.5.1 Aerated Waste Water Treatment System

On the subject site, the limiting factor for effluent dispersal from an aerated waste water treatment system producing effluent with a total nitrogen content of 10mg/L and a total phosphorus content of 8mg/L, would be climatic conditions (Minimum Area Method). A **3 bedroom** residence, utilising the above system with treated effluent being dispersed of via surface spray or drip and trickle irrigation, would require a primary and back up reserve dispersal area each of **395-715m^2** depending on the phosphorous sorption capacity of the soil at the dispersal location. A **4 bedroom** residence with the same system would require a primary and back up reserve dispersal area each of **475-860m^2** depending on the phosphorous sorption capacity of the soil at the dispersal location. A **5 bedroom** residence with the same system would require a primary and back up reserve dispersal area each of **630-1145m^2** depending on the phosphorous sorption capacity of the soil at the dispersal location.

On the subject site, the limiting factor for effluent dispersal from an aerated waste water treatment system producing effluent with a total nitrogen content of 30mg/L and a total phosphorus content of 12mg/L, would be the Nitrogen uptake by vegetation (Nitrogen Loading

Method). A **3 bedroom** residence, utilising the above system with treated effluent being dispersed of via surface spray or drip and trickle irrigation, would require a primary and back up reserve dispersal area each of **870-1075m^2** depending on the phosphorous sorption capacity of the soil at the dispersal location. A **4 bedroom** residence with the same system would require a primary and back up reserve dispersal area each of **1045-1290m^2** depending on the phosphorous sorption capacity of the soil at the dispersal location. A **5 bedroom** residence with the same system would require a primary and back up reserve dispersal area each of **1395-1715m^2** depending on the phosphorous sorption capacity of the soil at the dispersal location.

The above effluent dispersal areas may be revised upon receipt of effluent treatment result data from accredited systems with different total nitrogen and phosphorus contents.

7.5.2 Septic Tank with Aerobic Sand Filter

The aerobic sand filter, treats effluent from a septic tank to the standards of an aerated waste water treatment system as set out in AS 1547 and On-site Sewage Management for Single Households (see attachment). The manufacturer will determine the required plan surface area of the sand filter for a 3-bedroom, 4-bedroom or 5-bedroom dwelling.

The required dispersal area will be equivalent to that of a system treating effluent to a standard with a total nitrogen content of 30mg/L and a total phosphorus content of 12mg/L. The treated effluent collected from an Aerobic Sand Filter must be dispersed of via sub-surface irrigation and will require a primary dispersal area and reserve dispersal area each of **870-1075m^2** for a **3 bedroom** residence, **1045-1290m^2** for a **4 bedroom** residence and **1395-1715m^2** for a **5 bedroom** residence depending on the phosphorous sorption capacity of the soil at the dispersal location.

8. Consultation with Regulatory Authorities

8.1. Singleton Council

A telephone conversation was undertaken with Mr Ken Horner, Singleton Councils Development Planner and during these conversations, Mr Horner advised that the following issues would be considered in the rezoning of the subject site:

- Works should be undertaken in accordance with Singleton Councils “Local Environmental Plan (1996)”, “Rural Residential Development Strategy (2005)” and the “Draft Subdivision and Infrastructure Development Control Plan (2005)

- Any re-zoning of lands and the categories they may be re-zoned to will be subject to the outcomes of this review.

8.2. Mines Subsidence Board

A telephone conversation was held with Ms Sally Smith from the Mine Subsidence Boards Singleton Office. During the telephone conversation, Ms Smith confirmed that the Mine Subsidence Board has no restrictions on developments on or surrounding the subject site.

9. Site Suitability

9.1. Flora

The existing disturbed nature of the site would reduce the likelihood of endangered or threatened species being identified on the site. It is understood that Ecovision have undertaken a Flora and Fauna Assessment on the subject site as part of the rezoning application. Details of the findings of the investigation were not available at the time of writing this report.

9.2. Acid Sulfate Soils

A desktop study was undertaken using the Department of Natural Resources "Acid Sulfate Soil Index Map". It was determined that the Department of Natural Resources does not produce an Acid Sulfate Soil Risk Map for the subject site as acid sulfate soils do not occur within Singleton area. As such the site is not believed to contain either actual or potential acid sulfate soils.

9.3. Slope Stability

9.3.1 Stability Assessment

The site was assessed as having a "**unlikely**" potential for a soil slide/soil flow landslide within the colluvial soil with a "**minor**" measure of consequences to property and therefore, a "**low**" risk level of instability as defined in the attachment "Landslide Risk Assessment – Example of Qualitative Terminology For Use in Assessing Risk to Property".

The onus is on the owner to decide whether the assessed level of risk is acceptable, taking into account likely economic consequences of the risk.

9.3.2 Construction Variation

The extent of testing associated with this assessment is limited to the testpit locations and variations in ground conditions may occur. Barker Harle should be contacted immediately should subsurface conditions differ from those given in this report.

9.4. Drainage & Flooding

A telephone conversation was held with Mr Ken Horner, Singleton Councils Development Planner and during these conversations, Mr Horner advised that the subject site is not located within a flood prone land.

Further to Singleton Councils records, the site's locality and the topography of the surrounding area does not create negative drainage and flooding issues on the subject site.

Future development applications for the subject site will be subject to Singleton Councils stormwater drainage requirements. It is anticipated that onsite stormwater detention may not be required.

9.5. Bushfire

Review of Bush Fire Prone Land Map for the subject site indicated that the site is located within an area of bushfire prone land and that a Bushfire Threat Assessment would be required to accompany any future development application.

10. Consultation with Service Providers

10.1. Energy Australia

Telephone conversations were undertaken with Mr Wayne Griffith, Energy Australia's Planning Engineer. It was determined that existing power mains owned and operated by Energy Australia are accessible to the subject site. It could not be determined by Energy Australia at this stage whether the existing power mains have the capacity to facilitate any subdivision of the subject site due to unknown future power requirements. It was recommended that following completion of the development layout, further advice may be given by Energy Australia regarding possible works to the existing power mains and their associated costs.

10.2. Telstra

During a telephone conversation with a Telstra customer service representative on 6 September 2007, it was advised that Telstra can provide telephone facilities to most households in NSW and that there should not be any problems associated with telephone connection to the subject site.

11. Registered Groundwater Bore Search

A registered groundwater bore search was undertaken by Ms Pam Clarke of the Department of Water and Energy resources (Maitland Office). A 5.0km radius from the midpoint of the subject site was used and 25 bores were identified. The following bores were identified within the 5km radius:

- GW016057
- GW016059
- GW027057
- GW027088
- GW027381
- GW027862
- GW028335
- GW028336
- GW035785
- GW037899
- GW037907
- GW038038
- GW042726
- GW044861
- GW047999
- GW052121
- GW053080
- GW056766
- GW060320
- GW061232
- GW064935
- GW066586
- GW067790
- GW078256
- GW078905

No bores were identified on the subject site. The nearest bore, GW064935, was located approximately 2.5km to the south of the subject site.

Where information was available, it was found that the water quality and bore yield varied significantly between the bores. Bore yield was found to vary between 0.38 – 45.00L/s and water salinity was found to vary between Fresh/Good – 3001-7000ppm. Water bearings zones were not identified within 10 of the 25 identified bores.

The Department of Infrastructure, Planning and Natural Resources map showing borehole locations and borehole logs have been attached to this report.

12. Conclusion

Following completion of the site investigation it was determined that:

- Soil contamination was not identified on the site. The majority of laboratory test results could not identify detectable amounts of contaminants.
- The site is suitable for the dispersal of wastewater which has undergone been secondary treatment. The wastewater dispersal area will be dependent on the size of any proposed dwelling and the phosphorous sorption of the soil within the dispersal area.
- Singleton Council advised that works should be undertaken in accordance with Singleton Councils "Local Environmental Plan (1996)", "Rural Residential Development Strategy (2005)" and the "Draft Subdivision and Infrastructure Development Control Plan (2005) and that any re-zoning of lands and the categories they may be re-zoned to will be subject to the outcomes of this review.
- The Mine Subsidence Board confirmed that there are no restrictions on developments on or surrounding the subject site.
- Acid sulfate soil was not identified on the site.
- The subject site is not subject to land instability and was assessed as having a "**unlikely**" potential for a soil slide/soil flow landslide within the colluvial soil with a "**minor**" measure of consequences to property and therefore, a "**low**" risk level of instability as defined in the attachment "Landslide Risk Assessment – Example of Qualitative Terminology For Use in Assessing Risk to Property".
- The subject site is not within and identified flood prone area.
- Service providers advised that services should be supplied to any subdivided lots and that service supply requirements would be assessed following application of the subdivision layout.

Yours Faithfully
Barker Harle

Mark Smith
B.E. (Environmental)
Environmental Engineer

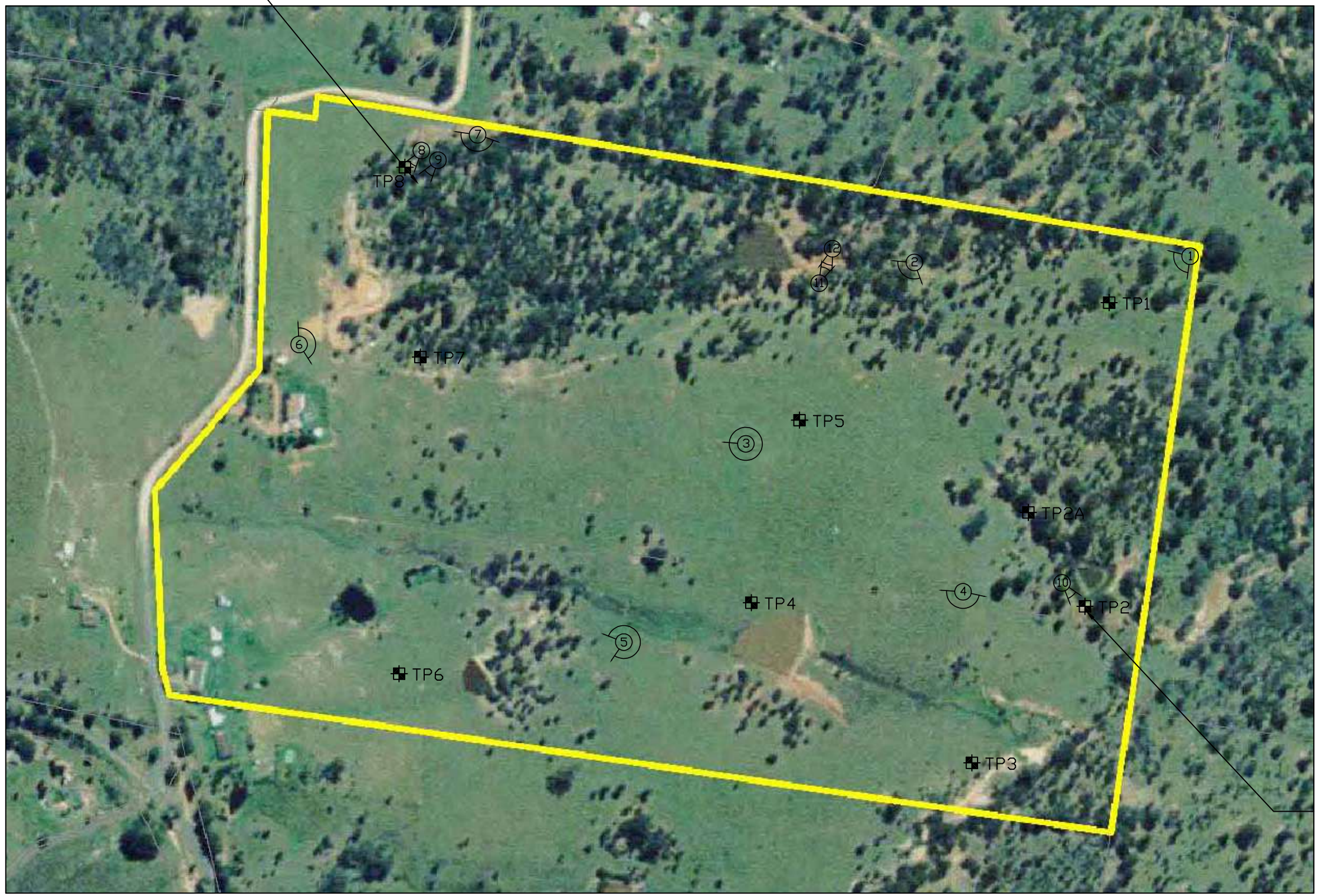
Attachments:

1. Drawing 70768/1, 70768/2 and 70768/3
2. Laboratory Test Results
3. Department of Infrastructure, Planning and Natural Resources groundwater bore search data
4. Photograph 1-12

SITE PLAN

1:4000 (A3)

APPROX. LOCATION
OF EXISTING STRIPPED
CAR BODY



LEGEND

TP1 HAND EXCAVATED TEST PIT

① PHOTOGRAPH LOCATION AND DIRECTION

Issue	Description	Date.	Design	Drawn.	Checked	Approved
A	REPORT ISSUE	4/10/07	MS	MS	RB	

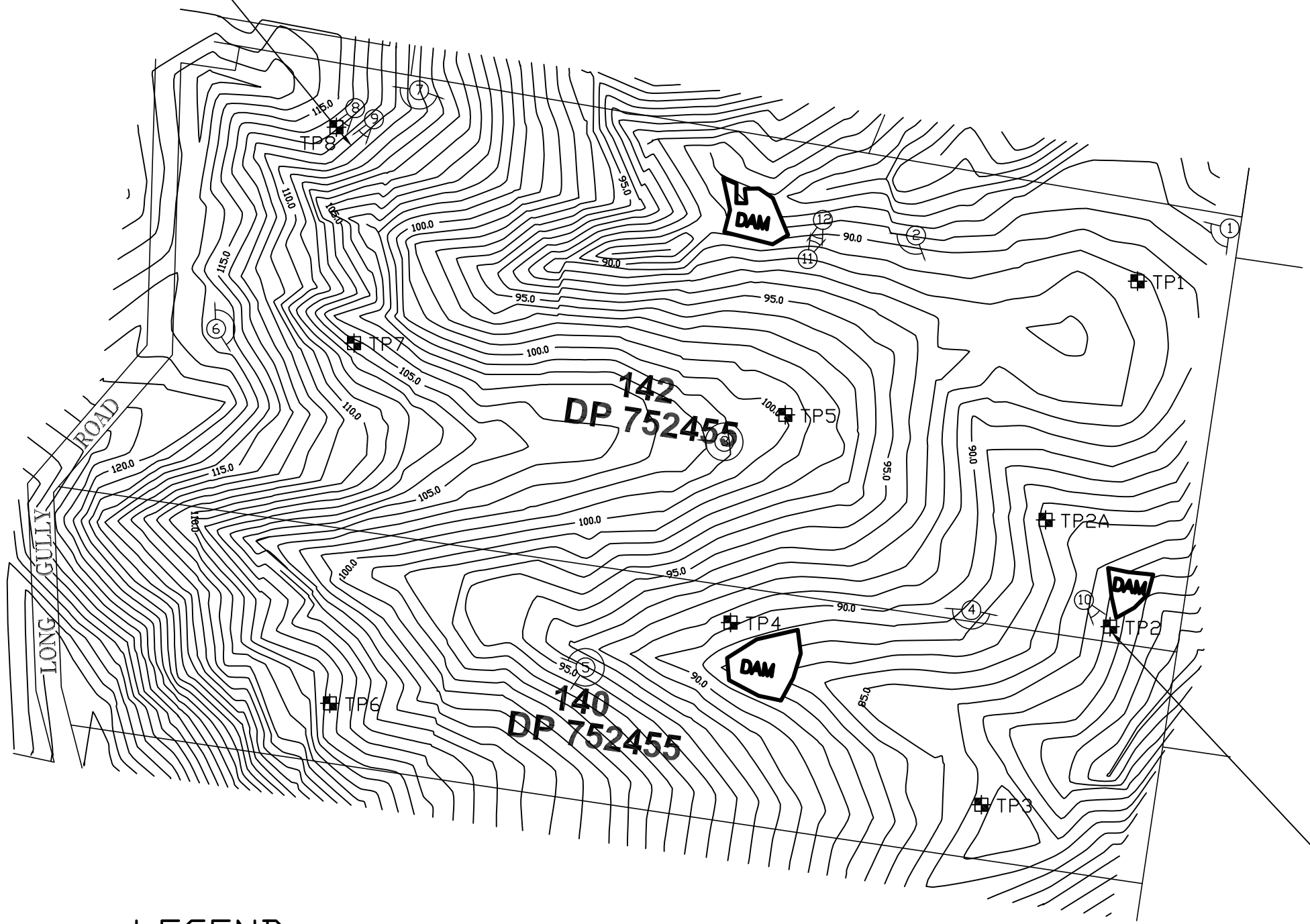
Barker Harle
Engineers & Scientists
Servicing Gosford to Forster
Tel: 4948 4088

PRELIMARY CONTAMINATED SITE INVESTIGATION AND URBAN CAPABILITY ASSESSMENT
LOTS 140 AND 142 DP752455 LONG GULLY ROAD, SINGLETON
ORBIT PLANNING

Job No. 70768
Sheet No. 1
Sheet Size. A3
Issue No. A

SITE PLAN

1:4000 (A3)



LEGEND

TP1 HAND EXCAVATED TEST PIT

① PHOTOGRAPH LOCATION AND DIRECTION

Issue	Description	Date.	Design	Drawn.	Checked	Approved
A	REPORT ISSUE	4/10/07	MS	MS	RB	

Barker Harle
Engineers & Scientists
Servicing Gosford to Forster
Tel: 4948 4088

PRELIMARY CONTAMINATED SITE INVESTIGATION AND URBAN CAPABILITY ASSESSMENT
LOTS 140 AND 142 DP752455 LONG GULLY ROAD, SINGLETON
ORBIT PLANNING

Job No. 70768
Sheet No. 2
Sheet Size. A3
Issue No. A

SITE PLAN

1:4000 (A3)

APPROX. LOCATION OF SUBJECT SITE

Issue	Description	Date.	Design	Drawn.	Checked	Approved
A	REPORT ISSUE	4/10/07	MS	MS	RB	

Barker Harle
Engineers & Scientists
Servicing Gosford to Forster
Tel: 4948 4088

PRELIMARY CONTAMINATED SITE INVESTIGATION AND URBAN CAPABILITY ASSESSMENT
LOTS 140 AND 142 DP752455 LONG GULLY ROAD, SINGLETON
ORBIT PLANNING

Job No.	Sheet No.	Sheet Size.	Issue No.
70768	3	A3	A

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Accredited for compliance with ISO/IEC 17205

Accreditation Number: 1464

Certificate of Analysis

Barker Harle
PO Box 63
WARNERS BAY NSW 2282
Australia

Attention: Mark Smith

Project	**07ENCA0017690**
Client Reference	ORBIT
	70768
Received Date	06/09/2007 03:00:00 PM

Customer Sample ID			**TP1_50**	**TP2_50**	**TP2A_50**
Amdel Sample Number			**612444**	**612445**	**612446**
Date Sampled			**06/09/2007**	**06/09/2007**	**06/09/2007**
VOC					
Test/Reference	PQL	Unit			
1200 BTEX &(C6-C9) in Soil by P&T					
Benzene	0.2	mg/kg	-	<0.2	-
Ethylbenzene	1	mg/kg	-	<1	-
Meta- & Para- Xylene	2	mg/kg	-	<2	-
Ortho-Xylene	1	mg/kg	-	<1	-
Toluene	1	mg/kg	-	<1	-
Total Xylenes	3	mg/kg	-	<3	-
C6-C9 Fraction	5	mg/kg	-	<5	-
4-Bromofluorobenzene - Surrogate	-	%	-	91	-
SVOC					
Test/Reference	PQL	Unit			
2300 OC Pesticides in Soil by GC-ECD					
a-BHC	0.5	mg/kg	<0.5	-	<0.5
a-Chlordane	0.5	mg/kg	<0.5	-	<0.5
a-Endosulfan	0.5	mg/kg	<0.5	-	<0.5
Aldrin	0.5	mg/kg	<0.5	-	<0.5
b-BHC	0.5	mg/kg	<0.5	-	<0.5
b-Endosulfan	0.5	mg/kg	<0.5	-	<0.5
d-BHC	0.5	mg/kg	<0.5	-	<0.5
DDD	0.5	mg/kg	<0.5	-	<0.5
DDE	0.5	mg/kg	<0.5	-	<0.5
DDT	0.5	mg/kg	<0.5	-	<0.5
Dieldrin	0.5	mg/kg	<0.5	-	<0.5
Endosulfan sulfate	0.5	mg/kg	<0.5	-	<0.5
Endrin	0.5	mg/kg	<0.5	-	<0.5
Endrin Aldehyde	0.5	mg/kg	<0.5	-	<0.5
g-BHC	0.5	mg/kg	<0.5	-	<0.5
g-Chlordane	0.5	mg/kg	<0.5	-	<0.5
Heptachlor	0.5	mg/kg	<0.5	-	<0.5
Heptachlor epoxide	0.5	mg/kg	<0.5	-	<0.5
Hexachlorobenzene (HCB)	0.5	mg/kg	<0.5	-	<0.5
Methoxychlor	0.5	mg/kg	<0.5	-	<0.5
Oxychlordane	0.5	mg/kg	<0.5	-	<0.5
2,4,5,6-tetrachloro-m-xylene - Surrogate	-	%	97	-	106
2500 OP Pesticides in Soil by GC-ECD					
Chlorpyrifos	0.5	mg/kg	<0.5	-	<0.5
Chlorpyrifos Methyl	0.5	mg/kg	<0.5	-	<0.5

Customer Sample ID			TP1_50	TP2_50	TP2A_50
Amdel Sample Number			612444	612445	612446
Date Sampled			06/09/2007	06/09/2007	06/09/2007
SVOC					
Test/Reference	PQL	Unit			
Diazinon	0.5	mg/kg	<0.5	-	<0.5
Ethion	0.5	mg/kg	<0.5	-	<0.5
Fenitrothion	0.5	mg/kg	<0.5	-	<0.5
Fenthion	0.5	mg/kg	<0.5	-	<0.5
Malathion	0.5	mg/kg	<0.5	-	<0.5
Methyl Parathion	0.5	mg/kg	<0.5	-	<0.5
Parathion	0.5	mg/kg	<0.5	-	<0.5
Ronnel	0.5	mg/kg	<0.5	-	<0.5
Triphenyl Phosphate -SURROGATE	-	%	96	-	97
2000 TPH (C10 - C36) in Soil by GC					
C10-C14 Fraction	10	mg/kg	-	<10.0	-
C15-C28 Fraction	20	mg/kg	-	<20.0	-
C29-C36 Fraction	20	mg/kg	-	29	-
Miscellaneous					
Test/Reference	PQL	Unit			
5000 Moisture Content					
% Moisture	1	%	8	12	7

Customer Sample ID			TP3_50	TP4_50	TP5_50
Amdel Sample Number			612447	612448	612449
Date Sampled			06/09/2007	06/09/2007	06/09/2007
SVOC					
Test/Reference	PQL	Unit			
2300 OC Pesticides in Soil by GC-ECD					
a-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
a-Chlordane	0.5	mg/kg	<0.5	<0.5	<0.5
a-Endosulfan	0.5	mg/kg	<0.5	<0.5	<0.5
Aldrin	0.5	mg/kg	<0.5	<0.5	<0.5
b-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
b-Endosulfan	0.5	mg/kg	<0.5	<0.5	<0.5
d-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
DDD	0.5	mg/kg	<0.5	<0.5	<0.5
DDE	0.5	mg/kg	<0.5	<0.5	<0.5
DDT	0.5	mg/kg	<0.5	<0.5	<0.5
Dieldrin	0.5	mg/kg	<0.5	<0.5	<0.5
Endosulfan sulfate	0.5	mg/kg	<0.5	<0.5	<0.5
Endrin	0.5	mg/kg	<0.5	<0.5	<0.5
Endrin Aldehyde	0.5	mg/kg	<0.5	<0.5	<0.5
g-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
g-Chlordane	0.5	mg/kg	<0.5	<0.5	<0.5
Heptachlor	0.5	mg/kg	<0.5	<0.5	<0.5
Heptachlor epoxide	0.5	mg/kg	<0.5	<0.5	<0.5
Hexachlorobenzene (HCB)	0.5	mg/kg	<0.5	<0.5	<0.5
Methoxychlor	0.5	mg/kg	<0.5	<0.5	<0.5
Oxychlordane	0.5	mg/kg	<0.5	<0.5	<0.5
2,4,5,6-tetrachloro-m-xylene - Surrogate	-	%	90	97	114
2500 OP Pesticides in Soil by GC-ECD					

Customer Sample ID			TP3_50	TP4_50	TP5_50
Amdel Sample Number			612447	612448	612449
Date Sampled			06/09/2007	06/09/2007	06/09/2007
SVOC					
Test/Reference	PQL	Unit			
Chlorpyrifos	0.5	mg/kg	<0.5	<0.5	<0.5
Chlorpyrifos Methyl	0.5	mg/kg	<0.5	<0.5	<0.5
Diazinon	0.5	mg/kg	<0.5	<0.5	<0.5
Ethion	0.5	mg/kg	<0.5	<0.5	<0.5
Fenitrothion	0.5	mg/kg	<0.5	<0.5	<0.5
Fenthion	0.5	mg/kg	<0.5	<0.5	<0.5
Malathion	0.5	mg/kg	<0.5	<0.5	<0.5
Methyl Parathion	0.5	mg/kg	<0.5	<0.5	<0.5
Parathion	0.5	mg/kg	<0.5	<0.5	<0.5
Ronnel	0.5	mg/kg	<0.5	<0.5	<0.5
Triphenyl Phosphate -SURROGATE	-	%	100	102	103
Miscellaneous					
Test/Reference	PQL	Unit			
5000 Moisture Content					
% Moisture	1	%	10	11	12

Customer Sample ID			TP6_50	TP7_50	TP8_50
Amdel Sample Number			612450	612451	612452
Date Sampled			06/09/2007	06/09/2007	06/09/2007
SVOC					
Test/Reference	PQL	Unit			
2300 OC Pesticides in Soil by GC-ECD					
a-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
a-Chlordane	0.5	mg/kg	<0.5	<0.5	<0.5
a-Endosulfan	0.5	mg/kg	<0.5	<0.5	<0.5
Aldrin	0.5	mg/kg	<0.5	<0.5	<0.5
b-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
b-Endosulfan	0.5	mg/kg	<0.5	<0.5	<0.5
d-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
DDD	0.5	mg/kg	<0.5	<0.5	<0.5
DDE	0.5	mg/kg	<0.5	<0.5	<0.5
DDT	0.5	mg/kg	<0.5	<0.5	<0.5
Dieldrin	0.5	mg/kg	<0.5	<0.5	<0.5
Endosulfan sulfate	0.5	mg/kg	<0.5	<0.5	<0.5
Endrin	0.5	mg/kg	<0.5	<0.5	<0.5
Endrin Aldehyde	0.5	mg/kg	<0.5	<0.5	<0.5
g-BHC	0.5	mg/kg	<0.5	<0.5	<0.5
g-Chlordane	0.5	mg/kg	<0.5	<0.5	<0.5
Heptachlor	0.5	mg/kg	<0.5	<0.5	<0.5
Heptachlor epoxide	0.5	mg/kg	<0.5	<0.5	<0.5
Hexachlorobenzene (HCB)	0.5	mg/kg	<0.5	<0.5	<0.5
Methoxychlor	0.5	mg/kg	<0.5	<0.5	<0.5
Oxychlordane	0.5	mg/kg	<0.5	<0.5	<0.5
2,4,5,6-tetrachloro-m-xylene - Surrogate	-	%	110	112	99
2500 OP Pesticides in Soil by GC-ECD					
Chlorpyrifos	0.5	mg/kg	<0.5	<0.5	<0.5
Chlorpyrifos Methyl	0.5	mg/kg	<0.5	<0.5	<0.5

Customer Sample ID			TP6_50	TP7_50	TP8_50
Amdel Sample Number			612450	612451	612452
Date Sampled			06/09/2007	06/09/2007	06/09/2007
SVOC					
Test/Reference	PQL	Unit			
Diazinon	0.5	mg/kg	<0.5	<0.5	<0.5
Ethion	0.5	mg/kg	<0.5	<0.5	<0.5
Fenitrothion	0.5	mg/kg	<0.5	<0.5	<0.5
Fenthion	0.5	mg/kg	<0.5	<0.5	<0.5
Malathion	0.5	mg/kg	<0.5	<0.5	<0.5
Methyl Parathion	0.5	mg/kg	<0.5	<0.5	<0.5
Parathion	0.5	mg/kg	<0.5	<0.5	<0.5
Ronnel	0.5	mg/kg	<0.5	<0.5	<0.5
Triphenyl Phosphate -SURROGATE	-	%	108	100	104
Miscellaneous					
Test/Reference	PQL	Unit			
5000 Moisture Content					
% Moisture	1	%	10	5	9

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

Description	Extracted	Analysed
1200 BTEX &(C6-C9) in Soil by P&T	06/09/2007	10/09/2007
2000 TPH (C10 - C36) in Soil by GC	07/09/2007	12/09/2007
2300 OC Pesticides in Soil by GC-ECD	07/09/2007	11/09/2007
2500 OP Pesticides in Soil by GC-ECD	07/09/2007	11/09/2007
5000 Moisture Content	07/09/2007	07/09/2007

Amdel Internal Quality Control Review

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. Proficiency Trial results are available on request.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spike or surrogate recoveries.
5. Test samples duplicated or spiked, are for this job only and are identified in the following QC report.
6. SVOC analyses on waters are performed on homogenized, unfiltered sample, unless noted otherwise.
7. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.
8. The 'Sum of PAHs' result in the body of the report is the sum of any positive results and PQLs of other non-detected results.
9. Sampled Dates quoted in this report are those listed on the COC or sample jars; if no sample dates are noted, the date the samples are received at the laboratory have been used
10. Matrix Spike recoveries are calculated on an 'As Received' basis; the parent sample result is moisture corrected after the %recovery is determined

Holding Times

Please refer to 'Sampling and Preservation Chart for Soils & Waters' for holding times. (Amdel form AS-FOR-ADM-020)

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgement.
If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitability qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

Quality Control Results

Laboratory: **EN_SVOC**

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
616242 [Method Blank]							
2300 OC Pesticides in Soil by GC-ECD							
a-BHC	mg/kg	<0.5			< 0.5	T	
a-Chlordane	mg/kg	<0.5			< 0.5	T	
a-Endosulfan	mg/kg	<0.5			< 0.5	T	
Aldrin	mg/kg	<0.5			< 0.5	T	
b-BHC	mg/kg	<0.5			< 0.5	T	
b-Endosulfan	mg/kg	<0.5			< 0.5	T	
d-BHC	mg/kg	<0.5			< 0.5	T	
DDD	mg/kg	<0.5			< 0.5	T	
DDE	mg/kg	<0.5			< 0.5	T	
DDT	mg/kg	<0.5			< 0.5	T	
Dieldrin	mg/kg	<0.5			< 0.5	T	
Endrin	mg/kg	<0.5			< 0.5	T	
Endrin Aldehyde	mg/kg	<0.5			< 0.5	T	
g-Chlordane	mg/kg	<0.5			< 0.5	T	
Heptachlor	mg/kg	<0.5			< 0.5	T	
Heptachlor epoxide	mg/kg	<0.5			< 0.5	T	
Methoxychlor	mg/kg	<0.5			< 0.5	T	
Oxychlordane	mg/kg	<0.5			< 0.5	T	
2.4.5.6-tetrachloro-m-xylene-SURROGATE	%	101			70-130 %	T	

Laboratory: **EN_SVOC**

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
616254 [Method Blank]							
2500 OP Pesticides in Soil by GC-ECD Ext							
Chlorpyrifos	mg/kg	<0.5			< 0.5	T	
Chlorpyrifos Methyl	mg/kg	<0.5			< 0.5	T	
Diazinon	mg/kg	<0.5			< 0.5	T	
Dichlorvos	mg/kg	<0.5			< 0.5	T	
Ethion	mg/kg	<0.5			< 0.5	T	
Fenitrothion	mg/kg	<0.5			< 0.5	T	
Fenthion	mg/kg	<0.5			< 0.5	T	
Malathion	mg/kg	<0.5			< 0.5	T	
Methyl Parathion	mg/kg	<0.5			< 0.5	T	
Parathion	mg/kg	<0.5			< 0.5	T	
Ronnel	mg/kg	<0.5			< 0.5	T	
2-nitro-m-xylene-SURROGATE	%	100			70-130 %	T	
Triphenyl Phosphate -SURROGATE	%	101			70-130 %	T	
616266 [Method Blank]							
2000 TPH (C10 - C36) in Soil by GC							
C10-C14 Fraction	mg/kg	<10			< 10	T	
C15-C28 Fraction	mg/kg	<20			< 20	T	
C29-C36 Fraction	mg/kg	<20			< 20	T	
616243 [Laboratory Control Sample]							
2300 OC Pesticides in Soil by GC-ECD			Expected Value	Percent Recovery			
a-BHC	mg/kg	4.0	5.0	80.5	70-130 %	T	
a-Chlordane	mg/kg	4.1	5.0	82	70-130 %	T	
a-Endosulfan	mg/kg	4.2	5.0	84	70-130 %	T	
Aldrin	mg/kg	4.4	5.0	89	70-130 %	T	
b-BHC	mg/kg	4.1	5.0	82	70-130 %	T	
b-Endosulfan	mg/kg	3.9	5.0	79	70-130 %	T	
d-BHC	mg/kg	4.4	5.0	88	70-130 %	T	
DDD	mg/kg	7.7	10.0	77	70-130 %	T	
DDE	mg/kg	8.6	10.0	86	70-130 %	T	
DDT	mg/kg	9.3	10.0	93	70-130 %	T	
Dieldrin	mg/kg	4.2	5.0	85	70-130 %	T	
Endosulfan sulfate	mg/kg	3.9	5.0	77	70-130 %	T	
Endrin	mg/kg	4.3	5.0	85	70-130 %	T	
Endrin Aldehyde	mg/kg	4.3	5.0	86	70-130 %	T	
g-Chlordane	mg/kg	4.3	5.0	86	70-130 %	T	
Heptachlor	mg/kg	3.8	5.0	77	70-130 %	T	
Heptachlor epoxide	mg/kg	4.2	5.0	85	70-130 %	T	
Methoxychlor	mg/kg	4.3	5.0	86	70-130 %	T	
Oxychlordane	mg/kg	4.2	5.0	85	70-130 %	T	
2.4.5.6-tetrachloro-m-xylene-SURROGATE	%	99	N/A	N/A	70-130 %	T	
616255 [Laboratory Control Sample]							
2500 OP Pesticides in Soil by GC-ECD Ext			Expected Value	Percent Recovery			
Chlorpyrifos	mg/kg	4.5	5.0	90	70-130 %	T	
Chlorpyrifos Methyl	mg/kg	4.5	5.0	90	70-130 %	T	
Diazinon	mg/kg	4.2	5.0	85	70-130 %	T	
Dichlorvos	mg/kg	4.3	5.0	87	70-130 %	T	
Ethion	mg/kg	4.4	5.0	89	70-130 %	T	
Fenitrothion	mg/kg	4.5	5.0	90	70-130 %	T	
Fenthion	mg/kg	4.5	5.0	90	70-130 %	T	
Malathion	mg/kg	4.5	5.0	90	70-130 %	T	
Methyl Parathion	mg/kg	4.5	5.0	91	70-130 %	T	
Parathion	mg/kg	4.5	5.0	90	70-130 %	T	
Ronnel	mg/kg	4.5	5.0	90	70-130 %	T	
2-nitro-m-xylene-SURROGATE	%	100	N/A	N/A	70-130 %	T	
Triphenyl Phosphate -SURROGATE	%	98	N/A	N/A	70-130 %	T	

Laboratory: **EN_SVOC**

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
616267 [Laboratory Control Sample]							
2000 TPH (C10 - C36) in Soil by GC			Expected Value	Percent Recovery			
C10-C14 Fraction	mg/kg	130	125.0	105.442	70-130 %	T	
C15-C28 Fraction	mg/kg	120	125.0	98.208	70-130 %	T	
C29-C36 Fraction	mg/kg	120	125.0	97.182	70-130 %	T	
612463 [Duplicate of 612444]							
2300 OC Pesticides in Soil by GC-ECD			Result 2	RPD			
a-BHCDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
a-ChlordaneDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
a-EndosulfanDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
AldrinDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
b-BHCDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
b-EndosulfanDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
d-BHCDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
DDDDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
DDEDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
DDTDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
DieldrinDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
Endosulfan sulfateDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
Endrin AldehydeDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
EndrinDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
g-BHCDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
g-ChlordaneDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
Heptachlor epoxideDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
HeptachlorDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
Hexachlorobenzene (HCB)DB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
MethoxychlorDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
OxychlordaneDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
2.4.5.6-tetrachloro-m-xylene-SURROGATE	%	94	N/A	N/A	70-130 %	T	
612464 [Duplicate of 612444]							
2500 OP Pesticides in Soil by GC-ECD			Result 2	RPD			
Chlorpyrifos MethylDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
ChlorpyrifosDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
DiazinonDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
EthionDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
FenitrothionDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
FenthionDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
MalathionDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
Methyl ParathionDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
ParathionDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
RonnelDB	mg/kg	<0.5	<0.5	<1	0-30 %	T	
Triphenyl Phosphate -SURROGATE	%	105	N/A	N/A	70-130 %	T	

Laboratory: **EN_SVOC**

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
612465 [Spike of 612446]							
2300 OC Pesticides in Soil by GC-ECD			Spike Value	Percent Recovery			
a-BHCDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
a-ChlordaneDB	mg/kg	4.1	N/A	N/A	N/A	N/A	
a-EndosulfanDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
AldrinDB	mg/kg	4.6	N/A	N/A	N/A	N/A	
b-BHCDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
b-EndosulfanDB	mg/kg	4.2	N/A	N/A	N/A	N/A	
d-BHCDB	mg/kg	4.6	N/A	N/A	N/A	N/A	
DDDDB	mg/kg	8.1	N/A	N/A	N/A	N/A	
DDEDB	mg/kg	8.7	N/A	N/A	N/A	N/A	
DDTDB	mg/kg	10	N/A	N/A	N/A	N/A	
DieldrinDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
Endosulfan sulfateDB	mg/kg	3.9	N/A	N/A	N/A	N/A	
Endrin AldehydeDB	mg/kg	4.5	N/A	N/A	N/A	N/A	
EndrinDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
g-BHCDB	mg/kg	4.8	N/A	N/A	N/A	N/A	
g-ChlordaneDB	mg/kg	4.4	N/A	N/A	N/A	N/A	
Heptachlor epoxideDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
HeptachlorDB	mg/kg	3.9	N/A	N/A	N/A	N/A	
Hexachlorobenzene (HCB)DB	mg/kg	4.5	N/A	N/A	N/A	N/A	
MethoxychlorDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
OxychlordaneDB	mg/kg	4.3	N/A	N/A	N/A	N/A	
2.4.5.6-tetrachloro-m-xylene-SURROGATE	%	128	N/A	N/A	70-130 %	T	
612466 [Spike of 612446]							
2500 OP Pesticides in Soil by GC-ECD			Spike Value	Percent Recovery			
Chlorpyrifos MethylDB	mg/kg	5.1	N/A	N/A	N/A	N/A	
ChlorpyrifosDB	mg/kg	5.1	N/A	N/A	N/A	N/A	
DiazinonDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
EthionDB	mg/kg	5.1	N/A	N/A	N/A	N/A	
FenitrothionDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
FenthionDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
MalathionDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
Methyl ParathionDB	mg/kg	5.1	N/A	N/A	N/A	N/A	
ParathionDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
RonnelDB	mg/kg	5.0	N/A	N/A	N/A	N/A	
Triphenyl Phosphate -SURROGATE	%	100	N/A	N/A	70-130 %	T	

Laboratory: **EN_VOC**

Sample, Test, Result Reference	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Codes
613319 [Method Blank]							
1200 BTEX &(C6-C9) in Soil by P&T							
Benzene	mg/kg	<0.2			< 0.2	T	
C6-C9 Fraction	mg/kg	<5			< 5	T	
Ethylbenzene	mg/kg	<1			< 1	T	
Meta- & Para- Xylene	mg/kg	<2			< 2	T	
Ortho-Xylene	mg/kg	<1			< 1	T	
Toluene	mg/kg	<1			< 1	T	
4-Bromofluorobenzene - Surrogate	%	89			70-130 %	T	
613320 [Laboratory Control Sample]							
1200 BTEX &(C6-C9) in Soil by P&T			Expected Value	Percent Recovery			
Benzene	mg/kg	5.2	5.0	103	70-130 %	T	
C6-C9 Fraction	mg/kg	54	50.0	110	70-130 %	T	
Ethylbenzene	mg/kg	5.1	5.0	102	70-130 %	T	
Meta- & Para- Xylene	mg/kg	10.0	10.0	100	70-130 %	T	
Ortho-Xylene	mg/kg	5.1	5.0	102	70-130 %	T	
Toluene	mg/kg	5.1	5.0	103	70-130 %	T	
4-Bromofluorobenzene - Surrogate	%	88	N/A	N/A	70-130 %	T	

Project Comments

Comments	N/A

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Samples correctly preserved	Yes
Organic samples had Teflon liners	Yes
Samples received with Zero Headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Anthony Crane	Operations Manager	Accreditation Number: 1464
Greg Towers	Senior Analyst - VOC	Accreditation Number: 1464
Laura Schofield	Production Manager - Organics	Accreditation Number: 1464

Laboratory Manager

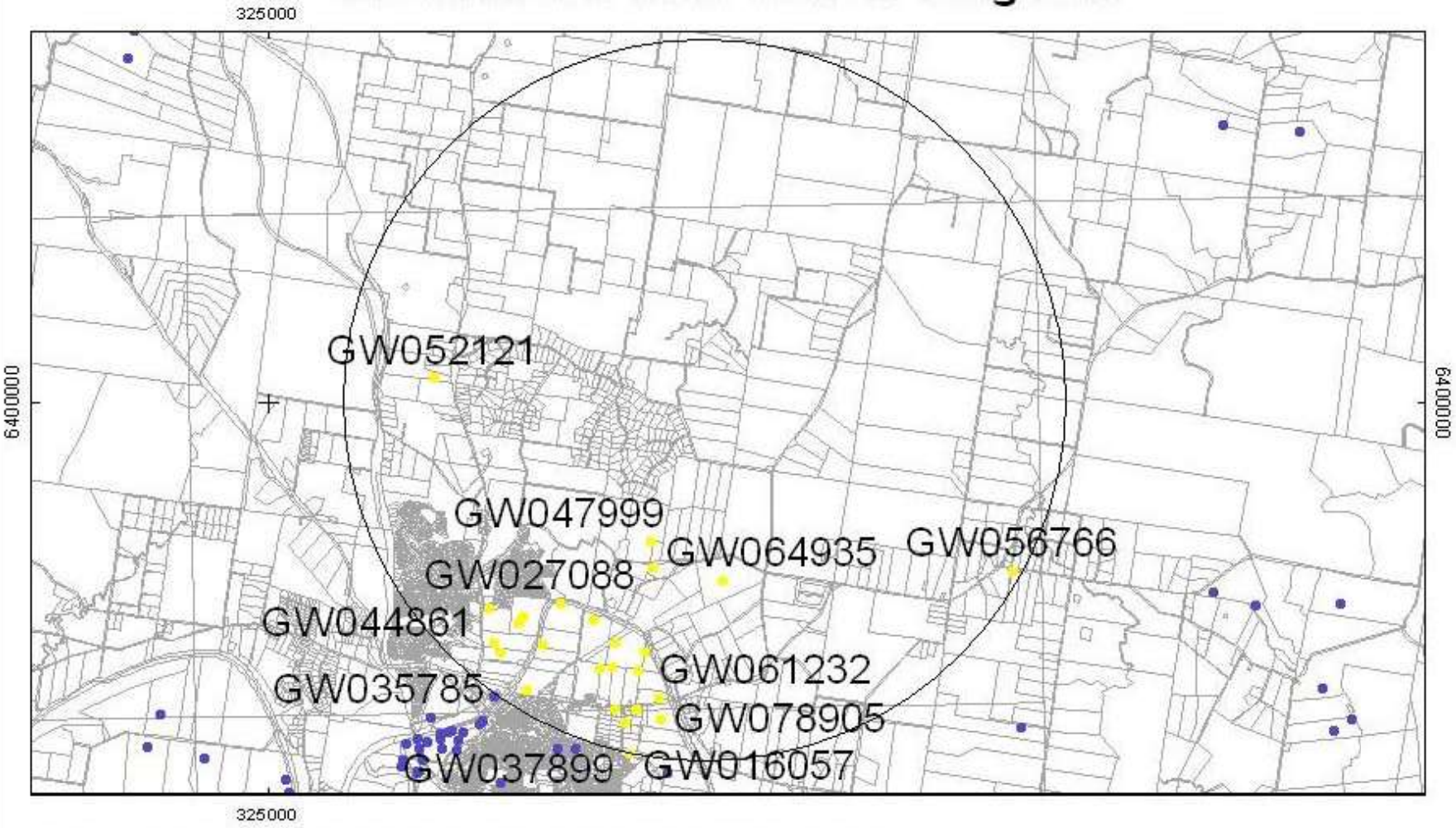
Anthony Crane	Operations Manager	

Final Report

- Indicates Not Requested * Indicates NATA accreditation does not cover the performance of this service

The samples were not collected by Amdel staff.

Groundwater Bore Search Singleton



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N

Produced by: [illegible]

Date : 23/10/2007

g:\boresearches\boresearch\boresearch2007\3472.apr

Date/Time :23-Oct-2007 12:26 PM
User :PCLARKE
Report :RMGW001D.QRP
Executable :S:\G5\PROD32\Ground.exe
Exe Date :13-Sep-2007
System :Groundwater
Database :Edbp

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW016057

Converted From HYDSYS

Licence :20BL009841
Licence Status Active
Authorised Purpose(s) IRRIGATION, STOCK
Intended Purpose(s) NOT KNOWN

Work Type : Well
Work Status : Collapsed Bore
Construct. Method :(Unknown)
Owner Type : Private

Commenced Date :
Completion Date :01-Jan-1958
Final Depth : 11.60 m
Drilled Depth : 11.60 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - KINTYRE
GWMA :017 - HUNTER
GW Zone : -
Standing Water Level :
Salinity : 501-1000 ppm
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	12
Licensed :	NORTHUMBERLAND	WHITTINGHAM	18 3631

Region :20 - HUNTER
River Basin :210 - HUNTER RIVER
Area / District :
CMA Map :9132-4N SINGLETON
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)
Northing :6395327
Easting :330112
Latitude (S) :32° 33' 59"
Longitude (E) :151° 11' 25"

GS Map :0053A3
MGA Zone :56
Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;
H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.90	-0.90	1067			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
7.60	11.60	4.00	Unconsolidated	1.80		5.46			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.91	0.91	Soil Black	Soil	
0.91	2.13	1.22	Clay Red	Clay	
2.13	3.66	1.53	Gravel Red Fairly Dry	Gravel	
3.66	7.62	3.96	Gravel Red Water Bearing	Gravel	
7.62	11.58	3.96	Gravel Red Water Supply	Gravel	

Remarks

WELL COLLAPSED 24/11/78

***** End of GW016057 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW016059

Converted From HYDSYS

Licence : 20BL007931
Licence Status Cancelled
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) NOT KNOWN

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Dec-1957
Final Depth : 11.00 m
Drilled Depth : 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : 017 - HUNTER
GW Zone : -
Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	DURHAM	DARLINGTON	217
Licensed :	DURHAM	DARLINGTON	12 192526

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6397212
Easting : 328619
Latitude (S) : 32° 32' 57"
Longitude (E) : 151° 10' 29"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.50	-0.50	1219			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
8.20	10.90	2.70	(Unknown)	8.20		5.46			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW016059 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW027057

Converted From HYDSYS

Licence : 20BL020382
Licence Status Active
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) NOT KNOWN

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Jan-1947
Final Depth : 15.20 m
Drilled Depth : 15.20 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - NOT KNOWN
GWMA : -
GW Zone : -
Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	12
Licensed :	NORTHUMBERLAND	WHITTINGHAM	5 3348

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6396469
Easting : 330223
Latitude (S) : 32° 33' 22"
Longitude (E) : 151° 11' 30"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Timber	-1.20	-1.20	2134			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
13.70	15.20	1.50	Unconsolidated	10.70		15.16			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	13.72	13.72	Soil Clayey Soil	Soil	
13.72	15.24	1.52	Gravel Water Supply	Gravel	

Remarks

***** End of GW027057 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW027088

Converted From HYDSYS

Licence : 20BL020383
Licence Status Active
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) NOT KNOWN

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Jan-1930
Final Depth : 15.20 m
Drilled Depth : 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -
Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	6
Licensed :	NORTHUMBERLAND	WHITTINGHAM	PT6 755269

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6397406
Easting : 329138
Latitude (S) : 32° 32' 51"
Longitude (E) : 151° 10' 49"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Timber	0.00	0.00	1829			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW027088 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW027381

Converted From HYDSYS

Licence : 20BL020381
Licence Status Active
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) NOT KNOWN

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Jan-1966
Final Depth : 14.90 m
Drilled Depth : 14.90 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - COMBO
GWMA : -
GW Zone : -
Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	23
Licensed :	NORTHUMBERLAND	WHITTINGHAM	PT23 755269

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6397167
Easting : 329585
Latitude (S) : 32° 32' 59"
Longitude (E) : 151° 11' 6"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.50	-0.50	1524			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.10	14.90	5.80	Unconsolidated	10.70		25.26			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.44	2.44	Soil	Soil	
2.44	9.14	6.70	Clay	Clay	
9.14	14.94	5.80	Gravel Coarse Water Supply	Gravel	

Remarks

***** End of GW027381 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW027862

Converted From HYDSYS

Licence : 20BL019950
Licence Status Active
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) IRRIGATION

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-May-1968
Final Depth : 12.50 m
Drilled Depth : 12.50 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 501-1000 ppm
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	12
Licensed :	NORTHUMBERLAND	WHITTINGHAM	42 1003638

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6396525
Easting : 329857

Latitude (S) : 32° 33' 20"
Longitude (E) : 151° 11' 16"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete	-0.90	-0.90	1219			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.80	12.50	2.70	Unconsolidated	-9.80		12.38			1001-3000 ppm

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.22	1.22	Loam	Loam	
1.22	9.75	8.53	Clay	Clay	
9.75	12.19	2.44	Sand Water Supply	Sand	
12.19	12.50	0.31	Gravel Water Supply	Gravel	

Remarks

***** End of GW027862 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW028335

Converted From HYDSYS

Licence : 20BL020379
Licence Status Active
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) IRRIGATION

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Jan-1965
Final Depth : 14.60 m
Drilled Depth : 14.60 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : 017 - HUNTER
GW Zone : -
Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	12
Licensed :	NORTHUMBERLAND	WHITTINGHAM	40 870350

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6396491
Easting : 329675
Latitude (S) : 32° 33' 21"
Longitude (E) : 151° 11' 9"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.60	-0.60	1219			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
14.00	14.60	0.60	Fractured	11.30		8.84			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.05	3.05	Soil	Soil	
3.05	14.02	10.97	Clayey	(Unknown)	
14.02	14.63	0.61	Shale Water Supply	Shale	

Remarks

***** End of GW028335 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW028336

Converted From HYDSYS

Licence : 20BL020380
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Well	DOMESTIC	NOT KNOWN
Work Status : (Unknown)	IRRIGATION	
Construct. Method : (Unknown)	STOCK	
Owner Type : Private		

Commenced Date : **Final Depth :** 14.00 m
Completion Date : 01-Jan-1967 **Drilled Depth :** 14.00 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : 017 - HUNTER
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	WHITTINGHAM	25
	Licensed : NORTHUMBERLAND	WHITTINGHAM	PT25 755269

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6396864 **Latitude (S) :** 32° 33' 9"
Easting : 329904 **Longitude (E) :** 151° 11' 18"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.60	13.40	1524			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.40	14.00	4.60	Unconsolidated	9.10		15.16			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	9.45	9.45	Soil	Soil	
9.45	14.02	4.57	Gravel Sandy Water Supply	Gravel	

Remarks

***** End of GW028336 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW035785

Converted From HYDSYS

Licence : 20BL030417
Licence Status Cancelled
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) IRRIGATION

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Dec-1972
Final Depth : 13.20 m
Drilled Depth : 13.30 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - CORRA LYNN
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : invalid code
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	DURHAM	DARLINGTON	L13 (217)
Licensed :	DURHAM	DARLINGTON	L13 (P+ Port 217)

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6396867
Easting : 328234
Latitude (S) : 32° 33' 8"
Longitude (E) : 151° 10' 14"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.10	13.30	1219			(Unknown)
1	1	Opening	Perforations		0.00	1219		1	SL: 0mm; A: 0mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
6.00	13.10	7.10	Unconsolidated	8.50		22.73			invalid code

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	6.09	6.09	Soil Black	Soil	
6.09	13.25	7.16	Gravel Sandy Water Supply	Gravel	

Remarks

WELL UNUSEABLE DUE TO SAILINITY

***** End of GW035785 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW037899

Converted From HYDSYS

Licence : 20BL031451
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Well	DOMESTIC	IRRIGATION
Work Status : (Unknown)	IRRIGATION	
Construct. Method : (Unknown)	STOCK	
Owner Type : Private		

Commenced Date : **Final Depth :** 11.80 m
Completion Date : 01-Dec-1973 **Drilled Depth :** 11.90 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : invalid code
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	WHITTINGHAM	L11 (12)
	Licensed : NORTHUMBERLAND	WHITTINGHAM	11 3631

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6395758 **Latitude (S) :** 32° 33' 45"
Easting : 330053 **Longitude (E) :** 151° 11' 23"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.30	11.80	1219			Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.40	11.80	2.40	Unconsolidated	9.40		3.99			invalid code

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	5.18	5.18	Soil Black	Soil	
5.18	9.14	3.96	Sand Red	Sand	
9.14	11.88	2.74	Gravel Water Supply	Gravel	

Remarks

***** End of GW037899 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW037907

Converted From HYDSYS

Licence : 20BL031134
Licence Status Active
Authorised Purpose(s) DOMESTIC, STOCK
Intended Purpose(s) IRRIGATION
Work Type : Well
Work Status : Manual observations - 6 monthly/annually - water leve
Construct. Method : (Unknown)
Owner Type : Private

Commenced Date :
Completion Date : 01-Oct-1973
Final Depth : 14.30 m
Drilled Depth : 14.30 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -
Standing Water Level :
Salinity : invalid code
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	DURHAM	DARLINGTON	L12 (217)
Licensed :	DURHAM	DARLINGTON	12 192526

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation : 39.00 m (A.H.D.)
Elevation Source : R.L. at Surface
Northing : 6397142
Easting : 328571
Latitude (S) : 32° 32' 60"
Longitude (E) : 151° 10' 27"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GPS - Global Positioning System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.20	14.30	1219			
1	1	Casing	Concrete Cylnder	-0.20	14.30	1219			(Unknown)
1	1	Casing	Concrete Cylnder	-0.15	14.30	1219			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
7.40	14.30	6.90	Unconsolidated	7.40		25.26			invalid code

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	7.31	7.31	Loam	Loam	
7.31	11.27	3.96	Clay Sandy Water Supply	Clay	
11.27	12.49	1.22	Sand Water Supply	Sand	
12.49	14.32	1.83	Gravel Sandy Water Supply	Gravel	

Remarks

Bore location surveyed during the regional groundwater salinity monitoring by Matthew Baker on 09/08/2001.

***** End of GW037907 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW038038

Converted From HYDSYS

Licence : 20BL104899
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Well	DOMESTIC	IRRIGATION
Work Status : (Unknown)	FARMING	
Construct. Method : (Unknown)		
Owner Type : Private		

Commenced Date : **Final Depth :** 15.80 m
Completion Date : 01-Oct-1974 **Drilled Depth :** 15.80 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : invalid code
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	WHITTINGHAM	6
	Licensed : NORTHUMBERLAND	WHITTINGHAM	34 997245

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6396847 **Latitude (S) :** 32° 33' 9"
Easting : 328886 **Longitude (E) :** 151° 10' 39"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** PR.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete	-1.20	-1.20	1219			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
11.20	15.40	4.20	Unconsolidated	11.50		11.37			invalid code

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	11.27	11.27	Driller	(Unknown)	
11.27	12.49	1.22	Sand	Sand	
12.49	15.84	3.35	Gravel Water Supply	Gravel	

Remarks

***** End of GW038038 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW042726

Converted From HYDSYS

Licence : 20BL104600
Licence Status Lapsed

Work Type : Well
Work Status : (Unknown)
Construct. Method : (Unknown)
Owner Type : Private

Authorised Purpose(s)
DOMESTIC
IRRIGATION
STOCK

Intended Purpose(s)
IRRIGATION

Commenced Date :
Completion Date : 01-Jan-1916
Final Depth : 0.00
Drilled Depth : 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 501-1000 ppm
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	DURHAM	DARLINGTON	217
Licensed :	DURHAM	DARLINGTON	PT217

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6396714 **Latitude (S) :** 32° 33' 13"
Easting : 328315 **Longitude (E) :** 151° 10' 17"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe Seq	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Timber	0.00	0.00	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW042726 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW044861

Converted From HYDSYS

Licence : 20BL104789

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Well	DOMESTIC	DOMESTIC
Work Status : Collapsed Bore	STOCK	STOCK
Construct. Method : (Unknown)		
Owner Type : Private		

Commenced Date : **Final Depth :** 12.20 m
Completion Date : **Drilled Depth :** 12.20 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : DURHAM	DARLINGTON	217
	Licensed : DURHAM	DARLINGTON	P+ Port 217

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6397327 **Latitude (S) :** 32° 32' 53"
Easting : 328148 **Longitude (E) :** 151° 10' 11"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Brick	0.00	0.00	1829			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	12.19	12.19	Sandstone Permian Water Supply	Sandstone	

Remarks

***** End of GW044861 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW047999

Converted From HYDSYS

Licence : 20BL116765

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Well	DOMESTIC	IRRIGATION
Work Status : Supply Obtained	IRRIGATION	
Construct. Method : (Unknown)	STOCK	
Owner Type : Private		

Commenced Date : **Final Depth :** 12.50 m
Completion Date : 01-Mar-1981 **Drilled Depth :** 12.50 m

Contractor Name :
Driller : 1432 WILSON, Daryl George
Assistant Driller's Name :

Property : - NOT KNOWN
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	WHITTINGHAM	12
	Licensed : NORTHUMBERLAND	WHITTINGHAM	6 3348

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6398259 **Latitude (S) :** 32° 32' 24"
Easting : 330402 **Longitude (E) :** 151° 11' 38"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	0.00	8.80	1800			Seated

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
8.80	12.50	3.70	Unconsolidated	8.80					(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	4.57	4.57	Loam Water Bearing	Loam	
4.57	5.49	0.92	Gravel Silt	Gravel	
5.49	10.67	5.18	Sandy	(Unknown)	
10.67	12.50	1.83	Gravel Sand	Gravel	

Remarks

***** End of GW047999 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW052121

Converted From HYDSYS

Licence : 20BL119274
Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : Supply Obtained	STOCK	STOCK
Construct. Method : Rotary		
Owner Type : Private		

Commenced Date : **Final Depth :** 30.50 m
Completion Date : 01-Jan-1981 **Drilled Depth :** 30.50 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : DURHAM	DARLINGTON	61
	Licensed : DURHAM	DARLINGTON	61

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6400518 **Latitude (S) :** 32° 31' 9"
Easting : 327388 **Longitude (E) :** 151° 9' 44"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	30.50	130			Seated on Bottom
1	1	Opening	Slots - Vertical	24.50	30.50	130		1	SL: 0mm; A: 6mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
28.00	30.50	2.50	Fractured	6.00					(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.75	1.75	Clay	Clay	
1.75	24.38	22.63	Shale	Shale	
24.38	27.00	2.62	Coal	Coal	
27.00	30.49	3.49	Shale Water Supply	Shale	

Remarks

***** End of GW052121 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW053080

Converted From HYDSYS

Licence : 20BL117489

Licence Status Active

Work Type : Well
Work Status : Supply Obtained
Construct. Method : (Unknown)
Owner Type : Private

Authorised Purpose(s)
DOMESTIC
IRRIGATION
STOCK

Intended Purpose(s)
IRRIGATION

Commenced Date :
Completion Date : 01-Apr-1981

Final Depth : 18.30 m
Drilled Depth : 18.30 m

Contractor Name :
Driller : 1432 WILSON, Daryl George
Assistant Driller's Name :

Property : - NOT KNOWN
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	24
Licensed :	NORTHUMBERLAND	WHITTINGHAM	PT24 755269

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6396717
Easting : 330324

Latitude (S) : 32° 33' 14"
Longitude (E) : 151° 11' 34"

GS Map : 0053A3 **MGA Zone :** 56

Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	0.00	0.00	1524			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	10.67	10.67	Loam	Loam	
10.67	13.72	3.05	Sand	Sand	
13.72	17.98	4.26	Gravel	Gravel	
17.98	18.29	0.31	Driller	(Unknown)	

Remarks

***** End of GW053080 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW056766 *Converted From HYDSYS*

Licence :

Licence Status Active

Authorised Purpose(s)

Intended Purpose(s)
DOMESTIC
STOCK

Work Type : Bore
Work Status : (Unknown)
Construct. Method : Rotary
Owner Type : Private

Commenced Date :
Completion Date : 01-Sep-1980
Final Depth : 61.00 m
Drilled Depth : 0.00

Contractor Name :
Driller : 1404 McKECHNIE, Malcolm Dexter
Assistant Driller's Name :

Property :
GWMA :
GW Zone :
Standing Water Level :
Salinity : 3001-7000 ppm
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	DURHAM	SEDGEFIELD	60
Licensed :			

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1 **Scale :** 1:25,000

Elevation :
Elevation Source : (Unknown)

Northing : 6397850
Easting : 335393
Latitude (S) : 32° 32' 40"
Longitude (E) : 151° 14' 49"

GS Map : 0053A3 **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Drilled	0.00	61.00	152			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

TDS=5700 MG/L

***** End of GW056766 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW060320

Converted From HYDSYS

Licence : 20BL131558
Licence Status Active
Authorised Purpose(s) RECREATION (GROUNDWATER)
Intended Purpose(s) RECREATION (GROUNDWATER)

Work Type : Well
Work Status : (Unknown)
Construct. Method : Auger
Owner Type : Local Govt

Commenced Date :
Completion Date : 01-Mar-1983
Final Depth : 15.00 m
Drilled Depth : 15.00 m

Contractor Name :
Driller : 1432 WILSON, Daryl George
Assistant Driller's Name :

Property : - N/A
GWMA : 017 - HUNTER
GW Zone : -
Standing Water Level :
Salinity : 1001-3000 ppm
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	L5 DP263209 (22)
Licensed :	NORTHUMBERLAND	WHITTINGHAM	100 737187

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :
CMA Map : 9132-4N SINGLETON
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6396196
Easting : 328663
Latitude (S) : 32° 33' 30"
Longitude (E) : 151° 10' 30"

GS Map : 0053A3
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete Cylnder	-0.30	15.00	1670			Seated on Bottom
1	1	Opening	Perforations	0.00	0.00	1670		1	SL: 0mm; A: 38mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
11.00	15.00	4.00	Unconsolidated	11.00		45.00			1001-3000 ppm

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	11.00	11.00	Soil Alluvial	Soil	
11.00	15.00	4.00	Gravel River Sand Water Supply	Gravel	

Remarks

TDS=1054 MG/L

***** End of GW060320 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW061232

Converted From HYDSYS

Licence : 20WA100589
Licence Status Current
Authorised Purpose(s) DOMESTIC
Intended Purpose(s) DOMESTIC

Work Type : Bore open thru rock
Work Status : (Unknown)
Construct. Method : Rotary Air
Owner Type : Private

Commenced Date :
Completion Date : 01-Aug-1985
Final Depth : 91.50 m
Drilled Depth : 91.50 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : 606 - MANGROVE MOUNTAIN
GW Zone : 007 - LOWER MANGROVE AND POPRAN CREE
Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	COWAN	143
Licensed :	NORTHUMBERLAND	COWAN	143

Region : 10 - SYDNEY SOUTH COAST
River Basin : 212 - HAWKESBURY RIVER
Area / District :
CMA Map : 9131-3S GUNDERMAN
Grid Zone : 56/1
Scale : 1:25,000

Elevation :
Elevation Source : (Unknown)
Northing : 6396105
Easting : 330517
Latitude (S) : 32° 33' 34"
Longitude (E) : 151° 11' 41"

GS Map : 0055A2
MGA Zone : 56
Coordinate Source : GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	0.00	6.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
59.00	59.40	0.40	Consolidated	13.70		0.38			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	5.00	5.00	Soil Clay	Soil	
5.00	29.00	24.00	Sandstone	Sandstone	
29.00	29.50	0.50	Shale	Shale	
29.50	91.50	62.00	Sandstone Water Supply	Sandstone	

Remarks

***** End of GW061232 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW064935

Converted From HYDSYS

Licence :

Licence Status Current

Authorised Purpose(s)

Intended Purpose(s)
STOCK

Work Type : Bore
Work Status :(Unknown)
Construct. Method :
Owner Type : Private

Commenced Date :
Completion Date :01-Jan-1980

Final Depth : 0.00
Drilled Depth : 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property :
GWMA :
GW Zone :

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By

County
Form A :NORTHUMBERLAND
Licensed :

Parish
COWAN

Portion/Lot DP
203

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9132-4N SINGLETON
Grid Zone :56/1 **Scale :**1:25,000

Elevation : 0.00
Elevation Source :

Northing :6397722
Easting :331402

Latitude (S) :32° 32' 42"
Longitude (E) :151° 12' 16"

GS Map :0055A2 **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details

(No Construction Details Found)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW064935 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW066586

Converted From HYDSYS

Licence :

Licence Status Current
Authorised Purpose(s) **Intended Purpose(s)**

Work Type :
Work Status :(Unknown)
Construct. Method :
Owner Type :

Commenced Date : **Final Depth :**
Completion Date : **Drilled Depth :**

Contractor Name :
Driller :
Assistant Driller's Name :

Property : **Standing Water Level :**
GWMA : **Salinity :**
GW Zone : **Yield :**

Site Details

Site Chosen By **County** **Parish** **Portion/Lot DP**
Form A :NORTHUMBERLAND WHITTINGHAM 12
Licensed :

Region :20 - HUNTER **CMA Map :**
River Basin :210 - HUNTER RIVER **Grid Zone :** **Scale :**
Area / District :

Elevation : 40.00 m (A.H.D.) **Northing :**6395940 **Latitude (S) :**32° 33' 39"
Elevation Source : Est. Contour 8-15M. **Easting :**329919 **Longitude (E) :**151° 11' 18"

GS Map :0053A3 **MGA Zone :**56 **Coordinate Source :**GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Concrete	0.00	0.00	1400			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW066586 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW067790

Converted From HYDSYS

Licence : 20BL139437
Licence Status Cancelled

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	STOCK	STOCK
Construct. Method : Rotary Air		
Owner Type : Private		

Commenced Date : **Final Depth :** 47.00 m
Completion Date : 07-Apr-1989 **Drilled Depth :** 47.00 m

Contractor Name :
Driller : 1550 ROSE, John
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : DURHAM	DARLINGTON	L11 DP733261
	Licensed : DURHAM	DARLINGTON	11 733261

Region : 20 - HUNTER
River Basin : 210 - HUNTER RIVER
Area / District :

CMA Map :
Grid Zone : **Scale :**

Elevation : 0.00
Elevation Source :

Northing : 6397899 **Latitude (S) :** 32° 32' 36"
Easting : 330422 **Longitude (E) :** 151° 11' 39"

GS Map : **MGA Zone :** 56 **Coordinate Source :** GD.,ACC.GIS

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details

(No Construction Details Found)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	Topsoil,brownclay	Topsoil	
2.00	5.00	3.00	Weathered Sandstone	Sandstone	
5.00	47.00	42.00	Sandstone,siltstone	Sandstone	

Remarks

***** End of GW067790 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW078256

Licence : 20BL166170
Licence Status Active
Authorised Purpose(s) IRRIGATION
Intended Purpose(s) IRRIGATION
Work Type : Bore
Work Status : (Unknown)
Construct. Method :
Owner Type :
Commenced Date :
Completion Date :
Final Depth : 12.20 m
Drilled Depth :
Contractor Name :
Driller :
Assistant Driller's Name :
Property : - NOT KNOWN
GWMA : -
GW Zone : -
Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	NORTHUMBERLAND	WHITTINGHAM	PT LOT 12 DP 755269
Licensed :	NORTHUMBERLAND	WHITTINGHAM	8 3348

Region : 20 - HUNTER
River Basin :
Area / District :
CMA Map :
Grid Zone :
Scale :
Elevation :
Elevation Source :
Northing : 6395945
Easting : 330206
Latitude (S) : 32° 33' 39"
Longitude (E) : 151° 11' 29"
GS Map :
MGA Zone : 56
Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Hole/Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details

(No Construction Details Found)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW078256 *****

DEPARTMENT OF WATER AND ENERGY
Work Summary

GW078905

Licence : 20BL167288

Licence Status Active

	Authorised Purpose(s)	Intended Purpose(s)
Work Type : Bore	DOMESTIC	DOMESTIC
Work Status : (Unknown)	FARMING	FARMING
Construct. Method :	STOCK	STOCK
Owner Type :		

Commenced Date : **Final Depth :** 10.00 m
Completion Date : **Drilled Depth :**

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - DEHAVALYN
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By	County	Parish	Portion/Lot DP
	Form A : NORTHUMBERLAND	WHITTINGHAM	Lot7/Sec13//3631
	Licensed : NORTHUMBERLAND	WHITTINGHAM	2 1096341

Region : 20 - HUNTER
River Basin :
Area / District :

CMA Map :
Grid Zone : **Scale :**

Elevation :
Elevation Source :

Northing : 6395809 **Latitude (S) :** 32° 33' 44"
Easting : 330535 **Longitude (E) :** 151° 11' 42"

GS Map : **MGA Zone :** 56 **Coordinate Source :**

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

Id	Pipe	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	10.00				(Unknown)
1	1	Casing	Concrete	0.00	10.00	1524			Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW078905 *****

***** End of Report *****

Photograph 1 - Taken in the northeastern portion of the subject site looking south through west

Photograph 2 - Taken in the northeastern portion of the subject site looking southeast through west

Photograph 3 – Taken in the approximate midpoint of Lot 142 looking 360°

Photograph 4 – Taken adjacent to the southern boundary of Lot 142 looking east through south to the west

Photograph 5 – Taken in the approximate midpoint of Lot 140 looking northwest through east to the southwest

Photograph 6 – Taken adjacent to the western boundary of the site north through southeast

Photograph 7 – Taken adjacent to the northern boundary of the site looking east through south to the west

Photograph 8 – Taken in the northwestern potion of the site looking southwest

Photograph 9 – Taken in the northwestern portion of the site looking southwest

Photograph 10 – Taken in the northeastern portion of the site looking southeast

Photograph 11 – Taken in the northeastern portion of the site looking northeast

Photograph 12 - Taken in the northeastern portion of the site looking southeast

Attachment 4 – Aboriginal Cultural and Archaeological Assessment report

Newcastle Office
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Our Ref: 26432: PS&GG
Date: 23 April 2010

FOR INTERNAL USE ONLY

GREENBANK CIVIL
PO BOX 691
SINGLETON NSW 2330

ATTENTION: STEVE MONKS

Dear Sir,

RE: ARCHAEOLOGICAL GROUND TRUTH ASSESSMENT FOR LOT 120, LOT 138, LOT 140 AND LOT 142 IN DP 752455 LONG GULLY ROAD, WATTLE PONDS, DRAFT REPORT.

RPS Australia East Pty Ltd (RPS Newcastle Office) was commissioned by Greenbank Civil to conduct an archaeological ground truth assessment and walkover of an area incorporating Lot 120, Lot 138, Lot 140 and Lot 142 in DP 752455, Long Gully Road, Wattle Ponds. The Wattle Ponds Study Area is referred to in Figure 1.

The Study Area is situated approximately five kilometres north east of Singleton, NSW and is accessible from Long Gully Road. Long Gully Road is an unsealed access route that intercepts the Study Area in a north to south direction, dividing Lot 120 from Lots 138, 139 and 140. Lot 120 is bounded to the south by Retreat Road which runs in an east to west direction. Surrounding the Study Area are established rural properties. The Study Area has been subject to high levels of disturbance caused by general farming practices and localised weathering processes.

1 Introduction

The Study Area is located in the Singleton Council Local Government Area. This report details the results of the ground truth survey undertaken on the 12th April 2010 by Philippa Sokol, Archaeologist for RPS Newcastle, together with Suzie Worth of the Wanaruah Local Aboriginal Land Council (WLALC). This additional archaeological assessment and ground truth survey was undertaken in order to address outstanding Aboriginal Cultural Heritage Issues for a rezoning proposal LA42/2005 encompassing Lots 120, 138, 140 and 142 in DP 752455 and had been requested as some time had elapsed since previous cultural heritage survey had been undertaken on the property. This request by the Wanaruah Local Aboriginal Land Council was supported by the Department of Environment, Climate Change and Water. This report will form part of a Development Application (DA) for rural residential development.

26432\DRAFT\ARCH FIG 1 SITE LOC A A4

TITLE: FIGURE 1 STUDY AREA

LOCATION: WATTLE PONDS

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 8/4/2010
PURPOSE: ARCHAEOLOGICAL

LAYOUT REF:
VERSION (PLAN BY): A (A.P-P.S)

CLIENT: GREENBANK CIVIL
JOB REF: 26432

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2 Background and Scope

Previous studies conducted in Study Area (Hamm 2007 and Myall Coast Archaeological Services 2008) showed that the area had been formerly utilised as farming land, with pastoral activities and land clearing being the main, types of disturbance. Disturbances included the grazing of cattle, localised burning of dead bush debris and land clearing. Drainage channels in the Study Area had been severely affected by gully and rill erosion with many large tree roots and exposure of skeletal soils. Naturally occurring erosion processes were evident at all of the drainage lines in the Study Area. Creek bank areas have also been affected by sheet wash and erosion scour which has caused much of the A horizon to be removed leaving extensive exposures of B horizon. Other disturbances caused by general farming practices included the formation of vehicle access tracks used by farm machinery, fenced cattle holding areas, the effects of hoofed animals, cleared land, burning of tree debris and dumping building materials.

Table 1: Aboriginal Community Stakeholder Consultation log.

Date	Description	Contact Method	Outcome
23/03/10	Proposed dates sent to WLALC for ground truth survey. Sent attached letter and associated reports.	Email	WLALC replied with available dates around 12th April 2010 24/03/10.
24/03/10	RPS reply to WLALC to confirm ground truth survey date	Email	
29/03/10	RPS informing WLALC proposed change of date to 13TH April 2010 for ground truth survey.	Email	WLALC said unable to do 13th will be available until the 16th April 2010.
31/03/10	RPS informed WLALC Monday 12th APRIL 2010 OK for survey.	Email	WLALC confirmed this date.
12/04/10	RPS to WLALC confirmed meeting time fro ground truth survey at 10:30am.	Phone	WLALC confirmed survey for the morning.
21/04/10	RPS to WLALC update on report status, sending copy of site card and requesting WLALC site recommendations.	Email	Awaiting response.
23/04/10	RPS to Suzie Worth (WLALC Site Officer) confirming received email and status of Aboriginal community stakeholder report.	Phone	WLALC
23/04/10	RPS contact Suzie Worth WLALC; confirmed RPS will send final draft for comment on finalisation of our figures.	Phone	WLALC have agreed to send their report as soon as possible after receipt of RPS draft.

The scope of this ground truth survey and walkover was to traverse the Study Area on foot and to ground truth the location of previously recorded AHIMS sites #33-6-0028 and #33-6-0029 as some time had elapsed since previous survey had been undertaken – Refer Figure 2.

A search of the Department of Environment, Climate Change and Water (DECCW) Aboriginal Heritage Information Management System (AHIMS) was undertaken on the 17th September 2009 covering a 4 km radius encompassing the Study Area at Wattle Ponds (Refer Figure 2). The AHIMS search revealed Isolated Finds (n=24 including the two isolated finds recorded in the immediate Study Area), to be the most common site type for the area, Artefact Scatters (n=21) with other unnamed Aboriginal archaeological finds comprising n=2. Many of the sites registered on the AHIMS database were recorded as being located on spurs and slopes often associated with the break of slope and eroded areas, and within proximity to permanent water courses.

NPWS sites #33-6-0028 (Grey quartzite flake) and #33-6-0029 (Yellow tuff broken flake flake), which are recorded in the immediate Study Area follow this pattern and are also located less than 100 metres from water. Site #33-6-0028 is recorded on the AHIMS database as an Aboriginal Resource Gathering site, but the report conducted by Hamm (2007:30) described the site as an isolated find comprised of a quartzite flake. A copy of the site card was obtained from the DECCW and it was found that an error had been made at the time the site card was entered on the AHIMS database.

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

LEGEND

- Site Boundary
- AHIMS Sites

Ahims Search Records

- Artefact Scatter
- Artefact(s) Unspecified
- Isolated Find

N

37-6-0375, 37-6-0374, 37-6-0408, 37-6-0407, 37-6-0410, 37-6-0409, 37-6-0412, 37-6-0411, 37-6-0639, 37-6-0801, 37-6-0800, 37-5-0034, 37-6-0373, 37-6-0372, 37-6-0040, 37-6-1543, 37-6-0420, 37-6-1545, 37-6-1544, 37-6-1547, 37-6-1542, 37-6-1543, 37-6-1546, 37-6-1535, 37-6-1541, 37-6-1537, 37-6-1540, 37-6-1534, 37-6-1118, 37-6-1523, 37-6-1530, 37-6-1533, 37-6-1527, 37-6-1529, 37-6-1525, 37-6-1522, 37-6-1531, 37-6-1514, 37-6-1512, 37-6-0029, 37-6-0028, 37-6-0802, 37-6-0029, 37-6-0028

OBANVALE
WATTLE PONDS
DARLINGTON
SINGLETON HEIGHTS
HUNTERVIEW
FERN GULLY
COMBO
PIGEON POINT
SEDGEFIELD
DUNOLLY
ALROY PARK
SINGLETON WASTE DEPOT
SEDGEFIELD CEMETERY

0 0.5 1km

SCALE: 1: 20000 AT A3 SIZE

TITLE: FIGURE 2 AHIMS SEARCH RESULTS	LOCATION: WATTLE PONDS	DATUM: DATUM PROJECTION: MGA ZONE 56 (GDA 94)	DATE: 8/4/2010 PURPOSE: ARCHAEOLOGICAL	LAYOUT REF: 26432\DRAFTINGS\ARCHAEOLGY\FIG 2 AHIMS SEARCH RESULTS A A3 VERSION (PLAN BY): A (A.P-P.S)	

CLIENT: GREENBANK CIVIL
JOB REF: 26432

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3 Legislative Requirements

Greenbank Civil is bound to comply with the legislative requirements associated with cultural heritage. A brief overview of relevant NSW legislation is listed below with a more detailed explanation of legislation governing heritage provided in Appendix 1.

The National Parks and Wildlife Act (1974)

The primary state legislation relating to cultural heritage is the *National Parks and Wildlife Act* (NPW 1974, as amended). The legislation is overseen by the Department of Environment, Climate Change and Water (DECCW), and specifically the Director-General of the DECCW.

There are three main sections of the NPW Act (1974) that the proponent should consider during works in the associated leases. These include (but are not limited to) the following:

It is an offence under Part 6 of the NPW Act (1974) for any person/company to:

- destroy, deface, damage, cause or allow the destruction/defacement to an Aboriginal object or Aboriginal place (Section 90);
- disturb, move, excavate for the purposes of finding Aboriginal objects, or take possession of Aboriginal objects (Section 86) unless a valid Permit under Section 87 of the Act has been issued by the Director General of the DECCW; and
- be aware of the location of an Aboriginal object and fail to report it to the DECCW (Director-General) within a reasonable timeframe (Section 91).

In 2004, the DECCW released the *Interim Community Consultation Requirements for Applicants* which guide Aboriginal community notification and consultation procedures for sites that require applications under Section 87 and Section 90 of the *National Parks and Wildlife Act* (1974).

On the 12th April 2010 the DECCW released the new Aboriginal Cultural Heritage Consultation Requirements for proponents. These replace the Interim Community Consultation Requirements (ICCR's) and are effective immediately.

Under Part 3A of the Environmental Protection and Assessment Act (EP&A Act 1979), the requirements to obtain a Section 90 Permit for a site or Section 87 Permit for conservation/research are not required.

Environmental Planning & Assessment Act 1979 (EP&A ACT)

This Act regulates a system of environmental planning and assessment for New South Wales. Land use planning requires that environmental impacts are considered, including the impact on cultural heritage and specifically Aboriginal heritage.

Part 3A of the EPA relates to major projects, and if applicable, obviates the need to conform to other specific legislation. In particular, s75U of the EPA Act explicitly removes the need to apply for s87 or s90 permits under the NPW Act. This means that although Aboriginal cultural heritage is considered during the planning process, a permit is not required to disturb or destroy an Aboriginal object or place. However, the Director-General of Planning must nonetheless consult with other government agencies, including DECCW, prior to any decision being made.

4 Geology, Topography and Hydrology

The Study Area is located on the Sedgefield soil landscape. This geological environment is comprised of the Branxton formation, Muree Sandstone and Singleton Coal Measures. This geological group is predominantly located north of Singleton and comprises a landscape of undulating low hills. Hills have a common elevation of 60-170 metres with slopes lengths ranging from 500 through to 800 metres with a local relief of 40-60 metres. Drainage channels are common in the area and generally drain to the south east, however some drain to the south west. This area comprising the Sedgefield landscape has a moderate to low water holding capacity and poor soil fertility. Erosion in this area is severe contributed by gully and sheet wash which is commonly noted on slopes and in drainage lines (Kovac & Lawrie, 1991: 372).

The Study Area is intercepted by numerous ephemeral drainage channels. These drainage lines are tributaries of First Creek to the east of the Study Area. There is evidence of extreme erosion along most of the drainage lines indicating strong water flow would most likely occur during heavy rain periods.

The proximity of the Study Area to several ephemeral tributaries of First Creek (3rd order stream) would have meant that although the Study Area would have provided resources such as adequate food and water during the periods that the streams were full; once the streams had started to dry up, Aboriginal people in the past may have had to move to areas containing more permanent water sources. Therefore, the geographical location of the Study Area suggests that this area may have been suitable as a transitory site and not necessarily for permanent camping grounds.

5 Ground Truth Survey of Aboriginal Cultural Heritage Sites and Survey Strategy

The aims of the archaeological survey were to ground truth the existing AHIMS recorded sites #33-6-0028 and #33-6-0029 with targeted investigations of creek and drainage channels, areas of ground surface exposure such as erosion scalds, cleared areas, along drainage lines and disturbed soils associated with dammed areas and areas with old growth trees. Any new sites identified during the course of the survey were to be recorded and a site card lodged with the DECCW.

The results of the additional survey would assist in the appropriate management of this area and in the event that any Aboriginal Cultural Heritage sites would be impacted upon during future development of the site, then a permitting process and consultation with the relevant stakeholders could be undertaken at that time.

6 Field Survey Methods

The survey was conducted in warm, sunny and gusty conditions. The walkover and ground truth survey was undertaken by RPS Newcastle Archaeologist Philippa Sokol and Sites Officer Suzie Worth representing WLALC. The ground truth survey identified the locations onsite of AHIMS recorded sites #33-6-0028 and #33-6-0029, and examined the ground surface any unrecorded Aboriginal archaeological sites. All exposed areas were targeted and investigated including drainage corridors, creek banks, top of crests and sloped areas. Safe practices were to prevail at all times.

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.
Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

Legend

- Site Boundary
- Creek lines
- Creek Banks
- Slopes
- Crests
- Ground-truthed Sites
- RPS WP IF1

N

LONG GULLY RD

LONG GULLY RD

FIRST CK

RETREAT RD

Lot 120

Lot 142

Lot 140

Lot 138

33-6-0029

33-6-0028

RPS WP IF1

0 200 400

metres

SCALE: 1: 5000 AT A3 SIZE

TITLE: FIGURE 3 TARGET SURVEY AREAS & STONE ARTEFACT SITES

LOCATION: WATTLE PONDS

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 27/4/2010
PURPOSE: PURPOSE

LAYOUT REF: 26432\DRAFTING\ARCHAEOLGY\26432 FIGURE 3 TARGET SURVEY AREAS & STONE ARTEFACT SITES A A3
VERSION (PLAN BY): P. HILLIER

CLIENT: GREENBANK CIVIL
JOB REF: 26432

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7 Field Survey Results

The site survey identified one isolated yellow mudstone single platform core (Refer Appendix 2 - RPS WP IF1). This isolated find was not *in situ* being located mid slope in exposed soils surrounded by native grass. It is therefore presumed to be a discard piece with low archaeological context within the landscape. No other Aboriginal Cultural Heritage sites or objects were found in the Study Area

The Study Area was surveyed Lot by Lot and comprised an undulating landscape with exposed ground surface areas predominantly on sloped landforms, along drainage lines and the immediate surrounds – Refer Figure 3.

Lot 138.

A residential dwelling was located in the west of Lot 138. The area was steeply sloping and bisected by an east trending drainage line. Vegetation in the area was mainly native paddock grasses with numerous clusters of mature and sapling eucalypt trees (Plate 1).

Erosion in the area was severe and was evident along the banks of the drainage lines, sloped areas and in areas of modified landform. The banks of the drainage lines had been severely eroded and in some areas the erosion extended up to two metres high exposing tree roots and B horizon soils. No intact A horizon was evident, as most of it had suffered sheet wash movement, and there were no additional artefacts present (Plate 2).

Survey of the area identified an isolated mudstone core, RPS WP IF1 (Refer site card). This site was located in the southern portion of Lot 138 on exposed soils on a mid slope landform (Plate 3).

The location for AHIMS recorded Site #33-6-0028 was identified on a crestal area that is intersected by the fence line which divides Lot 138 from Lot 140 (Plate 3). The site area was subsequently ground truthed but no artefacts or Aboriginal Cultural Heritage material was found probably due the effects of erosion and recent farming practices.

Lot 140.

No Aboriginal archaeological heritage items were identified in this part of the Study Area.

This area contained a drainage line intercepting the site from the east with two adjoining dam areas located in the western portion of Lot 140. These dams were situated in the drainage corridor containing moisture rich grass with reeds and water plants within the dam walls. A rural residential dwelling was identified in the west portion of Lot 140 with an area sectioned off for livestock on a very steep, densely grassed slope. The remainder of the area comprised an undulating landscape with open grassed meadow areas, scatters of trees and grass cover (Plate 5). Several clusters of mature trees were noted and investigated.

Signs of erosion were evident along the drainage line located to the east of Lot 140, and severe erosion was also noted around dam walls of the other dams in the area. The drainage line in the west was densely grassed and comprised the main water runoff area at the base of a steep slope. These areas were investigated and were noted as comprising a majority of quartz, quartzite and conglomerate lateritic cover with no signs of stone artefacts.

Lot 142.

No Aboriginal archaeological heritage items were identified in this area.

This area was bisected by an ephemeral creek line which formed a confluence in the northern portion of Lot 142 and further bisected the area in the south westerly direction. A dam lay to the west and immediately north of the drainage line. Exposed soils and laterite pebbles and cobbles on the surface of soils in the area comprising the dam wall and surrounding area were investigated for archaeological potential. Vegetation in this area comprised eucalypt trees which were mainly contained along the drainage line areas and produced thick leaf litter.

AHIMS Site #33-6-0029 was ground truthed in this area. Site #33-6-0029 is recorded on AHIMS as an isolated find comprising a yellow mudstone broken flake. The site area was relocated on a gentle mid slope above and to the south of the drainage line (Plate 6). The recorded site area was located on an eroded vehicle track. B horizon soils were exposed and no A horizon was present. There was lateritic cover of quartzite, veined quartz, mudstone and conglomerate pieces. This ground truth survey was unable to relocate the isolated find recorded previously at AHIMS Site #33-6-0029, and considering the close proximity to the drainage line and the time that had lapsed since the site was first recorded, it was likely that the isolated find had suffered from the effects of erosion and disturbances.

Lot 120.

No unrecorded Aboriginal archaeological heritage items were identified in this area.

This area comprised an ephemeral creek line which was a tributary of First Creek. The area was drained from the north, and a dam was located in the south west corner of a gentle undulating spurred area. The area was generally severely affected by erosion. Several small drainage gullies were also observed in the west flowing into a stream located adjacent to and outside of the Study Area. All these drainage gullies had been heavily affected by sheet wash and gully erosion. Exposed soils across the area consisted of B horizon which had suffered from sheet wash leaving behind a lateritic cover on the surface of the clayey soil.

Vegetation in this area was predominantly meadow grasses and eucalypt species. One large eucalypt tree was identified situated in the western area surrounded by a cluster of small trees. This area was inspected for archaeological material (Plate 7). Other trees in the area lined drainage areas and bordered the fence lines. These were also investigated for archaeological material. Away from the drainage corridor exposures were subject to scalds, gentle slopes and dirt access track.

8 Discussion

The results of the ground truth survey showed that all drainage lines, stream banks and sloped landform had been subjected to severe erosion. The site localities for the two previously recorded AHIMS sites #33-6-0028 and #33-6-0029 were unable to be relocated despite ground truth survey being conducted using a differential GPS.

On the AHIMS database site #33-6-0028 had been recorded as an Aboriginal Resource Gathering site, but in the report by (Hamm, 2007:30) it was described as an isolated find (quartzite flake). The site card for Long Gully 1 (AHIMS #33-6-0028) was therefore obtained from DECCW and it was found that an error had been made at the time the site card was entered on the AHIMS database. The site card description matched the details outlined in the report conducted by Hamm (2007:45) and therefore this site should have been recorded on the AHIMS database as an isolated find rather than a resource gathering site. Both of the recorded sites had been affected by land clearing and natural erosion processes and neither isolated find were relocated.

The ground truth survey identified one new Aboriginal archaeological site; RPS WP IF1 (Refer Appendix 2). This site was identified on a mid sloped landform on the surface of exposed B horizon soils and is not *in situ.* RPS WP IF1 is a single platform mudstone core. The area surrounding the site was investigated but no additional artefacts were identified. Mitigation measures for the site are outlined in Recommendation 1.

The vegetation of the Study Area was typical of the local area and comprised several eucalypt species and native grasses covering the upper and mid slope areas and crests. Trees bordered some drainage areas and were located along some fence lines. There were a number of mature trees, but the majority of the treed areas were comprised of regrowth trees. Visibility in the Study Area was generally good with severely eroded areas associated with drainage lines allowing full exposure of soils; exposed soils were also found on upper sloped areas and crests. Disturbance in the Study Area was generally associated with general farming practices including the formation of vehicle access tracks, fenced cattle holding areas, hoofed animals, cleared land, burning of tree debris and dumped building materials.

9 Conclusion

A comprehensive pedestrian survey was conducted across the majority of the Study Area. The Study Area was found to be extremely modified and disturbed from previous farming practices and localised weathering processes.

Although the areas recorded for AHIMS sites #33-6-0028 and #33-6-0029 were identified, no artefacts were located during the ground truth survey probably as a result of severe erosion of the area. One Aboriginal archaeological site was identified by RPS Newcastle and recorded as RPS WP IF1 being a single platform mudstone core, found in the southern portion of Lot 138 and has now been registered with the DECCW AHIMS Register (Refer Appendix 2).

Due to the severe erosion of the Study Area there were no intact A horizon soils evident and there were no *in situ* artefacts located.

In the event that ground disturbance works are likely to occur in the area of RPS WP IF1, then it is suggested that an appropriate permit will need to be sought from DECCW to salvage the isolated find prior to the commencement of development works.

10 Recommendations

The ground truth survey identified one isolated find (RPS WP IF1) but no other Aboriginal archaeological constraints were identified in the survey area. The areas containing the two AHIMS recorded sites #33-6-0028 and #3-6-0029 were ground truthed but the isolated finds previously recorded at these sites could not be relocated. If the newly recorded site is likely to be impacted upon during the course of future development works, then further consultation with the local Aboriginal Community Stakeholders will need to be undertaken and a Heritage Impact Permit sought prior to ground disturbance works.

The management recommendations that stem from this archaeological ground truth survey are based on legislation designed to address the impact of development works upon sites of Aboriginal cultural significance and discussions held onsite with the representative of the Wanaruah LALC present during the course of the survey.

With regard to the proposed site development works the following recommendations should be implemented;

Recommendation 1

RPS WP IF1 is not an *in situ* site and is located on a mid sloped landform on the surface of B horizon exposed soils. The artefacts are located in open pasture grassed area. If there

is potential for impact by proposed development works, or if the site is at risk of being impacted upon in any way, then a Section 87/Section 90 Aboriginal Heritage Impact Permit Collection Permit should be sought from the Department of Environment, Climate Change and Water (DECCW) prior to any proposed ground disturbance works commencing. Works should only recommence when an appropriate and approved management strategy has been agreed to by all relevant stakeholders. Under the *National Parks and Wildlife Act* (1974) it is an offence to knowingly destroy, damage or deface an Aboriginal site or object without obtaining the prior written permission of the Director General of the DECCW.

Recommendation 2

In the event that the proponent uncovers previously unidentified Aboriginal artefacts or archaeological sites, work must cease in that immediate area and they will need to consult with the DECCW and relevant Aboriginal Community Stakeholders and an approved management strategy be implemented.

Recommendation 3

In the event that skeletal remains are uncovered, work must cease immediately in that area and the proponent will need to contact the NSW Police Coroner to determine if the material is of Aboriginal origin. If the remains are subsequently determined to be Aboriginal, then the relevant Aboriginal Community Stakeholders, Wanaruah LALC, and the DECCW must be notified, in order to determine an action plan for the management of the skeletal remains prior to works re-commencing.

Recommendation 4

If, during the course of clearing work, significant European cultural heritage material is uncovered, work should cease in that immediate area. The NSW Heritage Branch should be notified and works only recommence when an appropriate and approved management strategy instigated. If, during the course of clearing work, significant European cultural heritage material is uncovered work should cease in that area immediately. The NSW Heritage Branch should be notified and works only recommence when an appropriate and approved management strategy instigated.

Recommendation 5

Where possible any mature trees remaining should be retained in the area.

We trust the information and the advice provided will meet all legal requirements for the proposed works by the proponent in the Study Area. At any time, if the proponent is uncertain about their risk of impacting Aboriginal sites, they will need to contact a suitably qualified archaeologist to investigate.

We also trust that the proponent has ensured that every measure has been taken to avoid impact on any cultural heritage sites.

If you have any further queries, please do not hesitate to contact Philippa Sokol or Gillian Goode on (02) 4940 4200.

Yours Faithfully
RPS AUSTRALIA EAST

Philippa Sokol
Archaeologist

REFERENCES

Hamm, G. 2007. Aboriginal Cultural Heritage & Archaeological Assessment of Lands at Long Gully Road, Singleton. A report to Orbit Planning.

Kovac, M. and Lawrie, J.W. 1991. Soil Landscapes of the Singleton 1:250 000 Sheet. Soil Conservation Service of NSW, Sydney.

Myall Coast Archaeological Services, 2008. Wattle Ponds Aboriginal Heritage Assessment Consultation Update. Report prepared fro Regional Land.

Plates

Plate 1: Overview of the Wattle Ponds landscape.

Plate 2: Erosion along drainage line.

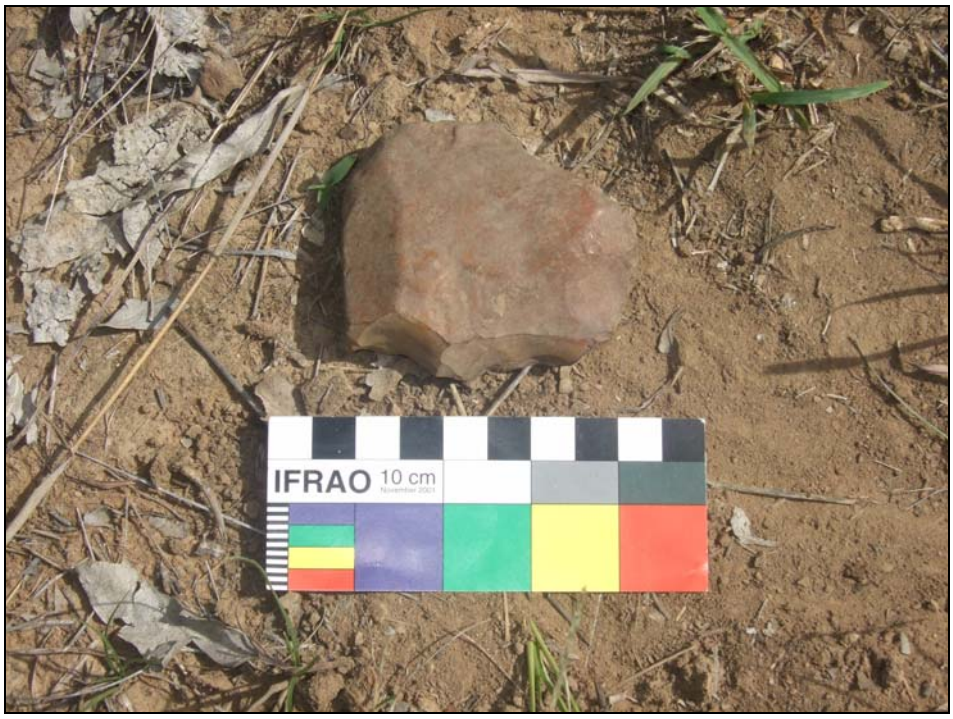


Plate 3: RPS WP IF 1 Mudstone Core.

Plate 4: Area locality for AHIMS site #33-6-0028.

Plate 5: Types of vegetation comprising the Study Area.

Plate 6: Area locality for AHIMS site #33-6-0029.

Plate 7: Large Eucalypt identified in the Study Area.

APPENDIX 1

LEGISLATIVE REQUIREMENTS

Summary of Statutory Controls

The following overview of the legal framework is provided solely for information purposes for the client, it should not be interpreted as legal advice. RPS Harper Somers O'Sullivan will not be liable for any actions taken by any person, body or group as a result of this general overview, and recommend that specific legal advice be obtained from a qualified legal practitioner prior to any action being taken as a result of the summary below.

Commonwealth

Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (ATSIHP Act), Amendment 2006

The purpose of this Act is to preserve and protect all heritage places of particular significance to Aboriginal and Torres Strait Islander people. This Act applies to all sites and objects across Australia and in Australian waters (s4).

It would appear that the intention of this Act is to provide national baseline protection for Aboriginal places and objects where State legislation is absent. It is not to exclude or limit State laws (s7(1)). Should State legislation cover a matter already covered in the Commonwealth legislation, and a person contravenes that matter, that person may be prosecuted under either Act, but not both (s7(3)).

The Act provides for the preservation and protection of all Aboriginal objects and places from injury and/or desecration. A place is construed to be injured or desecrated if it is not treated consistently with the manner of Aboriginal tradition or is or likely to be adversely affected (s3).

The Australian Heritage Commission Act 1975

The Australian Heritage Commission Act 1975 established the Australian Heritage Commission which assesses places to be included in the National Estate and maintains a register of those places. Places maintained in the register are those which are significant in terms of their association with particular community or social groups and they may be included for social, cultural or spiritual reasons. The Act does not include specific protective clauses.

The Australian Heritage Council Act 2003 together with The Environment Protection and Biodiversity Conservation Act 1999 (Amended) includes a National Heritage List of places of National heritage significance, maintains a Commonwealth Heritage List of heritage places owned or managed by the Commonwealth and ongoing management of the Register of the National Estate.

State

It is incumbent on any land manager to adhere to legislative requirements that protect indigenous culture heritage in NSW. The relevant legislation includes but is not limited to:

National Parks & Wildlife Act 1974 (NPW Act), Amended 2001.

The DECCW issued their *Interim Community Consultation Requirements* in January 2005 to replace all previous consultation guidelines that related to Part 6 of the NPW Act 1974. The requirement of the guidelines is for the proponent, or consultant for the proponent, to contact the Local Aboriginal Land Council(s), Registrar of Aboriginal Owners, Native Title Services, local councils and the DECCW, to request contact information for any/all potential Aboriginal people/groups with an ancestral interest in the cultural heritage of the project area.

On the 12th April 2010 the DECCW released the new *Aboriginal Cultural Heritage Consultation Requirements* for proponents. These replace the Interim Community Consultation Requirements (ICCR's) and are effective immediately.

The NPW Act provides statutory protection for all Aboriginal relics (not being a handicraft made for sale), with penalties levied for breaches of the Act. Part 6 of this Act is the relevant part concerned Aboriginal objects and places, with the Section 86 and Section 90 being the most pertinent:

Section 91: Under Section 91 of the Act it stipulates that a person who is aware of unregistered Aboriginal sites must report these to the DECCW, regardless of the land status (Freehold, leasehold, Crown land).

Section 90: "A person who, without first obtaining the consent of the Director-General, knowingly destroys, defaces or damages, or knowingly causes or permits the destruction or defacement of or damage to, an Aboriginal object or Aboriginal place is guilty of an offence against this Act." Under s.5 of the Act "object" means any deposit, object or material evidence (not being a handicraft made for sale) relating to indigenous habitation of the area. This applies to habitation both prior to and concurrent with the occupation of that area by persons of non Aboriginal extraction, and includes Aboriginal remains.

Section 87: Preliminary Research Permits issued under Section 87 of the Act, allow the permit holder to conduct investigations of areas considered to be potential sites for the purpose of research, and also for conservation work associated with known sites.

Impact Permits issued under Section 90 of the Act are for salvaging sites prior to ground disturbance works associated with construction. Any disturbance, damage or destruction of Aboriginal sites, known or unknown, is considered to contravene the NPW Act (1974) and the DECCW will pursue the person/company responsible.

Penalties under these two sections are currently 50 penalty units, or 6 months in gaol, or both for an individual and 200 penalty units for a corporation. The DECCW record all S.87 and S.90 permits issued in order to manage Aboriginal sites and ensure representative samples of sites are left in situ for future generations. In order to achieve this, the DECCW need to be made aware of all Aboriginal sites located in NSW.

Section 86: This section of the Act states that "A person, other than the Director-General or a person authorised by the Director-General in that behalf, who:

- disturbs or excavates any land, or causes any land to be disturbed or excavated, for the purpose of discovering an Aboriginal object,

- disturbs or moves on any land an Aboriginal object that is the property of the Crown, other than an Aboriginal object that is in the custody or under the control of the Australian Museum Trust,

- takes possession of an Aboriginal object that is in a national park, historic site, state conservation area, regional park, nature reserve, karst conservation reserve or Aboriginal area,

- removes an Aboriginal object from a national park, historic site, state conservation area, regional park, nature reserve, karst conservation reserve or Aboriginal area, or

- erects or maintains, in a national park, historic site, state conservation area, regional park, nature reserve, karst conservation reserve or Aboriginal area, a building or structure for the safe custody, storage or exhibition of any Aboriginal object,

except in accordance with the terms and conditions of an unrevoked permit issued to the person under section 87, being terms and conditions having force and effect at the time the act or thing to which the permit relates is done, is guilty of an offence against this Act."

Section 84: Aboriginal places of traditional significance (that may or may not contain archaeological material) are given protection under Section 84 of the NPW Act. To be an Aboriginal place for the purposes of this Act, this is a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture.

Environmental Planning & Assessment Act 1979 (EP&A Act)

This Act regulates a system of environmental planning and assessment for New South Wales. Land use planning requires that environmental impacts are considered, including the impact on cultural heritage and specifically Aboriginal heritage. Within the EP&A Acts, Parts III, IV, and V relate to Aboriginal heritage.

Part III regulates the preparation of planning policies and plans. Part IV governs the manner in which consent authorities determine development applications and outlines those that require an environmental impact statement. Part V regulates government agencies that act as determining authorities for activities conducted by that agency or by authority from the agency. The National Parks & Wildlife Service is a Part V authority under the EP&A Act.

In brief, the NPW Act provides protection for Aboriginal objects or places, while the EP&A Act ensures that Aboriginal cultural heritage is properly assessed in land use planning and development.

Part 3A of the EPA relates to major projects, and if applicable, obviates the need to conform to other specific legislation. In particular, s75U of the EPA Act explicitly removes the need to apply for s87 or s90 permits under the NPW Act. This means that although Aboriginal cultural heritage is considered during the planning process, a

permit is not required to disturb or destroy an Aboriginal object or place. However, the Director-General of Planning must nonetheless consult with other government agencies, including DECC and National Parks & Wildlife, prior to any decision being made.

The Heritage Act 1977

This Act protects the natural and cultural history of NSW with emphasis on non-indigenous cultural heritage through protection provisions and the establishment of a Heritage Council. Although Aboriginal heritage sites and objects are primarily protected by the National Parks & Wildlife Act 1974 (NPW Act), Amended 2001, if an Aboriginal site, object or place is of great significance, it may be protected by a heritage order issued by the Minister subject to advice by the Heritage Council.

Other legislation of relevance to Aboriginal cultural heritage in NSW includes the NSW Local Government Act (1993). Local planning instruments also contain provisions relating to indigenous heritage and development conditions of consent.

APPENDIX 2

SITE CARD

Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville NSW 2220

Office Use Only

Site Number | | | – | | – | | | | |

Date received / / Date entered into system / / Date catalogued / /

Entered by (I.D.)

Information Access

☐ Gender/male ☐ Gender/female ☐ Location restriction ☐ General restriction ☐ No access

Office Use Only

For Further Information Contact:

☐ **Nominated Trustee**

Title | Surname | First Name | Initials

Organisation

Address

Phone number | Fax

Client on system ☐

☐ **Knowledge Holder**

Title | Surname | First Name | Initials

Organisation

Address

Phone number | Fax

Client on system ☐

Aboriginal Heritage Unit or Cultural Heritage Division Contacts

Geographic Location

Site Name RPS WP IF1

Easting 330936 Northing 6399977 AGD/GDA GDA

Mapsheet SINGLETON

Zone 56 Location Method Differential GPS

Other Registration

Primary Recorder

Title | Surname | First Name | Initials

MIS | SOKOL | PHILIPPA | PS

Organisation RPS AUSTRALIA EAST

Address PO BOX 428 HAMILTON NSW 2303

Phone number 02 4940 4200 Fax 02 4961 6794

Client on system ☐

Date recorded 12/04/2010

NPWS Aboriginal Site Recording Form - Site Information

OPEN/CLOSE SITE Open Site

Site Context

Landform

- [ ] Mountainous
- [ ] Plain
- [ ] Rolling hills
- [ ] Steep hills
- [x] Undulating plain

Landform Unit

- [ ] Beach
- [ ] Coastal rock platform
- [ ] Dune
- [ ] Intertidal flat
- [ ] Lagoon
- [ ] Tidal Creek
- [ ] Tidal Flat
- [ ] Cliff
- [ ] Crest
- [ ] Flat
- [ ] Lower slope
- [x] Mid slope
- [ ] Upper slope
- [ ] Plain
- [ ] Ridge
- [ ] Tor
- [ ] Valley flat
- [ ] Levy
- [ ] Stream bank
- [ ] Stream channel
- [ ] Swamp
- [ ] Terrace
- [ ] Terrace flat

Slope

6-18 degrees

Vegetation

- [ ] Closed forest
- [x] Grasslands
- [x] Isolated clumps of trees
- [ ] Open forest
- [ ] Open woodland
- [x] Scrub
- [ ] Woodland
- [ ] Cleared
- [ ] Revegetated
- [ ] N/A

Land use

- [ ] Conservation
- [ ] Established urban
- [ ] Farming-intensive
- [x] Farming-low intensity
- [ ] Forestry
- [ ] Industrial
- [ ] Mining
- [ ] Pastoral/grazing
- [ ] Recreation
- [ ] Semi-rural
- [ ] Service corridor
- [ ] Transport corridor
- [ ] Urban expansion
- [ ] Residential

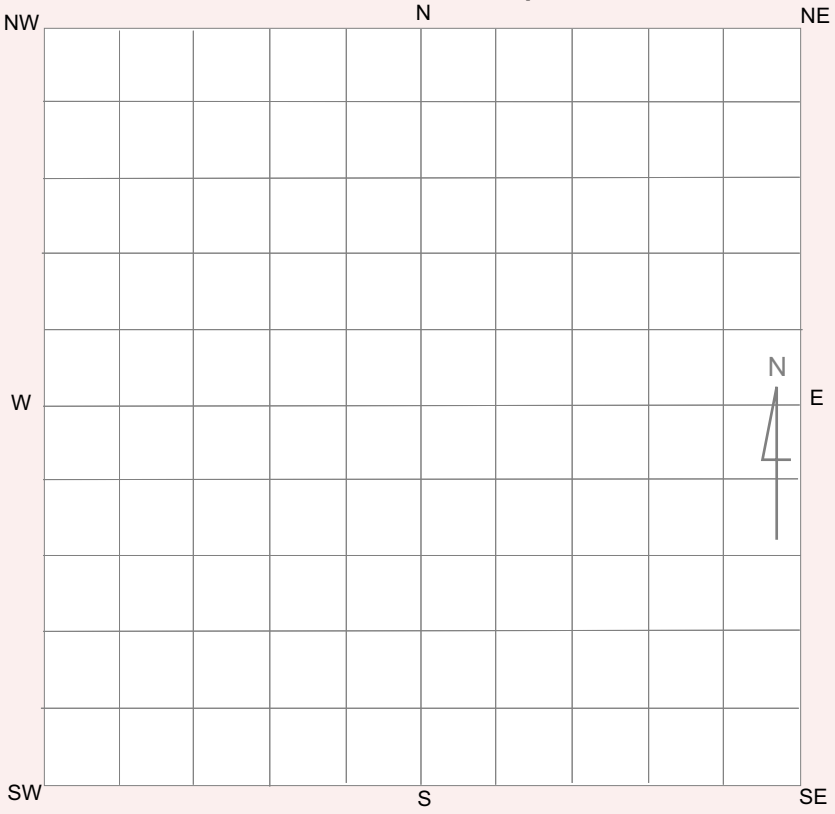
Water

Distance to permanent water source	1000 metres
Distance to temporary water source	100 metres
Name of nearest permanent water source	First Creek
Name of nearest temporary water	Unnamed Tributary

Directions for Relocation

Enter Lot 138 from property gate north of Retreat Road, walk in easterly direction towards south of Lot 138 for about 100 m towards a north east facing mid slope area. Site is located on exposed B horizon soils with sheet wash erosion containing scattered grass.

Site Location Map



Current Land Tenure

- [ ] Public
- [x] Private

National Park / other Government Dept.

Primary report **I.D.** (I.D. Office Use only)

NPWS Aboriginal Site Recording Form - Site Information

General Site Information

Closed Site

Shelter/Cave Formation

- [ ] Boulder
- [ ] Wind erosion
- [ ] Water erosion
- [ ] Rock collapse

Rock Surface Condition

- [ ] Boulder
- [ ] Sandstone platform
- [ ] Silica gloss
- [ ] Tessellated
- [ ] Weathered
- [ ] Other platform

Condition of Ceiling

- [ ] Boulder
- [ ] Sandstone platform
- [ ] Silica gloss
- [ ] Tessellated
- [ ] Weathered
- [ ] Other platform

Shelter Aspect

- [ ] North
- [ ] North East
- [ ] East
- [ ] South East
- [ ] South
- [ ] South West
- [ ] West
- [ ] North West

Open Site

Site Orientation

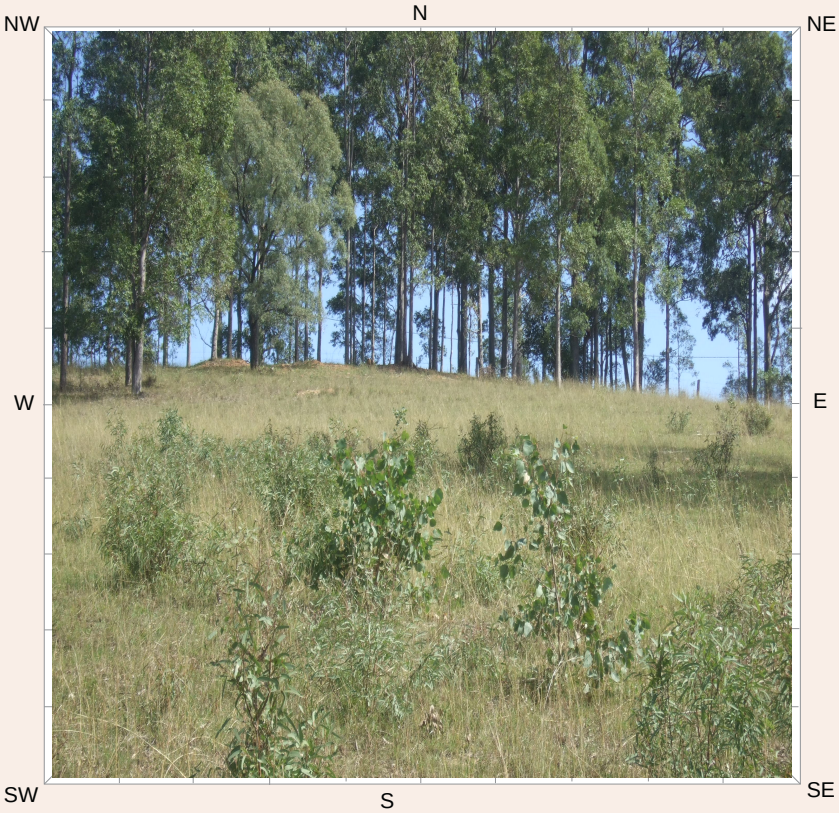
- [ ] N-S
- [x] NE-SW
- [ ] E-W
- [ ] SE-NW
- [ ] N/A

Features

- [ ] 1. Aboriginal Ceremony & Dreaming
- [ ] 2. Aboriginal Resource & Gathering
- [ ] 3. Art
- [x] 4. Artefact
- [ ] 5. Burial
- [ ] 6. Ceremonial Ring
- [ ] 7. Conflict
- [ ] 8. Earth Mound
- [ ] 9. Fish Trap
- [ ] 10. Grinding Groove
- [ ] 11. Habitation Structure
- [ ] 12. Hearth
- [ ] 13. Non Human Bone & Organic Material
- [ ] 14. Ochre quarry
- [ ] 15. Potential Archaeological Deposit
- [ ] 16. Stone Quarry
- [ ] 17. Shell
- [ ] 18. Stone Arrangement
- [ ] 19. Modified Tree
- [ ] 20. Water Hole

Site Plan

Indicate scale, boundaries of site, features



Site Dimensions

Closed Site Dimensions (m)

	Internal length
	Internal width
	Shelter height
	Shelter floor area

Open Site Dimensions (m)

10m	Total length of visible site
10m	Average width of visible site
100sqm	Estimated area of visible site
10m	Length of assessed site area

Aboriginal Community Interpretation and Management Recommendations

Preliminary Site Assessment

Site Cultural & Scientific Analysis and Preliminary Management Recommendations

If the site is to be impacted upon by future works to the area an Application for a Section 87 and Section 90 Aboriginal Heritage Impact Permit will need to be sought from the Department of Environment, Climate Change and Water (DECCW) by the proponent.

This section should only be filled in by the Endorsees

Endorsed by: ☐ Knowledge Holder ☐ Nominated Trustee ☐ Native Title Holder ☐ Community Consensus

Title | Surname | First Name | Initials

Organisation

Address

Phone number | Fax

Attachments (No.)

- ☐ A4 location map
- ☐ B/W photographs
- ☑ Colour photographs
- ☐ Slides
- ☐ Aerial photographs
- ☐ Site plans, drawings
- ☐ Recording tables
- ☐ Other
- ☐ Feature inserts-No. ☐

Comments

See attached photo's.

NPWS FEATURE RECORDING FORM - ARTEFACT

Site I.D.

Site Name: RPS WP IF1

First recorded date: 12/04/2010

Importance: Cannot be presently determined

No. of instances: 1

Recorded by: PS

	Yes	No
Stone artefacts only	Yes	
Artefacts collected		No
Permit issued		No

Percentage of Non-stone Artefacts to Percentage of Stone Artefacts

0-9% | 10-19% | 20-29% | 30-39% | 40-49% | 50-59% | 60-69% | 70-79% | 80-89% | 90-100%

0-9%

Feature Context & Condition

Scatter No. 1

Easting: 3 3 0 9 3 6

Northing: 6 3 9 9 9 7 7

Density (Artefact count per square metre): 1

Dimensions: 10 Length (m) × 10 Width (m) × 0 Depth (m)

	Yes	No
In situ		No
Stratified		No

Feature Condition

- [ ] Very good
- [ ] Good
- [x] Poor

General Condition

- [x] Weathered
- [ ] Vehicle damage
- [x] Surface water wash
- [ ] Fire damage
- [x] Erosion
- [x] Stock damage
- [ ] Exposed archaeological material

Recommended Action

- [ ] Boardwalk
- [ ] Fencing
- [ ] Closure to public
- [x] Continued inspection
- [ ] Fire hazard reduction
- [ ] Expert assessment
- [ ] Meeting with land manager
- [ ] Revegetation
- [ ] Signage
- [ ] Soil erosion control
- [ ] Track closure/re-routing
- [ ] Additional recording

Feature Plan (Indicate scale, location of instances)

Feature Environment

(Complete when *feature* environment differs to *site* environment, use attributes from cover card, p. 2)

- Land form: Undulating Plain
- Land form unit: Mid slope
- Slope: 6-18 degrees
- Vegetation: Tree cluster, grasslands
- Land use: Farming - low intensity

Water

Distance to permanent water source: 1,000 metres

Distance to temporary water source: 100 metres

Name of nearest permanent water source: First Creek

Name of nearest temporary water: Unnamed tributary of First Creek